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August 2001 #123

Popular Woodworking

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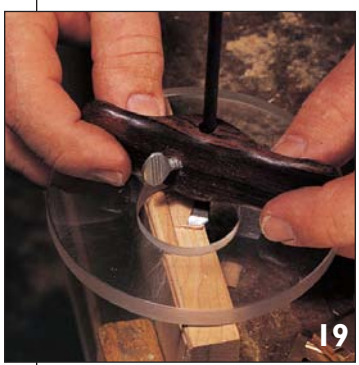
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TOOLS & TECHNIQUES

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On the Cover

If you've got a small shop and big dreams, take a close look at this rolling, knock-down assembly bench. Store your tools, build big projects, and push it against the wall when you're done for the day.

Cover photo by Al Parrish

In Every Issue

Projects

Popular Woodworking (ISSN 0884-8823, USPS 752-250) is published six times a year in February, April, June, August, October and December by F&W Publications, Inc. Editorial and advertising offices are located at 1507 Dana Ave., Cincinnati, OH 45207; tel.: (513) 531-2222. Unsolicited manuscripts, photographs and artwork should include ample postage on a self-addressed, stamped envelope (SASE); otherwise they will not be returned. Subscription rates: A year's subscription (6 issues) is $24.96; outside of U.S add $7/year ■ Canada Publications Mail Agreement No. 0546232. Canadian return address: 2744 Edna St., Windsor, ON N8Y 1V2 ■ Copyright ©2001 by Popular Woodworking. Periodicals postage paid at Cincinnati, Ohio, and additional mailing offices. Postmaster: Send all address changes to Popular Woodworking, P.O. Box 5369, Harlan, IA 51593 Canada GST Reg. # R122594716 ■ Produced and printed in the U.S.A.

Eatin' Biscuits

We did our own research, and the results are . . .

There's a legend about the early woodworking days of Sam Maloof. Seems that one day Sam wanted to test the joint strength of a table or chair leg.

Sam's test didn't involve rigorous scientific methods. Being a practical guy, he took the mocked-up joint to the second floor of his house and chucked the thing on the driveway. The joint didn't break and Sam was satisfied.

In that same spirit, we decided to get to the bottom of the debate over which is stronger: biscuits or mortise-and-tenon joints. We were ready to fling two open-sided cubes off a water tower. But then I realized a flaw in Sam's test. Furniture is rarely thrown to the ground. In reality, all sorts of objects land on them, be it an abundant backside on a chair or a heavy object on a table.

So there was only one real test, and all the staff here knew it. Hey, we all watched poor old Wile E. Coyote try to drop that anvil on Roadrunner hundreds of times, only to become the victim of his own making. One phone call later, and a 100-pound anvil from Grizzly Industrial was on its way.

We constructed two cubes, 24" on each side, using 7/8" x 3" poplar. For one cube, each rail-to-leg joint was made using a 3/8"-thick x 2"-wide x 1 3/8"-long tenon. The legs were 2" x 2". The other cube was joined using two #20 biscuits in each joint. All joints were glued using Titebond.

To drop the anvil we set up a beam with an eye bolt. We threaded nylon rope through the eye bolt and then attached it to the anvil. On top of the cubes we set a 2"-thick, 16"-wide piece of birch.

It was amazing. In truth, we all thought the first drop at just over 4' would barely cause any damage. Were we wrong. On the first drop, the cube with biscuit joints was destroyed. The sides that took the brunt of the impact had their joints completely sheared off.

The mortise-and-tenon cube fared better. It survived enough of the first drop to warrant a second whack.

We examined the joints, and here's what we concluded. First, take care not to drop 100-pound anvils on your furniture, no matter what joints you use. Next, as we have concluded before, the wood always gives out before the glued joint does, whether it's a biscuit joint or a mortise and tenon. Last, the length of the tenon relative to the biscuit, along with the rounded shape of the biscuit, gives the mortise and tenon greater mechanical strength, glue or not, than biscuits.

Other observations? Biscuits are not a good choice for the kinds of stress that chair joints receive. If you know that what you are building will have to withstand repeated, heavy stresses, don't use biscuits. For regular woodworking biscuits are fine. And, oh yes, it was a lot of fun doing the test! **PW**

Steve Shanesy

The anvil about to hit the cube made from biscuits.

The cube made from biscuits after impact.

The mortise-and-tenon cube after the first hit.

The mortise-and-tenon cube after the second hit.

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Safety is your responsibility.
Manufacturers place safety devices on their equipment for a reason. In many photos you see in *Popular Woodworking*, these have been removed to provide clarity. In some cases we'll use an awkward body position so you can better see what's being demonstrated. Don't copy us. Think about each procedure you're going to perform beforehand. **Safety First!**

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A Fast Way to Make Octagons on the Table Saw

You Don't Need a Planer to Make Eight-sided Objects

While scanning through the April 2001 issue, I came across the "Planer Tricks" section of Steve Shanesy's article "Using Your Planer Through Thick and Thin." He offered a jig to plane octagons for turning. I have a handy trick along those lines that is probably much quicker (one pass per corner) but uses a table saw (obviously not in the scope of the article).

Set the table saw blade to 45°, raise it up to give a good surface along the blade, then lay a flat side of your square stock on the blade. Slide the fence up to the resulting corner, and lock it there. Remove the stock from blade, lower the blade to a safe height that just cuts through the stock, fire up the saw and rip off the four corners. This produces very nice octagons for turning (although they might not be perfectly regular, they will be close enough to chuck up on a lathe). Keep up the great work on a great magazine.

Doug Sager
Denver, Colorado

Other Places You Can Find Help With Compound Miters

I just read the letter from George F. McCullough in the April 2001 issue of *Popular Woodworking* about cutting compound miters. Recently, I also looked into calculating the angles required to cut various compound miters. After searching the internet for some solutions, I came across a website (www.turnedwood.com) called "Kevin's Woodturnings." Kevin Neelley is an extremely helpful and talented gentleman. His works represented on his website are incredible and inspiring. Kevin also has a software program available that will calculate exactly what blade angle and miter angle are required to make practically any number-sided figure. He uses his program for calculating the compound angles required in segmented bowl turning. It can easily be used for other applications. Kevin also made me aware of other websites which would help to determine compound miters. These sites are Better Woodworking (www.betterwoodworking.com/compound_miter.htm) and Badger Pond (www.wwforum.com/faqs_articles/miter_formula.html). Badger Pond explains the mathematics behind calculating these angles, and Better Woodworking's website includes an informative chart with all of the blade tilts and miter gauge angles listed. I might add, Kevin and Badger Pond's sites both include illustrations which help to explain the slope.

Thanks to Kevin for his help and insight. If it weren't for him I would probably still be looking for this information.

Brook Snyder
Lakeland, Florida

Editor's note: You also can download Nick Engler's compound miter calculator for the Excel spreadsheet from our website at: www.popwood.com/features/mag.html.

Why Do Horsepower and Amps Never Seem to Add up?

I am a marine engineer by trade and at the risk of sounding stupid, perhaps you could explain to me the difference that occurs between horsepower and amps in machines sold in the United States and rated for that market. In Europe when you buy a machine, regardless of its type, it is rated in

We Want to Hear From You

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watts or kilowatts. The formula, as I am sure you know, is the same all over the world: wattage = volts x amps. The make of tool is not important.

A router advertised in your February 2001 issue has a motor rated at 15 amps. By my calculations, wattage = 110 volts x15 amps = 1,650 watts. There are 749 watts for every horsepower, so 1,650/749 = 2.2 hp.

In your test it states the router is 3 hp. Could you please explain this difference?

Andrew J Ferrie
Dordrecht, the Netherlands

Editor's Note: The easy way to explain the difference between what the box says the horsepower is and the real power of the tool is to chalk it up to exaggeration. Some manufacturers derive horsepower by using a formula that uses rpms and torque. Other manufacturers use "developed" horsepower, which can be calculated by stalling the motor and seeing how many amps the tool uses to pull itself out of the stall. In truth, even amperage is an inaccurate yardstick for measuring power because some highly efficient motors can produce great torque while consuming few amps. The best measure, in our book, is to compare the torque of the various machines — a statistic that is rarely found on tools except for cordless drills.

— Christopher Schwarz, senior editor

Even Basic Planers Work Fine

I would like to offer a comment on the reliability of my planer, a Delta Model 22-540C. I bought the machine in 1994 and used it to plane all the rough lumber (Eastern white pine, cedar and spruce) we used when we built a 1,200-square-foot cottage and a 16' x 30' deck.

Most of the timber was sawn with a Wood-Mizer and air dried. I have gone through two sets of knives so far and the brushes in the motor still have some life left. The machine is still in use and my solution to the dreaded snipe problem is I cut the boards a bit longer, plane them and then trim the ends to length. The only problem I have concerns the flimsy stamped metal table extensions that attach to the machine with a screw/keyhole system. **PW**

John Askitis
Eganville, Ontario

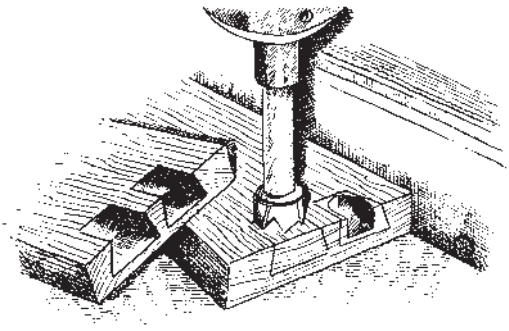
Illustrations: John McCormick

Forstner-Powered Dovetail Pins

THE WINNER:

Use Your Drill Press to Remove Waste

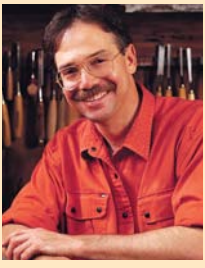
In an article in the February 2001 issue of *Popular Woodworking* the time-honored way of creating half-blind dovetails is illustrated. The steps showing chiseling and paring away the waste between pins can be largely eliminated by using a Forstner bit to remove the waste. Set up a Forstner bit (the diameter equal to your drawer side thickness) in your drill press and set the depth stop to just clear the bottom layout line. Drill into the rear face of the piece, then simply pare the remaining waste for a perfect fit. This trick saves a lot of time.



Robert Poole
Vancouver, British Columbia

TRICKS OF THE TRADE FROM THE AMERICAN WOODSHOP

GREETINGS FROM 'THE AMERICAN WOODSHOP'



As host of "The American Woodshop" I've collected a lot of tips, tricks and great woodworking ideas over the years. Some are basic helpful hints, while others are just good common-sense solutions to everyday problems. I'm happy to share these with you here. In addition to my ideas, we pick the best tip or trick sent in by a reader and publish it on these pages as well. Delta Woodworking Machinery is the sponsor for the Tricks of the Trade column, and the company is giving away a model 46-250 Midi Lathe (shown at left) to the best "trickster."

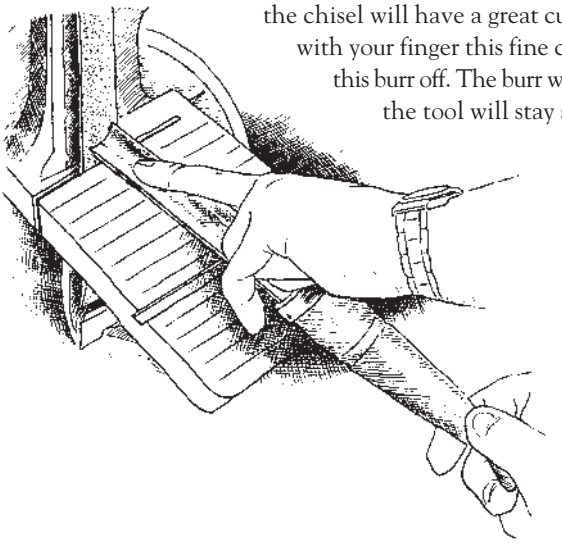
To submit your tip or trick, e-mail it along with a daytime phone number to DavidT@FWPubs.com or mail it to: Tricks of the Trade • *Popular Woodworking* • 1507 Dana Ave. • Cincinnati, OH 45207.

- Scott Phillips

DELTA MACHINERY

The Sandpaper Sharpening Solution

For decades carvers have used thin-belt sanders (sometimes called strip sanders) to sharpen carving chisels. These inexpensive machines are also useful for sharpening lathe chisels. Everyone has different preferences on techniques, but I like to use 100- and 120-grit aluminum oxide belts (the purple stuff) to sharpen my lathe chisels. The beauty of using sandpaper to sharpen lathe chisels is the wonderful burr it creates on the cutting edge. My technique is to first adjust the angle of the sander's table so the bevel of the chisel is flat against the belt. The chisel blade or shank should be resting securely on the sander's table during the entire sharpening process. Turn on the sander and ease the bevel into the moving belt. Keep the blade flat to the table with one hand and guide the sharpening process with the other hand. Watch your fingers! Keep the tool moving against the belt and it won't overheat and become blue. Once the bevel is uniform from the heel to the cutting edge the chisel will have a great cutting burr. You'll be able to feel with your finger this fine curl of cutting steel. Don't hone this burr off. The burr will produce wonderful results and the tool will stay sharper longer, especially if the blade is made of high speed steel. The only lathe chisel that I hone is the skew. The burr on a skew can be lapped off with a fine diamond stone very effectively. You'll be amazed how effective a strip sander is for sharpening chisels of all makes and sizes.



— Scott Phillips

Turners' Top Tips: How To Turn Like A Pro

Few activities are more enjoyable than turning a project on a wood lathe. I can only think of two. Anyway, if you've ever marveled at how professional turners make it look easy, read on.

First: remember that they practice a lot. Experience is the best teacher.

Second: they use only sharp lathe chisels. If the tool is getting really hot while cutting, or only sawdust flies off the cutting edge, then it's dull. Sharpen it and everything will become twice as easy.

Third: the lathe must be stable and vibration-free, so weigh it down. Better yet, bolt it down.

Fourth: adjust and lock the tool rest so it positions the cutting edge of the lathe chisel right at or slightly above the centerline of the workpiece. This is the most common mistake. Often beginning turners miss this adjustment and get "grabby" cuts that produce chatter. Naturally there are exceptions to this centerline rule. For instance, the lathe skew should be throwing the shavings off the workpiece halfway between the centerline and the top diameter of the workpiece. Otherwise it, too, will be "grabby."

Now head to the lathe and try these tips before you are tempted by the first and second best things in life. Enjoy!

— Scott Phillips

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Tricks of the Trade

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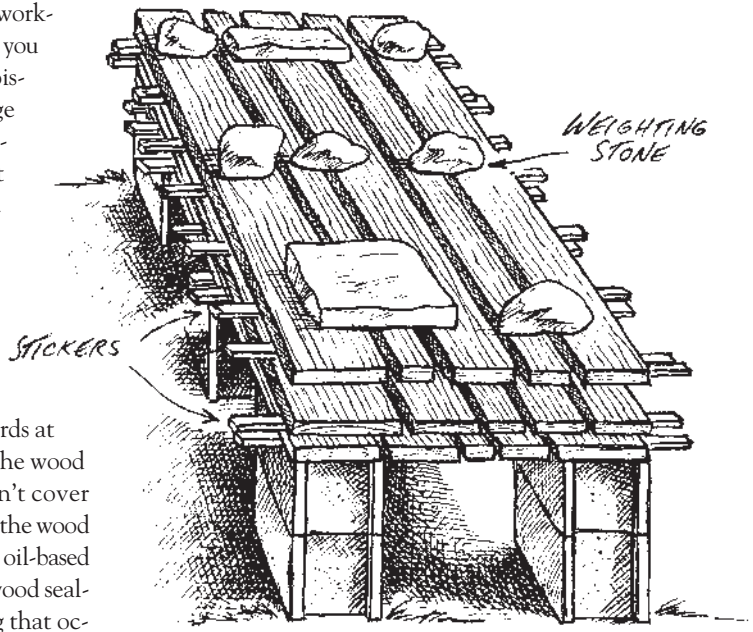
Air-Dried vs. Kiln-Dried

One reader recently asked what the keys were to working with air-dried lumber. The simple answer is that you must use a moisture meter to make certain the moisture content is from 6-10 percent. The ideal range is from 6-8 percent, yet this is rare in air-dried lumber. So here are the tips: always dry lumber at least 18" off the ground and in a well-ventilated, dry place. Try to avoid temperature extremes such as hot, poorly ventilated attics. Sticker the green wood with ¾"-square wood strips (called "stickers") at 18" intervals. Always place the "stickers" perpendicular to the boards being dried and keep them in line above one another, otherwise a stack of improperly positioned stickers will make all the boards at the bottom wavy. While it's a good idea to cover the wood to keep rain off (not shown in the drawing), don't cover the sides or the air won't be able to circulate around the wood evenly. Sealing the ends of the boards with either an oil-based paint or even better a specially formulated green wood sealer will limit the amount of splitting and checking that occurs. Finally remember that green wood generally requires two summers of air drying for every inch of thickness. The old rule of one year per inch applies only to ideal air-drying conditions.



— Scott Phillips

Lee Valley Adds to Veritas Plane Line with #4½ Smoothing Plane

Veritas of Canada has entered the bench plane market with a #4½ smoothing plane that the company says is the first new hand plane design in ages.

Well, maybe. The Veritas #4½ smoothing plane will look radical to woodworkers on this side of the Atlantic, especially the fact that the rear handle isn't attached to the base of the plane. Instead, it's attached to the frog, which supports the blade. British woodworkers will recognize this feature from the Narex 3 and the Marples X04 planes.

But what seems truly different about the Veritas #4½ is the fact that the frog extends to the sole of the plane and rides the wood you are smoothing. This, according to Veritas, reduces blade chatter. Other differences include two adjustable setscrews on either side of the blade that help prevent it from shifting during use. And you can easily close up the mouth of this plane when you want to take fine shavings or work in difficult woods.

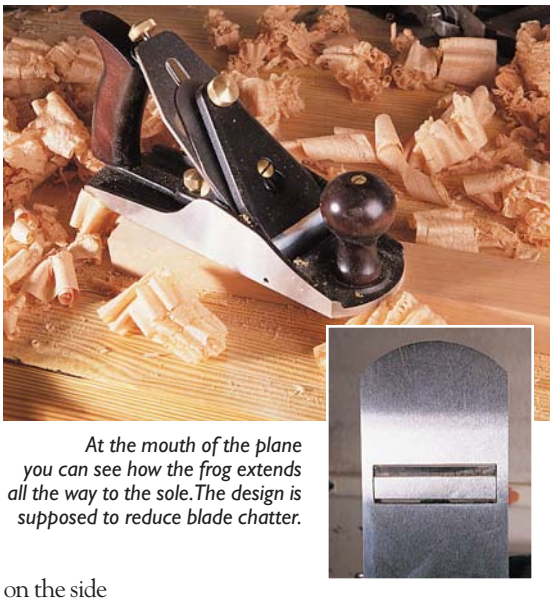
That is an improvement over what most woodworkers are used to. When you want to close up the mouth of a Stanley plane, it's a complex dance of releasing screws, adjusting screws and changing the depth of your cut. On the Veritas #4½, you usually have to loosen one knob and turn another.

And while adjusting the mouth is simple, setting up this plane is not for the novice. I've set up two of these planes, and here's what I found. The soles of both were reasonably flat out of the box. The blades came ground and honed, though both needed to be flattened, reground and honed. Plus I rounded the corners of the iron to keep them from digging into the wood.

Once the iron is sharpened, tuning the plane to cut a nice shaving was a balancing act. First make certain your chipbreaker is tight against the blade. Sharpen the chipbreaker to make sure, or you'll regret it later. When I closed up the throat nice and tight (like I do on my old Type 11 Stanley #4½) the Veritas' throat became clogged with shavings after a couple passes. After backing out the frog a bit, I got good results. I also was flummoxed by the setscrews on the side of the plane. Maybe I'm just a lummox with a screwdriver, but when I eased the screws up to the side of the blade I knocked it out of square several times before getting it right. The final delicate dance occurred while setting the frog. In addition to the one knob you must loosen to move the frog, there's also a "frog locking screw" located beneath the blade. If this is too tight, you can't move the frog. If it's too loose, the handle and frog will shift as you plane. So you have to find the sweet spot.

So how does she cut? Once fettled, it's a good plane. Though the design has yet to be proven, the price is less than you'd pay for a Lie-Nielsen #4½ or a vintage Stanley Bed Rock #4½. So it's worth a look.

— Christopher Schwarz



At the mouth of the plane you can see how the frog extends all the way to the sole. The design is supposed to reduce blade chatter.

SPECIFICATIONS:

Veritas #4½ smoothing plane

Street price: $159
Body size: 2⅞" x almost 10"
Body material: ductile iron
Blade size: ⅛" thick; 2⅜" wide
Blade adjustment: Bailey-style, controls both cut and lateral adjustment
Blade angle: 30° bevel; 35° microbevel
Weight: 5 lbs.

Performance: ●●●◐○
Value: ●●●●○

Lee Valley Tools 800-871-8158, or www.leevalley.com

For more information, circle #144 on the Resource Directory Coupon.

How We Rate Tools

At *Popular Woodworking* we test new tools and products with an honest, real-world workout. We check for ease of assembly and determine how clear and complete the manuals are. Then we use the tool in our shop to build projects that appear in the magazine. Each issue, the magazine's editorial staff shares its results and experiences with the tools, rating each for performance and value.

We use a one-to-five scale, with "five" in performance indicating that we consider it to be the leader in its category. For value, "five" means the tool is a great deal for the money, while "one" means we consider it pricey. However, a tool with a low value rating may be worth the high price.

If our tool reviews don't answer all your questions, e-mail me at DavidT@FWPubs.com or call me at 513-531-2690, ext. 255. If we haven't reviewed the tool you're considering, there's a good chance I've used the tool, but simply haven't had a chance to write a review. Give me a call and see if I can help. You can also visit our website www.popwood.com to check out our past published tool reviews and sign up for our free e-mail newsletter (focusing on tools) that's sent out every other week. —*David Thiel, senior editor*

Craftsman Offers the First Corded Drill with Cordless Drill Features

Not too long ago it seemed the corded drill was becoming obsolete thanks to the amazing array of cordless drills becoming available. Corded was only necessary for big-time torque and unlimited run-time. One black eye for corded drills was that cordless drills had features you couldn't get on the tools needing an outlet, such as a clutch and a two-speed gear box. Craftsman got smart and has introduced a corded drill that is the best of both worlds. The new 27994 ⅜" drill offers a 5.5-amp motor that provides a torque range from 150 to 700 in./lbs. It also offers a two-speed gear box, a 24-position adjustable clutch and a single-sleeve keyless chuck. Add a 10' rubber cord, plastic carrying case, 360° auxiliary handle and a 30-piece bit set for $100 and you've got a nice package at a good price. Initially we were surprised a drill this size had a ⅜" chuck and not a ½", but when we put the drill through its paces we didn't find it lacking in any way (except when we wanted to chuck up a ½"-shanked bit). The mid-handle design and overmolded soft grip made it comfortable to use. The auxiliary handle is convenient, but isn't honestly designed for abuse. While 24 positions on any clutch is more than you need, having a multi-position clutch is very handy. Even more useful is the two-speed gear box. Even the bit set components (drill bits, screw tips, magnetic holder, spade bits and nut drivers) were a pleasant surprise. While not of the highest quality, they'll certainly get used and are welcome extras.

—David Thiel

SPECIFICATIONS:

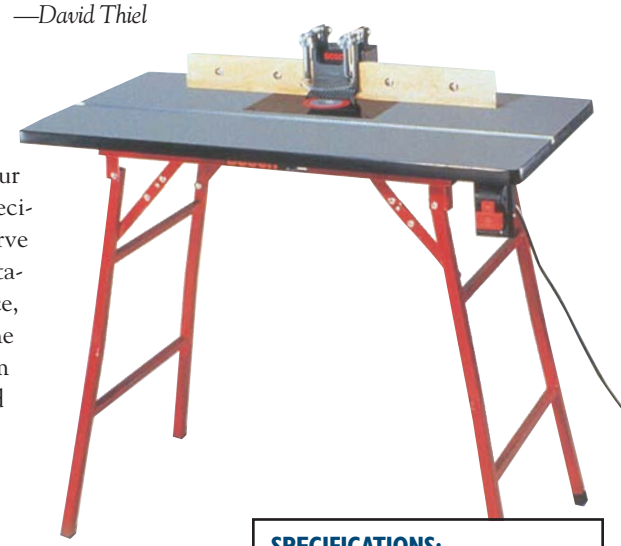
Craftsman #27994 ⅜" Drill

Street price: $99.99
Motor: 5.5 amp
Torque: 150 to 700 in./lbs.
Speeds: 0-400/0-1,400 rpm
Chuck: ⅜", 24-position clutch
Performance: ●●●●○
Value: ●●●●○

Sears stores are located in most cities. Or visit www.craftsman.com

For more information, circle #145 on the Resource Directory Coupon.

Bosch RA1200 Router Table Offers Stationary Features in a Portable Unit



We've debated the value of buying a router table versus making your own a number of times. Making your own is the most economical decision, but there are still a number of manufactured models that deserve a look. The RA1200 from Bosch is a portable table that provides a stable, tabletop-height work surface. The fold-up legs lock firmly into place, and one leg sports an adjustable foot to level out the table quickly. The 24" x 44" tabletop is one of the largest available, offering plenty of room to maneuver and support work. The mounting plate is located toward the rear of the table (which is where it should be) rather than in the center. The insert itself is sturdy, easily adjusts flush to the tabletop and has snap-in rings to quickly change the throat size for safety. The fence is machined cast aluminum with plywood faces and a 2½" dust collection port. The fence is of an adequate height for most tasks and we found it to be square to the table and easy to adjust. The fence also has a built-in mechanism above the opening with an attached fingerboard and finger guard. The mechanism looks over-complicated and takes a few minutes to set up, but once in place it is fairly easy to use and very versatile in positioning. Another feature we like is the power switch mounted to the front of the table that keeps you from fumbling under the table to turn on the router. There is also a slotted aluminum T-track mounted in the table to mount another fingerboard or a miter gauge. All in all Bosch thought of a lot of things to make this a useful router table. We have only two gripes. For a portable model, this thing is still pretty darn heavy and could use a set of wheels. Also while it's got lots of nice features, its $350 price tag makes us think again about the economy of making our own table.

— David Thiel

SPECIFICATIONS:

Bosch RA1200 Router Table

Street price: $350
Table: 1¼" x 24" x 44", MDF/laminate
Fence: 3¼" x 30", birch ply/aluminum
Insert: Rousseau-style, 2 insert rings
Weight: 76 lbs.
Performance: ●●●●○
Value: ●●●○○

Bosch: 877-267-2499, or www.bosch.com

For more information, circle #146 on the Resource Directory Coupon.

Two Terrific Tools

Making a router plane and a beader is simple using shop scraps and scrap metal.

If you are asking yourself, "Making a what?" don't feel bad. I spent the first half of my woodworking career not even knowing what a router plane or a beader was — and the second half wondering how I did without them.

Simply put, a router plane cuts a groove while a beader shapes an edge. Together, these two simple handle tools do some of the same jobs that a handheld electric router does. And they do them just as accurately with a minimum of set-up time. In some applications, they are more capable and versatile than a router. And best of all, they won't cost diddly. You can make them in a few hours from scraps.

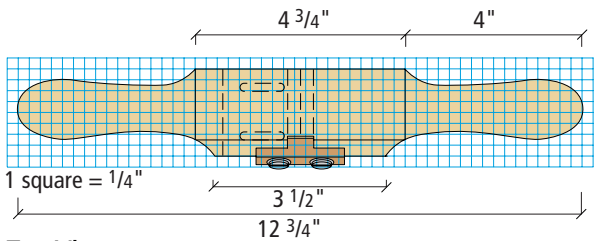
Photo by Al Parrish

A beader (above) is a great tool for hand detailing furniture and is easier and safer than an electric router in some cases. A hand router excels at cutting hinge mortises and cleaning out grooves.

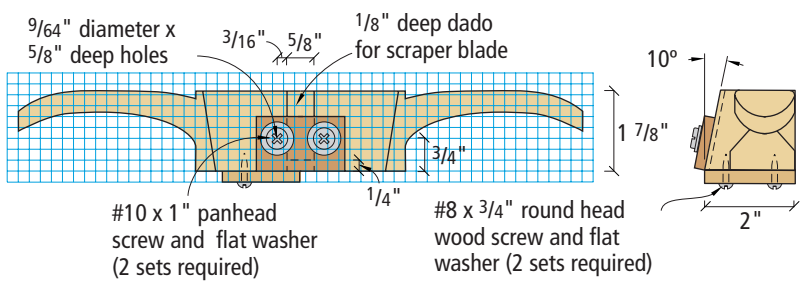
The Beader

A beader is a small scraper plane. But instead of scraping a flat surface, it scrapes a profile. Because it scrapes away such a small amount of stock with each pass, you don't have to worry about chipping or tear-out. Nor do you need to sand the shapes afterwards to remove millmarks. You can scrape smooth profiles in highly figured wood, if need be. You also can cut much smaller profiles and a greater variety of them than you can with a router. You can make a scraper blade from a worn-out hacksaw blade and file whatever shape you wish to make.

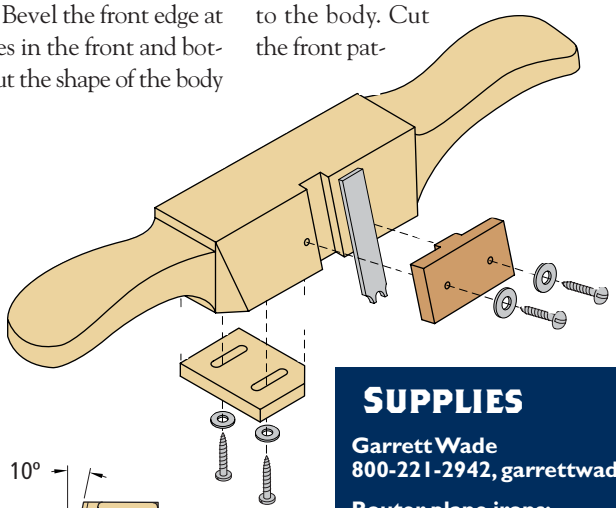
Create the body of the beader from a scrap of hardwood. Bevel the front edge at 10°, then cut dadoes in the front and bottom faces. Rough out the shape of the body by making a compound cut on a band saw. To do this, first trace both the top and front patterns of the body on the wood. Cut the top pattern first, then tape the waste back to the body. Cut the front pat-



Top View



Front View



Supplies

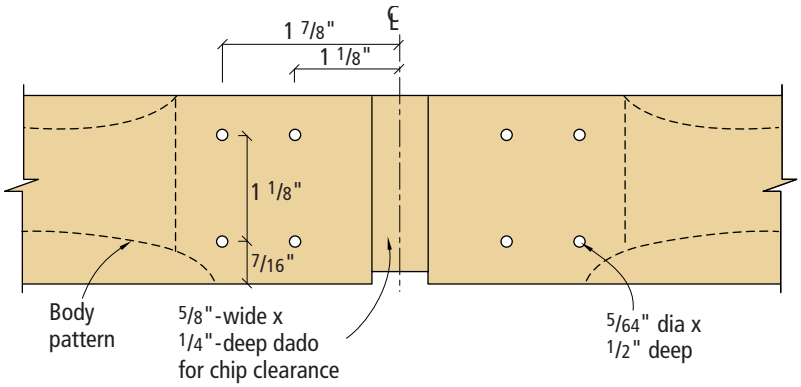
Garrett Wade
800-221-2942, garrettwade.com

Router plane irons:
½" blade, item # 23P07.04, $13.25
¼" blade, item # 23P07.03, $13.25

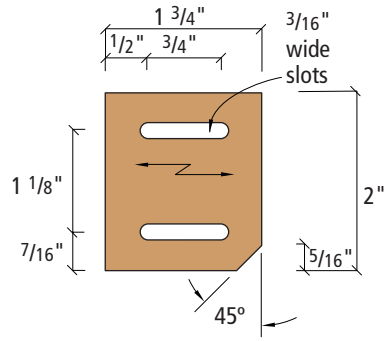
Beader blades:
5 scratch stock blanks, item # 25K01.02, $7
8 cutters, pre-shaped, item # 25K01.03, $40

continued from page 19

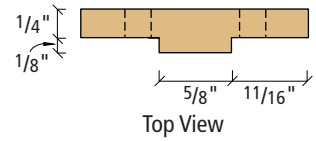
The trick to using the beader is to draw it along the wood in the opposite direction in which the blade is sloped, just like a scraper. Don't press too hard — light cuts will get you the results you want faster than heavy ones.



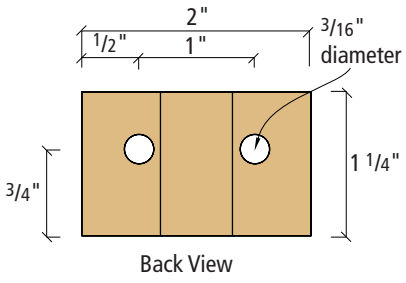
Bottom Detail



Fence Layout



Top View



Back View

Clamp Layout

tern, discard the waste, and round over the edges of the handles with a rasp so they fit your hands comfortably.

Also make a blade clamp and a fence. These simply screw onto the body. Note that the ¼" fence can be mounted on either side of the blade, depending on the operation.

To use a beader, first make sure the blade is sharp. Lightly file the profile to create a burr or turn the burr with a burnisher, just as you would sharpen a scraper. When mounting the blade, set the depth and be sure the burr faces in, toward the body. Align the beader on the work with the beveled front facing away from you. Draw the tool toward you, applying light pressure, and the blade will remove a small amount of stock. Repeat until you have cut the profile to the desired depth.

The Router Plane

Like the beader, the iron of a router plane reaches down below the bottom of the tool. But this plane iron cuts rather than scrapes. If you're up for a little blacksmithing, you can make your own iron from a length of tool steel. (I made the iron shown here from drill stock.) You can also buy the irons from most mail-order woodworking catalogs.

Centennial Flyer Update

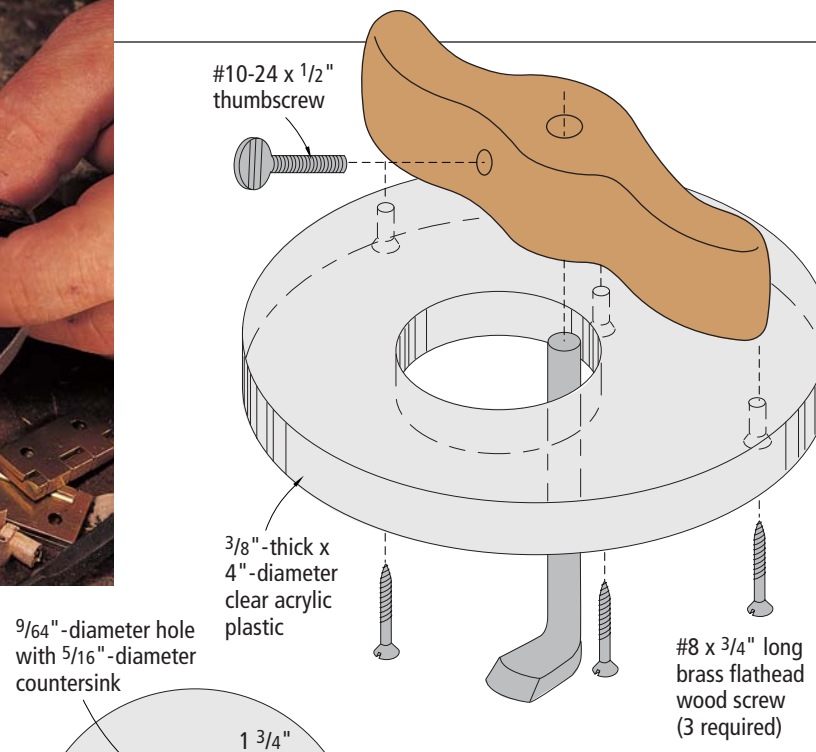
We've run our first workshops in Lakeland, Fla., and Norfolk, Va., made a few ribs for the 1903 Wright Flyer we're building, and I'm happy to report that the results were outstanding. Both the kids and the adults had a great time, they turned out some very usable airplane parts, and everyone went home with their fingers and toes intact, mostly. We've started shipping the workshop kits to the volunteer leaders and by the time you read this, we should be assembling the first wing.

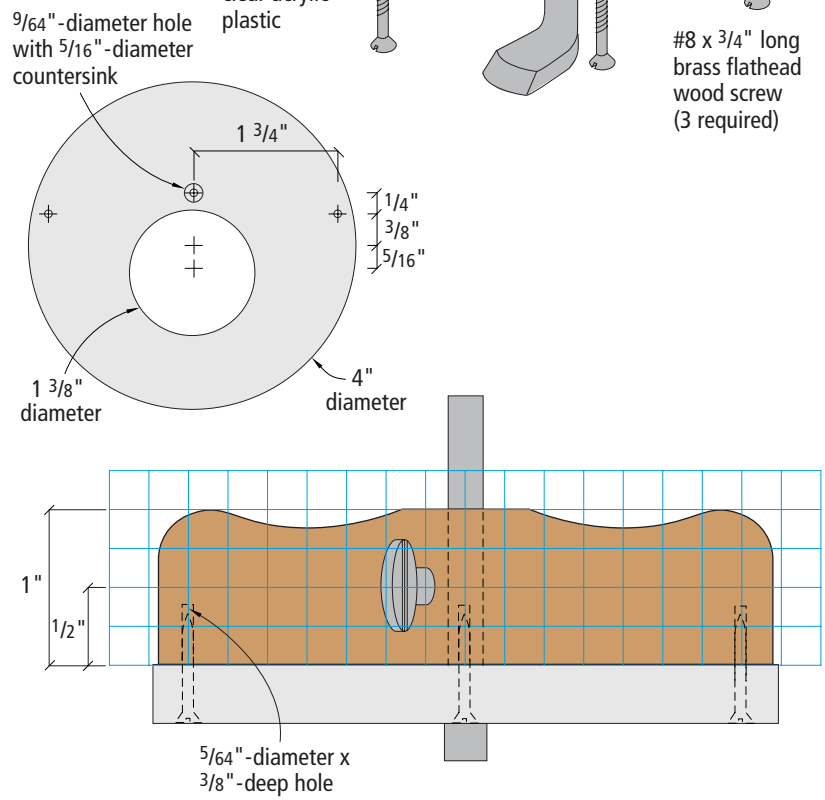
Thanks to Ross Walton of Vintage Aero Fabrics in Mendon, Vt., we've been able to locate a covering for the wings that is just a few thread counts off the original. "Pride of the West" muslin, which the Wrights used to cover the wings of their Flyer, was a cotton fabric that was used mostly for women's undergarments. It's no longer available, but Ross found a cooperative mill that ran off enough to cover a few vintage airplanes — or a small town of Victorian ladies.

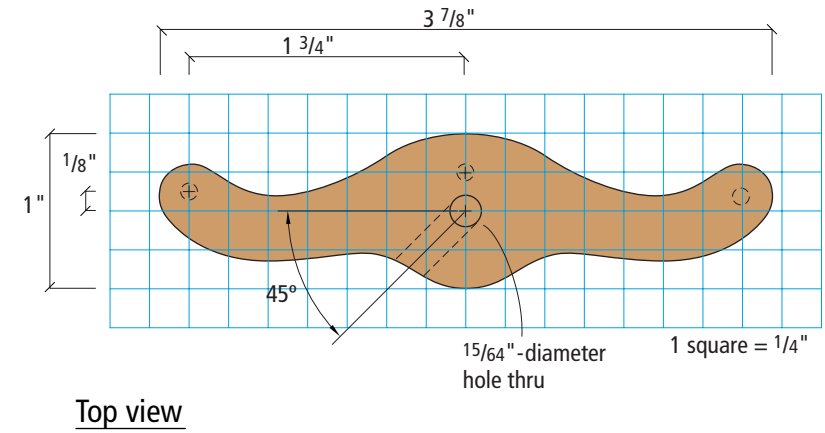
By the way, we're on our way to Kitty Hawk on Sept. 8 and 9 of this year to test fly our replica of the 1901 Wright Glider. (Last year, we flew our 1900 Glider on the centennial of the Wright's first gliding flights.) If you'd like to see us fly, consider yourself invited. If you can't make it, we'll be web-casting the flights at our web site, www.wright-brothers.org.

Patrick D'Angelo makes his mark on aviation history.

I've found that the plane seems to cut better if you "pivot" it into the wood. Hold one side of the handle stationary and push the other so the cutting edge swings in a small arc.







While you can make the base from hardwood, I recommend clear plastic. This lets you see the cut as you make it. Cut the handle from very hard wood, such as rock maple. (I used a scrap of rosewood.) You need the hardness to cut threads for the thumbscrew. I've found that an ordinary metal tap works reasonably well when cutting small threads in hard wood, provided you don't need to tighten the threaded fastener much. I imagine the threads will eventually become too loose to hold the thumbscrew — mine is still tight after several years — but you can make a new handle simply enough.

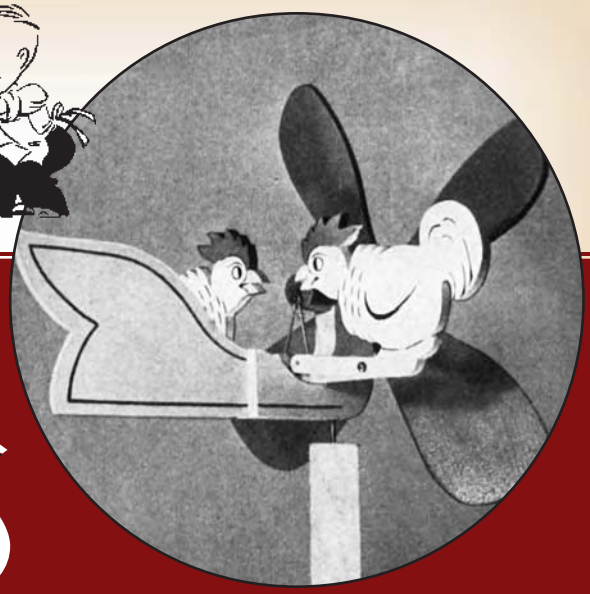
Mount the iron in the handle and set it to the desired depth of cut. Don't try to remove more than 1/32" of stock at a pass; you get better results if you just shave the wood. I use my router plane for trimming the bottoms of dadoes, grooves and mortises when I need them just a little deeper. Where this tool shines is in making hinge mortises. In fact, you can use the edge of the hinge leaf as a gauge to set the depth of cut. Cut the outline of the mortise with a chisel, then shave away the waste with the router plane. The mortise will be perfectly flat across the bottom and just the right depth. **PW**

Nick Engler is the author of over 50 books on woodworking, plus countless articles and project plans. Currently, he's organizing kids across America to build ribs for a full-size replica he's building of the first true airplane, the 1903 Wright Flyer.

The Deltagram

A nostalgic look back at plans published by Delta Machinery during the World War II era.

From Practical Projects, Book #9, 1945



Fighting Roosters

You'll like this for the lawn or atop the garage. Make the cutouts from the full-size plan, and paint both sides. The vane is white; prop, red. Slots in the prop hub for the blades are cut on the table saw before sawing the hub to thickness. All hub corners are sanded. The unit is mounted on a metal pin, which should be a loose fit inside the pivot tube to permit turning of the vane. **PW**

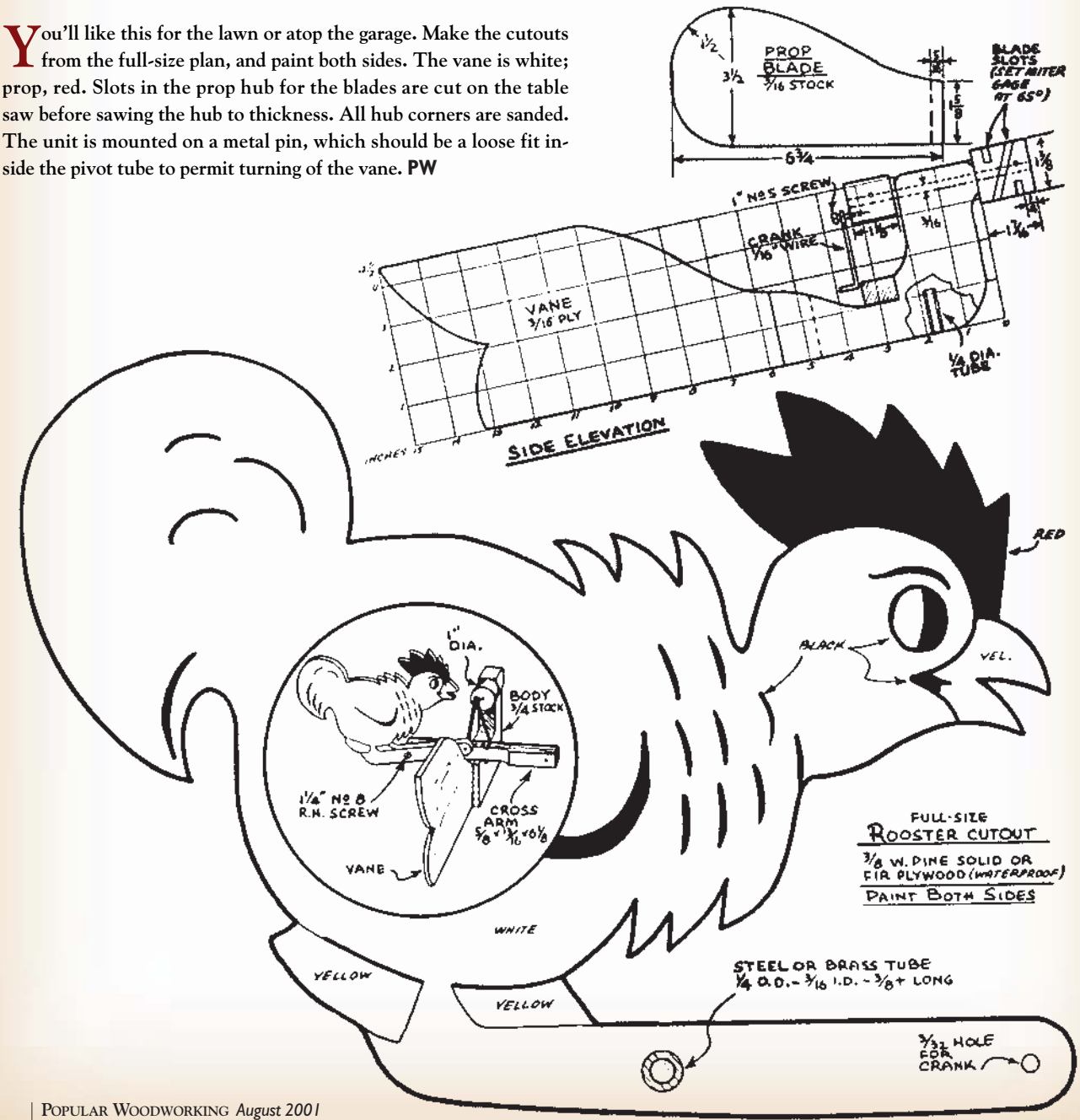


Photo by Al Parrish

Country Dry Sink

Though this dry sink won't store pitchers of milk fresh from the cow, it will give your kitchen an old-time feel that no modern cabinet could.

Traditional American dry sinks were made from yellow pine and had deep wooden troughs on top that were useful for storing pitchers, churns and buckets of liquids. Now that we've got refrigerators and ice makers, the dry sink has graduated to become an expensive item at antique markets.

This updated version preserves the form of the traditional dry sink, with its high splash guard on back and storage down below, but I've altered a few key components. Instead of a sunken wooden trough on top, I've added two drawers. And instead of yellow pine, this dry sink is made from curly maple. Put the finished project in your kitchen to add a country touch to a farm home, or use it as a buffet in an informal dining room.

Traditional Construction

I build all my casework the same way, and I'm convinced that these methods will ensure that the furniture will be around for a long time. Begin by building the face frame of the cabinet because most of the cabinet dimensions are based on the face frame. I use mortise-and-tenon joinery to join the rails and stiles. I make the tenons on all the rails 1" long, and all the mortises $1\frac{1}{16}$" deep, which will ensure your tenons won't bottom out in your mortises and give some space for excess glue to go. Dry-fit the face-frame parts, then put glue in the mortises and glue up all the rails and stiles. Start with the center rail and stile and work out.

Doors Next

Once the glue is dry from the face frame, I like to make my doors because they are easier to hang and fit while the face frame can be laid flat on my bench. The doors are built much the same way as the face frame, with 1"-long tenons on the rails. To hold the panel in place, I plow a $\frac{3}{8}$" x $\frac{3}{8}$" groove down the inside edge of all the door parts. Be sure to make the tenons on the rails haunched because of this groove.

Once you have the rails and stiles fit, measure the opening for the panel and cut your stock to size, making sure that you leave a $\frac{1}{8}$" gap all around to accommodate

by Troy Sexton

Troy Sexton designs and builds custom furniture in Sunbury, Ohio, for his company, Sexton Classic American Furniture. Troy is a contributing editor for Popular Woodworking.

Begin building the top by gluing and nailing the side splash pieces to the back splash pieces. I like to hold the back splash in place using a vise to keep everything in line as it's nailed together.

Now glue and nail the splash pieces to the top. Turn the splash upside-down and put a bead of glue on the entire length of the back splash. Then put a bead of glue on the back third of the side splash. If you glue the entire side splash, your top might bust apart after a few seasons.

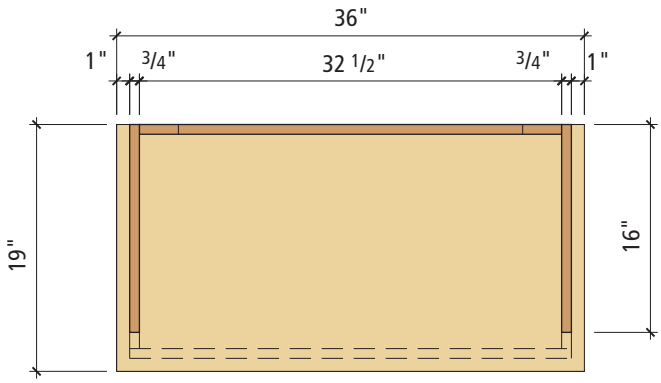
Place the top on the splash assembly and nail it in place through the underside of the top.

wood movement in the panel. I cut an 8° bevel on the edges of the panel using my shaper, though you can easily cut this bevel by tilting the blade about 12° on your table saw. Finish sand the panel and add one coat of stain.

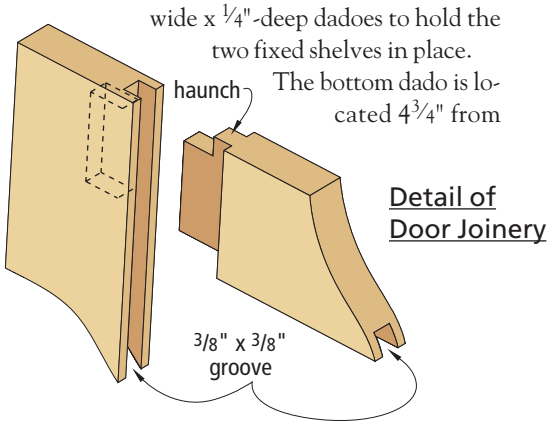
Place the panel in the groove, glue up the mortise-and-tenon joints and clamp the doors. You'll notice that I make the doors the same size as my opening in the face frame. This is on purpose. Once my doors are complete, I trim them to size on my jointer. Hang the doors in the face frame, then remove the doors and move onto the case.

Build the Case

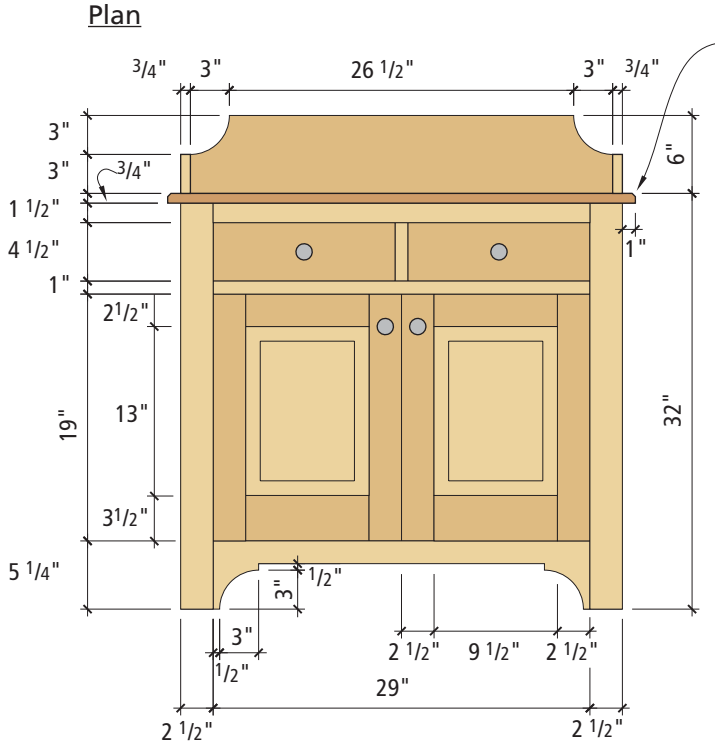
Begin building the case by gluing up some boards to make the side pieces and shelves. Once those are cut to finished size, cut ¾"-wide x ¼"-deep dadoes to hold the two fixed shelves in place. The bottom dado is located 4¾" from



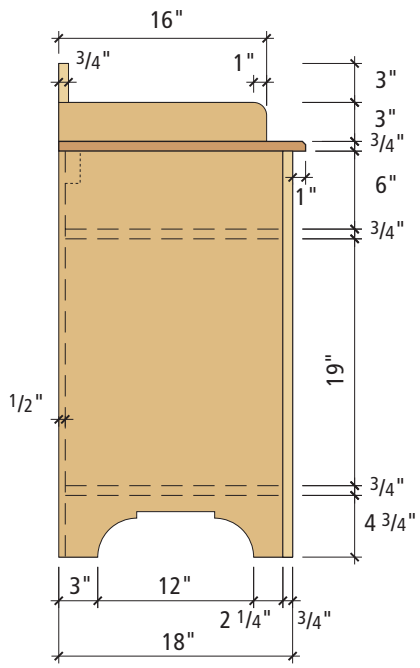
Plan



Detail of Door Joinery



Elevation



Profile

Country Dry Sink

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	NOTES
Face Frame							
❑	2	Stiles	3/4	2 1/2	31 1/4	Maple	
❑	1	Top rail	3/4	1 1/2	31	Maple	1" TBE
❑	1	Bottom rail	3/4	5 1/4	31	Maple	1" TBE
❑	1	Mid-stile	3/4	1	6 1/2	Maple	1" TBE
❑	1	Mid-rail	3/4	1	31	Maple	1" TBE
Case							
❑	2	Sides	3/4	17 1/4	31 1/4	Maple	
❑	2	Fixed shelves	3/4	16 3/4	33	Maple	
❑		Back	1/2	33	31 1/4	Poplar	shiplapped
❑	1	Top	3/4	19	36	Maple	
❑	1	Splash, back	3/4	6	32 1/2	Maple	3" radius
❑	2	Splash, sides	3/4	3	16	Maple	1" radius
❑	1	Nailing strip	3/4	1 1/2	32 1/2	Poplar	
Doors							
❑	4	Stiles	3/4	2 1/2	19	Maple	
❑	2	Top rails	3/4	2 1/2	11 1/2	Maple	1" TBE
❑	2	Bottom rails	3/4	3 1/2	11 1/2	Maple	1" TBE
❑	2	Panels	5/8	10	14	Maple	
Drawers							
❑	2	Fronts	3/4	4 3/8	13 7/8	Maple	
❑	4	Sides	1/2	4 3/8	17	Poplar	
❑	2	Backs	1/2	3 1/2	13 7/8	Poplar	
❑	2	Bottoms	1/2	16	13 3/8	Poplar	

TBE = TENON ON BOTH ENDS

the bottom edge of sides. This will make the bottom shelf stick up 1/4" above the bottom rail of the face frame and serve as a door stop. The second dado should be flush to the top of the center rail because the drawers will ride on that shelf. Now cut 1/2" x 1/4" rabbets in the sides for the back.

Put a bead of glue in the dadoes, then put the shelves in the dadoes and nail the case together through the sides. Some people might wince at nailing a case together this way; I don't. I figure that when the glue finally gives way, as it will someday, it's the nails that will hold the piece together.

Now nail the nailing strip between the sides. The nailing strip should be flush to the top of the sides and 1/2" in from the back edge of the sides. You'll nail your back to this when the project is complete.

To complete the lower case, glue and nail the face frame to the case. When the glue is dry, cut the shape of the base on the front and sides using a jigsaw. Then clean up your cuts using sandpaper. Now it's time to move on to the top.

Make the Top to Last

There's some cross-grain construction in the top, so you need to be careful about how you put it together to ensure the top doesn't self-destruct.

Begin by gluing up the boards for the top piece, cutting the top to finished size and sanding it to its final grit. Cut a 1/4" x 1/4" chamfer on the top edge to soften the edge.

Cut your three splash pieces to size and cut the curved parts. The back splash gets a 3" radius cut on either end. And the side splashes get a 1" radius cut on the front edge as shown in the drawings. Finish sand all the pieces and follow the instructions under the photos.

Finishing Touches

I make the drawers using half-blind dovetails. I build a simple jig that cranks these out in just a few minutes. See the jig in action at www.popwood.com/features/fea33.html.

To keep the drawers running straight, I nailed in 3/4" x 1" strips of wood on the upper fixed shelf and stops at the back of the case to keep the drawer fronts flush to the front of the case.

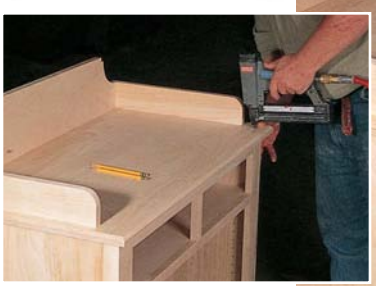
The back is made from 1/2"-thick poplar boards that I shiplap so the edges overlap. I also cut a bead on the shiplapped edges using a beading bit in my router. Fit the back pieces, being sure to leave a gap between each board; don't nail them in place until the dry sink is finished.

Now finish sand all the parts, putty your nail holes and dye the project. I use a diluted red aniline dye, followed by three coats of lacquer. **PW**

Sources

Horton Brasses Inc.
800-754-9127
1 1/4" knobs (4)

Woodworker's Supply
800-645-9292
Amerock adjustable hinges (4)
item #891-749, $2.95 each



Now put a bead of glue on the side pieces and top rail of the face frame.The sides will expand and contract the same as the sides pieces so there isn't a cross-grain problem here.Toenail the top into the case piece.

MORTISER SLUG-FEST

Forget what you've read about mortisers when it comes to the motor speed. Slower is not always better.

When you buy a table saw from almost any manufacturer, chances are it's going to function fine. Over the last 65 years, the people who make table saws have figured out what works well on this machine and have borrowed each others' best ideas so that the differences between competing saws at a certain price are usually minor.

Not so with benchtop mortisers. These relatively new machines are still in their infancy. As a result, many of the machines have fundamental differences that are worth paying attention to. Manufacturers are starting to figure out what works, and many of these machines have undergone face-lifts in the last five years as a result.

Rest assured all of these machines will make square holes. It's just that some machines make the process easier than others. Until the day comes when mortisers have evolved more like table saws, here's what you should look for when shopping.

About the Test

We wanted to make sure we tested the machine and not the chisel, so we equipped each machine with a 3/8" professional-grade chisel from Delta Manufacturing. To reduce the chance that one bit was sharper than the others, we sharpened each auger bit the same way before the test.

After installing the bit with 1/8" clearance between chisel and bit, we determined if the chisel was square to the table. If it wasn't (and it rarely was)

by Christopher Schwarz

Comments or questions? Contact Chris at 513-531-2690 ext. 407 or ChrisS@FWPubs.com.

Photo by Al Parrish


JET
EQUIPMENT & TOOLS
ON
OFF
WARNING
DO NOT REMOVE OR OBSCURE THIS LABEL

Bridgewood HM-11

Three of the mortisers in our test were virtually identical: the Bridgewood, Woodtek and Grizzly machines. They looked the same down to the last screw, and all performed quite well. This fast-speed machine refused to stall in any cut and plowed through ash, hard maple and white oak with ease. During setup, the table needed to be shimmed with two pieces of tape to square it to the chisel — a 5-minute job. The fence sits 1/8" above the table for chip clearance. On the down-side, all three of these machines had an arm that was tedious to adjust, and the access to the chuck is cumbersome. You don't get a lot of frills with the Bridgewood, but you do get solid performance. Contact Wilke Machinery at 800-235-2100.

Craftsman 21906

This machine has a lot going for it, except for the motor. This slow-speed machine had the weakest motor of all the mortisers tested. In all three woods, the Craftsman would stall, no matter what the clearance was between the auger bit and chisel. We even tried a different chisel to make sure the first wasn't defective. On the positive side, this is a heavy machine that stays put on your bench. The tool holder has a place for everything (except a couple hex wrenches you need) and the table is easily adjustable and removable. The fence sits 1/8" above the table for chip clearance. To shim the table square to the chisel we had to add three pieces of tape. If you're working in soft woods only, this machine is fine; otherwise, look elsewhere. Contact Craftsman at 800-377-7414.

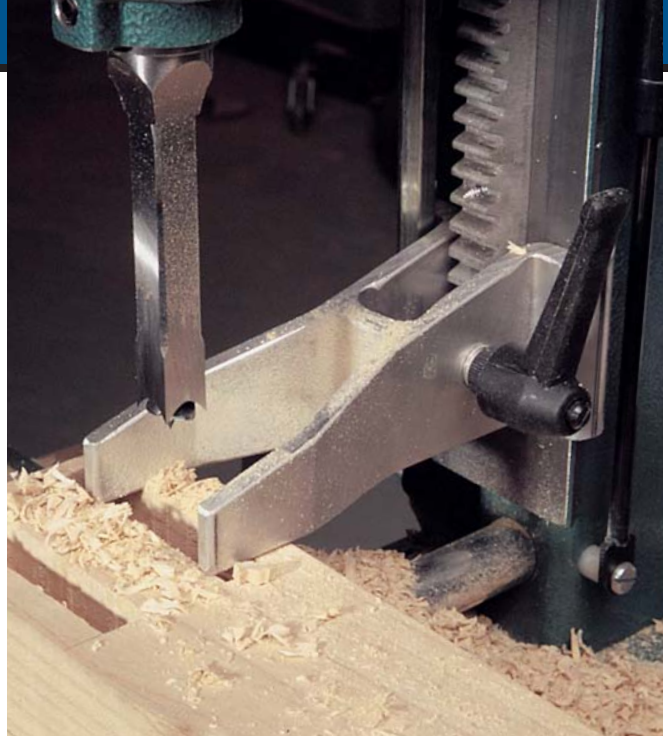
Delta 14-650 type 2

When Delta first introduced this machine it was a fast-speed mortiser. This newer version spins at 1,725 rpm. And though this machine stalled more than the slow-speed Jet, it had considerably more umph than the Craftsman, also a slow-speed machine. The fit and finish of this machine is a little rougher than what we expect from Delta — the cast-iron base wouldn't sit level on our bench, and the screw hole for the fence lever had to be jimmied to work properly. It took five pieces of masking tape to square the table to the chisel. This machine does have its good points. The tool caddy is useful, and the gap below the fence controlled chips better than any other machine. Contact Delta at 800-438-2486.

Benchtop Mortisers

Model	Street Price	Motor				Fence			Hold-Down	
		Horse Power	Amps/ No-Load	Amps/ Load	Speed/ RPM	Length in Inches	Height in Inches	Max." Fence to Chisel*	Max Depth Under Hold-Down	Min. Depth Under Hold-Down
Bridgewood HM-11 wilkemach.com	$219	1/2	3.8	6.62	3,400	13 3/4"	1 9/16"	2 5/8"	3 1/4"	1 5/8"
Craftsman 21906 craftsman.com	200	1/2	3.06	5.7	1,725	13 5/8	1 5/8	2 3/8	4 3/4	1 3/4
Delta 14-650 deltawoodworking.com	240	1/2	4.68	6.43	1,725	13 3/4	1 9/16	2 1/8	3 3/4 ***	1 15/16
Fisch BTM99-44252 fisch-woodworking.com	250	1/2	3.96	5.25	1,725	13 9/16	1 5/8	2 9/16	3 1/4	1 5/8
General 75-050 M1 general.ca	299	1/2	2.2	4.25	1,720	11 1/16	2	3 1/8	5 1/4	1
Grizzly G3183 grizzly.com	225	1/2	3.75	6.6	3,400	13 3/4	1 9/16	2 5/8	3 1/4	1 5/8
Jet JBM-5 jettools.com	240	1/2	3.05	5.6	1,720	14	1 5/8	2 5/8	3 5/8	1 3/4
Multico PM12 garrettwade.com	449	1/2	4.44	6.88	3,470	13 3/4	1 9/16	3 1/2	3 3/8	1 1/2
Shop Fox W1671 woodstockinternational.com	235	1/2	3.9	4.75	1,760	16	2 1/8	2 1/8	7 3/4	2 1/4
Woodtek 876-775	240	1/2	3.75	5.89	3,450**	13 3/4	1 9/16	2 5/8	3 1/4	1 5/8

*Notes: * All measurements were taken with a 3/8" chisel and bit installed, which is why these measurements will sometimes disagree with those supplied by the manufacturer. **Woodtek will switch to*



Without a doubt, the hold-down on the Multico is the best. In fact, it can hold your stock a little too firmly. When setting the hold-down, put a piece of paper over the work, lock the hold-down's lever and remove the paper.

Fisch BTM99-44252

Fisch is a relative newcomer to the mortiser market with this new two-post design.The company recently improved the depth stop (which slipped on earlier models), and we can now say this new depth stop is bulletproof. Other unique features of this machine include a second depth stop that controls the upward movement of the head, a strong return spring that makes the motor emerge more easily from a mortise, and a nice micro-adjustable fence.The fit and finish of this machine is excellent. Like other slow-speed machines, the Fisch was more likely to stall in tough woods.And the table needed five pieces of tape to be shimmed square to the chisel. If you're in the market for a slow-speed machine, the new model Fisch is worth checking out. Contact Fisch at 724-663-9072.

we shimmed the table with tape. This step — more than anything else — will ensure your mortises are straight and true. After shimming, we checked to see if the fence was square to the table. All of the machines came in real close, so we didn't shim the fences.

To test the machines' motors, we cut 1¼"-deep x 10"-long mortises in ash, hard maple and white oak. All of the sample boards came from one plank of each species to ensure the wood was of a similar density. After cutting the mortises, we sliced open the test boards to see if the mortises went straight into the board or if they were at an angle. If the machine's table had been shimmed properly, the mortises were invariably true.

Motor Speed: Slower isn't Better

Perhaps the biggest factor you need to consider when buying a mortiser is whether

CHISEL				TOOLS NEEDED TO ...				PW RATINGS (1 TO 5; 5 IS BEST)		
MAX SPINDLE TRAVEL*	MAX CHISEL ACCEPTED	CHISEL BUSHINGS INCLUDED	CHISELS INCLUDED	...ACCESS CHUCK	...ADJUST HOLD-DOWN	...CHANGE DEPTH STOP	...REMOVE CHISEL	FIT & FINISH	EASE OF USE	OVERALL
4 5/16"	1/2"	5/8", 3/4"	none	none	hex key	hex key	screw	3.8	3.5	4.2
3 7/8	3/4†	5/8	3/8	none	hex key	hex key	screw	2.5	2.6	1.3
3 5/8	1/2	5/8	1/4, 5/16, 3/8, 1/2	none	hex key	hex key	hex key	2.7	3.3	3.2
3 3/4	1/2	5/8	none	none	hex key	none	hex key	4	4.2	3.3
5 1/4	5/8	5/8, 3/4	1/4, 5/16, 3/8, 1/2	none	none	none	none	4	3.8	3.3
4 5/16	5/8	5/8, 3/4	none	none	hex key	hex key	screw	3.8	3.5	4.2
4 5/16	1/2	5/8, 3/4	1/4, 3/8, 1/2	none	none	none	screw	4.2	4.5	4
4	1/2	5/8	3/8	hex key	none	hex key	hex key	4.7	4.3	4.7
4 1/2	3/4	5/8, 3/4	none	none	hex key	none	hex key	4	4.3	3.8
4 5/16	1/2	5/8, 3/4	none	none	hex key	hex key	screw	3.3	3.5	4

*a slow-speed motor in the coming months. ***Add Delta's 14-611 height adjuster ($14) to this machine and it will increase the capacity to 5¾". † in softwood.*

General 75-050 M1

General International's new benchtop mortiser suffers from one major flaw: the hold-down. Though it looks like the champion hold-down on the Multico, the General's is different. The General's is in two pieces that ride on the dovetailed ways on the post of the mortiser. The hold-down is tricky to adjust flat on the work, and it is prone to slipping under heavy use. Unlike other mortisers, there's a clamp on the front of this machine that holds the work against the fence. This assists the hold-down, but it slows your work down considerably. This slow-speed motor was beefier than most and would stall only occasionally under heavy use. It also had the best handle of any of the machines tested. If General could tweak the hold-down to grip the post tighter, this machine would be an excellent slow-speed model. Contact General at 819-472-1161.

Grizzly G3183

Grizzly's fast-speed mortiser is identical to the Woodtek and Bridgewood machines, except in the paint. And in that one difference, Grizzly did a good job. Of the three clones we tested, Grizzly's fit and finish was the best, edging out the Bridgewood by a nose. Like the Woodtek and Bridgewood, this machine was gutsy and plowed through ash, maple and white oak without a care. Once you figure in shipping costs, the Grizzly is basically tied with the Bridgewood as the least expensive machine tested (the Bridgewood actually is more expensive when shipped to some states). If you can't afford the Multico (or perhaps you want two machines for about $500), we recommend the Grizzly. Contact Grizzly at 800-523-4777.

JET JBM-5

Of all the slow-speed mortisers, Jet's had the most power. In fact, it stalled only once, and that was in hard maple. Jet put a lot of thought into this machine, and it shows. The chuck key is longer than normal, which makes it easy to maneuver to the chuck. The fingers on the hold-down are 3" long, while most mortisers have shorter fingers, usually 2" to 2¼". And the fit and finish are excellent. The table on ours needed to be squared to the chisel with two pieces of tape. And the gap between the fence and table is 1/16", which helps clear chips out of your way, but not much. Also, the hold-down worked a little loose after several mortises. But overall, when you consider that you get three chisels with the JBM-5, it's a hard deal to say "no" to. This is our favorite slow-speed machine. Contact Jet at 800-274-6848.

to buy a fast-speed machine or a slow one. When benchtop mortisers first hit the market, they were all powered by induction motors that turned at 3,450 rpm, the same speed as the motor on your table saw. Recently, manufacturers have introduced slow-speed mortisers that turn at 1,720 rpm. What's the difference? Plenty. Take a look.

• **Smoking:** The slower speed is supposed to reduce the smoking you see in fast machines. All mortisers can produce smoke when plunging the chisel and bit into the wood. In tough woods especially the tremendous friction caused by the combination of the cutting and the chips passing up the flutes of the auger bit inside the hollow chisel causes the chips to scorch. We found that slow-speed machines reduce, but do not eliminate, smoking.

• **Stalling:** Without a doubt, fast-speed mortisers were much less likely to stall during a difficult cut than slow-speed machines. In fact, we couldn't stall a fast machine, even when we pushed it. With the slow-speed machines, some performed better than others. We stalled the Jet only once during our test. But the Craftsman machine stalled more than a dozen times in each 1¼"-deep 10"-long mortise we cut during testing.

Why are slow-speed machines more likely to stall? It's simple math. One of the formulas for determining horsepower lays it out simply. To determine horsepower, you multiply the torque of the motor by the rpms and divide that number by 5,250. So it's logical that if you reduce the rpms by half, you're going to reduce the overall power of the motor.

It's important to note here that not all slow-speed motors are weak. The burly 1 hp motor on the Powermatic floor-model mortiser 719A (which is not in this test) turns at a slow speed. But because the motor is so much bigger, it has no problems with stalling. It was some of the ½ hp slow-speed machines that gave us trouble.

Reducing the clearance between the chisel and bit reduced, but did not eliminate, the stalling in slow-speed machines. It also noticeably slowed the cutting rate of the machine.

• **Temperature:** Slow-speed machines are supposed to reduce the amount of heat in the chisels compared to fast-speed machines, so your tooling will stay sharp longer. In our tests, fast-speed mortisers heated up the chisel to an average of 237° after one 10"-long mortise. The slow-speed machines' chisels averaged 209° after the same amount of work. Heat is the enemy of a sharp edge, so you probably will be caring

Multico PM12
Multico invented the benchtop mortiser, and in our opinion the company still does some things better than any of its imitators. For starters, the hold-down is the best of all the mortisers. It will always stay put. The fast-speed motor grinds through everything you throw at it, and it was the only mortiser that needed no shimming to bring the table and chisel into alignment. The machine does have some peculiarities, however. The base is quite small, so you must bolt it to a board that you clamp to your bench. You must keep the post well-oiled, or the head will become difficult to move. The handle is no fun to adjust and has only four positions. And make sure you always tighten the depth stop securely. If you don't, it can slip. In all, this European machine is a beauty to use. It should be. It costs $449 plus shipping. Contact Garrett Wade at 800-221-2942.

Shop Fox W1671
At first glance, this machine looks a lot like the Fisch, but it's different in several ways. The base is larger and heavier, the depth stop is a rod that you lock down instead of a collar on one post, and the table and fence are longer. And unlike any other mortiser, the Shop Fox comes with three different hold-down posts you can swap out when dealing with really thick stock. You can easily reconfigure this machine to mortise a board as thick as 7¾" — more than any other benchtop mortiser on the market. The chisel and table were almost perfectly square out of the box. However, like the Fisch, the Shop Fox uses a slow-speed motor, and it will stall occasionally under heavy use. This machine would be a big winner if it were available with a different motor. The manufacturer indicates some changes are forthcoming, so stay tuned. Contact Shop Fox at 800-840-8420.

Woodtek 876-775
Like its other high-speed brothers, the Woodtek 876-775 mortiser plowed through the ash, oak and maple without a complaint. And while it also suffers from some of the same limitations (an arm that's difficult to adjust; a chuck that's inconvenient to get to), the Woodtek also has a couple other issues. The paint job on the model we examined was a little less than perfect. And the price is higher than the identical mortisers sold by Grizzly and Bridgewood that have better paint jobs. Woodtek officials say they will be switching to a slow-speed mortiser soon, so watch the Woodworker's Supply catalog, which is where they are sold. If the fast-speed model goes on sale, you could pick up a good machine at a good price.
Contact Woodworker's Supply at 800-645-9292.

more for your chisels or replacing them if you own a fast-speed machine.

If you do buy a fast-speed machine, we recommend you use a 1/8" clearance between the auger bit and the chisel. This clearance produced the least amount of smoking in fast-speed machines and kept us from cooking the bit. For slow-speed machines, we actually found there was less stalling when there was less clearance, more like 1/16".

• **Working time:** Fast-speed machines will make your work considerably faster. It took us about a minute and 15 seconds to cut a 10"-long mortise using a fast-speed machine. When using the slow-speed Jet, the beefiest slow-speed machine, that same mortise took 2 minutes and 9 seconds. Other slow speed-machines that would occasionally stall in a cut took more than 3 minutes to complete the cut.

So which is better? We prefer the fast machines. The slow machines run cooler and generally have more features than the fast-speed mortisers. But the fast-speed machines are simply less frustrating to use. You spend a lot less time babying the machine and more time working wood.

Hold-downs With a Weak Grip

One of the biggest gripes with benchtop mortisers is the way the hold-down works. After you plunge the bit into your board, the hold-down is supposed to keep the work in place as you pull the chisel and bit out of

Too New to Test

As we went to press we learned about a new mortiser that will hit the U.S. market in June. The Record RPM75 is manufactured in Sheffield, England, and has many interesting features, including a large hold-down that rides on the main post. The motor spins at 3,400 rpm, the machine will mortise to the center of a 7½"-wide board and it has an impressive 5-year warranty. Expect the machine to retail for $289. Contact Promax Tool Corp. at 800-933-1562 for more information. Or try the company's website at www.recordpower-usa.com.

the work. The hold-down on the Multico PM 12 (the most expensive machine tested) is the best, hands down. It rides on the same dovetailed ways that the motor moves up and down on. You tighten a lever to set the hold-down and the thing stays put. End of story.

Other manufacturers use a hold-down that works something like this: there's a steel post that comes up off the back of the fence. A two-pronged hold-down rides on that post and is held in place by a small screw tightened against the post.

The problem is that these screws work loose after some use, no matter how much you tighten them down. Some of them require you to use a hex key to tighten them down (instead of a lever). See the story below for a tip on how to improve the hold-down on some machines.

Toolless or Not Toolless

Another significant difference among the machines is the tools you need to make routine adjustments. Some require you to use a hex key to tighten the hold-down, set the depth stop or tighten the chisel bit in its bushing. The Multico even requires a hex key to get access to the chuck.

In our book, the fewer hex keys you need, the better. The Jet JBM-5 has only one place you need a hex key, and that's for attaching the steel hold-down post to the fence.

Use the chart on the previous pages to see a list of common adjustments and the hand tools you'll need to make them.

Other Details

All of these machines are noisy, and they get noisier as they heat up. We recorded decibel levels between 70 dB and 92 dB when the machines were on but not cutting a mortise. During operation, we recorded decibel levels between 76 dB and 93dB. Most of that noise came from the chisel and auger bit contacting each other, not from the machine. As a result, we recommend hearing protection for all of these machines.

Check out the arm of the machine that makes the head plunge. You need to be able to adjust this arm easily for different mortising situations. On some machines (such as the Craftsman, Jet, Delta, Fisch, Shop Fox and General), you can quickly adjust the arm without tools. Others require you to loosen a bolt or screw, change the arm position and then tighten the bolt. It shouldn't be this hard.

While you're messing with the handle, check out the grip. They run the gamut from pretty good to pretty bad.

Machines also vary in how much gap there is between the fence and the table. On the Fisch and General, the fence is flush to the table. Other machines have a gap between 1/16" and 5/16". This gap is supposed to help clear out chips that build up around your work during mortising. The gap helps, but there are so many chips that even a 5/16" gap isn't enough.

Some of the machines have a tray or rack that allow you to store tools and tooling with the machine. These are a nice plus, but by no means a deal-breaker.

In fact, it's a good idea not to get too worked up about the bells and whistles when shopping for a mortiser. Spend the majority of your time shopping for the machine with the gutsiest motor, and mortising will be a lot less frustrating. **PW**

Quick Fix for Some Shaky Hold-downs

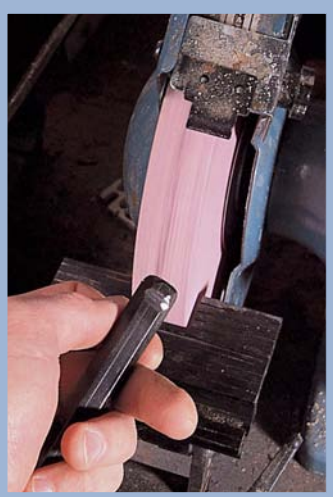
One of the quickest ways to raise my blood pressure is to use a machine that malfunctions because of a simple design flaw. Many of the mortisers in this test have a hold-down that works loose after a dozen or so mortises. They work loose because the hold-down is secured by a small setscrew that isn't up to the job.

To make matters worse, the Jet, Delta, Fisch, Craftsman and Shop Fox machines also have a second small screw that holds the post for the hold-down in place in a hole in the fence (on the three Taiwanese clones, the post is welded to the fence, so it won't come loose).

I haven't come up with an easy way to fix all the hold-downs, but I have come up with a way to greatly improve the hold-downs on the five machines with a second setscrew.

You see, the problem with securing the post with a screw is that there's nothing much for the screw to grab. Shake the post enough and it will work loose. To fix this problem, all you have to do is grind a notch in the post for the screw to rest in. I cut the notch using my grinder. The notch is only about 1/8" deep, but it's flat on the bottom and keeps the post firmly in place. It takes about five minutes at most. If you don't have a grinder, you can make the notch using a file, which will take a bit longer to do.

If you've got a simple solution to fixing the top part of the hold-down, drop me a line at ChrisS@FWPubs.com and we'll publish it in a future issue.



Grind the notch in the post freehand using the tool rest on your grinder. If you've used the mortiser even a little, there will be a slight depression where the setscrew meets the post. This is where the notch should go. The result should look like an angled notch at the bottom.

Fit the post back in its hole with the notch facing the setscrew.

a new Manual for MORTISERS

Hollow chisel mortisers are decidedly fussier than their cousin, the drill press.

To properly set up one of these useful machines you need a few tricks that aren't in the manual.

Though the hollow chisel mortiser is one of the most useful joinery machines you can buy (besides a biscuit joiner), it's shocking how little information is out there on how to properly set up and use these machines.

That's too bad because a handful of simple tricks are the difference between making perfect square holes and breaking an expensive mortising chisels or scorching the wood. The tricks fall into three categories:

Setup: First you've got to fuss with the tooling, which consists of the square chisel bit and the round auger bit that spins inside it. Believe it or not, it's important to figure out which way to put the chisel bit into the mortiser. Also, to clear chips from the chisel, you've got to create the right amount of space between the end of the auger bit and the chisel. And you've got to square the chisel to the fence and table and then set the depth of your cut correctly (here's a hint: it's not the length of your tenon).

Use: Once you lay out the locations of your mortises on your wood, you've got to set your mortiser's fence correctly. Otherwise, your joints won't be flush and you'll be sanding and planing for a long time to fix this common mistake. As you make your cuts, you've got to space them correctly or your chisel will bend or break. Also, as the auger bit and chisel heat up, they need to be lubricated.

Maintenance: Sharp auger bits and chisels will make all the difference in the world. You can buy a little $90 device to sharpen your chisel bits, but it's not necessary. You also need to occasionally deburr the shaft of the auger bit.

Set Up Your Machine

If you've ever used a hollow chisel mortiser, you've probably run into some frustrating problems. Perhaps the motor stalled in a cut, or the chips smoked or scorched. Or, assuming you managed to avoid these problems, you ended up with mortises that had to be cleaned up with a chisel, which is the thing you wanted to avoid when you bought the machine in the first place.

Check Your Chisels: Whenever I set up a mortiser, I grab my dial caliper. These useful measuring tools get cheaper every year, and they will ferret out

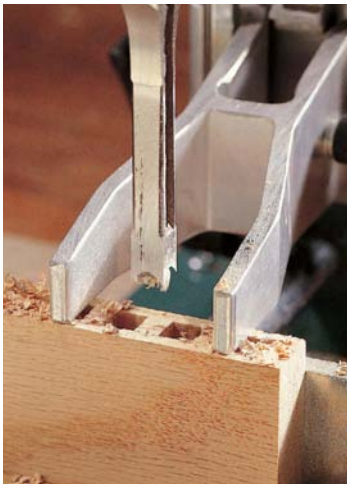
by Christopher Schwarz

Questions or comments? You can contact Chris at 513-531-2690 ext. 407 or at ChrisS@FWPubs.com.

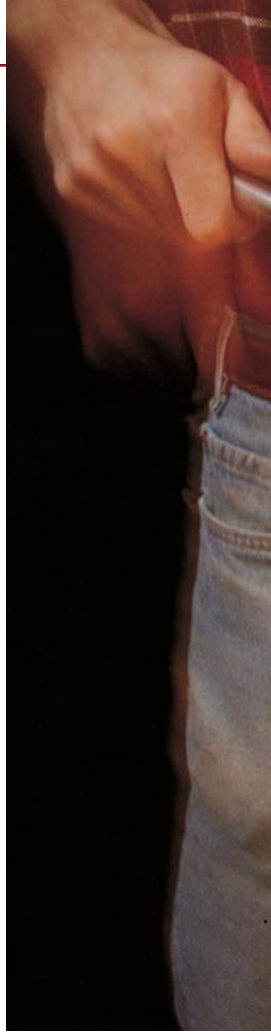
Photo by Al Parrish

You can control precisely how much clearance there is between the auger bit and chisel bit by first mounting the chisel bit and backing it out of the bushing by the amount of clearance you want. Next install the auger bit pushed all the way up into the chisel bit.Then loosen the screw in the chisel bit and push it all the way into the bushing.

It's critical to put your mortises exactly where they should be. If you want them in the middle of your stock, use a dial caliper to measure either side of the mortise wall and adjust the fence until the two measurements are equal.



Cut one hole, skip a space, then cut another. If you cut one right next to the other, you are heading for a bad bend or break in the chisel or auger bit.



lots of woodworking errors. The first step is to use your dial caliper to measure the thickness of your chisel bit. It's supposed to be square; most aren't (some are .01" off, or about the thickness of six pages of this magazine).

Figure out which two sides of the bit are closest to the dimension they're supposed to be and use those two sides to always determine the thickness of your mortise. If you install your bit the other way, you'll make a slightly different-size hole, which can throw a monkey wrench in things.

Next you need to install the two bits in the machine. First thread the auger bit into the chisel bit and put the chisel bit into its bushing until it's fully seated. Back it out 1/8". Lock the chisel bit in place with its screw. Now put the auger bit into the chuck. Hold its tip in place up against the chisel bit and tighten the chuck. Finally, loosen the screw that holds the chisel bit and push the chisel up until it seats completely in the bushing. The chisel bit and the auger bit are now 1/8" apart, which is a good place to start.

The distance between the two bits is critical. Think of the clearance between the chisel and bit like you would the throat on a hand plane. With a good deal of clearance, say 1/8" or more, you will work faster because you'll cut bigger chips. However, too much distance and you'll make mortises with round holes at the bottom that are no fun to clean out. And big chips can easily stall slow-speed mortisers.

Tighten up the clearance to about 1/16" and you'll cut smaller chips (good for slow-speed mortisers) but your cuts will take a good deal longer. Also, different types of wood seem to work better with different clearances, so don't be afraid to experiment until you find something that works.

Here's a helpful hint: When chips clog your bit, don't dismantle your bits. Instead, turn off the machine and rotate the machine's chuck using your hands. Go counterclockwise then clockwise, and the chips should come right out.

Get Parallel: To make overlapping holes that line up perfectly, you usually need to set the chisel bit so it's parallel to the fence. There are lots of ways to do this (using a piece of wood between the fence and chisel bit, trial and error etc.), and they all work. The important thing is that when you've got it right, make a test mortise in a piece of stable wood and set it aside. Next time you need to set up your mortiser, use the test mortise to square the chisel to the fence.

While we're talking about the fence, it's a good idea to make sure the fence, chisel and table are at 90° to each other. First use a square to determine if the table is square to the chisel. If it's not, shim the underside of the table with masking tape. Once the chisel and table are square, check the squareness of the fence. If the fence is not square to the table, return it to the manufacturer or shim it with electrical or plastic tape. A fence that's out of square can cause your mortises to be at an angle.

Set the Depth: Finally, you need to set the depth of your cut. Always make the mortise 1/16" deeper than the length of your tenon. That is, if your tenons are 1" long, make the mortises 1 1/16" deep. This does two things. First, you won't have to clean out the bottom of your mortises with a chisel because it's usually the last 1/16" or so that's grungy. Second, you'll experience little or no glue squeeze-out with your joints because that extra space in the mortise gives excess glue a place to collect.

SUPPLIES

Woodcraft
800-225-1153
www.woodcraft.com
- **Tapered round sharpening stones 4" x 1/8" x 1/4", set of three, item #07E02, $34.99.**
- **Clico Chisel Bit Sharpener, item #06V90, $86.99**

Highland Hardware
800-241-6748
www.highlandhardware.com
- **7" Auger bit file, $8.99**

Lee Valley Tools
800-871-8158
www.leevalley.com
- **4" dial caliper, item #88N62.01, $21.50**

The secret to cleaning out the bottom of your mortise is to go back over your work once you've cut the shape of the entire mortise. I repeatedly raise and lower the head of the mortiser about ½" while moving the workpiece in small increments side-to-side.

Use Your Mortiser Right

One of the most common problems for mortiser users is that the mortised part and the tenoned part don't line up correctly. As a result, your project is out of square or you need to do a lot of sanding and planing to flush up your joints. Several things can cause this problem: your bit's not cutting in the center of the stock, your stock isn't all the same thickness or you're not being consistent in the way you are cutting your mortises.

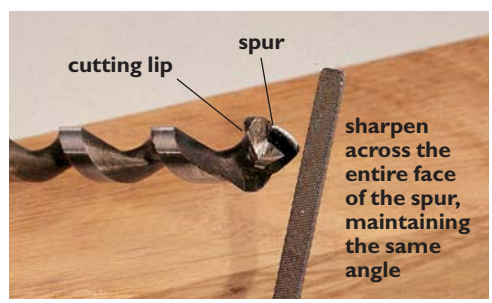
Fortunately, there are easy ways to prevent these problems. First, cut all your mortises with the face side against the fence. Second, make sure your bit is cutting in the center of the stock. Some people make the mistake of marking a centerline down the wood and lining that up with the tip of the auger bit. It's an easy mistake to make. The tip of the auger bit is supposed to be in the middle, but this is rarely the case.

Instead, mark on your test piece of wood where the shoulder of the tenon will go. For example, if you're mortising into ¾"-thick stock, you should use a ⅜" chisel bit. (As a rule of thumb, tenons should be one-half the thickness of the wood.) That means you should have a 3/16" shoulder on either side of the mortise. Mark a line on either side of the wood 3/16" in and line up the chisel bit between these marks. Make a test cut, then measure the resulting shoulder using a dial caliper. Adjust the fence until these two measurements are equal. Now you're in the center of your stock. Even when your mortise isn't supposed to go in the center, use the calipers to determine exactly where your mortise should go.

Another common mistake that pros and amateurs make is to cut the first hole with their mortiser, and then to cut the next hole adjacent to the first. This a serious mistake. Here's why: When you cut an adjacent hole, the bit has one side that is against wood, and one side that's against nothing. The bit tends to bend toward the unsupported side. Do this enough times and your chisel will bend or break.

Finally, after you've cut a few mortises, your machine will probably change its tune, from a thrumming to a noise that sounds like a kicked cat. Turn off the machine for a minute and get out some canning wax (you can buy it at your grocery store; sometimes it's called paraffin). Rub it against the auger bit through the slot in the chisel bit. The heat of the bit

continued on page xx



When you sharpen the cutting spur, try not to touch the cutting lip (left). When you sharpen the cutting lip, stroke the file upwards into the bit and try not to change the cutting angle.

Conical sharpening stones can be used to touch up the inside edges of your chisel bit. This should create a burr on the outside of the bit that you can remove with a stroke or two on a fine-grit sharpening stone.

Mortisers

continued from page xx

will melt the wax and allow it to run between the auger and chisel.

Once you finish cutting a mortise, go back and clean it up by rapidly raising and lowering the head about ½" or so and moving the workpiece back and forth. This straightens up a lot of the gunk at the bottom of your mortise.

Sharpening

If you follow all these instructions and you still have trouble, your bits are probably dull. When it comes to sharpening, the less you do on bits, the better. If you get too aggressive, you can change the geometry of the bit and then you're really in trouble. Err on the side of caution.

You can sharpen the chisel bits using a cone that chucks into your drill. It's quick and foolproof, but at a $90 cost. I prefer to touch up my chisel bits with a sharpening stone in the shape of a cone. Stroke only the inside edges of the bit. If you're doing it right, you'll create a burr on the outside edge of the chisel. This needs to be removed, but carefully. To remove the burr, rub each face of the chisel against a fine-grit sharpening stone. Use a single stroke and then feel the edge for the burr.

Sharpening the auger bit also requires care. Never file the outside of the bit and never file the center tip. Instead, focus your attention on the two other parts of the bit: the inside of the spurs and the underside of the cutting lip.

Sharpen the spurs using an auger bit file, if you've got one. These files have sides that don't have teeth, called "safe" sides. (If you don't have one of these files, you can create a "safe" side on a regular file by covering it temporarily with tape.) File the spurs with the teeth against the spur and the "safe" side against the cutting lip. Try to maintain the same angle as was on the bit before.

Now turn to the cutting lip. Touch up the underside of the cutting lip with your file, again maintaining the cutting angle as best you can. Finally, check the shaft of the auger bit for burrs. A burr can cause the bit to seat in the chuck improperly, causing all sorts of trouble. Remove small burrs with sandpaper; take off larger burrs with files. **PW**

TSUNAMI

Band-Saw Box

n

Photo by Al Parrish

Break out of the need for precision

and let your creative side express itself with a band-sawn box.

There comes a time to give your ruler a rest so you can give your woodworking whimsy a chance to tickle your imagination. How do you know when that time is? When your curiosity is captured by your first glimpse of a band-sawn box sculpture, of course! Whether flowing or comical, elegant or a mere blob, a well-executed band-sawn box requires no mind-numbing calculations and is an eye-catching, functional project that anyone can display with appreciation.

Although I design them principally to hold jewelry, these boxes find their diverse places among stone, gem and coin collectors as well as functional art appreciators. My dad has a walnut wave box, drawers gushing with gift golf tees; I haven't lost my car keys once since making a habit of putting them in the snake-shaped box by the phone. At one arts festival, a Saudi Arabian oil princess bought several of my pricey designs to use as gift boxes for some rather expensive jewels, while students visiting from various European, Asian and South American countries purchased them as gifts for their art teachers back home.

Band-sawn box technique is easy enough for the beginner to tackle, but challenging enough for the seasoned veteran to say, "Hey, that's cool! How'd you do that?" Plus, if your shop is not equipped to the ceiling with a sampling of every tool, the basic ones will work quite well.

My favorite band-sawn box designs are the ones that convey a theme of movement — ones that make the wood appear to bend and sway and flow. Thus Tsunami (or tidal wave) was born. The radiant ripples of the curly maple drawer pulls complement the splash of light sapwood on this aqueous walnut box. Originally a large four-drawer design, I scaled this one back a bit and simplified it by adapting it to two drawers.

Begin with a block of hardwood 11" long by 5½" wide by about 4" thick. It won't hurt to be a tad on the generous side of any of these measurements, as absolute accuracy is not required to make this type of box. I recommend laminating 4/4 or 5/4 kiln-dried stock to avoid any cracking you might get with a solid, air-dried block (see "Simple Lamination" on the next page). Choose one of the 11" x 5½" faces to be the front of your box, then square the bottom edge to the back of the block. The simplest way do this is to run the bottom over the jointer with the back against the fence, removing only small amounts of material at a time. Alternatively, using the table saw, raise the blade to just over

Feed the block slowly into this small blade. Forcing it will only give you a rough cut and possibly cause the blade to bow to one side.

Smooth pattern cuts are accomplished by keeping the blade guide close to your work. Feed slowly to prevent straying from the lines.

by Lois Keener Ventura

Lois Keener Ventura creates unique boxes as co-owner of Knothome Designs (see www.knothomedesigns.com), and is the author of Building Beautiful Boxes With Your Band Saw *(Popular Woodworking Books).*

Simple Lamination

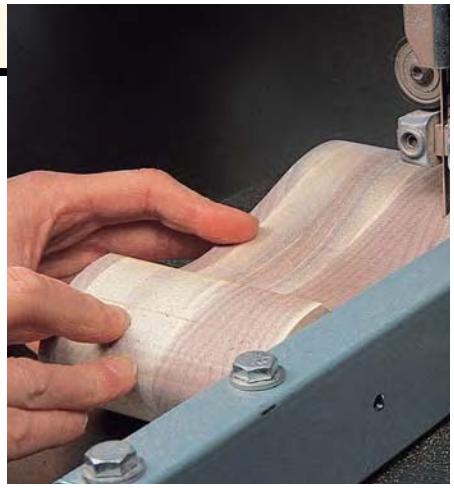
To get a good crack-resistant lamination for this box, cut kiln-dried, 4/4, surfaced hardwood stock into five or six 5½" x 11" long pieces. One 5' or 6', 6"-wide clear board, with no cracks at the ends or edges ought to do it for you. Most times, you would pass up a board with sapwood running along the edges, but bookmatched sapwood does some neat things with the curves of this box. Sand any planer ridges out with coarse and medium-grit sandpaper so that all surfaces are completely flat. Access to a thickness sander quickens this job. Choose the piece with the most interesting grain to serve as the front of your block. Then arrange the remaining pieces by bookmatching them end to end to create end-grain patterns, or you can stack them randomly if you prefer.

Have an assortment of clamps at the ready. Heavy, 10" handscrews work the best, as you can use the threaded bar as a straightedge to keep the pieces from sliding around as you tighten down the clamps. Other clamps will do just as well, but you may have to adjust and readjust the pieces to keep them relatively even while tightening the clamps. Spread glue thoroughly over the wood surfaces to be joined, sandwich them together, then clamp until you see glue squeezing out of the joints on all four sides. Allow the block to dry overnight or longer.

The bar on a handscrew clamp helps keep the pieces in line while clamping a block.

This block isn't going to fall apart! It pays to be generous with the clamps, glue and the drying time.

Glue and clamp the back slice on, making sure all surfaces are contacted. Go lightly on the glue close to the inside backs of the drawer cavities to prevent too much excess glue from squeezing into the box innards.



Rip ¼" off the back and ½" off the front of each drawer.

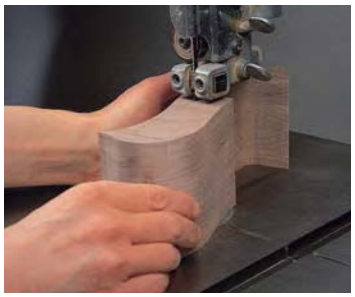
half the thickness of the block, rip a small amount off half of the bottom of the block, then flip the block over front-to-back and do the same so that the bottom is flat. Now you can transfer the pattern onto the face of the block. You can either trace it with carbon paper or attach a copy with a light application of spray adhesive.

Next, tune up the band saw and tension a 3/16", 10 TPI (teeth per inch) regular-tooth blade. Test the tension on a thick scrap to make sure the blade won't bow in a thick cut. Re-tension, if necessary. Set the fence to ¼" from the blade. With its bottom on the table and its back to the fence, rip a ¼" slice off the back of the block. Set the back slice aside, and adjust the blade guide height to just above the thickness of the block as it lies on its back. Cut the drawer blocks out according to the pattern lines. Turn the saw off to back out of each cut.

Once the drawer blocks are removed, use any type of drum sander (an oscillator works best) to soften the saw lines inside the box cavities. Don't sand too much off the insides though, or else the gaps left when you replace the finished drawers will be too large and unsightly. You can glue and clamp the back slice onto the back of the box once you're done sanding the inside. Three 10" handscrew clamps work the best, as they contact the entire width of the box and prevent the wood from sliding around as you clamp it. But any number of other clamp designs will work just as well if you add a flat clamping block on either side of the box to ensure contact with all surfaces. Don't squeeze the entrance kerf at the bottom of the box closed while clamping the back on. You'll need room to chisel and sand a roundover there later, integrating it into the design.

While that dries, set the band saw fence to ¼", readjust the blade guide height accordingly and slice the back off each drawer. Then set the fence to ½" and slice the front off each drawer. Next, mark the cuts that hollow out the drawers, using the pattern as a guide. Alternatively, you can customize the sizes of the drawer sections once you remove the clamps from the box. Do this by setting the blocks (without their fronts and backs) into their respective cavities in the box body. Mark the sections using a square to keep the lines level and perpendicular to the bottom/top and sides of the box block.

Adjust the blade guide height and make the hollowing cuts in the drawer blocks. Then glue and clamp the fronts and backs onto the drawers. Clamp them as accurately as possible to avoid having to sand them to excess. While they dry, select an attractive piece of ¾" scrap from your wood pile to serve as the drawer pulls. Trace their shapes and cut them out. Use a push stick for safety with these small pieces. You

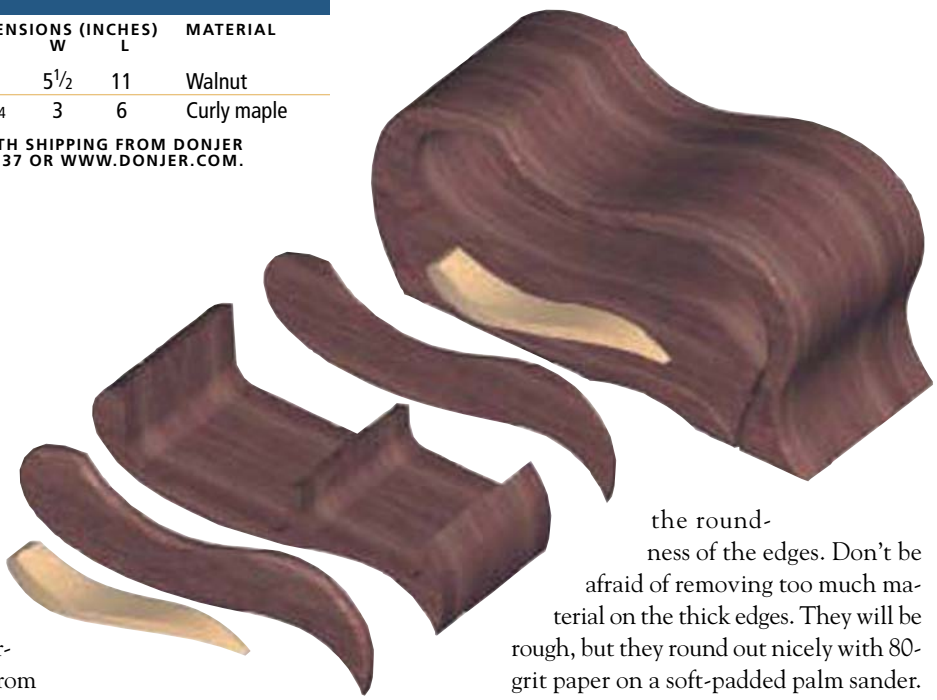


If you take it slowly, a 3/16" blade can achieve sharp curves in the corners when hollowing out the drawers.

Tsunami Band-Sawn Box

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	1	Block	4	5½	11	Walnut
❑	2	Drawer pulls	¾	3	6	Curly maple

MINI FLOCKER KIT $25.30 WITH SHIPPING FROM DONJER PRODUCTS CORP., 800-336-6537 OR WWW.DONJER.COM.



can cut the outer shape of the box body at this time too, but don't be too concerned if the outer shape is rough at this point.

Once all the clamped parts are thoroughly dry — this can be anywhere from a couple hours to overnight, depending on temperature and humidity — you can begin belt sanding. Set the belt sander in the vertical position, with the table square to the belt. If there is a guard obstructing the top cylinder, remove it, as you will use the shape of the cylinder in your sanding and shaping process. This is the creative part, and there are no set rules to follow, except to keep a firm grip on your work. Don't get over-aggressive when feeding your work into the belt — the belt just might get aggressive right back by pulling a drawer out of your hands and throwing it to the floor! It is important to note at this point to sand the outer shapes of the drawers with a light hand. You want to remove all the saw lines, but you don't want to remove so much material that the drawers leave huge gaps at the tops when placed back into their cavities in the box.

Begin belt sanding the outer box shape with a coarse 60- or 80-grit belt. First lay the box flat on the table and smooth the saw lines out to the pattern shape. You'll need to use the cylinder at the top of the sander or a drum sander with a 3" drum for the concave surfaces. While you have the coarse paper on the sander, grind, shape and round the edges of the front and back of the box. Curve in the concaves at the bottom and side using either the cylinder on the belt sander or a drum sander. This type of "carving" adds a sense of depth rather than flatness to the box by varying the roundness of the edges. Don't be afraid of removing too much material on the thick edges. They will be rough, but they round out nicely with 80-grit paper on a soft-padded palm sander. Shape the drawer pulls in the same way, taking care not to sand too much of your fingertips off in the process. Be sure the backs of the pulls, which will be glued to the drawer fronts, are flat. Continue on through medium and fine grits to remove the coarse sanding lines. To make palm sanding easier, belt sand with the grain on the sides with the medium and fine grits to remove the cross-grain lines. Do this by feeding the box sides in a gentle upward motion against the pull of the belt.

On the router table, round over the drawer fronts with a ⅜" roundover bit. With a hand-held router, round over the edges of the drawer cavities in the box body with a ⅜" roundover bit.

Palm sanding with 80-grit makes quick work of the hard edges you roughed out on the belt sander. From there, palm sand the entire project with a succession of medium and fine grits, making certain to remove any cross-grain lines that may be left over from belt or drum sanding. You can roughly chisel and sand a roundover in the saw kerf edges at any time during your palm sanding operation. Hand-sand beginning with 80-grit to make quick work of rounding over the chiseled kerf edges. Continue sanding, working through progressively finer grits, and stop with 180. Hand-sand the drawer pulls to soften their shape, apply a thin layer of glue to the flat backs, and position them on the sanded drawers. Eye them up to your taste for symmetry, using

When shaping the box edges, feed the wood into the belt with an upward motion. In general, take more wood off on the thicker edges, and less where it's thin.

A little twist of the wrist over the top cylinder can create some interesting effects in your box's inner curves.

You can taper the drawer pulls to add depth if you choose, or you might decide to leave them flat and just round the edges a little. Experimenting with these little shapes not only gives you an idea of what you can do on a larger scale with your box, but comes with the added benefit of a manicure, too.

It's easiest to handle the small drawers on a router table, while…

…a hand-held router lets you see what you're doing as you rout the inner edges of the drawer cavities on the box body.

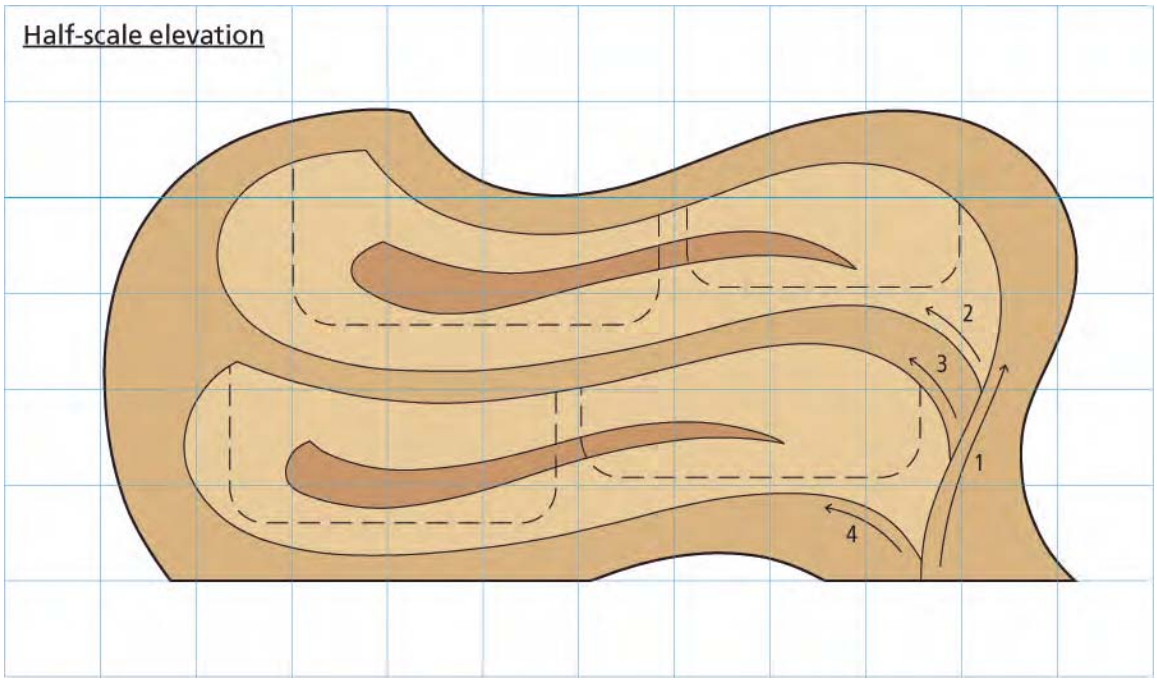
the pattern as a guide, then apply hand pressure for a couple minutes to clamp and set the glue.

While you're waiting for the drawer pulls to dry, do a final touch-up sanding with 180-grit by hand over the entire box, especially around the edges and in the cavities of the box. Use a sharp chisel to chip off any glue squeeze-out on the inside of the drawer cavities where the back was clamped onto the box. When the drawer pulls dry, lightly chisel and/or sand any squeeze-out there also.

Band-sawn boxes lend themselves well to an oil finish. Oil is much easier than trying to spray or brush a varnish inside those box cavities, but that's just my humbly biased opinion. Whichever type or brand of oil you decide to use, make sure you wet sand with 600-grit wet or dry paper between the first and second coats. Wipe off any excess oil with a dry cloth. And make sure each successive coat is thoroughly cured before applying the next one. This will ensure a smooth, even, luxurious finish for those curves — a treat for the fingertips as well as the eye.

Thought you were done? You still need to flock those drawers yet. A flocking kit is simple to use and comes with basic instructions. Seal the insides of the drawers with a coat of shellac or other varnish so the flocking adhesive won't soak in too much. Using a cardboard box turned on its side as a mini spray booth to catch the excess flocking material, pump a heavy coat of flocking into the drawers until all the wet spots are gone. Tap out the excess and pump more flocking material in if any wet spots reappear. Then, collect the overspray of flocking and let the drawers dry overnight. When dry, vacuum out the loose fibers and dust off the drawers. A light coat of paste wax, well-buffed, will make the drawers glide smoothly.

Once you see how easy and liberating the less-structured process to make a band-sawn box can be, you may just decide to give up squinting at those $\frac{1}{16}$" lines on your ruler. And maybe your unusual woodworking technique will catch the eye of a



storage & assembly BEN

My shop at home is a two-car garage. To make things more complicated, my wife feels pretty strongly that the two cars should be allowed to stay in the garage. What a silly idea, but it's been an interesting challenge to keep her happy and still work comfortably on my projects. At the heart of this dilemma is getting enough storage and assembly space. There's enough room in the garage to put some shallow cabinets on or against the walls, but storing my "assembly bench" (fold-up horses, planks and a partial sheet of plywood) stops me from getting to my storage. And while the fold-up horses are handy, they're not as stable as I'd prefer and I can't adjust them higher or lower. Sometimes I want to work 24" off the ground, other times 34". I decided it was time to solve my dilemma and here you see the result. When assembled, this unit offers sturdy, adjustable-height bench space with easy access to the stuff in the drawers. When not in use, the two cabinets store conveniently against the wall. You also can use them as benchtop tool stands and still have easy access to the drawers.

Building Boxes

This is a basic project. The only complicated part is the height-adjustment feature of the cabinets. I haven't spent a lot of time illustrating the cabinet construction, but the illustrations and the construction description should get you there safely.

The cabinets consist of a ¾"-thick plywood top and bottom, rabbeted between the two ¾"-thick sides. The back is also ¾" and is rabbeted into the sides, top and bottom. Start by cutting the pieces to size, then cut ½" x ¾" rabbets on the top, back and bottom inside edge of each side. I made the rabbets on my table saw, but you could easily use a router instead. Then cut the same rabbet on the back edge of the top and bottom pieces.

I used my 2" brad nailer to shoot the cases to-

by David Thiel

Comments or questions? Contact David at 513-531-2690 ext. 255 or DavidT@FWPubs.com.

Photo by Al Parrish

CH

When space is tight (and when isn't it?) this modular system gives you a height-adjustable assembly bench, two stands for benchtop tools and six drawers of roll-around storage. Best of all, it breaks down fast and stores in small spaces.

By adding smaller tops to the individual cabinets, each makes a fine tool stand with lots of storage beneath. Note the roller stand mounted on the underside of the top. Flip the top over and you've created an outfeed table for any machine.

Storage & Assembly Bench

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	NOTES (W/INCHES)
Cabinets							
❑	4	Sides	3/4	15	21 3/4	Birch ply	1/2 x 3/4 rabbets, 3 sides
❑	4	Tops & botts	3/4	15	27	Birch ply	1/2 x 3/4 rabbet, back
❑	2	Backs	3/4	27	21 1/4	Birch ply	
❑	2	Tops	3/4	30	72	Birch ply	
❑	4	Support arms	3/4	6	19 5/8	Birch	
❑	2	Top plates	7/8	6	29 1/8	Birch	1/2 x 3/4 rabbets, ends
❑	8	Channel sides	3/4	7/8	20	Birch	
❑	8	Channel fronts	3/4	2	20	Birch	
❑	4	Channel botts	3/4	7/8	6	Birch	
❑	4	Dowels	1		2 1/2"	Maple	
❑	4	Dowels	3/4		1 5/8"	Maple	
Drawers							
❑	4	Fronts	3/4	5	25 7/8	Birch ply	clearance space incl.
❑	2	Fronts	3/4	10	25 7/8	Birch ply	clearance space incl.
❑	8	Box sides	1/2	4	13 1/4	Birch ply	1/4 x 1/4 groove, 3 sides
❑	4	Box sides	1/2	9	13 1/4	Birch ply	1/4 x 1/4 groove, 3 sides
❑	4	Box fronts	1/2	4	24 1/2	Birch ply	1/4 x 1/4 tongue, ends
❑	4	Box backs	1/2	3 1/2	24 1/2	Birch ply	1/4 x 1/4 tongue, ends
❑	2	Box fronts	1/2	9	24 1/2	Birch ply	1/4 x 1/4 tongue, ends
❑	2	Box backs	1/2	8 1/2	24 1/2	Birch ply	1/4 x 1/4 tongue, ends
❑	6	Bottoms	1/4	13	24 5/16	Ply	

gether, adding some glue to the joint for good measure. Screws (#8 x 1 1/4") would also do the job here. Use the backs to square up the cabinets. This will be important when you install the drawers.

I was feeling pretty minimalist with this project and decided to let the utility show through by simply rounding over all the plywood edges with a 1/4" roundover bit in my router. If you prefer a more finished appearance, take the extra time to apply iron-on veneer tape to the exposed plywood edges.

To make adding the height-adjustable supports easier I attached the four casters (two standard, non-swivel and two swivel locking) to the cabinets at this time.

I used my brad nailer to tack the channel bottom in place between the two channels through the front and through the sides. Be careful about shooting too close to the end of a piece to avoid blow-outs.

Going Up, Going Down

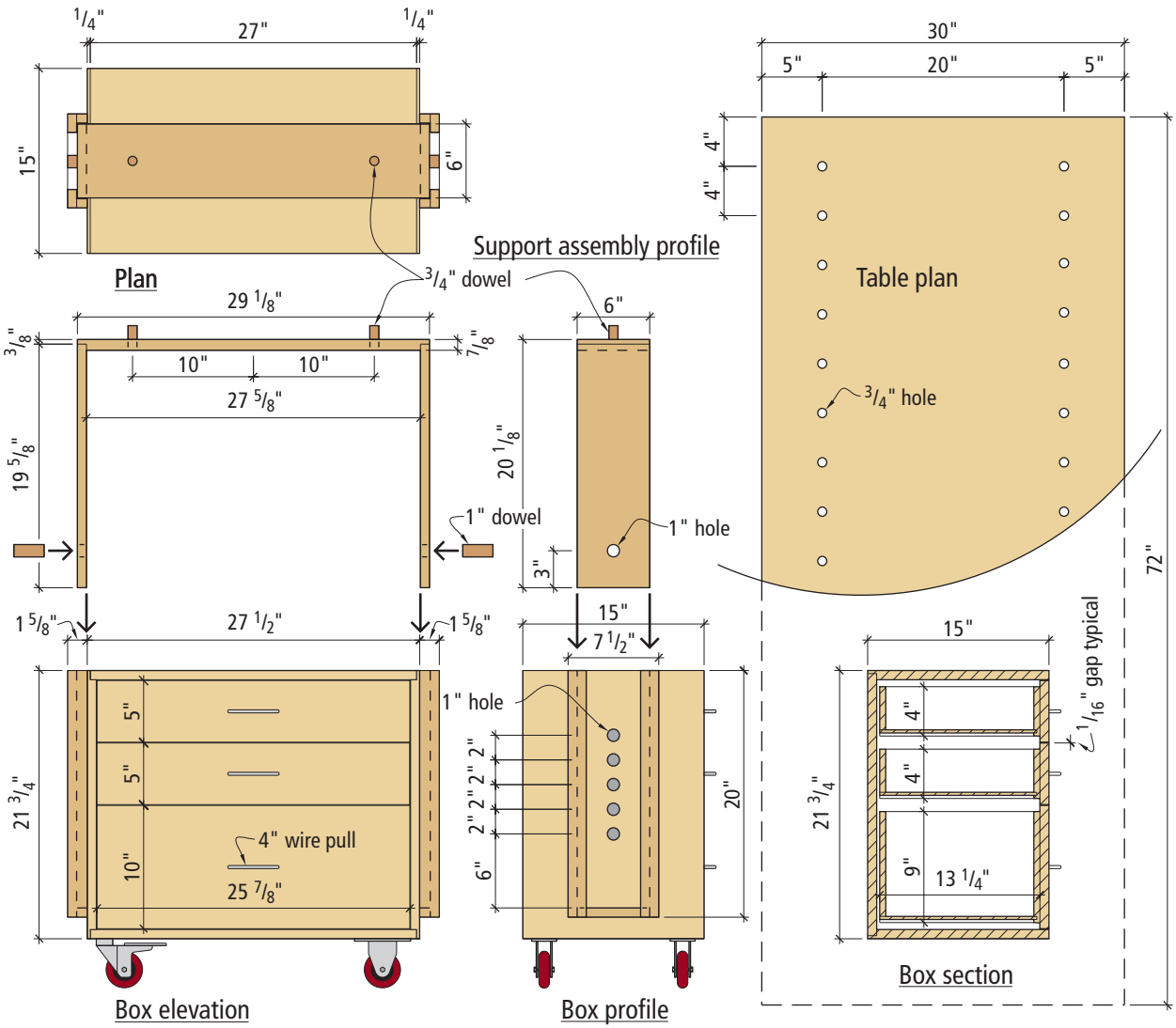
I went through a lot of different ideas to make the top height-adjustable. After making it a lot more complicated than necessary, I threw away those drawings and went back to simple. The height-adjustable table supports are brought to you by the letters "U" and "L." The support arms are U-shaped solid birch assemblies that slip into two L-shaped channels on each side of the cabinets.

After drilling the clearance holes in the cabinet sides, I used a clamp to hold the channel assembly in place while pilot drilling, then screwing the channels in place from the inside of the cabinet.

Start by jointing and thicknessing all the solid birch necessary for the pieces and cut them to finished size, except for the channel pieces. Leave those pieces a little long until after they're glued up. I once again took advantage of my brad nailer to speed up the assembly process. Glue and nail the channel fronts to the channel sides, then set everything aside to let the glue cure.

While they're drying, cut the channel

A 1" dowel is a simple and secure way to hold the support arms at the proper height. The five hole locations (and the all-the-way-down position) give you a variety of working heights.



bottoms to length. Cut an extra one to use as a spacer while you're at it. When the channels are ready, clean up any extra glue, then get the roundover router out again. I rounded all the outside surfaces on the channels and the top lips where the support arms will enter the channels.

Glue and nail the channel assemblies together, using the extra bottom to help maintain even spacing at the top of the assembly.

To attach the channels to the cabinets, first use a combination square to make a line 4⅛" in from the front and back edges of each cabinet. Double-check the lines to make sure they will fall in the exact center of each of the channel sides. After checking, drill five evenly spaced 3/16" clearance holes on each line. Countersink each hole from the inside of the cabinets, then attach the channel assemblies to the cabinets, holding the top of the channel flush to the cabinet top.

Now move to the support arms themselves. Use your drill press to make a 1"-diameter hole through each support arm, 3" up from the bottom edge and centered on the piece. On each cabinet, mark the location for five 1" holes centered on the spaces between the channels, locating the first 6" up from the inside of the channel bottom, then 2" on center from that first mark. These holes shouldn't be drilled all the way through the cabinet side, or the dowels will interfere with the drawers. Make the holes about 5/8" deep. I used a Forstner bit and used the spur tip as an indicator of depth. By drilling slowly I was able to tell when the spur poked through on the inside, and stop the hole at that depth.

Next, round over all the edges on the support arms except those on the top, then slip the arms into the channels and check the fit. If they don't move easily (though they shouldn't be too loose) adjust the fit. With the arms all the way down in the channel, take one of the top plates and lay it across the two arms. Mark the location of the arms on the top plate, allowing the arms to naturally settle in the channels. If they're pushed too tightly to the cabinet, the arms won't move easily.

Head to the table saw and cut ½"-deep

The drilling jig is simply a piece of plywood with an edge stop (like a bench hook) with a guiding block screwed in position over the hole (centered 5" from the edge).You'll notice another hole drilled through the plywood in front of the block.That hole is in line with the guiding hole and lets you see your positioning line drawn on the top to know if you're in the correct location to drill.

rabbets on each end of the top plate using the marks for the support arms to determine the width. Then drill clearance holes, and screw the top plates to the support arms after pilot drilling the hole to avoid splitting.

You should be able to raise and lower the entire assembly with little resistance. I used simple dowels to lock the arms at whatever height I wanted. Round over the edges of the top plate, then move on to building the benchtop.

More Than an Assembly Top

The top is made from two ¾"-thick pieces of plywood glued together. Use lots of glue spread thinly over the entire surface of one piece, then nail the corners to keep the top from slipping around while you clamp up the top "sandwich."

To give the top even more versatility, I added dog holes along the front and back edge of the top to accommodate a set of Veritas Bench Pups and Wonder Pups. These work like vises and can hold almost any workpiece. These holes also become the attachment points to hold the top in place on the cabinets.

Locate the dog holes 5" in from each edge and spaced 4" on center, starting 4" from either end. I used a ¾" auger bit to make the holes, and the photo shows a jig we've used before to make sure the holes are straight.

With the holes drilled, mark a centerline down the length of each support top plate. Then lay the benchtop on top of the cabinets and position it evenly on the top plates. Now look through a set of dog holes in the benchtop and move things around until the centerline on the plate is in the center of the holes. Use a pencil to mark the hole locations on the top plate, then remove the top.

Drill ¾"-diameter holes partway through the top plates (⅝" deep). Then drill a 3/16" clearance hole the rest of the way through the plates, centered on the holes, countersinking the holes from the underside of the top plate. Cut four ¾"-diameter dowels to 1⅝" in length, and screw them in these holes from the underside of the top plates.

The top can now be easily located on the dowels without having to bend over. Once in place, the dowels hold the cabinets in place, and make the entire bench more sturdy. But don't forget to round everything over. Not only did I round the top's edges, but I also rounded the lips of the dog holes. This makes it easier to locate the dowels and dogs and also keeps the plywood from splintering at the sharp edges.

Sturdy Storage Drawers

The drawers are the last step and are designed for basic utility. They are ½" plywood boxes with ¼"-thick plywood bottoms and a ¾" false front. I used tongue-and-groove joinery on the drawer boxes.

Set up either a ¼" stack dado in your table saw, or a ¼" bit in your router table. Then set the fence to leave ¼" between the fence and bit or blade. Set the depth of the cut for ¼", then run the front, back and bottom inside edges of each drawer side. Also run the bottom inside edge of each drawer front.

Next adjust the fence on your saw/router table to cut the tongues on the drawer fronts and back. Check the fit, then run all the fronts and backs. The drawers are then glued and nailed together. The bottoms slip into the groove in the sides and front, and then are nailed in place to the bottom edge of the drawer back. Use the bottoms to make sure the drawers are square before nailing them in place.

The false drawer fronts are again simple and utilitarian: ¾" plywood with the edges rounded over. I held each drawer box ¼" up from the bottom edge of each front. Attach the drawer handles (simple 4" chrome pulls from almost any home center store that cost about $2 each) to the fronts, countersinking the screw heads flush to the back of the drawer fronts. The false fronts are screwed in place through the drawer box fronts. Mount the slides following the hardware instructions.

I added a couple coats of paint to the cabinets, but left the top as bare wood. I added a coat of lacquer to the top support assembly and the drawer fronts. There's only one thing left to do to make these storage cabinets all they can be. Make a couple of auxiliary tops to fit on the individual cabinets. I made mine with a piece of ¾" plywood (drilled to match the dowels). Add a roller and you have a height-adjustable outfeed table that can be used with your table saw, jointer, planer or any other machine. When not in use as a bench or outfeed table, you've now got two very handy tools stands that tuck away against the wall — right next to the cars. **PW**

Sources

Grizzly Industrial Inc.
800-523-4777, or www.grizzly.com
4 - H0689 3" fixed casters - $3.95 ea.
4 - H0693 3" swivel casters w/brake - $5.95 ea.
6 - G5084 12" full-extension slides - $9.95 pr.

Lee Valley
800-871-8158, or www.leevalley.com
2 - 05G10.02 Wonder Pups - $18.95 ea.
1 - 05G04.04 Bench Pups - $12.75 pr.

Photo by Christopher Schwarz

Lathe Turning's FAB 5

By using five basic lathe tools you can do almost any type of turning project. Learn the basics, then let yourself experiment.

Few activities render the joy and creative expression that wood turning does. It is immediately rewarding to see shapes appear right before your eyes. Yet less than 10 percent of American woodworkers turn. Perhaps it's just hard to get started. If that's your excuse, I can show you how to make turning simple using only five basic turning tools. If you're interested in learning to turn, read on. If you're already a turner, you may learn how to simplify your craft by using some of your tools more efficiently.

So what are these five wonder tools? If you become handy with these chisels, you'll be a master in no time. They are (from left to right above) the 3/16" diamond parting tool (the cross section of the blade is diamond shaped), the 1 1/4" roughing gouge, the 1/2" bowl gouge (perhaps the most important), the 1" oval skew (its edges are rounded for easier use), and the 1/2" roundnose scraper.

I recommend spending the extra bit of money to buy high-speed steel lathe chisels from Sheffield, England, for two reasons. First they hold their edge longer than high carbon steel, and second, if you do slightly blue an edge while sharp-

by Scott Phillips

Scott Phillips is host of the PBS television show "The American Woodshop," and is a contributing editor to Popular Woodworking *magazine. He lives and works in Piqua, Ohio.*

First get comfortable and stand close to the lathe so no reaching is required to make your cuts. Note too that the long handles are designed to be held comfortably to the body as the cut is made. This technique is called the three-point grip. The control hand is on the handle to position the bevel and to control the cutting edge. The other hand rests safely on the tool rest and grips the chisel securely. The chisel must always rest on the tool rest as any cut is made. Never allow your fingers or hand to be pinched between the tool rest and the work piece.

ening on a grinder the chisel will still perform well.

The best beginner turning project is an object locked between the drive spur and the live ball-bearing center. This is called spindle turning. To start, always set the lathe at the lowest speed setting when starting a new turning, then mount the workpiece securely between the centers. Adjust the tool rest as close to the edge of the workpiece as possible, rotate the turning square by hand to make sure no points contact the tool rest, then lock it in place. The next step is perfecting your stance. The photo shows how to do it correctly. Some good turning (and woodworking) habits are to remove all rings and jewelry and roll up your sleeves. Also, you should

Bookshelf

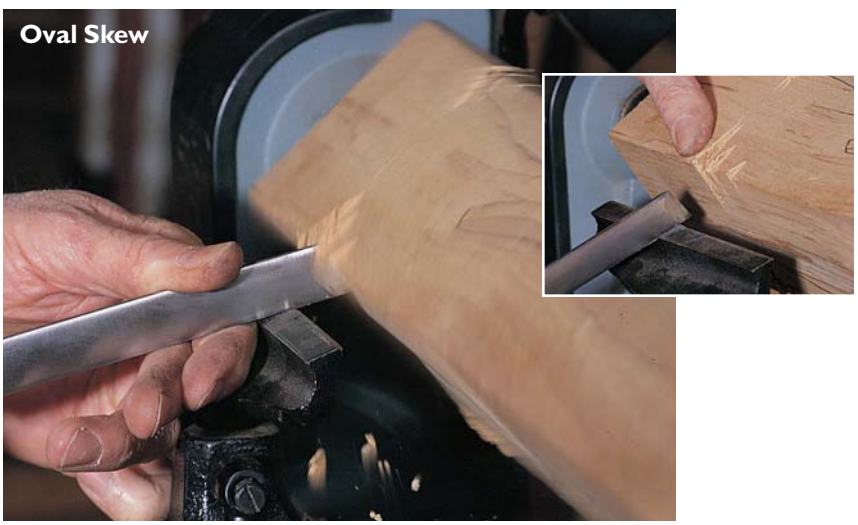
If you're looking for good books on turning, here's a few we recommend at *Popular Woodworking*:

"Turning Wood With Richard Raffan" (Taunton Press) This classic has been newly updated and revised. It's a complete education for the novice turner.

"Woodturning: A Foundation Course" by Keith Rowley (Guild of Master Craftsman). Another good book for the beginning turner.

"Turn a Bowl with Ernie Conover" by Ernie Conover (Taunton Press). Focuses on bowl turning for the novice woodworker.

Check with your local bookseller, or buy them at a discount after joining the Woodworker's Book Club by calling 800-221-6364.



With the tool rest locked in place, the lathe is turned on and the cut is made with the flat of the skew blade held perpendicular to the tool rest and square to the workpiece (above). After the cut is completed and the lathe is turned off you can see how the square corners of the turning blank have been sheared to help limit tear-out (right).

read, understand and follow all the instructions that come with the tools you use. Always work safely and wear a face shield while turning.

The project I'm working on in this article is a candlestick pedestal. The turning blank measures 3" square and 16" long, and the bottom segment will remain square. Before turning the lathe on, I first adjust the tool rest so the cutting point of the lathe skew (called the toe) is right at or slightly above centerline, as shown in the photo (below left).

Next the ½" bowl gouge is used to gently cut a sweeping cove (a cove cut is a cave-like cut). Make certain that the tool rest is adjusted and locked to allow the cutting edge of the chisel to be right at or slightly above the centerline. The flute of the bowl gouge is tilted slightly to the right. The photo (top) shows the proper blade orientation.

You may have noticed the spalting that is beginning to show up on the work piece. These colors and zone lines of decaying maple are beautiful yet pose a serious health threat. Always wear a NIOSH class 2 dust mask when working with spalted wood, especially when sanding. Allergic reactions to these wood dusts can be severe.

Once the corners are sheared and the sweeping cove is formed, use the 1¼" roughing gouge to remove the rough edges and create a smooth cylinder above the square base (right).

Next use the 3/16" thick diamond part-

The cove cut is made by easing the cutting edge of the bowl gouge into the workpiece (left). Try to rub the bevel to get the smoothest cut. My hand holds the chisel to the tool rest and steadies the gouge as the cut is made. With the lathe off (top right), you can see the proper blade orientation. The chips and shavings should be coming off the right edge of the fingernail grind (a modified shaping of the tip for improved cutting, shown above right). The beauty of this bowl gouge is that it is ideal for both spindle and bowl or faceplate work. This is my favorite chisel because of its versatility.

Once again notice how the flute (the channel running the length of the blade) is rolled slightly to the right as the cut is being made from left to right (above). This will allow the bevel of the chisel to rub the wood fibers and consequently support the cutting edge. The trick to this cut is to rub the bevel and engage the cutting edge at the same time (right). When done in sync the result is a super smooth sheered wood surface. That's the magic of shearing. One tip: rub the bevel first then raise the handle slightly until the bevel and the cutting edge are working in harmony. When it works right that is called "the dance" in turning. If not, well your turning just got a little smaller. Don't sweat it! Have fun and try it again! By the way, the roughing gouge is only used for spindle turning. It is too grabby for bowl or faceplate work.

Parting Tools Roll Nice Beads

The photo above shows that the tool rest has been raised slightly and locked in place to cut the first of the slots to form the beads. The cutting edge is now about ½" above the centerline. This slight adjustment makes for more efficient cutting. The typical parting cut is made by holding the flat of the chisel perpendicular to the tool rest and square to the work piece. In the next photo you can see how the parting tool can be used to roll graceful beads by slowly laying the chisel flat on the widest part of the blade. This technique requires practice yet is easy to learn. Remember that the blade of the chisel always remains securely on the tool rest during all cutting passes. The bead is made by first rolling one half of the bump. Then roll the second half while always working from the larger to the smaller diameter. Another way to think about it is to always turn downhill. That means start high and turn low (third photo). When the beads are formed the parting tool is used traditionally to square up the shoulders of the beads and to detail accents (last photo).

The key to the roundnose scraper is to lower the tool rest and lock it in place so the cutting edge of the scraper is precisely at centerline. The roundnose scraper is like a steel cliff. The overhanging cutting edge is always on top. I like to use this scraper to cut uniform coves (left). Just turn up the lathe to approximately 1,200 rpm and gently ease the cutting edge in to the proper depth. Open up the width of the cut as you go deeper to prevent the blade of the chisel from binding. Turn off the lathe to inspect the quality of the cuts often (right).

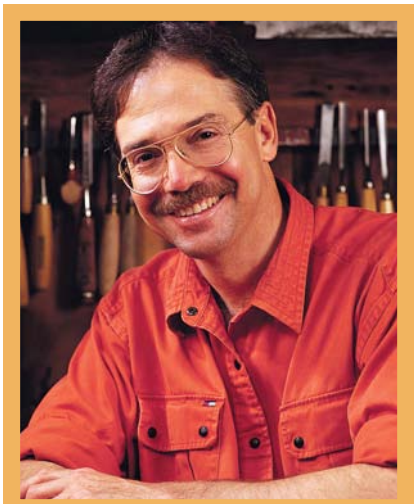
ing tool to accent the candlestick pedestal by first cutting three identical slots straight into the workpiece (previous page). Then turn the slots into three beads. A bead is simply a bump.

The fifth versatile lathe chisel is the ½"-wide roundnose scraper. Scrapers can be used to do just about every cut imaginable. In fact, if you have trouble with the shearing techniques, just use the scraper to get the profile close then add details with the parting tool.

One final tip is for advanced turning. The lathe skew is primarily used by experienced turners to form perfectly smooth cylindrical shapes. This spindle turning (turning between centers only) technique is tricky to master, but follow the tips in the photo caption below to turn a perfectly smooth cylinder to finish the candle stand.

These tips should allow you to enjoy the successes of turning your own masterpieces in only a short while. And remember what my father taught me years ago: Never tell anyone what you're turning until it's done, that way no one will be the wiser if things change shape along the way! Have fun! **PW**

Look closely at the height of the locked tool rest in the photo above. The tool rest must be positioned so the bevel and cutting edge of the skew is approximately halfway between the centerline (the imaginary line connecting the point of the drive spur and the point of the live ball-bearing center) and the top of the work piece. Rub the bevel first then raise the handle slowly until the bevel and the cutting edge engage the work piece at the same time. The bevel must be rubbing the wood for this shearing technique to work properly. The shaving should come off of the skew's edge about ¼" away from the heel of the skew (the back part of the skew opposite the toe) and not quite to the center of the cutting edge.



Turn Like Scott

Don't think you have to spend a fortune to enjoy turning. The lathe in the turning photos is the new Delta Midi-Lathe with the bed extension. The Midi-Lathe (model 46-250) retails for around $380 (including the extension bed) and offers a ½ hp motor, 37" between centers (again with the extension bed; yes, you should buy the extension bed) and operates at six speeds ranging from 500 to 3,700 rpm. It's a great tool that's reasonably priced and with lots of utility.

And now that I've told you to start turning with five specific turning tools, it wouldn't be fair not to tell you how to get them. We've made arrangements with Woodcraft (which sponsors my show) to offer the five tools I recommend as two specially priced packages, one from Sorby (pictured on the opening pages of this article) and one from Crown, at special PopWood prices. Let's call them, oh, I don't know, the Scott Phillips Fab Five Turning Sets.

Item #142710
Scott Phillips
***5 Piece Sorby Set* - $219.99 (Usually $249)**
or
Item #142711
Scott Phillips
5 Piece Crown Set
- $169.99 (Usually $215)

To order either set, call Woodcraft at 800-225-1153 or visit the company's website at www.woodcraft.com. Be sure to specify the item number listed here to receive the special pricing.

- Scott

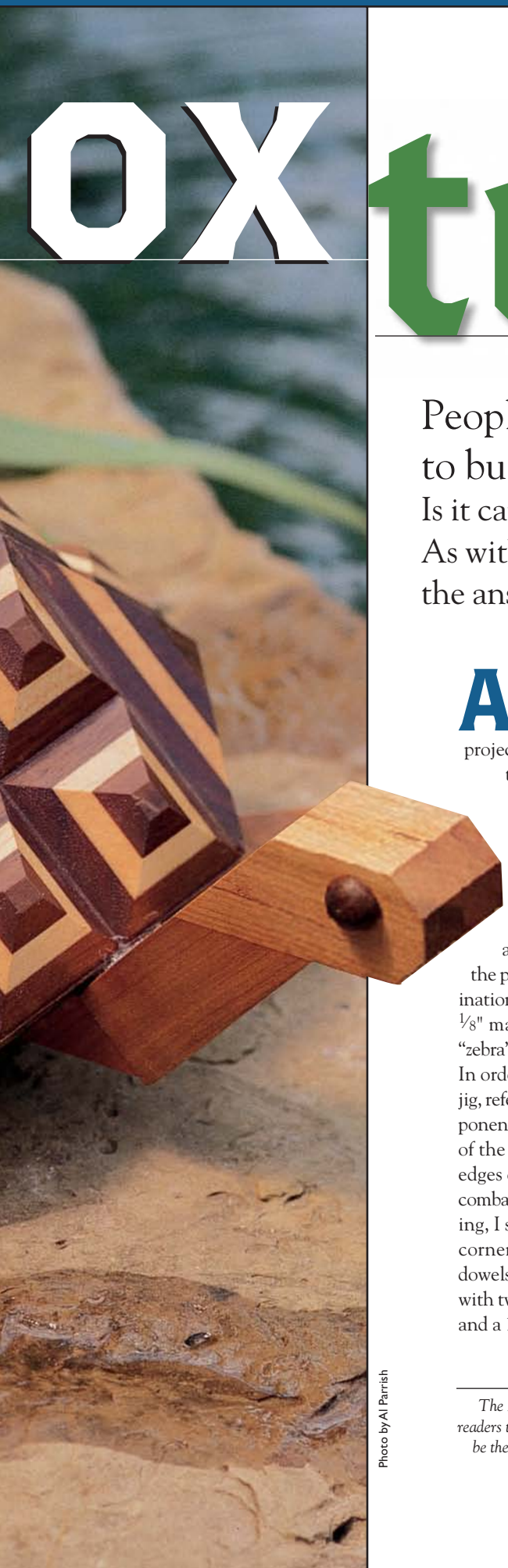


Photo by Al Parrish

ox turtle

People will wonder how you managed to build this multi-faceted shell.

Is it carved? Assembled from individual parts? As with many amazing things in woodworking, the answer is a router with just the right bit.

Almost every project requires a special tool – one that is occasionally pulled out of the back of a cabinet drawer or purchased specifically for the project. In the case of the Box Turtle, the reverse was true. A tool led to a project. I saw an unusual 120° v-grooving router bit in a catalog (Eagle America) and couldn't help but wonder what anyone would do with it. The Box Turtle is an answer.

Begin your box turtle by preparing laminated stock for the shell. You will need ⅜"- and ⅛"-thick material no less than 5½" wide. For the prototype appearing in this article, I stacked laminations starting with a base of ⅜" walnut, followed by ⅛" maple, topped with ⅛" walnut. This ⅝"-thick "zebra" plywood can be made of any contrasting woods. In order for the stock to be manageable in the router jig, refer to the cut sheets for layout of all the shell components on three 12" lengths. Since the width of some of the pieces is 5¼", it is important to keep the long edges of the laminations aligned during glue-up. To combat the inevitable sliding that occurs during clamping, I start with 13"-long strips, drill ¼" holes at the corners, and insert short lengths of ¼" registration dowels. My "press" consists of eight pistol-grip clamps, with two small bar clamps thrown in for good measure, and a 1x backer board.

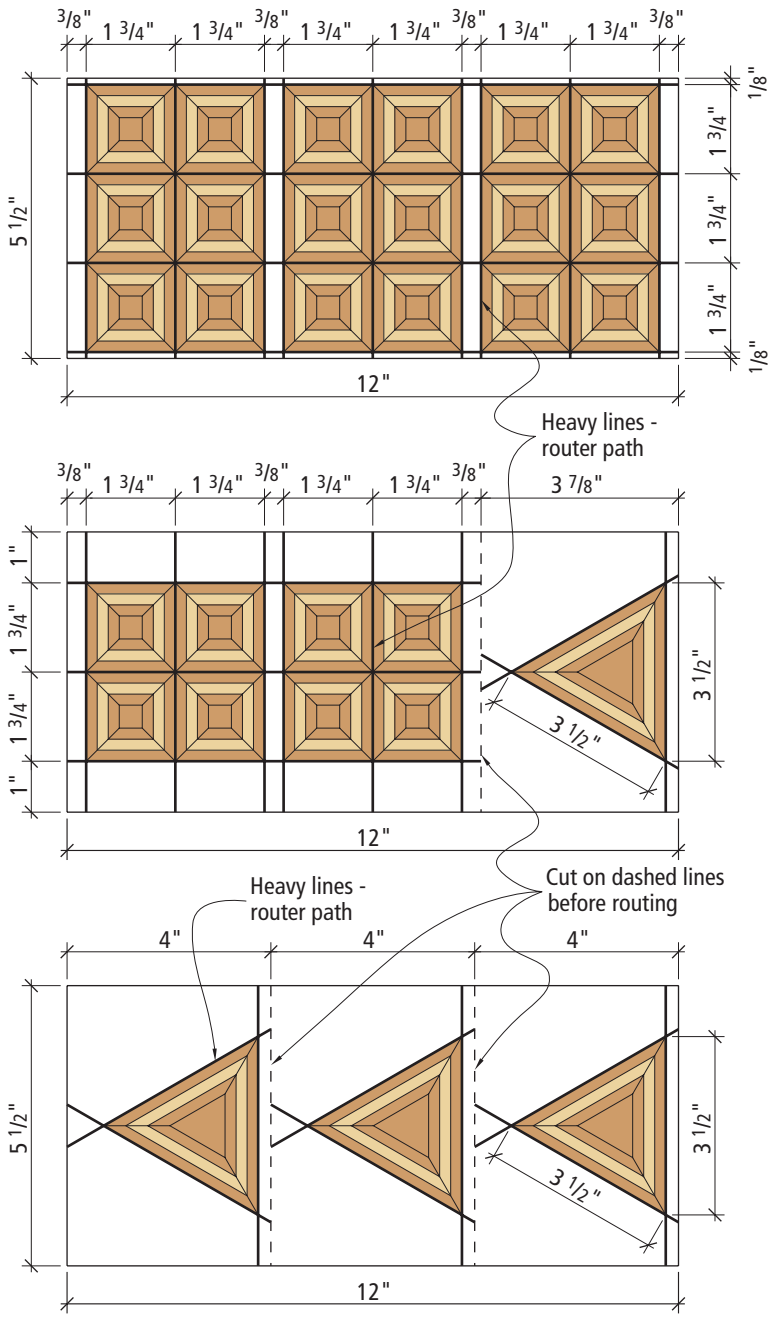
To make the shell, first make your own plywood. I used alternating layers of walnut and maple, though any contrasting woods would do nicely (lacewood and maple perhaps?). As with veneering, you need to make sure you use enough glue and enough clamps. Apply the glue with a stiff-bristled brush and clamp it up with whatever you've got. Be sure to clamp the middle.

by John Hutchinson

The Box Turtle marks John's third appearance on the pages of Popular Woodworking. For those readers that have not attempted his Secret Toad Box or Sea-D Otter, we hope that this third project will be the charm. As we went to press, still more life forms were clawing their way up from the ooze of John's fertile mind. Stay tuned. You can contact John at JTHutch1@aol.com.

The surfacing jig (left) holds the parts in place during routing. To ensure they're at the correct angle, I cut blocks of plywood at the desired angle and wedged those against the work. Everything is then secured by toggle clamps. The router rides on a track above the jig (center). After two completed cuts, you can see how the triangular bits of the shell begin to take shape (right).

Cut Sheets

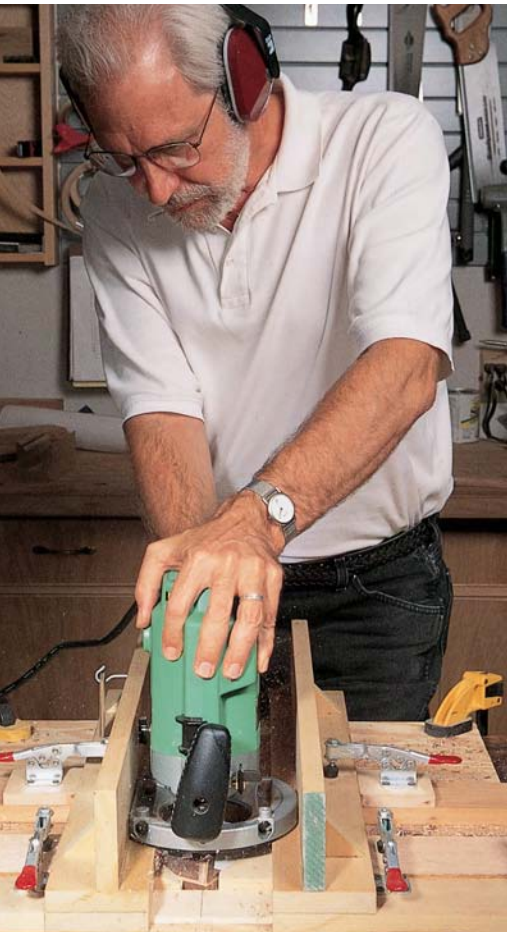


Cut the Shell

Next, separate the rectangular and triangular components following the instructions on the cut sheets. After securing these parts in a router surfacing/dado jig (shown above), form the pyramid mounds on the turtle shell by plowing v-grooves on the router path lines to a depth of 3/8". Due to the large diameter of the bit, make the cuts in multiple 1/8" descending passes with a router speed around 16,000 rpm.

With all routing operations complete, cut out the four- and six-square segments of the shell on a radial-arm saw with the assistance of a hold-down jig. The edge of the cut is the bottom of the v-groove. Cut all mating edges at 22½°, bevel in. Cut all bottom edges at 90°. Study the overall plan and exploded drawings of the turtle to determine mating and bottom edges. You may want to differentiate the two by running different colored pencil lines in the grooves before making the cuts. The triangular corners of the shell, although apparently more complex, are cut in the same manner as the square segments. Lay

Once you get the body segments cut, glue them to the base piece.



out an equilateral triangle on the plywood, 3½" per leg, and plow the 120° grooves on the router paths. Once again, cut the mating edges at 22½° and the bottom edges at 90°. Since there is no good way (that I know of) to clamp the segments during glue up, use a glue with a short open time such as Titebond II.

Build the Turtle Body

The lower container begins with a ½"-thick base. The sides require 1⅛" stock. Lay up two layers of 1x cherry and then plane the two-ply material down to

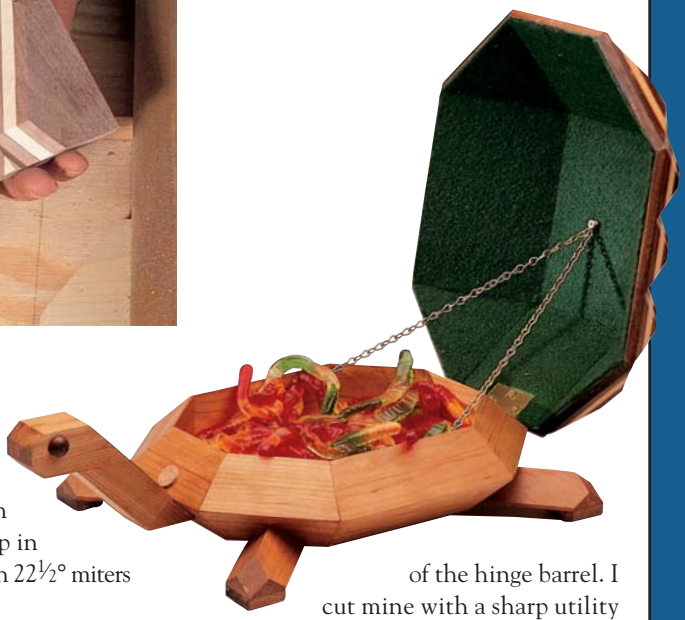
Once again, I used toggle clamps to secure the shell pieces when cutting them to size. Because of the pyramid shape of the shell, it was difficult to find a place for the clamp head to grab, so I put a piece of scrap plywood on top.

the required thickness, taking equal amounts off each face. Ripping the material at 45° produces the 2¼" high wall stock. Glue this up in segments to the base with 22½° miters at the corners.

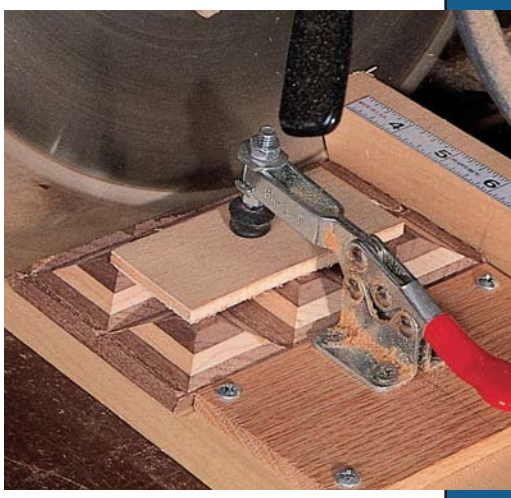
Make the head and neck components from the same 1⅛"-thick stock ripped to 1"-wide strips. Refer to the overall plan and section drawings for assembly. Add ⅜" walnut button plug eyes.

Cut the legs from ¾" cherry stock with multiple 45° rips and crosscuts per the pattern. Attach ¾"-square foot pads cut from ¼"-thick walnut.

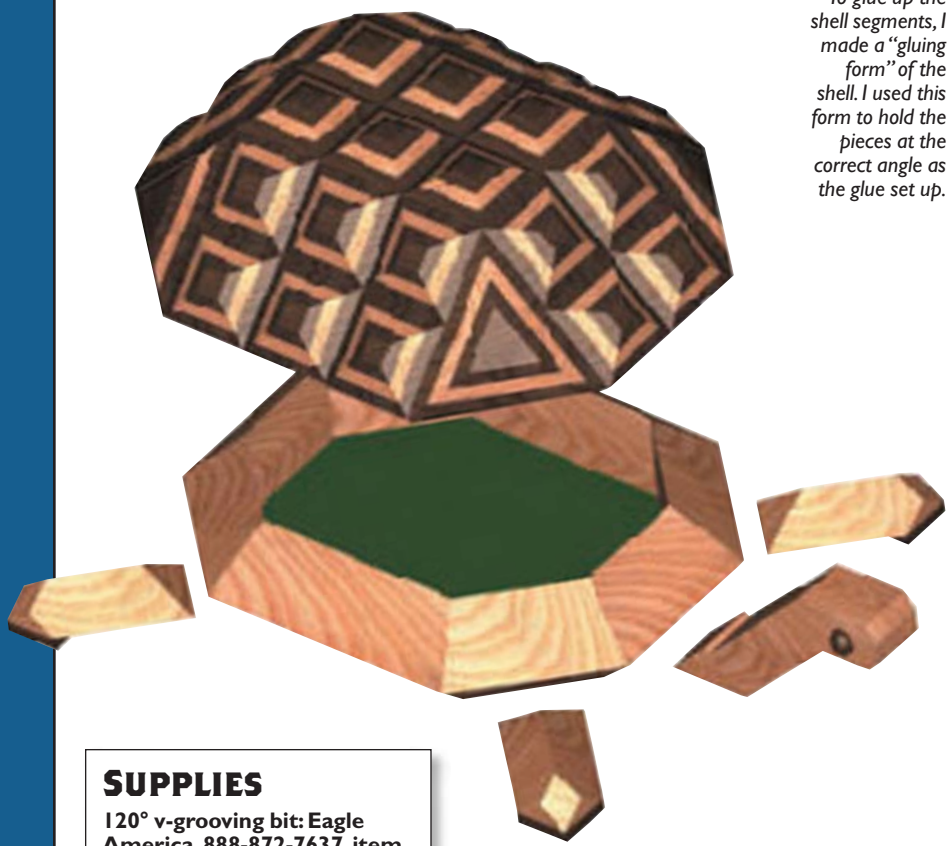
Connecting the lid to base requires a common 1½" x 2" brass hinge, some careful mortising, and a little cheating. The mortises are radius-depth; that is, they are cut to a depth equal to half the diameter



of the hinge barrel. I cut mine with a sharp utility knife and a chisel blade installed in my art knife. The hinge is easily secured to the base with the ½" screws that come with the hinge. Cheating comes into play when attaching the hinge to the lid. Since the screws are longer than the thickness of the lid, glue the plate in place with polyurethane glue. I have found that polyurethane tenaciously bonds anything to anything. I once, accidentally, glued a screwdriver to my workbench. Removing it took a divot of wood from the top. The lid screws are simply nipped heads glued in as hole fillers.



With your saw set to 22½°, make your cut. You can just as easily use a miter saw for this operation.



To glue up the shell segments, I made a "gluing form" of the shell. I used this form to hold the pieces at the correct angle as the glue set up.

Avoid the normal (and commendable) habit of sanding before finishing except on the razor edges on the base. The sharp angularity of the lid, head, neck, and legs, gives the turtle its faceted geometric character. Finish with your favorite wipe-on oil.

Line the underside of the lid with self-adhesive felt to prevent wear and tear on adjacent wood surfaces, silence the assembly, and add a touch of elegance to the interior.

Finally, attach the chain lid supports. I use light-gauge "hobby chain" available at any hardware store. Install the chain with brass wood screws to the sides of the box and the inside center of the shell. Experiment with the length until the chain neatly folds itself into the box as the lid is closed. As you drive the last screw into the

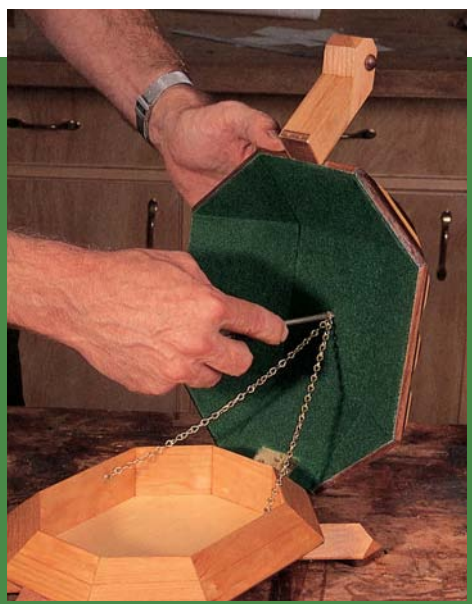
Supplies

120° v-grooving bit: Eagle America, 888-872-7637, item #132-2805, $56.99

Toggle clamps: De-Sta-Co clamps, Reid Tool Supply, 800-253-0421, item #TC-215-U, $8.15 each

We almost pulled it off

More correctly, we did pull it off — the head, that is. In the photo at right, you'll notice that the head is tenuously attached to a walnut tab protruding from the shell. In John's original incarnation of the Box Turtle, the head was to serve as the handle for the lid. After the construction photos were taken, the lead "location" shot was made by our intrepid wildlife photographer, Al Parrish. While positioning the turtle to catch its best side, Al inadvertently snapped off the head. Rather than blaming Al for mishandling the beast, John admitted the design flaw and reworked the project as reflected by the text, drawings and all other photographs in the article. We thought we'd successfully pulled off the switch until we noticed the turtle still rearing its head in the chain attachment shot. Rather than cropping the head, we thought we'd give you an insight into some of the behind-the-scenes madness associated with the evolution of a project — especially when John is involved.

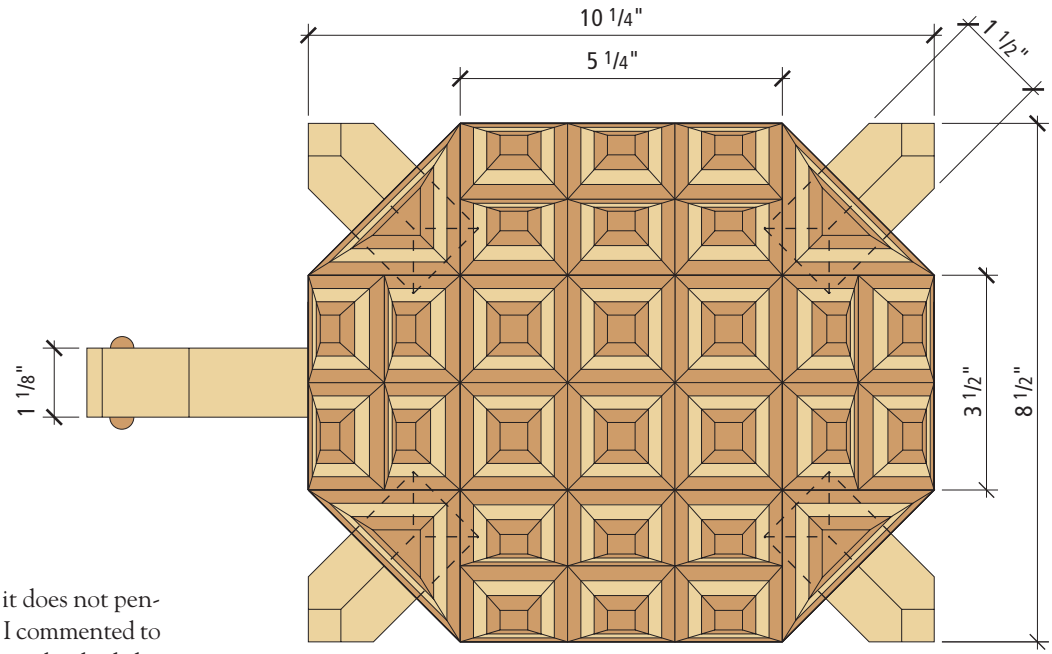


As you install the chain, be careful where you place the screw in the shell; parts of it are thin and your screw could appear on the outside of the shell.

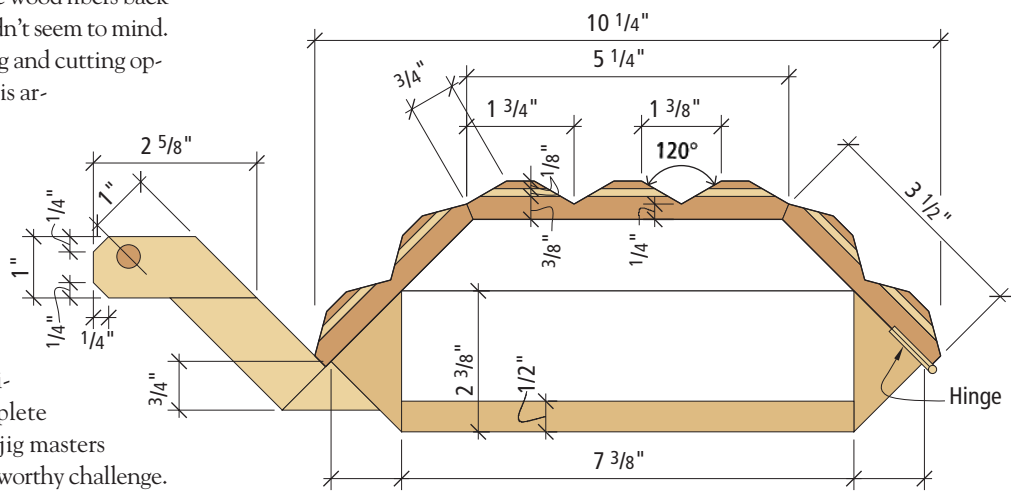
shell lid, be careful that it does not penetrate the top. Mine did. I commented to myself on my carelessness, backed the screw off, and pushed the wood fibers back into place. The turtle didn't seem to mind.

P.S. All of the routing and cutting operations described in this article can be accomplished on a table saw with the assistance of jigs. Since the angled surfaces of the plowed valleys are ¾", a 13⁄16" stack dado, set at 30°, will form one side of the valley. Reversing the direction of cut will complete the valley. I'm sure the jig masters out there will find this a worthy challenge.

PW

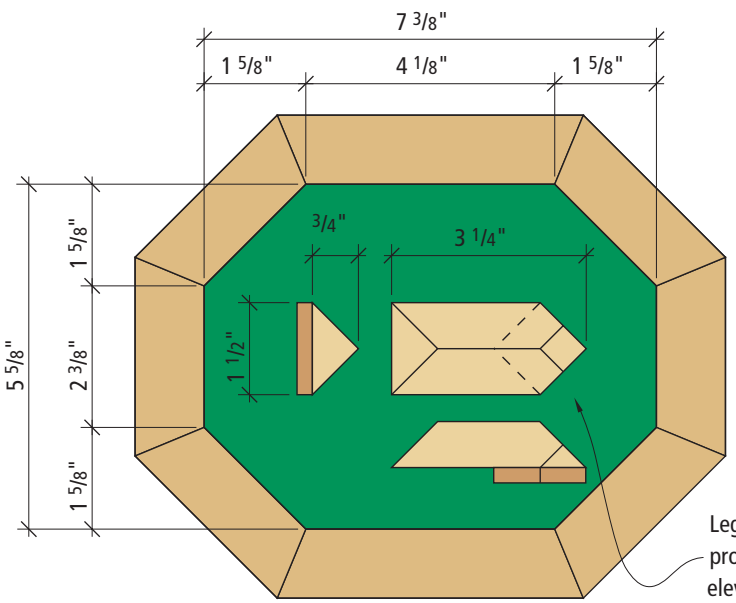


Overall Plan



Section

A little sanding between coats produces a nice finish. Also, note how the feet are attached to the underside of the base.



Box Plan

shaker trestle d

This reproduction of a Harvard classic was inspired by some good old-fashioned competition.

by Glen Huey

Glen Huey builds custom furniture in his shop in Middletown, Ohio, for Malcolm L. Huey & Sons and is a contributing editor for Popular Woodworking. *See his work at www.hueyfurniture.com*

Part of the job requirement of being a self-employed custom woodworker is self-promotion. Word of mouth works well, but starting the word can sometimes be a challenge. That's where competitions come into play. There are a number of woodworking shows every year throughout the country where I set up my booth and sell my wares. Many of them also have some type of woodworking competition. The competition can be organized so woodworkers compete in a certain category (professional, amateur, intarsia, turning). But it was a slightly different competition that brought me to the table pictured here. It's called a "side-by-side," and the idea is that an original piece, usually an antique of some note or reputation, is chosen by the event's organizers, and the competitors build a reproduction to mimic the piece.

The table shown is attributed to the Shaker community at Harvard, Mass., and is believed to have been used as a work table, side table or writing desk. The table is a wee bit wobbly, and the drawer may have been added at a later time. On the original, the drawer is maple, while the rest of the table is cherry. My desk is also cherry and maple, but the finish is done so it's hardly obvious.

As mentioned above, the reproduction (like the original) is a little unsteady. My recommendation for your piece is to make the stretcher between the legs considerably wider (6" or more), perhaps even cutting a decorative arch in the stretcher to lighten the look. Depending on how you plan to use the table, you may want to take that into account.

The Wood

This is a fairly simple table with some basic mortise-and-tenon construction, so contrary to Shaker philosophy I wanted to adorn the heck out of this thing with some amazing flame cherry. Quite honestly, I'm not allowed to tell you where I got it, and I don't know if I'll ever get any like this again. Suffice it to say you should look for some nicely figured cherry, then follow the cutting list to rough the material to the sizes given.

The Joints

The legs are made from three boards that are joined together with mortise-and-tenon joints and then shaped. It's easier

Photo by Al Parrish

esk

After drilling out the mortises in the feet using my drill press, I cleaned up the mortise and squared the corners with a chisel. I'm glad they shot this picture because I don't use hand tools too often.

With the mortise-and-tenon joints complete, I transferred the shape of the legs from the template to the pieces. Band saw the shape, then sand the edges smooth. You might note that the grain orientation on the feet isn't really the best, as it makes a weak support. But when making a reproduction....

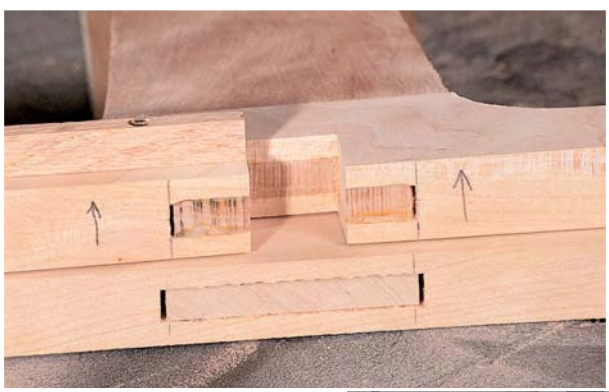
to make the mortises in a square piece of wood, so I cut the mortises on the feet and top cross braces before shaping them. I used my drill press to cut the 3/8" x 2" x 1 1/8"-deep mortise on the feet because the 7 3/8"-wide board wouldn't fit in my benchtop mortiser. However, my mortiser worked fine for the 3/8" x 2" through-mortises in the top braces.

Cut the tenons on the leg pieces (which go between the feet and top cross braces) on the table saw. First define the shoulder of the tenon by setting the rip fence for the tenon length and set your blade height for 1/4". Cut the shoulders on the two wide sides of the legs using the miter gauge, then raise your blade height to 13/16" and define the shoulders on the two edges. Reset the fence for the length of the other tenon and repeat the process.

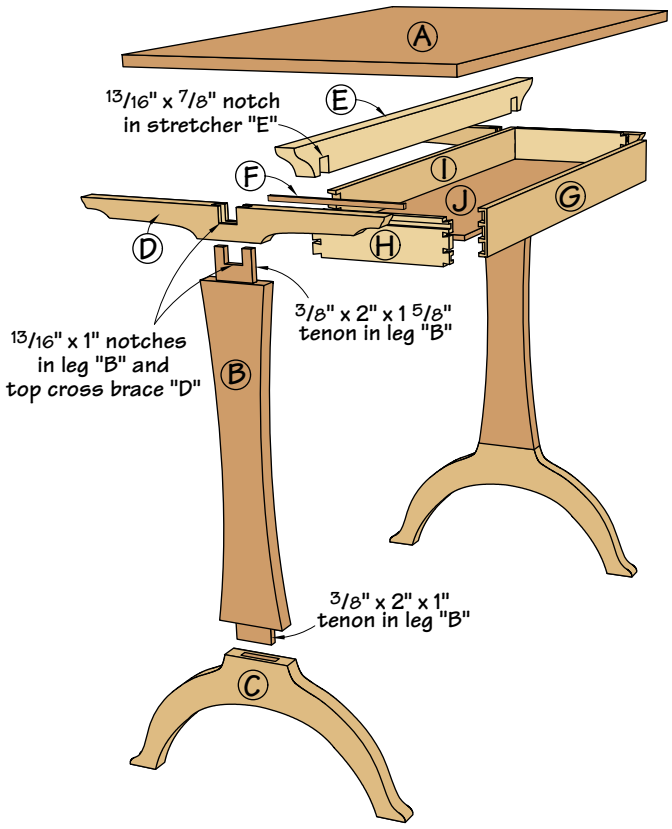
Shaker Trestle Table

No.	Let.	Item	Dimensions T W L	Wood	Notes*
1	A	Top	9/16" x 17 1/2" x 29"	C	
2	B	Legs	7/8" x 3 5/8" x 20 1/8"	C	TBE
2	C	Feet	7/8" x 7 3/8" x 16 1/4"	C	
2	D	Top cross braces	7/8" x 1 5/8" x 16 7/8"	C	
1	E	Stretcher	1" x 1 5/8" x 28 3/4"	C	
2	F	Drawer runners	1/4" x 7/16" x 7"	P	
1	G	Drawer front	7/16" x 2 1/4" x 21 3/4"	M	
2	H	Drawer sides	7/16" x 2 1/4" x 7 1/8"	P	
1	I	Drawer back	7/16" x 1 3/4" x 21 3/4"	P	
1	J	Drawer bottom**	1/4" x 7 1/8" x 21 1/8"	P	

*TBE=tenons both ends; C=cherry, M=maple, P=poplar
** chamfer edges to fit in groove



*The legs and stretcher are held together with an edge-lap joint. The legs are notched through the mortise-and-tenon joint **(above)**, and a mating notch is cut in the stretcher **(right)**.*



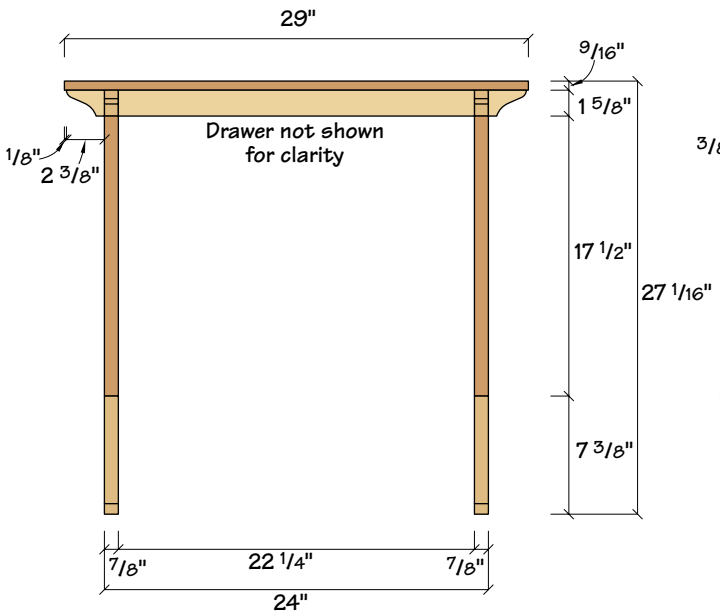
The edge lap joint isn't the strongest in the world, so I decided to add a screw to help out a little bit.

Now set your table saw fence to 5/8", set the blade height to match the lengths of the tenon and run the leg upright to define the cheeks. Set the fence for 2 13/16" and cut the other cheeks. Check the fit on your joints and make any necessary adjustments.

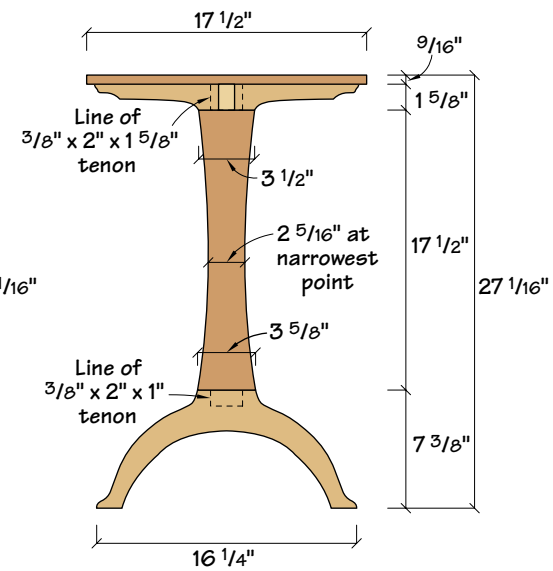
Shaping the Legs

With the leg pieces dry-assembled, transfer the leg shape from the scaled template on the next page to the legs. Then use your band saw to cut the legs to shape and sand the edges. I've found an oscillating spindle sander works well for this task, but if you can't spend the money, a drum sander attachment for your drill press is an economical option.

Glue up the legs, and while the glue is drying, cut out the stretcher. The stretcher fits over the legs using an edge lap joint, interlocking the legs and the stretcher. Cut two 7/8"-wide x 13/16" notches, 2 3/8" in from either end of the stretcher. The band saw works fairly well for this, with a little chisel clean up. When the glue is dry, cut the duplicate notches in the cen-



Elevation



Profile

When attaching the top to the leg assembly, use elongated holes drilled in the cross braces to allow for wood movement due to changes in humidity.

ter of the cross braces, cutting into the through-tenon on the leg. Check the fit and make any necessary adjustment. When the fit is good, add a screw to the joints to make it a little stronger.

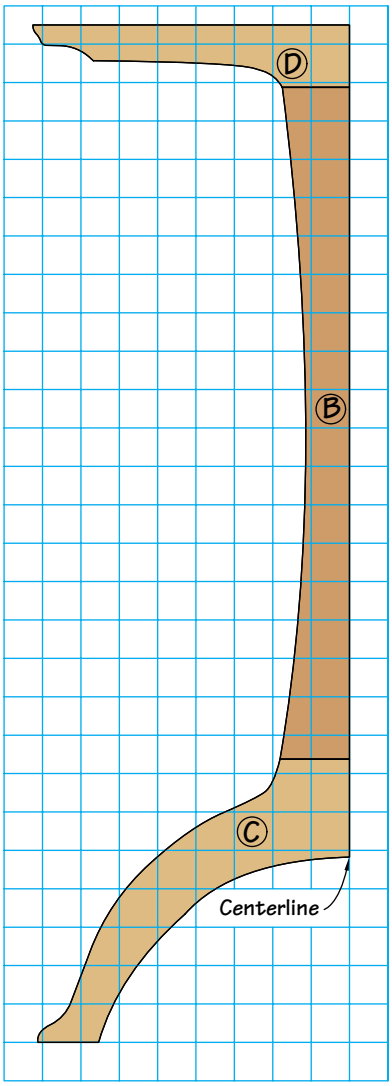
A groove in the top edge of the drawer sides slips over the drawer runners that are attached to the ends for a simple, but very efficient, drawer slide.

Make the Drawer

The drawer is made with traditional dovetail joinery. I used hand-cut half-blind dovetails on the drawer front and sides, and through-dovetails on the back. The drawer bottom fits into a 1/8"-deep x 3/16" groove in the sides and back, held up 3/16" from the bottom of the sides. Another 3/16"- deep x 1/4"-wide groove is cut on the outside of the drawer sides, 3/16" down from the top edge to serve as part of the drawer runner.

Attaching the Legs and Drawer

The drawer is hung on the legs using two drawer runners screwed to the inside of each leg. Adjust the location of the runners to allow the drawer to slide freely. Conveniently, this table design allows you to adjust the drawer's fit before the top is attached. Use screws and elongated holes drilled in the top cross braces to attach the top to the legs.



Scale: 1 square = 1"

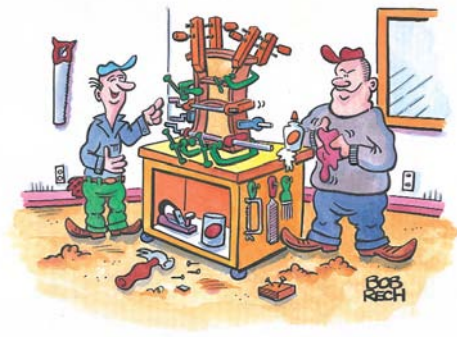
After everything fits well, remove the top and sand all the pieces in preparation for finishing. I used a water-base aniline dye (Moser's Dark Antique Cherry, Woodworker's Supply, 800-645-9292) to color the piece. I then followed the dye with a ragged-on coat of boiled linseed oil, a coat of clear shellac to seal the oil and then a final top coat of clear lacquer.

You may not be looking to drum up word of mouth about your woodworking to help your business, by I guarantee this piece will stir up word of mouth about your skills among your friends and family. **PW**

Cartoon

Illustrated by Bob Rech
bobrech@juno.com

#50



Submit your caption(s) for this issue's cartoon on a postcard to *Popular Woodworking*, Cartoon Caption #50, 1507 Dana Ave., Cincinnati, OH 45207 by **August 20**. Winners will be chosen by the editorial staff.

The winner will receive a four-piece router bit set from Freud, including a flush trim bit, straight bit, roman ogee and beading bit, plus a bearing to convert the beading bit into a 5/8" roundover bit. The runners-up each win a one-year subscription to *Popular Woodworking*.

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#48

"I hear bent wood furniture is in."

John Huckabee, Jr., of Seguin, Texas, is the winner of our Cartoon Contest from the April issue and recipient of a fine set of Freud router bits. The following runners-up each receive a one-year subscription to *Popular Woodworking*:

"I think I'll go cancel my dental appointment." **Adam Rum, Huntington, New York**

"Sure wish we had those nails when we built the bench." **Jinx Smith, Lucas, Texas**

"I think we're gonna hafta amputate!" **J. Stevens, Wilson, New York**

Rubbing for a 'Perfect' Finish

Don't be satisfied with a slightly lumpy finish. Here's how to finish the job right.

Go to any exhibition of handmade furniture and you'll see the problem right away. The woodworking is usually impressive, but the finish on many of the pieces is horrible. It looks and feels rough because there's dust and other debris in it, and there are runs and sags and either brush marks or orange peel, depending on the method the maker used to apply the finish.

How is it that some woodworkers come up with finishes that look and feel great and others just can't figure it out? Is the difficulty of applying a nice finish the reason so many woodworkers opt for oil finishes with the resulting sacrifice in protection and durability?

If you listen to advertisers and read the promotions for books and magazines ("Get a perfect finish every time"), you might think it's the product or the application tool that makes the difference, but it isn't. No product or application tool can produce a perfect finish, or even a near-perfect finish. Only one thing can – rubbing the finish, meaning rubbing with an abrasive.

There are two broad methods of rubbing a finish: the easy way and the hard way. The easy way is to rub with steel wool and maybe a lubricant. This produces noticeably better results than not rubbing at all, but not nearly as good as the hard way, which is to level the finish first with sandpaper, then rub it with abrasives and a lubricant. The hard way isn't hard to do; it just takes more time, and there's a greater risk of cutting or sanding through the finish and exposing raw wood.

In most cases, there's no advantage to rubbing surfaces that aren't seen in a reflected light and aren't touched. To make these surface (table legs, for example) the same sheen as the surfaces you're rubbing, apply a finish that produces that sheen naturally – gloss, semi-gloss, satin or flat.

You also can merely abrade the finish, which is not as effective as sanding. Steel wool (or gray Scotch-Brite pads) and a lubricant such as Murphy Oil Soap dissolved in water is all you need.

For best results, learn to sand your finishes with wet/dry sandpaper, a block with cork backing and a lubricant (such as paint thinner).

Photos by Al Parrish

Abrading the Finish

Abrading is easy and quick. Simply take some #000 or #0000 steel wool (I prefer #0000) and rub the finish with the grain until you achieve an even sheen over the entire surface.

Pay special attention to the edges, because the finish there is very easy to cut through. To help control your strokes so you stop right at each edge, take many short strokes right up to it, then connect these short strokes (on both edges) with long strokes.

On small surfaces, you can stand at the end of the piece and rub away from you and then back towards you, but on larger surfaces, you should stand at the side and rub side to side. When you do this, be conscious to not rub in an arc, which is the natural way your hand and arm want to move. Instead, think in terms of making a reverse arc, like a shallow concave, so the actual stroke is straight.

You can use a lubricant with the steel wool to soften the scratches you're putting in the finish, but you risk making rub-throughs worse, because if you do cut through (most likely on the edges), you won't see it when it first happens and stop. I suggest you not use a lubricant until you've practiced a few times.

Any liquid or paste will work well for

the lubricant. The more oily or pasty (mineral oil or paste wax) the lubricant, the slower your cutting action and the higher the sheen or gloss you'll get. The more watery the lubricant (water, soap-and-water, or paint thinner), the faster you'll cut and the lower the resulting sheen. (Products with names such as "Wool Wax" or "Wool Lube," which are sold as rubbing lubricants, are simply soap in paste form – like Murphy's paste soap.)

There are other abrasives you can use instead of steel wool. These include Scotch-Brite pads and pumice (finely ground lava).

Gray Scotch-Brite (sold as "fine") is close in grit to #000 steel wool. Pumice, which you mix into a sludge with water, paint thinner or mineral oil and apply with a felt or cloth pad, is equivalent to #0000 steel wool.

Leveling and Abrading Using Sandpaper

Rubbing the finish with steel wool, Scotch-Brite or pumice merely smooths and rounds over the imperfections. To remove them entirely, you should sand with sandpaper.

Sanding a film finish is just like sanding wood except you almost always use much finer grits (320 and up), and you have to use a lubricant to keep the sandpaper from clogging and damaging the surface. If the surface is flat, you should back the sandpaper with a flat cork, felt or rubber block. (I find cork works the best. You can make a fine rubbing block by gluing some $\frac{1}{8}$" gasket cork onto a light pine block about 1" thick and chamfered on the top-side to conform to your hand.)

Choose a grit sandpaper that removes the flaws efficiently without creating greater work than necessary taking out the sanding scratches. If you don't have any idea what grit to start with, begin with 600-grit, sand a little, remove the lubricant and see what progress you've made. If you haven't completely flattened the surface with 10 or 15 strokes over the same area, drop back to a coarser grit and continue dropping back until you find a grit that flattens the surface quickly.

The most common lubricants to use are water, soap-and-water, mineral oil and paint thinner. If the sandpaper (always the wet/dry type) still clogs with water or soap-and-water, use mineral oil or paint thinner. You can mix them to control the viscosity.

Pour some of your chosen lubricant onto the surface and begin sanding. As long as you intend to move up to a finer grit, there's no reason to sand only in the direction of the wood grain. The finish doesn't have any grain, so you can sand in any direction as long as your final sanding with your finest-grit sandpaper is in the direction of the grain (to disguise the sandpaper scratches).

I usually begin by sanding in circles, except on the edges where I sand along them, not into them. By changing direction with each grit, it's easy to see when you've removed all the scratches from the previous grit and it's time to move on.

After flattening the entire surface, which you easily can check by removing the lubricant and viewing in a reflected light, remove all the lubricant and move up to the next sanding grit. To remove oil and paint-thinner lubricant, I wipe with naphtha, which evaporates very fast.

If you intend your final sheen to be that of #0000 steel wool or pumice, there's no reason to sand above 600-grit because these are equivalent. But if you want a higher gloss, you should continue sanding with 1,000-, 1,200-, 1,500- and even 2,000-grit until you're just below the sheen you want. Then switch to a commercial rubbing compound or rottenstone (finely ground limestone) and water or oil.

It should be obvious that there's some experimentation involved in perfecting your rubbing technique. I recommend you make up a sample surface on a fairly decent size piece of veneered plywood by applying three or four coats of your favorite finish, and then rub it out.

If you should, by chance, complete the job the first time without rubbing through somewhere, then continue until you do rub through so you can learn how much work it takes to do this and see what it looks like. **PW**

Bob Flexner is a nationally known finishing expert in Norman, Oklahoma, and the author of "Understanding Wood Finishing."

Junior's New Tools

When my son left for trade school, a set of tools seemed like the thing to start him off in life. I still don't know why he's miffed.

I went looking for my good #2 Phillips bits. They were the tough ones that hold up, unlike that soft hardware-store junk that strips out after the fifth screw. The golden finish and rough contact surfaces mean that they are genuine titanium bits; they hold screws firm in any position, but they cost like gold.

When a deadline looks you square in the face, titanium is the only thing that you want: it doesn't break when the chips are down. I thought my son Ryan had borrowed them and was tinkering on that '77 Ford he drives. For an 18-year-old kid, he is quite proud of that old car.

Then I heard the whirr of a motor and a screw chunk solidly into the oak frame of the cabinets we built. I turned, and found Ryan hard at work setting the nailers into the cabinet frames, using those titanium bits and my 24-volt screwdriver. He didn't seem to like the 15.6-volt driver I'd gotten him a few months ago; the 24-volt tool seemed much more efficient.

He anticipated what I would say. He knows how persnickety I can be with my tools. Then he asks a question.

"Dad, can we draw part of my college money so I can get a set of tools before I start trade school?" he says, cringing at what I would probably say.

I thought it over. "I guess so, son. I know Smitty, the lead instructor there. Woe betides the fool that violates his rigid safety standards: thou shalt not break off the grounding lug or patch extension cords with duct tape." I laugh.

"OK son, after we install the cabinets, we'll go to Voorhees, and get a real set of tools."

He almost jumped for joy. But we don't jump in a cabinet shop; it isn't safe to do so. We installed the cabinets and Ryan had a look of absolute gratitude on his face as we approached Voorhees. We got a huge steel rollaway toolbox, 3' deep, 8' long and 5' high. New 3/8" bulk air hose, fittings and a hand press to maintain them just seemed right. A set of four extension cords, with monitor lights at both ends of the clear plastic sheaths, made for an additional safety margin. Six 12" carbide saw blades and a new 12" chop saw made him smile hugely. We loaded the tools into the truck with almost a sense of worship.

Few loads can cause my 2-ton dually van to squat, but this load did. Finally we got to the shop and Ryan was ecstatic. He wanted to try out everything we had just bought, just like a kid wants to play with everything under the Christmas tree. I tried to get a word in edgewise now and then to no avail.

Then, proudly, I presented Ryan my antique rosewood square, with the brass inlay meticulously inscribed with: "To Wolfgang Jorgensberg: may your life be as pleasant as this tool is precise." Old-fashioned craftsmanship says it all.

Ryan sighed with tears. "That belonged to great-granddad, didn't it?"

"Sure did, son. We're vain about our tools in this family, and I want you to know that I'll always remember these tools fondly. Use them in good health in the trade school."

"What do you mean?"

"You see all these classic tools?" I ask. "They're treasures! They don't make 'em like this anymore. They're yours, and all this shiny new stuff is mine."

Ryan then broke down in the most disgusting, cold, overwrought snivel I have ever heard. "But daaaaaad...." **PW**

Mike Dykes is a writer and woodworker living at Dykes Vineyard in Olympia, Washington. He makes oak barrels under contract for area wineries and does other custom woodwork.