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Joinery: Mortises, Tenons & Mouldings

OW WE CAN RETURN to the framing parts, starting with the stiles. The first step is to lay out 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 the 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 foot 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 $\frac{3}{4}$ " 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 any-thing. Joint stools will give you lots of practice – there are 16 joints in each one.

Fig. 4.2 This story stick 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. If you make a number of different stool patterns, mark them with the date.



Fig. 4.3 Prick the points with the awl, 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 chiselwidth. 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"wide, 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 removable 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 upward 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 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 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. 4.13 A nice stout mortise chisel is essential when prying the material out of the mortise.



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, 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. 4.12 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

Fig. 4.11 Coming at the mortise first this way, then that way 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.

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 either the radial or tangential plane.

Chop the mortise to a depth of about $1\frac{1}{2}$ ". 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 toward the ends. Now bring up the chip on the back of the chisel.



convince you to use your whole body.





Fig. 4.15 This photo and the 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 experiment 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

ike with 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 bits 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 edge 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. Its steel 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.