Using a Hollow-Chisel Mortiser

One man's techniques for a machine vital to his craft

by John W. West

Some time ago, fresh out of school, I practiced architecture for several years. I discovered early on that I had to make too many compromises to practice my trade. Now I own and run a small custom woodworking business, and I'm often awarded jobs that demand we make things in limited production quantities. It's not unusual to get an order for two or three dozen large doors or to do a kitchen requiring 50 to 60 cabinet doors. For these jobs, I'd be lost without my mortiser.

I use a manual, foot-operated hollow-chisel mortise machine. There have been times when I would have appreciated the brute strength and speed of a pneumatic-operated chain or oscillating mortiser. But the one I use will produce a square-bottomed, square-ended mortise. It's easy to set up for angled or canted mortises, and it's the only type that will make a single square hole, like those in window-sash bars and louvered doors.

With a little ingenuity and some jig making, the hollow-chisel mortise machine will handle any angle or curve. I've used mine for cabinet face frames, chairs and benches, curved windows, lock sets, miniature fretwork and 10-ft.-high by 2½-in.-thick doors. I could cut mortises by hand or use either a drill-press attachment or one of the benchtop mortisers that have come onto the market in the past few years (see the photos at right). Neither of those would do the job as quickly or as accurately, but they are options.

Three ways to cut mortises. *The author uses a large foot-operated mortiser (left), a capable but expensive tool. Alternatives for smaller shops include dedicated benchtop mortisers like this Multico (below) and an attachment for a drill press (bottom).*

How the tool works

The cutting tool consists of a square hollow tube with a relief, or emptying slot, cut out of one face (sometimes two slots on opposing faces). The tool is internally flared and sharpened at one end and turned down at the other end to fit into a collet (see the drawing at left on the facing page). Within the tube is a double-spur machine bit (with no point) that telescopes through the chisel and fits into a drill chuck. The way it works is simple: As the tool plunges into wood, the bit drills a hole and the chisel cleans out the corners by scraping the side walls, producing a square hole. Multiple plunges in line produce a rectangular mortise slot. Chisel sets come in square sizes from ¼ in. to 1 in. and in various lengths.

Setting up and troubleshooting

There are two ways to set up the tool in the machine. Most manufacturers recommend this procedure: Slide the bit into the chisel,

Photos at right: Boyd Hagen

install both through the collet and place a 1/32-in. spacer (1/16 in. for sizes 3/4 in. and larger) between the chisel shoulder and the collet. Push the bit tight to the bottom of the chisel tube, and tighten the bit in the drill chuck. Then remove the spacer, push the chisel shoulder tight to the collet and tighten the collet clamp. This method provides the recommended clearance between the bit tip and the chisel tip, which prevents heat buildup from too much friction.

I prefer another method: Install the bit and the chisel assembly through the collet, push the chisel shoulder tight to the collet and tighten the collet clamp. Push the bit into the drill chuck, and sight the bit tip and chisel tip, adjusting the bit up or down until the straight cutting edge—not the spurs—of the bit is in line with the pointed corners of the chisel (see the top right drawing on this page). Tighten the bit in the drill chuck. I like this method because it's easier for me to get the cutting edge in line with the chisel points. And even though I risk more heat buildup, I'm convinced I get less wear on the tool.

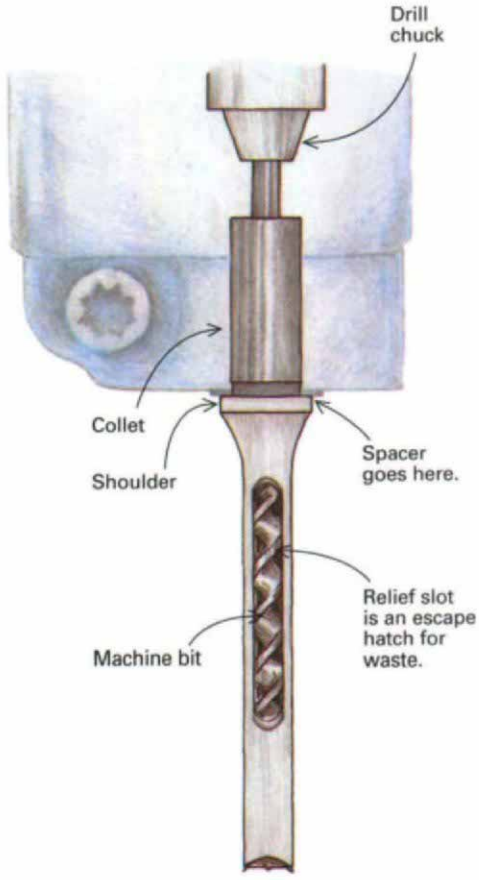
When I have to cut mortises 1/2 in. or larger into hardwoods like ash or white oak, I set up the tool a little differently. I keep the bit's Cutting edge as much as 1/16 in. below the corners of the chisel. This produces a little less resistance in the plunge. Under too much stress, tips will snap off. However, I have found that the incidence of tip breakage is the same for either method and is very rare. Allowing the bit to stick out much more than 3/32 in. from the chisel tip may cause it to begin oscillating within the hollow shaft, causing scoring and damage to the interior of the chisel.

Bits do rub against the inner wall of the chisel during normal operation. Older, much-used bits occasionally will begin oscillating, but they will stop when the plunge is started. This doesn't seem to affect performance, until the oscillating becomes so severe the bit tip wanders when the plunge is started. The only cure for that is to buy a new chisel.

Another serious problem can occur when the chisel overheats (see the photo above). This happens most frequently with smaller tools (1/4 in. to 3/8 in.) when mortising deeply into resinous wood like cherry or sugar pine. Hot debris collects in the flutes of the machine bit between the chisel tip and relief slot. If the material is not forced out the emptying slot with the next plunge, enough heat and pressure can build up to split the chisel. This usually happens on the weaker relief slot face at the thinner tip area (see the bottom right drawing). Plunging quickly helps prevent the problem.

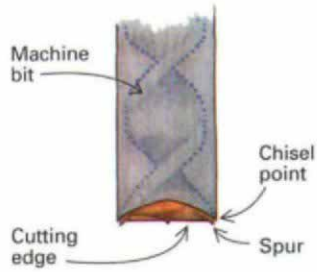
Overheating can be a problem, *especially with smaller bits and resinous woods, when chips get clogged inside the chisel. The faster you plunge, the less likely this is to happen.*

A mortise chisel and bit



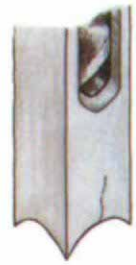
The cutting edges

When setting up his machine, the author takes pains to align the cutting edge of the bit with points of the chisel. Notice that the spurs of the bit make the first contact with the wood.



A chisel gone bad

The heat and pressure of clogged debris may cause the steel to crack, usually on the weaker relief side of the chisel.



When installing the tool into the machine, place the relief slot (as you face the machine) 90° to the right. The waste empties away from the direction of the plunging and away from the operator (hot debris can hurt). The weakest axis of the chisel is captured between the side walls of the mortise, decreasing chisel flex. Plastic drafting triangles work well for squaring up chisel to fence, as shown in the photo on p. 72, or setting the chisel on an angle.

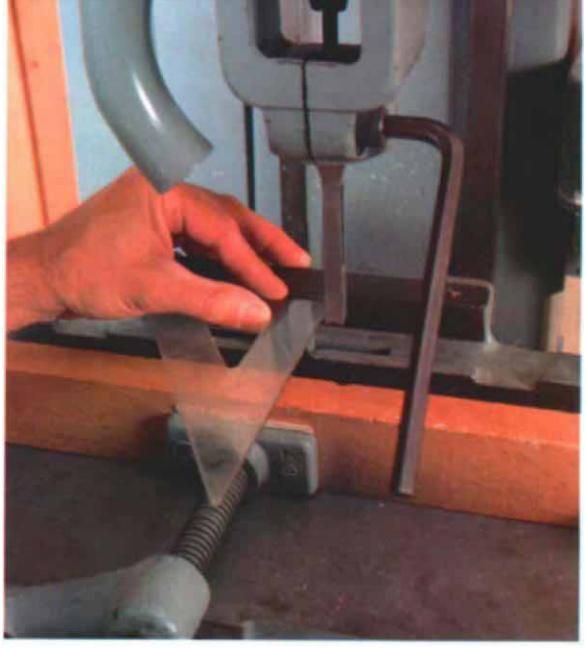
Plan your joints first

You must allow for the seasonal movement of a rail when laying out mortise-and-tenon joints. A wide rail locked tightly between

Drawings: Christopher Clapp; photos except where noted: William Duckworth

both ends of a mortise will be forced to cup when expanding in high humidity. This may create a bulge or even a split in the stile around the mortise area. I've seen stiles split out at the ends because the rails were locked in too tightly. It is best to accommodate movement so that as the rails expand, they'll move toward the inner part of the frame, as shown in the center drawing below. This is especially important for inset cabinet doors, so they won't bind.

I've always been dead set against gluing opposing grains. The joints break down after many years of service. I've never glued a mortise-and-tenon joint in a large interior or exterior door because I know it will last a lifetime. But narrow rails, depending on the species, won't move too much, so I glue these joints. (I prefer white glue; it has some elasticity when dry.) I usually pin the joint in some fashion.



Set the chisel square to the fence or at whatever angle the job demands. The author likes small plastic drafting triangles for this task because they're light and true.

Mark the joints precisely

After I've processed and sized the materials, I pair up the stiles, mark their faces and mark the faces of the rail stock. Machining of all the parts should be done with the faces against a fence, table or other fixed platform so that all parts are indexed from the face surface. This ensures that the relationship between the mortise and tenon will be the same on all pieces.

Establish and mark where mortise slots and haunch cuts begin and end. Using a sample piece, make a mortise to the desired depth (about ⅛ in. deeper than the tenon length) in its approximate location front to back. Use scrap from the materials being used.

Next make a tenon (with or without a cope) to the desired length, position it front to back on the rail (tenons are rarely centered on the stock) and thickness to fit the mortise. Then fine-tune the front-to-back position on the mortise machine so that the fit is flush on the face, or whatever position is desired. Remember that when you assemble frames with a coped and molded stile and rail, most copes will have a tendency to pull the tenon toward the face as the frame is clamped up, as shown in the bottom right drawing.

Making the plunge

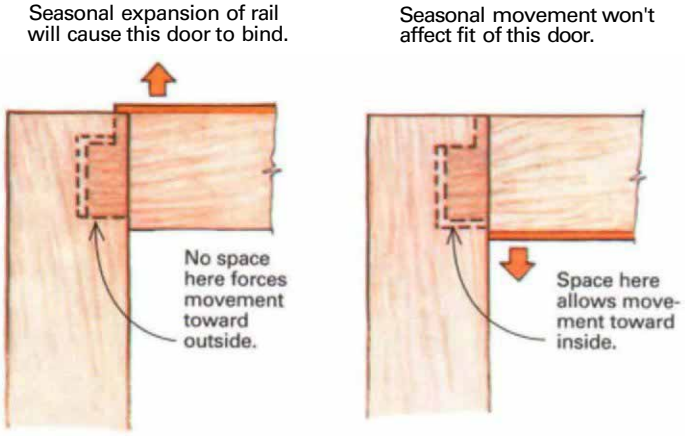
Plunging methods vary depending on the size and type of mortise and the material used. Facing the machine, I make the first plunge at the left end of the mortise. If I need to make a really deep mortise—too much work for the first plunge—I'll go as deep as possible, move to the right one-half the chisel width and plunge just short of the first hole's depth.

I return to the first hole and plunge deeper, repeating this process until the first hole is to the desired depth. I move to the right end of the mortise and make a full-depth plunge (or repeat the above process in reverse). Then, starting from the right and working to the left, I plunge one-half to three-quarters the width of the chisel with each overlapping plunge, until I reach the first hole on the left. I re-plunge in line from left to right. This cleans off the side walls and the bottom of the mortise. It's a little dangerous to drag the chisel across the bottom of the mortise to clean it; snagging may snap the bit tip, bend the chisel or both. But I do use this process for cleaning a tenon haunch, which isn't as deep.

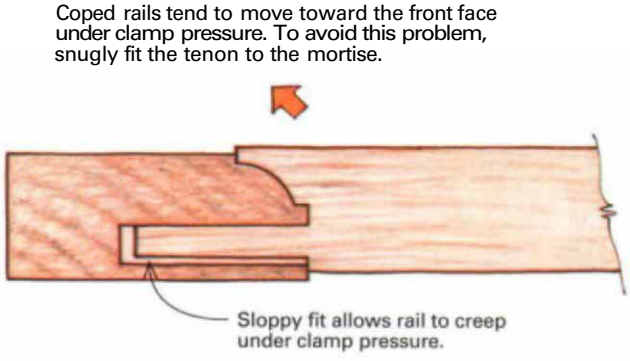
When the mortise slot is six or more times (my own rule of thumb) longer than the chisel size, I will make one or more midway holes between the left and right ends. This keeps the tool cutting straight on long mortises, especially when the edge of the mortise is close to the face of the stock. On very long mortises (for large door bottom rails, for example), I will split the tenon and make two mortise slots.

Cut haunches cleaner—On most frame-and-panel doors, a groove is cut in the rails and stiles to hold the panel. If this groove is the same width as the tenon, it can serve as the cut for the haunch. If not, a haunch cut must be made with the mortise ma-

Plan the joint for movement



Shape affects the fit



To limit depth, use a block. *Instead of resetting the machine for the shallow haunch, the author inserts a block of wood as a spacer (upper right).*

chine. When the machine is set up for the regular mortise, a stop controls the depth of the mortise. A second stop will serve to cut the desired haunch depth. Rather than reset the machine stop, I use a block of wood (see the photo at left) as a spacer to save time and trouble.

After the mortise is made, I plunge the haunch, working toward the end of the stile. Re-plunge the haunch from the outside back toward the mortise. Then, with the chisel pressed to the bottom of the slot, I slowly scrape the bottom of the slot clean with a side-to-side motion of the chisel. This produces a clean haunch cut, which may be visible at the end of a frame or top of a cabinet door.

Frames with no panels have joints that show—When making frames that have no panels, such as a cabinet face frame, a tight joint is required at the intersection of the mortise and tenon because the joint is not hidden inside a panel groove. Before cutting the mortise, I score the ends of the slot with a hand chisel the same width as the mortise. That helps prevent chipping.

I've noticed that the bit has a tendency to leave a slightly ragged edge as it plunges. I also use the chisel to shave back the tenon slightly, so it will go into the mortise easily but draw up tightly at assembly. Also, when the bit is exiting from the end plunge, it will sometimes snag on the edge and lift up some material with it. To keep that from happening, I exert slight pressure on the stock, with the wheel that controls the left-to-right movement of the table, keeping the chisel away from the edge of the mortise.

Large mortises need more passes—If you have to make a wide mortise and don't have a big enough chisel, make two separate mortise slots, leaving ⅛ in. or so of material in between. Go back and plunge out the middle. This is time-consuming. But if you overlap the first slot, the chisel will flex into it and produce a tapered mortise, and you'll have to taper all your tenons. In some cases, this routine may be your only choice because you'd have to be Godzilla to push a 1-in. chisel into a piece of hard maple.

Cut sash bars on both sides—If I have to make a through mortise for sash bars, I'll plunge from both sides to keep the mortise tracking straighter vertically and to eliminate tearout, which seems to occur even when I use a back-up piece.

Cut for lock sets before assembly—If I'm making a batch of passage doors or a lot of cabinet doors that require full-mortise

locks, I'll mortise all the stiles for the hardware before the doors go together. It's easier and more accurate than using a hand drill and chisels later on.

The benchtop versions

I don't use a drill-press mortiser, but I did try a few of the benchtop mortisers to see how the smaller machines compared to industrial-grade mortisers. Without going into a full-fledged tool review, I should say that I was skeptical of these machines before I got my hands on them. But I was surprised to learn how well a little ½-hp motor with a hand-lever driven, pinion-geared plunger could cut a fine mortise. The design is similar to the industrial-grade versions, but the devil is in the details. Driving the plunge by hand is more cumbersome and tiring, and the benchtop versions don't offer the same conveniences of table movement. The hold-down mechanisms are not nearly as strong and somewhat difficult and time-consuming to adjust.

If you're not in the market for a large mortise machine, I think you may be better off using a router. Unless, of course, you just want a new toy to play with. □

John West owns Cope and Mould Millwork Co. in Danbury, Conn.

Sharpening hollow chisels

by John Lively

You probably can get by with a slightly dull blade on your tablesaw or a less-than-exquisitely sharp slotting bit in your router. But if you're punching out mortises in oak or cherry with a hollow chisel, *very sharp* is a required condition. A dull hollow chisel just won't work. It takes lots of muscle to force a dull bit into the cut, and once buried in the stock, the bit sticks there. This is why you'll find more hollow-chisel mortising rigs in storage than in actual use.

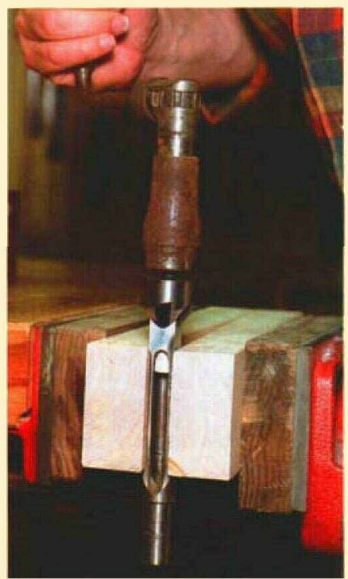
But if you keep your hollow chisels really sharp all the time, they'll cut crisply with minimal effort and back out of the hole with ease. With the right tools, sharpening hollow chisels can be an uncomplicated, uncluttered, quick affair.

Hone the outsides first: All four outside faces of the hollow chisel should be honed before you tackle the cutting edges of the tool. There are two reasons: First, you get sharper cutting edges, and second, you reduce binding in the cut. Honing polishes all those grinding scars, which act like treads on a tire, and reduces friction during cutting and withdrawal.

For honing the sides, I clamp the hollow chisel in my vise and use a medium-india slip stone (see the top photo at right). You could hone them on a benchstone just as you would the back of an ordinary chisel. Make sure you get a nicely polished surface on all four faces of the chisel—smooth and slick.

First, hone the chisel. *Use a small slip stone to hone all four outside faces of the hollow chisel until smooth and polished.*

Then ream the inside bevel. *interchangeable pilots fit different chisels. After selecting the correct pilot and mounting the reamer in a brace, gently grind the inside bevel. Any burrs may be removed with a slip stone.*



Then go after the bevel: Now that you've honed the four faces of the chisel, how do you get into the hollow of the tool to sharpen those bevels? Without the correct tool, that can be a big problem. A look through the stack of woodworking catalogs teetering on the back of your commode will reveal that almost every mail-order supplier offers hollow chisels. But few offer the simple little device you need to sharpen them.

This thing is a reamer, basically. Its body is a fluted conical cutter (sort of like a countersink). The reamer has a tapered square shaft on one end for chucking into a bit brace and a hole in the pointy end for accepting interchangeable pilots (see the photo at left). You insert the correct pilot into the reamer, insert the pilot into the hollow chisel and crank away gingerly (see the bottom photo) to remove enough tool steel to establish clean, sharp interior bevels. Return briefly to your stone to hone off any burrs, and you're finished.

I use a Clico reamer, which is available through Garrett Wade Co. (161 Avenue of the Americas, New York, NY, 10013; 800-221-2942). Wherever you buy one, make sure you ask whether the pilots fit into the bits you own. The Clico reamer that Garrett Wade sells, for instance, fits Clico's English chisels but may need a masking tape bushing to fit Taiwanese chisels. □

John Lively is the editor-in-chief of The Taunton Press.

Photos this page: Boyd Hagen