Make a Joint Stool From a Tree

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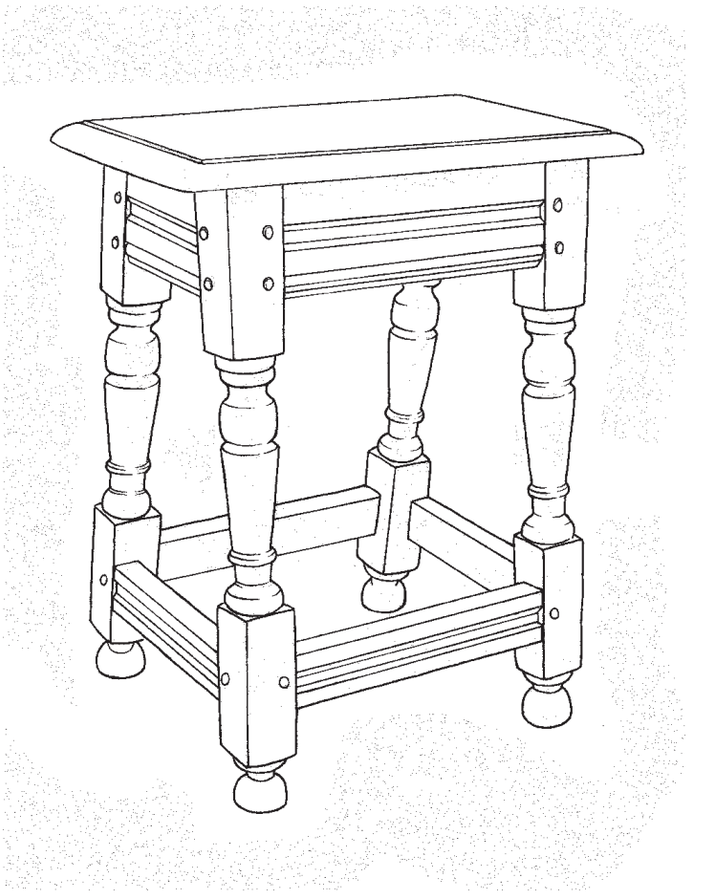
an introduction to 17th-century joinery



by Jennie Alexander & Peter Follansbee

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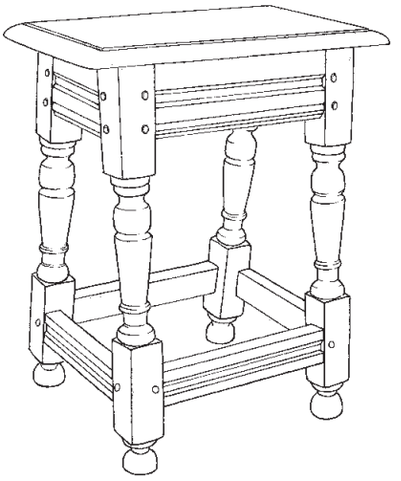
Introduction

The publication of this long-awaited monograph crowns a 50-year campaign to analyze and revive historical green woodworking technology. Even in my youth 50 years ago, received folk wisdom dictated that you should feel a turned chair post to see if it had shrunk oval, the intimation being that the chair was assembled with wet or green posts that had shrunk around dry horizontal components as part of the original assembly strategy. As I took apart chairs, I saw that some had turned tenons whose ends were flared, and I concluded that was why it was so hard to knock the chairs apart.

What was lacking was a comprehensive theory about how period artisans implemented such an assembly method, backed up by rigorous, scientific testing. The publication of John Alexander's *Make a Chair from a Tree: An Introduction to Working Green Wood* (Taunton Press) in 1978 provided just such a treatment, and the exposition of shaving as a fabrication method revolutionized our understanding of how parts were prepared. In particular, Alexander's analysis of "the joint," meaning exactly how a shrinking post gripped a round tenon, addressed the essence of the controversy. It didn't matter how decorative the components were, the joint was the same on all shaved or turned chairs. How all of this changed with the industrialization of chairmaking in the 19th century has yet to be explored. It is evident that in French-



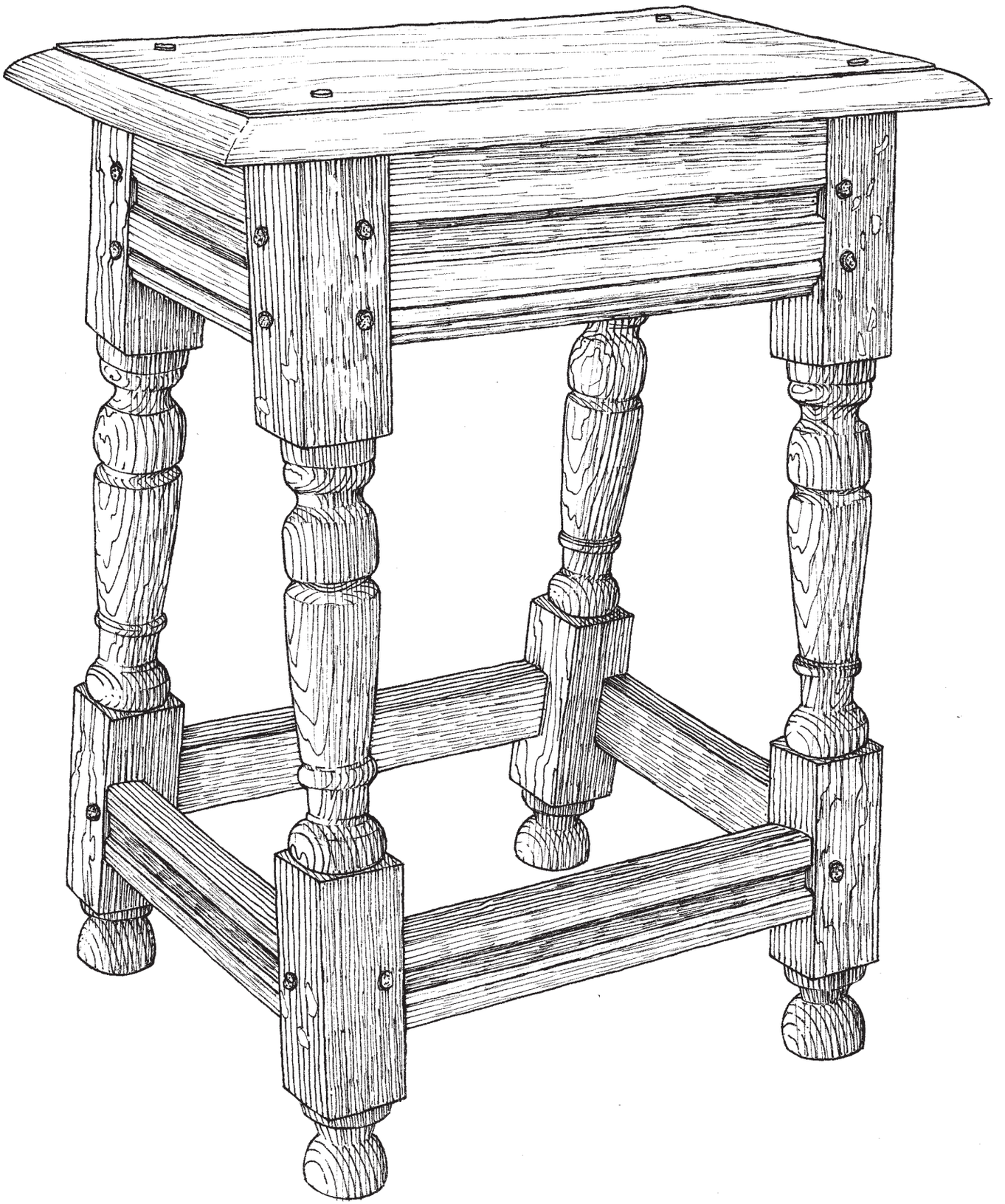
speaking sections of Canada and Louisiana and, famously, in Appalachia, the wet/dry assembly tradition survived well into the 20th century.

Now we have here the equivalent practical and theoretical study of wet, pinned, rectangular mortise-and-tenon construction. It is completely different from wet, round mortise-and-tenon work. Not only do the joints require test-fitting, but drawbored pinning. Again, the analysis of the relative wetness or dryness of each component in the system – mortise, tenon and pin – is elucidated in some detail. This has never been done before, because most of the extant joinery books operate on the assumption that all the components have reached equilibrium with ambient temperature and humidity before assembly. Most such books also assume that such joints are glued.

Certainly the history of early Dutch, French, German, English and American joinery has reached new levels of sophistication, but the differences between English and Germanic joinery are still poorly understood. The English tradition still relied on undercutting the inner shoulders of the tenon to ensure that the outer shoulders met the adjacent posts. Even the most superficial examination of Dutch and Dutch-American joinery proves that those artisans were working to a far higher standard, including wood selection, high-fidelity fabrication of parts, and joints wherein both shoulders abutted the adjacent posts. The strength of guilds in the Germanic lands of Europe provides only a partial explanation of this astounding difference in standards of workmanship.

Jennie Alexander and Peter Follansbee stand at the apex of American woodworking history, and the publication of *Make a Joint Stool From a Tree* is a triumph, not only of hard-won knowledge and proficiency, but of historical imagination. For Alexander, this monograph represents a crowning of a long and brilliant career as a theorist, practitioner and teacher. For Follansbee, it marks his emergence as a master of historical woodworking.

Robert F. Trent
Wilmington, Delaware
September 2011



Preface: About the Stool and the Book

THIS BOOK will outline the steps involved in splitting open a freshly felled oak log and working the resulting green wood into parts for a simple joined stool – our reproductions based on historical examples common in the 17th century.

First, we offer a few notes about our approach to this joinery. For our purposes, the geographical scope and time frame of this book is limited. Throughout the book we will use the term "period" as in "period joinery," "period craftsman" or even "period document" and by this we are referring to evidence we have found regarding 17th-century work, most frequently in our studies limited to New England. Exceptions will be noted as they arise.

Our foray into joinery is an attempt to rediscover a lost craft. In many cases, we have no way of knowing how "they" performed a given task. Thus, when confronted with differing possible alternatives, we have chosen that which is simple, quick and uses few tools. The tool kit is not extensive and some modern substitutes are discussed. There is no need for power tools of any kind.

One suggestion for the reader is to read the book through before beginning the work. We have developed an order of work that we find effective. It provides for what can be done when the wood is "tree wet," a term used to describe stock that has lost none of the water that was in the tree, and what work is best left until the wood has partially dried. All parts are rived, hewn and planed while the wood is tree wet. Because green wood cuts much more easily than drier stock, this amounts to a tremendous saving of time and effort. Some parts are made before others so that the wood may be allowed to dry to a "workable moisture content" – this is a term we invented to describe stock whose surfaces have begun to dry, while the interior of the wood still contains significant moisture. This creates a situation in which you get the ease of working wet wood, yet you also get a better, smoother finish on the stock than in tree-wet timber. Once that surface has begun to dry, it will plane smoothly without tear-out and can be turned, carved and finished.

Finally, about the book's format. We have worked on this project over the course of many years. By the time we came to shoot new digital photographs, Alexander's shop work had ceased due to health concerns. Consequently, many of the photographs are from Follansbee's shop. As you pore through the book, please keep in mind that this is the work of both authors.

A joint stool built by Jennie Alexander.

A joint stool built by Peter Follansbee.

Acknowledgments

A BOOK THIS LONG in the works accumulates a host of helpers. Many, many people have helped us over the years. Two deserve special mention. Robert Trent's help cannot be overstated. He worked with us in all our furniture studies from very early on; certainly from the beginning of our "joint" venture. His knowledge of New England furniture is unsurpassed, and his boundless generosity has brought us insights that would have taken us another 20 years, if we got there at all.

As a teenager in one of Alexander's chairmaking classes, Nathaniel Krause made a hit by finishing first, and then he went and found the broom. Like a true apprentice he watched, absorbed and performed. Furniture and slides in this book are the result of his patient and able contributions during many years in Alexander's shop. Without him this book would be but a fancy.

Any list of acknowledgements runs the risk of missing someone, or some place. We apologize in advance for any omissions. Several institutions have been very generous in allowing us access to their collections. We'd like to thank the numerous staff members, past and present, who provided help of various forms at the following institutions and organizations: The Winterthur Museum and Gardens; the Museum of Fine Arts, Boston; the Metropolitan Museum of Art; Plimoth Plantation; the Chipstone Foundation; Colonial Williamsburg Foundation; Smithsonian Institution; the Regional Furniture Society; the Early American Industries Association; and the Tools and Trades Historical Society.

Further, we have taught the joint stool class singly and together at Country Workshops in Marshall, N.C., Alexander's shop in Baltimore, MD., and most recently at Roy Underhill's The Woodwright's School. To our numerous students in these classes, we owe a note of thanks for helping us to learn how to make these little timber frames.

Many private collectors shall remain private, but they still have our thanks. The following individuals have our gratitude for their help and support during our studies.

Gavin Ashworth
the late Dorothy Low Alexander
the late Joyce Leach Alexander
Mark Atchison
Luke Beckerdite
Gerry and Rindy Bennett
Elia Bizzarri
Stuart Bolton
Susan Buck
Michael Burrey
Dennis Carr
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Edward S. Cooke Jr
Brian Cullity
Chris Currie
Ted Curtin
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Ron Diefenbacher
Jonathan L. Fairbanks
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Michael French
Jay Gaynor
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Gene Kijowsky
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Pat Lackey
Joshua Lane
Carl Larsson
Louise and Drew Langsner
Tom Latane
John Lavine
Thomas Lie-Nielsen
Liz Lodge
Bryan MacIntyre
Rick McKee
Duncan McNab
Timothy Nagel
Heather Neill
Susan Newton
Marie Pelletier
Anatol Polillo
Jonathan Prown
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Maureen Richard
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Jim Schneck
Christopher Schwarz
Steve Stentstrom
Stephanie Vaiden Stone
Jogge Sundqvist
Wille Sundqvist
Carl Swensson
Robert Tarule
Roy Underhill
John and Marie Vander Sande
Anne S. and Frederick Vogel III
Gerald W. R. Ward
Brian Weldy
Pret Woodburn

Dedications

Victor Chinnery (1944-2011)

THROUGHOUT OUR STUDY of 17th-century furniture, we used the word "Chinnery" to refer to the book *Oak Furniture: the British Tradition* written by Victor Chinnery."It's in Chinnery" we would say, or "Look it up in Chinnery." About 1998, we were fortunate to meet Victor Chinnery and his wife, Jan, and learn there was more to Victor than a book. I spent a few days studying furniture with them in museums here in New England, and Vic kept telling me that he really wanted me to see oak furniture in its "context." Eventually I made three trips to England to travel with Victor. He opened my eyes to the textures, variety and liveliness of period furniture in ways that are not possible in this country. Best of all, Vic became a great friend – generous, thoughtful and engaging. I learned much from Victor, and dedicate my work in this book to my wonderful memories of time spent with him.

— Peter Follansbee

Charles Hummel

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— Jennie Alexander

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Joinery: Mortises, Tenons & Mouldings

Now we can return to the framing parts, starting with the stiles. The first step is to layout the mortises. We'll outline these steps one at a time because it can get confusing. We will call the mortises for the front and rear rails "straight" mortises, those for the canted ends of the stool we will call "angled" mortises.

Stack the four stiles together, with their beveled inside corners touching, and with radial faces up.

These radial faces become the "front" and "back" faces of the stool. Take one stile, and work on its radial face.

To lay out the stiles' square blocks and the straight mortises, it's easier to use what a carpenter now calls a "story stick" that is marked with the stiles' details, rather than working from paper drawings or patterns. This shop-made stick records the markings that are then transferred to the stile. We have made these sticks to record different stools. The locations and heights of the squared blocks, turning details and positions of mortises can all be taken from the stick to the stile. It is best to mark ONE stile from the stick, then the other three stiles from that first stile.

Make sure the foot of the stile is trimmed square. Line up the foot of the story stick and the feet of the stile. With an awl, mark the limits of the square blocks and scribe these marks across all four faces of the stile, with one exception – the top of the stile is marked only on the radial face and the corresponding inside tangential face (where the straight apron mortise is located).

Now line the stick up on the inside face and mark the locations of the mortises on this tangential face.

One thing to keep in mind is that the top of the apron mortise is not at the same height as the top of the stile. This mortise drops down about ¾" from the stile's top end. Eyeball the top of the apron mor-

Fig. 4.1 Learn to chop mortises accurately and efficiently and you'll be able to build most anything. Joint stools will give you lots of practice – there are 16 joints in each one.

Fig. 4.2 This is another example of something for which we lack period evidence; but its effectiveness can't be beat. In addition to serving as the principal layout reference, it functions as a wooden notebook of sorts. If you make a number of different stool patterns, mark them with the date.

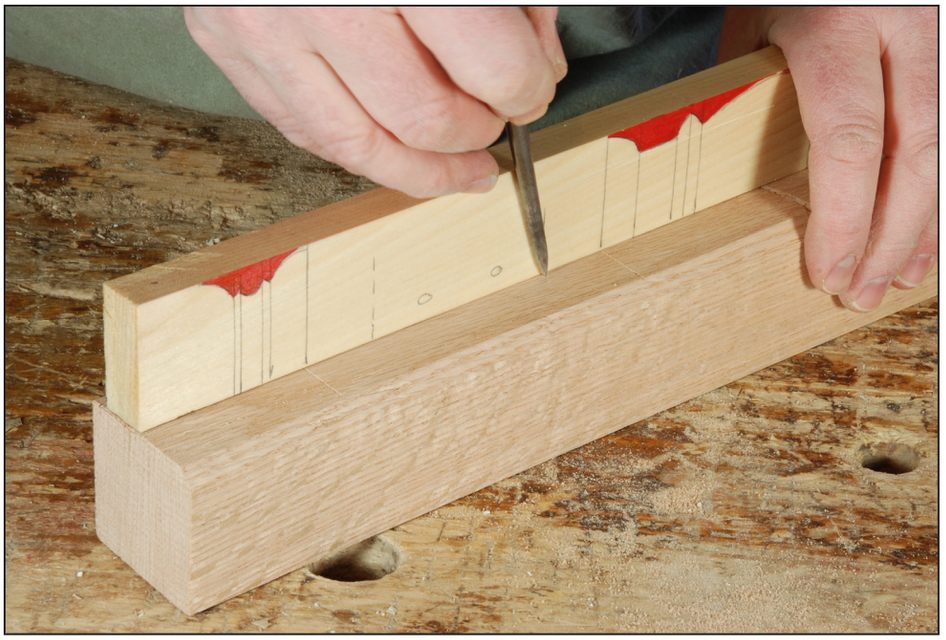

Fig. 4.3 The awl pricks the points, then scribe them with the square and awl. Sharpen the awl with a file from time to time. Careful, it can draw blood when it's sharp.

Fig. 4.4 This is a technique that if we heard it somewhere, we have forgotten where. It works very well. No ruler, no fiddling with the gauge up against the chisel's sharp edge. Mark the timber with the chisel, then put the chisel down. Very safe, and simple.

Fig. 4.5 Now move the chisel over one chisel-width. And lean on it. Now your setting is marked on the timber, and you just need to set the mortise gauge according to the chisel marks.

tise and scribe it with the awl and square.

The next step is to mark the mortises with the mortise gauge. To set the gauge, make a mark with your chisel's edge perpendicular to, but right against the stile's arris. Next, move over one chisel width and bear down hard enough to make a mark in the wood. Then set the pins of your mortise gauge according to the location of this second chisel mark. The result is a mortise that is set in from the face of the stock the thickness of the chisel. Our mortises are usually 5⁄16", set in from the face 5⁄16". This spacing is based on studies of period work; 5⁄16" is almost a standard from what we have seen.

The Angled Mortises

To find the location for the angled side mortises, use an adjustable bevel set to the desired flare angle. A slope of 1:6 is what we have used on several stools. Our studies of 17th-century stools show flare angles right around that figure, some less, none more. To set the bevel, set a straightedge on a framing square, positioning it at 1" on one leg, and 6" on the other. Then adjust the bevel to this angle and lock its nut to secure the setting. You can then scribe this angle on a piece of wood, or even scribe it on the wall. Like the adjustable gauges, the bevel can lose its setting if bumped. Having the angle scribed somewhere makes it easy to reset it. Alexander turned an adjustable bevel into a fixed one by threading a bolt through its stock and blade.

To lay out the side mortises, you must carry the line that designates the top of the stool from the front radial face across the side tangential face. Set the bevel with its handle on the front face of the stile. Line it up with the marked top of the stool, with its angled blade pointing upwards on the other outside face of that stile. Scribe this line with the awl.

Then use a square to carry this line across the other inside face. So the sequence is square, bevel, square. Remember that it's best to carry the lines across the outside faces; the inside faces are unreliable. This layout is both simple and complicated at the same time. Sometimes it helps to stand the stile up and tilt it as it will be in the finished stool. Then you can easily visualize where the angled mortises are and how they rise up higher than the straight mortises.

You can repeat this process for the top

edge of the stretchers' mortises. Or you can mark this from the story stick, this time lining up the top of the stool with the scribed line that designates the top of the side apron.

Now mark the mortises' height and width on these faces of the stile. After you mark out two stiles, lay them side by side and check that they agree. A front or rear pair should have their radial faces matching, with the straight mortises aiming at each other, and the side, angled mortises rising up toward the top of the stool.

Mortising

Once you have struck the layout of the mortises, secure the stile on the benchtop near its edge. Shove one end of the stile against the bench hook and then secure the stile with the holdfast.

Begin mortising by holding the mortise chisel with the handle tilted away from you, leaving its bevel just about plumb. Position the first cuts with the mortise chisel about in the center of the mortise's length. A blow from the wooden mallet drives the chisel downward. Turn the chisel around, and make another chop aimed at the first. The result is a V-shaped opening at the middle of the mortise's length. Alternate the chisel's position in this way, enlarging the V-shaped

Fig. 4.6 Using both hands on a marking or mortise gauge might seem like overkill, but the oak is very fibrous, and when it's green it can catch the gauge's pins. The result can be irregular and it's hard to re-mark a line once it goes astray. Extend the marking lines beyond the top and bottom of the mortise, this way you can check the spacing of the joint if you find you need to reset your gauge – if, for instance, it falls on the floor.

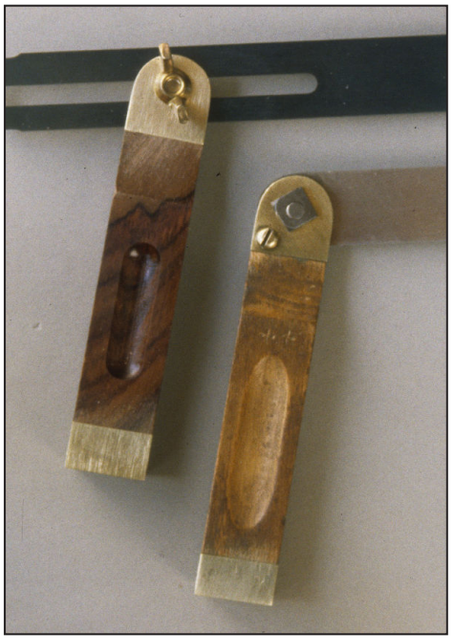

Fig. 4.7 Here is an adjustable bevel, and the modified one Alexander turned into a fixed bevel. If you are using one flare angle regularly, this is the way to go. It's easy enough to come up with an extra adjustable bevel.

Fig. 4.8 Marking this angle is the same as any layout, a couple of light passes will carefully scribe a line on the stile. We have often joked that this step requires two consecutive thoughts. It might be three.

Fig. 4.9 This is the first pair of blows with the mortise chisel. Note the chisel's bevel is just about plumb.

Fig. 4.10 Here, the stile is held in place by a holdfast, with a scrap of pine between the holdfast's "pad" and the stile. This prevents bruising the stock.

cut; the goal is to reach the depth at the center of the mortise as quickly as possible. Then the rest of the work is just cutting down the end grain, to lengthen the mortise. As you get to the ends of the mortise, bring the chisel upright so that its back surface is perpendicular to the stile's surface.

There are a few stances and postures we use that increase the efficiency in mortising. For most of the work the chisel is driven with a mallet, but sometimes hand pressure is useful as well. When using hand pressure, it helps if you rise onto the balls of your feet and come down with your whole body to drive the chisel. Lean on the top of the chisel handle with the front of your shoulder to help drive the tool into the wood. Then you can pry the waste up from the bottom of the mortise. In fig. 4.12, the left hand is used to position the chisel, and the right hand and upper body are driving the tool into the wood.

It is critical to keep the mortise chisel parallel to the face of the stile. You can sight against a square positioned on the benchtop. Drive the chisel into the mortise, and then step back and sight it against the blade of the square. With practice you will learn to sight this against the face of the stile, and not need the square.

Fig. 4.13 A nice stout mortise chisel is essential when prying the material out of the mortise.

Fig. 4.11 Coming at the mortise first this way, then that requires some shift in posture. Experiment with different methods to see what feels best. The idea is to get the mortise chopped quickly and easily.

Fig. 4.12 The amount of work that is split between hand pressure and mallet-driven will vary. Moisture content plays a role in this, drier stock is less forgiving with hand pressure. But either way, oak will convince you to use your whole body.

The moisture content of the oak is important at this stage; usually it's fairly wet inside when you chop these joints. The stock in the photos was planed wet from the log less than a month before cutting these joints. The straight-grained nature of the riven stock makes mortising easier than ever. The same principles that apply to splitting apply here as well. In effect the chisel is entering the wood directly on the either radial or tangential plane.

Chop the mortise to a depth of about 1½". It's easiest to get that depth at the middle of the mortise; at the ends it requires a little more attention. There is a tendency to pry against the end grain of the mortise – this will bruise and deform the wood there. Stay away from the final ends of the mortise at first, that way you can pry against the end grain that will end up as waste. Finish up by taking cuts straight down the end grain with the back of the chisel perpendicular to the stile.

To get the last bits out at the bottom of the mortise's ends, chop straight down into the ends, then turn the chisel around, and with the bevel down, drive the chisel into the midst of the mortise, and come towards the ends. Now bring up the chip on the back of the chisel.

Fig. 4.14 Here, the mortise's bottom is ragged, but it doesn't need to be much cleaner than this. The tenon will never reach that far.

Fig. 4.15 This photo and previous one were shot between a piece of oak and a pane of plate glass. This allows a cross-section view of a chisel cutting a mortise. This experimentation was quite helpful in understanding what goes on during the mortising process. Thanks to Roy Underhill for teaching us this technique.

Fig. 4.16 Lay the burnisher flat on the cutting face. You only need to work near the bit's end. It's not necessary to sharpen all the way up the flute. We usually only sharpen one side, but piercers are made to bore holes both clockwise and counterclockwise. Sharpen the side or sides according to how you will use the tool. Do not touch the outside of the piercer.

How to Sharpen A Piercer Bit

Like any tool, there are a lot of different ways to sharpen piercer bits. Files, stones, burnishers and more. We sharpen them on the inside only. Many different methods will work, including using burnishers, files and stones. The best tool we have found for sharpening these bits is a triangular burnisher. If you can't find one, then you can take a worn-out triangular file, grind off its teeth and mount it in a handle. Then you can use it as a burnisher to turn the piercer's edge from the inside. Mark Atchison, a blacksmith we have worked with for years, has a nice method of getting these things really sharp. He uses a worn-out round file, and grinds the end of it square and uses it as a burnisher to run down the inside of the piercer. Save your old worn-out round files; you can use various-sized burnishers to fit different-sized piercer bits.

Fig. 4.17 All you need to sharpen the piercer bit is a triangular burnisher, like the one shown here mounted in a turned handle. It is hard enough to turn a hook on the piercer's steel.

Fig. 4.18 This version of sharpening a piercer is not all that different from the previous idea. Blacksmith Mark Atchison pushes the file/burnisher down along the inside of the piercer's flute. This creates a hook, much like on a cabinet scraper.

Fig. 4.19 Boring with this type of bit requires some downward pressure because the piercer bit doesn't draw itself in. You can lean with your shoulder, forehead or chin. Try different approaches and use one that works.

Fig. 4.20 If the holes are too close to the ends of the mortise, you might blow out the tenon's edge later when pinning the joint. Once you're finished boring the holes, you might go in the mortise with a paring chisel to clean up the interior surfaces.

Boring Pin Holes

After mortising, bore the holes for the pins that secure the mortise-and-tenon joinery. Each apron mortise has two pin holes; the stretcher mortises have one. If you bore them as you go, you save having to bore 24 holes in succession. Also, seeing the pin holes bored in the stile instantly shows you that its mortising is complete.

Our piercer bits (see page 23 in the section on "Tools") are antiques, usually late 19th- and early 20th-century examples. At that time, these were sometimes known as "table bits" or "shell bits." These work like a spoon bit, giving us the characteristic torn grain seen when the bit's reaming action comes around from the long fibers to cutting across the end grain of the stock. Alexander coined the term "sprucks" to describe the grain disturbance and sound resulting from boring with this tool. The hole this bit makes is a somewhat elongated oval, tilted over just a bit.

You can use other bits for your pin holes, another antique bit is a gimlet, which is much like a piercer, but twisted.

Fig. 4.21 On your first few stools, it's helpful to align the adjustable bevel to sight against. Over time, you will get the feel for the angle and be able to chop these mortises without it.

Fig. 4.22 This is one of those movements that comes from your whole body. Brace your forearms against your torso and bear down with your shoulder against your hands.

Most modern bits will produce holes that look too round for period work. It comes down to a question of how much detail you want. Round holes will still work for drawboring your joints; we prefer using a period-style bit.

Eyeball the position of the pin holes in relation to the chopped mortises. They should not be too close to the top or bottom edge of the tenon. Their distance from the stile's inner arris equals the width of the bit or a little more. For the stretcher mortises, put the pin hole in one face slightly above the center of the mortise's height, and the adjacent one just below. This way the pins will not interfere with each other. When boring through the 2"-thick stiles, back the bit out from time to time to remove the packed shavings from the bit's flute.

Chop the Angled Mortises

Chopping the angled mortises is much the same as the straight ones, but take some care at the ends of the mortises. These, instead of being square to the stock, tilt up toward the top of the stile. Set your bevel on the workbench to help sight the chisel when you are cutting down the end grain. The top end of the mortise is easier to cut than the bottom end. At the bottom end of the mortise, you are cutting into the end grain and it's tough stuff; but several small chops will get it done. When cutting these mortises to depth, you will usually blow through into the first set. Not to worry; your tenons will be trimmed so they don't hit each other inside the stiles.

Tenons on the Rails

The sequence used for handling rail stock once it's planed to size is thus: Mark the shoulder-to-shoulder distance with the square, bevel and awl. Scribe the tenons' thickness and placement with the mortise gauge. Scratch or plane any mouldings, then cut the shoulders with the saw. Finally, split off the waste cheeks of the tenons. Pare each tenon to fit in its respective mortise during test assembly.

There are many ways to organize this work; each has merits and drawbacks. We have found it sometimes clumsy to scratch mouldings once the tenons are cut – the ends at the tenon shoulders don't cut as cleanly as we would like. Similarly, we dislike laying out the joints once the mouldings are cut. If there is a moulding at the bottom edge, it affects the way the mortise gauge rides on the face of the stock. Marking the tenons, then cutting the mouldings, then cutting the tenons is a little back-and-forth, but we have found it gets good results. There is no telling how this work was organized in period shops.

Using a square and an awl, scribe the shoulders of the tenons on the rail stock. Make sure the square's handle bears against the true edge of the rail. Once the first rail is marked shoulder-to-shoulder, then line up the next rail to it and transfer these marks to the other rails of the same length. For our stool, we are making the long rails 10" from shoulder-to-shoulder. It is not critical that you hit this 10", but it is critical that all four rails (two aprons and two stretchers) are equal in their shoulder-to-shoulder dimension.

Mark the tenon's width and placement with the mortise gauge, just as you did for the mortise itself. Check the gauge on the mortised stock to be sure that its setting is still reading the same as when you marked the stiles. Make certain that the gauge is pulled tight against the true face of the rail.

Fig. 4.23 17th-century joinery tolerates a great deal of variety in its textures and workmanship. But the tenon shoulders' layout is one of the places where you need to be absolutely accurate. Carefully scribe these lines. If you use a wooden square, check its blade from time to time to be certain that it's not deformed from use.

Fig. 4.24 Scribing this layout from one rail to another is the same concept as laying out the stiles' joinery. This method is favored over using a ruler to mark each rail. You need a ruler in your toolkit, but you don't want to use it too much.

Fig. 4.25 Once again, use both hands to scribe with the mortise gauge. Fix the rail stock in place as well. This reduces any chance of the gauge bumping around. You can shove one end of the stock against the bench hook and the other against your body. Mark all the long sides, then reposition the rail to scribe the end grain.

Fig. 4.26 Adjustable bevels are often small enough that you can grip the handle and blade in one hand, pinching the whole tool against the rail's top edge. However you hold the tool, be sure it has not lost its setting, and keep it steady while scribing the shoulders.

Scribe lightly several times to make a clear line. Extend the lines beyond the shoulders of the tenon. Remember to run them across the end grain as well.

The short apron stock for the canted end frames of the stool are laid out in a similar fashion to the front and rear rails. In this case, the shoulder is angled and marked with the bevel instead of the square. It is important to hold the handle of the bevel on the upper edge of the apron, (the true edge) with the blade running down and out. Mark the front shoulder, and carry this line across the edges of the stock with a square and awl. Then use the bevel again to mark the rear shoulder.

You will cut two angled aprons from one piece of apron stock.

Start at one end, mark the tenon's shoulder, making sure there is about 1¼" length for the tenon at the bottom edge of the stock.

Then measure at the top edge of the rail the shoulder-to-shoulder dimension (4¼") and then strike the angled shoulder with the bevel.

Mark off two tenons' length (at the bottom edge of the rail) and mark the shoulder for the next rail.

Then shoulder-to-shoulder, then one more tenon. It sounds more complicated than it is.

Now you have laid out the tenons, the next step is to do any moulded decoration before cutting the shoulders.

Two Methods of Moulding

One method of decorating the rails of joined stools features mouldings cut either in the face of the rail ("crease" mouldings in the period) or at the bottom edge of the rails. For either of these mouldings we prefer a "scratch stock" to a moulding plane. The scratch stock is a shop-made tool used to scrape the moulding's profile in the stock. Both methods were known and used in the 17th century. We don't know what period scratch stocks looked like, nor what they were called. But some period joined work has short runs of mouldings that fade in and out at the ends, something that usually cannot be done with a plane.

We use two different configurations of scratch stocks, depending on whether the moulding is a crease moulding or an edge moulding. For the crease mouldings make a scratch stock that works like a marking

Fig. 4.27 Make your scratch stocks from hard woods. This one is has a maple staff, an ash fence/head and a hickory wedge. A mixed bag to be sure, but it's worth keeping a selection of dry, straight-grained hardwoods around for just this sort of project.

gauge; simply use a profiled cutter instead of a pin. Secure the blade in a saw kerf in the beam. Close this kerf with a screw. Blades are made from saw steel – the thicker the better. Shaping the profile on the scratch stock calls for careful work. A saw-sharpening vise is a nice tool to secure the stock for filing. Use a large flat file to remove the bulk of the material, just outside the desired shape. Then cut the final pattern with smaller files, both round and flat. The blade's edge is square to the sides. The moulding's profile is perpendicular to the surface of the blade and will scratch from both directions. Shape the profile with small files.

The scratch stock pictured cuts a small bead. In this case, the bead is the first step in some carved decoration. Hold the tool just as you would a marking or mortise gauge and lightly scrape the moulding. Repeated strokes will develop the shape cleanly. By now, the surface of the stock must have reached that point that we call "workable moisture content"; dry enough to cut cleanly, and still green enough to cut easily.

Next use a small carving gouge to chop straight into the bead shape to begin de-

Fig. 4.28 The most common form of scratch stock, this time it's made from an off-cut of riven oak. You can cut a shape on each end of the blade and then switch it around for a different moulding. Make these as you need them. The price is right, as is its effectiveness and ease of use.

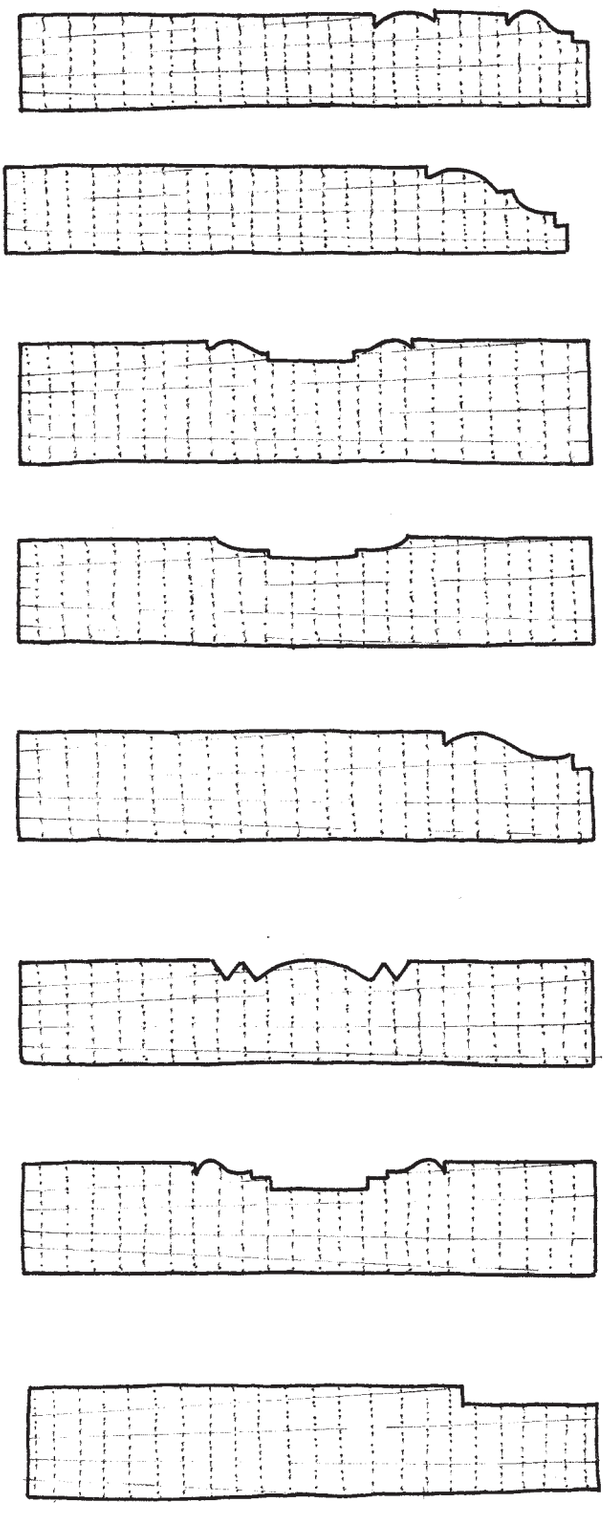

Fig. 4.29 The names of moulding profiles are derived from architectural antiquities. Both Joseph Moxon and Randle Holme list a number of moulding planes by name. Both writers include the round, hollow and ogee. Moxon adds snipes-bill and rabbet planes, and includes the grooving plane as a moulding plane. Holme adds the "Belection" [bolection] and the "Back-Ogee" planes. An additional unpublished note by Holme mentions the "Phalister" plane. Names we have seen in probate inventories and other court records add "revolving" "cresing" and "inboring" planes. It can be confounding to try to match these names to existing shapes; especially given the regional nature of some terminology and the mutable shapes created by blacksmiths or the joiners themselves. We'll leave it to the tool historians to work out the details.

fining a simple pattern. Ideally, the scratch stock is made to match the size of your carving gouge. Hold the gouge perpendicular to the stock and strike it once with a mallet. Eyeball the spacing of these cuts. The next step is to angle the gouge behind the first cuts and chop out the chip. You will sometimes need to move the tool laterally at the end of the cut to get the chip to pop out. Avoid the urge to try to flick the chip up with the gouge.

For mouldings at the bottom edge of the rail, use a scratch stock in a pistol-shaped handle. The blade fits tightly into a saw kerf that runs down the barrel to the handle or fence. The blade's inner edge seats firmly against the end of the saw kerf and is locked in place by a bolt or screw immediately tangent to the blade's outer edge. For edge mouldings, run the saw kerf ¼" into the handle so that a matching projection on the blade can fit into it. The bottom edges of the barrel are chamfered so that shavings do not jam in front of the blade. Things go easier if you first bevel the rail's edge with a plane; then the scratch stock removes less stock to finish the moulding's profile. You can mark this profile on the end grain before you begin to see how much of a bevel to cut. Then scratch the moulding. Concentrate on keeping the handle tight against the edge of the rail.

Rabbets and Edge Moulding

Rabbets, a special case of edge moulding, can be used to emphasize the bottom edges of rails. Make these with a rabbet plane. You can use a shoulder plane, essentially a metal-bodied variation on the rabbet plane. One nice thing about shoulder planes is that they usually have a low-angle blade, set with its bevel up. This slices the wood very cleanly. The downside is that they take a thinner shaving than we like. Thus, the wooden rabbet is still our tool of choice. (See page 90 for a photo of the plane in use.) If your rabbet plane has no fence, run it against a batten clamped to the stock. Make your rabbet about ½" to ¾" wide. You can eyeball the depth; it's just enough to throw a shadow on the rail. And don't make the rabbet so deep that it cuts into the face of the tenons. Rabbets are sometimes enhanced with gouge-cut decoration similar in technique to that described above. Others can use a zig-zag motif cut with a chisel, often

Fig. 4.30 Carving is a study by itself, but this is the simplest shape to get the hang of – one tool, two moves. This form of carved work is utilized in most 17th-century carved oak.

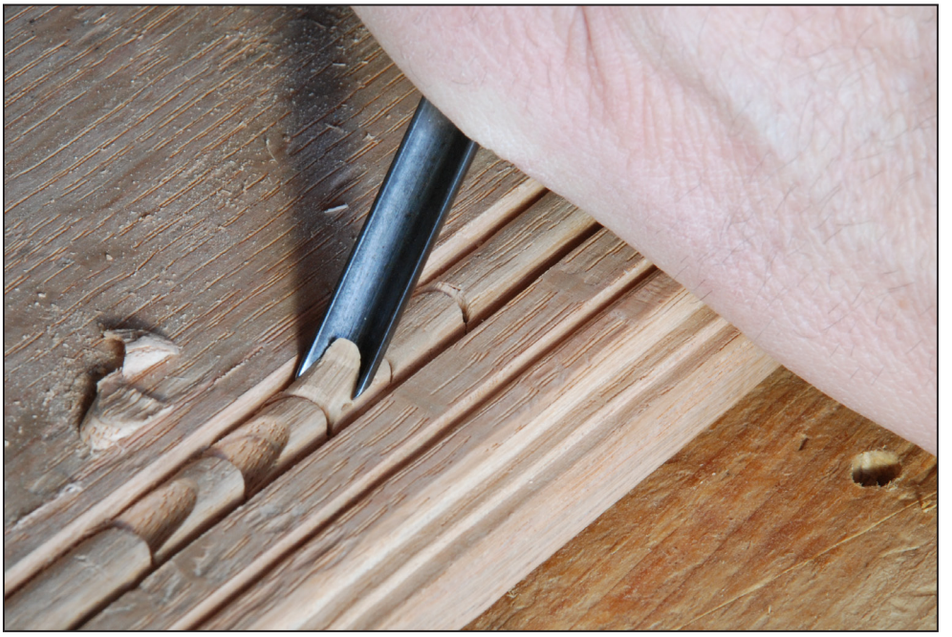

Fig. 4.31 Here is the chip coming up as the gouge meets the first incised vertical cut. Learn this, and any blank piece of oak becomes something more....

Fig. 4.32 This pattern is best used on a moulding like this; the effects of light and shadow are quite strong.

Fig. 4.33 This is a moving fillister plane, which is basically a rabbet plane with a movable fence attached to its sole. The best ones have skewed irons. This one has a depth stop that you needn't be concerned with for this sort of work.

then treated with a two-color paint scheme.

Some period moulding profiles have a central flat section, (a fascia) flanked by either beads, ogees or other shapes. We make these mouldings with a combination of a plow plane and a scratch stock. The plow plane is a grooving plane with an adjustable fence. It has interchangeable irons, often in sets of eight. First, set the plow plane to cut a flat groove about ½" wide down the center of the rails' width. Now, using a scratch stock that will reach into the area just plowed, scratch a small moulding that runs right against the edges of the plowed groove. If you made a scratch stock that has the full-width profile, you can make this moulding with one setting of the tool; if you have just made the detailed shape that flanks the groove, then you need to scrape one side, then adjust the scratch stock and scrape the other side.

Cut the Tenons' Shoulders

Take one of the rails and secure it in the wooden bench hook with its face up. A right-handed joiner uses the left hand to brace the stock in the bench hook, with the scribed shoulder just beyond the end of the cleat. Position the saw's teeth on the far edge of the rail, hitting just to the waste side

Fig. 4.34 The rabbeted lower edge of a rail is often further enhanced by a chopped decoration, in this case it was done with a carving gouge and a homemade punch in the form of a small cross.

Fig. 4.35 This scratch stock uses a marking-gauge type format; it's cutting both sides of the plowed groove at the same time. Sometimes you need to lean this way or that, depending on how the cutter fits into the staff.

Fig. 4.36 The shop-made miter square is taken right from Moxon's plate of joiners' tools. Sometimes we've seen this zig-zag motif done freehand, but it only takes a moment to lay it out.

The Zig-zag Motif

The sawtooth, or zig-zag, motif is a simple one to cut. Once you have planed the rabbet in the bottom edge of your rail stock, use the awl and miter square to mark the alternating lines to form the pattern. Then holding a wide chisel perpendicular to the rail, chop down heavily into the stock.

It's best to chop all the marks that aim one way, then turn the chisel around and come back to chop the other half. This method helps you be more consistent, and it's easier on your body. Now, using the chisel with hand pressure, hold it with the bevel up and pare toward the incised lines you just cut. It sometimes takes a couple of passes to reach the full depth. Again, do all the cuts heading one way, then turn around and do the others.

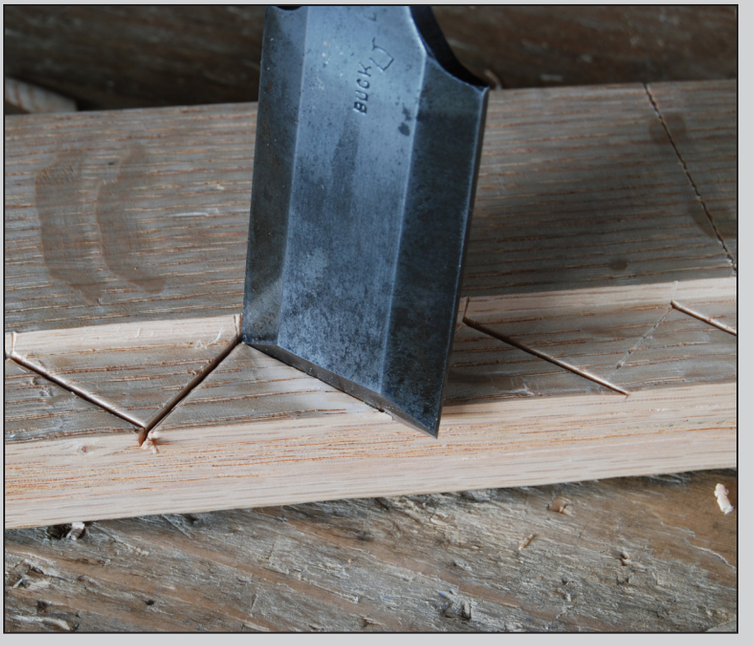

Fig. 4.37 Make sure the rail is flat on the bench when you chop into it. It can bounce around a lot if it's unsupported underneath, making the work awkward and difficult.

Fig. 4.38 Use a nice sharp chisel and some raking light for these cuts. In a sense, this is like the gouge-cut carvings done on the scratched mouldings earlier. Make a vertical incised cut, then remove a chip down to that cut. Then light and shadow.

of the scribed line. It helps to bump your thumb up against the sawblade to keep it from skittering into your stock. Hold the saw plumb and lift the handle slightly, thus starting the cut just across the corner of the rail. Now tilt the saw just a bit, so that the back of the saw is leaning away from the finished face of the rail. This will give you an undercut tenon shoulder.

The initial stroke is a light push with the saw to begin the kerf. As you saw back and forth, lower the handle so that the teeth begin to cut parallel to the plane of the rail's face. While you bring the saw down, be sure to keep the saw cutting right at the line. A few light strokes are all you really need; keep in mind that you are sawing only 5⁄16" deep. Watch the scribed lines that designate the tenon's thickness. A few practice cuts will be worthwhile to get the hang of the undercut. Remember that sometimes your rail stock is tapered in cross-section, depending on the riving and planing you have done. So there are cases where the saw's teeth are not parallel to the plane of the benchtop. Keep checking your progress against the layout lines struck with the mortise gauge.

Another method that is helpful for beginners is to create a shallow trench for the saw's teeth to ride in as they cut the tenon shoulder. In this scenario, cut the scribed lines with a marking knife instead of an awl. Using a sharp paring chisel, shave a slight bevel outside the scored line, making a triangular-sectioned trench about 1⁄32" deep and 1⁄8" wide across the face. When you place the saw in the chiseled trench, its teeth rest below the surface of the rail's face. This scored edge is your final finished tenon edge – it will never be worked again. Saw the undercut shoulder as described above. Then saw the inside tenon shoulder inside the layout line on the back of the stock. The inner tenon shoulder is not a part of the joint. This sawcut does not need to be undercut.

Because the rails have been made of rived straight stock, the waste outside the tenon cheeks can be rived away with a broad paring chisel or a small cleaver. Hold the stock vertically, either in a vise or the double screw. Split off the waste with a chisel and mallet. Hold the chisel by the blade, not the handle. Place your fingers on the back of the blade and on the end grain. This reduces the chance of the chisel splitting too far down the rail stock. Learn to read the ray plane on the end grain and split so any rays that are not parallel to the tenon cheek are running out of the tenon, not into it. This way the waste pops off without ruining the tenon. At the same time, read the grain on the edges of the stock to be sure it too is running straight. Usually you should split just outside the scribed line to get an idea of how true the grain is running. Alexander uses a small cleaving knife when making these splits; the benefit there is that the cleaving knife's length spans the width of the tenon, reducing the risk of a split running across the tenon's width. A hacking knife is an excellent modern substitute for a cleaving knife.

As you did with the angled mortises, leave the angled, side aprons for last. Here we are still working with this material longer than its finished size. It's just easiest to handle this stock when it is 15" long or longer, rather than in two very short sections. To this point, you will have laid out the tenons, cut any mouldings and then sawed the shoulders. Now the next step is

Fig. 4.39 The undercut shoulder is one of the critical elements in this joinery. It saves time when fitting the joints because only the scribed shoulder hits the mortised piece. It is just a slight tilt of the saw.

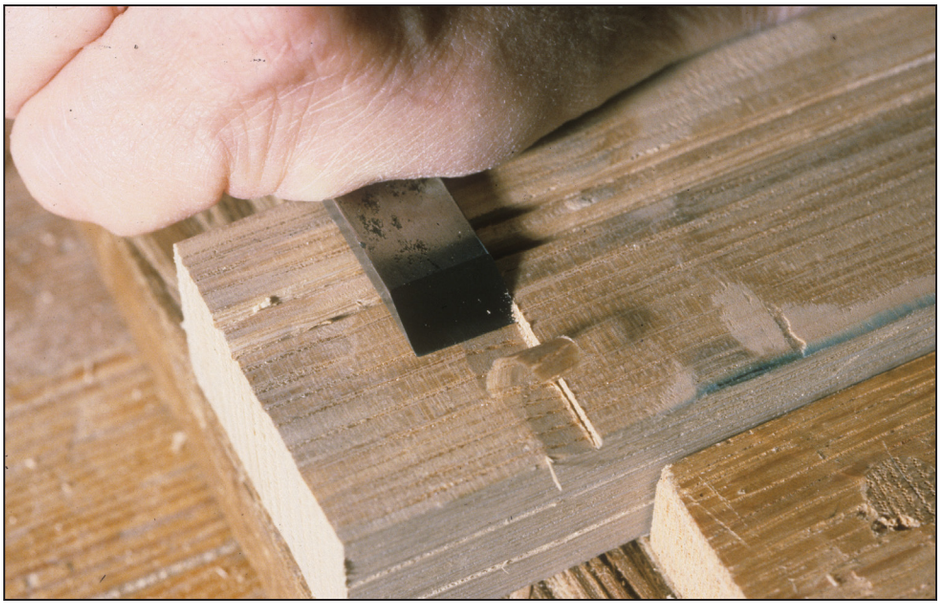

Fig. 4.40 Paring the trench for the saw helps keep the saw's teeth from skittering into the rail's face. With this method, the saw teeth never actually touch the rail's face, they start cutting below the face.

Fig. 4.41 This step is more akin to timber framing than modern furniture making. Its success comes from the intimacy with which you know the wood when you've worked it all the way from the log. Straight-grained oak is the key.

Fig. 4.42 Your fingers hit the rail's end grain to stop the motion of the chisel. That way, you don't drive the chisel into the shoulder.

Fig. 4.43 The hacking knife/cleaver spans the full width of the tenon, so it's one position and one whack.

to crosscut the piece in half and mark the newly exposed end grain for the tenons. After that, split the cheeks off. Marking the tenon thickness on the end grain with the moulded stock is a compromise. The moulded edge makes this layout less than perfect, but it's usually easy enough. If you marked the long edges before cutting the moulding, this layout can help sight where you need to position the chisel or cleaving knife for splitting the cheeks. For now leave the end cuts on these aprons square, you will trim them at test-assembly.

You will determine the shoulder-to-shoulder dimension of the side stretchers during a test fit. This again requires some back-and-forth work, but we have found it to be quite accurate. So in preparation, make your side stretcher with just one end tenoned for now. Check your bevel gauge, lay out the first tenon, and cut it just as before. We'll come back to this stretcher later to get the second tenon marked and cut. Now it's time to let the tenons sit and dry some while you go back to the stiles and work on the turned decoration.

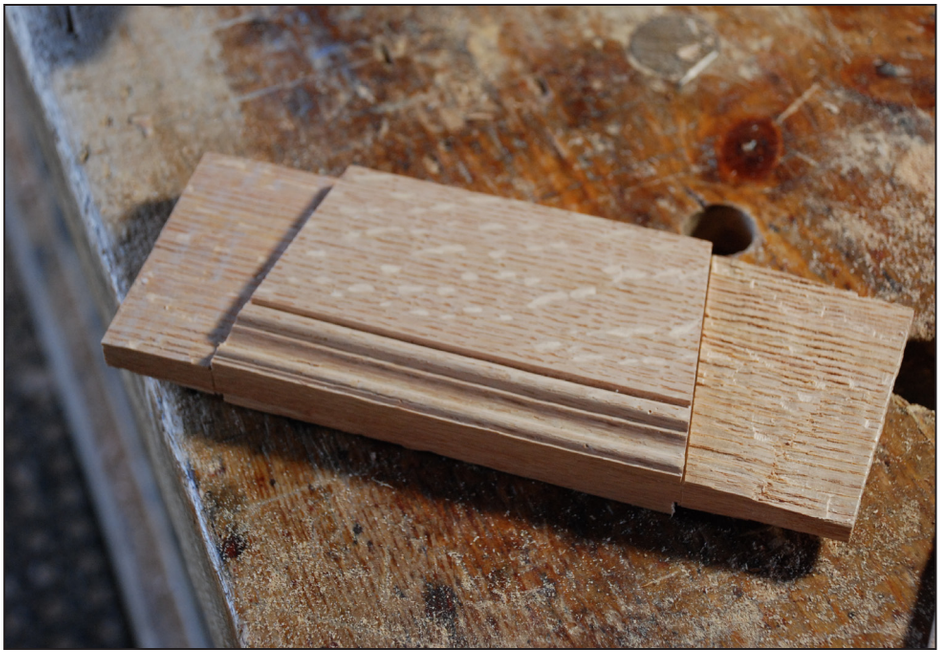

Fig. 4.44 Once the tenon is pared to fit its mortise, you will cut the ends of the piece to agree with the angled shoulders.