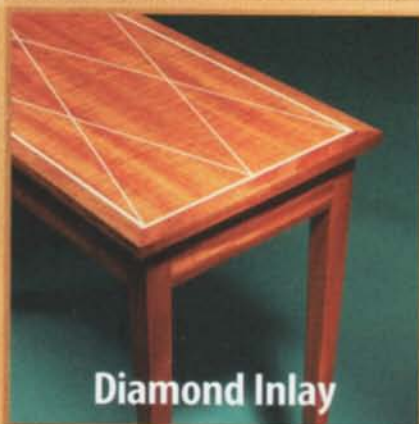


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Diamond Inlay



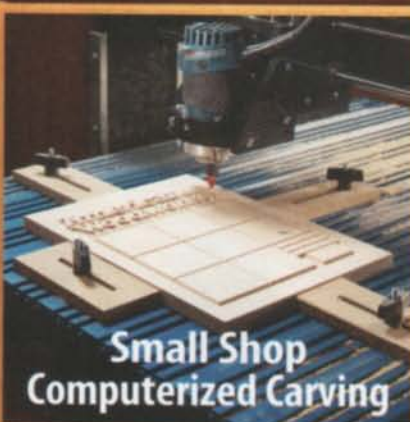
New Compact Router



Showcase Jewelry Box



Router-Made Pens



**Small Shop
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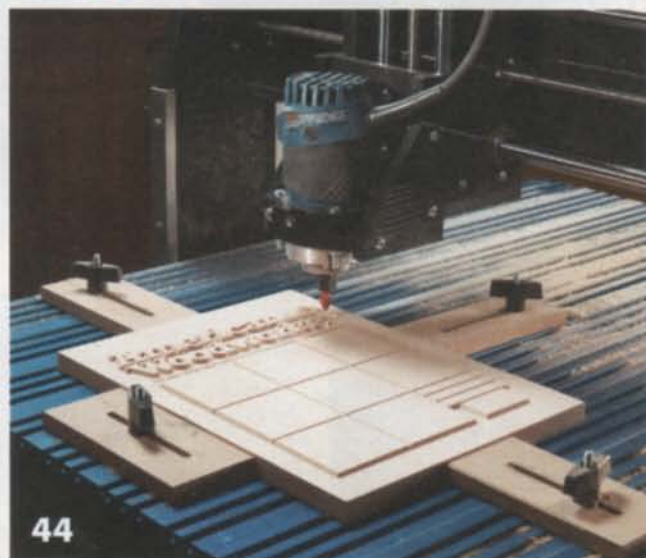
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From the Editor's Desk

Digital Woodworking – The Next Generation

WHEN IT COMES TO TOOLS AND MACHINES, woodworking is still a very traditional craft as practiced by most small shop woodworkers. The types of tools on the "I own, I want" check list haven't changed much in the past 100 years—or thousands of years if only hand tools are considered. Whether done with hand or power tools, woodworking still involves the same cutting, leveling, drilling and shaping processes that Noah used to build his big boat!



Now jump to 2011. We enjoy cordless drills, electronically controlled variable-speed routers, smart saws with flesh-sensing safety technology, and some of the finest hand tools ever made. But none of these have altered the fundamental practice of the craft. That's about to change—slowly perhaps, but as surely as the cell phone has gone from a convenience to a necessity, we're going to see changes in the way many woodworkers pursue their craft. The tool that's going to make this difference is the Computer Numerically Controlled (CNC) router.

CNC technology has actually been around for decades. It has already significantly influenced woodworking at the commercial level, because CNC routers are highly efficient at machining both regular and irregular shapes. With the availability of affordable professional machines (e.g. ShopBot) and the recent introduction of benchtop models (See "Benchtop CNC Routers," page 44), the technology is steadily making its way into small professional and home shops. In many ways, a CNC router is just another tool; but for being "just another tool," it holds tremendous potential for small shop woodworkers.

As a technology for the small shop, CNC routers are drawing both skepticism and curiosity. Three years ago, I decided to get off the "wait and see" fence and jump into the world of CNC/digital woodworking. It's been an exciting ride. I welcome your comments and questions about CNC routers and invite you to join the discussion at AmericanWoodworker.com/CNC.

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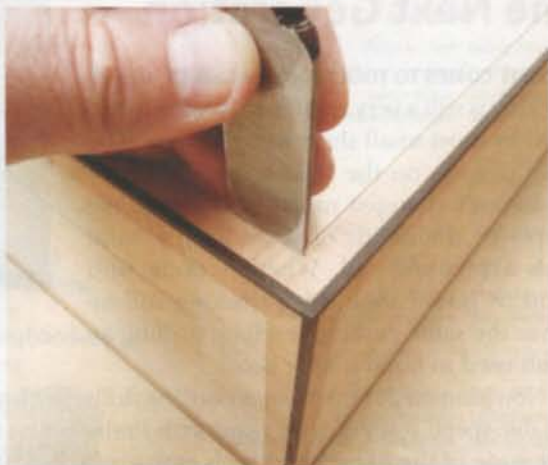


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Hand-Cut Dovetails

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Jewelry Box, In Depth

See 75 photos on making Jessica's Box (p. 35) at AmericanWoodworker.com/WebExtras



Veneer Press

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Shop-Made Crown Molding

We shape it on the tablesaw at AmericanWoodworker.com/WebExtras



Scooped-Seat Video

See the Gimbal Router Jig (p. 61) in action at AmericanWoodworker.com/WebExtras

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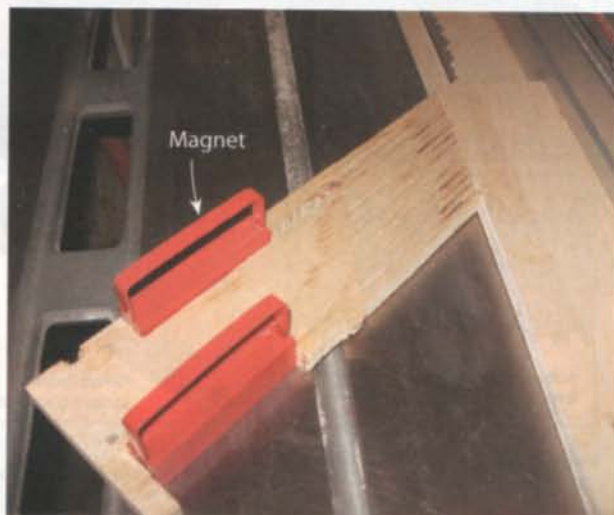
Terrific Tip!

Trash Can Outfeed

TO SAVE SPACE, my trash can doubles as a work support. I made a dolly with locking casters to fit the can's bottom, so I can roll the unit to wherever it's needed.

The work support is adjustable in height. It's just a round-nosed board with two 1/4" x 6" slots, held in place with 1/4" bolts and jig knobs. I routed curved grooves in the support's feet to match the trash can's rim, so the support doesn't slide off the can. When I want to empty the trash, I just lift off the support. I've made reference marks on the support for the correct height of each tool.

Jay McClellan



No-Clamp Featherboard

I ADDED A PAIR OF POWERFUL HANDLED MAGNETS to my shop-made featherboard. They fit snugly into two notches and hold the featherboard absolutely rigid. The magnets enable me to place the featherboard anywhere I want on my tablesaw or bandsaw without fumbling with clamps. Each magnet exerts 100 pounds of force—plenty of clamping power. To remove the featherboard, I just grab each magnet by its handle and tip it over.

Charles Mak

SOURCES

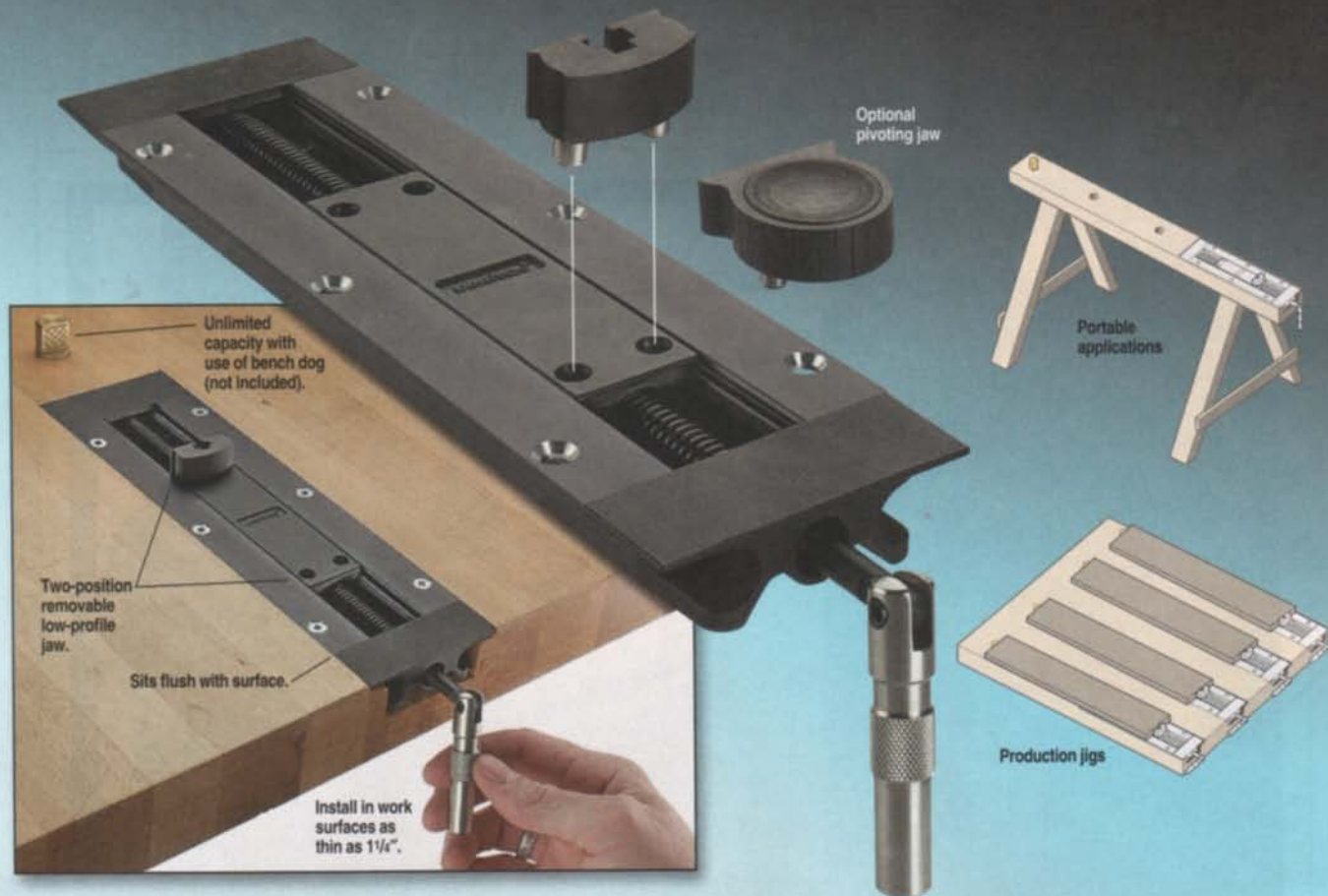
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Natural Poplar is OK!

YELLOW POPLAR DESERVES MORE RESPECT. I've read articles by professionals who say that poplar must be stained to look good, but I beg to differ. It just needs time.

When freshly planed, the heartwood of yellow poplar is often olive green. The sapwood is a much lighter color. I don't mind the contrast—in fact, I enjoy the challenge of cutting the wood to take advantage of it. The green color doesn't bother me, either. After a few years, I know the heartwood will turn to a lovely shade of brown.

I made the bench above 6 years ago. I finished it with several coats of Watco Teak Oil, and it has aged beautifully.

Ira Penn



Self-Cleaning Blast Gate

WHEN SAWDUST GOT PACKED into the back end of my planer's blast gate, I couldn't close the gate all the way. I solved this annoying problem by cutting a notch in the gate. Now, when I close the gate, all the dust slides right through.

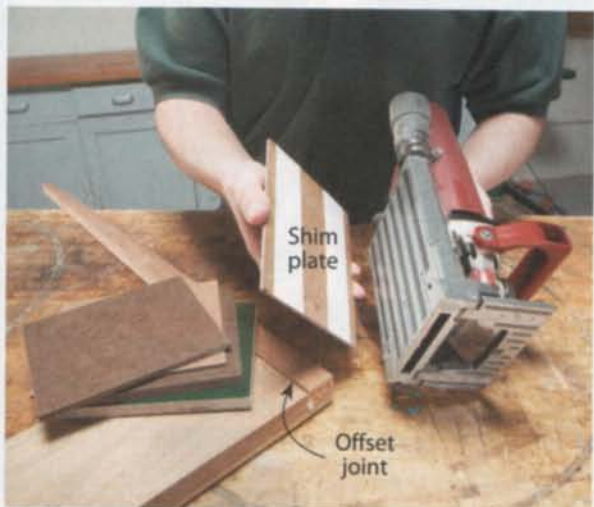
Fredrich Meder

Offset Biscuit Joints

I USE BISCUIT JOINTS in lots of small projects, particularly for joining rails to legs. I usually reference from the bottom of the plate joiner rather than use its fence. When I want to make an offset joint, I cut the slots in the rails first. Then I add a large shim plate to the bottom of the plate joiner, using double-faced tape, and cut the slots in the legs.

The offset between leg and rail is the thickness of the shim—no measuring required. I've made a set of five shims of various thicknesses for different offsets, and store them with my machine.

Tom Caspar



JASON ZENTNER



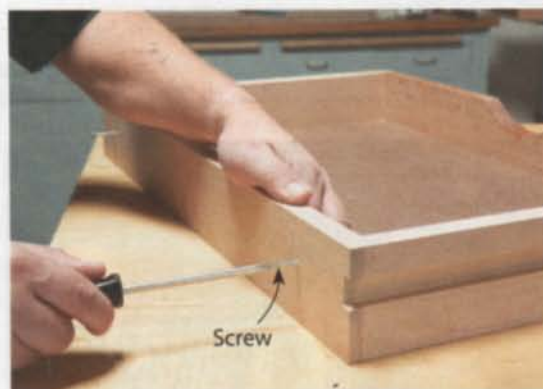
JASON ZENTNER

Tenon Preview

A TENON SHOULD BE ONE-THIRD the thickness of a rail—at least, that's what an old rule of thumb recommends. A 3/4" board should have 1/4" tenons, for example. But what about a 7/8" board? What's one-third of that?

I use my dial caliper to help solve this type of problem. I usually make a tenon the same size as one of my mortising bits, not some in-between fraction. So, for a 7/8" thick board, should the tenon be 1/4" or 5/16" thick? If I could "see" the tenon on the board, I'd know which one to pick. That's easy: I just place the dial caliper on the board and open it to 1/4". Now I can instantly tell what a 1/4" tenon will look like—and its shoulders, too. Then I open the caliper to 5/16", make a mental note of what that tenon looks like and decide.

John English

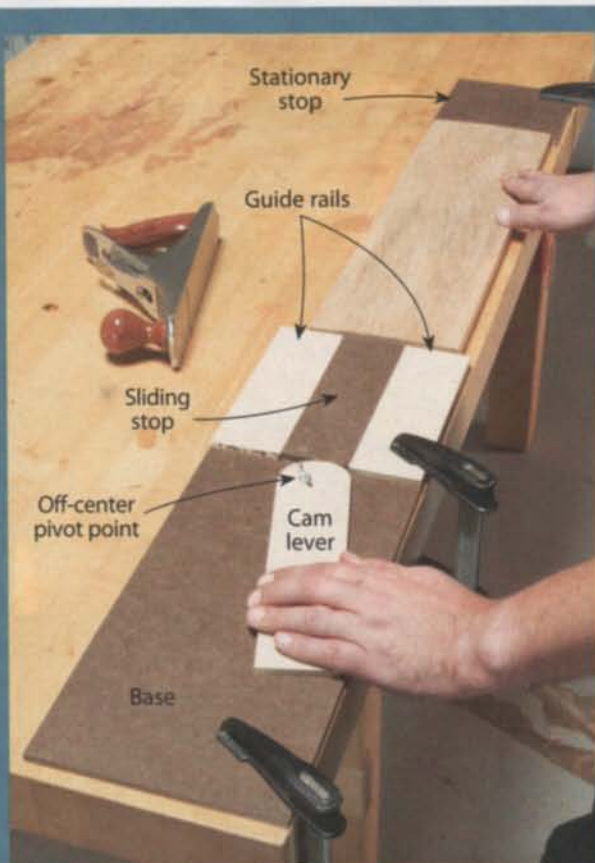


JASON ZENTNER

Drawer Stop Screws

MAKING AN INSET DRAWER line up flush with the face of a cabinet can be fussy work. To make it easy, I just install two screws on the back of the drawer and turn them until the drawer's front is perfectly aligned.

Bob Smith



JASON ZENTNER

Cam-Action Bench Dog

I MADE A CLAMPING DEVICE for my bench that can quickly snug up a board just by swinging a lever. The lever has a cam that pushes a sliding stop tight against the board.

I made all the parts from 1/4" thick stock. The total thickness of the device is 1/2", so I can use it for planing or sanding any piece that's more than 1/2" thick.

The base for the stop is 6" wide and 20" long. The guide rails are 6" long. The inner edges of the rails and the outer edges of the sliding stop are beveled at 10°. The bevels on the rails point up, while the bevels on the stop point down. This dovetailed arrangement keeps the stop from lifting up when it's tightened. The rails are glued to the base.

The cam lever is 2" wide and 6" long; its rounded end is a circle with a 1" radius. The lever rotates on an 8-32 FH machine screw, 3/4" long. The hole for the screw is offset: It's located 5/8" in from the left side of the lever and 1" down from the lever's end. Drill this hole first, using a 1/8" bit, then align the lever with the sliding stop and continue the hole through the base. Countersink the bottom of the hole, insert the screw and fasten it with a wing nut.

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Compact Routers

DEWALT AND PORTER-CABLE have jointly manufactured a router that introduces woodworkers to a new class of compact machines. There are small differences between the two models, but both combine the maneuverability of a laminate trimmer with the power, versatility and user-friendly features of a larger router. Each model is available as a fixed-base unit or as a kit with an additional plunge base.

These routers have two features in common with laminate trimmers: They are very comfortable to hold with one hand, and they only accept 1/4" shank bits. But that's where the similarities end. Most laminate trimmers have 3/4 hp to 1 hp motors that pull about 5.5 amps; the new compacts have more powerful 7 amp, 1-1/4 hp motors. Most laminate trimmers have awkward height-adjustment controls; the new compacts have a system borrowed from larger machines that's very precise and easy to use. No laminate trimmers have a plunge-base option; the new compacts do.

In fact, it's the plunge base that really takes these routers to a new level. The plunge's subbase accepts Porter-Cable-style template guides; the subbases of the fixed-base models do not. The plunge models also accept a very nice edge guide (available as an accessory); the fixed-base models take a different edge guide that isn't as large or as easy to adjust. The plunge base offers 2" depth of travel, while the fixed base offers 1-1/2" of travel.

We've given our Editors Pick award to the DeWalt version of this router because it has two useful features that the Porter-Cable model does not: variable speed and LED lights. Variable speed allows you to decrease the speed of a large-diameter bit in order to make the router easier to control. LED lights illuminate the area around the bit, which is really handy for precision work.

If you've been looking for a one-handed router with



more guts than a laminate trimmer, you really should give these machines a road test. In some ways, these routers bring us full circle. After years of marching towards larger and more powerful machines, we finally have a compact router comparable to the 1/4" collet high-quality machines of 30 years ago, such as the legendary Stanley dome-top series. But these new routers have many more features than the old models and are better engineered.

SOURCES

DeWalt, www.dewalt.com, (800) 433-9258, 1-1/4 HP Peak Variable Speed Compact Router, DWP611, \$199; 1-1/4 HP Max Torque Variable Speed Compact Router Combo Kit, DWP611K, \$139.

Porter-Cable, www.deltaportercable.com, (800) 223-7278, 1-1/4 HP Max Torque Compact Router Fixed/Plunge Combo Kit, #450PK, \$189; 1-1/4 HP Max Torque Compact Router, #450, \$129.

Replaceable-Head Bits

PLASTIC LAMINATE and other composite materials dull even the most expensive router bits in a hurry. A busy shop that kicks out a lot of laminate work can spend a lot of money on new bits. Amana has reduced that cost by designing replaceable cutters for three of the most widely used laminate bits. The cutters for their new EZ Change bits are roughly half the cost of a new standard bit.

When an EZ Change bit gets dull, you just unscrew the cutter from the shank and install a new one. Leaving the shank in your router saves set-up time.

The three profiles include a flush-trim bit for trimming laminates, a template/pattern bit for plunge cuts and dados, and a no-file bit for leaving a slightly rounded edge on trimmed laminates. EZ Change bits have 1/4" shanks.



SOURCE

Amana Tools, www.amanatool.com, (800) 445-0077, EZ Change Template/Pattern Bit, #47174, \$25; 3-pack of Carbide-Tipped Cutters for #47174, \$37; EZ Change Flush Trim Bit, #47170, \$23; 3-pack of Carbide-Tipped Cutters for #47170, \$34; EZ Change No-File Bit, #47176, \$33; 3-pack of Carbide-Tipped Cutters for #47176, \$59.



JASON ZENTNER

A Router's Best Friend

WE'VE ALL HEARD OF BENCH DOGS—the devices that clamp the ends of a board to keep it from slipping—but have you heard of Bench Paws? They're the latest addition to a growing family of products that elevate and grip a board for routing, sanding and finishing.

Bench Paws have five pads on both sides that resist slipping. You can place a board on a set of four Paws and have it with a router or belt sander, but the board won't budge an inch. The advantage of elevating your work above the bench, of course, is that you can rout all the way around the board with a profile bit or a flush-trim bit. You couldn't do that if the board were sitting on a sanding mat, or clinched between bench dogs. The bit would dig into the benchtop or smack against a dog.

Bench Paws also have one new twist: a counterbored hole in the middle that accepts a screw or a 3/8" dowel. You can screw the Bench Paws directly to your worktable (to keep them from slipping if your table has a finished surface) or use them as standoffs for finishing by inserting pointed dowels into the holes. Each Bench Paw has a chamber for storing its own screw and dowel.

SOURCE

Woodworker's Supply, www.woodworker.com, (800) 645-9292, Wolf Bench Paws, #157-877, \$19.99 (set of four).

Make Your Own Flooring

LET'S SAY YOU'VE FOUND a way to get a lot of lumber for next to nothing. You're working on your house, and you want to mill some of that wood for molding; no problem, there are lots of router bits available for that. You're ambitious, and you also want to make your own floors. Can you find bits specifically tailored for this job? Yes—Infinity now has them.

Infinity's Floor Making bits have 1/2" shanks and are designed to work with material up to 1-1/8" thick. One bit creates a rounded tongue, which makes assembling a floor much easier. (A standard tongue-and-groove set creates a square tongue, which doesn't slip into a groove quite as nicely.)

The tongue-forming bit also cuts the bottom edge of each board at a 1/2° slant, tapering inward from top to bottom. When two flooring boards made by these bits come together, there will be a small gap at the bottom. This unique innovation was suggested to Infinity by a professional flooring installer, who found that dust and debris on the subfloor prevented boards from nesting tight against each other. The gap provides a cavity for that debris.



SOURCE

Infinity Cutting Tools, www.infinitytools.com, (877) 872-2487, Floor Making Router Bit Set, #61-509, \$120.

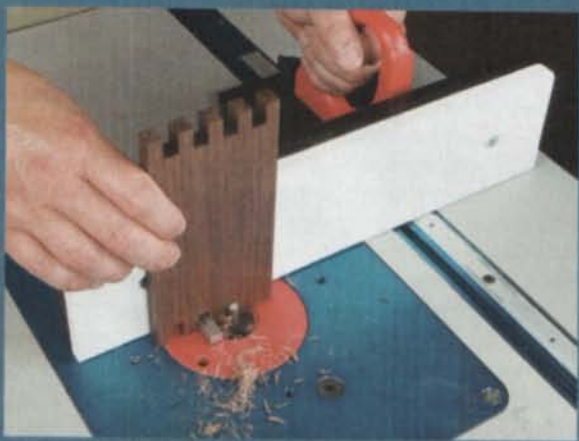
Router Table Box Joints

MAKING BOX JOINTS on a router table is a time-saving alternative to making them on the tablesaw. You don't have to fuss with a dado set, for one. More importantly, using a router table leaves your tablesaw free for making those unexpected cuts that every project inevitably requires.

This box joint jig from Eagle America works on a tablesaw and a router table. (The router table must have a miter slot, however.) The jig makes joints that are 1/4", 3/8" or 1/2" wide, and includes metal guide fingers for each width. The jig's miter bar is adjustable to eliminate wiggle in the slot—an important feature for making precise joints. The jig's major parts are available separately or as a complete kit.

SOURCE

Eagle America, www.eagleamerica.com, (800) 872-2511, Ultimate Box Joint Jig Value Package, #420-4519, \$120; Ultimate Box Joint Jig, #420-4510, \$79.99; Ultimate Box Joint Jig Sled, #420-4511,



\$39.99; Miter Gauge Adapter Plate, #420-4514, \$9.99; Sacrificial Face Plate, #420-4513, \$16.99; Safety Guard, #420-4512, \$12.99.



Dovetails in One Pass

LEIGH DOVETAIL JIGS have long been known for their ability to make drawer joints that look handmade—joints with wide tails and narrow pins. This was a major improvement over standard half-blind dovetail jigs, which could only make joints with pins and tails of equal width. These standard jigs had one big advantage, however: You could rout both the front and side of a drawer at the same time, in a single pass. With a Leigh jig, you had to cut each piece separately, using different setups.

The newest Leigh jig—the D4RPro—now allows you to make equal-spaced half-blind dovetails in a single pass, just like a standard jig. But if you have a variable-space jig, why would you want to do that? Leigh suggests two good reasons: First, if variable spacing isn't that important for your project, and you have a number of drawers to make, routing fronts and sides in a single pass goes faster. Second, most drawers made in the last 100 years were made with equal-spaced dovetails, and someday you may need to copy or repair one.

The new feature on the D4RPro that allows you to rout two pieces at once is really quite simple. It consists of two parts: a black stop rod, inserted through the fingers, that limits the router's cut into the drawer front; and a snap-on spacer that automatically offsets the drawer front and side by the correct distance.

Both the rod and the spacer are available as upgrades to the previous Leigh model, the D4R. You'll have to drill some holes through its fingers to accommodate the rod, however, or you can purchase a new set of fingers with holes already drilled in them.

SOURCE

Leigh, www.leighjigs.com, (800) 663-8932, Leigh D4R Pro, \$549; D4R Upgrade Kit, \$29; D4R Pro Guide Finger Set, \$99.



STAFF



Lock Miter Setup Jig

A LOCK MITER IS AN EXCELLENT JOINT for building boxes and small cases. It creates lots of surface area for glue and a tight mechanical fit—the two requirements of any good woodworking joint. There's one big downside, however. Setting up a lock miter bit in a router table is a pain. A new jig from Prazi, the GrooveCenter, makes the process much easier.

With a lock miter bit, one of the parts is routed horizontally, lying flat on the table, while the other is routed vertically, standing against the fence. You use the same fence and height settings to cut both parts. (You can't cut one part, readjust things and cut the second part to fit.) Both the fence and height settings need to be accurate to within a few thousandths of an inch. Usually, that accuracy requires a lot of trial-and-error cuts; the GrooveCenter nails both settings much quicker.

The GrooveCenter was initially designed to quickly position a router table's fence for cutting grooves or mortises precisely in the middle of any stock. It performs that task quite well, but the folks at Prazi also realized that their device, with the addition of a depth gauge, could also be used to quickly set up a lock miter bit. You can see how the jigs works by watching a video at Prazi's website. The GrooveCenter has an adjustable stop to accommodate each major brand of lock miter bit.

SOURCE

Prazi USA, www.praziusa.com, (800) 262-0211, GrooveCenter, PR-6000, \$149; 2-Axis Depth Gauge, PR-6500, \$49.

PowerLift.

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has a bi-directional **Electronic Foot Pedal**, that allows you to make micro-adjustments to a spinning router bit (within .005") for real precision.

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- Make repeatable plunge cuts for mortises and dados. The built in **Depth Stop** sets the maximum height the bit can protrude above the table.

Only The PowerLift has a **Digital Control Panel** (with mounting arm included), so you can set the speed, direction, and height of the lift.



- Tap the footswitch to make incremental passes, achieving clean cuts without turning off the router.



- Make your table a mortising machine. A jig that controls the work piece up top, combined with raising the spinning bit via the footswitch yields perfect mortises.

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#200.....\$69.95



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Motorized Router Lift

THE NEW POWERLIFT from MLCS has the potential to take woodworkers one step closer to the ultimate router table. Using only a foot pedal, you can raise or lower your router bit by a few thousandths of an inch. A digital readout gives you the exact height of the bit. Total travel is up to 4".

The PowerLift allows you to make mortises and stopped grooves by plunging upwards into a board, which is much safer than lowering a board on a spinning bit. You can't make upward plunge cuts with a hand-cranked router lift, of course.

The PowerLift's control box has two buttons for moving the router up or down, two buttons for adjusting the speed of that movement, a button for changing the readout from inches to millimeters and a button for zeroing out the height of the bit at any point.

While all these features work well, there is room for improvement. For example, the PowerLift has a mechanical depth stop—a rod attached to the lift that stops the lift's upward movement when the end of the rod contacts a switch. We found the rod awkward to use. Hitting a specific height to within a few thousandths of an inch required trial-and-error adjustments of the rod. Ideally, we would want an electronic, programmable stop. You'd simply punch in a number and the bit would automatically stop at that programmed height. The PowerLift doesn't have that capability.

The PowerLift comes mounted to a 9" x 12-1/8" aluminum router plate. Once you fit the plate to your table—or just drop it into a table from MLCS—setup is pretty straightforward. Mount a router in the lift, attach the digital control box to your table, plug in four cables, power up and you're ready to go. The lift travels high enough to bring the router's collet above the table, so you can change bits quite easily.



JASON ZENTNER

The lift only fits 3-1/2" dia. fixed-base routers, such as the Porter-Cable PC690 and 890 series, Dewalt DWD616, Bosch 1617EVS and 1618EVS, and Craftsman 320.17543. Most of these routers have 1-3/4 hp to 2-1/4 hp motors. If you're going to use large panel-raising bits, we recommend the extra power of a 3 hp router, such as the Porter-Cable 7518 or Milwaukee 5625-20. These routers have 4" dia. motor housings, and won't fit the PowerLift.

SOURCE

MLCS, www.mlcswoodworking.com, (800) 533-9298, PowerLift, #9450, \$390; PowerLift System plus Router Table Top and Fence, #2200, \$520; PowerLift System plus Router Extension Table (for a tablesaw), #2201, \$520; PowerLift System plus Cast-Iron Router Extension Table (for a tablesaw), #2202, \$610.

Dust-Collection Upgrade

MOST ROUTER TABLES need better dust collection. They usually have a port on the fence, but that's only half the battle. What about all the dust that's thrown below the table? Rockler has an answer—actually, two answers: the Dust Bucket, which encloses your router, and the Dual Port, a tee that allows you to hook up a 4" hose to both the Dust Bucket and the fence's port.

Properly sizing the enclosure around a router is essential for good dust collection. If you have a cabinet below your router table hooked up to a dust-collection hose, you've probably noticed that the cabinet still fills up with dust. Why does this happen? Usually, the volume of the cabinet is too large. The air inside it isn't moving fast enough, so the dust particles settle to the bottom. In order for the dust to remain suspended in the air you'd need an enclosure with a much smaller volume—such as the Dust Bucket.

The Dust Bucket is made from galvanized steel. It has a front door for accessing your router, a 4" port, keyhole slots for mounting to your table (so you can easily remove



the unit) and a vent for controlling airflow. It measures 13" wide x 13" high x 10" deep.

SOURCE

Rockler, www.rockler.com, (800) 279-4441, Dust Bucket Dust Collection for Router Tables, #32321, \$79.99; Dust Right Router Table Dual Port, #20225, \$14.99.

It packs a punch.



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American Woodworker Magazine Dec / Jan 2011 Issue #151 tested the 2 hp Smart Dust Collector

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Patent # US 7,824,457 B2

Patent # US 7,550,021 B2

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- INNOV8 2011 Award

Wood Magazine, Dec/Jan. 2010/2011

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Spa Shop

MOST OF MY FRIENDS associate terms such as “relaxing,” “refreshing” and “renewing” with a visit to a spa. Although I love being pampered as much as any girl, I’ve discovered that woodworking has the same rejuvenating effect. The scent of fresh-cut wood is my aromatherapy!

My 20' x 20' shop started out 19 years ago as a second garage in the backyard of our home in northern Ohio. As my self-taught hobby has grown, so has my power tool collection. We complete nearly all home repair and remodeling jobs ourselves, thus the initial reason for acquiring tools. In addition, my husband has given me tools on many occasions. Instead of flowers on Valentine’s Day, for example, I received

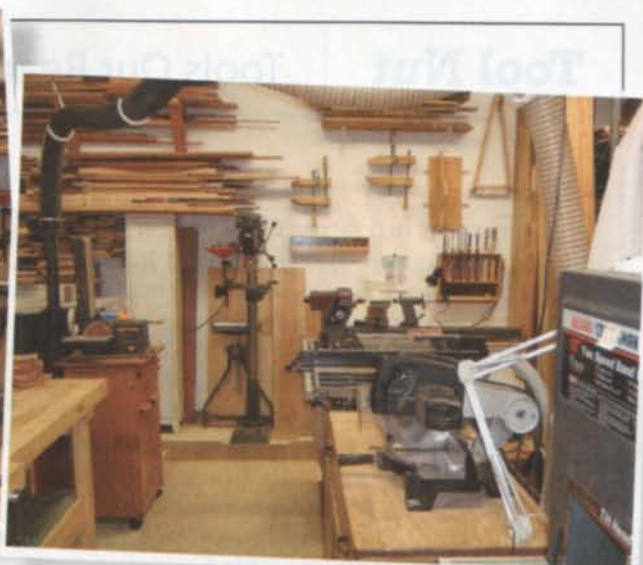
a Wood Wizard—much to my satisfaction. Flowers fade, tools keep on giving! Years ago we built a grandfather clock from a kit. Since then I’ve been on my own, except for occasionally needing structural advice on a project. My husband helps with assembly and gluing on large projects and most of the spray finishing. He’s also the tool assembly, demo, maintenance and repairman.

The most important aspect of any workplace is organization. If you’re wondering, the spices in my kitchen are alphabetized on turntables by category—efficiency in the kitchen gets me to the workshop sooner! All of my wood is separated by type and size. Cherry and walnut are my favorites. Long stock is stored in racks

above the garage door. Incidentally, I never miss an opportunity to acquire old beds. The head- and footboards are great sources for good, recyclable hardwood. One person’s trash is this woodworker’s treasure!

I keep all of my smaller tools in cabinets or drawers. My favorite shop cabinet is an old medication cart that I bought from a hospital supply store. It has heavy-duty locking casters and drawers on both the front and back. Its top can serve as a work surface or hold a benchtop tool. I’ve loaded this cabinet with supplies and tools—one side for wood preparation and the other for finishing.

An electric wall heater makes it possible to work all winter long. I



use my dust collector and ceiling-mounted air filtration system to keep workshop dust under control. The aisles of the concrete floor are covered with salvaged commercial carpet samples that can be easily repositioned or replaced if necessary. Keeping the shop "dog-proof" is a priority, as we foster puppies for a local rescue center and have two shop-loving dogs of our own.

Fretwork, intarsia and turning are my favorite woodworking activities. I've made stair railings, a baby buggy, map puzzles and nightstands as well as ornaments,



boxes, shelves, clocks, plaques and frames. Enclosing a claw-foot bathtub was my most unusual project and bandsawn boxes are my latest endeavor. As I see it, woodworking projects offer two particularly appealing benefits. First, they provide a genuine sense of accomplishment. Second, they allow me to make huge messes that don't have to be cleaned up for days. Now that's refreshing! 

*Diane Davison
North Olmsted, OH*

Tell Us About Your Shop

Send us photos of your shop, a layout drawing, and a description of what makes your shop interesting. Tell us what you make in it and what makes your shop important to you. If "My Shop" features your shop, you'll receive \$100.

E-mail your entry to myshop@americanwoodworker.com with digital photos attached. Or mail your description with digital photos on a disc to My Shop, American Woodworker, 1285 Corporate Center Drive, Suite 180, Eagan, MN 55121. Please include your phone number. Submissions cannot be returned and become our property upon acceptance and payment. We may edit submissions and use them in all print and electronic media.

Legacy of the WPA

I BOUGHT THIS OLD 18" BANDSAW for a song from a used machinery dealer over 30 years ago. "It came from a local high school," he said. "I heard that it was purchased by the school back in the 1930s with funds from the WPA—one of those Depression-era back-to-work programs."

This bandsaw needed a lot of work. I didn't recognize the brand, but I did notice a small brass plate on the back of the upper housing that read "ERECTED BY M. SUTTON AND P. HOFFERT." Imagine that! These two men (and the company they worked for) were so proud of this machine that they wanted the future to know who built it. That plate clinched the sale.

The saw's motor didn't run, so I placed a 16" pulley on the rear end of its shaft and added two more motors to the saw. One is a geared-down 3/4 hp, 1725 rpm motor for cutting metal; the other is a 1-1/2 hp, 3450 rpm motor for cutting wood. This is an unconventional solution, I know, but it works! I use the saw almost every day.

Years after I purchased my saw, I found it on a website devoted to old machinery (www.owwm.com) and discovered that this old relic was a real gem. It was made by the legendary Oliver Machinery Co., of Grand Rapids, Michigan—a No. 192. I learned that Oliver's were widely used in vocational programs and pattern shops, which helps explain why that school bought this particular machine. The website featured an ad for a No. 192 in a 1926 edition of *Industrial Education* magazine.

The serial number on my machine confirmed the story I had heard long ago: The saw was made in 1929, just before the stock market crash and the dark days of the Depression. When I use my vintage saw, I like to think of those brighter times when it was "erected," and hope that somewhere, today, there are more M. Suttons and P. Hofferts who also take pride in their work. Thanks, guys!

Tony Sporborg



All That Glitters

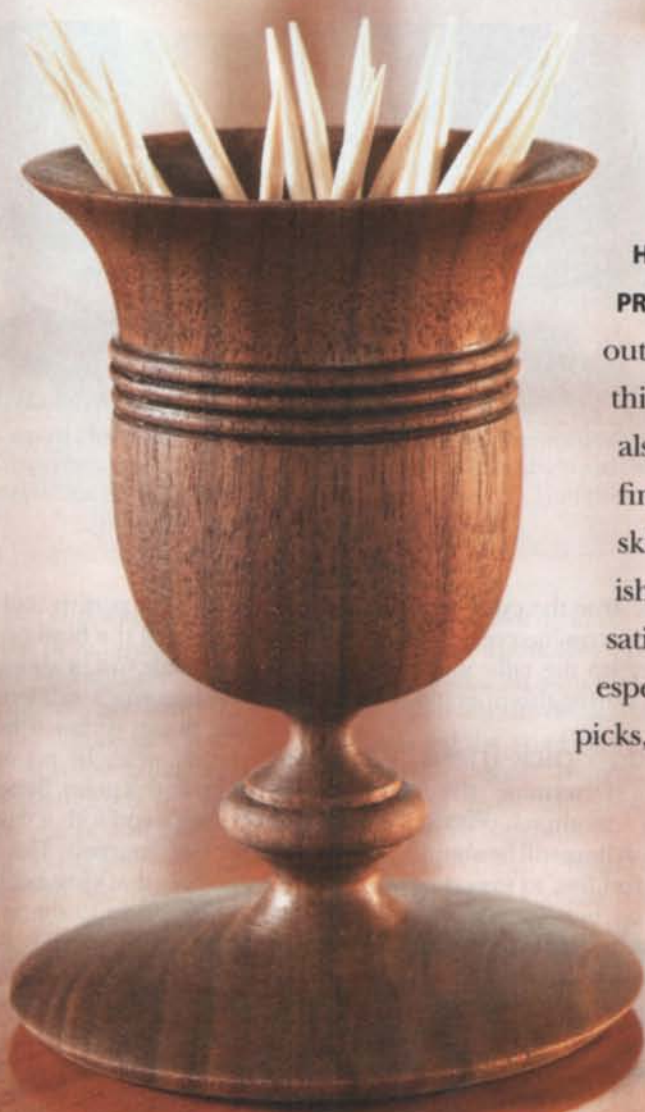
"SO THIS IS WHAT THEY USED TO LOOK LIKE. Wow!" That's what I told all my friends after spending hours completely disassembling, cleaning and polishing a Porter-Cable Model 507 Extra Heavy-Duty circular saw, made in 1956. I went to all this extra trouble because I thought this particular saw was something special. It had what looked like a gold nameplate (regular 507s have a silver one). "A presentation saw," I thought. "Maybe unique!"

I eagerly polished all the aluminum surfaces by hand—machine buffing would have changed the saw's appearance too much. As a last step, I thought I would gingerly clean the nameplate, too. As I rubbed, the gold turned to silver. That beautiful yellow was just tarnish, or an old finish, or stars in my eyes. I simply have an average 507, but man, does it sparkle!

Dick Ford

Turned Toothpick Holder

An introduction to hollowing end grain.



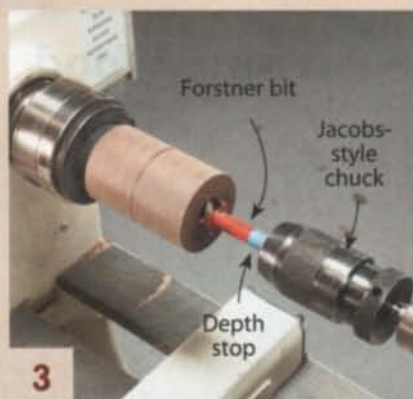
HERE'S AN ATTRACTIVE LITTLE PROJECT to learn the ins and outs of hollowing end grain. Its thin shaft and delicate details also present an opportunity to fine-tune your spindle-turning skills. And when you're finished, you'll have a nifty conversation piece for the dining table, especially if you turn the toothpicks, too (just kidding!).



1 Mount the blank in a scroll chuck after turning a tenon on one end. The tenon's shoulder must be slightly concave.



2 Use a toothpick to set the depth of the hollow cup. Mark the line all the way around the blank.



3 Drill out the cup, using a Forstner bit and a Jacobs-style chuck. The bit's taped-on depth stop matches the line on the blank.



4 Establish the bottom of the cup by cutting in slightly below the line marked earlier. Support the blank with a cone center.



5 Use a detail/spindle gouge to roughly shape the outside of the cup, including the flared rim.



6 Refine the bowl's shape and add decorative elements such as tiny beads with the gouge and the skew chisel.

Prepare the blank

1. Begin by mounting a blank that's about 2-1/2" square x 5" long between centers on the lathe. You can use virtually any type of wood, as long as it's relatively dry and doesn't contain any pith.

2. Round the blank into a cylinder using the roughing gouge.

3. Using either a parting tool or a skew chisel, turn a short tenon on one end of the blank so you can mount it in a scroll chuck (see Sources, page 27). Make sure that the tenon fits in the scroll chuck without bottoming out (reduce the tenon's length) or having to extend the jaws too far beyond the chuck's body (reduce the tenon's diameter). Also, be certain that the tenon's shoulder is slightly concave. Remove the blank from between the centers.

4. Install the scroll chuck and mount the blank (Photo 1).

5. True the cylinder if the mounting process has created any variation. Bring up the tailstock for extra support during this operation.

A toothpick-friendly shape

6. Determine the cup's depth with a toothpick (Photo 2). The cup shown here will be about 1-1/2" deep, but feel free to experiment, depending on how far you want the toothpicks to extend above the holder.

7. Mount a Jacobs-style chuck (see Sources) in the tailstock and install a 5/8" Forstner bit (see Sources). To avoid scorching the wood, this bit should be carbide-tipped or made of high-speed steel. Use tape to mark the drilling depth on the bit.

8. Turn on the lathe at slow speed. Then slowly advance the tailstock to drill the hole (Photo 3). Go slowly to avoid overheating the bit or the wood. Retract the bit often to clear the chips.

9. Use a parting tool to establish the bottom of the bowl on the outside of the blank. Cut in about 1/4" away (on the headstock side) from the depth line drawn earlier (Photo 4). Reduce the diameter by no more than one-third at this point. Support the blank's tailstock end with a tapered cone center (see Sources). The cone fits inside the hole that's just been drilled.

10. Begin to shape the outside of the cup (Photo 5). Be very careful not to reduce the diameter too much at this point; doing so will make it much more difficult to hollow the cup's inside. Start at the upper rim—I like a flared rim on this type of holder, but this is an excellent opportunity to play with a variety of curves, both concave and convex.

11. Add interest by using a skew chisel to create one or several small beads (Photo 6).

12. Back off the cone center.



7 Hollow the cup with a radiused or round-nose scraper. Insert the tool without touching and engage the near side as you draw it out.



8 Clean the hollowed surface by shear scraping. Raise the scraper onto a corner at 45°. Then work the near side, as before.



9 Shape the base and begin to reduce the stem's diameter with the detail/spindle gouge. Work from large to small diameters.



10 Shape the bottom of the cup and its transition to the stem by working in the opposite direction.



11 Embellish the stem with thin diameters and delicate details.



12 Part off the completed holder with a parting tool or the skew and a light touch to grasp the holder as it separates.

Then hollow the cup with a 1/2" or 3/4" round-nose or left-side radiused scraper (**Photo 7**). Hold the scraper flat on the tool rest, with the back end of its handle slightly elevated. In order to work with the grain, insert the tool without engaging the wood and cut only as you pull the tool out of the hole. It's best to hollow the cup in stages. Start with the upper third, then move to the next third and finally to the bottom. The final pass starts at the bottom, moves up along the side and over the rim.

13. Refine the cup's inside surface by shear scraping, a finishing process used prior to sanding that removes very little wood but results in a finer surface than the initial shaping. Put a fine burr on the curved-edge scraper and tilt the tool in the direction you want to move (**Photo 8**). At approximately a 45° angle you'll notice a change in the chips being produced—

and improved surface quality.

14. Establish the holder's overall height by cutting in with the parting tool. Then use the detail/spindle gouge to begin shaping (**Photo 9**).

15. Use the same movement—from large to small diameters—but from the opposite direction to shape the bottom of the cup (**Photo 10**).

16. As toothpicks weigh next to nothing, push your skills to the limit by turning the stem very thin and adding small details (**Photo 11**).

17. Finish-sand the outside of the holder to 220 grit.

18. Separate the completed holder from the blank, using the parting tool or the skew chisel (**Photo 12**). The parting tool is easier to use, but the skew leaves a better surface.

19. Make sure the bottom of the holder is flat by rubbing it on a piece of sandpaper adhered to a flat surface. I sand the bottom to the same

grit as the outside surfaces.

20. A toothpick holder doesn't need much protection, so you can use almost any finish. Your top priority is the way the finish looks. 

SOURCES

Packard Woodworks, Inc.
www.packardwoodworks.com, (800) 683-8876,
Oneway Talon 4-Jaw Scroll Chuck, #112670,
\$232; Threaded Insert for Chuck, #112606,
\$24.95; Oneway Live Center #2 MT (includes
cone center), #112622, \$120; Jacobs-Style
#2MT Keyless Chuck, #111022, \$37.95.

Highland Woodworking
www.highlandwoodworking.com,
(800) 241-6748, Freud 5/8" Carbide-
Tipped Forstner Bit, #472004, \$26.99.

Alan Lacer is a woodturner, writer and instructor who lives near River Falls, WI. To see more of Alan's work visit www.alanlacer.com

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Diamond Inlay Table

Create striking patterns
with a router.

by Peter Schmitt



THIS HALL TABLE POSED A CHALLENGE, because it was built for a fundraiser. I wanted it to stand out, but I also wanted to limit the amount of time I invested in it. So I started with a tapered leg base—stylish, elegant ... and easy to build. I planned to cover the top with figured veneer (an excellent way to make a top look special). Adding inlay—another sure-fire attention-getter—seemed out of the question until I came up with a simple method to complete the job. With its fiddleback mahogany top and contrasting curly maple inlay stringing, the finished table turned heads all night and drew substantial bids.

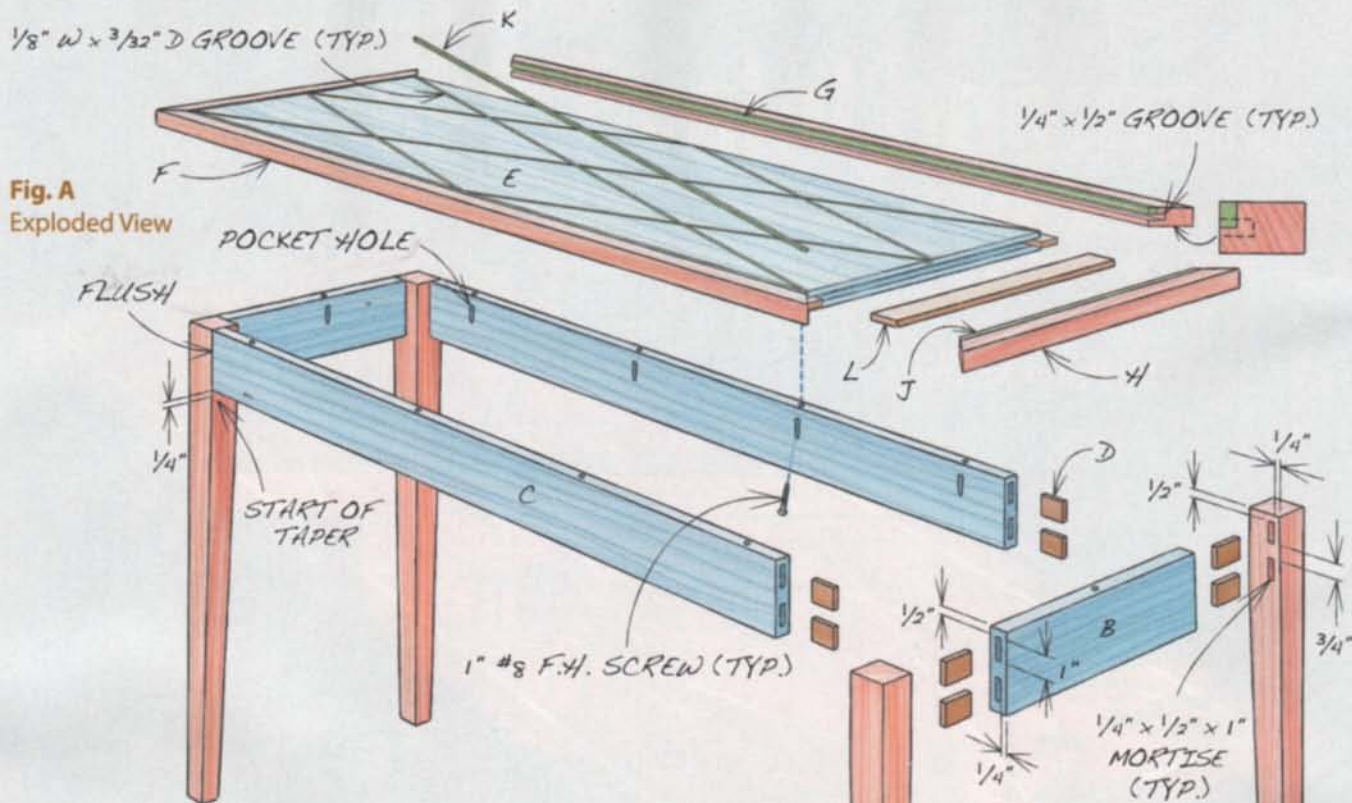
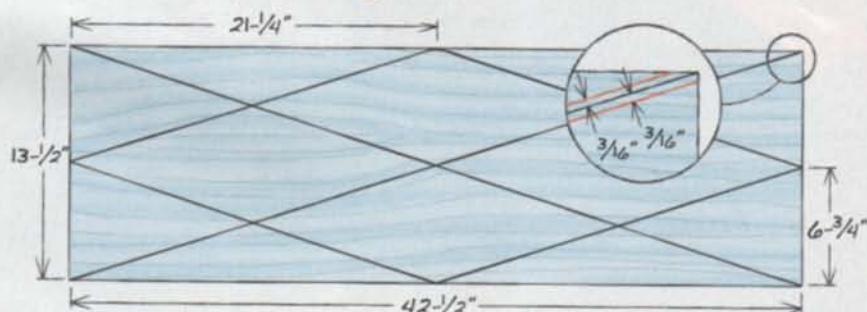


Fig. B
Diamond Inlay Layout and Registration Lines



Cutting List

Overall Dimensions: 30\"/>

Part	Name	Qty.	Material	Th x W x L
A	Leg	4	Mahogany	1-1/2\"/>

Notes:

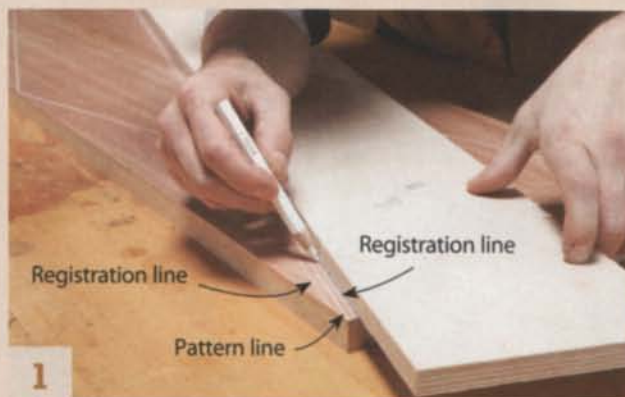
- a) Both inside faces are tapered, starting 1/4\"/>



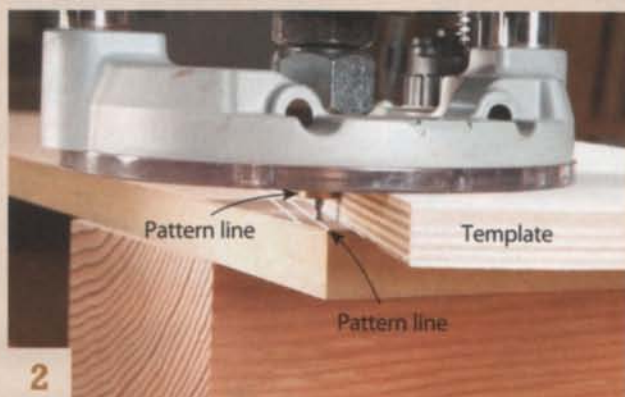
Watch a video showing how to veneer a tabletop in a vacuum bag press at AmericanWoodworker.com/WebExtras



Learn how to veneer a tabletop the traditional way at AmericanWoodworker.com/WebExtras



1 Lay out the inlay pattern on the top by marking a centered diamond and two end-to-end diagonals. Then precisely mark registration lines on both sides of each diagonal pattern line.



2 Center the bit on the pattern line. Clamp the template on the first registration line. Then position the router's guide bushing against the template. The bit should automatically bisect the pattern line.



3 Rout a groove from end to end. Then move the router to the other side of the template and rout a second, shorter groove. You'll have to reposition the end clamp before routing.

Build the base

Mill stock for the aprons and legs (see Fig. A and Cutting List, at left). Feel free to change the joinery. I used a mortiser to chop square mortises and then cut loose tenons to fit, but dowels, biscuits or even pocket screws would also work. Leave the legs (A) as square blanks until the mortises have been cut; then taper both inside faces on each leg. Cut the aprons (B and C) to final dimensions; then cut the mortises and drill the pocket holes. Make the loose tenons (D). Glue the legs and end aprons. Then glue the side aprons between the two assembled ends.

Veneer the top

Cut the top (E) to final size, making sure the dimensions are correct and

the ends are square. Any variation will mess up the inlay pattern. MDF makes the best substrate for veneering, but hardwood-veneer plywood and solid wood can also be used.

I use traditional methods to lay up veneer (see how to lay up a veneered table top the traditional way at AmericanWoodworker.com/WebExtras). But instead of using cauls and clamps to glue the veneer to the substrate, I use a vacuum bag press. Here's how to do it.

Cut a piece of 3/4" MDF slightly larger than the top to use as a pressure board inside the press. Cover this piece with rosin paper to keep the veneered top from sticking to it.

Use a small paint roller to apply even coats of yellow glue on both the top substrate and the veneer. Position the veneer on the substrate,

using centering marks for reference, and tape it in position. Then place the top veneered-face down on the rosin paper-covered pressure board inside the bag. Close the bag, start the pump and maintain the vacuum pressure until the glue has dried.

Remove the substrate from the press and then remove any rosin paper that has adhered to the veneer—dampening the paper softens the glue and makes it easy to remove. (Note: sand the surface as little as possible to maintain the veneer's thickness.) Trim the veneer flush with the substrate on all four sides.

Stabilize the top by applying veneer to the bottom side, following the same procedure. The veneer used for this side doesn't have to be pretty, because it won't show.



4

Move the template to the opposite side of the pattern line, align it with the second registration line and clamp it. Then rout a third groove.



5

Cut lengths of inlay stringing on the tablesaw.



6

Glue in the first three pieces of stringing. Scrape them flush after the glue has dried. Then rout the three grooves that run in the opposite direction and install the last three pieces of stringing.

Lay out the inlay pattern

The veneered top's inlay pattern consists of diagonals running from corner to corner and a diamond created by connecting the center-points on each side (Fig. B). The border is created by inlaid edging pieces (F-J) that surround the top.

Laying out the inlay pattern requires accurate measurements and precisely drawn lines. Mark the diagonals and the diamond on the veneered top. Then draw registration lines on both sides of each diagonal pattern line, spaced exactly $3/16$ " away (Photo 1).

Install the stringing

Use a plunge router equipped with a $1/2$ " o.d. guide bushing and a $1/8$ " down-cut spiral bit to rout the grooves for the inlay (six $1/8$ " wide

$\times 3/32$ " deep grooves altogether, three in each direction). Use a 48" long template made of $3/4$ " plywood or MDF and cut exactly $6-1/16$ " wide to guide the router. (Note: Using a different size guide bushing changes two things: the spacing of the registration lines and the width of the template.)

Clamp the template on the first registration line and check the bit's location at both ends of the top to make sure the template is properly located (Photo 2). In fact, you must make sure the bit bisects the pattern line before you rout each groove—and reposition the template, if necessary.

Rout the first two grooves from the same setup, using both sides of the template (Photo 3). If everything is correctly sized, you won't have to

reposition the template. To rout the third groove, move the template to the second registration line (Photo 4). Again, make sure the bit is properly centered on the pattern line before you rout.

Cut the $1/8$ " square inlay stringing (K) on the tablesaw, using a 48" long piece of maple (Photo 5). Set the fence $1/8$ " from the blade and make four passes with the board on edge. Then reset the fence and make four more passes to cut four 48" lengths of stringing.

Install the first three pieces of stringing (Photo 6). Apply a thin bead of glue to the bottom of each groove. Press in the stringing and tape each piece to hold it in place. After the glue has dried, flush the stringing with the surface, using either a card scraper or a sanding block with



7 Create the decorative edging by gluing a large piece of stringing into a rabbet cut on the inside edge.



8 Install the edging, using splines to level the pieces with the surface of the veneered top.



9 Apply a finish. I prefer to wipe on tung oil, followed by polyurethane.

80 grit paper. Then follow the same procedure to rout the three grooves that run in the opposite direction and install the stringing in them.

Attach the edging

Cut three $3/4" \times 1-3/8" \times 46"$ blanks of mahogany for the edging (one blank for each side and one for the two ends), along with three 45" lengths of $3/8"$ square maple stringing. Cut or rout a $3/8" \times 3/8"$ rabbet in the top face of each mahogany blank. Then glue in the stringing (Photo 7). After the glue has dried, rip the edging blanks to their final $1-1/4"$ width—position each blank so the cut cleans the joint on the inside edge. Then scrape or sand the top inlaid surfaces flush.

Install a slot-cutting bit in the router table and rout grooves in

the edging blanks and the top for the spline. Orient the pieces top-face down for routing and install a featherboard on the fence to keep the pieces firmly pressed against the table. Mill lengths of spline (L) to mount the edging. The spline should fit the grooves without binding or wobbling.

Mark the edging blanks and cut and fit the miters. Then glue on the edging pieces (Photo 8).

Apply a finish

Level the joints between the edging and the top with a card scraper or a sanding block. Then finish-sand the top and base to 320 grit. Apply a finish (Photo 9). I start by wiping on several coats of tung oil. Then, for added durability, I wipe on several coats of polyurethane. 



Peter Schmitt trained at the Thomas Chippendale School of Furniture in Scotland and now runs Schmitt Custom Furniture in Minneapolis, MN. See Peter's work at www.schmittcustomfurniture.com

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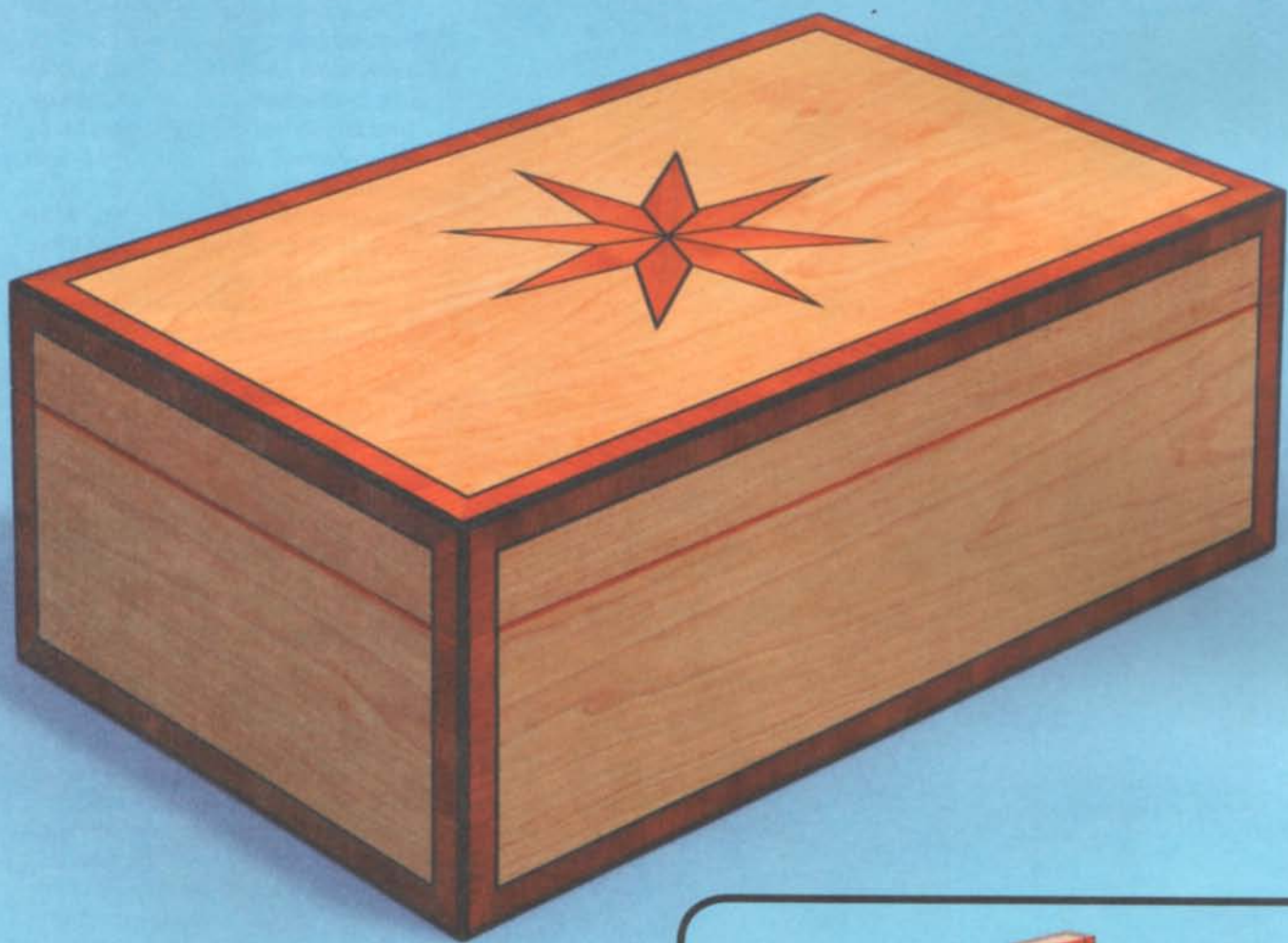
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Jessica's Jewelry Box

Display all your skills building an exquisite project.

by Martin Greshoff



BUILDING A SMALL BOX can challenge your skills just as much as making a huge cabinet. This box, made from maple, cherry and ebony, will take your craftsmanship to a new level. You'll learn an advanced dovetailing technique, make your own inlay, and embellish a piece with crossbanding and stringing.

That's a lot of work to invest in a small project, but I feel that a jewelry box should be just as elegant as its contents. I made this box as a present for my daughter, Jessica, on her 21st birthday. As a family heirloom, it will probably outlast the cabinets I've made!



Fig. A
Exploded View

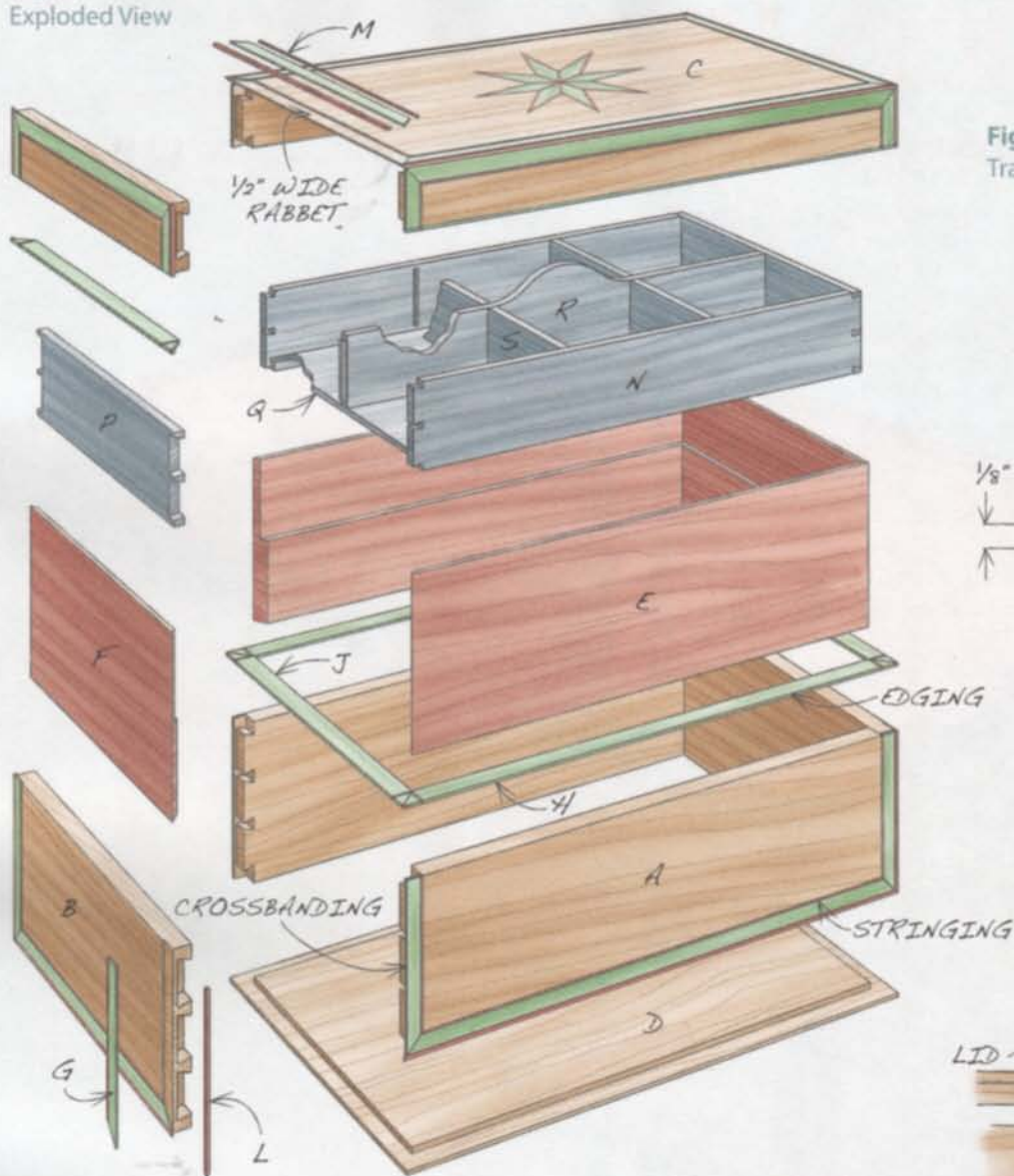


Fig. B
Tray Dovetails

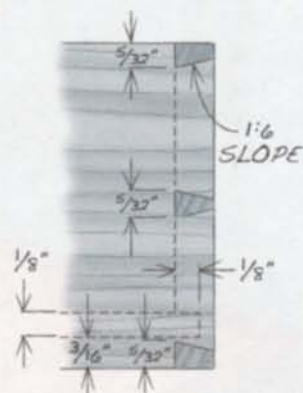


Fig. C
Lid and
Base Dovetails

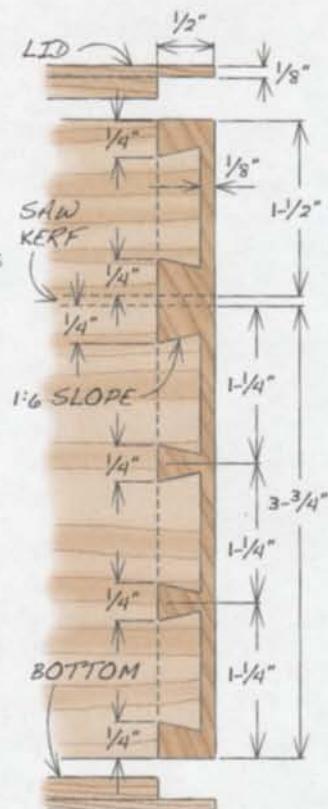
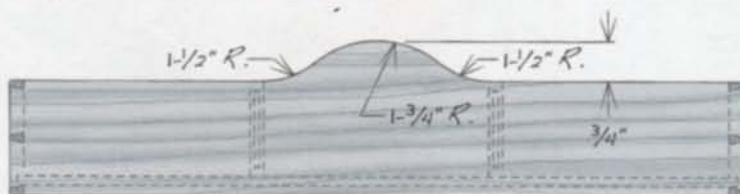


Fig. D
Tray Cross Section



Learn how to make precise dovetails by hand at
AmericanWoodworker.com/WebExtras

Notes on construction

I use an old trick: First, I glue up a hollow box, with sides, ends, top and bottom. Then I cut all the way around the box, creating a lid that's separate from the base. Following this technique, the figure of the lid automatically matches the figure of the base, and the lid and base are exactly the same length and width.

The sides, ends, top and bottom of this box are all made from solid wood. The top and the bottom are glued all the way around the lid and base. I live in the U.K., where wood's moisture content doesn't change much from season to season, so this method of construction is acceptable. However, if you live in a place where indoor humidity swings widely from summer to winter, solid

*While there are many ways
to join a box,
I believe dovetails are
the best choice.
They'll never come apart.*

wood may be a risky choice. The top and bottom could crack if they are sufficiently restrained by the glue from expanding and contracting. Consider making these parts from plywood instead. You could make your own, using a subtly figured maple veneer, if you wish.

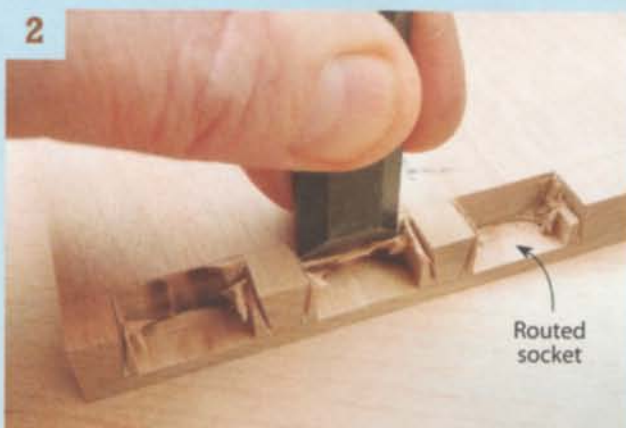
This box is embellished with ebony stringing and 1/16" thick cherry crossbanding, edging and inlay (Fig. A). I purchased the stringing (see Sources, page 42) and cut all of the 1/16" thick cherry pieces from solid wood. Alternatively, you could buy 1/16" thick cherry veneer (see Sources).

I made this box with an unusual kind of joint: double lap dovetails. While there are many ways to join a box, I believe dovetails are the best choice; they'll never come apart. However, through or half-blind dovetails wouldn't be appropriate

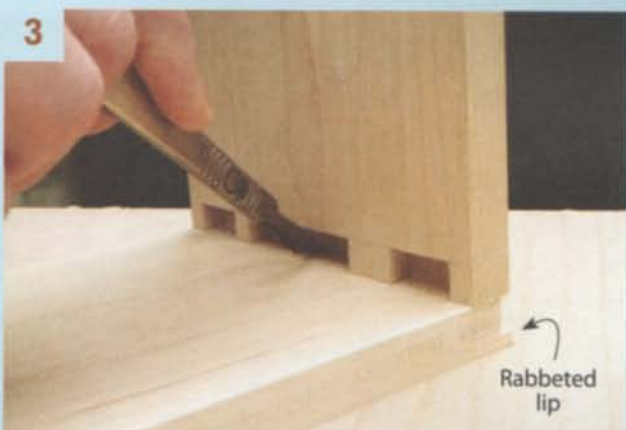
Saw the box's dovetails by hand, beginning with the end pieces.



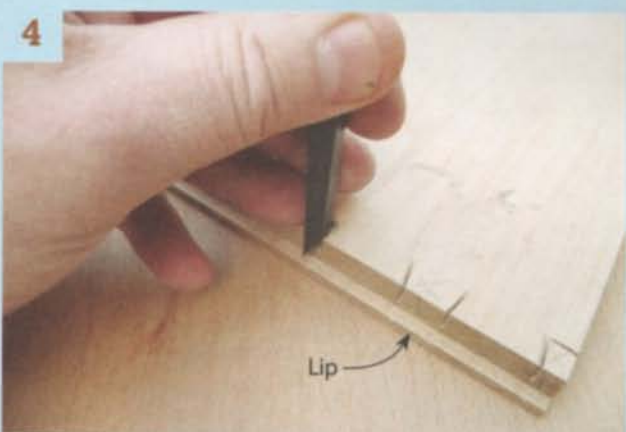
Remove the waste around the pins. Use a router first, then use a chisel to clean up the end grain and corners.

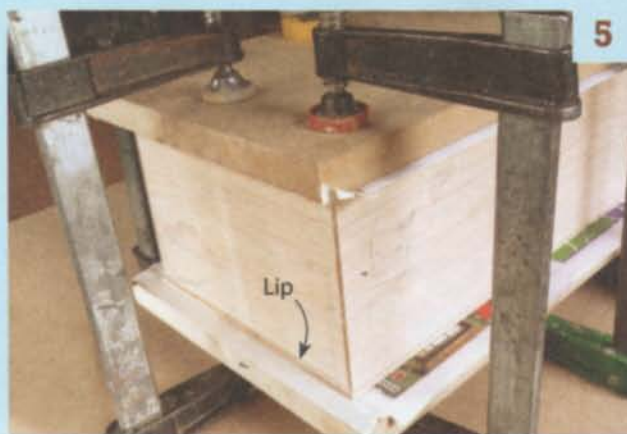


Cut a rabbet on each side piece. Stand the end piece on top of the side piece and mark around the pins.



Saw and chop the tails, then glue the sides and ends together.





5

Glue on the top and bottom pieces. They're rabbeted all the way around to fit inside the box. Use a flush-trim bit to remove the overhanging lips of these pieces.



6

Glue cherry crossbanding into a shallow rabbet routed into the top. Start with the corners, using tape to hold the pieces in place, then fill the spaces in between.

for this design. Over time, they'd show under the crossbanding covering the box's corners (see The Telegraphing Effect, below). Double lap dovetails avoid this problem.

Double lap dovetails require skill to make by hand. If you haven't had much experience cutting dovetails, I recommend that you master half-blind dovetails first. They're easier to make than double lap dovetails, but both use similar techniques.

It's possible to make double laps with a router and a dovetail jig, providing the jig can handle thin material. Basically, you'd make the sides of the box from 3/8" thick pieces and the sides from 1/2" thick pieces. You'd rout standard half-blind joints, then glue 1/8" thick faces onto the side pieces.

As a completely different alternative, you could miter the box's corners and reinforce the joints with cross-grain spline. If you were to make the box from plywood, this would be the best joint to use.

The Telegraphing Effect

YEARS AGO, DOVETAILS WERE COMMONLY USED to join high-end furniture. It's easy to spot them on the veneered jewelry box at right, isn't it? Over the years, the sides of the box have shrunk in thickness, but not in length. This results in dovetails that are slightly proud of the surface. Their protruding end grain has deformed the veneer on top.

Old-timers had a word for this: telegraphing. In this case, telegraphing doesn't refer to Morse code sent along a wire. It means "sending a message unwittingly," like raising your eyebrows when you're dealt four aces. Only here, you haven't hit the jackpot.

You can find many examples of telegraphing on antique veneered pieces of furniture. Most of these pieces were made using air-dried wood which has since contracted in width and thickness in modern, centrally heated homes. Just about any flaw in the substrate (the wood under the veneer) might show through. Knots, checks, uneven gluelines—all of these eventually come to the surface, so to speak, even though the veneers used were often quite thick.

Does telegraphing rule out the use of dovetails under a veneer? No, you just have to make a modified half-blind joint: the double lap dovetail (used on the jewelry box in this article), or a secret mitered dovetail (which is even trickier to make). When these joints are glued, neither the pins nor the tails show on the outside.



Double lap dovetails—open

Double lap dovetails—closed

Cut the dovetails

Begin by milling the sides (A) and ends (B). Lay out the pins on the end pieces (Fig. C), then saw and chop the joints (**Photo 1**). This procedure is just like making a half-blind drawer joint, only here you're making the drawer front first. I use a router, equipped with a fence, to remove most of the waste, then remove the remaining waste with a chisel (**Photo 2**).

Lay out the dovetails on the side pieces. First, scribe gauge lines $1/2$ " in from the end on the pieces' inside faces. Next, use a router table to cut $3/8$ " x $1/8$ " rabbets on the ends. Stand each side piece on the gauge



See 75 how-to photos on making this box, plus detailed instructions, at AmericanWoodworker.com/WebExtras

line of the corresponding end piece and trace around the pins (**Photo 3**). Saw and chop out the waste (**Photo 4**).

Before gluing, apply finish to the inside faces of the ends and sides—just on the upper half, above the lining (E & F), plus a $1/4$ " wide strip at the bottom. Finishing these areas will make it easier for you to remove dried glue after the box is assembled.

Glue the box

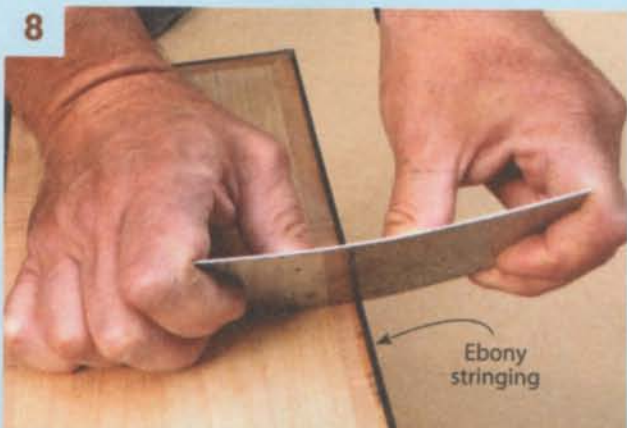
Glue the sides and ends. Plane or sand the outside corners flush. Mill the top (C) and bottom (D)—I glue them up from two book-matched pieces. Cut the top and bottom $1/8$ " oversize in length and width, then rout rabbets all the way around both pieces. Glue the top and bottom to the box (**Photo 5**).

Use a router and a flush-trim bit to remove the $1/16$ " overhang all the way around the top and bottom. When you're done, all the edges of the box should be perfectly even.

Cut a small rabbet all the way around the edges of the lid. Glue $1/8$ " square strips of ebony stringing into the rabbets.



Scrape the stringing so it's flush with the surface.



Rout a small groove on the inside edge of the crossbanding. Use a fence to guide the router.



Glue $1/16$ " square ebony stringing into the groove. Press in the stringing with a hammer—it doesn't need to be clamped.





11

Saw all the way around the box to separate the lid from the base. Minimize tearout by placing a laminate-covered piece of plywood on top of the saw.



12

Glue 1/16" thick cherry edging to the top edges of the base and the bottom edges of the lid. Trim the edging with a low-angle block plane.



13

Pare grooves at each corner to continue the stringing.



14

Begin making the star inlay for the lid by sawing out diamond-shaped pieces of cherry.

Add the cross banding

Cut the crossbanding (G) from solid wood or use veneer. Rout a shallow rabbet all the way around the top and glue the crossbanding in place (**Photo 6**). Use clamps and blocks—tape alone isn't adequate.

Plane, scrape or sand the cross banding so it's flush with the top. Remove any overhang with a block plane or a router and a flush-trim bit. Repeat the same process all the way around the sides and ends of the box.

Add the stringing

Make or purchase the stringing (L & M). Rout a slightly undersize 1/8" x 1/8" rabbet along all the edges of the box (**Photo 7**). Cut the 1/8" stringing to length using

*I use an old trick:
After gluing the box,
I saw all the way
around it,
separating the lid
from the base.*

a chisel, mitering the ends. Glue and tape each piece in place, then scrape or sand the stringing so it's flush with the surface (**Photo 8**).

Rout grooves for the 1/16" inner stringing (**Photo 9**). Miter the ends of the stringing and glue each piece in place (**Photo 10**). Scrape or sand the stringing so it's flush.

Cut off the lid

Saw all the way around the box using a thin-kerf crosscut blade (**Photo 11**). Plane or sand all of the sawn edges.

Using solid wood or veneer, make the edging (H & J) about 1/32" extra-wide. Cut the pieces to length, mitering the ends. They should be flush with the inside of the lid and base, and overhang on the outside. Glue them in place. Sand the inside edges and trim the outside edges (**Photo 12**).

Continue the 1/16" stringing around the corners of the lid and base (**Photo 13**). Score these grooves with a marking knife first, then remove the waste with a 1/16" chisel. Add a small ebony square on each outside corner, so the 1/8" stringing appears to run right through the corner.

Make the star inlay

Use a compass to draw a paper pattern for the star segments (Figs. E & F). Cut 8 small pieces of inlay material (K), trace the pattern on each piece, and cut the segments (**Photo 14**). Draw centerlines on the lid. Tape the segments together and place the assembly on the lid, aligning it with the centerlines (**Photo 15**). Score lines around the star.

Rout a recess for the inlay, freehand. Clean up the edges and corners with a chisel and a knife (**Photo 16**). Glue the inlay in the recess. Rout grooves for the ebony stringing that border the star segments

Fig. E
Star Inlay

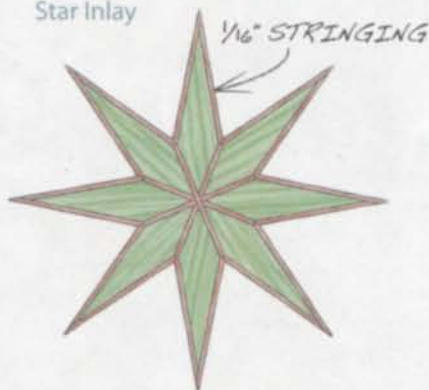
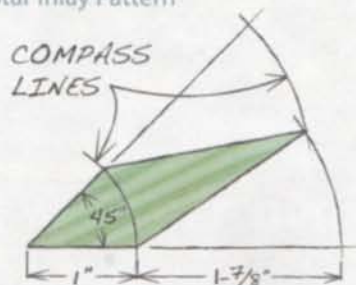


Fig. F
Star Inlay Pattern



Tape the pieces together and position the pattern on top of the lid. Score lines around the pattern.

15



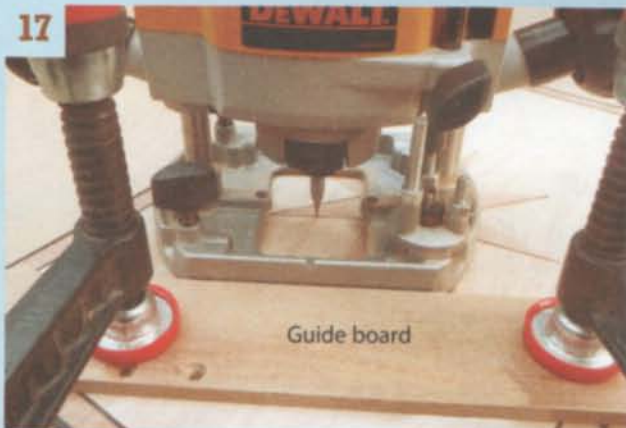
Make a recess for the inlay. Begin by using a router, freehand. Straighten the edges of the recess using a chisel, then use a knife to clean out the tips. Glue the inlay in the recess.

16



Rout a 1/6" groove all the way around the pattern. Use a straight board, clamped to the lid, to guide the router.

17



Glue stringing in the grooves. Trim the ends of each outer piece with a knife, guided by a straightedge, in order to fit the pieces that will go across the star.

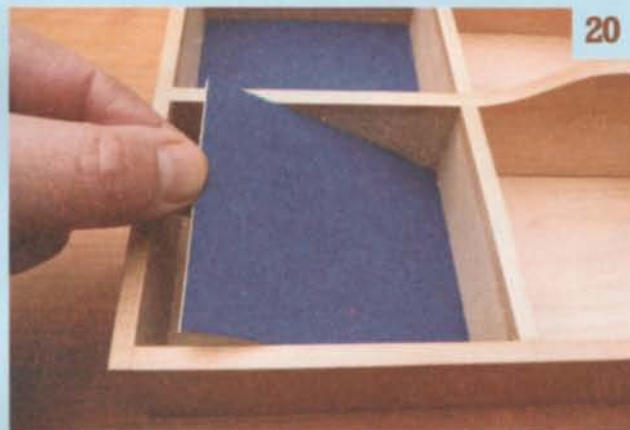
18





19

Dovetail the tray. These joints are very small and are best laid out using a thin-bladed knife or scalpel.



20

Add felt lining inside each section of the tray.

(Photos 17 & 18). Glue the stringing, then scrape and sand it flush.

Tray and hinges

Make pieces for the lining (E & F). (The purpose of the lining is to create a tight seal all the way around the box when it's closed.) Cut rabbets in the pieces (to support the tray), miter their ends, and glue them inside the base.

Build the tray (N through S). Dovetail the corners (Photo 19 and Fig. B) and chop shallow mortises for the dividers. Shape the top of the center divider (Fig. D) and glue the tray together. Add felt lining in each compartment (Photo 20). I glue felt fabric to pre-cut pieces of cardboard, but you could also use adhesive-backed felt, available at craft stores.

Install the hinges. I use quadrant hinges (see Sources), which incorporate a stay to hold the lid in an open position. These hinges require some careful mortising, but they're quite elegant—in keeping with the rest of the box. 

Cutting List

Overall Dimensions: 5-1/2" H x 14" W x 8-5/8" D

Section	Part	Name	Qty.	Material	Th x W x L
Box	A	Side	2	Maple	1/2" x 5-3/8" x 14"
	B	End	2	Maple	1/2" x 5-3/8" x 8-5/8"
	C	Top	1	Maple	1/4" x 8-5/8" x 14" (a)
	D	Bottom	1	Maple	1/4" x 8-5/8" x 14" (a)
	E	Side lining	2	Maple	1/4" x 4" x 13"
	F	End lining	2	Maple	1/4" x 4" x 7-5/8"
	G	Crossbanding		Cherry	1/16" thick (b)
	H	Long edging	4	Cherry	1/16" x 1/2" x 14"
	J	Short edging	4	Cherry	1/16" x 1/2" x 8-5/8"
	K	Star inlay	8	Cherry	1/16" x 1" x 3"
	L	Wide stringing		Ebony	1/8" x 1/8" x 13'
Tray	M	Narrow stringing		Ebony	1/16" x 1/16" x 26'
	N	Side	2	Maple	1/4" x 2" x 12-3/4"
	P	End	2	Maple	1/4" x 2" x 7-3/8"
	Q	Bottom	1	Maple	1/8" x 7-1/8" x 12-1/2"
	R	Center divider	1	Maple	1/4" x 2-3/8" x 12-5/8"
	S	Divider	4	Maple	1/4" x 1-11/16" x 3-1/2"

Notes:

a) Make from 2 bookmatched pieces.

b) Crossbanding pieces are 1/2" long, measured in the direction of the grain. Make enough for about 16 feet in total width.



Martin Greshoff,

a graduate of Rycotewood College, designs and builds custom furniture in Mitcham, South London.

You can see more of his work at www.martingreshoff.co.uk

SOURCES

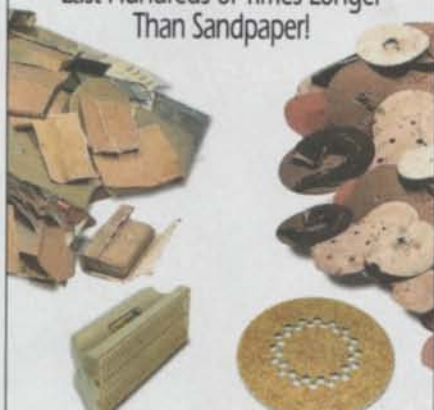
Inlay Banding, www.inlaybanding.com, (704) 221-2147, 1/8" x 1/8" x 36" Ebony stringing, \$6.40 ea.; 1/16" Ebony stringing, \$1.10/ft.

Constantines, www.constantines.com, (800) 443-9667, 1/16" thick cherry veneer, #16CH, \$2.25/sq. ft.

Rockler, www.rockler.com, (800) 279-4441, Brusso Solid Brass Quadrant Hinges, #11099, \$46/pr.

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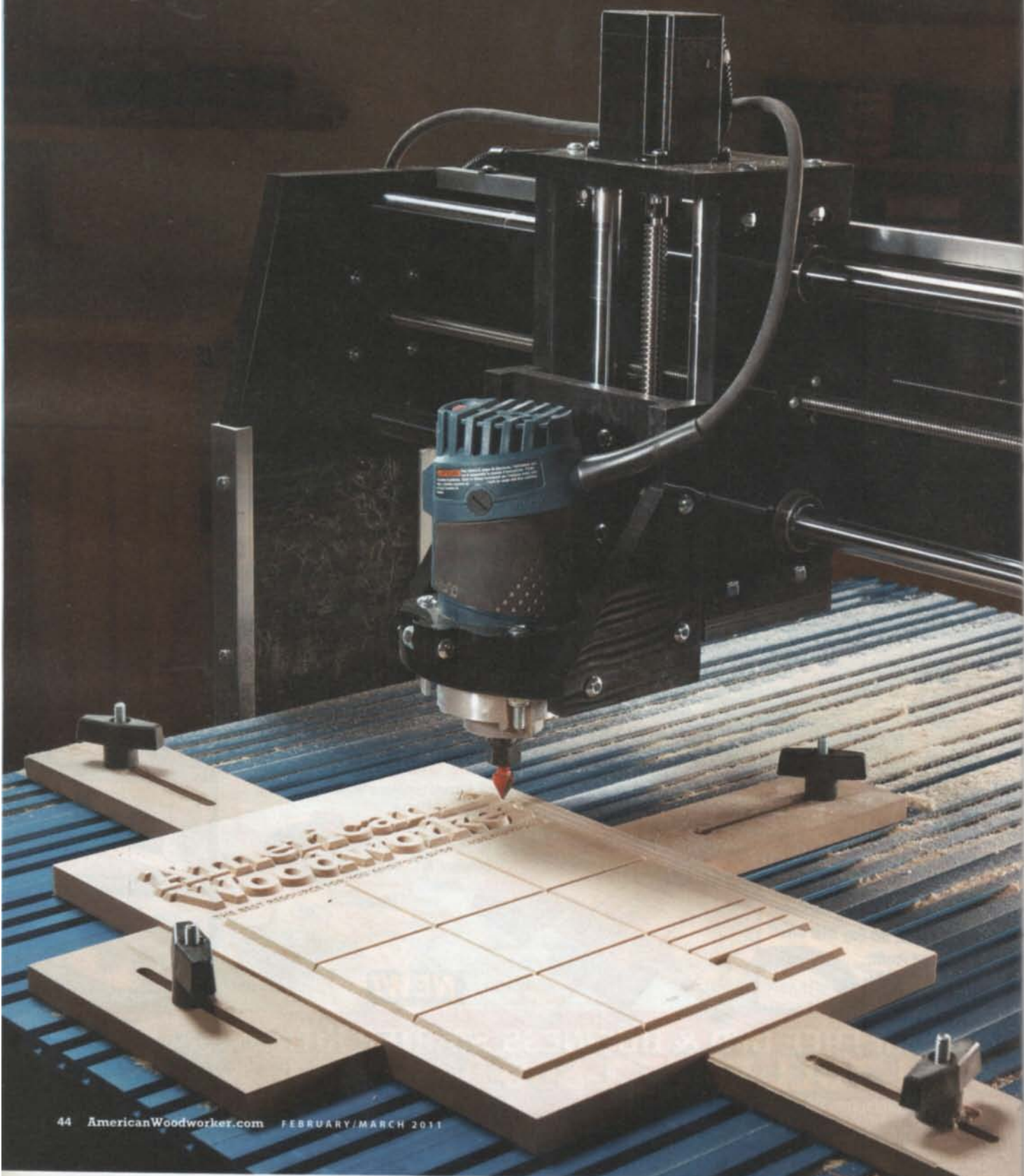
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Benchtop CNC Routers

Computerized carving for the small shop. by Randy Johnson



THE BUZZ IS GROWING around computer numerically controlled (CNC) routers—particularly around benchtop CNCs for the small and home shop. Why? I believe there are four reasons.

First, an increasing number of small shop and home shop woodworkers are discovering the creative possibilities these machines offer.

Second is the cost, which ranges from about \$2000 to \$6000. A benchtop CNC is still a major purchase when compared to most other pieces of small shop woodworking equipment, but the versatility of these machines is convincing many woodworkers that they're worth the price.

The third reason is size. Like other benchtop tools, you can store a CNC in a corner of your basement or garage. They easily fit on top of a mobile shop cart.

Finally, is the general intrigue I believe most of us have with technology. Benchtop CNCs are pretty approachable even for the average non-techy woodworker.

Smaller is catching on

Early industrial CNCs could easily cost \$250,000. In the late '90s Shop-Bot targeted the small shop market with machines under \$10,000. Their smallest machine at the time was a 4'x4'.

In 2006 CarveWright pushed the size and price bar even lower with the introduction of their CNC carving machine. Priced at under \$2000, it was designed specifically for the hobbyist market; it certainly caught the attention of many woodworkers. CarveWright reports having sold over 20,000 of these machines worldwide.

In 2009 the Rockler Shark CNC hit the market. Its traditional gantry design and benchtop size caught my attention, so I got one for our shop and started working with it. At the IWF tool show in Atlanta this past August, I discovered that several other companies were also introducing benchtop CNC routers, so I secured a Shopbot benchtop CNC router and a new version of the CarveWright CNC router for our shop. General International and

CAMaster were also introducing benchtop machines but they were not available in time for this article.

The big questions

From discussions with other woodworkers, I find the questions about benchtop CNCs boil down to three things: size, precision and usefulness. Although limited by their small sizes, the benchtops I tested did a good to excellent job of carving and small parts cutting. I believe that most woodworkers would find one useful in their shop.

CNC routing is a big topic, so in this article I've presented only the highlights of my research and a sampling of my test carvings. There's a lot I don't cover, such as CNC design software use, 3D carving, bit choices, tool path strategies, and ways to hold your work in place. But stay tuned, because next issue we're starting a new department on CNC routing that will further explore ways to use CNCs in a small shop.

American Woodworker

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CarveWright Version C

High-tech, easy-to-use push button operation makes it almost goof-proof.



The CarveWright Version C has several upgrades from the previous model, including a quieter spindle, simple-to-loosen chuck, modified board tracking system and reinforced frame design. Optional upgrades include heavy-duty rubber table traction belts (which replace sandpaper traction belts) and several new software options. CarveWright's simple push-button operation and high-tech engineering make it very easy to use.

Price: \$1599 (basic model)

SOURCE:
www.CarveWright.com

The hardware

The most significant things about the CarveWright Version C are its ease of operation and oops-proof approach to CNC routing. I've carved several dozen designs on the machine and haven't had a single "crash." That is to say, all the designs turned out as planned without the bit ever cutting at the wrong place or depth. I can't say this about my work on the other machines.

NASA engineers invented the CarveWright and loaded it with technology. It has several sensors that work in tandem with the software to automatically measure a board's width, length and thickness. It even prompts you when to change the bit and then automatically measures the bit's projection to ensure the correct cutting depth. It knows if your board is the wrong size for your design and will offer you the option to scale your design or to insert a new board.

This high-tech, oops-proof design comes at a price though. The sensors and mechanical parts that make the automatic operation possible

require regular cleaning and lubrication. Maintenance requirements are spelled out in the owner's manual and the machine operated smoothly (without warning messages) as long as I performed the necessary maintenance before each carving. This is more maintenance than most other kinds of woodworking machines require.

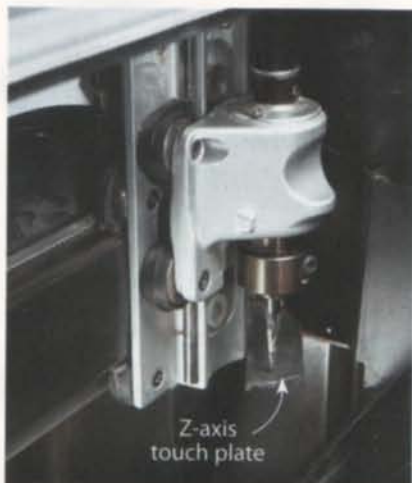
The CarveWright lives up to its name—its overall carving ability is very good. Unlike gantry-style CNC machines, the CarveWright feeds the board through the machine, similar to the way a surface planer feeds a board. The spindle carriage, which holds the router bit, operates like an ink jet printer, zipping back and forth as the board feeds through. The machine will accommodate boards up to 5" thick, 14" wide, 144" long and up to 20 pounds, but I found the machine had trouble feeding 3/4" thick by 14" wide boards that were much over 8' long. Narrower boards that were longer worked fine, but needed to be well supported at both ends while carving.

The software

CarveWright comes with its own preparatory design software that is easy to learn and well suited for relief carving, sign making and small-parts cutting. Optional software is available that allows you to import your own designs from other programs, including both 2D and 3D shapes. CarveWright also maintains a pattern store with 100s of carving designs for sale, ranging from about \$5-\$20. The large selection includes everything from shell carvings to rosettes, to animals and automobiles.

Pros: Compact size, near goof-proof user interface, operates independent of your computer, can carve long boards, uses both 1/4" and 1/2" diameter bits.

Cons: Tendency to stall unless regularly cleaned and lubricated. Light duty—not intended for commercial use.



The CarveWright spindle consists of a carriage with bearings that run on parallel round guides. The router bit is held in a chuck that is driven by a flexible shaft. Changing the router bit simply requires loosening an allen screw. The chuck accepts steel-shank bits from 1/8"-1/2" diameter. The Z-axis touch plate automatically measures the projection of the bit to ensure correct cutting depth.



Carving designs are loaded onto a memory card at your computer. The memory card is then inserted into the machine, allowing you to keep your computer out of your shop and away from the dust. Once the card is inserted, it's all push-button operation, as the machine steps you through several prompts to make sure the board, design and bit are correctly set up. Only then will it start carving.



To see a video of the CarveWright in action and maintenance tips, visit AmericanWoodworker.com/CNC

CarveWright Project Gallery



SERGE CARON

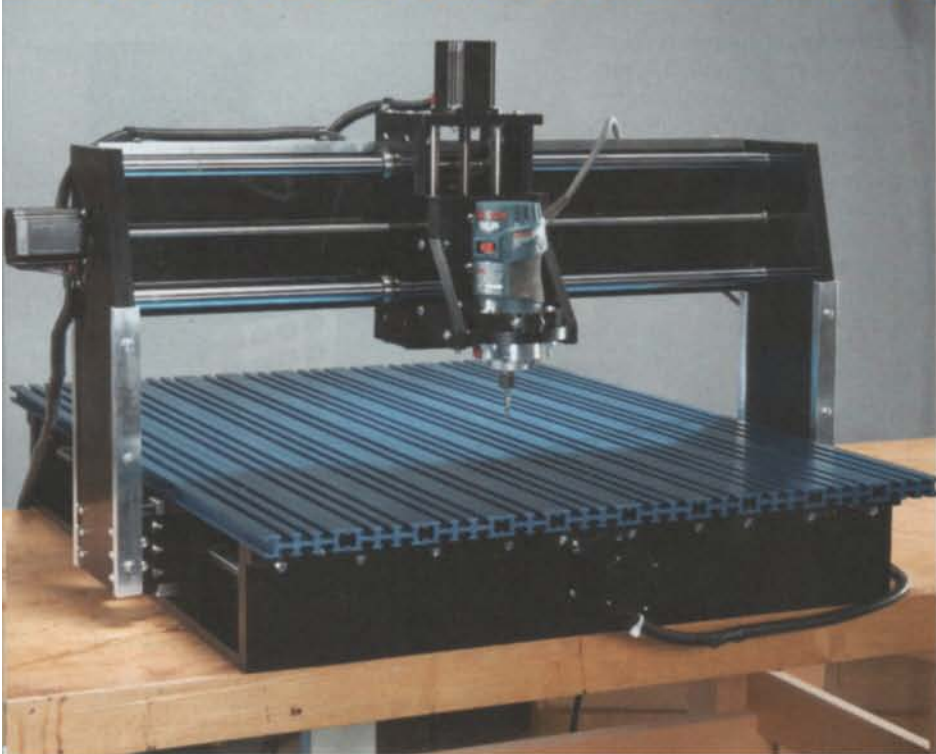
Armoire doors and panels made by Serge Caron, Quebec, Canada. Carved using the CarveWright. More pictures and information at www.lahucheapin.com.



BRANDON MACDOUGALL

Four and five string hollow body violins made by Brandon MacDougall, Ojai, California. Carved on the CarveWright. More pictures and information at www.liquidguitars.com.

Shark CNC Pro Plus



Simple design with user-friendly interface makes the Shark easy to learn and operate.

The Shark CNC Pro Plus was introduced the summer of 2010 with several enhancements over the previous version. Most importantly, a new T-slot aluminum table replaces the original MDF table, and the maximum cutting height capacity has been increased from 3" to 4". The operating software has also been improved, providing smoother operation when the machine changes cutting directions.

Price: \$3799 (router extra)

SOURCE:
www.rockler.com

The hardware

The two most common concerns I hear from non-Shark owners pertain to the Shark's plastic frame and its use of a Bosch Colt router. Neither of these created major performance issues as long as I didn't push the feed rate or depth-of-cut too hard. The Shark CNC Pro Plus has a top cutting rate of 200" per minute, but I usually use a feed rate of around 100" per minute to maintain the quality of cut and avoid taxing the router. As a comparison, full size small shop CNCs can cut at speeds of 400-600 inches per minute, depending on the bit and material. The Shark is not intended to compete with a full-size machine, so some patience is required. I also found that turning down the speed of the Colt router one or two steps tended to produce shavings rather than dust and reduced the sound level—both good things. It also keeps both the router and the bit cooler, which should extend the life of both.

The 25" x 25" cutting area of the Shark Pro Plus table is not big

enough to cut a cabinet side or long chair leg on, but it does have the largest cutting area of the three machines. Plus, I found that with some creative jiggling, I could successfully cut some long parts in two or three steps. It's not ideal, but it can be made to work.

Since the Shark doesn't have proximity switches, you must make sure your cutting pattern is set up within the cutting area of the table. Failure to do so can cause the gantry or router carriage to run into the frame and lose track of its location, spoiling your design. Doing so is called a "crash." Crashing is part of the learning curve; every CNC operator will experience a crash at some point. In fact, I have a nice collection of "crashed" boards.

I started out on the original Shark CNC Pro. It had an MDF table, which I found hard to keep flat. The 3/4" thick T-slot aluminum table on the new Pro Plus version is an excellent upgrade, offering both stability and ease of clamping.

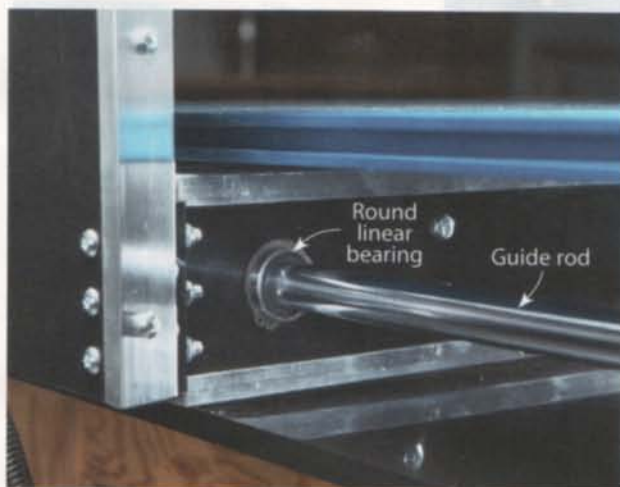
The software

The Pro Plus comes standard with V-Carve Pro and 3D Carve from Vectric. V-Carve Pro is primarily made for sign design, but it also works well for designing flat parts of almost any shape. It's easier to use than many CAD programs.

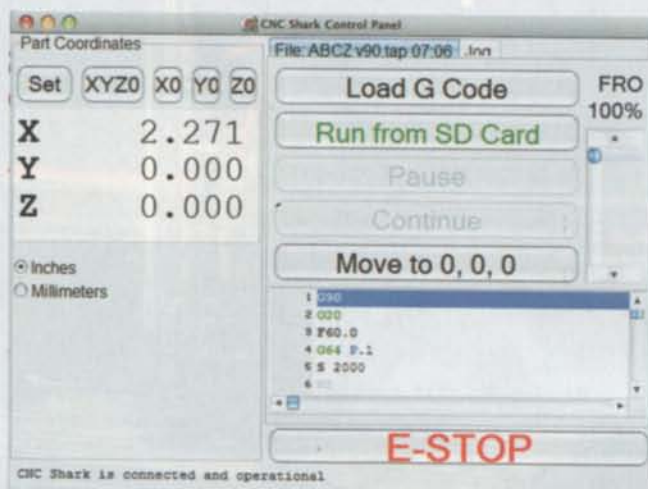
The "control" software that links your computer with the Shark is basic but easy to learn. Once you start running your design on the Shark, you can disconnect your computer from the machine—a handy feature made possible by an onboard memory card in the Shark's electronics.

Pros: 4" x 25" x 25" cutting area, T-slot table, simple controller, computer can be disconnected after program starts, flexible plastic frame springs back to position if bent.

Cons: Router carriage flexes if pushed too hard, limited to bits with 1/4" shanks. W, Y, Z positions must be set manually by eye, lack of proximity switches.



The Shark's frame is made of bolted together high-density plastic with aluminum corner reinforcements on the gantry. Round linear bearing on stainless steel rods guide the gantry's movements.



The Shark's control software is basic, but easy to learn. It gives you manual control over the X,Y,Z position of the router and is used to set the bit's starting position. The "Load G-Code" command loads your design. "Run from SD Card" runs your design. Clicking on the E-STOP button will immediately stop the machine if you notice something going wrong with the cut.



To see the Shark in action, visit AmericanWoodworker.com/CNC

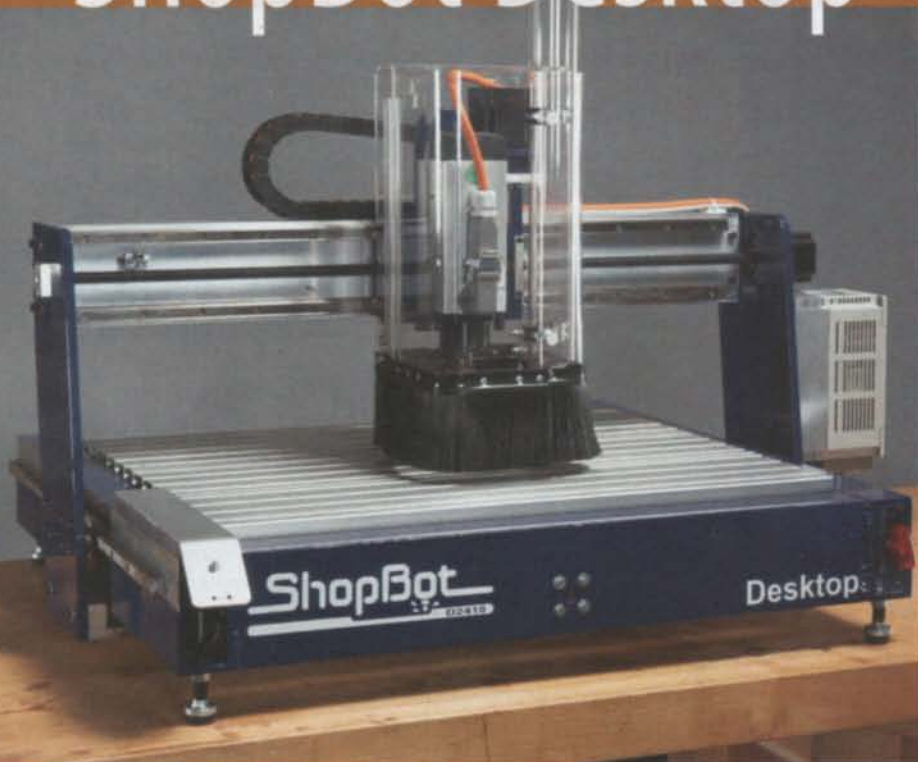
Shark CNC Project Gallery



Spalted end grain mahogany turned lidded box by Ed McDonnell, Parkland, Florida. Carved using the Shark CNC. The dragon is a VectorArt 3D model. The rest of the design was created with Aspire CNC design software (by Vectric). 7-1/4" diameter. Bits used were: .25" ballnose, .625" tapered ballnose, 30° engraving v-bit.

ED McDONNELL

ShopBot Desktop



A robustly built small scale machine with full size features that delivers precise results.

ShopBot has built CNC routers since 1996 and has always tried to keep their machines affordable for small shop woodworkers. With their new Shopbot Desktop model, price was still important—but not the top goal. Rather they pursued a machine design that would be highly accurate, robustly built, and could accommodate an industrial-grade spindle.

Price: \$4995 (without router or spindle)
\$6590 (with spindle as shown)

SOURCE:
www.shopbot.com

The hardware

The welded aluminum frame, the industrial grade THK linear bearings and steel guide rails were some of the first things I noticed on the Desktop. After some use I also discovered that the 1-1/2" thick T-slot table is very stiff and showed no signs of flexing, even under heavy clamping. Cutting capacity is 3" (with 1" bit extension) x 24" x 18". The cutting height capacity is somewhat of a limit when using longer bits. Some of which need to extend almost 2".

One of the most convenient and useful features of the Desktop is its ability to automatically set the Z axis height of your router bit. It also has proximity switches, which are used to accurately set the X and Y axes locations. The machine remembers these settings even after it's been turned off. This makes it easy to repeat a setup from a previous day.

The Desktop that I used included an .8 HP industrial spindle. It's a \$1595 upgrade with three huge benefits. The first is that the arbor operates with virtually zero run-out. A typical router can have arbor

run-out of as much as .005". This amount is not a problem for some operations, but can be for others. The second benefit of a spindle is that it can run 1000s of hours before it needs to be rebuilt. A typical router may need to have its bearings replaced after only 100 hours of operation.

The third benefit of a spindle is that its sound level is considerably lower than a handheld router's. The spindle on the Desktop has an arbor-driven (high speed) cooling fan that makes it louder than larger industrial spindles, which use independent lower speed fans. Industrial spindles operate with only a soft hum until the bit contacts the wood. Since CNCs can run for many hours at a time, the lower sound level is a valuable benefit.

The combination of the Desktop's robust frame and spindle allowed me to run the machine near its maximum cutting rate of 230" per minute and still get good results. The Shopbot Desktop is even capable of accurately machining aluminum.

The software

Operating the Shopbot desktop is similar to operating a full-size CNC machine, because it has mainly the same features. The ShopBot Desktop comes with both full and basic versions of their control software. The full version gives you lots of options for controlling the machine but takes a while to learn. So it makes sense to start with the basic version and graduate to the full version when you're ready. The Desktop comes with PartWorks CNC design software (by Vectric), which is similar to V-Carve Pro, also by Vectric.

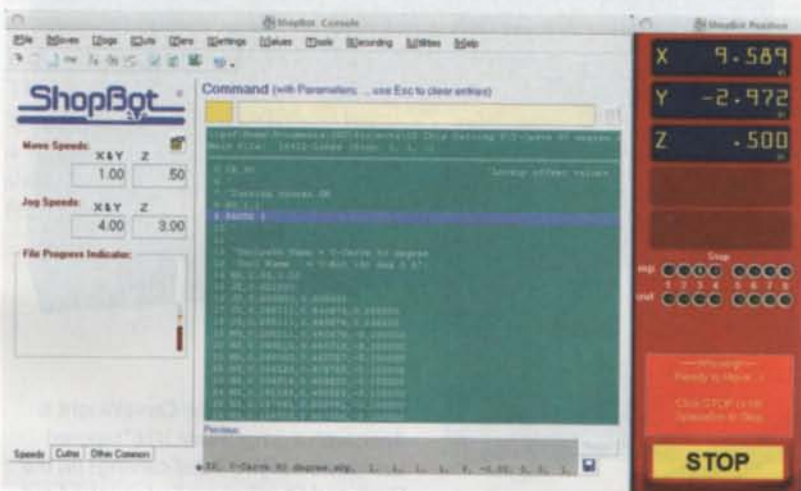
Pros: Aluminum frame, proximity switches, Z-axis zeroing function, 1-1/2" thick T-slot aluminum table, available with an industrial spindle, accepts 1/4" and 1/2" diameter bits, dust/safety shroud.

Cons: Computer must be connected during operation and cannot be used to run other programs (including PartWorks) while running the Desktop.



The ShopBot Desktop welded aluminum and machined frame and gantry come fully assembled. THK linear bearings run on frame-mounted steel rails and precisely guide the router's movements.

Zeroing out the height of a router bit on the Desktop is done the same way as on industrial machines by using an aluminum touch plate and a software command. The machine senses the plate and automatically records the bit's height relative to your work. It's an extremely useful and convenient feature.



The Desktop ships with Shopbot's full version controller (left) as well as a basic version. The full version takes a while to learn, but provides dozens of additional commands for controlling the actions and movements of the Desktop. Several of these advanced features are useful even to the beginner.



Watch the Desktop in action at AmericanWoodworker.com/CNC

ShopBot Desktop Project Gallery



Highly detailed relief carving created with the ShopBot Desktop. Made by the ShopBot staff. 9" x 16"



Dovetailed plywood coin bank machined on the Desktop. Made by the ShopBot staff. This box is an example of how CNCs allow and encourage you to explore construction techniques that can be difficult to accomplish with traditional tools. 7-1/2" x 3"

Benchtop CNC Test Carvings

Relief Carving

A major part of my early training in furniture building involved traditional Chippendale and Queen Anne style carving. I've always wondered how well a CNC would do with a finely detailed carving design. The design at right is neither Chippendale nor Queen Anne, but rather a test design that I created with Aspire software. Aspire is what's referred to as a 2.5D modeling program. It's capable of creating high-relief designs that are one-sided with no undercuts. I was able to run the design on all three machines. As you can see in the photos below, they all performed extremely well. The quality of the machined surface was so smooth that it took only about three minutes to sand off tiny mill marks and fuzzy grain before staining and varnishing.

The key to such a detailed carving is a 1/16" ball-nose bit. The fine tip cuts the details while the tapered shaft adds strength and reduces flexing that can cause chatter and breakage. It took about two hours to carve this 4" x 4" design.



Relief carving with the CarveWright is done with a proprietary 1/16" tapered ballnose bit (right). Relief carvings on the Shark and Shopbot are first roughed out with a 1/4" ballnose bit and then detailed with a fine ballnose bit such as the 1/16" Onsrud bit on the left.



The CarveWright excels at relief carving and its results are almost indistinguishable from those of the other machines.



The Shark Pro Plus performed exceptionally well at carving this 2-1/2 D relief.

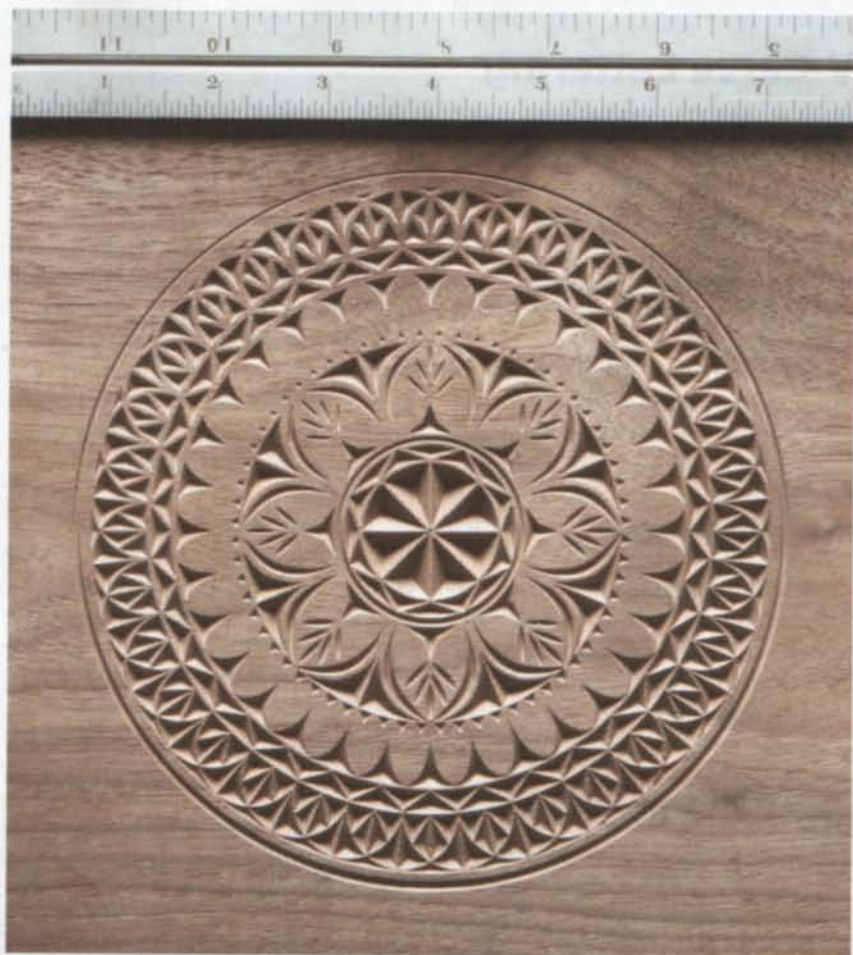


The Shopbot Desktop delivered excellent surface quality on this test relief-carving.

Chip Carving

I designed this Chip Carving with V-Carve Pro, which can be used to apply incised v-carving to almost any shape. CarveWright's Centerline lettering software only works on letters, so I didn't create a chip carving with their machine.

When viewed at arm's length, both the Shark and the Shopbot chip carving designs look good. Close examination does, however, reveal a difference. The Shopbot's chatter-free carving can most likely be attributed to the Shopbot's industrial spindle and rigid frame. The small chatter marks on the Shark's chip carving are probably a result of router shaft run-out, or slight flexing of the Shark's plastic frame—or a combination of both.



The Shark Pro Plus left some small chatter marks in the triangles of this chip carving test. Slowing the feed rate did not reduce the chatter. The cause is either router run-out or flexing of the router carriage.



The Shopbot produced perfect chatter-free cuts in this chip carving test, a testimony to the accuracy of the spindle and the robust mechanical design of the Desktop.

Benchtop CNC Test Carvings

V-Carve Lettering

Incised, or v-carved, lettering has been around since the Romans and its appeal still attracts woodworkers. If you've ever v-carved letters by hand, you know it takes a lot of skill and practice. V-carving with a hand held router and template guides is much easier, but typically results in a round cut at the end of the letters—unless you lift the router while exiting the letter. Doing so will create a v-shaped ending point, or serif, but it's more akin to cursive writing than to classical incised lettering.

A CNC router can precisely lift the bit at the terminal ends of letters to create a true incised appearance. The Shark and the ShopBot both accept letter files cre-

ated by V-Carve Pro, a dedicated CNC program made by the Vectric CNC software company. Cutting depth, number of passes and feed rate can all be controlled through V-Carve Pro. Adjusting these settings helps control the quality of the cut. CarveWright has its own proprietary v-carve lettering program called Centerline. The lettering test plaque only took about 8-10 minutes to complete on each machine.

The ShopBot Desktop and the Shark Pro Plus produced similar results with all the lettering sizes. Under close examination, the details in Shark's carved letters were not as crisp those of the Desktop, but the difference was not perceiv-

able when the plaques were held at arm's length. The Shark had to be run at a slower feed rate than the Desktop to achieve similar results—although that only amounted to a minute or two of running time for this test plaque.

CarveWright letters had two problems: chatter marks and burning along the v-cuts. These problems can primarily be attributed to CarveWright's method of v-carving in one pass at a slow feed rate. It's a software matter that CarveWright is looking at changing. Even though carving in a softer wood produced less burning, the chatter marks were still there.



The 4" letters were carved with a 90° v-bit. The 1/2" letters were carved with a 60° v-bit. The 1/4" and 1/8" letters were carved with a 60° engraving v-bit. Though there was little quality difference between the Shark CNC and Shopbot Desktop results, the Shark had to be run at a slower feed rate to achieve similar results.



CarveWright left noticeable burns in the cherry test board. It appeared that burning was caused by the cut being made slowly and in one pass. CarveWright is working on new letter-carving software to address this problem.



Shark Pro Plus produced very good v-carved letters at moderate feed rates. Higher feed rates caused some irregularities in the details of the letters.



ShopBot produced the smoothest, crispest letter carving and was able to do so at a faster feed rate than the other machines.

Keyhole Inlay

I conducted this test to see how accurately the machines could cut a 2" x 3" key and matching keyhole. Each test board had a series of increasingly larger keyholes. The key holes were "drawn" in the design program at .005" increments. This is a relative measurement since bit diameter, cutting direction and grain direction can affect the accuracy of the opening. This test also showed that the machines do a good job of cutting perpendicular to their tables. The gaps would have been larger if the cuts weren't vertical to the board's face. The visible gaps in the inlays below ranged from .005" - .010".



The CarveWright required the keyhole to be drawn .015" smaller than the key for it to fit. Odd? Yes. Cause: slight software, bit or machine variance.



The Shark CNC Pro Plus required the keyhole to be drawn .020" larger than the key to allow it to fit. A .010" gap remained around most of the key.



The Shopbot Desktop required the keyhole to be drawn .010" larger than the key to allow it to fit. This left a .005" gap at the top and bottom where the long grain was more easily cut.

Long Carvings



Long carvings are easily produced with the CarveWright, which feeds the board through similar to a thickness planer. The 8" x 60" carving above took about eight hours to carve using a 1/16" bullnose bit. The designs are from the CarveWright Pattern Store, which has hundreds of ready-to-carve patterns. Most sell for \$5-\$20.

The Shark and Shopbot Desktop are capable of long carvings, but they need to be done in stages. This might not be practical for some designs.

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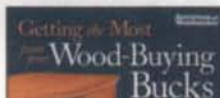
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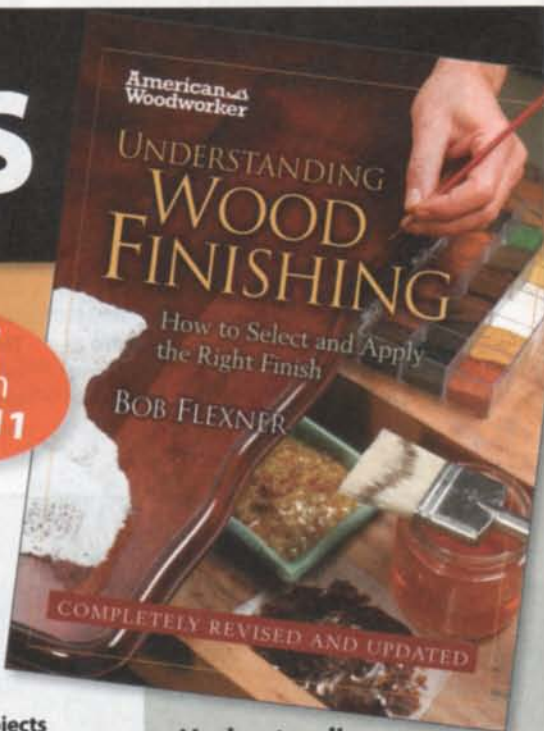
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Hexagonal Pen

Create geometric shapes
with your router and
a shopmade jig.

by Charles Mak



YOU CAN MAKE ATTRACTIVE WOODEN PENS without a lathe. All you need is a plunge router and a shopmade jig. The jig takes a while to build—certainly longer than it takes to rout a pen with it. But once you've built the jig, you'll be ready to rout pens by the dozens in many different geometric shapes.

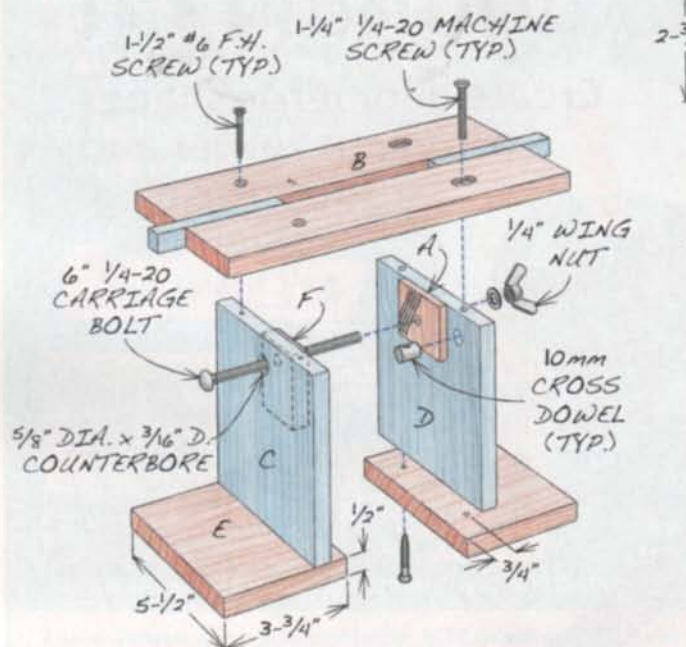
Of course, you'll also need pen hardware kits and wooden pen blanks. Pen kits include all the pen's necessary metal components, such as the ink cartridge and the decorative tip. They're avail-

able in woodworking specialty stores and online (see Sources, page 60). You can buy wooden pen blanks or make your own. Some pen kits include pen blanks.

I first learned about this pen-making method from Neil McCaw, a retired, self-taught woodworker. Although I never saw Neil make a pen, I created this jig based on his explanation, and now I teach pen-making classes at a local woodworking store.

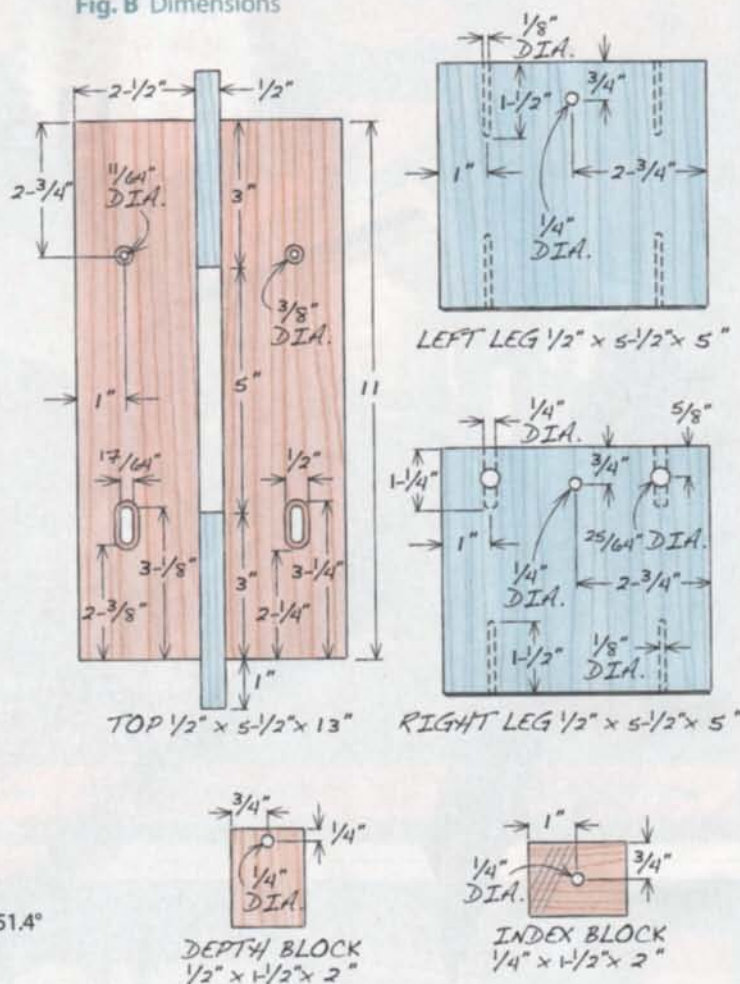
Fig. B Dimensions

Fig. A Pen-Routing Jig



Index block line angles

Pentagon: 72° | Hexagon: 60° | Heptagon: 51.4°
Octagon: 45° | Nonagon: 40°



Build the jig

Use lumber, plywood or MDF to build the jig (Figs. A and B, above). The jig shown in the photos is made of poplar. All the parts are 1/2" thick, except for the index block (A). Make sure the pieces are flat. Angled lines drawn on the index block are the key to making different geometric shapes. Changing the angle of these lines changes the shape. I keep several different index blocks on hand (**Photo 1**).

1. Glue the top (B) together using a pair of 1/2" wide pieces to establish the length and width of the slot.

2. Use a drill press equipped with a fence to accurately drill counter-sunk holes for #6 screws in the left side of the top and countersunk slots for 1/4-20 machine screws in the right side. Make sure the screw heads rest slightly below the surface

so the router will travel smoothly.

3. Cut the legs and feet (C-E) to final size. Mark the legs "left" and "right." Drill countersunk holes for #6 screws in the feet.

4. Drill holes in both legs for the carriage bolt. To make sure the holes are perfectly aligned, stack the legs, hold their top ends against the fence and make sure their sides are flush before drilling.

5. Use the same setup to drill the hole in each index block that you make. Reposition the fence to drill the hole in the depth block (F).

6. On the left leg, drill a 3/16" deep counterbore for the carriage bolt.

7. Drill pilot holes in the top and bottom of the left leg. First, mark the exact location of each hole: With the leg standing or clamped in a vise, position the top on it, so the sides are flush and the leg is

centered on the top's screw holes. Then drill shallow starting holes in the end grain, using a hand-held drill and the same bit you used to drill the holes in the top. Remove the top and chuck a 1/8" bit to drill the pilot holes. Note: Take care to drill straight. Any variance from 90° will result in a misaligned jig.

8. Follow a similar procedure to drill pilot holes in the right leg. After positioning the top, mark the sides of the slots on the top of the leg. Then drill centered 1/8" pilot holes, using the marks to position the bit. Finish by boring out the pilot holes with a 1/4" bit.

9. Drill holes in the right leg for the 10 mm cross dowels (see Sources).

10. Fasten the depth block to the left leg with a brad nail or small screw, so it's easy to replace. Insert the carriage bolt to align the holes



1 Index blocks with lines drawn at different angles allow using the jig to create pens with a variety of geometric shapes.



2 Start by gluing the brass tubes from a pen kit into a pair of wood pen blanks. Mark the blanks to keep the grain oriented correctly.



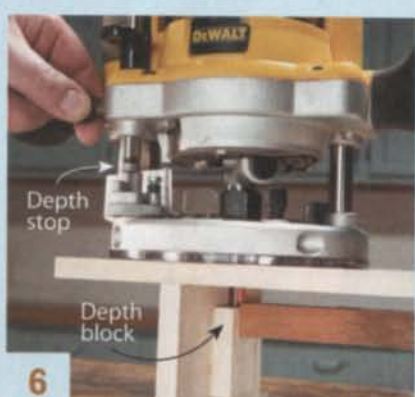
3 Disassemble the jig to install the blanks and the index block. Then reinstall the right leg assembly and tighten the wing nut.



4 Lock everything in place by screwing the stove bolts into the cross dowels that are mounted in the right leg assembly.



5 Install a guide bushing in your router to ride in the slot in the top of the jig. Use a straight bit for routing.



6 Set the plunge depth. Lower the bit until it touches the jig's depth block. Then lock the router's depth stop.

and use a try square to align the block and the leg. The depth block dimensioned in Figure B produces the 9/16" dia. hexagonal pen bodies shown on page 57. To create slimmer or wider pen bodies, make additional depth blocks with different hole locations.

11. Glue and screw the feet to the legs. Then glue and screw the top to the left leg. Keep all of these joints square and flush. Use machine screws and cross dowels to attach the top to the right leg.

Prepare the blanks

Wooden pen blanks are commonly 3/4" square and up to 6" long. Study the pen blank preparation instructions included in your pen kit before proceeding.

12. Cut each blank 1/16" longer than the brass tubes included

in your pen kit. Mark the center of each blank, and drill the center hole using the recommended drill bit. The tube should slide through the hole without binding or wobbling. It's OK if the hole isn't perfectly centered.

13. Glue in the tube with CA glue or 5-minute epoxy (Photo 2).

14. Square both ends of the blank and trim its length to match the brass tube.

Route the blanks

15. Slide a pair of blanks onto the carriage bolt between the depth block and an index block that's marked to create hexagonal blanks (Photo 3). Install the right leg assembly and securely tighten the wing nut to anchor the carriage bolt's square shoulder in the left leg. You shouldn't be able to rotate

the blanks with your fingers. Square the right leg assembly to the top and align the edges. Then secure it by tightening the machine screws (Photo 4). Note: To create tapered geometric shapes, simply install two or three playing cards between the right leg and the top before you tighten the machine screws.

16. Outfit your plunge router with a 1/2" o.d. guide bushing and a 3/8" straight bit (Photo 5 and Sources). Set the router's speed to about 18,000 rpm.

17. Mount the router on the jig to set the final depth of cut (Photo 6). Then mark the end of the routing pass (Photo 7).

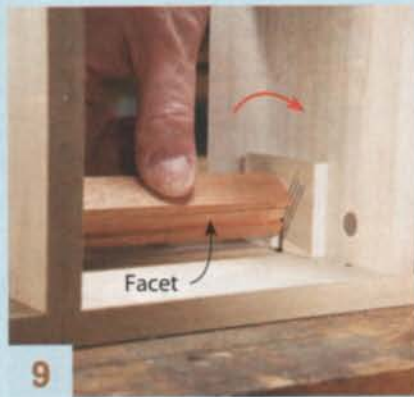
18. Return the router to the left end of the slot and lower the bit to remove about 1/8" of material on the first pass. Then rout from left to right (Photo 8).



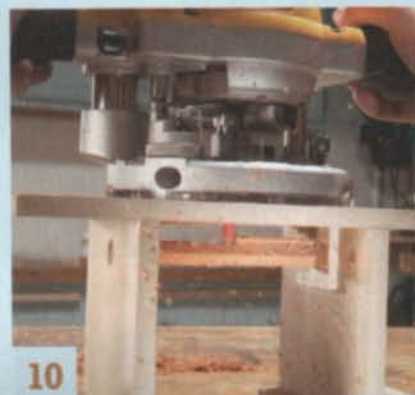
Mark where to stop routing. Slide the router until the bit touches the index block. Then trace around the router's base.



Rout the first facet on both blanks. Make several passes from left to right, removing no more than 1/8" with each pass.



Reposition the blanks with the jig upside down. Rotate them clockwise until the newly-routed facet aligns with the index block's marks.



Create the hexagonal shape by repeating the steps shown in Photos 8 and 9.



Assemble the pen, using the remaining parts from the pen kit.



Charles Mak

is a businessperson in Alberta, Canada. During his spare time, he can be found

working in his shop or at his local Lee Valley Tools store, where he teaches classes in making geometric pens, decorative brass etching, and creating automata/mechanical sculptures. Charles can be reached at geometricpens@gmail.com.

19. Turn off the router and wait until the bit stops. Then lower the bit for the next pass. Repeat Steps 18 and 19 until you reach the final depth of cut.

20. Remove the router and slightly loosen the machine screws and the wing nut so you can rotate the pen blanks with your fingers.

21. Turn the jig upside down and rotate both blanks clockwise until the newly-routed facet aligns with the diagonal lines drawn on the index block (**Photo 9**). Retighten the wing nut. Then turn the jig upright, square the leg, align the ends and tighten the carriage screws.

22. Place the router back on the jig and repeat the process until all six facets have been routed (**Photo 10**). Then remove the blanks.

Finish the blanks

23. Lay sandpaper of various grits on a flat surface. Hand sand each facet with the grain, using the same number of strokes. (Over-sanding any one facet will ruin the blank's symmetry.)

24. Apply your favorite finish. I spray on two coats of gloss lacquer or polyurethane.

Assemble the pen

25. Decide how to orient the blanks on the pen.

26. Use a C-clamp or a bench vise to press the tip (or "nib") into the bottom end of the lower blank. Then press the twist mechanism (brass end first) into the other end, up to the indentation on the mechanism. Install the cartridge (it screws into the twist mechanism) and check its projection at the tip,

to make sure you don't press the mechanism in too far. Slip the center band over the twist mechanism.

27. Press the cap and clip together into the top end of the upper blank. Then slide it onto the twist mechanism. 

SOURCES

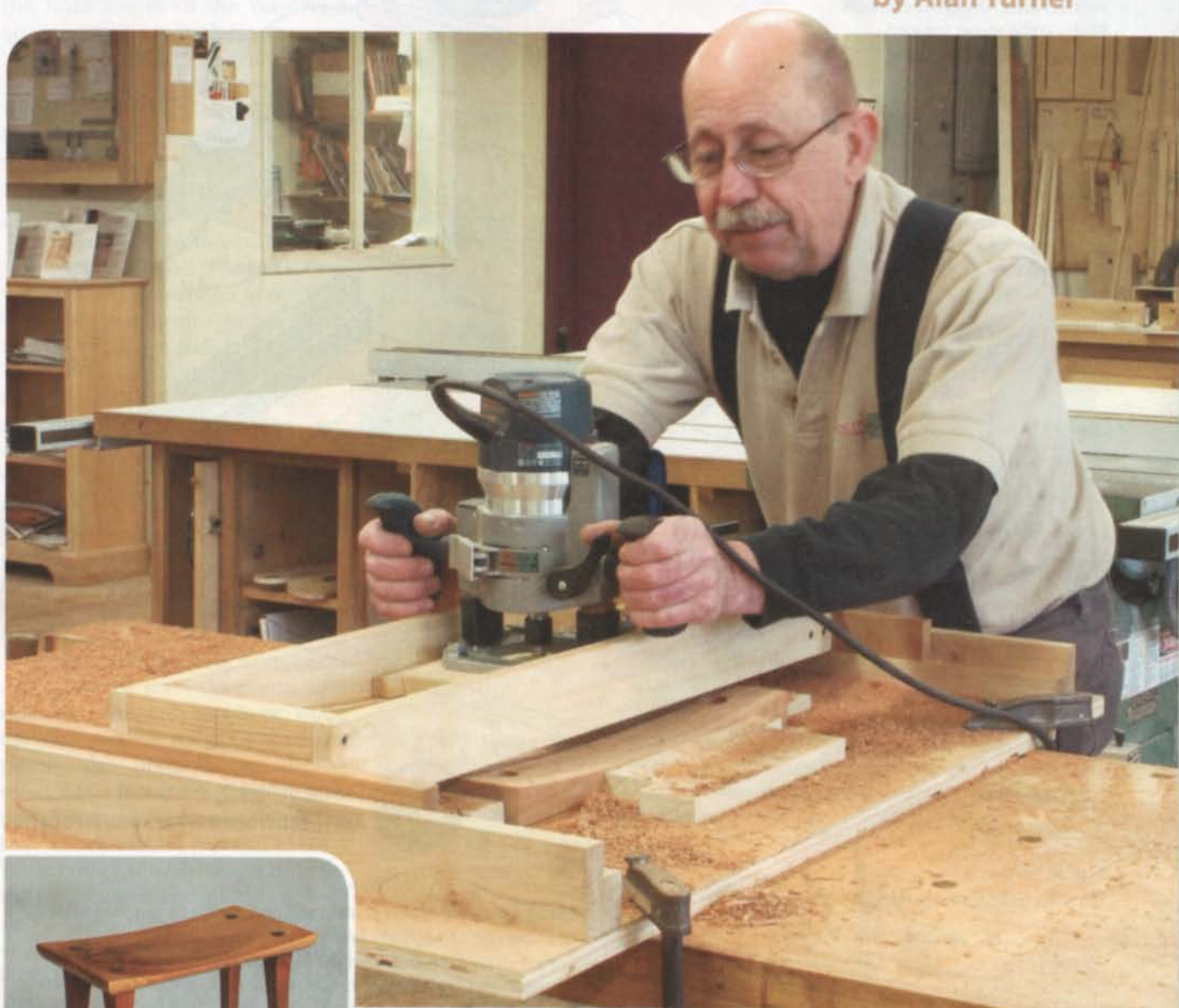
Lee Valley Tools, www.leevalley.com, (800) 871-8158, Ballpoint Twist Pen Hardware Kit, #88K70.02, \$4.90 each; Pen Blanks, prices vary; 10mm x 16mm Cross Dowel, #00N18.16, 40¢ each (2 req.); 1/2" Guide Bushing, #46J91.15, \$4.80; Guide Bushing Ring nut #46J91.11, \$2.90.

Woodcraft, www.woodcraft.com, (800) 225-1153, Pen Hardware Kit, #123052, \$3.50 each; Pen Blanks, prices vary; Freud 3/8" straight bit, #828669, \$19.49.

Gimbal Jig

How to use a plunge router to scoop out a curved seat.

by Alan Turner



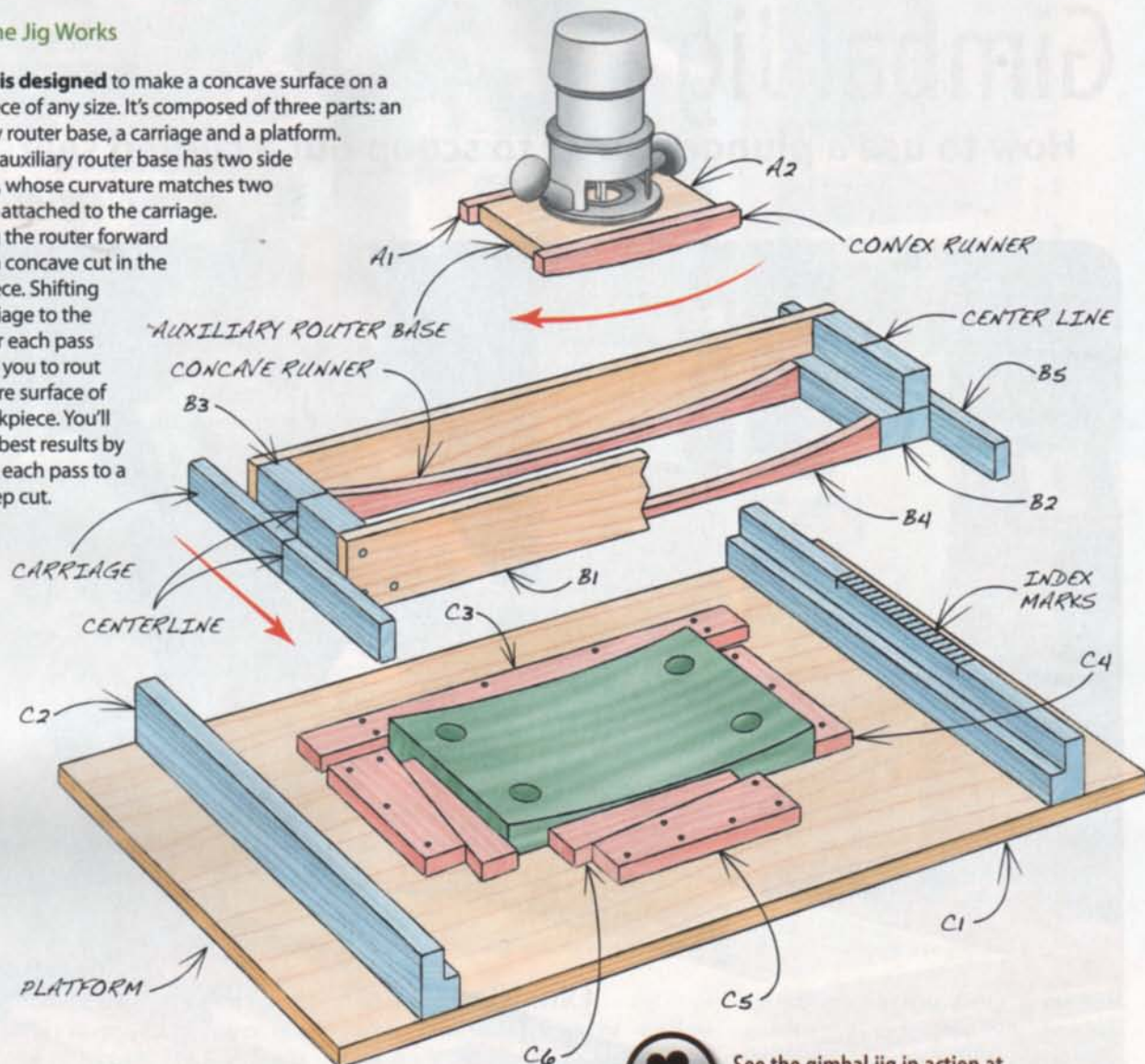
OK, HOW DO YOU MAKE A CONCAVE SEAT? I designed a stool quite a while ago that called for one, but I stalled out trying to decide what approach to take. I considered lots of options—such as using an adze (nope, too easy to screw up), a tablesaw (way too many cuts, and a lot of cleanup), or a bandsaw (again, too much cleanup). The best way, I've found, is to use a router.

Of course, you have to build a device to guide the router—something I call a gimbal jig (see *How The Jig Works*, Fig. A, page 62). It's not very complex, and it's easily adaptable to a seat of any size. All you need is a plunge router and a 1" dia. extra-long straight bit (see *Source*, p. 65). We've used this jig dozens of times at the school where I teach, Philadelphia Furniture Workshop, to build the stool I designed (left).

Fig. A
How The Jig Works

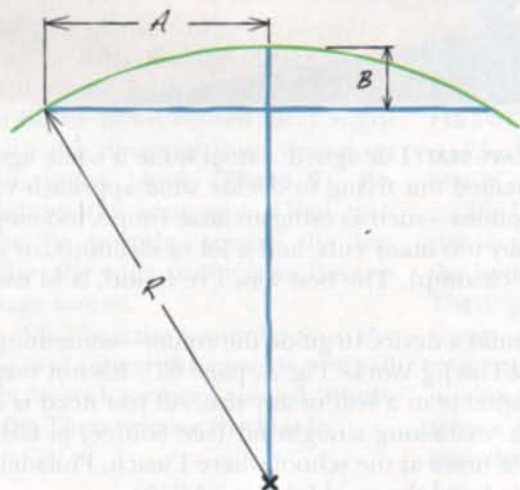
This jig is designed to make a concave surface on a workpiece of any size. It's composed of three parts: an auxiliary router base, a carriage and a platform.

The auxiliary router base has two side runners, whose curvature matches two runners attached to the carriage. Pushing the router forward makes a concave cut in the workpiece. Shifting the carriage to the left after each pass enables you to rout the entire surface of the workpiece. You'll get the best results by limiting each pass to a 1/8" deep cut.



See the gimbal jig in action at
AmericanWoodworker.com/WebExtras

Fig. B
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.

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. Next, determine how high the arc will go—let's call that the rise.

Next, use your calculator to convert these numbers to decimals. Finally, use this formula:

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

R = the radius of the arc

A = 1/2 of the run

B = the rise

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

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

Make the jig

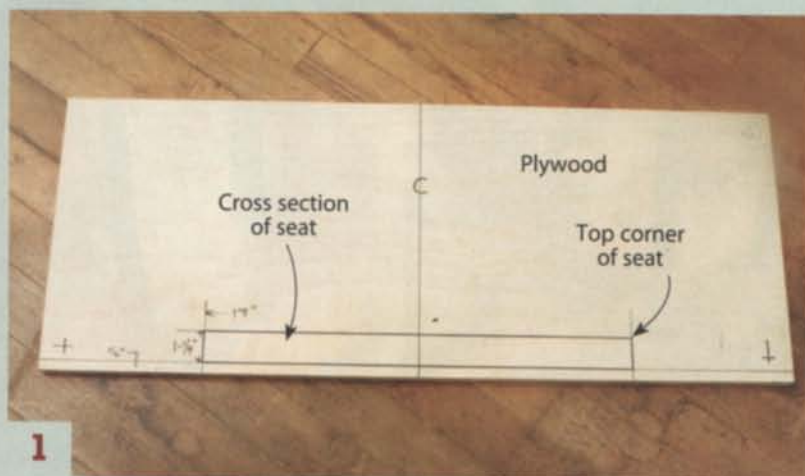
Begin building the jig by making the plywood runners (B4) for the jig's carriage. Baltic birch is the best material—it's strong, stable and doesn't have any voids. Cut a piece of Baltic birch about 6" wide and the final length of the runners—about 10" longer than the seat you'll be routing.

The runners will have exactly the same curvature as the seat. So, how do you accurately draw a curve that large? You'll need a simple formula (Fig. B), a calculator and a really big compass.

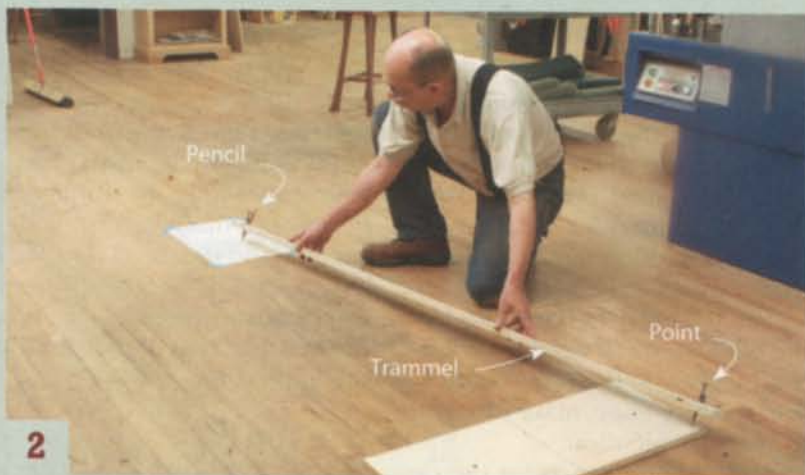
First, draw a cross-section of the seat on the plywood (**Photo 1**). Center the drawing, parallel to the long edge. My seat begins with a blank that is 17" long and 1-1/4" thick. The scoop is 1/2" deep in the middle. Using the formula, I find that the curve has a 72-1/2" radius—just over 6 feet! I'll need some elbow-room to draw a curve this big, so I move everything down to the floor. You'll have to anchor the piece of plywood so it can't move. In our teaching studio—an old industrial loft—I just screw the plywood to the floor.

Next, make a beam compass. I use a pair of trammel points that can be clamped anywhere on a narrow wooden stick. One of the points also holds a pencil; the other has a sharp tip. (While trammel points are convenient, because they're adjustable, you can make a beam compass by drilling a hole for a pencil in one end of a long stick and a hole for a nail in the other end, spaced the correct distance from the pencil.)

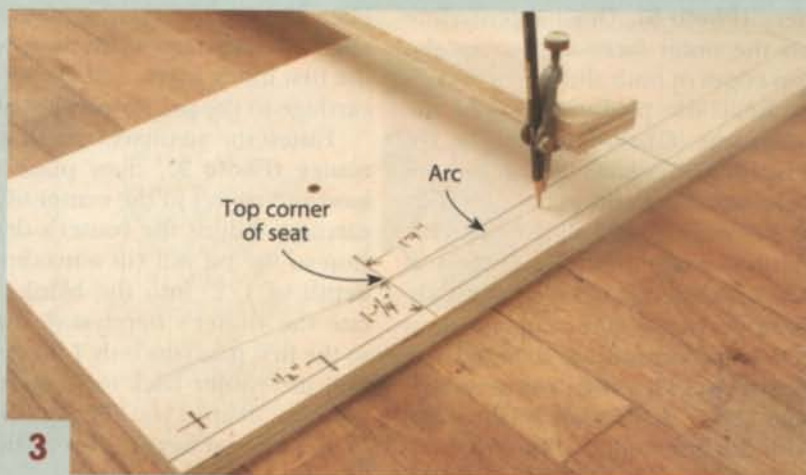
The next step is to find the center point of the seat's curve (**Photo 2**). Tape a heavy piece of paper to the floor (a manila folder works well). Position it about 6' away from the piece of plywood. Place the pointed end of the trammel on the upper right corner of the drawing and draw an arc on the paper. Next, place the trammel's point on the upper left corner of the drawing. Draw a second arc. The intersection of the two arcs is the center point of the curve.



1 Begin making the jig by drawing a full-size cross section of the seat on a piece of 3/4" plywood. Tape or fasten the plywood to your floor.



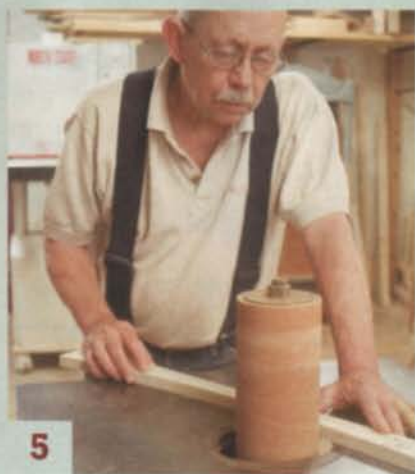
Tip To find the center of a large curve, make a trammel that's the radius of the arc. Place one end on each point you want to connect (here, the top corners of the seat). From each point, draw a short curve on a piece of paper taped to the floor. The intersection of these curves is the center point of the arc.



3 Draw the arc. Turn the trammel around, so the pencil end is on the plywood. Place the trammel's point on the center point of the arc. Draw a curve through the two top corners of the seat. Continue the curve all the way across the board.



4 Saw the arc, staying close to the line. Make another piece just like this one. They will become the jig's runners—the curved parts that guide the router.



5 Fair each runner's curve to eliminate lumps and flat spots. Use an oscillating spindle sander or a drum sander mounted in your drill press.



6 Assemble the carriage that holds the runners.

Turn the trammel around, place its point on the center point, and draw the curve all the way across the piece of plywood (**Photo 3**). You'll need two runners for the jig; repeat the process, using the other half of the plywood for the second runner.

Saw the runners (**Photo 4**). Save the offcuts—you'll need them later. Sand exactly to the line (**Photo 5**). When you're done, make sure both runners are identical.

Mill the other parts for the carriage (B1, B2, B3 and B5) and assemble them on a flat surface (Fig. C). Be sure that the sliders (B5) are parallel to each other. Add the runners (**Photo 6**). Draw a centerline on the outer faces and across the top edges of both sliders.

Build the platform to hold the workpiece (C1 through C6, Fig. D). The base (C1) must be flat, without bend or twist. Position the rails (C2) so the carriage will slide easily. Position the side stop (C4) so the seat will be centered between the rails. After the platform is complete, draw index marks on the right-hand rail. Begin by placing the carriage on the rails. Align the carriage's centerline with the inner edge of the rear stop (C3). Draw one index mark opposite the centerline, then continue the series of marks at 1/2" intervals (half the diameter of the router bit)

down the rail.

Using the offcuts from the runners, build an auxiliary base for your router (Fig. B). Apply a coat of finish to this base's runners, the runners and sliders on the carriage, and the rails on the platform—wherever two pieces slide on each other. Add a coat of paste wax after the finish dries.

Use the jig

Mill the seat blank and secure it to the platform (**Photo 7**). (My seat has holes drilled in it for through tenons—it's best to make these holes before the seat is routed.) Place the carriage on the platform, align the carriage centerline with the first index mark, and clamp the carriage to the platform (**Photo 8**).

Fasten the auxiliary base to your router (**Photo 9**), then place the base and router in the center of the carriage. Adjust the router's depth stop so the bit will cut a maximum depth of 1/2" into the blank. Rotate the router's depth-stop turret so the first pass cuts only 1/8" deep. Pull the router back to its starting position, nearest you (**Photo 10**).

Before you begin, stop to think about three safety issues:

- *Cut only on the push stroke.* If you cut on the pull stroke, you'll be climb-cutting, which can be unsafe.

- *Move the carriage from right to left for successive passes.* You'll be climb-cutting if you move the carriage the opposite way.

- *Use only the left half of the bit.* If your cut is wider than half of the bit's diameter, the router will probably be hard to control. The jig's index marks will limit the width of each cut by the correct amount.

Start the first cut. Push the router down the carriage (**Photo 11**), then pull it back. Turn off the router, re-clamp the carriage at the next index mark and make another pass. Repeat the process until you've routed all the way across the seat.

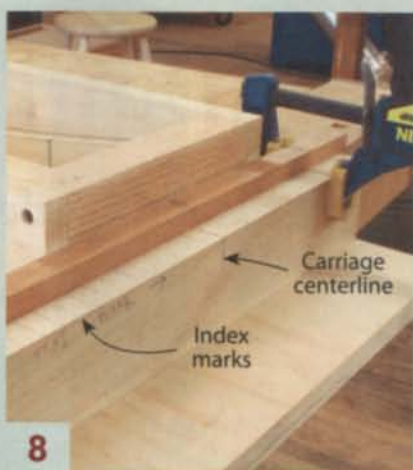
Return the carriage to the first index mark. Adjust the router to cut an additional 1/8" deep and rout the entire seat again. Repeat this once more; you've now gone a total of 3/8" deep. Make two final passes using 1/16" deep cuts.

When you're done, the seat should be fairly smooth (**Photo 12**). I glue the entire stool next, running the legs through the seat. After the glue is dry, I spokeshave the ends of the legs so they're flush with the seat, then lightly sand the seat and the end grain of the legs. 



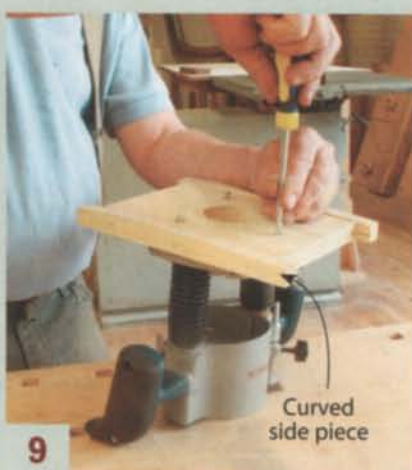
7

Set up the jig for routing. Begin by securing the seat blank to the jig's platform, using opposing wedges.



8

Clamp the carriage to the far right side of the platform. Line up the carriage's centerline with the first index mark on the platform.



9

Fasten a shop-made curved base to your plunge router. The side pieces on the base match the curvature of the runners on the carriage.



10

Place the router in the carriage. Adjust the router to make a 1/8" deep cut in the center of the seat, then pull the router back to the starting position, nearest you.



11

Push the router along the carriage to make each cut. Pull the router straight back to the starting position, then move the carriage to the next index mark and repeat. Make the same cut all the way across the seat.



12

The finished seat. The full scoop requires five passes of the router across the seat, taking 1/8" at a time. For the last passes, set the bit to remove only 1/16", and go slowly.

Cutting List

Section	Part	Name	Qty.	Th x W x L
Auxiliary Router Base	A1	Base	1	3/4" x 5-5/8" x 8" (a)
	A2	Runner	2	3/4" x 13/16" x 9-1/2" (b)
Carriage	B1	Side	2	3/4" x 2-5/8" x 30 (a)
	B2	End block	2	1-3/8" x 3" x 7-1/8"
	B3	End block stop	2	1-1/4" x 1-1/4" x 7-1/8"
	B4	Runner	2	3/4" x 1-3/8" x 27-1/2" (a)
	B5	Slider	2	3/4" x 1-1/2" x 16" (c)
Platform	C1	Base	1	3/4" x 24" x 39-1/4" (d)
	C2	Rail	2	1-3/4" x 2-1/2" x 24 (c)
	C3	Rear stop	1	3/4" x 2" x 24"
	C4	Side stop	1	3/4" x 2" x 7-1/2"
	C5	Fixed wedge	2	3/4" x 4" x 10"
	C6	Loose wedge	2	3/4" x 4" x 7"

Notes: a) Baltic Birch plywood
b) Use offcuts from B4
c) Use offcuts from B4
d) Shop-grade birch plywood



GARTH HERRICK

Alan Turner

is the founder of Philadelphia Furniture Workshop (www.philadelphia-furnitureworkshop.com), a woodworking school dedicated

to traditional furniture built with hand and power tools. Alan teaches a class on building the stool featured in this article.

SOURCE

Whiteside Machine Co., www.whitesiderouterbits.com, (800) 225-3982, (see website for a list of distributors), Double Flute Straight Bit, 1/2" shank, 3-3/4" overall length, #1095, \$30.

Cedar Plant Stand

An Asian-inspired display stand for deck, patio or porch.

by Spike Carlsen



THIS STAND WAS ORIGINALLY DESIGNED for bonsai plants—dwarf trees or shrubs—but it can be used to display any kind of potted plant. As a traditional bonsai stand, it's designed to be attractive yet not distract from the beauty of the plant.

I built the stand from 2x2 and 2x6 cedar, but you could also use other rot-resistant woods such as cypress, white oak or walnut. Treated wood would work as well, but the stand would look better if it were stained. The dimensions of the stand are easy to modify for smaller or larger pots.

To make the stand, cut the legs (A) to length, then draw the bot-

tom arcs (**Photo 1**). Cut the arcs with a jigsaw or bandsaw, then use the cutoffs to draw curves on the ends of the legs. Smooth the curves with a belt sander.

Cut all of the slats (B and C) to length. Use scrap pieces of the slats to lay out the exact width of the notches in the legs. Cut the sides of the notches with a jigsaw, or on a bandsaw or tablesaw, then use a chisel to square off the bottoms of the notches (**Photo 2**). You'll get better results by chopping a little bit off at a time rather than by removing the waste in one big chunk.

Cut the ends of all of the slats at an angle (see drawing). Place

the four short slats side by side and draw lines across them at 1-1/2" intervals (**Photo 3**).

If you'll be finishing or staining the stand, do it now, before assembling the pieces. Left unfinished in the sun, cedar will turn a beautiful silvery gray.

Tap the short slats into the notches so they overhang the sides of the legs by 1-1/2", drill pilot holes, and screw the slats to the legs using stainless steel screws or coated deck screws. Position the long slats on the layout marks and fasten them in place (**Photo 4**). 



1

Draw the arc for the bottom of each leg using a tape measure or a trammel. Cut out the curve, then use the waste piece to draw curves on the ends of the leg.



2

Notch the legs using a jigsaw and chisel.



3

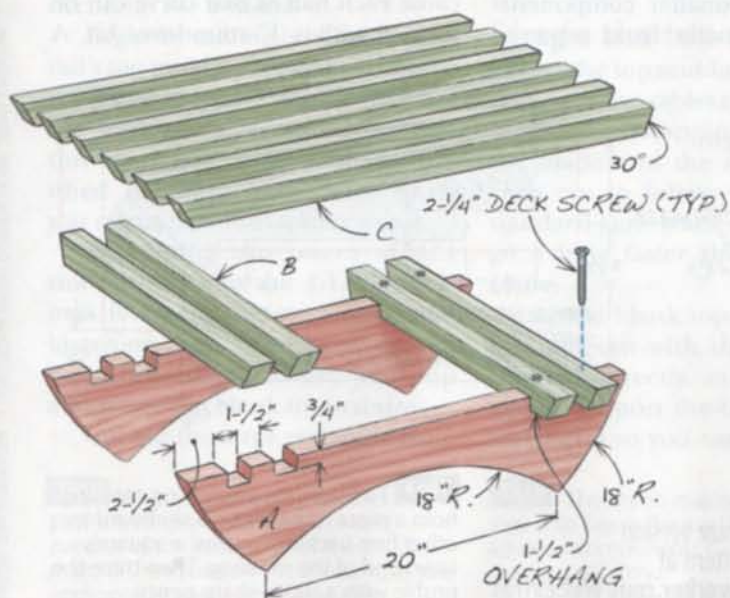
Cut the short slats to length, then draw layout marks at 1-1/2" intervals. Fasten these pieces to the legs.



4

Align the long slats with the layout marks, then drill pilot holes and fasten the pieces in place.

Left unfinished in the sun, cedar will turn a beautiful silvery gray.



Cutting List

Overall Dimensions: 7-3/4" H x 32" W x 19-1/2" D

Part	Name	Qty.	Material	Th x W x L
A	Leg	2	2x6 Cedar	1-1/2" x 5-1/2" x 30"
B	Short slat	4	2x2 Cedar	1-1/2" x 1-1/2" x 19-1/2"
C	Long slat	6	2x2 Cedar	1-1/2" x 1-1/2" x 32"



This and 40 more clever, easy-to-build woodworking projects are featured in Spike Carlsen's upcoming book, *Ridiculously Simple Furniture Projects*. Spike is also the author of *A Splintered History of Wood*. For more information, go to AmericanWoodworker.com/AWBookstore.

Make Your Own Bar Rail Molding

Plus 9 useful tips for making any large-profile molding.

by John English

IF ADDING A BAR is on your list of home improvements, you know that its large, contoured front rail is an essential element. Commercially available bar rail molding is costly and can be difficult to find in anything but oak. Fortunately, you can make this molding—and lots of other large-profile moldings—in your shop.

Divide and conquer

Bar rail molding patterns can be found by searching online or in a lumberyard catalog. Another option is to duplicate an existing molding—that's how I created the pattern shown here (Fig. A, at right). You can download a full-size version of this pattern at AmericanWoodworker.com/WebExtras.

Use the full-size pattern to match router bits with various parts of the profile. You'll need several copies of the pattern, one for each of the

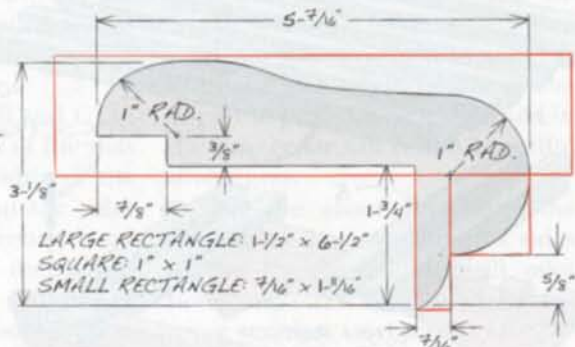
components that you identify in the next step.

Portions that can't be routed will be cut on the tablesaw. Divide the molding into smaller components that can be made from separate

boards. Here, a large rectangular component houses the top of the molding. This component begins halfway down the front curve because each half of that curve can be formed with a 1" roundover bit. A

Fig. A
Bar Rail Pattern

EACH RED RECTANGLE
REPRESENTS A
SEPARATE BOARD.



Download a full-size version
of this bar rail pattern at
AmericanWoodworker.com/WebExtras

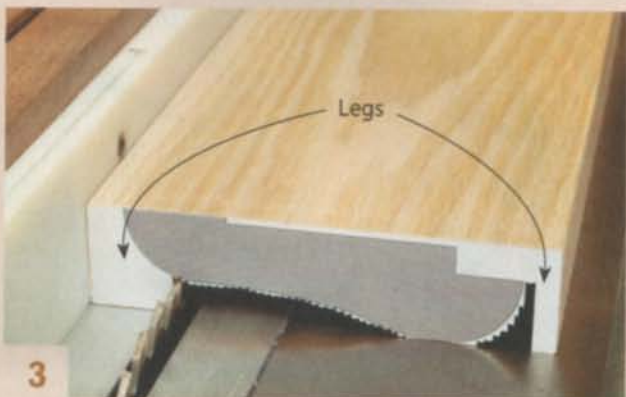
Tip ▶ To duplicate an existing molding, hold a piece of paper on a clipboard (or other firm backing) against a squarely sawn end of the molding. Then trace the profile with a super-sharp pencil.



1 Attach the top section of the pattern to a large rectangular blank. Make sure the pattern is parallel with the bottom edge.



2 Use a support to keep the blank's leading edge flat on the saw table, so you can precisely position the fence and the blade between cuts as you rough out the profile.



3 Shape the profile by making a series of overlapping tablesaw cuts. Legs on both sides support the blank and keep it level.



4 Rout a shallow dado on the bottom of the blank. Install featherboards to hold the blank against the fence and flat on the table.

square component yields a quarter-round molding for the front of the rail and a small rectangular component provides the cap molding that decorates the bottom.

Begin by milling a blank for the rail's top molding component. Make this blank at least 6" longer than the bar top's overall length. Note that this blank is 1" wider than the finished molding, for stability when you cut its profile in a later step.

Face-gluing two pieces of 4/4 stock to achieve the 1-1/2" thickness is acceptable, as long as the matching faces have been jointed flat. After the glue is dry, joint, rip and plane the blank to final size.

Cut out the large rectangle from

one copy of the pattern and attach it to one end of the blank (**Photo 1**). Spray adhesive is ideal, but yellow glue will do the job, too.

Shape the top molding

Create the top molding's contoured shape on the tablesaw by making a series of overlapping cuts. Adjust the blade and the fence between each cut to follow the profile. A standard-kerf blade makes things go a little faster than a thin-kerf blade.

Lay the blank top-face down on the tablesaw with the pattern positioned directly in front of the blade. Support the blank's cantilevered end so you can walk around

behind the saw to eyeball the setup before making each cut (**Photo 2**).

The extra-long blank provides several inches of waste at the leading end, which allows you to check each cut before committing to a full-length pass. Make a short, stopped cut (to the top of the blade). Then retract the blank, examine the kerf and make any necessary adjustments. Alternate between adjusting and cutting to slowly rough out the top's contoured profile (**Photo 3**).

Make several passes with a large-dia. straight bit to rout the reveal in the bottom of the blank (**Photo 4**). Then use the tablesaw to remove the legs (**Photo 5**).

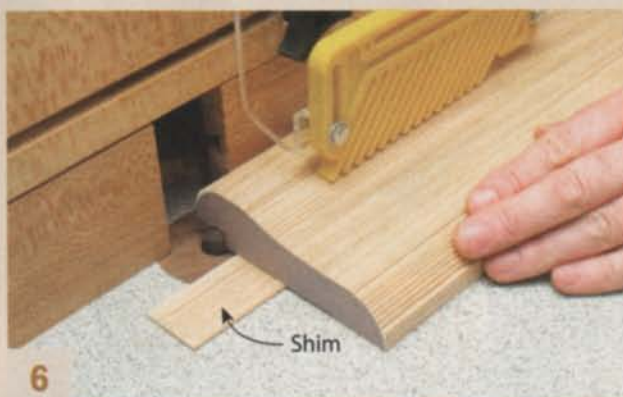
Tip When matching bit profiles to a pattern, simply slide the bit around a cut-out of the pattern until the profiles match. Then support the molding at the appropriate angle when you rout.

Tip The key to making large moldings is to break the profile into manageable components that can each be made separately.

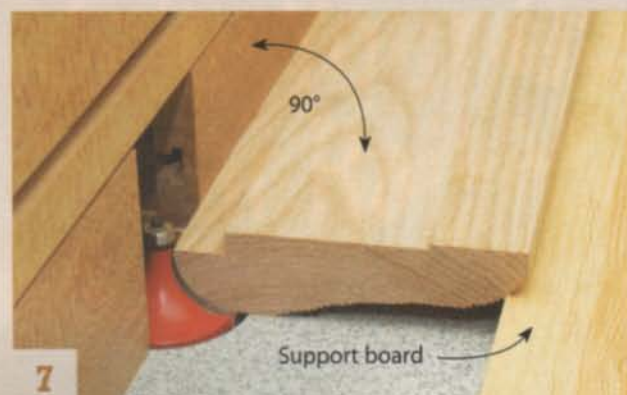
Tip Rift- and quartersawn boards make excellent molding stock. They're usually less likely to warp than plainsawn stock, which makes them especially well-suited to long, slender applications.



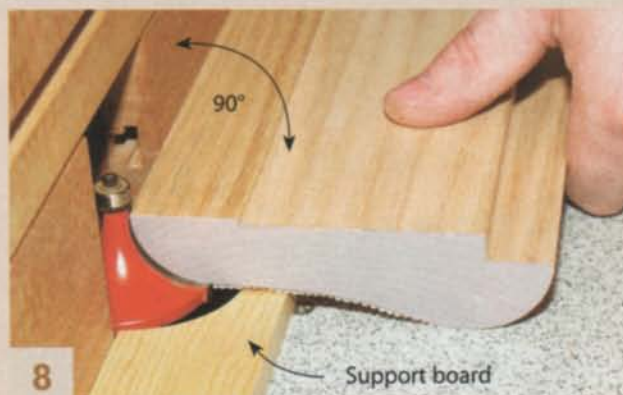
5 Saw off the legs with the blank facing right-side up. Feet created by routing the shallow dado support the blank.



6 Attach a shim to support the blank before routing the rabbet at the back—routing this rabbet removes the back support foot.



7 To clean the back radius, install a board to raise and support the front edge.



8 To clean the front radius, install a support board against the fence.

Rout the deep rabbet on the blank's back edge (**Photo 6**). Before routing, tack on a full-length shim to support the blank. Mill the shim's thickness to match the depth of the shallow dado.

The deep rabbet houses the bar's marble top. You may have to adjust the rabbet's depth to match the marble's thickness. If your bar doesn't have a marble (or raised) top, this rabbet isn't necessary.

Use the router table to clean up the roughsawn radius on the back edge of the blank (**Photo 7**). Install the 1" radius roundover bit and set the fence flush with the bearing. Then clamp a straight flat piece of scrap lumber to the router table

to support the blank. The support piece must be parallel to the fence and the bottom of the blank must rest at 90° to the fence. Move the support toward or away from the fence to adjust the setting—you may also have to run the support through the planer to reduce its thickness.

Install a thin, narrow support to clean the radius on the blank's front edge (**Photo 8**). This support has a cutout for the bit, so that it can be positioned against the fence. Adjust the support's width and thickness until the blank's bottom face rests at 90° to the fence. Use duct tape to affix this support to the router table—

taper the last few inches of the support's top face at both ends (or cut shallow rabbets in it), so the tape doesn't interfere with the blank.

Shape the small moldings

The rail's second component is a simple 1" square quarter-round molding. Mill the profile on a wide extra-long blank and then rip it on the tablesaw (**Photo 9**). Use the 1" roundover bit to create the rounded profile—complete the cut in several passes, as this large bit removes a surprising amount of stock. When you rip the molding from the blank, the square edge goes against the table-saw's fence—the molding is the offcut.

Mill an extra-long blank for the

Tip ▶ To shape a profile on a tablesaw, start with an extra-wide blank. Center the profile, so as you cut, material remains on both sides for support.

Tip ▶ Always keep the workpiece fully supported. If the workpiece tips during a cut, it can bind and violently kick back.

Tip ▶ To safely make a small molding, mill the profile on the edge of a wide blank and then rip the molding from the blank, using the tablesaw or bandsaw.



9 Cut the quarter-round molding from a wide blank that has been rounded over.



10 Use the blank for the cap molding as a temporary stop to align the quarter-round molding and the top molding for gluing.



11 Create the cap molding's profile by using a portion of the roundover bit. Lower the bit slightly below the table and position the fence in front of the bearing.



12 Complete the molding by smoothing the contoured surface with a card scraper or sandpaper wrapped around a can, plastic pipe or mailing tube.

cap molding (the rail's third component). Use this blank as a stop when you glue the quarter-round molding to the top molding (**Photo 10**).

Dry-clamp the top and quarter-round moldings to make sure their curved front edges align properly—adjust the stop if necessary. Then apply glue to the face of the quarter-round molding and use spring clamps to hold it in place against the top molding. As soon as these two sections are satisfactorily clamped, remove the stop, so it doesn't get glued on unintentionally.

Use the 1" roundover bit to create the cap molding's profile (**Photo 11**). This profile is a small arc of the bit's full radius, so it re-

quires setting the bit slightly below the table and setting the fence slightly in front of the bit's bearing. This setup will require a little trial and error, so use a test piece that's identical in size to the cap molding blank. This thin blank is susceptible to chatter, so make light cuts and use several passes to complete the profile. Glue on the cap molding to complete the bar rail molding.

The last step is to smooth the molding's roughsawn contoured surface (**Photo 12**). This can be done with concave- and convex-shaped card scrapers or with sandpaper wrapped around a can, plastic pipe, mailing tube or dowel that fits the contours. It's a good idea to

leave this process until the end, so the tablesawn profiles and routed profiles can be worked to blend seamlessly. 🛠️

John English teaches joinery at the Black Hills School of Woodworking in South Dakota. He's the author of *The Woodworker's Guide to Sharpening* and *How to Choose and Use Bench Planes and Scrapers*.

Tip ▶ When clamping together irregularly shaped moldings, temporarily clamp on a stop to keep the pieces aligned.

Tip ▶ Create unusual molding shapes by using only a portion of the bit's profile.



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FREE PLANS Shaker Sideboard

The essence of Shaker design is simplicity. Although I didn't use traditional construction techniques in this project, I did keep it simple. Behind this sideboard's elegant form and sides is a very easy to build bench plywood box joined with biscuits. It's strong and durable. The front and sides are assemblies that are added onto the box. The result is a beautiful, traditional-looking piece that doesn't require complicated joinery.

©2010 AWEXTRA Shaker Sideboard Plans

Shaker Sideboard



Build Your Skills Pro Tips for Repairing Finishes

All finishes dull as they age, but you can usually bring back their shine. The easiest way is to apply sandpaper. If the dulling has progressed to the point where you must rub the finish with the abrasive or apply another coat of finish, you can choose an abrasive that produces the desired grain. You can use a pencil, such as cellulose or paraffin, steel wool or a commercial rubbing compound. Intermittent products are good. Rub, polish and repeat until you produce a satin finish.

READ MORE ABOUT REPAIRING FINISHES



Random-Orbit Sanders How to choose the right one

Random-orbit sanders are terrific time-saving machines. They can remove milling marks left by a table saw, jointer or planer in no time flat. As simple as they are to operate, though, we found in our test that they're widely misunderstood tools. Knowing how to use a sander correctly is as important as picking the right model.

READ MORE ABOUT RANDOM-ORBIT SANDERS



Quick Tip How to Minimize Router Burns

End grain burns really are ugly and chippy. And these burns are hard to remove. After sending my fingers to the bone following one particularly unfortunate routing pass, I came up with an easy solution that removes those ugly burns without requiring that I adjust the bit's height or face with an edge guide.



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Back Leg Boo-Boo

MY WIFE ASKED me to repair a wobbly kitchen chair. All the joints below the seat had failed, so it didn't take much to knock apart the legs and stretchers. The joints were a bit loose after I removed all the glue, so I planned to wrap a shaving from a hand plane around each tenon during glue-up to tighten the fit.

Wrapping shavings around 16 tenons, applying glue, and assembling and clamping the joints required all my concentration. Fortunately, the job went smoothly, and after the glue was dry, I removed the clamps and triumphantly sat in the chair. But something was wrong, because the seat sloped sideways. I'd been so focused on fitting the joints, I'd installed the legs in the wrong holes—the shorter back legs were now on the side. Argh.

David O'Connell



Power Cord Catastrophe

MY WIFE THINKS that I have too many tools. I think my shop is too small. Everything is on wheels and lined up against the walls, to create some room to work. The 240-volt receptacle is about 6' off the floor, next to the shop's electrical supply box and on the opposite wall from where I store my planer. My spindle sander sits on a bench below the receptacle, with the drill press on one side and the bandsaw on the other. Get the picture?

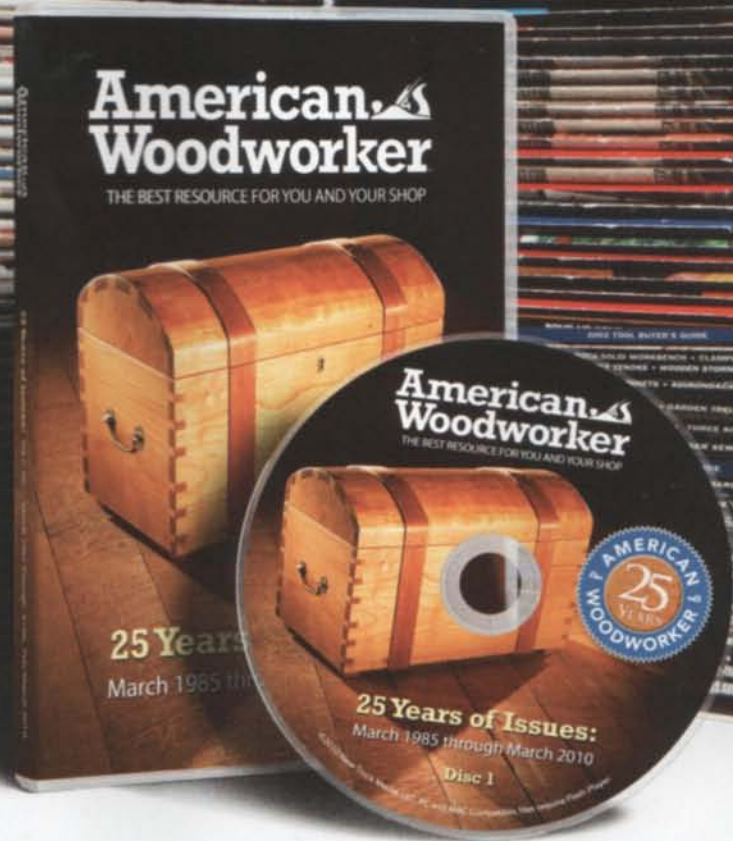
Today I rolled out the planer to mill some oak

and wound its 20' power cord around the tablesaw, and up between the drill press and spindle sander in order to lock the plug in the receptacle. After milling the oak, I rolled the planer back to the wall. But as I gave it one last push, I heard a sickening crash. I turned around to see the spindle sander on the floor, with its cast-iron top broken to pieces. Unfortunately, I'd forgotten to unplug the planer, so its cord had tightened and whipped the sander off the bench.

Joe Spencer



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