# Template Routing Basics

by Pat Warner

In 24 years of self-taught woodworking, I've made a lot of mistakes. Early in my career, though, I made a fortunate one. It started a learning process with the router that I'm still working on today.

I had discovered what looked like a devilishly simple technique for cutting dadoes. I used a board clamped across the workpiece to guide the router base. The first dado looked great, but the second wandered visibly off course. That day, I learned that a router base is never concentric with the bit. Turning the router as I cut the dado put a curve in it.

I began to look for better ways to guide routers. Some of the best, I have learned, are with templates. These are simply patterns of the shapes you want to cut. The

## *Three bits for routing with templates*

**Straight bits** and **collar guides are the most** versatile: Collars are not as accurate as bearings, but they have the decided advantage of allowing you to cut at any depth in both side and bottom cuts. Fitted to the router's base and used with straight bits, they work much like pattern bits. Collar guides also act as a shield for the bit. You'll find that you will inflict a lot less injury to the template and the work by using them.

Collar guides do have disadvantages. Because the collar must be larger in diameter than the cutter, the line of cut is displaced from the template. This offset means the finished work will never be exactly the same shape as the template. And collar guides are never exactly concentric with the bit: 1/16 in. eccentricity is typical. A way to compensate for this is to keep the same part of the collar in contact with the template throughout the cut.

**Pattern bits are the most accurate:** I choose pattern bits when I need the most accuracy. The bearings are typically concentric to the bit within .002 in. or better. Bearings do not leave as smooth a cut as collar guides, though the difference is generally minute. This is due to the way bearings can bounce against the template ever so slightly and very rapidly. Over time, this bouncing tends to wear the template edge unevenly.

The biggest disadvantage to bearing bits is that they're restricted to a small range of depth settings. The bearing must always engage the edge of the template. I've also found that bits of this design often have diameters slightly larger than their bearings. If you run this kind of bit with some of the cutter in contact with the template, you'll rout away some of the template. Measure your bits with calipers or test them to make sure this doesn't happen.

**Flush-trimming** bits are **the most common:** The main advantage to using flush-trimming bits for template work is that they are easier to find and slightly cheaper than pattern bits. They also come in smaller diameters than pattern bits, allowing cuts into tighter inside curves.

Otherwise, they have many disadvantages. Bottom cuts such as mortises are impossible. In other applications, the workpiece can hide the template from view, and the router must ride on the work. If it's a small or thin piece, the router will not be stable. —*P.W.*

Photos: Strother Purdy

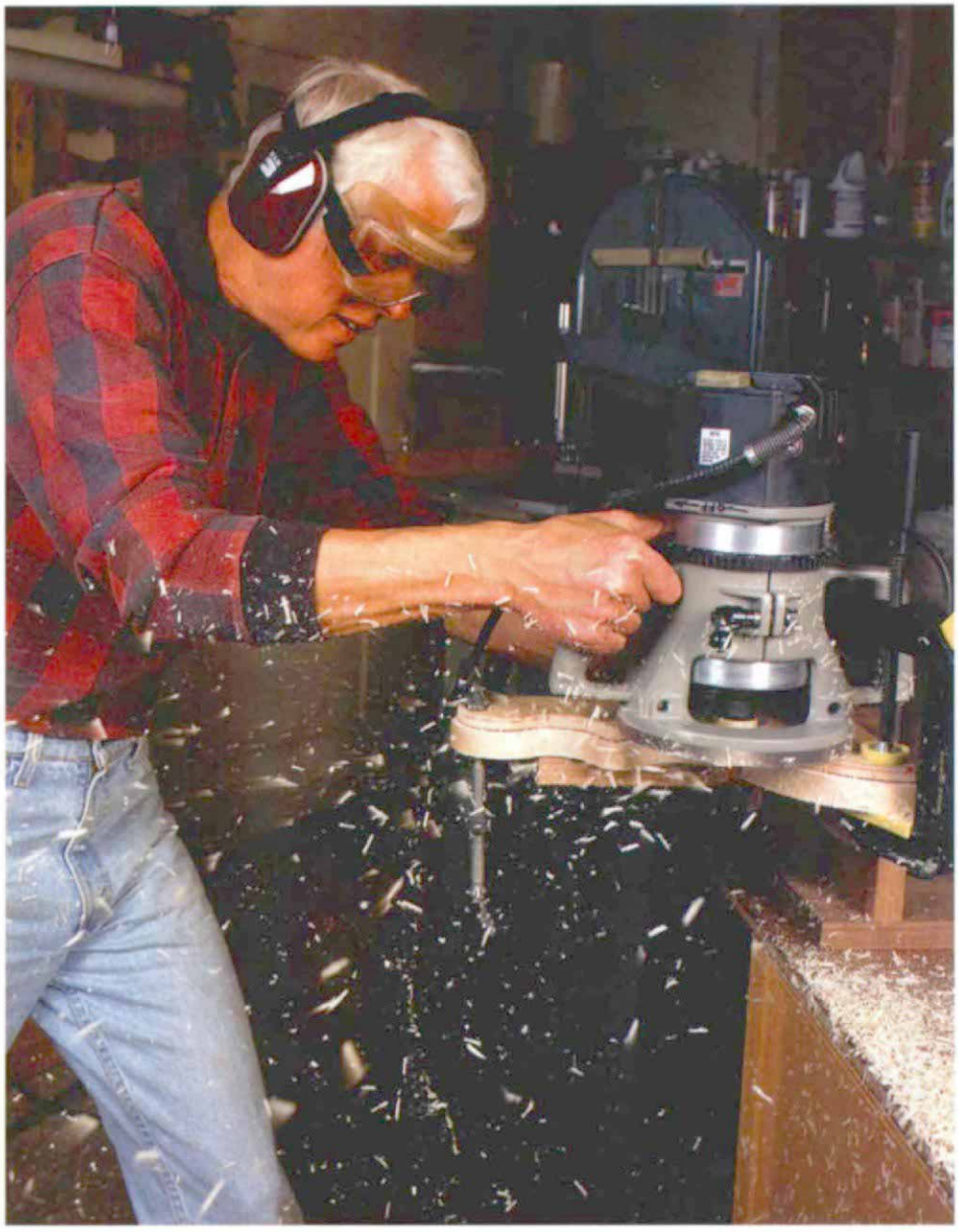
# *Simple guides make your router an accurate jack-of-all-trades*

router registers against a template, using it as a guide through the cut. The simplicity of templates, though, gives no hint of how powerful a tool they make the router.

The router's usefulness and versatility begin with the tremendous variety of bits that are available. With only a ball bearing on the end of the bit as a guide, you are really limited to detailing edges. When you use a template, however, you free the router from following the edge of the workpiece. The router becomes capable of two more fundamental woodworking tasks: milling repeatable patterns and all kinds of joinery.

You can easily make your own inexpensive, simple and accurate templates for a wide variety of joints and patterns. The initial investment of time to make a template for a precise task is well worth it. Your router will perform that task far faster and far more reliably than other tools can. And it's much harder to make mistakes when you are using templates.

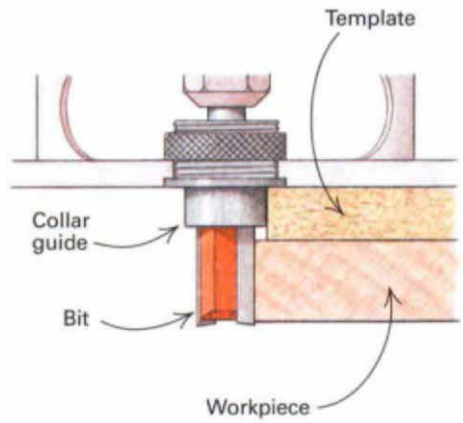
Templates will allow you to repeat cuts and shapes perfectly, but only if you remember to use the same bit with the same



## *Cutting multiples*

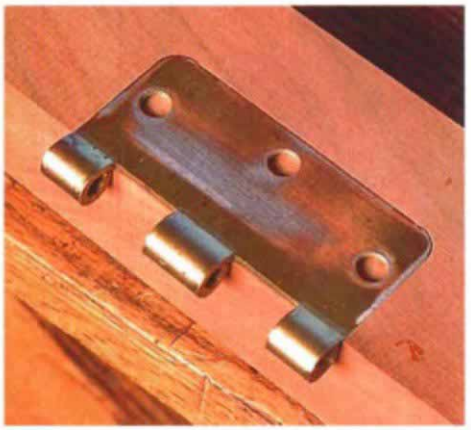
A straight bit and collar guide make a good combination for cutting a stack of profiled pieces, like decorative shelf supports. The bits can cut stock of any thickness and will produce a smoother edge than a bearing-guided bit. One thing to keep in mind: The template and the finished piece will not be identical because the collar guide keeps the bit away from the edge of the template.

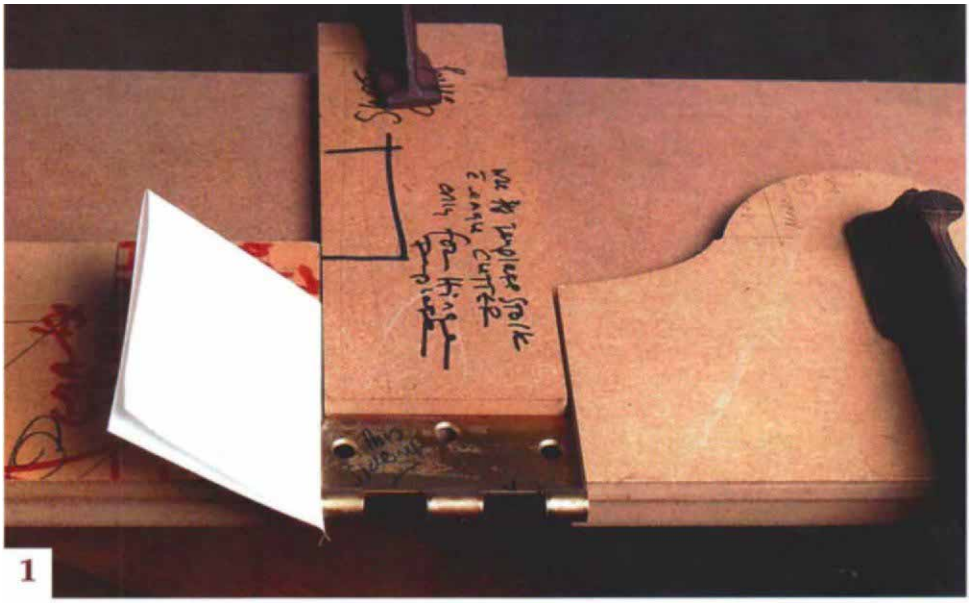
Straight bit and collar guide with template over work



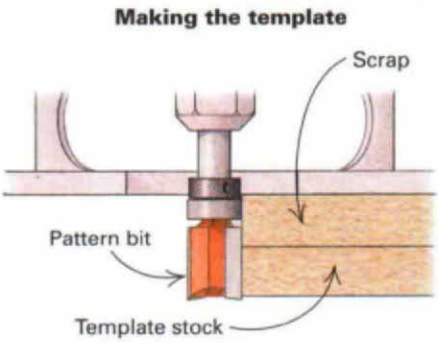

Drawings: Vince Babak

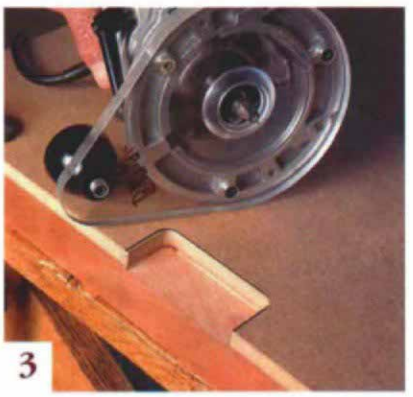
# *A template for butt hinge mortises*

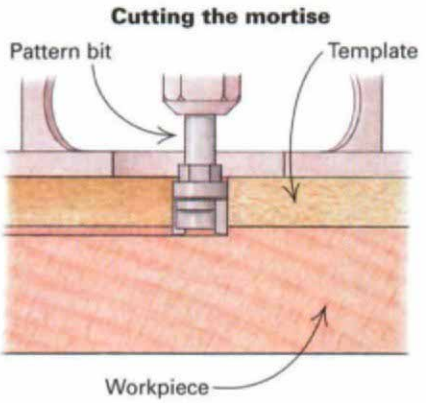





A pattern bit is a good choice for cutting shallow mortises precisely and quickly. To make the template, align the hinge on a piece of template stock, and then mark the outline with a pencil. Bandsaw out most of the waste, and reposition the hinge on the template stock. Clamp straight-edged scrap around the hinge to define the edges of the mortise (1). A paper shim will prevent the mortise from being too tight. Then remove the hinge, and rout to the line with the scrap as a guide **(2).** Remove the scrap, and you have a finished template that cuts an accurate mortise **(3).**


collar at the same depth. The best place to record this information is directly on the template itself.

## Make precise templates

The best way to learn the basics of template routing is to make and use some simple templates. But before looking at the practical applications for templates illustrated on these pages, it's a good idea to start with some general advice about how to make them, what materials to use and the best ways to use them.

The most difficult part of template routing is making the template itself. All the important information about the final shape you want to rout is encoded in the design of the template. The more accurately you make your templates, the more time you'll save in the long run. You'll do less sanding, fitting and fudging afterward.

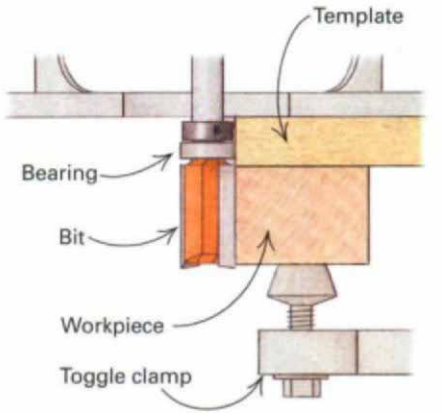
Sawing, rasping and filing are time-consuming and tedious ways to make templates. It's also very hard to make a perfect curve with hand tools. I never make a template by hand unless there is no other way. I've found that accurate templates are most easily made with sanders and, yes, routers, templates and other guides.

Templates should be dimensionally stable, durable and capable of taking fine details. Solid wood is a poor choice because it's not dimensionally stable. Steel is stable and durable, but to a fault. If you accidentally touch a spinning bit to one, you'll probably wreck both the bit and the template. Acrylic and Lexan are transparent and allow you to see the work beneath. They also won't kill bits. But be aware that a slow bearing will generate enough heat from friction to melt them. Medium-density fiberboard (MDF) is the best all around

## *Template for routing small pieces*

**Templates can be made so they hold small pieces as well as guide the router. Coupled with a pattern bit, the template above makes short work of cutting tapered coffee table legs. The workpiece is held on the template with toggle clamps. To keep toggle clamps out of the way while routing, the author flips the template upside down on the workbench (left). Blocks between template and bench provide room for the toggle clamps.**

Use a pattern bit for tapered legs




choice. Mind you, it isn't perfect. It's toxic and unpleasant to work with.

### Four everyday templates

You can use any one of the three kinds of router bits designed for template work. Each has its own strengths and weaknesses (for more, see the story on p. 48). Some bits are especially well-suited to certain kinds of templates, but all of them can bring speed and reliability to repetitive work.

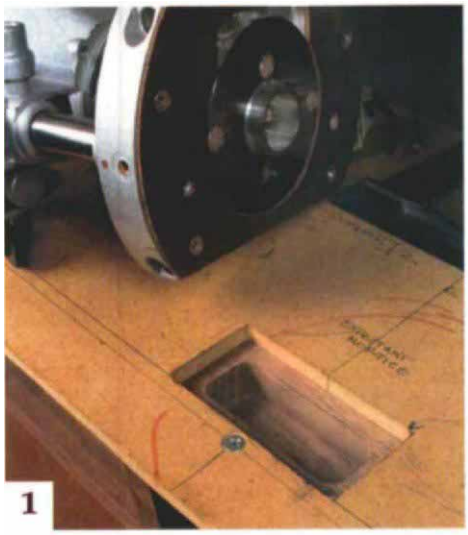
***Template for repeatable** shapes—Using* a scroll saw and an oscillating sander to make a single curved shape, like a decorative shelf support, might be just as fast as template routing it. But only the first time. If you make any more, template routing will be faster and easier. A router bit leaves a much smoother edge than a scroll saw, and the edge will need far less sanding. Make the template much the way you would make the support if you had no templates. Smooth, gradual curves on MDF are best obtained by sanding to layout lines on a stationary belt sander.

For this kind of work, it's easiest to use a straight bit with a collar guide because you can adjust the cutting depth to match the thickness of the shelf-support stock (see the photos and drawing on p. 49). Collar guides, however, will displace the cut from the exact edge of the template. With straight lines, this merely entails positioning the template the offset distance from the layout line. The lines will be just as straight.

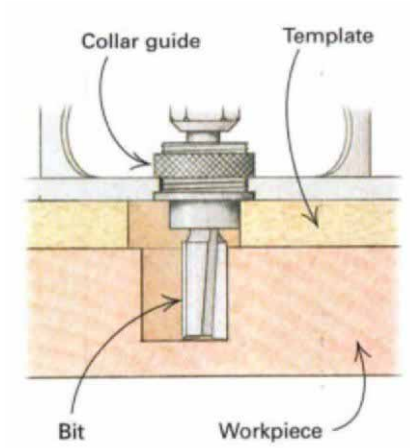
It's a different story with curves. A collar will make the bit cut slightly larger radii on outside curves and smaller radii on inside curves. The result will be a finished piece slightly different from the template. In com-

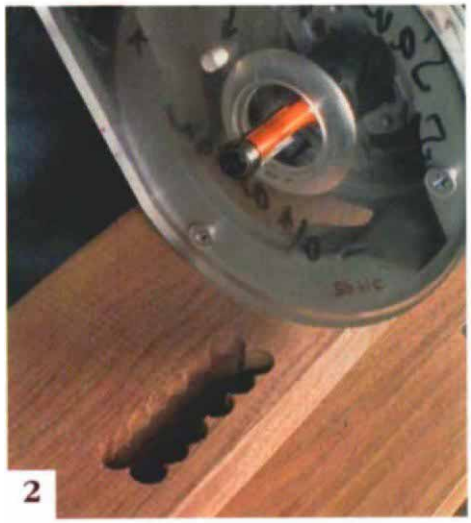
# Routing a through mortise

Deep mortises can be cut accurately by starting with a template and straight bit with a collar and finishing up with a flush-trimming bit. First rout the mortise as deeply as you can with the template as a guide **(1).** Then drill through to the other side. Remove as much waste as you can, and then flip the workpiece over (2), A flush-trimming bit that follows the upper part of the previously cut mortise will finish the job.

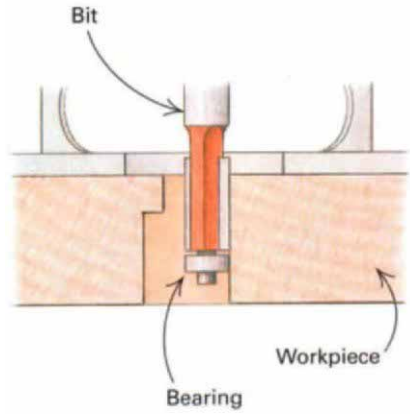



First pass with pattern bit




Finish with flush-trimming bit




plementary template work, this is a crucial consideration. But with something like the profile of a shelf support, the difference is not consequential. To tell where the bit will actually cut, run a pen in a loose bearing with the same offset as the collar along the template to draw the layout line.

***Cutting shallow mortises***—Cutting shallow mortises that are clean and evenly deep—like those that you would want for butt hinges—is a difficult task with traditional tools. Except for the very smallest hinges, a router guided by a template will give you more accurate cuts faster and with less variation between them. The photos and drawings on p. 50 show you how to make one.

Once you've made this template well, it's hard to go wrong using it as long as you are careful. Router stability on the template is essential to an accurate and safe cut. A 6-in. round base router with a ½-in.-dia. bit will have no more than 45% of its footprint on the template in an edge cut. If you make a turn around a 90° corner, that percentage is reduced to less than 20%. A router that wobbles with a lot of cutter engaged can break the cutter, tear the stock and template, or even cause a kickback that sends the router to the floor. The machine has to stay flat and stable at all times.

This butt hinge has rounded corners the same diameter as the bit. If it had square corners, you'd have to do some handwork to make the hinge fit. A bit with a larger diameter than the corners would also require handwork. Just never use a bit with a smaller diameter, or you'll have gaps to patch.

***Cutting tapers on small pieces***—Some workpieces are far too small to rout safely if they are sandwiched between a workbench and a template. To taper legs for a coffee table, for instance, I built a template (or a jig, if you like) that holds the workpiece firmly in place with toggle clamps, as shown in the photos and drawing on p. 51. Guide blocks position the side and end of the leg but leave enough room behind them to clamp the template upside down to a workbench edge. In use, neither the toggle clamps nor the clamps holding the template to the bench get in the way.

To get a good, smooth taper, you need only secure the guide blocks at the desired angle in relation to the edge of the template. As the router follows the edge, it cuts the taper angle of the blocks in the leg. Compared with tablesaw techniques that require more complex jigs, put fingers at risk and leave a coarse cut, this one is far superior.

***Template for through mortises—The*** plunge router is the best tool for inside template cuts, such as mortises,-but it needs a lot of support to make it safe and accurate. Plunge routers are top heavy and have comparatively small bases. This make them excellent candidates for router teeter-totter problems. A template for mortising must be large enough so that the plunge router's base is completely supported by the template at all times during the cut. The photos and drawings at left show a very simple technique to make a through mortise deeper than any bit you own.

*Pat Warner is something of a jack-of-all-trades. A woodworker, college instructor and tool-industry consultant, he also manufactures the Warner Offset Routerbase. His book* Getting the Very Best from Your Router *was released lastfall by Betterway Books. He lives in Escondido, Calif.*