

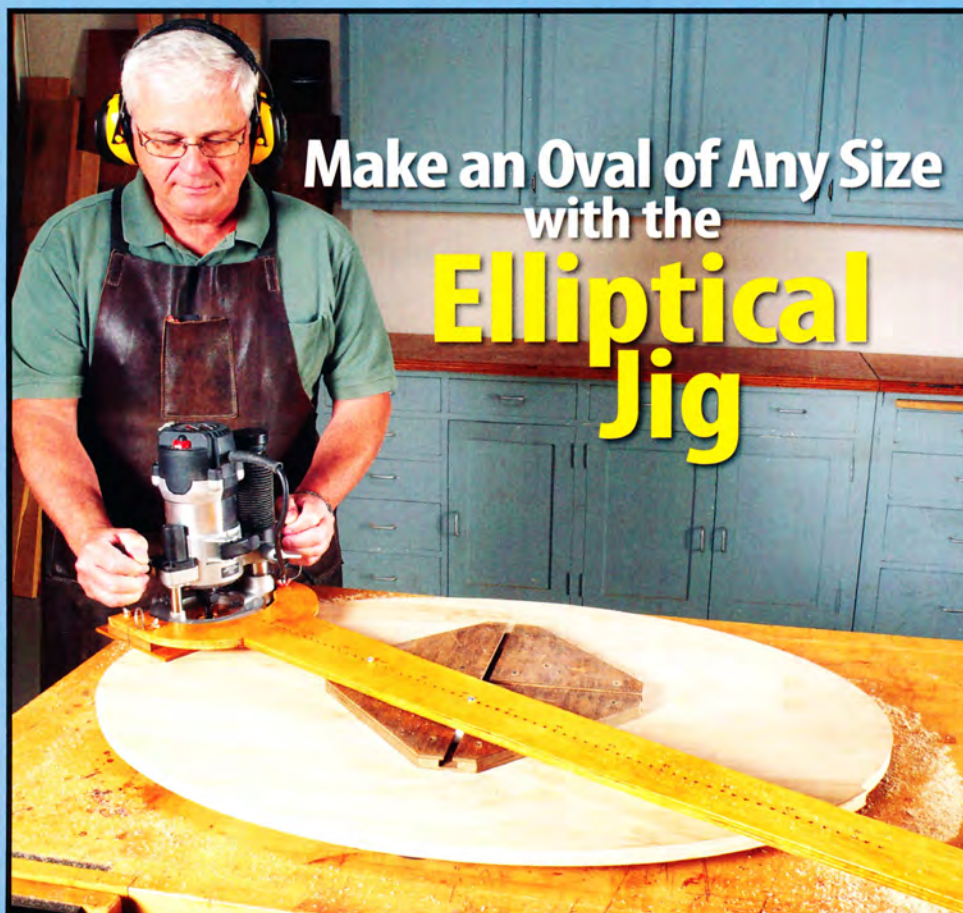
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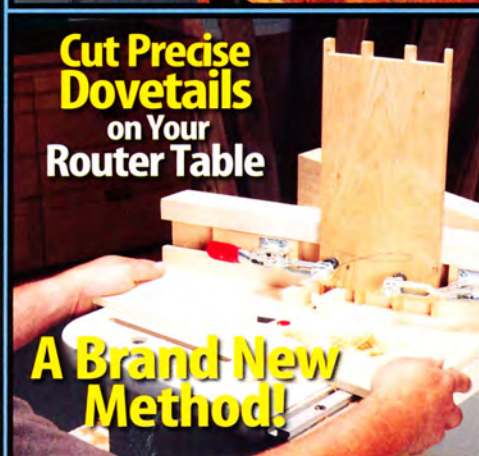
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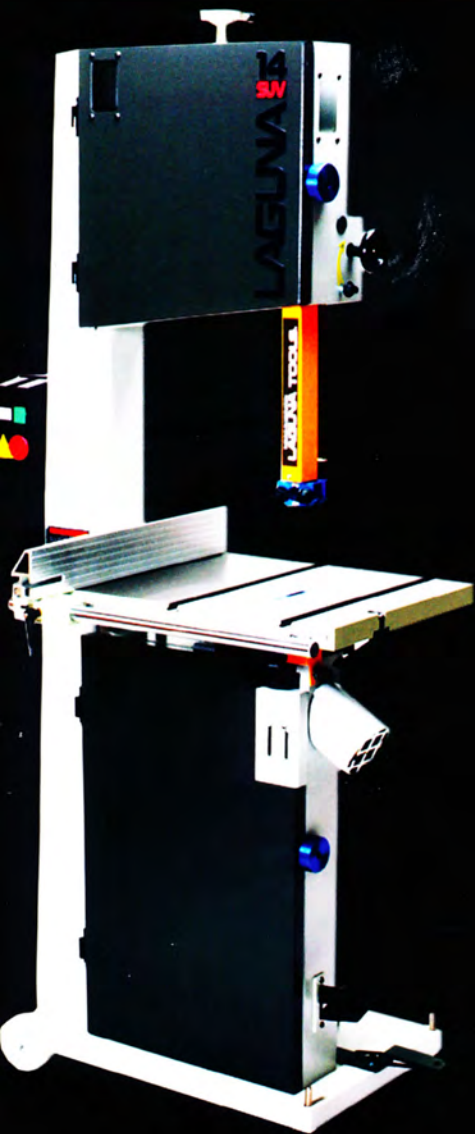


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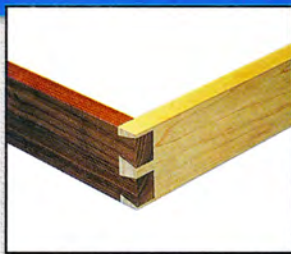
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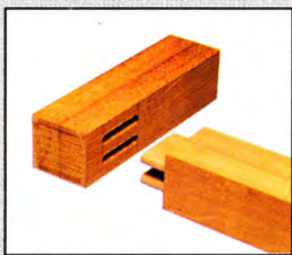
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#169, December/January 2014

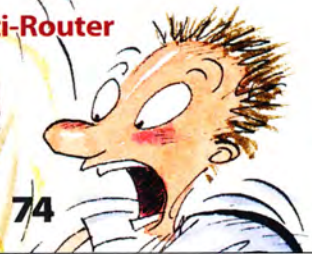
Features

- 34 12 Rock-Star Router Bits**
Add these great performers to advance your skills.
- 39 Router Table Dovetails**
Two sleds combine the ease of routing with the flexible spacing of hand-cut dovetails.
- 44 How to Make a Sliding Dovetail**
Tips and tricks for getting the perfect fit.
- 47 The Recipe Calculator**
A sliding dovetail can solve kitchen math problems.
- 48 Radial Router Jig**
Sometimes, the jig is more interesting than the project.
- 53 Radial Wave Lamp**
Playing with classic styles can be fun.
- 55 The Amazing Elliptical Jig**
This ingenious device takes you beyond the circle.
- 60 Wooden Router Plane**
Make this classic hand tool in an afternoon for less than ten bucks.
- 64 Finish Care**
Polish or wax: Which is best for furniture?
- 67 How to Rout a Large Arc**
Need a big, smooth curve? This method will do it!



Departments

- 8 Workshop Tips**
- 16 Well-Equipped Shop**
- 23 Tool Talk: Festool CMS Router Table**
- 25 Tool Talk: JDS Multi-Router**
- 28 Turning Wood**
- 32 My Shop**
- 74 Oops!**



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Routing an Ellipse

Watch our elliptical jig in action (p. 55) at AmericanWoodworker.com/WebExtras

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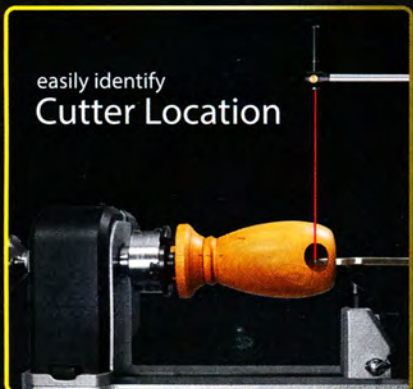
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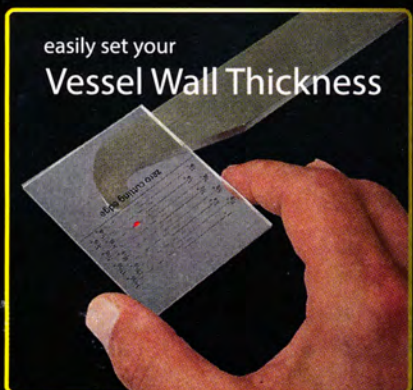
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Easy Cauls

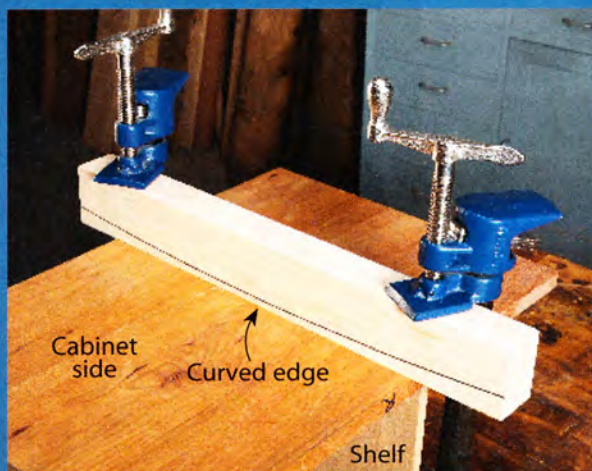
CLAMPING CAULS are indispensable for gluing up casework. A caul is simply a stiff piece of wood used to apply pressure where a clamp can't reach.

Sooner or later, you're going to run into a situation like this: You're clamping a wide shelf midway up a cabinet's side. You can't put pressure in the middle of the side because your clamps aren't deep enough. But without that pressure, the joint won't go home. You could use a caul, but it just bends and doesn't bring the joint up tight.

The answer is to make your cauls with a slight crown on one edge; this ensures pressure at the center. Here's how. Use stock that's at least 1" thick and 2" wide. Set the table-saw's fence to the same distance as the caul's width. Tape a shim—1/32" thick for each 18" of length—on one end of the caul. Run the caul through the saw with the shim side against the fence, non-shim end first. Flip the caul end-for-end, tape the shims to the other end and repeat.

You'll end up with a crown that's barely noticeable—just enough to apply pressure in the middle. If the crown were too large, you'd only get pressure in the center of the caul and none at the ends.

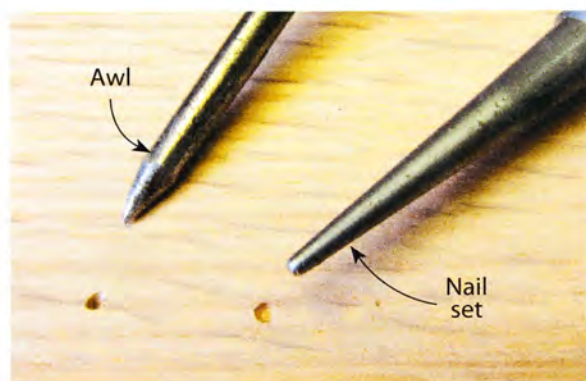
Howard Hirsch



Awl vs. Nail Set

USING AN AWL to precisely locate a hole for drilling can be problematic. Sometimes the awl will drift, going slightly off mark as it's deflected by the wood's growth rings. I found that using a nail set instead alleviates the problem. It punches a clean circular indent for locating a drill bit. I use the smallest-diameter nail set I can find, and use it only for this purpose, so its edges stay crisp.

Richard Helgeson



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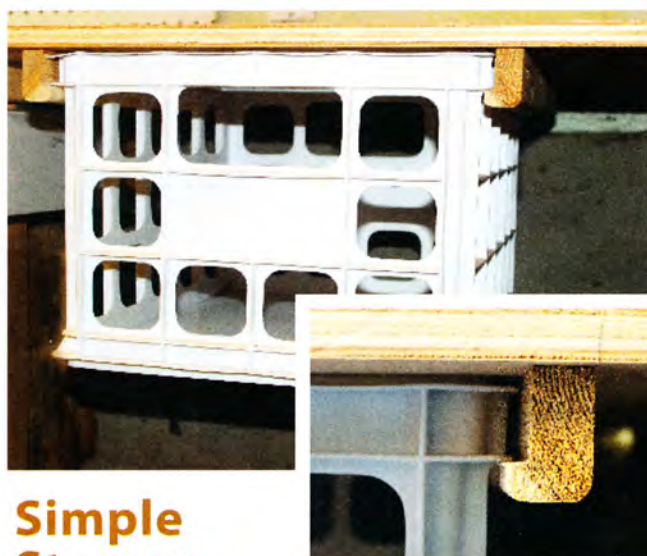
Turning-Tool Tamer

I WAS TURNING a vase recently, and as I got deeper into the turning, the vase's rotation pulled the tool's tip down, making it very difficult to keep the tool straight.

This jig solves that problem. It prevents the handle from being pulled up, but allows horizontal movement so I can easily work deep in the turning.

The jig consists of two pieces of wood. The lower piece (part A) fits under the lathe's bed, and has two rare-earth magnets to hold the jig in place. The upper piece (part B) fits between the ways. An eye bolt runs through both parts and has a length of light chain attached. A loop of cord goes around the handle of the tool, with an S-hook attaching it to the chain. Total cost: about \$5.

Richard Tendick



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Simple Storage

STORAGE SPACE in a small shop is hard to come by. My tool collection keeps growing, but my shop stays the same size! I needed to organize, so I bought a couple milk crate-type boxes and turned them into sliding storage bins underneath a shop table.

The crates have a lip near the top edge, so all I needed to do was rout ledges in two boards and fasten them to the underside of my shop table, to act as drawer slides.

Now I have large, out-of-the-way storage bins that can slide in and out, or be removed and carried to wherever I'm working. I keep vacuum attachments in one and finishing supplies in the other. I cut pieces of cardboard to fit the crates' bottoms so smaller items don't fall out.

Bill Wells

Blade Change Safety System

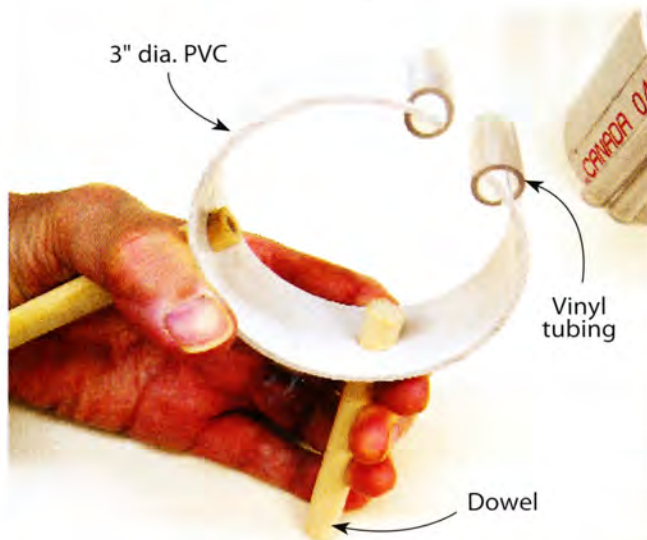
CHANGING SAW BLADES or router bits without unplugging your machine is an often overlooked "no-no." The risk of bumping the switch and inadvertently turning the machine on is probably low, but it's certainly not worth taking chances.

As a reminder, I fasten my machine's wrenches to the business end of the power cord using a piece of string. This way, I have to unplug before changing blades or bits. The string is just long enough to allow use of the wrenches without untying them.

John Cusimano



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Improved PVC Clamps

MAKING SPRING CLAMPS from PVC isn't a new idea. You just cut the pipe into short sections, slice it lengthwise and open up each piece by hand to apply light clamping pressure. I've made two improvements: First, I added two dowels installed 90° from each other (into tight-fitting holes so they will stay put) to act as handles. To be honest, those aren't actually dowels. Being a thrifty sort, I salvaged the handles from disposable foam brushes!

Second, I cut slits in short sections of vinyl tubing and slid the tubing onto the clamps' "jaws." This protects my projects from being marred by the PVC's sharp edges.

Serge Duclos



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Easy-Pour Cans

POURING SOLVENTS or finishes from cans like these can be messy; if you pour the wrong way, the contents come out in big "gulps" because air can't get in fast enough to replace the fluid that's coming out. If you pour the right way, tipping the can sideways with the hole at the top, you still end up with a pool of solvent on the top of the can.

To keep the can's top clean and avoid the gulping effect, I punch a small hole opposite the pouring cap and thread a #10 x 3/4" sheet metal screw into it. When I need to pour, I remove the screw. The small hole allows air to enter the can, so I can pour with the spout close to the container that I'm pouring into.

When I'm done pouring, I replace the screw to seal the container and keep the liquid from evaporating.

James Duxbury

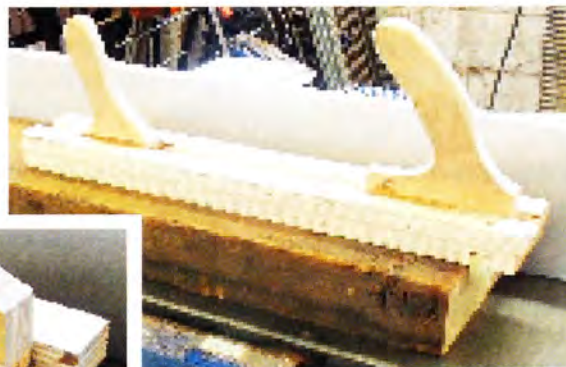
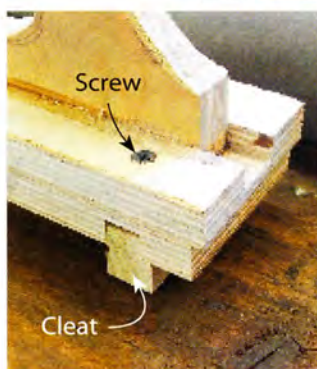
Jointer Push Plate

FACE-JOINTING BOARDS requires some safety precautions to keep your fingers out of the danger zone. I made this simple push plate with a cleat on the back end. Two handles allow me to apply downward pressure; the cleat provides forward pressure.

The push plate is made from two pieces of 3/4" plywood. I cut a groove down the center to create plenty of gluing surface for securing the handles.

The cleat is fastened with screws in the event that I need to replace it. It's housed in a dado so that I could fasten it with screws that are only 1-1/4" long. This eliminates the possibility of my jointer's knives getting anywhere near the ends of the screws.

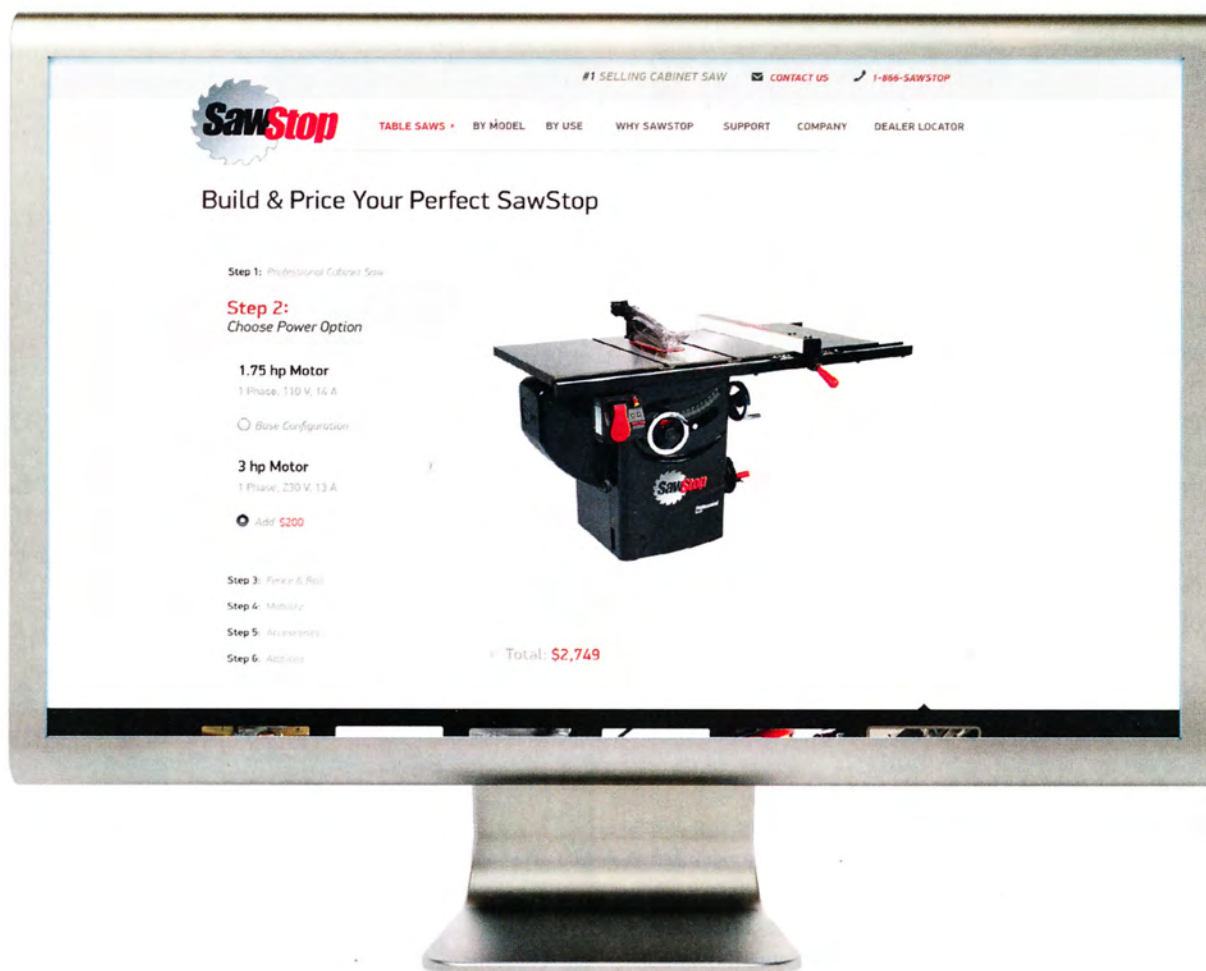
Yoav Liberman



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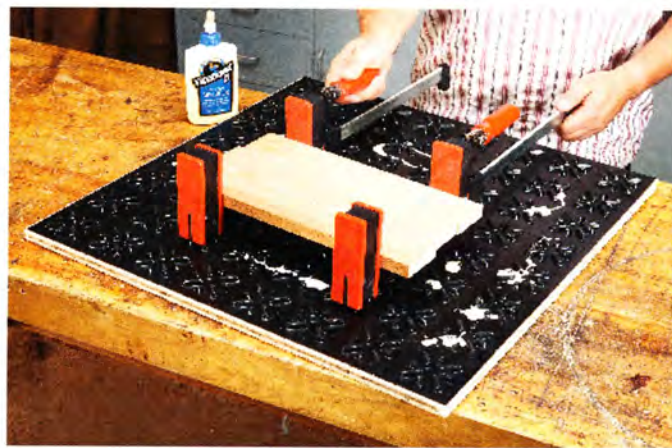
Sandpaper Cutting Board

I'VE GOT A SANDER that takes a half-sheet of sandpaper, another one that takes a quarter-sheet, and a sanding pad that uses a third of a sheet. I made this cutting jig to quickly and accurately cut sheets into all three sizes.

It's just a 1/2" MDF base with a 1/4" thick frame around the edge. A 1/4" thick guide block butts against the frame ends as a straightedge. One side of the guide block is straight, to cut half-sheets. The other side is notched for cutting one-third-sheets. I use a second guide with deeper notches to cut quarter-sheets.

Note that the frame is slightly wider than the sandpaper. That's so you can easily draw the knife all the way to the end of the paper.

Len Urban



Glue-Up Mess Catcher

SQUEEZE-OUT HAPPENS! You can't stop it, so you just have to try to contain it. One day while shopping at the local home center, I found a product called DRiCore Subfloor. It's used as a subfloor in basements as a moisture barrier.

It makes a great glue-up platform. The panels are flat, and the squeezed-out glue drips onto the plastic surface instead of onto my bench. Wet glue is easy to wipe off the plastic. If the glue dries, I just chip it off with a putty knife.

DRiCore comes in 2' x 2' tongue-and-groove panels and costs about \$6 per panel. I bought four panels, and just assemble as many as needed for a glue-up, then disassemble and store them until the next time.

Anthony Disabatino

SOURCE

DRiCore Products, dricore.com, 866-767-6374, DRiCore Subfloor, \$6 per panel.

Zero-Clearance Relief Cut

A ZERO-CLEARANCE THROAT PLATE is a must-have for every tablesaw. It prevents small offcuts and thin strips from dropping down alongside the blade and plugging up your dust collection. Some manufacturers sell blanks specifically for their saws but often you have to make your own. It's pretty easy. You just raise the blade through the blank and you're done.

Here's the problem. On some 10" tablesaws, the blade doesn't lower far enough to allow a shop-made insert to drop all the way into its recess. The prospect of lowering the insert onto a spinning blade is one that shouldn't even be considered, for obvious reasons.

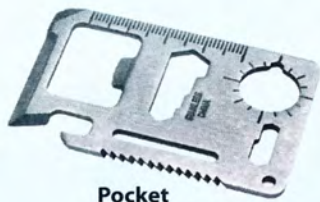
To get around this, I cut a groove on the underside of the blank throat plate deep enough to allow the insert to drop all the way into the recess. I cut two passes, making a 1/4" wide groove, so there's side clearance as well as clear-



ance above the lowered blade. That way, I can slide the fence over the insert's edge to hold it down and safely raise the blade through the blank. Make sure you don't raise the blade into your fence!

Brad Holden

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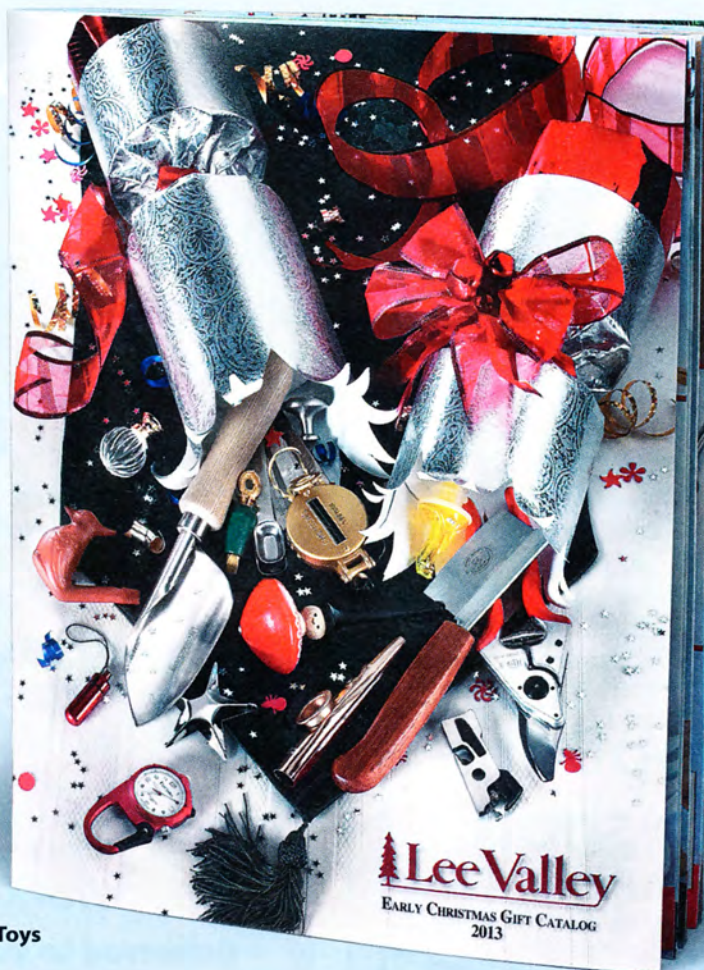
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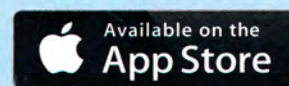
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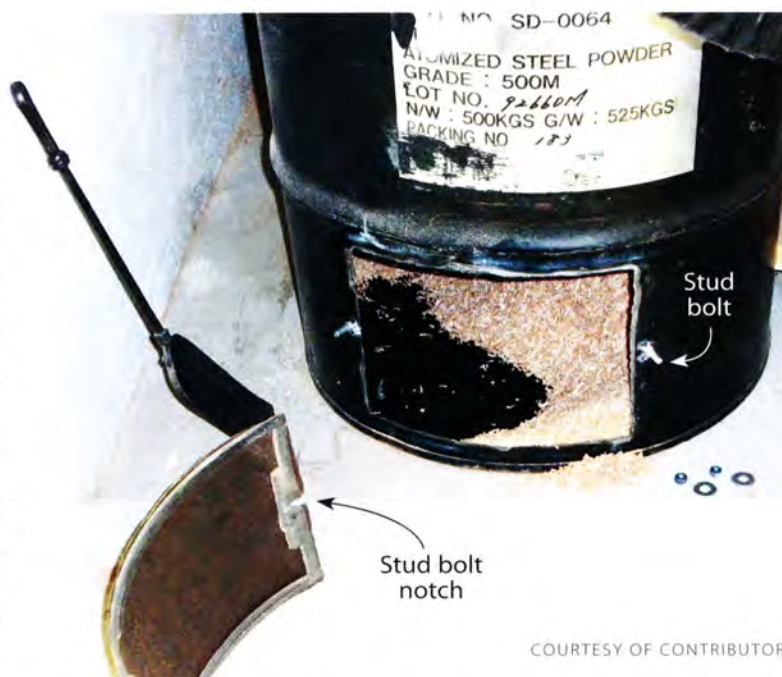
Dust Collector Trap Door

EMPTYING MY DUST COLLECTOR has never been something I looked forward to. For years I wrestled with the unit to empty the contents. First, I'd remove the bag and empty it into a plastic garbage bag. Then I'd lift the blower off the barrel cover, and then empty the drum, a bucket full at a time, into the garbage bag.

I have a friend with a cutting torch, and one day we put our heads together to solve the problem. First, he cut an 8" x 12" hole in the side of the drum, about 2" above the bottom. We drilled a hole in the center of each side of the cutout for stud bolts and then tack welded a 5/16" bolt sticking out of each hole.

We made a 9" x 14" steel door with a notch cut midway on each side for the stud bolts. Then we bent a curve into the door to match the drum and added weather stripping around the door's edges.

To use the door, I slide the notches over the stud bolts and secure it with washers and wing nuts. The vacuum



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pulls the door tight and maintains a good seal. Now, it's a simple task to empty the drum using a small fireplace shovel, and there's no heavy lifting.

Fred Burne

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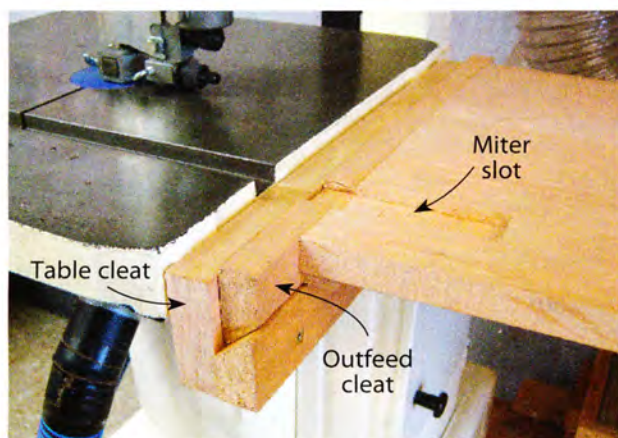
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Bandsaw Extension Table

BANDSAWING LONG BOARDS without a helper is tricky business. I don't like roller stands. Most aren't tall enough, and those that are have an annoying problem: If your stock butts into the roller instead of riding over it, the stand tips over.

This detachable outfeed table is much better. When not in use, it lifts off the saw (no tools needed) and folds flat for storage. It's plenty sturdy. I've used it to cut straight sides on large burl slabs weighing over 100 lbs. with no problem. The outfeed table is attached using a "French cleat," typically used for hanging cabinets without screwing into their backs.

Here's how the cleat system works. Attach a cleat with a 45° angle to the back edge of your bandsaw's table. (If your saw's table doesn't have any pre-drilled holes along its back edge, you'll have to drill a couple.) Attach a mating cleat to the underside of the outfeed table. The weight of the outfeed table holds it in place. Size and position your cleats so that the outfeed table's height is flush with your bandsaw's table.

At the far end of the outfeed table I attached a leg using two hinges on the outfeed's underside. A chain keeps the leg from rotating out too far. I also routed a groove into the outfeed table to extend the slot for my saw's miter gauge, if needed.

Rand Hall

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Simple Setup for a Fussy Joint

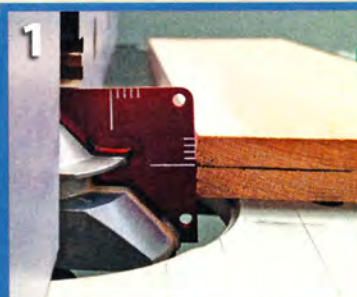
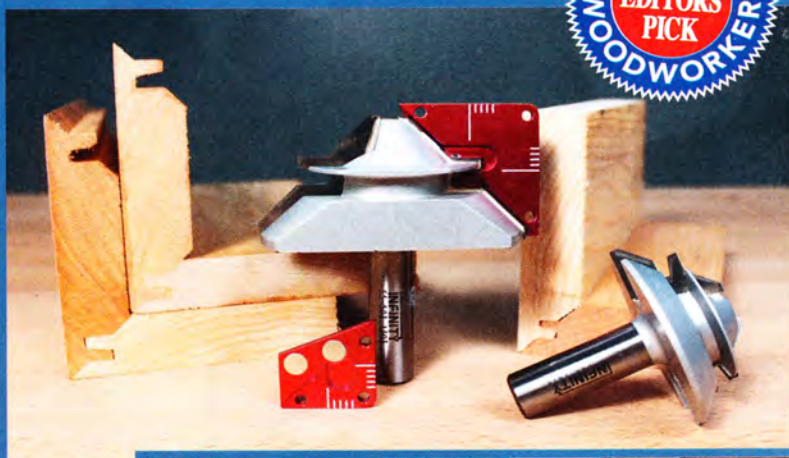
THE LOCK MITER is a strong and elegantly simple joint. Using just one bit, both halves of the joint are cut on a router table using the same setting. One half is cut vertically and the other is cut horizontally.

Neat—but have you ever tried setting up that bit? Both its height and its distance from the fence have to be dead-on perfect. That usually requires a lot of frustrating trial and error work, but the new Lock Miter Master from Infinity makes the setup quick and easy.

The Lock Miter Master is a small but ingenious jig. It has magnets embedded flush with its surface, so the jig sticks to your cutter and stays in position for the entire setup.

To use the jig, draw an accurate centerline on your stock. With the jig positioned on the cutter, set the bit's height by lining up the jig's horizontal mark with the centerline (**Photo 1**). To set the distance to the fence, line up the jig's vertical mark with the same centerline (**Photo 2**). That's it. My first attempt produced a perfect lock miter.

The jig's smaller marks are for use on stock of two different thicknesses or for off-setting the joint. Fortunately, this is a universal tool. The folks at Infinity say that they haven't yet found a lock miter bit on which it doesn't work!



SOURCE

Infinity Cutting Tools,
infinitytools.com, 877-872-2487, Lock Miter Master Jig For Bits Cutting 5/8" to 1-1/8" Stock, #LMM-003, \$30; Lock Miter Master Jig For Bits Cutting 3/8" to 3/4" Stock, #LMM-002, \$30.

Versatile Pen-Drilling Jaws

DRILLING A PEN BLANK on a lathe offers a finer degree of control and accuracy than using a drill press—particularly on a long blank. But how are you going to hold it? If you own a NOVA scroll chuck, you'd use the new Pen Plus Jaws.

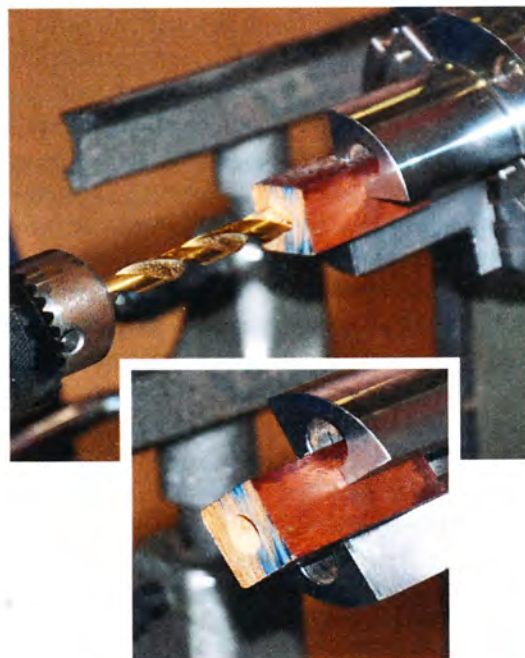
The two-piece jaws' circular cutout and 2" long gripping surface allow the Pen Plus Jaws to work well for numerous "free-end" turning tasks, not just drilling pen blanks. (In free-end turning, one end of the stock is unsupported.)

Used with a contracting grip, the Pen Plus Jaws will hold squares from about 3/8" to 1" across and rounds from about 1/2" to 3/4" dia., with lengths up to 10". Used with an expanding grip, the Pen Plus Jaws work for openings from about 1-3/8" to 2-1/2" dia., and also with lengths up to 10".

NOVA Pen Plus Jaws are compatible with all NOVA Chucks, including the NOVA Infinity Quick Change System.

SOURCE

NOVA Woodworking, teknaatool.com, 866-748-3025, NOVA Pen Plus Jaw Set, #6034, \$40.



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Get a GRR-Rip!

PUSH BLOCKS are essential in every shop. I've used my fair share of them, and the new GRR-Rip Block from MicroJig just might be the nicest one so far. Most push blocks use a soft rubber pad for a gripping surface. These pads work great for a while, until they start to harden and lose their gripping power.

The GRR-Rip Block doesn't have this problem. It uses a thin rubber material that doesn't rely on its squishiness for a good grip. Instead, the grip is provided by an array of raised discs.

Sawdust buildup is another nuisance with most push blocks, also causing them to lose their grip. Once again, the GRR-Rip Block's raised-disc design solves the problem. When the GRR-Rip Block gets dusty, just wipe it clean with a damp cloth.

Here's another clever feature: There are two pivoting cleats that hook the back edge of your stock on each end of the GRR-Rip Block. The cleats can be left to pivot freely, or can be locked in the raised position.



Pivoting cleat

The angled handle is large, roomy and comfortable. Two threaded inserts provide a place to attach MicroJig's Deflector/Connector for use when routing without a fence. Or, use the Deflector/Connector for connecting two GRR-Rip Blocks or GRR-Rippers.

SOURCE

MicroJig, microjig.com, 855-747-7233, GRR-Rip Block, #GB-1, \$30; Deflector/Connector #GRDC-20, \$13.

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110 Volt Cabinet Saw

A **CABINET SAW** is a woodworker's dream, but many simply can't afford one, or don't have a 220 volt circuit to accommodate one. The folks at Laguna have been working hard to put a cabinet saw within reach of more woodworkers, and the Laguna Fusion—a true cabinet saw that runs on a 110 volt circuit—is the result. The Fusion draws 15 amps, though, and requires a 20 amp circuit.

So what's the big deal about a cabinet saw as opposed to a contractors or hybrid saw? Power aside, here's the difference: A cabinet saw's motor is located *inside* the cabinet, not outside; its trunnions are mounted to the *cabinet*, not to the top.

Having the motor inside the cabinet is a big plus for a small shop, as the saw takes up less space. Cabinet-mounted trunnions make alignment of the saw's top with the blade a snap. This is the ideal arrangement of motor and trunnions.

Contractors saws and hybrid saws fall a bit short of this mark. A contractors saw's motor hangs off the back of the cabinet, making it hard to park the saw against a wall. A hybrid saw is better: Its motor is inside the cabinet. But the trunnions on both saws are mounted under the table, not to the cabinet, making alignment quite difficult when needed.

Most cabinet saws run on a 220 volt circuit and have 2 to 5 hp motors. Contractors saws and hybrid saws run on a 110 volt circuit with a maximum of a 1-3/4 hp motor. Cabinet saws also have more mass; i.e. lots of cast iron, which reduces vibration. With its 1-3/4 hp 110 volt motor, the Laguna Fusion doesn't have the same power output as a 220 volt cabinet saw, nor (at 266 lb.) is it as massive. But the Fusion's price tag isn't as massive either. And if you primarily work with wood that's 1-1/2" thick or less, you may not need that extra power or mass.

The Laguna Fusion has all the modern features you'd expect on a cabinet saw: large cast iron table and extensions, T-style fence, riving knife/splitter and guard, left-tilting arbor and good dust collection, including a shroud around the blade. The Fusion also includes a push stick that mounts into two brackets directly on the top of the fence, so it's always close at hand.

Another important safety feature is a magnetic switch. If you happen to blow a breaker while the saw is running, it won't automatically start up again when you turn the circuit back on.

The Fusion sits on two adjustable feet and two casters, giving it a built-in mobile base. The casters are oriented 90° to the direction you push stock through the saw, so it won't creep forward during use. To move the saw, you just lift the ends of the rails like the handles on a wheelbarrow. It's easy! The Fusion is available with a 36" or 52" rip capacity.

SOURCE

Laguna Tools, lagunatools.com, 800-234-1976, Laguna Fusion 36" Rip, # MTSAW17536110-0130, \$1295; Laguna Fusion 52" Rip, # MTSAW17552110-0130, \$1395.

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A Truly New Glue

CYANOACRYLATE (CA) GLUES have been around for years, but the folks at Bioformix have come out with a new twist, making a product that's much more practical for general woodworking.

Most CA glues have a very short working time. Nexabond 2500 is available in three different working-time ranges: 2500S bonds between 30 seconds and 2 minutes, 2500M from 2 to 4 minutes, and 2500L from 4 to 15 minutes. The range within each of these has to do with some heady chemistry and the particular wood species you're working with.

Unlike typical CA glues, which cure when moisture is introduced, Nexabond cures via salts and fatty acids. This allows the chemists at Bioformix to have much greater control over the duration of the chemical reactions to create a wide range of working times.

According to the manufacturer, Nexabond 2500 delivers the holding power of epoxy and polyurethane glues. But unlike epoxy, Nexabond is not a gap-filling glue. (Polyurethane glue doesn't fill gaps, either.) For best results, the pieces you're joining with Nexabond should have gaps no greater than .003".

The big advantage you'll get over typical yellow



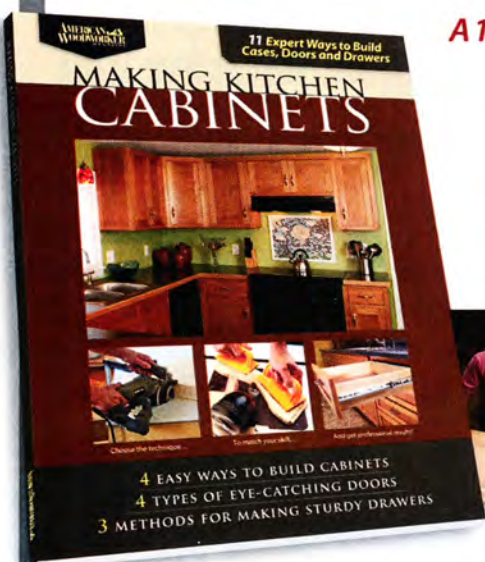
wood glue is the drastic reduction in cure time. You won't have to leave parts clamped for an hour or overnight before moving to the next step. Nexabond is more expensive per ounce than yellow glue, but the folks at Bioformix say that you'll need far less for a typical joint.

SOURCE

Bioformix, shop.bioformix.com, 860-953-5279, Nexabond 2500S, M, or L - 1 FL OZ, \$8; 4 FL OZ, \$13; 16 FL OZ, \$55.

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Modern Take on a Stanley Classic

SHOOTING A BOARD'S EDGE with a hand plane is a time-tested way to create perfect-fitting joints. Veritas' new Shooting Plane, made specifically for the task, hits the mark dead on. This modern take on the Stanley #51 shooting plane oozes quality, and is a dream to use.

This plane is beefy; it weighs 7-3/4 lb. That's a big deal, because shooting a joint requires momentum, particularly when you're dealing with miters or end grain. Its body is nearly 16" long—2" longer than a No. 5 jack plane. The sole is milled flat and square to the plane's running surface.

The Shooting Plane's 2-1/4" wide blade is beveled at 25° and bedded at 12°. Adding a 2° microbevel gives you a low, 39° cutting angle. The bevel-up iron is skewed 20°, creating a shearing effect to further reduce cutting resistance. The plane also has an adjustable mouth for reducing tearout on fine cuts.

The running surface of the Shooting Plane has parallel sides—like the Stanley #51. This feature enables you to run it down a guided track, as shown in the photo, making the plane much easier to control. Stanley manufactured the #52 Chute Board for this purpose. The Veritas Shooting plane fits the #52 Chute Board, on the off chance you've got one of



those lying around. I think I'll be making my own.

The rear tote rotates between two detents 60° apart, giving a comfortable hand position for planing on the running surface or on the sole, like a standard plane. The plane is available in either a right-handed or left-handed version.

You have your choice of blades, too: either 01 tool steel or Veritas' own PM-V11, for an extra fifteen bucks. The blade comes lapped dead flat, which saves lots of time.

SOURCE

Lee Valley & Veritas, leevalley.com, 800-871-8158, Veritas Right-Hand Shooting Plane 01 Blade, #05P54.51 or Veritas Left-Hand Shooting Plane, #05P55.51, \$300; Right or Left-Hand Plane with PM-V11 Blade, #05P54.71 or 05P55.71, \$315; Replacement 2-1/4" PM-V11 Blade, #05P34.72, \$46.

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A **SCROLL SAW** is the go-to tool for making fine, detailed cuts. But a scroll saw, for many shops, doesn't even break into the top ten must-have tools. The Dremel Moto-Saw is at a price point that makes a scroll saw much more attractive and affordable.

Compared to a full-size scroll saw, the Moto-Saw is a fairly light-duty tool. It performs best in stock that's 3/4" thick or less. The throat—at 10" deep—accommodates a reasonably large workpiece.

I can see how the Moto-Saw could come in very handy for the occasional scrolling task. It takes up no floor space and is extremely portable. The Moto-Saw is equipped with a base that can be clamped onto a bench wherever the saw is needed. With the push of a button, it slips out of its base, becoming a powered coping saw.

The Moto-Saw features a no-fuss auto-tensioning system, making blade changes fast and adjustment-free. Blade options include fine and coarse tooth blades for wood, plastic, etc., and a metal cutting option. A variable speed wheel lets you set the speed to match the task at hand. There's also a dust port under the table.

SOURCE

Dremel, dremel.com, 800-437-3635, Dremel Moto-Saw, #MS20-01, \$90.

Router Table Safety Boost

A **MAGNETIC SWITCH** is a safety device that's common on many new stationary tools. They're quickly becoming a requirement for schools and industry. For older tools, two new Mag Switches from General International provide an easy safety upgrade.

Imagine that you trip a breaker while a tool is running. In your frustration, you forget to turn the tool off. You flip the breaker and the machine starts right back up. Oops! This can't happen with a magnetic switch. If you lose power, the machine won't start up again until you turn it on.

One of the Mag Switches also has a lock-out button, adding another layer of safety. You have to twist the lock-out button before the machine will turn on, avoiding inadvertently bumping the switch and turning the machine on.

Mag Switches require no wiring. You just mount the switch's plate to your machine, plug your machine into the switch, and plug the switch into the wall. Mag Switches are available for 110 volt motors from 3/4 hp to 1-1/2 hp that pull from 8 to 17 amps. A 220 volt switch is also available.

SOURCE

General International, general.ca, 888-949-1161, Excalibur Mag Switch 110 V, 3/4 HP, 8 to 11 A, #MAGS110-V, \$139; 110 V, 1 HP, 10 to 15 A, #MAGS110-1, \$142; 110 V, 1-1/2 HP, 14 to 17 A, #MAGS110-2, \$142; 110 V, 1 HP, 10 to 15 A with lock-out switch, #MAGS110-L, \$169; 220 V, 1-1/2 HP, 8 to 11 A, #MAGS220, \$152.



Router Table with Nice Features, Nice Price

LOOKING FOR A FULL-FEATURED router table? Don't want to break the bank? If so, the Premium Die Cast Aluminum Router Table from Craftsman is definitely worth a look. It has all the necessary features and a few nice extras.

The 20" wide x 30" long cast aluminum top, coupled with a 26" long aluminum fence, gives ample space for routing large parts like cabinet doors or long moldings. The table has a miter slot and includes a miter gauge.

Bit height adjustments are done above the table (using various Craftsman router models only). The aluminum router plate has leveling screws and includes five insert rings for bits of different diameters.



The fence is split to adjust for various bit sizes. Each side of the fence has its own micro-adjustment knob, so the fences can be offset from each other by up to 1/2". This comes in handy when you're using a full profile bit that leaves the stock slightly narrower at the outfeed end. It's also nice if you use your router table for light jointing work.

The fence has an integrated flip-up guard and includes two featherboards that attach to the fence. The back of the fence has a 2-1/4" dust port, but there's no under-the-table dust port. A Premium Router Table Base Cabinet (pictured), with locking casters, is also available.

SOURCE

Craftsman, craftsman.com, 800-469-4663, Premium Die Cast Aluminum Router Table, #37610, \$250; Premium Router Table Base Cabinet, #3761, \$70.



Fully Loaded

by Brad Holden

ON ONE END OF THE SPECTRUM, we have a router screwed to the underside of a piece of plywood, supported on sawhorses, with a board clamped across for a fence. On the other end, we have the Festool CMS router table.

The basic principle and end result may be the same, but then, the same could be said for a driving a '74 Pinto station wagon versus a brand-new BMW.

I've had the "pleasure" of owning both the router screwed to plywood and the '74 Pinto. Never owned the brand-new BMW, but I've had a chance to test-drive the Festool CMS router table—with all the options.

The sliding table is the most obvious difference between the CMS and most other router tables (**Photo 1**). The table glides along the front rail so smoothly that it's hard to stop running it back and forth just for fun. A beefy miter gauge attaches to the sliding table. The miter gauge's back rail is adjustable so you can support your work as close to the fence as possible. Using the sliding table, cope cuts on narrow boards are a breeze. I'd like to see a built-in hold-down on the miter gauge's fence, though.

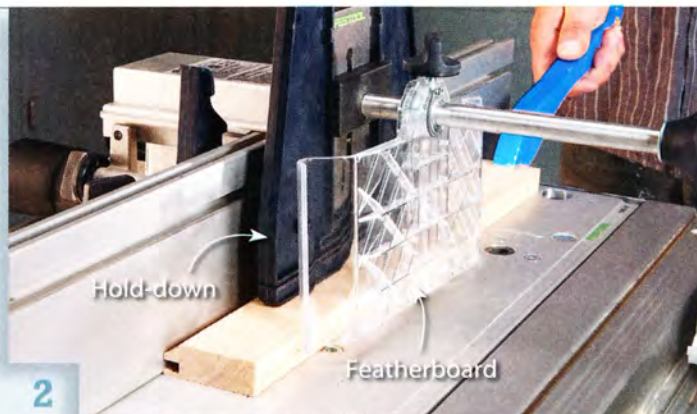
The CMS does have a hold-down solution on the main fence, however. It's a two-in-one hold-down/featherboard system for securing stock (**Photo 2**). Both components attach to a metal rod. Two generous knobs allow independent adjustment of the featherboard and hold-down. The rod does get in the way at times, even preventing use of a push stick in certain situations. All in all, however, the system works quite well.

The CMS' main fence is the heart of this table. It's a split fence; the two fence halves slide back and forth to accommodate different size bits. A micro-adjust knob lets you offset the infeed fence up to about 5/16" from the outfeed fence (**Photo 3**). This is useful for routing a full profile that leaves the board slightly narrower at the outfeed end. You can also use this feature for light jointing—a handy feature at a jobsite.

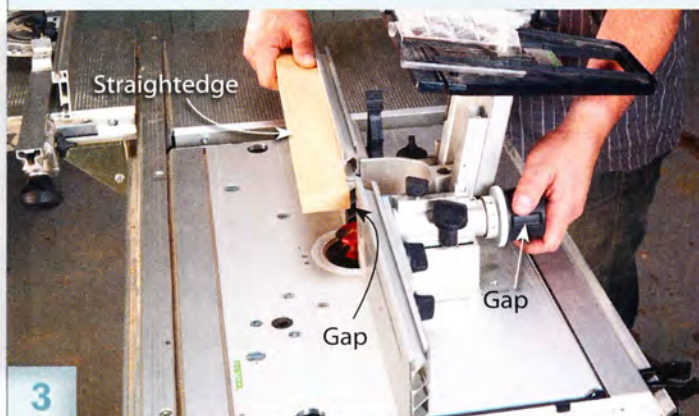
The bit's height is adjustable from above the table (**Photo 4**); that's much nicer than having to reach underneath the table. The height adjustment hole is located toward the front of the table, so it won't ever be covered by the fence. On some router tables, the fence



A sliding table glides on a rail attached to the front of the main table. Used with the miter gauge, this is the perfect setup for cuts on the ends of narrow boards.



A featherboard and hold-down are integrated into a single unit that's mounted to a metal rod. The featherboard rotates 180°, so it's out of the way when you don't need it.



A micro-adjustable infeed fence is nice when you're using a bit that cuts a full profile, or for light jointing.



Above-the-table bit-height adjustment is smooth and precise. The table's top lifts out to facilitate mounting the router. (But you don't have to tip it to adjust the bit's height!)

often blocks access to the hole—an unfortunate design.

Excellent dust extraction is a Festool hallmark, and the CMS is no exception. It has the usual port behind the fence, as well as a shroud that clips to the router's base, surrounding the bit with suction (**Photo 5**).

Overall, the CMS is a well-engineered piece of equipment. As a stationary shop tool, I'd like more heft for stability, as well as a larger table. But with its fold-up legs and relatively light weight, the CMS is clearly aimed at contractors who need portable tools capable of fine work and woodworkers with confined shop space. For these folks, the CMS hits the bull's-eye.

The CMS is compatible with either Festool's OF1400 or OF1010 routers. It's available as pictured—with all the options—or in a stripped-down version minus the sliding table and extension table. Both of those options are also available in a CMS table that attaches to Festool's multi-function worktable. 



A dust shroud under the table surrounds the router's collet. Combined with the dust port in the fence, there's virtually no escape for dust.



Learn more about the
Festool CMS Router Table at
festoolcms.com

SOURCE

Festool, festoolusa.com, 888-337-8600, CMS Free-Standing GE Basic, #P00112, \$1,200; CMS Free-Standing GE Set, #P00111; \$1,600; CMS MFT-Attached VL Basic, #P00110, \$1,000; CMS MFT-Attached VL Set, #P00109, \$1,300.

25 Years of Precision Joint-making

by Laurie McKichan



THE JDS MULTI-ROUTER recently passed its 25th anniversary. In all those years, there's been only one relatively minor change to this venerable joint-making machine—a remarkable feat when you consider how frequently woodworking tools are upgraded or redesigned. The Multi-Router can be used to cut dovetails and many other useful woodworking joints, but it excels at cutting mortises and tenons.

As a professional furniture maker and a member of a co-operative shop that has three Multi-Routers, I can't imagine building a project without this extraordinary tool. Our Multi-Routers are used nearly every day. I never worry about which one I use, because they all perform exactly the same way. These machines have proven so versatile that our shop motto could be, "If you haven't figured out how to solve your problem, you haven't tried the Multi-Router!"

Basic operation

Like a mortising machine, the Multi-Router features three-axis movement. The router mounts horizontally, behind the work, on a vertical surface that moves up and down. The work clamps on a horizontal table that moves in and out and from side to side. Levers and stops control the height, width and depth of the cut. Most operations require working two levers. To complete a cut, it's best to keep the bit moving and make multiple shallow passes.

To cut mortises, you set the stops to establish the depth

and length and then move the table in and out and from side to side (**Photo 1**). In most cases, the width of the mortise is determined by the bit's diameter, so the height is fixed. An extra-wide mortise requires working all three levers or making two side-to-side passes, with a single height adjustment between passes.

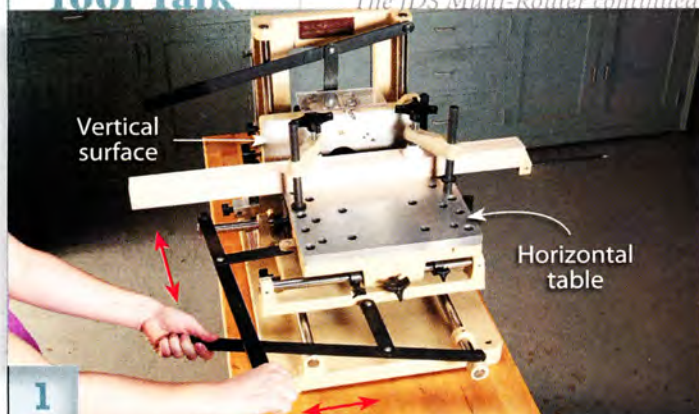
Similar operating methods are also used to cut rabbets, dadoes, grooves for blind splines and lap joints. Install a vertical panel-raising bit and you can even cut raised panels for cabinet doors. To cut tenons, it's best to use the Multi-Router's template system (**Photo 2**).

Precision routing

The template system produces joints accurately and consistently—it's great for repetitive work and production runs. To work the system, you install the appropriate template and trace around it using the ball-bearing stylus (**Photo 3**).

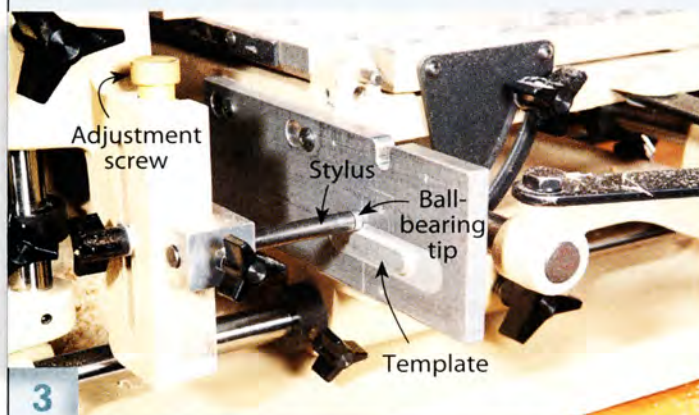
The one change mentioned earlier is that the stylus now has an adjustment screw that allows fine-tuning. Our shop has one old model and two newer models. Although this change is helpful, it hasn't diminished our use of the old model.

Machined aluminum templates are available for cutting box joints, through dovetails, mitered dovetails, traditional tenons and round tenons (**Photo 4**). Also available are variable-size tenon insert sets that allow adjusting the tenon size



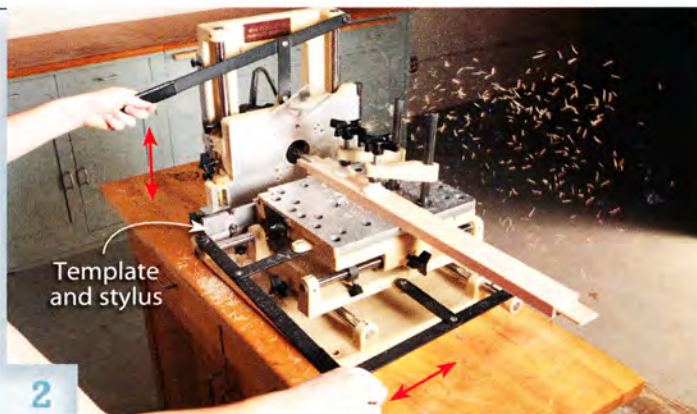
1

Cut mortises by moving the Multi-Router's horizontal table in and out and from side to side. The router mounts on an adjustable vertical surface that stays fixed for this operation.



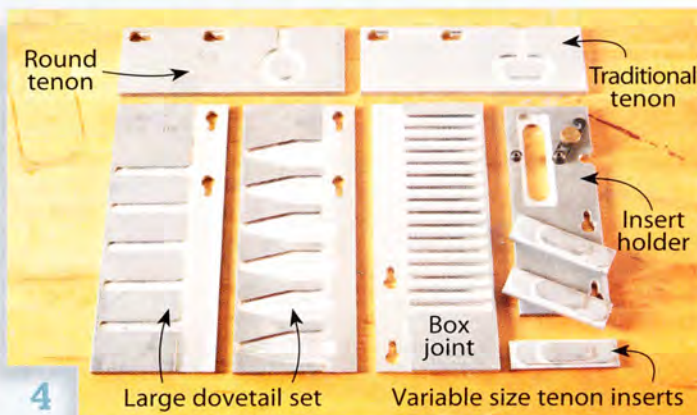
3

The stylus travels smoothly around the template thanks to its ball-bearing tip. A fine-adjustment screw allows precisely dialing in the starting position.



2

Cut tenons using the Multi-Router's template system. Move the vertical surface up and down and the horizontal table from side to side to guide the system's stylus around the template.



4

An extensive template system allows cutting dovetails, box joints, and round and traditional tenons in a wide variety of sizes.

in .010 increments to fit mortises that aren't accurately sized.

While it's true that mortise sizes can vary slightly due to wood density or bit diameter, I've rarely found it necessary to use anything but the largest variable-size insert (which cuts a standard-size tenon). If a tenon fits too tightly, I just pare its cheeks with a shoulder plane.

Prices range from \$42.95 for a standard tenon template to \$68.95 for a dovetail set (pin and tail templates). Each set of variable-size tenon inserts costs \$38.95; sets are available for 14 different tenon sizes. One way to control costs is to buy only sizes you'll commonly use. Another option is to use loose-tenon joinery, which only requires routing mortises—then you won't have to buy any tenon templates.

The Multi-Router's horizontal table tilts from 0° to 45° (see photo, page 25) and work can be positioned on it perpendicular to the bit or at almost any angle. That means you can cut angled and compound-angled mortises and tenons—a real bonus for chair makers. Clamp on shop-made jigs for even more variations (**Photo 5**).

Nuts and bolts

The Multi-Router has been built in the United States in the same foundry and machine shop since it was invented. Its

solid-aluminum castings, Thomson linear bearings, hardened steel rods and gas-cylinder assist to offset the weight of the router ensure smooth operation and long service life. The gas cylinder can be easily replaced, if necessary.

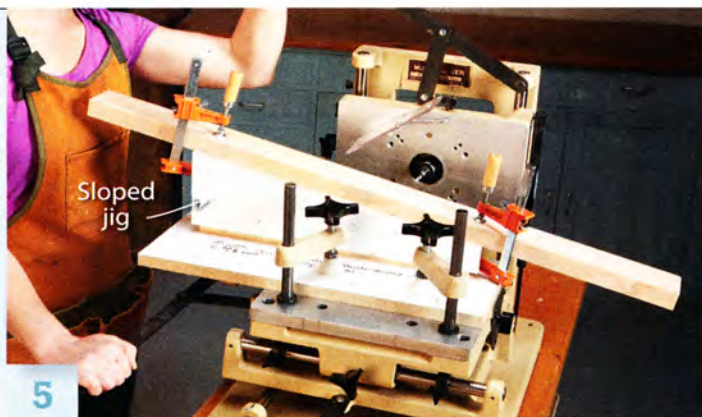
The Multi-Router comes almost completely assembled—install a couple parts and you'll be good to go. There are no adjustments to be made and nothing to get out of alignment.

You supply the router (1-1/2 hp minimum; 18 lbs maximum) and carbide or high-speed steel end mill bits. The vertical surface is pre-drilled and tapped for mounting several router makes and models—they're listed online and in the manual. If your router isn't on the list, you'll have to drill and tap mounting holes.

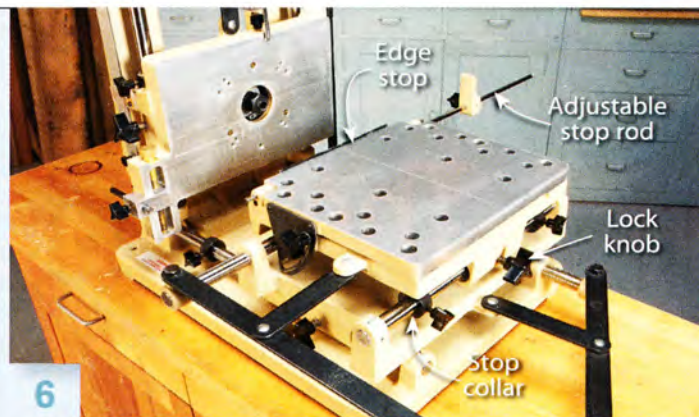
The sliding stop collars and lock knobs that set the height, width and depth of cut tighten easily and hold securely, even though they take constant knocking as you operate the levers.

The 10" x 12-1/4" horizontal table features a steel edge stop and a stop rod (**Photo 6**). The edge stop can be lowered out of the way or removed. I often substitute shop-made MDF edge stops, so I don't worry about cutting into them.

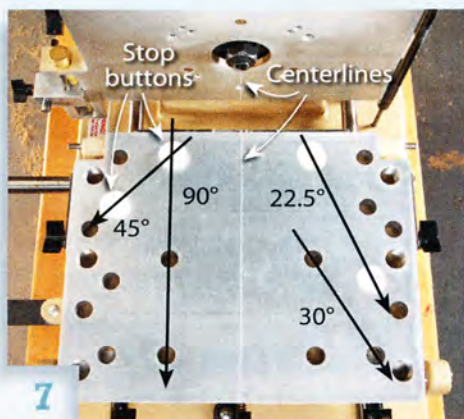
The stop rod is useful for making repeatable cuts on pieces that extend beyond the sides of the table. A similar



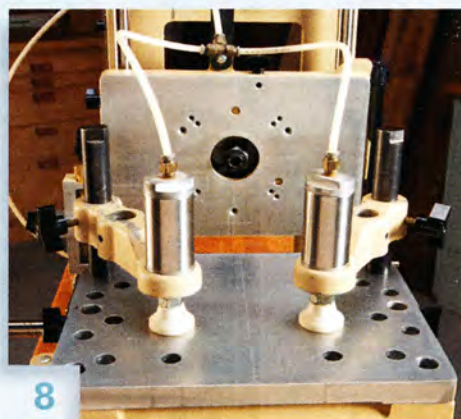
5 Install shop-made jigs to expand the Multi-Router's versatility. Here a sloped jig acts as a side-tilting table to cut angled mortises for the louvers on a shutter.



6 The horizontal table has sliding stop collars and lock knobs to set its travel, an edge stop for positioning work perpendicular to the bit and an adjustable stop rod for repeatable cutting.



7 Holes and stop buttons automatically position work at common angles. Machined centerlines make it easy to center the work on the bit.



8 Pneumatic clamps, an extra-cost accessory, speed up production when making repetitive cuts. The supplied manual clamps hold work just as securely.



9 The height adjustment scale, primarily used to position the stylus, is very accurate. I often line up offset loose tenon mortises by sighting the scale.

stop rod for pieces that extend beyond the front of the table would be equally useful. (A video on the Multi-Router website shows a wooden one that's easy to make.) Nylon stop buttons make it easy to position work at common angles (Photo 7).

Two heavy-duty manual clamps are included—two clamps are adequate for most operations. Additional clamps are available (\$49.95 each), but when I need a third clamp, I can usually find a place for a regular F-style clamp without obstructing any of the moving parts. Pneumatic clamps are also available (Photo 8; \$399 per pair). These clamps have two mounting positions and a longer reach than the standard clamps. The table is tapped for them in six locations.

The height adjustment scale is very accurate (Photo 9). The optional Pro-Scale digital measuring system (\$339) provides pinpoint accuracy, but as with pneumatic clamps, I haven't found it to be necessary.

The Multi-Router remains stable during use. It weighs 90 lbs, so there's little need to bolt it down. An open stand is available (\$176), but I'd recommend a stand or bench with drawers or shelves to store all the accessories.

Unfortunately, there's no easy way to collect dust, as the machine's levers, horizontal table and vertical surface must

be allowed to move freely. I've seen one creative solution that successfully captured most of the dust by combining a small overhead hood with a powerful collection system.

The bottom line

At \$2,695, the Multi-Router is a luxury most woodworkers will only dream about. But it's a dream machine that's guaranteed to expand your woodworking horizons. It's also built to last a lifetime. The Multi-Router shown here has required only one minor repair in more than 18 years of use: The vertical table's gas cylinder had to be replaced. That's it.

For small professional shops it's a no-brainer: The Multi-Router will pay for itself many times over in time saved. For a woodworking enthusiast, a Multi-Router may mean being able to actually complete those weekend projects in a weekend.

SOURCE

JDS Company, jdstools.com, 800-480-7269, Multi-Router, \$2695.

Laurie McKichan designs furniture to be "simple, honest and direct." You can see more of her work at lauriemckichan.com.

The Detail/Spindle Gouge

How to
sharpen and use
this basic turning tool.



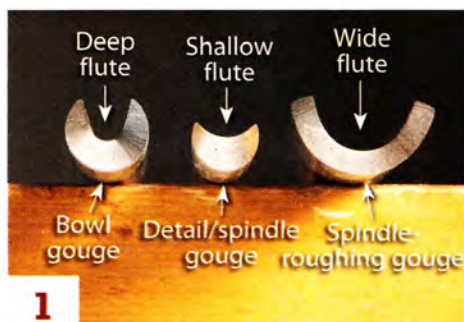
See Alan sharpen and use
a detail/spindle gouge at
AmericanWoodworker.com/WebExtras

PERHAPS WOODTURNERS should sell naming rights. The field has never standardized the names of its tools (or measurements of their widths or how to describe their angles), so they're often called different things. One tool stands out in this regard: Whether it's called a detail gouge, spindle gouge, shallow-fluted gouge, fingernail gouge, contour gouge, forming gouge, long-and-strong gouge or just plain "gouge," no other woodturning tool has as many names.

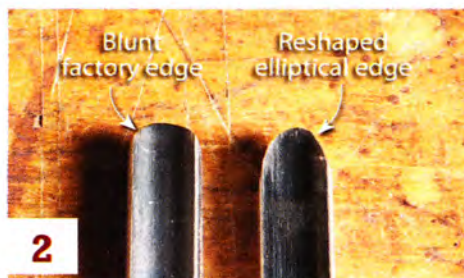
To avoid confusion in my classes, I call this essential tool a "detail/spindle gouge," because those are its two most commonly used names. A detail gouge is said by some to be thicker under the flute than a spindle gouge, but essentially they're the same tool.

This little gouge is used primarily for long-grain turning—when the stock is mounted so the grain runs parallel to the lathe's bed. For this application, it's hands-down the best choice for cutting coves (concave shapes). It's also excellent for rolling beads (convex shapes) and shaping ogee curves, which combine concave and convex cuts.

The features that make a detail/



1 A shallow flute distinguishes a detail/spindle gouge from bowl and spindle-roughing gouges, the other two types of gouges that woodturners commonly use.



2 Reshape the factory edge. An elliptical profile increases the cutting surface and allows cutting on both sides, which is much better for creating details with concave and convex shapes.

spindle gouge perfect for these cuts, however, also make it a poor choice for roughing, shaping cylinders or making other straight-line cuts, such as tapers. In essence, this little gouge is great for cutting details in all types of turning—even on a face-grain bowl (when the blank is mounted with its face grain against the lathe's faceplate). For this application, it's a fine choice for working the bowl's rims and the underside of its base—especially its feet.

A distinctive shape

The detail/spindle gouge is distinctively different than the other two types of gouges that turners typically use, because it has a shallow flute (**Photo 1**). Although the flute's radius and the metal's thickness below it can vary, the overall design of this gouge remains shallow when compared to the other two types. Detail/spindle gouges typically range from 1/4" to 1" in width. For the scale in which I most commonly work, I prefer the 3/8" and 1/2" sizes (see Sources, page 31).

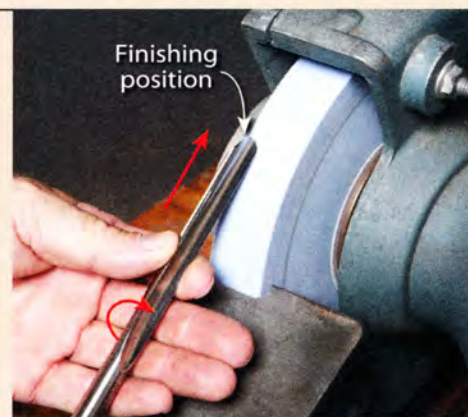
The bowl gouge is a heavy tool with a heavy round tang and a deep flute;



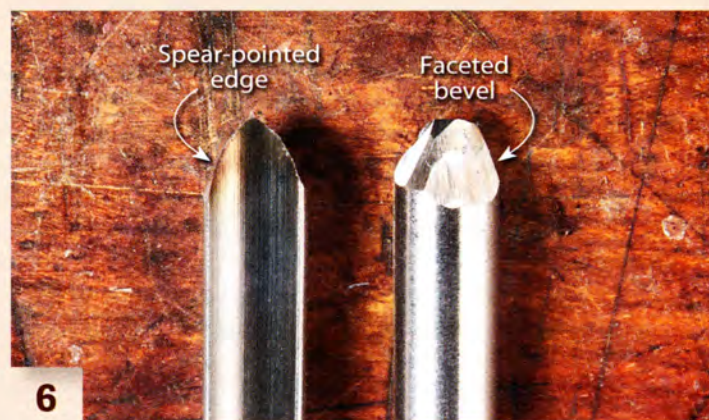
Grind the edge to an elliptical shape by swinging the gouge through an arc. Set the tool rest set at 90°.



Form the bevel and sharpen the elliptical edge one side at a time, using a push-and-twist motion. Rotate the gouge to follow the edge as you move it up the wheel; reverse the action as you move it back down.



Forming the bevel and sharpening an edge with a grinding jig is easy because it automatically sets the angle and makes a wide sweeping motion that follows the elliptical shape.



Avoid creating a spear-pointed edge, caused by overgrinding the sides of the tool's elliptical edge. Also avoid a faceted bevel, caused by changing the angle as you rotate the tool.

it's sometimes called a "deep-fluted gouge." This gouge is the norm for turning bowls and vessels. It's great for roughing out, shaping and finishing operations in such turnings.

The spindle-roughing gouge has a flat tang and a wide flute; it's sometimes called a "half-circle gouge." This gouge is used in long-grain turning to remove the corners from blanks and create cylinders, tapers and shallow concave and slightly domed convex shapes. It isn't a detailing tool and it shouldn't be used for turning bowls because its flat tang is weak and can break or bend.

In addition to a shallow flute, the other basic design element of the detail/spindle gouge is an elliptical cutting edge. As the tool's factory edge is more likely to be straight, slightly domed or pointed like a spear, a new detail/spindle gouge typically requires reshaping (**Photo 2**).

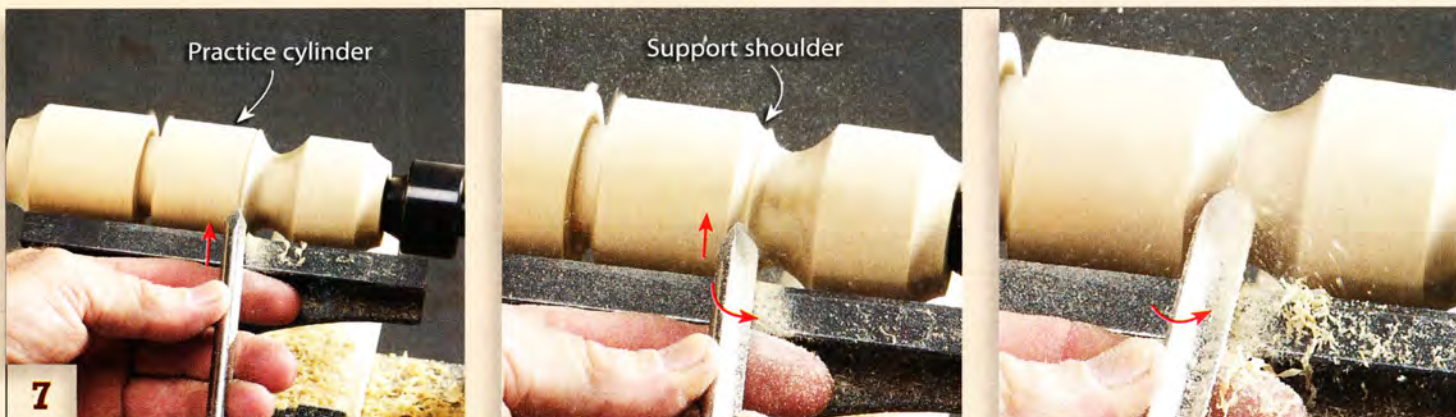
An elliptical profile allows cutting with both sides of the tool, which is especially useful because it allows shaping coves and rolling beads in both directions. On each side of the ellipse, the more sharply-curved portion neatly cuts concave shapes, while the more broadly-curved portion easily cuts convex shapes. An elliptical profile also provides more cutting surface to work with and helps to reduce mishaps such as run-backs and dig-ins, because the edge trails away, rather than ending abruptly.

Sharpening

Sharpening consists of three separate operations: shaping, producing a sharp edge, and honing. Shaping includes two grinding actions: one to shape the elliptical edge (**Photo 3**) and another to create the bevel that supports the edge. If considerable material must be removed during these roughing operations, use a 46 or 60 grit wheel. Make sure there's virtually no gap between the tool rest and the wheel and always wear eye protection and a dust mask when grinding.

How far back you grind the elliptical shape is a question of creating access for side-cutting operations. For the gouge shown here, bringing the sides back between 3/8" and 1/2" is usually more than adequate. For tight places, a longer, narrower ellipse might be better.

The bevel angle is usually between 25° and 35°. This is considerably lower than the bevel angles typically found on bowl gouges and spindle-roughing gouges—the edges on these tools require much more support. Producing a bevel with a sharp edge that follows the elliptical shape you've created is difficult. Most of these tools tend to be thick at the center, but very thin at the sides. This makes it easy to overgrind the sides and lose the shape. Creating a smooth bevel is another challenge. A bevel with multiple facets leaves an inconsistent edge that will be impossible to hone.

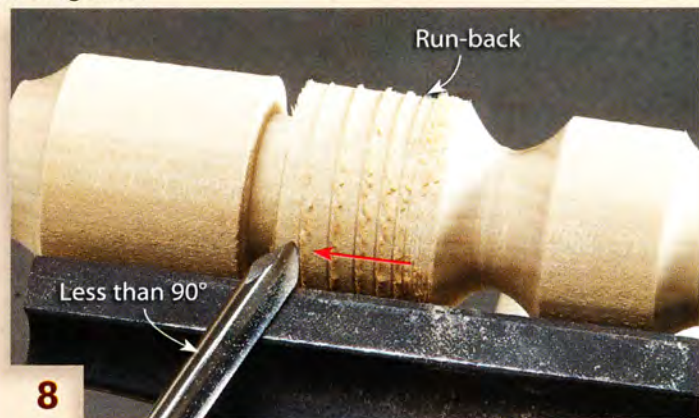


7

Create a cove by cutting mirror-image concave profiles. First, cut a groove to establish the depth at the center. Then make a shallow knife cut at one edge (left), just deep enough to create a shoulder that supports the tool. Push in the gouge (center)

while riding its bevel against the shoulder and gradually turning it face-up (right). Complete the shape by cutting a series of incrementally deeper and wider concave profiles on both sides of the groove.

To form a sharp edge on almost any woodturning tool you usually have two choices: Do it freehand or use a grinding jig. To sharpen the edge freehand (**Photo 4**), slightly elevate the tool rest to make it comfortable to hold the tool at the bevel angle you choose. Visually divide the tool into three sections: the center, the left half and the right half, and plan to grind one side at a time. Begin by lightly resting the tool on the wheel (the home position). Then simultaneously push and turn the tool up and onto its side while holding it against the wheel at the same angle. Reverse the action to return to the home position. Then repeat the process on the other side. Repeat the process on both sides until the bevel is fully formed. Finish with one or two large sweeps that connect all three sections.



8

Avoid run-back. If you make the initial knife cut at less than 90°, the gouge will skate back. Instead, push the back end of the handle toward the cove until the gouge cuts in at more than 90°.



When grinding a detail/spindle gouge, slow down and watch closely when the bevel is nearly complete. As soon as sparks start to consistently come over the top of the edge along its full length, it's time to stop: The edge is sharp.

If sharpening freehand seems too daunting, use a grinding jig (**Photo 5**); see Sources). Many are available and they all work well. With either method, be careful not to ruin the elliptical shape by over-grinding (**Photo 6**).

Honing

The process of refining and maintaining a sharp edge requires a flat hone for the outside bevel and a rounded hone to “slip” the inside edge. For modern high-speed steel tools, diamond or boron honing tools work best (see Sources).

To hone the outside bevel, hold the gouge securely and move the hone up and down all along the cutting edge—concentrate on touching the back of the bevel to just below the edge. To hone the inside, hold the curved hone flat in the flute and follow the edge all the way around, again with an up-and-down motion.

Making concave cuts

A detail/spindle gouge is most adept at cutting coves and

other concave shapes (**Photo 7**). When cutting a cove, the goal is to cut a pair of mirror-image concave curves that meet in the center. This requires a sharp tool, good technique and close observation of the shape as it's being formed—done by watching the horizon (the top edge of the blank) as you cut.

These tools work best when they can “move into air,” so practice cutting concave shapes on the ends of a cylinder or by working from both sides into a groove that you've cut with a parting tool. Always work from large to small diameters. Position the gouge at a right angle to the blank, with its flute facing the direction of the cut, and score the wood to create a small recess that will support the tool's bevel. Then begin a light and slow twisting cut with the gouge, while keeping the bevel against the wood.

The greatest obstacle when cutting a cove is overcoming the tendency of the tool to skate across the wood (or “run back”) when you start the cut (**Photo 8**). The underlying cause is the tool's sharp edge engaging the wood at the wrong angle, so there's no support for the bevel. This immediately pushes the tool backwards across the surface.

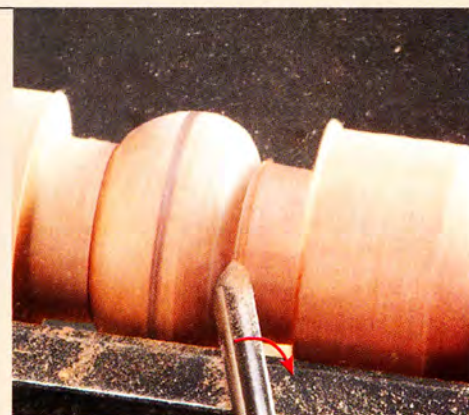
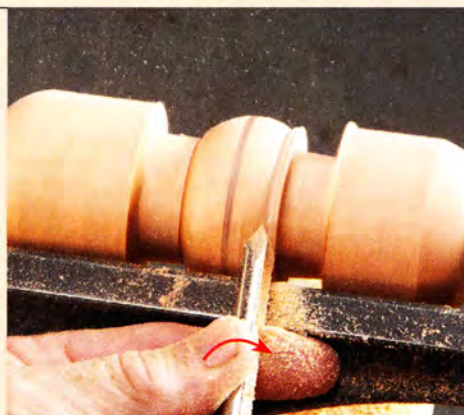
Cutting convex profiles

To create a bead, you cut a pair of mirror-image convex shapes (**Photo 9**). Here the challenge is to produce fully

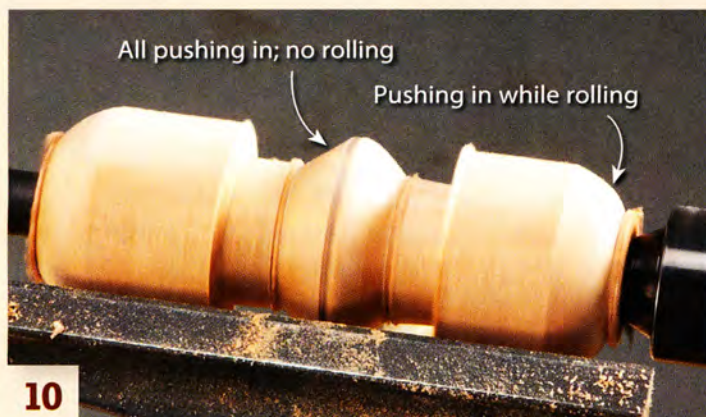


9

Create a bead by cutting mirror-image convex profiles. Rest the gouge on the blank while holding its flute face-up (left). Lift and roll the handle so the gouge “rides the bevel” until its edge starts



cutting (center). Continue the rolling action while gently advancing the gouge until it rolls completely onto its side (right). Refine the shape incrementally, by making shallow cuts on each side.



10

A flat “V” shape results, rather than a nicely rounded curve, if your advancing and rolling motions aren’t well coordinated.



11

Practice cutting coves (and beads) of different widths and depths to master the nuances of this extraordinary tool.

rounded surfaces with no flats. Begin with the flute upright, the bevel resting on the wood and the back of the handle held low. Gently lift the gouge until it begins to cut. Then, working from large to small diameters, turn the flute in the direction of the cut and gradually roll over the gouge as you continue to advance it. Aim to have the flute fully on its side at the bottom of the cut. A twisting motion that smoothly combines advancing and rolling is critical for good results (**Photo 10**).

Develop your skills

Mastering this tool requires practice, so use a spindle roughing gouge to create a bunch of 1-3/4" dia. x 7" long cylinders made from softer woods such as poplar, pine or alder. Then practice cutting concave shapes that curve smoothly and continuously from top to bottom (**Photo 11**). You’ll probably find that it’s easier to cut smooth curves from one direction than the other. If so, devote an entire cylinder to cutting curves from the more difficult direction. As you practice, the initial knife cuts and turning/rolling moves will start to make sense.

It’s a good idea to practice cutting coves of different sizes. Lay out a series of coves that gradually get smaller, (or more shallow, or both) on one or more of the cylinders. Start with a 1-1/4" wide cove and reduce the width by 1/8" until you reach a cove that’s only 1/4" wide. Then strive to cut fully rounded,

mirror-image concave shapes on every cove. You’ll discover the size and shape of the gouge determines how narrow a cove can become.

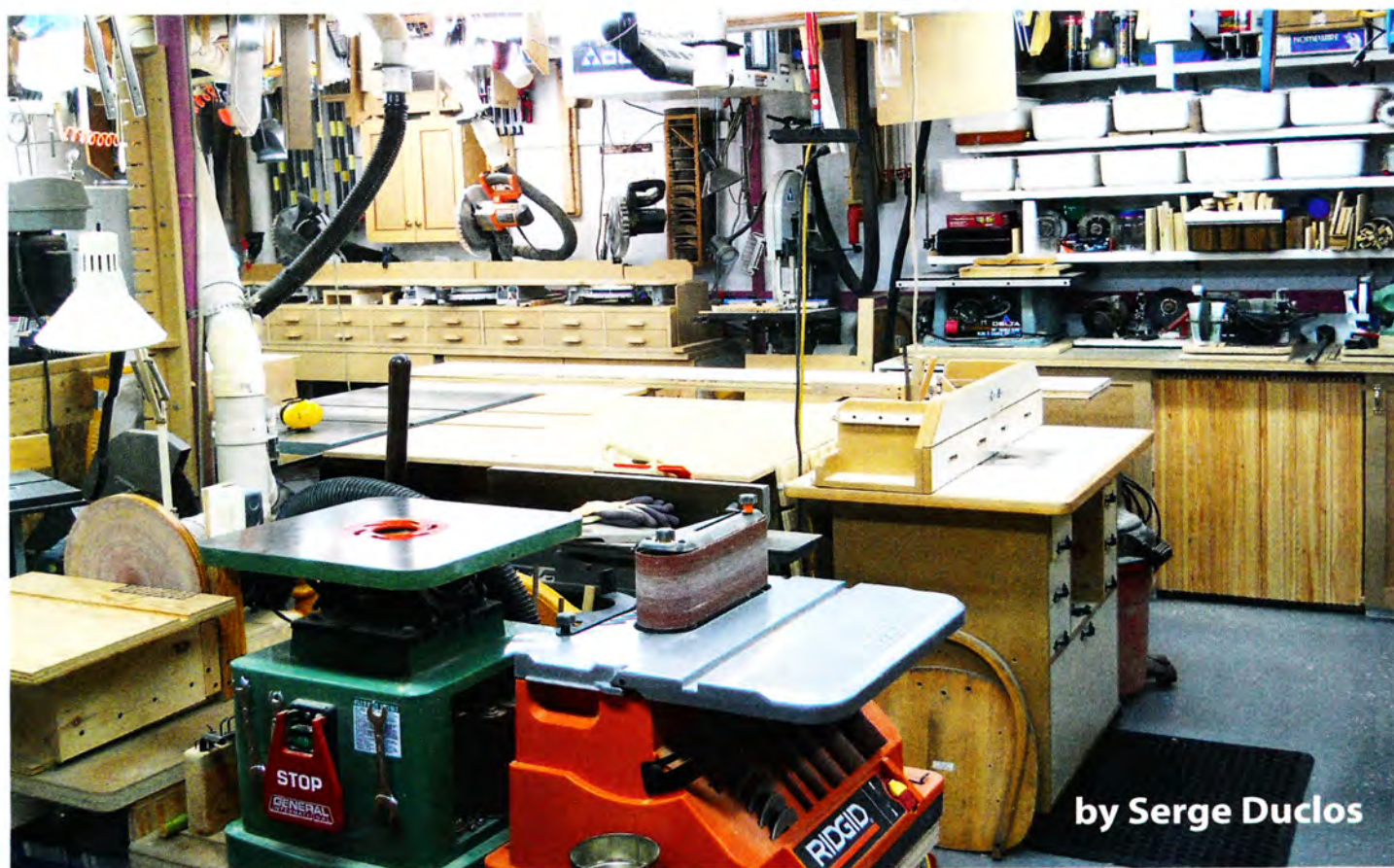
To practice cutting convex shapes, prepare 10" long practice cylinders and use a parting tool to lay out beads from 1-1/4" wide down to 1/4" wide. Then practice as for concave shapes. Parting down to different depths dramatically changes the look of the bead. Learning how to handle the gouge accordingly is part of the exercise.

SOURCES

- Packard Woodworks, packardwoodworks.com, 800-683-8876, Packard 3/8" Detail Gouge, #100108, \$35.95; Packard 1/2" Detail Gouge, #100109, \$40.95; Oneway Vari-Grind 2 Attachment, #142614-2, \$74.95 (requires Oneway Wolverine Grinding System, #142611, \$87.95); Sharp Fast Grinding System, #140909, \$99.95; Credit Card Hone, #145105, \$11.95; Honing Cone, #145110, \$30.95.
- Alan Lacer, alanlacer.com, 715-426-9451, Diamond Slipstone, #SLP600, \$88.

Alan Lacer is a turner, writer, demonstrator and instructor living near River Falls, Wis. For more information visit alanlacer.com.

Gettin' Jiggy



by Serge Duclos

40 years and a zillion jigs, fixtures and tools.

MY CREATIVITY reaches its peak when I'm underground, because my shop is in my basement. This is my third house (I live in Québec, Canada, near Montreal) and my third shop—I've been an enthusiastic woodworker for more than 40 years!

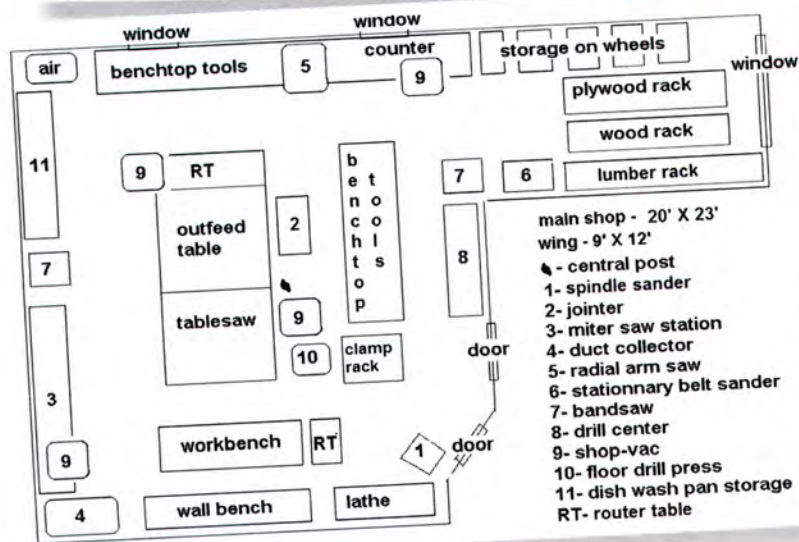
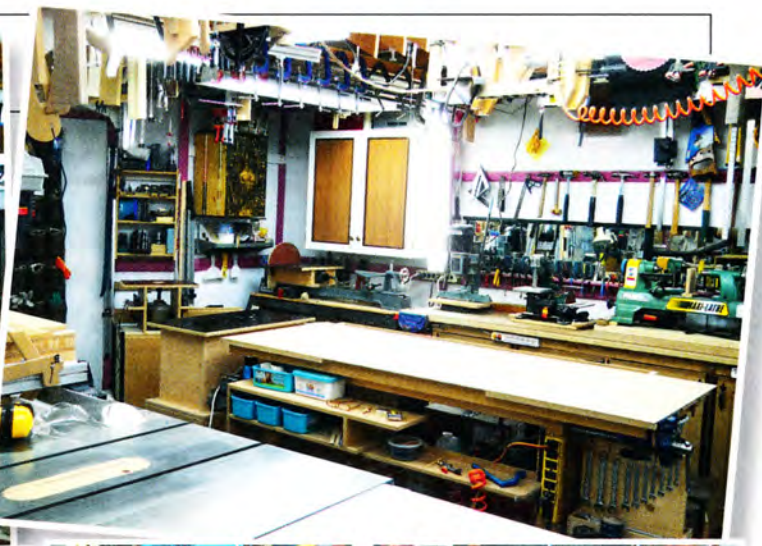
I build furniture pieces occasionally for family and friends, but spending time in my shop designing and building jigs and fixtures is what I love doing the most. Over the years I've built zillions of them. (You can see a portion of my collection hanging from the ceiling joists.) My goals are always the same: To save time and energy, increase safety and accuracy, and help me get the most from all my tools. Speaking of tools, I've also built several of them, including two disc sanders, five router tables and a spindle sander.

The main part of my L-shaped shop is about 20' x 23'. In its 9' x 12' wing, I store my lumber, sheet goods and other important stuff (as a thrifty woodworker, I never throw anything away). Everything in this area is on wheels—I'm still waiting for lumberyards to offer hinged sheet goods that

would be easier to move around the shop!

I want the many benchtop tools that I've acquired and fabricated to be readily available, so I've built benches and cabinets that provide close to 40 linear feet of countertop space, as well as plenty of drawers and shelf space (mostly behind doors). In the middle of the shop sits a huge U-shaped island that includes my tablesaw and outfeed table, my main router table and a 7' long mobile bench that holds benchtop tools and more storage space—did I mention that I'm a tool nut? This setup allows cutting a full sheet lengthwise with no problem. My main workbench sits close to the tablesaw so I can rest a full sheet on it while guiding it through the saw.

The frame of my main workbench is made of dimensional lumber. The top is three layers of 3/4" MDF topped with replaceable 1/4" hardboard and features bench dogs, two bench vises and a tool bin. It's heavy as hell, but I couldn't live without it. All the work surface areas are at the same height, except for the mobile bench that's part of the



See a collection of Serge's jigs at
AmericanWoodworker.com/WebExtras

center island. It has multiple levels to accommodate different benchtop tools.

My miter saw station features three saws (permanently set at 90° and both 45° angles) and 16 shallow drawers that store the hand tools I use most frequently. Three baseboard electric heaters and two carefully located ceiling radiant heaters keep the shop cozy during our long Canadian winters. Fluorescent fixtures and several task lights (including magnifying lights at my two sharpening stations) provide ample light.

A 2 hp dust collector sucks most of the dust from prolific dust producers such as the tablesaw, jointer and planer through a duct system that I installed several years ago. In addition, four shop vacuums are stationed around the shop. I use them for daily cleanups as well as collecting dust from benchtop tools such as router tables and sanders.

*Serge Duclos
Québec, Canada*

You may recognize Serge's name. More than 200 of his tips, jigs and fixtures have been published in 11 different woodworking magazines! —Ed.

Tell Us About Your Shop

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12 Rock-Star Router Bits

Add these great performers to advance your skills.

by Tim Johnson

1 Tiny Roundover



Every router bit starter set includes at least one round-over profile, but it won't be as small as this 1/8" radius—or nearly as useful. Say goodbye to tedious hand sanding. This little dynamo quickly and consistently eases a square profile's sharp edges without significantly changing its appearance. Such an edge-breaker is so handy to have on hand that pros often keep it permanently mounted in a palm router.

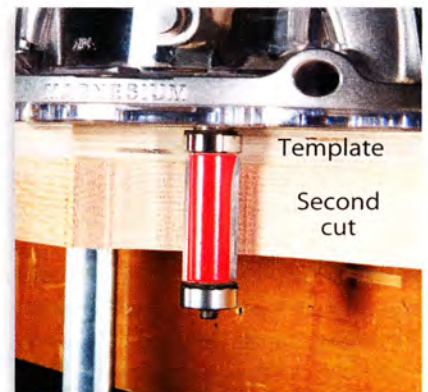
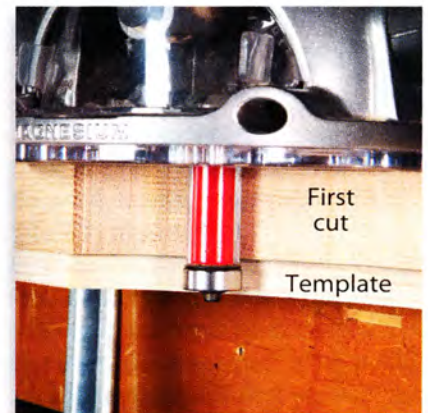


2 Double-Bearing Flush-Trim



As the go-to bit for template routing, you probably already have a flush-trim bit. So why pony up extra cash for the same bit with an extra bearing? Because it's two bits in one, that's why: A double-bearing flush-trim bit is also a pattern bit. (A pattern bit is a flush-trim bit with the bearing mounted on the shank, above the cutters.) That means you'll save time whenever a portion of the profile you want to rout runs head-on into the grain (see photo below).

To avoid ruinous tearout on such a profile, the standard procedure is to rout halfway with a flush-trim bit and then stop, flip over the work and switch to a pattern bit to finish the job. With a double-bearing flush-trim bit, you don't waste time removing one bit and installing the other; you just flip over the work, lower the bit and go (see photos at right).

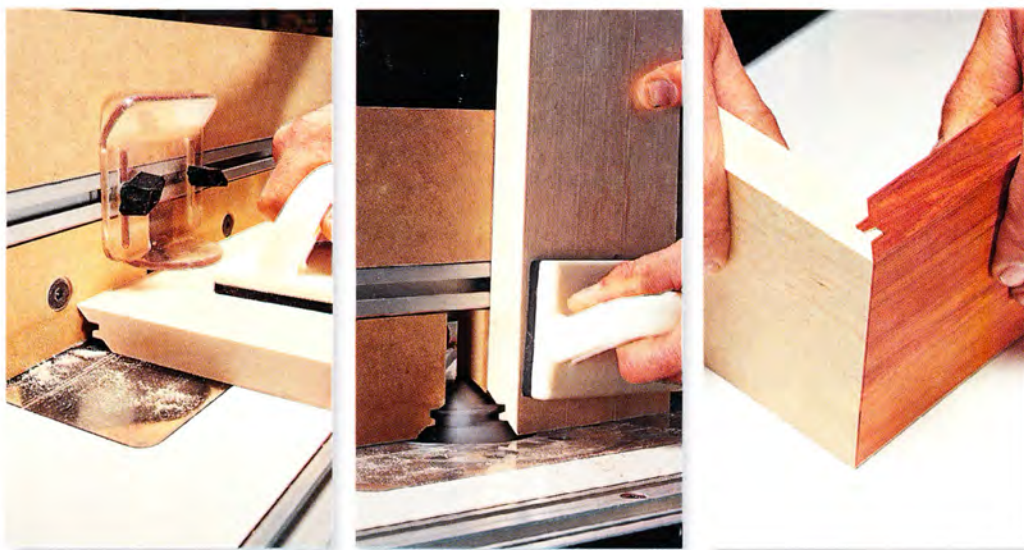


3 Lock Miter

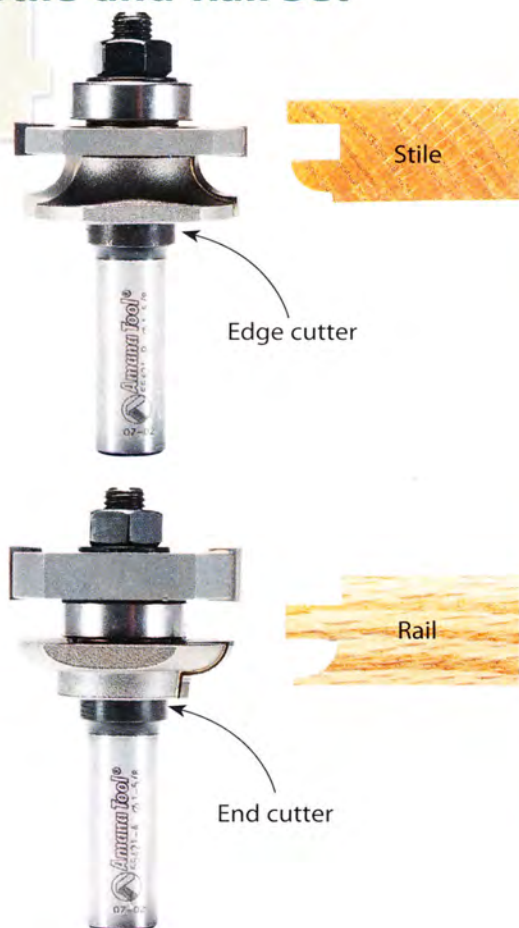


Nothing looks better than a perfect miter joint. But as woodworkers know, miters can be tough to cut, fit and glue together. Fortunately, a lock miter bit solves all three problems. After installing the bit, you use the same setup to rout both parts—one vertically and the other horizontally (see photos below). After routing, the parts lock together to form a seamless corner that won't slide out of position when you add glue and clamps.

Yes, it's true that lock miter bits can be difficult to set up. In fact, many manufacturers offer set-up blocks to aid the process. But Infinity Cutting Tool's new Lock Miter Master solves the problem altogether (See "Simple Setup for a Fussy Joint," page 16).

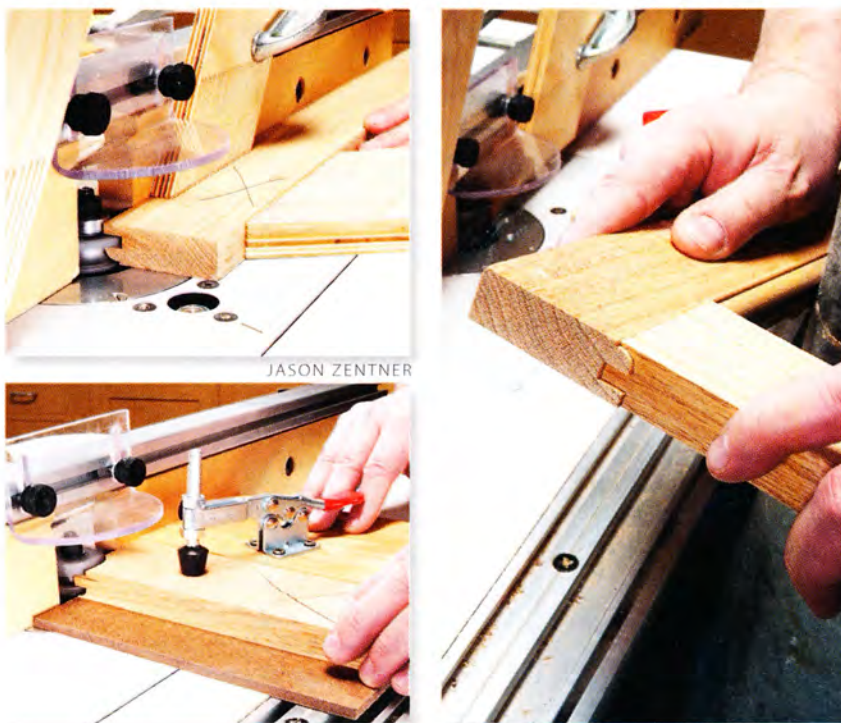


4 Stile-and-Rail Set

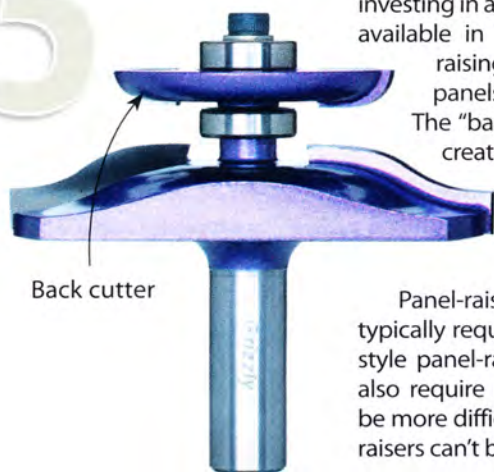


Making great-looking cabinet doors is fast and easy when you use dedicated stile-and-rail cutters. Rout the edges using one bit and the ends using the other (see photos at left and below). Voilà!

Choose from a number of attractive profiles, whether you go with a basic set that cuts a 1/4" panel groove (shown here), a set that allows adjusting the groove's width, or a top-of-the-line set that also allows adjusting the length of the tenons to increase the strength of the joints in larger, heavier doors.



5 Panel-Raiser



Back cutter

If you plan to build cabinets with raised-panel doors, investing in a panel-raising bit is a no-brainer. Typically available in bevel, cove and ogee profiles, panel-raising bits produce results in solid-wood panels that require only light finish-sanding. The “back-cutter” bit shown here automatically creates a 1/4" thick tongue by simultaneously routing both panel faces. Top-end back-cutter bits allow adjusting the tongue's thickness; basic panel-raising bits don't have back cutters.

Panel-raising bits must be used in a router table and typically require a 2-1/4 hp (or larger) router. Vertical-style panel-raising bits require less horsepower, but also require running the panel on edge, which can be more difficult, and means that vertical-style panel-raisers can't be used for arched panels.



6 Rabbeting Set



Sure, you can cut rabbets on a tablesaw. But only a rabbeting bit produces clean surfaces on both faces. You can also cut rabbets on a router table with a straight bit and a fence. But why bother when a rabbeting bit automatically sets the width? Also, a rabbeting bit is your only option if you want to cut a rabbet on a curved surface.

It goes without saying that a rabbeting bit will be included in that starter set. Chances are, though, you'll be cutting rabbets in many different sizes. So rather than buying rabbeting bits in every size, doesn't it make more sense to buy a set that cuts every size rabbet?

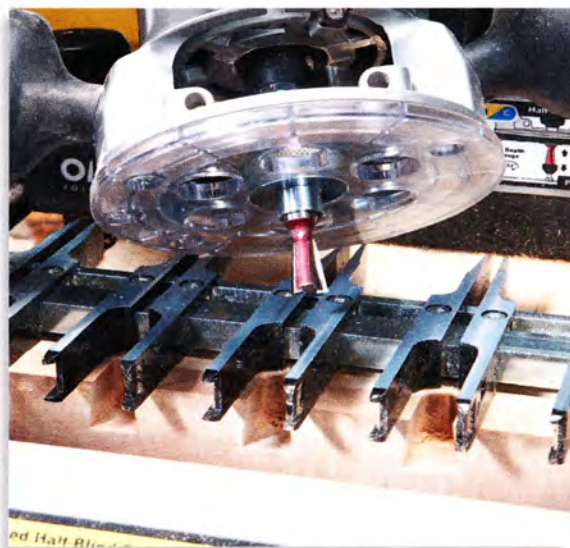


7 Specialty Dovetail



Your bit collection probably includes a 14° 1/2" dovetail bit that came with your first dovetailing jig. It's a perfectly good bit for routing half-blind dovetails with fixed spacing.

But now that you're weary of routing those production-style dovetails, you're probably thinking of upgrading to a more capable jig—one that can rout through dovetails that look hand-cut, for example, in both thick and thin stock. That means you'll also be adding dovetailing bits in different sizes, with flutes that slope at different angles. Note: These jigs often have proprietary designs that require dedicated bits.



8 Drawer Lock



Making sturdy, good-looking drawers is as easy as one-two-three when you use a drawer lock bit (also called a lock rabbet bit). Rout the drawer sides vertically and the front and back horizontally (see photos below). To make the drawer sides flush with the front and back, the simplest option is to use the same setup for both operations. To create an overlay for a lipped drawer front (or to hide side-mount drawer slides), make the drawer front appropriately longer than the back and set the fence to make a deeper cut.



9 Large-Diameter Flush-Trim



Whether you're flush-trimming tough end grain, a thick contour or a hardwood edge, a large-diameter bit provides the best results. It leaves a smoother surface and is less likely to burn, chip or chatter than a smaller one.

Go for the largest diameter your router can manage. Flush-trim bits (with the bearing mounted on the bottom, below the cutters) typically top out at 3/4" dia. Pattern bits (with the bearing mounted on the shank, above the cutters) come in larger sizes, such as the 1-1/8" dia. bit shown here.



10 Up-cut Spiral



You can rout a perfectly good mortise with a straight plunge-routing bit, but a spiral up-cut bit allows you to work faster. The bottoms of both bits are designed to cut cleanly—a must for plunge routing. But the spiral flutes in an up-cut bit lift the chips and expel them through the top of the mortise, rather than leaving them packed inside, so you don't have to spend time digging them out.

A spiral bit's up-cutting action can cause minor tearout at the top of the mortise, but this usually isn't a problem, because the tenon shoulders cover the joint. Spiral bits are available in both solid carbide and high-speed steel (HSS). Carbide bits cost more but stay sharp longer.



Slot-Cutter Set



Splined joints guarantee a flush surface when you glue up a tabletop or panel. Simply rout slots and install splines (see photos at right). In fact, virtually any time you want to cut a slot up to 1/2" deep, routing with a slot cutter provides the best consistency, accuracy and control.

The bit consists of a shank with a bearing and (usually) a three- or four-wing cutter. To cut slots of different widths, you simply purchase additional cutters, which range from 1/16" to 1/4" thick. Stick with the same brand and you won't have to buy another shank.

For the ultimate convenience and adjustability, consider a set with different cutters, bearings and washers. Then you'll be able to combine cutters to create slots of virtually any width.



Beading Bit



No collection is complete without a beading bit. Whether used to soften blunt edges (see photo, below left), define the panel inside a frame or disguise the gaps between a cabinet and its doors and drawers (see photo, below right), this ancient form adds a touch of elegance that fits almost every furniture style.



SOURCES

Each of these manufacturers offers some or all of the bits included in this story. 

- Amana Tool, amanatool.com, 800-445-0077.
- Robert Bosch Tool Corporation, boschtools.com.
- CMT Woodworking Tools, cmtutensili.com, 888-268-2487.
- Eagle America, eagleamerica.com, 800-872-2511.
- Freud, freudtools.com, 800-334-4107.
- Grizzly, grizzly.com, 800-523-4777.

- Infinity Cutting Tools, infinitytools.com, 877-872-2487.
- MLCS, mlcswoodworking.com, 800-533-9298.
- Porter-Cable, porter-cable.com.
- Rockler Woodworking and Hardware, rockler.com, 800-279-4441.
- Whiteside Machine Co., whitesiderouterbits.com, 800-225-3982.
- Wood River, woodcraft.com, 800-225-1153.

Router Table Dovetails

by Brad Holden

Two sleds combine the ease of routing with the flexible spacing of hand-cut dovetails.

THERE ARE LOTS OF EXCUSES for not using dovetails; cutting them by hand takes time, patience and experience. A dovetail jig is relatively foolproof, but if you don't use it regularly, be prepared for an hour or so of re-learning each time you use it. Also, dovetail jigs are expensive, particularly those that are capable of cutting dovetails with variable spacing to give a hand-cut look.

This router table method lays waste to all the excuses. It's easy, accurate and inexpensive. All you need are two bits and two sleds for your router table. Layout and cutting is straightforward, and you can space the dovetails any way you want!

Fig. A Tail Sled

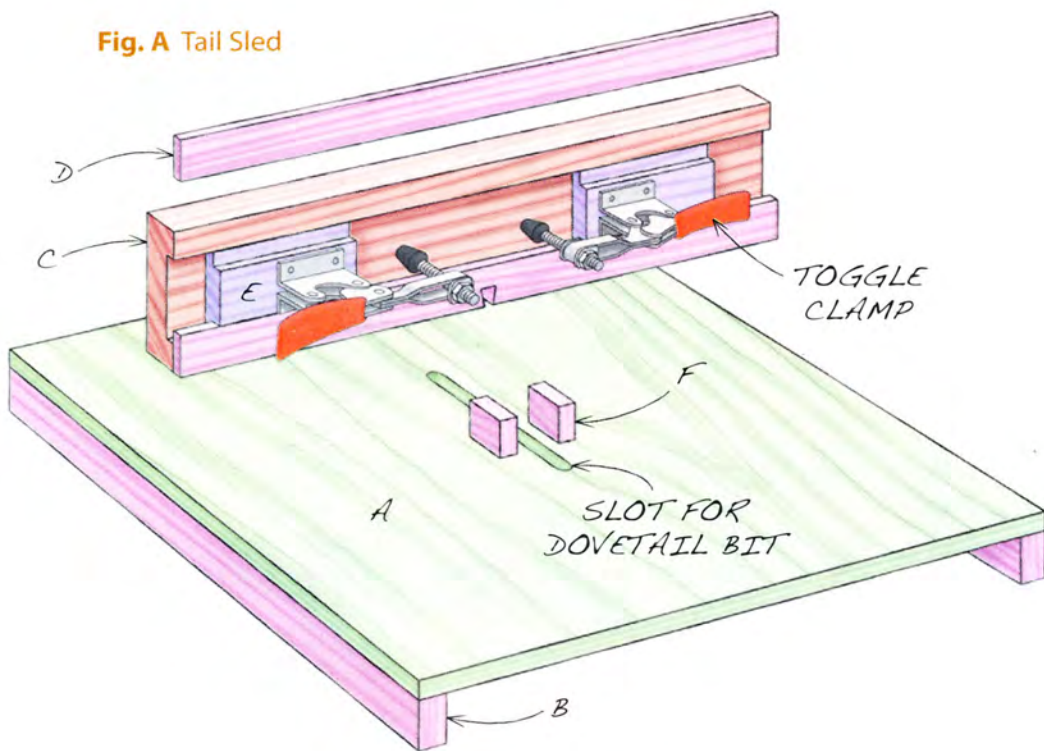


Fig. C Fence Detail

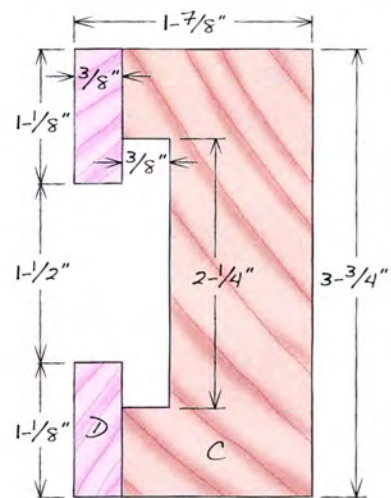


Fig. B Pin Sled

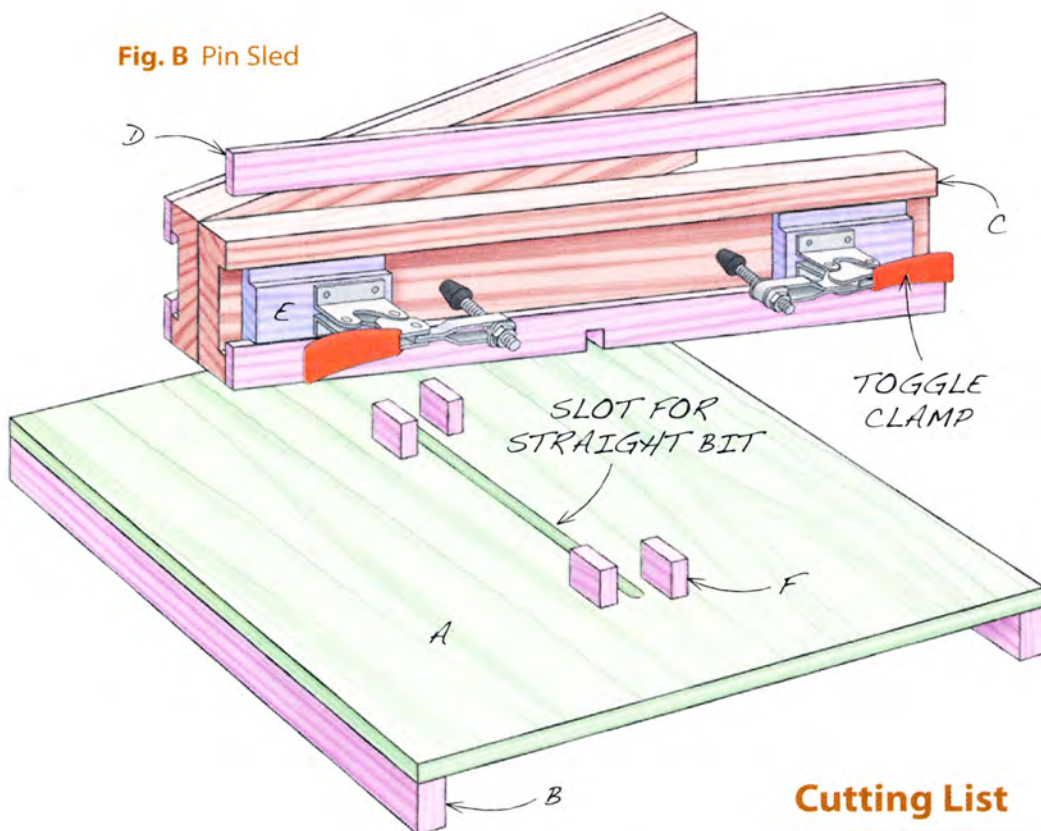
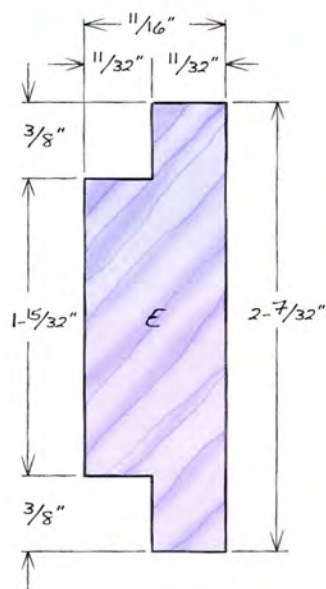


Fig. D Sliding Clamp Block Detail



*Toggle clamps give
your hands a break.*

Cutting List

Overall Dimensions: 5-1/2" H x 17-1/2" W x 22" L

Part	Name	Qty.	Material	Th x W x L
A	Base	2	Birch	1/2" x 17-1/2" x 22" (a)
B	Rail	4	Melamine	3/4" x 1-1/4" x 22"
C	Fence body	3	Maple	1-1/2" x 3-3/4" x 20" (b)
D	Fence keeper rail	6	Maple	3/8" x 1-1/8" x 20" (b)
E	Sliding clamp block	2	Oak	11/16" x 2-7/32" x 4"
F	Bit guard	6	Birch plywood	1/2" x 1" x 1-5/8"

Notes:

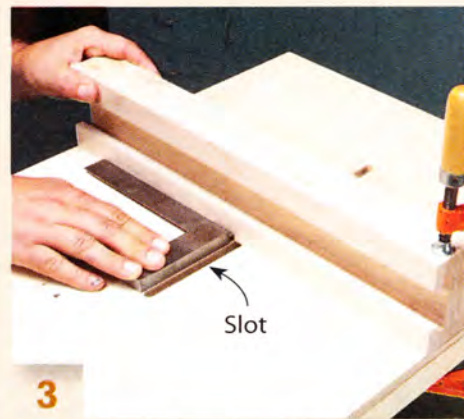
a) Cut to fit your router table. b) Cut length to fit sled.



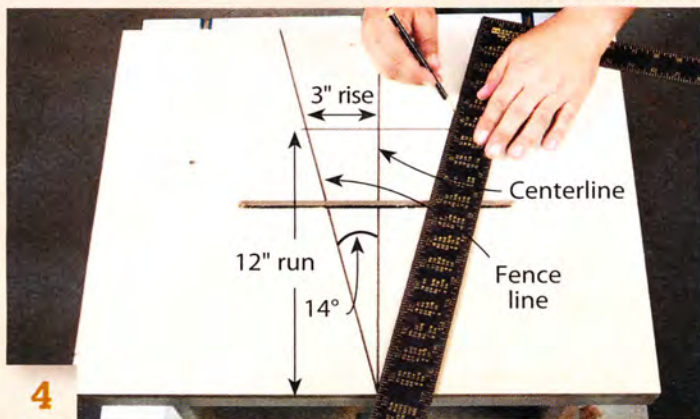
1 **Attach** side rails to the bases of the pin and tail sleds. These rails allow the sleds to slide without any side play.



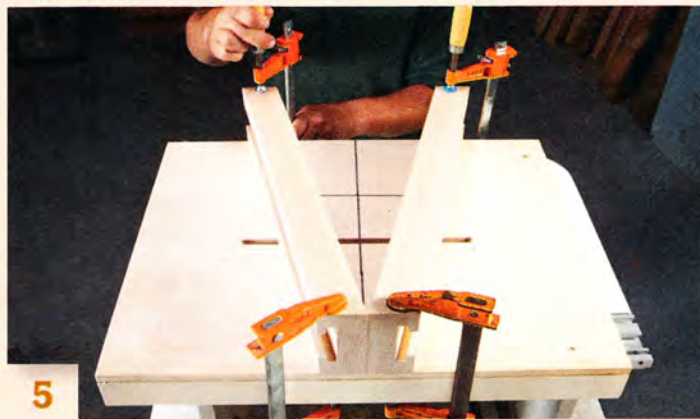
2 **Route** the pin sled's slot with the straight bit you'll use for routing the pins. Route the tail sled's slot wide enough to allow clearance for the dovetail bit's flared end.



3 **Square** the tail sled's fence to the slot. Clamp it in place and then attach it from underneath using screws.



4 **Lay out** the angles of the pin sled's fences. Use a rise over run method to match the angle of your bit. In this case, the angle is 14° , which neatly works out to 3" of rise over 12" of run.



5 **Clamp** the fences on the layout lines and attach them with screws. With both sleds complete, you can begin routing. Start by making the tails.

Make two sleds

The two sleds (Fig. A and B, page 40) must be custom fit to your router table, so use the Cutting List on page 40 as more of a parts index. As long as your router table has two parallel sides, you're good to go. Cut the bases (A) the same size as your router table's top, adding 1-1/2" to the width. The extra width allows you to attach the rails (B) to the underside of each base. When you attach the rails, squeeze them against the sides of your router table slightly (**Photo 1**). They should be snug enough to eliminate any play, but still allow the sled to move easily.

Use your router table to cut a slot in each sled (**Photo 2**). For the tail sled (that's the one you'll use with the dovetail bit), make the slot wide enough for the flared end of your dovetail bit to pass through. For the pin sled (that's the one you'll use with a straight bit), cut the slot using the same bit you'll use for cutting the pins. This slot is really the key to the accuracy of this method because it shows exactly where the bit will cut.

Make the fences

These fences are just giant wooden T-tracks. You'll need three of them. Use a dado set or router to cut the wide groove in the fence body (C, Fig. C) and then glue on the

keeper rails (D). When the glue is dry, check to make sure the fences are flat and square. If they're not, take the time to true them up on your jointer.

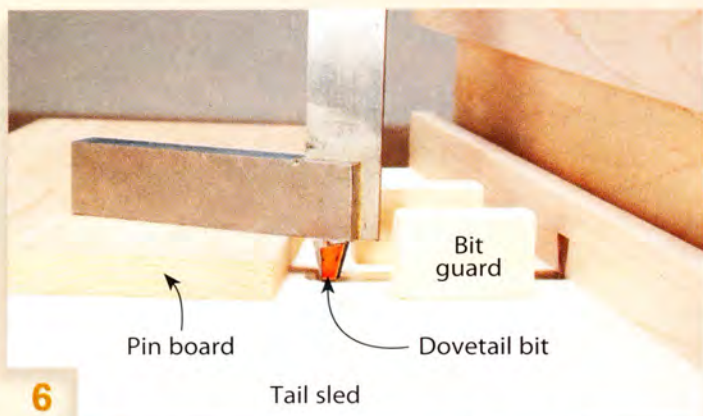
Next, mill one long board for the sliding clamp blocks (E, Fig. D) and cut both blocks from it. Attach a toggle clamp to each block. You only need two clamp blocks. You'll move them from fence to fence as you work.

Loosely clamp one fence to the tail sled. Use a square to align the fence exactly perpendicular to the sled's slot, then tighten the clamps (**Photo 3**). Turn the sled upside down and screw the fence in place. Don't use glue, just in case you need to make adjustments.

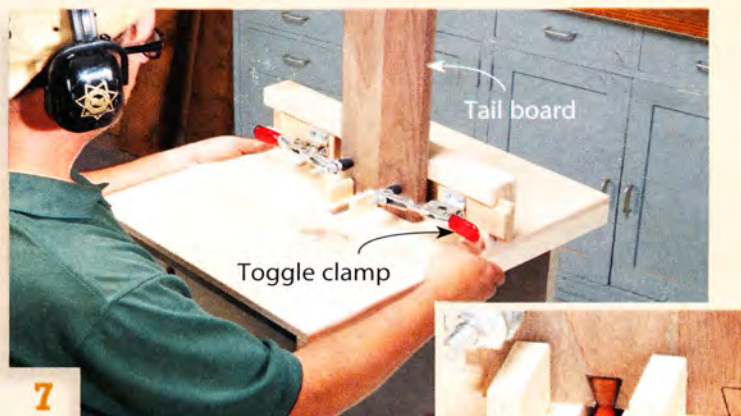
The pin sled uses two fences, both set at the same angle as your dovetail bit. You can use any dovetail bit you like. A shallow angle—anywhere from 6° to 8° —looks the most like hand-cut dovetails. I used a 14° bit because that's what I had on hand.

I used the "rise over run" method to mark the angles on my sled, as it's more accurate than a small protractor. If you don't know how to convert an angle to rise over run, use this handy calculator at blocklayer.com/riserun.aspx.

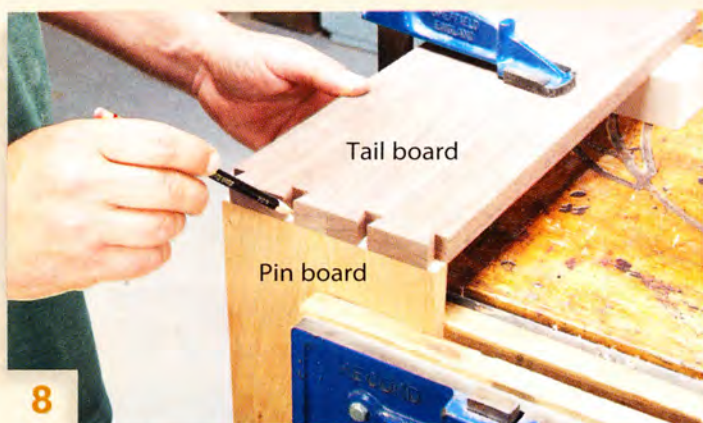
To use your rise-over-run figures, mark a centerline across the sled, 90° to the slot. Make a mark on the centerline 12" from the sled's edge. Make another mark 3" out from this



6 On the tail sled, set the dovetail bit's height to match the thickness of the pin board.



7 Rout the tails using whatever spacing you wish. It's helpful to sketch the layout on the board first.



8 Mark the tails on the pin board's end. These marks are just a handy visual reference so you don't get confused when you're routing the pins.



Extend lines from the edges of each tail onto the pin board's outer face. These are your layout marks for routing.

point, 90° from the center line. Connect that mark with the end of the centerline for a perfect 14° angle (**Photo 4**).

Cut the fences to length and clamp them to the base, one on each angled line (**Photo 5**). Attach the fences with screws, as you did the tail sled's fence. Glue the bit guards (F) to both sleds in front of each fence, on both sides of the slots. Leave enough clearance between the fences and the bit guards for your stock. The bit guards add a small degree of safety, but they're mainly a reminder to keep your fingers out of the danger zone.

Cut the tails

Install your dovetail bit (I recommend using one with a 1/2" shank, to minimize vibration) and place the tail sled on your router table. In order to raise the bit sufficiently above the sled, you probably won't be able to bottom out the bit in your router's collet.

Set the bit's height to your stock's thickness using a straightedge (**Photo 6**). If your pin board and tail board are different thicknesses, set the bit's height to the thickness of the pin board. That's it; you're ready to start routing tails.

The beauty of this method is that you can space the tails however you wish. You don't have to mark the tails

on the board, but I like to sketch them in so I can see what the finished joint will look like.

I cut the outer half-pin spaces first, then the interior pin spaces, but the order isn't important. Position your tail board, clamp it to the fence and rout each pin space to create the tails (**Photo 7**).

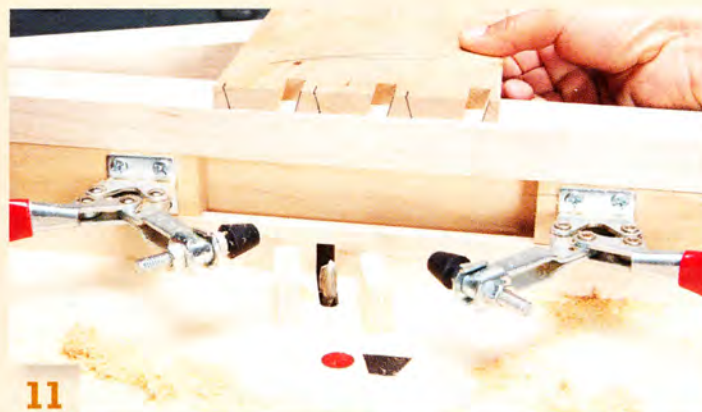
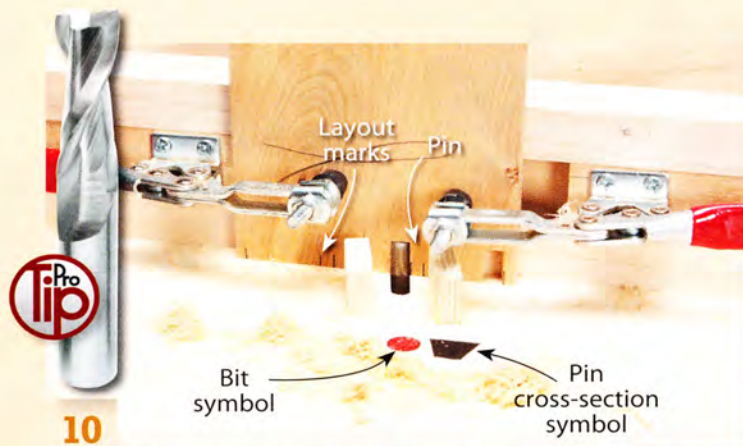
Cut the pins

Clamp the tail board in a vise with its end extending above the bench's top at the same height as a spacer block. Slide the spacer block to the pin board's end, clamp the pin board near its center and mark the dovetails on the pin board's end (**Photo 8**). Strictly speaking, these marks aren't necessary, but they're nice to have as a reference when you're orienting the pin board on the sled. Make a mark on each board to indicate its outer face.

With the pin board and tail board clamped in place, transfer the edges of the dovetails to the pin board's outer face.

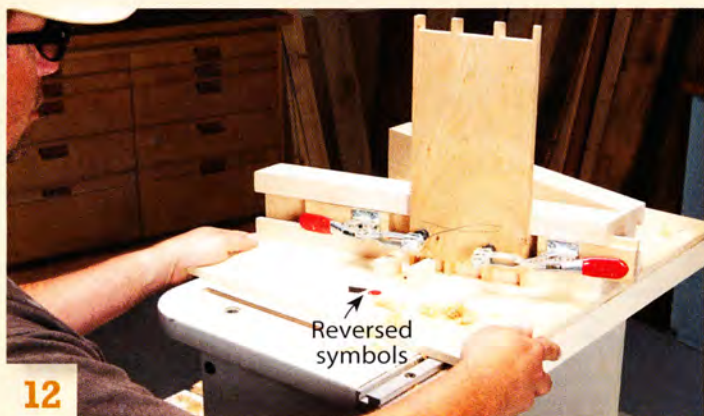


Traditionally, dovetails were cut slightly proud and planed flush after assembly. This isn't necessary here. Just clamp the pin board's face flush with the tail board's end. Now you can use a square to transfer your marks directly from the tails (**Photo 9**).



On the pin sled, align the layout marks with the slot's edge and rout one side of each pin. Mark the pin/bit relationship in front of each fence to ensure that you rout on the correct side of the pins.

Check your cuts against the layout lines on the pin board's end to make sure you've cut in the correct places—and in the right direction!



Rout the other side of each pin using the sled's opposite fence. Here, the pin/bit symbols are reversed. After making one cut next to the pin, rout out the rest of the waste.

Tap the joint together. This shouldn't require much force. If the fit is tight, mark the pins that are too wide and trim as needed, using the pin sled.

Install the bit you used to cut the pin sled's slot, and swap the tail sled for the pin sled. Set the bit's height to the tail board's thickness.

Pro Tip A spiral up-cut bit is perfect for use on a router table. (Photo 10; see Sources). An up-cut bit pulls the workpiece toward a router's base; in this case, that's down toward the sled. This makes the workpiece less likely to shift around, so your cuts will be more accurate.

Since you only mark the pin board's outer side, that's the side you'll have facing out. Draw symbols on the sled indicating the correct orientation of the bit and pin. This way, you'll always know on which side of the slot to position the pins. If the pin is to the left of the slot on one fence, it'll be to the right of the slot on the other fence.

Starting on either fence, align each pin's edge mark with the edge of the slot and rout one pass. To start with, cut a little wide of the mark and sneak up on the line. Check the cut against your tail board after each cut. After you rout a couple pins, eyeballing their alignment with the tails, you'll quickly learn whether to leave your layout marks visible, cut them off or split them down

the middle. A perfect fit is the goal, so leaving the pins slightly large for final adjustment is OK.

After routing the first side of all the pins, check to make sure everything is oriented correctly (Photo 11). Now move to the opposite fence and rout each pin's other side. Rout out any remaining waste by sliding the pin board over and routing another pass, repeating until all the waste is cleaned out (Photo 12).

Assemble the joint

The joint should fit with a few light mallet taps (Photo 13). If you were cautious, cutting the pins just slightly oversize, you'll have to trim a couple of them. When you test the fit, mark the pins that need trimming. Because of the "zero-clearance effect" of the bit's slot, you can easily shave off just a whisker for a perfect fit. As you gain experience, you'll spend less time trimming to fit. 

SOURCES

- Amana Tool, amanatool.com, 800-445-0077, 3/8" Up-Cut Spiral Flute Plunge for Solid Wood, #46257, \$65.
- De-Sta-Co, destaco.com, 888-337-8226, Horizontal Hold-Down Toggle Locking Clamp, #HH-225D, \$5 ea.

How to Make a Sliding Dovetail

Tips and tricks for getting the perfect fit.

by Chad Stanton

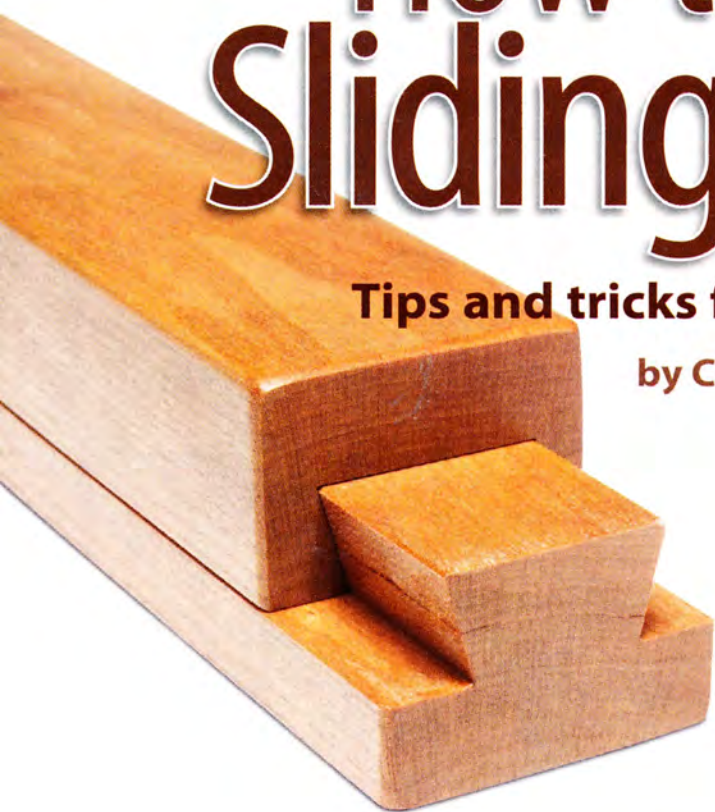
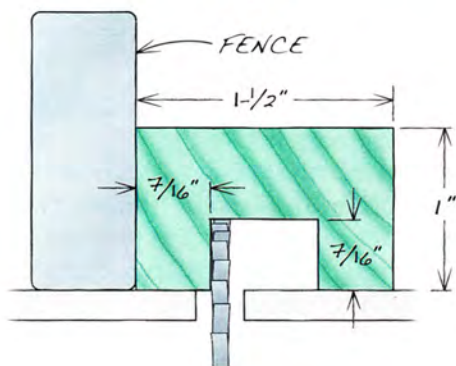
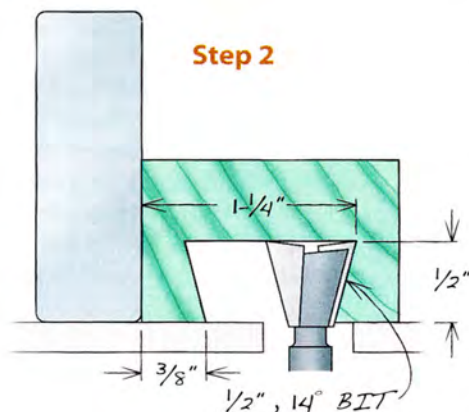


Fig. A Sawing and Routing Steps

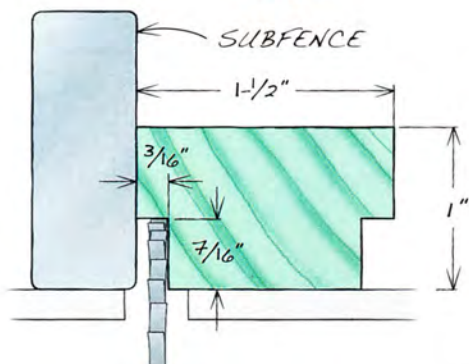
Step 1



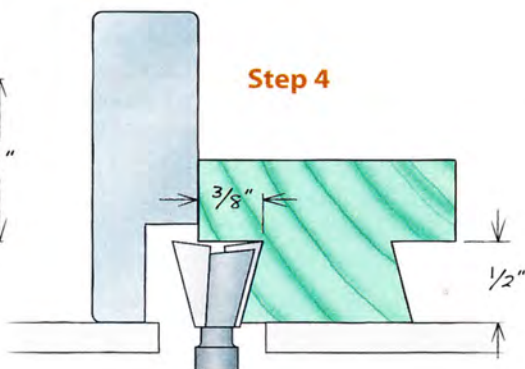
Step 2



Step 3



Step 4



MAKING SLIDING DOVETAIL JOINTS

is craftsmanship at its best. You need decent tools, an eye for precision and plenty of practice.

In this article, you'll learn a sure-fire method for getting fantastic results. I'll describe the general principles involved and show you how to set up your machines. I'll also point out where you might get into trouble—and how to avoid it. If you haven't made a sliding dovetail before, this sample joint is a perfect place to start.

Set the table

For this exercise, start by milling a clear piece of wood 1" x 1-1/2" x 36". You'll be routing this piece from end to end in both directions; to avoid tearout, the wood's grain should be straight and parallel to the piece's edges.

Your stock must be absolutely straight and flat, so it's best to mill it about 1/8" to 1/4" oversize in thickness and width first. Set the piece aside a few days to bend or twist, if it wants, then flatten it again and mill it to final dimension. Crosscut the piece into three 12" long sections.

One of these shorter pieces will be the "socket" half of the joint—you'll make this one first. The other two pieces will be used to make the "dovetail" half of the joint. Of course, you really only need

one dovetail piece, so why make two? The second is for test cuts. Trust me, you'll need it.

Whenever you make sliding dovetails, it's a good idea to draw the joint full size first in order to work out its proportions (Fig. B, below). Proportions are primarily a matter of taste, but here are a few practical considerations:

- Don't make the narrowest sections too thin and weak. Determine their width, using your best judgment, based on the strength of the wood and the amount of stress the joint will face.

- Know the angle of your bit. Angles range from 7° to 14°. (I used a 14°, 1/2" wide bit, the standard for half-blind dovetail jigs—see Source, page 46). The smaller the angle, the more precise the fit must be.

- Make the base of the dovetail piece fairly wide, if you can. If the dovetail is too narrow, balancing the piece on the router table is difficult (see Fig. A, Step 4). A wider dovetail offers more support.

Make the socket

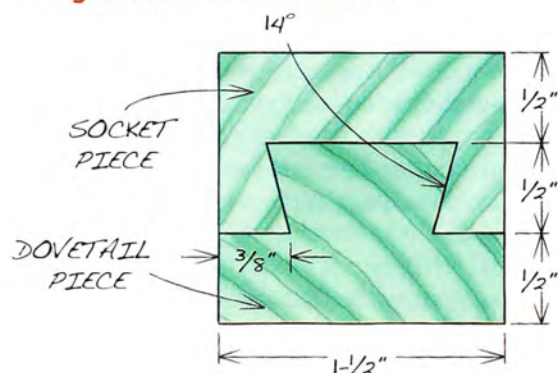
Draw the socket on the end of one of your pieces. Usually, there's a lot of waste to remove in making a socket, so I prefer to start on the tablesaw. Sawing is much faster than routing and easy to set up. This method also results in less wear on the dovetail bit; the sharper the bit, the easier it is to get a good fit.

Adjust the saw's blade and fence to cut 1/32" to 1/16" inside the outline of the socket (Photo 1; Fig. A, Step 1). This joint is centered on the workpiece, which makes all the cutting and routing operations more efficient. Each fence setting is a twofer: After making one cut, rotate the piece and make another cut. Move the fence a couple of times, making overlapping cuts, until the groove is complete.

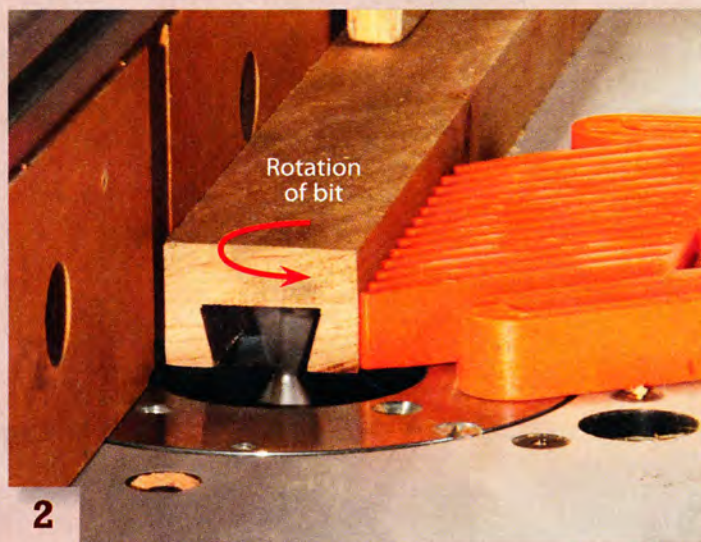
Next, set up the router table with the dovetail bit (Photo 2; Fig. A, Step 2). I'll bet you'll be tempted, as I was at first, to position the fence close to the bit—but you'll be rewarded with an unpleasant surprise. If you're not careful, the bit will jerk your workpiece forward. Why? Well, take a look at the bit's rotation: Set up this way, the side that's doing all the cutting is *pulling* the workpiece. (Imagine feeding a tablesaw from the backside—yikes!) The solution is simple. Adjust the fence so that the bit is cutting the opposite side of the socket; now the bit *pushes* against the workpiece as you feed it across the router table—the correct way.

Thanks to the tablesaw work, you're removing very little wood in this operation. Go right for the lines you drew. After making one cut, turn the piece around to complete the socket.

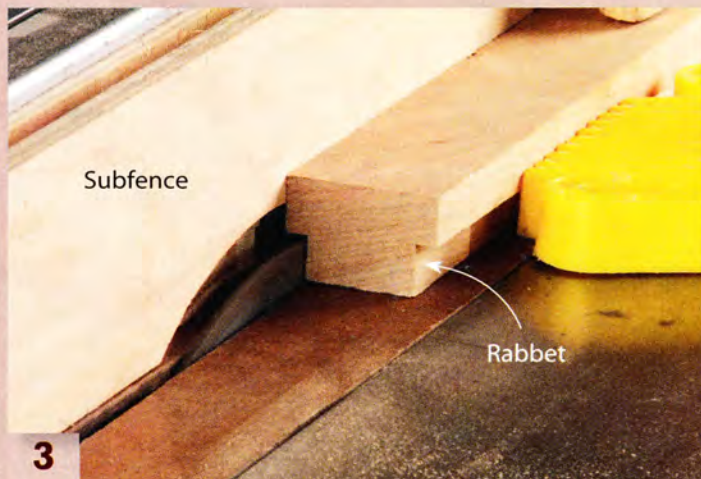
Fig. B Cross Section of Joint



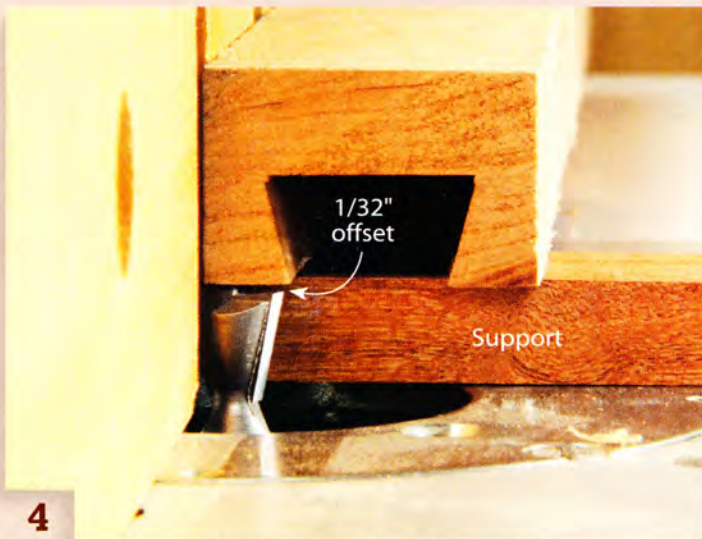
Start with the socket piece. Remove most of the waste on the tablesaw, using a standard blade or a dado set.



Route the socket. To prevent the workpiece from being yanked forward by the bit's rotation, position the fence so the side of the bit cuts only the featherboard side of the socket, as shown. Flip the workpiece around to cut both sides.



Remove most of the waste from the mating piece. Use a subfence so you can position the blade right at the edge of the workpiece, creating a rabbit.



4 **Set up** the router table for cutting the dovetail. Use the socket piece to position the fence. Support the piece on a board whose thickness equals the height of the bit.



5 **Rout** the dovetail. Don't go for the perfect fit on the first pass; start oversize, then move the fence back in small increments to make the dovetail narrower. Place several shims between a stop block and the fence. After routing both sides, remove one shim and reposition the fence.



6 **Plane** a few shavings off the bottom of the dovetail. This creates a clearance between the two halves of the joint, making it easier for them to slide past one another.

Make the dovetail

Mark one of your dovetail pieces as “Test,” then stand it on end in a vise. Place the socket piece on top of it and trace the socket on the end of the test piece—this is just a rough guide. Back on the tablesaw, remove most of the waste on the test piece and on the “real” piece (**Photo 3**; Fig. A, Step 3.)

It's time to go back to the router table—but hang on a sec. Tearout above the bit is a common problem when routing the dovetail. The result is a raggedy edge on the side of the joint. If this surface will show on whatever you're making, it's best to score the wood first. There are two ways you can do this. One option is to use a cutting gauge (a marking gauge with a knife-like cutter) to incise a deep line where the dovetail's shoulder will be. Alternatively, begin routing by adjusting the router table's fence so the bit makes a cut that's only 1/16" or so deep.

After the scoring cut, adjust the router table's fence to make the dovetail full-depth (Fig. A, Step 4). Don't go for it on one shot, however. The iron rule for this setup is to start fat and finish lean. That is, make the dovetail extra-wide at first, then reduce the dovetail's width by a series of light cuts until you get the fit you want. When you get close, a few thousandths of an inch matter—it's that fussy!

Without changing the height of the bit, use the socket piece to position the fence. Place this piece directly above the bit, then move the fence so that the bit's tip extends 1/32" to 1/16" short of the portion of the socket immediately above it (**Photo 4**). Rout both sides of the test piece, then try fitting it into the socket—if all is well, it shouldn't go. Rout both sides of the second dovetail piece.

To make the dovetail smaller, gradually adjust the fence back from the bit. I use a micro-adjust system that's dirt simple (**Photo 5**). There's nothing to build—you just need a clamp, a block, ten playing cards and a couple of small pieces of paper. Place the cards and paper behind the fence; they'll act as shims. Push the block against the stack of cards and paper, then clamp the block to the router table.

To set up the next test cut, remove one or two cards, then loosen the fence and push it against the remaining cards. Tighten the fence. Rout one side of the test piece and try fitting the piece into the socket; if the dovetail is still too large (and it should be), rout the other side and try again. If it doesn't fit, fine—you're good to rout the second, “real” piece.

Continue in this fashion until the fit is just about right; at this point, you should be removing only one card at a time. When you get extremely close, take even lighter cuts by removing the pieces of paper, one at a time. Just remember to rout the pieces in tandem; do the test piece first, try it out, then do the real piece. Be patient. When you get close, removing wood from just one side of the dovetail might do the trick.

When the parts fit, plane or joint the bottom of the dovetail piece to minimize friction between the two pieces (**Photo 6**).

Hang on to the sliding dovetail pieces once you're done. They'll be good to refer to later, when you need to make an actual joint, or you can turn them into a useful and clever project (see Recipe Calculator, page 47). 

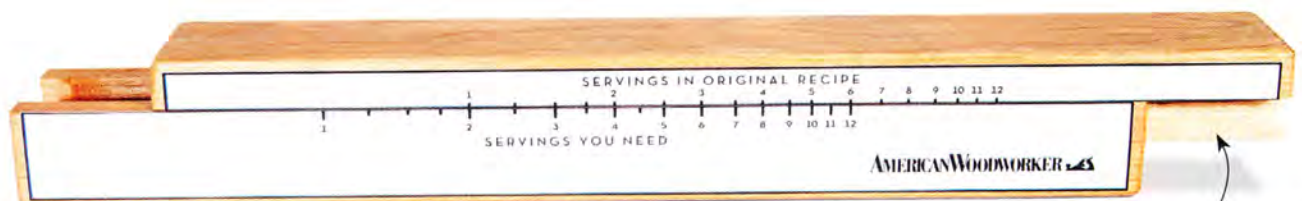
SOURCE

Freud, freudtools.com, 800-334-4107, #22-104 Dovetail Bit, \$15.

The Recipe Calculator

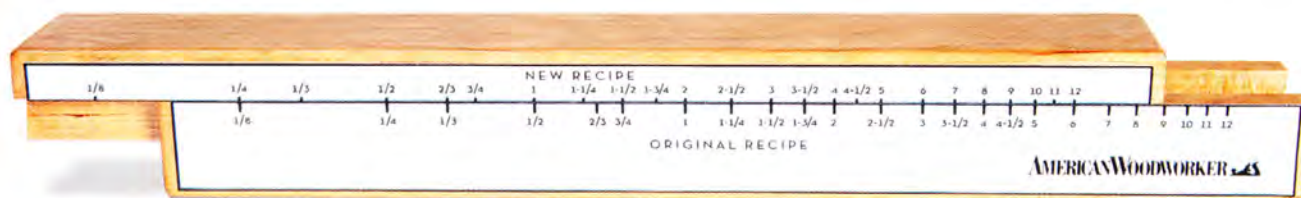
**A sliding dovetail
can solve kitchen math problems.**

by Tom Caspar



To increase or decrease the number of servings in a recipe,
slide the Calculator to align the appropriate numbers.

Sliding dovetail



Turn the Calculator around. Now, you can easily convert the amount of each ingredient.
This one is easy—everything is doubled.

REMEMBER THE SLIDE RULE? I sure do. Back in my high school chemistry class, when dinosaurs ruled the earth, we all had to learn how to multiply and divide large numbers with the same sophisticated device that Tom Swift used in his lab. Few of us succeeded. The gizmo looked so complicated that a lot of kids just gave up.

Browsing through an equally ancient book of woodworking projects the other day, I spotted something called a “Kitchen Slide Rule.” The idea was that if you had a recipe that made three servings, but you wanted to feed seven—or if you had any similar math problem—you could use the Kitchen Slide Rule to figure out how many teaspoons of this or cups of that you would actually need.

The Slide Rule itself was nothing more than a long sliding dovetail with two identical scales pasted onto both pieces—stripped-down versions of the C and D scales on a real slide rule. (If you reduce a slide rule to just two identical scales, it's very easy to figure out!) To work the thing, you just slide the two pieces past each other to the correct position and ... presto! All the conversions are at your fingertips.

Even in a digital era, it seems like a neat idea, doesn't it? Well, we sized the pieces in our “How to Make a Sliding Dovetail” article, page 44, to closely correspond to the parts of the original Kitchen Slide Rule. If you make our joint, you can turn it into a fascinating gift for anyone who cooks.

I've made one major change to the original design, however: The Recipe Calculator has scales on both sides of the sliding dovetail. You use the first scale to match up the number of servings in the recipe with the number of servings you actually need. Then you turn the thing around and read off the conversions from the second scale. Both of these scales were combined into one in the original design. Boy, is that confusing! Trying it out, I felt like I had been transported back to that chemistry class. The two-scale system is much easier to grasp, even for those who've only seen a slide rule in an antique shop. Enjoy! 🐭



To download full-size versions
of the Recipe Calculator scales, go to
AmericanWoodworker.com/WebExtras

Radial Router Jig

**Sometimes,
the jig is more
interesting than
the project.**

by John Hutchinson



SO TELL ME—how many jigs do you have scattered around your shop? Is it true that a guy can't have too many, just like you can't have too many clamps?

Well, here's one that I'll bet you haven't seen before. I used it to make a corrugated lamp reflector (see photos at left), but when I was done, I realized that building the jig was almost as much fun as making the lamp. I'm hanging on to the jig because I'm sure it could be used for many more things. But don't ask me just what—I'm still making plans!

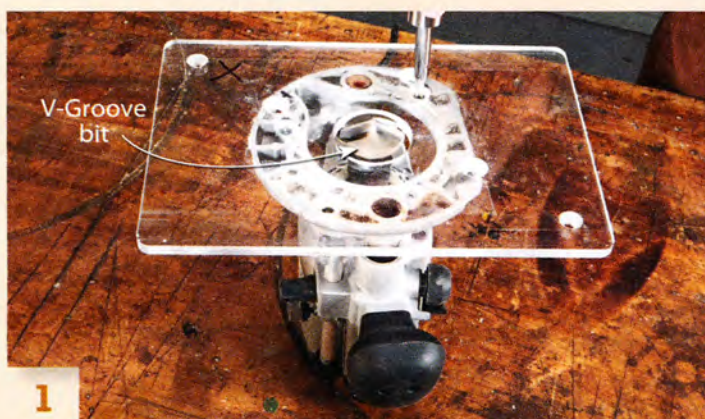
Basically, the jig allows you to rout across a circle, making a pattern like the spokes on a wheel. You rotate the circle after each pass, using a dirt-simple system of indexing marks. I also designed the jig to tilt, so that the router could cut deeper on the circle's perimeter than near its center. This has the effect of making cuts that taper in width and depth.

As I take you through the steps of building the jig, I'll use the method required to rout one side of the lamp reflector to illustrate how to set it up. I hope this gets your imagination going!

After designing this jig, I wondered, "What can I do with it?" Here's my first project: a reflector shade for a lamp (see Radial Wave Lamp, page 53).



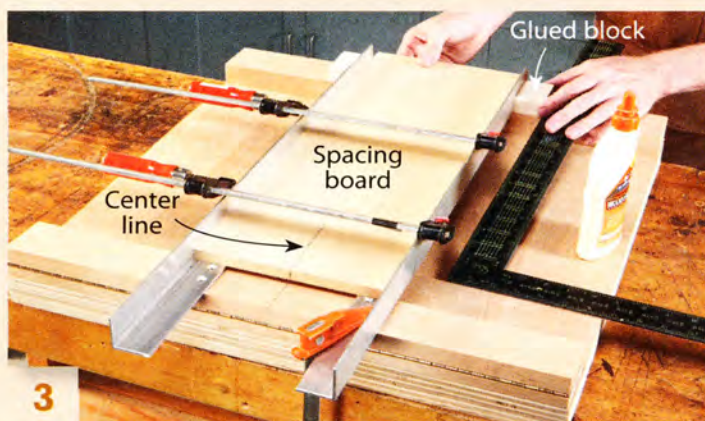
Get the complete plans for the radial wave lamp reflector at AmericanWoodworker.com/WebExtras



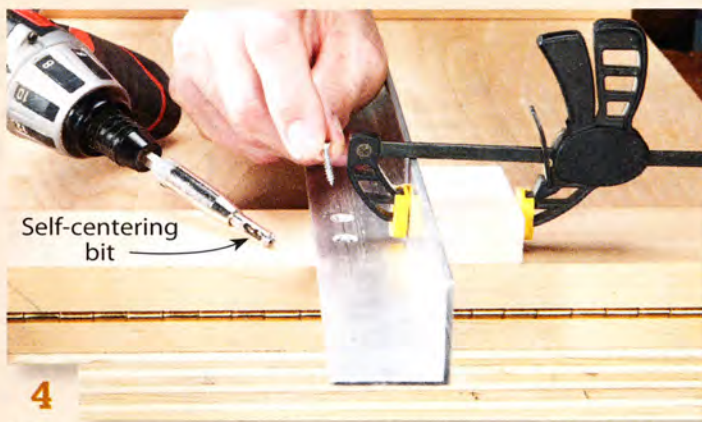
1 **Fasten** a large, rectangular plate to your plunge router. The plate must have a hole large enough to accommodate the bit you'll be using—in this case, a very large V-groove cutter.



2 **Begin** building the jig by fastening a pair of hinged stretchers to a double-thick plywood base.



3 **Center** a pair of aluminum angles on the stretchers, forming a carriage for the router plate. To space the angles, use a long board that's the same width as the plate. Glue small blocks next to the angles.



4 **Clamp** the angles to the blocks, then fasten the angles to the stretchers. Use a self-centering bit to drill the pilot holes.

Base and carriage

The first step in building the jig is to buy or make a large rectangular plate (A) for your plunge router (**Photo 1**). I used a 3/8" clear acrylic insert designed for a router table (see Sources, page 52). A plate that you can see through is handy for setting up the router's depth of cut and checking on your progress as you rout, but it's not strictly necessary. I'll be using a very large V-groove bit (see Sources), so I had to drill a hole in the plate large enough to accommodate the bit. Remove the sub-base from your router to install the plate.

Next, build the jig's base (B). Cut two pieces of plywood 24" x 24", glue them together, then trim the piece to final size. Mill some wood for the stretchers (C and D). Glue one of the 3/4" stretcher pieces to a 1/2" piece, then cut all of the pieces to final length. Use a hacksaw to cut a continuous hinge (E) the same length as the stretchers. Connect two of the stretchers with the hinge, then mount this assembly to the base (**Photo 2**).

The next step is to make a carriage for the router. You want the router to ride in this carriage without wobbling, so it's important to mount the carriage's rails (F) the correct distance apart. Here's one way to do it. First, cut the rails to length, then drill and countersink holes for their mounting screws (Fig. B). (Be sure to countersink the holes deep enough so that the heads of the screws are below the

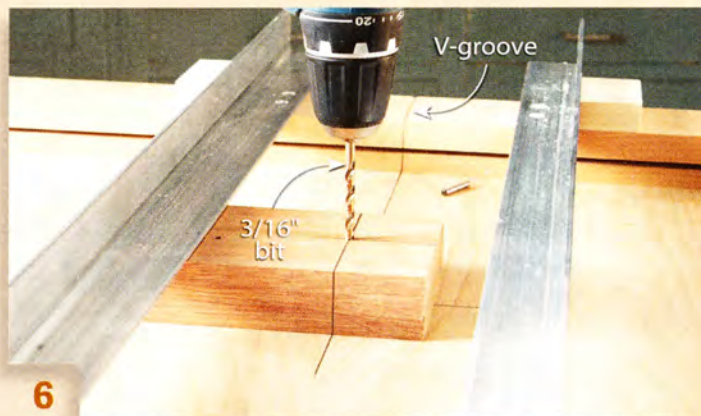
surface of the rails.) Next, cut a 22" long piece of plywood to stand in for the router plate. This piece must be exactly the same width as the plate. Finally, make some small blocks (G) to lock in the rail's position.

To mount the carriage, draw centerlines on top of the hinged stretchers and on top of the rear stretchers. Draw a centerline around the 22" piece of plywood as well. Place the plywood between the rails and align its centerline with the lines on the front and rear stretchers (**Photo 3**). Double-check the carriage's alignment with a framing square, then clamp the carriage so it can't move. Glue the small blocks tight up against the rails. (Just rubbing them in place is adequate.) When the glue dries, clamp the blocks to the rails, then use a self-centering bit to drill pilot holes for the carriage's mounting screws (**Photo 4**). Install the screws, then remove all of the clamps and the plywood board. Place the router between the rails to make sure it glides smoothly on the carriage.

Next, mark the exact centerline of the router's cutting path (**Photo 5**). The best way to do this is to chuck a V-groove bit in the router, then rout a shallow groove into the top hinged stretcher. Mark the center of this groove with a pencil, then continue the line down the hinged pieces and across the base.



5 Slide the router between the angles and cut a shallow groove across the stretcher. Mark the center of the groove.



6 Extend the groove's centerline across the jig's base. Use a guide block to drill a 3/16" hole in the base. Put a pin in this hole for rotating the jig's turntable.

Tilting the jig allows you to make tapered cuts.

Fig. B Detail of Rail Mounting Screws

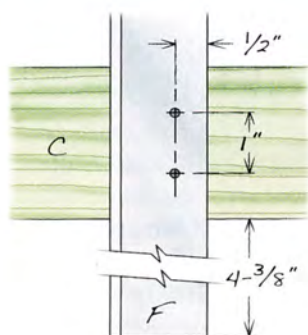
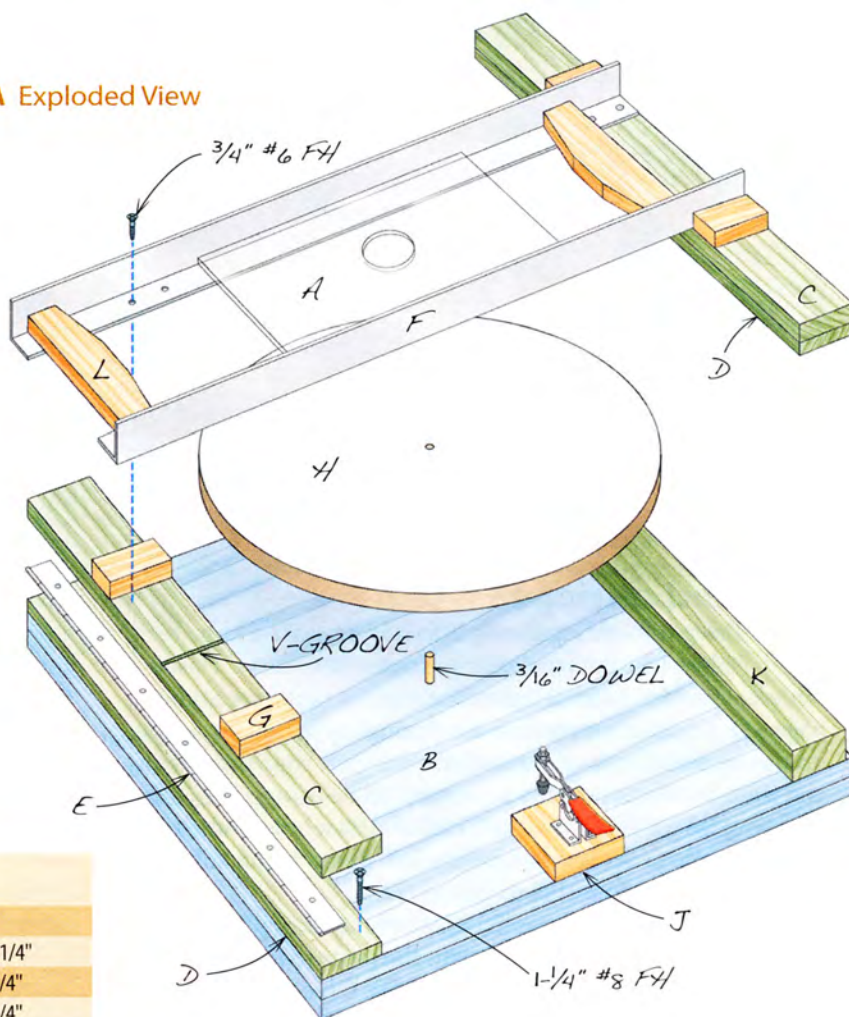


Fig. A Exploded View



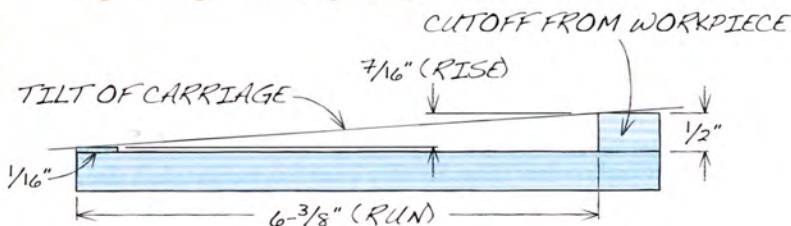
Cutting List

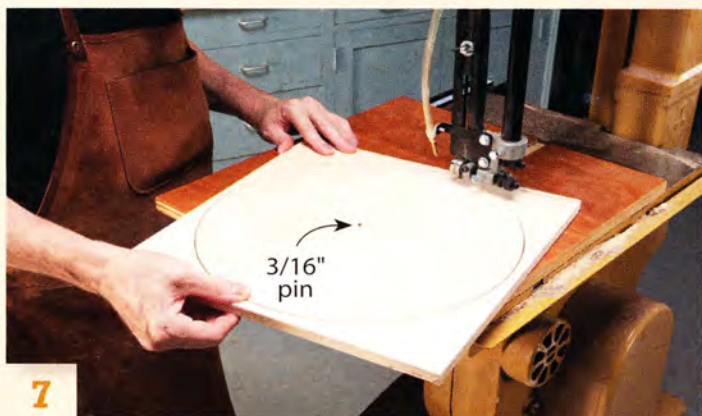
Part	Name	Qty.	Material	Th x W x L
A	Router plate	1	Clear acrylic	3/8" x 9" x 12" (a)
B	Base	2	Plywood	3/4" x 23-1/4" x 23-1/4"
C	Stretcher 1	2	Hardwood	3/4" x 2-1/2" x 23-1/4"
D	Stretcher 2	2	Hardwood	1/2" x 2-1/2" x 23-1/4"
E	Hinge	1	Steel	1-1/2" open width x 23-1/4"
F	Rail	2	Aluminum angle	1-1/2" x 1-1/2" x 27-1/2"
G	Glue block	4	Hardwood	3/4" x 2-1/2" x 1-1/2"
H	Turntable	1	Melamine	3/4" x 17" dia.
J	Toggle support	2	Plywood	3/4" x 3" x 3"
K	Spacer	1	Hardwood	1-1/2" x 2-1/2" x 23-1/4" (b)
L	Stop	2	Hardwood	3/4" x 1-3/4" x 8-1/4"

Notes:

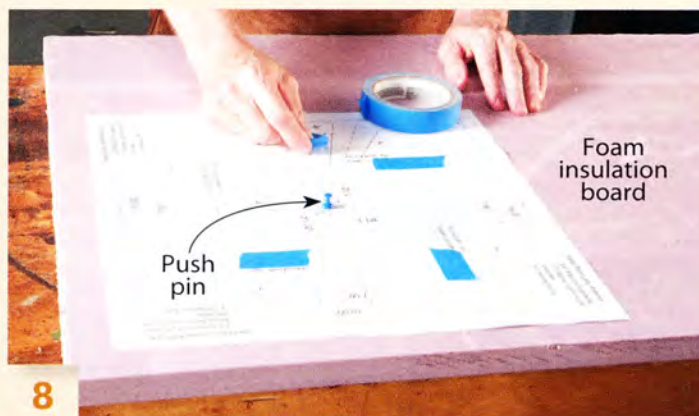
- a) Make a 22" long spacing block the same width as the router plate.
b) Exact thickness will depend on the taper required for the project.

Fig. C Angle - Setting Gauge





7 Saw a practice workpiece using a circle-cutting jig. Rotate the piece on a 3/16" pin. Make the turntable in the same way.



8 Make a pattern for the workpiece. This CAD drawing calls for 24 evenly spaced V-grooves. It's made from taping together four sheets of standard-size printer paper.



9 Mark the center of each V-groove by drawing a series of tick marks on the perimeter of the workpiece. Cut the pattern to guide your pencil.



10 Fasten the workpiece to the turntable. The center of this pattern will be cut out later, so it's OK to put the screws there.



When you must drill a precisely perpendicular hole on an object that's too large for your drill press, use a guide block (**Photo 6**). Drill the guide block on your drill press, then draw centerlines through the hole and around the block. To position the block, align these marks with centerlines on your project.

Place a short 3/16" dowel in the base's hole. (I use a metal dowel, but a wooden dowel will work just as well.) Make the turntable (H) and at least one practice workpiece using a circle-cutting jig (**Photo 7**). Be sure to use a 3/16" pivot pin—this will match the hole in the rotary jig. After cutting out the turntable, I drilled four holes for 10-24 machine bolts near its center for fastening the workpiece. I installed T-nuts in these holes, flush with the turntable's bottom, to receive the bolts.

Note: Use brass bolts, not steel ones as shown here. Brass will cause far less damage to a router bit if you accidentally hit the heads of the bolts.

Of course, this fastening method won't work with every project, since it requires drilling through the center of the workpiece. Alternatively, you could make the turntable the same size as the workpiece and clamp the workpiece directly to it using toggle clamps. But consider this: Clamping the turntable avoids putting pressure on a delicate workpiece. In any case, both methods require raising the toggle clamps on small blocks (J).

Indexing the workpiece

I don't use a complicated indexing device to rotate the workpiece to an exact position. I just draw pencil lines. I use a computer to draw a pattern, then print it out full size. The reflector I'll be making here is 14" dia.—larger than a single sheet of printer paper. No problem: I just draw part of the pattern, print four copies, then stick a push pin through the center of the circles on all four pieces. To make a full pattern, I fan out the pieces and tape them together (**Photo 8**).

The reflector requires 24 evenly spaced grooves on both sides of the workpiece. I don't need to draw the outline of each groove—just a short tick mark indicating its centerline. I use a scissors to cut each of the 24 pattern lines about an inch deep, then tape the pattern to the workpiece and trace each scissor cut (**Photo 9**). (To draw the opposite side, I turn the workpiece over and offset the pattern by half the distance between two tick marks.) Later on, I'll show you an easy way to position the turntable to hit each line right on the money.

Once you've marked the workpiece, place the turntable on the jig, then insert a short 3/16" wooden dowel into the center of the workpiece. Fasten the workpiece to the turntable (**Photo 10**).

Tilting the carriage

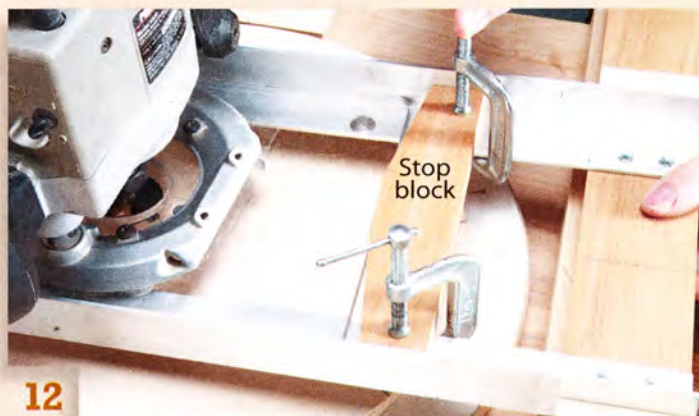
Here's where the jig's hinge comes into play: It allows you to tilt the carriage. When the carriage is tilted, the V-groove tapers in



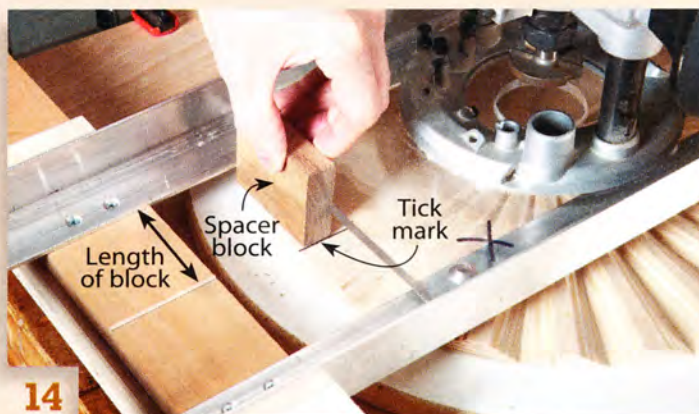
11 **Tilt** the carriage—this will cause the V-grooves to be tapered. Use a simple angle gauge that duplicates the exact rise and run of the taper you want. To lock in this angle, place a spacer board under the rear stretchers.



13 **Determine** the router's maximum depth of cut. Position the router so that the bit is centered on the inner circle of the workpiece. Plunge the bit until its tip contacts the wood. These practice cuts show the V-grooves tapering to nothing.



12 **Clamp** two stop blocks to the carriage in order to limit the router's travel up and down the rails.



14 **Make** a spacer block for indexing the workpiece each time you rotate the turntable. Line up the end of the block with each tick mark, then lock the turntable with toggle clamps.

width and depth. To lock in the tilt, you'll add a spacer under the carriage's rear stretchers.

OK, so how are you going to figure out how much tilt is correct? Forget about measuring a precise angle. Just treat the taper like the slope of a roof—carpenter's math. How much does the taper rise over a given length of run? Draw a cross section of your workpiece to obtain these numbers.

Once you know the taper's rise and run, build an angle-setting gauge that incorporates them (Fig. C). Place the gauge under the carriage (**Photo 11**). Slide the gauge back and forth until the carriage rests on both of the "rise" pieces, then make a spacer (K) to support the rear stretchers. (Be sure to clamp the stretchers and spacer to the base before routing.) When you make some practice cuts, you can fine-tune the carriage's tilt by adding shims under the spacer or by reducing the spacer's thickness.

Setting up the router

It's time to take a test run. First, you'll need to make some stops (L) to limit the router's travel. Angle the front edge of the stops to prevent dust from catching in the corners.

To position the stops, place the router in the carriage, then slide the router forward as far as you'll want it to go. (I drew a circle near the center of the workpiece to indicate the starting

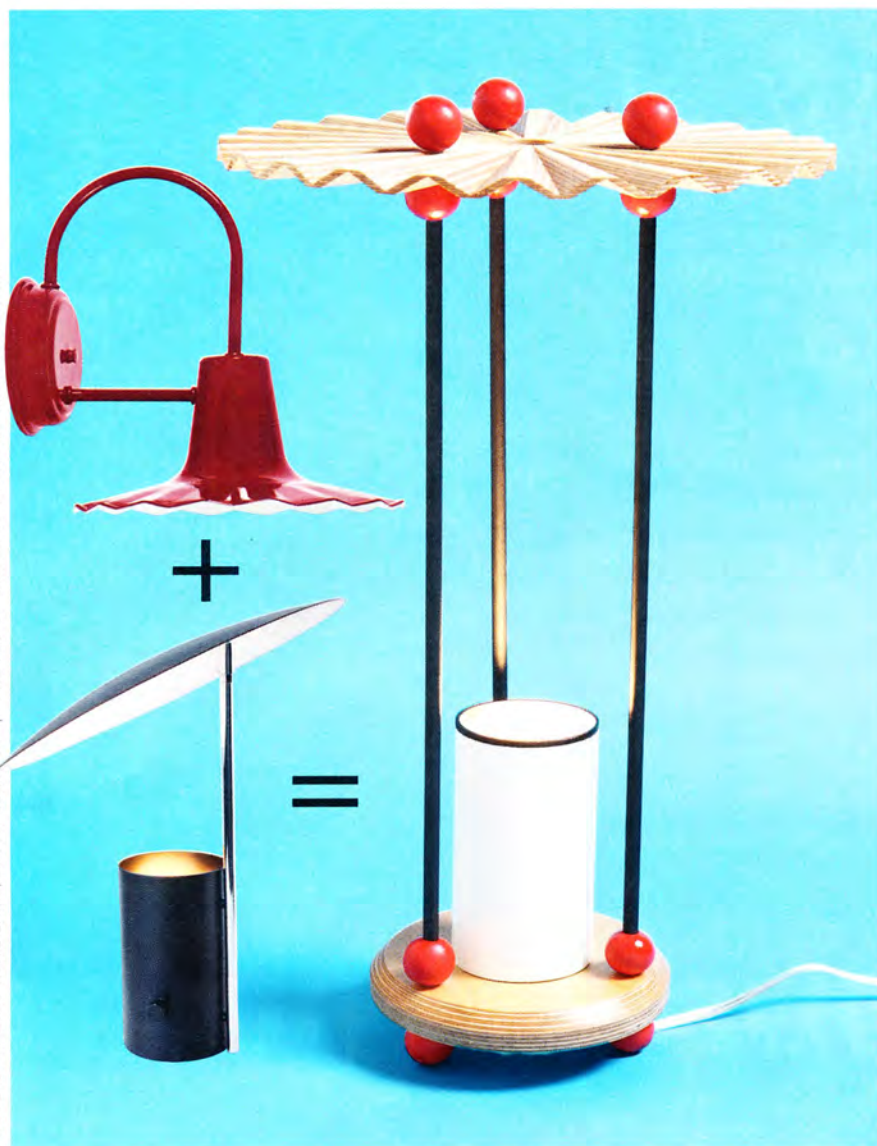
points of the V-grooves.) Clamp one stop against the router's plate (**Photo 12**). Pull back the router until the bit clears the workpiece, then clamp the other stop in place. This stop will prevent you from inadvertently routing into the front stretchers.

Next, set the router's maximum depth of cut. For this pattern, I just lowered the router until the bit touched the penciled inner circle (**Photo 13**). I don't intend to make a full-depth cut in one pass, so I also adjusted the plunge router's turret to make two shallower passes first.

Position the turntable so that one of the tick marks on the workpiece is aligned with the centerline routed into the front stretchers (**Photo 14**). You can eyeball this, but there's a better way: Use an indexing block. Cut the block so its length is the exact distance between one of the carriage's rails and the front stretcher's centerline. To use the block, butt one end against the carriage, then rotate the turntable until one of the tick marks on the workpiece lines up with the block's other end. Lock the turntable with the toggle clamps and you're ready to rout. 

SOURCES

- Router Table Depot, routertabledepot.com, 800-643-8716, Acrylic insert set of 2 with no predrilled holes, \$32.65.
- Eagle America, eagleamerica.com, 800-872-2511, Large V-Groove Bit, #132-2805, \$64.95.



RADIAL WAVE LAMP

PLAYING WITH CLASSIC STYLES CAN BE FUN

BILL OF MATERIAL

- | | |
|--------------|----------------------|
| 1 Reflector | 1/2" x 14" Dia. |
| 3 Dowel Rods | 3/8" Dia. x 24" |
| 12 Balls | 1-1/4" Dia. |
| 1 Base | 1" x 7-1/2" Dia. |
| 1 Canister | 3-1/2" Dia. x 6-1/2" |

by JOHN HUTCHINSON

Paul McCartney once said that he always walked around with his antenna up. Random sounds and images were stored in his cerebral temp folder only to reappear years later in unexpected combinations.

My Radial Wave Lamp was born in the same way. It's an amalgam of an unusual router bit that I purchased before I knew what I would do with it, a router jig that needed a purpose, a reproduction barn light (upper left)—originally patented in 1924—and a mid-century modern reflector lamp (lower left) designed by George Nelson in 1950.

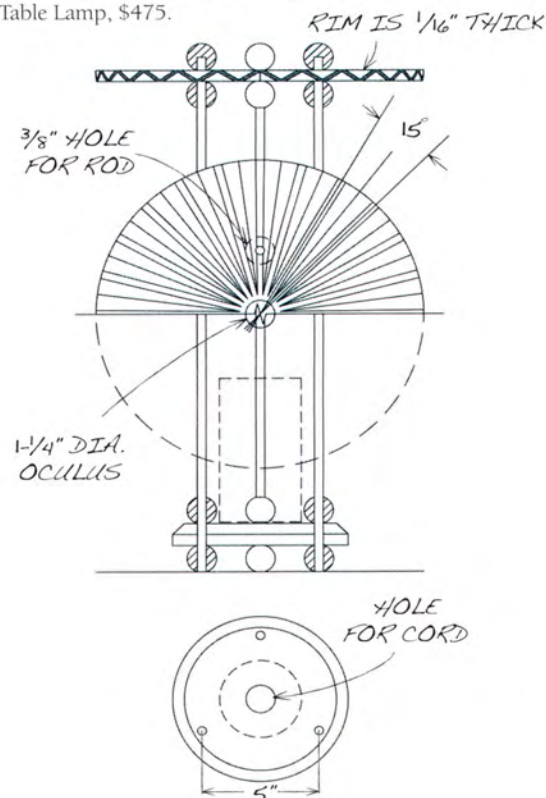
The last thing that I needed was another lamp, but sometimes doing something “just because I can” is enough justification for building a project. Besides, Radial Wave makes me smile.

You can build the lamp from a single piece of 20" x 30" Baltic birch plywood. See “Radial Router Jig,” page 48, for details on making the reflector. The lamp's base is glued up from two pieces. The balls and rods are painted with a spray-on enamel.

A local lamp store supplied the white canister and other electrical components; their electrician wired it for me, too. I used an 11 watt LED light that generates very little heat while providing a surprising amount of light. Like the whole idea!

SOURCES:

- Barn Light Electric Co., barnlightelectric.com, 800-407-8784, Wheeler Seaside Radial Wave Reflector Wall Sconce, BLE-W-RWS, \$256.
- Modernica, Modernica.net, 323-826-1611, Half Nelson Table Lamp, \$475.



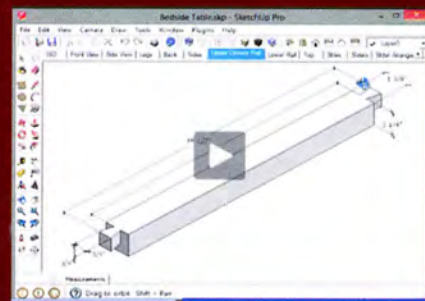
To download full-size plans for the lamp's reflector, go to www.AmericanWoodworker.com/WebExtras

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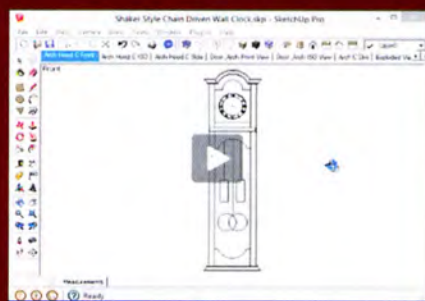
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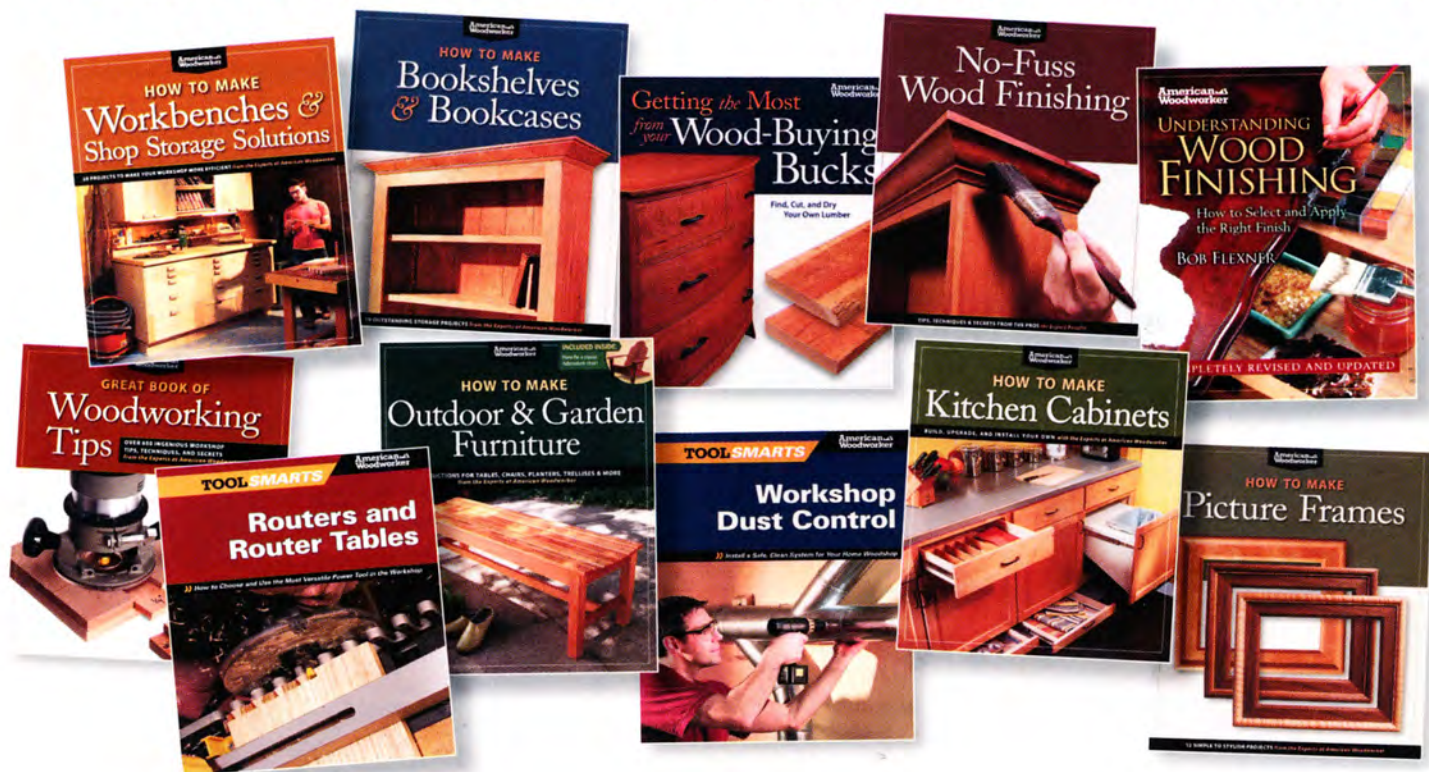


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The Amazing Elliptical Jig

This ingenious device takes you beyond the circle.

by Richard Tendick

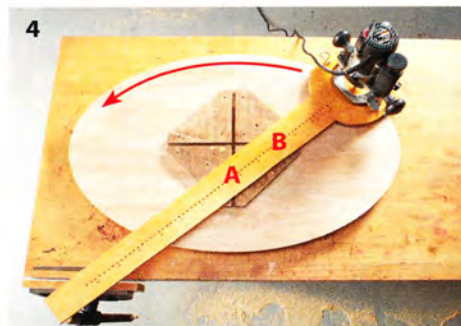
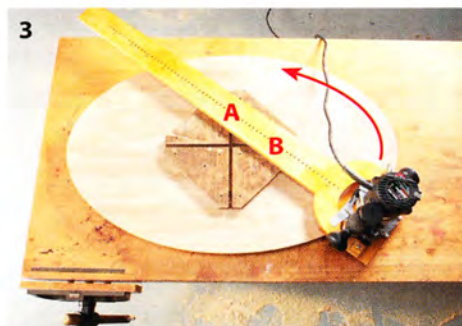
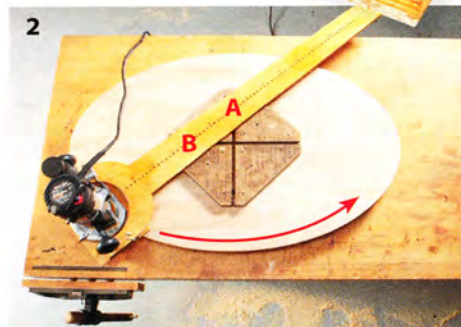
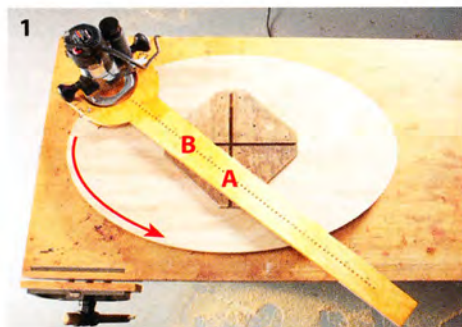
MANY WOODWORKING TOOLS, like the saw, chisel and plane, go way back. We've no idea who invented or refined them. An elliptical jig is one of those anonymous acts of genius—how did somebody come up with such a neat idea? You spin an arm around a block of wood that has two grooves arranged in a cross. Instead of tracing a circle, the end of the arm outlines a perfect ellipse. Wow.

Mechanisms like this were used by woodworkers long ago to draw an ellipse with a pencil or stylus, which they would then cut out by hand. Substituting a router for the pencil makes the job go much faster!

I've designed a modern version of this jig to work with an ultra-smooth action—it doesn't hesitate or skip. Using a simple micro-adjust feature, it produces a perfectly smooth edge.



Watch the jig in action at
AmericanWoodworker.com/WebExtras



This jig works on a simple principle: Two blocks (at points A and B) are screwed to a long arm. As you rotate the arm, the blocks slide back and forth in a cross pattern. To make ellipses of different sizes, you adjust the distance between the blocks.

PART 1 - Make the Jig



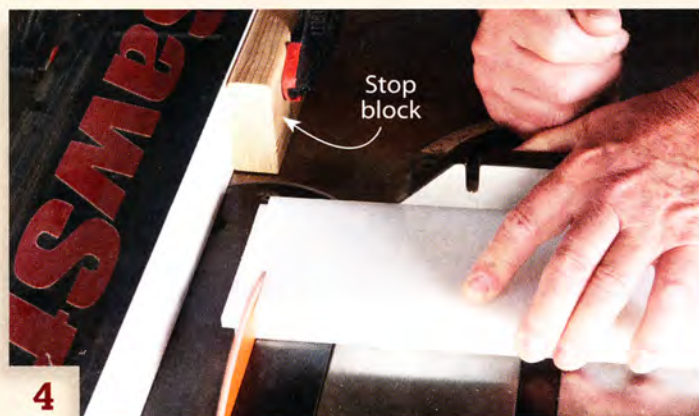
1 **Set up** a dado blade to cut a groove that precisely fits a piece of 3/4" thick UHMW plastic.



2 **Cut** two grooves at right angles to each other on a square piece of plywood. This is the jig's base.



3 **Rout** rabbets on both sides of the plastic, forming a T-shape. Repeat this operation on the other end of the plastic.



4 **Cut** off both ends of the plastic, creating two T-shaped "sliders." Use a 1" thick stop block clamped to your fence to set up this cut.



5 **Tap** holes in the sliders for fastening them to the jig's arm.

PART 1 - Make the Jig

The exact dimensions of the jig's base (A) aren't really all that important—what counts is sticking to this design. If you want to make an ellipse that's smaller or larger than the range given in Fig. H, you'll need to change the base's size.

For the jig to work smoothly, the sliders (B) that run in the base's grooves must fit just so—not too tight, but not too loose. The less friction, the better. While you could make the sliders from solid wood (maple would be best), I used UHMW plastic (see Source, page 59). This material is quite slippery and will never need lubricating.

Cut the base to final size. Be sure that it's absolutely square. Next, set up a dado set to cut a groove to fit your slider material (**Photo 1**). Cut two of these grooves in the base (**Photo 2**; Fig. B.)

Next, make the sliders. Begin by cutting two rabbets on both ends of the piece of plastic (**Photo 3**; Fig. J). I used a rabbeting bit in a router table, but a dado set would work just as well.

Crosscut the plastic to free the sliders (**Photo 4**). Note that the length of this cut determines the slider's height. The exact measurement will depend on the depth of the grooves you cut in the base. When you place each slider

in a groove, the top of its upper shoulder should be about 1/64" lower than the surface of the base. This clearance is necessary for the slider to travel freely.

I clamped a stop block to my saw's fence to set the length of the cut. The block is exactly 1" thick. Using the scale on the saw's front rail, I positioned the fence at the slider's precise height and added 1".

If, on the first try, you make the slider too tall or too short, you won't be able to salvage it. No problem. Just cut some new rabbets and try again. That's why I used my router table, rather than a tablesaw, to cut the rabbets.

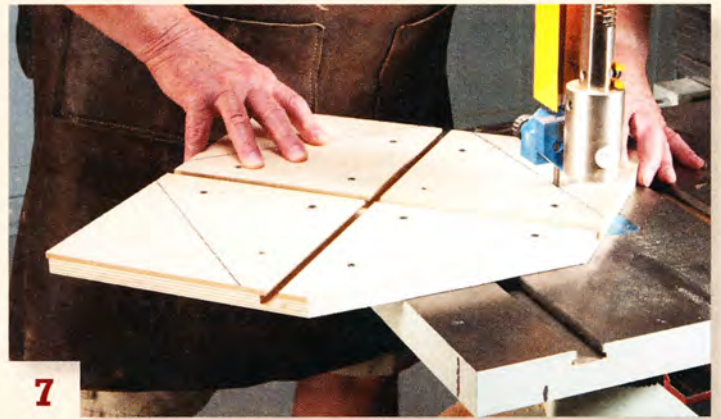


Using a router table to cut rabbets, dados and grooves can free up your tablesaw for other work. If there's a chance you must remake a piece, leave the router table set up as long as you can.

Drill holes in the middle of the sliders, then tap the holes to receive 8-32 screws (**Photo 5**). Place the sliders in the base. Four plates (C) prevent the sliders from lifting out of the grooves. Cut the plates to size and fasten them to the base (**Photo 6**). If you use ordinary plywood for the plates, which is slightly less than 1/4" thick, the top of the sliders will sit about 1/32" above the plates. That's fine—this clear-



6 Put the sliders in the base's grooves, then trap them with four square pieces of 1/4" plywood. Fasten these pieces to the base.



7 Cut off the corners of the jig.



8 Make the jig's arm. Drill holes spaced 1/2" apart down the length of the arm, then cut out the arm's shape.



9 Make two platforms for the arm. This one will be drilled to fit a router; the other one is for use with a pencil.

ance is exactly what you want. When you attach the jig's arm to the sliders, you don't want the arm to drag on the base. The arm should be slightly elevated above it.

To complete the base, cut off its corners (**Photo 7**). These cuts don't have to be dead straight—they just reduce the base's size for routing small ellipses.

The arm (D) can be as long or short as you wish. It's designed to place your router as close to the work surface as possible so you don't need an extra-long bit. You may have to modify the size of the arm's fork to fit your router.

The arm has a series of holes spaced 1/2" apart. They allow you to quickly set up the jig to make an ellipse of any size, in increments of 1".

Let me explain the spacing of the arm's holes. Ellipses are defined by two dimensions: a major diameter (the long way across) and a minor diameter (the short way across)—see Fig. H. Think of each hole in the arm as the center of a major or minor diameter; basically, it's the equivalent of a circle's radius. The actual diameter will be twice the distance that the hole is from the router bit, just

*Plastic sliders
give the jig an
ultra-smooth action.*

like a circle's diameter is twice its radius. For example, the hole labeled 10" refers to a 10" diameter, but it is actually only 5" from the bit. If you need to make an ellipse with fractional dimensions, just drill some new holes alongside the existing holes.

Drill the ellipse-diameter holes and the holes for mounting the spacers (E) and platforms (F) using a drill press. Cut out the arm (**Photo 8**; Fig. C) and mark the holes. Make the spacers (Fig. F).

Next, make the platforms (**Photo 9**; Figs. D and E). One is for drawing the ellipse; the other is for routing it. The drawing platform has a small hole for a pencil point. When you mount this platform on the arm, its pencil hole should be exactly 4" from the hole marked 8" on the arm.

The routing platform has a large hole for the bit to pass through. Note that the center of this hole is not in the same location as the center of the pencil hole. You'll want the edge of the bit to cut right on the pencil line, so the precise location of the routing platform's hole will depend on the diameter of the bit you'll use. I use a 1/2" bit.

I've added an optional micro-adjust feature to the arm

Fig. A Exploded View 1" 8-32 PAN HD.

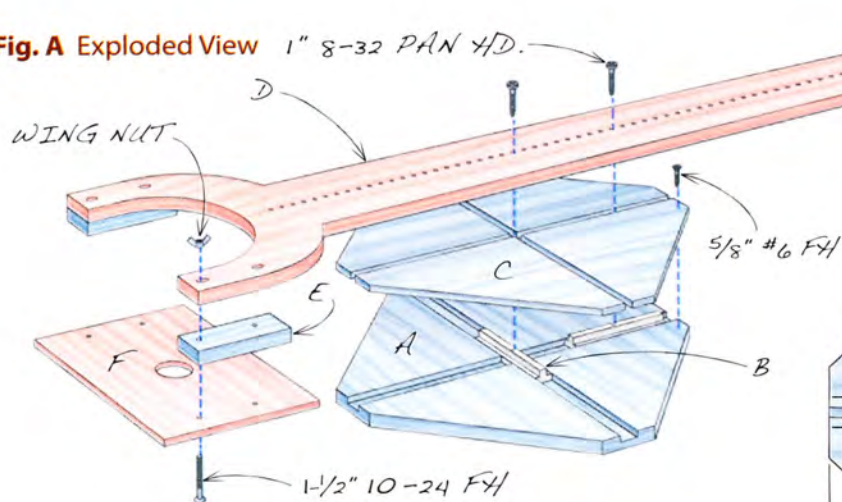


Fig. B Base Details

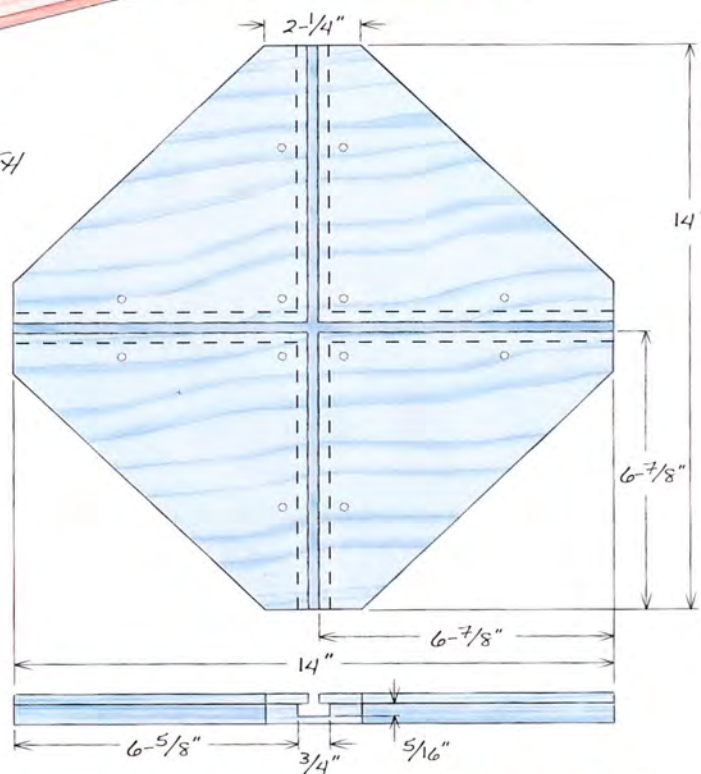


Fig. C Arm Details

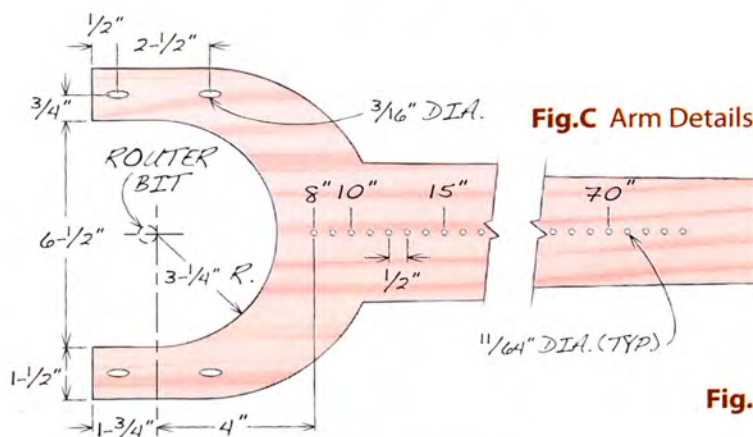


Fig. D Drawing Platform Details

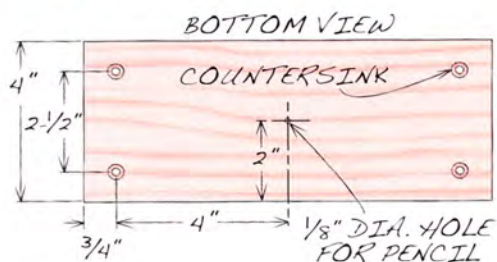


Fig. E Router Platform Details

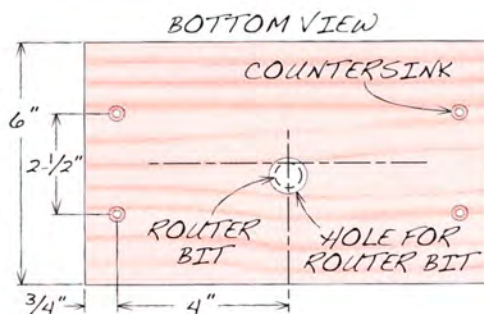


Fig. F Spacer Details

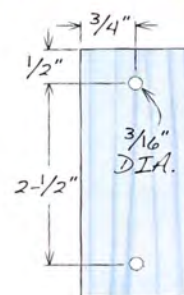


Fig. H
Range of
Ellipse Sizes

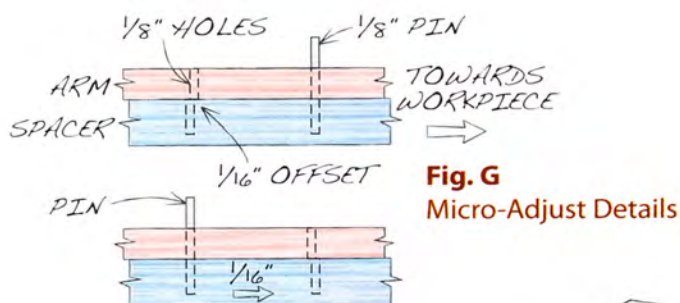
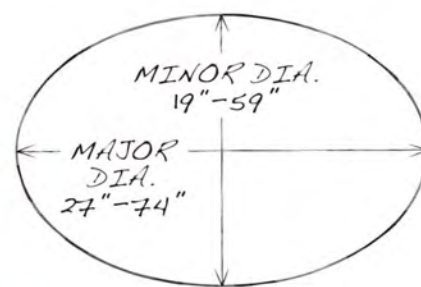
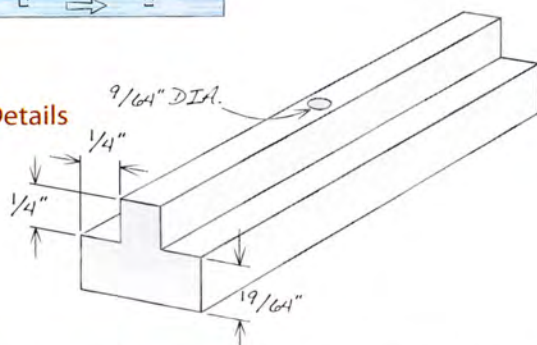


Fig. J
Slider Details



Cutting List

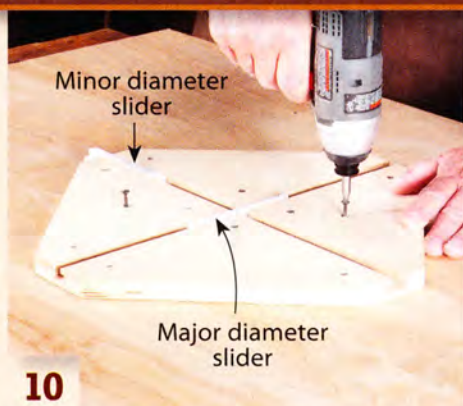
Part	Name	Qty.	Material	Th x W x L
A	Base	1	Plywood	1/2" x 14" x 14"
B	Slider	2	UHMW plastic	3/4" x 35/64" x 4"
C	Plate	4	Plywood	1/4" x 6-7/8" x 6-7/8"
D	Arm	1	Plywood	1/2" x 9-1/2" x 42"
E	Spacer	2	Plywood	1/2" x 1-1/2" x 3-5/8" (a)
F	Router platform	2	Plywood	1/4" x 6" x 9-1/2" (b)

Notes:

a) Thickness is approximate.

b) Use one platform for drawing only, if desired. Adjust width of second platform to fit the base of your router.

PART 2 - Using the Jig



10 **Fasten** the jig to the workpiece. Position the sliders as shown.



11 **Mount** the arm onto the major-diameter slider. Using a scale on the arm, thread a screw through the appropriate hole and into the slider.



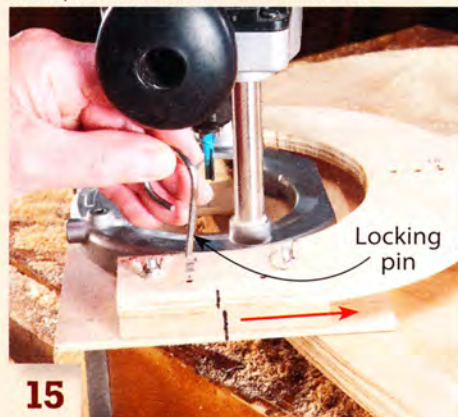
Mount the arm onto the minor-diameter slider. Move the slider back and forth until it is in line with the correct hole on the scale, then insert a second screw.



Use the pencil platform to draw the ellipse. Remove the waste with a jigsaw or bandsaw, staying about 1/8" away from the line.



Mount a plunge router and its platform onto the arm. Rout around the ellipse a number of times, cutting a little bit deeper on each pass.



Adjust the platform to move the bit about 1/16" closer to the center of the ellipse. Lock the platform's position with a pin. Make one final, full-depth pass.

that allows me to trim an ellipse 1/16" smaller all around on a final pass (see Photo 15). After making a series of stepped cuts to outline the ellipse, this final cut ensures that the edge of the ellipse will be perfectly smooth. Basically, the micro-adjust allows you to move the platform 1/16" closer to the center of the ellipse and lock it there with a pair of indexing pins (Fig. G). To do this, the holes in the arm that go under the wing nuts must be made oval, using a file.

Mount the routing platform on the arm before you drill the holes for the indexing pins. Note that there are two sets of these holes; they go on both sides of the platform. Neither the distance between the holes nor their location are important; it's their 1/16" offset that counts. To drill the holes, loosen the wing nuts and pull the platform to its farthest position away from the center of the ellipse. Tighten the wing nuts, then drill a 1/8" hole through the arm and down into the spacer. Move the platform in 1/16", then drill another set of holes; label these as the "Trim" position and you're all set.

SOURCE

Woodcraft Supply, woodcraft.com, 800-225-1153,
UHMW Sheet, 3/4" x 4" x 48", #124228, \$40.

PART 2 - Using the Jig

The elliptical jig's base must be fastened to your workpiece, so it can't move. Screwing it to the underside of the workpiece is the best solution (**Photo 10**).

Place the sliders in the position shown in Photo 10, then mount the drawing platform onto the arm. Attach the arm to each slider (**Photos 11 and 12**). Lining up the second hole with its slider can be a bit awkward; using an awl to align the holes before inserting the screw usually does the trick.

Draw the ellipse (**Photo 13**), then remove the arm from the base. Saw near the line to remove most of the waste. Place some non-slip blocks on your bench and put the workpiece on the blocks.

Remove the drawing platform and substitute the routing platform, with the router attached. Refasten the arm to the base and you're ready to rout (**Photo 14**). Remember to go in a counterclockwise direction, as you would when routing the profile of any piece.

If making stepped cuts resulted in a slightly uneven edge, cut a new edge using the micro-adjust feature (**Photo 15**). 

Wooden Router Plane

Make this classic hand tool in an afternoon for less than ten bucks.

by Brad Holden



THE MODERN ROUTER didn't arrive on the scene fully evolved; it descended from a hand-powered tool called the router plane. A quick glance at the router plane's handles—and the tasks for which it was used—makes the family resemblance clear.

The wooden router plane went out of favor in the wood-working trades long ago. It was replaced by the modern router because it couldn't match the production speed of an electric machine. However, a finely tuned router plane is anything but a relic. It still has a special place in my shop.

A router plane is my go-to tool for trimming any small surface that needs to be in the same plane as its surrounding surface, such as making a final adjustment to a dado or rabbet's depth, or trimming a tenon's cheeks.

Making this plane is a great introduction to tool-making,

and it's really quite simple. As you become more adept with your router plane, you'll reach for it more and more, in many cases finding it faster than setting up a power tool. And there really is nothing more satisfying than using a tool that you've made yourself.

Make the body

You can use any tough, hard-wearing species to make this plane. Hard maple is a classic choice. Start with a block that's a little oversize, and then mill it to final dimensions—1-1/2" x 3-1/2" x 9-1/2".

I recommend using the hardware listed in the Sources (page 63). The thumbscrew's oversize spade is perfect for holding the cutter. Drill the hole for the thumbscrew in the back edge of the body (**Photo 1**; Fig. A and B). Next, drill the



1 Drill a hole on the back edge of the plane body's blank for the cutter holder, which is made from a large thumbscrew.



2 Drill the plane's large throat opening using a Forstner bit. Make sure your bit is sharp, so it doesn't burn the inside of the throat.



3 Drill the two smaller holes that define the insides of the handles, also using a Forstner bit.



4 Bandsaw the body's shape. A jigsaw or coping saw would also work for this.

2" dia. throat opening (**Photo 2**; Fig. A), followed by the two 1" dia. holes (**Photo 3**). Use the pattern (Fig. A) to draw the plane's shape on your blank, then cut it out on the bandsaw (**Photo 4**). Sand the plane's body and round over the corners of the top edges, so it's comfortable in your hands. Don't round over the bottom edges though, just ease them a bit.

Make the cutter's holder

The cutter holder is made by drilling a hole in a beefy iron thumbscrew. To hold the thumbscrew for drilling and filing, drill an 11/32" x 2" deep hole in the end of a wood block. Thread the thumbscrew into the hole. It'll be tight, but that's what you want. When you can't turn the thumbscrew by hand anymore, stick the thumbscrew's spade in your vise jaws and turn the block.

Drill the hole in the thumbscrew using cutting oil so you don't overheat your drill bit (**Photo 5**). Using a square file (see Sources), shape the hole to fit the hex key's cross-section (**Photo 6**). This sounds more difficult than it is, so don't sweat it. Perfection isn't necessary and the malleable iron thumbscrew files easily.

To make it even easier, the file listed in the sources is the perfect size for this task. Start by filing one flat on the side of the hole opposite the threads. Do your best to make sure this first flat is square to the threads, as this is what holds the cutter square. Once you've made the first flat, roll the

file one file's-width either left or right and file the adjacent flat. Continue in this manner until you've come all the way around. Check the hex key's fit often so that you don't file more than necessary. The fit should be snug, so the cutter doesn't move during use.

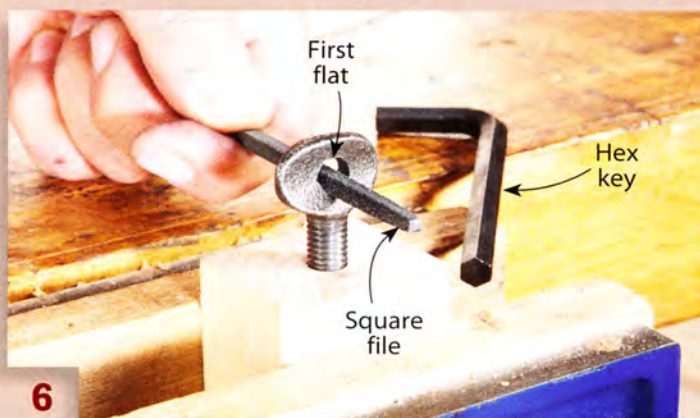
Make the cutter

Make another block to hold the hex key for cutting and grinding. Drill a 5/16" hole in the end, and then use a mallet to drive the hex key into the hole. Again, it'll be a tight fit, but that's what you want. Hold the block in your vise to cut the 30° bevel angle (**Photo 7**; Fig. B). The hex key is hardened steel, so you can't cut it with a hack-saw. A rotary tool with a cutoff wheel works well. *Caution: There will be lots of sparks, so make sure there's nothing flammable nearby.* Cut off the waste at the 30° bevel angle. The short end of the hex key should end up about 1" long.

Once you've made the bevel, cut off the bottom edge of the hex key (**Photo 8**). There are two things to consider when making this cut. First, the cutting edge needs to be at the widest part of the hex key (from point to point, not flat to flat). Second, the cut must angle up away from the cutting edge (Fig. B). This relief angle ensures that in use, the only part of the cutter that contacts the work is the actual cutting edge. Cut off the long end of the hex key so that the cutter is about 2-3/4" tall.

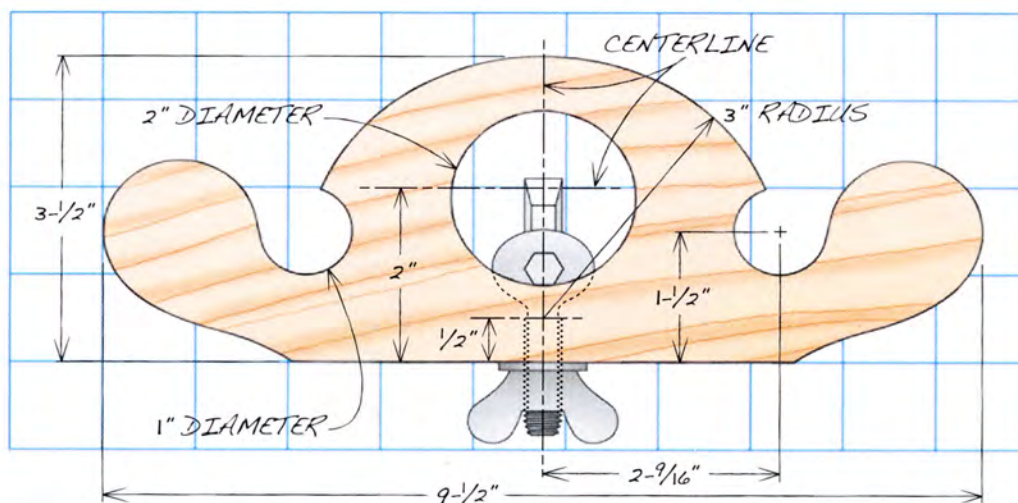


5 Drill a hole in the thumbscrew to hold the plane's cutter. Use a wooden block to hold the thumbscrew securely, and cutting oil to keep from overheating your drill bit.



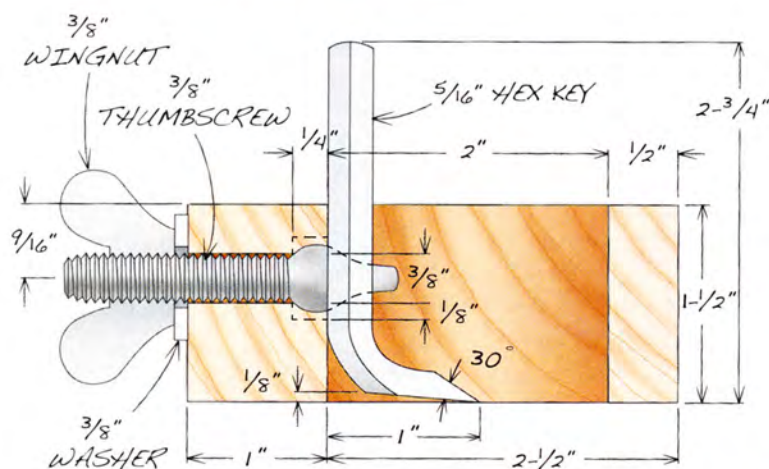
6 File flats in the thumbscrew's hole to match the cross-section of a hex key, which will become the cutter. The first flat determines the cutter's alignment; be sure to make it square to the threads.

Fig. A
Plan View



1 SQUARE = 1"

Fig. B Section View



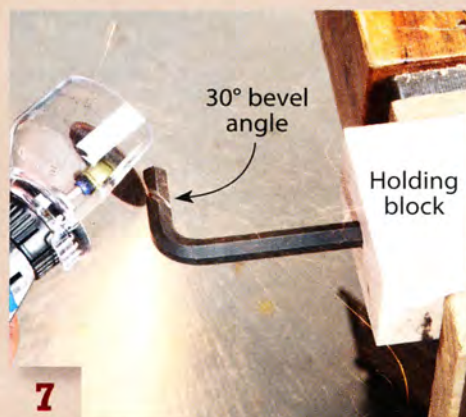
Sharpening a small, L-shaped cutter like this is tricky, so I made a guide block to ensure a flat, square cutting edge (**Photo 9**). To make the guide block, cut a shallow groove in the block that's just wide enough to firmly hold the cutter. Cut a 30° bevel on the block's front edge. Insert the cutter and slide it forward until it protrudes just slightly beyond the block's bevel.

Diamond paddles (see Sources) work really well for sharpening small, odd shapes; they're easy to control, and give fast results. Start with coarse grit, and work your way up to super-fine. Depending on how accurately you cut the bevel, sharpening should take less than fifteen minutes.

The last step before assembling your plane is to chisel out a recess for the thumbscrew's head (**Photo 10**). Cut the recess deep enough so that when you tighten the thumbscrew, it pulls the cutter firmly against the plane's body. It's a tight spot, but with a little patience, you'll be done before you know it and ready to put your new creation to work.

Using the router plane

A router plane isn't meant to hog off 1/4" of material in one pass. Instead, you'll take a light pass, reset the depth and take another pass, repeating as many times as necessary.



7 Form the cutter's bevel angle by cutting off the waste at 30° using a rotary tool outfitted with an abrasive wheel.



8 Cut the bottom off of the hex key so that the cutting edge is the widest point.



9 Sharpen the cutter using a guide beveled at 30° to ensure a flat, square cutting edge.



10 Excavate a recess for the thumbscrew's head. The recess has to be deep enough to allow the cutter to bear against the body when you tighten the thumbscrew.



11 Tap the cutter's end to increase the cutting depth. With the thumbscrew tight, a sharp whack will deepen the cut by a few thousandths of an inch.

Assemble all the parts, with the cutting edge slightly above the plane's sole, so it doesn't make a cut, and then tighten the thumbscrew. Use a mallet to tap the cutter until it just takes a shaving. As you gain experience, you'll be amazed at how precise your mallet-driven adjustments become.

Pro Tip For trimming tenons, I used to reach for a shoulder plane until I learned the router plane method (Photo 11). The fundamental difference between the two methods is that a shoulder plane rides on the surface being trimmed whereas a router plane rides on the surrounding surface. With a shoulder plane, it's easy to cut too deep, or not in the same plane as the face of your workpiece.

Here's how the router plane method works to solve both of those issues. Fasten a piece of scrap the same thickness as your workpiece to the plane's sole. It works as an outrigger, supporting the plane's end as you trim. Because you're planing from the workpiece's surface, the tenon is guaranteed to be co-planar. Since the cutter is suspended, it's impossible to shave off any deeper than your last setting. 

SOURCES

- Reid Supply Company, reidsupply.com, 800-253-0421, 5/16" Hex Key, #AHK-28, \$1.16; 3/8" Shoulderless Spade Thumbscrew, #MIT-23, \$3.19; Iron Wing Nut, #MIN-4, \$1.74; Square American Pattern File, #GRO-32-414, \$3.32.
- Eze-Lap Diamond, eze-lap.com, 800-843-4815, Set, 1 each Super Fine Grit (1200), Fine Grit (600), Medium Grit (400) & Coarse Grit (250) Diamond Paddles, #L PAK 4, \$27.



This method for building a router plane is from John Wilson's fantastic book "Making Wood Tools". It's a practical and resourceful manual for a lost art. John has designed projects that are attainable for anyone with a modicum of ability. His frugal sensibility is refreshing—the router plane hardware costs less than ten bucks—in a time when quality hand tools are often more expensive than their corded counterparts. To purchase the book, contact John at 517-543-5324 (9-5 EST). Visit John Wilson's website at shakerovalbox.com.



Finish Care

Polish or wax: Which is best for furniture?

MY GRANDMA always used lemon oil to clean and polish her wood furniture. Either she just enjoyed having everything clean and dust free or she believed everything she read on the label.

Many interesting myths surround furniture polishes, because marketing and selling them is big business. The labels on some of these products make entertaining reading by claiming that using a product will feed, nourish, condition, moisturize, replace lost natural oils—and even prevent cracking, warping and sun damage. Hmm.

Fortunately, caring for the finishes on wood furniture isn't nearly as complicated as those labels would have you believe. The two most important things you can do are fairly obvious. First, avoid exposure to harsh elements. Direct sunlight, high heat, water, abrasions, and strong cleaning chemicals can cause serious damage to finishes and to the wood beneath them. Using coasters and trivets helps.

Second, occasionally clean the surface to keep crud from accumulating. My preferred cleaning method is to simply dust the surface using a rag dampened with water. This is my standard recommendation to customers.

Sometimes a deep cleaning is useful on older or neglected pieces (see “How

to Clean a Dirty Finish,” page 66).

Additionally, you may choose to maintain the finish with polish or wax (see photos, opposite page, at top). There are some good reasons to use

Museum conservators typically use a soft, dry, electrostatic cloth to dust furniture finishes.

these products, but whether a finish is new or antique, it doesn't really need any help from wax or polish to do its job of beautifying and protecting the wood. Simply put, furniture finishes are typically far more durable than polishes and waxes.

Wax and polish rarely cause problems. “Build-up” only occurs when the excess isn't wiped off. Extra care should be taken on valuable antiques with fragile old finishes, as oil can soak into cracks and voids to discolor the wood below.

Liquid polish

Liquid polishes are easy to use (see photo, opposite page, bottom left). They

by Kevin Southwick

work well for quick dusting and cleaning—and unlike a damp rag, they add a bit of sheen to dull surfaces. They also hide minor scratches (see photo, page 66, top left), add a small amount of scratch resistance, and usually contain fragrance to leave a pleasant aroma. These limited benefits aren't permanent, so fairly frequent reapplication is needed. Liquid polishes cannot really add much to the life span of a finish because they do not add much protection against the elements. But with regular use they do keep wood looking its best and smelling nice.

Furniture polish manufacturers aren't required to accurately list ingredients, so it's almost impossible to know what's in them. However, it is easy to verify that they all contain some type of non-evaporative oily substance by the slick, oily feel they leave behind for a time. Mineral oil and silicone oil are the most commonly used oils. Silicone oil is used because its polishing effect lasts longer. Some “all natural” brands contain olive oil. Products labeled as cleaners probably do not contain any oil.

Oil is the ingredient that adds a little shine and helps a bit with scratch resistance by making things a little



Furniture polishes typically contain a clear non-drying oil such as mineral oil or silicone oil. They may also include solvents for cleaning, wax, and fragrance.



Paste waxes are made from solid wax dissolved in solvent. Different types of waxes are often blended to achieve the best combination of working properties and protection.



Furniture polishes clean, shine, leave a pleasant scent, and add a bit of scratch and water resistance. These benefits last until the ingredients evaporate, soak in or wash away.



Paste waxes are tedious to apply and buff. However, waxing adds a thin layer of hard, durable material that provides more protection than polish and lasts much longer.

slippery. Liquid polishes that look clear are mostly oil. Lemon oil and orange oil are usually mineral oil with a little lemon or orange fragrance, and maybe a little solvent for cleaning.

Several of the brands I tested looked milky. This probably indicates that they are emulsions of oil and water (and maybe other ingredients). These mixtures are popular because they do both cleaning and polishing in one step. Some polishes combine non-drying oil with wax to form a thick goo. This behaves like a thick liquid polish, because the wax can't dry to a hard film. Such formulations tend to leave surfaces slightly greasy and susceptible to fingermarks.

Color is sometimes added to polishes to cover scratches on dark woods (see

photo, page 66, top center). This often works well, but these products should be used with caution because they can darken scratches more than desired and the coloring effect may be permanent.

The lack of information about ingredients can make it hard to choose a polish. In fact, many brands boast more about things that aren't in their product, such as silicone, wax or abrasives. As a professional refinisher, I recommend avoiding silicone oil because my job would be a bit easier if no one ever used polish that contains silicone oil. Once silicone gets on a surface, it's there to stay, complicating refinishing (see photo, page 66, top right). However, while silicone contamination often requires professional help to overcome, it doesn't cause any permanent damage.

Paste wax

Paste wax is appropriate to use when the goal is not only to raise the sheen of a

finish, but also to add better and longer-lasting protection than liquid polish (see photo, above, bottom right). The difference is that the wax hardens to a thin solid film after the solvents evaporate. Water beads up on waxed furniture finish as it does on a freshly waxed car. The effect lasts until the dried wax is worn away by the elements or washed off with solvents. This makes wax a good choice for rejuvenating and protecting old shellac and other antique finishes. Wax also has a nice "feel" on objects that will be handled or touched.

Paste wax is more tedious to use than liquid polish. You have to apply it, allow the right amount of time for it to set up, and then buff it. Over time, however, a waxed finish requires less maintenance: Only occasional reapplication will be necessary. Do not use a liquid polish to dust a waxed surface, as polishes typically contain ingredients that will soften or remove wax.



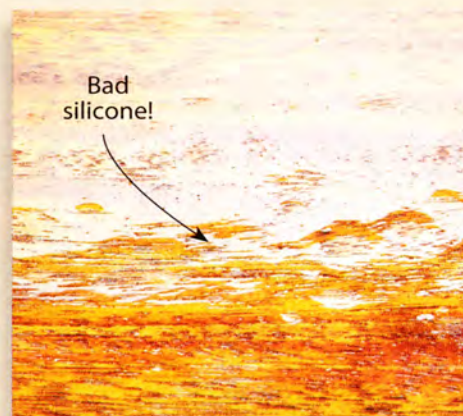
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Clear polish can temporarily hide minor scratches in light colored wood. Clear wax may not work as well to hide such scratches.



Colored polishes can hide light-colored scratches in dark wood. Their use requires caution, however, because they can permanently make scratches too dark.



Silicone oil makes polish last longer than other non-drying oils. The only drawback is that silicone can cause fisheyes or craters to form if you refinish.

Paste waxes are usually made from beeswax, carnauba wax or paraffin wax. These solid waxes are softened by dissolving them in evaporative solvents, including mineral spirits, paint thinner, turpentine, citrus and others. This formulation makes it possible to apply and buff a thin protective film of wax. Beeswax and paraffin are a little softer and easier to buff than carnauba, so a blend is often used to get the best mix of working properties

and protection. Because solvents dry at different rates, manufacturers select them to control the working time and set-up time prior to buffing. Some brands say what kind of wax and solvents are in them. I prefer a softer wax with plenty of working time because it makes buffing easier. My favorites are Liberon and Antiquax. I don't like Briwax, because it contains toluene and dries extremely fast.

Dark colored waxes are commonly

available. They're useful because, like colored polishes, they can work well to hide light scratches on dark finishes. It's important to choose the color carefully to avoid darkening scratches more than desired. 🐾

Kevin Southwick is a wood-finishing specialist and furniture restorer/conservator. Learn more at southwickfurnitureconservation.com.

How to Clean a Dirty Finish

Well-used and antique finishes often look much better after a thorough cleaning. Whether an heirloom rocking chair or kitchen cabinet doors, the two-step cleaning approach shown here works best, because two different cleaners are used to dissolve and remove two different categories of crud. Both of these cleaning steps are safe for any type of finish unless it's seriously decayed or fragile. If the item is valuable and has a delicate finish or lifting veneer, any treatment should probably be done by a qualified professional.

Step 1: Wipe on mineral spirits or paint thinner to readily dissolve and remove old waxes, polish and oily residue (top photo, at right). Don't substitute lacquer thinner for paint thinner—lacquer thinner can ruin many types of finish. Allow the mineral spirits to evaporate. Then wipe off the residue and repeat, as necessary. Use light-colored rags to monitor your progress (middle photo). When the rag stays clean, you're done with this step.

Step 2: Use a mixture of mild dish soap and water to effectively remove normal dirt and grime (bottom photo). Add just enough soap to produce some suds. If you use too much, you'll have to do more rinsing. Gently wash the surface with a cotton rag or soft bristle brush—a brush is good for getting into crevices. Use a damp rag to completely rinse off the suds. Then dry the surface with a clean dry rag.

Many woodworkers are reluctant to use water on wood for any reason, even for a short amount of time. It's true that soaking a piece for an extended time in a hot bath would definitely cause all kinds of problems, including damaging the finish, loosening joints and lifting veneer. It might help to know that museum conservators use soap and water to clean precious wood objects. They use Orvus, a special gentle soap containing sodium laurel sulfate that's similar to no-tears unscented baby shampoo.



How to Rout a Large Arc



by Jim Baumann

**Need a big, smooth curve?
This method will do it!**

CURVED LINES in any project are both a blessing and a curse. They're a blessing for the eye of the beholder, but a curse for the poor guy who has to make them.

Executing a perfect, fair curve isn't easy—particularly a large one. If you cut one freehand, you're often faced with hours of sanding to true it up. I build custom fireplace mantels, which often require a horizontal front board with an arc that follows the insert below. I can't afford to use such a slow, inexact method, so I've adopted a much more efficient and precise approach using a router. The results are so good that I hardly have to sand at all.

Calculate the radius

An arc can be elliptical, oval or circular, or some combination of these three shapes. I'll only deal with the simplest one—an arc that's a segment of a circle. Using the equivalent of a giant trammel (a compass that uses a beam instead of two legs), this type of arc is fairly easy to make with a router.

Let's say you have a pretty good idea of how large the

arc should be. You know how tall it will be (its rise) and how long it will be (its run). In order to calculate the trammel's length, you'll need to figure out the radius of the circle that defines the arc. And in order to pivot the trammel, you'll need a method to pinpoint the circle's center. No problem.

*This approach is faster,
more efficient
and more precise
than any other.*

Using the measurements of your arc's rise and run, calculating the circle's radius is a simple math problem (see "How to Calculate the Radius of An Arc," page 69). Once you know the radius, it's pretty easy to find the circle's center—but we'll deal with that later.

Although your arc may not be very long, the circle that it's based on might be huge. In this article, I'll be routing an arc with a rise of only 4". From endpoint to endpoint, its run is 42". Doing the math, I'll need to rout an arc with a radius of 57-1/8"—almost five feet! My method will work for making an arc of virtually any size, but it's particularly well-suited for big ones like this.

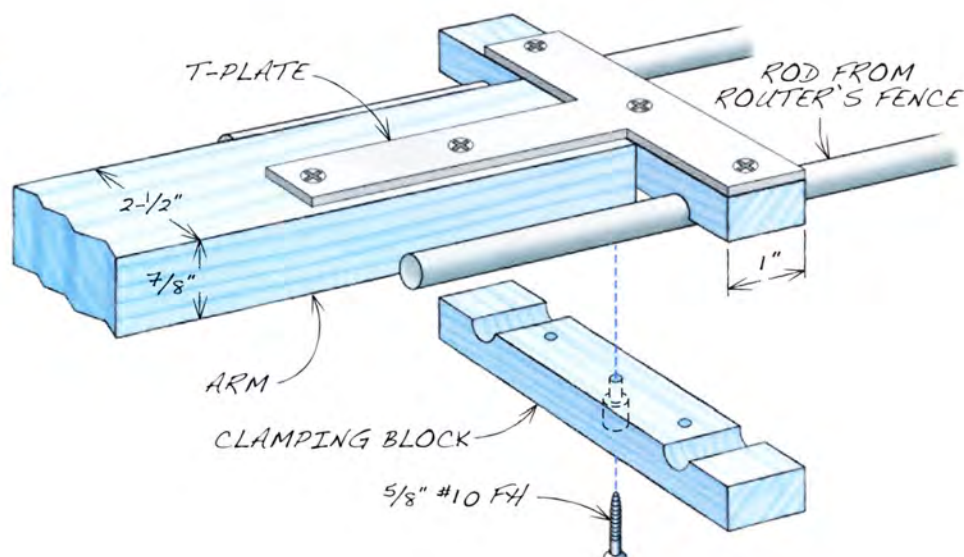


Start by making a pair of blocks that will clamp onto the rods for your router's fence. Place two 1/16" spacers between the blocks, then drill holes the same size as the rods.



Fasten the clamping blocks onto the rods. You won't need the fence—you can set it aside.

Fig. A Exploded View



Make the arm

To rout the arc, you'll be mounting your router on the end of a long arm. Making the arm is very simple—it's just a straight piece of wood. Once you're done with the job, there's no need to hang on to the piece; you can just put it back in your woodpile.

So how do you connect the arm to the router? I use a very simple system that should work with any router that accepts a fence. You don't need the fence itself; you just need the rods or bars that the fence slides on—the parts that slip through the router's base. (If you don't have these parts, you'll probably be able to find or make substitutes.) To connect the rods to the arm, you'll be making a wooden device that clamps around the rods (Fig. A).

You'll have to adjust the dimensions of this clamping

device to suit your router, of course. Both parts of the clamp are the same thickness, and that thickness is a critical measurement. Why? The bottom of the clamp must be even with the bottom of the router, or slightly above it, so the clamp doesn't bump into your workpiece when you're routing the wide part of the arc (Fig. B, page 71).

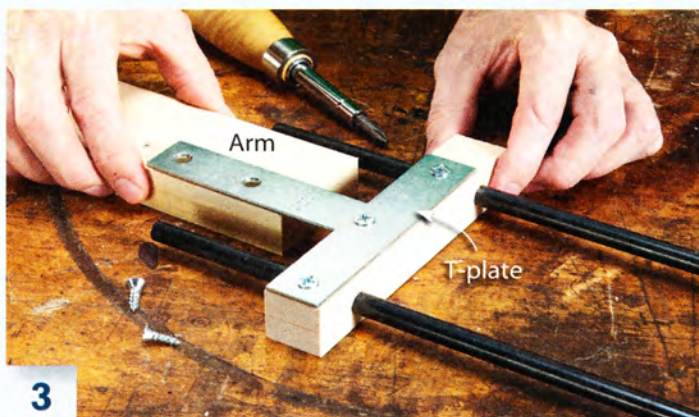
To determine the thickness of the clamp's parts, measure the distance from the center of the rods to the base of the router. Subtract 1/32" or so from this measurement, then mill the clamp's parts to this dimension.

The two halves of the clamp must firmly grip the rods when you tighten the clamp's screws. The best way to ensure this is to insert spacers between the halves when you clamp them together and drill the holes for the rods (Photo 1). (I made my spacers from a craft stick, similar to a tongue depressor, but any piece of wood will do.) These holes should be the same diameter as the rods—not smaller or larger. When you're done, test the holding power of the clamp by fastening it to the rods (Photo 2).

Next, fasten a T-plate to the top of the clamp. The exact position of the T-plate doesn't matter—I offset it so that



Torsion beams (Photo 4) are lightweight, sturdy and dead flat. Find out how to make them at AmericanWoodworker.com/WebExtras



3

Make a stout arm that's about the same length as the radius of the arc you'll rout. Fasten the arm to the clamping blocks with a T-plate.



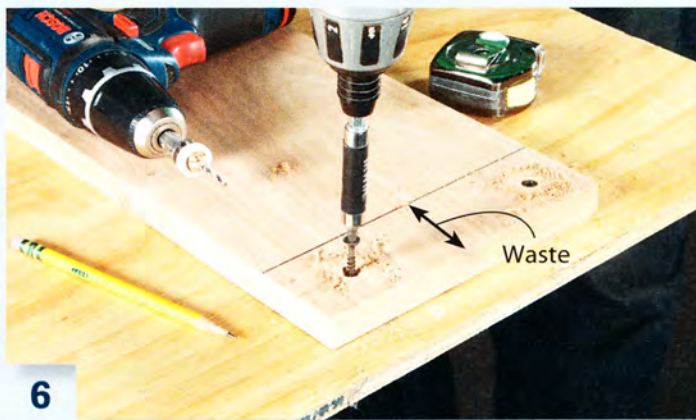
4

Assemble a plywood platform for routing the arc. The plywood shouldn't droop—you may need to support it with 2x4s or these torsion beams.



5

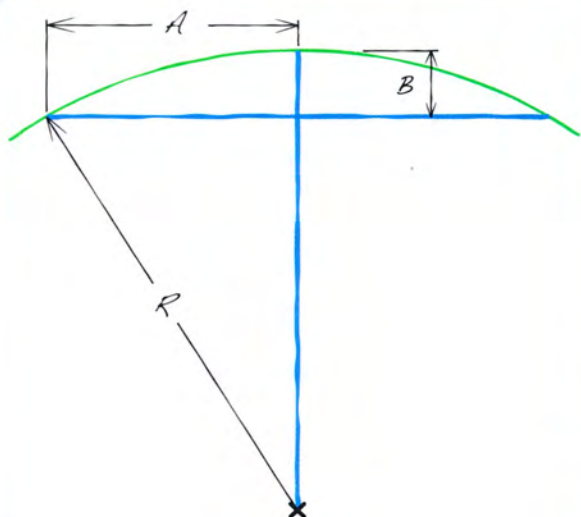
Mark the endpoints of the arc on your workpiece.



6

Fasten the workpiece to the plywood. Allow about 2" of waste on both ends of the board to provide room for the screws.

How to Calculate the Radius of an Arc



Have you ever been stumped trying to figure out the radius of a large arc? It's actually fairly easy—with a calculator. If you're allergic to math, visit the website listed below.

First, draw a line between the two points that the arc will connect—let's call this the run. Mark the midpoint of that line. Measure the distance from the midpoint to the end of the line (A).

Next, determine how high the arc will go—let's call that the rise (B). Use your calculator to convert A and B into decimals.

Finally, use this formula:

$$R = \frac{A^2 + B^2}{2B}$$

R = the radius of the arc

For example, for a curve that connects two points 17" apart and rises 1/2", the calculation goes like this:

$$\text{Radius} = \frac{8.5^2 + 0.5^2}{2 \times 0.5} = \frac{72.25 + 0.25}{1.0} = 72.5$$



To calculate a radius just by filling in the blanks, go to handymath.com and click on "Calculator for Radius of an Arc."



7 Cut two sticks that are the exact length of your arc's radius. For precise measurements later on, miter their ends.



8 Fasten a block to the plywood to serve as a pivot point for routing the arc. Use one of the radius sticks to position the block—close is good enough.



9 Locate the center of the arc. First, place the radius sticks on the endpoints of the arc (see inset). Support each stick with a block that's the same thickness as the workpiece.



10 Position the other ends of the sticks so that their points meet. Trace around the miters.

its screws didn't run into the rods or clamping screws. Make the arm from a stout piece of wood. (You don't want this part to flex when you're routing.) Mine is 7/8" thick by 2-1/2" wide. Cut the arm the same length as the arc's radius, more or less, then drill a hole for the pin that the arm will pivot on (Fig. B). This hole should be perpendicular, so use a drill press. Position the hole about 4" from one end of the arm. I used a 6d nail for the pivot pin, which required a hole 3/32" dia. Fasten the T-plate to the arm (Photo 3).

Adjust the arm

Before you set up the router, you'll need to come up with some method of anchoring your workpiece so it can't move. You'll also have to lock down a second board, which will act as a pivot point. Let's call that the "pivot block." Depending on the radius of your arc, the workpiece and the pivot block might be quite far from each other—my arc requires them to be about five feet apart.

My workbench isn't large enough for this arrangement, so I set up a platform on sawhorses, using a ratty sheet of plywood (Photo 4). Screwing the workpiece and pivot

block to the plywood guarantees that they won't move relative to one another. It might be possible for you to fasten these pieces to your floor, but the platform method has an additional benefit: It puts everything at a comfortable working height.

Cut your workpiece about 4" extra long, then mark the endpoints of the arc, leaving extra space at both ends of the board (Photo 5). Fasten the board to the plywood, countersinking the screws (Photo 6).

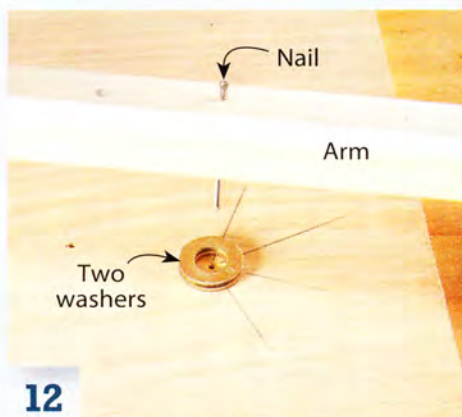
Next, cut two sticks the exact length of the arc's radius (Photo 7). Miter both ends of each stick. Cut a piece of scrap for the pivot block—it should be the same thickness as your workpiece and about 8" square. Use one of the sticks to position the pivot block (close is good enough), then fasten the block to the plywood (Photo 8).

Use the two sticks to locate the center of the arc (Photo 9). Trace around the pivot-block ends of both sticks (Photo 10). Drill a hole in the block for the 6d nail (Photo 11). Insert the nail through the arm and two washers, then into the pivot block (Photo 12). Next, make a support stick that's about the same length as your workpiece. Its role is to keep the router level, so its



11

Drill a small hole at the intersection of the lines. This is the exact center of the arc.



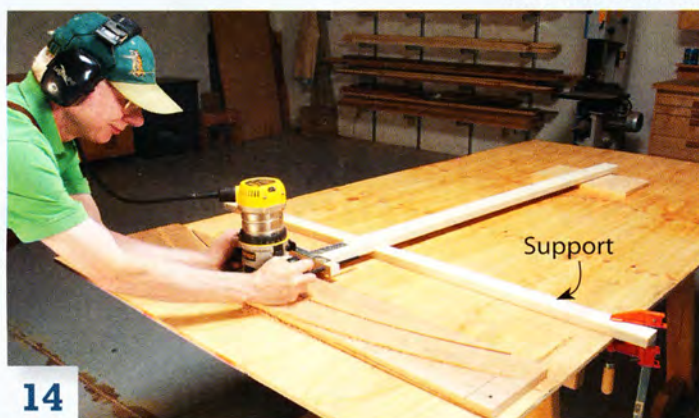
12

Insert a nail through the arm that's attached to the clamping blocks. Place some washers on top of the pivot block, then insert the nail into the block's hole.



13

Adjust the position of the router by sliding its base along the rods. The outside edge of the bit should touch one of the arc's endpoints.



14

Swing the arm and begin routing the arc. The first pass should only be 1/4" deep or so. To keep the router level at both ends of the arc, support the arm with a long stick.



15

Reset the depth of cut a few more times until you cut all the way through your workpiece. The result is a perfectly smooth, true arc.

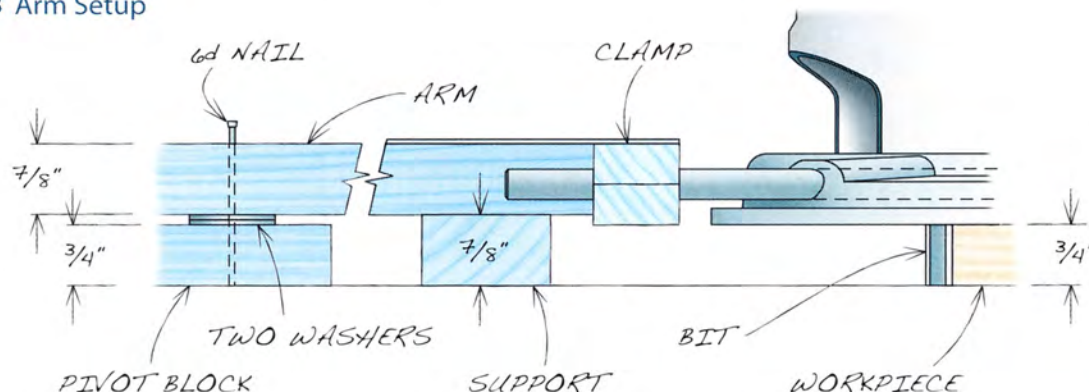
thickness is important: It should be the same as the pivot block plus the two washers. See Fig. B for a cross section of the whole setup.

Install a straight bit in your router (I use a 3/8"). Adjust the bit's height so that the end of the bit is flush with the router's base. Slide the router onto the rods on the other end of the arm, then position the router so the edge of the bit touches the arc's endpoint (Photo 13). Swing the router

over to the other endpoint—the bit should touch that, too. If it doesn't, you'll have to go back a few steps and reposition the pivot block in order to drill a new nail hole.

Lower the bit to cut about 1/4" deep, then turn on the router and swing it through the entire arc (Photo 14). Repeat this process a few times—the last pass should cut 1/16" or so deep into the plywood so that you can cleanly separate the waste from the arc (Photo 15). 

Fig. B Arm Setup



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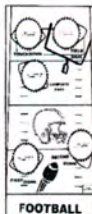
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My Boring Story

I NEEDED TO ROUT a deep stopped groove in a long 2x12. So I installed an up-cut spiral bit in my plunge router, jointed a board to use as a straightedge and clamped everything to a pair of sawhorses.

My first pass—3/8" deep—went without incident. But halfway down the board on the second pass, the bit hit a resinous area and grabbed so hard it twisted

the router—and both my arms—completely around. As I held on for dear life, the plunge mechanism somehow unlocked and the bit began to bore into the wood. Everything began to rock, but my arms were so tangled and I was so flustered, I couldn't figure out how to turn off the router. Ultimately, I just had to let go and get out of the way.

The router twisted out of the board and ransacked the floor as I ran to the wall and pulled the plug. The router was fried, but I didn't care. That deranged tool had a date with the Dumpster.

David Caskey



Rags to Router

I WANTED TO ROUT an ogee on the edge of a board, but didn't have one of those rubber mats you lay underneath to stabilize the board. So I substituted a couple of rags instead. I started routing, and everything was going fine until the bit caught one of the rags and ripped it out from under the board. As I instinctively jerked away the

router, the rag snared the power cord and wrapped it up, too. The router abruptly stopped. I pulled the plug and ruefully examined the damage. The cord was partially ripped out, its insulation was torn and bare wires were exposed. Thus ended my routing for the day.

Larry Ozella

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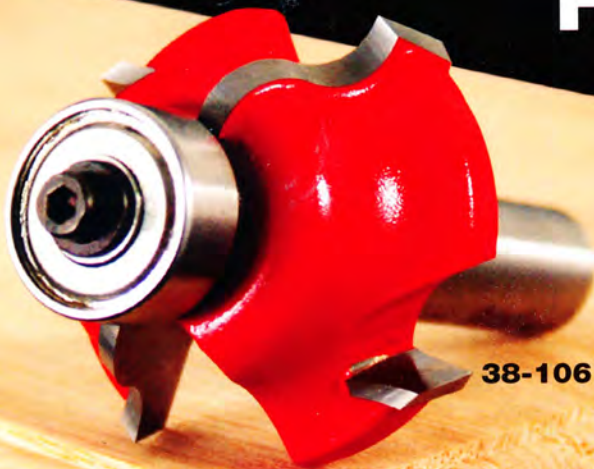
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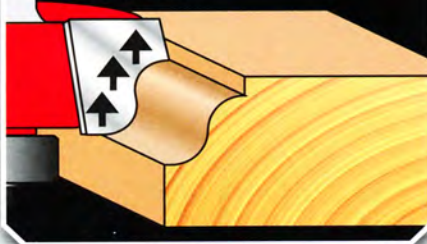


U.S. Patent No. 8,899,252

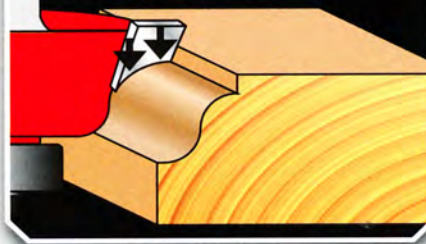
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