# Get the Most from Your 

 RouterMake controlled cuts using special jigs that hold the work and keep hands away from cutters

BY PATWARNER

Judging from the growing ranks of ready-made router tables and the numerous articles in magazines on how to build one, the router table has become a must-have tool for woodworkers. Unfortunately, instruction in the correct use of this tool has been all but ignored. I can tell from the e-mails I receive that too many woodworkers are using risky methods to obtain disappointing results.
Most routing can be done safely and accurately on the router table if certain guidelines are followed. Here I'll cover three keys to success and talk about bits. I'll also discuss which routers are okay for use in a table and how to determine the correct feed rate. And I'll give a few tips on getting smooth cuts every time, even with special cuts or bits.

## Three keys to successful routing

If you decide to build your own router table, you are welcome to make it as so-

phisticated as the one John White built (FWW \#153, pp. 55-61). However, the table does not have to be that complex. All that is required for maximum control of the workpiece and highest quality of cut are a flat table that's at a comfortable working height and a good fence.
If the work is not at a comfortable height, any form of routing will be a struggle. Even for shorter woodworkers, the standard bench height ( 34 in . to 36 in .) is too low for routing. You can't see the work, and if you
try, you'll fold yourself in half. What level feels comfortable varies considerably even among those of the same height. A good way to discover what feels right for you is to use a drill-press table as your experimental height platform. Hold a workpiece as if you were routing it, and adjust the table to see what height feels comfortable.

Whether a router tabletop has been "windowed" for an insert or not, it must be flat and uninterrupted. If the workpiece bumps into any minor changes of height between
the router insert and the tabletop, these imperfections will be transferred to the workpiece. The top must also be as square to the spindle as practical.
The fence must be straight, flat and square to the top. Adjustability would be nice, but if it ain't flat and straight, the depths of cut will vary, and there may be some risk to the user.

## A bit about cutters

Router bits come in many diameters, lengths and shapes. Some are easy to use, and some, in my opinion, require extra vigilance on the part of the operator. A bit must be sharp to cut cleanly. No matter how skillful you may be, you cannot get good cuts from a dead bit.
Certain cutters-because of their size and shape-require special skills and jigs to achieve good results. I think most woodworkers are unaware of this. Not surprisingly, manufacturers of router bits advertise a bit's application, not its difficulty in use. For instance, cutters that are over $2^{1} / 4 \mathrm{in}$. dia. are adapted from other cutters designed specifically for the shaper spindle. Manufacturers present these cutters to the amateur as being like any other tool bit in their inventory. But they are not. The bits require special methods for controlling the workpiece, slower speeds and advanced operator skill.
Moreover, there is no way these bits can cut their profiles in one pass; often three or four are required. A consequence of taking multiple swipes is that the bits dull pretty quickly. You can expect a good cutter to have a half-life of 200 ft . to 300 ft ., if the bit is treated with respect. I wouldn't say to rule out large cutters entirely; they are going to be popular no matter what I say. Instead, I recommend using them with extreme caution: Take light cuts, practice, be sure the workpiece is secured firmly and use special fences or guards to keep your hands away from the bit.

## Horsepower vs. human power

It is fairly easy to push wood across a router table, so you may tend to feed stock too quickly. To compensate for this, I recommend using as large a router as possible in a table-ideally a $21 / 2$-hp to 3 -hp model. A large router not only provides pure muscle, but it also evens out any balance problems with a bit, and the "flywheel" action keeps the cutter moving uniformly. That

TABLE-ROUTING TECHNIQUE


STANCE
Standing to the right-hand side of the router table allows you to feed a longer board with fewer hand movements.


HAND POSITION
The left hand guides the stock as the right hand pushes. Let the workpiece slip through the fingers of the left hand. Maintain steady forward momentum with the right hand.

## END-GRAIN SLED

This jig is used when cutting the ends of a workpiece on the router table. Examples include cutting tenons and the profile on the end of a rail using matched rail-and-stile bits.

said, a $1 \not 12$-hp router with a sharp cutter will work for short runs and light cuts (the equivalent of a $3 / 8$-in. by $3 / 8$-in. cut). However, if it's working more than 30 minutes or if you're making larger cuts, a small-horsepower router may tend to overheat. Routers with 1 hp or less should be confined to bits with $1 / 4-$ in.-dia. shanks. A big cutter in a small router is a recipe for poorquality cuts.

Determine the feed rate for every cut-Feed rate on the router table is not fixed and must be learned for each combination of router, workpiece, cutter design and sharpness, and the depth of cut. If the feed rate is too slow, you can burn the work and destroy the cutter. If you feed the work faster than the cutter can cut and eject its chip, you may chatter the work or break the bit.
Production shops aim for maximum productivity with minimum adversity, and you
should too. Even the fanciest of production shops relies on the test cut. Once you are set up, test the process. Start with a feed rate that's almost slow enough to burn the stock and increase the speed to the point of tearout. Although many factors affect the feed rate
(such as the hardness of the wood and the sharpness of the bit), in general you can achieve a quality cut at a steady rate of about 20 ft . per minute. Remember, just as it takes some time getting used to a new set of golf clubs, it will take some practice to get familiar with the correct feed rate for a new setup.

## Tips for smooth cutting

There's more to achieving good results on a router table than just the equipment and the feed rate. You need well-prepared stock, secure hold-downs when necessary and good working habits. With practice, the following guidelines will ensure consistent, satisfactory results with your tablemounted router.

Begin with good stock preparationMaterial preparation cannot be overlooked in any aspect of woodworking. But routing, due to its methods of registering the work to the cutter, is more sensitive to misshapen work than most tools are. A stick with a crook, cup or bow is not to be trust-


Cutting profiles. Warner uses this long-grain sled when routing profiles on long, narrow boards. The toggle clamps are safer and more effective than using fingers to guide the work this close to a cutter.

## LONG-GRAIN SLED

This jig is used for running the long side of a workpiece past the cutter. The sled can help cut the long edges of rails and stiles using one cutter from a matched set. It can also aid in cutting decorative profiles and moldings.


Hardwood fence, 1 in . thick by 3 in. wide by 23 in . Iong

ed. One that is poorly jointed or not uniform in thickness will be a surprise during each operation, and the resulting cut will be a disappointment. Improperly prepared stock is also a safety issue: Warped stock cannot be cut accurately and may be hard to push past the bit, increasing the chance of injury.

Get a grip on your work, and stop chattering-Like a group of mischievous lads, a router can get where no other tool can. You can enter the edge, the end or the face of nearly any stick. The cut can be blind, half blind, through or cut to any fractional depth.

A router bit can't be expected to behave without adversity under all of these conditions. A cutter can chatter the walls and floors of its pathway. It can tear out as it encounters wavy grain. It can burn in cherry and spoil the entry and exit of cross-grain cuts such as dadoes. A bit can break, bend, burn, vibrate, scream, lose its carbide or go dull in seconds if it's abused.
To combat these problems, it is the accepted practice to use hold-downs, featherboards and other contrivances to manage difficult cuts on the router table. I don't. In my view, if the operation is a risky one, it requires a proper jig to control the workpiece safely and achieve a quality cut.

Over the years I've developed numerous jigs for use with a router, but two simple ones will aid many of your cuts on the router table. The first is an end-grain sled (see the photo and drawing on the facing page) used when cutting the end of a workpiece, particularly a narrow one. The work is secured with toggle clamps, and a backup piece of scrap can be placed between the workpiece and the jig's fence to prevent breakout.
The second jig is a long-grain sled (see the photo and drawings above) used when routing the face of long, narrow stock, where control by fingertips alone would be an accident waiting to happen. Stock

## USE SPACERS FOR STEPPED CUTS

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Small bites with large bits. Large cutters last longer and yield a cleaner cut when the cut is made in small stages. Four ${ }^{1 / 4}$-in.-thick pieces of MDF are placed against the fence and secured over a metal rod.
that is rigidly held, not resonated with a featherboard, will be chatter-free.

Think about how you're working-The ergonomics of table routing is also important. I see many woodworkers stand in front of the table and feed the work hand over hand in a series of jerky movements. For a smooth cut you need one long, flowing movement, and this can only come if you stand at the front corner of the router table on the infeed side. Use your right hand to provide the forward momentum while the left hand directs the workpiece down and against the fence.

Take light passes-If a new cutter is making a mess of the workpiece, you're probably trying to take off too much wood at once. The solution is to take lighter cuts, adjusting the depth of cut until the quality is acceptable. The starting point may cause the bit to cut far less than the profile itself, but it has to be your starting point or you'll kill the cutter or mutilate the workpiece. You can adust the depth of cut by lowering the cutter, by shimming the workpiece or by making adjustments to the fence.
There are three ways to adjust the depth of the cut without adjusting the cutter. The first method is to use spacers under the workpiece. A second way is to use spacers against the fence. Spacers allow you to cut the profile in increments, easing the strain on the equipment and giving a cleaner cut (see the photos at left).
The third way can be used with any type of fence (see the photos and drawing on the facing page): First establish the location of the fence during the final depth of cut using a sample with the finished profile. Clamp a registration block at this point, and then move the fence forward so that only a small part of the cutter is revealed. Make the first cut. After the first cut, gradually move back the fence, taking incremental cuts until the fence is resting against the registration block. Now you're ready for the final cut.

## Strategies for special cuts and bits

There are several cutting strategies that will render the cut safe and of maximum quality. For example, skinny moldings can be harvested off wide stock, broad rabbets on narrow stock can be "tunneled" first and then ripped, and large cuts can be done in two or more stages. Special strategies are


Fence and cutter setup. Using a sample with the desired final profile, establish the correct height of the cutter and the final position of the fence (top). Mark this location by clamping a registration block to the table (center). Make stepped cuts by moving the fence back in stages (bottom). The final cut will be with the fence against the registration block.

## A SIMPLE, EFFECTIVE FENCE

You can get by with a piece of MDF or jointed hardwood as long as it is straight. A pivot point at one end makes fine adjustment easier. The other end is secured with a C-clamp.

also required for trapped cuts, dovetail cuts and climb cuts.

Trapped cut-When the cutter is trapped in the work, such as when profiling a stile, it can lift the work and spoil the profile. For cuts like this, stock must be well-prepared (flat and straight) and under firm control using a long-grain sled.

Dovetails-For a smooth cut, a dovetail bit usually requires its path to be preplowed with a straight bit. This strategy also prevents the bit from breaking.

Instead of gradually raising the straightcut bit, which can be backbreaking if you don't have a router lift, you can vary the
height of the workpiece via stackable spacers. Take multiple passes, removing the spacers-I use $1 / 4$-in.-thick medium-density fiberboard (MDF)—one at a time. When the workpiece is resting on the surface of the router table, you're ready to make the final cut, with the bit having to establish only the finished profile.

Climb cutting-These cuts should only be made by those with experience on the router table. The purpose of feeding the wood in the same direction as the turning cutter is to get a very smooth cut with no tearout. If the operator loses control, the workpiece is propelled off the table and can pull the operator's hands into the
router bit. Take only very small cuts, and make sure that both the workpiece and the fence are perfectly straight.

## When to go with a handheld router

I stated earlier that the majority of cuts are best performed on the router table, but there are some cuts that are either safer or better when done with a handheld router. These include cuts on long boards, particularly the ends, profiles on the edges of large tabletops, inside cuts and cuts best made with a plunge router. To table-rout for these cuttings is to ask for trouble.

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