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OCTOBER 2004
ISSUE #143

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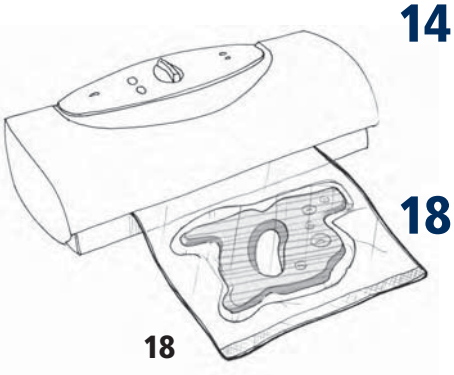
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ON THE COVER

A cabriole leg is a classic furniture detail we all aspire to. Our template makes building them easy work.

Cover photo by Al Parrish

DEPARTMENTS

PROJECTS, TOOLS AND TECHNIQUES

Popular Woodworking®

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SAFETY NOTE

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!

Send a Free Magazine And Do a Good Deed

You may find the following a bit off-topic compared to the usual fare found in this space so let me start by asking your indulgence and telling you about a meeting I had last winter at the headquarters of Lee Valley Tools and Veritas in Ottawa, Ontario.

I was talking with Robin Lee, the company president, covering a wide range of interesting subjects. At one point Robin steered the conversation toward corporate charitable giving and described a program his company started some years ago. I was thoroughly taken by the concept. It's one of those "everybody wins" ideas, a "no brainer."

We've adopted the idea from Lee Valley Tools, and here's how it's going to work:

You help us find a woodworker who becomes a *Popular Woodworking* subscriber, and we, in turn, make a $5 donation to a charity.

Let's say you have a friend and you think he or she might enjoy receiving *Popular Woodworking*. All you need to do is fill out the form below and mail it to the address shown or visit popwood.com/charity.html and fill out the electronic form there. We'll send your friend a free copy of the magazine and a note saying we were given their name by a friend. (However, we won't say who, so it would be good to let them know to expect the free magazine.) If they decide to subscribe, all they do is complete the order form and mail it back (it will have a code so we know the order is from our charity program).

I fully understand any concerns you might have about providing the names of friends who might then start receiving unsolicited mail. So let me make this pledge to you: No names provided to *Popular Woodworking* under this charity program will ever be made available to an outside party.

You may wonder how we can afford such a program, giving up to 25 percent of a subscription price to charity. The simple fact is new readers who come to us via this program save us the money we'd otherwise spend on advertising to go out and find them.

We've decided to support two charities with the funds we will be donating. One is the American Cancer Society (cancer.org). It is safe to say everyone has been touched in some way by this widespread, ongoing health problem. We see evidence that significant progress is being made on many cancer fronts, but there remains much work to do.

The other charity we will support is The Nature Conservancy (nature.org). This organization's no-nonsense approach to preserving important habitat is commendable: It buys land outright to protect it in perpetuity. The Nature Conservancy also works with individuals and businesses to keep private land in private hands while making sure use restrictions preserve its natural state. **PW**

Steve Shanesy
Editor & Publisher

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GLEN HUEY

Glen's motto is this: "If you can't do it on a table saw, it's not worth doing." Once a lover of all things Shaker, Glen has since immersed himself in the Queen Anne, Chippendale and Federal styles to produce custom furniture from his shop just north of Cincinnati. He's a master at finding simple ways to tackle complex operations, such as his cabriole leg technique shown on page 96. Unlike some hobbyists-turned-career-woodworkers, Glen – a professional since 1989 – still loves the craft. "I get up every morning and can't wait to get started," he says. He has written two books on building early American furniture and also teaches woodworking classes regularly.

BOB FLEXNER

For 10 years, Bob's quest has been to demystify finishing – long considered a "black art" shrouded in mystery and made more complex by confusing labels on finishing products. Bob's landmark book, "Understanding Wood Finishing" (Readers Digest), opened the eyes of thousands of woodworkers. But Bob's not a chemist. He started his career in 1976 building custom furniture in Oklahoma. He eventually turned to furniture restoration, which better challenged his skills. Finishing, however, proved to be a problem. So he started reading books and talking to chemists. Today, he skewers finishing myths (such as the one on page 110) through his writing and workshops.

Gloves at Heart of Lathe Safety Debate

Reader Argues that Hand Protection Is Too Dangerous – Author Disagrees

I was glad to see the start of the recurring column on woodturning – "At The Lathe" (August 2004) – until I saw the turner wearing a glove. I noticed that she was shown using a few common-sense safety devices (such as the facemask and earplugs) but thought it quite ironic and irresponsible that a glove was being worn, especially considering the article was geared toward new turners. The American Association of Woodturners recommends not wearing gloves in the third section of its safety guidelines (woodturner.org/resources) and for very good reason.

I've heard all kinds of justifications for wearing gloves while turning – protecting the user from heat and bark flying off, reducing vibration, using fingerless or tight-fitting gloves isn't as dangerous and, of course, saying "I haven't had a problem yet." None of them justify the enormous risk of getting that glove caught on just the slightest bit of wood and pulling it (and the rest of you) into the spinning piece. The turners, experienced or novice, that I know who have had injuries sustained by wearing gloves at the lathe don't think the risk is worth it anymore, either.

If you feel you need to wear a glove to protect your hand during turning, you're doing something wrong. Don't use the glove as a crutch to overcome deficiencies in your technique or project planning. For example, you can adjust the tool position or your hand position to keep the hot shavings or sharp bark off your skin.

This isn't a situation where a blade guard is taken off the table saw for photographic purposes. A number of pictures in this article show the glove in close proximity to the spinning wood. This is a serious and dangerous practice that must not be perpetuated in your magazine by having pictures of it being practiced. At the very least, I implore you to make mention of the danger of wearing gloves near a lathe in upcoming articles. Let the public know of the risks involved.

Andrew Hilton
Springfield, Missouri

Author Judy Ditmer responds: I often use a glove while turning to protect my hands from injury. If the gloves fit well and the turner's hands are kept entirely on the near side of the toolrest at all times – as they should be in any case – wearing a glove should present no hazard. (Note that in the photo on page 77 at left and on page 78 at top-left, I moved my hands so the tool's position can be seen.)

It is essential (whether you're wearing a glove or not) to keep both hands away from the piece while the lathe is on. It's not distance, but rather a positive orientation of the upper hand to the toolrest that ensures this. Some part of this hand is placed against the rest in a way that prevents the hand (or the tool itself) from being pushed or pulled into the piece.

Without this positive connection to the toolrest, there is no way to control the in-and-out movement of the tool. It is the leverage and control this contact affords that keeps your hands, gloved or not, safely on your side of the toolrest.

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WRITE TO US

Popular Woodworking welcomes letters with comments about the magazine or about woodworking in general. We try to respond to all correspondence. Published letters may be edited for length or style. All letters become property of *Popular Woodworking*. How to send your letter:

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Letters

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Width Not Necessary in Leg Equation

The formula given in Stephen Allen's letter "Relatively Simple Equation Helps Tablemakers Find Bevel Angle" (Letters, August 2004) can be simplified by factoring out and canceling the width (*w*). If the leg is square, its width is not a factor. An equation for the corner-to-corner bevel angle, *a*, in terms of leg bevel angle, *b*, would then consist of simply:

$$a = \tan^{-1}(1.414 \times \tan b)$$

Gary Hordemann
Spokane, Washington

Details on 24-hour Workbench's Vise

While it's not looking like I am going to quite make the deadline for the "24-hour Workbench" (December 2003), things are progressing pretty well. I have the plywood top glued up and the skirt on. But I have a question in regards to the vise attachment.

I purchased the large front vise from Veritas, but it's unclear how to attach it. Specifically, which rear-jaw configuration did you use? I thought from the drawings you may have used a 2" x 8" x 15" piece for the front and another for the rear jaw, but after looking at the picture it looks like you glued up two pieces for the front jaw, then either used another piece for the rear jaw or went with a smaller rear half-jaw. How did you do this?

Matt Lunger
Roswell, Georgia

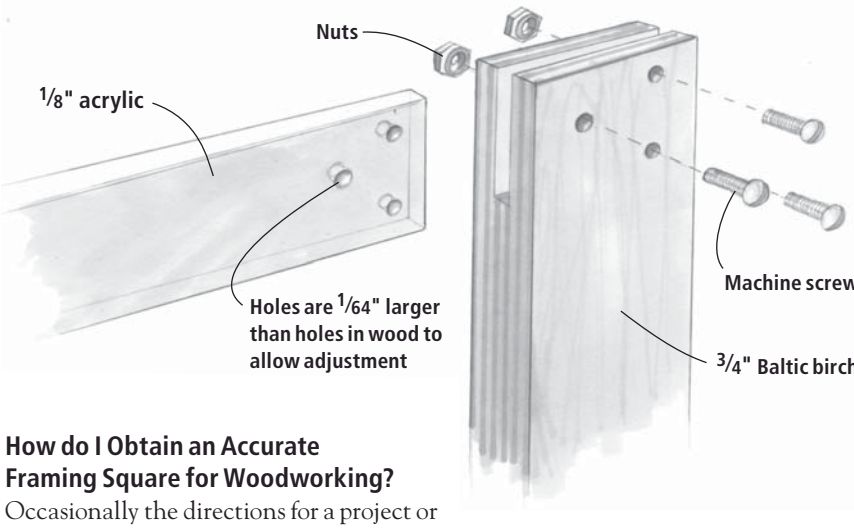
Editor's Note: The front jaw is indeed two pieces of material that we glued face-to-face. After jointing and planing, it finished up at 2¾" thick, as the cutting list shows. The rear jaw is 2" material and is technically a "half jaw" – it is below the top and flush to the skirt. **PW**

– Christopher Schwarz, executive editor

CORRECTIONS

- To make a cove cut, the gouge should be turned counterclockwise – not clockwise – as was shown in a photograph on page 78 of "At the Lathe" (August 2004).
- You shouldn't feed your work between a fence and router bit, as shown in the bottom right photograph on page 51 of "Sliding Dovetails" (August 2004). You should bury the bit in the fence, instead.
- In the "Isaac Youngs' Wall Clock" (August 2004), the thickness of the back should be 1/4", not 1/2", as shown in the cutting list.

How to Fix a Square That Isn't Square



Illustrations by Hayes Shanesy

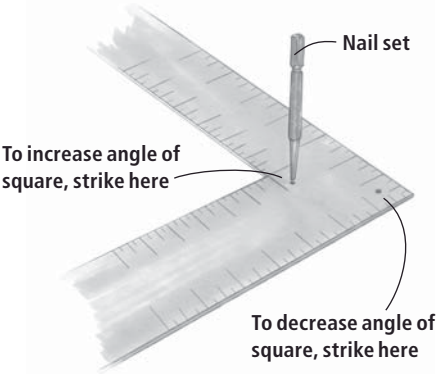
How do I Obtain an Accurate Framing Square for Woodworking?

Occasionally the directions for a project or jig will call for the use of a framing square to establish the location of a component in the project. I own four framing squares, none of which, in my opinion, is accurate enough for this application, and I have never seen one that is. Do you have a solution, alternate tool or know of anyone who sells a framing square that is accurate?

William Rector
Canton, Michigan

Essentially you're trying to do a cabinetmaker's job with a carpenter's tool. But there are several good solutions to the problem you're having.

1. If you already have a framing square, you can true it using a nail set and a hammer. First figure out if the framing square is measuring less than 90° or more than 90°. Now place the square flat on your bench and turn your attention to the corner where the two legs of the square intersect. If the square is measuring less than 90°, place the tip of your nail set near the inside corner of the square, about 1/4" in from that inside corner. Strike the nail set once with a hammer and check your result. A couple taps at this location can usually fix the problem.



If the square is measuring more than 90°, place the nail set at the outside corner, about 1/4" in and strike it. This will reduce the angle the square measures at.

2. If that solution doesn't suit you, another fix is to purchase a Veritas Square Fence. This $15 jig clamps to your square and allows you to do two things. By shimming it on one leg of the framing square, you can correct the other leg. The jig also is very handy because it adds a lip to your square that allows you to hook it on your work, vastly increasing the accuracy of any framing square. (Contact Lee Valley at 800-871-8158 or leevalley.com.)

3. If you don't own a framing square, the best solution to the problem is to make one yourself to whatever length you desire. I like squares that

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have one leg that's 3/4" x 2" Baltic birch with the other leg as an acrylic plastic (available at home-supply stores). Join the two legs of your square with a bridle joint in the plywood and secure it with wood screws, or small nuts and machine screws. If you go to the extra trouble to use the nuts and machine screws, you can make the holes in the acrylic a 1/64" larger than they need to be to allow you to true the square if you drop it.

— Christopher Schwarz, executive editor

Why Isn't My Router Bit Centered in My Aftermarket Guide Bushing?

I have a Skil 1823 plunge router and I bought a Vermont American universal guide bushing kit for it, model #23458. The kit contains a base plate that you secure to the router, and the guide bushings attach to the kit's base plate. The base plate seems to bolt on OK, but when I locate the position of the router bit inside the guide bushing, it is off-center. The cutter doesn't rub on the bushing but I would think that the bit should be centered. I saw some reference to redrilling the base plate holes to help this situation.

Is this a common problem? Should I go ahead and drill out the holes?

Mike Shafer
New Vienna, Ohio

It's more a problem, I believe, with the router itself. Some premium routers allow you to adjust the tool's base plate so it is centered perfectly over the collet. However this is not a common feature on less expensive tools, such as your router.

I'd definitely go ahead and elongate the base plate holes just a bit. Here's how: First unscrew the base plate from the router. Chuck a straight bit into the tool's collet and install a guide bushing that has the same interior diameter as the bit. Place the bushing (mounted on the base plate) over the bit and rotate the base plate until you can see where the screws go. They won't match up exactly, but you'll see where you need to ream them out. Drill out the holes a little bit at a time until you can secure the base plate to the router.

— David Thiel, senior editor

Where Can I Find Good Information on Restoring Wooden Hand Planes?

Following the advice of Don McConnell in his articles concerning the use of wooden hand planes in issues #138 and #139, I recently purchased a used 22" wooden jointer plane. I would like to restore this plane into good working condition. I intend to use it extensively, with no desire to purchase its modern counterpart, the powered jointer.

My biggest concern is the fact that the body has several cracks, some on both ends, and a few small ones on the bottom, which I believe is the result of a previous owner forcing the cutter into its resting place. The body is sound, and the sole is flat, and I think this tool can be made useful again.

Please provide suggestions or recommendations for returning this tool back into something useful once again.

Thomas Baker
Monroeville, Pennsylvania

There's a lot to know about restoring a wooden plane. Cracks in the stock of a wooden plane can be no big deal or fatal. So I'd really consider getting some books on the topic – which will give you a better education.

The first thing to know is what you're buying at the flea market or antique store. For that important step, I recommend "The Wooden Plane" by John M. Whelan (Astragal Press). This sizable book classifies many wooden planes and explains their history and use. Another good book for identifying wooden planes is "A Guide to the Makers of American Wooden Planes" by Emil Pollak and Martyl Pollak (Astragal Press).

But if you can purchase only one book, it should be "Making Traditional Wooden Planes," also by Whelan (Astragal Press). In addition to offering instructions on making wooden planes, this text shows you how to tune them, which will definitely help you restore vintage ones. **PW**

— Christopher Schwarz, executive editor

WRITE TO US

Every day we get questions from readers on all subjects about their woodworking. Some are letters; many are e-mail messages. We are more than happy to share our woodworking experience with you by answering your questions or adding some clarity to whatever aspect of the craft you are unsure about. In addition to the hundreds we answer privately every month, we want to share the best questions here with readers.

Send your questions via e-mail to popwood@fwpubs.com, or by mail to:

Q&A • *Popular Woodworking*
4700 E. Galbraith Road
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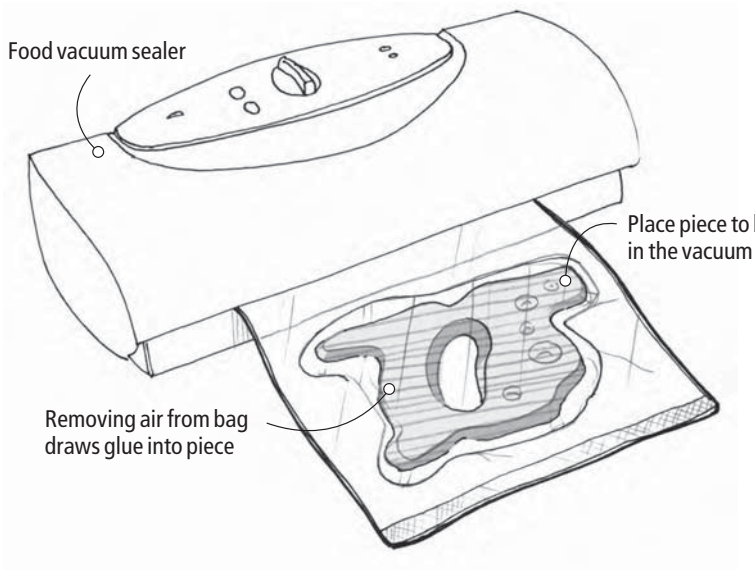
Compiled by Paul Anthony
Illustrations by Matt Bantly

The Easy Way To Get Glue in Tight Places

THE WINNER:

I was repairing an old saw handle that had a small but deep crack that resisted glue injection. I was puzzling over how to fix it when I landed upon the idea of drawing epoxy into the crack using vacuum pressure. I dug out the kitchen vacuum food bagger, put a blob of epoxy over the crack, then put the handle in the plastic bag and sucked the air out. The epoxy disappeared into the crack like magic, after which I quickly removed the piece from the bag and wiped off the excess before it set up. The technique works great for any project small enough to stick in the bag, including broken plane totes and small turnings.

Wayne Anderson
Elk River, Minnesota

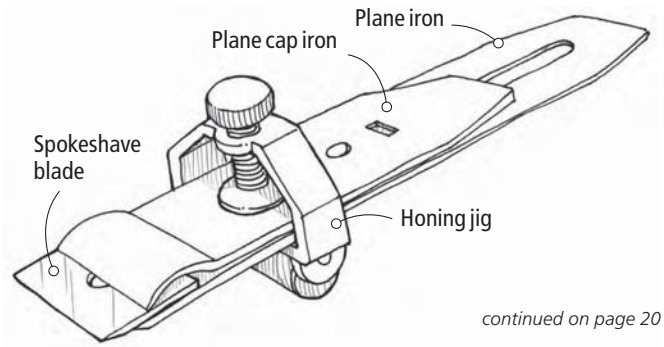


Honing Spokeshave Blades

I was trying to hone a spokeshave blade by hand for the first time recently and was having a hard time holding it at the proper angle. I typically use a honing jig for sharpening plane irons, but the spokeshave blade was too short to fit into either of the jigs I own.

So I got to thinking and came up with the idea to remove the iron and chipbreaker from a jack plane, loosen the screw and clamp the spokeshave blade between the iron and the cap iron. This projected the spokeshave blade out far enough for honing. This configuration won't withstand a lot of pressure, but it's strong enough to hold the blade in place for me to hone it.

Dan Donaldson
Canton, Michigan



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CASH AND PRIZES FOR YOUR TRICKS AND TIPS!

Each issue we publish useful woodworking tips from our readers. Next issue's winner receives a General 75-050 tilting-head benchtop mortiser. This high-quality machine features heavy-duty, cast-iron construction, a gas cylinder for smooth 6" chisel strokes, 5/8" and 3/4" sleeves for multiple chisel shanks, heavy-duty rack-and-pinion gearing for smooth, accurate mortising and a TEFC 1/2-horsepower motor operating at 1,720 rpm.

Runners-up each receive a check for $75. When submitting a trick (either by mail or e-mail) you must include your complete mailing address and a daytime phone number. If your trick is selected for publication, an editor will need to contact you. All entries become the property of *Popular Woodworking*. You can send your trick by e-mail to popwoodtricks@fwpubs.com or mail it to Tricks of the Trade, *Popular Woodworking*, 4700 E. Galbraith Road, Cincinnati, OH 45236.

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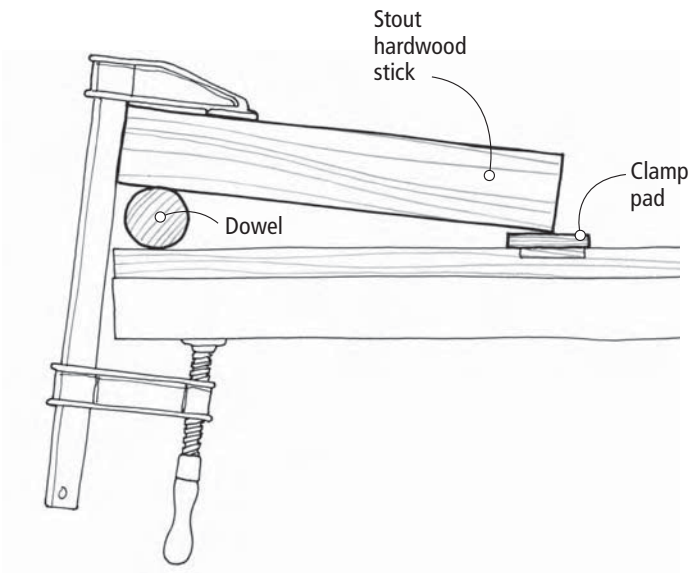
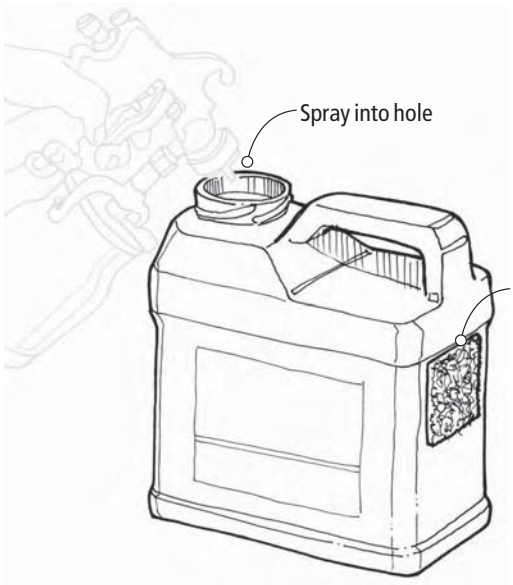
Ancient Idea Extends a Clamp's Reach

Recently, I found myself needing to clamp down a patch on a tabletop, but it was out of the reach of my deep-throat clamps. Recalling a trick a pal showed me years ago, I grabbed a long, stout piece of hardwood and a short piece of thick dowel. Placing the dowel near the edge of the table where it could serve as a fulcrum (an ancient idea), I laid one end of the stick on top of it with the other end on top of a protective clamping pad over the patch. Clamping the stick ahead of the dowel transferred pressure to the patch. If you don't have a section of dowel, a triangular piece of stock will work as a fulcrum, too.

Matt Lackerman
Eureka, California





Spray-waste Management

When cleaning out my spray gun, I aim the nozzle into a jug to capture the escaping cleaning fluid. When first doing this, I learned quickly that back pressure caused the fluid to shoot right back out of the spout at me. To solve the problem, I cut a $3\frac{1}{2}$" x $4\frac{1}{2}$" hole high in the rear wall of a large plastic jug and attached a synthetic abrasive pad over it using hot-melt glue. The hole allows the excess air pressure to escape without shooting out of the spout, and the lower section of the jug captures the used cleaning fluid.

I use a rectangular-shaped jug that once contained cat litter, but any large plastic container with a spout should work. When you're done cleaning the spray gun, simply pour the cleaning fluid out into another container for re-use or disposal.

Wayne Johnson
Grand Ledge, Michigan

Locating Butt Hinges with Tape and a Countersink

Installing butt hinges precisely is a constant challenge in woodworking and you need as many tricks as possible in your arsenal. Here's one more: To get your screws to fit precisely in your hinges, it's sometimes necessary to ream out the tapered screw holes a bit so the screw heads seat flush to the hinge leaves when installed. This is often the case with English-made hardware, which has usually been drilled with a 90° countersink, while American-made screws used for attachment have an 82° angle. To make the two mate, I ream out the holes slightly with an 82° countersink and then deburr the backside of the leaf with a mill file.

As I was installing hinges on a case recently, it occurred to me that the burr could be useful for positioning the hinge when installing it. First ream out the screw holes and install the hinges on the door. Stick blue painter's tape to the case where the hinges go. Position the door exactly where you want it and temporarily clamp it in place. Tap the door with a mallet where the hinges meet the case. The burr will cut a circular hole into your tape where the screws are supposed to go. Now you can deburr the hinge, drill your pilot holes and screw the hinges to the case.

Christopher Schwarz
executive editor

A Plane Iron for Chiseling

I needed to chisel away some dried glue squeeze-out from the inside corners of a small box, but all of my chisels were too long to fit inside the box. I was wishing I had a short chisel when my eyes landed on my block plane. I simply removed the plane iron and I had a 4"-long chisel without a handle. It worked just fine for the job.

Anne Toney
Las Vegas, Nevada

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Slide-out Chisel Holder

I built this slide-out chisel holder for convenience and safety. The unit easily mounts to the side of a cabinet or bench (great for tight spaces) on a couple of drawer slides. The holder was built by laminating several lengths of ¾"-thick hardwood together after sawing mating slots of various widths into adjacent pieces to create the rectangular openings.

To accommodate Japanese chisels with their long, round shanks, drill a hole in the middle of each slot. The slots also can be made in different sizes to accept tools such as marking gauges and knives. For safety, I attached an acrylic panel over the exposed side of the holder to prevent unintentional contact with the sharp chisel blades.

Dennis Kugizaki
Colorado Springs, Colorado

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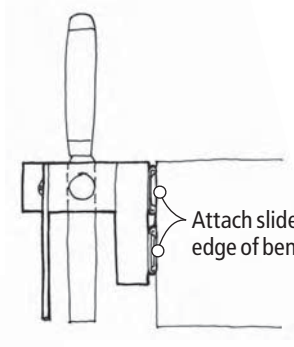

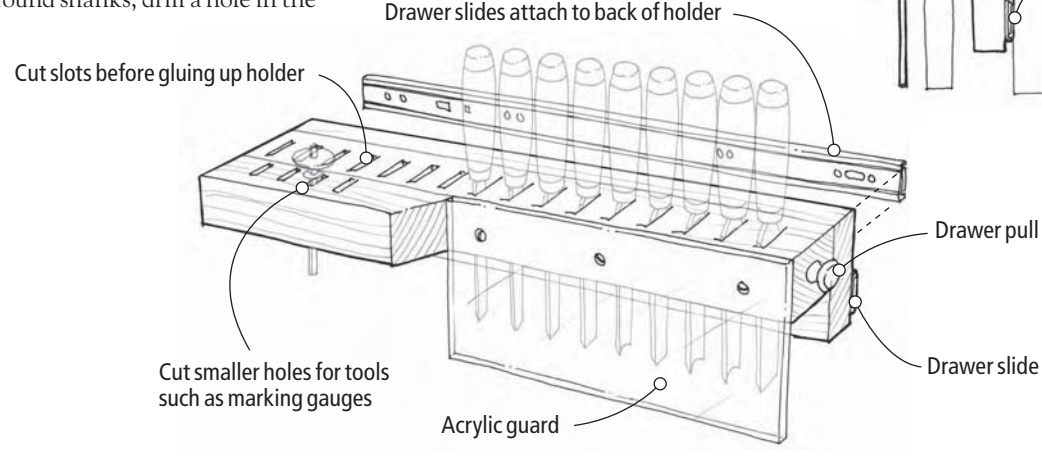

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Zero-clearance Routing

When shaping stock or cutting joints on a router table, it's best if the opening in the table is not much bigger than the bit diameter. This is particularly important if the stock is small, thin or narrow, and therefore is subject to bending or tipping down into the bit opening. Some commercial insert plates include accessory insert rings to reduce the size of the opening, but these don't always sit flush with the plate and can snag the end of a workpiece. Plus, they're only available in particular diameters.

I find a much better solution is to cover the router table's top with a sheet of inexpensive 1/8"-thick tempered hardboard (such as Masonite) that has been drilled out to create a near-zero-clearance opening for the particular bit I'm using. To locate the hole, I first install a straight bit in the router table and adjust it so it projects just 1/16" or so above the tabletop.

After clamping the hardboard sheet in place, I quickly turn the router on and off to mark the center location of the bit opening. Then I drill a hole with a diameter that only slightly exceeds the diameter of the router bit I intend to use. After lightly chamfering the edges of the hole, I wax the hardboard to reduce friction, then install my chosen bit. I clamp my router fence down on top of the sheet and rout away.

Mike Turner
Renton, Washington

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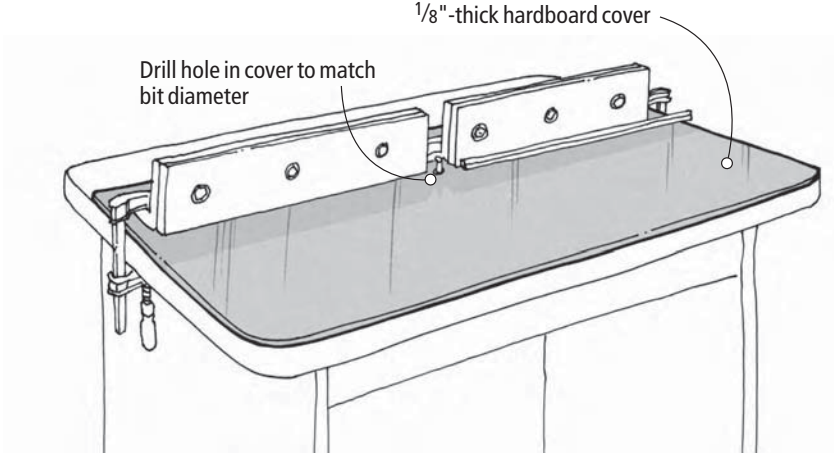

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Nursing Nail Holes

When filling nail holes in cabinets or moulding, it's all too easy to smear filler into the pores adjacent to a nail hole. This makes for a lot of subsequent sanding and an uneven finish, especially if the work will be stained.

I've developed a system for neatly targeting just the nail holes. I remove the needle and plunger from a large veterinary syringe and use a putty knife to fill the syringe with fresh, soft, water-based wood filler. After replacing the plunger, I inject putty into the nail holes, which minimizes sanding and clean-up of the surrounding area. For easiest application of the putty, use a syringe with an opening approximately 1/8" in diameter.

Capping the syringe prevents the filler from drying out for at least a couple of days, but as soon as possible after I'm done with my filling session, I clean out the syringe with water. If you can't get a syringe from a friendly veterinarian, you can use glue syringes that are available from Lee Valley (800-871-8158 or leevalley.com).

Steve Hopper
Ridgeland, Mississippi

The Faster Way To Find Studs in a Wall

When hanging a cabinet that will span two or three wall studs spaced at 16" on center, I use a yardstick to simplify the process. I've drilled three 1/8"-diameter holes midway across the width of my yardstick. The first hole is at 1", the second at 17" and the third at 33". This gives me my 16" stud spacing.

After locating one stud, I drive a small finish nail into the center of the stud at the desired height for my project. Next, I hang the yardstick on the nail and place a small level on its upper edge. Once the stick is level, I mark the remaining hanger locations through the other holes, then install my screws or nails into the studs. Using the same yardstick and process to locate the receiving holes or hangers in the back of the project ensures identical spacing. Just make sure the yardstick is positioned parallel to the horizontal edges of the project for level positioning on the wall. **PW**

Richard Wegner
Joliet, Illinois

Side-clamp Honing Guide

Ignore the naysayers. This jig produces square, sharp edges every single time.

Photos by Al Parrish

SPECIFICATIONS

Side-clamp Honing Guide

Street price: $10-$13

For more information: The jig is available through most woodworking suppliers.

Many of my fellow hand-tool users give me a rash of grief about my simple side-clamp honing guide, which has been a fixture on my workbench since 1993.

"Isn't it time you learned to sharpen properly?" they ask. And then they rattle off a list of the advantages of sharpening freehand:

- Freehand is faster because you don't have to set up a jig every time you sharpen.
- You remove less metal with freehand sharpening so your hand tools will last longer before they're used up.
- Freehand sharpening produces edges just as sharp as those produced with a jig.
- The side-clamp jig won't work for odd-shaped or very short tools.
- Sharpening with a jig is just for beginners. Real hand-tool users can sharpen without this little one-wheeled crutch, they say.

To most of those criticisms I roll my eyes. I can sharpen freehand, and I'm pretty good at it. After all, some tools must be sharpened freehand because they won't fit in the jig properly (such as gouges and skew chisels), which is one of the few valid criticisms of the jig.

But most furniture makers spend more time sharpening bench chisels and plane irons than they do odd-shaped specialty tools. And when it comes to sharpening these basic and common tools, nothing beats this jig.

Here are the facts: Sharpening with the side-clamp honing guide is as fast or faster than sharpening freehand. Using a few well-placed marks on my bench, I can set a chisel or plane iron at the perfect sharpening angle in just a couple of seconds. After a few more seconds to secure the tool in the jig, I'm ready to roll.

Freehand sharpeners sometimes forget that it takes time to adjust the tool in their hands so its edge contacts the stone at the right angle. And they have to make this adjustment every time they lift the tool from the stone.

As to the complaint that sharpening with a jig removes more metal and shortens the lifespan of the tool, I say "So what?" Few woodworkers ever manage to use up a chisel or plane iron in their lifetime. If the jig does shorten the usable life of the tool, it's usually something that won't be a problem until our grandchildren use it decades in the future.

When it comes to producing a quality edge every time, sharpening with a jig is unbeatable. Beginners who have a jig can produce edges as good (sometimes better) than people who have been sharpening freehand their entire adult lives. This is because the jig takes all the guesswork out of the angle the tool must be held at during sharpening, and produces perfect and repeatable edges every time. Freehand sharpening is more prone to error. Even experienced sharpeners will occasionally round over an edge on a bad day.

As I stated earlier, one of the criticisms of the jig is valid: You can't sharpen everything with it, but it does take care of 90 percent of my sharpening needs.

And as to the claim that the jig is a crutch for beginners, I disagree. This side-clamp honing guide is for any woodworker who wants keen square edges every time they sharpen so they can get back to woodworking.

Sharpening shouldn't take years for you to master the muscle memory. This jig gives you good edges the first day you use it, and that's reason enough to own one. **PW**

— Christopher Schwarz

ABOUT OUR ENDURANCE TESTS Every tool featured in our Endurance Test column has survived at least two years of heavy use in our shop here at *Popular Woodworking*.

Powermatic's Feature-laden 14" Band Saw

Powermatic's 14" band saw has all the bells and whistles, but you're going to have to assemble a bunch of them, so plan for a day in the shop. And although it's a little pricey, this is a quality machine.

The PWBS-14CS has a 1½-horsepower totally enclosed, fan cooled (TEFC) motor housed in an enclosed base. The motor provides lots of power, and the cabinet-style base contributes to a quiet and smooth cut.

The cast-iron table is oversized (15" x 20½") thanks to the addition of a 5½" auxiliary table close to the post. The auxiliary table (although a bit fussy to adjust) can be tweaked to match the main table height. Both tables are beveled on their mating edges so the main table can be tilted and still fit closely to the auxiliary table.

To make this table more useful, Powermatic has included an accurate T-syle rip fence that locks tightly, moves smoothly and can be adjusted for blade drift. The fence also offers a resaw guide attachment that's handy.

When it comes to cutting, the quality bearing guides are fully adjustable and track dead on. Another feature is the Carter-brand quick-tension release that allows for fast blade changes and also helps keep the blade and wheel bearings in good shape by removing tension when the saw is not in use.

There's still more: A blower attachment keeps things clean at the work surface. And so you can see that it's clean, there's a work light that throws a good beam, and is still flexible enough to avoid getting in the way.

Resaw capacity is a little more than 6", but a riser block is available to push that to 12". And unlike many 14" band saws, the 1½-hp motor on this model is up to the task of reasonable resawing tasks.

The bottom line is this: In the 14" cast-iron category, the Powermatic PWBS-14CS is priced at the top. On the flip side, it's loaded with all the features available and puts in a great performance. *— David Thiel*

For more information, circle #177 on Free Information Card.

SPECIFICATIONS

Powermatic PWBS-14CS Band Saw
Street price: $900
Motor: 1½ hp, 115/230V TEFC
Blade speed: 3,000 surface feet per minute
Weight: 203 lbs.
Performance: ●●●●●
Price range: $$$$$
Powermatic: 800-274-6848
or powermatic.com

Multi Window Shark 240 mm Japanese Saw

Some Japanese saws fail to live up to expectations in the hands of Western woodworkers because the tools aren't used properly or they're used in woods that are unsuitable for that saw's tooth design.

The most frequent result of this mishandling is broken saw teeth or a bent blade. However, for the last 18 months, I've been using a Japanese saw that seems as robust and versatile as any Western handsaw in my tool chest.

The Multi Window Shark saw sold by Hiraide America is designed to both crosscut and rip in a wide variety of hardwoods. Usually when tools are designed for more than one task, there are compromises, but not with the Multi Window – so named because the Japanese word for "window" also means "possibilities." So the name means it's a versatile tool. With 18 teeth per inch, it cuts quickly and cleanly in every material I've tried it on – exotics to birch plywood to Southern yellow pine. And it tracks like a dream.

The teeth are extraordinarily hard (68 on the Rockwell "C" scale) and tough – I have yet to snap one. And the saw blade has remained true. (If you do damage the Multi Window's blade it's easily replaceable.)

At .02" thick, the impulse-hardened blade is about twice as beefy as a fine-tooth dozuki or small ryoba, yet it has a finer kerf than my Western saws.

What is especially nice about the Multi Window Shark is its versatility. Thanks to the thickness and shape of the blade, it is quite rigid, which allows it to be useful for joinery cuts – it excels at cutting tenon cheeks. And the fact that it doesn't have a steel back (like a dozuki) allows it to make deep cuts.

Its only downside is that the blade cannot be resharpened, only replaced. So woodworkers who don't like "disposable" tools won't approve – though the frugal can make a scraper from a used-up blade.

One saw cannot do everything. But if you are looking for a saw that comes close, check out the Multi Window Shark.

— Christopher Schwarz

For more information, circle #178 on Free Information Card.

SPECIFICATIONS

Multi Window Shark Saw
Street price: $46
Overall length: 22½", 240 mm
Blade length: 9.45"
Blade width: 1⅞" at toe
Performance: ●●●●○
Price range: $$$$$
Hiraide: 877-692-3624
or japanesetools.com

Dadonator Makes the Cut

After months of testing the new Dadonator stack dado set from Infinity Cutting Tools I'm convinced this tooling gives you a premium cut at a less-than-premium price.

I tested this dado set against sets from Freud and Forrest, and found that the Dadonator held its own. The bottoms of the cuts were just as flat and smooth, and the edges were as free from splinters as in the higher-priced tools. One unique feature of the Dadonator is that the chippers have six teeth instead of the four found on other premium sets. These extra teeth, the tooth geometry and the precise machining make for very smooth cuts in both plywood and solid wood.

A couple of things to note: This 8" set isn't exactly 8" in diameter, more like 7 7/8". And the joints produced by the Dadonator (without shims) were between .008" to .01" undersized on our saw, something that is readily remedied with the included shims and is common among other stack dado sets, too. Bottom line: It's a good tool at a good price. — CS

SPECIFICATIONS

Dadonator
Street price: $180
Outer blades: 8", 24-tooth, -5° hook
Chippers: 1 - 3/32"; 4 - 1/8"; 1- 1/16"
Performance: ●●●●○
Price range: $$$$$
Infinity Cutting Tools: 800-430-9920
or infinitytools.com

For more information, circle #179 on Free Information Card.

Noden Adjust-A-Bench

Because woodworkers come in a variety of heights, one bench height doesn't satisfy all. And the perfect-height workbench is a moving target – the height is always wrong for some project. The Adjust-A-Bench satisfies all.

Capable of adjusting from about 27" to just under 44" tall (with 12 locking positions in between), the bench base changes heights simply, with no motors or hydraulics. Lift from each end a few notches at a time until you've reached your optimal height. A foot pedal releases the locking bar to lower the top.

Assembly does require some time and extra materials. Because the bench length is adjustable to meet your needs, you provide the bench vises, wood stretchers and threaded rods for assembly between the leg sets.

Because of the adjustable height, I was a little skeptical of the bench's stability, but it provides a solid, heavy-duty work surface. By adding the optional caster set, the bench is quickly portable and still easy to lower into a solid working position.

Though the bench base is pricey, after using it for a couple of months in the shop, I feel the money was well spent – even after buying the casters. The Adjust-A-Bench is always just the right height and always in the right location for whatever the job. — DT

SPECIFICATIONS

Adjust-A-Bench
Street price: $380,
top and stretchers not included
Caster set: $160
Performance: ●●●●○
Price range: $$$$$
Adjust-A-Bench: 609-882-3300
or geocities.com/adjustabench

For more information, circle #180 on Free Information Card.

VERITAS BULLNOSE IS PRECISE, VERSATILE

Bullnose planes are workhorses in my shop. They're ideal for cleaning and fine-tuning rabbets or flushing up the fit of sides and dividers in an assembled cabinet. Plus, with the front toe piece of the tool removed, a bullnose plane acts as a pretty good chisel plane to clean up glue or waste in corners.

The new bullnose shoulder plane from Veritas has improved on the vintage version of this tool by adding some quality features. Set screws on the sides and a Norris-style adjuster help position your iron more accurately. And the mouth of the tool is adjustable thanks to a small screw in the toe piece. This screw also acts as a stop to prevent damage to the iron when installing the toe piece.

The plane wasn't difficult to set up. The sole was .0015" hollow under the toe, which I quickly lapped flat. The 1"-wide iron was in good shape and took less than 20 minutes to prepare for use. The sides were ground perfectly square to the sole – a key indicator of quality.

Compared to vintage bullnose planes, the Veritas is heavier at 1 lb. 4 oz., more comfortable and far more precise. — *CS*

Street price: $130, item #05P42.01
Performance: ●●●●●
Price range: $$$$$
Lee Valley: 800-871-8158
or leevalley.com

CIRCLE NO. 183 ON FREE INFORMATION CARD.

TOOL RATINGS

Performance is rated on a one-to-five scale. You won't see a low rating ("one or two") because we don't publicize inferior tools. "Five" indicates the leader in the category. Five dollar signs indicates highest price in the category. Three indicates an average price. If you have tool questions, call me at 513-531-2690 ext. 1255, or e-mail me at david.thiel@fwpubs.com. Or visit our web site at popwood.com to sign up for our free e-mail newsletter.

Photos by Al Parrish, PW staff and courtesy of manufacturers.

— David Thiel, senior editor

Craftsman's New Hybrid Table Saws

Hybrid is in. Manufacturers are working hard to offer the features of a cabinet saw at a contractor saw price, and Craftsman is right in the middle of it with three new table saws: two three-quarter enclosed base (#22104 and #22114) with varying features and one fully enclosed base model tagged as a "professional" saw (#22124).

These new saws offer an interior-mounted, belt-drive induction motor, cast-iron tables and precision T-style rip fences. That's similar to what other hybrid saws also are offering, but Craftsman has a few new tricks that allow these saws to stand out in the crowd.

While most contractor (and hybrid) saws mount the trunnions to the underside of the top, cabinet saws always have the trunnion system mounted on the cabinet for greater stability and easier adjustment. All of the Craftsman hybrid systems are cabinet-mounted and offer beefed-up, oversized cast-iron trunnion assemblies – very nice.

The motors are suspended inside the enclosed cabinets, improving dust collection, and decreasing noise and required storage space. The motors are TEFC induction motors (1½ hp or 1¾ hp) and power is transferred to the blade with a good quality poly V-belt for less vibration and good torque.

Both the entry-level (#22104, $530) and the mid-level hybrid (#22114) saws have 1½-hp motors and are left-tilt saws. The entry-level model includes stamped-steel wings, and the basics. The mid-level model (which we tested) also includes 10" cast-iron wings, an improved miter gauge, auxiliary rip fence and a dust chute with a 4" port. The professional model ($950) includes a fully enclosed cabinet, 12" cast-iron wings, 1¾-hp motor and a Biesemeyer rip fence.

Contractor saws range in price from $500 to $850, and hybrid saws routinely run $850 and much higher. So in testing the $650, #22114 saw we were expecting some compromises. We didn't find any.

The saw performed well during operations, was solid, accurate and well manufactured. The blade guard is designed for easy on-and-off operation promising more routine use. The T-square fence is a hybrid itself, offering good features (fully adjustable, two-sided operation and an extendable auxiliary fence) that borrow from both the Biesemeyer and the Delta Unifence designs.

Our only quibble was with Craftsman's need to mount the fence rails so far to the left. While this offers good left-of-blade capacity, we don't feel it's necessary on a left-tilt saw.

Overall, this was the first hybrid saw that felt like a real hybrid saw and it's priced very well for the quality offered. —*DT*

For more information, circle #181 on Free Information Card.

SPECIFICATIONS

Craftsman #22114 Table Saw

Street price: $650
Motor: 1½ hp, 7.5 amp, left tilt
Table: 27" x 40", cast iron
Fence: Front-locking, T-style
Weight: 385 lbs.
Performance: ●●●●○
Price range: $$$$$
Craftsman: 800-377-7414 or sears.com

Sjöberg Benchtops – One Less Thing to Build

Every woodworker needs a workbench. Building one can be a very involved project that highlights the woodworker's skills, or it can be a quick-and-dirty 2 x 4 version that's destined to be "upgraded" some day. If you're stuck with caviar tastes but a tuna budget for time, consider adding a manufactured workbench top to a simple base.

Sjöberg offers three different benchtops through Woodcraft. Each top is made using laminated, kiln-dried birch, and offers front and tail vises. It's also drilled every 3¾" for bench dogs (four sturdy plastic-coated dogs are included) and a holdfast for securing irregular items. And they even include the hardware to build your own base to save you another trip to the hardware store.

The benchtops are available in three lengths (all are 19¾"- wide): 47" (49 lbs.), 58½" (53 lbs.) and 66½" (60 lbs.). The slabs aren't the same thickness through the entire width of the top; they have built up edges that are 2¾" x 1½"-wide at front and back, with a center thickness of 1⅛".

We found the 66½" top to be a sturdy, well-made slab. The vises are adequate for most tasks, but aren't heirloom quality. While I was initially concerned about the thinner center with built-up edges, this didn't seem to limit the top's performance in any way. The width was narrower than was my preference, but some woodworkers prefer the narrower top. These are good, well-made benchtops, but slightly more expensive than I thought was appropriate. —*DT*

For more information, circle #182 on Free Information Card.

SPECIFICATIONS

Sjöberg Bench Tops

Street price: #124821, 47"-$270
#124822, 58½"-$310
#124823, 66½"-$360
Performance: ●●●○○
Price range: $$$$$
Woodcraft: 800-225-1153
or woodcraft.com

Router-made Mortises & Tenons

There are many ways to make this joint, but none is better than with the router.

The traditional way to make a mortise is to chop it out with a chisel and mallet; the matching tenon is cut with a backsaw. Fitting is done with a shoulder plane. Every joint has to be marked out. The work is slow and time-consuming, but quiet. Doing it well demands skill.

However, the router can do both jobs. It can do them faster, and it can do them better.

With the proper setups, you can minimize layout, which saves time. The cuts are accomplished faster (but with more noise). Machine setups produce uniform cuts, which minimizes the need for fitting individual joints. And the mortise cheeks will be smooth, which means the joints will glue well.

I always make the mortises first, then cut the tenons to fit those mortises. The reason is simple: It's easier to adjust the size of a tenon than that of a mortise. Before I show you how I cut this joint, study the illustration below to familiarize yourself with its parts.

Disposable Mortising Fixture

Successfully routing mortises requires a good plunge router and a good fixture to hold the workpiece. Over the years I've tried a variety of fixtures. In designing one, you have three challenges. You must:

- Provide adequate bearing surface for the router base to keep it from tipping.
- Position the router and control its movement so every mortise is identical.
- Minimize the workpiece handling.

The drawing and photos at right show that this fixture is simple to build and use with a plunge router and an edge guide. The more precise your edge guide, the more accurate your mortises will be, particularly in terms of placement on the edge. The width of the mortise is determined by the diameter of your bit. The router's plunge mechanism controls the mortise depth.

The basic fixture, made from scraps, has five parts: a base, two supports (or fences) and two stops. The supports are attached to a plywood base with drywall screws. The router stops are screwed (or clamped) to the top edge of the long support.

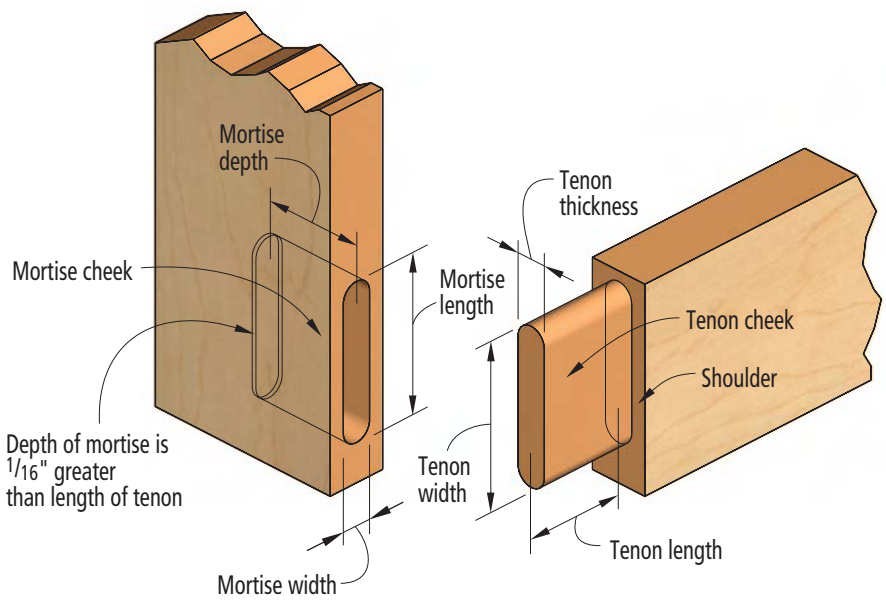
A setup line is squared across the edge and down the face of the long support, equidistant from the ends. Align the midline of the mortise – the only layout mark needed on all but one of the workpieces – with this line. Your router, edge guide and the stops will ensure that each mortise is uniform in placement, width, depth and length.

The upshot of this fixture is that it's easy to make and is disposable. Make one for a particular job, use it, then dismantle it and recycle the scraps for something else.

If you are so inclined – and I haven't been so far – you can make a spiffy model with sliding stops and a built-in work clamp.

by Bill Hylton

Bill is the author of several books about furniture construction and router operations. When he isn't writing about woodworking, he's doing it in his home shop in Kempton, Pa.



Anatomy of a mortise-and-tenon joint

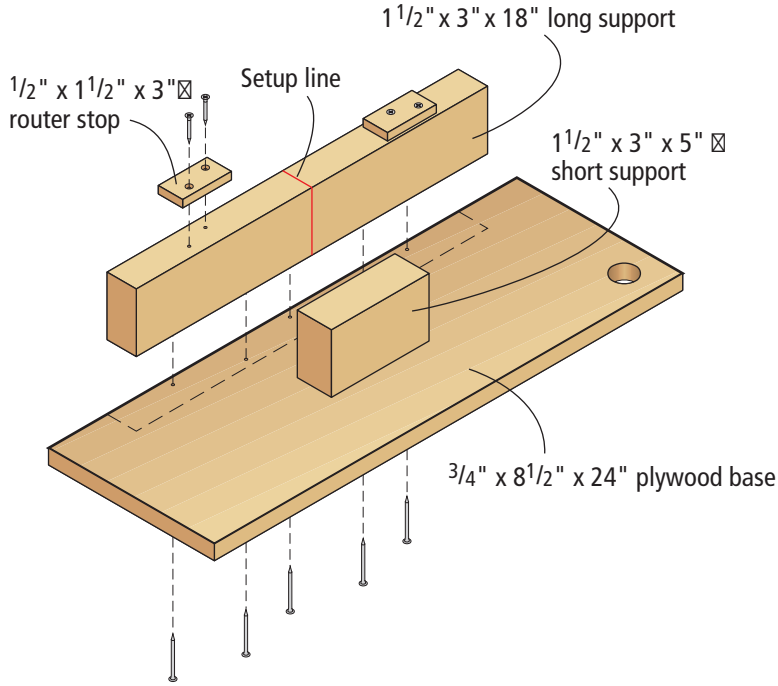
Using the Fixture

Clamp the fixture to your bench and chuck the bit you want to use in your router's collet. Mount the edge guide on the router.

Lay out a sample mortise on a scrap, including the midline mentioned above. I wouldn't use an actual workpiece, but I always use a piece of the working stock. Thickness is critical to the setup. The mortise layout must clearly define the mouth of your mortise.

Set the sample in the fixture, align it with the setup line and clamp it to the long support. Set the router on the fixture and plunge the bit down to the stock. Align the bit within the layout lines and set the edge guide, cinching down its screws.

With the bit still bottomed against the work, zero out the router's depth adjuster and reset it for the depth you want.



Edge mortising fixture - exploded view

Finally, set the router stops, which control the mortise length. Move the bit so it aligns with one end of the mortise. Set a scrap on the long support against the router's base and attach it to the fixture. Move the router to the other end of the mortise, align the bit, then attach the second stop.

Move the router to the appropriate end of the mortise for bit rotation, switch it on and plunge the bit about 1/8" into the work. Make a cut and retract the bit.

At this point, you can remove your sample from the fixture and measure the mortise shoulders. Assuming the mortise is to be centered, you want them equal. Adjust the edge guide as necessary to center the cut.

(If the mortise is intended to be centered on the work and your edge guide is less than precise, here's a trick. After routing the mortise to its full depth, unclamp the work and turn it around. Align the setup lines and reclamp the work. Re-rout the mortise. While it now will be wider than the bit, it will be centered. When you rout the matching tenons, simply cut them to fit the mortise.)

Now you can clamp a fresh sample in the fixture and make a full-depth mortise. Never remove more than about 1/8" of material in a single pass with your plunge router.

If the sample mortise is properly located and it's the correct length and depth, you should be ready to rout the good stuff.

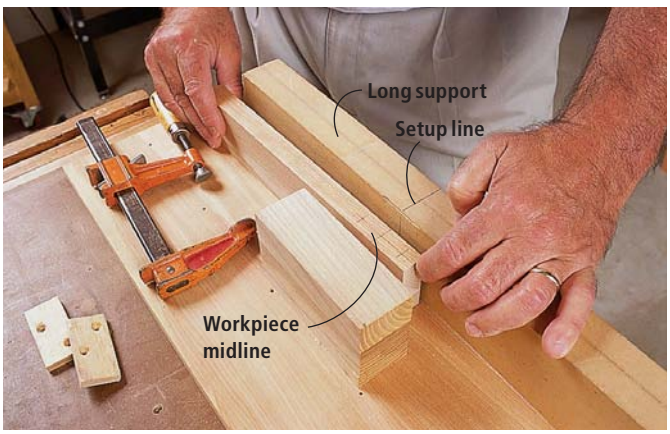
Routing Tenons

A good tenon has straight, square shoulders and smooth cheeks (smooth surfaces glue best). Gaps and misalignments at the shoulder not only degrade the joint's appearance, they weaken it. You want a clean and square intersection of the shoulder and the cheek – no ridges of waste, which could prevent the joint from closing completely. The shoulders must be in the same plane all the way around the workpiece so they'll seat tight against the mortise's shoulders.

Router-cut tenons meet all these criteria and they're easy to make. While there are a variety of ways you can rout tenons, my favorite is with a router table and a simple jig. You can set this up in just a few minutes, you don't have any layout to do, and you can cut a typical tenon in four passes.

The key is the bit. Most manufacturers call it a mortising bit (intended for hinge mortising), but some call it a planer bit. The bit is designed to cut on the horizontal surface as well as the vertical. Thus it's perfect for tenoning, where you want shoulders square to cheeks and both surfaces smooth.

Mortising bits are available from many manufacturers with both 1/4" and 1/2" shanks and in diameters up to 1 1/2". With the biggest



Align the midline of the mortise with the jig's setup line, then clamp the work to the jig's long support using an F-clamp.

The jig provides support under each plunge post, which enables you to plunge your router smoothly. When cutting, move the router in the proper direction, so the bit's rotation pulls the edge guide against the support.

Photos by the author

size, you can cut a typical tenon's cheek in a single pass. Even a bit that large can be run safely at the router's full speed.

I guide the work with an easy-to-make sled that's essentially a short, stocky T-square. The sled rides along the tabletop edge so you get a straight, consistently placed shoulder cut. The fence holds the workpiece and backs up the cut, so you don't get tear-out. A stop clamped to the fence sets the tenon length.

The sled is simple to make, but be careful about some details. Specifically, the shoe must be perpendicular to the jig fence, the edge of the fence must be perpendicular to the tabletop and the stop must be perpendicular to the edge of the fence and the tabletop. Misalignment of any of these reference surfaces can result in skewed tenons and shoulders.

Using the Sled

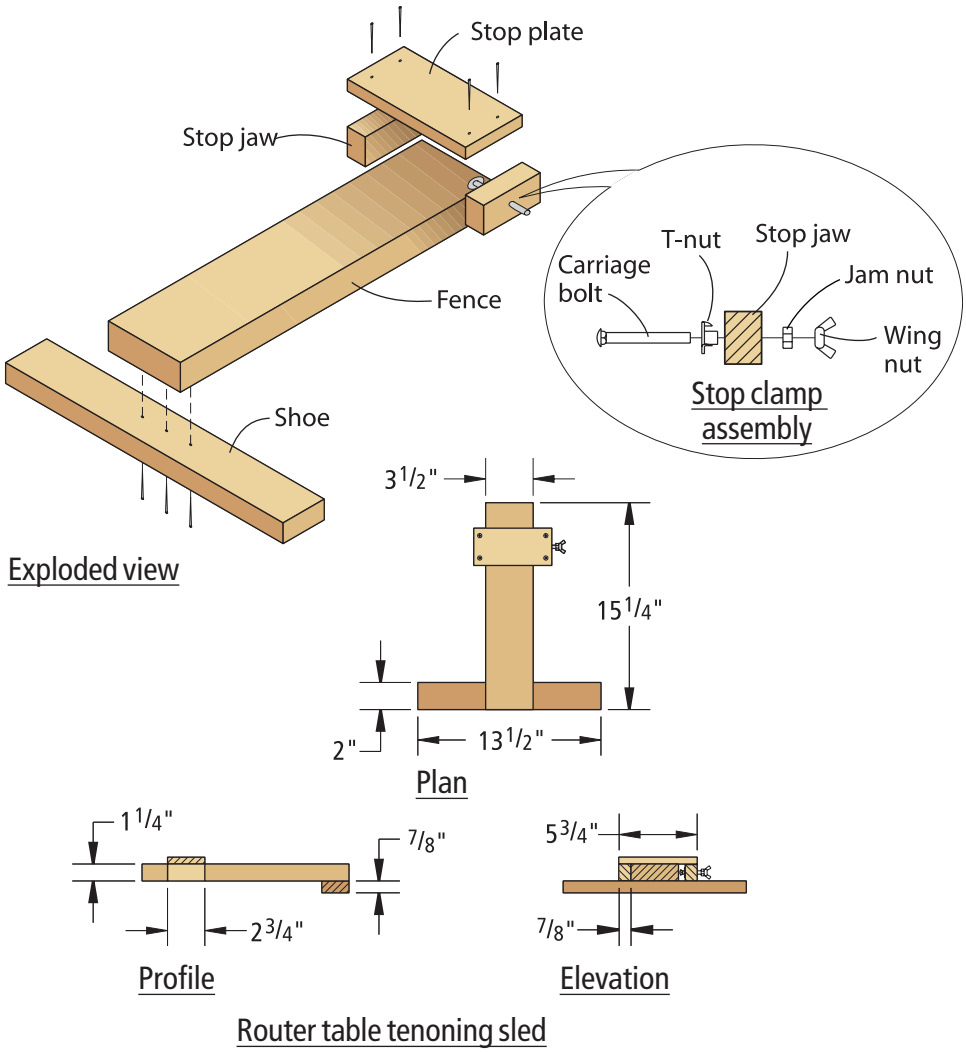
The first thing is to install the bit in the router and set its elevation. Use a rule to measure the exposure of the cutting edge above the table. I set the bit just under the width of the mortise's shoulder; that way, I can creep up on the right setting (determined by fitting a test tenon in a mortise) with test cuts.

Set up the sled next. Set the stop on the sled's fence to establish the tenon length. To do this, measure from the cut made into the fence by the bit. (You always want to use the same bit with the sled; otherwise you will get tear-out.) If the tenon is to be 1 1/8" long, as shown in the photo at right, align the 1 1/8" mark on the rule at the edge of the cut. Slip the stop onto the fence and bring it against the end of the rule. Seat it firmly so it's square to the fence and the tabletop. Tighten its clamp.

Then cut a sample tenon to check the setup. Make one pass, cutting the first cheek and shoulder. Roll the workpiece over and cut the second cheek and shoulder.

Check the fit of this tenon in your mortise. You need a close fit for the joint to glue well. If you have to hammer the tenon to close the joint, the fit is too tight. Hand pressure should close it. But don't make it too loose, because the joint should stay closed until you separate the parts.

Obviously, "plain vanilla" tenons, which have the same width of shoulder all around, are the easiest to cut. An offset tenon or one with wider or narrower edge shoulders takes one or two more setups.



Position the stop by measuring from the shoulder of the cut in the sled's fence. Use the same bit for tenoning so the shoulder cut remains accurate for setups and for backing up the tenon shoulders.

Cutting your tenon takes only one pass per cheek. Lay the work on the table, pull it against the sled's fence and stop and feed it across the bit. The bit cuts the cheek and shoulder simultaneously.

In any case, your square-cornered tenon doesn't match your routed mortise, with its rounded ends. You can resolve this problem in one of several ways. Some address it by squaring the ends of the mortise with a chisel. I've often rasped the tenon's corners to roughly match the mortise.

A third option is to scale the tenon width to fit the mortise. The primary glue surfaces are the broad cheeks, and you've got the shoulders working to resist twisting and racking. If the narrow edges of the tenon aren't in contract with the ends of the mortise, it doesn't significantly impact the strength of the joint. **PW**

A Passion for Old Cast Iron

One woodworker's quest has become a historical treasure trove for all to share.

Dana Batory didn't start out to become the authority on vintage woodworking machinery. His college education was leading him to a career in geology, but that didn't take. After stepping back to reassess his interests, he came up with a list that included writing, history, woodworking and machines. Suddenly the answer to what he should do with his life became obvious.

Today, Batory is the go-to guy if you have a question about an old woodworking machine. His knowledge is not just for those who collect machinery. More often (and more to his preference) it's for woodworkers who have found a bargain and need to know how to rebuild, maintain and use an old tool in their shop.

And we're not talking about hand planes: We're talking about machines such as 16"-wide, heavy-duty, cast-iron jointers. Why would anyone buy such a machine, you might ask? Let's compare: Batory's 16" J.A. Fay & Egan Co. Inc.'s jointer (shown at right in his Crestline, Ohio, shop) cost him $250 in 1985. A 12" jointer from Delta costs about $4,100 today. Talk about a bargain.

Of course, it's not that simple. To get this vintage 1912 jointer up and running, Batory applied a lot of elbow grease to remove a heavy layer of rust that was covering the entire machine. Then there was the squirrel's nest in the base that had to be cleaned out. He also needed to find some replacement parts, including flat cloth belts and a new set of screws for the cutterhead. But the end result of this labor of love is an amazing machine and a piece of history that's back in action.

by David Thiel

Comments or questions? Contact David at 513-531-2690 ext. 1255 or david.thiel@fwpubs.com.

A Quest for Catalogs and Manuals

When Batory purchased the Fay & Egan jointer, he quickly discovered he needed information on its care and maintenance. He also wanted to know the history of the machine. So he started looking for old, rare, entertaining and useful catalogs and manuals

Photos by Al Parrish

This Fay & Egan 16" jointer from 1912 is the machine that started Batory on his road to self-discovery and historical conquest.

One of the most difficult tasks when rehabbing Batory's John A. White planer was finding reproduction leather pulley belts. It was a lot of work, but the belts are one of the coolest aspects of the machine.

from a wide variety of woodworking machinery manufacturers. Throughout the years, he has cultivated contacts with other machinery collectors. Some of the manufacturers are still in business, while others are long gone. His impressive collection now numbers about 3,000 catalogs and manuals.

Batory has turned his avocation of collecting catalogs and manuals into a business. His first book, "Vintage Woodworking Machinery" (Astragal Press) covers the history and machinery of Fay & Egan, Yates-American Machine Co. Inc., Defiance Machine Works and Oliver Machinery Co. It also includes chapters on buying vintage woodworking machinery and restoring those machines once purchased. A second book covering Crescent Machine Co., Parks Woodworking Machinery Co., Boice-Crane Co. and Baxter D. Whitney & Son is scheduled for later this year.

But you don't have to wait for Batory to publish to benefit from his collection. He shares his hard-found information by selling photocopies of any catalog he owns for a modest fee. That fee is channeled back into further research and acquisition (*see "Need Info on a Tool?" on page 40 for more information*).

A Personal Collection

Batory, a woodworker who enjoys reproducing Shaker furniture (often built from pallet wood), has a surprisingly modest collection of machinery. If he rehabs a machine, it stays in his three-car garage shop. He doesn't resell.

Although small in number, the machinery he has is impressive. The aforementioned 16" jointer is the jewel of his collection. He also owns and uses a two-speed, 24"-wide John A. White planer made in the late 1870s. Batory purchased the planer for $350 with a friend 15 years ago.

Because of Batory's space concerns, the planer was stored at his friend's shop. The motor wasn't included in the deal, so the planer was powered by a take-off pulley on the friend's Allis-Chalmers Manufacturing Co. tractor. Six months ago, Batory added a phase converter to his shop, picked up a surplus motor and bought out his friend's half of the planer. Getting it to his shop took some considerable effort. It involved taking a wall down to get the planer out of the friend's shop and onto the truck.

Another planer (this one is 20" wide and more than 50 years old) is from the Buss Machine Works (shown at right). It required slightly less work to get it up and running, but Batory spent some extra time trying to get the new coat of green paint to match as accurately as possible to the original color.

One unique non-powered woodworking machine in Batory's shop is a combination mortiser/tenoner made by Parks Ball Bearing Machine Co. in the 1890s. By switching the cutting head, this handy machine will cut mortises or tenons. A foot treadle means your legs provide the power.

Scattered about the rest of the shop are a Delta contractor saw from the 1970s and an early 1940s Craftsman tilt-top table saw (purchased for only $15) that was manufactured by King-Seeley Corp. To make bevel cuts with this table saw you angle the tabletop – rather than the saw blade.

An interesting juxtaposition from the White planer, the Buss Machine Works' planer (purchased for $400) shows a design transition from appearance to utility. While it's still a good planer, it doesn't evoke the same emotional response.

Other fun machines include a homemade wide-belt sander and a spindle sander. The wide belt was made from odds and ends, while the spindle sander used to be a ring-joint machine. With a little tinkering, it's now a serviceable woodworking machine.

Batory also has bought a number of jigsaws, which today's woodworkers call scrollsaws. "I'm a sucker for jigsaws," Batory says. And

they're not just in his shop – another half dozen are on display in his home.

While these machines are a treasure, the real gold in Batory's collection are the manuals. I asked Batory how he found the unique machines and manuals and his answer was simple: "Dumb luck."

DIY Restoration

Batory frequently is contacted by non-collectors who have come across older machines and are interested in trying to sell them. While he is willing to help by providing information, his first passion is the collection of information, not commerce.

Much old machinery information can be found online. A following of old-machinery enthusiasts regularly gather at Old Woodworking Machines (oldwwmachines.com) to share information in the online discussion forum.

Keith Bohn, founder of the forum, says he first stumbled upon Batory in 1999. "I'd bought a 1939 Delta Unisaw Model No. 1450 which my wife quickly dubbed 'El Guapo'. The only available means of research was the local library, as there wasn't anything on the Web at the time. I stumbled upon a reference to Dana and – not knowing any better – I called him. Despite the fact that he didn't care for people calling him out of the blue, he was quite gracious and did what he could to help me out. This conversation sparked what would become a flame, which has since developed into a raging inferno. I consider him to be the 'Father of the Old Woodworking Machinery Forum.'"

If you're looking for a deal and are willing to put some time and energy into rehabbing an older machine, Batory recommends looking at machines from Crescent and the Fay & Egan company. "Fay & Egan never made a clunker," he says.

Other brands worth looking at are Tannewitz for band saws, Oliver Machinery for table saws and Whitney for planers.

While still very functional, this foot-powered mortiser/tenoner (purchased for $35) is a lot more fun as a conversation piece.

A Tidbit of History

As much as Batory enjoys researching the machines, he also enjoys studying the history of the companies. One piece of history from Batory's book that's of note is Oliver Machinery's introduction of round cutterheads to the U.S. market. The head was first developed in England and later in Germany, where it was patented in 1908. Oliver purchased the German patent the same year.

The May 1910 issue of "The Grand Rapids Furniture Record" states: "The Oliver Machinery Company were the first American makers of machinery to market a cutting cylinder for use in a hand planer (jointer) that would save the operator's fingers and hands from serious mutilation."

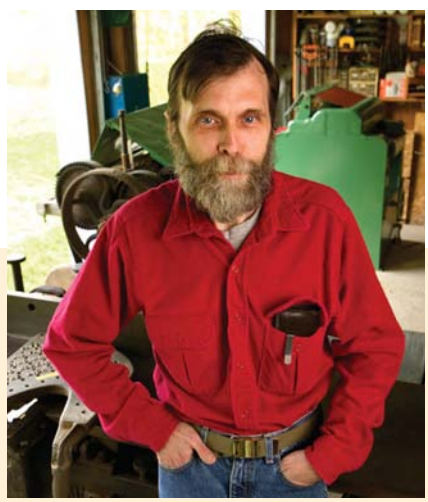
Originally, cutterheads were square in cross-section and left large intermittent gaps between the jointer tables while in operation that could catch an unwary user's fingers.

The Craftsman tilt-top table saw was revolutionary for the early '40s. All of today's table saws owe their lineage to this machine. We now tilt the arbor rather than the table, but it's nice to see the beginnings of such an important machine.

"Though the round cutterhead was originally invented to prevent serious accidents, its side benefits were less noise, less vibration, efficient use of power and smoother surfacing," Batory wrote in his book.

The design continues as a mainstay in nearly every woodshop jointer today.

It's hard to say whether Batory's shop is more interesting because of the physical machinery still in use or for the history that's still accessible. Either way, for those interested in old woodworking machines, Batory is a good man to have around. **PW**



Dana Batory: writer, historian, woodworker

NEED INFO ON A TOOL?

A copy of the 70-plus page list of the catalogs Batory has available can be obtained by sending $7.50 (money orders only) by regular mail to:

D. M. Batory
402 E. Bucyrus St.
Crestline, OH 44827

Bottle Stoppers

A simple lesson in spindle turning.

Photos by Al Parrish

These bottle stoppers are great projects for beginners and more advanced turners alike. Their relative ease of turning makes them a manageable project for beginners; for more advanced turners that simplicity offers the opportunity to focus on design. And they make nice gifts for almost any occasion.

Almost any hardwood is suitable, but I find for small items like these, woods with rich and contrasting grain work best.

Cut pieces about 1" to 1½" square by about 1½" to 2" long, and drill a ⅜" hole about ¾" deep in one end. You don't have to be exact. Glue a ⅜"-diameter x 2¼"-long hardwood dowel into the hole using yellow woodworker's glue. Use good hardwood dowels; the typical hardware-store dowels are not strong enough to withstand the turning process.

Attach the blank to the lathe by mounting the protruding dowel in a Jacobs-style chuck. If you don't have one, get one; it's inexpensive, easy to use and useful for mounting small items. Look for one with a Morse taper size that matches your lathe, and that has a threaded hole in the end of the taper. This allows for a draw rod to hold the chuck in the headstock when there is no tailstock support, such as when you have parted off the far end of the workpiece. A draw rod is threaded and screws into the end of the Morse taper. The rod goes through the headstock extending about an inch beyond its opening. It's held in place by a large knurled nut (and washer, if needed).

by Judy Ditmer

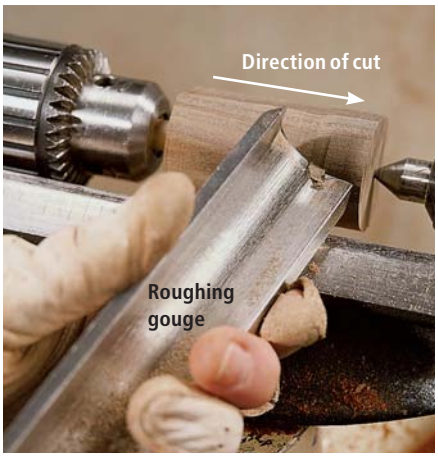
Judy, author of two turning books and many articles, has been turning since 1985. She teaches and demonstrates her skills throughout the United States and Canada.

For now, you want the support of the tailstock while doing the rough turning and shaping; otherwise the piece would break off where the dowel comes out of the workpiece.

First turn the blank to a cylinder using the roughing gouge. Keep the bevel on the wood, move the tool in the direction the flute is pointing and cut on the low side of the tool. Next you'll work on shaping.

Begin the shaping by making a few cuts with a parting tool. This roughs in the general shape of the piece. You are getting excess

Here I have knocked out the crosspiece of the chuck key and mounted it in a power driver. This speeds mounting, as the chuck must be very tight (almost, but not quite enough, to crush the dowel) to hold the piece securely during turning. A chuck that will accept a draw rod is available at Penn State (800-377-7297 or pennstateind.com).



Round the workpiece with a roughing gouge.

Rough out a shape with a parting tool.

Refine the shape and make the finishing cuts with a long-fingernail-grind spindle gouge.

wood out of the way so you can begin the final shaping. I find shapes that vary considerably in diameter are generally more pleasing than more oval or cylindrical ones.

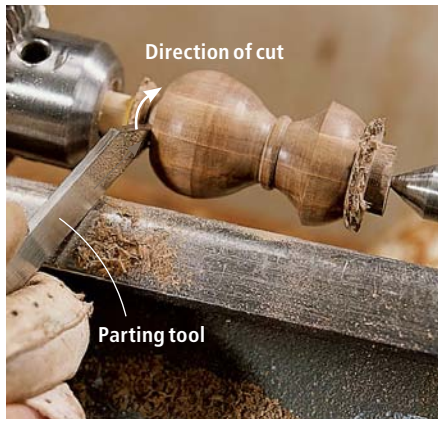
Continue refining the shape with a long-fingernail-grind spindle gouge. This is a terrific grind for detail work because the long tip will reach into very tight spaces, yet the rest of the edge is out of the way. (This reduces the tendency for kickback.) Keep the bevel rubbing.

Once all of the shaping and finishing cuts are done, part off the top end of the piece (it's still held by the dowel; you don't need the tailstock support for sanding and finishing).

Make the parting cut on the bottom slightly concave, so the cork will seat well around the outside edge. The parting tool (at right) has a tiny hook on the right side, which leaves a very clean cut across the end grain.

I burn lines with a steel wire to emphasize details, as shown on page 44. Attach the wire to pieces of dowel. The wood can grab the wire and pull it hard, so don't ever hold the wire itself. Always hold it by the dowels.

When you like the shape of your piece (or when there isn't much wood left), sand and finish to your satisfaction. I usually sand these to #280 or #320 grit, but with very hard woods



Undercut the bottom slightly with a parting tool.

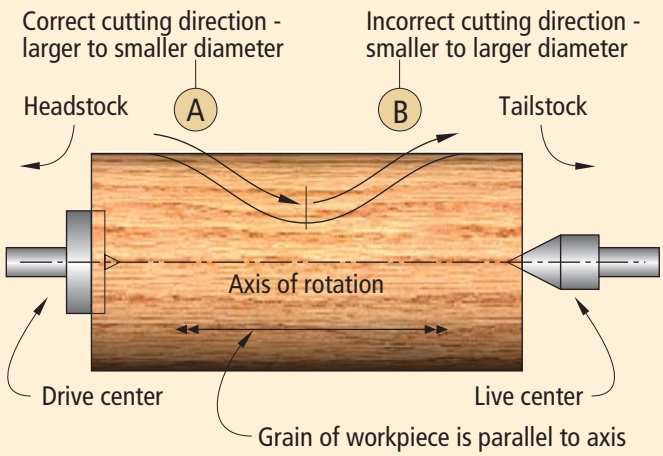
PROPER CUTTING DIRECTION FOR SPINDLE TURNING

There are two kinds of turning – spindle and faceplate (which we'll talk about in a future column). They're completely different from one another. The type of turning determines the cutting direction.

In spindle turning the wood grain is parallel to the axis of rotation; in faceplate work it's perpendicular. This axis is the imaginary line between the headstock (which provides the driving force) and the tailstock (which holds the work against the headstock). The workpiece rotates around this axis.

Spindle work is anything – from pens to bottle stoppers; chair legs to weed pots – with the grain parallel to the turning axis. On spindles, you always cut from the larger diameter to the smaller diameter (see "A" in the illustration). This way, the wood fibers are supported by the mass of wood below as you are cutting them. If you begin cutting uphill (or from the smaller to the larger diameter, as shown in "B" in the illustration) the unsupported fibers will bend, tear and break off instead of being cut. The effect of this will be very dramatic, and you may have serious dig-in or kickback of the tool.

Cutting in the right direction and keeping the bevel behind the cutting edge on the wood will help you to stay in control of your cuts.



(such as ebony) or plasticized wood you may need to go to a finer grit to eliminate sanding marks. I use a hard wax, applied and buffed on the lathe, to finish my bottle stoppers.

Remove the stopper from the chuck, glue the cork (available at Craft Supplies 800-551-8876 or woodturnerscatalog.com) onto the dowel using yellow woodworkers glue, and trim and sand the end of the dowel and cork.

Now make more – 50 is a good start. Then you'll be warming up and you'll start seeing design differences you can't see when you've made 20. After 100, you'll see things that weren't apparent yet at 50 … have fun. **PW**

Burn the details.

Sand and finish.

Now glue on the cork and trim the cork.

THE 9 RULES OF SAFE TURNING

Begin by familiarizing yourself with your equipment. Read and understand the instructions that came with any machine you use. In addition, the following procedures and habits will increase your safety. These rules and procedures are very important. Be sure you understand them and refer to them often. Accidents happen not only when we don't know the safe way to do something, but when we forget or neglect to actually do it that way. This list is not necessarily all-inclusive; I have seen people do dangerous things I had never even imagined. But if you will learn and follow these rules and procedures, it will go a long way toward keeping you safe.

Material, Equipment and Tools

RULE #1: Choose appropriate material. Any wood you're going to put on a lathe should be, as best you can determine, free of defects that will affect its physical integrity. At high rotation speeds any cracks, inclusions, rotted areas or other defects can cause the wood to break apart. This happens most often when the wood near the defect encounters the tool, but failure can also result just from the centrifugal force of the rotation itself. You can't always see such defects in the wood (hence rule #6), but if you know they are there, it's best not to put the piece on the lathe in the first place.

RULE #2: The workpiece must be held securely on the lathe. Even if the workpiece loosens only a bit, but doesn't actually come off the machine, it will become increasingly difficult to cut cleanly.

RULE #3: The lathe's speed (and the lathe itself) must be appropriate for the size, weight and orientation of the workpiece. If the wood is too heavy or too large for the lathe the machine may shake and even move across the floor or bench; the piece could even come off the machine. Even short of such obvious disasters, if the lathe is not large or sturdy enough for the intended work, excessive vibration will make it hard to cut cleanly.

RULE #4: Always use sharp tools. Dull tools will not cut well, and you'll use too much force trying to make them cut. If the dull tool slips, this excessive force may push the tool or your hands into the rotating workpiece, creating a dangerous situation.

Procedures and Habits

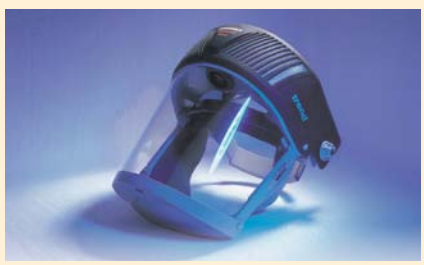
RULE #5: Before you turn on the lathe, always make sure that the toolrest is in position and firmly locked. If it's loose, it can move during use, which may result in injury. Rotate the workpiece by hand through a full rotation to ensure that no part of the rotating piece will hit any part of the lathe. Keep the toolrest close to the workpiece, and always stop the lathe before moving the toolrest. Too much distance between the toolrest and the wood puts greatly increased forces on the tool; you may lose control. Initially, as you round the piece, you may need to move the toolrest often. If you do this while the lathe is running, the tool, the toolrest or your hand may be pushed into the rotating workpiece.

RULE #6: Always wear a full face shield. The workpiece can come off the lathe (this is rare if reasonable caution is used in mounting it); the tool itself can break (very rare, but it can happen. Please don't ask me how I know this…). Most importantly, because it will surely happen sooner or later, a piece of wood may break off of the workpiece and come at you. Safety glasses alone don't adequately protect your face. You can find face shields from major turning suppliers. Shown is the Trend Airshield (859-485-2080 or trend-usa.com or airwareamerica.com).

RULE #7: Use respiratory protection. A good dust mask, respirator or dust helmet will protect you from the significant damage that repeated exposure to wood dust can do to your lungs.

RULE #8: Don't work at the lathe if you are impaired in any way (tired, distracted or medicated). Your judgment is the first thing to go, and judgment generates the little voice that tells you you are about to do something unsafe.

RULE #9: Think: first, last and always.



You should no more be willing to turn without a face shield than to drive down the highway without a windshield. Find a face shield (or a dust helmet with a face shield) that is comfortable.

TORNADO

One afternoon – start to finish – is all it takes, even for a new woodworker. This may be the easiest (and coolest) table you'll ever build.

If mid-20th century modern furniture design were as popular as the Arts & Crafts style is today, then thousands of these tables would be turning up for sale at craft shows any day now. Why? Anybody can build this table. And the more tables you build at once, the less time each one will take.

In spite of its simplicity and minimal materials, the table is very sturdy, owing to the geometry of the dowel placement. Isamu Noguchi (1904 - 1988), a sculptor and designer recently honored with the issue of U.S. Postal Service commemorative stamps, designed the table in the 1950s using a cast-iron base and chrome-plated steel rods. Wooden dowels, even 5/16"-diameter ones as used in our model, provide ample strength.

Many different materials can be used to make the table. In addition to the wood or steel dowel options, the base can be solid wood or plywood. The top can be solid wood, plywood covered with plastic laminate or even glass with a ring of plywood to capture the top of the dowels and support the glass. Marble, granite or slate are still other possibilities.

by Steve Shanesy & John Hutchinson

Comments or questions? Contact Steve at 513-531-2690 ext. 1238 or steve.shanesy@fwpubs.com. Contact John at jhutchi2@columbus.rr.com.

TABLE

Photo by Al Parrish

The Secret to its Simplicity

When you've settled on the materials, the first order of business (and the genius that makes the table so easy to build) is making one simple jig. This is what will guide your drill bit when boring the holes for the dowels.

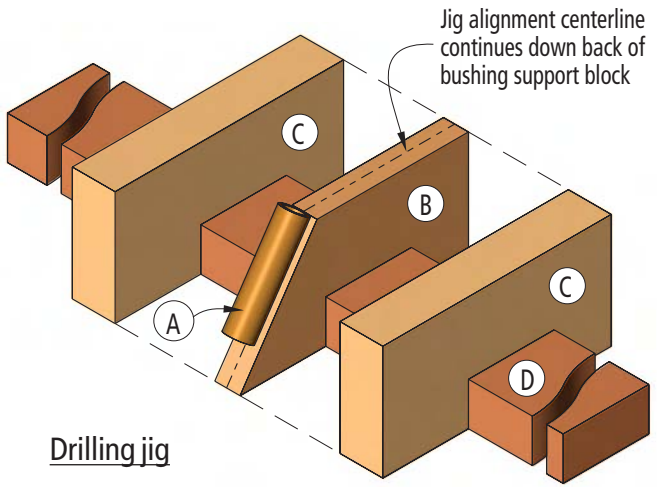
You'll need something to use as a guide for the drill bit, which we'll call the drill bit bushing. Aluminum or copper tubing can be used for 1/4" or 3/8" dowels, but for 5/16" dowels (which we used for the table shown on page 47), you should buy a 1" long x 5/16" threaded rod connector and drill out the threads. Just make sure the inside dimension of whatever you choose to guide your drill matches your dowels' diameter.

To build the jig, first rip and crosscut a 2"-wide x 6 1/2"-long board. The thickness of the board should be the same as the outside dimension of the drill bit bushing. On this board, cut a 56° angle across its width at one end (use a miter saw or a miter gauge with a 34° setting).

Next, cut two 2"-wide x 6 1/2"-long pieces of scrap wood (the thickness isn't critical). These will be glued to the angled piece to create a space to capture the drill bit bushing. Glue the drill bit bushing to the angled section of the jig using epoxy.

After the glue has cured, cut a notch in the bottom of this assembly and attach the long, transverse "wing" board. This board provides you with a place to attach the clamps that will hold the jig in place while you drill your holes for the dowels. Simply secure the wing to the jig using four countersunk drywall screws.

The drilling jig is made from four pieces of wood, with the center piece cut at the proper angle before gluing the blocks in place. The metal drill bit bushing is then glued in place using epoxy.



Drilling jig

- (A) Metal tube drill bit bushing (inside diameter = dowel diameter)
- (B) 2"x 6 1/2" bushing support cut at 56° (thickness = bushing outside diameter)
- (C) 3/4"x 2"x 6 1/2" blocks
- (D) 3/4" x 1 1/2" x 24" clamping "wing"

A finish nail serves as the pivot point for the circle-cutting jig. For outside cuts, measure from the inside edge of the router bit; use the outside edge of the bit for measuring inside cuts. Mark the radius distance on the jig, then drill a small hole for the nail.

Cutting Circles

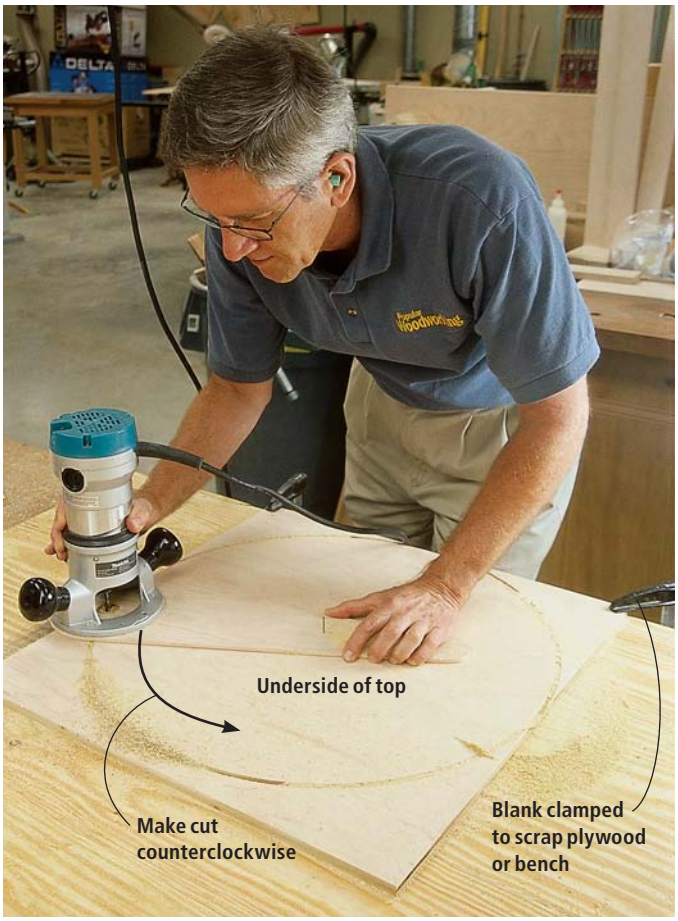
With the jig built, you can cut the top and base to shape. You can use a band saw or jigsaw for this, but a perfectly round shape is best achieved by using a router with a circle-cutting jig. Although you can purchase this jig, a simple shop-made version will handle this project easily.

Simply mount a piece of 1/4"-thick plywood that's about 24" long to the base of your router. Drill a hole so a straight bit can pass through the jig. For the three radius sizes required for this project (the top, and the outside and inside circles of the base) drill a small hole for a finish nail that will be the pivot point of the jig.

Where you drill these pivot holes depends in part on whether you are cutting the outside edge of the top or base or the inside edge of the hole in the base. To cut the outside edge of the top and base, you don't want to include the diameter of the straight bit in your measurement; for the inside hole, you do.

Next, prepare the two square blanks for the top and base from 1/2"-thick material of your choice. Each blank should be at least 1/8" bigger than the finished size. On the underside of each plywood blank (the side that won't show) find the center by drawing two lines from corner to corner of each square. The center is where those lines intersect. Mark that spot with an awl for the finish nail that is the pivot point of your circle-cutting jig.

Insert the finish nail in the appropriate hole in the jig and hammer it in the center of the blank. When cutting the circles in the base, you can drive the nail clear through because – if your design calls for it – the center piece is later cut away and discarded. Cut the outside circle first. (The inside circle is cut after you drill



Mark the center of the circle with an awl. Then use the point of the nail in the jig to drop in the hole. Give the nail a couple of taps with a hammer to secure it. Cut the circle by moving the router counterclockwise. Make the cut in several passes, lowering the bit about 1/8" after each pass.

your holes for the dowels.) Do the same thing for the top, except this time don't drive the nail all the way through.

When cutting all the circles, you should make the cut in three passes, so set the depth of your router bit's cut accordingly. Be sure to clamp each blank to your benchtop. You'll likely want to protect your work surface from the last router bit pass by putting some scrap below the work.

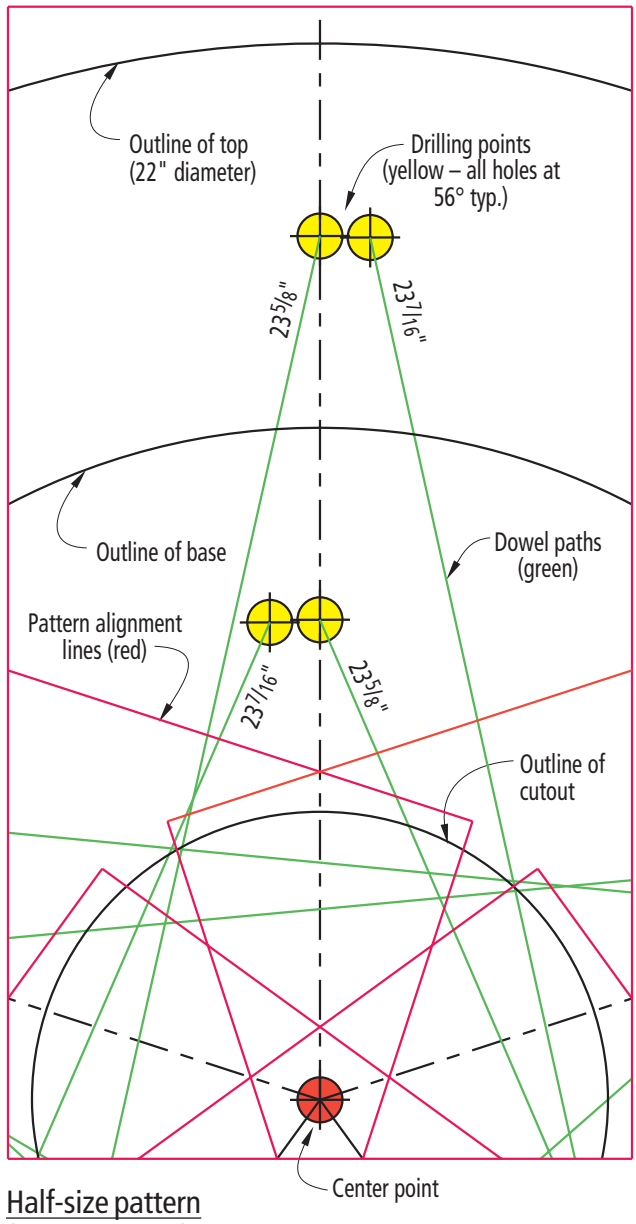
Also, keep in mind that when you later cut the inside circle of the base, the outer ring should be clamped down so it isn't damaged by the router bit at the moment it's cut free of the outer ring.

Cut the top and the outside base circles. As mentioned earlier, before cutting the inside base circle, you'll need to drill the dowel holes first because you'll need to use the waste material of the inside circle to align the jig.

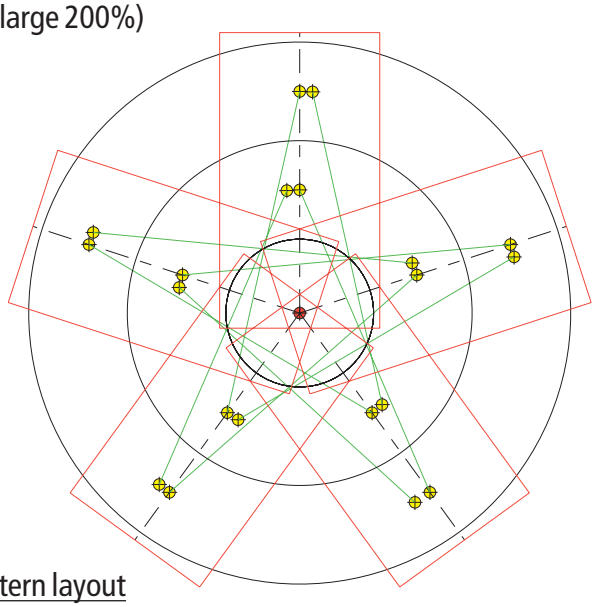
Drilling Holes

Prepare to drill the holes for the dowels using the jig you made and the hole-drilling pattern at right. To use the pattern provided here, you'll need to enlarge it 200 percent (double the size). It fits nicely on legal-size paper. Then make five copies, trim to the pattern border and match them up so that corresponding, overlapping lines are in place, as shown at right. Tape the five pages together, then carefully tape them to the top side of the base.

Next, study the pattern and sort out the various circles. The very outside circle is the outside diameter of the top. The next



Half-size pattern (enlarge 200%)

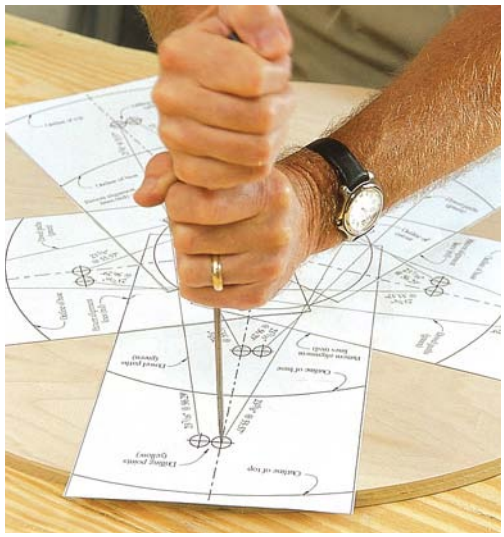


Pattern layout

circle in is the outside diameter of the base. It contains the five pairs of small circles that are the drilling locations for the holes in the base where the dowels will be glued. Note: Each drilling location has a straight line (green in the drawing on page 49) that connects it to the location in the top for gluing the other end of the dowel.

Before clamping the jig in place and drilling your holes, you must mark the centerline of the guide bushing on the back of the jig.

Transfer the drilling locations from the paper template to the work. Use an awl or other pointed implement to softly mark each hole's center. Then follow the straight "dowel" line mentioned earlier about 8" back and softly mark another point. Designate pairs of dimples that go together When all these are made for the base, remove the template, keeping it intact, then connect the paired dimples with a pencil line. (Or, you can make two copies of the pattern, attach one to the top and one to the base, and drill right through each pattern.)



Tape the five-piece pattern together and lightly secure it to the underside of the top. Use an awl to mark the hole's drilling center for the dowels. Make two more marks, one to represent the hole center for the base and another along the line indicating the dowel path. Mark the center about 8" back from the dowel center for the top.

Connect the dots made by the awl with a pencil line. The pencil line will represent the dowel's path from the top hole to the base hole. You'll use this line to set up the drilling jig in proper alignment.

To clamp the jig to the work, you'll need to elevate it. Use short lengths of 2x4s. Now you can position the jig as shown below.

Use the drill bit bushing as a sighting device so you can see the center of your marked hole.

With the drilling jig clamped in place, drill a 1/4"-deep hole for the dowel. You should mark your drill bit with a pen or piece of tape to tell you how deep to drill. Obviously, you don't want to drill through your top.

Align the pencil mark on the back bottom edge of the jig with the straight line for that hole location. Verify the position by sliding your brad-point drill bit through the bushing. If the point hits the dimple, it's perfect.

Clamp the jig to the work and drill a 1/4"-deep hole. Because you're drilling at an angle, one side of the hole will be longer than 1/4". To establish a consistent hole depth, mark on your drill bit where you should stop drilling when the mark reaches the top of the bushing. Repeat the process for each hole center on the base and the top. Once you drill all the holes in the base, place the template on the underside of the top piece and follow the same steps to drill the mating holes. To make assembly easier, redrill the holes in the top using a bit that's 1/64" larger than 5/16". It's not necessary to use the jig – just chase the existing holes with the larger bit.

Now that the drilling is complete, you can go back and rout out the inner circle of the base.

Before assembly, you may want to apply edge veneer tape to the exposed plywood edges. Use pressure-sensitive adhesive-backed veneer tape because of the size of the inside circle of the base.

Assembling the Storm

It's time to cut your dowels to length – five at 23 5/8" and five at 23 7/16" to create a 20"-high table when assembled. Designate length by color-coding the ends.

Next, dry-fit the base, dowels and top. First insert the dowels in the base. Each pair will make a "V" shape. Insert the slightly longer dowels first in the left hole of each pair. Next, place the shorter dowels in the right hole making sure these dowels overlap outside all of the previously placed dowels. Study the 3-D illustration at right to get a clearer picture.

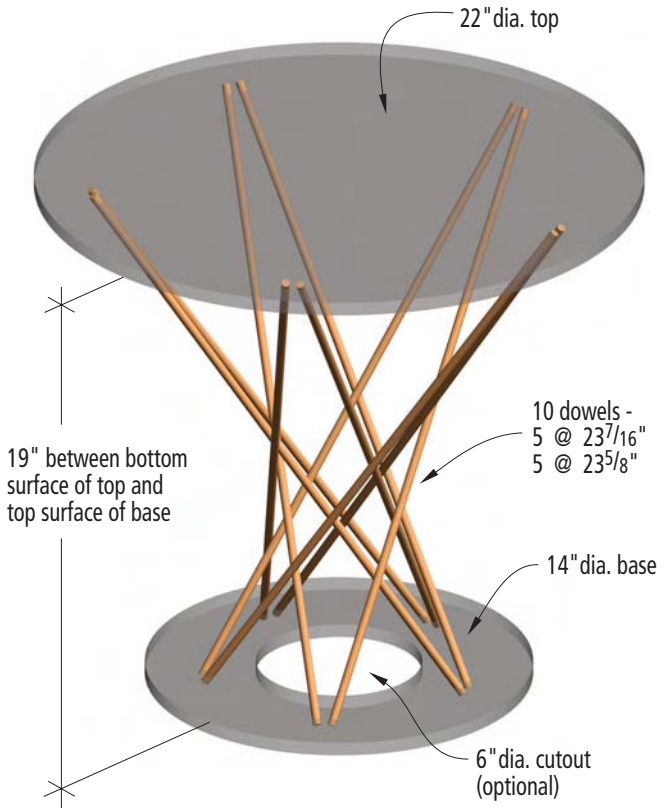
When you're satisfied with the assembly, take the table apart. Sand it and get ready to finish the base, dowels and underside of the top. If you want, finish the good side of the top, too. Just be

careful not to damage it during final assembly.

Before applying any finish, plug the dowel holes and tape off the ends of the dowels. This will ensure that you're gluing wood to wood, not finished wood to finished wood. To finish the dowels, consider screwing cup hooks in one end so you can apply the finish and then hang them to dry.

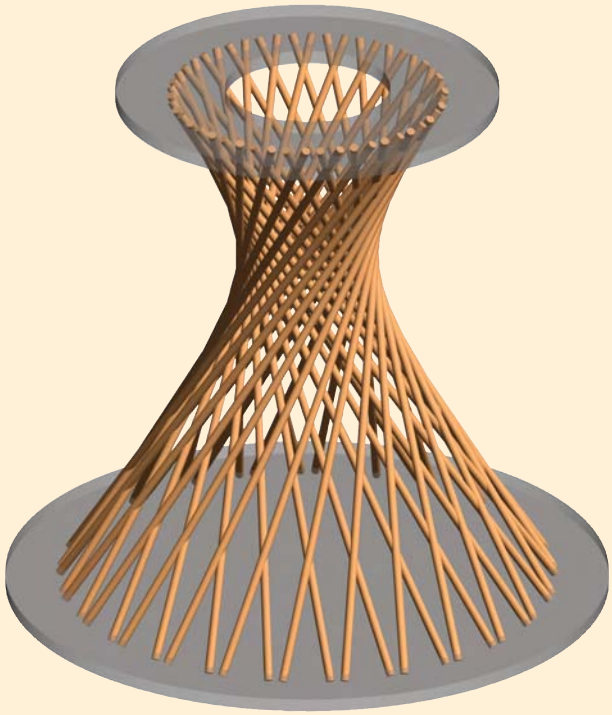
For final assembly, place the top upside down and glue all the dowels in the top first. Then apply glue to the holes in the base and carefully slip the dowels in their respective holes. Be sure all the dowels are seated home. Measure the distance between the base and top to make sure they're parallel. This will ensure a table with a top that's parallel to the floor. While the glue is drying, place a weight on top of the base.

The Tornado Table described here is basic and representative of the original Noguchi table. As you can see from the gallery of tables our entire staff made (on page 52), the variations of tornado tables are limited only by your imagination and materials.



TORNADO TABLE

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	1	Top	1/2	22-dia.		Maple plywood
❑	1	Base	1/2	14-dia.		Maple plywood
❑	5	Dowels	5/16-dia.		23 7/16	Maple
❑	5	Dowels	5/16-dia.		23 5/8	Maple



THE HYPERBOLOID: A SHAPE FOR ATOMIC-AGE FURNITURE

As a child of the 1950s, I used to classify myself as a Baby Boomer. After researching Isamu Noguchi's Tornado Table, I've decided to switch titles to "Offspring of the Atomic Age." (The fact that my father worked for the Atomic Energy Commission doesn't hurt, either.)

If commercial nuclear power has a birthday, it would be Dec. 8, 1953. That was the day President Eisenhower gave his "Atoms for Peace" speech. As a result, the first wholly commercial power plant was ordered in 1955 and built in 1959 by Commonwealth Edison in Morris, Ill. Coincidentally, Noguchi presented his design for the rocking stool (yes, the table started as a rocker) to furniture manufacturer Knoll Associates in 1955. When inverted and with a few dowels added, the Tornado Table takes on the shape of a nuclear power facility's cooling tower. How much more "atomic" can you get? Despite its current negative connotations, the shape of the cooling tower was the icon for a bright new tomorrow in the mid-1950s.

As a pure geometric form, the shape of the Tornado Table (and the illustration above) is what is known as a one-sheeted hyperboloid. For more information on all the cool math, check out http://mathworld.wolfram.com/Hyperboloid.html. Apparently, hyperboloids came in one- and two-sheet varieties.

But what about three sheets? Yet another Internet search gave me the answer. The phrase "three sheets to the wind" dates to 1821. The "sheet" is a reference to a rope on a sailboat. To have a sheet loose in the wind is bad seamanship; to have three loose means you are not capable of controlling the boat i.e., wasted. And you thought you'd only be learning about woodworking.

— JH

EASY TO BUILD AND EASY TO PERSONALIZE

To show you how simple the Tornado Table is to build, we had each member of the *Popular Woodworking* staff design and construct their own interpretation. Here's a quick look at what each person created.

• Steve Shanesy, editor and publisher
Materials: Walnut top, white oak base, steel supports
The idea behind it: I wanted to get closer to the look and materials of the original Noguchi design. The base is turned, giving it a slight domed shape, and the 1/4" steel round stock is bent at the base and secured with clinch nails. The walnut top is a single board (believe it or not) and features a so-called "pencil edge" detail often seen on Knoll furniture pieces of the era.

• Linda Watts, art director
Materials: White oak
The idea behind it: I delight in sitting on my front porch on a warm afternoon, so my goal was a practical one. I wanted a side table that could withstand the weather and hold a good book, a glass of iced tea and a planter of flowers. I cut a hole in the top to inset the lipped planter for stability and finished the table with a light coat of boiled linseed oil.

• Christopher Schwarz, executive editor
Materials: Cherry base and dowels, sugar pine top
The idea behind it: I was going for a high-tech, high-texture look, so all the surfaces are finished with hand tools. The rippled surface of the top was created with a scrub plane. The chamfers on the base and underside of the top were made with a drawknife, block plane and scrapers. And the circle in the base was shaped with a small gouge.

• David Thiel, senior editor
Materials: Poplar top and base, hardwood dowels
The idea behind it: Black lacquer has always held a magical appeal for me. With such a simple table, a gloss black finish seemed an obvious way to dress it up. I left the dowels natural as a counter-balance to the stark reality of the top and base. The edge of the top was radiused above and a heavy chamfer applied below to slim the appearance.

• Kara Gebhart, managing editor
Materials: Maple plywood top and bases, hardwood dowels
The idea behind it: I wanted a top with a more fluid shape, but then there was a stability issue. So John suggested creating a two-base tornado "storm." The amoeba-shaped top (cut out on the band saw) is two 22"-diameter circles connected with curves. The overall height is 17" and I chose 1/4" dowels. The drilling angles remained the same. I finished it with spray lacquer.

• Michael Rabkin, associate editor
Materials: Poplar top and base, hardwood dowels
The idea behind it: Baseball has always been a big part of my life – Mom was a huge Yankee fan and Dad was my Little League coach who took my best friend and me to our first of many major league games. I changed the circular base to a home plate and painted the entire table white. Then my friend Amy (a great artist) painted the red stitching on the top so it looks like the ball I caught while walking with Dad in the left-field bleachers during batting practice in Pittsburgh this year. **PW**

WOODWORKING ESSENTIALS

BY NICK ENGLER

CHAPTER 1

Intro to the Table Saw

Few tools have revolutionized a craft as much as table saws have changed woodworking. These saws saved tedious hand work and – beyond making single pieces – made it possible to precisely reproduce parts quickly and accurately. This affected how furniture and other woodenware was built and transformed woodworking design.

The table saw first appeared in about 1800, although historians disagree on who invented it. Some credit a German craftsman, Gervinus; others think it was developed simultaneously by several different people in Europe and the United States. The story I find most interesting was told to me by the late Brother Theodore (Ted) Johnson, a Shaker scholar and member of the Sabbathday Lake Shaker community in Maine.

According to Brother Ted, the idea popped into the head of Sister Tabitha Babbitt as she sat at her spinning wheel at the Watervliet, N.Y., community. (Sister Tabitha, it seems, was from an inventive family – her brother developed Babbitt metal, an alloy still used in bearings and bushings.)

Sister Tabitha happened to be looking out the window at two Shaker brothers as they bucked firewood with a two-man saw. She marveled at how much more efficient her revolving wheel was than their reciprocating saw. Why couldn't the brothers simply mount saw teeth on a wheel?

She asked them, and they decided to try it. They snipped a crude circular saw blade from tin, mounted the tin blade on an arbor and fastened the arbor to a workbench. Spinning the arbor with a hand crank, they found that a circular motion cut much more efficiently than a traditional straight-line, back-and-forth motion. The brothers soon installed an improved version in a water-powered mill to cut siding and flooring to size – the first recorded circular saw in America. From these humble beginnings evolved the table saw.

GREAT TRICK:

Cutting on the Table Saw As Easy as 1-2-3-4

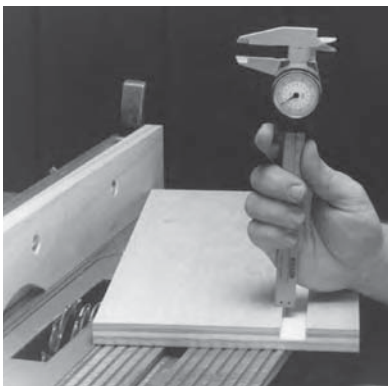
No matter how you slice it, there are only four steps to making a table saw cut:

- Lay out the cut on the board.
- Adjust the blade and other accessories for that cut.
- Align the board with the blade.
- Pass the wood over the saw.

TIPS & TRICKS

GREAT TRICK:

Before Making Your Parts, Make Test Cuts on Scraps



After you've made the necessary adjustments, always make a test cut in a scrap piece before cutting good stock. Measure the position of the cut on the board with a ruler or tape measure and gauge the width and depth with a dial caliper.

PRO TIP:

Think Ahead Before Cutting

When laying out a cut on a board, think ahead to how you will line up the cut marks with the saw blade. If necessary, use a square to transfer the marks to a more visible or more convenient surface. Many woodworkers mark a face and an edge – they use the mark on the edge to align the stock with the blade and the mark on the face to monitor the cut as it progresses. Also, it's best to indicate the waste side of the line so you can see on which side of the line to make the kerf.

Choosing a Table Saw

For more than two centuries, the table saw has remained a simple machine. There are only four crucial components, the same four that comprised the original invention – a table, a blade, an arbor and some means of powering the arbor.

However, there have been several useful developments along the way. For example, most modern table saws have a fence and a miter gauge to guide the wood past the blade, a blade carriage to adjust the angle and height of the blade, and a blade guard to protect the operator.

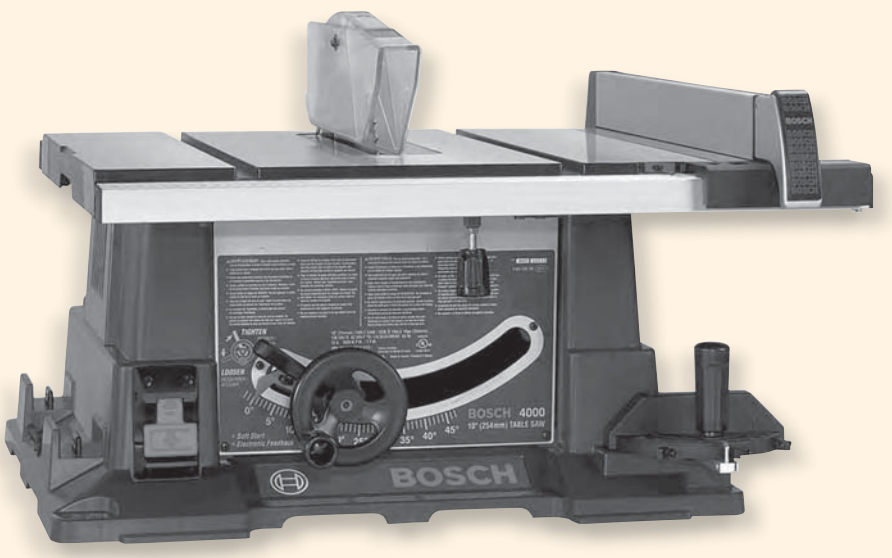
There are several different ways in which the basic components of a modern table saw can be arranged. The configuration of these components determines the type of saw.

■ On a **benchtop saw**, the motor and blade carriage are encased in the saw body. These are "direct-drive" table saws, meaning the blade is mounted directly on the motor shaft. The body may be mounted on a stand or simply clamped to a workbench.

■ The motor of a **contractor saw** is mounted behind the table, making it easier to disassemble the saw and transport it. The motor connects to the arbor by pulleys and one or more V-belts, which help isolate motor vibrations so they don't reach the blade. With more room under the table, the blade carriage can be bigger and beefier, and these big components further absorb vibrations from the saw. As a result, the blade runs smoother and truer.

■ Hanging the motor off the back of the saw is OK on an open building site where there's lots of room, but it can take up space in a shop. The motor of a **cabinet saw** is mounted beneath the saw body, encased in the stand. This configuration not only saves room, it's also better balanced. This, together with the mass of the enclosed stand, makes the tool less top-heavy and more stable. Some cabinet saws have a larger blade capacity as well.

■ New to the table saw world is the **hybrid saw**. Hybrid saws are essentially contractor saws with some cabinet saw features. This is most often a partially or totally enclosed base, with the motor mounted inside the cabinet. Higher performance motors (up to 2 horsepower) are also part of the package, and some of the newest hybrids from Craftsman (shown at right) are offering beefed-up trunnions that are mounted on the cabinet rather than the saw top, as is the norm in contractor saws.



A benchtop saw combines portability for a job site and features to make it functional. But the portability can be a trade-off for performance. The only reason to buy a benchtop saw for woodworking is if you need to transport it or if you don't have the space for a bigger saw.

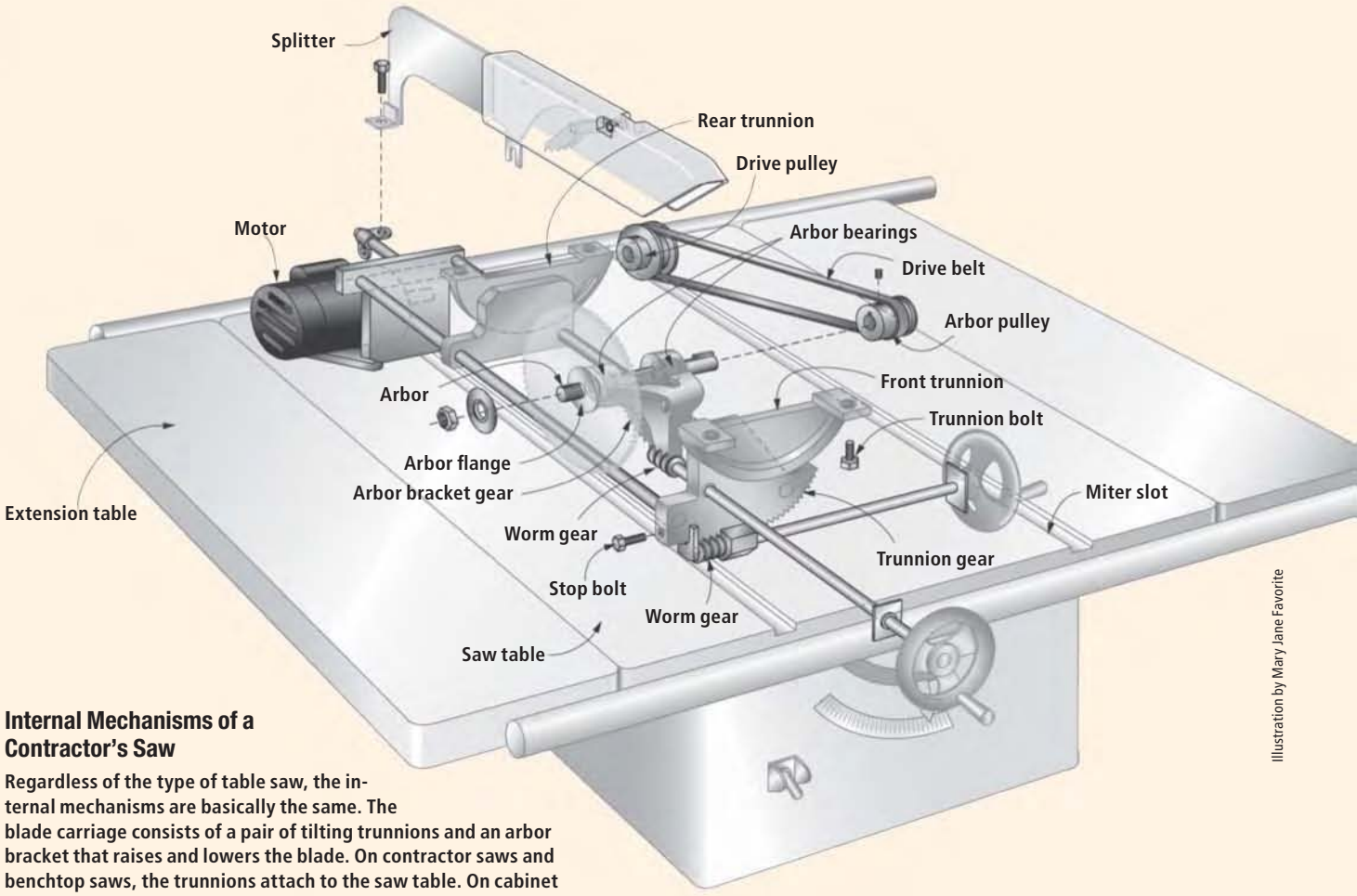


Illustration by Mary Jane Favorite

Internal Mechanisms of a Contractor's Saw

Regardless of the type of table saw, the internal mechanisms are basically the same. The blade carriage consists of a pair of tilting trunnions and an arbor bracket that raises and lowers the blade. On contractor saws and benchtop saws, the trunnions attach to the saw table. On cabinet saws, they attach to the cabinet.

A contractor saw is a great first table saw for most woodworkers. The fence is more accurate, the motor is quiet, reliable and more powerful than that of a benchtop saw, and you can add hundreds of accessories to it. One catch – because the motor extends behind the body of the saw through an opening in the cabinet, it reduces dust collection efficiency.

Some manufacturers are introducing a new kind of table saw for woodworkers to consider for their shop – the hybrid saw. A hybrid saw is still a contractor saw but has many features of a cabinet saw, including an enclosed internal motor.

TIPS & TRICKS

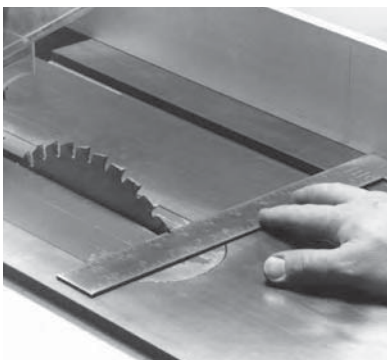
GREAT TIP:

'Measure Twice, Cut Once' – It's Not Just a Cliché

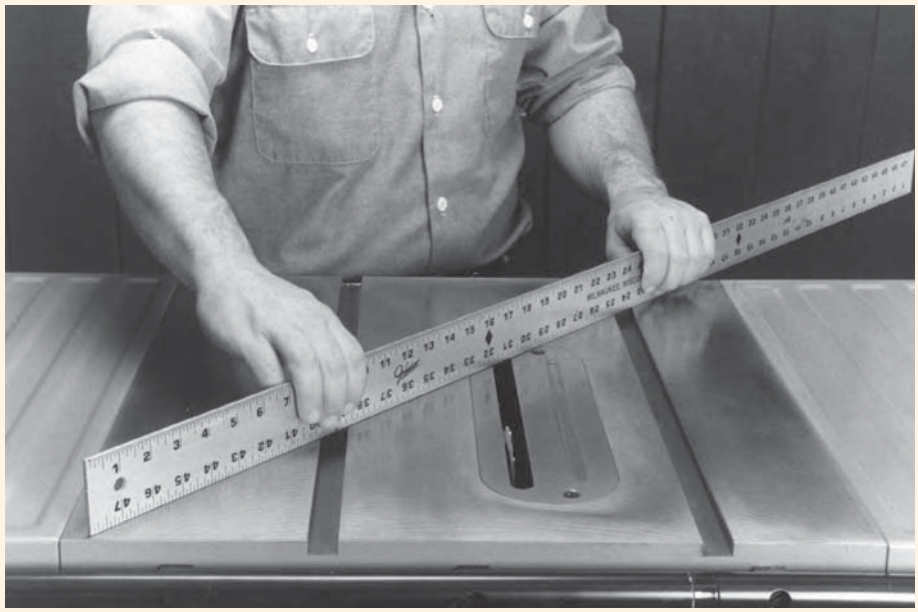
Remember the adage "measure twice, cut once" – it describes this age-old technique: Measure the cut, make a mark, then measure the mark. This takes very little effort – just an extra glance at the measuring tool before you remove it from the board.

PRO TRICK:

Take Care to Set the Saw's Rip Fence Correctly



If you've found your fence to be unreliable, here's a good trick. To position the rip fence accurately, first select a tooth. Rotate the blade by hand (with the machine unplugged, of course) until this tooth is near the front of the throat opening. Adjust the position of the fence, measuring from the inside edge of the tooth to the inside face of the fence. Lock the fence in place, then double-check the setup by rotating the tooth to the back of the saw and measuring again. Note: A framing square that is true is the easiest and most accurate measuring tool for this adjustment.



To determine if the top of a table saw is flat, lay a level or a straightedge diagonally across the table from right front to left rear, then left front to right rear. If you can see large gaps of daylight anywhere between the table and the straightedge (the maximum amount acceptable is .004" to .008"), the table has been improperly cast or machined. Note: This is the first thing you should check if you order a saw that is delivered through the mail. If the table isn't flat, don't accept the shipment.

Key Components of the Saw

When purchasing a table saw, carefully match the individual features with your own requirements.

- **Materials**

The materials from which a table saw is made will tell you a lot about its quality. On the better saws, the table and blade carriage are made from cast iron or anodized cast aluminum. Cast iron is considered the best material because it's massive and wears well. Anodizing will make aluminum hard enough to resist wear, but it doesn't add much weight. Table saws made from stamped steel or plastic are on the low end of the scale.

- **Blade Size**

The advertised size of a table saw is the largest diameter blade that it will accommodate. This, in turn, determines its cut-off capacity (the thickest board it will saw through). The larger a blade, the larger the cut-off capacity. It's useful to have a cut-off capacity of at least 2½" – this allows you to cut 4/4 and 8/4 stock in one pass, and 16/4 in two passes. However, there's no sense in buying a saw with a blade that's too large. Large blades require lots of power, and you may not have the necessary wiring in your shop. Saws with 10" blades have adequate cut-off capacity and most can be powered with ordinary 110-volt motors. Also, there is a better selection of 10" blades than any other size.

- **Arbor Size**

Most saws have ⅝"-diameter arbors, so there is a larger variety of blades with ⅝" arbor holes than any other size. Some small benchtop saws have ½" arbors, while some cabinet saws have ¾" arbors. As well as considering the arbor's diameter, you should give thought to its length. If you want to mount a dado cutter or moulding head on the arbor, it should accommodate a ¾"-thick accessory.

- **Table**

Most woodworkers think the bigger the table on a table saw the better it is. Bigger tables offer more support for the work. However, bigger is not necessarily better if you have a small shop or do fine work. Pick a comfortable size rather than automatically choosing the biggest. Also check to see that the table is perfectly flat. If it is unacceptably out of true, either don't buy the saw or demand another table.

Blade Carriage

Because this part of the saw will see the most stress, it should be made from massive, well-machined components. Avoid saws with carriages made from stamped steel or plastic components; these often flex under a load. This, in turn, can play havoc with the accuracy of your saw cuts.

Horsepower

The power you need is determined by the type of woodworking you do and the diameter of the blade on the saw. Needless to say, the lighter the work and the smaller the blade, the less power you need. If you own a 10" saw and the jobs you do vary between light and heavy, the saw should have a motor rated for at least 1½ hp. The general rule of thumb is that benchtop saws should be ¾ hp to 1½ hp, contractor saws should be 1½ hp to 2 hp, and cabinet saws should be 3 hp to 5 hp.

Motor Type

In addition to the horsepower of the motor, you should also be concerned with the type of motor, especially when buying a benchtop saw. All direct-drive saws have universal motors, similar to those in hand-held power tools. Universal motors are OK for jobs that can be accomplished quickly, but they won't stand up to continuous use. A table saw should have an induction motor.

Drive

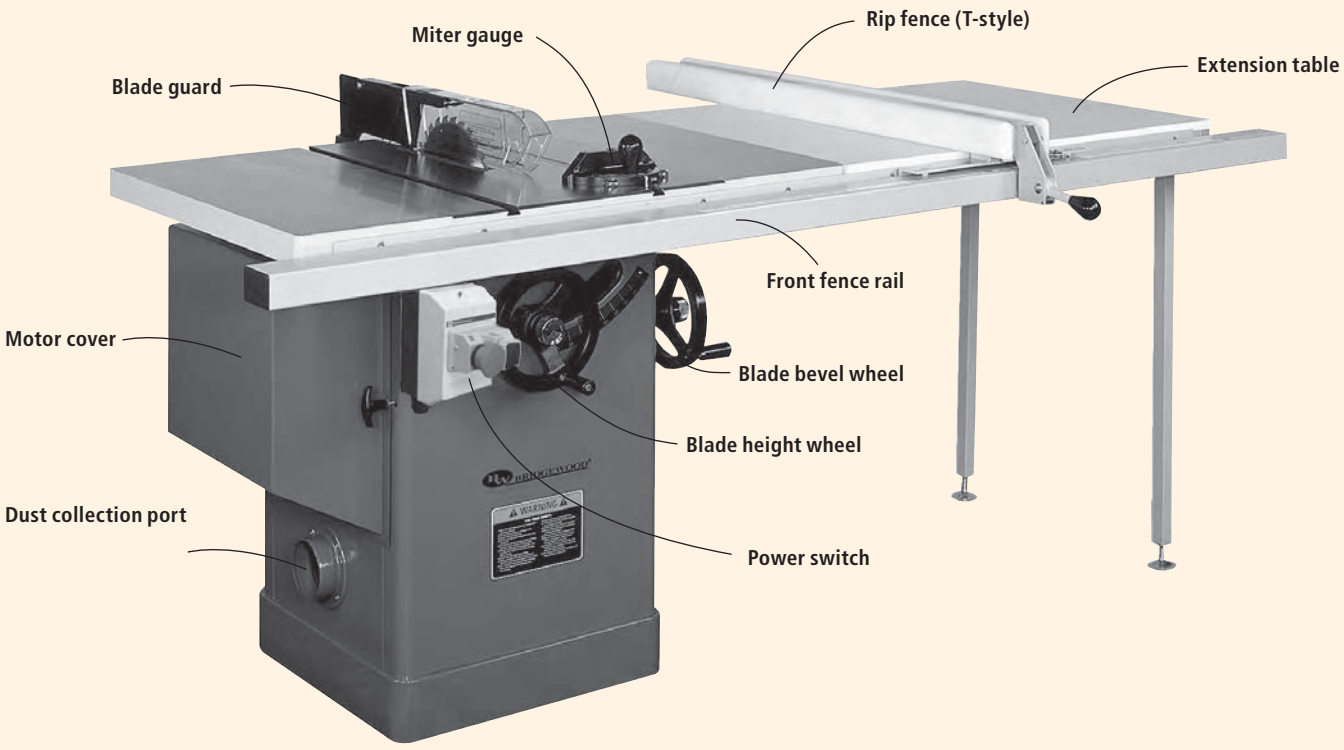
As mentioned earlier, belt drive is better than direct drive because a V-belt helps isolate motor vibrations from the running saw blade.

Fence

The rip fence is the Achilles' heel of every table saw, even on the high-quality machines. Trying to make a piece of furniture with a fussy or inaccurate rip fence is just asking for trouble. There are two common types of fences that should help you improve your accuracy. Benchtop fences lock at the front and back of the saw and can be difficult to align to the blade. Contractor saws also can use front- and rear-locking fences, though they can interfere with outfeed tables. The most accurate and convenient fence is the front-locking T-square fence, which locks only at the front rail of the saw, is dead-on accurate and is easy to align and set up. (*Editor's Note: We will talk more about fences in Chapter Four of this series.*)

Slot Miter Gauge

The most important part of the miter gauge is the bar or guide. The bar should be solid, machined steel. Avoid poorly machined gauges – they won't provide accurate results. Many woodworkers prefer T-shaped slots and bars because the slot holds the miter gauge bar flat on the



Cabinet saws are a lot like contractor saws, except they are enclosed. Everything is beefier (and generally better) but it's also more costly. One other significant difference is that the trunnions, blade and motor are mounted on the cabinet rather than to the saw's top. This adds stability and reduces vibration. Cabinet saws can be used all day, every day, and provide decades of service. Instead of an open stand, cabinet saws feature a steel cabinet, enclosing the motor and trunnions, which adds weight and improves dust collection. The motor is bigger, is enclosed inside the cabinet and turns the blade using multiple V-belts, so cabinet saws can actually take up less space than contractor saws. But all this comes at a price – an entry-level cabinet saw starts at about $825, but you could spend more than $2,000 in a heartbeat.

TIPS & TRICKS

PRO TRICK:

Miter Gauge Angles can be Tricky to Get Right

To set the angle of the miter gauge, loosen the miter gauge head and place one edge of a square against the gauge face. Slide the tool sideways until another edge touches the blade plate (it must not contact the teeth). Turn the head until the tool rests flat against the face and the plate, then secure the head.

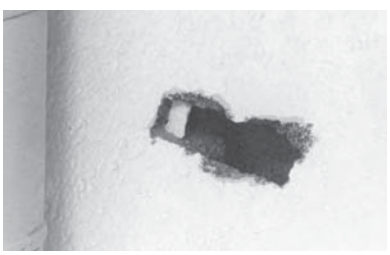
GREAT TIP:

Drafting Triangles Help you Find the Correct Angles

A set of drafting triangles helps set the miter gauge angle and the blade tilt. The various corners are cut to precise 30°, 45°, 60° and 90° angles.

PRO TIP:

Don't Get Hit by Kickback



The very act of using the table saw is a vivid reminder of one of its dangers – any tool that cuts wood can cut you. The danger of kickback is not as evident, but it's just as serious. The hole in this concrete block wall was made by a board that was thrown by a table saw blade 15 feet away.

table at all times. Some table saws are now available with miter gauges that offer adjustable-width guide bars. These bars can be tweaked to fit the groove with little or no side play. This feature is also available on a number of aftermarket accessory miter gauges and are a good feature to look for.

- **Body/Stand**

It doesn't matter what materials the body or stand are made from as long as they are rock-steady. It's helpful to have a means of sawdust collection built into the body or stand. This shouldn't be a deciding factor, though, because as long as your saw body or stand is open at the bottom, you can easily build your own.

[*Editor's Note: Of course, one item that we haven't mentioned here is the saw blade, which is the most important piece of the machine. We will focus on the blade in Chapter 2 of this series.]*

Remember that these recommendations are just advice, not absolute gospel. Depending on circumstances, it may not even be good advice. My first table saw was none of the things that I recommend to you – it was inexpensively made and underpowered. It was what I could afford, not what I wanted. Yet I used it professionally for seven years to make musical instruments.

This just goes to show that there are factors that affect the quality of your sawing more than the saw itself – accurate alignment and adjustment, careful layout, proper sawing technique and (most important of all) a good blade.

Photo by Al Parrish

Along with the miter gauge (the Osborne aftermarket gauge is shown here), there are a number of other accessories you could add to upgrade your saw. Some of our favorites are, from top, a shop-made push stick, a zero-clearance throat insert, a Power Twist Link Belt and a Biesemeyer snap-in splitter. (Editor's Note: For more information on these and other accessories, be sure to check out Chapter 4 of this series.)

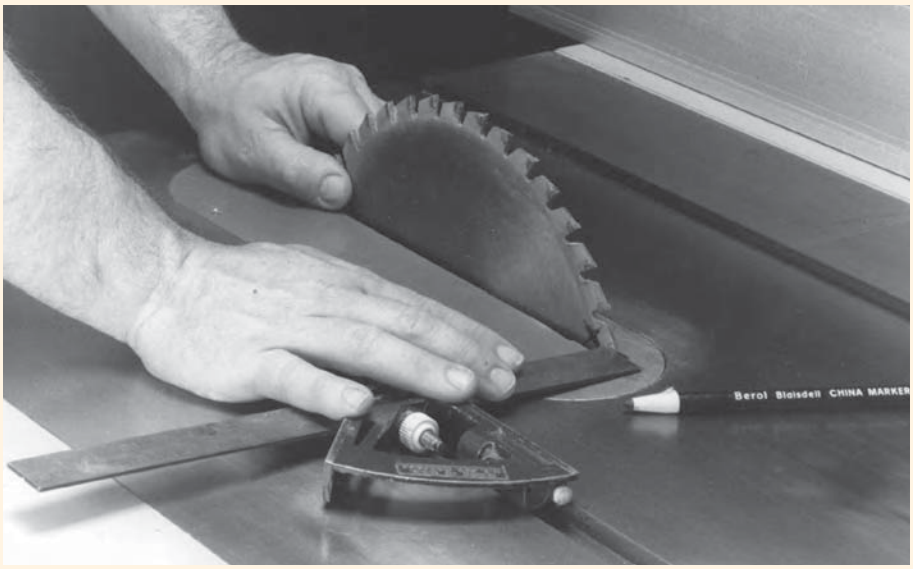
Three Important Alignments

There are many parts to check and adjust on a table saw, and each saw will be slightly different, depending on its construction. However, there are three important alignments that affect the machine's accuracy and ease of operation more than any others – the blade must be parallel to the miter gauge slots, the rip fence must be parallel to the blade and the splitter must be parallel to (and in line with) the blade.

Aligning the Blade

Before you can align any part of the table saw, you must select a base of reference – a line or plane from which you can measure the position of every other part. The reference most often used is a miter gauge slot, because these positions can't be changed.

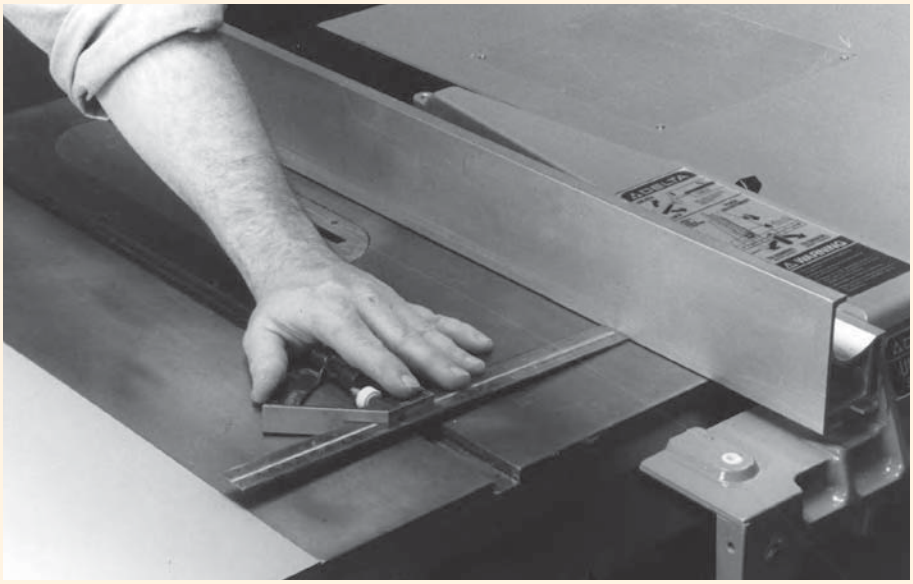
Use a combination square to measure the distance between a slot and a saw tooth near the front of the blade. Then rotate the tooth to position it near the rear of the table and measure again. These measurements must match for the blade to be parallel to the slot. If they differ, consult your manual to adjust for parallel. The steps are different for contractor and cabinet saws.



To align the blade, mount a blade and mark a tooth. Rotate the blade so this tooth is near the front. Place a square against a miter gauge slot and slide the rule until it touches the marked tooth. Then rotate the blade so the marked tooth is near the back. Move the square and measure the distance from the slot to the tooth again. If the measurements match, the blade is parallel to the slot.

Aligning the Rip Fence

Position the fence near a miter gauge slot and lock it in place. Use the combination square to measure the distance between the slot and the fence face near the front and back of the saw. If the measurements differ, adjust the fence to be parallel to the slot. When both the fence and the blade are parallel to the slot, they will also be parallel to each other.



Once you know the blade is parallel to the miter gauge slots, check the fence alignment. To do this, position the fence near a slot. Rest a square against the side of the slot, near the front of the saw. Slide the rule until it just touches the rip fence, then repeat this near the back. If the measurements are the same, the fence is parallel to the blade.

Aligning the Splitter

Lay a straightedge against the blade and the splitter to check the alignment. If the straightedge doesn't lie flat against both parts, the splitter is misaligned. Bend or adjust the splitter into position according to your owner's manual.

Another important alignment you should check is the arbor flange for runout, as shown at right. Unfortunately, if there's significant runout (about .003"), there's not much you can do about it short of replacing the part. **PW**

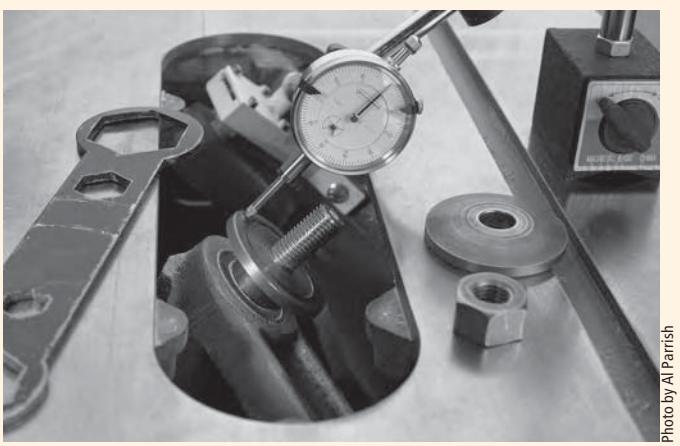


Photo by Al Parrish

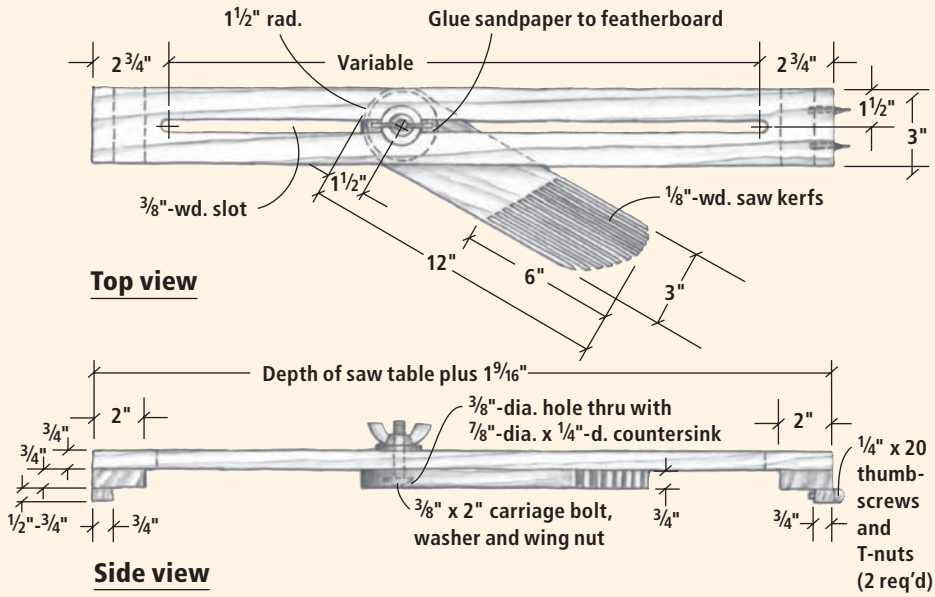
Use a dial indicator to check the flange for runout. It needs to be flat or "true" for the machine to work optimally.

Adjustable Featherboard

Most featherboards are single pieces of wood with flexible "feathers" or fingers cut into one end. They're designed to be clamped to the worktables or fences of various power tools. Unfortunately, this simple design doesn't always work for the table saw because the table often is too large to clamp the featherboard near the work.

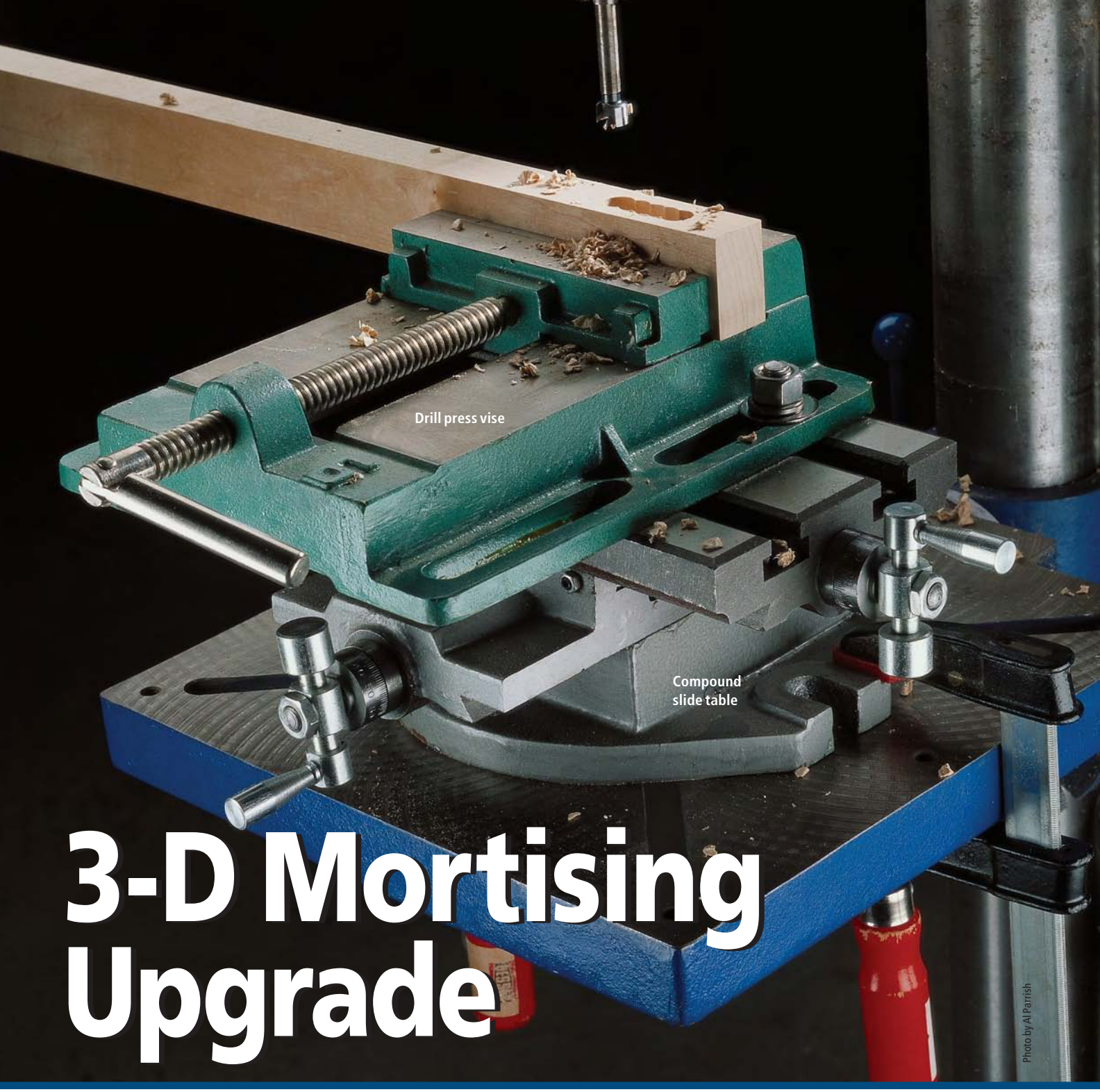
This adjustable featherboard solves that problem by having the mount clamp to the table. By moving the mount from side to side and the featherboard back and forth, you can position the featherboard anywhere you need it on the saw.

Making this jig is straightforward, but there are two important considerations. First, you must adjust the length of the mount to fit your saw – when assembled, the space between the inside edges of the mount blocks should be about 1/16" longer than the front-to-back dimension of the table. Second, you must glue a disc of #220-grit sandpaper to the top surface of the featherboard, over the pivot hole, to help keep it at the proper angle.



To mount the featherboard on the saw table, place it so the mount blocks straddle the front and back edges of the table. Turn the thumbscrews with your fingers only. They don't have to be any tighter than that – the sideways pressure from the featherboard locks the assembly in place.

Place the wood you want to cut on the saw. Position the featherboard next to the wood and adjust the angle so the feathers are flexed slightly. Secure the featherboard by tightening the wing nut. Note: The featherboard must press against the wood before it reaches the blade. If there is sideways pressure at the blade or behind it, the blade may bind in the cut.



3-D Mortising Upgrade

Photo by Al Parrish

A modified cross-sliding table turns your drill press or benchtop mortiser into a precision boring machine.

Affordable benchtop mortisers have changed the way many woodworkers produce joinery for a variety of projects. By being able to conveniently make one of the strongest woodworking joints – the mortise-and-tenon joint – we can produce more durable projects.

That said, a benchtop mortiser has limitations. Primarily, the table, fence and how the workpiece is held in place all can be improved.

by David Thiel

Comments or questions? Contact David at 513-531-2690 ext. 1255 or david.thiel@fwpubs.com.

The Problem: The Holddown

All mortisers have a fence running from left to right behind the bit. The fence can be adjusted forward and back to orient the mortise location directly under the mortising chisel. Then the fence is locked down.

To keep your work held in place while mortising, you can clamp it to the fence. Or you can secure it using the holddown, which keeps the work from lifting off the table when you pull the tooling out of the cut. After each plunge, you need to shift the work left or right to make the next hole.

Having to unclamp, move and reclamp the workpiece before drilling each hole takes a long time. And many holddowns on mortisers have design shortcomings that cause them to slip during use, ruining your work.

The Solution: An X/Y Vise

Enter the cross-sliding (or sometimes called X/Y) vise: this nifty device allows you to hold the workpiece firmly in place but still be able to easily move it under the mortising chisel.

Originally designed for work on metal milling machines, cross-sliding vises allow the operator to clamp a workpiece tightly below the spindle (or, in our case, the chisel) then smoothly move the piece forward and back, as well as side-to-side, without having to release the work from the clamp.

Many floor-model mortisers have these vises built in, but these big machines can cost $800 or more. But we've found a $50 upgrade that can be added to almost any benchtop mortiser. If you don't have a mortiser, you can also use it to upgrade your drill press and use overlapping holes to effortlessly create your mortises.

Is it too good to be true? Well, almost. There are some technical difficulties to overcome before you decide if this vise belongs in your shop.

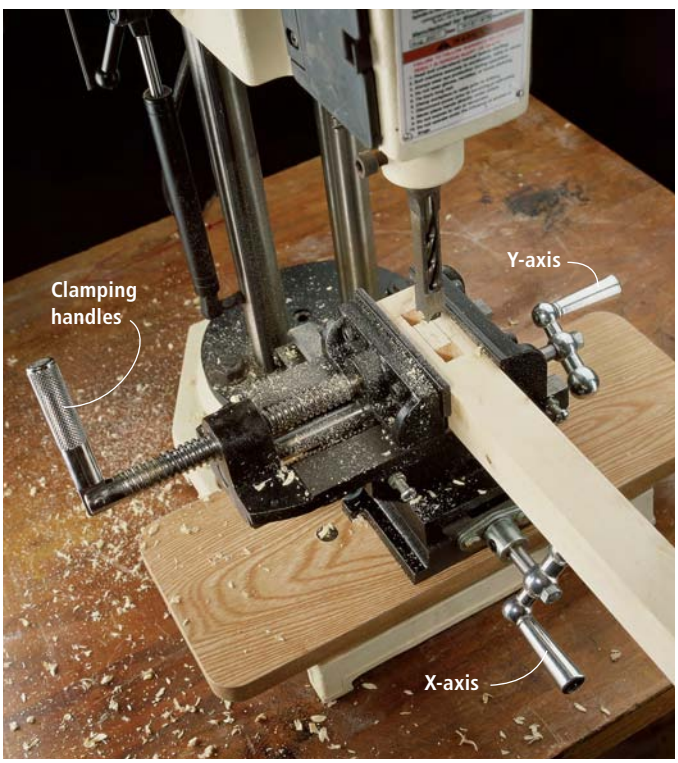
Problems with the Solution

First, as you'll note in the picture below left, there are three operational handles on the cross-sliding vise (X-axis, Y-axis and clamping handle) located on three of the four sides. The non-handled side is the one facing the column of the machine. This keeps the clamping vise oriented front-to-back so that if it is holding a table leg, for example, the leg will jut straight out from the mortiser. This orientation, which is at a 90° angle from the way a mortiser is usually used, puts the part in an awkward location during mortising. But that's only one problem.

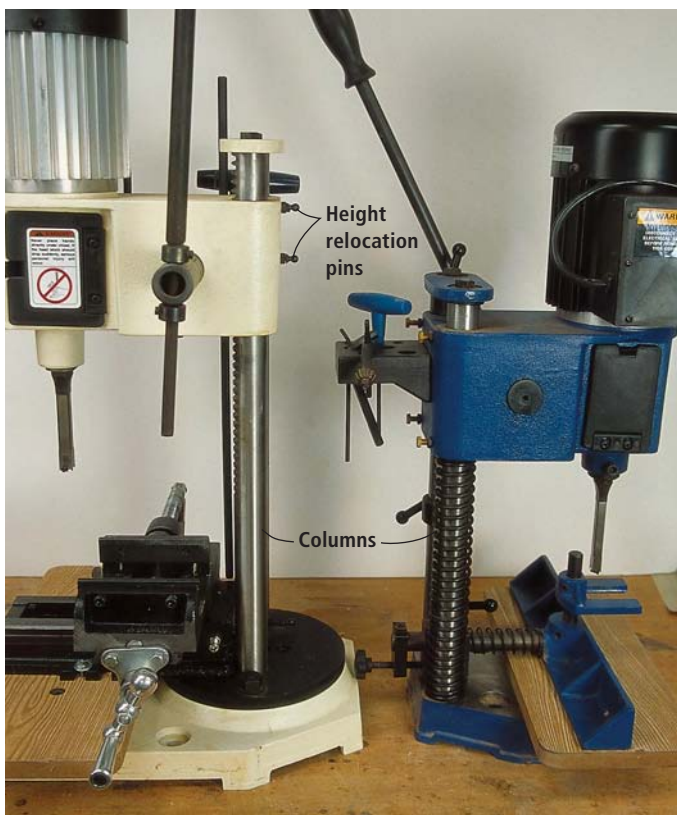
The next hurdle is height. As shown in the photo below right, benchtop mortisers come in a variety of heights. The Shop Fox is designed to allow the motor to raise 12" above the table. This allows 8" below the chisel for the cross-sliding vise (shown attached). The Fisch mortiser (on the right) and most other benchtop mortisers available on the market today allow only 4" of space between the table and the tip of the chisel, leaving no room for the vise.

Combo Solutions

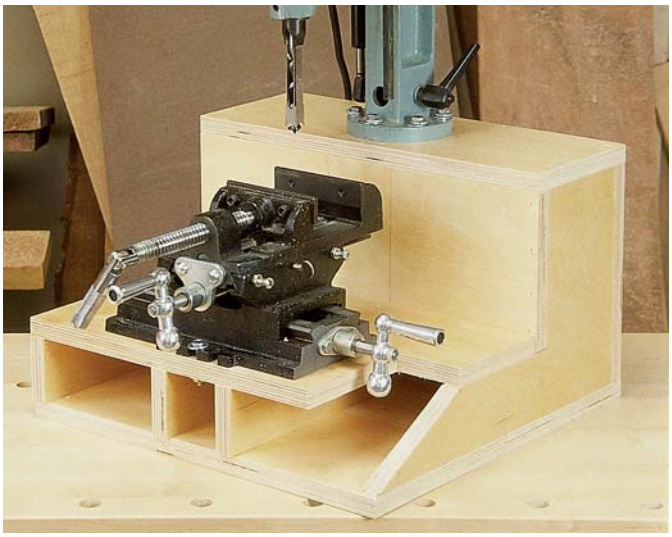
We've come up with a couple of options to solve both of these problems. First, by buying two separate metalworking accessories and combining them, the



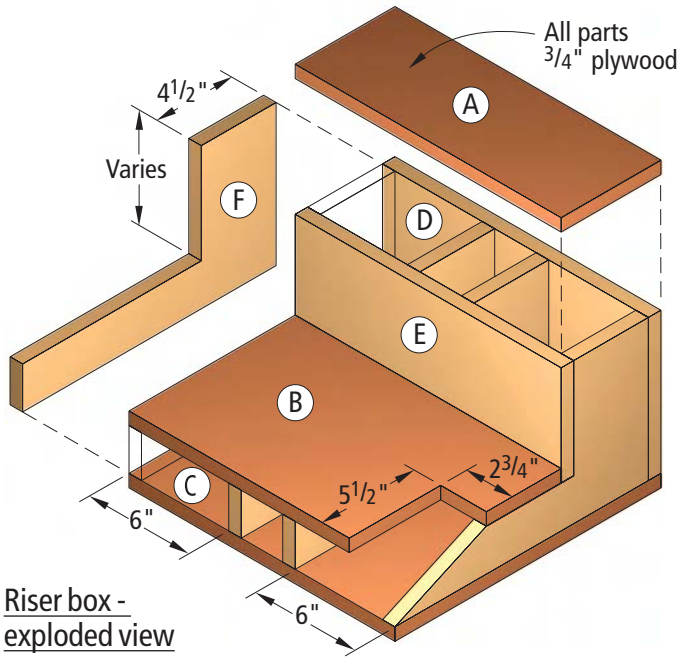
While you can use a cross-sliding table mounted in this position on the mortiser, it's an awkward reach. With the project pointing straight at your stomach, you can't adequately operate the machine. Beyond that, any intermediary mortises will require the workpiece to slip between the posts on this mortiser and will be blocked by the center post on other mortisers.



These two mortisers quickly make the height difference apparent. The Shop Fox, left, has longer columns and is capable of being adjusted to gain additional height by relocating the gas cylinder on optional pins.



The riser shown adds 4" in height to the mortiser, allowing plenty of space for the cross-sliding vise. It's also a simple torsion box providing great strength, so there's no concern of twist when using the mortiser. The angled cutaway at the front right corner of the box allows the left-right handle to operate without banging your knuckles.



Riser box - exploded view

RISER BOX

	NO.	LET.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	1	A	Top	3/4	6	16	Plywood
❑	1	B	Table	3/4	10	16	Plywood
❑	1	C	Bottom	3/4	16	16	Plywood
❑	1	D	Back	3/4	6 1/2	16	Plywood
❑	1	E	Table back	3/4	4	16	Plywood
❑	4	F	Center supports	3/4	6 1/2	15 1/4	Plywood

right-angle orientation problem can be solved. The photo on page 61 shows a compound slide table (Grizzly #G5757, $90) mounted directly to a drill press table. That provides the X- and Y-axis movement we're looking for, but doesn't give us a way to hold the work.

Mounted on top of the slide table is a 6" drill press vise (Grizzly #G5753, $22.50) that allows the workpiece to be oriented in the traditional left-to-right orientation. You need just a couple of bolts and you're ready to drill.

Fortunately, our floor-model drill press, which we have the two accessories mounted on, easily accommodates the extra 7" in added height. Unfortunately, a benchtop mortiser isn't quite so accommodating, but we'll get to that in a minute.

Machining Solution

You may have remembered that we threw out a $50 price tag earlier in this article. And if you're paying attention, you may have noticed that the slide table and vise combined cost more than $110. Well, there is another option that will put us back in the $50 range.

A single cross-sliding vise (Grizzly #G1064) costs only $40, but still has the workpiece orientation problem. But by moving a few of the pieces around on the vise and tapping two new bolt holes, it's easily rearranged to work just the way we want.

The end result has the vise handle and the front-to-back slide handle closer to each other than we'd like, but ultimately it's worth the little bit of metalwork to improve your mortiser's performance. We've included step-by-step photos to retrofit the cross-sliding vise for mortising work on pages 64 and 65.

Gaining Height

Even with our sleight of hand on the cross-sliding vise, there is still a height issue to deal with if you own a benchtop mortiser. While the cross-sliding vise adds only 5 1/2" above the table (compared to 7" with the combo solution), that 5 1/2" is still too high for most mortising machines.

To fix this, we need to build a riser, but building just a box (which is all most risers are) isn't good enough. Most benchtop mortiser columns can be unbolted from their base. The base is no longer necessary with the cross-sliding vise, but the column must still be firmly supported in proper orientation to the vise. Plus, when used, a mortiser exerts a fairly high amount of pressure against the column mount. Any flex in that connection will cause problems with your mortise.

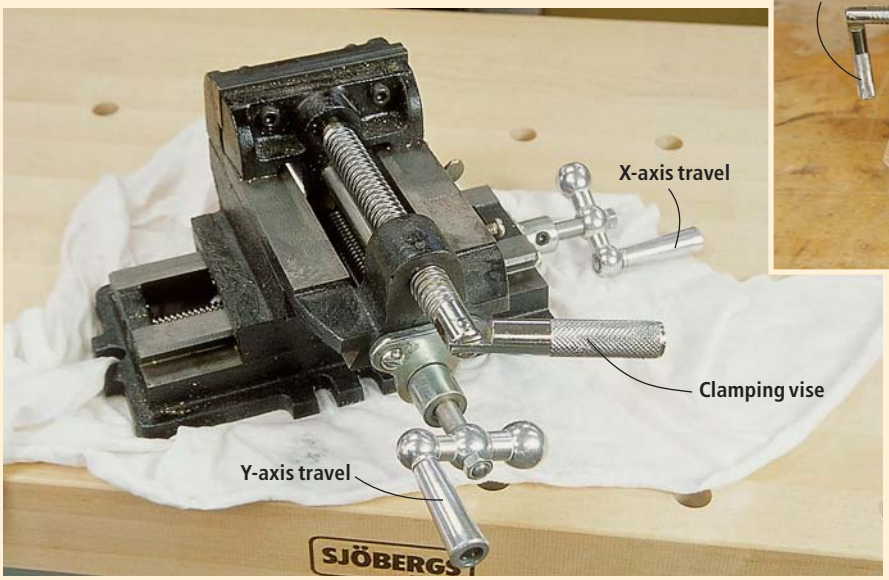
So we came up with the riser box shown above. The "L" shape and torsion-box design make a riser and stand that's sturdy enough to park a car on and won't flex under the strain of mortising.

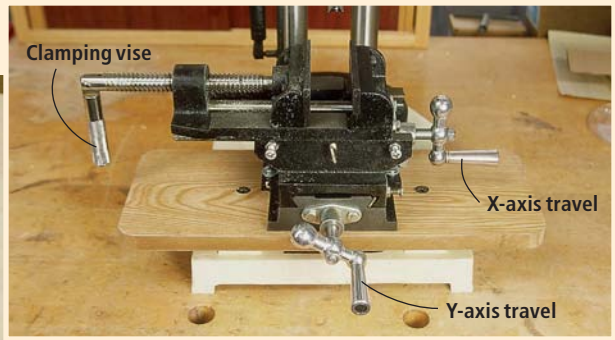
While the dimensions given worked for our mortiser, you may need to customize them to fit your situation. Make sure that when the chisel is plunged to full mortising depth, the tip of the chisel will reach the inside bottom of the vise opening. Everything else will then fall in place.

Also, the center supports (F) on the riser should be located directly under the mounting holes on the mortiser column. This allows the bolts holding the column in place to extend through the top (A) and into the supports for lots of strength.

As an added bonus, the spaces below the cross-sliding vise make clamping easy, and provide bit and tool storage.

A BETTER X-Y TABLE

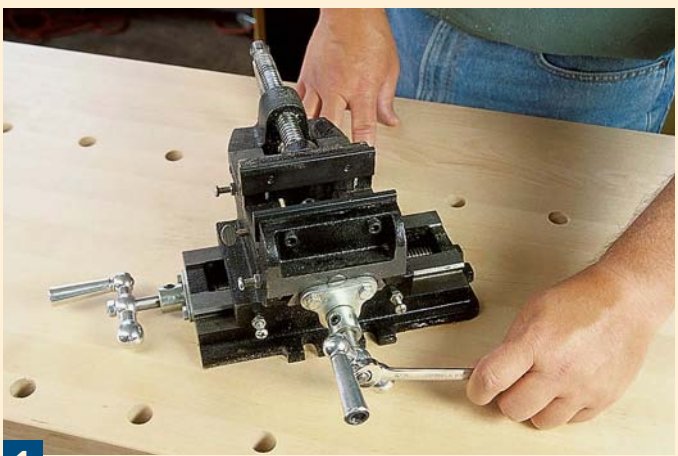




▲ PROBLEM: As purchased, the cross-sliding vise holds material sticking straight at the operator, rather than horizontally.

◀ SOLUTION: REWORKED VISE

By flipping the clamping vise around and tapping a couple of new holes, you can make your cross-sliding vise functional for your mortiser.

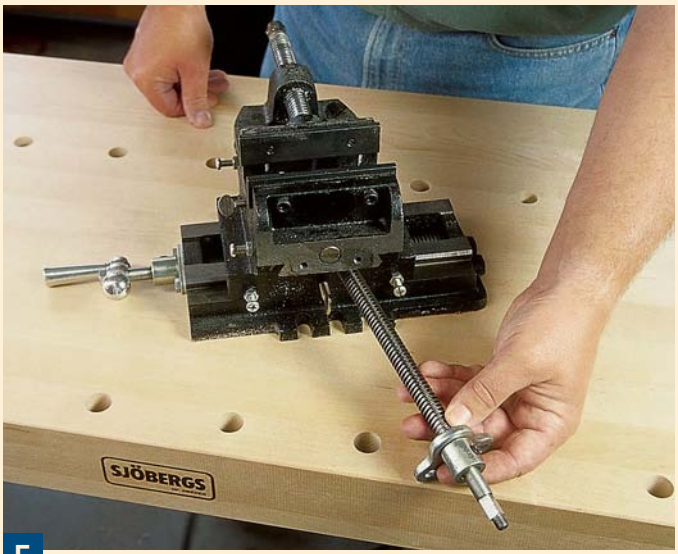


1 The first step is to remove the nut from the front handle.

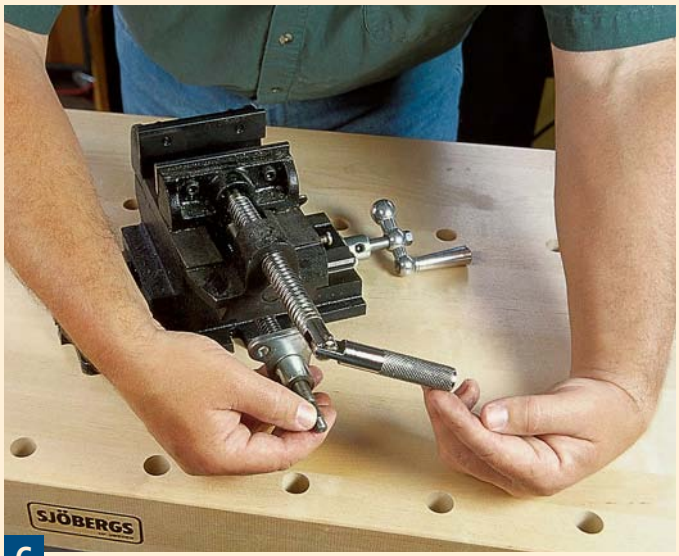
2 Remove the front handle by pulling it straight off the threaded rod.

3 Then remove the two machined bolts holding the cover plate in position.

4 Allow the plate to swing down, away from the mounting holes.



5 By turning the threaded rod counterclockwise, you can unscrew it from the center guide block and pull it free of the vise.



6 Slide the vise out of the dovetailed ways and spin the vise 180°. Rethread the rod into the center guide block from the opposite side.

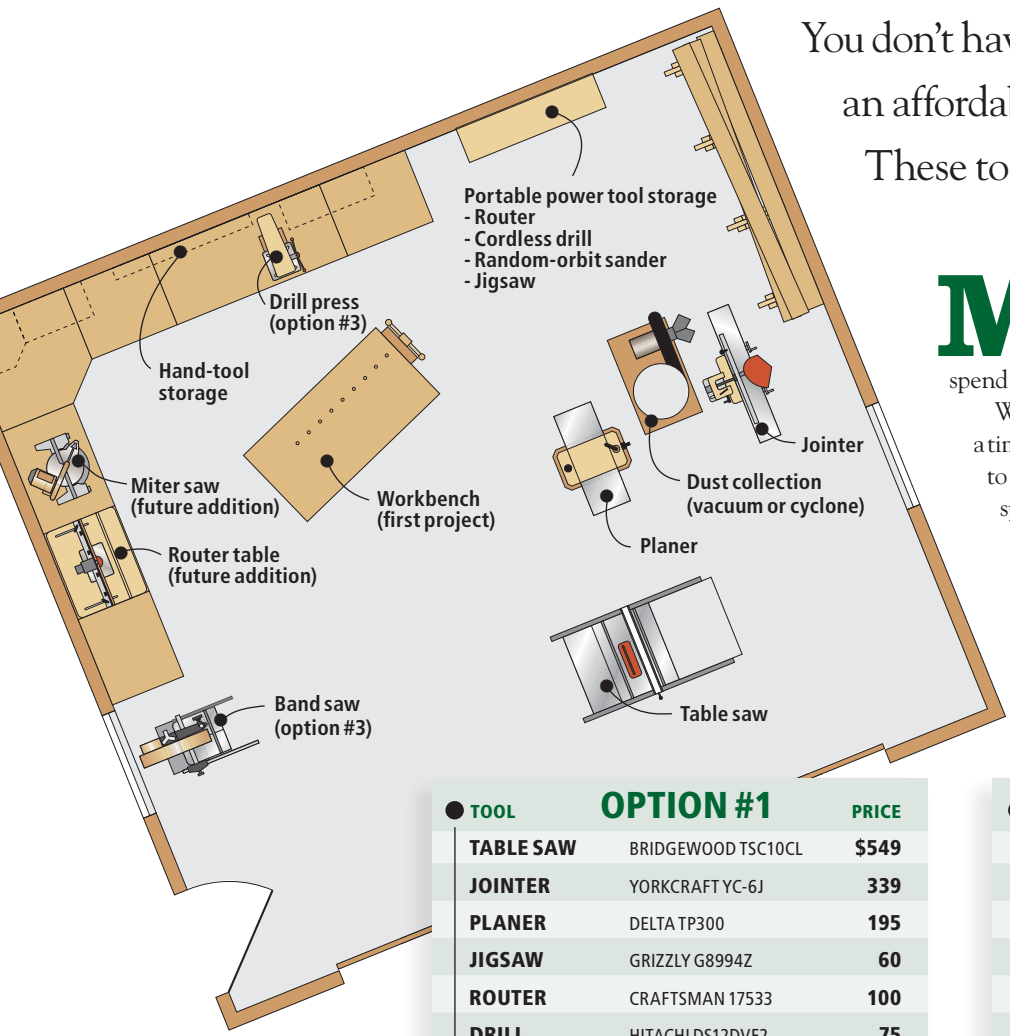
7 There are no tapped holes on this side. Turn the vise on its side and carefully mark two holes on the vise. An awl leaves an easily identifiable mark.

8 Using a #7 drill bit for a ¼"-20 tap, drill the two holes. Use some cutting oil to keep things cool.

9 Using the corresponding tap, cut the threads into the two holes. Again, cutting oil makes the process smoother.

10 Last, screw the plate in its new location and your reworked vise is ready to work. **PW**

$1,500 WORKSHOP



Interested in laying out your shop on screen before moving machinery? Visit grizzly.com and test the company's new Workshop Planner program.

You don't have to sacrifice quality to set up an affordable (and complete) workshop. These tools do good work on a budget.

Most woodworkers don't have the luxury of buying all the tools and machinery for their shop at one time. But if you did, how would you spend your money and what tools would you choose?

Whether you're setting up your shop one machine at a time or if you're just thinking of adding a new machine to the shop you already have, we're here to help you spend your money wisely on tools that perform at high levels but have low prices.

by David Thiel

Comments or questions? Contact David at 513-531-2690 ext. 1255 or david.thiel@fwpubs.com.

TOOL	OPTION #1	PRICE
TABLE SAW	BRIDGEWOOD TSC10CL	$549
JOINTER	YORKCRAFT YC-6J	339
PLANER	DELTA TP300	195
JIGSAW	GRIZZLY G8994Z	60
ROUTER	CRAFTSMAN 17533	100
DRILL	HITACHI DS12DVF2	75
SANDER	PORTER-CABLE 333	60
SHOP VACUUM	CRAFTSMAN 17761	90
CYCLONE LID	VERITAS	33
	TOTAL	$1,501

TOOL	OPTION #2	PRICE
TABLE SAW	GRIZZLY G0444Z	$525
JOINTER	GRIZZLY G1182HW	325
PLANER	DELTA TP300	195
JIGSAW	BOSCH 1590 EVS	170
ROUTER	RYOBI RE180PL	100
DRILL	HITACHI DS12DVF2	75
SANDER	PORTER-CABLE 333	60
SHOP VACUUM	CRAFTSMAN 17761	90
CYCLONE LID	VERITAS	33
	TOTAL	$1,573

Our goal here is to help readers who are on a budget but are still quality-conscious. This list is filled with tools we've tested during the last 10 years that are capable of precise work and, together, make a "complete" shop.

We know almost everyone out there will disagree with at least one of our selections. And by virtue of trying to spend a little to get a lot, we've included a fair number of machines from Grizzly Industrial. That's the nature of the market, and these choices are offered without apology. Each of the machines we recommended here is a good value.

When crunching the numbers we kept getting close to $1,500 – that seemed like a reasonable amount of money to set up a working woodshop. To be honest, that amount doesn't include some things every shop needs, including a good selection of hand tools, supplies, storage and, of course, clamps. But we feel this is a good place to start. And we also have a strong suspicion that many of you already have a reasonable selection of hand tools for household chores (if not enough clamps).

The three most important machines on the list are the table saw, jointer and planer. Add to those three machines a decent jigsaw, router, cordless drill and random-orbit sander, and you can build almost anything.

We left a band saw and drill press off the $1,500 list, rationalizing that a jigsaw and drill can fill in for these more expensive machines until your checkbook can bear the extra expense.

We also thought it was important to include dust collection on the list. It's as important to your health as ear and eye protection is. While a traditional dust collector is an option (and in the same price range), we're fond of the efficiency and convenience of cyclone collectors. So we opted for a good shop vacuum and cyclone lid.

In the charts at left you'll also see that we've given you two different brand options in four of the categories. Either choice will work, but some features will appeal more to different woodworkers.

One other item that's critical to a fully functioning shop is a good workbench. We haven't included that in our calculations because a bench is a terrific first project to break in your new machinery. Complete plans for an affordable, sturdy and functional workbench are available at our web site. Go to popwood.com and click on "Magazine Extras" to find it.

And for those of you who think $1,500 isn't spending enough, we've included a shopping list of tools and machines for a $3,100 workshop. This list (see page 70) includes some nice upgrades and adds a couple of machines.

One other comment: Depending on where in the country you're ordering from, you should check into shipping charges for all companies and add them into your price calculations.

At worst, consider this article a fantasy shopping trip to the tool store. We hope you'll at least find some valuable advice on setting up a quality woodworking shop in an economical way. **PW**

10" Table Saw

This incredibly important piece of machinery is what almost every shop should be built around. Choosing the right table saw is critical. Saving money and buying less machine than you think you need now (and will need later) is a common mistake. It's our opinion that a benchtop saw isn't a good choice for woodworking. As a minimum, you need a contractor saw with a 1½-horsepower motor, two solid cast-iron wings (for weight and stability) and a good rip fence. We've given you two very good choices here that cost within $25 of each other. The Grizzly and Bridgewood machines offer solid cast-iron wings and T-style copies of the well-respected Biesemeyer rip fence system. Either will provide accurate and reliable performance for many years.

The Grizzly G0444Z offers a powerful 2-hp motor set for 220-volt usage at the factory (switchable to 110V), while the Bridgewood is rated at 1½ hp and set as 110V, but is switchable to 220V. Beyond the motor, the essential difference between the two machines is that the Bridgewood has a left-tilting arbor, while the Grizzly is right-tilting. Many woodworkers prefer a left-tilt machine, but we wanted to give you the choice between a left-tilt saw and one with a beefier motor.

Also, the Grizzly comes standard with two cast-iron wings, while the second cast wing on the Bridgewood is an upgrade. To sweeten the deal, though, Bridgewood tossed in a Powertwist LinkBelt that will reduce vibration during operation.

$549

BRIDGEWOOD TSC10CL CONTRACTOR SAW
MOTOR: 1½ hp
FENCE: Align-a-Rip, 30" capacity
CONTACT: Wilke Machinery, 800-235-2100 or wilkemach.com

$525

GRIZZLY G0444Z CONTRACTOR SAW
MOTOR: 2 hp
FENCE: Shop Fox Aluma-Classic, 30" capacity
CONTACT: Grizzly Industrial, 800-523-4777 or grizzly.com

Jointer

Along with the table saw, two other machines are important to producing decent lumber to build with: the planer and jointer. The jointer is critical for flattening and squaring rough lumber. Even if you purchase surfaced lumber from a supplier, it's rarely flat enough. That's why you need a jointer. Minimum requirements are a 1-hp induction motor and a 6" cutting width.

We've offered two choices (within $15 of each other) in this category: Grizzly and Yorkcraft. They're enclosed-base designs and have 1-hp motors that can be wired for 110V or 220V power. Both also use jackscrews to set the three high-speed steel knives and either will provide good service in your shop.

The Yorkcraft YC-6J is manufactured by Bridgewood and operates at 4,800 rpm and has a cutting width capacity of 6 1/8". The bed length is 46" and the fence moves on a rack-and-pinion mechanism for smooth adjustment. The switch is mounted above the fence for easy user access, and the table height is adjusted by a rear lever. The machine has a mobile base built into its cabinet, which is a nice feature.

$325

- **GRIZZLY G1182HW 6" JOINTER**
  MOTOR: 1 hp
  TABLE SIZE: 6" x 47"
  CONTACT: Grizzly Industrial, 800-523-4777 or grizzly.com

The Grizzly G1182HW operates at 5,000 rpm and has a cutting capacity of 6". The bed length is 47" and the table height is adjusted by hand wheels, which many woodworkers prefer for easier repeatable accuracy.

Again, you need to research and consider shipping expenses in your calculations when determining which best fits in your shop.

$339

- **YORKCRAFT YC-6J 6" JOINTER**
  MOTOR: 1 hp
  TABLE SIZE: 6" x 46"
  CONTACT: Wilke Machinery, 800-235-2100 or wilkemach.com

Router

This is another category in which we've given you options. Routers can do an amazing number of woodworking tasks. They can make mortise-and-tenon joints, create edge profiles and make raised-panel doors. And that's just the beginning. One option we've listed is a dedicated plunge router. While you can do many fixed-base router operations with a plunge router, it doesn't work both ways. So if you can only have one tool, a plunge router is the one to have. A second option is the best of both worlds: a kit from Craftsman that offers a single motor to be used with either a plunge or fixed base (both included). Both tools cost just $100, an amazing value.

The Ryobi RE180PL has a 2-hp "peak" motor rating and electronic variable-speed control that lets you slow down the motor with larger bits and provides constant torque while under load. It's unlikely to bog down in a cut. The Ryobi also includes both 1/4" and 1/2" collets, again extending the bit flexibility. A spindle lock allows for one-wrench bit changes, a plus in our book.

The Craftsman 17533 router also has a 2-hp peak motor, but it's a single-speed tool that is outfitted with a only a 1/4" collet. This router also has a spindle lock for one-wrench bit changes. To balance the 1/4" collet limitation, the option of interchangeable bases makes for a very versatile kit.

$100

- **RYOBI RE180PL PLUNGE ROUTER**
  MOTOR: 2 hp, 10 amp
  COLLETS: 1/4" & 1/2"
  SPEED: 15k-23k rpm
  CONTACT: Ryobi, 800-323-4615 or www.ryobitools.com

$100

- **CRAFTSMAN 17533 ROUTER KIT**
  MOTOR: 2 hp, 9.5 amp
  COLLET: 1/4"
  SPEED: 25k rpm
  CONTACT: Craftsman, 800-377-7414 or sears.com

Planer

Once you've used your jointer to flatten one face and square one edge of your lumber, a thickness planer will cut it down to the exact thickness you want.

There are a lot of planers on the market ranging from 12" to 20" and wider, but for this shop, a benchtop 12" planer is adequate and affordable for all but the most strenuous tasks.

At less than $200, the Delta TP300 12" portable planer is a proven design that has consistently provided a quality cut at a reasonable price. The 15-amp universal motor isn't designed for running hundreds of board feet of oak each week, but for the home woodworker, it's an outstanding choice. With easily replaceable two-sided disposable knives, it's also a very user-friendly machine. The four-column design adds rigidity for smooth, even cuts. All that's missing is a head lock to reduce snipe and some of the niceties found on the more expensive machines. For our money, though, this will do just fine.

$195

- **DELTA TP300 PORTABLE PLANER**
  MOTOR: 15 amp
  MAX DEPTH OF CUT: 3/16"
  SPEED: 16,000 cuts per minute
  CONTACT: Delta, 800-438-2486 or deltawoodworking.com

Cordless Drill

Even though this category has hundreds of tools to choose from, we didn't hesitate a second in selecting our best value for the $1,500 shop. Trading little in performance or features for price, the Hitachi DS12DVF2 cordless drill packs 195 in./lbs. of torque, variable-speed control with electronic feedback for constant torque under load, a two-speed transmission, a 3/8" keyless chuck and a 22-position clutch. Oh, and they include two batteries and a flashlight. For $75, this is a heck of a deal.

$75

- **HITACHI DS12DVF2 DRILL**
  BATTERY: 12 volt (2), 1.2 amp hour
  CHARGE TIME: 1 hour
  SPEEDS: 0-350/1,050 rpm
  CONTACT: Hitachi, 800-829-4752 or hitachi.com/hpt

Random-orbit Sander

This is another no-brainer category for us. We've been happily using the Porter-Cable 333 random-orbit sander for years. It removes material quickly, doesn't shake our hands to pieces and is capable of finesse work when required. Add to that its durability and easy hook-up to dust collection and it's a proven, useful tool. Costing only $60, we'll happily add it to this shop.

$60

- **PORTER-CABLE 333 SANDER**
  MOTOR: 2.4 amp
  SPEED: 12,000 orbits per minute
  CONTACT: Porter-Cable, 800-487-8665 or porter-cable.com

Jigsaw

A jigsaw fits well in the $1,500 shop – it's the one tool that doesn't cut just straight. If you need a curve or circle, the jigsaw makes it easy and is significantly less expensive than a band saw. And if you need to trim a 4' x 8' sheet of plywood to a manageable size before heading to the table saw, the jigsaw is a good choice for the job. There are lots of jigsaws on the market. While we wanted to save money, we didn't want to give up performance. We came up with two options, both obvious in our book.

The Grizzly G8994Z looks like an older Bosch model and offers a screwdriver blade changing system. It also offers good performance provided by a 5-amp motor, variable speed and four-position orbital action. For $60, that's a fair deal.

Bosch's 1590EVS offers near-perfect toolless blade change, superior blade control, variable speed and the most powerful motor in its class. At $170, it's expensive. But it's also the last jigsaw you'll ever buy.


$60

- **GRIZZLY G8994Z**
  MOTOR: 5 amp
  SPEED: 0 - 3,100 rpm
  CONTACT: Grizzly Industrial, 800-523-4777 or grizzly.com

$170

- **BOSCH 1590EVS JIGSAW**
  MOTOR: 6.4 amp
  SPEED: 500 - 2,800 rpm
  CONTACT: Bosch, 877-267-2499 or boschtools.com

Dust Collection

We opted for a shop vacuum and cyclone lid rather than the more common bag-based collector. Our rationale is two-fold. First, we like the benefits offered by a cyclonic dust collection system. Functioning as a two-stage dust collector, it allows the bulkier chips to be collected in one place and the fine particles to be more effectively collected in another. This cuts down on trips to empty the vacuum. Second, the size and portability of a vacuum makes it easy to bring the dust collection to the machine without running extensive duct work.

The suction power and storage provided by this 6-hp, 16 gal. Craftsman vacuum (model #17761) is adequate to all small shop tasks. The Veritas Cyclone lid attaches to any standard garbage can and gives you two-stage performance at a drastically reduced price.

$90

- **CRAFTSMAN 17761 WET-DRY VAC**
  MOTOR: 6 hp
  CAPACITY: 16 gallon
  CONTACT: Craftsman, 800-377-7414 or sears.com


$33

- **VERITAS 05J30.01 CYCLONE**
  HOSE INLET: 2 1/2"
  FITS: 19" - 23 1/2" dia. cans
  CONTACT: Lee Valley, 800-871-8158 or leevalley.com

$3,100 WORKSHOP

While many woodworkers work carefully within a budget to set up their shops, some lucky ones can spend a little extra and buy machines and tools that will be the ones they'll keep for decades. Well, you can still do that without breaking the bank. We've put together a shop that includes a selection of machines you'd want to have in a complete shop and allowed ourselves enough money to upgrade the tools. These selections aren't the most expensive tools in their categories, but instead are proven and affordable tools that are an excellent value. We consider this selection our "step-up" shop.

TOOL	OPTION #3	PRICE
TABLE SAW	GRIZZLY G1023S	$825
JOINTER	GRIZZLY G1018	640
PLANER	DELTA 22-580	365
JIGSAW	BOSCH 1590 EVS	170
ROUTER	DEWALT DW618PK	225
DRILL	HITACHI DS12DVF2	75
SANDER	PORTER-CABLE 333	60
DRILL PRESS	GRIZZLY G7943	180
BAND SAW	GRIZZLY G0555	375
DUST COLLECTOR	PENNSTATE DC1BXL	230
	TOTAL	$3,145

$825

TABLE SAW

While the contractor saws offered in the $1,500 shop are good machines and will last for years, it's hard to discount the performance of a 3-hp, 220V cabinet saw. And Grizzly's rock-solid G1023S offers that and more for only $825. That's a bargain and a worthwhile step up.

- **GRIZZLY G1023S CABINET SAW**
  MOTOR: 3 hp, 220 volt
  FENCE: Shop Fox Classic, 30" capacity
  TABLE SIZE: 36 1/4" x 27 1/8"
  CONTACT: Grizzly Industrial, 800-523-4777 or grizzly.com

$640

JOINTER

A 6" jointer will handle a fair amount of work, but if you work mostly with solid wood, you'll want an 8" jointer some day for wider boards. The Grizzly G1018 has the 8" capacity and offers a 1 1/2 hp, 220V motor and 65" long bed. Priced at $640, it's another intelligent step up and a good value.

- **GRIZZLY G1018 JOINTER**
  MOTOR: 1 1/2 hp, 220 volt
  TABLE LENGTH: 65"
  SPEED: 15,000 cpm
  CONTACT: Grizzly Industrial, 800-523-4777 or grizzly.com

$375

BAND SAW

A jigsaw works well for most curvy tasks, but ultimately it's wise to include a band saw in your shop. For straight, non-straight and smaller resawing tasks, the Grizzly G0555 14" band saw features a 1-hp motor, quick tension release lever (for improved blade and machine life), ball bearing blade guides and even a nice rip fence, all for $375. That's an extra machine in the shop at a price we like.

- **GRIZZLY G0555 BAND SAW**
  MOTOR: 1 hp, 110/220 volt
  CUT CAPACITY: 6" high x 13 1/2" deep
  SPEEDS: 1,500 & 3,200 feet per minute
  CONTACT: Grizzly Industrial, 800-523-4777 or grizzly.com

$180

DRILL PRESS

A drill press is a better option for some shop tasks than a cordless drill. We opted for the Grizzly G7943 benchtop – a 14", 3/4-hp drill press for $180. For $20 more, you can upgrade to the G7944 floor-model version.

- **GRIZZLY G7943 DRILL PRESS**
  MOTOR: 3/4 hp, 110 volt
  SPINDLE TRAVEL: 3 1/4"
  SPEEDS: 12, 140 - 3,050 rpm
  CONTACT: Grizzly Industrial, 800-523-4777 or grizzly.com

ROUTER

The value offered in a two-base router kit is obvious, but the DeWalt DW618PK also offers precise and easy-to-use depth adjustment, through-the-column dust collection, both 1/4" and 1/2" collets and a powerful 12-amp motor that makes any task easy. At $225 it's worth the extra money.

$225

DEWALT DW618PK ROUTER
MOTOR: 2 1/4 hp, 12 amp
COLLETS: 1/4" & 1/2"
SPEED: 8K - 24K rpm
CONTACT: DeWalt, 800-433-9258 or dewalt.com

PLANER

Aside from increasing capacity and switching to an induction motor (both expensive upgrades), there is another way to improve planer performance and still stay in an affordable range. The Delta 22-580 13" planer offers two feed speeds (20 and 30 feet per minute) as well as a four-post head lock to provide a smoother finished pass and reduce snipe. At $365 it's a step up in price and performance.

$365

DELTA 22-580 PLANER
MOTOR: 15 amp
MAX DEPTH OF CUT: 1/8" on 6" stock
PERFORMANCE: 83/56 cuts per inch
CONTACT: Delta, 800-438-2486 or deltawoodworking.com

$230

DUST COLLECTOR

While the shop vacuum will do a good job, sometimes you want to run two machines at a time. That's why we stepped up to the Penn State DC1BXL with 850 cubic feet per minute performance and 1-micron bags for very efficient dust management.

PENN STATE DC1BXL DUST COLLECTION SYSTEM
MOTOR: 1 hp, 110/220 volt
CFM: 850
BAG: 1 micron, 25 gal.
CONTACT: Penn State, 800-377-7297 or pennstateind.com

TOOL PRICES ABOUT TO GO UP

For years we've been saying that woodworking machines keep getting better and their prices often are lower than they were 20 years ago. Unfortunately, that trend is swinging the other way.

As mainland China continues to face a booming industrial economy, more steel is required to feed that growth. China's iron ore production isn't able to meet the need, so ore and steel are being purchased from other countries. This problem is not affecting only China. Taiwan is experiencing as bad – or worse – shortages. Some smaller factories can't buy the raw materials even if they have the cash, manufacturers tell us.

And the problem extends to all raw materials. Anything related to manufacturing, including fuel, trucking and freight expenses, are all tied together. As all of these factors impact the market, it will cause a ripple effect that will ultimately hit our woodworking pocketbooks.

While China is working hard to meet the growing demand, "it takes five or six years to build a foundry," says Shiraz Balolia, president of Grizzly Industrial. China's infrastructure also is being stretched by the economy's rapid growth. Balolia says there also is a shortage of power. "Energy is government-regulated, and in many cases the foundries may only get three days of electricity," he says.

In Balolia's opinion, China is in the middle of this growth process and it may take another two to three years to resolve. In the meantime, he anticipates price increases in Far East woodworking machinery of at least 10 - 15 percent by the beginning of 2005.

Tim Hewitt, president of HTC Products (makers of mobile bases), sent out a letter to its current customer list in April 2004 that warns of price increases. The company relies heavily on steel, and the letter says steel costs increased 70 percent in the beginning of the year. Hewitt warned customers of an average (fluctuating) price increase of about 9.5 percent.

"[Machinery] prices have been depressed for many years," says Balolia, "but they're making up for that five or seven year's difference in just a couple of months."

Scott Box, vice president of marketing and product management for WMH Tool Group (owners of Jet, Powermatic, Performax and Wilton tools), said WMH saw significant price increases because of the shortages. "We were hit with requests of 14 percent to 34 percent increases from our Asian suppliers. We absorbed some of the costs and, when necessary, went looking for other vendors. We did have to pass along an 8 percent surcharge, though."

Balolia adds that Grizzly intends to absorb price increases to keep prices where they are until the end of year, but then prices will have to be increased to meet costs. He anticipates that some areas of the woodworking machinery market will see inventory shortages because of the situation. But, Balolia added, Grizzly anticipated the shortage difficulties and has good inventory, so there should be no delivery problems for them.

He does say to expect a lack of discounts in Christmas catalogs. "We just can't do it," Balolia says. "Everything is costing us more. The prices you see now are as low as you're ever going to see it. If they can afford it, they need to buy it now. It'll never be cheaper."

Box's outlook isn't as dark. He says he thinks prices are stabilizing now, and while there had been inventory shortages, they too are stabilized and are no longer a problem.

Knowing the mind set of most woodworkers, they'll find a way to keep woodworking, no matter what the cost. *— DT*


STANLEY
Professional
DRYWALL SQUARE

Hand Plane Cabinet

Hard-working tools deserve a decent place to rest.

On certain holidays, such as New Year's Day, craftsmen in Japan clean their tools, put them on a shrine and offer them gifts such as sake and rice cakes. It is their way of thanking the tools for the service they have provided and will provide in future days.

As my own collection of hand planes grew from a few rusty specimens handed down from my great-grandfather to a small arsenal of new high-quality instruments, this Japanese tradition began to weigh heavily on my mind. My planes generally squatted on my workbench when not in use, and I had to constantly move them around to avoid knocking them to the floor as I worked.

After some thought, I decided that a cabinet dedicated to my planes was the best way to protect them from dings and to thank them for the service they provide almost every day of the year.

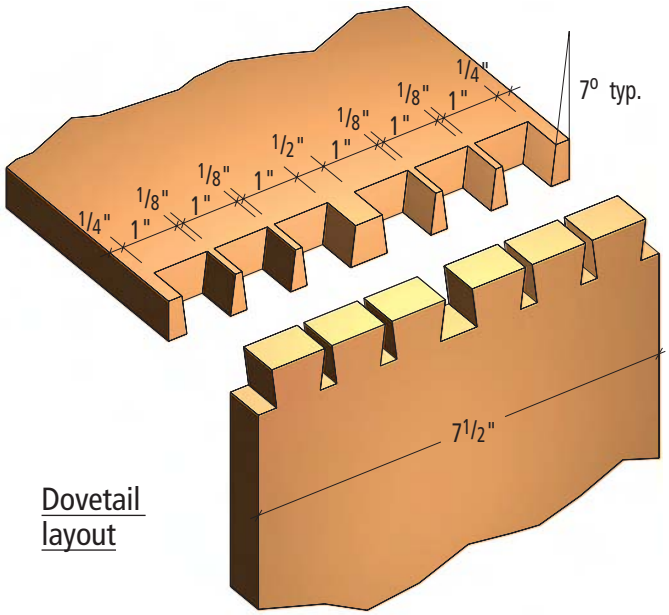
This piece is designed to be used either as a traditional tool chest that sits on a bench or as a cabinet that hangs on the wall on a tough French cleat. Because planes are heavy tools, the case is joined using through-dovetails. The lid is a flat-panel door assembled using mortise-and-tenon construction. And the dividers inside the cabinet are screwed together so the configuration can be rearranged easily as my collection (or needs) change.

As you design your own version of this cabinet, you should measure your planes to ensure there's enough space for everything you own, or plan to own. This cabinet should provide plenty of room for all but the largest collections.

by Christopher Schwarz

Comments or questions? Contact Christopher at 513-531-2690 ext. 1407 or chris.schwarz@fwpubs.com.

Photos by Al Parrish



Dovetail layout

Dovetails with the Pins First

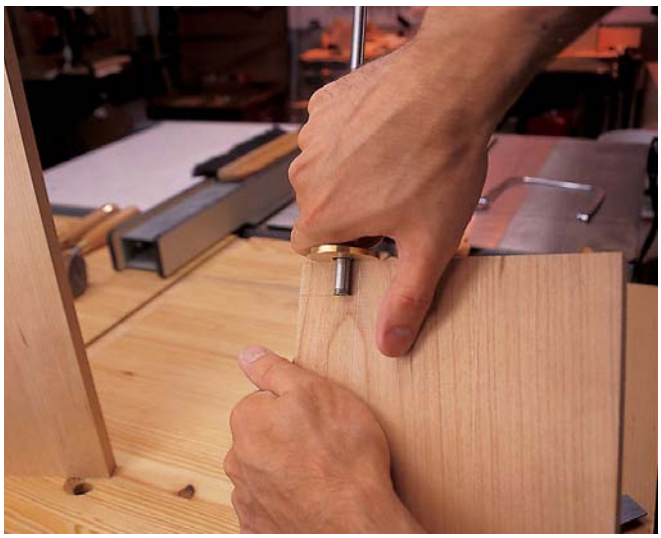
Because of all the cast iron and steel in hand planes, the cabinet's carcase needs to be as stout as possible to resist the stress that all this weight will put on the corners. In my opinion, the through-dovetail is the only joint for this job.

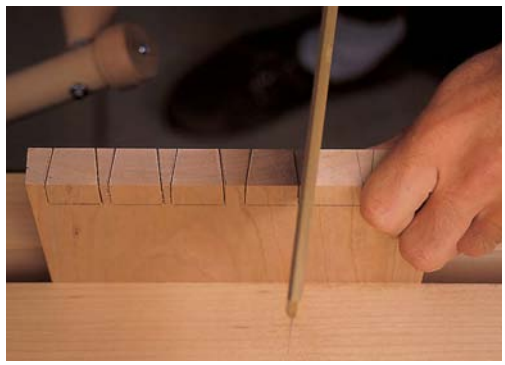
Whether you choose to cut pins or tails first (or use a dovetail jig and a router) is up to you. Usually I cut the tails first, but I try to keep an open mind about different techniques. So for a year I built as many things as I could by cutting the pins first – this is one of those projects.

Lay out the joints using the illustration at left, a marking gauge, a square and a sliding bevel square set for 7°. I strike the lines with a marking knife and color them in a bit with a mechanical pencil. The pencil marks help me see the line and the knife lines keep me accurate. In fact, once you get some practice sawing, you should be able to easily remove the pencil marks from only one side of your knife lines. It sounds crazy, but it's actually not that hard.

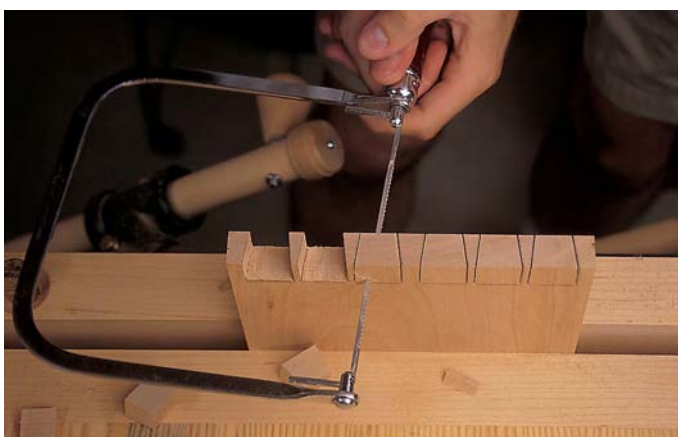
There are many ways to remove the waste from between your saw's kerf lines. Some just chop it away

Mark the length of your pins and tails. There's a debate as to whether you should mark exactly how long you want them, a little less or a little more. I prefer to mark them 1/32" longer so the ends are proud when assembled. Then I plane them flush after gluing.





Once the cut is started, hold the saw like you would hold a small bird that you're trying to prevent from flying away. Don't clench the handle; just keep enough pressure to avoid losing control. And never apply much downward pressure as you saw – this will cause your blade to drift.



With the pins defined, get out a coping saw with a fine-tooth blade and remove as much waste as you can. The closer you get to the scribed line at the bottom of the joint, the less cleanup you'll have with a chisel. But if you overshoot your line, you're cooked.

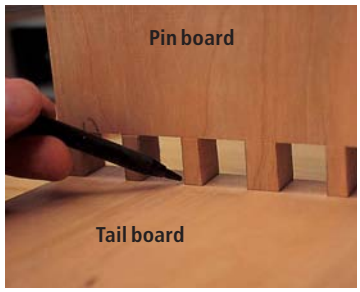
Clamp your pin board to a piece of scrap and remove the rest of the waste using a sharp chisel and a mallet. I sneak up on the line on one side, then on the other, then clean up any junk in the middle. Clean out the corners of the pins using a sharp knife.

directly with a chisel and a sharp blow from a mallet. I find that I'm sharpening my chisels less if I saw out most of the waste and chop out the little bit that's left. A coping saw with a fine-tooth blade works well, as does a jeweler's fret saw.

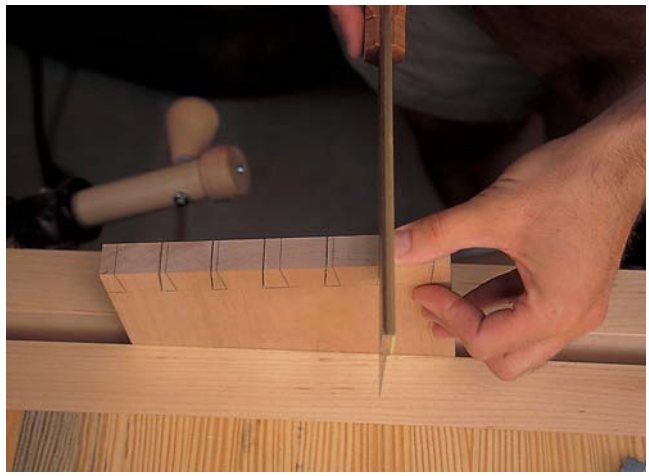
When you chop out the waste, be sure to stand so you can see the profile of your chisel – it must be perpendicular to the work. I use a standard bevel-edge chisel for this operation. Just make sure that if you do the same that your chisel can be struck by a mallet without splitting the handle.

Next you need to mark out the mating part of the joint by using the first half of the joint as a template. Here's the main difficulty you'll encounter by cutting the pins first: You have to balance the pin board on edge to mark out the tail portion of the joint. With a small case it's manageable. But with a dresser it can be tricky.

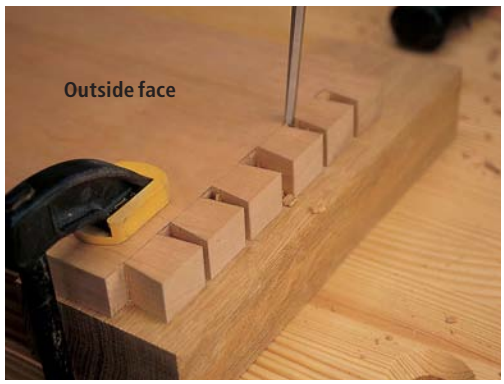
Mark the joints with a sharp knife followed by a pencil. Then cut the tails. For this project I tried a technique you might want to take for a spin: As you can see from the photo above right, I skewed the tail board in my vise so I was



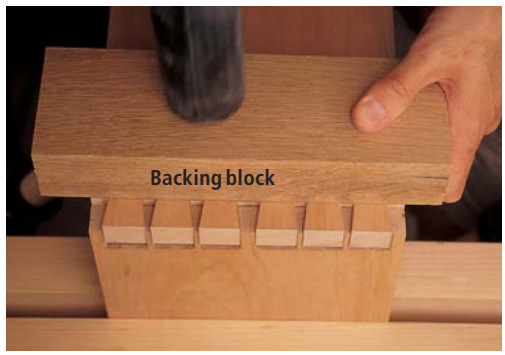
Put your tail board on the bench with its inside face pointing up. Position its mate on top of it and mark the locations of the tails using a knife, followed by a mechanical pencil. Be careful not to shift either board during this step. If you do, erase your lines and start anew.



Transfer the lines on your tail board across the end using a square. Clamp the tail board in a vise. You can see how I skewed the board in my vise so I'm actually cutting straight down. Angle the board one direction and make half of the tail cuts, then reverse the angle for the other cuts. Remember to cut ever-so-slightly outside of the lines.



Remove the waste from the outside face of the board first, then remove the rest from the inside face. This will result in a neater joint if the grain buckles while you are chopping it. Again, clean up your corners with a knife.



Now it's time for a test fit. Assemble the joint using a deadblow mallet and a backing block to distribute your blows across the entire joint. You should be able to push the mating pieces together most of the way using only hand pressure, plus a few taps to seat it in place.

PLANES AT REST: ON THEIR SOLES OR ON THEIR SIDES?

One of the big debates among plane users is whether to place the tools on their soles or their sides when they are not in use. Traditional carpenters place the tools on their sides to protect the iron from getting dinged. Many woodworkers have picked up this tradition and it's frequently passed on from teacher to student (as it was to me).

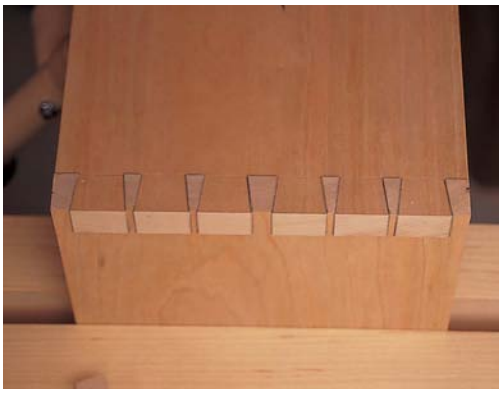
But it might not be necessary.

A couple of years ago I was convinced by a fellow craftsman that it's better to place planes on their soles when you are working at your bench. Here's the rationale. The old carpenter's rule applied to work on the job site, where you could never be certain about where you were setting your plane (this was back when you might actually see planes on a job site). So placing the plane on its side protected the iron from grit and gravel that

could cover any flat surface in a newly built home. Also, carpenters say that putting planes on their sides prevents the iron from being pushed back into the plane's body, which is what could happen when a plane is rested on its sole.

Woodworkers, however, work on a wooden bench – far away from mortar dust and gravel. So they say it's best to place an unused plane on its sole to prevent the iron from getting dinged by another tool on the bench. What about the iron getting pushed up into the plane's body? If you think about this statement for a moment, you'll see how ridiculous it is. The plane's iron is secured tightly enough in the plane's body to withstand enormous pressure as the plane is pushed through the work. It should be child's play for the iron to stay in one place with only the weight of the plane pushing it down.

Other woodworkers have come up with other solutions that work, too, including placing the planes sole-down over the tool well of their bench. Or they rest the sole on a thin wooden strip that holds the iron slightly above the bench. But I don't mess with that. After unlearning years of training, I now put my planes sole-down on the bench. — *CS*



You can see the pencil lines on the tails and how the ends of the pins and tails stick up a bit on the completed joint. This makes it easier to trim them flush, but more difficult to clamp during glue-up.

Cut the groove for the 1/2"-thick bottom in two passes using a plunge router outfitted with a straight bit and an edge guide. On the pin boards, you can cut the groove through the ends because it won't show.

On the tail boards, you need to stop the groove in one of the tails as shown. The dovetail layout shown in the illustration allows you to put the groove solidly into a tail.

sawing straight down instead of at a 7° angle. I think this is a good trick for beginners as it makes it easier to track your lines. However, you have to shift the board 7° the other way for the other half of your cuts, so it's a bit more work.

At this point you have to pay close attention to your lines or your joint will have a sloppy fit. Saw on the waste side of the line, leaving the pencil line intact. This makes the joint just a little tight – something you can tweak by paring with a chisel.

Use a coping saw to remove most of the waste between the tails and chop the rest of the waste away with a chisel. Now you're ready for a dry run. Ease the inside edges of the tails just a bit with a knife. If the joint is too tight, try shaving off a bit on the inside faces of the pins – parts that won't show in the completed joint.

Bottom and Assembly

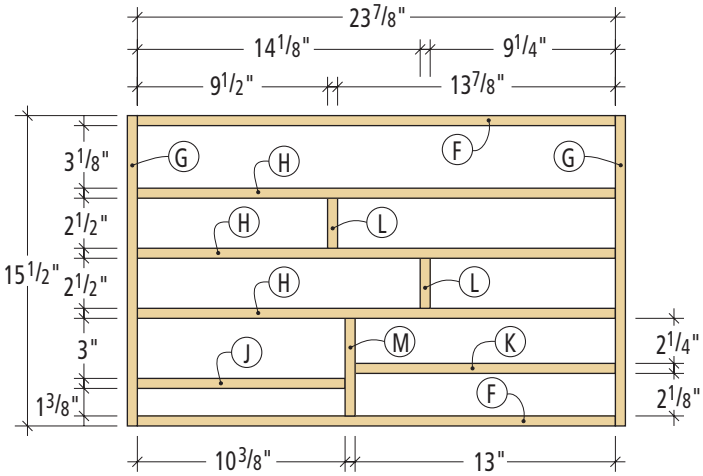
Cut the remainder of your dovetails and mill the 1/4"-deep x 1/2" groove for the plywood back/bottom. I milled this groove using a plunge router, a straight bit and an edge guide. Make sure you put the groove 1/2" in from the bottom edge of the sides to make room for the French cleat that attaches the cabinet to the wall (if you're hanging this cabinet on a wall).

Before you assemble the case with glue, use a smoothing plane to prepare all the inside surfaces of the carcase for finishing – including the bottom piece. I sharpen a gentle camber on the cutting edge of the blade (about .002") and set the plane to take a very fine shaving, about .001" thick. This creates a surface that generally needs little or no sanding, especially with wood that has mild, easy-to-plane grain.

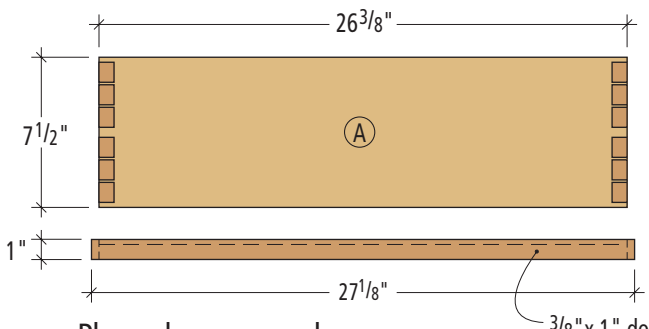
Once you glue up the case, trim the dovetail joints flush to the outside and use a smoothing plane to prepare the exterior of the case for finishing.

HAND PLANE CABINET

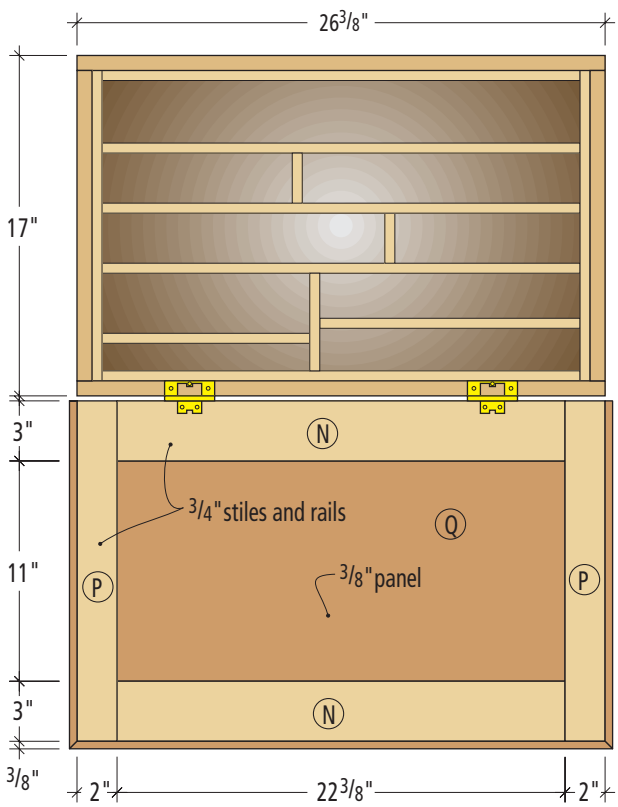
	NO.	LET.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
Carcase								
❑	2	A	Top, bottom	3/4	7 1/2	26 3/8	Cherry	Cut 1/16" long
❑	2	B	Sides	3/4	7 1/2	17	Cherry	Cut 1/16" long
❑	1	C	Back/bottom	1/2	16	25 3/8	Plywood	In 1/4"-deep groove
❑	1	D	French cleat for case	1/2	2 1/2	24 7/8	Maple	45° bevel on one edge
❑	1	E	French cleat for wall	1/2	2 1/2	22 7/8	Maple	45° bevel on one edge
Dividers								
❑	2	F	Top, bottom	1/2	2 1/2	23 7/8	Maple	
❑	2	G	Sides	1/2	2 1/2	15 1/2	Maple	
❑	3	H	Horizontal dividers	1/2	2 1/2	23 7/8	Maple	
❑	1	J	Horizontal divider	1/2	2 1/2	10 3/8	Maple	
❑	1	K	Horizontal divider	1/2	2 1/2	13	Maple	
❑	2	L	Vertical dividers	1/2	2 1/2	2 1/2	Maple	
❑	1	M	Vertical divider	1/2	2 1/2	4 7/8	Maple	
Door								
❑	2	N	Rails	3/4	3	24 3/8	Cherry	Cut long to fit cabinet
❑	2	P	Stiles	3/4	2	17	Cherry	Cut long to fit cabinet
❑	1	Q	Panel	3/8	12	23 3/8	Poplar	In 3/8" x 1/2" groove
❑			Moulding	3/8	1	65	Cherry	1/4" roundover on one edge



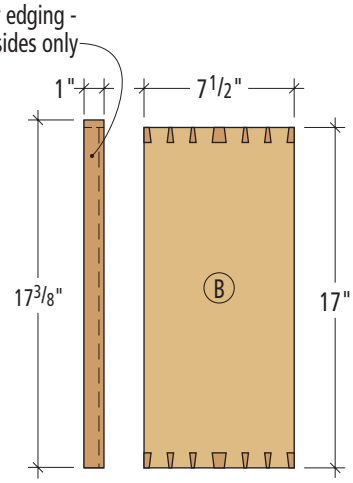
Elevation – internal dividers



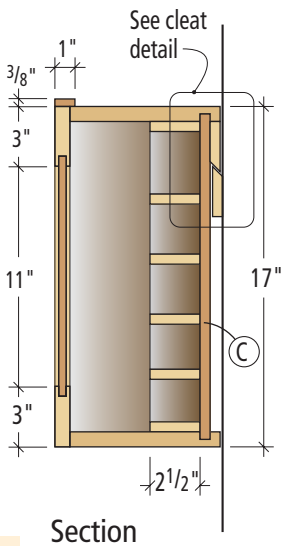
Plan – door removed



Elevation



Profile – door removed



Section

SLICK SOLE FOR SMOOTHING

When using a smoothing plane to prepare wood for finishing, you'll get better results if the plane's sole is waxed. The wax lubricates the sole and allows the plane to skim over the work. You'll use less effort and the end result looks better because you're less likely to stall during the cut. I use inexpensive canning wax found at any grocery store that costs a few dollars for a box. Apply the wax in the pattern shown below (keep it off the iron; that will change how the plane cuts). Then start working until you feel the plane becoming harder to move. Just reapply the wax and get back to work. *— CS*

SUPPLIES

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

2 • Forged flush rings, 1½" x 2" #00L02.02, $13.60 ea.

2 • Colonial chest handles #06W02.01, $14.50/pair

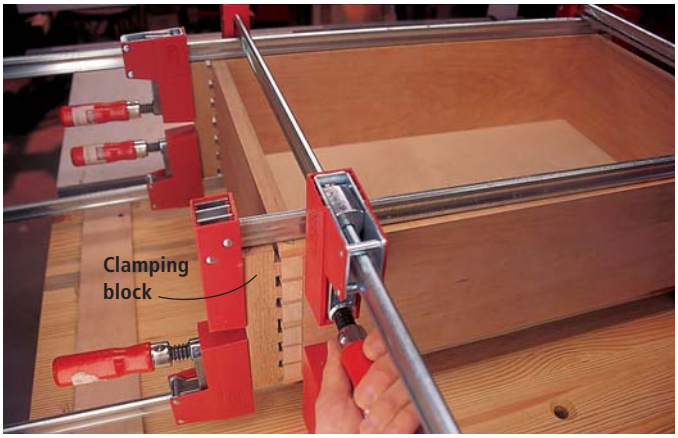
2 • 2½" non-mortise hinges #00H51.13, $1.20 ea.

Local home-supply store

2 • Magnetic catches

Prices as of publication deadline

I don't like to clamp carcase pieces between dogs unless I have to – the clamp pressure can bow the pieces as I'm working them. I prefer a stop on my bench, as shown. After planing the case pieces, I'll hit them with some #220-grit sandpaper to remove any ridges left by the plane.



I use simple clamping blocks to clamp the tail boards firmly against the pin boards. These are easy to make using a hand saw or band saw. Apply a consistent but thin layer of glue to the tails and knock the case together with the bottom in its groove. Clamp up the case using the clamping blocks and let it sit for at least 30 minutes.

Build the Door

With the glue dry and the case complete, measure its width and length to determine exactly how big your door should be. You want the door to overhang the case by 1/16" on either end and 1/16" on the front, so size your door's rails and stiles accordingly.

As much as I enjoy handwork, I decided to cut the mortise-and-tenon joints for the frame-and-panel door using my "tailed apprentices" (my power tools). I begin making this classic housed joint by cutting a sample mortise with my mortising machine. Then I cut all the tenons using a dado stack installed in my table saw.

The rule of thumb is that your tenons' thickness should be one-half the thickness of your stock. The doors are 3/4" thick, so the tenons are 3/8" thick with 3/16" shoulders on the face cheeks.

Now install a dado stack in your table saw. These tenons are 1" long, so I like to put in enough chippers to make a 5/8"-wide cut in one pass. Set the height of the dado stack to 3/16" and set the fence so it's 1" away from the left-most tooth of your dado stack. Make several passes over the blade to remove the waste from the face cheeks, then remove the waste from the edge cheeks and test the fit in your sample mortise.

Raise the dado stack to 3/8" and remove the remainder of the waste on the edge cheeks. The bigger edge shoulders ensure that you won't blow out the ends of your mortises at glue-up.

Mark the location of your mortises using your tenons as a guide, as shown in the photo above right. Cut the 3/8"-wide x 1 1/16"-deep mortises in the stiles using a hollow-chisel mortiser.

Next cut the 3/8"-wide x 1/2"-deep groove on the door parts that will hold the panel. I use a rip blade in my table saw. Don't worry about stopping the groove in the stiles; the hole won't show on the front because it will be covered by moulding. On the back you'll almost never see it because that is where the hinges go. If the hole offends you, by all means patch it with a scrap.

Assemble the door and make sure it fits on the case. When all is well, plane or sand the panel for the door and glue up the door – making sure not to put glue in the panel's groove.

With the door complete, mill the moulding that surrounds the door on three edges. Miter, glue and nail it in place. Then install

A dado stack makes quick work of tenons for the door. The table saw's miter gauge guides the rails over the dado blades to cut the face and edge cheeks.

Test the fit of your tenon in a test mortise. When you're satisfied with the fit, cut the tenons on all the rails this way, being sure to check the fit after cutting each one.

the hardware: the butt hinges, catches, pulls and handles.

Divide and Organize

Finally it's time to make the dividers for the planes. This is the easy part. I fastened the dividers using screws to make sure I could change the configuration in case my plane collection ever changed. The first step when building the dividers is to screw the four outermost pieces together and plane them down so they fit snugly inside the case.

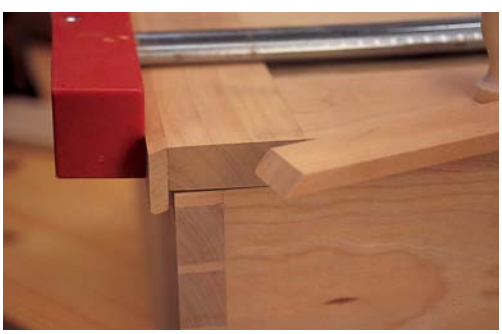
Then divide up the rest of your space and screw everything in place. Secure the assembled divider in the case with a couple of 1"-long screws. As this is shop furniture, I didn't choose a fancy finish. A few coats of clear lacquer is enough protection.

I hung my cabinet on the wall using a French cleat system, shown at right. When installing the cleats, be sure to use 3"-long screws to fasten the cleat to the studs in the wall. This cabinet, when full, is quite weighty.

With this project complete and hung on my shop wall, I loaded the tools into their slots and thought for a moment about offering my planes some sake in the Japanese tradition. But then, coming to my senses, I offered myself a cold beer instead. **PW**

Use the tenons to mark where the mortises should go on the stiles. I like this method because there is less measuring and therefore less room for error.

When cutting the mortise, cut one hole, skip a space, then cut the next one. Then come back and clean up the area in between. If you cut all your holes in a row, the mortiser's chisel can bend or snap because it wants to follow the path of least resistance.



The 3/8" x 1" moulding creates a dust seal around the edge of your cabinet and gives the piece a nice finished look. I cut a 1/4" roundover on the inside edge of the moulding. Miter the ends, then glue and nail the moulding to the door's edges.

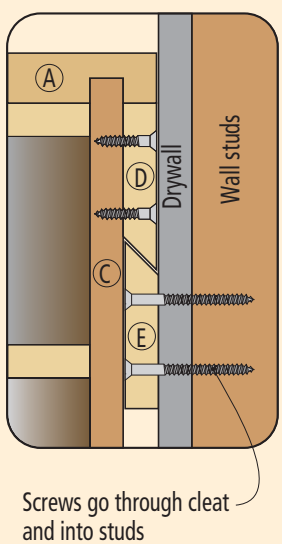
As you install the interior dividers, it's a good idea to double-check your initial measurements against the real thing. I had a rude shock when my No. 4 plane was wider than I had anticipated. When everything looks good, screw all the parts together using #8 x 1" screws. Then screw the whole thing into the cabinet. I ran the screws in from the backside of the cabinet.

THE GENIUS OF FRENCH CLEATS

When you hang a cabinet that will be loaded with heavy objects, I recommend a French cleat to fasten it to the wall. These cleats take a little more work than metal cabinet hangers, but they are well worth it because the cabinet will be more secure and it will be easy to put on the wall and remove.

To make a French cleat, take some of the 1/2" stock left over from building the dividers for the interior of your cabinet. You'll need one piece that's 24 7/8" long, which you'll attach to the backside of the cabinet. And you'll need a second piece that's a couple of inches shorter than the first. Set your table saw to cut a 45° bevel and rip one long edge of each piece at 45°.

Glue and screw the long cleat to the top edge of the backside of the cabinet with the bevel facing in. Now screw the second cleat to the wall where your cabinet will go – with the bevel facing the wall. Be sure to use big screws (I used #12 x 3") and anchor the screws in the studs in your wall. *— CS*



Photos by Al Parrish

Block

Get the most out of this versatile hand tool through proper tuning and good technique.

My tool cabinet contains a number of planes—bench planes for smoothing, shoulder planes for trimming and even a full set of hollows and rounds. But the planes I use most often are block planes. I own a number of block planes and I reach for them several times a day to smooth away saw marks, level intersections at joints, trim miters and even create simple shapes such as chamfers.

What makes the block plane so versatile? Well, it has several features that distinguish it from other planes, such as its small size, adjustable mouth, low bed angle and a unique bevel-up blade. Let's take a closer look at each of these features.

by Lonnie Bird

Lonnie is the author of "The Complete Illustrated Guide to Shaping Wood" (The Taunton Press) and teaches woodworking. You can learn more about his classes online at lonniebird.com.

Plane BASICS

Small and Adjustable

Most block planes are compact so they can easily plane small parts or maneuver in areas that are too tight for a bench plane to reach. This is a great advantage when leveling joints in frames and casework. Additionally, the short length, dimpled sides and domed lever cap make the block plane fit easily in the hand and ensure a firm grip and good control.

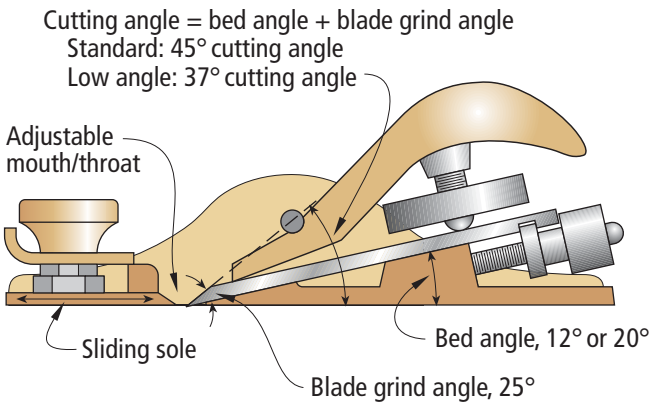
For precise cuts that are free of tear-out, the mouth of a plane must be as small as possible. It works like this: As the edge lifts a shaving, the sole of the plane directly in front of the edge presses the shaving down. This helps break the shaving and prevent tear-out. If the mouth of the plane is adjustable, it can be set for either a coarse or a fine shaving.

To adjust the mouth, bench planes use a movable frog – the casting that supports the iron. Adjusting the frog of a bench plane is a bit tedious. However, the toe of the sole on most block planes is a separate casting that slides in a machined recess in the front of the plane. This design makes mouth adjustments quick, easy and precise.

Standard or Low-angle?

Another feature that distinguishes block planes is that they're available in standard and low-angle versions. This allows you to select a plane for the type of cut you want – face grain or end grain.

The angle refers to the bed angle. Standard-angle block planes are typically 20°, while the low-angle planes feature a bed angle of 12°. Realize, though, that the bed angle is not the cutting angle. Because the blade of a block plane is bedded bevel-up, the cutting angle is the sum of the bed angle and the grind angle.



Anatomy of a block plane

There are many different styles of block planes. Some are new, others are vintage. Some are small, others are large. From left: Lie-Nielsen 60½ low-angle block, Lie-Nielsen 62 low-angle jack, Stanley 60½ low-angle block, Lie-Nielsen standard-angle block and Lie-Nielsen 102 low-angle block.

The sole of a block plane can be trued on sandpaper (#100 to #320 grit) supported on a granite reference plate.

A small mill file can rescue the bed of an inexpensive plane by ridding it of any defects. However, a light touch is key.

On a standard block plane, the cutting angle is typically 45°, the same as most bench planes. Low-angle block planes have a cutting angle of 37°. Which one is best for you depends upon the planing you plan to do. You'll probably want both. Here's why:

When planing end grain, a low cutting angle works best. End grain is tough, and a low cutting angle shears the fibers. But face grain requires a different approach. Although a low cutting angle will give good results on face grain much of the time, especially when the wood is moderately soft and straight-grained, it has a tendency to lift and tear out hard and highly figured wood such as curly maple. Here's where you need a higher cutting angle. In fact, the higher the better. The steep bevel of a higher cutting angle breaks and curls the shaving, which limits its tendency to splinter and tear.

That's where a block plane's bevel-up design is an advantage. The cutting angle can be altered simply by changing the grind angle on the blade. You can't do that with a bench plane; because a bench plane's iron is bedded bevel down, the cutting angle is determined by the bed angle of the frog.

On my standard block plane with a 20° bed angle, I've ground the iron to 30°, which yields a cutting angle of 50°. This steeper cutting angle, sometimes referred to as a York pitch, is quite effective at smoothing highly figured, difficult woods such as tiger maple.

When I need to trim the end grain on a miter, I use my low-angle block plane. The sum of the 12° bed angle and a 25° bevel angle yields a low 37° cutting angle – just what's needed for shearing tough, fibrous end grain. In fact, you can lower the grind angle another 2° for a 35° cutting angle. Any lower, however, and the edge becomes too fragile.

Finally, the bevel-up blade also means that the bed of the plane can support the blade much closer to the edge. This stiffens the blade where it needs it most and virtually eliminates chatter.

Other Block-plane Styles

Although the 6"-long block planes are most common, there are other styles you may want to add to your tool kit. Remember: Any plane with the iron bedded bevel-up is, technically, a block plane.

For example, take a look at a low-angle jack plane. At first glance it resembles another bench plane. It even features a wooden handle and knob like a bench plane. But the iron is bedded bevel-up at a low, 12° angle. Mouth adjustments are made with a movable toe piece. Although it resembles a bench plane, it functions as a low-angle block plane. And its large size gives it lots of mass for clean slicing through tough end grain.

Some plane makers feature a small, 5"-long block plane. Although the throat isn't adjustable and is somewhat large for fine work, its small size and comfortable shape make this plane feel like an extension of the hand. This plane is one of my favorites for light trimming and other less-demanding tasks.

Tuning Your Block Plane

New planes vary widely in quality of workmanship and design. All new block planes require tuning, although the best ones require only honing the blade and adjusting the mouth. But many less-expensive planes require reworking to function. If you've been frustrated by your new (or old) block plane, you may find that it just needs a tune-up.

Start by examining the sole of the plane. It must be flat to provide support to the blade. A warped sole or one that was sloppily ground can be flattened by rubbing it on coarse sandpaper. The sandpaper must be supported by a flat, stiff surface such as a granite plate or the cast-iron top of a machine. Start with #100 grit and finish with #320.

The next step is to flatten the bed. On a quality plane the bed is large and dead flat. But less expensive block planes feature a small bed just behind the mouth and

Block planes are ideal for working tough end grain. You must apply firm pressure to the toe of the plane for success, as shown at left. The result should be a ribbon of end grain as shown above. If you get dust, you're doing something wrong.

When planing a drawer, be careful to not plane across the grain when turning a corner. To avoid this, just turn the plane 45° as you round the corner.

Chamfering is done easily with one hand. Simply follow the intersections at the corners.

the surface often has burrs or a glob or two of paint. Although you can't increase the bed size, you can use a small, flat mill file to smooth away any defects. Be careful, however, and don't be overzealous with the file.

Next, turn your attention to the lever cap. The lever cap applies pressure to the iron just behind the cutting edge. To perform properly it must also be flat and free of leftover burrs or traces of excess paint. You can easily flatten the cap with a coarse, flat bench stone.

The next step is to sharpen the iron. Like all sharpening, it involves polishing the back and the bevel. Most new plane irons have coarse scratches in the back that remain from the manufacturing process. As each scratch intersects the edge, it forms a tiny serration that resists cutting and will tear out fibers. Start with a coarse bench stone and work through to the finest stone until the back of the plane iron is absolutely flat and reflects like a mirror. Then hone the bevel.

Finally, install the iron in the plane and adjust it for a very fine cut. Then close the mouth of the plane so that a thin shaving can barely pass through. A tight mouth is critical, especially on face grain when planing.

Proper Technique

A sharp, finely tuned low-angle block plane can remove ultra-thin shavings from tough end grain. I often use a plane to skim the mitered surface of mouldings; the plane will smooth away all saw marks, ensuring a tight, gap-free fit. With the workpiece secure in a vise, I grasp the plane with one hand and apply firm pressure to the toe with the thumb of my other hand. A sharp plane iron and a light cut are the key to a clean cut here, along with smooth, positive strokes.

When planing the end grain of a board, you'll need to take steps to avoid splintering the grain along the edge. One approach is to clamp a backup board to the trailing edge of the workpiece. The backup board will apply pressure to support the grain and avoid splintering. Another method is to plane from both edges and allow your cuts to meet somewhere near the middle. I especially like this method when planing the end of a wide board such as a tabletop.

When fitting small drawers, such as those in a spice cabinet, the block plane is my favorite choice. I position the drawer against the bench stop and steady it with one hand while planing with the other. As I approach the intersection, I turn the plane 45° as I push the plane around the corner. This avoids planing across the grain and tearing the grain on either of the two pieces.

Chamfering can also be done one-handed. I usually chamfer the ends of chair legs, table legs and bed posts; this prevents them from inadvertently splintering as they're dragged across a floor. As with a drawer, you can position the leg against a stop while you steady it with one hand and plane with the other.

Although you can pencil in layout lines to guide you as you plane, I never do. The intersections at the corners will show you where you need to adjust the chamfer. Besides, I like a small amount of irregularity that's often associated with hand planing. It gives the work a classic look that says, "handmade." **PW**

Steel-stringed Guitar

Building your first guitar is not just another project; it's a journey.

Ever since my early days of woodworking, the idea of building a musical instrument has fascinated me. Unlike building cabinets and furniture, the delight in completing a musical instrument would be much greater, I surmised. Rather than merely enjoying the looks of a completed project, there would be a kind of "birth moment" when the instrument came to life, issuing its first sounds. Not long ago I realized this 25-year-long fascination when I first strung up a steel-string guitar I built from a kit purchased from the legendary C.F. Martin & Co.

I wasn't disappointed. As I'd hoped, the guitar came to life producing clear, rich dulcet tones – and a big smile on my face.

Building the instrument was a kind of a journey, taking me down woodworking avenues I'd never ventured before. Like most adventures, there were a couple of stumbles along the way. Nothing serious, mind you, just wrong turns anyone makes when crossing uncharted ground.

While I can't begin to cover all the background, instructions and steps necessary to build a guitar – even from a kit – in this article, I can provide you a "diary" of the 100-plus hours I spent making jigs, assembling and finishing my Martin model 000-18 guitar.

For the Novice, Go With a Kit

Building from a kit offers many advantages for the novice luthier (or stringed-instrument maker). Most, but by no means all, of the critical shaping work is already complete. For example, the guitar neck, a complex shape with several critical features, is almost finished. The sliding dovetail where the neck joins the body is milled, although final hand-fitting is necessary.

The solid mahogany sides were pre-shaped, but weren't really close to final shape. The solid Sitka spruce top and mahogany back arrived in their final thickness and oversized shape. The rosewood fingerboard was (thankfully) precut with kerfs for frets and the rosewood bridge was shaped.

The kit is complete, including a 24-page instruction book. All the builder needs to supply are adhesives, finish material and time.

When the kit arrived in its sturdy box I set about reviewing and inventorying the many parts, some of which were familiar and others not so. This process helped familiarize me with such oddities as ribbon, perfling, binding, neck heel cap and nut blank.

This is also a time to very carefully check each part to make certain it is the right part for the kit you ordered. I found, for example, that the wrong fingerboard was included in my kit, which would have rendered the guitar impossible to tune. Martin, through its retail kit and supplies company, The Guitarmaker's Connection, replaced the fingerboard with the correct one when I brought it to their attention.

Read, Then Read Some More

Then came the reading and rereading of the instruction book. My first impressions were that I had a lot to learn. The instruction book seemed to raise more questions than answers. To find these answers I turned to a friend who had built guitars and he recommended the "bible" of guitar making – a book called "Guitarmaking: Tradition and Technology" by William R. Cumpiano and Jonathan D. Natelson (Music Sales Corp.).

After a lot of reading I was now confident enough to begin working on my guitar. The first order of business was building an adjustable fixture that was made to the exact shape of the guitar body. You can see it in photos on page 87. It took some time but was worth it. Overall, I'd guess a quarter of the time it took to make the instrument was spent making jigs and fixtures that would make building the guitar much easier.

by Steve Shanesy

Comments or questions? Contact Steve at 513-531-2690 ext. 1238 or steve.shanesy@fwpubs.com.

Photo by Al Parrish

Gluing Up the Rim

The first steps in building the guitar was gluing the neck and end blocks of solid mahogany to the delicate guitar sides. The completed assembly is called a "rim." The neck block is stout and provides the internal body part of the tapered, sliding dovetail joint that connects the body to the neck.

While this glue-up was curing, I worked on the back. The book-matched solid-mahogany back was already joined and slightly oversized. It did require routing a shallow groove lengthwise through the joint where the black perfling strip was inlayed. Once this was glued and sanded flush, I glued in the back bracings.

Top and Back Bracing

Guitar back and top bracings are very important in providing engineering structure, but they also play a critical role in the quality of sound the instrument produces. Braces must be strong enough to withstand the force of the tightened strings, but flexible enough to allow the back and top to vibrate and amplify the sound of the vibrating string.

Reducing the material on the braces for a better fit, called scalloping, is shown in the photo above. The carving is done after the braces are glued in place.

Braces of various shapes and sizes are glued to the inside of the back and top. It's best to "scallop" the braces, as shown here, by carving away some material. Scalloping weakens the brace but also makes the back and top more responsive to the vibrating strings.

At this point, I put the rim in the fixture and prepared to glue the "ribbon" in place. Ribbon looks like miniature dentil moulding. It reinforces the top and bottom edge of the sides and provides the necessary glue surface for joining the back and top to the sides.

In the photo at right, ribbon is being glued and clamped to the top edge of the sides with simple household clothespins used as clamps. You'll also see that side braces have been glued cross grain to the sides. They prevent the sides from cracking and provide compression strength.

Before gluing the back and then the top to the sides, the decorative inlay around the sound hole in the top (called the "rosette") must be installed. The inlay con-

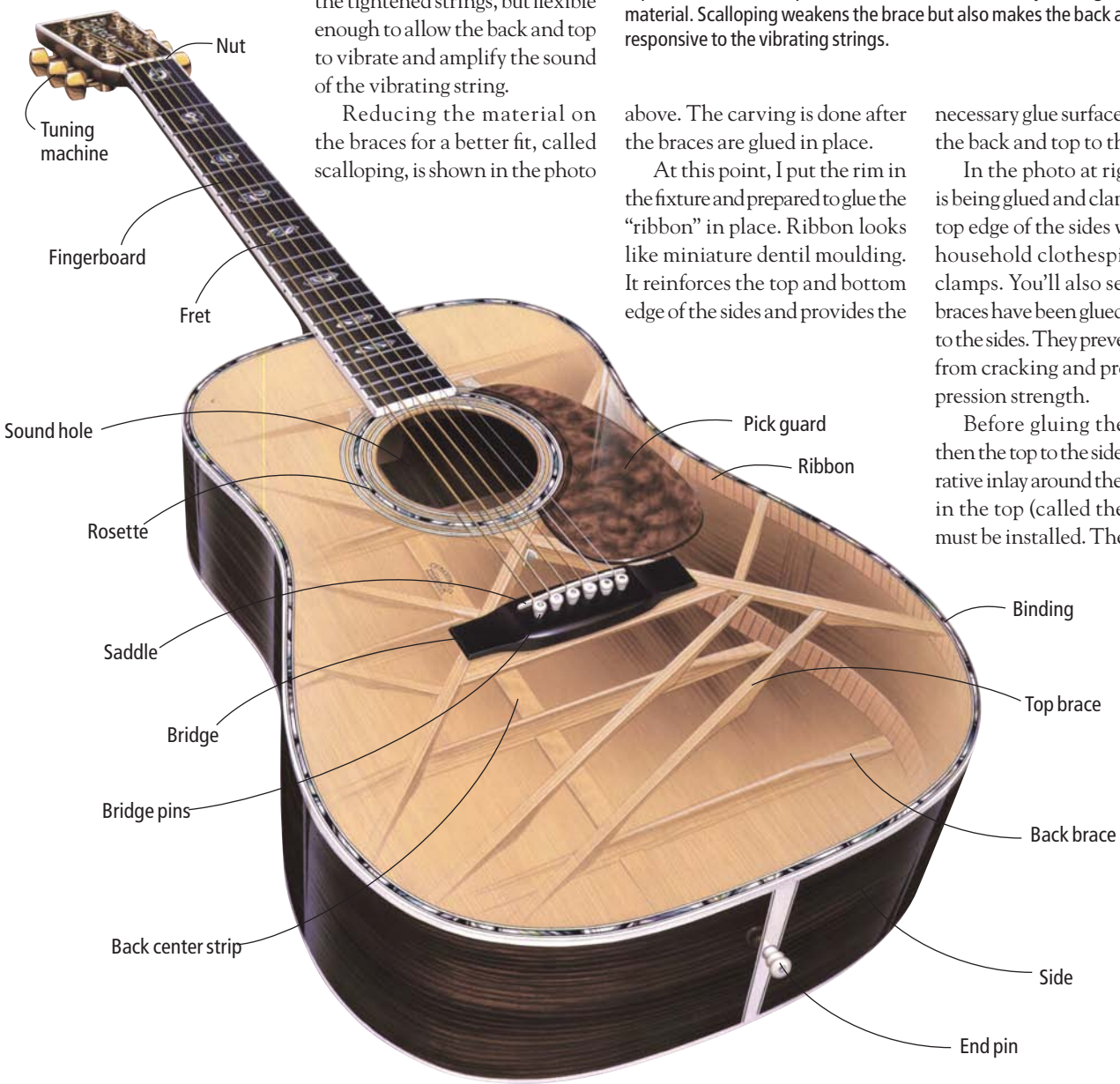


Illustration courtesy of C.F. Martin & Co.

Clothespins are the perfect clamps for gluing on the ribbon at the top and bottom edges of the sides. The strips of ribbon are flexible enough to follow the contour of the sides. Note the side braces – walnut vertical pieces – also have been glued.

sists of straight, thin strips of flexible black and white material of two different thicknesses. Varying the pieces as they nest side to side gives the inlay its design.

The two channels around the sound hole where the inlay is glued are routed at the factory. After the rosette is glued, it's sanded flush with the top. When this step was successfully completed I breathed a sigh of relief. This delicate work is one of the most visible parts of the finished guitar.

The bracings for the top (which includes the tone bars, the reinforcement strips around the sound hole and the bridge plate) and a hardwood piece glued directly below the bridge location, were all glued in place and scalloped as necessary.

Glue Up the Body

As mentioned earlier, the back is glued on first. But before it can be glued, notches must be made in the ribbon where the braces intersect it as shown below left. Because the back is contoured, it must be on top when glued. It's best to make a gluing board – a flat, ¾" piece of plywood – which is roughly the shape of the rim. With the rim in the fixture, elevate the gluing board to allow clamps to be placed under the assembly and position the rim on board. Apply glue to the edge of the rim, carefully place the back in position, then clamp things up.

After the glue has dried, the top can be glued to the assembled rim. Again, use the gluing board, position the top on it with the braces up, apply glue to the rim edge and carefully position it. Now clamp it together.

Once the glue has dried, the overlap of the top and bottom can be trimmed flush to the rim. A router with a flush-trim bit works, but care must be taken to avoid any tear-out, especially on the straight-grained spruce top.

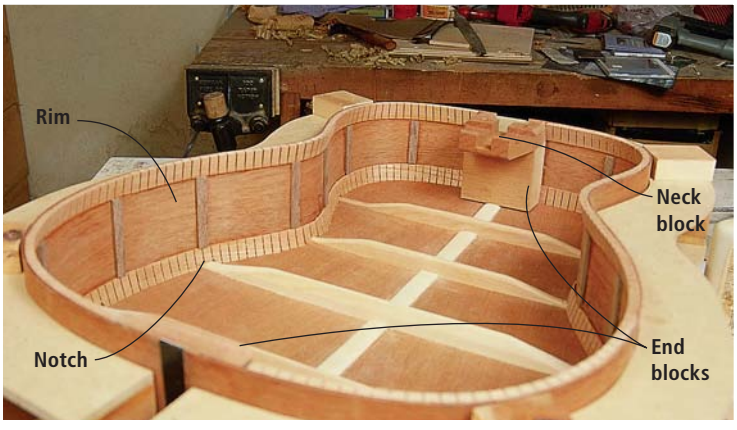
Then it was time for another delicate routing operation. A small "rabbet" was required all around the edge of the joint where the top and bottom join the rim. I used a rabbeting bit to make this cut. After cutting the rabbet, I glued in strips of black binding material. I used many strips of masking tape to hold the binding material in place while the glue dried.

By the time the tape was removed the body was finally taking shape and started looking like the beginnings of a real guitar. A light thump on the top or back produced a nice resonant tone.

Carefully Fit the Neck Joint

I wish I could say that each step of the process built my confidence in completing the project successfully. But unfortunately, it seemed each new step provided another challenge in which the success of the project hung in balance. The next task, which was fitting the

After the back is in position and the ribbon is notched to receive the ends of the braces, they are ready for gluing (below). The rim is turned over, glue is applied to the top edges of the ribbon and the back is positioned and then clamped. A clamping board, slightly larger than the guitar body, is placed below the rim fixture, which is where the clamp pressure is applied. Blocks are placed below the clamping board to create space for the clamps (right).



neck to the body by paring away minute amounts of material from the sliding tapered dovetail joint, was no exception.

Not only was a solid joint required, but the position of the neck on the body was critical. Shaving too much from one side could skew the neck to the right or left, or create a condition where the guitar strings would end up too high or too low on the fingerboard. Needless to say, I did a lot of test fitting as the paring work proceeded. In the end, I felt the job was satisfactory, but the real proof would be in stringing up the guitar once completed.

Before attaching the neck, more work was required on it. Holes had to be drilled in the head for the tuning machines (the studs where the strings attach and are tightened to the correct note). I also took this time to inlay three small diamond shaped pieces of ivory that I had tucked away years ago waiting for "just the right project." If this wasn't it, I didn't know what would be.

After the top and bottom are glued to the sides (also called the rim), the overhang must be trimmed flush to the sides. A router and flush-bearing bit work well. Once trimmed, a small rabbet is routed in the edges where bindings will be glued.

Black binding material is glued into the rabbets on the top and bottom edges of the body sides. It's carefully glued using model cement. It's held in place with many pieces of masking tape, gluing a section, then taping, gluing more, then taping, etc. Note the black center line, which is the perfling strip.

It was also necessary to carefully cut away part of the spruce top below where the fingerboard would be later glued. This would accommodate the adjustable metal truss rod that travels through the length of the neck and into the body. The rod makes subtle adjustments in the height of the strings above the fingerboard.

When this fitting is satisfactory, you can glue the truss rod and fingerboard to the neck. I took no chances of the rod working loose over time and used epoxy.

Fretting Over Fret-work

The next chore is installing the frets in the fingerboard. These are the metal pieces that run across the neck and make the various musical notes by pressing down the strings just behind the fret. Placement is critical to making the right sound – not too sharp or flat. Fortunately, as mentioned, the slots were pre-cut in at the factory so location wasn't an issue.

The fret wire, as it's called, came in a long length. While it looks round when installed, it actually has a flat edge that's barbed. This edge is hammered into the kerf made to receive it. The barbs prevent the fret wire from being pulled out. The trick in installing the 20 frets is to pound them into their kerfs so they all seat fully.

While a high fret could be filed down, it's best to get them all as close as possible. After the frets are installed, it's still a good idea to carefully run a file over them to ensure they are the same height.

It's recommended that you finish the neck and body before gluing them together. It's necessary, therefore, to carefully mask off areas like the fingerboard and neck-to-body dovetail joint so finish doesn't get on these areas.

After sanding to #220 grit, I applied a three-step finish to the mahogany section of the body. I first used a red, water-based aniline dye, then applied a warm brown oil-based stain over the dye. I then applied a topcoat using clear, semi-gloss lacquer, spraying from an aerosol can. I applied several lacquer coats, wet sanding with #400- and #600-grit wet/dry sandpaper between coats.

Because I'm an experienced finisher, this process was actually the easiest and most relaxing part of the entire building process. When the finishing was done, it looked wonderful and I knew I was nearing the finish line. Only two more critical steps to go – gluing the neck and body, then locating and gluing the bridge in precisely the right location.

The body and guitar neck are joined using a tapered, sliding dovetail. Most of the machining of this crucial joint is done at the factory, but final fitting is done by the builder, slowly paring away material and frequently checking the fit. The brass fitting in the neck is not used in assembly, but it helped hold the part in place when it was shaped at the factory.

The care and test-fitting of the body to the neck joint paid off when gluing and clamping the parts together. In all, it was a fairly simple process. Because of the taper in the dovetail joint, the pressure of a single clamp here was all that was needed. Two other clamps were used where the fingerboard was glued to the top. To my delight, when I removed the clamps the next day, my guitar project was becoming a guitar.

While there remained a few other chores to complete the instrument, only one had the potential for leading to a major problem if not done correctly. That was the placement and gluing of the bridge. The bridge rests on the top and is where the strings connect to the body. Placement is crucial because the distance from it to the frets on the neck determine the sound of each note.

Before the bridge is glued, very careful layout following a mathematical formula determines the precise location. Then, the finish is scraped away to bare wood in order to create a good wood-to-wood glue connection.

Two Steps Backward

Because this was my last chance to create a major problem, I naturally took advantage of the situation. I took too long to position and clamp the bridge, too much of the glue dried and it was obvious the joint wouldn't withstand the tremendous pressure from the tensioned strings. I concluded I should remove the bridge and re-glue it – except that it was, unfortunately, half glued.

You know how it is: When one thing goes wrong with a project, one bad thing leads to another. In my case, using water to soften the glue to release the bridge reacted with the very thin piece of metal I was using to work the water into the joint and apply slight prying pressure. The water and the metal created a black stain that leached through the soft spruce top and under the finish around the bridge. It looked awful. After bit of cursing and self-condemnation for not knowing better, I concluded the damage would require more than a touch-up. I proceeded to sand off all the finish from the top.

The second finish job and gluing of the bridge went well. I was in the home stretch. I shaped the "nut" and the "saddle." The nut is placed at the top of neck where the strings are stretched over from the head and travel down to the body of the guitar. The saddle performs the same function on the bridge. Each required a fair amount of shaping and fitting to get them just right.

Lastly, the tuning machines were installed in the head and the pick guard was positioned on the body. These were probably the easiest tasks of the entire job, and fittingly, the last.

The Moment of Truth

It was time to string it, tune it and test it out. As I began tensioning the strings the first tentative sounds emerged. As the strings were tightened more the sound of my new instrument gained clarity and began to reveal its sound quality. Then came some strums, some chords and at last a call to the family to gather round while I showed off what was the fulfillment of a quarter-century fascination – the making of a musical instrument – a project that came to life, in my very own hands.

Upon reflection, I realized that most of the anxiety I felt during numerous steps of the process were largely a fear of the unknown – concern about making some terrible mistake. I now know that much of my fear was unfounded. Certainly, caution was necessary, but I should have relied more on my confidence as a skilled woodworker and just proceeded without so much worrying. In the end, the skills prevailed and I'm the very proud owner of one fine-sounding steel-string guitar. **PW**

SUPPLIES

C.F. Martin & Co.
800-247-6931 or
martinguitar.com

1 • Martin 000-18 Guitar Kit #18KITFM, $350

Amazon.com

1 • "Guitarmaking, Tradition and Technology" by William R. Cumpiano and Jonathan D. Natelson (Music Sales Corp.) $24 plus shipping

After the fingerboard is glued to the neck, fret wire is installed. The wire, which comes in a long length, is gingerly hammered into position. Very thin kerfs in the fingerboard receive the flat area on the edge of the wire. The flat part has small barbs in it to keep it from coming loose.

The last crucial step in completing the guitar is gluing the bridge in its precise location. If positioned wrong, it will be impossible to properly tune the instrument. I used two drill bits with the same size holes as those to be drilled for the bridge pins to keep the bridge in position while clamping. This worked well after my first failed attempt at gluing the bridge.

Four Good Ways to Build Drawers

Our staff offers simple, strong and fast ways to make this important furniture component.

In woodworking magazines, books and plans there's almost always an omission that's big enough to drive a truck through: How to build the drawers for the project.

Usually the woodworking author (always well-intended, I can assure you) writes instructions such as: "Build the drawers using your method of choice."

Well that's all well and good unless you're like a lot of woodworkers who have never actually chosen a method of drawer-making. To remedy this problem, we've come up with four good techniques for building drawers that our editors have refined after years of shop work.

Each method has its pros and cons. But based on your skill level and your particular set of tools, there is likely something here you can use for your woodworking. Before we discuss the differences of each method, here are the similarities.

By Christopher Schwarz & David Thiel

Comments or questions? Contact Christopher at 513-531-2690 ext. 1407 or chris.schwarz@fwpubs.com. Contact David at ext. 1255 or david.thiel@fwpubs.com

Photo by Al Parrish

Drawer Basics

When designing a drawer and coming up with a cutting list, here are some rules we follow.

In general, the drawer front should be 3/4" thick – unless it's a drawer with a "false front." False-front drawers are a simple drawer box with the front screwed to the box. It's a handy way to fit drawer fronts in projects where the drawers run on metal slides.

The sides and back of the drawer should be 1/2" or 5/8" thick. Use thinner stock for smaller drawers and thicker stock for big ones.

The bottom is usually 1/4"-thick plywood for small drawers or 1/2"-thick material for bigger drawers, or drawers that will hold heavy objects.

The bottom should slide into the drawer in 1/4" x 1/4" grooves milled in the sides and drawer front. If the bottom is thicker than 1/4" you'll need to cut a bevel or rabbet on its edges. The back of the drawer should be 1/2" narrower than the sides to allow the bottom to slide into place at the rear.

Sliding Dovetails

This tricky technique uses only two setups on your router table to cut very strong drawers that are perfect for a project that uses drawer slides. That's because it automatically creates a 1/2" space for side-mount drawer slides.

The drawers go together like a puzzle, and the interlocking nature of the joint ensures their longevity. The downside to the technique is that you need to be very persnickety in setting up your tools; sliding dovetails do not suffer fools lightly.

The thickness of your materials must be dead on (check it with a dial caliper) and you must make a couple more test runs on scrap with this technique than the others. But once you master it, watch out. You'll use it all the time.

Hand-cut Dovetails

This is the traditional, and many would argue, the strongest way to make a drawer. Traditional drawers have through-dovetails at the back of the box and half-blind dovetails at the front.

Our favorite technique is to make the drawer sides, front and bottom using 1/2"-thick stock and then glue on a 1/4" -thick piece of veneer for the front. This technique allows you to cut through-dovetails at all four joints (which is easier) and to stretch your supply of good drawer-front material.

This method is the most time-consuming of the four in this article. But that's the cost of strength and endurance.

Drawer-lock Bits

This specialty router bit allows you to cut all the corner joints with one router table setup. With minor adjustments the bit will even mill the groove for the bottom.

Drawer-lock joints are easy to assemble and attractive. The interlocking design is strong and offers significant gluing surface.

The downside to this method is that you need to make several test cuts to get the settings perfect, and you need to purchase a fairly pricey router bit – about $30 to $55 depending on the brand.

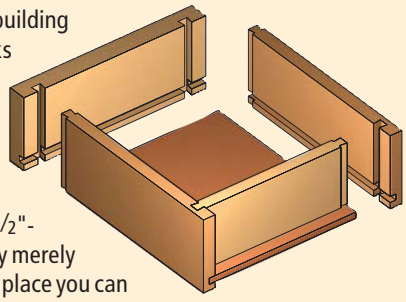
Rabbets and Brads

When we need to make drawers fast, this is the way we go. You can cut all the joinery for your drawer (including the bottom groove) with just a stack dado and one setup on your table saw.

It's a fairly forgiving technique that beginners master quickly. It's only real downside is that it's the weakest of the four joints. While the drawer is plenty strong for most applications, it's not in the same league as a traditional dovetailed drawer.

— CS

SLIDING DOVETAIL DRAWERS



Sliding dovetails aren't just for building bookcases. This technique works extremely well for constructing drawers that will be mounted with mechanical drawer slides.

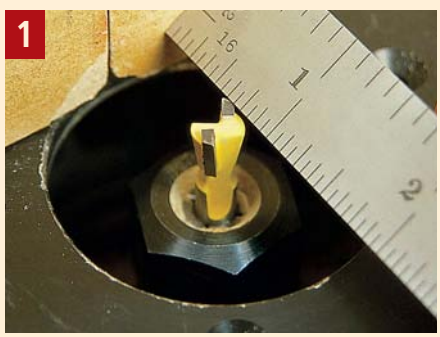
When you follow these instructions you'll end up with an inset drawer that has a perfect 1/2"-wide space for a drawer slide. By merely putting the socket in a different place you can create an overlay or lipped drawer, too.

A couple notes on this technique: You need the right-size bit for the joint. The common 1/2"-diameter dovetail bit is too big when using 1/2"-thick drawer sides. You're better off with a 3/8"-diameter dovetail bit, which is commonly available.

Also, you need to take some care when making the test cuts on the male portion of the joint. If your drawer uses a different species of wood for the sides than for the front, check the fit of the male portion of the joint in a socket in both species. This might sound a bit odd, but different species react differently to a cut. It might just be .002" difference or so on each side of the joint. But with sliding dovetails, even small amounts matter.

Finally, cut all your parts 1/16" wider than your finished size. The router bit will tend to blow out the grain when it exits the work. After you mill all the joints, run each long edge over your jointer to remove the inevitable tear-out.

— *CS*



1

To cut the socket, set your 3/8" dovetail bit so it protrudes 5/16" above the top of your router table. Set the fence so there is exactly 9/16" of space between the bit and the fence. Make a test cut to confirm your settings.

2

Cut the sockets on both ends of the drawer front. Note that I use a backing board faced with sandpaper. This minimizes tear-out when the bit exits the work. The #220-grit sandpaper keeps the work in place during the cut.

continued on page 92

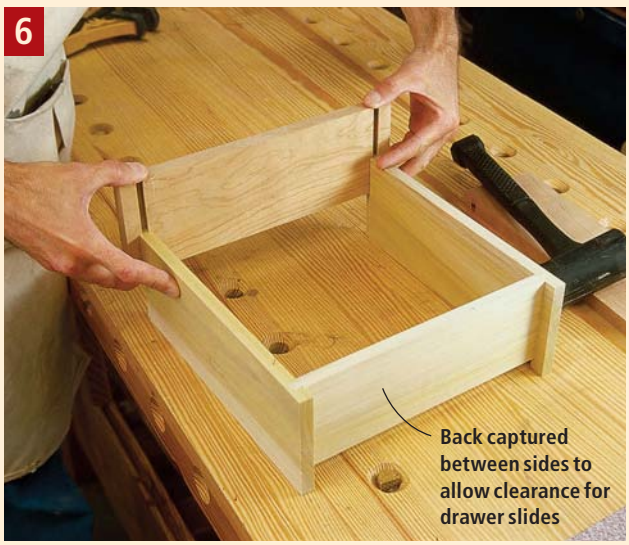
SLIDING DOVETAIL DRAWERS

continued from page 91

Using the same setting, cut the socket on the back end of the side pieces. This socket holds the back in place.

The finished result. You can see the tear-out on one of the joints. Also note the "cabinetmaker's triangle" drawn on the edges. This reminds me of which way my parts will be oriented as I machine and assemble them.

To cut the male portion of the joint, leave the height of the bit the same. Shift the fence so only $^{7}/_{64}$" of the bit protrudes from the fence. This measurement worked for my Oldham bit, which measures .275" at its smallest point. Your bit may vary.



Make a test run before cutting the groove in the sides and front for the drawer's bottom. The parts should slide together easily and require just a couple taps from a mallet to seat them firmly.

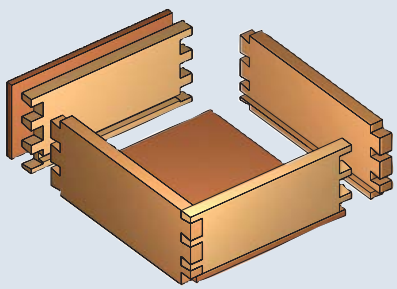
In the end, this technique produces a wicked-tight mechanical joint with just a couple tool setups. It's one of those few techniques that is both fast and strong.

HAND-DOVETAILED DRAWERS

This is a time-consuming but rewarding way to make a drawer. There is no stronger, beautiful or individual technique than cutting dovetails by hand. Like all good things, it requires practice. But once you have a couple drawers built, you'll find your saw and chisel skills improve exponentially.

A couple notes on this technique: There are entire books written about dovetailing, so we couldn't possibly cover everything that's involved. However there are a few basic principles and tricks that make the process easier.

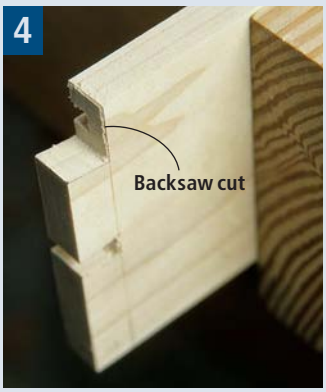
Use good tools. A sharp well-tuned saw and chisel make all the difference. Cheap, inaccurate or dull tools will make the learning curve much steeper. Before you try this technique on a drawer for a project, try it out on some scraps first. Even experts need to "warm up" with a test joint or two when dovetailing. — *CS*



A sharp and high-quality cutting gauge, such as the Tite-Mark, makes lines that are easier to see than with a scratch gauge, which uses a pin.

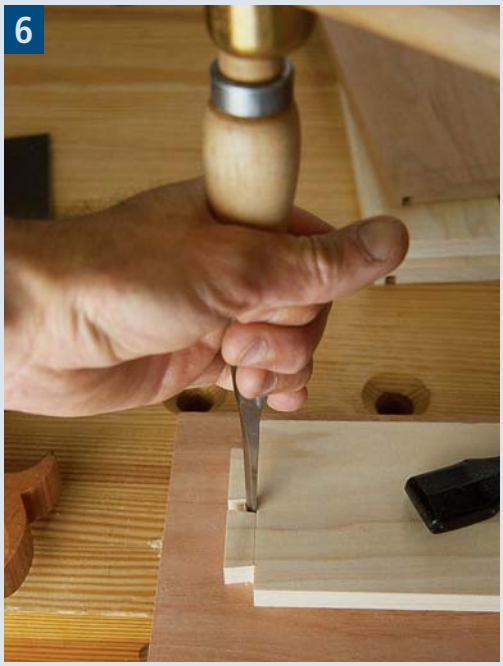
Mark out your tails on the end grain and the outside face of the drawer side. Strike your lines with a marking knife followed by a mechanical pencil. This will increase your accuracy. Mark the waste portions of the joint with an "X" and then make your cuts.

Remove the waste between the tails with a fretsaw or coping saw. The closer to the bottom of the tail you get, the less clean-up work you'll have with a chisel.



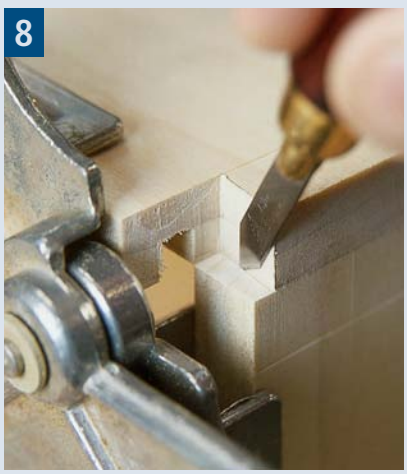
Remove the waste outside of the tails with a backsaw, which cuts straighter than the fretsaw.

The Tite-Mark gauge can be used like a chisel to remove waste from between the tails and on the ends of the joints, as shown. If you sharpen the tool's flat cutter, it will slice wood like a chisel.

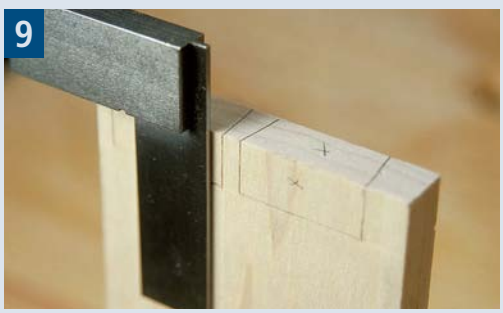


Remove the remainder of the waste with a bench chisel. The most important thing to note here is you should stand so you can see when the chisel is perfectly perpendicular to the work, as shown here.

I picked up this trick from the Internet and it works great. To mark the pins, clamp the tail board in place to the pin board using a set of inexpensive 90° clamps, available from any home-center store. This clamping setup allows you to focus on marking accurate lines.



I like a spear-point knife as shown here because you can work on the left and right sides of a tail with just one tool. With other tools, such as a pocketknife, you run the risk that your knife line isn't in exactly the right place.

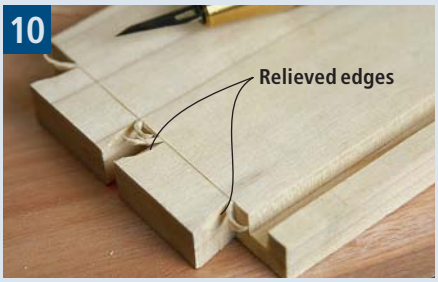


Transfer the lines marked on the end grain down the face of the board. Mark your waste pieces and remove the waste using a backsaw, fret saw and then a chisel.

continued on page 94

HAND-DOVETAILED DRAWERS

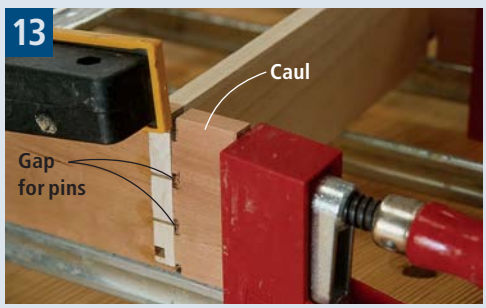
continued from page 93



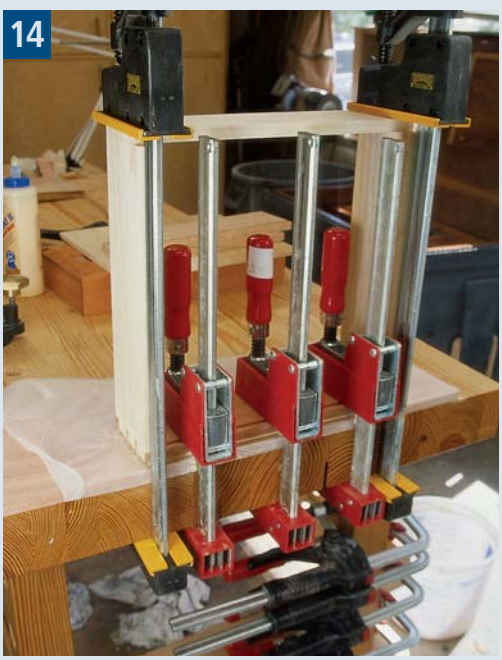
Before you try to assemble the joint, relieve the inside edges of the tail board with a knife as shown. This part of the joint is never seen and it allows you to easily slide the parts together.

A deadblow mallet is all you need to assemble small drawers. For larger assemblies, I recommend backing up the joint with a piece of scrap to distribute the hammer blows evenly.

The assembled joint. No, those aren't gaps. Those are the pencil lines that I split in half with my saw.



I have tried a variety of ways to clamp dovetails, but I keep coming back to these cauls. They take just a couple minutes to make and put the pressure right where it's needed.

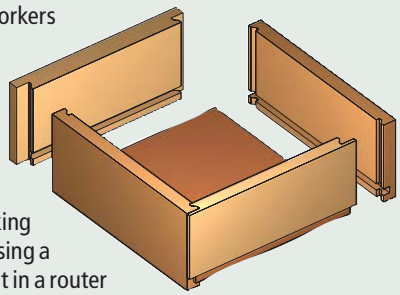


To glue the 1/4"-thick veneer front to the assembled drawer box, use your workbench as a giant clamping caul as shown.

Apply the veneer before planing or sanding your dovetail joints. Otherwise you'll just make more work for yourself. It's better to do all the trimming at once.

The completed joint. Once the finish is applied and the cherry drawer front ages a bit you will barely be able to tell the front is applied.

DRAWER LOCK BITS

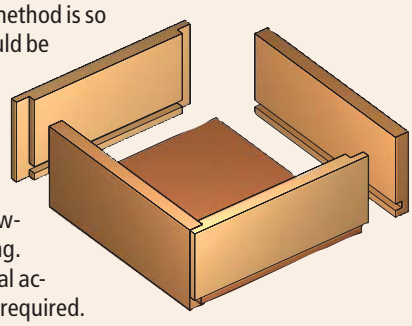


Some woodworkers swear by the router. And why not? It's a great tool for many applications – including making drawers. By using a drawer lock bit in a router table it's a simple process to quickly create dozens of hardwood drawers (plywood isn't advised) and end up with strong, attractive joints. It doesn't matter how deep, wide or tall your drawer is. With the bit set, all you do is run the inside edge of each side – no adjustment necessary.

There's always a trade-off, and with drawer lock bits it's price and set-up. Though you'll need only one bit, it can cost as much as $55. Once you have the bit, it's critical to get it set correctly in your router table for a tight, accurate fit.

While the following steps walk you through the setups for a simple inset drawer, the bit can also be used for overlay drawers and also allow clearance for mechanical drawer slides. By first rabbeting the necessary clearance on the backside of the drawer fronts, the same bit will once again do all the joints for any of these drawers. *— DT*

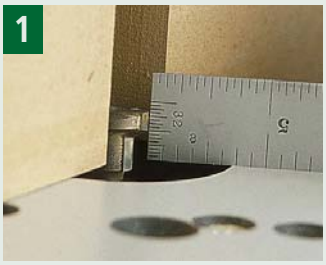
RABBETS AND BRADS



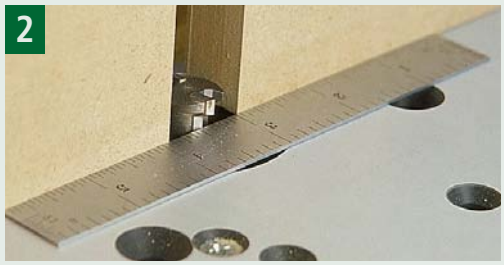
This drawer method is so simple it should be illegal. With one table saw setup and a dado stack you can build drawers all day long.

Two critical accessories are required. You need a stacking dado set. You'll only use the two outer blades of the dado set to cut 1/4" rabbets. (If you don't have a dado set you could also use a single 1/8"-kerf blade. This would require some set-up changes, but the concept is the same.) You also need a zero-clearance insert for your saw, which supports your work during the cut.

On a finished front drawer as shown here, rabbet the front and back. On a false front drawer, rabbet the sides. We recommend shooting brads through the sides into the rabbet. These brads will add some strength and reduce the clamping necessary to build these drawers. *— DT*



First set the bit to 1/2" high. This probably isn't the final setting, but it will put you in the ballpark. Make sure the router is unplugged for any step that puts your hands (or tools) near the bit.



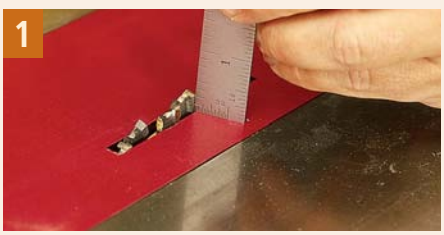
The second setup step is to align the rear cutting flute flush to the fence face. A small rule or straightedge makes this quick. To make things easier, it's also a good idea to set the fence parallel to the miter gauge slot at this time. Note that your fence faces should be set as close to the bit as possible.

Now it's time to adjust the final bit height. Run two pieces of scrap material (the thickness of the scrap doesn't need to match your workpieces) flat against the table supporting the cut with your miter gauge. A perfect mating fit is shown. If the tongues fit all the way into the socket, great; but if the fit is loose, raise the bit.

Make the first cuts on both ends of the sides, with the inside surface against the fence. Use a backing block to stabilize the drawer side and avoid tear-out. This same setup will create the bottom grooves in the front and sides.

To run the drawer front and back, the fence must be reset. Unplug the router, then use one of the sides to adjust the fence to set the protruding flute of the bit flush to the outside edge of the side piece.

Then simply run both ends of the fronts and backs with the workpiece flat on the router table. Use a miter gauge to guide the cut. If you were making an overlay drawer, the front would need to be rabbeted for the necessary offset and the fence reset to run the drawer fronts.



Set it up once and forget it – how simple. The first step is mounting the two full dado blades to achieve a 1/4"-wide cut. Then set the cut height.

Next, slide the rip fence toward the blades and lock the fence exactly 1/2" from the outside tip of the blades.

You're ready to cut. The rabbets are made only on the drawer fronts and backs. The side pieces are left intact. The first pass should be made at the end of the piece. Use your miter gauge to guide the cut to remove the waste.

The second pass is made with the end of the piece guiding along the rip fence, defining the inside shoulder of the rabbet. It may be necessary to make a third pass to clean out the center of the rabbet's cheek.

The last cut is for the 1/4" x 1/4" groove to accept the bottom. It's made by running the two sides and front piece (shown) flat on the saw, guiding the bottom edge against the fence. The back is 1/2" narrower and has no bottom groove. **PW**

Make Your First

Learn to create this classic furniture detail using a template, a band saw and a little lathe work.

Photo by Al Parrish

I like the look of the Queen Anne side table shown here mostly because of the elegant shape of the cabriole legs. This table was produced in Philadelphia between 1740 and 1760, but the design of the cabriole leg has been around a lot longer.

Its actual history is a little murky – similar shapes have been found in ancient Egyptian chairs. The shape also is very prominent in traditional Chinese furniture.

The shape has two curves – the upper one is convex and the lower one is concave. It's often given anthropomorphic qualities, evoking an elephant trunk, dragonfly legs or some four-legged animal, leading (not surprisingly) to the frequently seen ball-and-claw feet carved at the foot of cabriole legs.

From a cabinetmaker's point of view, this table is a good introduction to making cabriole legs and it's a piece that can be built in a relatively short amount of time. I chose the basic cabriole turned foot or "club" foot because it also is a good introduction to the leg design.

I'll focus on the legs in this article, and in the November issue we'll include an article on how to complete the rest of the table project.

by Glen Huey

Glen builds custom furniture in Middletown, Ohio, for Malcolm L. Huey & Son, teaches woodworking and is a contributing editor for Popular Woodworking. *He is the author of "Building Fine Furniture" and "Fine Furniture for a Lifetime" (Popular Woodworking Books). See more of his work at hueyfurniture.com.*

Cabriole Legs

Baby Steps to a Shapely Leg

When taken in small steps, forming a cabriole leg is straightforward work. First you choose the proper leg blanks (to show the best grain pattern), then transfer the pattern to the leg. Most of the material removal is done on the table saw and on the band saw.

The lathe is an important part of the process, but because much of the leg is shaped on the band saw, it's mostly clean-up work.

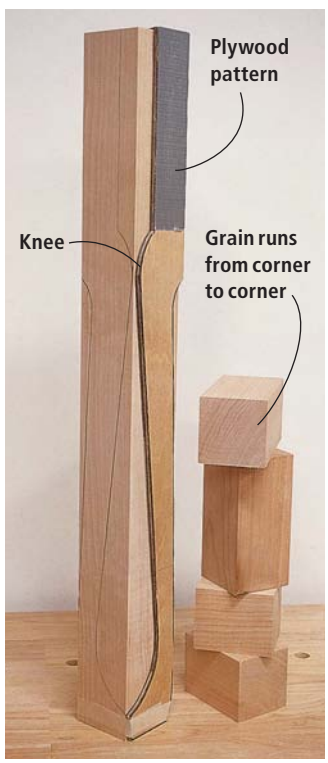
The last part is creating the details with a rasp, files, scrapers and sandpaper. Don't think of it as carving; it's simple stuff.

Pattern First

I've included a scaled drawing for the leg on page 98, and that's where you begin. Scale that pattern 400 percent to full size and adhere it to a piece of 1/4"-thick plywood (A full-size pattern is available at popwood.com; click on "Magazine Extras.") Then cut the pattern out on a band saw.

To ensure good-looking legs, it's necessary to select the best grain orientation on the 2 3/4"-square leg blanks. Align the blank so that the growth rings run from corner to corner in cross section with the grain terminating at the corner where the knee is located.

Use the pattern to lay out two silhouettes that touch at the knee. With the pattern transferred, cut the legs to length, saving the cutoffs for the knee blocks – the transition from the leg to the apron.



The pattern is the secret of cabriole legs. With the pattern transferred to the "best" faces the legs can be cut to length, but hang on to the scrap pieces for later.

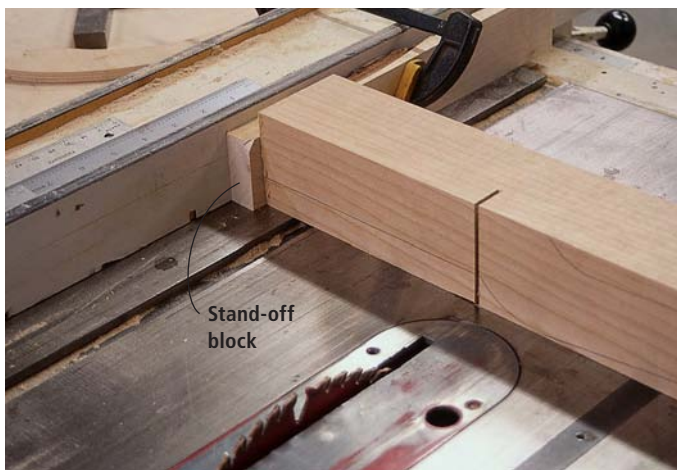
Defining the Leg Shape

The next step is to remove most of the material from the leg blanks to make them look like the pattern. This is done in two stages, using the table saw to shape the leg post and the band saw to shape the curved part of the leg.

At the table saw make two cuts per leg to define the top edge of the knee. Make the cuts at the bottom edge of the leg post just above the knee. Cut only on the two sides that are patterned and cut just deep enough (about 7/8") to reach the edge of the pattern, leaving 1 7/8" width of the leg post intact until later.

That's all for the table saw for the moment. Next head to the band saw and cut the outside-facing pattern on one side. Do this in two cuts, starting from the top end of the leg and stopping in the middle. Then cut up from the foot. Leave a small bridge section in the middle uncut to keep the waste piece in place for now.

Leaving the waste pieces in place gives you a stable surface for



Photos by the author

The point where the leg post meets the shaped part of the leg is defined by two crosscuts on adjoining faces. I used a miter gauge on my table saw to make these cuts. Notice that I've used a stand-off block clamped to the lead part of my rip fence to gauge the proper height and to avoid any binding problems during the cut.

cutting the second side and leaves the entire pattern visible.

On the outside of the leg (above the knee) there isn't an easy way to leave a bridge, so I complete the cut and use a hot-melt glue gun to reattach the waste.

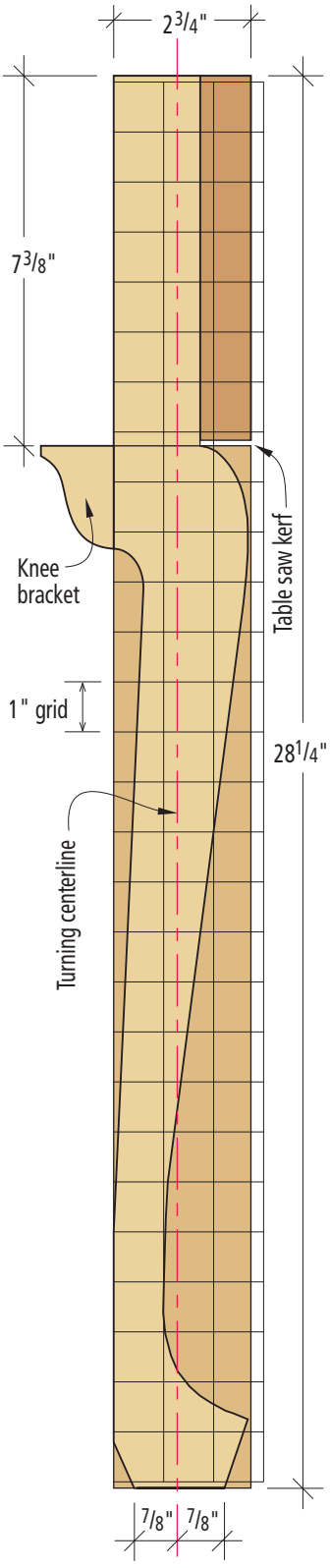
When the first side is cut, turn the blank 90° and remove the waste on the second side. The second side of the leg can be finished without bridging the cuts.

Once the second side is removed, return to the first side and finish the cuts by removing any connections. Repeat the process on the other three legs.

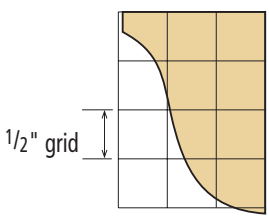
Turning the Leg

With the leg post and leg rough-shaped, mount the leg onto the lathe. Use the illustration to mark the center of the top and bottom of each leg blank, and mount the first leg on center.

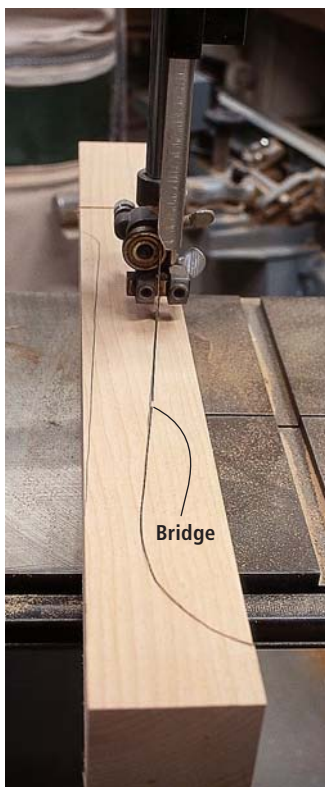
The turning starts at the foot of the leg. Begin by ensuring that the blank turns free and is not making contact with any part of the lathe. At your slowest speed, turn the foot with a gouge to a 2¾"-diameter just to the top edge of the foot (1⅛").



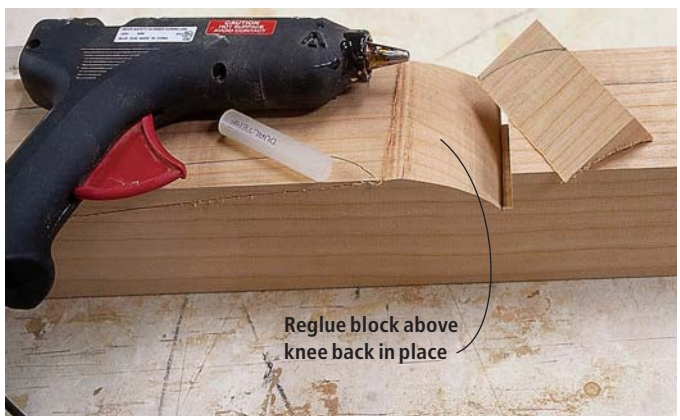
Leg pattern
(enlarge 400%)



Knee pattern
(enlarge 200%)

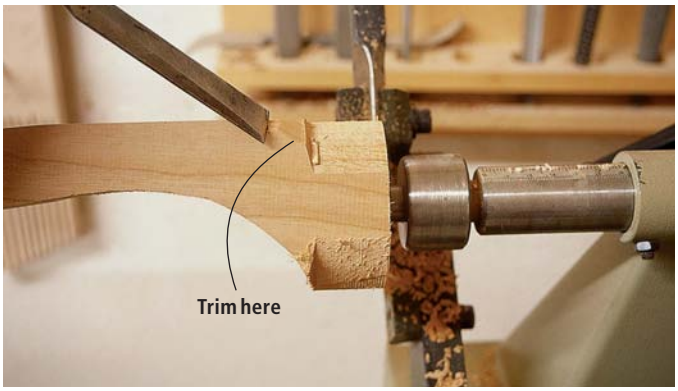


Cut the outside shape of the leg on the band saw, but leave a bit of material (the bridge), which keeps the waste intact until after the second face is cut.

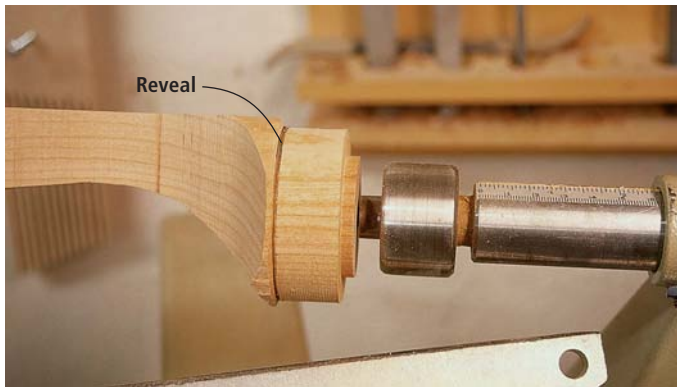


On the inner part of the leg a bridge isn't possible, so I use a spot of hot-melt glue to hold the waste piece temporarily in place.

With the waste pieces removed, the four legs quickly assume their classic cabriole shape.



After mounting the leg on the lathe, turn the foot to its finished diameter. It will be necessary to stop the lathe and trim the back of the leg where it meets the foot with a chisel, as shown.



With the foot at its final diameter, cut a slight reveal to separate the foot visually from the leg, as shown above.

You will need to stop the lathe and remove the waste material at the rear of the foot with a chisel. This will allow you to get your lathe tools in close enough to finish shaping the foot.

Use the point of your skew to mark and define the top of the foot. Then cut the 1/8" pad to a 1¾" diameter using a parting tool. Finally, roll the foot edge to the pad using a skew to complete the shape of the foot. Then go ahead and turn the other three legs to match the first one.

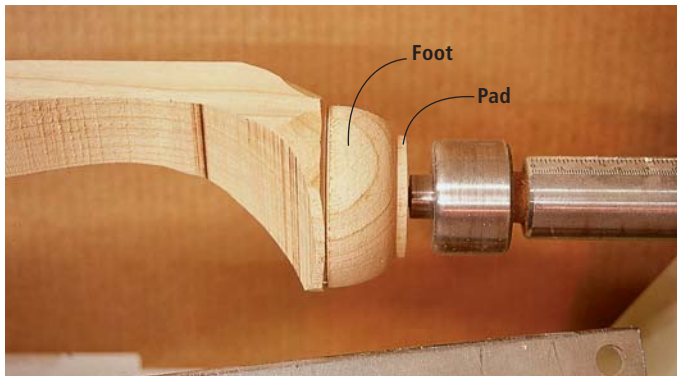
Sanding and Hand Work

The next step is to flatten the top of the foot so that the foot transitions smoothly into the ankle of the leg. While this can be completed with chisels and rasps, I find that a spindle sander speeds the process along.

It's time to shape the legs themselves. I use this Shinto Saw Rasp (tools-for-woodworking.com, $27) for the majority of my shaping, along with a few other finer rasps, files and scrapers.

These particular legs have a rather pointed knee so the shaping is basic. I begin by rounding the ankle to a complete diameter and then gradually I move up the leg by transitioning the shape to a square at the knee. By sight and feel you want to move from the roundness of the ankle to the square of the knee area.

This last step will give you the shape you want, but it's still pretty



Finally, the pad is turned to a 1/8" tall by 1¾" diameter at the base of the leg and the foot is radiused to meet the pad.

A spindle sander takes a lot of the effort out of the process of smoothing the transition from the leg to the foot.

There's no getting around some muscle power to shape the legs themselves. Proper tools speed things up, such as this aggressive open-form rasp.

rough. I follow the rasp with files and scrapers and finally sand the leg to a final grit of #150.

Mortising and Post Time

With the legs shaped and the leg posts still at full width, now is the time to choose your best legs for the front of the table.

Determine the most attractive leg orientation, then mark the 1/4" x 2 1/4" x 1 1/4"-deep mortise locations. They are set 1 3/8" in from the inside of the legs and 1/2" in from the top or bottom edge.

I used a mortising machine to cut the mortises for the aprons. The front lower apron is a single mortise while the side and back mortises are double mortises (with a 1 7/8" gap) to avoid weakening the leg posts.

With the mortises complete, you can now remove the rest of the material from the leg posts to give them their final shape. Head back to the band saw and cut away the waste at the leg posts. A wide 1/2" blade works best here. Make sure to cut the sides in the correct order to ensure a flat surface to support your cuts. Make the cut slowly to eliminate any wandering of the blade. These cuts establish the face sides of the leg posts and should be as neat as possible.

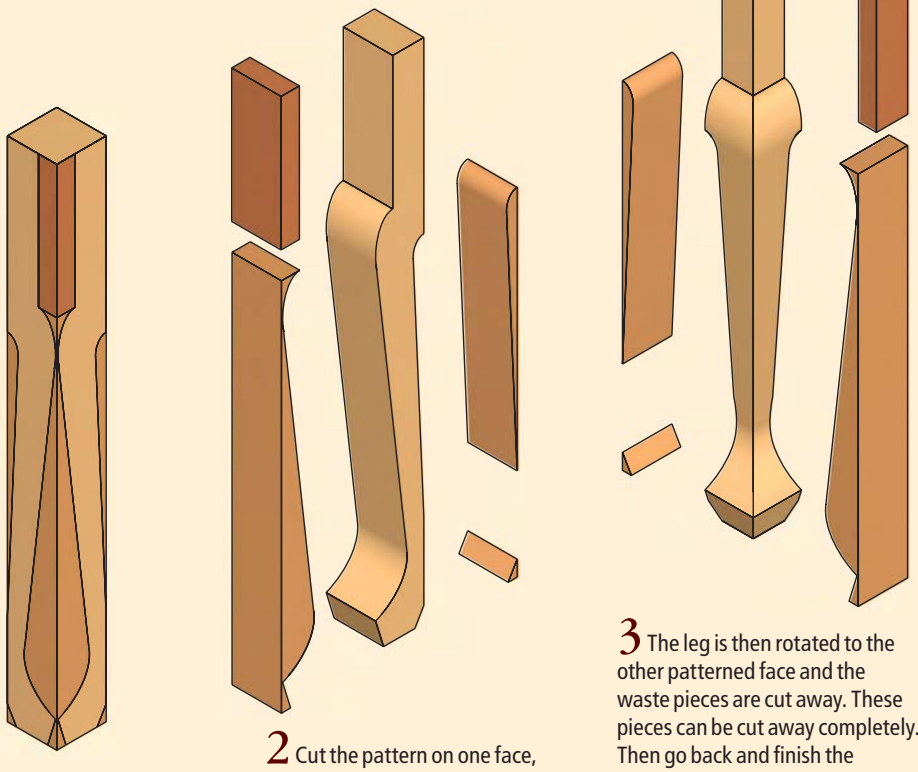
Spin the leg 90° and make the second cut. The legs are now complete. In the November issue I'll show you how to add the legs and knee blocks to the delicately sculpted table aprons and show you how to add a simple top to complete this heirloom-quality project. **PW**

TO LEARN MORE

For more information about cabriole legs, visit:

http://www.pbs.org/wgbh/pages/roadshow/speak/cabriole.html

THREE SIMPLE STEPS ON THE BAND SAW



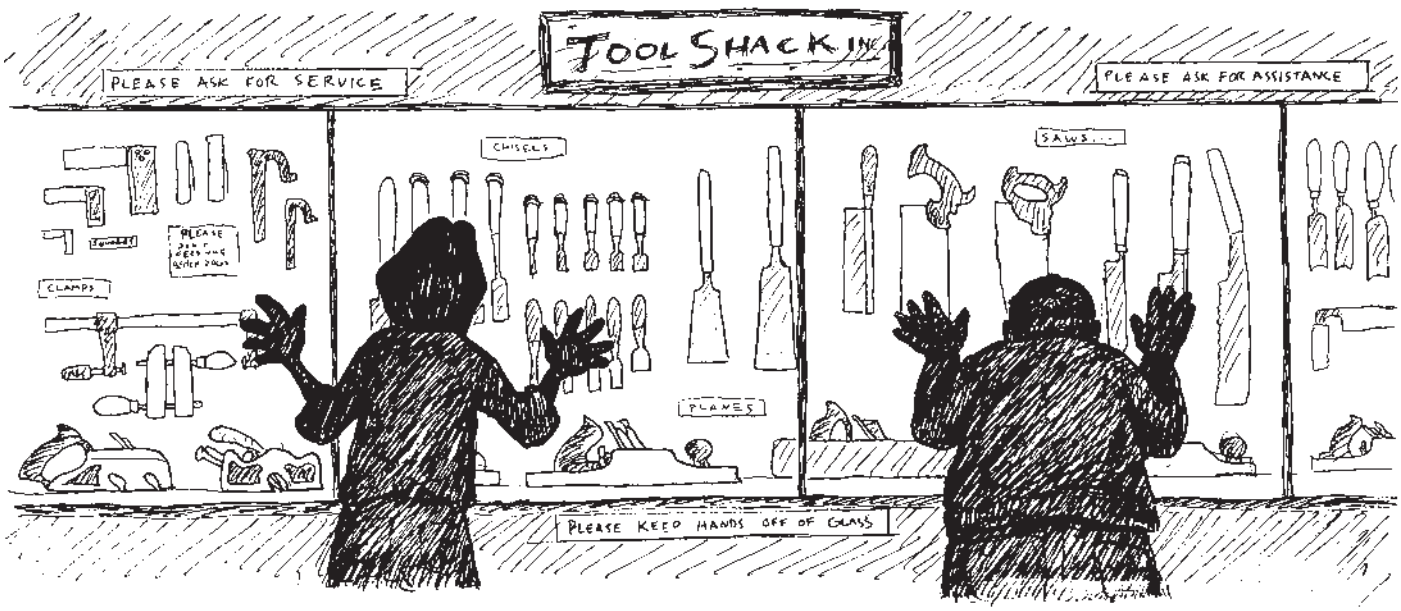
1 The first step is to trace the pattern onto perpendicular faces of the leg blank with the "knees" touching. These are outside faces, so choose the best grain pattern.

2 Cut the pattern on one face, working in from either end of each section. The pieces are separated from the leg above, but you should leave a small center section uncut to hold the waste in place for now.

3 The leg is then rotated to the other patterned face and the waste pieces are cut away. These pieces can be cut away completely. Then go back and finish the stopped cuts on the first face to complete the leg. Most of the work is done, and you can see the leg emerging from what had been a simple stick of wood.

While it might seem logical to finish sizing the leg posts before drilling the mortises, the full width helps support the leg during the mortising process.

After the mortises are complete, head back to the band saw and carefully trim away the waste from the leg posts on the two outside faces of the legs.



Illustrations by Will McDonnell

3 Most Essential Tools

You can't buy them, but you already have at least two.

When I started woodworking in New Hampshire with my fellow over educated woodbutcher buddies in the late 1960s, one of the most alluring aspects of working wood for a living was looking at, fondling and generally coveting fine woodworking tools. The guy who brought a new and interesting tool into work would get to be the leader of the pack – at least until he was topped by someone else showing up with another nifty tool acquisition.

I clearly remember when the lead carpenter brought in a thin-bladed, European-type miter saw (which made our rather clunky and heavy Stanley miter boxes look like crude stone-age tools). He was looked upon with great awe and amazement. Then he showed up with a set of brand-new wood-handled chisels that actually fit your hand and could take and keep a razor-sharp edge. Soon after, blue-painted hand planes that were of far better quality than any we could find on the shelves of our local hardware store (though not antique stores, where we regularly unearthed Stanley "Bed Rocks") began to appear in this one individual's toolbox.

It seemed that nearly all these tools, branded with names such as Marples and Record, were coming out of England. It turns out that the "British invasion" wasn't just happening in the music scene; it was in the tool world, as well. It soon became apparent to everyone on the crew that the bar was being raised every time this certain someone managed to get himself out of town. We finally wrangled it out of him that he had, indeed, found tool nirvana – a store on the outskirts of Boston that was selling a mouth-watering variety of imported hand tools.

After various threats, my crew mates finally extracted the directions to the place, allowing us to make the first of many pilgrimages to the original Woodcraft store in Woburn, Mass. Standing before the altar-like displays, we drank in visions of wood-handled chisels, specialized hand planes, bar (not pipe) clamps and many other "esoteric" tools that most of us had never actually seen in person. Woodcraft was the first place I laid eyes on a brand new jointer plane, a cabinetmaker's oval wood-handled screwdriver and a new timber-framer's mortise chisel – and I had to have at least one of each.

A similar phenomenon occurred when we stopped at Dunkin' Donuts on the way home. Over time, I did manage to acquire a wide selection (of tools, not donuts – well, actually both).

But then one fateful winter day, I experienced an amazing (though bittersweet) epiphany. I came to understand that tools – like donuts – were only a means

by Jim Tolpin

Jim has operated a finish carpentry and custom cabinetmaking business since 1969. He has written several books, including "Table Saw Magic" and "Measure Twice, Cut Once" (Popular Woodworking Books).

to an end: You could be a well-rounded woodworker as a result of the donuts, but not the tools.

This realization happened while I was working on the Pilgrim – a trawler yacht I had the pleasure and honor of helping build at Penobscot Boat Works in Rockport, Maine. As I busied myself laying out a curved transom window with my German-made trammel points set to a center point I had painstakingly established with my Starrett try square and marked with my Swedish-made layout knife, I looked up to see Tom Brown – an elderly, down east boatbuilder who had been working on boats since probably the end of the 19th century – begin to cut the yacht's rub rail to length.

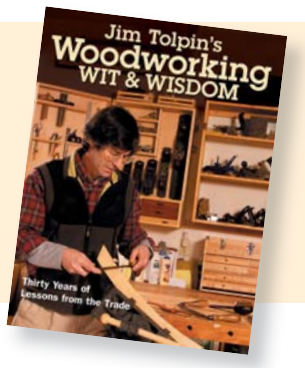
To get the new section of rub rail to mate with the section already attached to the hull, Tom had to cut a long scarf at a precise compound angle because the rub rail was curved two ways: to the sheer line and to the outside sweep of the hull.

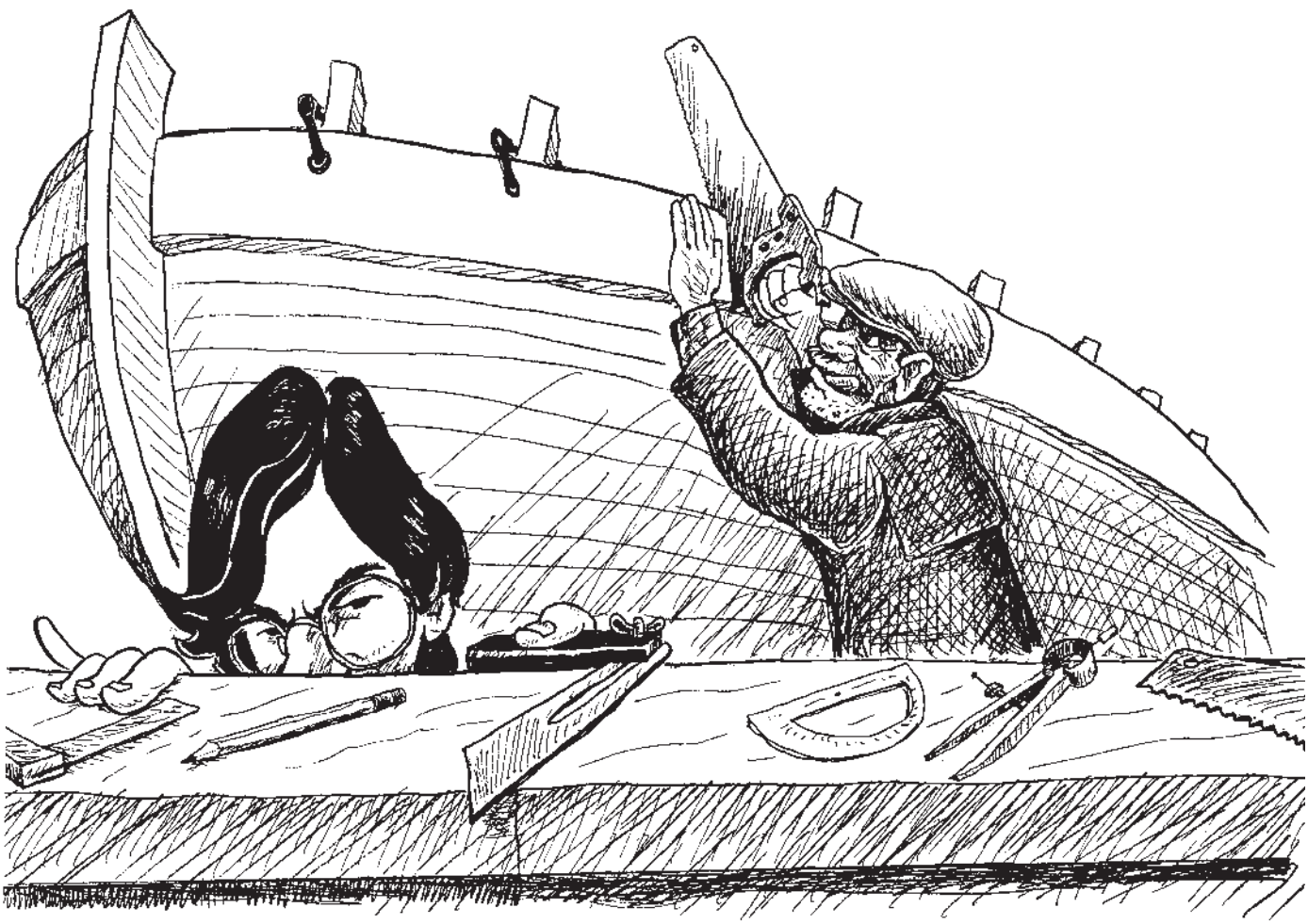
As I watched, Tom simply squinted at the new rub rail and began hand-cutting the scarf with his trusty old panel saw (a shorter version of a carpenter's standard hand crosscut saw). There were no layout lines on the rub rail. Instead, Tom was holding the length of wood in front of the scarf already cut in the rail that was attached to the hull. I was stunned! He was simply cutting that complex joint by eye!

On the first try, he got it "spitting close." He then pushed the loose rail hard against the one on the hull and ran the saw through the juncture of the two pieces to make a perfect match. In less than two minutes, Tom had made a joint that I would have used up to six tools to make in an hour.

Tom had made use of a woodworker's three most essential – and impossible to purchase – tools: his eyes, his hands and his own experience. **PW**

This article is adapted from Lesson Five in "Jim Tolpin's Woodworking Wit & Wisdom: Thirty Years of Lessons from the Trade" (Popular Woodworking Books). To obtain your copy, visit your local bookseller, call 800-448-0915 or visit the Bookstore at popwood.com.





Finish Both Sides? Not Necessary.

Leaving the underside of your tabletop bare doesn't cause warping.

Photo by Al Parrish; special thanks to The Lost Art, Cincinnati

Old tabletops commonly cup on their tops even though the direction of the boards' rings and the fact that the bottom sides are often left unfinished would indicate that the opposite should have happened. The cause is compression shrinkage. The gap of light between the ruler and the wood indicates a warp.

Logic is usually a good guide, but it doesn't always apply. A case in point is the widely held belief among woodworkers that the way to prevent warping is to apply finish to both sides of a board.

This practice does seem to make sense at the outset. Moisture exchange is responsible for warping, and a finish slows moisture exchange. So assuming the wood was properly kiln-dried to begin with, if the moisture leaving or entering the wood from changing humidity conditions is equalized on both sides, wouldn't this prevent warping?

Not at all.

In fact, all the evidence points the other way – that it doesn't make any difference whether the wood is finished on both sides or not. It will warp or not warp totally independent of how it's finished, because a finish only slows moisture exchange. It doesn't stop it. Both sides of the board will adjust reasonably rapidly whether they're finished or not.

(This is not to say that you shouldn't finish both sides, especially if the underside or inside will be seen or touched. A finished surface looks and feels nicer to most people than an unfinished surface.)

Let's look at two objects you're very familiar with (tabletops and decks) to explain what actually causes warping, then use the explanation to understand how to correct warps when they do occur.

Warped Tabletops

Have you ever noticed that old tabletops, especially drop leaves, always seem to cup concave on the top? You rarely, if ever, see a tabletop bowed convex on the top. Usually, these old tops are unfinished on the bottom, so you may have assumed that this accounts for the cupping.

But it doesn't. In fact, if the unfinished side made a difference, it should have caused the top to warp in the other direction – convex. The bottom would have dried out and shrunk faster than the top as interior conditions in buildings became increasingly drier over the last century.

Nor does the natural shrinkage of plain-sawn boards (twice as much around its rings than perpendicular to its rings) explain the concave warp. Old plain-sawn tops almost always have the heart-side up, and this should mean that any shrinkage occurring because of the furniture adjusting to drier interior climates would result in the top bowing rather than cupping.

With regard to quartersawn tops, the natural shrinkage occurs fairly evenly in both dimensions, so there is very little or no warping because of drier conditions and shrinkage. Yet quartersawn tabletops sometimes cup just as much as plain-sawn tops.

Photo by the author

Because of compression shrinkage, all the boards in this deck have warped concave on the top even though they were laid randomly.

Warped Decks

Take another example: Boards placed in a deck almost always cup on the top despite usually being laid randomly. Some boards have

by Bob Flexner

Bob Flexner is the author of "Understanding Wood Finishing" and a contributing editor to Popular Woodworking.

their heart-side up, some have their sap-side up and some are quartersawn.

The concave warping occurs whether or not the boards are painted, coated on the top with a water repellent or deck stain, coated on both sides, left totally unfinished or if they are in the sun or shade. When the cupping stresses become great enough, the boards check and split.

There must be an explanation for warping other than the ring pattern of the wood or whether the wood is finished on both sides. And there is. It has to do with the greater amount of moisture that comes in contact with the top of a tabletop or the top of a deck.

Compression Shrinkage

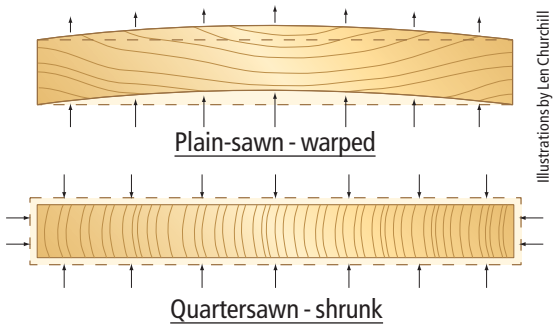
Over a period of many years, a tabletop can be wiped thousands of times with a damp cloth. As the finish ages, it becomes more porous and lets moisture through, so the wetness gets into the wood. Likewise on a deck, more moisture enters the top surface than the bottom because rain wets the top more than the bottom.

When moisture enters wood, it causes the wood to swell. The top surfaces of the tabletop and deck thus try to expand. But the wood's thickness remains stable and prevents this. As a result, the cells at the top surface are compressed from their original cylindrical shape to an oval shape. When the wood eventually dries out again, the cells don't return fully to their cylindrical shape. The top surface thus shrinks, pulling the board concave.

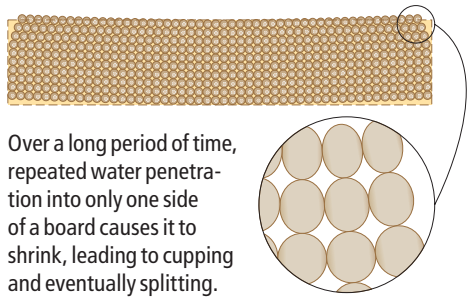
Each time the top is wetted and dries out, it shrinks a little more. This phenomenon is called "compression shrinkage" (or "compression set,") and it explains warpage and eventual splitting when neither the ring pattern of the wood nor a finish applied to one or both sides does.

A built-up film finish in good shape resists water penetration pretty well, but a deteriorated finish doesn't. So refinishing whenever a finish ceases to serve its protective function extends the useful life of the object. This is the problem with the "do not refinish" message being conveyed by the popular television series, "Antiques Roadshow." If people heed this message, a lot of furniture will be destroyed over the long term. Thoughtful refinishing can extend antiques' lives.

As wood dries out, it shrinks about twice as much around its rings than perpendicular to its rings. (Wood doesn't shrink appreciably in length.) As a result, plain-sawn boards cup on the sap side (think of the shrinkage as causing the rings to partially straighten out), while quartersawn boards shrink without warping.



Illustrations by Len Churchill



Over a long period of time, repeated water penetration into only one side of a board causes it to shrink, leading to cupping and eventually splitting.

Straightening Warps

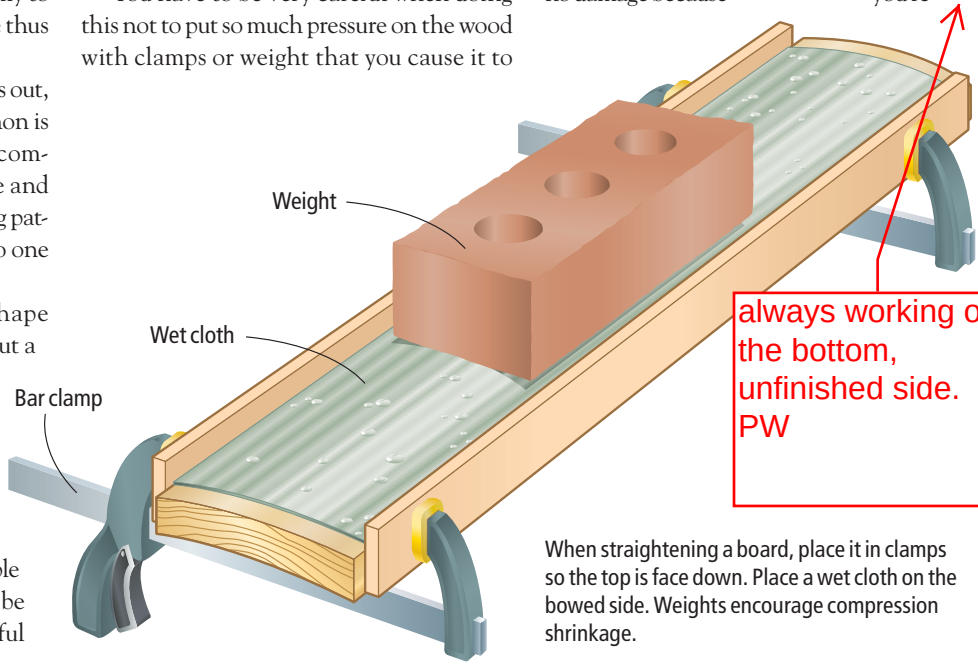
Understanding warping caused by compression shrinkage helps us find a method for straightening warps. Recreate on the bottom the same conditions that caused the cupping on the top. You could do this by wetting the bottom and letting it dry out many times until the wood flattens out, but there is a faster way.

Place the warped board upside down and hold it firmly in clamps so it can't expand. Then repeatedly wet the upper bowed side by covering the board with a wet cloth. At the same time, place some weight on this side to encourage compression shrinkage. Once thoroughly wet, remove the wet cloth and let the wood dry, with the weight still in place. You can encourage the flattening even more by introducing steam using wet cloths and a hot iron.

You have to be very careful when doing this not to put so much pressure on the wood with clamps or weight that you cause it to split, or that you soak the wood so much that you cause glue bonds to separate. If there are severe splits in the wood, this fix probably won't work.

As few as two cycles of wetting and drying should result in some improvement. Usually it takes quite a few cycles to bring a severe warp reasonably flat again.

However many wettings it takes, the real benefit of this type of repair is that it does no damage because you're always working on the bottom, unfinished side. PW



When straightening a board, place it in clamps so the top is face down. Place a wet cloth on the bowed side. Weights encourage compression shrinkage.

$17,050 PENCIL SHARPENER (YES, YOU READ IT RIGHT)

Here's proof that even the most mundane task can have an extraordinarily expensive (and cool) tool to accomplish it.

A small 1906 pencil sharpener that works similar to a hand-cranked disc sander sold at auction in April for a record $17,050. The sharpener, made by the Chelsea Manufacturing Co., is a fascinating cast-iron gizmo that was expected to fetch about $3,000, said Clarence Blanchard, president of Brown Auction Services, which sold the tool. But two motivated collectors drove the price way up, shattering the previous record for a pencil sharpener ($10,000).

This particular little sharpener was desirable because it's quite rare, it had never been used and it was still in its original box, Blanchard said. But how well does it work?

"It's a pretty foolish device," he said. "And pretty dirty, too. Makes a mess." But, he hastened to add, the sharpener was good for something. "For the collector, it's the best of the best." *– Christopher Schwarz*

Photo courtesy of Brown Auction Services

SHIPYARD SAW DRAFTED FOR LUMBERYARD SERVICE

Salvaged from the Philadelphia Naval Shipyard (which shut down in 1996), this monster of a machine – a 67" band saw with 6' wheels – was once intended to saw decking for aircraft carriers. Today, sawyers at Hearne Hardwoods Inc., in Oxford, Pa., are using it to saw rare and large logs, such as a 60"-wide x 14'-long piece of English brown burr oak.

It took two years to get the band saw running. Refurbishing it required adapting its old castings to many custom-machined parts. Its manual wooden carriage – which feeds the logs through the saw – was replaced with a hydraulic one and a 30-ton crane was needed to install the carriage on the tracks.

The 1930 band saw was brought into the 21st century by adding computerized touch screens, a digital camera that takes pictures of each board as it's sawn for immediate archiving and a vacuum hoist that can take 1,200-pound boards off the saw's carriage, says Rick Hearne, owner of the lumberyard. In fact, only 20 percent of the original saw remains.

For more information and to see pictures of the saw in use, visit hearnehardwoods.com. *– Kara Gebhart*

Photos by Brian Hearne

The band saw's 1/8"-thick by 10"-wide blade (above left) is cutting through a 32"-wide by 14'-long cherry log for a tabletop. In the photo at right, this 36"-wide by 9'-long black walnut log has been cut and is now sitting on the band saw's carriage.

THE ULTIMATE SCROUNGER BUYS 109 TOOLS FOR $100

Everyone knows tools aren't cheap – except for Hal Logan of Chadds Ford, Pa. A 15-year member of the Early American Industries Association (eaiainfo.org), Hal says he had a hard time finding fellow members who shared his interest in scratching around garage sales to find old tools. So at the end of the 2003 annual EAIA meeting, he drew up a list of 75 common tools he wanted to try to find for less than $100 to show off at the 2004 meeting.

Hal didn't hit that goal. He beat it.

In one year, Hal bought the 75 tools – plus 34 more – for a total cost of $99.55. Of course, many of the items were in terrible shape, he says, but he "cleaned them up and restored them, put new handles on them and fixed them up," helping capture many of his fellow members' imaginations during the exhibit.

Because he's going to try to match or beat that run for next year's meeting in Charleston, S.C. (a few of his fellow members said they'd give it a try, too), Hal donated the tools to the organization's silent auction. The collection was broken into smaller groups and sold for a total of about $650, he said. We can't wait to see what's in Hal's toolbox next year.

(Editor's note: For Hal's list of 75 tools and a photo, go to popwood.com and click on "Magazine Extras.")

– Michael A. Rabkin