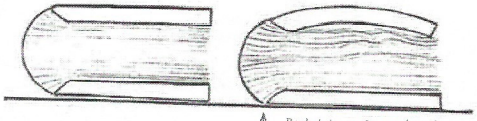
Jim Croft Excerpts from Suave Mechanicals II

CHANGES OF MOISTURE LEVELS

Cool, damp environment: The outside face of the upper board swells and becomes wider than the inside face.



Book sitting out in an unheated classroom overnight or on a rainy day.

From a cool to hot environment: The outside face loses moisture, shrinks, and becomes less wide than the inside face.

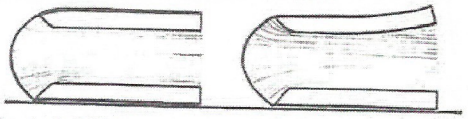


Fig. 1. Any book cover—even a very good wooden board—can move. If left under undesirable conditions for long, the paper and boards will also react to the environment. This will strain the structure to some degree. A light weight can do a lot to slow down the movement. When we are in my unheated classroom, I tell people to keep a brick on their text blocks and boards when not working on them and overnight.

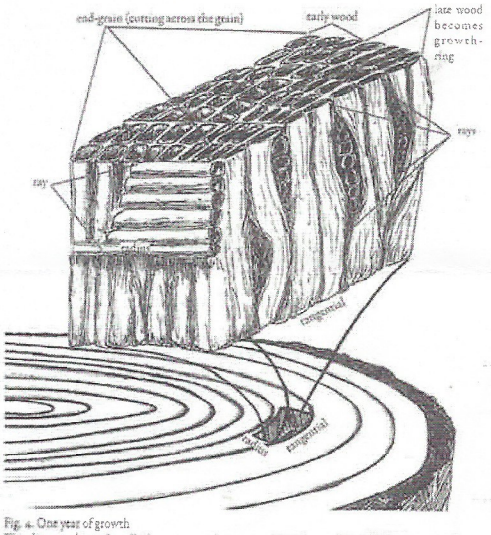


Fig. 4. One year of growth

Fig. 35. Flip side of quarter-split book board in Fig. 33, but this side is sawn, showing long rays. "I am God's Plywood" is written in pencil. One could say "nature's plywood" to express the same idea. (The red spot is blood.)

GALLERY OF THE NATURE OF WOOD AND MILLING FIGS. 2–11

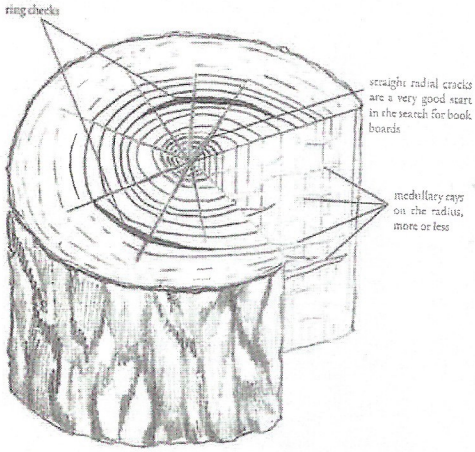


Fig. 2. VGSGTQ firewood with one quarter missing
Ideally, quartering follows the radius. If the grain is straight, long medullary rays might show up, running in straight lines across the face of the split or cut. This piece of wood looks like oak, which splits relatively easily and is often surprisingly flat. This piece has great medullary rays and definitely qualifies as God's Plywood raw material, but the ring checks (fissures around growth-rings) could be worse than we hope they are.

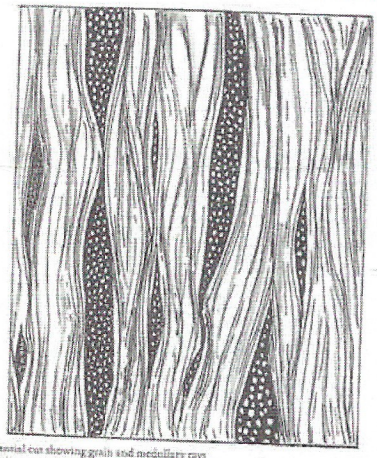


Fig. 5. Tangential cut showing grain and medullary rays
The grain cells running vertically in the drawing can grow straight, twisted, spiraled, interlocked, or any combination of these. The nature of this grain can differ greatly within the same species and within the same trunk. The grain on the butt tends to be denser and often interlocked. My land is littered with "long butts" of Western larch from 1916, which were cut off the log because lumber from the butt was worth more unstable than the mellower grain 6 to 10 ft. higher up on the trunk.

Whether the grain be straight or spiral, it is usually consistent throughout the entire trunk.

In this drawing, there are small and large medullary rays. Because this is a tangential cut (see Fig. 7), we have cut across the cells of the rays. Medullary rays can be one-cell wide or as many as 30–40 cells wide. They can be tiny or more than 1 in. tall. Some woods (ash and chestnut, for instance) look so much alike that only subtle differences in the rays can distinguish them. Would you agree that rays appear to have respiratory and structural capabilities?

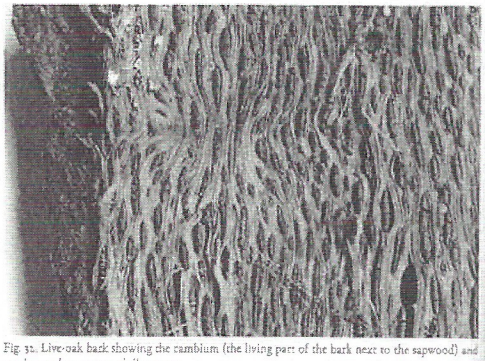


Fig. 32. Live-oak bark showing the cambium (the living part of the bark next to the sapwood) and ample attachment to medullary rays.

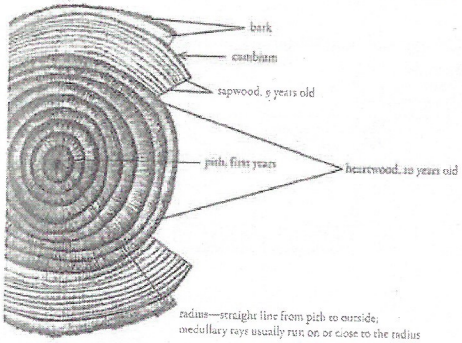


Fig. 3. End-grain view of tree stem
Adapted from Hoadley, *Identifying Wood*, 8. End-grain is the view one sees when one cuts across the grain of the tree, perpendicular to the length of the trunk. This view will not tell us how straight the grain is; we need some length of wood to tell that.

It is best to cut the boards somewhat thicker than needed to allow for planing irregularities and shrinkage in drying. I try to machine-plane the boards as soon as possible with at least one side flattened and with the board near finished thickness. Remember that to make sure of a board's personality, you must finish curing it already thicknessed.

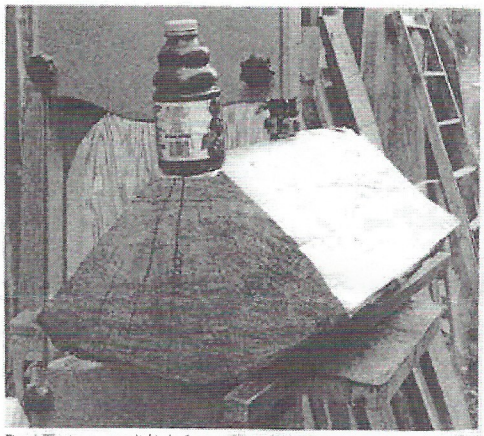


Fig. 76. This is a quarter-split block of a piece of Tree of Heaven. It is sitting on a hewn flat surface. This block is pushing the limits of the saw's 11½ in. clearance. The stick of lumber helps stabilize the top-heavy block.

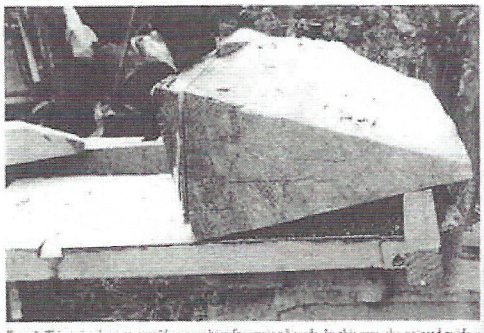


Fig. 78. Trimming base to provide a new base for sawing boards. In this case, the pointed guide is being used. Sometimes the outside surface is rough and no guide is used. Shown is a small block (or large billet) of silver maple that will make 9 in. wide boards. As the thin end of the block is a thin one of an assortment of different thicknesses kept on hand. Where to place the shim and how thick it should be determine the new trim angle for the block to rest on for the next series of cuts. Note the old versus new (partially cut) flat side on the upper-left side (formerly the outside of the tree). Also note the relatively small cracks on the end-grain. They are beautifully straight, and the split qualifies as straight-grained. As the narrower pieces are cut, the sawyer judges how to proceed by reading the rays and grain. Yes, it takes a longer time to turn the block, but the quality is well worth it.

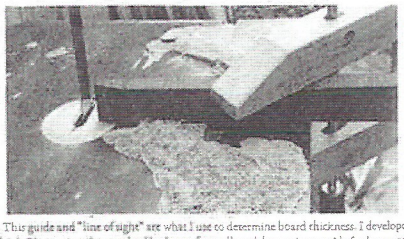
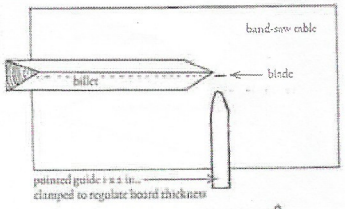


Fig. 79. This guide and "line of sight" are what I use to determine board thickness. I developed my "line of sight" by cutting thousands of leg bones from elk and deer, using a guide for bones only get in the way.

Jim Croft

Excerpts from Sweave Mechanicals II

Fig. 80. Guide for band-sawing. The orientation of this drawing is looking down from above the band saw; see Fig. 79.



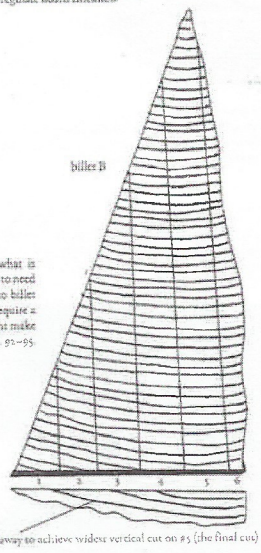
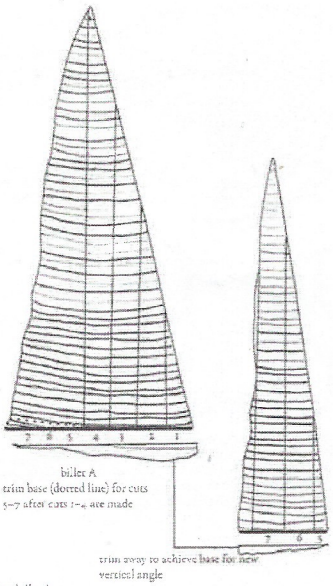


Fig. 81. Sawing billet B
The sawyer judges where to cut based on what is uncovered in previous cuts. Billet B was judged to need only one turn (trim of the base) as opposed to billet A (Fig. 77) that required two turns ("turns" require a new base trim). Number 6 cut on billet B might make a good scaleboard; also see Figs. 33–35 and Figs. 92–95.



Quartering billet A
ating the first board from billet A (one of the billets cut from the block in Fig. 73), a sawyer kely decide to turn the block. Until now, the hewn side was the base to ensure vertical, true-ng cuts. After judging where the next prime cut will be, the sawyer must trim a certain angle a round portion of billet A that remains. Choosing what size shim to use in order to make hat will provide the base for the new radius of the new quartering cut is a judgment call. 78–79. It is so slow and difficult to construct a guide for this step that this base-trimming y done freehand. After trimming the new unwobbling base, the sawyer goes back to the guide (Fig. 79) for succeeding boards. Billet A was judged to need two base trimmings to get boards on the true quarter.

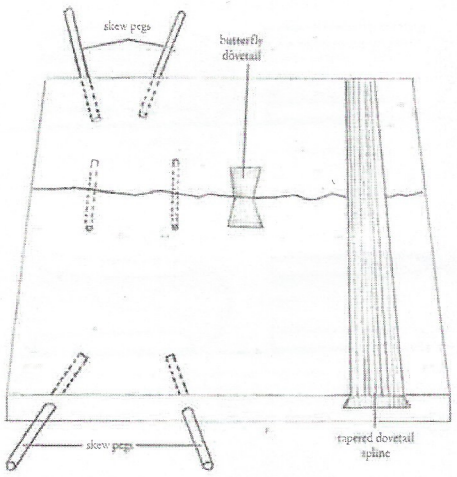


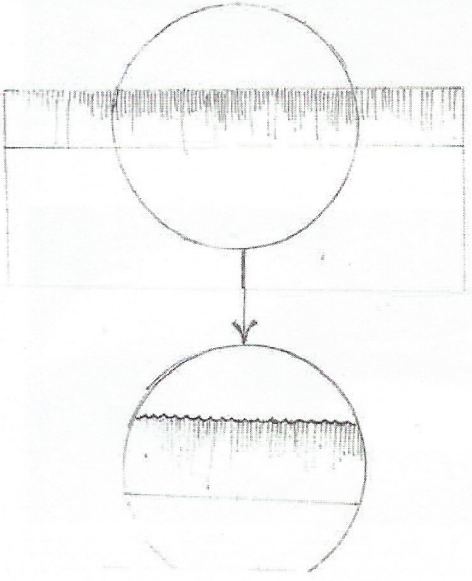
Fig. 142. Sampler of wood board repair and reinforcements
Decisions about the proportions of pegs and dovetails, and where to place them, should be made individually for every board. I have made butterfly dovetails that were about 1/3 of the board thickness and tapered dovetail splines that were about ½ the board's thickness. I worked the splines totally by hand from quarter-split yew. I have only used the splines on new boards, not for board repairs.

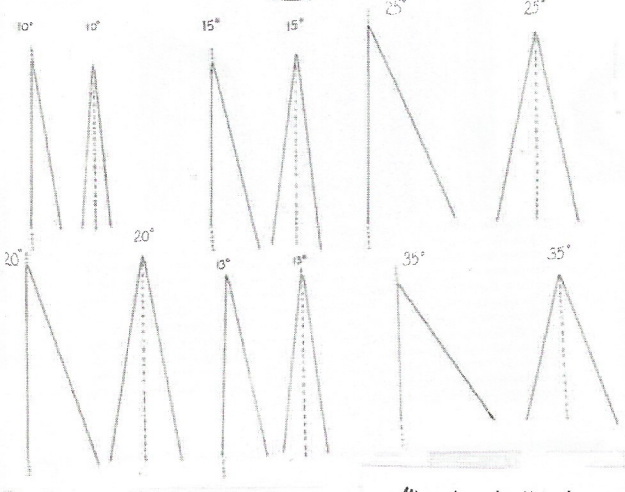
For pegs, I get some good bamboo and use a jeweler's drawplate to take them down to about one third the thickness of the board. You can sometimes find shish-kebab skewers that will be strong enough. If you use bamboo, the outside of the round is the strongest. You will find it splits easily and shaves down nicely whether with a spokeshave alone or finished off with the drawplate.

Of course it is tricky to drill deep into the middle through the edge. With accurate vertical guides, hand-eye prowess, and a good drill bit, one can do wells practice on scraps.

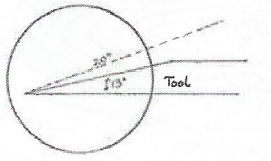
Skew pegging and straight pegging reinforce across the grain, but skew pegging also performs an ingenious locking dovetail function at the same time. From: Phleps, *Craft of Log Building*,195–214, 221–230, on skew pegging.

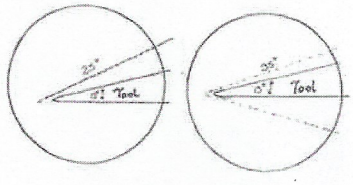
Sharpening



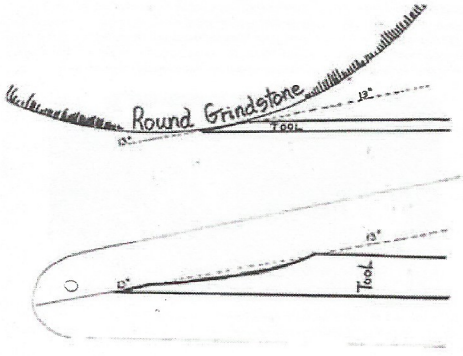


Getting a true reading of cutting edge

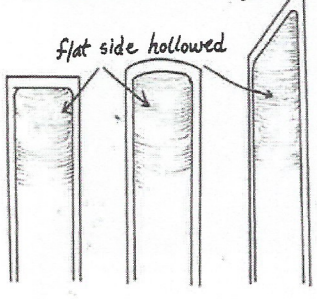


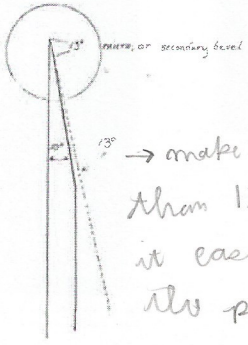


Alternative to Hollowing



Also → Hollowing the flat side
...and what about absolutely flat?





→ make this less than 13° to make it easier to sharpen the point

All drawings by Melody

Excerpts from Sauve Mechanicals II

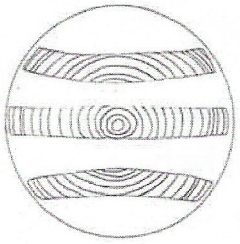


Fig 22. Three cuts
Notice how the two outside cuts are warping in the expected direction. That is, the growth-rings try to straighten out and warp the boards as illustrated. The middle board is relatively stable, except for the forbidden pith area. The middle of all three boards is thicker, while the most quartered areas have shrunk the most in thickness. Tangential cuts swell and shrink significantly more after the initial drying, while quartered wood shrinks more initially in curing, but less subsequently than other cuts.

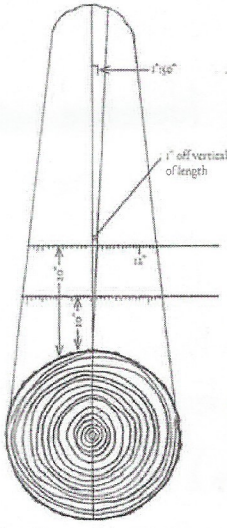


Fig. 23. Official straight grain
A slope of 1:20 means that the grain spirals 1 inch or less for every 20 inches of length. (Inspectors determine this by running a dullish scratch awl along the edge of the board; it will run with the grain.) I have seen the specification for straight-grained material set less stringently at 1:10 or 1 inch in 10 feet. Two different antique aircraft restorers told me that they want spruce that is 1:50. One of them is Pat Ryan, an aircraft restorer from Doniphan, Missouri, and my partner in May 2013 when we were working on the beech tree at Canary's home. From Mills et al, *Materials of Construction*, 525.

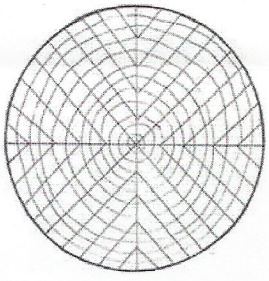


Fig. 9. Quartering Method #2
Most, if not all, of these boards could pass for quarter-sawn by some standards (growth-rings at a 45° angle). The middle of each of the four quarters is the best and the widest. Again, the thinner and larger the board, the more important it is that it be a truly quartered piece.

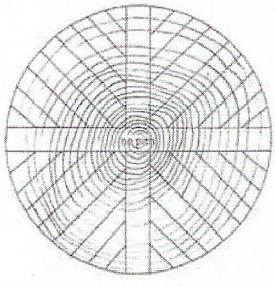
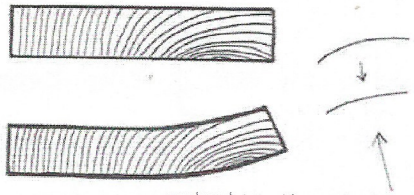


Fig. 10. Quartering Method #3
Of the three methods, this one results in the most and best boards. I just hope they get rid of the pith. The four main boards look good and also the wider boards in each quarter look promising, especially if one trims the most unvertical growth-rings.

Because some people are willing to pay more for a brand-name product, as soon as somebody says "quarter-sawn," the price shoots up. Sadly, as time goes on, the actual quality of what sells today for quarter-sawn is but a vague remembrance of old quality. Figs. 22–22. It hearkens to the practice of putting fake raised bands on spines: designed to imply old quality.

Straight-grained boards (SG) are cut with the grain from a straight-grained tree. Fig. 23. The ancients knew how to choose straight-grained trees and cut following the grain because an object's end use required the strength that comes from being cut with, or parallel to the grain. It would malfunction if not made right. We forget that in the old days, only wood was available to make objects that today are made of metal or plastic, for instance gearing, bows and arrows, skis, and measuring devices. Modern sawmills cut with careful attention to the grain only for the most specialized uses.



curved growth-rings straighten out as boards cures

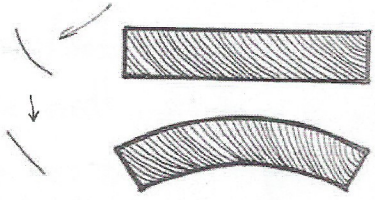


Fig. 11. Poor quarter-sawing
The fact that the growth-rings "straighten out" as a board cures enables one to predict the warpin tendencies of any particular board. Besides other factors, the more off-of-vertical the growth-rings are the more pronounced the warping tendencies. In the Wechsler and Galiano articles about wood-boar replacement, both assume the replacement board will not be truly quartered at all, but instead the discuss which way to orient the inevitable warp of the new replacement boards that are not quartered.

THREE METHODS OF QUARTERING
(OR THE MOST COMMON WAYS OF TRYING TO SAW RADIALLY CUT BOARDS).
NOTE: SIGNIFICANTLY FEWER GROWTH-RINGS APPEAR IN THE ILLUSTRATIONS THAN IN REALITY.

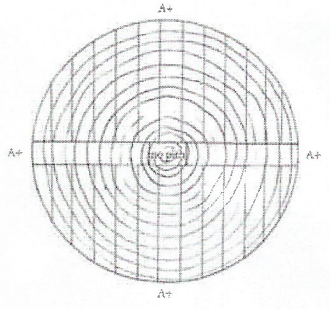


Fig. 8. Quartering Method #1
First, a board is cut out of the middle, then each half is "flat sawn." These boards would be tangentially sawn on the outside, becoming quartered towards the middle. In America today, the great majority of these boards could pass as vertical grain (VG) or quarter-sawn, for instance, for flooring. If possible, we would like straight-grained wood cut with (parallel to) the grain. The end-grain should have growth-rings perpendicular to the wide surface of the board; see Fig. 11. These boards are marked A+. If you can, you pick out the best vertical growth-rings, you get an A+.

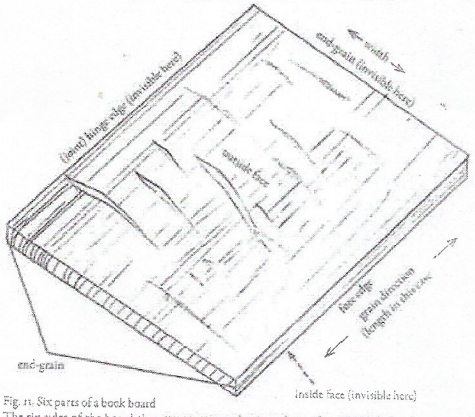


Fig. 12. Six parts of a book board
The six sides of the board that you must examine in order to draw conclusions about strength and stability are: head and tail end-grain, inside and outside face, fore edge and hinge edge. Good rays on end-grain, almost vertical growth-rings, vertical grain on face and fore edge. Look at the other three edges.

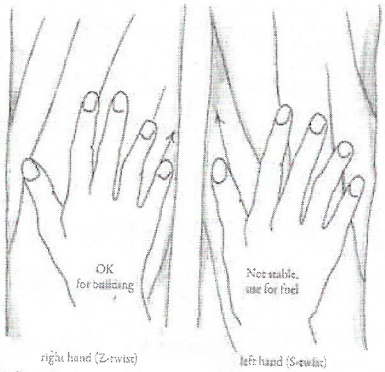


Fig. 24. Spiraling grain
Lay your right hand on the tree with the fingers extended upward in the direction of the tree's growth. If the grain twists in the direction of the little finger, the spiral is said to be right-handed (Z-twist) and if towards the thumb, it is a left-handed twist (S-twist). After Phleps, *Craft of Log Building*, 40.

The historian of wood building and wood scientist Hermann Phleps describes a traditional Bavarian carpenter technique for evaluating the direction of a spiral grain. Fig. 24. Right-handed (Z-twist) wood is usable, according to Phleps, but left-handed (S-twist) wood should be rejected for building purposes.[16] He warns that, in left-handed wood, "the bundles of fibers attempt to twist back during drying and in the dried state. This process, which may go on for years, is so powerful that it may force log walls out of plumb and loosen or even force apart roof framing."[17]

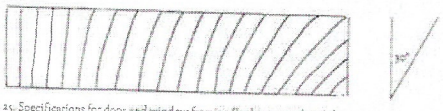


Fig. 25. Specifications for door and window framing (looking at end-grain)
Door and window frames are thicker and narrower than most book boards but require high standards for important work in difficult conditions. Strictly speaking, the right side of the board seen here should cause the whole board to be rejected, though this board would pass most of today's vertical grain (VG) and quarter-sawn designations easily. Referring to vertical growth-rings (as opposed to VG, vertical grain) is rare in lumber grading. Today's definition of VG requires that the grain must run parallel with the long side of the board (not visible here, but visible in most pictures in this article showing the board face). According to Hoadley, the terms quarter sawn and vertical grain both seem to imply that growth-rings can be as much as 45° off vertical (if anyone bothers to look). From Hoadley, *Understanding Wood*, 11–12.

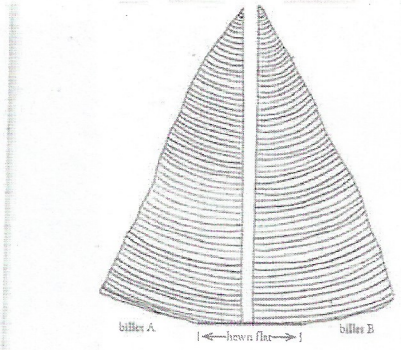


Fig. 13. Quartered block to quartered billets
Quartering can refer to cutting or splitting a round into fourths, but strictly speaking, it is the act of cutting or cleaving along a radius, regardless of whether the act results in blocks, billets, staves, or boards. Blocks (in this case) are quarter-split pieces of wood up to 6 ft. long that I can pick up and run through the band saw. I cut billets from blocks. These smaller pieces are roughed out and saw-ready, and from them, one can cut or split staves or boards. If I am going to saw a block or billet, I need a flat base. I hew a flat area on the round part of the block (the outside of the tree) so that it can sit securely on the band-saw table so as to make billets with the best possible vertical cut down the middle of the block. The hewing hatchet (Figs. 53 and 54) is the link between the raw wood and a machinable block with one flat side. The hewing hatchet and the hand plane are two ancient tools that frequently and quickly outperform any power tool in my opinion.

In making the first band-saw cut in the block, the hewn flat side, and perhaps some lines on the block, will be your only guides for judging how to make the best cut down the middle. You have to

Learning from a Woodpile

My wood-board career began when I started splitting and hand-sawing interesting pieces of wood into book boards in 1973. At the time, I was more interested in figure and color and had made a number of warpy boards in my experiments, but I did notice that the grain of the wood showed me where to split or cut. I loved splitting and also the monotonous rhythm of hand sawing boards. The wood was quite attractive, and even better, a split quarter was often relatively flat, with one face already made! It turned out that I had been making "quartered" wood for some time before I actually learned the term and its meaning, because even firewood, which I had been cutting, is routinely split on the quarter.

Locating promising wood, whether in a woodpile or a lumber store, is the beginning of a process that unfolds with the potential for many surprises and setbacks, and you may find that even expensive (or very old cured) wood can distort. Thickness your wood early and watch it before you think you have something. As you continue to work with a piece

Burrs 1) Sharpening burr – (or wire edge) – On old steel & perhaps some modern tool steels, a perceptible bent over or hanging thin layer that indicates one has polished or ground all the way to the edge & now one can turn the blade over and/or move to the next highest grit. It can easily break off & should be gone after stropping

Jim Croft

2) Scraping burr – hook edge purposefully made by burnishing a sharpened edge with a harder steel that is pulled (or pushed) to shave wood, bone, or book edges (to name a few)

3) Paring burr. There's some confusion about this because it's in the literature on sharpening paring knives. The knife is sharpened and then pulled on the strop at a very high angle (near vertical), effectively making the edge into a push scraper. I started this way, but don't recommend it. Its slow and more gentle (usually making dust rather than shavings). It's easier than maintaining a truly sharp cutting edge, but can still cut through the leather

4) Dullness burr – If the bevel is too thin (an uncommon problem) the blade will chip (harder steels) or bend over – A good blade will do good work before it will bend over.

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from The COMPLEAT BINDER

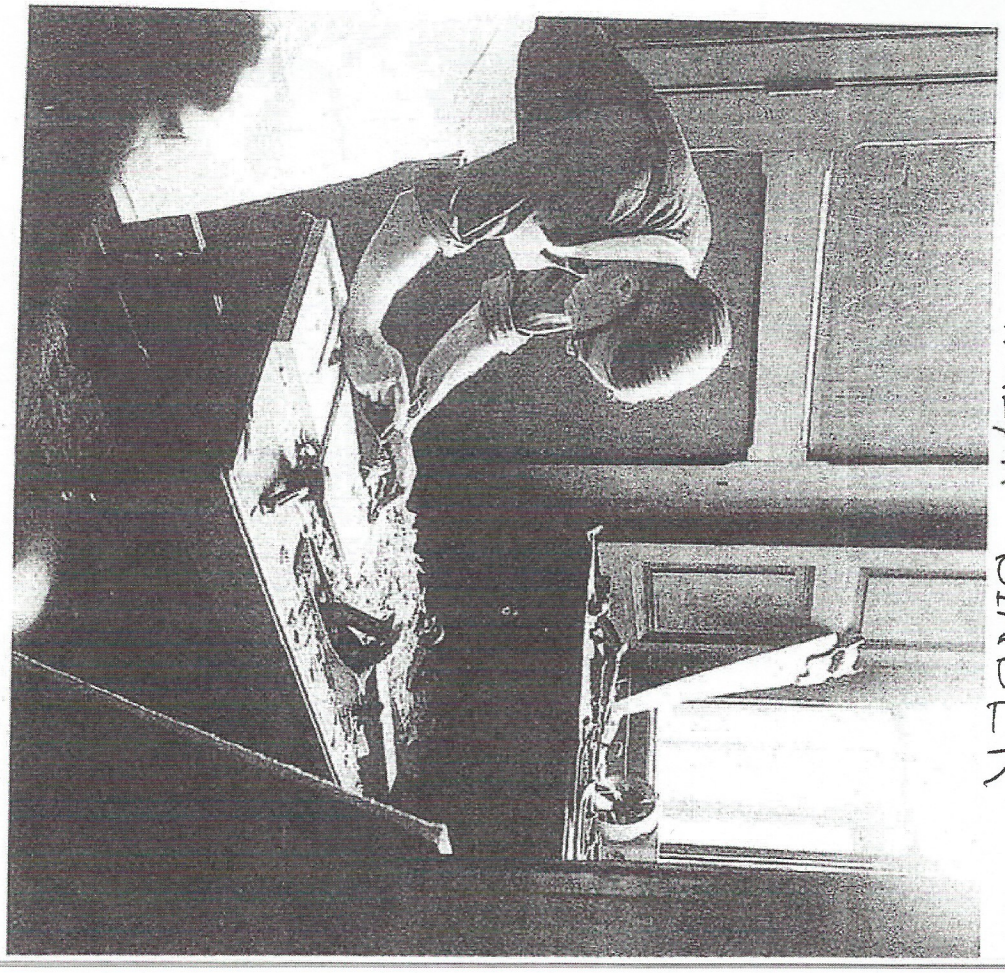

Fig. 15. Roger Powell preparing boards for the binding of an early manuscript.

Roger Powell, 1896-1990 • 23

Jim Croft BIO

I've often referred to myself as one of the five reincarnations of Dard Hunter. Early in our careers, we both wanted to move to a tropical island and make books from local raw materials. We were both vividly inspired by the Arts and Crafts movement and the "Book Beautiful" and the "Book Harmonious" that was hot when he was young one hundred years ago, and was still hot when I was learning book making in the 70's. We both got the "book bug" in Europe and made worthy attempts at making the whole book – maybe the me-book generation(s)? They want to control everything! My particular focus has been to try to recreate the historic materials of structures of old Europe that are still functional that were common before the invention of moveable type (1450's) Its a lofty-crafty goal to try to recreate what took hundreds (European paper) to thousands (fiber, skin work) of years of ~~accumulated~~ accumulated human knowledge. to perfect & perpetuate. Luckily we have models & time to dabble. How did they make that oil-tanned deer leather on books from Charlemagne's time – 1200 years old & in excellent condition.