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I Can Do That –
CD/DVD Rack



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JUNE 2008 #169

Easy Tea Table, Solid Joints

Build Furniture Without a Shop

Bob Flexner's 5 Rules for Better Finishes

Dado Jig: 2 Pieces, Perfect Results

Make Your Own Band Saw Blades

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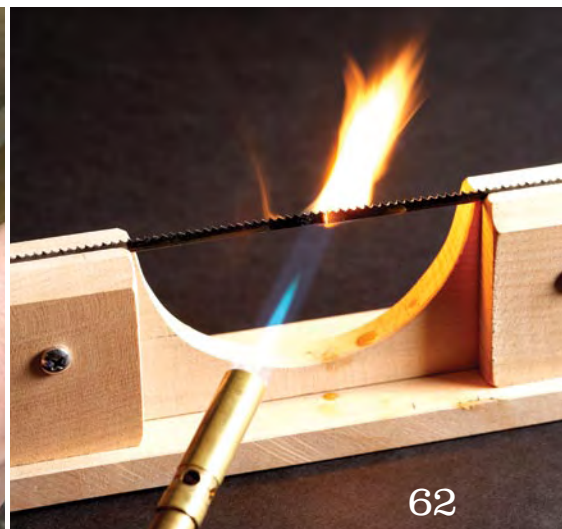
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ON THE JUNE COVER

Gentle curves and delicate feet characterize the classic design of this 18th-century-style tea table built by Senior Editor Glen D. Huey. Page 34.

COVER PHOTO BY AL PARRISH



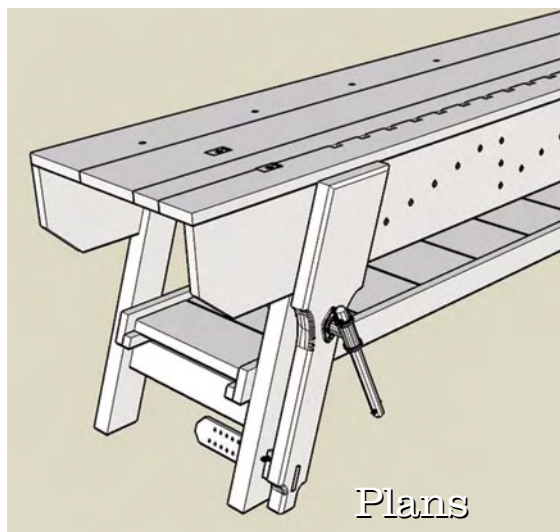
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Tillers International

We took a lot of extra interesting photographs for the Great Woodshops article in this issue (page 74) of the non-profit educational organization Tillers International. You can see them all in our online slide show.

popularwoodworking.com/jun08

Video Gallery

Make Cove Mouldings

Senior Editor Glen D. Huey walks you step by step through the process of making the custom cove moulding for his tea table (on page 34 in this issue). All it takes is your table saw and an auxiliary fence.

popularwoodworking.com/video

New This Month: SketchUp Files

3 Free Workbench Plans

Download free SketchUp plans for the Roubo, Nicholson and Holtzapffel workbenches.

popularwoodworking.com/workbenches

CD/DVD Rack

Senior Editor Robert W. Lang takes you from start to finish (literally) on the CD/DVD rack he made for the "I Can Do That" project (page 28).

popularwoodworking.com/video

And More!

Visit popularwoodworking.com/jun08 to find a complete list of all the online resources for this issue.

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You Could Win a Powermatic PM2800 Drill Press!

You'll be eligible to win a Powermatic PM2800 Drill Press, just for answering a few questions about the drill press on our web site.

The PM2800 18" drill press is powered by a heavy-duty 1 horse-power, TEFC motor, which gives you plenty of power for tough jobs. And, a single-handed control arm allows you to choose the spindle speed – while the machine is running – without ever touching the belt, as the LED display indicates the exact speed. Plus, the generous 21"-wide x 16"-deep table surface has adjustable wings that expand to more than 30" wide, and the table tilts 90° left and right with detents at 0°, 45° and 90° (and can be locked at any point).

To enter, visit popularwoodworking.com and click on the contest link to answer the questions. All visitors who submit correct entries will be eligible to win. Hurry – the contest ends May 30, 2008.



Robert W. Lang, a senior editor for *Popular Woodworking* since July 2004, has just finished writing his latest book, "Drafting & Design for Woodworkers." It will be available in October from Popular Woodworking Books, but you can pre-order it now at Amazon.com. Bob's earlier books, which include "Shop Drawings for Greene & Greene Furniture" and "Shop Drawings for Craftsman Furniture" (Cambium), are available at his web site: craftsmanplans.com. For this issue, Bob built a simple dado jig for the "Jig Journal" column (page 82), and a mitered CD rack for the "I Can Do That" column (page 28). Now, he's working on a new workbench that's a blend of traditional elements with a few custom twists. We'll feature it in an upcoming issue of the magazine, but you



can read a bit about it now (and weigh in on his design) on our editor's blog at blogs.popularwoodworking.com/editorsblog.

Bert Johansen has been an amateur woodworker for about eight years. For this issue, he's designed an ebony and jatoba hall/garden bench (page 49). Bert's career has included working as an engineer for NASA, a security analyst on Wall Street, a vice president of a New York Stock Exchange-member firm and the chief executive officer of a chemical company. After he "retired," he taught creative writing at a community college and founded two Internet companies. When he's not at work in his shop he might be at the computer working on a screenplay about the meeting of John Muir and Teddy Roosevelt in Yosemite.



Philip Leon is a professor emeritus of English at The Citadel in Charleston, S.C., where he taught for 32 years. He has published six books, most of them on 19th-century literary figures, including Mark Twain and Walt Whitman. A frequent contributor to "Out of the Woodwork," Philip enjoys learning the origins of woodworking terms. He spends most of his time in his shop making (what else?) bookcases for himself and his friends.



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How to Enroll in Hand Tool College

After many years of teaching people how to set up and use hand tools, I've come to three conclusions:

1. The best way to choose the right plane, chisel or saw for your work is to handle and use a wide variety of sizes and brands.

2. The best way to understand a technique is to watch someone perform it a few times and to ask questions about what you don't understand.

3. The best way to become skilled at hand work is to use your tools with an experienced teacher watching you and making the small corrections in your methods that will make a big difference.

As you probably know, the written word makes it a challenge for us at *Popular Woodworking* to do these three things from our offices in Cincinnati.

That's why we've spent many months planning a special weekend conference in Berea, Ky., for Nov. 14-16 that is designed to expose you to a rich and wide variety of expert craftsmen, tools and hand woodworking skills.

The conference, which we're calling "Woodworking in America," is going to help hundreds of woodworkers jump-start their hand-tool skills, expose them to tools they've seen only in catalogs and offer them face-to-face instruction with some of the best hand-tool woodworkers alive today.

We're still working out the details as I'm writing this column, but here is the conference in broad strokes (for more details, please visit WoodworkingInAmerica.com).

For starters, we're lining up many of the country's large and small manufacturers of

well-made hand tools – everyone from the large companies that make high-quality tools down to the individual makers who build high-end, individually designed hand-planes. As a result, you'll be able to try a wide variety of tools – and get to know the maker – before you make that once-in-a-lifetime purchase. But trying and buying tools is just one small part of this conference.

Right now we're scouring the continent to invite the leading hand-tool craftsmen to teach seminars and hands-on classes on a wide variety of topics, from basic sharpening, planing and sawing, to marquetry and advanced joinery.

All this will be held on the beautiful campus of Berea College – a picture-perfect jewel of a campus in Kentucky's foothills, and right off Interstate 75. Berea is one of the country's great

epicenters of the furniture craft, with dozens of world-class makers, and it is a stone's throw from the Pleasant Hill Shaker Village near Harrodsburg, Ky. (That would be a great side trip for you – if you have some extra time in your schedule.)

So I hope you'll mark your calendar for Nov. 14-16 and visit the conference's web site at WoodworkingInAmerica.com for full details. One more thing: Space is extremely limited at the conference. We want to keep things personal and intimate so that you will have the richest and most rewarding hand-tool experience possible. **PW**



Christopher Schwarz

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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.

Patching Article Evokes Memories of Navy Days

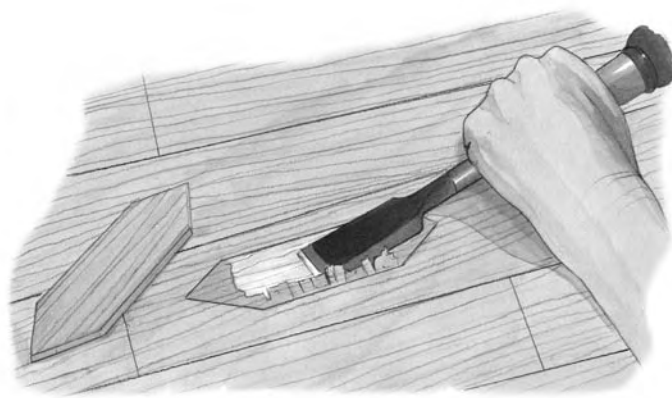
In reading the article on “Perfect Patching” by Carl Bilderback in the February 2008 issue of *Popular Woodworking* (#167), I recalled that when I joined the Navy in 1956 and went to Damage Control School, we had to learn to do the same thing on wooden boats.

When we were repairing a boat and found a small dent or gouge in a plank, and it was not so bad that the plank had to be replaced, we would install a “graving” piece.

We didn’t have to match the color of the wood; we just used the same wood species, and made sure the points of the graving piece ran with the grain of the wood to be patched. The size depended on the size of the damage. Most of the time we didn’t make a repair larger than 3" x 6". And if we had to go deeper than 1/4" of the plank, then we had to replace the plank.

The operation was about the same as in the patching article. We cut out the graving piece and laid it over the damaged area then marked around the edges. Then we chiseled out the damaged section for the graving piece. When the fit was right, we installed it with countersunk wood screws and bedded it in white lead. When it was dry, we sanded it smooth and filed over the countersunk screws. When all was done, we painted.

Somewhere in the early 1960s, the Navy began using fiberglass boats for all but the wooden mine sweepers (though they were phasing in fiberglass boats in the late 1950s, so we had to learn how to repair both).



After retiring from the Navy in 1976, I worked for a small shipyard, where I used graving pieces many times. The United States Coast Guard would come to inspect a boat, find a bad place in a plank or keel, and want us to replace it. I would ask them if I could install a graving piece instead, and they were surprised that I brought it up, and always said yes.

I no longer work on boats but there are still a lot of old wooden boats around. By the way, they stopped making white lead years ago. Now the best product to use to bed a graving piece is 3M 5200 Marine Adhesive.

—Robert A. Witt, Summerdale, Alabama

You Can't Be Too Careful

I certainly agree with you on the importance of workshop safety and look forward to reading Marc Adams' columns on that subject.

However, Editor Chris Schwarz's statement, "... when you try these methods ... the chances of you getting hurt have dropped to nil," caused me to raise an eyebrow ("Out On a Limb," December 2007, issue #166).

In addition to being a professional woodworker, I've worked as a sheet-metal fabricator, welder and heavy-machinery maintenance mechanic. In each job, safety was paramount; I practiced it religiously, even serving on several safety committees. Yet I never reached the point where I felt I'd mas-

tered safety techniques and that my chances of getting injured had disappeared.

Your statement may cause people to be less vigilant in the workshop. The chances of getting hurt never go away. Perhaps a better choice of words might have been, "the chances of you getting hurt will be greatly diminished."

On the subject of safety, I always find it ironic that tool manufacturers and television-show producers remind us ad nauseam that the most important rule of workshop safety is to wear safety glasses.

Of course, I am in complete agreement that eye protection is important. However, I have yet to meet a woodworker who has lost

an eye in a workshop accident, but I have met many scores of them who have missing digits and nasty scars, myself included.

To me, the most important rule of workshop safety – if I were to condense all safety advice into one “golden rule” – would be to always think about what you are doing or are about to do. What can go wrong? Where are the potential dangers? Is there a better, safer way to do something? Think through every process before undertaking it. As my father once sagely advised me, “John, you need to keep your wits about you.”

—John Koski, Mukwonago, Wisconsin

CONTINUED ON PAGE 16

Scratch Patterns Reveal When It's Time to Switch Sharpening Grits

I'm a novice woodworker. And although I wore a green beret in the Army and I watched my fellow Special Forces guys shave with their fighting knives, I was never able to get an edge that sharp on mine.

In many sharpening articles, the author writes to begin this process with a #1,000-grit waterstone, then do the same operation with a #4,000 grit and then an #8,000-grit stone. The backside should look like a mirror when you are finished.

I have waterstones in #220, #1,000, #4,000 and #8,000 grits but I'm not sure how long I should be using the #1,000-grit stone before moving up to the next one. Roughly how long, in minutes or strokes, do I spend on each stone? I'm sure I'll get to "know" this process as soon as I've done it a time or two, but for the first time, with my new chisels, how long should I use the individual stones?

— David Dalrymple, St. David, Arizona



1,000 grit



8,000 grit

I'm afraid this is one of those questions like: When do I switch grits when sanding? The answers are, "when you are done with the first grit" and "it depends."

Here's the best explanation I can give. Each stone leaves a particular scratch pattern. Because of the size of the abrasives, each grit can make the steel only so shiny. So you begin with your coarse grit and work until all the scratches are the same and are right up by the cutting edge (you might have some low spots away from the cutting edge that you can ignore).

The vast majority of your work on a new tool is at this coarse (usually #1,000) grit. A new 1/2" chisel in fairly good shape might require 15 minutes of lapping time for me.

When all the scratches look the same, I move up. The finer grits take less time, but the goal is the same: Make the scratches consistent all the

way across the cutting edge. Some of this requires learning to "see" the individual scratches, which comes with practice and observation.

At the #4,000 grit, I might polish the 1/2" chisel for five minutes. At #8,000, I give it a minute or two.

After that, I never have to work through all these grits again. I only touch that flat side with the #8,000 grit. So it's a one-time issue.

And here's the important thing to remember: Your edges will improve over time. So what is "sharp" today will not be "sharp" a year from now. So get the edge so it cuts and you can get to work. The rest will come with practice.

— Christopher Schwarz, editor

Sugar Chest Glaze Specifics

The sugar chest article (June 2007, issue #162) states that you use Mohawk glaze – can you tell me which color?

— Kelly Taylor, Chattanooga, Tennessee

When I'm finishing in a darker color, such as the cherry sugar chest, I use Van Dyke Brown glaze. With other finishes (tiger maple, etc.) I use Burnt Umber. Those are the only two glazes I use.

— Glen D. Huey, senior editor

Some 'Tricks' Seem Unsafe

Popular Woodworking is one of my favorite periodicals on the subject of woodworking and I look forward to reading each issue. I really appreciate that you've started the series on working safely; none of us need to go through life without all our body parts intact.

That said, I am puzzled why you publish "Tricks of the Trade" that contain unsafe suggestions. The "Simple Safety Switch" and "Help with Horizontal Drilling" tips in the December 2007 issue (#166) offer opportunity for serious injury. An unguarded device using a motor from any source and then used to drive buffing or grinding wheels, or other home devices, is not a wise practice. And to follow the suggested method of making horizontal holes has the possibility of spinning the washer either by moving toward the bit or the chuck. **PW**

— Dan Southworth, South Bend, Indiana

'Arts & Mysteries' Why I Subscribe

In the February 2008 issue (#167), Editor Christopher Schwarz comments (in "10 Years



and 10,000 Hours") that many people like the Arts & Mysteries articles the best.

I would like to second that sentiment. I subscribe to Popular Woodworking for that column alone. As a professional woodworker, I accumulated a lot of magazine subscriptions over time. I finally got tired of all the "Build a Workbench in an Hour" articles, so I discontinued most magazines. I'm down to just three now. I keep Popular Woodworking because the Arts & Mysteries column is so unique in a world of slam-it-together-in-a-day mentality.

— Mike Dembroke, Alameda, California

Question? Comment? We want to hear from you.

Popular Woodworking welcomes comments from readers about the magazine or woodworking in general, as well as questions on all areas of woodworking. 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, and if you have a complaint, we want to address it whenever possible.

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Letters
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Correction

For the April 2008 issue of Popular Woodworking (#168), we tested lithium-ion, battery-operated drills. In the article, we write that the Ryobi kit (P813) has only a single battery included, which we didn't like.

In fact, the kit has two batteries. I had set the second battery aside to make sure we had an unused battery when it came time for testing. And then I forgot about it.

Several readers told us the kits do, in fact come with two batteries. Ryobi confirmed it. And we apologize.

— Glen D. Huey, senior editor

THE WINNER:

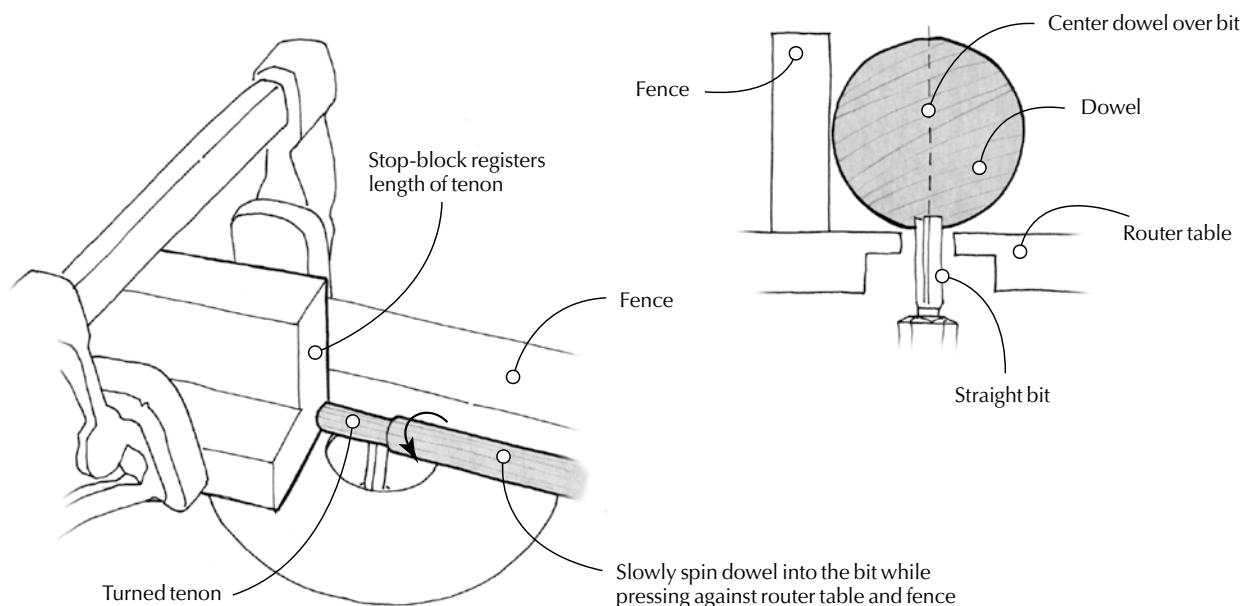
Routing Round Tenons on Dowels

Over the years, I have had a number of occasions to create a round tenon on the end of a dowel. Because I don't own a lathe, I turn to the router table to do the job. I mount a straight bit in the router and adjust its height to half of the amount I want to remove. (For example, to reduce the end of a $\frac{3}{8}$ " dowel to $\frac{1}{4}$ ", I raise the bit $\frac{1}{16}$ " above the table.) I adjust the fence so that the dowel is centered over the bit, then set up a stop-block to register the desired length of the tenon. I turn on the router and, holding the dowel against the fence, slowly push and twist it into the bit until it hits the stop-block.

In addition to creating round tenons, you can use this technique to create small, custom-sized dowels that can then be cut from the end of a thicker piece, including a broom handle or other available round stock. It's good for repairing broken spindles, and I've found it to be a helpful technique in a number of circumstances, including construction of toy parts.

— Michael Mann, Quartz Hill, California

CONTINUED ON PAGE 20



Cash and prizes for your tricks and tips!

Each issue we publish useful woodworking tips from our readers. Next issue's winner receives a \$250 gift certificate from Lee Valley Tools, good for any item in the catalog or on the web site (leevalley.com). (The tools pictured at right are for illustration only, and are not part of the prize.)

Runners-up each receive a check for \$50 to \$100. 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.



Mending a Radial-arm Saw Table

A radial-arm saw table does more than just support a board for sawing. It also serves as a backup board, supporting the wood fibers on the exit side of a kerf to produce a cleaner cut. Unfortunately, as your table gets scored over time, you lose that support. Here's a cheap fix:

First, replace the wooden fence if necessary. When reinstalling it, slip a piece of waxed paper between it and the table before clamping them back together. Mix up a suitable amount of clear epoxy and use a cheap acid brush to apply a thin coat of clear epoxy into the groove(s) to be repaired. (This aids in the bonding process.) Now mix the rest of the epoxy with sawdust to create a sticky putty of sorts. Push the mixture into the grooves with a putty knife, allowing it to mound up a little. When the epoxy is no longer tacky, but before it sets up hard, use a wide, sharp chisel to level the mounded filler to the tabletop. After the repair completely hardens, a light sanding will complete the job.

— Frank Petruso, Florissant, Missouri

(Editor's note: A polyester body filler such as Bondo will also work.)

Securing Small Pieces for Spraying

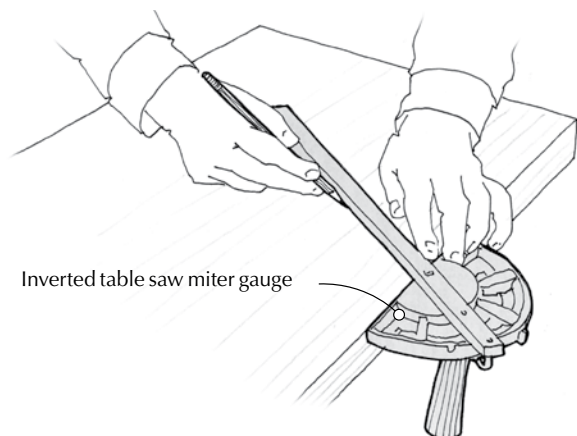
In my intarsia work, I finish a lot of small workpieces using lacquer from an aerosol can. To hold the pieces in place against the force of the spray, I affix them to a piece of cardboard using double-stick tape. This also allows me to wield the cardboard like a sort of artist's palette, rotating and tipping it as necessary to spray the work efficiently, whether held horizontally or vertically.

— Amy Nielsen, Maple Valley, Washington

Use Miter Gauge as Bevel Gauge

If you need to strike long angled lines across a board or panel, there may be a better tool for the job than your bevel gauge, which typically has a fairly short blade. Instead, try using your table saw's miter gauge, locking it at the proper angle, then holding it upside down and against the edge of the workpiece.

— Sherry Gautier, New Orleans, Louisiana



Better Bevel Ripping

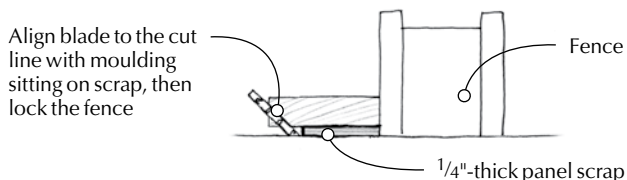
When making mouldings on my table saw recently, the last step was to rip 45° bevels on the back side. Unfortunately, this turned out to be more troublesome than I expected. The narrow rippings would droop into the wide opening on my stock throat plate, catching on the end of the opening and impeding forward motion.

I realized that I needed a zero-clearance insert for the saw blade. However, I didn't want to have to make one just for this job. Fortunately, I didn't have to. Instead, I used double-stick tape to secure a narrow panel of 1/4"-thick hardboard to the table over the stock insert plate. After raising the spinning blade up through the panel, it served as a zero-clearance panel that fully supported the ripping throughout the cut, making the process clean and painless.

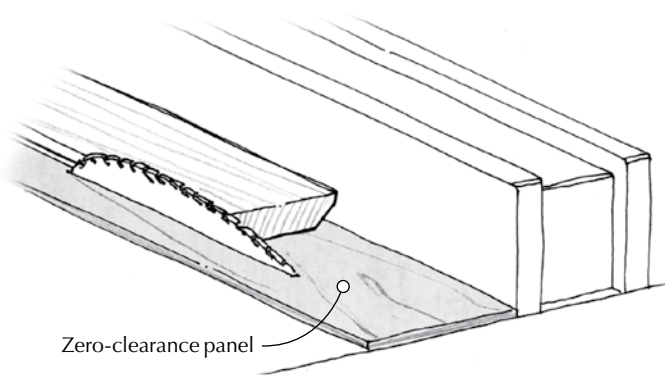
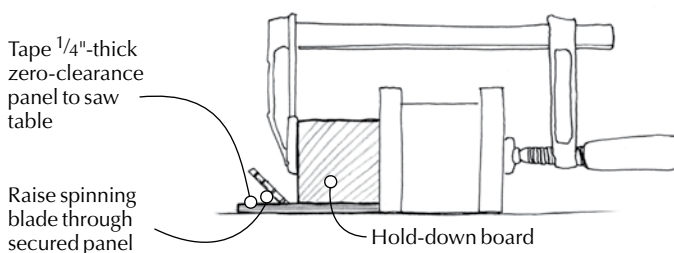
For best bearing, the edge of the hardboard should ride against the fence. To calculate the correct fence setting for the job, set up for your bevel cut with the stock placed atop a scrap strip of the hardboard. Lock your fence in this position, then tape your zero-clearance panel to the table with its edge pressed against the fence. To prepare for slotting, clamp a thick hold-down board to the fence, pressing it down against the panel to prevent the rising blade from lifting it. After slotting the panel, remove the hold-down and rip your bevels.

— Gabriel Castro, Victorville, California

SETTING UP THE CUT



SLOTING THE PANEL



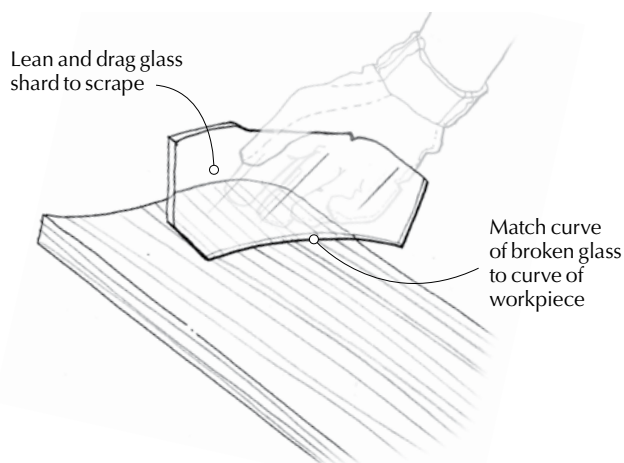
Scraping With Glass

Scraping smoothes wood much more effectively than sanding. Steel card scrapers are available in various shapes but to work well, they must be sharpened and burnished to create a hooked edge. Fortunately, there's an alternative: broken glass. Woodworkers of old used it to smooth gunstocks and other wooden items, and the technique is just as viable today.

Using broken windows, jars and bottles, I pick out select shards that have just the right edge for the project at hand, whether straight or curved. To protect my fingers when scraping, I wear thick leather gloves or drape a piece of leather (perhaps the tongue from an old shoe) over the edge being grasped. When initially breaking the glass, I place it under a piece of leather or thick canvas, and whack it with a hammer to create shards of about the right size for the service intended. (Be sure to wear eye protection and gloves when doing this.)

Scraping with glass yields results equal or superior to metal-scraper smoothing. Glass doesn't require sharpening, and you can get quite a bit of scraping done before the edge dulls enough to discard it. It's a cheap, effective way to smooth wood. And if you want to get fancy – use colored glass!

— Wayne Hodges, Savannah, Georgia



The Pure Way to Wet Wood

Water-based dyes are a great way to stain wood because they afford great color control and consistent penetration, even on dense woods such as maple, cherry and oak. The only problem with water-based dyes and finishes is that they raise the grain. The solution is to wet the wood first with a damp sponge, let it dry, then lightly sand it with #220-grit sandpaper to knock off the raised fibers before applying the stain or finish.

But you knew that.

What you might not know is that the minerals in tap water can react with the tannins in woods such as oak and cherry, causing undesirable dark staining. The solution is to use distilled water instead. And here's the cool thing: You don't have to buy it if you have a dehumidifier. During the summer, save a few gallons of the water for staining purposes. You can use it in your household iron or car radiator to prevent mineral buildup. You can also use it in your humidifier in the dry months. How about that – woodworking tips and household tips!

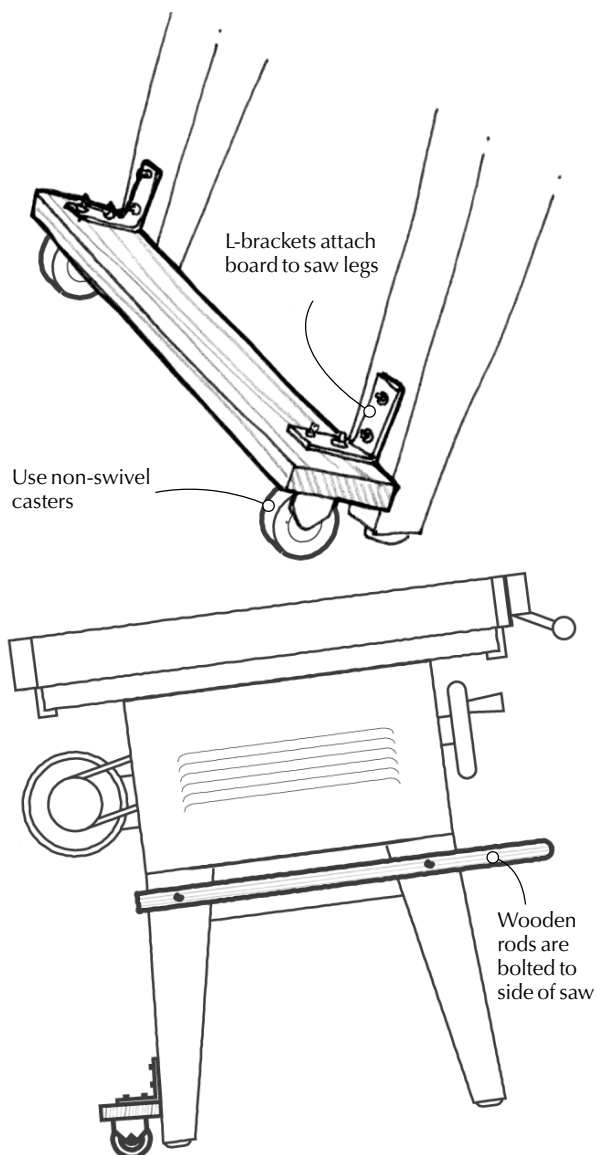
— Serge Duclos, Delson, Québec

Mobilizing a Contractor's Saw

My contractor's saw shares a garage with my car, so it's stowed against a wall when not in use. It's not an easy thing to drag into place when it's time to set up for woodworking, so I decided to outfit it for wheelbarrow-style mobility. I screwed a couple sturdy non-swiveling casters to a stiff board, then bolted a couple strong L-brackets to the board, matching the spacing of the saw legs. I bolted the brackets to the rear saw legs with the casters just clearing the floor.

Next, I bolted two stout wooden rods to the sides of the saw base, extending them toward the front just enough to serve as handles for comfortably lifting that end of the saw. Now moving the saw is as easy as lifting the handles just enough to allow the casters to engage the floor. After wheeling it into place, the saw once again sits solidly on all four feet. It works great, and I find that the projecting handles don't get in my way while I'm working. **PW**

— Richard Zegers, Bellingham, Washington



18th-century Chairmaking

Building a 'Rush Bottum'd Chaire' – PART 1

I'm going to turn my attention to chairmaking for a while. I've been hesitant to make chairs because they are fairly difficult to build, and frankly, I didn't feel I was up to the task. Joint quality is much more important in chairs than casework. If 80 percent of my dovetails are tight, my carcass will be fine. But if a chair has 20 percent of its joints loose, it's going to fail.

To make matters worse, chair joints are often not perpendicular to their reference faces or to other joints. I have been getting away with fairly crude stock preparation and in some instances, marking and measuring. A cabinetmaker can often simply mark one piece directly from its mate. You generally can't do that with chairs. Parts are built up individually and joined later.

I think I've had good reasons to shy away from chairmaking. But I've decided to face my chair phobia head on. I'm going to start with a relatively simple chair and work up from there. My goal is to acquire skills, not chairs. I'm hoping this pursuit will make me a better woodworker.

A Common Chair

There were a variety of seating forms in the 18th century, from stools to chairs to upholstered pieces. Early 18th-century documents include what we call "ladder-back" chairs more often, and in greater numbers, than any other form of seating furniture. Sorry Windsor chairmakers – these uncomfortable, structurally marginal chairs were the ubiquitous seating of the 18th century. The basic frames were made with great speed. One late 17th-century source indicates a chairmaker's apprentice could build two-and-a-half frames per day. Seats could be woven at a rate of nine per day.

Primarily identified by their seating material (flagg, straw or rush bottomed), ladder-



Back first. In this article (part one of two), I'm going to build up just the back of this chair. In part two, I'll build the front and finish the job. This isn't a lot of work, but there are many little details that deserve our attention.

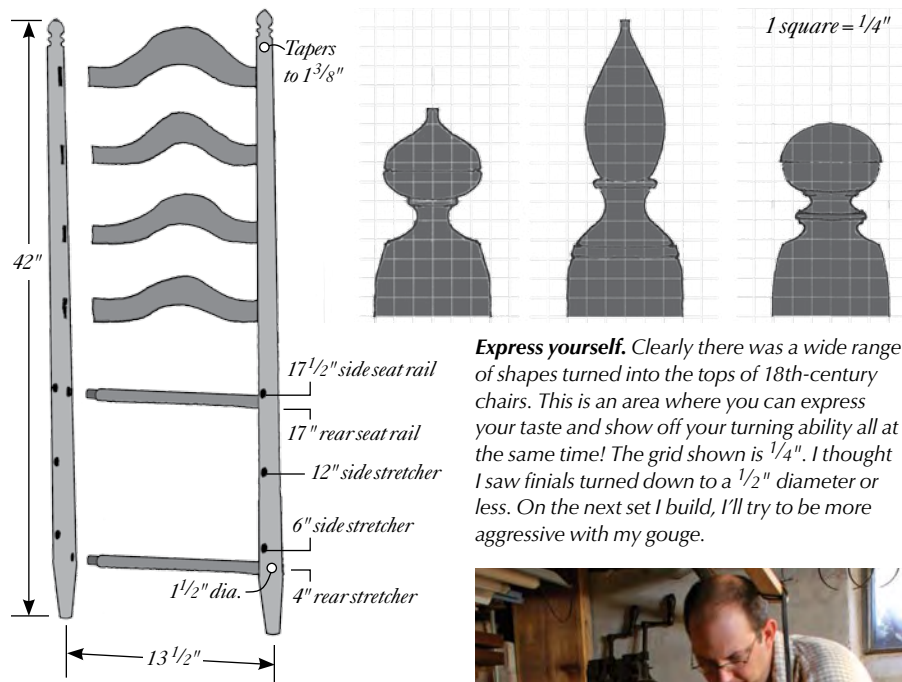
backs' exact appearance can't always be linked to specific documents. Backs may have been comprised of vertical spindles or horizontal slats. Legs and backs may have been decoratively turned or simply riven and shaved. What we do know is that many have survived to our time. They were made from a range of domestic hardwoods and were almost always painted. Surviving chairs feature straightforward construction; turned posts are joined to turned stretchers with cylindrical tenons. The mortises are, of course, holes. X-rays show round-bottomed holes – the telltale sign of the use of spoon bits.

I suspect all of us have sat in ladder-back chairs at least once in our lives. Simple to make, these chairs were reproduced in great numbers by chair factories in the 19th and 20th centuries. These factory-made chairs, undoubtedly the very chairs many of us experienced, are generally unsatisfying. Their loose joints and uncomfortable backs may be contributors to the undeserved bad reputation these chairs have gotten. I'm not saying this will be the chair you'll seek out for A&E television's six-hour presentation of "Pride and Prejudice." But I can't help but wonder how good these chairs can be if they are carefully and faithfully reproduced.

Stock Prep

Period stock preparation for chairs like these would probably have involved riving all of the components from logs. I suspect the legs would have been made by splitting a small log into quarters, then using a froe to rive roughly 2" x 2" pieces. I didn't have a log long enough for this project, so I began with 8/4 S2S soft maple. Kiln-dried maple is more difficult to turn and bore with a spoon bit than is green wood. It's also important to ensure that the grain is very straight or the finished leg will not remain so. Its dryness necessitates even tighter joint quality, as we can't expect the posts to shrink around the tenons. That said, commercial boards can be used successfully, though they are clearly disadvantageous. I sawed my boards into squares, following the grain rather than the edge of the board.

I cut the mortises for the back slats before turning the legs. I cut them in my usual fashion, but intuition tells me period chairmakers probably bored a series of holes with a small spoon bit after the leg was turned. If you decide to mortise before turning as I did, make sure you choose centers in line with the mortises.



Get started. I discuss the slat spacing in the article, but you can start making your story pole with this diagram.



Slat mortises. I'm cutting the slat mortises for two chairs. I suspect period chairmakers would have used more mass production techniques than cabinetmakers due to the repetitive nature of their work.

If you are starting with riven stock, you may choose against mortising first.

Pole Lathe Turning

Documentary evidence suggests period chairmakers could turn out chair parts very quickly. Period images suggest they used spring pole lathes. I've found spring-pole lathe turning to

Express yourself. Clearly there was a wide range of shapes turned into the tops of 18th-century chairs. This is an area where you can express your taste and show off your turning ability all at the same time! The grid shown is 1/4". I thought I saw finials turned down to a 1/2" diameter or less. On the next set I build, I'll try to be more aggressive with my gouge.



It's not plugged in. I wanted to try spring-pole lathe turning, but didn't want to spend a lot of time carefully constructing stiff ways and poppets. I found my electric wood lathe had nearly everything I needed in a spring pole lathe – a stiff bed, adjustable tailstock and a tool rest. So I screwed an 8' long red oak 1x2 to the ceiling and tied some scrap leather to it. I passed the knotted leather strap down to a scrap of pine on the floor. I won't be demonstrating at shows with this lathe, but it's been sufficient to learn on.

be both rewarding and challenging. You can forget about going straight from the grinder to the lathe, for example. Your turning gouges must be as sharp as any other chisel in your shop. Scraping generally doesn't work well. Unlike a treadle lathe, the spring pole lathe's belt transmits torque well. The workpiece doesn't slip forgivingly when you do something wrong. If you're not careful, you can get catches on the return stroke (the workpiece spins forward and backward with each tread). Make too many mistakes and your center will become oval. But using a light touch, a sharp tool and careful technique, the spring pole is capable of fast and beautiful work.

Boring

The spoon bit can be difficult to start at a precise location. I found a little more down force helped. You can also cheat by boring a starter hole with a center bit. I've heard of guys using a gouge to make a dimple in the round leg as a starting place for the spoon. My take is that this is one of those things you must simply practice.



Boring. I'm smart. I use my head! Windsor chair-makers don't need this crutch technique. But steadying the top of the brace (wimble) with my noggin helps me to bore straight holes. A piece of scrap in a slat mortise helped me to set the angle. This angle is 30°, which proved too much for large people.

Keep in mind that boring a precise hole in a scrap pine board is different than boring a hole in the center of a hardwood dowel.

Slats

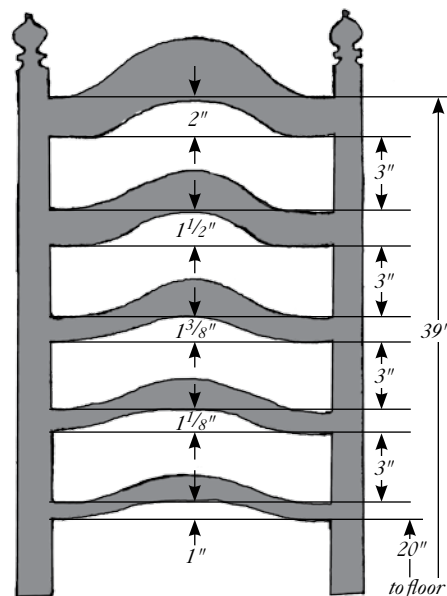
The backs of this sort of chair feature carefully scrolled slats, bent into a comfortable, curved shape. I've not seen an 18th-century chair with flat slats, either unformed or un-scrolled.

Rarely are the slats identical top to bottom. Sometimes the top slat is slightly larger than the others. I think these slat designs were quite carefully considered. I don't believe these were done thoughtlessly. The graduated slats create an exaggerated perspective that juxtaposes the tapering of the legs and detailing of the front legs, which I believe sought to correct a standing observer's perspective of the chair.

I want to leave you with two thoughts: First, this shape is really important artistically. If you want to capture the period, look carefully at as many chairs as possible, preferably in the flesh. I prefer to bring a sketch pad and draw them right there. Back in the shop, mock up a half-dozen sets in cardboard before you cut any wood. Take your time and get this the way you want it. It's important.

Second, the slats on period chairs are fairly thin, rarely more than 1/4". And the oxbow shape is an effective torsion spring. I hinted earlier about how uncomfortable these straight-backed chairs are. Well this design introduces a little flex, which I've found helpful. I can't help but think this was deliberate.

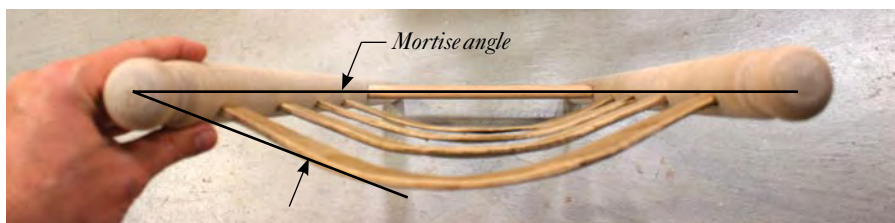
Period chairmakers probably didn't make steam boxes to bend chair slats. I was told they simply boiled parts like these, so that's what I did. You may find success bending straight-grained, kiln-dried, flat-sawn stock. The curvature is subtle. I had some success with test pieces. My advice is to try it before



Shape selection. I examined many chairs before making my own. The various shapes of their back slats fascinated me. This oxbow shape appealed to me most. Each slat appeared to be twice as high as its tenon. The tenons increased in size from 1" to about 2". On no chair was the topmost slat higher than the legs. I also noticed the spaces between the slats were equal.

you decide it's impossible. For this chair, I had some green white oak lying around so I used that. I split out pieces on the medullary rays with a froe. Don't bother trying to flatten these pieces with a handplane. Bring them smooth and to a uniform 1/4" thickness (depending on your mortise chisel's width) using a drawknife. Thick areas won't bend as readily as thin. So uniformity of thickness is important in achieving a smooth formed curve.

Shape the slats with a turning or coping saw and smooth the saw cuts with a spoke-shave or rasp. Test fit the slats into the mortises in the chair back. Mark a line on the slat indicating the depth of penetration into the



Right angles. The mortise angle for chairs like these should be between 20° and 30°. Choosing the correct angle can be difficult. Dozens of people sat in one of my chairs at a recent furniture show. Some were comfortable. Some were not. Smaller people with smaller rib cages (women in particular) were more comfortable with a greater curvature to the slats, describing the chair as "cozy." Larger folks preferred flatter slats. I would build a chair to accommodate the size of the sitters if I could. Otherwise, less curvature seems to hold a slight advantage for the wider public.



Dowels. Make a chair from a what? That's right: Dowels from the local home center. My chief concern building this sort of chair was the joinery. So I bought dowels from my local home center and made a practice chair from them. I couldn't find dowels bigger than 1 1/8". That threw off my design a little. And dowels aren't cheap. But there is a rack full of them at the home center and I felt this was a cheap education.

leg. When you later bend the slats in place, you can use this line to ensure the slat has reached the mortise's full depth. So just let me be clear: I shaped the slats first, then bent them. I don't know if this is how it was done in the period.

Insert the wet, hot, slats into the mortises. The lower stretchers have been already been fitted and glued with hot hide glue. Clamp or tie the tops of the legs together to prevent them from spreading. Check that the slats are fully inserted using the line you drew earlier. If the slats aren't perfectly aligned you may be able to force them into shape with clamps while they are still hot.

In the next issue of *Popular Woodworking*, I'll conclude this two-part article by building the chair front, and examining the turnings and joinery. I'll finish the chair by weaving its rush seat. **PW**

Visit Adam's blog at artsandmysteries.com for more discussion of traditional woodworking techniques.

Mitered CD/DVD Rack

Two tricks for taming miter joints.

Learning a new skill is often a matter of getting past the scary part. If you can reduce the number of things that can go wrong, you become comfortable enough to push past what once seemed an insurmountable obstacle. Miter joints are never a walk in the park, but they don't have to be a middle-of-the-night trip through the cemetery.

A four-sided frame or box is the usual starting point for mitered joinery. In this scenario, the beginner will likely be frustrated by tiny errors in the degree of angle or the length of the parts. Any errors made will show up in the last joint to be closed.

At this point errors aren't tiny any more. On a square frame with 12" sides, even with only $1/10^\circ$ of error, the gap at the last corner will still be $1/8"$. The degree of perfection required is obtainable, but there are two other hurdles to overcome for successful mitering.

This I Can Do That project addresses the two problems that can cause even perfectly cut miters to fail: Getting a strong glue joint and clamping the corners together. There is a simple solution for each, and knowing these will make getting perfect corners easier.

Two Sticks, Glue and Packing Tape

One 6' length of 1x2 (actual size $3/4" \times 1\frac{1}{2}"$), and one 2' length of 1x4 (actual size $3/4" \times 3\frac{1}{2}"$) provide all the material. These were available in red oak at our local home center. Look for the straightest pieces in the pile. If you don't have yellow wood glue at home, pick up a small bottle before you leave the store. And while you're there, purchase a roll of clear packing tape.

Begin by cutting two pieces of 1x2 to $22\frac{5}{8}"$ long. This length isn't critical, but both pieces should be the same length, and both should have two square ends. Sometimes the material you buy has a ragged end, so I usually cut



No other joint looks like a miter. Miter joints allow the wood grain to flow around a corner, without exposing any end grain. Good miters aren't always easy, but a few tricks make them manageable.

$1/4"$ or so off the end of a new piece to make sure it's square and clean.

Make a mark on the edge of one of these pieces that's $4\frac{1}{2}"$ from the end, and with your combination square draw a line at a 45° angle back toward the end. Only mark one piece – you will use that to set up the miter saw to cut identical lengths.

Swing the miter saw to the right and lock it in at 45° . Without turning on the saw, put your marked piece below the blade and bring the blade down until a tooth of the blade is on the pencil line, with the blade to the left of the line. Let the saw swing back up out of the way and without moving the workpiece, draw a pencil line on the back fence of your

miter saw at the end of the workpiece.

When you cut each piece, line up a square end of the $22\frac{5}{8}"$ pieces with the pencil line, hold the work with your left hand well away from the blade and make the cut. You don't want to clamp a stop-block to the fence because the short piece will be trapped, and the blade could send it flying. Make the cut in one smooth motion and leave the blade all the way down until it stops spinning.

Flip the piece over, and make certain that the angle you just cut is pointing in the opposite direction of the next cut. Line up the square end with the pencil line and make the cut. This procedure will yield all six pieces of the upper part of the rack, with only four saw cuts, and your hands will stay safely away from the blade at all times.

Swing the saw to the $22\frac{1}{2}^\circ$ setting to make the cuts for the feet and middle rail. Cut one end of the middle rail, then turn the rail around, measure, mark and cut the

Online EXTRAS

To see videos about making and finishing this project, visit:

popularwoodworking.com/jun08

other end. The feet can be cut the same way as the short uprights, but it will be better to return the saw to the 90° stop, and tilt the head 22½° to the left.

Bevel cutting the flat face will keep the work on the saw table. There is a chance if you cut it on edge that the short piece could fall into the blade. The two ends of the rail are angled in opposite directions, but the ends of the feet are parallel. Make a pencil line on the fence, and slide the stock up to the line, holding on to the long end of the board as you make the cuts.

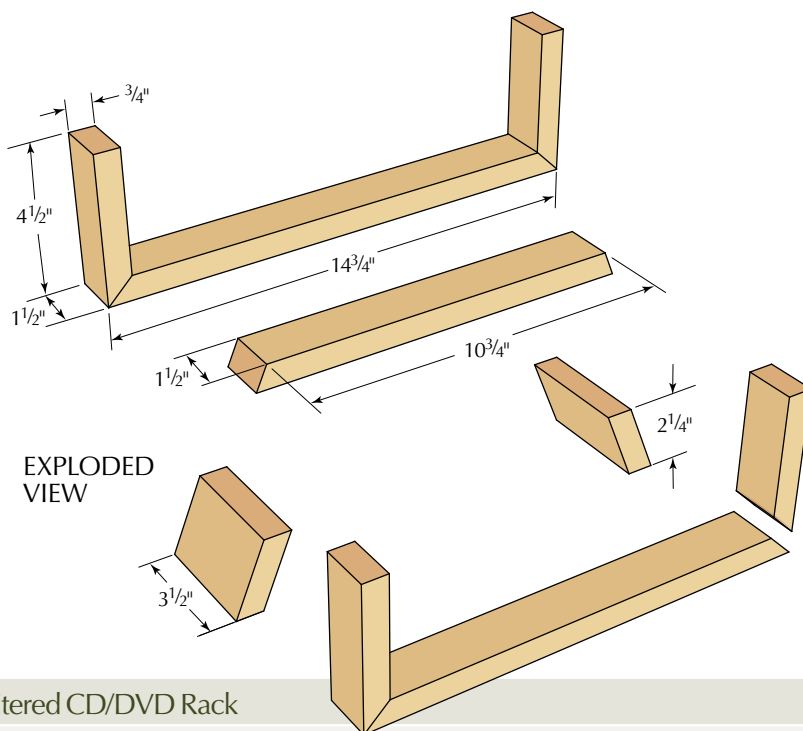
Two Ways Tape Makes it Easy

Sand all the pieces, except the mitered ends with #120 grit sandpaper before assembling. To put the top parts together, lay the three pieces of each section end to end. Hold the ends together with a piece of tape, as seen in the photo below left, then flip the taped pieces over.

Smear some glue on each side of the joints and walk away for about five minutes. The glue will wick up into the short grain, and if you try to put it together now, most of the glue will disappear from the joint, leaving it weak. When you come back, apply more glue and fold the joints together. The tape will act as a hinge, keeping the pieces from sliding apart and holding the ends tightly together.

Flip the pieces over, and use another piece of tape to hold them in position while the glue dries. The tape will stretch, so be careful not to pull it too tight. You should see some glue squeezing out of the joints. Wipe off the excess with a wet rag.

Mark the top of each foot 1½" in from each end and put some glue in between the pencil marks. Again this is a short-grain surface, so let the glue soak in for five minutes before



Mitered CD/DVD Rack

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
❑ 2	Rails	3/4	1½	14¾	Oak	45° miter both ends
❑ 4	Uprights	3/4	1½	4½	Oak	45° miter one ends
❑ 1	Bottom	3/4	1½	10¾	Oak	22½° bevel both ends
❑ 2	Feet	3/4	3½	2¼	Oak	22½° bevel both ends

assembling. Use tape to hold the ends of the center rail to the tops of the feet and allow the glue to dry overnight.

The last step before finishing is to glue the two outer assemblies to the middle rail and feet. Apply some glue to the exposed top of each foot, let it soak in, then apply more glue to those spots, and along the length of the middle rail. Put the edges of the three rails together, centering the middle rail end-to-end. Use a couple small clamps to hold them in place, or you can wrap some tape around all three instead.

Let the glue dry overnight, remove the tape or clamps and lightly sand the entire project with #150-grit sandpaper. Round the sharp edges slightly and you're ready for a finish. We used an oil-based stain followed by Danish oil to obtain a dark brown satin finish. **PW**

Bob is the author of "The Complete Kitchen Cabinet-maker" (Cambium) available from his web site, craftsmanplans.com. Contact Bob at 513-531-2690, x1327 or robert.lang@fwpubs.com.



Tape as a hinge. Clear packing tape holds the ends of the joints together, and it lets you see what is happening as you assemble the joints.



And as a clamp. Fold the ends up and use the tape to hold the parts in place while the glue dries.

About This Column

Our "I Can Do That" column features projects that can be completed by any woodworker with a modest (but decent) kit of tools in less than two days of shop time, and using raw materials that are available at any home center. We offer a free online manual in PDF format that explains all the tools and shows you how to perform the basic operations in a step-by-step format. You'll learn to rip with a jigsaw, crosscut with a miter saw and drill straight with the help of our manual.



Visit ICanDoThatExtras.com to download the free manual.

Get a (Soft) Grip on Drill Chucks

Jacobs Chuck's SoftGrip-series of chucks increase hand torque to make drill-bit slippage obsolete.

Like most woodworkers, we here at *Popular Woodworking* are fond of our cordless drill/drivers. So when two officials from Jacobs Chuck Manufacturing Co. showed us a new aftermarket keyless chuck, they had our complete attention.

The SoftGrip chuck replaces the stock chuck on most drills with keyless chucks, no matter if it's a $\frac{3}{8}$ " or $\frac{1}{2}$ " chuck, single-sleeve or double-sleeve. There are a number of advantages to the SoftGrip that are obvious and unexpected.

The chuck is noticeably easier to close than a hard metal or smooth plastic chuck. And that's thanks to its soft, nubby, almost gummy-worm-like feel. You can really get a grip on the chuck to close it on the bit, which is great for anyone who suffers from arthritis or anything else that reduces his or her grip.

The soft grip isn't just something molded



SoftGrip Keyless Chucks

Jacobs Chuck ■ 864-654-5926

or jacobschuck.com

Street price ■ \$25 - \$32

For more information, circle #154 on Free Information Card.

onto the outside of the chuck. It's integrated into the structure of the chuck using a proprietary double-injection molding process, according to Mike Goodson, the core products development manager for Jacobs.

What that means for you and me is that the soft surface isn't going to peel off in use.

The SoftGrip can be lighter in weight than your stock chuck. For example, our stock Makita chuck weighs 9.2 ounces and the SoftGrip 3000 series chuck for that drill weighs 5.6 ounces. That weight difference is noticeable when you hold the drill and can also increase your drill's run-time by about 10 percent, according to James Hou, the product marketing manager.

However, the weight savings are mostly in the SoftGrip 3000 series of chucks, which use more aluminum in their construction. The industrial version of the SoftGrip, the 6000 series, has more steel in its construction, which adds weight. Our stock Hitachi chuck weighs 9.3 ounces. The SoftGrip 6000 replacement weighs 10.2 ounces.

The only other consideration with the SoftGrip is that you have to get your old chuck off. Sometimes this is easy, and sometimes it is not — as I found out as I replaced the chucks on several drills. Here's the drill (sorry 'bout that): Remove the screw inside the chuck that

secures it to the drill motor. It's a reverse-thread screw, so it's righty-loosey. Then you chuck a large Allen wrench into the jaws of the drill and knock the Allen wrench with a hammer to spin the chuck counterclockwise. This loosens the chuck and you then unscrew it off. Adding the SoftGrip is even easier (instructions are included).

I had no problems replacing the chuck on our Milwaukee and Hitachi drills. Our Makita gave us a little bit of a fight, but after a few love taps the chuck came loose. But the Ridgid drill simply refused. Everyone tried it (we even fetched former Senior Editor David Thiel — a brute — to try it).

We eventually got the chuck off — along with the drill's clutch assembly, spilling ball bearings everywhere. Not good. Perhaps our chuck was torqued on by a particularly sprightly robot. Who knows? So do take care when removing your chuck.

Bottom line: We like these SoftGrip chucks and have been pleased with them in our shop. The chucks are now available from Home Depot and Lowe's.

—Christopher Schwarz

CONTINUED ON PAGE 32



Brute force. After five or six drills, we found the best way to remove the old chuck was to clamp the drill to the benchtop then knock the hex-head wrench to loosen the chuck.

Blue Spruce Paring Chisels Approach Perfection

Paring chisels were once a common and important part of a woodworker's tool kit, but nowadays few manufacturers make them anymore and even fewer make them well.

The problem with all paring chisels is that they are difficult to manufacture so that they work correctly. A paring chisel should have a nice flat back (what some people call the "face" of the chisel). The flat back allows you to plant it on your work and pare a plug or other proud area flush.

If the blade is warped, the tool will either dig into your nice workpiece or it won't cut the plug flush.

Leave it to Blue Spruce Toolworks to make a paring chisel that is exquisite, comfortable to hold and perfectly functional.

For the last month I've been testing out 3/4"- and 1/2"-wide paring chisels in our shop and have been impressed.

The tools are 12 1/2" long overall, the blades are 1/8" thick and use a tang-style construction. But most important, the blades are dead

straight and flat. Not only does this make them easy to use, it makes them easy to sharpen and set up.

Perhaps part of the reason the blades are so flat is that they are made from A2 steel, which warps less than high-carbon steel when it is heat-treated. I was initially worried that A2 was the wrong steel for a paring chisel. A2 holds its edge best when it's sharpened at 30° (which is how these come from the maker). Most traditional paring chisels are sharpened at a lower angle, even as low as 20°. However, the Blue Spruce chisels worked fine sharpened at 30°, even in end grain.

If you've struggled with setting up vintage paring chisels or those from another company, I can highly recommend the Blue Spruce versions of this valuable tool.

The chisels are available in six sizes with prices ranging from \$65 to \$88 each with handles in a variety of woods to suit your taste. Sets are also available.

—CS



Blue Spruce Paring Chisels

Blue Spruce Toolworks ■ bluesprucetoolworks.com

Street price ■ \$255 for a set of four

For more information, circle #155 on Free Information Card.

Milwaukee Compact Driver

Milwaukee has long been a top choice for drills, and this compact 12-volt Lithium-ion driver continues that tradition of excellence. This new battery technology allows for more power in a small, easy-to-handle lightweight tool. This little guy performs comparably to older drills that are much larger and heavier.

Weighing in at just over 2 pounds, the kit includes two batteries, a charger and a canvas carrying case. I decided to test the driver by drilling countersunk pilot holes and #6 x 2" screws in cherry. After driving and removing 100 screws, I decided the drill might outlast me, so I switched to drilling 1/2"-diameter holes with a spade bit. On hole number 12 the battery finally expired.

The speed is variable, with a maximum of 500 rpm. The gear drive is all metal and the 14-position clutch works well and locks out for drilling. Recharge time is less than an hour, and I doubt that you could run the battery down in that time doing normal work. The Lithium-ion batteries also maintain a charge when not in use, and battery life is longer than with Nickel-Cadmium batteries.

The drill was comfortable to use, due to its light weight and rubber grip. There is an

onboard LED just above the trigger that illuminates the work, and an electronic "fuel indicator" that displays the remaining charge on the battery. The reversing switch is located just above the trigger, and some users may need to adjust their grips to keep from hitting it accidentally.

The chuck is a quick-release sleeve that accepts only hex-shank bits. A Jacobs-style chuck would be more versatile, but the trade-off would be an increase in overall length, weight and cost. The upside is that with a hex-shank countersink and bit holder, tool changes can be made quickly when drilling holes and driving screws.

This tool is ideal for working in a tight, dark space but that doesn't mean you'll be making any compromises in day-in, day-out use. It's a good drill that happens to be small. It works hard and works well, and to my aging



Milwaukee 2401-22 Driver

Milwaukee Tool ■ 800-729-3878 or milwaukeetool.com

Street price ■ \$125

For more information, circle #156 on Free Information Card.

wrist, the small size and easy maneuverability make this my go-to drill.

My older 12v drill has been gathering dust since the Milwaukee arrived, and I'm impressed enough to consider retiring it permanently. **PW**

—Robert W. Lang

A Tailored



A graceful slipper-footed design enhanced with additional period details.

In Colonial America, prior to Paul Revere's famous midnight ride, colonists adopted many of the lifestyles of English citizens. One such behavior was afternoon tea. Of course, you couldn't be of a wealthy class and partake in tea without having the necessary serving implements – including a tea table.

Tea tables came into vogue in the early 1700s and were built in many designs such as tray-topped, round-topped and porringer-topped tables with either carved cabriole legs or turned cabriole legs. A tray-topped design with carved legs was by far the most high-end table one could possess.

After the tea party in Boston, the idea of afternoon tea all but disappeared in the American colonies, but the furniture design survives to this day.

Cabrioles Without a Lathe

Queen Anne-style furniture makers focus on curves and achieving a light, graceful look. Cabriole legs are all about

curves, and to give a lighter look to the design, slipper feet were the choice for many tea tables.

Forget the lathe. A slipper foot is shaped by hand. To begin work on the legs, copy the pattern from the drawings on page 38. Next, transfer the shape to a piece of hardboard or thin plywood. Each leg requires you to trace the pattern onto two adjacent sides of each leg blank. Transferring from paper would be tedious. Mill the leg stock to size and trace the pattern to the stock.

At the band saw you'll need to cut to the lines. Freehand cutting is the only option, but there are a few tips to make the task easier. Starting with one face, begin cutting on



Tea Table



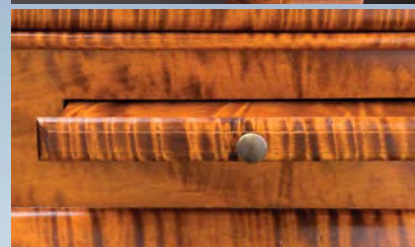
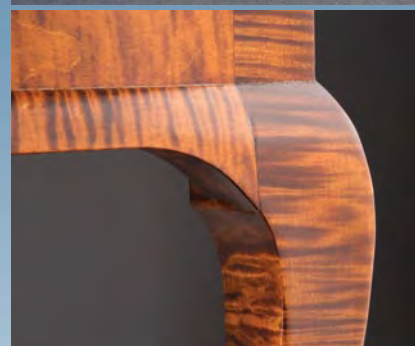
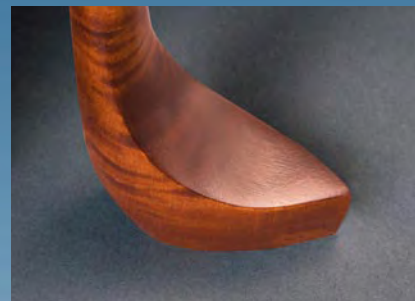
BY GLEN D. HUEY

a straight section of the leg. Cut halfway, then carefully back the blade out of the cut. Cut the balance of that profile entering from the opposite direction, but stop prior to reaching the previous cut. That creates a bridge that holds the waste material in place so the leg pattern remains on the second face. If the blade shows signs of being pinched as you back out of that cut, squeeze the leg at the straight cut to allow ample room for extraction.

Complete the band saw work on the remaining lines for the first face of the leg. On the second face there's no need for a bridge, so saw away until the parts fall free.

Then it's back to the first face to break down the bridge.

***It's in the details.** Mundane becomes exceptional with the addition of slipper feet, graceful curves and intricate details and craftsmanship.*



When the cuts are all completed, you have a square-shaped leg that is in need of shaping.

From Round to Square

Shaping the legs looks more intimidating than it is. Start at the ankle and make that area completely round. To guide me, I use a pattern that's made with a 1" drill bit. Drill a hole in a plywood or hardboard scrap then split the hole down the center. The resulting half-circle is used as a template for rounding the ankle, as shown on page 36.

Next, shape each leg from round at the ankle to square at the knee. Work one leg at a time shaping each edge from bottom to top. The transition is gradual. Use your hands to feel the shape. A Shinto rasp is my tool of choice for shaping legs. I like the aggressiveness of the tool when roughing out the profile.

Smooth the leg with the second side of the Shinto or other rasp but save the finish sanding until the foot area and above the knee is shaped.



All sized and ready to work. If you begin the leg layout work with the stock milled to size, it doesn't matter whether you match the knees or the heels when tracing your patterns.

Shaping a Slipper

Shaping the leg is a rather quick task. But, the work on the individual feet is where the majority of shaping time is spent. Begin shaping the foot by drawing an "X" on each foot's bottom. Next, make a pattern of the foot from the drawings just as you did for the leg. Center the pattern on the foot bottom with the point matching the front corner of the leg. (See photo at bottom left.) Trace the pattern onto each foot.

Use a combination square to draw 45°-angle lines across the foot, parallel to the pattern. Extend those lines up the sides of each foot then saw away the waste material. The lines on the sides guide your sawing to keep from wasting needed material. It's easy to cut too close to the ankles.

Shape the foot to the pattern making sure

you keep the sides of the foot perpendicular to the foot's bottom. Pay particular attention to the rear of the foot. The heel has to roll down and blend in with the foot's shape.

Finish shaping the foot by drawing a matching profile $\frac{1}{8}$ " inside the foot bottom. Each side of the foot is then beveled slightly to that profile. The heel continues to roll to the inside line.

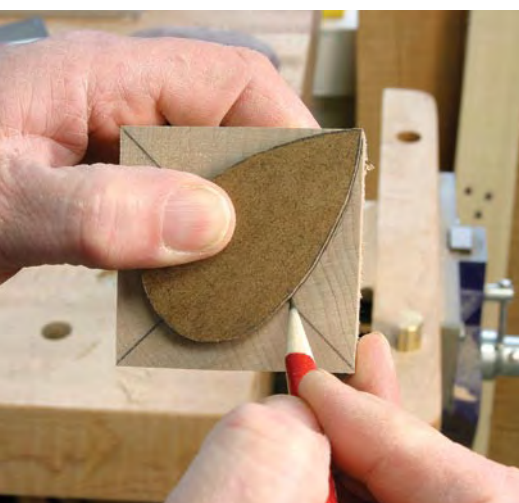
Shaping the top of the foot is the next task. Using hand tools for this is real work. The simplest method I've found is to use a spindle sander. Install a 3" drum with a coarse-grit sleeve on the sander, then slowly sculpt the top of the foot. The idea is to level the foot's top and make a gradual transition to the ankle. Check your progress often. As you get near the ankle, begin to slowly rotate the leg and form the beginnings of the roundness that transitions to the full-round ankle.

Once the shaping of the leg and foot is completed, move to the band saw to remove the waste material from the top block. There is a certain order in which to make this cut. The first cut is with the knee positioned facing the saw's table. To make the second cut simply rotate the leg 90° so one face of the knee is facing up. Following this procedure allows the leg to be fully supported as you cut.

Shape the knee, as well as the area above the knee, then sand the entire leg with #150-grit sanding discs. At this time stand the legs side by side and look for any variations in shape. This is the time to fine-tune the legs so they match. But, don't get carried away with this task. Remember—the legs stand 17"



Simple is better. A simple shop-made jig is the perfect tool for defining the shape of the ankle of a cabriole leg. This slim tea-table ankle is 1".



A foot pattern to match. Transfer the foot pattern to hardboard to make repeated layout easy. If you start shaping with a matching pattern, the end results should match as well.



Work to your plan. The majority of the waste in shaping the slipper foot is removed with a saw. It's important to plan the layout lines and cut to those lines. Deviations could alter the foot shape.



Tapered sides. The edges of the feet taper $\frac{1}{8}$ " while the heel continues to roll to the floor. Draw the inner profile freehand.



Shape with power. Hand tools can achieve a flat foot top, but power sanding at a spindle sander is quick, accurate and repeatable. Goodbye hard-to-work end grain.



A right way to cut. There is a specific cut order to remove the waste from the two faces of the leg block. Choose wisely and the work is quick.

apart at minimum. Slight variations will be imperceptible in the finished table.

Profile and Fit the Aprons

Aprons join the legs with mortise-and-tenon joints. Positioning the legs to cut a mortise in the correct location is a bit tricky. Place a support under the top block of the leg to keep the knee off the surface. As you can see in the photo below left, I cut the $\frac{1}{4}" \times 4\frac{3}{4}" \times 1"$ mortises with the back of the leg block against the fence of a dedicated mortise machine.

Aprons are cut to size according to the cut list on page 38 and tenons are formed on both ends of each apron to fit the mortises. Before assembly takes place, slot openings for the candle slides have to be cut into the end aprons. Locate the slot, then use a plunge router with a $\frac{5}{8}"$ straight bit to create the opening. A straight fence attached to the router makes this quick work. Chisel the corners square, then begin work on the inside face of the apron.

On the inside of each end apron there are two $\frac{3}{4}" \times 2\frac{1}{8}" \times \frac{1}{4}"$ -deep dados that capture

the candle-slide supports. The supports are held down from the top edge of the aprons $\frac{3}{8}"$ to accommodate the recessed top and are press-fit into the candle-slide openings. A straight fence and $\frac{3}{4}"$ pattern bit work great to make the dados. Again, square the corners with your chisel.

Sand the aprons through #150 grit then fit one apron to a mating leg. Hold the apron flush with the top edge of the leg, then draw a pattern on the lower apron edge so the rounded profile of the knee bracket area continues onto



Leg support. To cut the mortises into the legs, you need to add support under the top block so the knee is off the table. Add a small wedge below the knee to stabilize the piece.



Plough out the groove. A plunge router and straight bit make quick work of cutting the candle-slide opening. Of course, an attached fence is a must-have.



Right with the pattern. Routing the dado for the candle-slide supports is a snap. Use a pattern bit with a straight fence that you set right on the layout line.

Tea Table

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
❑ 4	Legs	2 1/2	2 1/2	26 1/2	Tiger maple	
❑ 2	End aprons	3/4	5 3/4	18 1/2	Tiger maple	1" tenon both ends
❑ 2	Side aprons	3/4	5 3/4	26 7/8	Tiger maple	1" tenon both ends
❑ 1	Top	3/4	18 3/4	26 15/16	Tiger maple	
❑ 8	Wooden clips	3/4	7/8	2 1/2	Tiger maple/poplar	
Knee Return Brackets						
❑ 2	End brackets	3/4	2 1/8	16 1/2	Tiger maple	
❑ 2	Side brackets	3/4	2 1/8	24 7/8	Tiger maple	
Candle Slide Parts						
❑ 2	Supports	3/4	1 3/4	26 3/4	Poplar	
❑ 2	Candle slides	9/16	8 1/4	8	Tiger maple	
❑ 2	Candle-slide fronts	1/4	7/8	8 1/2	Tiger maple	
Tray Moulding Parts						
❑ 2	Long beads	3/8	7/8	29 1/8	Tiger maple	
❑ 2	Short beads	3/8	7/8	20 3/4	Tiger maple	
❑ 1	Long cove	3/4	2 1/2	32	Tiger maple	Becomes 2 pcs.
❑ 1	Short cove	3/4	2 1/2	23	Tiger maple	Becomes 2 pcs.

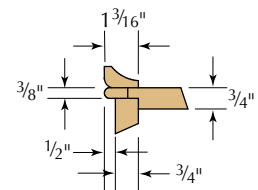
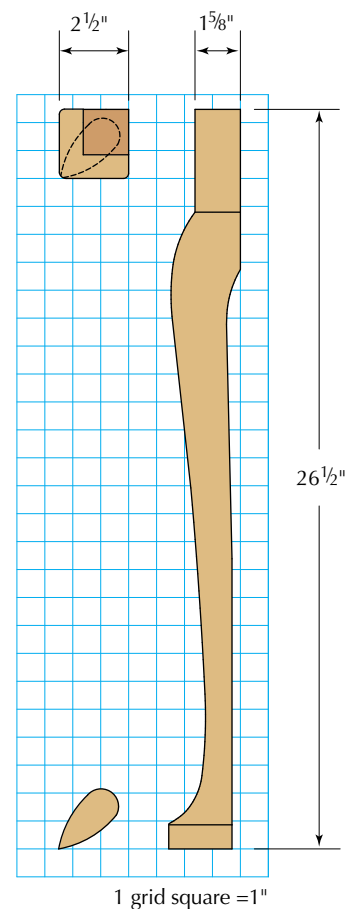
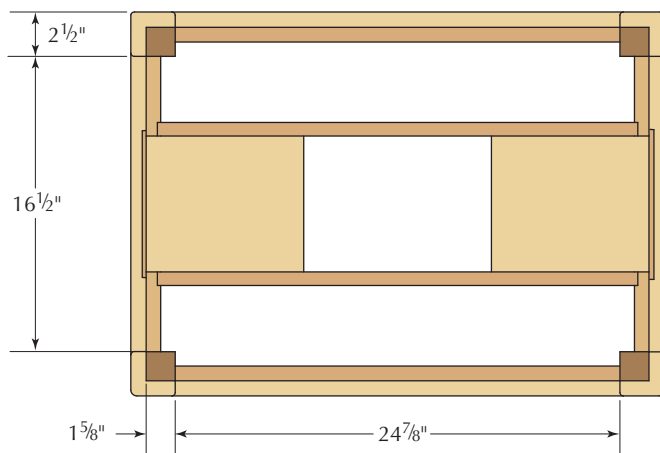


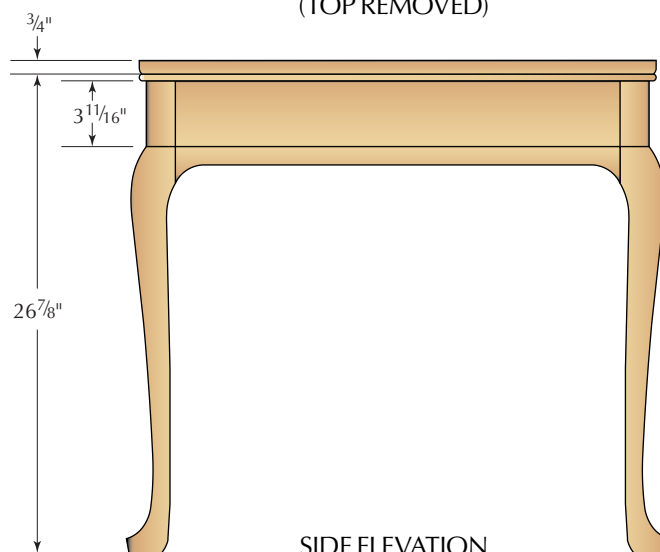
TABLE EDGE DETAIL



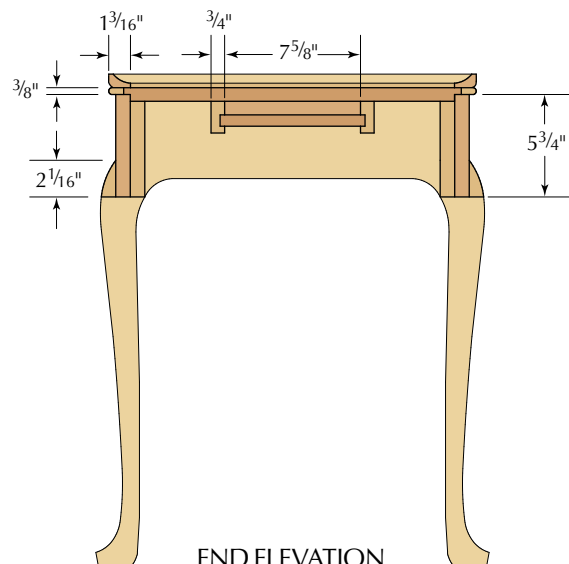
FOOT & LEG PATTERNS



INTERIOR VIEW
(TOP REMOVED)



SIDE ELEVATION



END ELEVATION



At-hand solution. It takes time to set up a compass or trammel to lay out the curve necessary for the transition from knee to apron. Shop items such as this sanding disc do the job – and are usually right at hand.

the apron as in the photo above. (A 5" sanding disc makes a perfect pattern.)

Blend the radius of the pattern up $1\frac{1}{16}$ " on the apron. Repeat the pattern on both ends of each apron then make the cuts at the band saw. Smooth the edges with light sanding at a spindle sander.

Now it's time to assemble the base of the table. It's best to assemble the base in two steps. First, glue the side aprons to the legs. After the glue is set, assemble the end aprons to the legs. Add glue to both the mortises and tenons, then slip the joints together, making sure to keep the top edges flush. Allow the glue to dry, then sand the entire workpiece to #180 grit. You'll have to touch up the sanding later during the project, but this is the best time to do the majority of the work.

Next, you'll need to create small slots for the wooden clips used to secure the top. A couple options for cutting the slots are a router or router table with a $\frac{1}{4}$ " slot-cutting router bit (the tea table is light and compact enough to hoist onto your router table), or use a biscuit joiner and complete the slot in two overlapping cuts.

Position the slots from $\frac{1}{2}$ " to $\frac{3}{4}$ " down from the top edge of the aprons. With the slots located in this position, the tongue of each wooden clip is set toward the middle. (See top-left photo on page 42.) If you slide any further down the apron, you'll likely cut into the candle-slide opening in the end aprons.

Shaped Knee-return Brackets

Another feature that adds interest to the design of this tea table is the shaped knee-return brackets. On most carved cabriole-legged furniture, the knee returns extend to or slightly over the aprons or other rails. However, on

some tea tables the brackets extend from leg to leg, adding shape and shadow lines.

Begin with blanks that fit snug between the knees of the legs. Draw pencil lines along the leg curvature to transfer the shape to the returns. Also, transfer the design from the bottom edge of the aprons onto the returns.

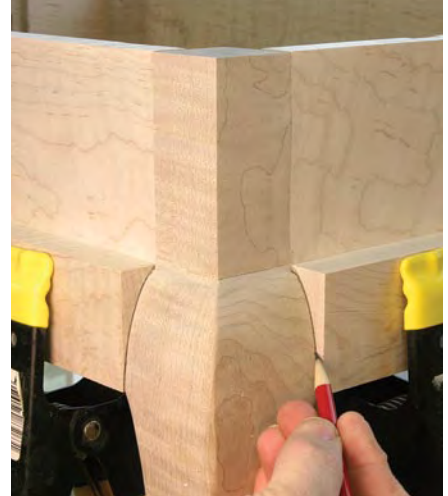
Angle the table saw blade then position the fence to remove as much waste as possible.

The flat surface on the face of the returns is enough to hold the pieces flat at the band saw to cut the apron-matching design. But, if you make a continuous cut, the flat area is removed and the piece becomes unsteady. It's best to make the cut in sections to leave short portions of flat area intact. This allows you to maintain control throughout the cut.

Use a spindle sander or drum sander at the drill press to smooth to the lines. Again, the flat areas help maintain control. Once the edges are smooth flip the piece and, using a pencil or marking knife, connect the straight portions to provide a line to remove the balance of the waste material. Return to the band saw to remove the final waste material then sand those areas; the return brackets are now ready for final shaping to the leg profile.

Final shaping is done with a small hand-plane. Work the profile to match the leg area, then finish smoothing with rasps and by sanding. Finish sand the returns to #180 grit.

The brackets are glued to the lower edge of the aprons – no fasteners are needed. To



Dressing up the apron. The knee-return brackets add visual interest to the overall design. Once the proper thickness is achieved, transfer the profile and begin to shape the returns.



Waste not, want not. Bevel the table saw blade to remove as much waste as possible from the knee returns without cutting into the profile portion.



Keeping balance. To keep the stock level throughout the cut, leave tabs on the knee-return brackets. Create a tab as you reach the end of the band saw table. The tabs are later removed with the stock positioned face up.

keep the glue from squeezing out above the bracket where it would be difficult to remove, make a shallow table saw cut just below the top edge of the bracket on the back face. That cut acts as a reservoir for excess glue. Add a thin bead of glue to the bracket below the cut then position the brackets to the apron. Add a few spring clamps until the glue is set.



Shave to shape. The best way to shape the knee-return brackets is with a small handplane. Watch the grain direction and the results should be near finish-ready.

Adding the Candle Slides

While the glue sets, cut and fit the candle-slide supports. Fit the pieces to the base then mark the exact location of the slide opening. Cut a $\frac{5}{8}$ " x $\frac{1}{4}$ " x 10" groove at each opening.

A straight bit and a router table are your best bet for this task. Align the layout marks with the router bit, set the fence and create the groove. Setting a stop for the length of cut allows easy removal of the support after the groove is cut. The supports are held in place with a small amount of glue where the bottom of the slide fits the dado in the end aprons.

Next, make the candle slides so they fit the opening. Mill the material, making sure to orient the grain across the opening. Then create the front piece for each slide with all edges profiled with a $\frac{1}{4}$ " roundover router bit.



Turn for alignment. With the opening for the candle slides transferred to the support, locating the cutting position of the matching router bit is all that's needed to create the groove. Turn the carbide cutter perpendicular to the fence to set up the cut.

Mill this profile on wide stock, then slice the fronts at the table saw. This eliminates working with small pieces. Run the four edges to create a $\frac{1}{16}$ " shadow line on the profile (as you would when profiling drawer fronts), then rip the fronts off. A zero-clearance insert keeps the moulded piece from dropping into the saw.

Finish sand the candle-slide parts to #180 grit and prepare to attach the fronts to the slides. Align the fronts with a $\frac{1}{4}$ " above the slide and equal distance to each side. Again, a small amount of glue does the job. Add a thin bead of glue, position the fronts to the slides then use tape to hold the connection until the glue has dried. Use small brass screws as stops to keep the slides from being pulled from the base. Those stops are applied after finishing is complete.

Beginning the Tray Mouldings

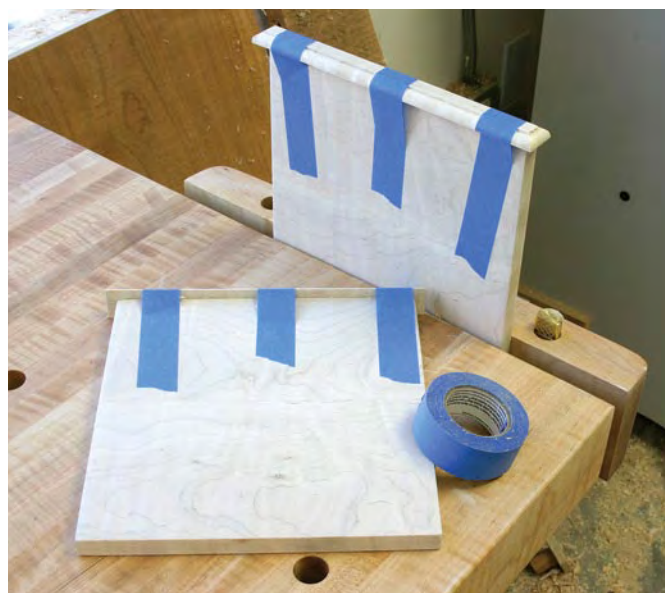
In order to properly size the top, you'll need to build the first layer of tray moulding, which is the beaded frame. The overhang of the completed frame is $\frac{1}{2}$ " all around. Prepare the four pieces of stock then rout the edge profile with a $\frac{3}{8}$ " bead-forming router bit.

The beaded frame is joined at the corners with half-lapped joinery. Make the necessary cuts at the table saw and keep in mind the orientation of the profiled edge. It's easy to remove the incorrect portion of the joint.

I found it best to create the bead then round the corners at the joints after assembly versus



Saving the digits. Profile the edges of the candle-slide fronts on a larger piece of stock, then rip the individual pieces to size. At no time do my fingers get close to the blade.



No brads allowed. To keep from marring the fronts of the slides, use tape and a small bead of glue. The tape acts as a clamp until the glue sets.



Thicker is better. With the bead-frame stock at $\frac{3}{8}$ ", it has plenty of rigidity to shape at a router table. There's no need to rip profiled moulding from wider boards.

Easy does it. Cut the half-lap joinery on the bead frame using the table saw and a miter gauge. Pushing the stock back and forth across the blade creates a smooth level surface.



Framing the tabletop. The bead frame is the first layer of moulding. It's joined at the corners with half-lap joinery and captures the recessed top.

joining the frame and moulding it afterward. This allows you more control working with thin stock.

Assemble the frame with glue. Small F-style clamps apply pressure to hold the corners tight. You need to check the assembly for square as you walk through the glue-up. Once the glue is dry, make sure the overhang is correct, then use a thin bead of glue and 23-gauge pins to attach the frame to the table base.

Free-floating Table Top

Because this table has mouldings in a cross-grain relationship to the top, I elected to attach the tray mouldings to the top edge of the base and allow the top itself to float. With the bead frame in place, fit and install the top.

Mill the top to size and thickness, then fit the top inside the bead frame. Because wood moves across the grain, you'll need to take into consideration what season of the year you're building the piece. Allow $\frac{1}{8}$ " if you're in low-humidity times to almost no gap if you're building with humidity on the high side. As for the length of the top, wood doesn't move much with the grain, so I fit that area snug.

The top is rabbeted along all sides to fit flush with the bead frame. I use a two-step rabbeting method at the table saw, but there are many ways to cut rabbets. Select the method that works best for you.

Whatever method you choose, there is one additional step necessary before the top is attached to the base. You need to remove material at the corners of the top that correspond with the leg posts. Use a straightedge and flush-cut router bit to remove the waste.

With the milling of the top complete, sand the piece to #180 grit, add a drop of glue to the exact center of the end aprons, then position the top to the base. The glue adds extra hold to the top, forcing any movement outward to the sides and divides overall wood movement in half. Each half acts independently.

Add the wooden clips to the base and installation of the top is complete. The clips are made at the table saw, counterbored for screws, then installed with #8 x $1\frac{1}{4}$ " wood-screws. The clips allow the top to move, but keep it tight to the base.

Creating the Tray's Cove Moulding

The tray's cove mouldings begin as two pieces of flat stock milled to $\frac{3}{4}$ " thick. Next you'll need to produce a cove cut centered on the stock that results in the correct end measurements for the cove once the stock is ripped into two matching pieces.

At the table saw, with the blade height adjusted to $\frac{1}{2}$ ", position an auxiliary fence for the cut. Twisting the fence manipulates the cut, so it's necessary to find the exact setup



Trim to fit. Any straightedge and a pattern router bit, in this case a $\frac{5}{8}$ "-diameter bit, produces a clean cut at the top corners to allow for the recessed top to fit in position.

Supplies

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horton-brasses.com

2 ■ brass desk interior knobs, $\frac{1}{2}$ "
#H-42

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A top with movement. Wooden clips hold the floating top to the table base and allow for seasonal movement. This relieves any cross-grain construction concerns.

position. I take two pieces of stock and draw my cove profile on opposing ends. Position the drawn profile toward the blade and maneuver the auxiliary fence until the infeed and outfeed of the blade align with the layout marks. Once found, lock the position of the fence.

The above-right photo shows the setup at the table saw. I like my auxiliary fence on the outfeed side of the blade, and I've secured the stock in position with a magnetic fence to keep the moulding from moving.

Lower the blade then make successive cuts, each time raising the blade incrementally to produce a cove profile matching the desired design. Take the last pass very slowly in order to remove as many mill marks as possible, which will reduce the amount of sanding.

Finish sand the tray cove mouldings to #180 grit then use a table saw to split the stock in half, forming two identical strips per piece. Each piece is routed with a $\frac{3}{8}$ " roundover bit on the bottom edge to reflect the edge treatment of the profile of the bead frame below. Finish sand any rough areas before fitting the moulding to the table.

Those mouldings are attached to the table with brads located so the top is free to move. The brads extend through the cove moulding and the bead frame into the aprons. Fit each piece of moulding in place, then temporarily attach it to the table with one 23-gauge pin at each end. When the task is complete, the mouldings and pins are easily removed.

Clean up any pencil lines. Add a thin bead of glue to the cove, position the mouldings to the table and attach them with brads – the square holes left from the brad gun mimic antique, square-head nails.

To secure the coved corners, peg each miter with a short length of $\frac{1}{8}$ " dowel.



Make cove moulding. This is the setup used to create cove mouldings. With the fence above the blade, you're responsible for holding the stock tight to the fence. A featherboard helps with that task.

Ready to miter. The tray cove moulding is created as a single cove moulding then split exactly at the center to provide twice the length.



Race to the Finish

For the finish I elected to stain the piece with water-base aniline dye stain (a 50-50 mixture of golden amber maple and brown walnut), add a single coat of boiled linseed oil to highlight the stripes, then topcoat with a few layers of shellac.

Normally I would rub out the shellac to achieve a dull sheen. To save time and effort, I elected to spray a single coat of dull-rubbed-effect lacquer to achieve that sheen. If you don't spray your finish, try wiping on a coat of satin polyurethane or wiping varnish.

Add the brass knobs and brass screw stops to the candle slides and you're ready to sit

Online EXTRAS

For more information on this project and to watch a video that shows making the tray cove moulding on a table saw, go to:

popularwoodworking.com/jun08

down for an enjoyable afternoon of tea – or coffee, if you just haven't been able to get over that entire taxation-without-representation mess. **PW**

Glen D. Huey is a senior editor of Popular Woodworking, a published author and the host of the Woodworker's Edge DVD series. Contact him at 513-531-2690 x1293 or glen.huey@fwpubs.com.



Prep work saves patience. Half the battle in fitting the tray cove is determining where the cut lines are located. Lay out 45° lines that bisect the corners, then cut to those lines.

Band Saws

by Marc Adams

I once toured a very large custom cabinetmaking shop and noticed that they had no band saws. When I asked the owner what his reason was for not having one of these saws, he responded by saying, “Band saws are for curves, and when we need to cut a curved line we use either a scroll saw or a saber saw.” I was shocked to think that a multi-million dollar manufacturer of wooden products did not have one of the most valuable and versatile tools in the shop.

As a matter of fact, I have since toured many production and home shops that do not have band saws either. How can that be? I think the band saw is one of the most versatile woodworking tools. Yes, it can cut curves and irregular lines, but that is just the beginning. Band saws can be used to cut thick materials, re-saw lumber, make

A versatile machine. The band saw can be used for straight cuts of course, but it's also handy for cutting cabriole legs, dovetails, mortise and tenons and much more.



PHOTOS BY AL PARRISH

A Better Way to Work • Part 5

WOODWORKING Essentials

compound cuts such as those used for creating cabriole legs, reproduce or make duplicate parts with a high degree of accuracy, cut a variety of joints including dovetails and mortise and tenons, cut circles, square notches, make angled cuts, and of course they can cut any type of a straight line – both with a fence and freehand.

The band saw gets its name because the blade that cuts the stock is a narrow steel strip where the ends have been welded together to form a continuous band. It is usually not the first machine purchased by the home woodworker, but it can be one of the most useful machines in the shop. Band saws are not typically used in the final milling process to make boards square or S4S (surfaced on four sides) but they can be wonderful tools to help cut rough lumber to length and width before starting the milling process.

They are sold in a variety of sizes. I have heard over the years that the size of a band saw is determined by the wheel diameter or the distance from the blade to the throat. This measurement is the limiting factor on how wide wood can be cut to the left of the blade. Most home-shop band saws are 10" to 14" in size. However, this measurement or size limitation is only one part of the equation. The other consideration when determining the size of a band saw is the depth of cut it can make.

The depth of cut on a band saw is determined by the overall distance from the table to the guides when they are at their highest point. Generally, the larger the machine the more powerful it will be and the more capacity it will have. Bigger machines can typically accommodate larger-width blades which could be desirable for certain applications of re-sawing. All saws should be able to handle narrow blades.

The size of the table is usually not a consideration when buying a band saw, but the larger the table, the more support and control the saw will afford. Today, some manufacturers such as Powermatic offer extension tables that fill the void between the left side of the table and the upper arm. The size of the table will determine how much it can tilt to both the right and left of the

blade. Most band saws can tilt 45° to the right and about 10° to the left.

The purpose of this article is not about how to select blades or whether or not to de-tension them when not in use. It is not about how to align the wheels or discuss the difference between bearing guides or cool blocks. Nor is it about the techniques of how to re-saw lumber, cut cabriole legs or how to make and use the variety of jigs and fixtures that make fancy cuts. There are a lot of good articles and books that have already been written on those topics.

The purpose of this article is to explain the proper and safe techniques for using this saw. For the purpose of proceeding, from this point on we will assume that the mechanical function of the saw such as blade tracking and blade tension, as well as the adjustment of the guides, are all in proper working order and adjusted correctly.

Band saws are quite easy to use and fairly safe, as long as you understand two basic fundamentals of the machine: the action of the cut and how to plan the cut.

Cutting Action

Band saws do not create a kicking or throwing motion toward the operator. Instead they have pinch points. Because the cutting action of the blade is created by a downward motion, all cutting forces are directed toward the table. This all but eliminates kickback toward the operator. It can, however, pull the stock, especially small offcuts, through the throat plate toward the bottom guides. This in turn could possibly break the blade, damage the throat plate, wreck the guides and throw off the tracking, any of which could create risk to both the machine and operator. So what should you do with all those small offcuts? It is tempting to tap them away with another piece of wood or with your fingers. However, this would put your hands within the 3" rule – which is in violation of safety rule number 1. These small offcuts cause no harm until you put them in motion. More than likely, the next piece of wood to be cut will push those small pieces out of the way. When the last cut is complete, wait for the blade to come to a complete stop before removing any offcuts next to the blade.



Pinch points. If you have to make a sculptural cut that will result in wood that's not flat to the table, be aware of pinch points, and plan the cut to minimize this problem.



Round. When cutting round stock, the initial point of contact between the blade and workpiece is unsupported. Exercise caution, as your stock may start to spin and be pulled into the blade.

It is also important to know that the blade on a band saw will only cut on the front edge and not the sides or back. Since the sides and back have no teeth, wood that comes in contact with these parts of the blade will not be cut or pulled in any direction. Even if the sides or back of the blade do cause some kind of force to the stock, it will be minimal and more than likely not cause any risk. This is where some confusion comes in with the guides. The guides do not act as guards. Remember, the guides keep in close proximity to the side and back of the blade, yet they leave the business side of the blade totally exposed.

In order for a band saw blade to cut, the stock must be pushed or pulled into the descending teeth on the blade's front edge. Band saw blades will not cut stock that is idle. The cutting action requires that the stock be placed in motion toward the rotating teeth. With stock sitting flat and supported on the table, it is fine to "let go" of the stock to reposition your hands while cutting. Once you stop pushing, the cut at the point of contact stops. This safety feature allows the operator to always be in control of the cutting action/motion.

It is not recommended to do sculptural work, round or unsupported freehand cutting on the band saw without providing some type of control under the work. For example, round stock at the point of contact is unsupported, which in turn can cause the

stock to start to spin and be pulled into the blade. I recommend that a V-block be used to support all round stock to prevent this from happening.

Although it is not advisable to do sculptural work on a band saw, there are considerations that must be taken into account when doing this type of cut. It is important to set your work on the table to create the least amount of angle or "tip" between the stock, the blade and the table. When cutting wood that is "tipped" off the table, the support is gone and the blade will want to grab the wood and slam it toward the table. This pulling will be sudden and can create a major pinch point. If you ever make this unadvisable type of cut, set your work so that the angle of the pinch point is minimized.

Planning the Cut

Usually, the correct cutting position for operating a band saw is to face the blade. However, you can operate it by standing to the right-hand side or the back of the saw if it places you in a better position to see and control the work. (Be aware that if the blade breaks and is thrown from the saw, it has a tendency to whip to the right-hand side as you face the band saw.) Make sure you keep a well balanced stance. Think about your body position at the

starting point of the cut as well as at the finish point of the cut to avoid over-reaching.

Before the saw is turned on, the upper guides have to be adjusted for the height of the wood being cut. A good rule is to set the guide about 1/4" above the top edge of the stock. Keep in mind that the upper and lower guides are not guards, but are guides. The function of these guides is to support the blade and to help it run true. They also keep the blade from drifting and deflecting during the cut.

Two things are basic to properly functioning guides: feed rate and the amount of pressure applied to the stock as it is pushed into the cutting path of the blade. Both feed and pressure will depend on the kind and thickness of wood, and the size of the blade and speed that it is traveling. If the feed is too fast, the saw blade will chatter and squeak as the back of the blade is pushed against the ball-bearing blade support at the back of the guide. If the stock is fed too slowly into the blade, it could cause burning. Pushing too hard with one hand or the other could cause the blade to be pushed sideways, resulting in wear on the side guide system. This could cause the blade to dull or break and will more than likely result in an uneven cut.



Backing out. If you need to back the blade out of a curved cut, turn off the machine and wait for the blade to come to a complete stop. Then, use a stick of wood to steady the blade as you pull the workpiece out along the kerf.



Pre-cut. If you're cutting an inside radius, make the initial cut at the drill press or mortise machine before moving to the band saw.



Relief. On outside radius cuts, it's a good idea to first make a series of relief cuts in the waste area of your workpiece.

When the work is so large or heavy that it causes you to pay more attention to supporting it than cutting it, an extra hand or support system would be a good idea. Always let the machine build up to full speed before starting.

Before you cut wood it will be important to think about the path of the cut. Some pieces will swing in such a way that they will not clear the main upper arm support. Without a plan, you might find yourself in a position where backing out of the cut might be necessary.

There are a few simple rules for backing out of cuts: It's OK to back out of straight cuts but not OK to back out of curved cuts. When backing out of short, straight cuts, the blade remains unaffected in the cut path and the stock has little chance of catching the back of the blade. But when trying to back out of a curved cut, the stock can catch the back of the blade and pull it off the wheels. If you find that you need to back out of a curved cut, simply shut the machine off and use a stick to steady the motionless blade while you remove the stock. If your project requires that cuts be made from two sides, always make the shortest cuts first. This will make backing out easier. Whenever possible, it is better to cut through the waste rather than backing out.

Cutting inside corners that are either radiused or rounded can best be accomplished by pre-cutting on either

the drill press or the mortise machine. This is an especially handy idea when you have tight radii or need a high degree of accuracy. When cutting outside radii it would be a good idea to make relief cuts to help keep the back of the blade from binding in the kerf. These relief cuts allow waste stock to fall away as you are cutting to provide more room for the blade to turn.

Hand Placement

One interesting fact about the band saw is that cuts are usually made freehand, by good old hand-eye coordination. Making accurate cuts depends on the tension and tracking of the blade along with good feed direction. The basic cutting rule is to keep the blade on the line that you have drawn. Most woodworkers push wood into the blade when making cuts on a band saw. This seems to be the natural and usual way to cut either curved or straight lines. However, I teach students that sometimes it is better to cut by "pulling" the wood into the blade by positioning their hands to the outfeed or back side of the blade as soon as possible. Make sure to allow for the 3" rule. If you watch the hand position of professional scroll saw craftspersons, you will see that they have a tendency to place their hands to the back of the blade. This gives them better control, allows for better sight of the line and, most importantly, keeps their hands away from the front of the blade.

Remember: The back of the blade does not have teeth so if by accident your hands were to somehow slip or contact the blade, nothing would happen. If you keep your hands on the infeed side of the cut, if you slip, your hands could fall directly into the blade side with the teeth.

Whenever I re-saw, I place both hands to the pull side as soon as possible and try to avoid using my thumb as a hook on the end of the board. Sometimes when re-sawing if there is a lot of stress in the board, the last few inches of wood could pop open suddenly and if your thumb is hooked on the back it will immediately continue, with force, into the front of the blade resulting in a serious injury.

There are no real guards on the band saw other than the guard that prevents undue blade exposure. This guard is usually well above the guide system. It's important that you establish a boundary of 3" around this guide/guard system and make it a rule that your hand not encroach this area. If you're cutting very small or short pieces, use double-stick tape to adhere them to a larger board that places your hands beyond the boundary. Never flick away small pieces with your hands; I've had several people over the years tell me they got cut on their band saw by inconsequential hand movement.

Another rule about hand placement is that when you are pushing wood from the front side of the blade, the

farther away your hands are from the blade, the better leverage you will have to turn and make corrections. It seems natural to place your hands as close to the blade as possible to gain control of the cut, however, I believe you have better control with your hands farther away. Try this for yourself. Take a large piece of scrap plywood (at least 24" x 24") and draw a curvy line down the center. If you keep your hands close to the blade, just beyond the 3" limit, you will find it difficult to control the turning motion of the cut. Now place your hands at the back edge of the board and notice the gain in control. I recommend that you either learn to pull wood through the cut by placing your hands to the back of the blade, or that you position your hands as far away from the blade as possible to gain leverage.

Important Safety Steps – The Process

The following is how I teach students to accurately and safely use a band saw. There are so many situations that we simply can not cover in this article. All of these rules will apply in most situations. The key is to learn good common sense. If you follow these steps and make them a part of the sawing process, then the “skill” of using a band saw will always be accurate and be safer for the user.

1. Wear protective personal safety gear. Remember your eyes, ears and lungs. Make sure all loose clothing is secured and away from any action that could pull it in – no gloves. Always stay alert.

2. Keep the guards and guides in place and in working order. Make sure there are no chips or offcuts that could affect the performance of either. Make

sure the upper and lower wheel guard doors are closed tightly before turning on the saw.

3. Use proper blades that are sharp and well maintained. Be aware of proper blade tension, tracking and alignment. Use the correct blade for the type of cut being made. The narrower the blade, the sharper the curve it will cut. Wider blades should be used for larger curves and re-sawing.

4. Make sure that all moving parts are free and clear. Maintain a regular maintenance schedule and read the important user information in the owner’s manual.

5. Since the main guard on a band saw is used to prevent excess blade exposure and is located above the guide systems, it will be very important to establish a boundary limit of 3" from that blade that your hands will not enter.

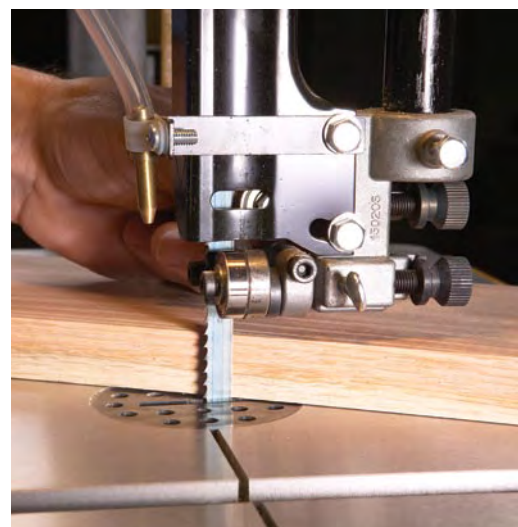
6. The upper guide system should be set to approximately 1/4" or less above the height of the work surface. If the guide is too high, the blade will not have the proper support and that could cause the blade to twist.

7. Be aware that the right-hand side of the saw is where broken blades have a tendency to travel. Keep bystanders away from this area.

8. Always keep your fingers and hands away from the path of the blade.



Re-saw. When resawing, try to move your hands to the other side of the blade as soon as possible – and avoid using your thumb as a hook.



No guards. The only “guard” at the band saw is the one that moves up and down to minimize blade exposure. Make sure you follow the 3" rule around this guard and the guide blocks.



Working small. To cut small pieces at the band saw, first secure them with double-stick tape to a larger board that allows room to hold the work safely throughout the cut.

Avoid using your thumb(s) to hook behind your work to push the work forward.

9. Always use push sticks, featherboards, or any other necessary safety device when cutting small or short stock, or as a way to gain control. Remember that double-stick tape is a great way to hold small parts to larger, more manageable materials.

10. Do not attempt to cut stock that does not have a flat bottom surface (such as round stock) unless a suitable support is used or your work is clamped to a sound surface of some sort. Always remember that the table is your control surface.

11. Hold the material firmly and feed it into the blade at a moderate speed – never force the cut. Allow the machine to come to full speed before making any cut. If the motor starts to slow down and drag, you are feeding the stock too fast.

12. As a general rule, it is OK to back out of short straight cuts. Turn off the machine if the work is to be backed out of curved cuts. It is a good idea to make release or relief cuts before cutting long curves. Without relief cuts, the blade could become pinched in the work; this will dull or break the blade.

13. If the blade breaks, shut the machine off and stand clear until the machine comes to a complete stop. Unplug the machine and wait for the

motor to stop rotating before you open the doors.

14. Keep a balanced stance while using the machine. It is possible to move from the front of the saw to the back to pull your work through, because there are no kickback forces. It is recommended that you get help if your workpiece is too large for one person to safely handle.

15. Never try to pick up or push away small offcuts that are next to the blade. Because there is no kickback hazard, learn to leave these pieces alone. If they are in the way, shut off the machine and wait until the blade comes to a complete stop before removing any such piece.

16. Do not overfeed or force your stock into the blade. It can reduce blade life and cause blade breakage.

17. When cutting with the table at an angle, be sure to block or clamp the workpiece to prevent it or the offcut from falling off the table.

18. Give the work your undivided attention. Make sure you shut the machine off when you are finished. Never leave a running band saw unattended. **PW**

Marc Adams is the founder of the Marc Adams School of Woodworking in Franklin, Ind., one of the largest woodworking schools in the world. For details, visit marcadams.com or call 317-535-4013.

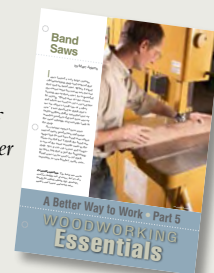
Work with More Accuracy (and Safety) in your Woodshop

The best way to use your machines is rarely explained in the manual. Find out how to operate machines to get accurate results without sacrificing safety.

• Part 5

Band Saws

Band saws are safe if used correctly; however it's easy to step over the line and get bit.



IN FUTURE ISSUES

• Part 6

Planers

Powered planers seem like safe machines until you start testing their limits.



• Part 7

Table Saws

The fundamental skills to get good (and safe) results with the most important woodworking machines.

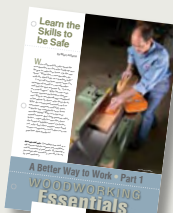


IN PAST ISSUES

• Part 1

Learn the Skills to be Safe

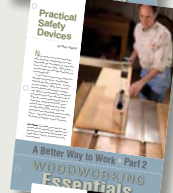
The groundwork for a lifetime of accurate woodworking is to understand your tools.



• Part 2

Practical Safety Devices

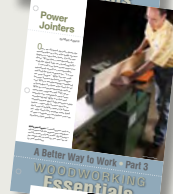
Choose the right guards, push sticks and hold-downs to work safely.



• Part 3

Power Jointers

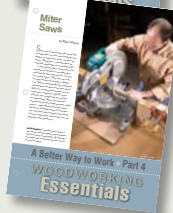
Most people use their jointers wrong, resulting in warped stock and unsafe operations.



• Part 4

Miter Saws

Stock miter saws are neither accurate or safe. Here's how to fix both problems.





JATOBA Bench

BY BERT JOHANSEN

Ebony spacers and plugs add visual interest to this indoor-outdoor design.

My lovely wife asked me to build a bench for our entry hall. After considering the intended space—which consists of an 11' wall—I initially planned on an 8' bench and sketched several possible options. However, the more I considered the challenges of building such a long bench and crafting the joinery so that the bench wouldn't warp, I opted for two 4' benches instead. And although they are intended for indoor use, I decided to make them suitable for outside as well, because the final design is perfect for a garden bench and who knows what the grandkids will do when they inherit them?

Influenced by Japanese design and inspired by its versatility, I crafted this simple bench using hidden stainless steel hardware for durability in either indoor or outdoor settings. For materials I selected jatoba with ebony accents. Dimensions of the completed project are 48" x 19 1/4" x 14".



Start with a blank. A 6"-wide blank is ideal for laying out the slats so you can nest the parts.



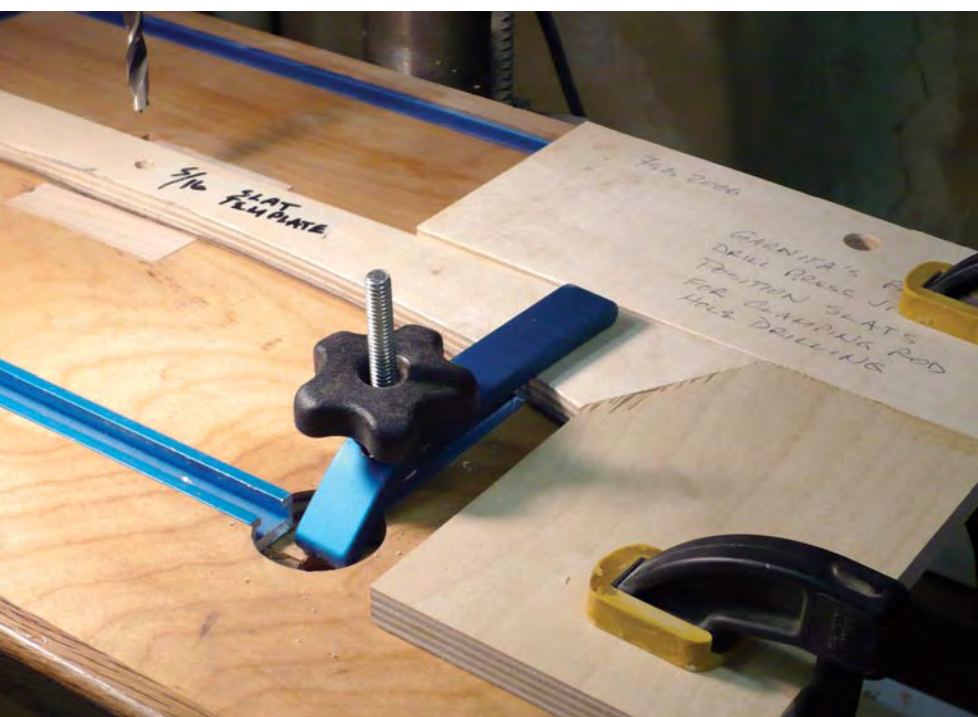
Pattern-route the slats. Jatoba is very brittle and prone to splintering, so attention to grain direction while routing is essential to avoid tear-out.



Mark the notches. Carefully mark the notches for the rails. Here, a lower rail blank is lying on top of the stretcher blank.



Tight is key. Strive for a snug fit between the stretcher and lower rail.



Critical holes. Set up to drill $\frac{5}{16}$ " holes in the slats. Both ends of the slats are secured with hold-downs for this critical operation.

Procure the wood and hardware, then joint and surface-plane the stock to final thickness.

Lay out the parts and make the straight cuts on the table saw. Cut the legs and rails to final length, but leave the slats and stretcher an inch or two longer than the final dimension. It is a good idea to make an extra slat and an extra leg as you proceed, as tear-out when you machine the curved edges could be a problem.

Making the Bench Top

The top consists of nine slats and 16 ebony spacers, held together by two stainless-steel all-thread rods. Draw a fair curve for the top of the slats and create a template from $\frac{1}{2}$ " plywood. Sand the curved top edge smooth. (An oscillating spindle sander expedites this job – and many others in this project.) Drill $\frac{5}{16}$ " holes exactly 10" from the ends of the template, as shown on the drawing on page 52. Use the template to trace the curved profile and cut the slats on your band saw, leaving about $\frac{1}{16}$ " outside the line. (Don't cut them to final length yet.)

Attach the template to each slat with double-stick tape and use a pattern-routing bit at the router table to clean up the band saw cuts. Be aware of the grain direction, as jatoba is brittle and can easily tear out during edge treatment. You may have to climb cut as you rout the rising edge.

Remove the template and cut the ends to final size using your miter saw set to 30°. Carefully sand the curved slats on the oscillating spindle sander, or with a sanding drum on your drill press. These surfaces are the most important aspect of the project, as they constitute the bench seat. Users will invariably caress the surface with their fingers, and you want to eliminate any "ripple" from the router bit – hence the importance of the sanding.

The center "keel" slat has an extra inch added to the bottom. As you will see, this allows the use of a bridle joint to attach the top to the top rails. As shown on the drawing, mark the notches, centered 10" from each end of the keel slat. At the same time, mark the notches for the lower stretcher, as the keel slat and stretcher must be aligned. Also mark the top and bottom rails for their notches. Raise your table saw blade to $\frac{1}{2}$ ", make a test cut and adjust as necessary. Machine the notches in the keel slat and top rails. Sneak up on the final width, checking as you go for a snug fit. Reset the table saw blade height to $\frac{13}{8}$ " and machine the two notch cuts in the stretcher,



Level the slats. I use my ancient (and very loud) belt sander to level the slats. This operation requires a light touch and good hearing protection.

along with the notches in the bottom rails. Test-fit and clean up the notches with a shoulder plane or chisel.

With the notches completed, machine the curved edges of the keel slat and stretcher, repeating the process used for the slats – i.e. band saw, template-route, cut to length and sand smooth.

Make a simple jig with a 30° notch as shown at left below. Use the slat template and jig to set up your drill press. Drill $\frac{5}{16}$ " holes in the slats. Note that the two outside slats also receive $\frac{1}{2}$ "-deep counterbored holes, centered on the previously cut $\frac{5}{16}$ " holes. Use a $\frac{5}{8}$ " Forstner bit for these counterbored holes, and drill them while the slats are still in the clamps.

When all the slats are drilled, gang the slats together, secured with two $\frac{1}{4}$ "-20 threaded rods (about 15" long) and corresponding $\frac{1}{4}$ " washers and nuts. Number the slats for later re-assembly and sand them as a unit, first with a belt sander and finally with your random-orbit sander (ROS). Next, ease the edges with a $\frac{3}{16}$ " roundover bit at the router table. As before, pay attention to grain direction. Finally, sand all slats individually with your ROS working up to #220 grit. (I find that Mirka's Abranet does a quick job on this tough wood.) There should be no sharp edges, except for the notches in the keel slat. I finished the process by hand-sanding with #600 grit.

Machine a piece of ebony to 1" x 1" x 12" and slice 16 $\frac{1}{2}$ "-spacers at the band saw. Each spacer receives a $\frac{5}{16}$ " hole, centered by using a jig. This is a critical operation as the spacers must align perfectly during assembly. While at the band saw, cut four $\frac{3}{8}$ "-long ebony plugs using a $\frac{5}{8}$ " plug cutter. Also cut four jatoba plugs, which will be used later.

The top is now ready for assembly. Add

washers and nuts to one end of the two threaded rods, with the nuts threaded just enough to be flush with the rod ends. Insert the rods through one of the outside slats so that the washer/nut combinations are recessed in the counterbored holes. Slide a spacer onto each rod, add a slat and repeat until all the slats are in place.

Add the washers and nuts to the other end of the threaded rods and snug the short end using a $\frac{7}{16}$ " nut driver. (I discovered that not



Perfect slices. After machining a piece of ebony to 1" x 1" x 12", slice 16 $\frac{1}{2}$ "-spacers at the band saw. And make a few extra, just in case.



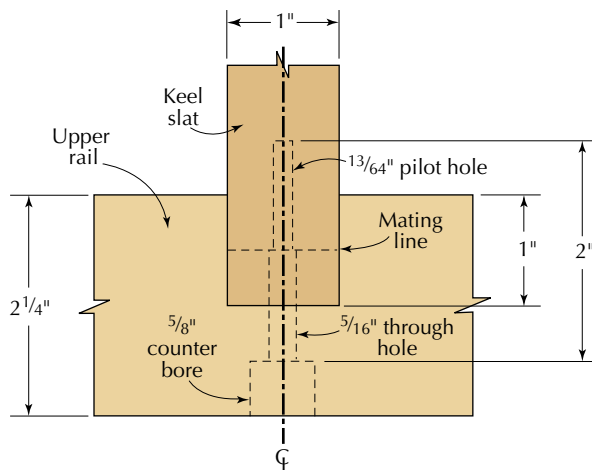
Jig and drill. Drill $\frac{5}{16}$ " holes in the center of the spacers. I made a simple bird's mouth, along with a 90° jig, to secure the spacers during this operation.



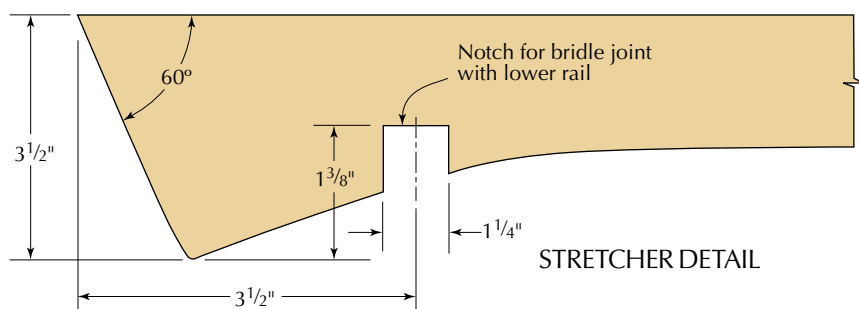
Top assembly. To start assembly, insert a rod through one of the outside slats so the washer and nuts are recessed in your counterbored holes. Slide on a spacer. Repeat.

all $\frac{7}{16}$ "-nut drivers will fit in the $\frac{5}{8}$ " holes. I had success with a $\frac{1}{4}$ "-drive set.) Measure the width of the top. You may find it somewhat different than the 13" dimension because slight differences in thickness of the slats or spacers are cumulative. In any case, the final width is important for cutting the threaded rod. Subtract $\frac{1}{2}$ " from the measured top width and record this number.

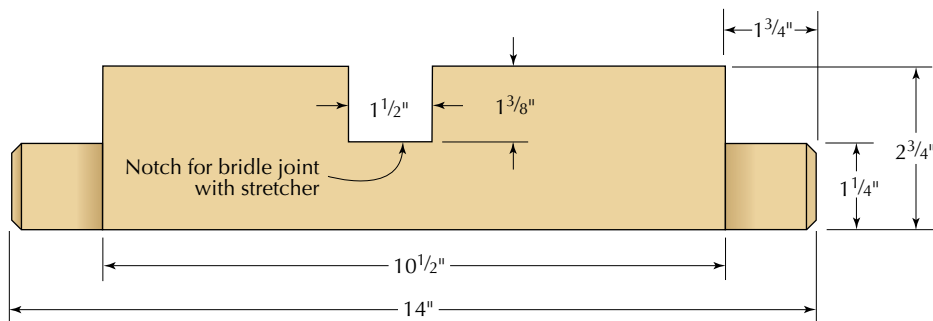
Disassemble the top and use a hacksaw to cut the threaded rods to that length. File the ends of the rods to eliminate any sharp or jagged edges, and test them with the nuts to ensure they thread easily. Assemble the top as before and tighten the nuts "finger tight." Check and adjust the spacers so they are all aligned, then tighten the nuts firmly. Using a waterproof glue or epoxy, glue in the ebony plugs you made earlier. When cured, cut off the excess being careful not to mar the slats. Sand smooth to complete the top assembly.



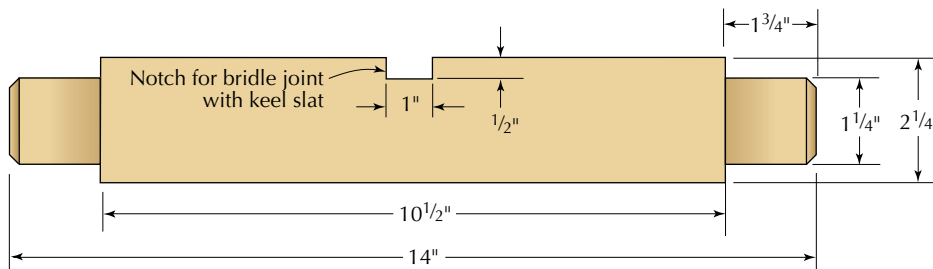
BRIDLE JOINT MATING UPPER RAIL AND KEEL SLAT



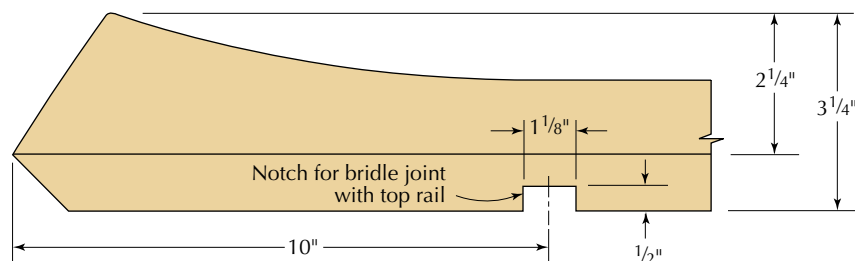
STRETCHER DETAIL



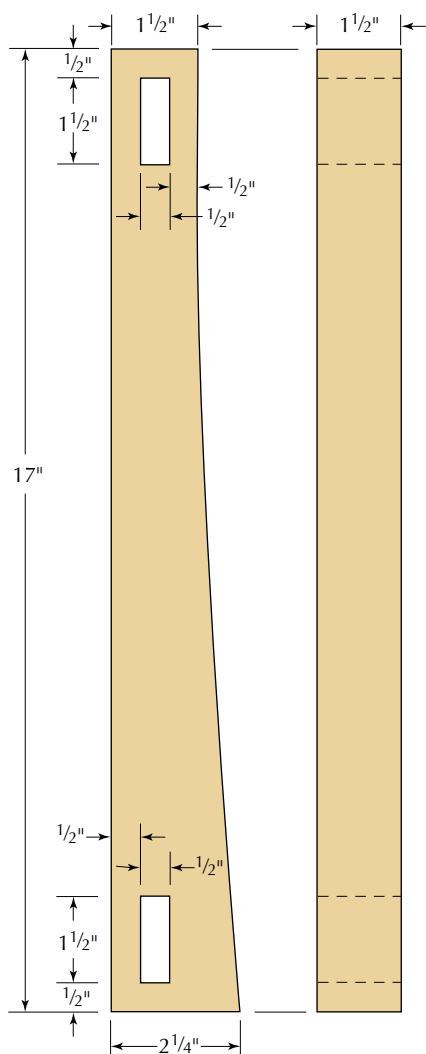
BOTTOM RAIL DETAIL



TOP RAIL DETAIL



KEEL SLAT DETAIL



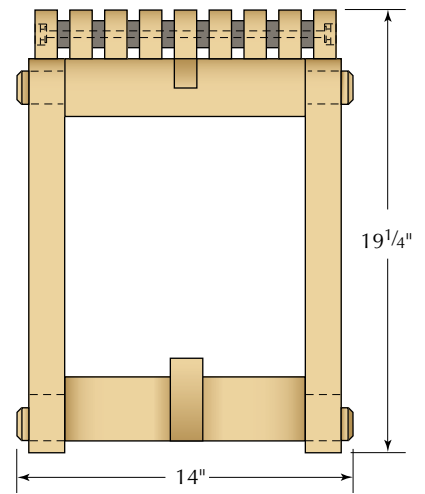
LEG DETAIL

Jatoba Bench

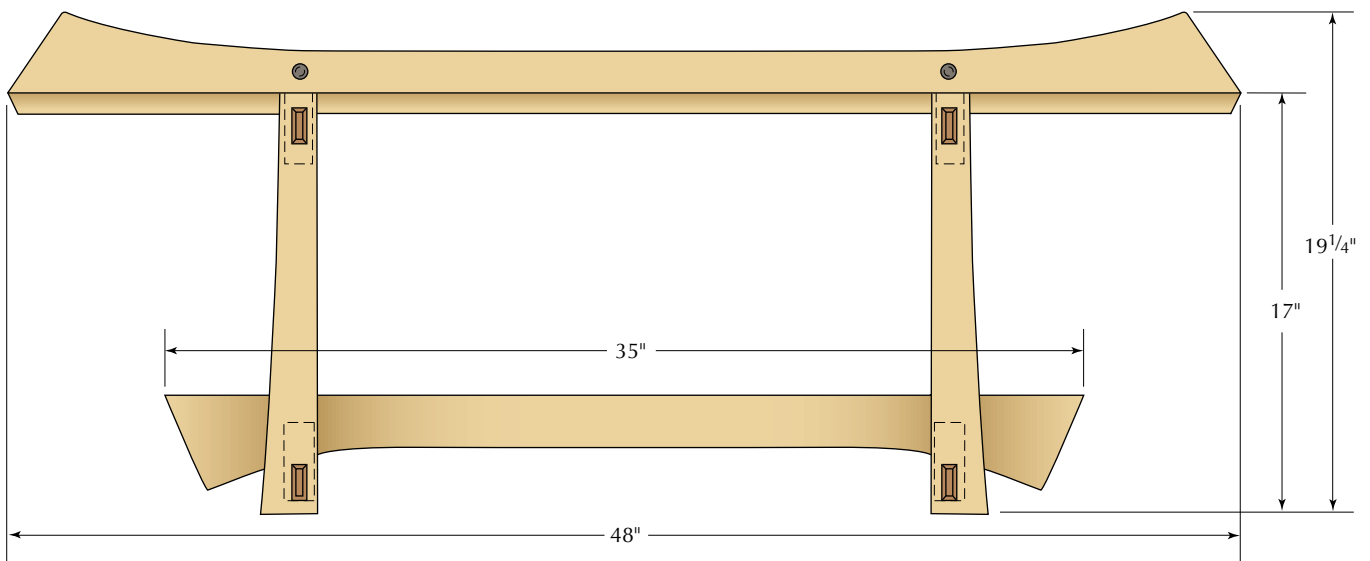
NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL
		T	W	L	
8	Regular slats	1	2 1/4	48	Jatoba
1	Keel slat	1	3 1/4	48	Jatoba
4	Legs	1 1/2	2 1/4	17	Jatoba
1	Stretcher	1 1/2	3 1/2	35	Jatoba
2	Top rails	1 1/8	2 1/4	14	Jatoba
2	Bottom rails	1 1/4	2 3/4	14	Jatoba
16	Spacers	1/2	1	1	Ebony
4	Plugs	5/8 dia.		1/4	Ebony
4	Plugs	5/8 dia.		1/4	Jatoba

Hardware

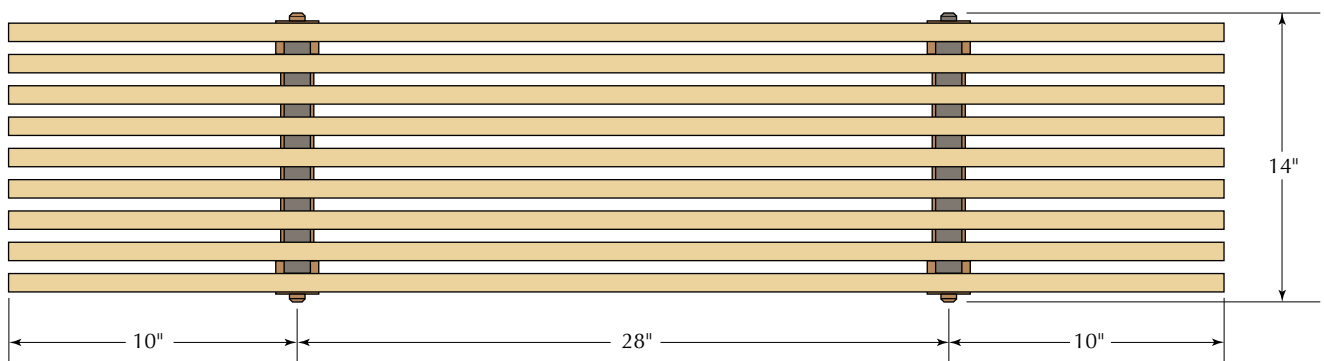
2	Threaded rods	1/4-20	12	Stainless steel
4	Nuts	1/4		Stainless steel
4	Washers	1/4		Stainless steel
2	Lag screws		2	Stainless steel
2	Lag screws		2 1/2	Stainless steel



PROFILE



PLAN



ELEVATION

Making the Legs

You previously machined leg blanks to 1½" x 2¼". As shown on the drawing (page 52), the legs taper from 1½" at the top to 2¼" at the bottom. Make a template of the fair curve, just as you did with the slats. Attach the template to the leg blanks with double-stick tape before machining them on the band saw. Because they are 1½" thick, instead of using a pattern bit on the router I used my oscillating spindle sander to bring them to final dimension. Ease the edges with a ⅜" roundover bit. As with the slats, consider the grain orientation in this operation.

Mark the locations of the leg mortises and cut the mortises. I set up the horizontal slot mortiser on my Robland X-31 with a ½" spiral upcut bit. I milled all eight mortises and squared the corners with a sharp bench chisel.

Now for the rails. Note that the top and bottom rails are quite different. First, they have different thicknesses. I designed the bottom rails somewhat larger because the legs taper, and because the stretcher is robust. Also, note

from the drawing that the tenons are located differently. The top rail must align with the top of the legs in order to form a flat surface and support the top. Thus the shoulder cut for the top rail tenon is ½" to match the topmost mortise cut. To give the mortises symmetry, the bottom mortise is placed ½" from the bottom of the leg. However, the rail should not extend to the floor. To solve this, I offset the tenon on the bottom rail, omitting a shoulder cut in the process. Thus the lower rail begins ½" above the floor.

Machine ½"-thick tenons on both rails. I mounted a slot-cutting blade on the shaper and adjusted it to make the tenon cheek cuts. Make the shoulder cuts on the band saw and make final adjustments with a shoulder plane or bench chisel. "Dress" the ends of the through tenons with hand-cut chamfers.

Next, drill ⅝"-counterbored holes ½" deep into the bottom of each rail, centered below the bridle-joint notches. Drill pilot holes for ¼" stainless steel lag screws to secure the top and stretcher. As with the slats, sand all pieces through #220-grit with your ROS, then finish by hand-sanding with #600 grit.

With all pieces machined, it is time for a trial assembly. Put together the leg assemblies and add the stretcher. Set the top in place. Check that all bridle joints are fully in place. Perform any last-minute tweaking as necessary. Glue and clamp the mortise-and-tenon joints on the legs and rails.

Finish and Final Assembly

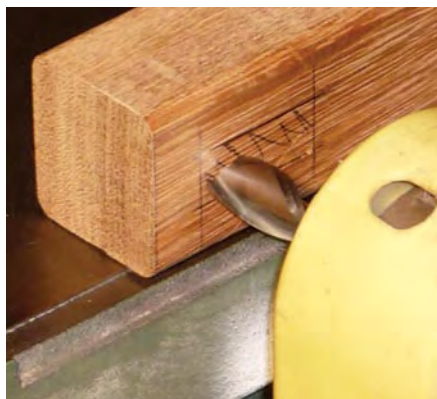
Apply several coats of boiled linseed oil on all pieces, along with a top coat of wax. Complete the assembly by adding the lag screws to



Time-saving layout. Lay out the mortises on only one leg, which you'll use to set up the stops on your mortiser — no need to mark the others.



Horizontal mortises. I used the horizontal mortiser with a ½" spiral upcut bit on my Robland X-31 to machine the mortises in the legs



Setup. Here, you can see where the plunge bit will enter the cut.



All square. Use a chisel to square your mortise corners as necessary.



Key measurement. The fit of the milled tenons is critical to success, so check them with a dial caliper.

secure the bridle joints, then glue the jatoba plugs in the counterbored holes. Sand flush and finish with boiled linseed oil and wax. If you are planning to ship the bench to a client, omit the jatoba plugs and send the pieces flat. Add instructions and lag screws for the client to perform the final assembly. **PW**

Bert has been an amateur woodworker for about eight years. After he "retired," Bert taught creative writing at a community college and founded two Internet companies. When he's not at work in his shop he might be at the computer working on a screenplay about the meeting of John Muir and Teddy Roosevelt in Yosemite.



Chamfer. I finished the end of each through-tenon by clamping the workpiece into my bench vise, then clamped on a jig to hand-cut the chamfers.



Test fit. The leg assembly should be test fit to make sure all the bridle joints are correct. Tweak as necessary before glue-up.



Finish line. Apply several coats of boiled linseed oil, and a topcoat of wax. Oil increases the contrast between jatoba and ebony. The spacers and plugs, seen in the inset photos, add visual interest.

PLANE CRAFT, PART II:



Jointer & Block Planes



Jointer and block planes – and beyond the basics.

In the first part of my article on bench planes (April 2008 *Popular Woodworking*, issue #168), I discussed the historic versatility of bench planes, and explained how to use a scrub, jack and smooth plane. In the second installment of this two-part article, I'll discuss the jointer and block plane, and some advanced planing techniques.

Jointer Plane

A jointer plane's primary purpose is to straighten and square the edges of boards either to achieve a finished edge, or to prepare them for gluing. That is why this plane's sole is so much longer than those of other bench planes. Because it is used for squaring edges, its iron's cutting edge is straight, rather than crested.

Consider the edge of a board that is going to be glued to another to create a wider surface such as a tabletop or a panel. You will not achieve a good result if the plane rocks or if the edges are not square to the surfaces. If the plane rocks along the edge you will have gaps at the ends of the joint. If the edges have different angles, the panel will not be flat. So, while using a jointer plane successfully requires a bit of practice, there are a couple tricks to help you achieve success.

To avoid the problem of gaps on a long joint, I find it easier to spring the joint. This means that when the two boards are placed together, there is a very slight gap in the middle of the joint, while the two ends are in contact. Clamps compress the joint in the middle. This technique is a lot easier and more successful than trying to use clamps to close gaps in the ends of the joint.

To spring a joint, I first joint the edges of the two boards. My last pass is a touch-and-go. It begins not at the corner, but rather several inches beyond. Several inches from the far end, I lift the plane and sever the chip. The result is two ends of the joint that are higher than the center by the thickness of the shaving I removed. Now, when the two edges are butted together, there is the slightest gap along the

joint, but the two ends are tightly in contact. Wood is flexible enough that clamps placed in the center pull the narrow gap together. This is a technique that should not be overdone, as you can only compress the boards so much.

To joint a square edge, I grip the plane not by the knob, but by the body, somewhere ahead of the cutter. The fingers of my left hand are holding the sole, with my fingertips running along the surface of the board. My fingertips act as a fence. Unlike a fence on most tools, my fingers do not guarantee a 90° edge, but I trained myself to feel when I am close,



Tight ends. *Springing a joint results in the two ends being tightly in contact with a slight gap in the middle.*



Finger fence. *With a little practice, your fingers make the perfect fence for 90° edges using your jointer plane.*

BY MICHAEL DUNBAR



All together. Joint your two edges at the same time to ensure a flat panel.



Prevention is key. Clamping a block of wood against the far corner when planing end grain prevents chipping when your plane reaches the end of your workpiece.

and can distinguish if the plane lists to one side or the other.

If I am planing the finished edge of a part such as the edge of a tabletop or a door, this technique is sufficient. After all, the edge only needs to look square. No one is going to place a square on the edge to make sure it is exactly 90°.

While about 90° is fine for an edge, it not good enough for a glue joint. So, try using this trick. Instead of jointing the edge of one board first and the other second, do them both at the same time. Determine which of the boards' surfaces will be up and place those two surfaces together. If the boards are wide and project more than several inches above your vise, use clamps to hold the two ends together. You do not want any gap between the boards' broad surfaces as you perform this trick. Joint the two edges at the same time. If

you're a bit off square, one side will balance the other. For example if you are one degree off square, one side of the joint will be 89°, while the other will be 91°. Together they add up to 180° and a flat panel.

Ends of boards frequently need to be planed to either trim them, make them square or to remove tool marks. Depending on the board's dimensions, you may very well do this with a jointer plane. When planing end grain you need to be aware that the far corner will probably chip. This results from the corner being unsupported and the corner being pulled away as the cutter passes over it. The answer is to clamp a block of wood against the far corner that will support it. Then, it is the far corner of this block that chips, and not your workpiece.

Block Plane

Woodworkers have always owned small planes for small jobs. Such planes could be held in one hand. Woodworkers have also always used low-angle planes for working end grain and trimming miters. So, when Stanley began developing metal bench planes, a low-angled block plane was a natural addition to the product line. Block planes are the most widely owned plane among woodworkers.

While technically not a bench plane, the block plane is frequently used at the bench. Stanley developed two similar, but different versions with different bedding angles. One is bedded at 20° and the other at 12°. Both these angles are so low that the cutter has to be inverted so that its bevel is up rather than down. With a stock only 6" long, the plane is

useful for small jobs, or for working in tight places. The top of its knob is concave and this is where the user generally places the tip of the index finger. With the heel of the hand behind the plane and the finger on the knob, one can generate enough force to cut efficiently yet hold the plane stable with one hand.

However, for very fine or very small work, two hands create even more stability and control.

Like bench planes, block planes have a lever cap to hold the cutter securely. They also have lateral and longitudinal adjustment. Block planes are too small for a frog. So, on some models the mouth is adjusted by a sliding plate that can be moved closer to or farther from the cutting edge. This adjustment is done by loosening the brass knob and pivoting a device called a quadrant. When the plate has reached the desired position, it is secured in place by retightening the brass knob.

Because a block plane is generally used on small or narrow parts rather than a wide surface, its cutting edge, like that of the jointer, is ground straight.

Shaping and Fitting

The term "bench plane" seems to imply that these tools are only used for preparing stock. However, this is only a small fraction of what they can do. They are useful for shaping parts or for cleaning up parts that have been shaped. Long planes such as a jack or jointer can round or even roll an edge on a board. Small planes such as a smooth or a block will do the same for shorter edges. A plane can be used like a large spokeshave to smooth curved surfaces. I often use a plane to round the knuckles on a chair before beginning to carve.



Block plane. The concave knob of a block plane typically holds the tip of your finger while the heel of your palm holds the plane steady.



Plane round. Planes aren't limited to creating flat surfaces. Here, I'm using a jointer plane to roll the edge of a board.

Tapered legs can be made very quickly and accurately with handplanes. I remove most of the waste with a jack plane, as it will hog off wood. I clean up down to my layout lines with a smooth plane. Using planes, it is equally easy to make doubletapered legs.

The best tool for fitting parts and components is a sharp, well-tuned plane. I once hired a carpenter to do some work. I watched in amazement as he tried to use his chop saw to trim as little as $\frac{1}{32}$ ". I fetched a plane and fitted the piece for him in a couple of passes. He asked me to leave the plane with him while he finished the job.

The ability to adjust handplanes and the fact they stop cutting when you stop pushing, makes them an ideal tool for fitting drawers and doors. By the time you have reached the stage where you are fitting these components, you already have a lot of work invested in them. It is nice to fit them in a manner that poses little risk.

Nontraditional Uses

As I mentioned above, a plane's very name risks limiting the user's imagination in finding ways to use the tool. There is no rule that you can only use a smooth plane for smoothing, or a jointer plane for jointing. In other words, the best plane for the job is the one that meets your particular needs. For example, I have a No. 7 with a blade whose cutting edge is slightly



Pull stroke. Though planes are generally pushed, sometimes circumstances dictate a pull stroke instead. Here, I'm using a smooth plane to clean up down to my layout lines on a tapered leg.



Control. Clamping your plane upside down in a vise and running the workpiece over the blade gives you more control when planing short pieces.

crested in the manner of a smooth plane, rather than being straight across. I use it for smoothing large table tops and occasionally for dressing the surface of my workbench. The jointer is as well tuned as one of my smooth planes and thus takes a very fine cut. Used on a broad, long surface, it finds and eliminates high spots that a smooth plane might follow.

Bench planes are configured with a tote over the heel, because they are intended to be pushed. However, there are plenty of times when I turn a plane around and pull it in the manner of Chinese and Japanese planes.

Planes are most often used with the sole down and are pushed over wood. However, they can be used very effectively with the sole up and the wood being pushed over the plane.

I frequently clamp a jointer plane upside down in a vise and run short pieces over it, as this position gives me more control.

We use this technique in every chairmaking class to joint the hand blocks that have to be glued to a bent arm. I am always amused by students who express fear of the plane's cutting edge, knowing that at home, many of them would do this job by passing the block over jointer blades spinning at 3,000 rpm. I illustrate how safe this technique is by dragging my fingers over the cutting edge. Skin is soft and pushes out of the way. In fact, the greater danger is to the plane. You must grip it so the vise's pressure is across the sole. If you grip the cheeks, you may very well break the casting.



Upside down. Turn your plane over and run small pieces across the blade; this is especially useful for mitered moulding corners.

It is also possible to hold the plane upside down with one hand and use your other hand to drag the wood across the plane's cutting edge. I find this a useful position for accurately fitting mitered corners on narrow moulding.

With Other Mechanisms

Bench planes are associated with the workbench, but are also used with other mechanisms. Shooting boards were developed for jointing and squaring small parts. They allow the user far more control than a vise. They also make it easier to work parts that are too small to be held or secured in other ways. There are three basic types of shooting boards: the joint and square, the miter and the donkey's ear. The joint and square is used for the edges and

ends of small parts. The miter shooting board trims and fits miters. The donkey's ear is used for fitting and adjusting standing miters, such as are found on a bracket base.

A miter jack is a special type of vise (usually made of wood) that holds miters for trimming. The jack usually has a cleat that allows it to be secured in a vise so both hands are free.

I recommend having a dedicated plane for use with shooting boards, although a smooth plane will work well on a miter jack. A jack plane is a handy and usual size for most shooting boards, but for very small work, you might use a smooth plane or even a block plane. As the name "joint and square" implies, this shooting board is used with a plane for trimming edges and ends. Therefore, the plane's cutting edge is square, rather than crested. Because tolerances are so tight in small work, this plane should be well tuned and maintained. I have a Bedrock 605 I keep for use on shooting boards.

The bench hook is another device that is handy for planing parts too small to clamp or hold in a vise. The hook is a very simple object, nothing more than a strip of wood with blocks glued on the ends, but on opposing surfaces. In use, one block is hung over the end or edge of the bench. The other acts as a dog and prevents small pieces of wood from moving forward while being planed. The weight of the plane holds the part down on the hook. **PW**

A chairmaker since 1971, Michael is the founder of The Windsor Institute in Hampton, N.H., where he teaches hundreds of students each year to build Windsor chairs. Visit thewindsorinstitute.com for more information and to read his blog.



Shoot away. This shooting board affords more control than a vise for planing straight edges.



Miter jack. This specialized shooting board holds miters tightly for trimming.



Bench hook. This simple device is perfect for planing parts too small to be held by a clamp or vise.

What's Meant by 'Bench Plane'

Although planes can sometimes be used without a bench, there is a real good reason for the term "bench plane." The bench is so important to using planes that the two tools are almost one subject. Planing uses so much force that a weak, loose or lightweight bench is unacceptable. Your bench must be heavy and rigid.

Most of today's workbenches are designed for assembly or use with tools such as routers. As a result, they tend to be too tall for efficient planing. When you plane you need to use the muscles in your legs, as they are much stronger than those in your arms and shoulders. To use your legs, you must be able to lean so that you are over the plane and the work. My test for a proper bench height is to stand upright next to the bench with your arm hanging straight by your side. Bending your wrist so your hand is parallel to the floor and about 2" above the benchtop, establishes the best bench height for you. In our shop where every class has people of different stature, our bench height is a compromise that accommodates a wide range. However, we do have one bench that is a couple inches lower than the others. We do gently direct shorter students to that bench. Being only 5' 9" and having all my life envied tall guys, I have not felt the need to boost a bench specifically for them.

The best bench in the world is not useful for planing without adequate mechanisms for securing wood. Boards need to be held upright for jointing edges. They must be held securely on the benchtop when planing their surfaces. The most effective solutions are vises. You will be very dependent on your vises, and I strongly advise against pinching pennies when buying or making these critical tools. Acquire or make the best. The worldwide standard used to be the Record 53, and for that reason we have one at each of our 28 workstations. This vise is, regrettably, no longer in production. While a number of similar vises are being imported from developing countries, in my experience none is as good as the original.

You will want to include some device for supporting the end of a long board when jointing. Some woodworkers use nothing more sophisticated than a row of holes in the far leg of the bench, into which a dowel can be placed. In our classes, students never need more than to joint the edge of a seat blank. We support the far end of the pine blank with a shop stool.

Gripping a board between dogs is the

best way to plane a wide or a long surface. The Record 53E has a built-in dog that can be moved up for use, and down out of the way when not needed. Other vises, including the earlier Record 53, do not have a dog. This is accommodated by adding a wooden jaw with a dog hole in it.

You need a row of holes in your benchtop that are in line with the vise dog. These secure the front end of the board.

Running a plane into a metal dog really

does a number on the cutting edge. Fixing such damage takes a lot of effort and time. So much metal has to be removed to remove the damage that the tool's life is shortened considerably. To prevent these accidents, we have replaced all the metal dogs both in our vises and bench stops with nylon dogs that we have dubbed "tool friendly." When I look at the nicks and gouges students have cut into the dogs, I realize just how valuable they are to me.

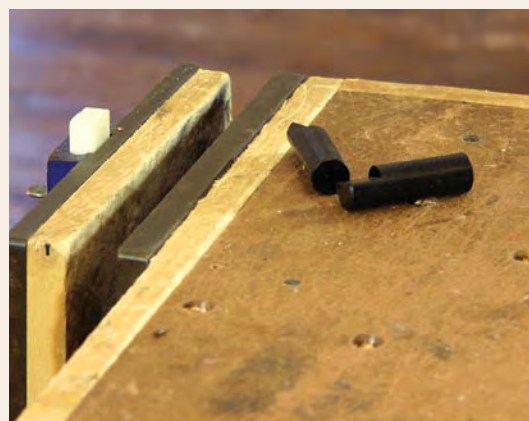
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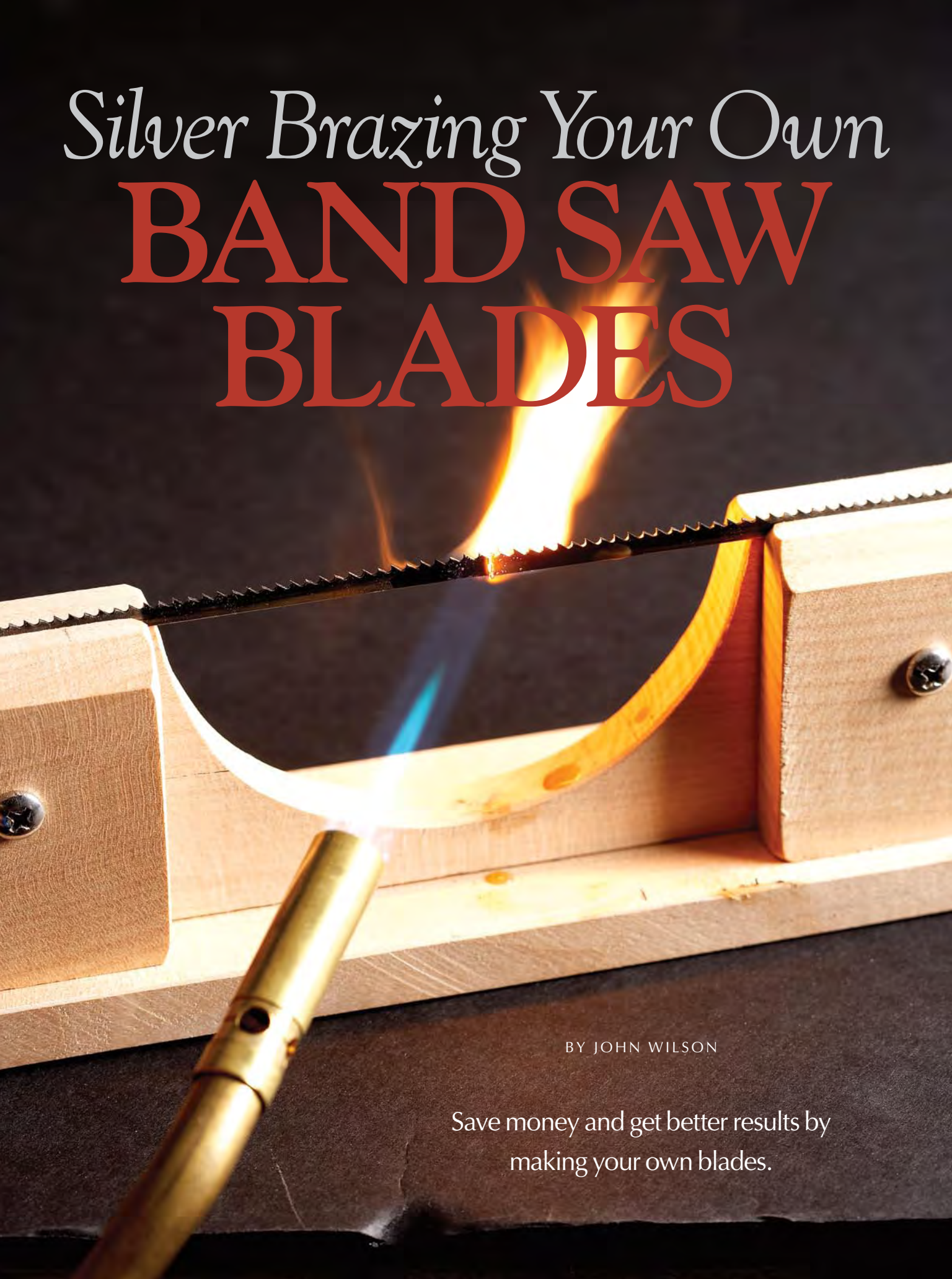
Put your legs into it. Your leg muscles are far stronger than those in your arms and shoulders; use them to your planing advantage.



Record vise. The worldwide standard in vises used to be the Record 53; it's on all the benches at The Windsor Institute. Check flea markets or eBay if you're in the market; it's no longer manufactured.



Nylon dogs. Metal dogs can really muck up the cutting edge of your plane; these nylon versions are far more tool friendly.



Silver Brazing Your Own **BAND SAW BLADES**

BY JOHN WILSON

Save money and get better results by
making your own blades.

I was on the road teaching a woodworking course recently when my band saw blade broke. Not carrying a spare meant buying a replacement locally.

It had been 20 years since I began silver brazing my own band saw blades, and I had forgotten what a broken band saw blade means for woodworkers who don't. First, there is the inconvenience of stopping operations while shopping for the blade. Second is the cost. Third is the disappointment in the poor quality of the weld on the band.

My store-bought blade got me through my immediate need, but it soon broke. All these factors are improved by making your own band saw blades.

What must be the best-kept secret in the band saw market is worth your time to learn. Dependence on pre-dimensioned blades can be a thing of the past. What you need to know and the tools you use and the materials to make your own are all readily available. No special machinery, no elaborate instruction, no obscure source of supply.

You can make up your own band saw blades in 10 minutes using nothing more than a propane torch and a holding jig. Buy the same band blade material you are currently using from the same supplier and you'll save 50 percent to 70 percent. And you'll get back to work doing what you came to do in the first place – working wood in your shop.

Silver Brazing vs. Resistance Welding

There are two methods for splicing band saw blades: resistance welding and silver brazing. In welded blades, the ends to be joined are cut square and electric current supplies the heat to arc weld the butt joint. Silver brazing joins using a fill material of silver alloy. The surface area of the joint is increased by scarfing the ends back about $\frac{3}{16}$ ". The heat for joining the ends is from a common propane torch.

Silver brazing is not the same as soft soldering used in copper plumbing fittings. While both processes use solder, flux and torch heat, brazing is done at a higher temperature, and there is more strength in the band when the filler material is silver alloy. It is, in fact, as strong as the metal itself.

Silver alloys such as N50 or Easy-Flo 3 are examples available today that contain cadmium. Used for decades, we now know that the cadmium in them creates a health risk. Cadmium-free alloy such as BRAZE 505 (visit LucasMilhaupt.com for a brazing book you can download) contains 50 percent silver, 20 percent copper, 28 percent zinc and 2 percent nickel.

Just as with soft soldering, a suitable paste flux is needed to ensure joint surfaces that are free from oxidation. Both silver alloy and flux are available in convenient quantities from catalog stores. While the conventional propane torch is used for both soldering and brazing, the temperature range for silver brazing is much higher: 1,200°F to 1,600°F.

"You can make up your own band saw blades in 10 minutes using nothing more than a propane torch and a holding jig."

Band Saw Blade Stock in the Coil

If the ingredients for brazing are simple and easily obtained, what about the band saw blade material itself?

Olson Saw Co., a major supplier of band saw blades, will sell blade stock in the coil directly to you. Most common types of blades are available, and at significant savings. You also can find other sources for band saw blades in coil form on the Internet (even at the auction site eBay.com) or through other suppliers. Other major blade manufacturers, such as Starrett, Lenox and Sandvik, provide blades in coil form. A large and user-friendly source is MSC Industrial Supply Co. (mscdirect.com), which carries Starrett and Morse brands. (Keyword search on the site for a list and price of different types.)

For example, Olson sells .014" x $\frac{1}{4}$ " x 6-tooth blades for fine work in a 100' coil for

about 50 cents a foot. Coils of .025" x $\frac{1}{4}$ " x 6-tooth blade is about 70 cents a foot. Olson doesn't mention the availability or price of the coils on its web site or in its catalogs; you need to call them.

In researching the article I asked folks in the band saw blade industry about this. Their answer was that their customers had been dissatisfied with the results of their shop-made blades. The solution, I suggest, is better information.

Steps in Making Up Blades

Here is how you go about saving money and gaining independence by making your own band saw blades.

1. Buy a coil of your favorite band saw blade from a supplier.
2. Obtain a "refill kit" for splicing your blade that contains silver alloy and flux from a catalog store.
3. Make a jig for holding the ends of the blade as shown on page 65, or buy one.
4. Cut your band to length (add $\frac{1}{4}$ " for the scarf joint).
5. Scarf both ends of the band on a belt sander to prepare them for joining.
6. Align the blade in the jig, add flux and a premeasured wafer of silver alloy into the scarf joint.
7. Heat the joint cherry red with a propane torch.
8. Anneal the blade with several passes of the torch to remove brittleness on either side of the joint.
9. File the joint smooth.

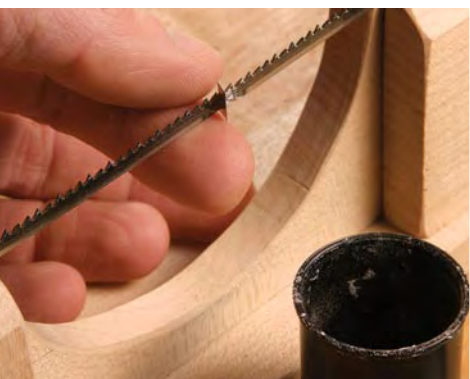
Let's take these steps one at a time. The sources of supply at the end of this article will help you locate the blades and materials you need. Silver alloy sells for \$25 to \$40 per ounce, and flux is \$6 in a 4-ounce jar. Both quantities are more than you will need, so it makes sense to buy a "refill kit" from a catalog store. What is significant to getting good results is knowing about what is called "ribbon solder." This is .003" thick by $\frac{1}{4}$ " or $\frac{1}{2}$ " wide. A page of this magazine is .003" thick to give you an idea of how thin this is. Cut it with paper scissors and make confetti-sized squares as a pre-measured unit for use. For a $\frac{1}{4}$ " blade a piece that is $\frac{1}{4}$ " x $\frac{3}{16}$ " is plenty.



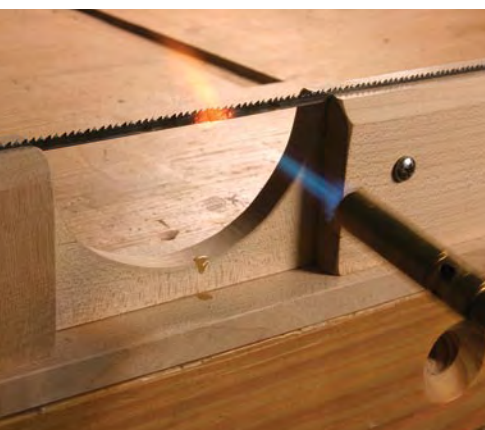
1 Cut your band $\frac{1}{4}$ " longer to allow for the overlap at the joint. Here we're using a belt sander to bevel one end of the band to create the scarf joint.



2 Align the two ends of the sawblade in your jig. Sight across the blade and use a screwdriver to tap the ends into position.



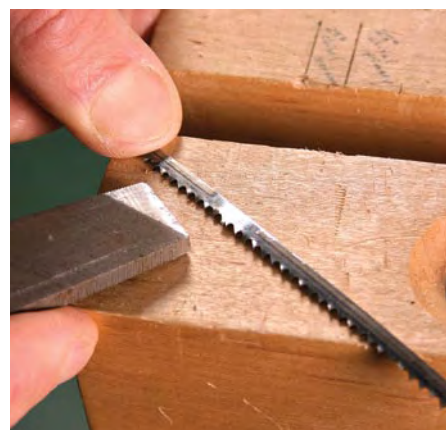
3 Place silver alloy in ribbon form between the two scarfed ends of the blade (above). Add flux to the joint using a small shop scrap (right).



4 Use a propane torch to heat the joint to a cherry red.



5 Remove the brittleness from the band by heating the joint using successively less and less heat. Back up the torch on each pass.



6 The final step is to file off the burrs at the joint and remove the glass-like residue left by the flux.

Cut a dozen such pieces and place them in the flux jar where they are ready for use along with the flux. Note: Flux contains zinc chloride and needs to be used with caution.

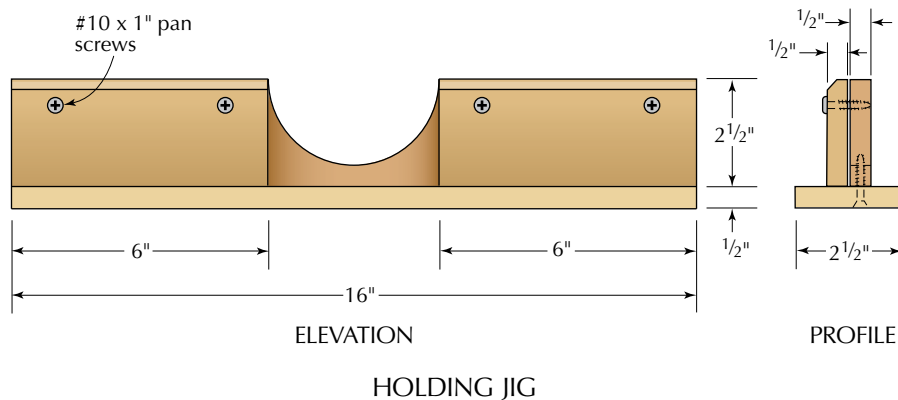
Use a scrap of wood to pick out the pre-measured silver alloy square along with a dab of flux. This is a more convenient and accurate way than using wire solder common in plumbing work. The refill kits differ in this regard. Woodcraft sells its joint kit for \$34.99 with a 10" length of wire silver solder and the refill kit for \$9.99 with the same length of wire. Lee Valley Tool's splice kit sells for \$32.40 and has a 7½" length of ¼" ribbon solder, while the refill kit at \$18.90 gives you a larger jar of flux and 38" of ribbon silver solder. This will do 150 splices. I rate this a good buy.

The holder for the band joint is easily made from ½"-thick hardwood. It will hold the two ends for brazing and gives you the opportunity to accurately align the blade by sighting along the top. This wood jig is intended for small blades and torches as shown in the article. A metal holder is used with larger torches and heavier blades requiring more heat.

Joining the Blade; Playing with Fire

After cutting the band stock to length (plus ¼" for the scarf lap), the ends need to be ground to a bevel angle back about ⅜" to ¼". Rather than do this at a grinder, I touch them on the belt sander. Visual inspection will guide you to making them even on both ends. Hold the blade so that the bevels are on opposite sides and mate when aligned in the jig.

The beauty of the ribbon solder will be appreciated as soon as you line up the band joint and have the ends touching each other. The wafer of solder and the small dab of flux



are held in place by the blade ends.

It is now time to turn on your torch. Silver alloy flows at about 1,200°F, and the joint will be heated cherry red in the 1,600°F range.

When it is fully hot the joint appears to have a molten shimmer to it. It takes less than a minute to heat. The joint is now brazed, but an important step remains: annealing. Heat makes the blade brittle. If you skip the annealing step, your blade will soon break near the joint where the brittle joint area meets the non-heated steel.

In annealing, the torch is used to accomplish a series of heatings to restore the needed toughness to the blade. Back the torch away from the blade an inch and apply a few seconds of heat across the joint area. Allow it to cool for about 10 seconds, and repeat four or five times more, backing away a bit more each time you swipe the joint. You want to heat the blade into the 400°F to 600°F range to temper out the hard brittle steel.

How do you know you have it right? Look carefully at the blade the next time it breaks. If the joint fails, then you have missed with the flux or given insufficient heat to the joint. If it breaks just beyond the joint, you have not properly annealed the blade. If it breaks elsewhere, then you have a stress fracture from the blade repeatedly flexing over the wheels of the saw.

Annealing in the Literature

If the instructions with the two splice kits are what people follow, it is not surprising that the technical support people at band saw blade companies report poor results from woodworkers making their own blades. Nowhere is there any mention of annealing the joint in either kit.

So I turned to the standard reference, Mark Duginske's "Band Saw Handbook" (Sterling). Both methods of making up a band are discussed. Here is what he says about resistance welding: "Before it can be used, you must

anneal it to restore the weld joint to the same metallurgical hardness and strength as the rest of the band. This is done by reheating it to an annealing temperature and then cooling it slowly." When discussing silver brazing, however, there is no mention of annealing after heating the joint with the torch to flow the solder.

One band saw blade manufacturer spent \$60,000 on the annealing machine for its blades. They guarantee the results. What you can do is the finesse of the blacksmith. It starts with knowing what needs to be done and how to do it. Then look at your failures and try it again.

The final step is to file the joint smooth. Surplus flux forms a glass-like bead on the metal that scratches off with the end of your file. You will appreciate the premeasured flake of ribbon silver solder at this step, because there will be very little surplus metal to be filed away as a result.

You can achieve consistently good results doing your own silver brazing. Moreover, you can make up a new band the moment you have a need for it in a matter of 10 minutes. In my book, quality and convenience rank every bit as high as the savings in cost.

Finally, you will come to appreciate that silver brazing is not just for repairing a broken blade. Don't believe the catalog descriptions. In fact, you may find that by the time your blades break there is little or no useful life left in them, which is testimony to your newfound skill. **PW**

Author's note: Thanks to Dave Hout for showing me this practical method for making up band saw blades. As shown, it works best on ½" and smaller blades rather than larger resaw and band mill blades.

John runs The Home Shop in Charlotte, Mich., which supplies wood, copper tacks and other critical supplies for the Shaker oval boxmaker. He also offers classes on a wide variety of woodworking topics. Contact him at shakerovalbox.com or 517-543-5325.

Supplies

For silver brazing kit and refill:

Lee Valley Tools

leevalley.com or 800-871-8158

Woodcraft Supply Corp.

woodcraft.com or 800-225-1153

For band saw blade stock by the coil:

Olson Saw Co.

olsonssaw.com or 203-792-8622

■ blade stock in 100' coils

MSC Industrial Supply Co.

mscdirect.com or 800-645-7270

■ Starrett and Morse blades in 100' coils

BUILD FURNITURE *Without a Shop*

BY CHRISTOPHER SCHWARZ

When you get started in woodworking there are many paths to follow, forks in the road, dead-ends and shortcuts. It's a journey that our forebears would make with the help of a living, breathing guide: a master, a grandfather, a shop teacher.

Sadly, the guides are fewer in number today. And so you are left with people like me to help. Like the making of meat byproducts, it's not a pretty sight. Getting your woodworking instruction from books, magazines, television and an occasional class is a slow way to learn a complex task. In fact, many woodworkers spend a long time (years!) simply accumulating machines and tools before they ever build a single stick of furniture. And when they do begin to build, they inevitably discover that they actually need different machines and tools to make what they really want to make.

So they buy more tools and machines.

I want you to know something important that doesn't get said much: There is another way to begin building furniture. You don't need a table saw, a workbench or even a shop. You don't need to spend \$1,000 to build your first birdhouse. You can go to the home center in the morning and build something in the garage on the same day.

I'm not talking about building junk, either. The difference between a nice-looking set of bookshelves and a rude assemblage of 2x4s isn't a table saw. The difference is cleverness, sound design and just a wee bit of patience.

To build nice furniture you need three things: A handful of decent tools that you won't



Our 'I Can Do That'
manual shows you
how a few tools can
go a long way.

outgrow, some help getting started and some realistic projects to build.

This story is an introduction to our "I Can Do That" column, which we have featured on our web site and in the magazine since June 2006. The core of "I Can Do That" is a free 79-page manual you can download on our web site at popularwoodworking.com/icandothat that will help you choose all your tools and introduce you to the skills you need to cut wood and put the pieces together. The other essential component – project plans – are something we feature in every issue of *Popular Woodworking* in our "I Can Do That" column. It's on page 28 of this issue.

We call the column "I Can Do That" because we want readers to say that phrase (out loud or in their heads) when they open our magazine to that page.

Eventually, we think you'll outgrow this approach to construction as your skills improve. I bet you will want a table saw someday. And a drill press. And a smoothing plane. When that day comes, however, you'll also have a house full of well-proportioned, well-built projects under your belt. You will be ready for those awesome tools, and the learning curve will be mercifully shorter.

If all this sounds like something that a bunch of idealists cooked up at a corporate strategy meeting, you're wrong. Though I had some carpentry training from my father and grandfather, I started building furniture on my back porch in Lexington, Ky., with a similar set of tools. Probably the only major difference is that I had a circular saw instead of a miter saw (at the time I didn't know those existed). I built a lot of stuff with my simple setup – some stuff we still have today and some stuff was long ago abandoned at the curb.

So this, dear readers, is a valid path.

My only regret in following it is that I wish that I'd had this manual (or a master woodworker) to make my journey easier.

Rules for Tools

I'm not an emotional guy. I don't get nostalgic about high school, my first car or my first dog. I don't much hug family members at holiday gatherings. But I do have the deepest respect

***It doesn't take much.** Inexpensive home-center tools and materials can be used to build pieces that are surprisingly sophisticated. All it takes is a little ingenuity and some decent designs.*



'I Can Do That' Tool List

The foundation of the "I Can Do That" approach is the small number of tools you need to build nice and sturdy furniture. Here's a list of the basic kit. For details on how to purchase these tools, download our free I Can Do That Manual at popularwoodworking.com/ican-do-that. The manual also shows you how to use these tools for building furniture (as opposed to houses).

- 12" combination square
- 16' tape measure
- jigsaw
- 10" miter saw
- 7¹/₄" circular saw
- electric drill
- scratch awl and brad awl
- bastard-cut file
- file card
- palm-grip random-orbit sander
- block plane
- combination oilstone
- pocket-hole jig or a biscuit joiner
- 16 oz. hammer
- nail sets
- 4-in-1 screwdriver
- Workmate
- F-style clamps

and affection for my tools. The care you give tools will gush readily into the things you build with them. None of the tools in the kit we recommend should be disposable; if you take good care of them, they will last.

First, take a look at the list of tools in the box on the previous page. You probably have at least a few of these tools already, even if you're an apartment dweller. The remainder can all be bought at any home center with a



A jigsaw cuts it all. You can make clean rips, crosscuts and curves with a jigsaw. It's a safe and easy tool to master, and you'll always need one, even when you are a master cabinetmaker.



Adapt for accuracy. Most home-center tools are designed for home construction. But you can make them accurate for furniture-making. Our free online manual shows you how. Here, sticky-back sandpaper will prevent your work from sliding around on your miter saw.

minimal investment. But before you rush out and spend your beer money, take a moment to read about my tool-buying philosophy.

You want to be careful when buying tools because these tools should last most of your lifetime. You won't replace these tools with fancy machinery when your skills advance, so you don't want to buy the cheapest tools on display in the tool crib.

So what's wrong with that \$39 jigsaw? Everything. Chances are the motor is underpowered, the bearings (if it even has bearings) are flimsy and the electronics are poorly insulated. Push the tool a little hard and it will – no lie – catch fire.

That said, you also want to avoid the tools that are loaded with lots of gizmos and features (with the price tag to match). In general, tools with lasers, bubble levels, wrist straps, micro-adjustable doo-dads and digital readouts aren't necessary for accurate work. In fact, they might actually make life harder for you.

So I recommend you do two things. First, before you go shopping, visit toolseeker.com and browse around so you can see what brands and models are out there. Toolseeker.com also will help you figure out what to expect as far as price. Second, when you go shopping, seek out the brand-name tools, but choose a brand's stripped-down version of the tool.

Here's an example: Let's say you want to buy a random-orbit sander, and you like the Porter-Cable brand. The company offers the



Two drills. A brand-name corded drill is a lot less expensive than a fancy cordless one. We think you'll eventually want both types, but you'll be surprised how much you can do with the old-fashioned corded one.



343 model for \$69 and the 344 for \$79. The more expensive model has variable speed. And while variable speed might sound helpful, it's not useful in a sander, really. Skip it and spend the \$10 on wood, glue or finish.

This philosophy extends to blades, bits and sandpaper. Buy brand names. Nothing is more expensive than cheap sandpaper, bargain blades or no-name drill bits. But don't buy the fancy professional accessories with plastic cases and flashy graphics. Flashy graphics are supposed to impress the guys on the job site. At home you'll impress only the family dog.

Once you get your tools home, treat them like shards of the true cross. Never ever let your tools rust. Rust spreads like a cancer in ferrous materials (iron and steel) and can make your measuring and cutting tools difficult to use. There are a lot of products out there to prevent and remove rust, but the best thing going cannot be found on the shelf: a small can of vigilance.

When you are done with a tool, wipe down the metal surfaces – especially the cutting surface – with a rag that has been soaked with WD-40. Always keep the rag nearby (mine is seven years old) and renew it with a squirt of WD-40 when it gets dry. Wiping your tool down does two things: First, it removes dust from the tool. Dust can carry salt. Salt attracts water. The combination of salt and moisture will start breaking down your iron and steel tools.

Second, the WD-40 helps prevent rust by forming a thin protective barrier, albeit one that must be constantly renewed to be effective. Other people will disparage WD-40 (I once did). Ignore them.

Buying Materials

Another key component to the "I Can Do That" philosophy is that all the materials come from a home center. You don't have to buy your



Yup, from the home center. These Egg Crate Shelves (from the August 2006 issue, #156) were built in a couple afternoons with materials and tools from the home center.

materials there, but you also don't have to trek out to some exotic hardwood supplier, learn the foreign language of lumber and spend a ridiculous sum on wood for a purpleheart planter box.

The truth is, you can build a lot of nice things with the run-of-the-mill (literally) lumber and plywood from a home center. You just have to learn how to shop for it.

Let's talk about home-center wood. In gen-



Be choosy. The best wood and the worst wood all costs the same. It's up to you to find the good stuff. Sighting down the edge of a board will reveal twisting or cupping.

eral, you are going to find lots of construction lumber—white pine, yellow pine, Douglas fir and perhaps hemlock. This is sold in thicknesses best for construction: 2x4s, 2x6s, 2x8s and so on. There are times you are going to want to pick through this stuff, but when you do, you need to know that it is usually too wet to be used immediately for furniture. If you buy construction lumber, take it home, crosscut it to rough length and let it dry out for a couple weekends before you dive in. You'll be glad you did.

In addition to construction lumber, you'll find hardwoods and softwoods that are thinner and designed to be used for trimwork in a house and even furniture. This stuff has been planed to $\frac{3}{4}$ " thick and is in convenient furniture-sized hunks. But you need to be quite wary of it. Why?

Well, first off, this stuff is far more expensive than wood will be at an old-fashioned lumberyard—convenience costs, I tell you. And though it's quite expensive, the really flat and clear boards are just as overpriced as the warped, knotty and split ones.

So sort through the entire pile of wood when looking for boards. Yes, you might get dirty looks from the employees; but if you are going to pay \$30 for a pine 1x12, then by God you should get the best one in the store. When you are done, re-assemble the store's wood pile so it's better than you found it.

What sort of furniture woods are you going to find at the home center? For the most part, lots of pine, red oak, poplar, and sometimes

maple and aspen. You can build a lot of nice stuff using this wood, especially if you are willing to paint your projects (we'll talk about finishing next).

Also, don't forget to visit the moulding section of the home center. You can get away with a lot of store-bought moulding when building furniture—you don't have to have a router. And the nice thing is that most stores sell the moulding by the linear foot, so you can cut what you need right there (and get some practice with a handsaw.)

As far as fasteners go, let me put one little bug in your ear. The worst thing you can do is to buy screws and other fasteners in those little boxes and plastic bags. You know, the ones that have five wood screws in them. Those are, for the most part, made from soft metal and cost too much. If I have to buy screws at a home center, I'll buy a box of 100 or more that are intended for home builders. Heck, I'd buy drywall screws before I'd buy the little plastic baggies.

And as far as glues go, you're in luck. Home centers have a great selection of glue. Just don't buy the no-name stuff. It might be great. It might not. The name brands (Titebond, Pro-bond, Gorilla) don't cost much more.

Finishing Materials

When it comes to finishing materials you are in tremendous luck when it comes to shopping at a home center. If you know what to look for you can achieve almost any kind of finish you desire.



How to be clever. The online manual helps you figure out how to do many complex operations with simple tools. You don't need 10 clamps to create a flat panel. One clamp and a few well-placed screws do the job nicely.

First, let me say a word about paint. Don't let other magazines or woodworkers bully you out of using paint. A lot of excellent and well-made furniture is painted (for example, virtually every Windsor chair ever made). Personally, I love paint on certain pieces. It allows the graphic lines of a project to really stand out. Paint allows you to easily get the color exactly like you want it. And it's a finish that is hard to mess up. In general, I find that latex semi-gloss paint works very well for furniture. It's durable, doesn't stink up the house like oil-based paint and is easy to clean up.

But what if you don't like paint? Again, you're in luck. Home centers carry a wide variety of stains. And here's a trick that you don't hear a lot: You can mix two (or three or more) stains to get the color you are looking for. Just be sure to mix oil-based stain with oil-based stain, and water-based with water-based.

And while we're talking stains, I recommend you avoid the products that both stain and protect your project. These "one-step" products are usually just stains with a little more binder material in them. They offer little protection to your project, and I don't think they look good, either.

Instead, you should protect your wood with some sort of film finish. In general, you are going to find three sorts of products at the home center that will do this.

There will be Watco, Danish oil and tung oil. These usually are a blend of boiled linseed oil and varnish. It's OK stuff, but you need four or five coats to build up a nice film.

You'll find lots of polyurethane. In general, I think polyurethane is harder than necessary; plus, it doesn't bond well to itself. So sometimes a coat can flake off. If you use polyure-

Paint can be pleasant. *This Shaker-style stepstool was painted (as was a lot of Shaker furniture) using latex paint available from any home center.*



thane, be sure to sand the finish thoroughly between coats with #320-grit sandpaper or sanding sponges.

You'll also find varnish or spar varnish. This is the good stuff. It's a lot like polyurethane, except it's a bit softer and bonds more easily to itself. Buy a can of varnish and a can of paint thinner/mineral spirits (they are the same thing). Thin your varnish with three parts varnish and one part paint thinner and you can then apply a nice thin coat with a rag. After three coats or so, you'll build up a nice sheen. Just be sure to sand your finish between coats.

Finally, get some paste wax and some way to apply it. I like the fine synthetic steel wool, which is a gray pad. The gray pad will smooth your finish to the touch and the wax will give the whole project a nice consistent sheen.

Don't Forget Your Workmate

The last important piece of your toolkit is a Workmate. This is a portable workbench that you will never outgrow, even if you become obsessed with workbenches, build 10 of them and write a book about it.

The Workmate is one of the greatest woodworking inventions of the 20th century. It's a big vise, a worktable, a clamping surface, a stepstool. With a Workmate, you can work almost anywhere in the house or yard.

When you buy one, get the nicest one in the store (I know that this contradicts my earlier advice on tools). The plastic ones aren't so nice. In fact, the best way to buy a Workmate is to pick up an old one from a garage sale. My Jimmy Carter-era one cost me \$30 and even included the plastic dogs, which are great for holding panels.

Now Get to Work

Once you download the "I Can Do That" manual, buy your tools, pick out a project (we have several available for free download on our web site) and get your materials, you should dive immediately into the project. No matter how daunting the joinery journey ahead, I promise you that most of the barriers in woodworking are mental. The first step is always the hardest, and that's true when it comes to cutting your first pocket-screw hole or sand-shading your first piece of inlay. **PW**

Christopher is the editor of this magazine and the author of "Workbenches: From Design & Theory to Construction & Use." He still uses the circular saw he first acquired 18 years ago.

MORE RESOURCES ONLINE

Our "I Can Do That" column features projects that can be completed by any woodworker with a modest (but decent) kit of tools in less than two days of shop time, and using raw materials that are available at any home center. We offer a free online manual in PDF format that explains all the tools and shows you how to perform the basic operations in a step-by-step format. You'll learn to rip with a jigsaw, crosscut with a miter saw and drill straight with the help of our manual.



Visit ICanDoThatExtras.com to download the free manual.



Mix a winning finish. *By combining colors from several home-center finishes, you can create just the right hue for your project.*

Woodworking With a Mission

Tillers International teaches sustainable skills to help improve lives.

Most woodworking classes start the same way – with the students introducing themselves and telling about their backgrounds and interests. The most recent class I attended, at Tillers International, was different. It started with a walk in the woods alongside a couple big fellows named Marco and Polo.

I arrived on Friday afternoon, well before the 5 p.m. start of the class, so I joined Marco and Polo and a few other staff members as they gathered wood for the weekend-long Windsor Tall Stool class.

Throughout my life, lumber always seemed to fall into two overly simplified groups. Before I became a woodworker, the two types of lumber were 2x4s and plywood. After I discovered woodworking, I tended to think of hardwoods and softwoods. Later, I found wood could be kiln-dried or air-dried. Then, just four hours before the class officially started at Tillers, I discovered something that should have been obvious: Lumber comes from trees.

As I watched, Christian Guerrero drove Marco and Polo (they're oxen, you see) into the woods where they picked up their prize. As they returned dragging a log of cherry behind them over the snow-covered ground, I struggled to visualize the finished Windsor tall stools that were hiding under the bark.

Then, outside the woodshop, as John Sarge used a chainsaw to segment the tree into the lengths that instructor Dave Abeel requested, I struggled with the concept of a log becoming usable furniture without spending either years as rough-cut boards air drying in stickered piles—or at least a few days in a kiln. However, as I helped wheel the cut logs into the shop, time started to roll back, as I began a weekend where I discovered tools and techniques that although new to me, date back to the foundation of woodworking.



Straight from the source. Christian Guerrero drives Marco and Polo back to the woodshop from the wood source – the forest. Guerrero, from Ecuador, is completing an internship at Tillers International on harnessing animal power.

A Simple Machine

Fittingly, it started with a wedge, one of man's original six simple machines. Abeel and his assistant, Jim Crammond, said the key to splitting logs is to divide the mass. So with this thought in mind, I began driving the wedge into the end grain of a cherry log along a line that went directly through the pith (the center of the tree). Feeling like John Henry, I swung the sledgehammer, driving the wedge deeper into the frozen log, eventually ending up with two halves. To divide the mass of each half, the

wedge was placed and driven again and again until the log was quartered. Each quarter was large enough to provide blanks for three legs. This was done by splitting off the pointed front of each pie piece, then dividing the remaining section in two. For these smaller divisions it was possible to use a froe and a large mallet to separate the log quarters.

The quickly learned lesson of turning a tree into workable stock is to always use the coarsest tool possible. A sledgehammer and wedge are used for splitting. A froe and mallet

CONTINUED ON PAGE 76

Tillers International is a non-profit organization that runs the best woodworking school you've never heard of. But woodworking is only part of Tillers' approach to fulfilling its mission statement:

To preserve, study and exchange low-capital technologies that increase the sustainability and productivity of people in rural communities.

Executive Director Dick Roosenberg was quick to tell me of the many people who make up Tillers, but I also figured out that Tillers International is what it is because of Roosenberg's vision. A Peace Corps volunteer from 1969-1972, Roosenberg spent time in the West African country of Benin. The lesson he carried away was, "teach a man to fish, and you have fed him for a lifetime," which, while always good-intentioned, often had ineffective execution. For example, emerging countries get little benefit from American-supplied diesel tractors if there's no diesel fuel to power them or spare parts to repair and maintain them. Roosenberg found that an African farmer properly trained to plow with a team of oxen was far more efficient than the same farmer with a shovel, a hoe and a broken tractor rusting in a field.

Tillers (tillersinternational.org or 800-498-2700) offers approximately 50 classes that teach age-old skills including woodworking, blacksmithing, beekeeping and sustainable farming to students from all over the world. At the same time I traveled 70 miles from my home to take a class on Windsor tall stools, there was a young Ecuadorian man, Christian Guerrero, who was completing a Tillers International internship on harnessing animal power.



A man with a mission. Dick Roosenberg, executive director of Tillers International, founded the non-profit organization to teach sustainable skills to people in emerging countries around the world.



More than woodworking. Blacksmithing is among the many old-world – and practical – hand skills that are taught at Tillers.

Tillers International's 450-acre Cook's Mill Learning Center in Scotts, Mich., is the primary site for the education programs. The woodworking school offers instruction in three major categories: skills, tools and timber framing.

Woodworking skills classes include Windsor chairs, wheelwrighting, cartwrighting, wooden wheelbarrows, coopering and Shaker boxes. Woodworking tool classes include spokeshaves, handplanes, coopering tools, saw sharpening and tools for timber framing. Among the timber-framing classes are an introductory framing course, assembly and joinery and barn raising.

The southern Michigan facility also has a modern 6,000-square-foot house. The massive home has a ski-lodge feel to it, and is efficiently divided to accommodate multiple needs. The lower level serves as the offices. The main floor houses the kitchen and dining area along with a library. The upper levels function as a bed and breakfast to accommodate students who wish to stay overnight.

The word is steadily getting out about the good work of Tillers International. During my visit in January 2008, I learned that Roy Underhill had spent a week at Tillers the previous summer while filming an episode of "The Woodwright's Shop." The episode has already been broadcast in several areas of the country.

In addition to taking a class at Tillers, another opportunity exists for your visit this summer. On Saturday, July 19th, Tillers International is the location for the Midwest Tool Collectors Area C Meeting. A reasonable registration fee opens up myriad tool treasure possibilities. Look for details at the MTCA web site: mwtca.org.

— JS



A fowl endeavor. Tillers also teaches a variety of sustainable farming skills, including how to raise and care for poultry.

work to rive the parts to a manageable size. Then a hatchet takes away as much waste as possible before the blank is taken to a shaving horse to be further refined with a drawknife. Although the drawknife was used to remove waste wood prior to turning, it can be used to produce a finished surface by those with a little experience.

Each process of transforming logs into turning blanks uses different muscles and requires varied levels of effort. However, it is shocking how physically painful hatchet work can be to the uninitiated. Hatcheting is done through a process called ladder cuts, where one hacks on a given corner at about 45° starting at the bottom and moving to the top. Hacks are made about every inch, and after the edge looks like the peeling layers of an artichoke, a sweeping cut is made from top to bottom along the entire face to clear off material.

I have been watching Roy Underhill do this for years on “The Woodwright’s Shop” television show, long before I became a woodworker. Yet until I took hold of a hatchet that Friday at Tillers, I had no idea how much this seemingly simple task could fatigue one’s hand. Ninety seconds of hatchet work is worse than shaking hands with Popeye after he’s chugged a six pack of spinach. (If you ever get into a team chair-building event and the tasks are divided, choose the sledgehammer and wedge work over the hatchet cleanup. Your hands will thank you.)

Building Experience

Before the class began, I asked Abeel the simple question, “What is a Windsor tall stool?” I expected to hear a lengthy description of archeologists finding secret taverns filled with bar stools of antiquity at various Shaker communities in the United States. However, Abeel shattered that weird thought with an answer equally strange in its frankness.

He said making the Windsor tall stool “was an excuse to have a basic turning class at Tillers.” Abeel went on to explain that in the four-day hoopback Windsor Chair class at Tillers, they find the turning takes so long that the class almost invariably falls behind



Power tool. Author Jeff Skiver tries his hand at one of mankind’s original simple machines as he uses a wedge to split log sections into more user-friendly chunks of wood.

schedule and ends up rushing to finish. Some schools provide students with pre-turned legs, stretchers and spindles at the beginning of the class, but Abeel said that scenario creates a chairbuilding class that only focuses on excavating a seat and then assembling it with a bunch of ready-made components. So Tillers has created the Windsor Tall Stool class as a recommended precursor to the hoopback chair class. In an intense Friday night through Sunday afternoon, students gain experience in all of the skills required for making the lower half of a chair. Then, if those students return to build a Windsor chair, their efficiency will be greater from the outset. So, Tillers can continue to offer a Windsor Chair class where students handcraft every part of the project rather than assembling a kit.

New Techniques and Tools

The first class task was roughing out the hatched blanks with a drawknife. I had never held a drawknife before, but I enjoyed the shaving horse work so much that I bought a drawknife—and a couple spokeshaves—within one week of coming home. I have almost justified building a shavehorse as I now find myself looking for opportunities to work this blissful task into my daily routine. (“Before we gather round the table for Thanksgiving, I’m going to run down to the shop and carve the turkey at my shaving horse. Honey, is my drawknife in the dishwasher?”)



A close shave. A shaving horse holds a hewn leg blank in place as Skiver roughs out the shape prior to turning. Instructor Dave Abeel looks on.

With my blanks roughed out, I moved to the lathe and turned out four legs, two short stretchers and two long stretchers. With my turning experience limited to ink pens, bottle stoppers and a maple carving mallet, I was a little worried about having to turn multiple parts that needed to look identical (or at least similar). However, with the profile of my simple bamboo-style legs copied on my story stick, the legs turned out at least as identical to each other as members of the Osmond family, and each pair of stretchers was similarly lacking in individuality. I was pleasantly surprised how easy this worrisome task was.

The seat was created by edge-gluing two 8/4 blanks of pine. Because our completed stools were to be finished in milk paint, it wasn’t necessary to make the legs and seat from the same wood. The pine was available, so we used pine. Using my No. 8 jointer plane, I edge-jointed my two pine planks and glued them together. After letting the seat sit overnight, I traced on the seat pattern, and cut out the rough shape on a band saw. Tillers is not opposed to the use of power tools such as lathes and band saws. However, these tools are used in a way that complements the instruction in basic woodworking hand skills that fits into Tillers’ mission of providing sustainable, productive skills.

Online EXTRAS

For a slide show of pictures from Tillers International, go to:

popularwoodworking.com/jun08



A fine edge. Here, Skiver is using a spokeshave to refine the edge of the seat.



On an angle. After the seat is roughly shaped, the angled holes for the stool legs are tweaked using a brace and spoon bit.

The four holes for the leg tenons are drilled while the seat blank is still somewhat square. These holes are drilled at a compound angle, and this task was my first encounter with spoon bits. When teamed with a brace, spoon bits have an uncanny ability to cut compound-angled holes in wood. Spoon bits excel at this task because they can be steered should the angle need to be tweaked after the drilling process has begun. Given the variation possible in the joints of a handcrafted chair, spoon bits make it easy to ensure a good fit at each joint.

Another unique experience I encountered in building this stool was heating the stretcher ends in hot sand prior to fitting them to the legs. Because the stool is made of green wood, “cooking” the tenons of the stretcher drives off moisture and causes the tenons to shrink. The stretcher joints are fitted and assembled in this shrunken state. Over time as the entire stool reaches equilibrium, the mortises will also shrink and the joints will become even tighter.

Excavation Methods

Excavating the seat of the stool provided another opportunity to use tools I had never encountered. Using the coarsest tool possible for each step of the process meant the adze was the first steel that began hogging out lumber in the area where my backside would soon sit. Next, a scorp was used to further define the shape. The scorp is sometimes called an inshave, and it looks like a drawknife that has been wrapped around a 4"-diameter pipe during a late-night episode of the World's Strongest Man competition on cable television.

After the scorp work has turned the wooden blank into something that looks a great deal like a seat, the travisher is used to finish the excavation process.

The work in seat excavation is governed by the influence of the grain as it relates to the compound curves. The travisher is used to cut “downhill,” so the cutting process is a dynamic experience of judging grain direction, blade orientation and cut elevation to avoid tear-out. After a couple minutes, the technique becomes intuitive and good results follow. (It also helps to remember that milk paint will cover a multitude of sins.)

Satisfyingly Functional

Although this class was to be an introduction to duplicate turning and chairmaking fundamentals, I am very happy with the functionality of Abeel's saddle seat stool design. I

recently built a behemoth workbench that I plan to use for the next 100 years or so, and this stool is an ideal complement during the times I want to get off of my feet, rest my elbows on the benchtop and ponder the challenges of planing interlocking grain.

And there is something extra special about sitting on this stool knowing that I also sat on the log that it was made from. I saw two oxen named Marco and Polo pull a log out of the woods, and three days later I had a stool that I will keep for the rest of my life. Tillers International is providing instruction that is clearly helping people all over the world (see the story on page 78), but on a personal level, they gave me a weekend class that was the experience of a lifetime. **PW**

Jeff Skiver may well be the world's funniest woodworker — really. Discover his sometimes-warped sense of humor at jeffskiver.blogspot.com.



Ready for paint. The stool on the left is ready for paint; the one on the right needs but the top of the legs trimmed flush with the seat.

Router Dado Jig

Take the tool to the work for quick and accurate dados.

The quest for accuracy in woodworking is often like trying to find your way out of a maze. Make the wrong choice early on, and you'll find yourself going in circles and not getting any closer to your goal. Often the entrance to a path looks promising but soon becomes an uphill journey.

Making dados seems like a simple task, and it is. The difficulty is that there are so many different ways to go about it that it isn't always clear which choice makes the most sense. On the surface it would seem that setting up an accurate stationary machine, such as a table saw or router table, would be the best way to go. This is true if the pieces are small enough to be manageable all the way across the machine's table.

When the work gets too large, however, it makes more sense to move the machine over the work than to move the work over the machine. This simple jig and a router will make dados that are square, straight, a predictable width and depth and, most important, exactly where you want them to be.

The two parts of the jig will likely come from your scrap bin. A piece of plywood with a straight edge guides the base of the router. Its thickness and width allow you to clamp it to your work without interfering with the handles of your router. The second piece registers the jig at a right angle (or any other angle if you're so inclined) and locates the exact position of the router bit. I make this about 1/8" thinner than the workpiece, 1 1/2"-2" wide and about 12" long.

Pivot to Perfect Alignment

Two screws and a dab of glue hold the parts together. Spread glue where the parts overlap and drive one screw. Use a square to align the parts at a right angle and drive the second screw. Set the jig aside and let the glue dry.



***In the groove.** Maneuvering a large piece of wood across a stationary machine can be inefficient and yield less-than-perfect results. Take the easy way out and cut dados with a router and this simple jig.*

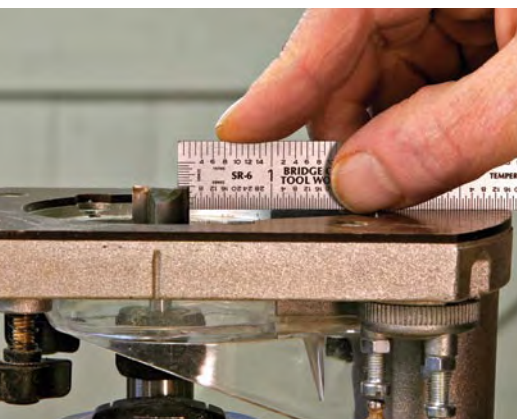
It's important to let the glue dry completely. If you don't wait, the two parts of the jig can slip out of square.

Install a straight bit in your router that matches the width of the dado you want to cut. Adjust the depth of cut by measuring from the router base to the tip of the bit. In most cases, the dado will be 1/4" deep or less so you can make the cut in one pass. Clamp the jig to a piece of scrap and make a cut, keeping the base of the router firmly against the fence, cutting a notch in the other part of the jig. This notch will be used to align the jig with your layout marks.

On the Straight and Narrow

A router with a straight edge on its base will work better than one with a round base. The advantage of the straight edge is that it keeps the router in the same location on the work. A round base may not be perfectly centered and if so, holding a different part of the base against the fence will change the distance from the fence to the bit.

If your router has a round base, you can either make a new baseplate with a straight edge, or you can make a mark on the router base to ensure the same point is held against the straightedge of the jig.



Easy setting. With the base of the router riding on the surface of the work, setting the depth of cut is a simple matter.



Time to be picky. Dial calipers will quickly give an accurate measurement. Knowing the size you need is key to obtaining a good fit.



The fix for plywood. Most plywood varies so much in thickness that a good match isn't possible. A small rabbet makes a good joint manageable.

To use the jig, lay out the location of the dado on the work, line up the notch in the jig to the layout marks, then clamp the jig in place. Use another clamp to hold the work to your bench if you need to. Turn on the router and run it across the work, holding it firmly against the fence.

If you have numerous pieces, you don't need to measure each and every one. You can lay out one piece, stack up the parts and use a square to transfer the marks to the front edge of all the pieces. Marking both sides of the dado will prevent you from cutting on the wrong side of your layout line.

If you want to make an odd-width dado or stopped dado, you can easily add a second straightedge, or a block to limit the router's forward progress. You can also use a combination of bits. After routing a shallow dado, you can come back with a dovetail bit to make a housed-dovetail joint. The cuts will be centered because the distance from the mid-point of the cutter and the jig is constant.

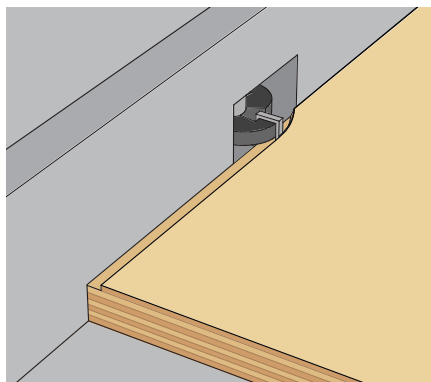
If you mill the wood just slightly oversize, a few strokes with a handplane allow you to sneak up on a perfect fit.

Plywood is a different matter. Most plywood varies in thickness within a sheet and that deviation is enough that you won't be able to match it. If you try to match a thin portion,

the rest of the shelf won't seat in the joint, and if you match a thick portion you will have a visible gap somewhere along the joint line.

Don't waste your money on router bits that claim to be undersized to match plywood thicknesses or believe someone who tells you the plywood is a metric size. What you really need to do is match the wavy edge on the plywood to the straight dado you cut.

If you're working with nominal $3/4$ "-thick plywood, rout the dado with a $5/8$ "-diameter bit. At the router table, set up a slot-cutting bit so the bottom of the bit is $5/8$ " above the table and outside the fence the same distance as the depth of the dado. Run the end of the plywood under the bit, producing a small rabbet. Because you're capturing the plywood between the table and the bit, you'll produce a consistent thickness that will fit the way it ought to. **PW**

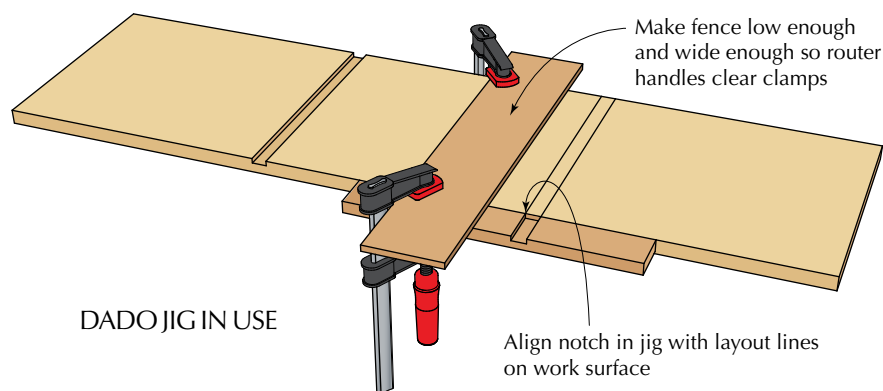


Trap the rabbet. Placing the work between the table and the cutter will ensure a tongue with consistent thickness, making a good fit.

The Other Part of the Equation

All that remains is to fit the piece that goes in the dado. The fit should be snug, taking a little effort to push it together by hand, but not so tight that you need to beat on it or crank down unreasonably with a clamp. How to achieve this fit depends largely on the material you're using. Solid wood is easy; plywood can be a nightmare.

Now is the time to get a good finicky measurement of the thickness, and a pair of dial calipers will deliver that easily. If you're planning your own solid wood, measure the width of the dado, and compare that to the thickness.



DADO JIG IN USE

Bob is a senior editor of Popular Woodworking and author of several books on Craftsman-style furniture. His web site is craftsmanplans.com.

Rules to Finish By

They explain so much.

It's often possible to sum up a lot of situations with a rule, a principle that applies in almost all cases. When I teach seminars on finishing, I often find myself citing a rule I've created to explain a procedure or to answer a question. These rules can be very helpful for understanding finishing.

Here are my five favorites, the ones I repeat most often.

Rule #1

Choose a grit sandpaper that removes the problem efficiently without creating larger-than-necessary scratches that then have to be sanded out.

This rule answers the question, "What grit sandpaper should I use?" It varies for different situations.

For example, you would choose a coarser-grit sandpaper (#80 or #100) to remove severe washboarding caused by a jointer or planer but a finer grit (#120 or #150) on pre-sanded, veneered plywood or MDF. And you would begin sanding with an even finer grit (#180 or #220) if you were just checking to make sure your stripper had removed all the old finish from a refinishing project.

Likewise, you would choose a coarser-grit sandpaper (#220 or #320) to sand out brush marks in a finish but a finer-grit (#400 or #600) to remove fine dust or orange peel.

It's most efficient if the grit you begin with isn't any coarser than necessary so you don't have to sand out the deeper scratches.

How do you determine which grit is appropriate? Experience is the best teacher. In the meantime begin with a grit you think is about right, or even a little finer than necessary and then "cut back" to coarser grits until you find the one that removes the problems efficiently. Woodworkers will disagree here because everyone sands differently. But keeping this



Three tools. Compared to the complexities of woodworking, finishing is easy. Most importantly, there are only three categories of application tools: rag, brush and spray gun.

principle in mind will help you reduce the amount of work.

In all cases, remove coarser-grit scratches with finer grits until you reach the grit you want to end with. Skipping a grit will require you to sand more to remove previous grit scratches than progressing through each successive grit, but either way is legitimate.

Rule #2

There are only three common tools used to apply finishes: a rag, a brush and a spray gun (including aerosols).

Finish application is therefore far less complicated than woodworking, with its dozens of tools. Each of the three finish tools transfers liquid – finish, paint, stain, whatever – from a can to the wood and is simple to use. Even a spray gun is no more difficult than a router.

On large surfaces, fast-drying finishes are harder to apply with a rag or brush because you can't move fast enough to keep a "wet edge." But there's less problem if the surface

is small – for example, a turning. All finishes, no matter how fast or slow they dry, are easy to spray onto any surface.

The real differences in the tools are cost, speed and the degree to which they produce a level film.

Rags are cheap and efficient for applying any stain or finish you intend to wipe off, but they leave pronounced ridges in finishes when you're trying to build a film.

Brushes are also cheap and are the least wasteful of finish material, but they're very inefficient because they transfer the liquid so slowly, and they leave ridges (brush marks) in the film.

Spray guns transfer the liquid very rapidly and leave the most level film. But they, and the added compressors or turbines needed for operation, are expensive. And because of the finish that misses or bounces off the surface, spray guns are wasteful of finish material and require an exhaust system, which increases the expense.



Sanding. The most efficient sandpaper grits to use vary with the situation. It's inefficient, for example, to begin sanding with # 80 or #100 grit on this pre-sanded veneered plywood. The #120-grit sandpaper I'm using here is coarse enough to be efficient and doesn't create more work.



Blotching. Some woods, such as the pine shown here, blotch when stained. Blotching is the only situation in finishing that can't be fixed fairly easily, with stripping and starting over being the worst-case scenario.



Sealing. Sanding sealers contain a soap-like lubricant that causes the finish to powder so it doesn't clog the sandpaper. But sanding sealers don't seal the wood any better than the finish itself and, in fact, weaken water resistance and the bond of the finish.

Rule #3

The only thing you can do in finishing that can't be fixed fairly easily is to blotch the wood with a stain.

The purpose of this rule is to encourage you to relax about finishing; you can't "ruin" your project unless you're staining a blotchy wood, such as pine, cherry or birch. All problems other than blotching can be fixed, with the worst case being you have to strip off the finish and begin again. Professional finishers know from sad experience that having to strip and start over is not that uncommon. It's equivalent to the woodworker's distress over having to make a new part because of cutting a board too short.

To fix blotching, you have to sand, scrape or plane the wood to below the depth the stain has penetrated.

To avoid blotching, the stain has to be kept from penetrating. Do this using a gel stain or by partially sealing the wood with a thinned finish called a "washcoat." An example is wood conditioner, which is varnish thinned with two parts mineral spirits. Be sure to let whichever washcoat you use dry thoroughly (six or eight hours for wood conditioner) or it won't eliminate the blotching.

Rule #4

The first coat of any finish seals the wood; all additional coats are topcoats.

This rule is important for understanding that products labeled or promoted as "sealers" don't seal the wood any better than the finish itself. They are used to solve a problem.

Sanding sealers contain a soap-like lubricant that reduces sandpaper clogging, making the sanding of varnishes and lacquers easier



Staining. As long as you wipe off excess stain, the coloring will always be even unless the wood is naturally blotchy or, as with this oak, the grain is highlighted.

and faster. Sanding sealers are great for production situations but offer little advantage for most home or small-shop projects, especially when you can get similar easy sanding by thinning the first coat by half with the appropriate thinner. In fact, sanding sealers weaken water resistance (because of the soap) and the bonding of the topcoat, so it's better not to use them unless you have a big project.

Shellac is effective as a barrier against silicone and odors (refinishing problems), and pine resin and the oil in oily woods such as teak and rosewood. These substances can interfere with the flow and drying of finishes. But there's no reason to use shellac as the first coat if the wood you're finishing doesn't have one of these problems.

Of course, shellac is an excellent finish in its own right and can be used effectively for all the coats.

Rule #5

Apply a wet coat of stain and wipe off the excess before it dries.

This is the basic instruction for applying

all stains. As long as the wood is not naturally blotchy, and as long as it has been prepared well (all the milling marks and other flaws are sanded out), this method of stain application will produce an even coloring.

Confusion has been introduced by the Minwax ad on television, which shows brushing thick coats of stain and not wiping off the excess. This procedure cannot produce an even coloring.

To get a darker coloring, you can leave a stain on the wood for a while to allow some of the thinner to evaporate, essentially increasing the colorant-to-binder ratio. Then wipe off the excess. You can also leave a little of the excess, called a "dirty wipe," or apply a second coat of stain after the first has dried.

But in all cases, unless you're spraying the stain, you have to wipe off most or all the excess to get an even coloring. **PW**

Bob is teaching a weekend finishing seminar at the Marc Adams School of Woodworking near Indianapolis, Ind., June 21-22. Visit marcadams.com or call 317-535-4013 to register, or for more information.

Does Your Shop Speak English?

An ocean-wide gap in terminology can cause confusion.

The first time I went to England, I soon learned to take the lift instead of the elevator. And to avoid getting run over by all those cars driving on the wrong side of the road, I usually took the tube instead of what we call the subway. When the power goes out we reach for a flashlight, but they say electric torch. No matter which side of the pond you are on, the differences between modern American English and British English can be both charming and confusing, and those differences can also be found in the workshop.

We call basic tools by different names. What Americans call a wrench the Brits call a spanner. Apparently, we emphasize what the tool does – in this case to twist or force a bolt – and the English describe the fit or span of the tool to the size of the bolt. Similarly, what we call a ball-peen hammer they call a ball-pane hammer. The spelling probably mirrors the pronunciation in this case. Any end of a hammer that is not the flat, pounding end is the peen. The claw on a hammer is, in fact, a peen, but most Americans make that distinction. For Americans, the claw hammer is the standard, but in England, the common woodworker's hammer has a spade-like peen and is called the "Warrington pattern cross pane."

We also see clamps differently. One of the most useful tools in my workshop is a C-clamp, so called because of its shape and function of gripping wood that is setting after gluing (or in England, "glueing"). They call this same tool a G-cramp. Notice that is "cramp," not "clamp." Whereas we see the tool in the form of a C, the Brits see a G – and if you have been cramped between passengers in the middle seat of an airplane, you can see that the word cramp makes perfectly good sense to describe the function of this tool.

When we want to put a smooth finish on our woodworking projects, we use various grades of sandpaper, but if you go to a woodworker-supply house in England, ask for glasspaper. Modern abrasives might be made from various substances, but both our American and British words reflect their silicon-based origins. It's the same product, just different words.

We Yanks call small nails brads and use them for picture-frame mouldings and other small work. The Brits use the term brad (or cut brad) only for a much larger nail resembling (though not as large as) a railroad spike. We also have various sizes of finishing nails – basically thin, headless nails that won't be seen in the finished product. The Brits call these panel pins. Our standard general-purpose American nail with a flat head is called a box nail. They come in various sizes to fit the need. But the English do not use the term box nail, preferring instead the term round wire nail (or French nail).

How many times have you joined perpendicular boards by toenailing them, driving nails at an angle from opposite sides of a board? In England, our fellow woodworkers never use that term. They say dovetail nailing (or skew nailing) to describe the same function. We reserve dovetailing for joints, but, if you think about it, the dovetail shape also describes the angle of the nails that join those boards.

Speaking of boards, I think most of us American woodworkers do not draw a sharp distinction between a board and a plank.

My dictionary defines a board as "a long, flat slab of sawed lumber; plank." Even here in America there might be regional differences, but in my part of the country we usually just say board for any dressed piece of wood. But the Brits precisely define a board as a converted timber less than about 2" thick but more than 4" wide. They define a plank specifically as a piece of softwood two or more inches thick and 10 or more inches wide, of any length. We dress raw wood, but the Brits convert it.

Do you plow out a rabbet or do you plough out a rebate? The difference in plough and plow is simply spelling, but when rebate (to reduce) in England evolved into rabbet in America, that is what linguists call a variant. Time and geographical separation cause words to vary in spelling and pronunciation. Such variations occur in all languages.

Armed with this basic lesson in vocabulary, if some bloke comes to your shop and asks to borrow a Warrington pane, a handful of panel pins and some glasspaper to finish a project, you won't have to say, "Speak English!" **PW**

Philip is a Professor Emeritus of English; he retired from The Citadel in Charleston, S.C. in May 2007. He's also a hobbyist woodworker who specializes (specialises?) in making bookcases for himself and for friends.

