Mortising with a Router

Auxiliary fences, fixtures and templates help ensure quick, consistent results

by Gary Rogowski

I cut my first set of mortises by hand. It was a fabulous learning experience. I found that chopping through red oak was like digging postholes in dry clay. I had to resharpen my chisel after each mortise, but I learned. I also bought a router.

A router is the quickest and most accurate tool for cutting mortises. Its versatility and speed is unmatched, and it can be used in a variety of setups, both upright and upside down in a router table. In minutes, a router cuts mortises that would take hours by hand. And you can reproduce your results with a minimum of hassle or setup time. When I have mortises to cut these days, the router is my first choice. Either a fixed-base or a plunge router can produce excellent results.

Choosing the right bit

There are a variety of bit sizes and types that can be used for mortising (for more on router bits, see *FWW#116,* pp. 44-48). Two shank sizes are commonly available: ¼ in. and ½ in. Either will work, but bits with ½-in. shanks flex less under load, give a better cut and are less likely to break.

I don't bother with high-speed steel (HSS) bits because they need to be sharpened too often. Carbide-tipped bits cost two to three times more but they last much longer. Solid-carbide bits are great, too, but they're even more expensive.

Straight bits come in two flavors: single flute for quick removal of material and double flute for a smooth finish. Because you'll find double-fluted bits in most tool catalogs, you'll get more size options.

The flutes of a spiral bit twist around the shank. This gives a shearing cut that is even smoother than one from a double-fluted straight bit. Spiral bits are available both in solid carbide and carbide-tipped steel. They spiral up or down.

An up-cut spiral bit cuts quickly while pulling most of the chips out of the mortise. However, it also will tend to pull the workpiece up if it's not securely fastened. The up-cut spiral also can leave a slightly ragged edge at the top of the mortise where wood fibers are unsupported. Because the edges of a mortise are usually covered by the shoulders of a tenon, this kind of tearout generally isn't a problem.

A down-cut spiral bit pushes the work and the chips down. The result is a cleaner mortise but one that can become clogged with debris.

I have used mostly double-fluted straight bits and a carbide-tipped up-cut spiral bit. Recently, though, I bought a solid-carbide up-cut spiral, which cuts even better.

Using a fixed-base router

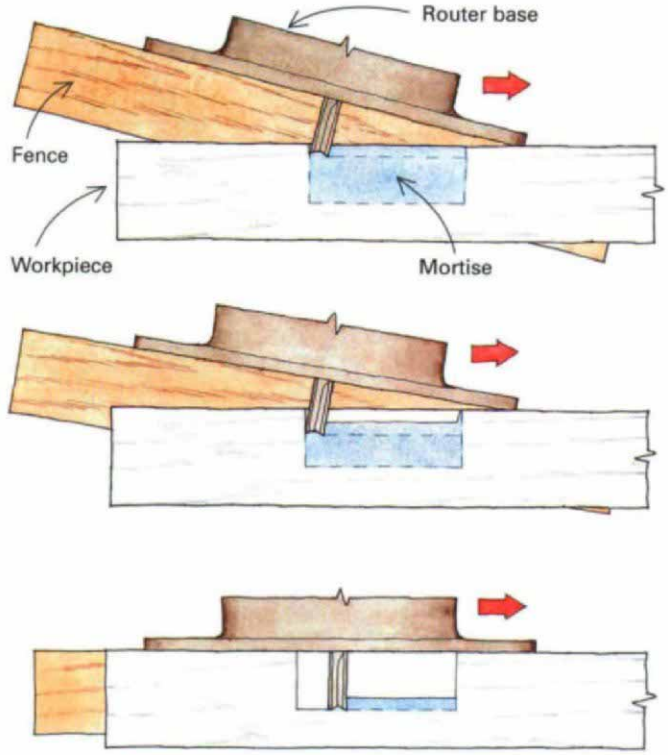
If the only router you have is a fixed-base router, you're not out of luck. It will just take a little more attention to detail and skill to get good mortises than it would with a plunge router.

A straight fence attached to the router is essential for accurately guiding the cut. Adding a long wooden auxiliary fence to your router's stock fence will give the router more stability. A second fence, clamped to the router base and on the other side of the workpiece, is a good idea, too (see the photo below). This fixes the position of the router laterally, so it can't accidentally slip to one side or the other during the cut. Combined with end stops, a double fence will virtually ensure accurately located mortises. The only thing left to set is the depth, and here you have a choice of methods.

Multiple depth settings—One way of mortising with a fixed-base router is to take just a little bite with each pass, gradually lowering the bit until you're at full-depth. The biggest drawback with this approach

Two fences keep a router in line. When routing to full-depth with a fixed-base router, you want to make sure it doesn't veer out of the mortise.

Mortising with a fixed-base router: You will get a cleaner mortise by setting the bit to full-depth right from the start. Cut the mortise in several passes with the router tipped at an angle.



First pass

The first pass, with the router held at an angle, should remove about ⅛ in. to ¼ in.. of material.

Second pass

The angle of the router is lowered for the second pass, but bit depth remains the same. This and each successive pass removes from ⅛ in. to ¼ in.

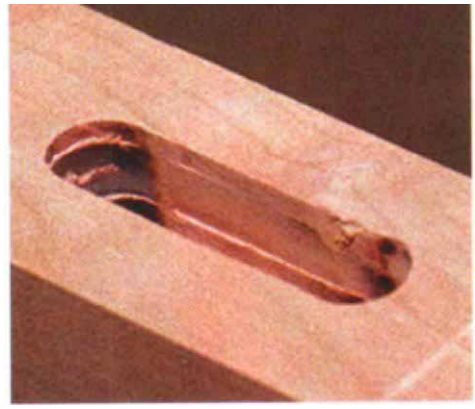
Last pass

The last pass is made with the router flat against the workpiece and the bit straight up and down.

Photos: Vincent Laurence; drawings: Jim Richey

is that it's hard to get a smooth-walled mortise. The reason is that the motor and, consequently, the bit may not stay centered in the base as you adjust the depth of cut.

With most routers, adjusting the bit height requires that you turn the motor in the base housing. When you do, the bit moves in relation to the fence, only slightly, but enough to give the walls of the mortise a stepped, rough surface (see the photo at right). Exceptions are DeWalt, Black & Decker and Elu routers, which employ a rack-and-pinion adjustment system that keeps the collet and bit centered at a fixed distance from the fence.



Multiple depth settings create steps. *To adjust the bit height on most fixed-base routers, you have to twist the motor in its base. This often results in stepped, sloppy sidewalls.*

One depth setting—*One* way around this stepping problem is to set the bit at full depth right from the start. To mortise, you just move the router at an angle to the workpiece so you introduce a little more of the bit to the wood with each pass (see the drawing and photo on p.73). The router is tilted, resting on one edge of its base, until the final pass is made. An extra-wide auxiliary fence is advisable, and a second fence clamped to the router base on the other side of the workpiece is essential.

Router-table mortises

Why would anyone want to cut mortises on a router table? Well, for narrower stock, a router table provides plenty of support. When routing narrow pieces from above, a hand-held router can become tippy and unstable. The edge of a door stile, for example, just doesn't offer very much support for a router base. With a router table, you have both the table and the fence against which to register the workpiece, and you only have the weight of the workpiece to control. For small table legs or cabinet doors, mortising on the router table is worth trying.

When mortising on a router table, use the fence to position the mortise from side to side and stops to establish the ends of the mortise. As you face the table, the work should move from right to left. This feed direction will help keep the work tight against the fence. Start with the workpiece against the right-hand stop, and lower the work into the bit. Because most bits don't cut in the center, it helps to lower and simultaneously move the work along just a little to avoid burning. Move the workpiece from right to left across the bit until it hits the other stop.

If you're using a plunge router, you can set the turret stops for incremental cuts, make three passes and finish up at full-depth. But if you're using a fixed-base router, you'll have a problem getting a smooth-walled mortise if you adjust the bit height between passes—just as you would when using the router upright.

My solution to this problem is to use shims made from ¼-in. hardboard, like Masonite, notched around the bit, to elevate the workpiece above the table (see the bottom photo). In this way, I can set the bit at full height and just remove a shim after each cut, gradually working down until the workpiece is on the table and the last cut is made.

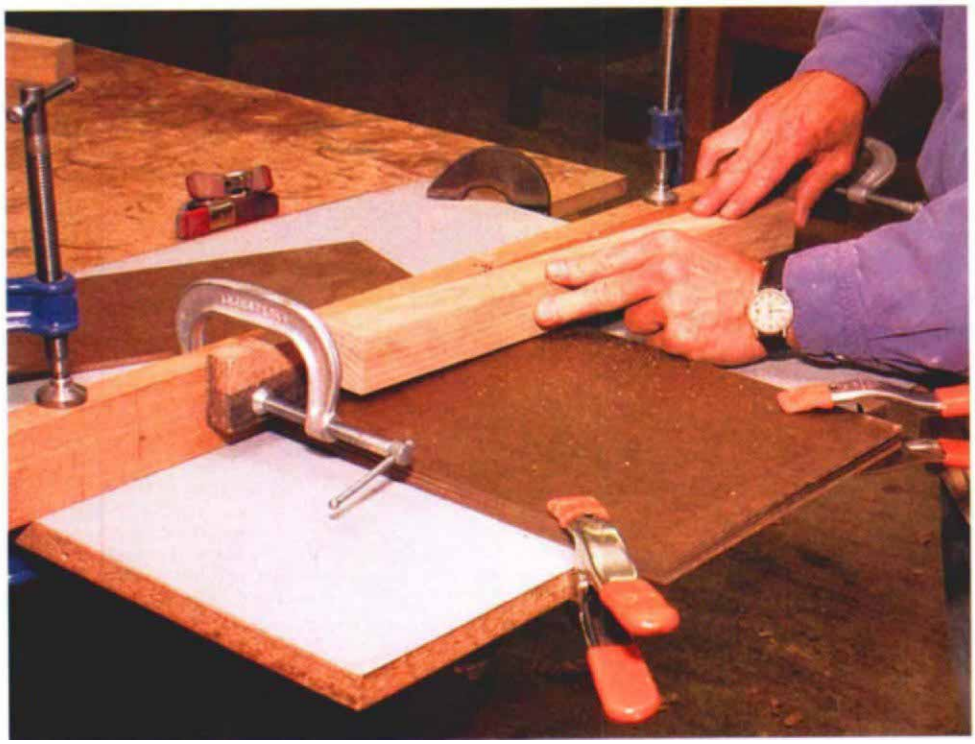
Mortising with a plunge router

The best tool for mortising is the plunge router used on top of the work. This is the job it was designed for. There are many different kinds of fixtures that can be used with the plunge router. Two that I use frequently, a U-shaped box and a template with a fence, are discussed below.

There are several schools of thought as to how to plunge the bit into the work. One method is to plunge a full-depth hole at each end of the mortise and then make a series of cleanup passes between those two holes. The drawback to this method is that you may get some burning as you plunge to full depth because most bits don't have center-cutting capability.

Alternately, you can make a series of successively deeper, full-length passes, always moving left to right with the bit lowered and locked in place each time. For me, making full passes without locking the plunge mechanism on each pass works best. I keep the router moving. Try each of these methods to see which one works best for you.

Using a stock router fence—The simplest method for mortising with a plunge router is to mark the mortise ends on the workpiece and to set the last turret stop for



With hardboard shims, you set the bit just once. *By removing one shim after each pass, you can take safe, manageable bites without having to change the router's depth setting. Increments of either ¼ in. or ⅛ in. are possible.*

the full depth of the mortise.

To adjust the bit's position, place the router on a marked-out workpiece, and lower the bit so it's just touching the surface of the work. Rotate the bit so its cutting edges are in line with the width of the mortise. Adjust the fence so it's flush against the side of the workpiece and the edges of the bit are within the layout lines. Then clamp the workpiece firmly to the bench, and rout away. Keep in mind, though, that the router will be tippy on narrow stock.

You can try to bring the bit just up to the end marks of the mortise with each pass, but it can be difficult to see them with all those chips flying around. Another way to accomplish this is to line up the edges of the bit at both ends of the mortise and make a pencil mark at the outside edge of the router base (see the top left photo). These marks are a lot easier to see than layout lines at the ends of the mortise.

If you're concerned about cutting beyond the layout lines, just clamp on stops to limit router travel. It only takes a second. Clamp the stops directly onto the workpiece once you've determined the length of the mortise (see the top right photo).

Mortising with the U-shaped box—One of the most versatile router-mortising fixtures that I've come across is a simple U-shaped box (see the drawing on p. 76). I first saw one of these boxes in a magazine article by Tage Frid. Since then, I've made a number of them dedicated to particular pieces of furniture.

But having one fixture that handles a variety of different-sized parts is really useful, too. The one in the photo at right is made of ¾-in.-thick medium-density fiberboard (MDF). Its sides are rabbeted for the bottom (this helps align it during assembly). I also made the bottom longer than the side walls so I could clamp it down easily to any work surface.

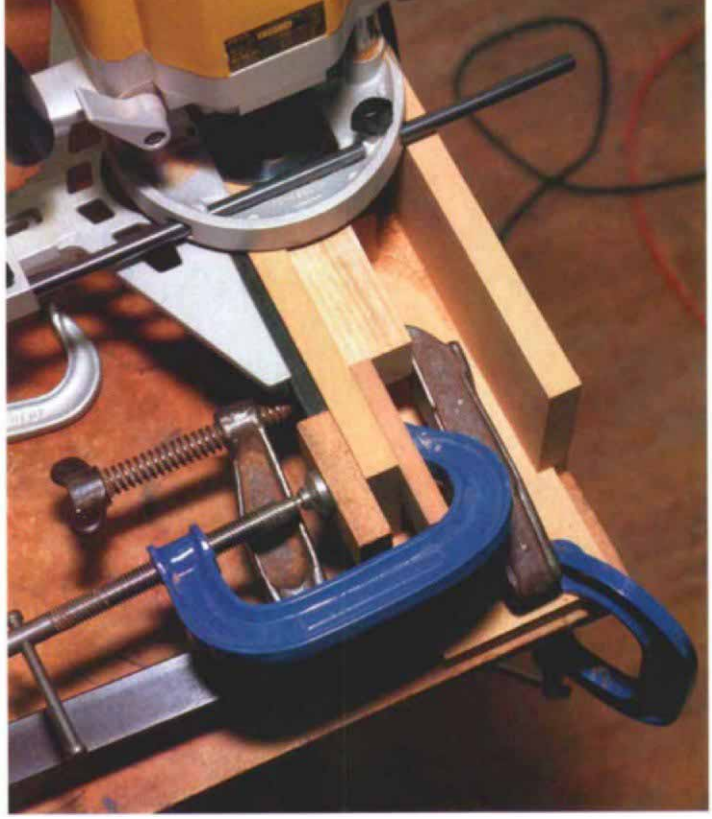
The best way to deal with multiple identical mortises is to clamp an end stop to the side wall of the fixture (see the photo on p. 76). This way, each new piece will automatically be fixed in the right spot. Stops to index the mortise length also can be clamped onto the fixture. I prefer clamping these on rather than using an adjustable stop—I don't want to risk the stop being nudged out of place.

When placing the workpiece in the fixture, always make sure the piece is sitting flat on the fixture bottom and tight to the inside wall and end stop. Clamp the work-

Layout lines are much easier to see when they're not hidden. *The pencil marks show where the router base should stop, and the tick marks indicate that you're getting close.*

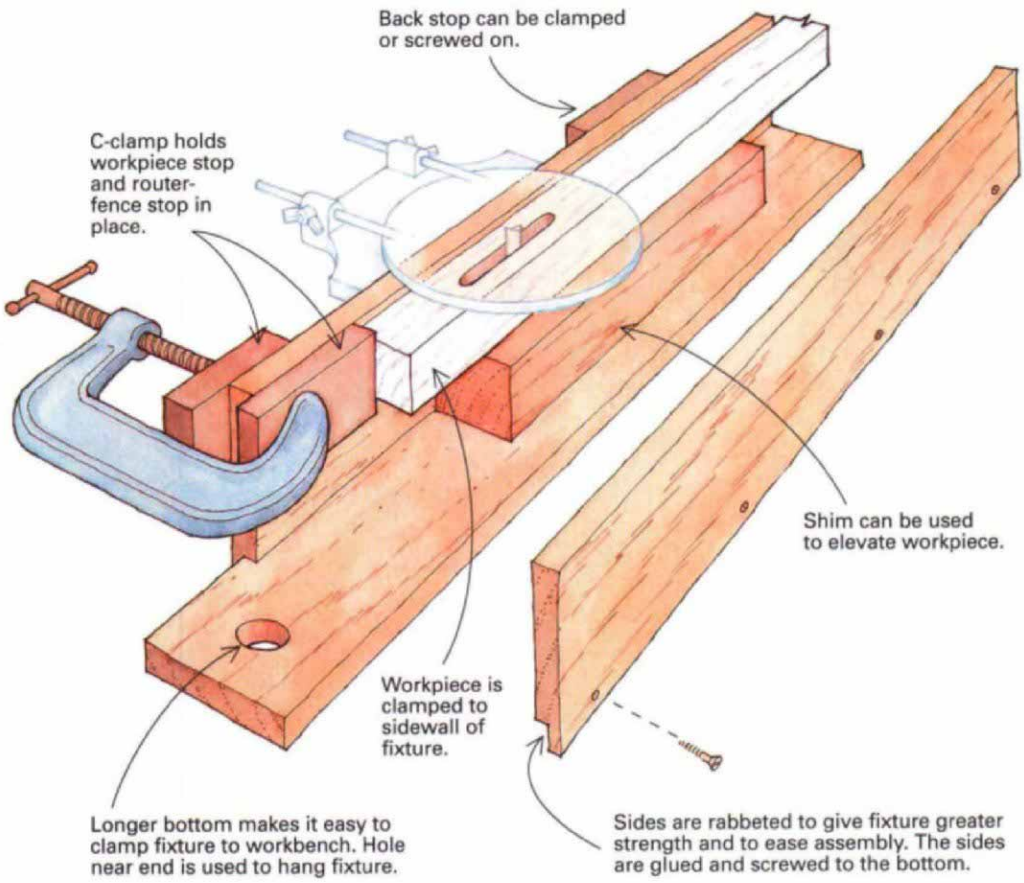
Stops are foolproof. *Clamp or screw stops in place to limit the travel of the router, front and back. You won't have to worry about trying to see layout marks when the chips are flying.*

One fixture cuts many mortises—This *simple U-shaped box is one of the most versatile mortising fixtures you can build.*



Measure once, and clamp a stop in place. *The less measuring you have to do, the fewer errors you're likely to make. The stop on the inside of the fixture positions the workpiece. The one on the outside is a fence stop, which establishes one end of the mortise.*

U-shaped mortising fixture: This router fixture is simple to make and incredibly versatile. It can be made to accommodate a wide range of work and only takes a few minutes to set up for a mortising operation.



piece securely. Spacers can be used underneath pieces to bring them higher in the fixture or to push a piece away from the sidewall. Make sure the spacers are milled flat and support the workpiece well. Be sure that the clamps holding the work don't get in the way of the router.

To improve stability, attach a wooden auxiliary fence to the one that comes with the plunge router. Then position the bit in the right spot. Remember to hold the fence tightly to the wall, and be sure to move the router so the fence will be drawn up against the wall of the fixture by the rotation of the bit.

Dedicated mortising fixtures are extremely useful when you plan to reproduce a number of cuts on a regular basis. I made an angled fixture to cut the mortises for a stool I build at least once a year. The end stop locates each leg in the proper spot. A spacer block positioned against the stop locates the second set of mortises in the legs. Stops screwed to the outside of the fixture wall limit the length of travel of the fence and, therefore, produce mortises that are the correct length.

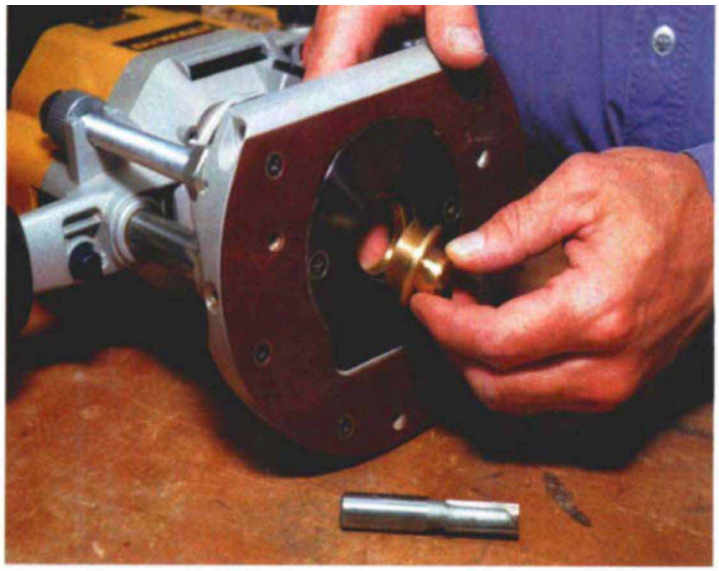
Templates and template guides—A template guide is a round metal plate with a thin-walled rub collar that extends out from its base (see the top photo on the facing page). The guide is screwed to the router base, and a router bit fits through it without touching the inside wall of the collar. The outer wall of the rub collar is guided by a straight edge or template as the router cuts (see the bottom photo on the facing page).

Templates that are made of hardboard, plywood or MDF include a slot to guide the rub collar as it makes the cut. The template is clamped to a workpiece with its slot centered over the mortise. I make up a template for a mortise when I'm doing a job I expect to repeat.

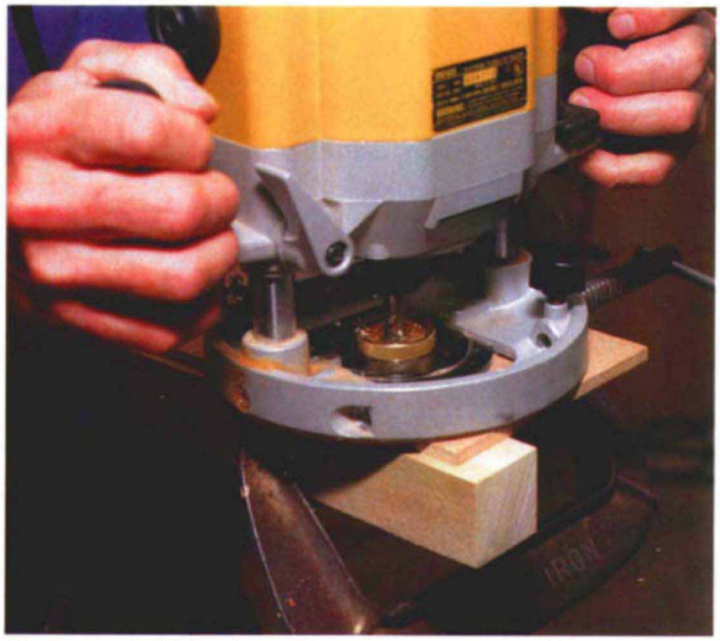
To make a template, nail a piece of ¼-in. hardboard about 5 in. wide and 10 in. long to a piece of wood approximately 2 in. sq. and a little longer than the hardboard (see the drawing on the facing page).

The wood block is the fence, and the hardboard gets a slot cut in it that is exactly the width of the rub collar. Cut the slot in the template on the router table. To be sure the slot is parallel with the fence—which ensures that the mortise is square to the stock you're routing—tack the hardboard back a little bit from the edge.

Set up the router table with a straight bit

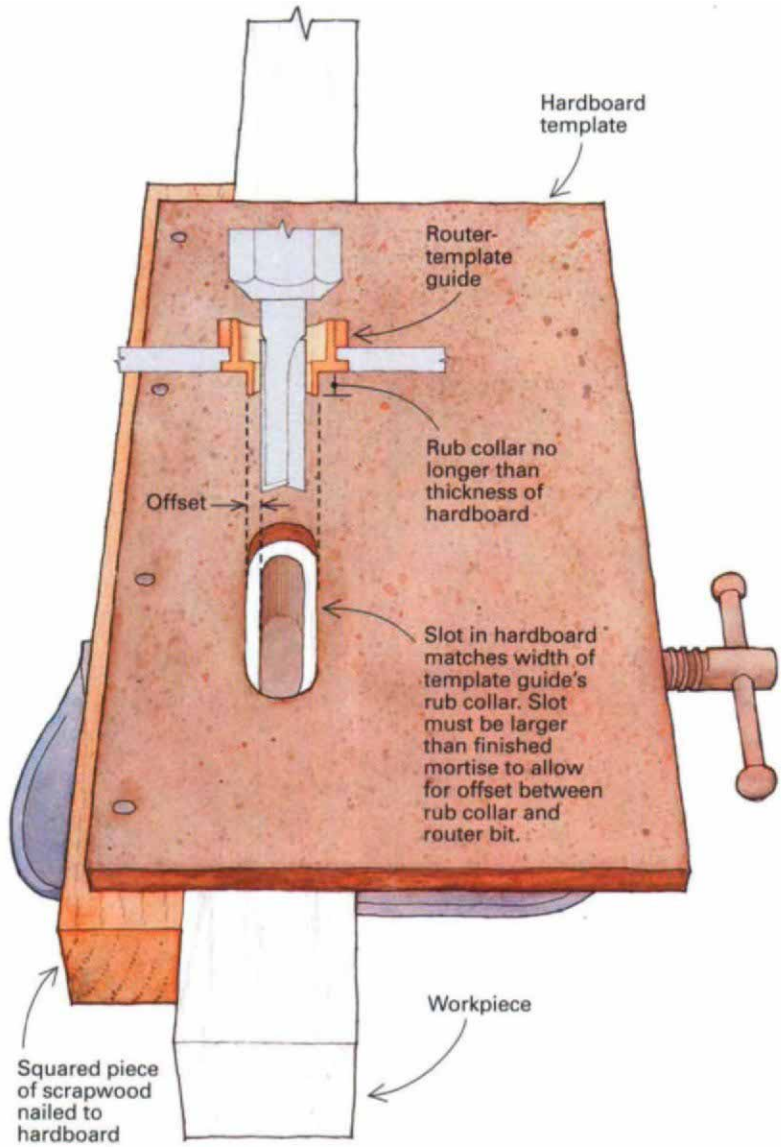


A template guide screws to the router base. *The guide's rub collar follows a slot cut in the template.*



Stops are built in. *A template prevents side-to-side movement of the bit and automatically sets the length of the mortise.*

Using a template and guide to mortise: Routing mortises with a hardboard template and router-template guide is quick and virtually foolproof. The size of the slot in the hardboard determines the size of the mortise. The template is clamped to the workpiece, and the assembly is then clamped to the bench.



that matches the outside dimension of the rub collar. The template slot is pencil-marked on the hardboard. The diameter of the template guide is greater than that of the bit you'll use when mortising. So you'll need to add the distance from the outside of the rub collar to the edge of the router bit to each end of the slot in the template (see the drawing above). Typically, this offset is between 1/16 in. and 1/8 in.

Before cutting the slot in the hardboard template, take a minute to determine the setback from the edge of the workpiece to the edge of the mortise. Then set the router-table fence accordingly. I like to double-check that the fence is in the right spot. So I make a nibble cut at the end of the template, and then measure the distance from that point to the fence. This method ensures that you get the correct distance. Once you have it, plunge the template down onto the bit as close to the center of the slot as possible, and then slide the template back and forth just up to the pencil marks at each end.

Templates like these are versatile. For example, a template made to cut a mortise 3/4 in. from the edge of a table leg also could be used to cut the same sized mortise 1/2 in. from the edge. How? Simply by inserting a 1/4-in. shim between the template fence and the workpiece.

Once you have made the template and clamped it to the workpiece, position the plunge router with the template guide on the work. Set the bit depth, taking into account the thickness of the template. An upcut spiral bit will pull most of the debris out of the mortise as the cut is made. Compressed air can help clear a mortise that's really packed with chips. □

Gary Rogowski designs and builds furniture in Portland, Ore. He is a contributing editor to Fine Woodworking.