CHOOSING AND USING RASPS AND FILES p.36

WOODCRAFT® magazine

Projects, Techniques, and Products

Build this

Morris Chair p.42

and learn...

- Mortise & Tenon Joinery
- Wood Bending
- Precision Assembly

22 TIPS and JIGS

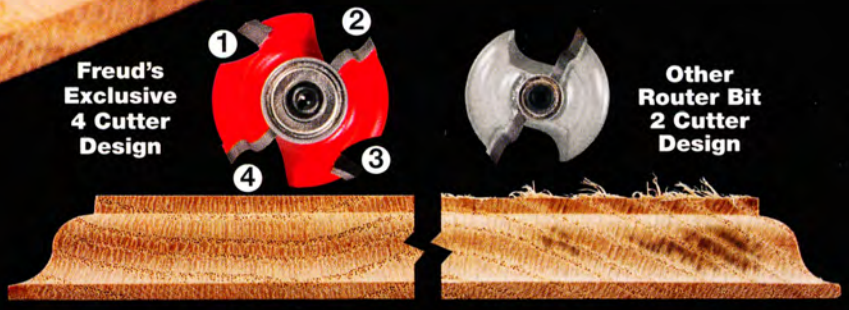
MORE PROJECTS

- Pencil-Post Shelving Stand
- Inside-Out Holiday Ornament
- Personalized Geo Boxes
- Pen Presentation Box

VOL. 9/NO. 55 OCT/NOV 13

What's The Secret To Flawless Edge Profiles With NO REWORK?

Freud's Quadra-Cut™ 4 Cutter Design Router Bits



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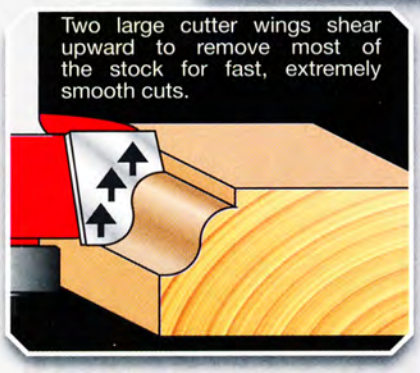

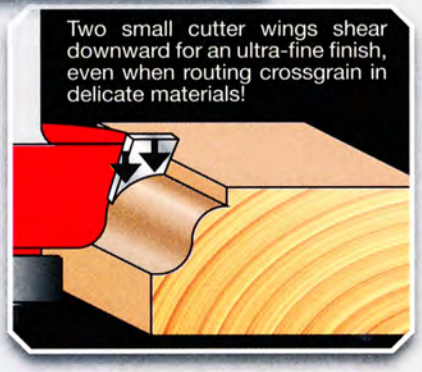

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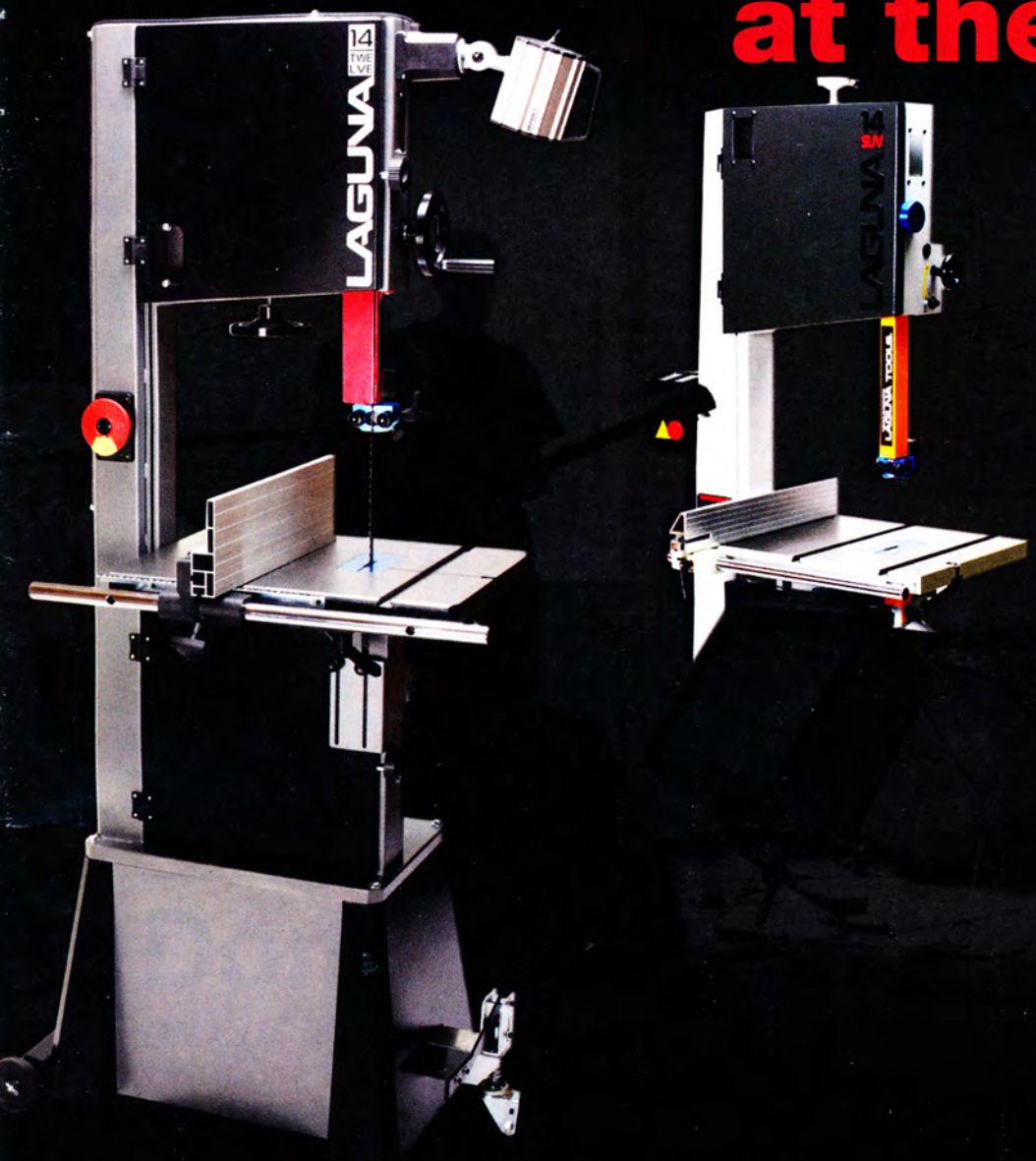
Last time a band played this well, Ringo was at the drums!



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WOODCRAFT magazine
Oct/Nov 2013

Contents: Projects

24 Pencil-Post Bookshelf
Add whimsy to a child's room with this colorful four-shelf stand. Make the giant-sized pencils at the tablesaw and lathe. Then, attach them to the shelves with connector bolts and cross dowels.

30 Inside-Out Ornament
Add something special to your cache of Christmas ornaments by trying your hand at this unusual "peek-through" spindle turning. Its construction will surely keep onlookers guessing.

58 Geo Boxes
When it comes to making personalized presents, it's hard to beat a very cool, easy-to-make, and inexpensive box that honors the recipient's geographical roots.

42 Modern Morris Chair
Few furniture pieces scream Arts & Crafts more than the beloved Morris chair. This updated version teaches techniques that range from mortise-and-tenon joinery to bending wood.

64 Pen Presentation Box
If you like turning pens and giving them away, then build this handsome container out of fancy woods to make your gift extra special.

Cover photo: Donna Chiarelli

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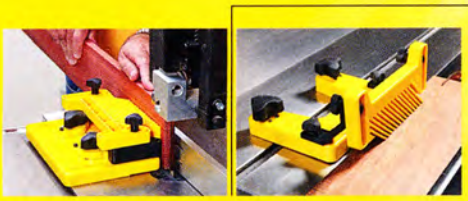

Vertical Featherboard Attachment safety

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- » Absolute must buy with Starter Kit.
- » Dual plane workholding.
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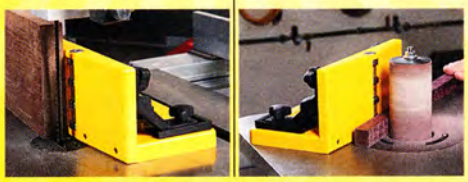

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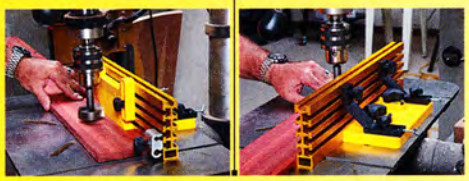
- » Thin stock hold near blade.
- » Clean cuts with strong hold near blade.
- » Cut thin strips with roller guide.



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Contents: Tools & Techniques

36 Rasps and Files
Match the tool to the assignment as you remove wood or metal with one of these handheld specialists.

56 Finishing Cherry at the Lohr School of Woodworking
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68 Problem-Solving Product: Micro Jig's Tapering Jig
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Love those woodworking road trips

One of the benefits of this job is traveling to an accomplished woodworker's shop for a story. I get to watch a true craftsman do what he or she does best and pick up on tips, shortcuts, processes, and, in general, woodworking knowledge that the individual has gleaned over decades of shop time while designing, building, and finishing projects. I get to study the woodworker's shop and take inventory of his or her favorite tools. I get to rub elbows with greatness while enjoying a one-to-one teacher/student ratio. Needless to say, I consider myself fortunate to meet so many experts who help me grow during my ever-continuous woodworking education.

One such example is my meeting with craftsmen Jeffry Lohr and Rob Spiece of the J. D. Lohr Woodworking School in Schwenksville, Pennsylvania. Last September, during issue planning, a time when the magazine's editorial and art staff convene to develop the project, tool, and technique stories for the upcoming year, art director Chad McClung suggested that we do a Morris chair. We all agreed that this project, a favorite in the minds of those who build Arts and Crafts furniture, would be a great fit. It fell to me to find the right guy (or, in this case, guys) to bring a first-rate Morris chair into the magazine. Hands-down, Jeffry and Rob proved to be those guys, sharing a time-tested chair design that each has built many times over. When you read through the project plan on page 42 and their take on finishing cherry on page 56, you'll see techniques, jigs, and tips that promise to deposit a few choice nuggets in your bank of woodworking knowledge.

"But it's not like being there!" you might argue. True. On the other hand, there are likely quality woodworkers where you live who may be open to your visiting. Ask around at a local woodworking club or woodworking specialty store for a name or two. That way, in addition to the knowledge presented in the magazine from our trips, you can further enhance your education with woodworking road trips in your neck of the woods. Be careful, however. They can be addicting.

Jim Harrold

Photo: Larissa L. Huff

WOODCRAFT magazine

Oct/Nov 2013
Volume 9, Issue 55

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Circulation
Circulation Specialists, Inc.

Subscriptions
U.S. and Canada, $19.97 for one year
Single copy, $5.99
customer_service@woodcraftmagazine.com
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P.O. Box 7020
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Email: *editor@woodcraftmagazine.com*
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Woodcraft Magazine (ISSN:1553.2461, USPS 024-953) is published in January, March, May, July, September and November and printed in the United States by Woodcraft Supply, LLC, 4420 Emerson Ave., Suite A, Parkersburg, WV 26104. Tel: (304) 485-2647. Periodical Postage paid at Parkersburg, WV, and at additional mailing offices. Copyright 2013 by Woodcraft Supply, LLC. All rights reserved. POSTMASTER: Send address changes to *Woodcraft Magazine*, P.O. Box 7020, Parkersburg, WV 26102-7020. Canada Post: Publications Mail Agreement #40612608
Canada Returns to be sent to Pitney Bowes, P.O. Box 25542, London, ON N6C 6B2

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Safety First! Working wood can be dangerous. Always make shop safety your first priority by reading and following the recommendations of your owner's manuals, using appropriate guards and safety devices, and maintaining all your tools properly. Use adequate sight and hearing protection. Please note that for purposes of illustrative clarity, guards and other safety devices may be removed from tools shown in photographs and illustrations in this publication and others.

ROUGH CUT

WOODWORKING WITH TOMMY MAC

New projects! Design inspiration! Expert techniques! Season 4 of America's favorite woodworking show, *Rough Cut - Woodworking with Tommy Mac*, premieres Saturday, October 5, 2013 (check local listings).

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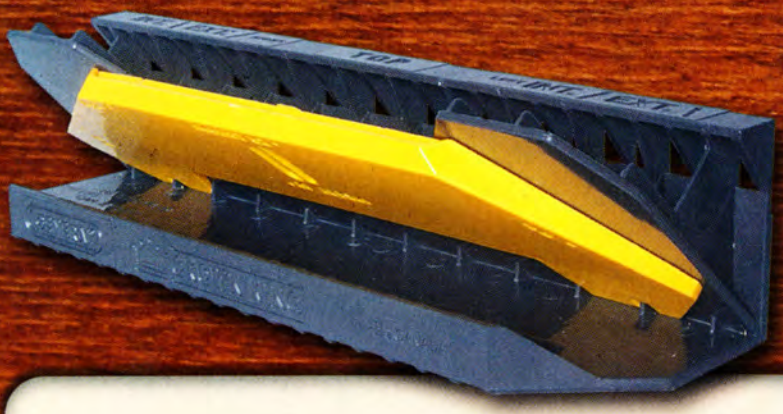

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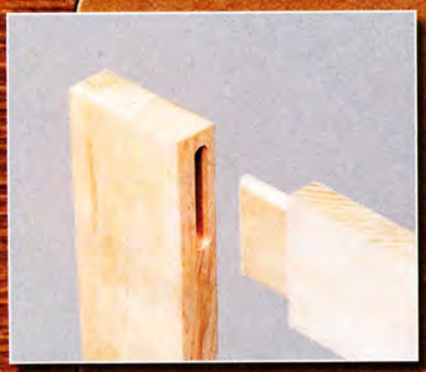
Meet the Joint Chiefs



The E•Z *Pro*™ Mortise & Tenon Jig lets you make perfectly matched mortise & tenon joints with one jig.

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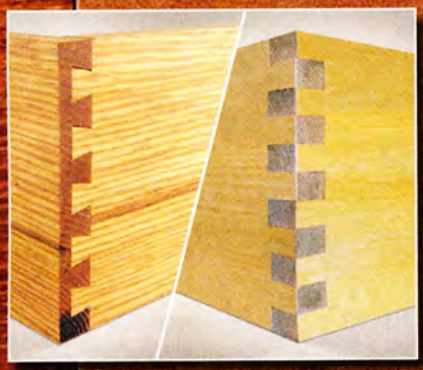

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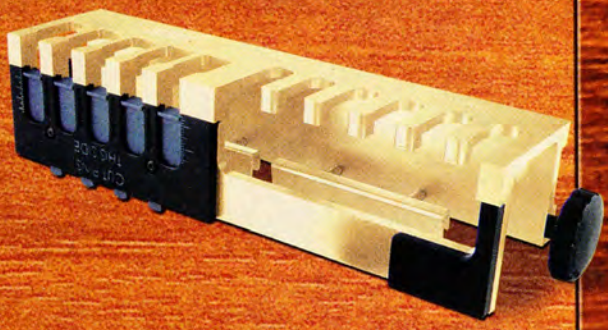

The E•Z *Pro*™ Pocket Hole Jig has everything you need to make flush, corner and angle pocket hole joints.

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The E•Z *Pro*™ Doweling Jig lets you make perfectly aligned dowel joints every time.

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Show caution to the wind

After reading the Tips & Tricks column in Issue #54, I am concerned that the suggested method of removing disposable gloves with compressed air could be very dangerous. I was taught never to direct compressed air toward your skin because even low-pressure air can penetrate the bloodstream through a cut or blister, introducing an air bubble in the bloodstream, and possibly causing a fatal embolism.
—William Simmons, Potsdam, New York

William, you've joined a half-dozen other readers who brought this to our attention. Surprisingly, I had never heard of the danger, nor have most of the woodworkers I've spoken to about it. Many of us have dusted ourselves off countless times using compressed air. But a bit of research on the Internet proves that you're correct: in extremely rare cases, even low-pressure air directed toward the skin has been known to cause serious injury if it enters a wound. Thanks for sharing.
—Paul Anthony, senior editor

Errata

As careful as we are, errors occasionally find their way into articles. If you spy an apparent mistake, particularly in a project article, please visit *woodcraftmagazine.com/corrections.aspx* for corrections.

The red badge of boxelder explained

I'm writing in regard to the article "Spotlight on Boxelder" in the Aug/Sept 2013 issue of *Woodcraft Magazine*. I'm a professor of wood anatomy at Oregon State University and have been researching spalting for ten years. I was dismayed to find the article perpetuated the myth of the "spalting" of boxelder. Morse and Blanchette thoroughly debunked this myth in 2002 ("Etiology of Red Stain in Boxelder" in *Plant Health Progress*). The characteristic red/pink stain in boxelder is caused by the tree as a response to wounding or stress, not a specific fungus. Many trees make pigments under similar circumstances. One of the easiest ways to tell if a pigment on wood is caused by the tree or the fungus is to note its colorfastness. As noted in your article, the red stain in boxelder fades in light. A spalting fungus would generally be light-stable.
—Dr. Sara C. Robinson, Corvallis, Oregon

Here's to you, Ms. Robinson, for setting the record straight on the boxelder stain.
—Jim Harrold, editor-in-chief

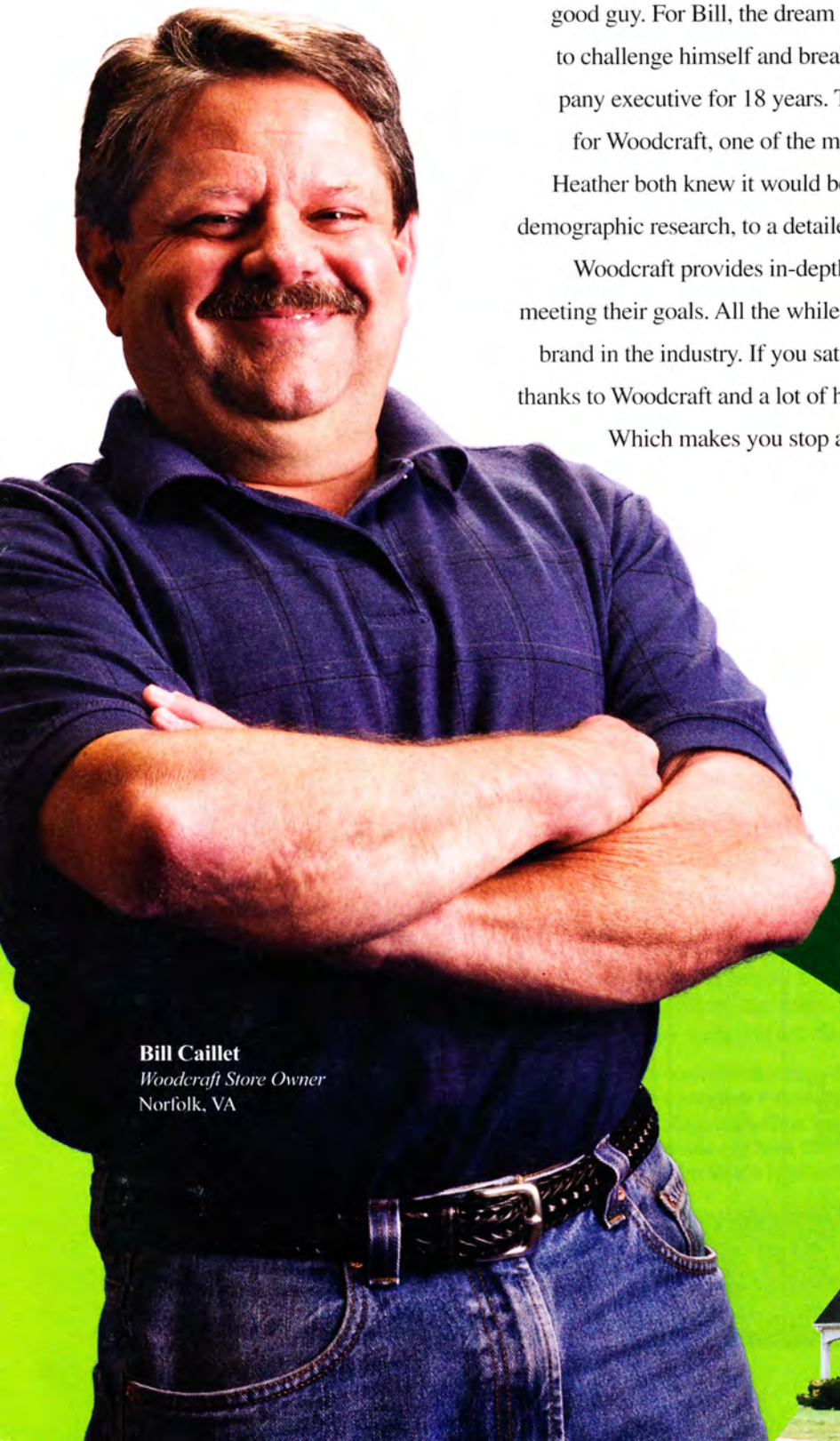
Chime in

Have comments about the magazine, questions about an article, or something to share with your fellow *Woodcraft Magazine* readers? Send an email to *editor@woodcraftmagazine.com* or a letter to **Woodcraft Magazine, PO Box 7020, Parkersburg, WV 26102.**

Photo: Larry Hamel-Lambert

IT WAS DIFFICULT TO WALK AWAY FROM THE SECURITY OF LONG-TERM JOBS. BUT, WE WANTED TO CHALLENGE OURSELVES, AND THIS WAS A GREAT FIT.

Say hello to Bill – experienced woodworker, savvy entrepreneur and all around good guy. For Bill, the dream of owning a Woodcraft store started with his desire to challenge himself and break out of the routine world he knew as a paper company executive for 18 years. That's why when he saw a franchise opportunity ad for Woodcraft, one of the most trusted names in woodworking, he and his wife Heather both knew it would be the perfect fit. No wonder. From site location and demographic research, to a detailed training program and ongoing technical support, Woodcraft provides in-depth franchise models to assist the franchise owners in meeting their goals. All the while being backed by the power of the most recognized brand in the industry. If you sat down and talked with him, Bill would tell you that thanks to Woodcraft and a lot of hard work, he's well on his way to living his dream. Which makes you stop and think, when are you going to start living yours?



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Woodcraft Store Owner
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Made-to-travel music stands

I built two music stands from your article in the Feb/March 2013 issue of *Woodcraft Magazine* for my two grandchildren who play the violin. Because they live in California and I live in Maryland, I had to ship the stands to them. To do that, I modified the plans. I made all three legs removable using the same hardware approach to facilitate transporting the stands. I also changed the cross section of the legs from square to round for a more pleasing profile and reworked the way the rests mount to the stand.

—Haim Loran,
Easton, Maryland

Haim, I'm sure readers will be interested in seeing how you made your stands more portable than the original. Thanks for sharing.
—Jim Harrold, editor-in-chief

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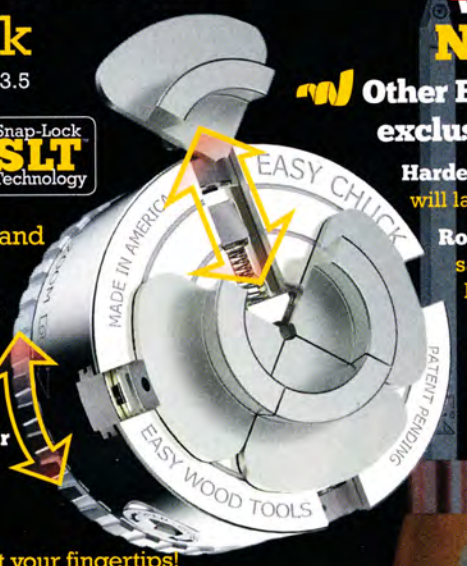

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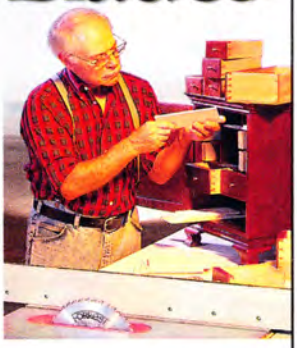
Carl Stude – Burbank, CA



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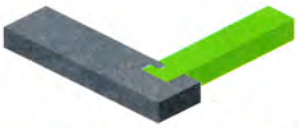

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Photo: Larry Hamel-Lamert

Almost-instant woodworking

Nexabond 2500M Instant Wood Adhesive

Bioformix's Nexabond 2500 may change how you assemble your next project, and it will definitely shorten the time it takes to finish the job. To test the glue's viability as an all-purpose wood glue, I face-glued joints using a variety of sample woods and then hammered them apart. I expected the joints to crack along the glue-line (CAs tend to be brittle), but the wood failed and splintered instead, similar to a PVA glue joint. I even used my dishwasher as a torture chamber. The Nexabond joints held and remained stuck even in the intense heat and moisture.

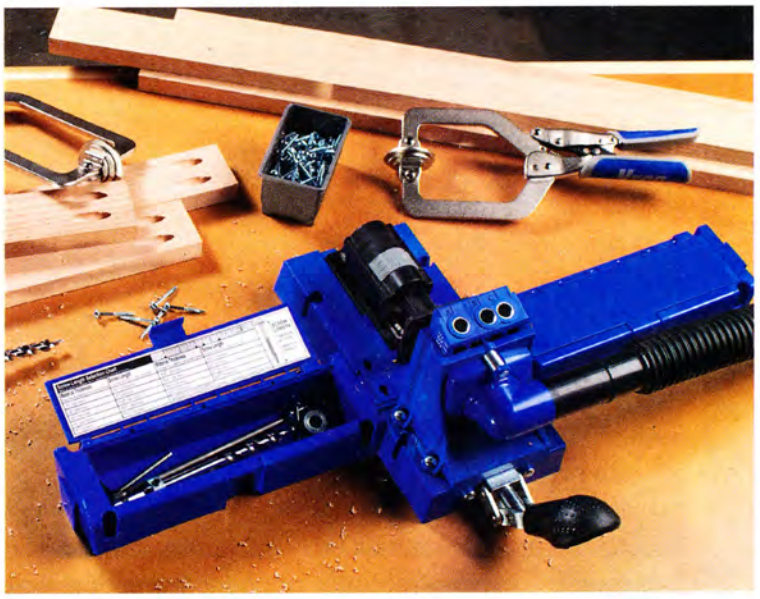
Nexabond provides a reasonable open time (about five minutes). A full cure takes about an hour, but after five minutes of clamping time, the bond strength will allow you to remove the clamps and move on to the next assembly. Nexabond's water-free formulation means that you can sand projects immediately without worrying about water-induced joint swelling and shrinking (a problem with PVAs).

Nexabond costs more than PVA and isn't as easy to clean up, but its combination of speed and strength makes it a valuable viable alternative when you're facing time constraints or a lack of clamps.

#158792, 4 oz., **$16.50**
Tester: Joe Hurst

Premium pocket-holer

Kreg K5 Pocket-Hole System



Not happy to rest on their laurels, the folks at Kreg listened to pocket-hole jig users and created a brand-new jig that not only streamlines the making of pocket-hole joints but also contributes to a cleaner, more organized workshop.

The most obvious improvement is the K5's ratcheting clamp. Designed to hold workpieces from ½" to 1½" thick with uniform pressure, the clamp adjusts without tools. Simply slide it against the back of the workpiece, and then pull down on the front toggle to lock it in place (a rubber pad on the clamp's face prevents marring your work). To ease setup and use, the jig includes a gauge block for setting the drill-bit stop collar and a face-frame stop to ensure consistently positioned pocket holes. The swiveling dust-collection port and storage compartments in the support wings might seem like minor improvements, but these details have done the most for making pocket-hole drilling a cleaner operation and helping me keep track of parts.

#158631, **$139.99**
Tester: Peter Collins

Featured products available from Woodcraft Supply unless otherwise noted.

Nexabond photo: Larry Hamel-Lambert; Kreg photo: Manufacturer

Not-so-little Laguna

Laguna 14|12 bandsaw

At long last, Laguna has responded to woodworkers who want a rock-solid 14" steel-framed bandsaw but don't have the big bucks to spend on one or the desire to wire their workshop for a 220-volt machine.

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Woodworkers who routinely resaw wide boards might opt to save for a slightly taller and more powerful model. However, for those who rarely max out the capacity of their 12" thickness planers, the saw offers plenty of capacity and power and comes ready for duty in any garage or basement.

#854323, **$1,110**
Tester: Andrew Bondi

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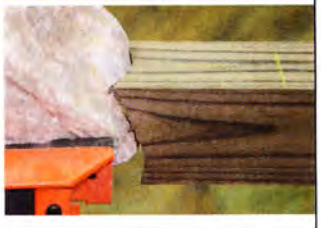

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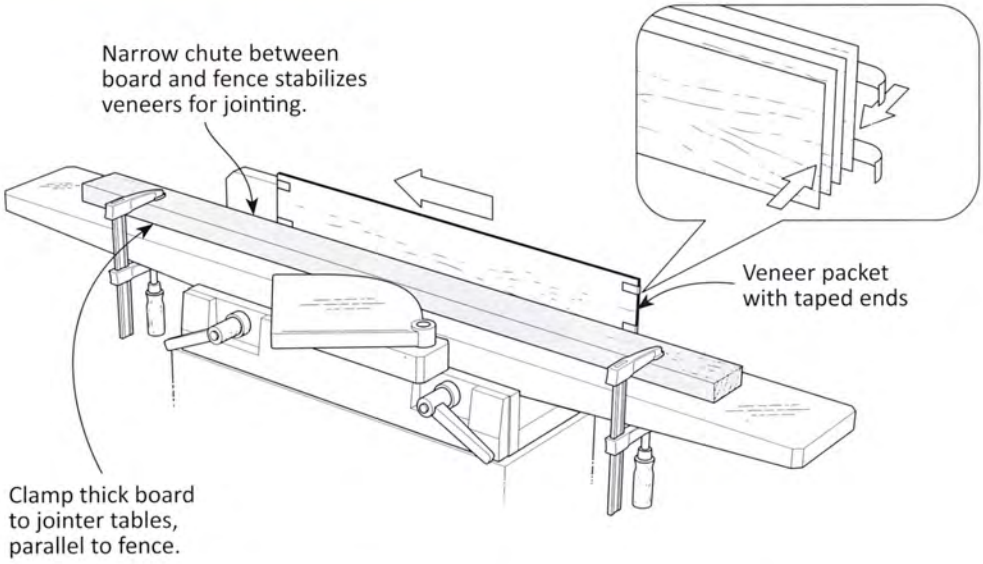
TOP TIP

Jointing veneer

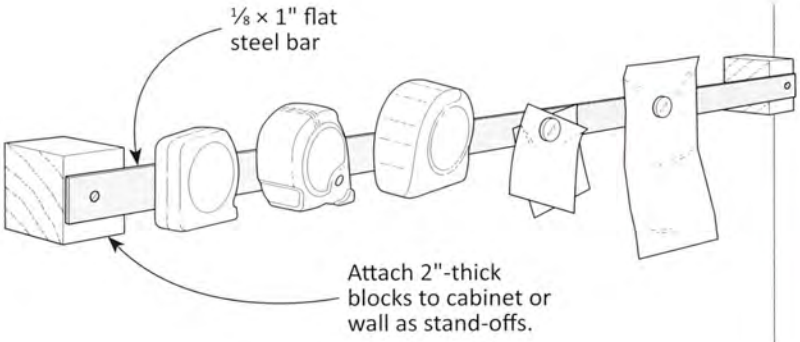


Over the years, I've tried about every method for jointing the edges of veneers. Ultimately, I've found that the best way is also the simplest. Here's how it works.

Begin by laying out your veneer sheets in a way that suits your project. Then stack together similarly sized sheets, taping these packets together at their ends. Next, lay a long, thick board across your jointer tables, bringing the jointer fence up against the board to ensure that the two are parallel. Then clamp the board to the tables.

Sandwich a veneer packet between the board and the fence, adjusting the fence to allow the packet to slide easily but with just a bit of friction. This creates a chute that compresses and stabilizes the stacked veneers to allow easy, accurate jointing of their edges. After jointing the first packet, readjust the fence if necessary to suit the thickness of the next packet, and continue in the same manner.

—Thomas Starbuck Stockton, Montgomery Creek, California



Tape Rule Hangar

I've managed to accumulate quite a few tape rules in my shop over the years, which tended to pile up on shelves or get lost in the general clutter of the shop. To solve the problem, I screwed a length of ⅛"-thick × 1"-wide flat steel bar to a couple of 2"-thick stand-off blocks fastened to the front of an open cabinet to serve as a hanger for the tapes. Now the tapes are all organized in one place, and I can immediately identify which one I need for the job at hand. As an added benefit, the bar provides a magnet-friendly surface from which to hang shop drawings and notes.
—Jeffry Lohr, Schwenksville, Pennsylvania

Share a Slick Tip. Win Cash or a Prize!

Here's your chance to help someone become a better woodworker and get rewarded for the effort. Next issue's Top Tip will receive an **EZ Pro Mortise & Tenon Jig Kit**, an **EZ Pro Dovetailer II Jig Kit**, and an **EZ Pro Deluxe Pocket Hole Kit**, all from **General Tools**, and worth a total of **$280**. Runners-up will receive **$125** for an illustrated tip; **$75** for an unillustrated one. Winning entries become the property of Woodcraft Magazine. Send your original ideas to: **Tips & Tricks, *Woodcraft Magazine*, P.O. Box 7020, Parkersburg, WV 26102-7020 or email *editor@woodcraftmagazine.com*.** Important: Please include your phone number, as an editor may need to call you if your trick is considered for publication.

Illustrations: Chris Glowacki

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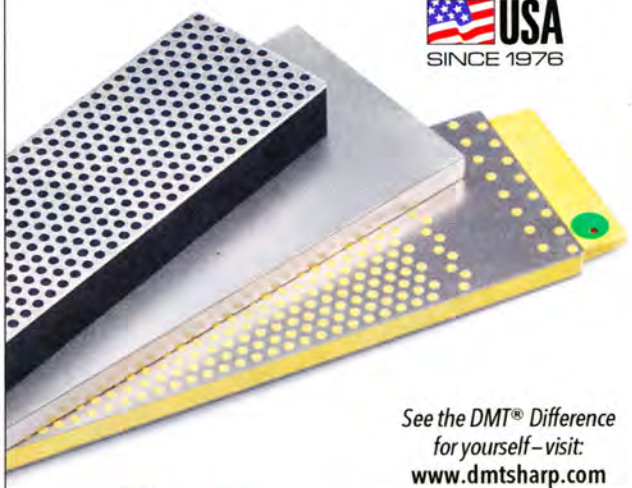

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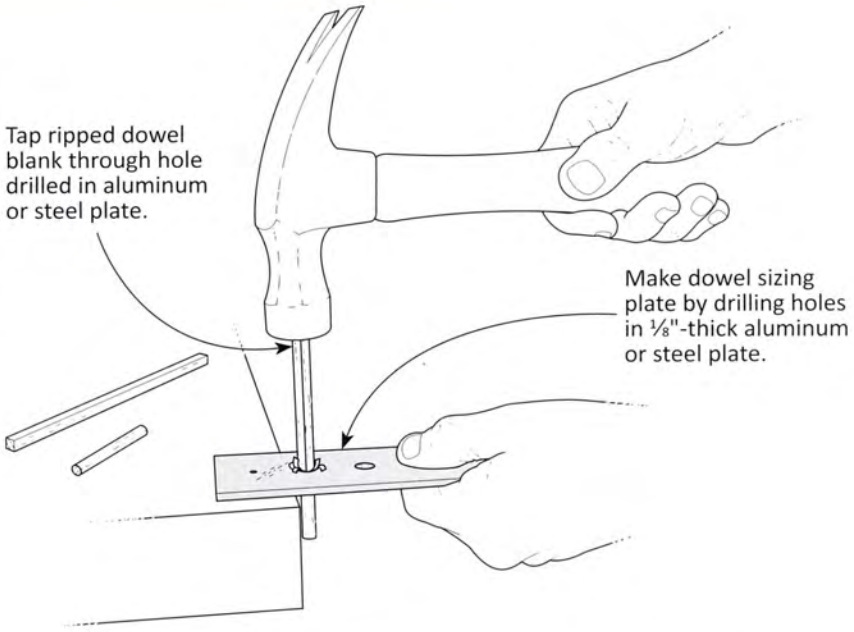
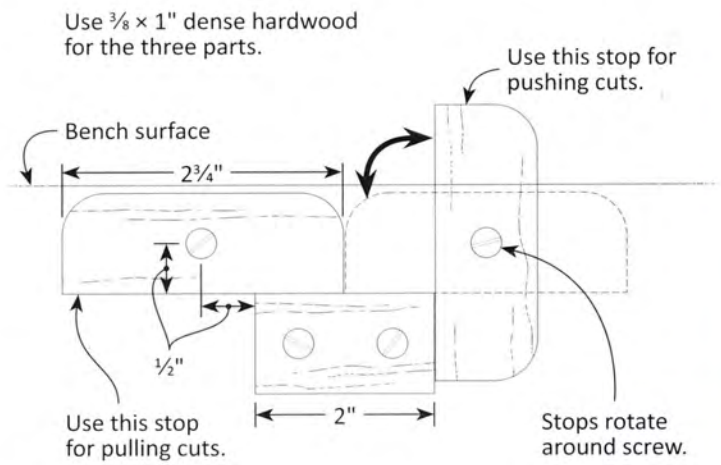
Shop-made dowel sizer

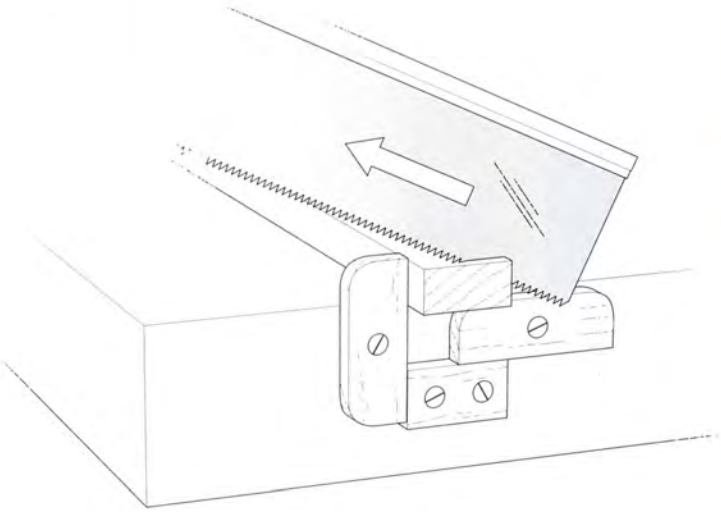


Occasionally, I use dowels as pins to join parts or as plugs for inlaid accents, as in the Geo Box on page 58. Although dowels are available commercially, they have often swelled too much to fit properly into a hole of the correct size. The other problem is that they're not available in a wide variety of woods.

To solve both issues, I made a dowel sizer by drilling common dowel size holes in a scrap piece of aluminum plate. (Steel works as well.) To use it, I place the appropriate size hole over a bench dog hole (or adjacent to the edge of the bench), chamfer one end of the dowel, and then drive it through the appropriate hole. To make a dowel from scratch, I rip a piece of straight-grained wood roughly oversized, chamfer the end, and drive it through the hole.

—Geoff Noden, Trenton, New Jersey





Dual-purpose bench stops

Over the years, I've seen a variety of bench-mounted stops, some designed for planing and some for sawing. One of my favorite designs is this dual-purpose stop that mounts out of the way on the end of a bench to serve for small planing and sawing tasks. To use as a planing stop, rotate either stop so that it projects above the benchtop. To use as saw stops, place the overhanging workpiece against the appropriate stop–one suiting push saws, and the other pull saws. For strength, make the stops from a dense wood, like hard maple or rosewood, and take your time locating and installing the parts so that they rotate correctly into position. For proper tension, place a drop of thread-locking adhesive, such as Loctite®, on the screw that holds each stop, then tighten the screw until the stop rotates easily but without play.

—Andy Rae, Asheville, North Carolina

Pencil-Post Bookshelf

Sharpen basic turning skills as you turn 2×4s into No. 2s.

By Joe Hurst-Wajszczuk
Design by Andy Rae

Overall dimensions:
39¼"w × 12⅜"d × 51"h

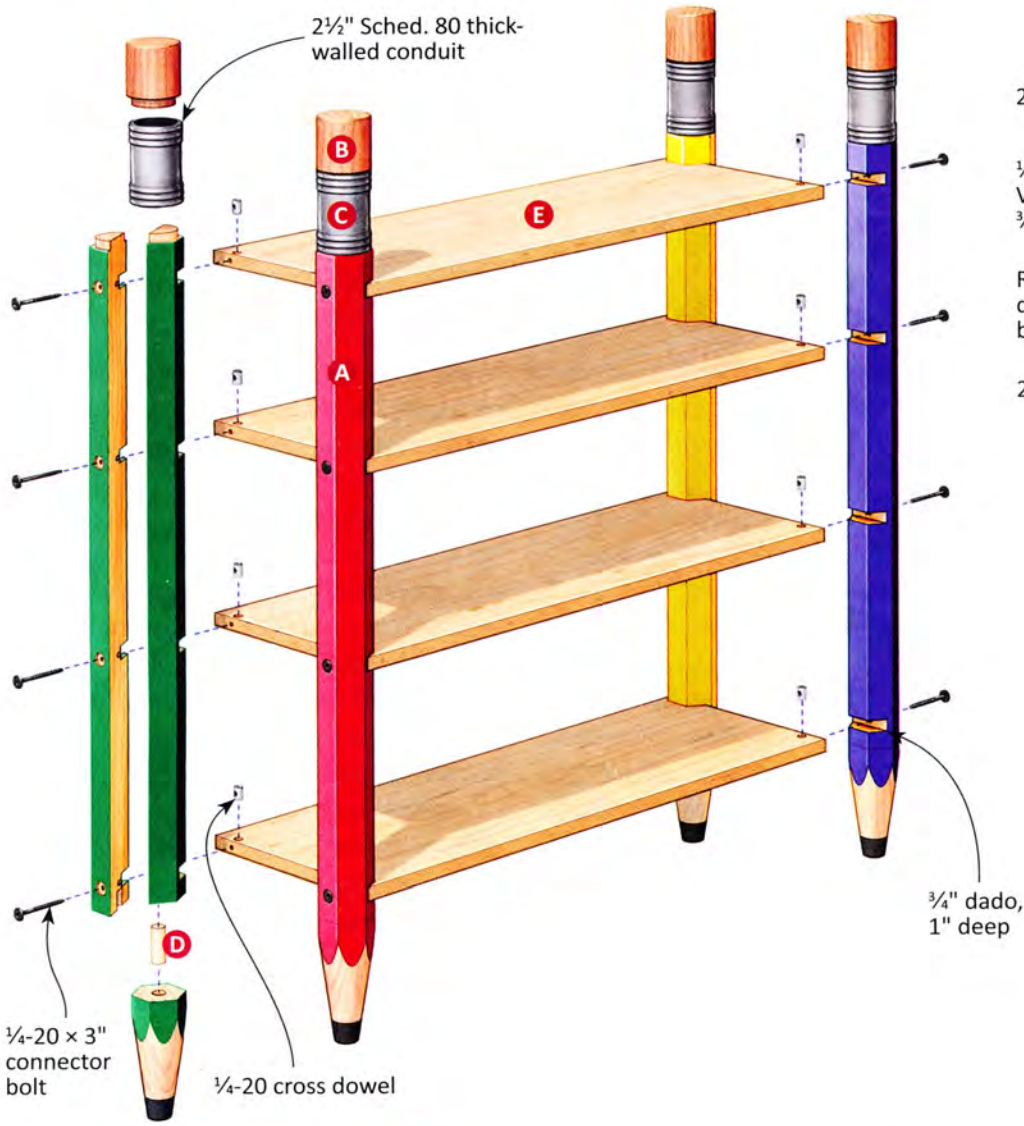
For those who think that pencil post furniture is too "period," here's a literal reinterpretation that fits perfectly in a child's playroom or bedroom.

Knowing how quickly kids outgrow furniture, designer Andy Rae created this bookshelf to be fun, easy to build, and inexpensive. You'll find the bulk of the materials at your home center: the posts are laminated 2×4s; the erasers are turned from a 4×4 cedar fence post; and the ferrules are 2½" thick-walled PVC conduit. (I used Baltic birch for the shelves, but you can save money by substituting hardwood plywood.) The connector nuts and cross dowels not only lock the shelves to the posts but also make it easy to disassemble the pieces and transport them to the grandkid's house.

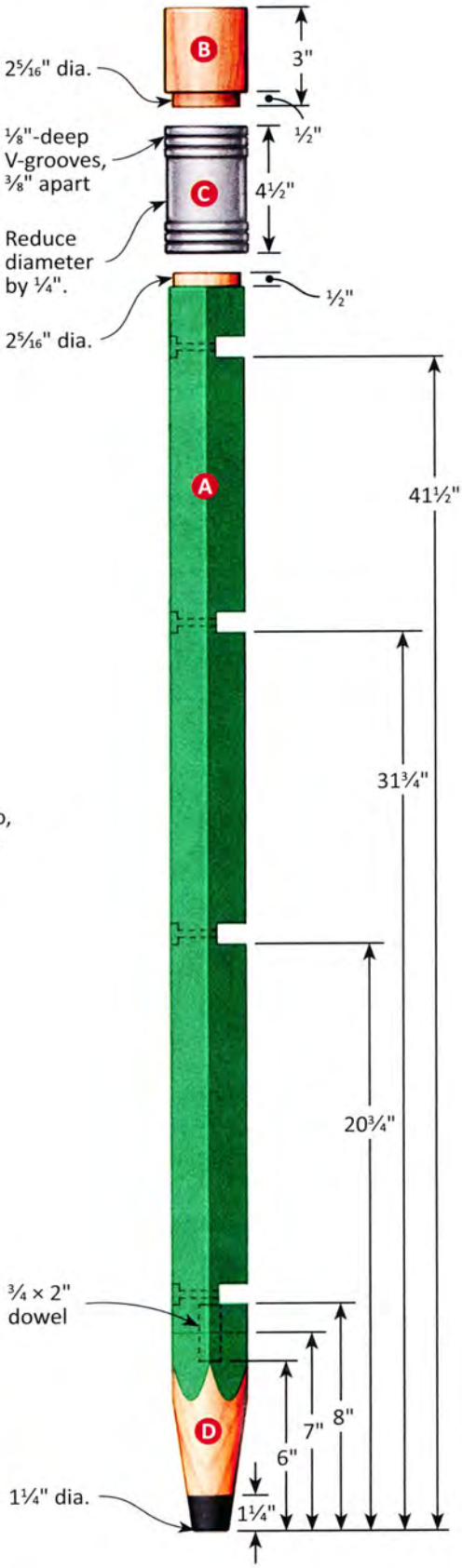
Depending on your clamp collection, assembling the pencil posts may take a few glue-up sessions, but after that, the shelving unit can be finished in a weekend. Despite its simplicity, there are a few interesting twists and turns. You'll learn how to lay out a hexagon; practice turning cones, cylinders, and tenons; and discover a few tricks for negotiating long columns with a short-bed lathe.

(*Note: Bright colors add a nice dose of whimsy, but painting the posts yellow or black–or leaving them bare–provide options that may work better with your home's decor.*)

Figure 1: Pencil-Post Bookcase Exploded View



Leg Detail



Make the legs

1 Select six 96"-long 2×4s to make the posts (A): one for each leg, one to test your setups, and an extra in case you make a mistake. (*Note: Avoid loose knots and waney edges. The best 2×4s are sometimes sold as "select" or "prime" stock.*)

2 Cut each 2×4 into two equal lengths and arrange them side by side for the best-looking grain. Mark the ends to ensure that each half stays properly paired with its mate.

3 Using a jointer, flatten the inside faces and edges of each matching pair. Next, apply glue to the inside face of one half, attach a small clamp across the edges to help align the halves, and then apply clamping pressure across the faces (**Photo A**). To ensure a seamless joint, space the clamps 6-8" apart. Glue up all six pairs, and let the assembled post blanks dry.

Tip Alert

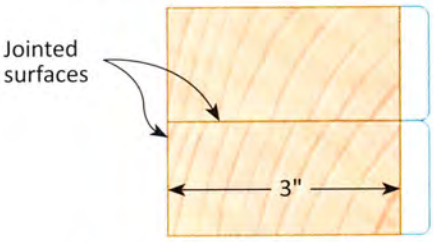
To keep your wood handscrew clamps from sticking to your posts, protect their faces with packing tape.

Photos: Larry Hamel-Lambert; Illustrations: John Hartman

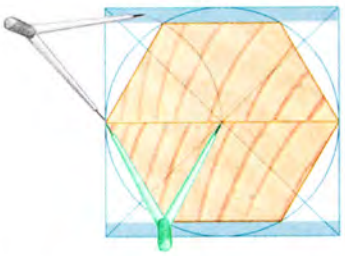
Use a threaded rod to trowel glue evenly across the face of the post, ensuring a good, clean glue-up.

As you rip and flip the hexagonal post, make sure that the glue line stays in contact with the rip fence.

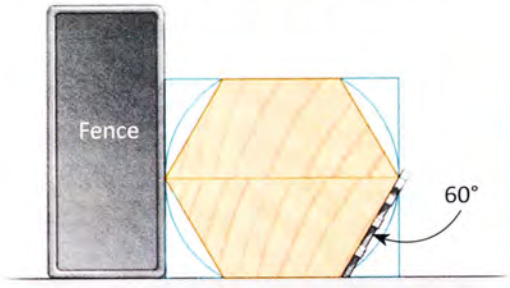
Figure 2: Turning a 2×4 into a No. 2 in 3 Steps



Step 1: Joint one face and edge, and glue up the leg blank. After the glue cures, rip the leg blank to 3" wide.



Step 2: Find the centerpoint, and draw a circle. Without adjusting the compass, "walk" it around the circle to find the hexagon's corners. Mill the excess material from the top and bottom faces.



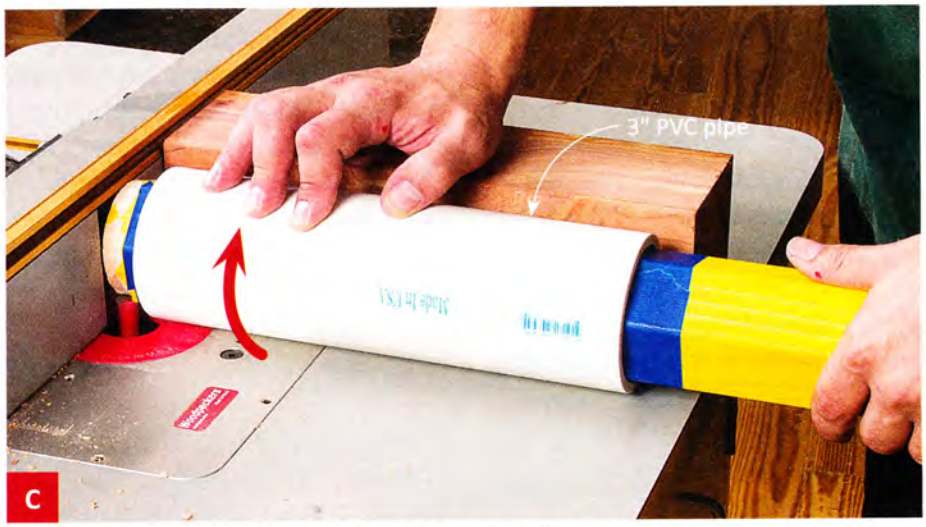
Step 3: Adjust the fence, and rip along the outside of the layout lines.

4 Referring to **Figure 2, Step 1**, rip the post blanks to 3" wide. (You may need to rip a little material from the jointed edge to remove the remaining rounded corners.) Next, refer to **Step 2** and lay out a hexagon on the end of your test piece, and mill all the blanks to the proper thickness.

5 Rip the first face, as shown in **Step 3**. Now flip the blank end for end, and rip the adjacent edge; (When you flip the stock for your second cut, the layout lines will be facing you.)

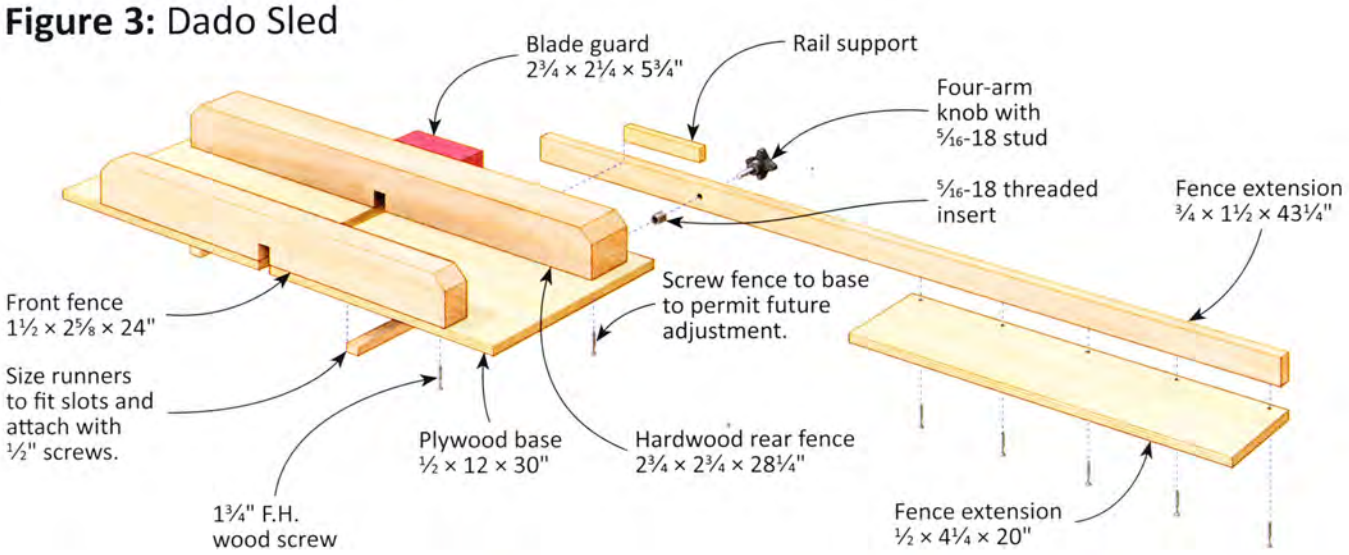
6 Rotate the blank 180° so that the cut edge rests against the fence, and rip the remaining two edges (**Photo B**). Double-check your cuts against your layout lines; if no adjustments are needed, cut the remaining legs. Finally, crosscut the posts (A) to length. (*Note: Save your scrap. You'll use the rippings to prevent tear-out when dadoing the posts and a hexagonal offcut to make the dowelling jig.*)

7 Finish the pencil posts (A). To add color but reveal some grain, I used BioShield Stain/Finish, a nontoxic, one-part stain and finish. An acrylic paint would create a more classic No. 2 pencil look, or you could finish the shafts with a clear finish. Whatever you choose, it's important that you



Sliding the hexagonal post into a PVC pipe allows you to rout a round tenon. Painter's tape protects the finish and packs the post in the pipe.

Figure 3: Dado Sled



finish the posts now in order to achieve the scalloped end when you "sharpen" the tip.

8 Chuck a ½" straight bit into your table-mounted router, and set the fence for a ½"-wide rabbet. Next, wrap the top end of a post (A) with painter's tape to protect the finish, and slide it into a 12"-long piece of 3" PVC. Guiding the pipe against a block of wood (or miter fence), feed the post into the bit, and then slowly turn the post/pipe clockwise, as shown in **Photo C**. Gradually raise the bit until the tenon fits inside the 2½" thick-walled conduit. Repeat with the remaining posts.

9 Build the dado sled shown in **Figure 3**. Next, set up your dado cutter to the width of your shelf material, and adjust the cutter for a 1"-deep dado. Tape a strip of wood (left over from ripping the hexagonal post) to the back face of the pencil to control tear-out, and cut the dadoes, as shown in **Figure 1 Leg Detail** and **Photo D**.

10 At the drill press, drill counterbores and through holes for the connector bolts through the posts (A), where shown in **Figure 1 Leg Detail**.

Use a sled with stops to ensure that the shelf dadoes line up. Cut the corresponding dadoes in each leg before readjusting the stop.

Turn the pencil parts

1 From 4×4 cedar stock, create three turning blanks for the erasers (B), each approximately 3 × 3 × 8". Next, cut four 4½"-long pieces of 2½"-diameter thick-walled conduit for the ferrules (C).

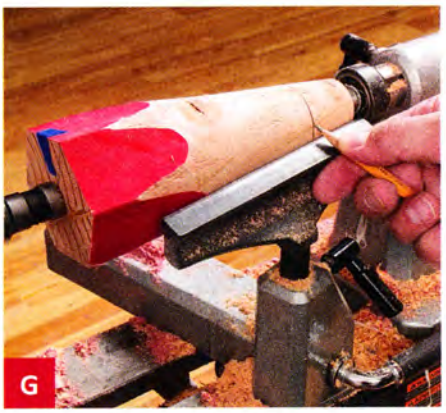
2 Using a tablesaw, chamfer about ½" from the corners of the eraser blanks to facilitate turning, and then mount the blank between your headstock and tail centers. Set the lathe to slow speed (around 1,500 rpm), and use a carbide cutter or roughing gouge to rough out a cylinder. Next, reposition the rest closer to the blank, and adjust the speed to around 1,800 rpm. Using a light touch, turn the cylinder to match the outside diameter of the conduit (approximately 2⅞").

3 Using a parting tool or square-edged carbide cutter, turn a 1⅛"-long tenon in the center of the cylinder, as shown in **Photo E**. (*Note: To obtain a snug-fitting tenon, use calipers rather than relying on dimensions.*) Measuring up from the tenon's shoulders, cut the erasers (B) to the sizes listed in the **Cut List** using a saw or parting tool, and then cut through the tenon to separate the pair. Repeat the procedure with the remaining two blanks. Cut the final blank in half but do not trim the ends; you'll use these pieces as jam chucks to turn the ferrules (C).

Using calipers to check your progress, turn the eraser blank and tenon to match the conduit's outside and inside diameters.

Use the corner of the square-edged carbide cutter to create the V-grooves, then use the flat edge to reduce the diameter between the coves.

4 Using the jam chucks made in Step 3, mount the conduit. Leaving the speed at 1,800 rpm, lightly run a round carbide cutter against the conduit to smooth and true the cylinder. Now, locate the ferrule V-grooves, where shown in **Figure 1 Leg Detail**, and cut the grooves as shown in **Photo F**. Next, turn the center section. Complete the remaining ferrules (C), and then put the erasers (B) and ferrules aside for now. *(Note: This is a good time to spray-finish the ferrules.)*



Lay out the lead line with a pencil. Note the wavy edge at the top of the sharpened tip.

5 With a mitersaw or tablesaw and crosscut sled, equipped with your best crosscut blade, trim 7" from the bottom end of each post (A). Mount one of the pieces into your lathe with the intended tip against the tailstock. Now, adjust the speed to 1,500 rpm. Staying 1" away from the headstock end, lightly rough out a cylinder. Stop the lathe to inspect the scalloped edge.

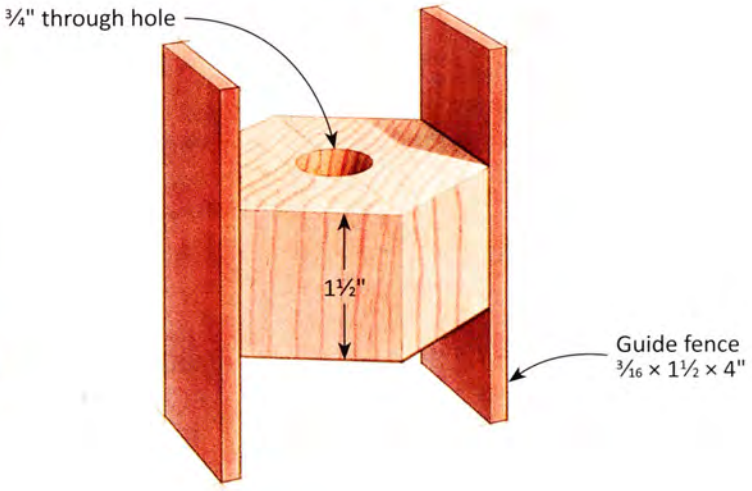
6 Using a parting tool or square edged carbide cutter, establish the tip's final dimension, as shown in **Figure 1 Leg Detail**. Now, working downhill from right to left, "sharpen the pencil." Finally, establish a "lead tip" line about 1¼" in from the tailstock end, as shown in **Photo G**. Repeat with the remaining pencil tips.

7 Using a post offcut, make a doweling jig, as shown in **Figure 4**. Now, using the jig, drill ¾ × 1" holes in each pencil post end (**Photo H**). Reassemble the tips to the posts using glue and ¾"-diameter × 2"-long dowels (D).

8 Touch up the pencils' finish where needed. Finally, dip the pencil tips into Plasti-dip to create a nonslip tip, as shown in **Photo I**.

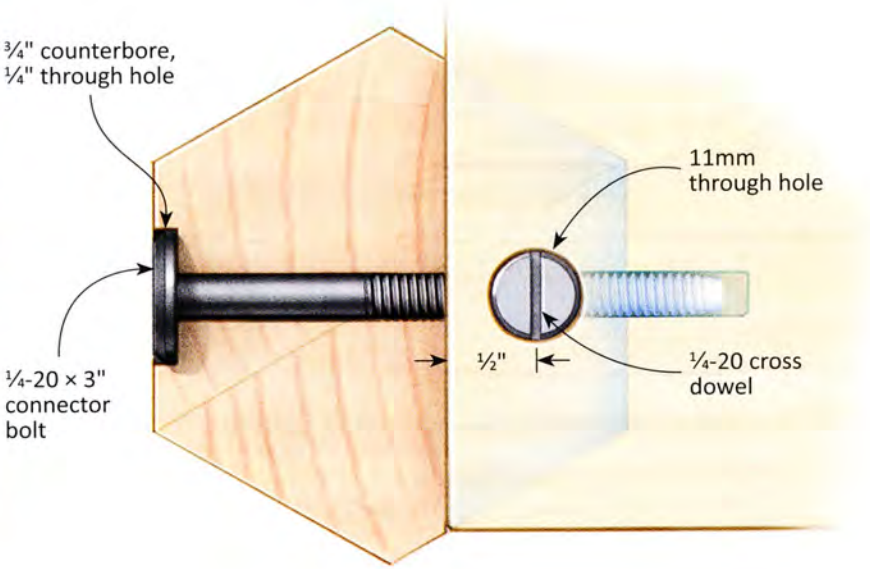
Drill matching holes in the posts and tips with a shop-made doweling jig. Use painter's tape to keep track of matching faces.

Figure 4: Doweling Jig



Dipping the pencil tips into rubberized paint creates non-slip, non-marring footpads.

Figure 5: Leg-to-Shelf Detail



Make the shelves and attach the legs

1 From ¾" Baltic birch plywood, cut four shelves (E) to the sizes in the **Cut List**.

2 Sand the faces, knock off any sharp edges, and then finish the shelves with 2-3 coats of water-based polyurethane.

3 With a helper, fit the shelves (E) into the posts (A). Using the pre-drilled holes as guides, drill ¼ × 3¼"-deep holes into the ends of the shelves.

4 Remove the shelves, and drill 11mm holes through the face of each shelf for the cross dowels, where shown in **Figure 5**.

5 Insert the cross dowels into the shelves, and then attach the posts to the shelves with connector bolts.

6 Attach the erasers (C) to the ferrules (B) and the ferrules to the posts (A). (To join the wood to the PVC, I used Nexabond, but epoxy would also work). Consider leaving one ferrule unglued since kids appreciate a secret hiding spot for small treasures. ■

Pencil Post Bookshelf Cut List

	Part	Thickness	Width	Length	Qty.	Mat'l
A*	Posts	2⅝" (approx.)	3"	44	4	P
B	Ferrules		2⅞" dia.	4½"	3	Schedule 40 PVC
C*	Erasers		2⅞" dia.	3"	4	C
D	Dowel pins		¾" dia.	2"	4	B
E	Shelves	¾"	12"	36"	4	BP

Materials: P=Pine, C=Cedar, B=Birch, BP=Baltic Birch Plywood.
*Indicates that parts are initially cut oversized. See instructions.

Convenience-*PLUS* BUYING GUIDE

☐1.	BioShield Aqua Resin Stain Finish Royal Blue, 0.12 liter	#155324	$14.00
☐2.	BioShield Aqua Resin Stain Finish Crimson, 0.12 liter	#155341	$14.00
☐3.	BioShield Aqua Resin Stain Finish Sunflower, 0.12 liter	#155330	$14.00
☐4.	BioShield Aqua Resin Stain Finish Forest, 0.12 liter	#155336	$14.00
☐5.	General Finishes High Performance Top Coat, Semi-Gloss, Pint	#148414	$16.50
☐6.	¼-20 × 3" Connector bolts (10/pkg), 2 needed	#06K90	$4.99
☐7.	Cross Dowels ¼-20 (10/pkg), 2 needed	#06K70	$3.19
☐8.	11mm Brad-Point bit	#854358	$6.99

Above items are available at Woodcraft stores, *woodcraft.com* or by calling (800) 225-1153.
Prices subject to change without notice.

☐9.	Rust-Oleum 7277830 Metallic Spray, Matte Nickel, 11 oz. ($11); Performix Brand Plasti-Dip, Black, 14.5 oz can; ($7), 2½" thick-walled conduit (10' section, $15); 3" S40 PVC-DWC pipe (5' section, $7)

Above items available at home centers and hardware stores.

Inside-Out Ornament

Turn a profile into a picture.

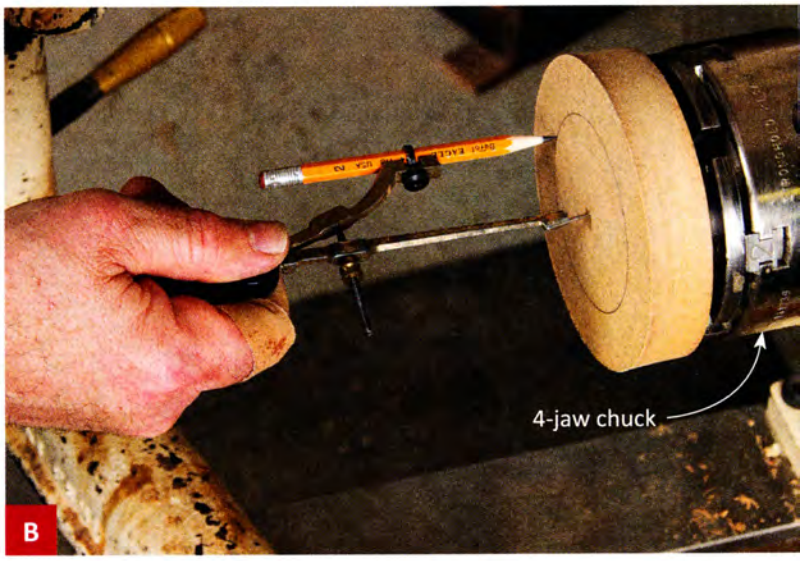
By Mike Kehs

The world of woodturning can produce some pretty tricky looking projects. Among them are "inside-out" turnings. These spindle-turned pieces feature a hollowed-out interior that's visible through shapely window silhouettes that are created by the edges of the interior profile.

As mystifying as an inside-out turning might appear, it's not all that difficult to make one. Basically, you bundle together four identically sized, squared lengths of stock, and mount them on the lathe between shop-made chucks that hold the unglued pieces tightly together. You then turn the bundle to a specific profile. Afterward, you remove the pieces, orient the turned surfaces inward, and glue the pieces together. This creates the windows that expose the shapely hollowed interior. If you like, you can then remount the assembly on the lathe, and turn the outside of the block to a complementary shape.

Here, I'll show you how to make a simple tree ornament with a turned exterior. Although it's too heavy to hang on a Christmas tree, you can suspend it from a ceiling hook or curtain rod. It also makes a very nice standing table ornament. Just be prepared for someone to ask you, "Say, how did you do that?"

Overall dimensions: 3" dia. × 7¾" high



Make the tailstock jam chuck

1 Turn a 1"-thick piece of MDF to about 5" in diameter. Press this jam chuck blank between a 4-jaw chuck and a live tail center, and turn a ¼"-deep groove that's wide enough to accept the jaws of your 4-jaw chuck (**Photo A**). Afterward, reinforce the tenon fibers by dripping thin CA glue onto the shoulders of the tenon.

2 Invert the jam chuck, inserting the tenon you just turned into your 4-jaw chuck. Touch a pencil to the spinning disc to determine its center point, and then use a compass on the stopped disc to lay out a precise 3"-diameter circle (**Photo B**).

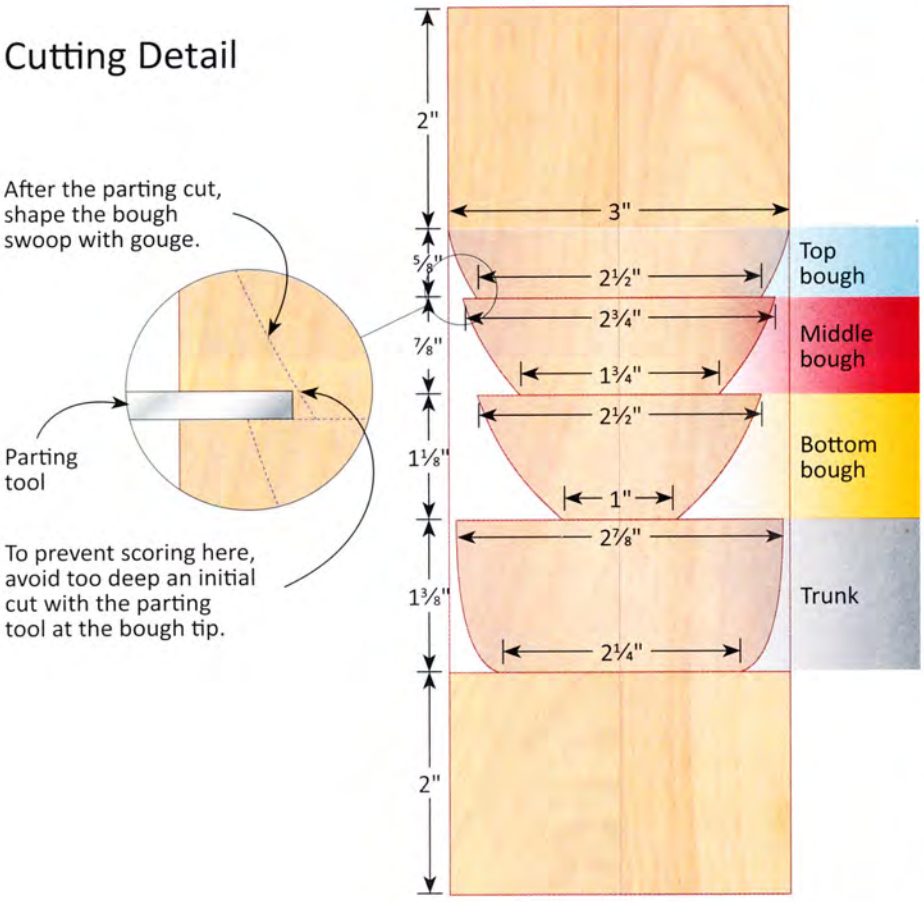
3 Turn a ¼"-deep recess within the circle (**Photo C**). Then invert the blank again, mounting it by expanding the chuck jaws outward into the recess you just cut.

4 Drill a recess that will fit snugly onto the rotating section of your live tail center (**Photo D**). This will allow the jam chuck to remain securely in place on the tailstock when replacing and removing turning blanks.

5 Hold a drafting triangle precisely tangent to the circle's perimeter and lay out the corners for the square recess (**Photo E**). Remount the jam chuck, and enlarge the diameter of the existing recess to 3½". (This minimizes the amount of chiseling necessary to square the recess.)

Opening photo: Larry Hamel-Lambert; Project photos: Paul Anthony

Figure 1: Inner Profile



Turn the inner profile

1 Dress four pieces of hardwood to 1½" × 1½" × 8". Mount these as an unglued bundle between your 4-jaw chuck and the jam chuck you just made, shimming the walls of the jam chuck recess if necessary to ensure a snug fit.

2 Referring to **Figure 1**, lay out the 4"-long center section to be turned, extending the lines across two faces so they'll be visible when spinning (**Photo F**). Also, number the quadrants of your chucks and turning blanks for precisely balanced remounting if necessary.

3 Using a small bowl gouge, round the section between the layout lines almost to a cylinder, leaving slight flats at the seams for now. Taper inward from about 1" outside of the layout lines to allow better gouge access for subsequent cuts (**Photo G**).

4 Referring to **Figure 1**, lay out the lower extent of the top bough by marking ⅝" down from the layout line at the tailstock end (**Photo H**).

5 Make a parting cut to the left of your layout line to turn a 2¾"-diameter groove. To the right of the groove, part as deeply as you think you can without cutting into what will be the adjacent swooped section (see **Figure 1**, detail). Follow up by shaping the swooped section of the bough using a ⅜" spindle gouge with a fingernail grind.

6 Lay out the lower extent of the middle bough, measuring down 1½" from the top of the tree profile, where shown in **Figure 1**.

7 Make the parting cut to the left of the middle bough layout line. The easiest way to determine its 2½"-diameter is to

G

H

I

J

K

check for a ¼"-deep groove, as measured from the seam at the flat unturned section (**Photo I**).

8 Now make the parting cut to the right of the groove (**Photo J**). As before, cut as deeply as possible without endangering what will be the surface of the swooped section to be cut next.

9 Use a ⅜" spindle gouge with a fingernail grind to shape the swooped section of the bough (**Photo K**).

10 Turn the remaining (bottom) bough and the trunk section in the same manner. Then sand the turned surfaces to 220 grit.

Glue up the blank

1 Dismount the bundle, and glue and clamp the pieces together in pairs to create two halves (**Photo L**). Apply clamp pressure at the seams to perfectly align them. Also, make sure the pieces are flush at the ends.

2 After the glue dries, sand the two inner faces on a disc

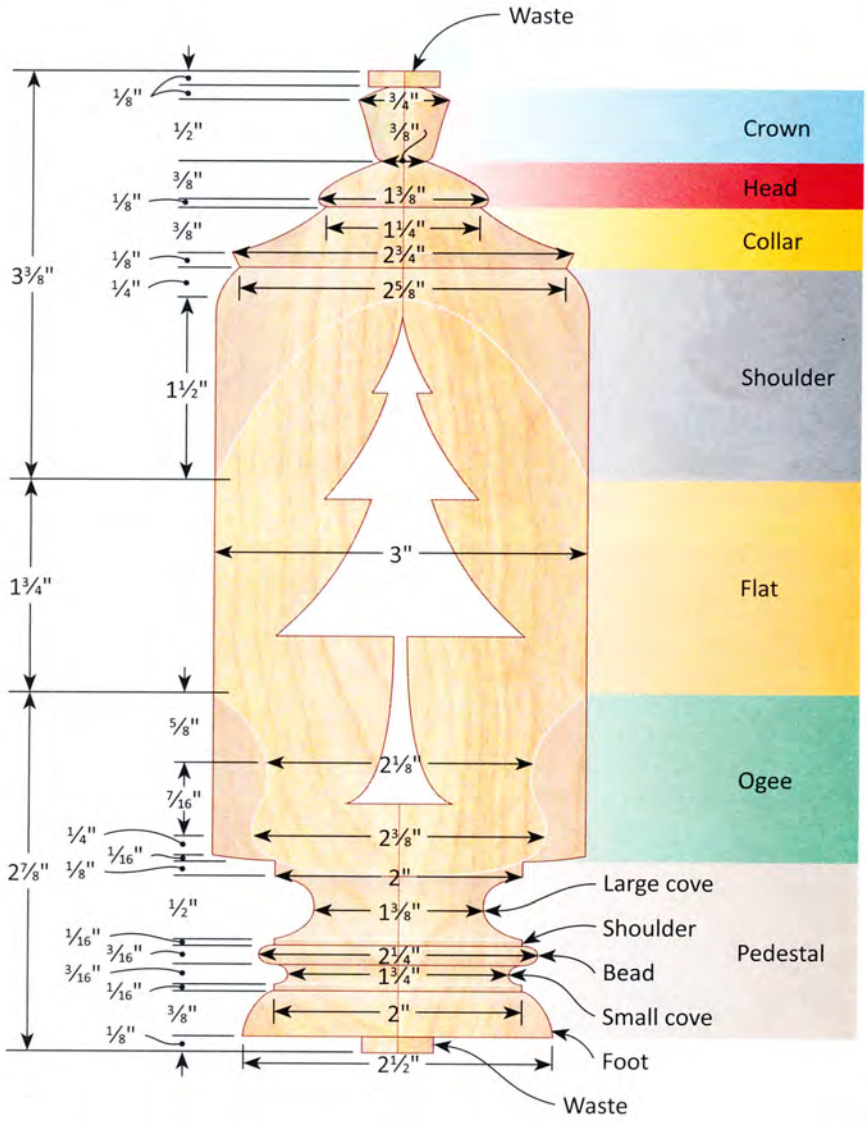
Tip Alert

The best time to paint or decorate the interior faces (if you wish) is before they're glued together.

L

Illustrations: Mario Ferro

Figure 2: Outer profile



sander or on a piece of sandpaper fixed to a dead-flat surface. Then, glue the two halves together in the same fashion as before, with the turned profiles oriented toward the inside.

Turn the outer profile

1 Mount the blank on the lathe between a cup center on the headstock and a live cup center on the tailstock. Referring to **Figure 2**, mark out the extents of the 1¾"-long squared area at the center (which retains the corners of the block). Carry your lines across two sides so that they will be evident when spinning.

2 Using a ½" spindle gouge, rough out the upper section of the ornament, making sure to leave a flat area surrounding the entire tree cutout.

3 Mark out the extents of the crown, head, and collar details, where shown in **Figure 1**, and use a parting tool to cut just shy of their final diameters.

4 Use a ⅜" spindle gouge with a fingernail grind to detail the crown and head (**Photo M**). Then, shape the collar (**Photo N**), and finally, the shoulder (**Photo O**).

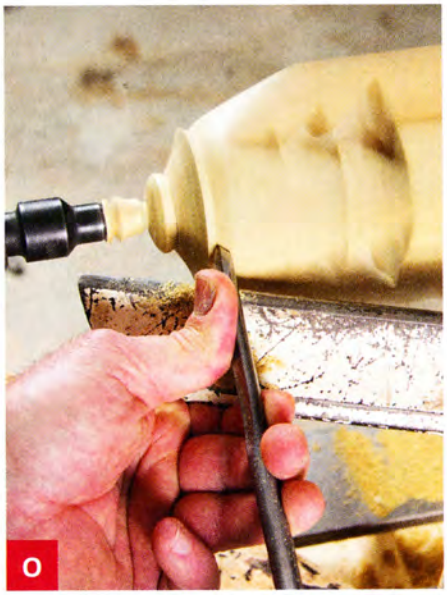
5 Moving to the lower section, begin by roughing out the ogee using a ½" spindle gouge with a fingernail grind.

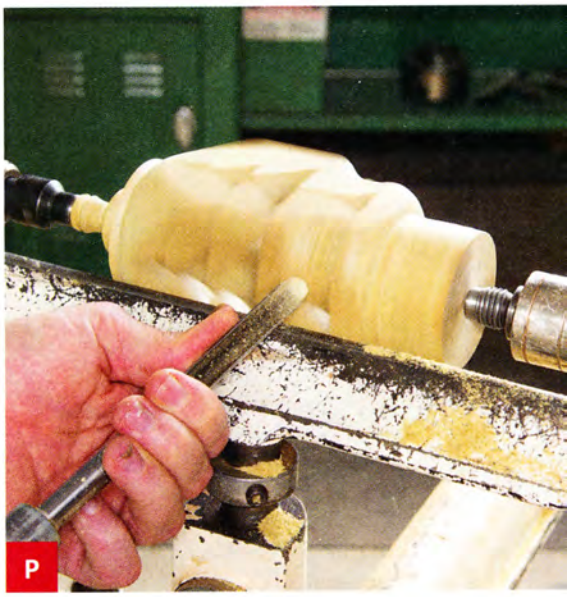
6 Turn the pedestal section to a 2½"-diameter cylinder.

7 Still using the ½" spindle gouge, go back and finesse the ogee curve, cutting inward from each end downhill to the grain (**Photo P**).

8 On the pedestal section, mark off the individual elements, and then use a parting tool to size them just slightly larger than their final diameters. At the same time, turn away as much as possible of the bottommost ⅛" waste section to remove the

N


O


P

Q

R

marks left by the live center.

9 Round over the foot with a ⅜" spindle gouge.

10 Round over the bead (**Photo Q**), and turn the small cove between the bead and the foot, leaving the lower transitional shoulder.

11 Turn the large cove with its small adjacent shoulders (**Photo R**).

12 Use a ⅜" spindle gouge to turn a shallow recess of about 1/16" into the underside of the foot for stability.

13 Finally, use a spindle gouge or skew chisel to reduce the waste at the ends to about ⅜" in diameter to minimize cleanup afterward.

Finishing Up

1 Hand-sand through 220 grit, stopping the lathe to smooth the flat sections.

2 Dismount the piece, and cut and sand away the nubs.

3 Apply a finish. I usually brush on oil or spray on an aerosol lacquer or acrylic finish. ■

About Our Author

Michael Kehs has been carving and turning wood for 30 years. In addition to creating award-winning designs for commission and exhibition, he teaches woodcarving and turning at his studio in Bucks County, Pennsylvania, and at the local Woodcraft store in Allentown, Pennsylvania.

Rasps and Files

Shape and smooth more (and sand less) with these simple tools.

By Craig Bentzley

For years, I've regarded my rasps and files as my not-so-secret secret weapons. Hidden in plain sight beside my workbench, my collection has never generated a single comment from any visitor. Admittedly, these simple steel-toothed tools lack the romance of my planes, handsaws, and chisels, but what they lack in allure, they make up for in function.

Truth be told, files and rasps rank among my most reached-for tools because they're quick and efficient to use. Whether the job calls for heavy stock removal, erasing tool marks, refining curves, taming tear-out, fitting a metal part, or even repairing some other tool, there's a file or rasp that can get the job done.

These simple shapers and smoothers require a bit of skill to use effectively, but as you'll soon see, the learning curve is surprisingly short. And unlike most other hand tools, files and rasps come ready to work fresh out of the package. The biggest hurdle to using these tools may be selecting the right ones.

Read on to learn what's available and how you can make these toothy tools work for you. As a wrap-up, I'll provide you with a starter set that can be put to immediate use in almost every workshop.

Rasps

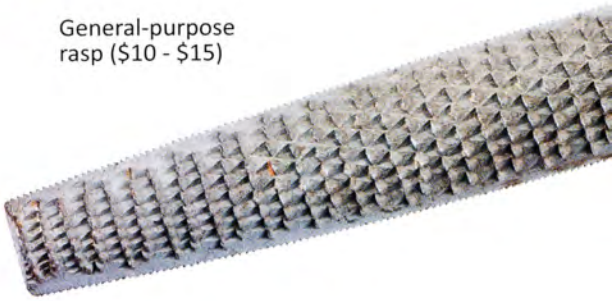
Easily identified by their prominent triangular teeth, rasps excel at initial shaping and sculpting operations on wood. Unlike other shaping tools, such as drawknives and spokeshaves, rasps won't tear out material where the grain changes direction or if the stock is highly figured.

Using a rasp is fairly intuitive, but a few tips can help you achieve faster cuts and smoother surfaces. When using a rasp, start by making a few light test strokes to determine the preferred angle of attack. (This is especially true with hand-stitched rasps. Many are designed for right- or left-hand use only.) Then, use long, continuous passes at approximately a 45° angle, simultaneously feeding down and across the work, as shown in **Photo A**. Let the tool do the work; a sharp rasp should not require much pressure to cut. (In contrast, a dull rasp will skip across the workpiece.)

With rasps, as with other hand tools, you get what you pay for (see **Photo B**, below). Generic general-purpose wood rasps, sometimes referred to as "cabinet" rasps, have uniform rows of teeth that leave a fairly ragged surface in their wake. The poor cut quality can require considerable cleanup.

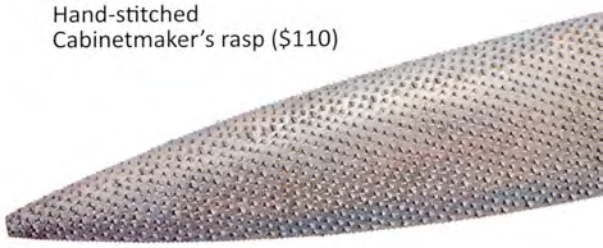
Better quality rasps are labeled as "patternmaker's" or "cabinetmaker's" rasps. These tools sport staggered teeth that leave a much smoother surface than general-purpose rasps. Patternmaker's rasps can be machine-made or hand-stitched. As you might expect, the priciest hand-stitched rasps require the least amount of cleanup.

General-purpose rasp ($10 - $15)



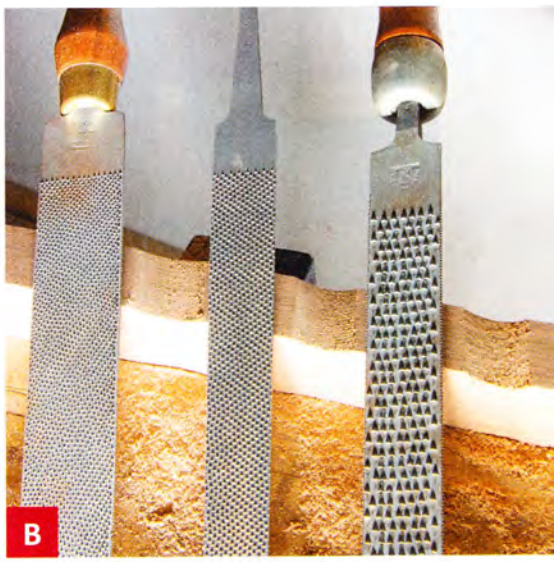
Grobet Patternmaker's rasp ($90)

Hand-stitched Cabinetmaker's rasp ($110)



A

Feed the rasp simultaneously down and across the work. Try to use the full length of the tool to wear the teeth evenly.

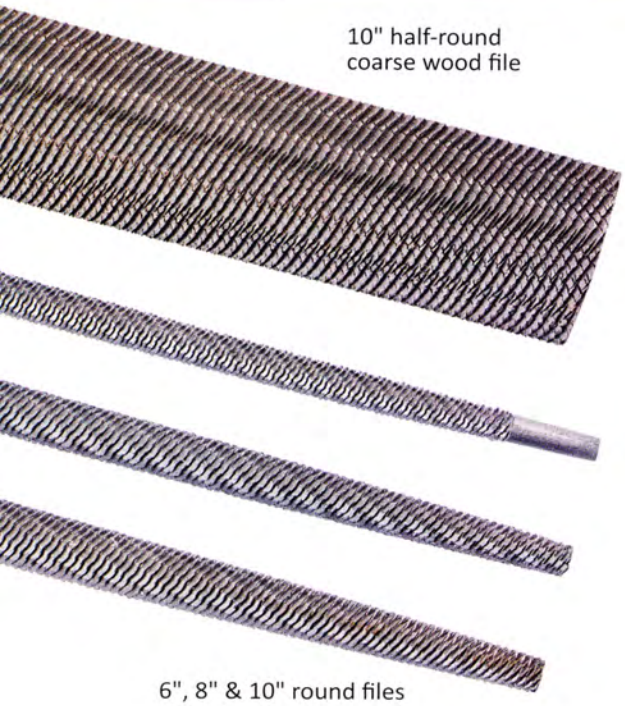


B

Better machine- and hand-stitched rasps cut quicker and produce smoother surfaces than a visibly coarser, low-cost rasp.

Technique photos: Paul Anthony; Product photos: Larry Hamel-Lambert

Files for working wood



10" half-round coarse wood file

6", 8" & 10" round files

Files are used to refine the rasped surfaces, but they can also serve as stand-alone shaping tools. For most woodworking chores, I use fairly coarse files, like the ones shown at left. With most files, tooth size is proportional to tool length; the longer the tool, the larger the teeth. I find the 6"- and 8"- long round files are most useful in the woodshop, as the 10" is a bit too aggressive. When it comes to flat and half-round files, I find the 8" and 10" long double-cut bastard files best for woodworking. (Because the teeth on shorter, finer-cutting files quickly clog with sawdust, I reserve them for metalworking.)

Files cut on the push stroke, but how you feed the tool across the work can influence the cutting speed and quality. Feeding the tool down and diagonally across the wood, as done with a rasp, is suitable for general shaping and fairing. For rougher shaping (**Photo C**), you can feed the file perpendicularly across the work, which is called "cross-filing." For a smoother surface, run the file parallel with the grain, called "draw-filing" (**Photo D**).

Clean Your Teeth

A file card is a must-have accessory. Use the nylon bristle side to clean rasps and the wire bristle side to clean files. You can use a metal pick or finishing nail to clean stubborn debris from file teeth, but any metal–even brass bristles–will eventually dull your rasp's teeth.

Tip Alert

To prevent prematurely dulling a file, lift it on the return stroke.

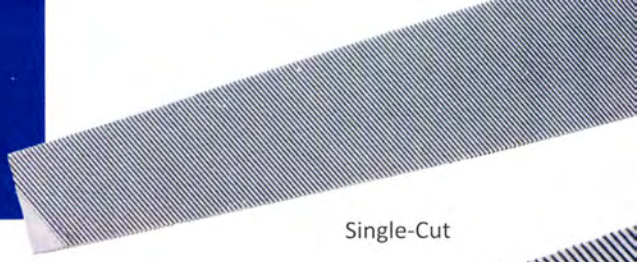
C

Cross-filing removes stock quickly, but leaves a rough surface and may create some chip-out at the back of the cut.

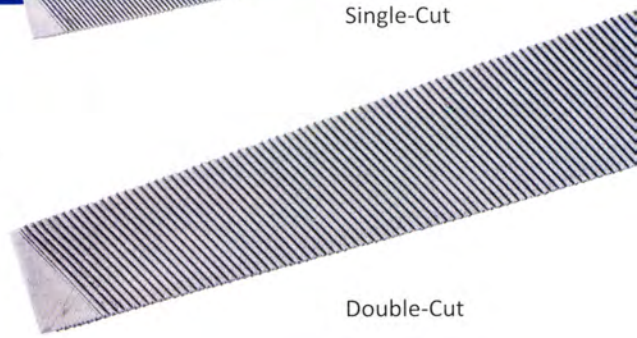
D

Draw-filing is slower, but produces a smoother surface.

Files for working metal



Single-Cut



Double-Cut

As we all know, woodworkers often work with metal as well as wood. Files can do double-duty, but I find that once a file is used on metal, it doesn't perform as well as on wood anymore. For that reason, I suggest investing in a separate set of files for metal work.

Metal files are available in two types of tooth configurations: single-cut and double-cut (see photo at right). Single-cut files have a single set of parallel teeth. Double-cut files have a second, opposing set of teeth that create a diamond pattern. I prefer using single-cut files for straightening and refining critical metal surfaces. When I need to remove a lot of metal during initial rough shaping or fitting, I'll start with a double-cut file and then follow up with a single-cut file for the finished surface.

In addition, there are three tooth sizes: bastard (coarsest), second-cut, and smooth (finest). You can shop around for shorter files with larger teeth, but in most stores, the in-stock files are sold in common-size tooth combinations. (See the "File and Rasp Starter Set" page 41 for specific recommendations.)

Tip Alert

Aluminum and brass will quickly clog file teeth. To make it easier to remove built-up debris, try rubbing a piece of chalk across the surface of the file before use.

Metal Working for Woodworkers

Using a straight-filing motion quickly reestablishes a straight edge on a cabinet scraper.

Use a small, round chainsaw file to quickly shape curved metal parts, such as beading blades for a scratch stock.

A mill file is suitable for cleanup and general shaping, such as softening sharp edges and removing nicks from a plane sole.

Capable of fitting into tight spots, needle files can be used to shape and smooth ragged edges, such as those on rough-cast hardware.

Rifflers

Rifflers are slim, double-ended tools curved to opposing shapes. They are well-suited for getting into tight areas and doing detail work or cleaning up carvings. They are sold in a wide variety of configurations, including flat, round, half-round, and triangular. (Rifflers are available with either file or rasp teeth. I prefer the files, as I find rasp-rifflers a tad too aggressive.)

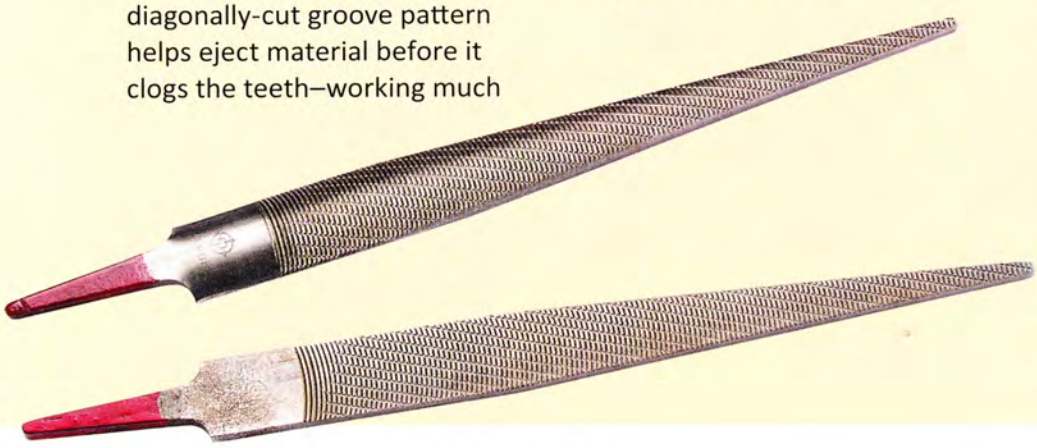
To use a riffler, hold the tool like a pencil, apply pressure with the finger of your other hand, and work in back-and-forth strokes. Admittedly, riffler work can be tedious. Because the cutting face is small, the work goes slowly and the teeth clog quickly. However, for their ability to erase the tool marks out of reach of larger tools, they earn their keep in my shop.

Rifflers aren't the fastest cutting tools, but they offer a precise way to clean up ragged edges in tight areas.

Iwasaki Files

A fairly new entry into the world of wood shaping tools, Iwasaki files deserve special mention. Although technically files, these tools cut as aggressively as rasps and still produce super-smooth surfaces. The secret is in the cutting edges. The milled, chemically etched teeth shear materials, producing shavings instead of dust. In addition, the diagonally-cut groove pattern helps eject material before it clogs the teeth–working much like miniature chipbreakers. (They're good for wood and plastic, but don't even think of using them on metal.)

Iwasaki files are available in a wide range of sizes and configurations (see *woodcraft.com*). All of the profiles have "safe" (tooth-free) edges, allowing them to work up against adjacent surfaces without scarring them. These files haven't yet bumped any tools from my must-have starter set, but they are an attractive, affordable option for woodworkers saving for a hand-stitched rasp.



With sharp teeth that cut fast and leave a smooth surface, Iwasaki files can serve as a single-tool stand-in for files and rasps.

Protect yourself and your tools

You'll want to make or buy handles to protect your hands from injury when handling these tools. Auxiliary handles are sold for grasping the tool at its far end, but a wrap of masking tape will also do the job.

To protect your rasps, files, and rifflers, store them in a rack or tool roll to prevent the edges from banging together. Rust can also contribute to premature dulling. For long-term storage, consider using a sealed tool box with a VCI (vapor corrosion inhibitor) inside. Oils and other dust-collecting lubricants should not be used because the teeth will load up more readily and require more frequent cleaning.

Riffler photos: Bob Etter

File and Rasp Starter Set

Considering the different sizes and tooth configurations of files and rasps, selecting a starter set for shaping and smoothing can be downright dizzying, but don't fret.

You can build a decent starter set for about as much as you'll pay for a single premium hand plane. Here's a list of my go-to tools.

1. Patternmaker's rasp ($90)

A quality patternmaker's rasp is an investment. Buy the best tool you can afford, take care of it, and it will tackle all sorts of shaping and sculpting chores for years to come. Rasps are available in flat, half-round, and round configurations. I find that a half-round rasp is the most useful.

2. 8" single-cut bastard round file ($5)

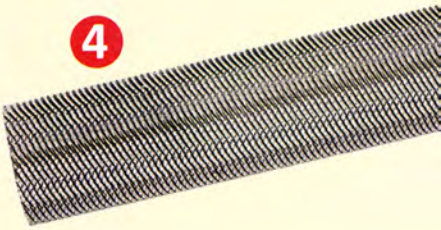
Good for getting into tight radii and enlarging holes on woodworking projects. Consider buying a second for metalworking chores, such as filing curved scraper blades and fitting hardware.

3. 10" half-round coarse wood file ($25)

Although typically used after initial shaping with a patternmaker's rasp, this file can serve as a stand-alone shaping tool for light-duty work.

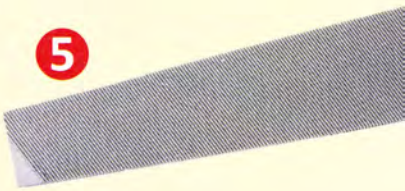
4. 8" double-cut bastard half-round file ($8)

I often use this file to clean up surfaces after working on them with a 10" file, but it can also be used for general metal-shaping chores.



5. 10" single-cut bastard mill file ($8)

Although this is my go-to tool for truing up edges on cabinet scrapers and performing other metalworking jobs, it is equally handy for a host of wood-shaping chores, so buy two.



6. 3/32" diameter × 8"-long chainsaw file ($5)

This slim file is perfect for smaller metal-shaping chores, such as creating scratch stock and molding plane blades. It's also handy for cleaning up the edges of metal hardware and machinery.

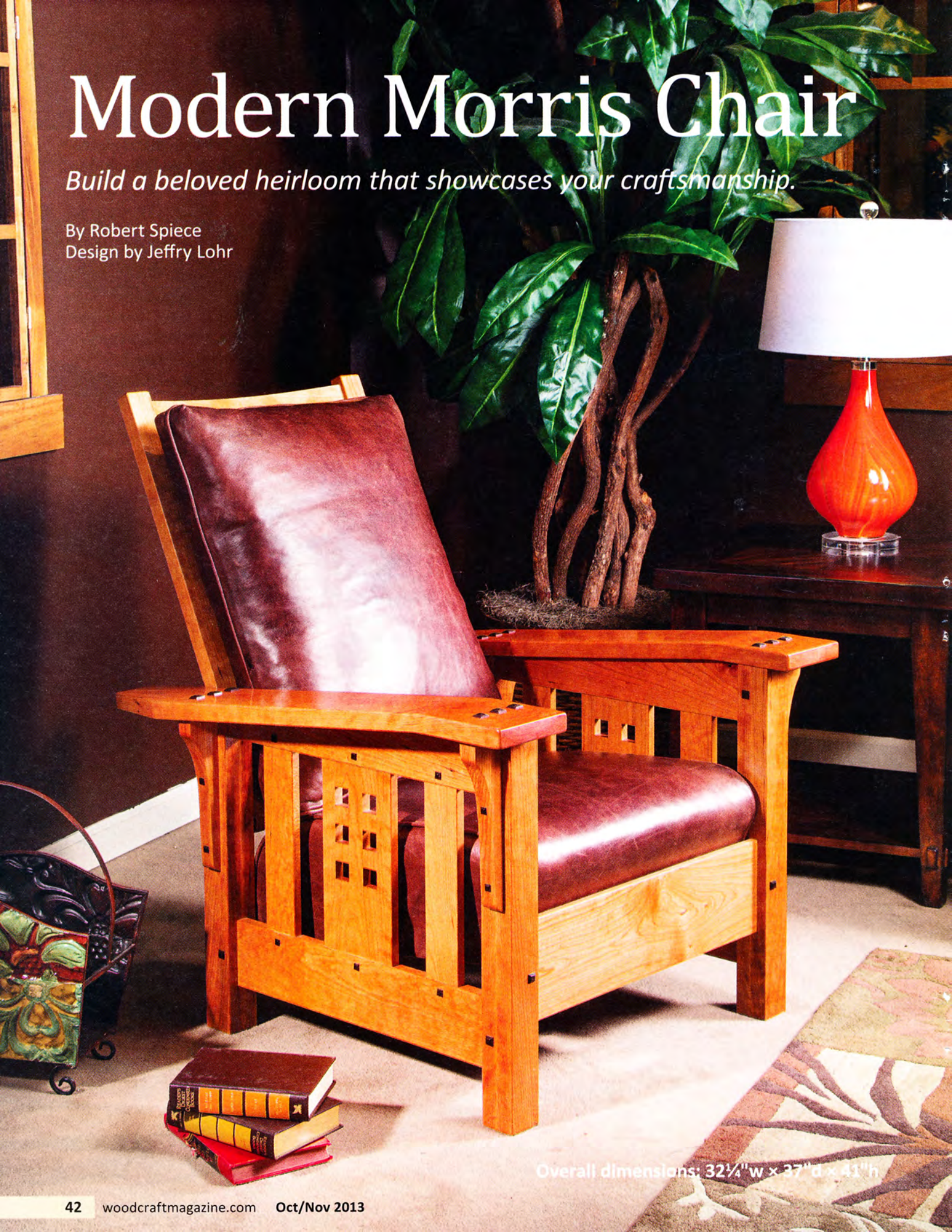
7. Needle file set ($25)

These super-small files are indispensable for intricate shaping and cleanup of both metal and wood, including the smoothing of scrollsawn edges.

Modern Morris Chair

Build a beloved heirloom that showcases your craftsmanship.

By Robert Spiece
Design by Jeffry Lohr



Overall dimensions: 32¼"w × 37"d × 41"h

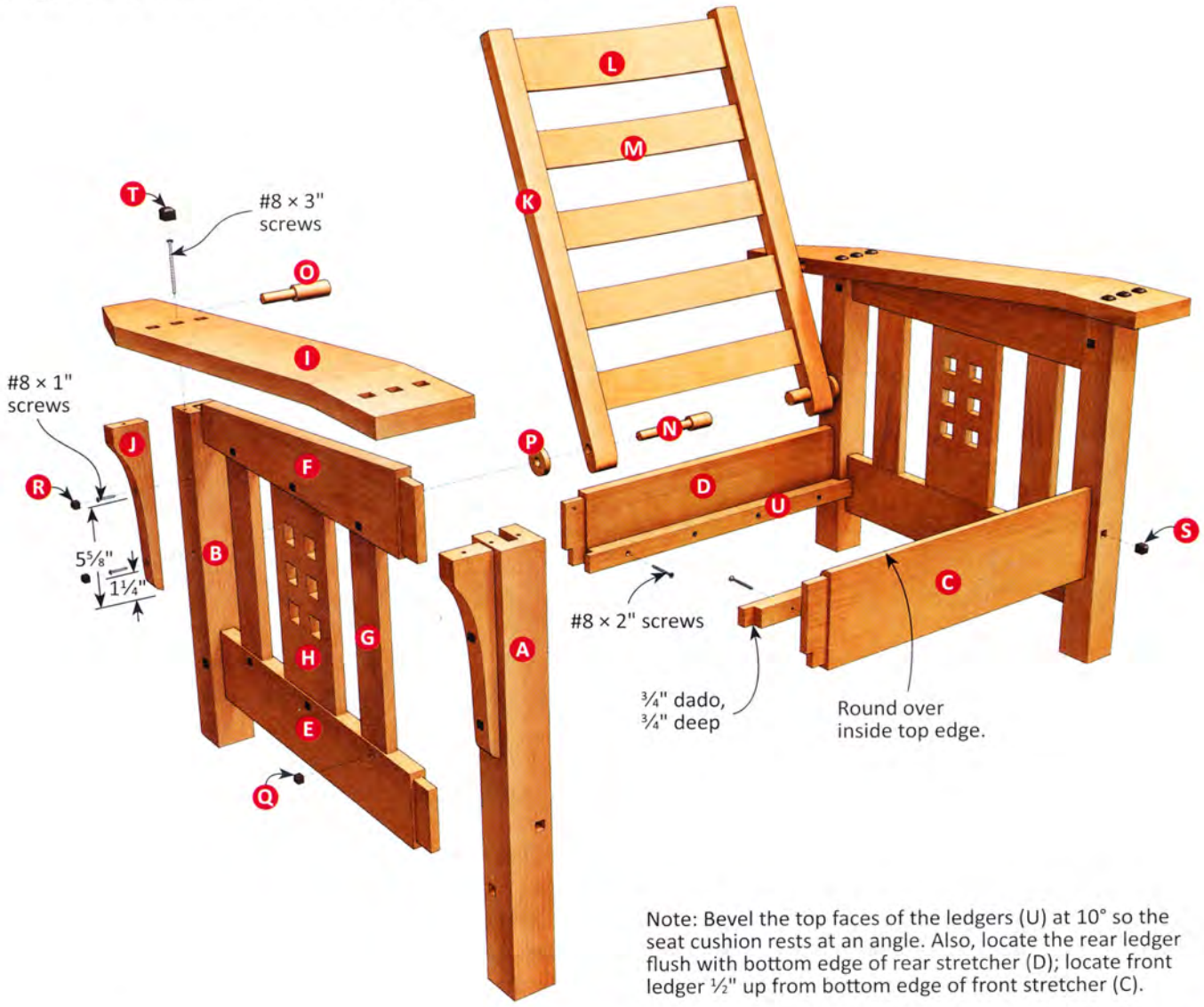
Since the creation of the Morris chair by Englishman William Morris in the late 1800s, much has happened to improve and stylize the original design. Most notable are the versions in early 20th-century by Gustav Stickley during the American Arts and Crafts era. Over time, Morris chairs offered several ways to pivot and support the reclining back. Many of the chairs included through-tenon joinery in the legs.

Pennsylvania craftsman Jeffry Lohr's take of the beloved Morris chair preserves the best elements while adding a few more. Among them are the broad center side splats with their eye-catching square openings and walnut buttons. Concealed mortise-and-tenon joints ensure enduring strength, while bent-wood back slats add welcome comfort. Departing from the traditional quartersawn white oak of earlier chairs, Jeffry chose cherry to give his piece modern appeal.

I'll carefully cover the construction of Jeffry's chair to help you build a classic like the one shown at left. Although you can make the needed mortises with drill-press-mounted bits and hand chisels, you'll find that using a mortising machine will save hours of building time. Take care with the measuring, marking, and machining, using scrap to check your tool setups. In the end, you'll be rewarded with a treasured heirloom admired by all who see or sit in it.

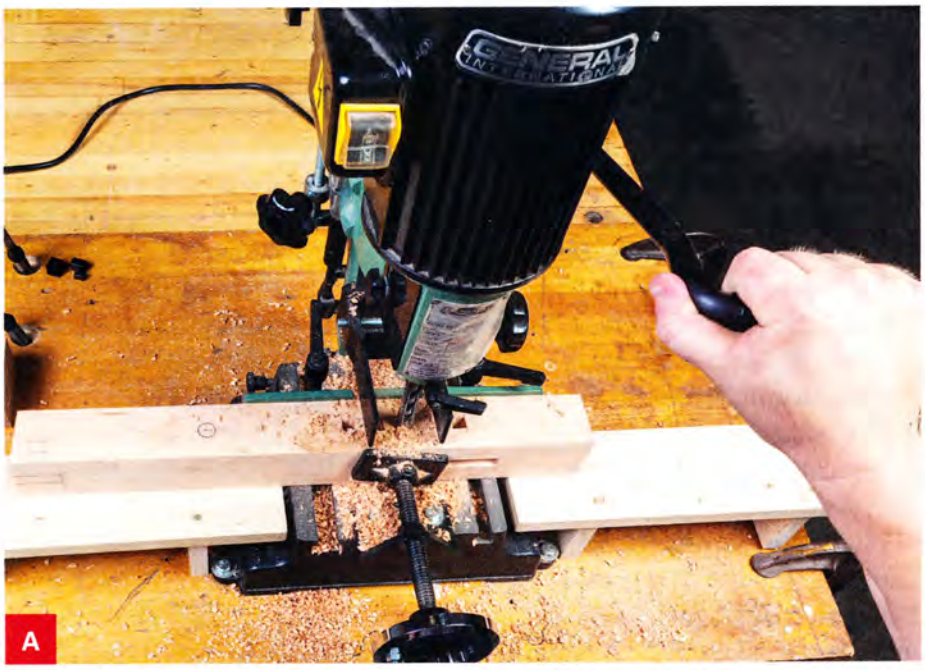
Note: Because upholstery is beyond the skills of most woodworkers, I'll provide a sidebar that tells how the cushions are made, along with my source. Feel free to use a local source.

Figure 1: Morris Chair Exploded View



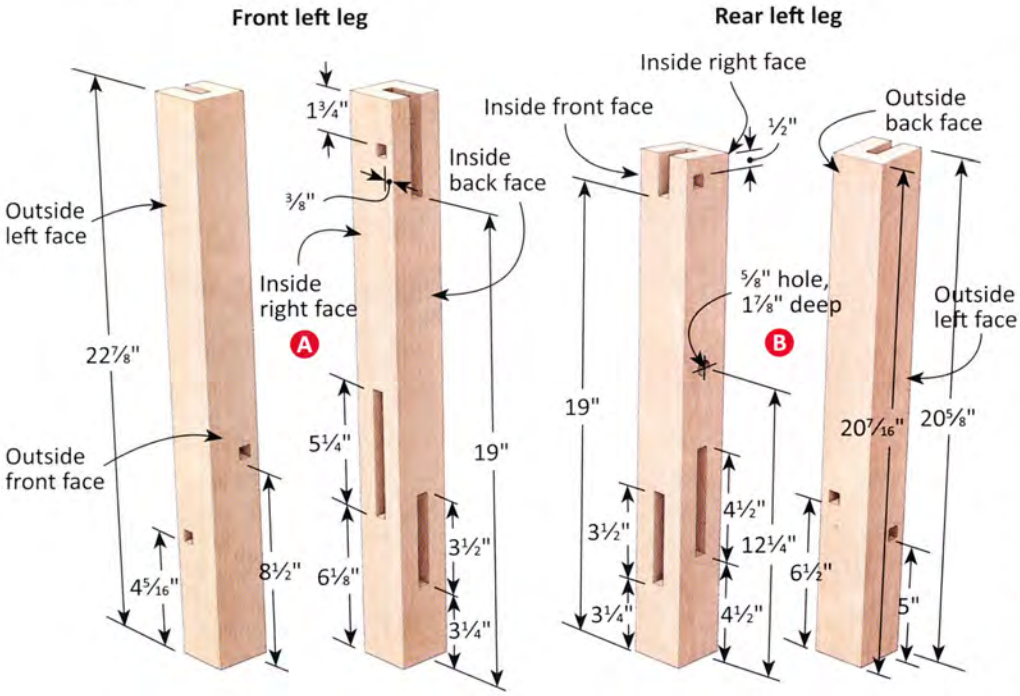
Note: Bevel the top faces of the ledgers (U) at 10° so the seat cushion rests at an angle. Also, locate the rear ledger flush with bottom edge of rear stretcher (D); locate front ledger ½" up from bottom edge of front stretcher (C).

Opening photo: Larry Hamel-Lambert; Illustrations: Christopher Mills



Bore out the ends of a laid-out mortise first. To keep the bit true, cut out the waste in intervals. Then bore out the waste between the square holes.

Figure 2: Legs Detail

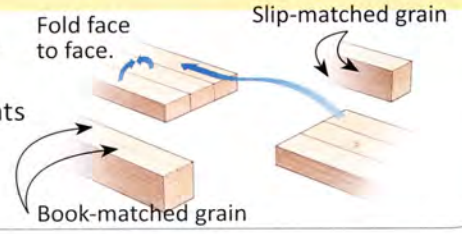


Note: All stretcher mortises are ½" wide, 1½" deep. All button mortises are ½ × ½", ⅜" deep.

Note: Left legs are mirror images of right legs.

Tip Alert

For the best seamless grain match, face-join the leg pieces as shown for book-match and slip-match joints where the edge grain tends to run in roughly parallel lines as shown.



Start with the legs

1 Mill enough 5/4 (1¼"-thick) stock for the legs (A, B), referring to the **Cut List**. (I used 8"-wide cherry boards for this, cutting three 2½" pieces from each one.) Strive for a thickness of no less than 1⅜₁₆" at this time. If you have access to 10/4 (2½"-thick) stock, save time and go with it, skipping the laminating in **Step 2**, but not the planing.

2 Face-glue and clamp the cherry pieces together, matching the grain as shown in the **Tip Alert** below, left. Once dry, remove the clamps and edge-joint the opposite edges for 2⅜ × 2⅜" laminations. Plane the sawn edges to a final dimension of 2¼ × 2¼". Crosscut two front legs (A) and two rear legs (B) to the lengths in the **Cut List**. As you do, be sure to angle-cut the top ends of the rear legs as dimensioned in **Figure 2**.

3 Lay out the mortises for the front and rear legs (A, B), where shown in **Figure 2**. Adjust the fence and depth stop on a benchtop mortising machine, and bore out the mortises to 1½" deep using a ½" bit, as shown in **Photo A**. Clean up the mortises with a chisel.

Make the stretchers and splats, and assemble the chair base

1 Mill enough 4/4 cherry for the front stretcher (C), rear stretcher (D), bottom side stretchers (E), and top side stretchers (F). At the same time, mill enough stock for the front and rear side splats (G) and the center side splats (H). Leave the thickness just proud of the final thickness at this time. See the **Cut List**.

2 Rip and crosscut the stretchers (C, D, E, F) to length and width.

3 Lay out the ½"-thick tenons on the stretchers (C, D, E, F) as dimensioned in **Figure 3,** and cut a spacer block. Install a ¾" dado head in your tablesaw, and adjust its height, making test cuts on scrap. Slide the saw fence over to where the distance between the outside end of the spacer block and the outside teeth of the dado head equal the tenon length. Using a miter gauge and extension fence, slide a stretcher against the block, slide the block out of the way, and cut the tenon cheek shoulders, as shown in **Photo B**. Cut away the cheek waste. Cut the tenon cheek shoulders and waste on the other stretchers. Adjust the dado set height, and, using the spacer block, flip the stretchers on edge and cut the shoulders and waste on the edges.

4 Lay out the notches on the ends of the tenons, where shown in **Figure 3**, and cut them out at the bandsaw or with a handsaw.

5 Install a ½"-radius round-over bit in the router and round over the inside top edge of the front stretcher (C).

Note: Rough-sand to 180 grit any pieces that will receive the button mortises at this time. Sanding after the button mortises are complete can expose torn end grain fibers and appear ragged.

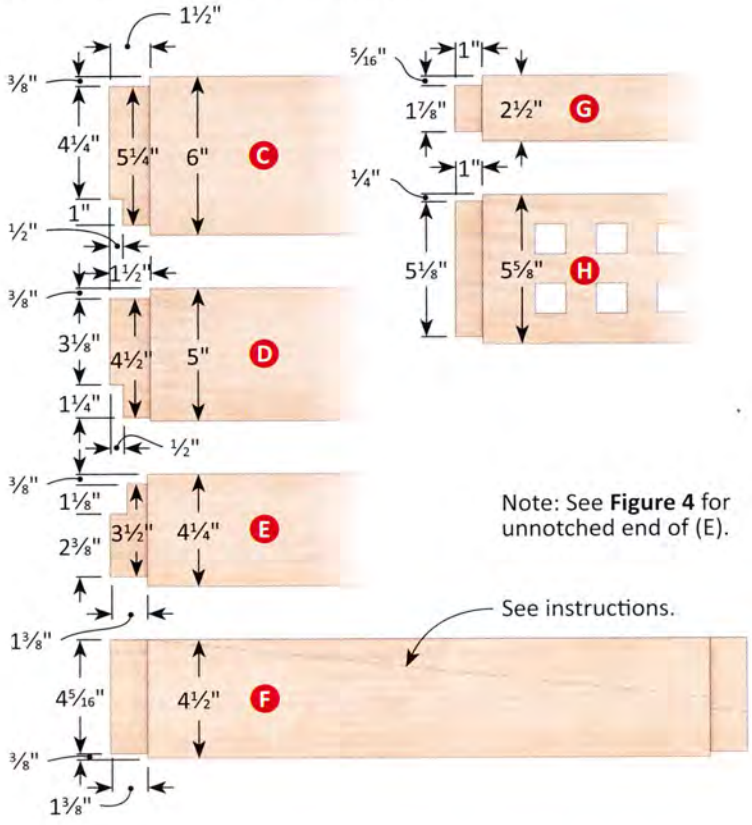
6 Referring to **Figure 4**, lay out the mortises for the splats on the opposing edges of the side stretchers (E, F). Using a ⅜" mortising bit, cut the mortises. Clean them up with a chisel. Also, lay out the ½ × ½" button mortises on the legs (A, B) and the ⅜ × ⅜" button mortises on the side stretchers (E, F). (Clear waste away from the mortising chisel as it enters the wood. A stray wood fiber can spoil the crisp appearance of the square mortise.) Mortise to a final depth of ⅝" on the legs. Cut a piece of scrap to fit in the mortises of stretchers (E,F), and mortise through the side wall. If you don't support the wall, the chisel will splinter the inside of the mortise as it breaks through.

7 Cut the front and rear side splats (G) to rough width. Cut two blanks for the center side splats to 15⁄16 × 6½ × 14⅛".

8 Before cutting the parts from the center side splat blanks in **Step 9**, make a full-scale drawing of the blank stock on paper, referring to **Figure 4**. Lay out the kerfs of the saw blade and allow room for jointing part edges. From that, make a story stick like the one in the

Use the spacer block to establish tenon's shoulders. Then cut the cheeks and edges of the tenons using the proper dado set height for each cut.

Figure 3: Chair Base Tenons



Align the center side splat blank and story stick at the top end, and lay out the crosscut lines for creating the square openings.

Using the waste blocks as spacers, apply glue to one edge of the mating parts and stack them on edge. Then, lay the assembly face down and clamp.

drawing to lay out the positions of the crosscuts on the two blanks. Using a square and the story stick, lay out the blanks, as shown in **Photo C**. (Once I have those dimensions, it's just a matter of making the cuts and ensuring that I put everything back in the right place. This also guarantees that the grain will match well at assembly time. Tight-grained pieces work best for this match.) Also, mark the blank with diagonal lines to give yourself a visual cue that everything is in its right place when the time comes to assemble the center side splats.

9 Cut out the parts making up the center side splats (H). Here, you'll rip the same board into five pieces. Set the rip fence at 1 7/32", and rip the first piece. Set the rip fence at 1 3/16" for each successive cut and rip the remaining four pieces. Place all the ripped pieces in order edge to edge, and number them 1 through 5. Set the jointer for a light cut, and joint the mating edges of pieces 1 and 5 and one edge of pieces 2, 3, and 4. Joint the opposite edges of pieces 2, 3, and 4 to achieve a final width of 1 1/8".

10 Using the lines established by your story stick, make the crosscuts on pieces 2 and 4. Starting from the top ends, make the first crosscut at 2 15/16", cutting on the waste side of the layout lines. Save the offcuts, as they will be useful in the glue-up. Readjust your crosscut setup for a 1 1/8" length, and cut the next block. Be sure to place all parts directly back to the blank after each cut. Repeat this process until you've established two rows of three square openings.

11 Remove any splinters from crosscutting the parts making up the center splats (H) with a light touch of fine sandpaper. Next, make indexing marks to ensure that the two rows of square openings in the center splats align. I used the waste blocks as indexing blocks for the glue-up. Orient them to achieve perfect 1 1/8 × 1 1/8" square openings. Now, apply glue to the mating edges and stack them, as shown in **Photo D**. Avoid getting glue on the exposed surfaces. Clamp lengthwise over pieces 2 and 4 to register against the indexing blocks, and then clamp across the grain to close the joints. Once tight, pop out the indexing blocks and scrub the inside of the square openings clean of glue, as described in the **Tip Alert** above.

Tip Alert

I pull any excess glue squeeze-out off with a dry toothbrush. I then lightly moisten the bristles with fresh water and scrub the joint clean of squeeze-out.

12 After the glue dries, plane all the splats (G, H) to finished thickness, and cut them to the finished widths and lengths.

13 Lay out the tenons on the splats (G, H), referring to **Figure 4**. Now, cut the splat tenons following the process described earlier for the stretcher tenons. Test-fit the tenons in the side stretcher mortises, using a shoulder plane and cabinet scraper for any final fitting.

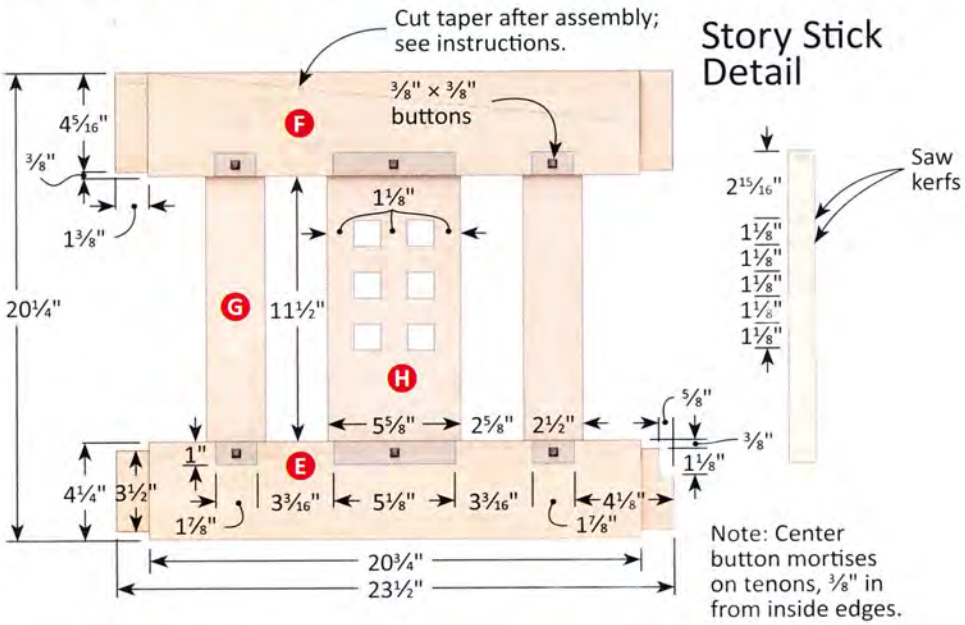
14 Glue and clamp the rail and splat assemblies (E/F/G/H) together. To allow for expansion and contraction of the broad center splat, apply glue only to the center of their mortises and tenons. With a straightedge, check that the shoulders of the top and bottom stretchers are aligned, as shown in **Photo E**. Wipe up squeeze-out with a clean, moistened rag, and let the assembly dry.

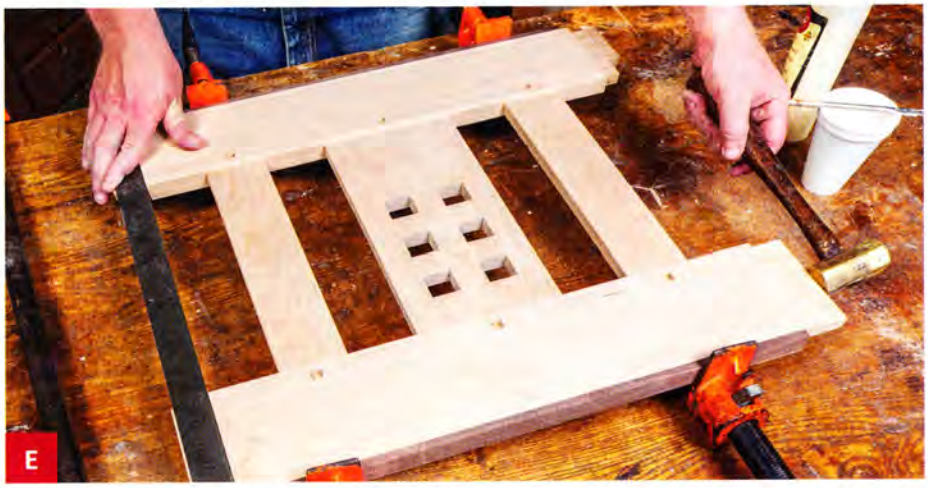
15 Dry-assemble the legs onto the side assembly to make the full side assembly (A/B/E/F/G/H), and mark ½" above on the top side stretchers (F) where they intersect on the legs (A, B). Strike cutlines, and bandsaw the tapered edges of top side stretchers just proud of the lines. Clean up the sawn edges with a pass on the jointer. Trim the protruding tenons flush with the top of the legs (see **Figure 1**).

16 Glue and clamp the stretcher and splat assemblies (E/F/G/H) to the legs (A, B).

17 Apply glue to the opposing mortises in the legs (A, B) and fit the front (C) and rear (D) stretchers in place. Clamp the side assemblies and front and rear stretchers together to form the chair base. Check the chair base for square and adjust. If it's out of square, fitting the upholstered seat could be a problem.

Figure 4: Side Assembly View





Hold a straightedge against the stretcher ends to ensure that the side assembly is square. Adjust if needed.

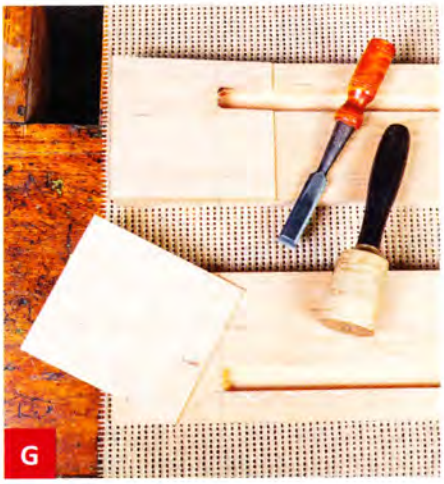
Make and install the arms

Note: While it appears that the chair arms are bent, in reality I face-glue additional 6"-long pieces of wood to the underside of the arms at the front ends and cut these assemblies to their final shape at the bandsaw. To achieve a great match, cut the 6" from the boards you are using for the arms. If this piece is cut directly from the front of the arms, the edges and end grain will match perfectly.

1 Referring to the **Cut List**, mill enough 5/4 stock to 1 1/16" thick for the arms (I), adding 6 1/8" in length to both arms. Cut the arms to just over the listed width and to the exact length. Save the offcuts.

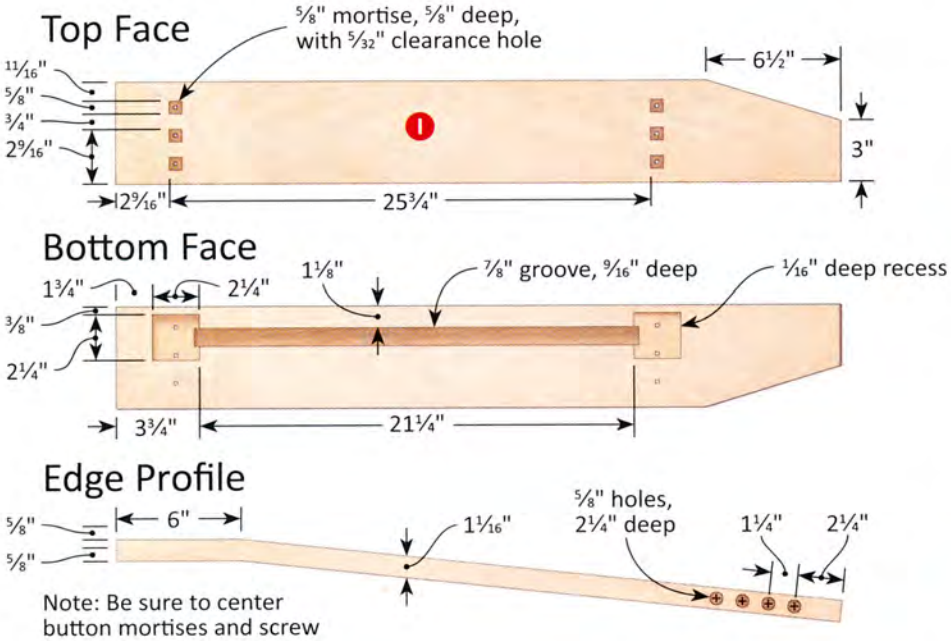
2 Lay out the grooves to fit the top side stretchers (F) to the underside of the arms (I), according to **Figure 5**. Label the arms "left" and "right." Strike lines across the width of the arms where the grooves terminate at the front ends. Extend the lines onto the edges. Using a ½" bit in your handheld router along with an edge guide, cut a 9/16"-deep groove 1 1/8" from the inside edges

Guiding off the edge guide, rout the grooves in the bottom faces of the arms, making at least two passes to cut to depth.



Extend the groove into the wedges, stopping at the stop line. Square the groove ends with a chisel.

Figure 5: Arm Views



Note: Be sure to center button mortises and screw holes over legs and corbels.

of the arms, as shown in **Photo F.** Readjust the edge guide to create a groove that fits the thickness of the upper side stretchers. Test-fit the arms on their respective side assemblies, and leave them there for the next step.

3 Position the 6" offcuts on the underside of the arms so they match well on the ends and edges. Note the best grain matches, and then lay out the tapers, as shown in the **Edge Profile** in **Figure 5.** Now, using the bandsaw, cut proud of your layout lines to make a pair of 6" wedges. Sand the bandsawn faces of the two keeper wedges smooth with a stationary belt sander or sanding block. Save the offcut (waste) wedges to use as clamping cauls for the glue-ups.

4 Dry-fit the wedges to the underside of the arms (I) to make sure the joints will close completely under adequate clamping pressure. Now, apply glue to the wedges, and clamp them in place using the offcut wedges to help hold them in place. Avoid using water for the glue cleanup as it can penetrate the end grain and weaken the joint. Instead, after the glue has slightly hardened, pare off the excess with a chisel. Let dry.

5 Strike stop lines between the edge marks on the arms and across the glued-on wedges indicating where the grooves terminated at the front ends. Returning to your router and edge guide, rout into the wedges, as shown in **Photo G,** stopping at the lines. Square the groove ends with a chisel.

6 Joint the edges to final width. Then lay out the top edge profile of the arms (I), as shown in **Figure 5,** to achieve the "bent" arm. Bandsaw the profile to shape, cutting just outside the cutlines, as shown in **Photo H.** Plane and sand the top and bottom faces for a smooth transition.

7 Place the chair base upside down on the workbench with the top side stretchers (F) seated in the routed grooves in the arms (I). Next, use a marking knife to score around the legs where they meet the arms. Remove the chair base. Now, using a handheld router with a ¼" bit, carefully rout a 1/16"-deep

recess so the leg ends can seat inside the arms. Direct a lamp at the work area to see the shadows created by the knife lines. Stay just shy of your knife lines when routing. Finish the recess with a sharp chisel, as shown in **Photo I**. This ensures a clean look. Any gap where the top of the leg meets the arm will be hidden inside this recess. Sand the arms to 180 grit.

8 Lay out the ⅝" holes on the back inside edges of the arms (I), where shown in **Figure 5**. (These are for registering the reclining positions of the chair back assembly in the completed chair.) Now, with the arms against the drill press fence and using a brad-point bit, bore the holes to 2¼" deep.

9 Lay out the tapered back ends of the arms (I), where shown in **Figure 5**. Note that the arms are mirror images of one another. Bandsaw off the waste and sand or hand-plane the sawn edges to the cutlines.

10 Fit the arms (I) in place on the side assemblies, as shown in **Figure 1,** and lay out the locations of the screw holes and ⅝"-square button mortises on the top faces with a marking knife. Align these mortises so that they are centered over the legs. Because benchtop mortisers typically don't accept ⅝" mortising chisels and because a ⅝" chisel is costly, cut these square button mortises to size and depth using first a ½" brad-point bit to remove the waste. Then complete the square mortise with a chisel, as shown in **Photos J** and **K**. Do all the square mortises in both arms front and back at this time.

H

With an arm resting on its edge, bandsaw the top face, cutting just proud of the cutline.

I

First establish the shoulders at the knife lines with a chisel, and then remove the recess waste.

11 Drill the centered 5/32" clearance holes through the square mortises in the arms (I) for the 3" screws. Finish-sand the arms to 220 grit.

12 Place the arms (I) on the side assemblies. Using an awl, make a dimple in the center of the ⅝" mortises in the top ends of the front and rear legs (A, B). Remove the arms and carefully drill the pilot holes in the legs for the 3"-long screws. Screw and glue the arms to the legs.

13 Enlarge and make two copies of the pattern for the corbels (J) on page 50. Cut four pieces of 1⅛"-thick stock to 2 × 10 1/16" and stack them together in two pairs with double-faced tape aligning the ends and edges. Adhere the pattern to the top faces of each stack and bandsaw the corbels to rough shape. Sand the stacks to the cutlines using disc and oscillating spindle sanders. Separate the corbels.

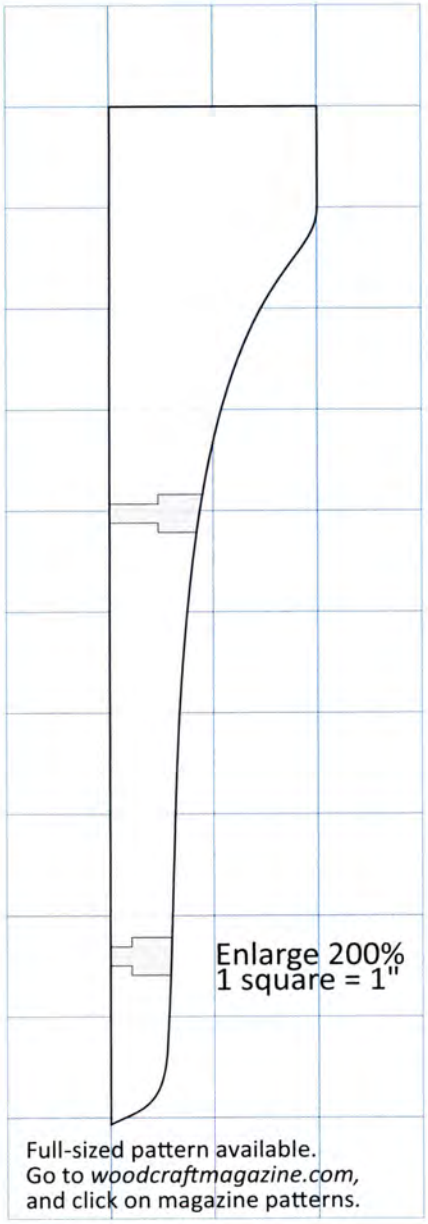
J

Drill to depth in the centers of the laid out ⅝" square mortises with a ½" bit, leveling the workpiece by using the tapered stretcher cutoffs.

K

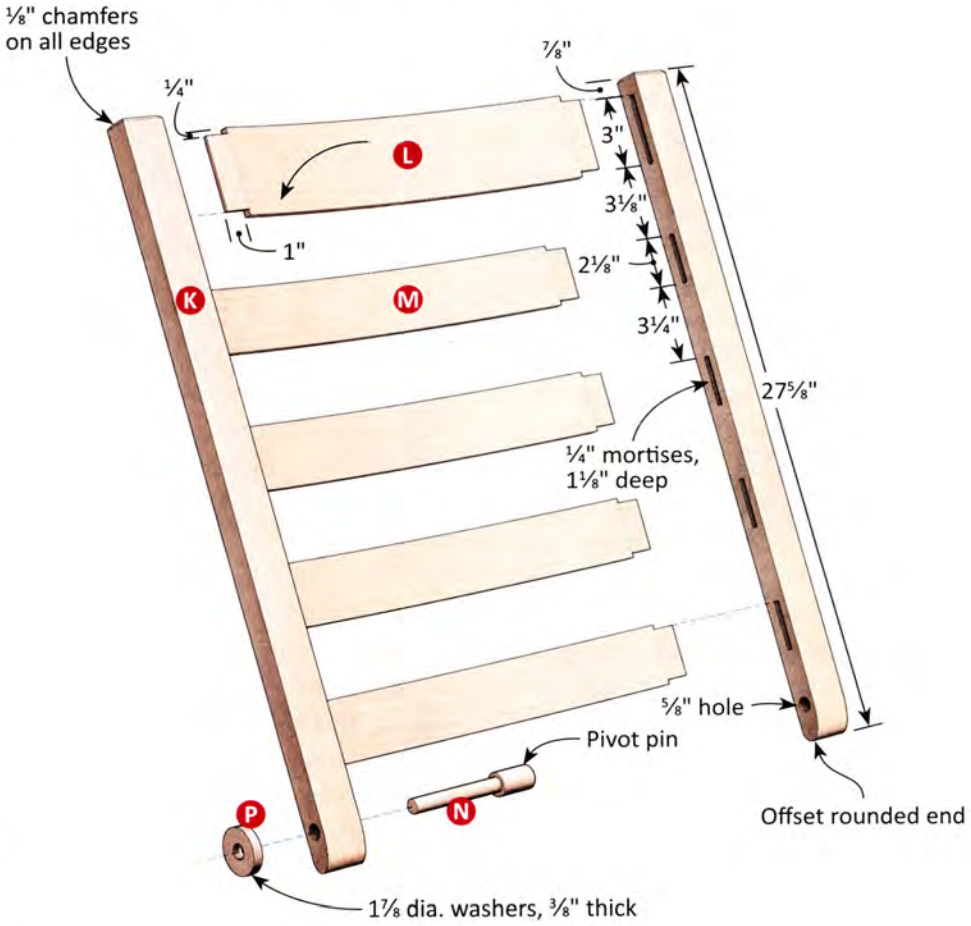
Square the button mortises with a chisel and mallet, removing the waste to depth.

Corbel Half-Sized Pattern

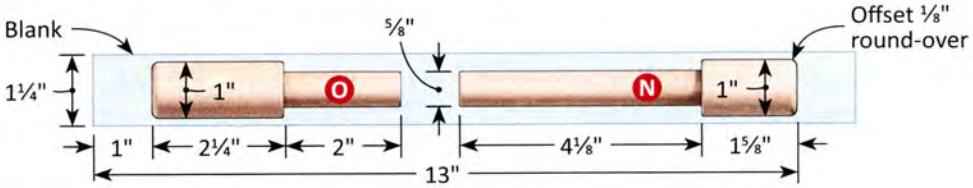


Full-sized pattern available. Go to *woodcraftmagazine.com*, and click on magazine patterns.

Figure 6: Back Exploded View



Pivot and Back Rest Pins Detail



With the front corbel clamped to the leg, use a rule to mark the angle at the top end.

14 Lay out the two button mortises on each corbel (J), where shown in the pattern. Using a ⅜" bit at the mortiser, cut the button mortises to depth on both corbels. At the drill press, drill the clearance holes for the screws, centering them in the mortises. Note that the button mortises are 90° to the back edge of the corbels.

15 Put the corbels in position under the arms (I) and centered on the legs. The undersides of the arms are not at a 90° angle to the corbels, so the top ends need to be scribed to fit. Carefully scribe a line along the top ends of the front corbels using a thin rule and pencil, as shown in **Photo L**. Use a disc sander and miter gauge to sand to line. Capture the angle of the slanted arms on the rear legs using a T-bevel. Transfer the angle to the top ends of the rear corbels, and cut the bevels at the tablesaw. Test the fit. Glue and screw the corbels to the legs and arms (A, B, and I).

Create the back rest and pins

1 Mill enough 5/4 stock to 1⅛" for the back uprights (K), and cut the parts to the sizes in the **Cut List**. Referring to **Figure 6**, drill the through holes through bottom ends of the uprights where shown. These will be used for the pivot pins that allow the back assembly to recline in the completed chair. Rout or sand ⅛" chamfers around the top ends and round the bottom ends, as shown in **Figure 6**.

2 Lay out the centered mortises on the uprights (K) for receiving the wide back slat (L) and the narrow back slats (M), where shown in **Figure 6**. At the mortising machine, cut the mortises with a ¼" bit. Clean up the mortises with a chisel.

3 Make the bending jig shown in **Figure 7**. I made mine from a block of pine and some scrap oak. I cut the 4' radius curves at the bandsaw. Note that this jig can form three back slats at the same time.

4 Ripcut enough milled stock for the wide back slat (L) and for the narrow back slats (M), making the pieces just ¼" wider than listed in the **Cut List**. Cut some extra as well. At the bandsaw, resaw 9/64"-thick strips from the stock for the parts. Plane the pieces to ⅛" at the thickness planer using carrier boards and double-faced tape, or use a drum sander. Each back slat lamination will contain three ⅛"-thick or slightly thicker strips.

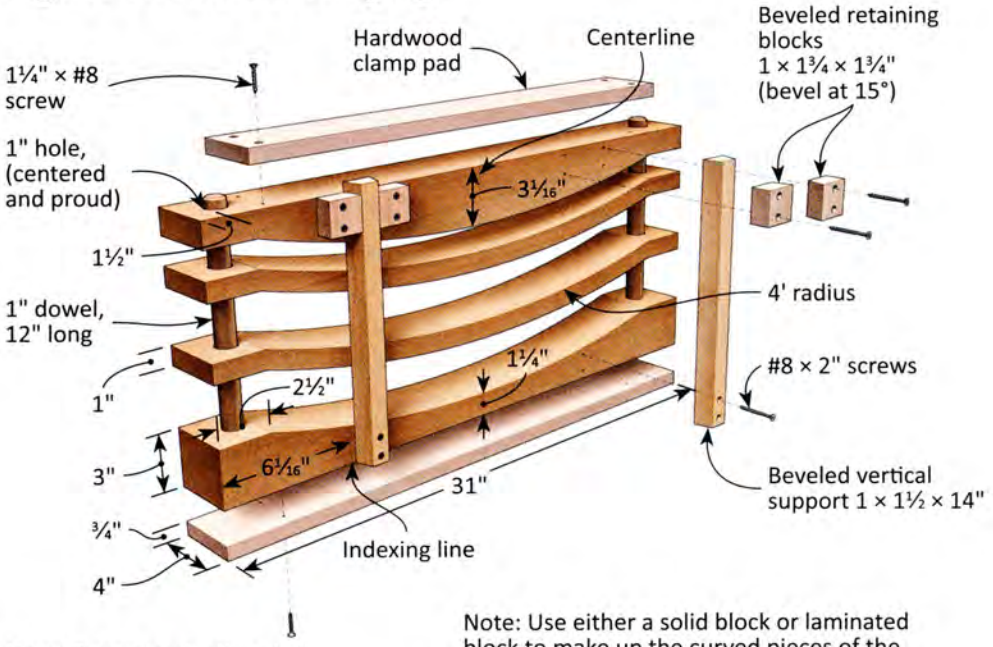
5 Using the jig, apply glue to the mating faces of three strips and wrap the ends of the glue-up with tape to prevent slippage. Place the bundle between layers of waxed paper in the jig to prevent sticking. Similarly, add two more back slat bundles to the jig. Add clamps, as shown in **Photo M**, to press the lamination strips together face to face. Let the "bent" laminations dry overnight. Then, scrape any squeeze-out on the edges with a paint scraper. Once clean, joint the edges at 90° to the faces. Rip the curved slats (L, M) to width at the bandsaw, and clean up the sawn edges at the jointer. Do an extra set, including the wide back slat, for the critical offset tenon setups.

6 Cut the slats (L, M) and extra pieces to length by marking the ends and trimming them at the bandsaw using a miter gauge.

7 Make the tenon-cutting jigs in **Figure 8**. Note that the concave and convex parts have the same 4' radii used in the back slats. Bandsaw these to shape and attach.

8 Lay out the tenons on the back slats (L, M), including on the extra pieces. Install a dado set in the tablesaw, adjust its height, and set up a spacer to place against the saw fence for

Figure 7: Slat Bending Jig



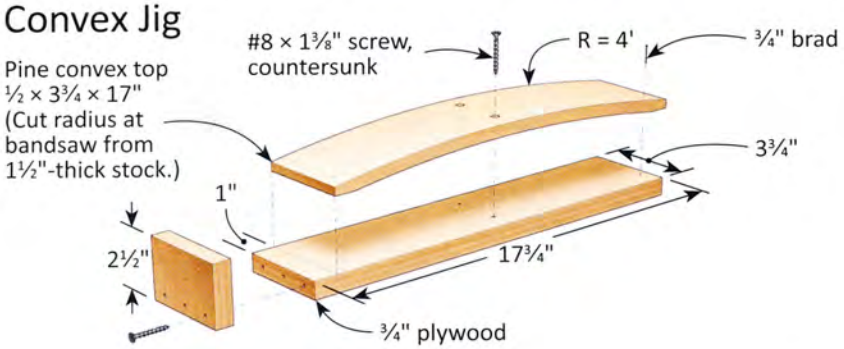
Note: Center laminations in jig and against the vertical supports. Apply clamps to clamp pads.

Note: Use either a solid block or laminated block to make up the curved pieces of the jig. Cut the pieces to shape at the bandsaw.

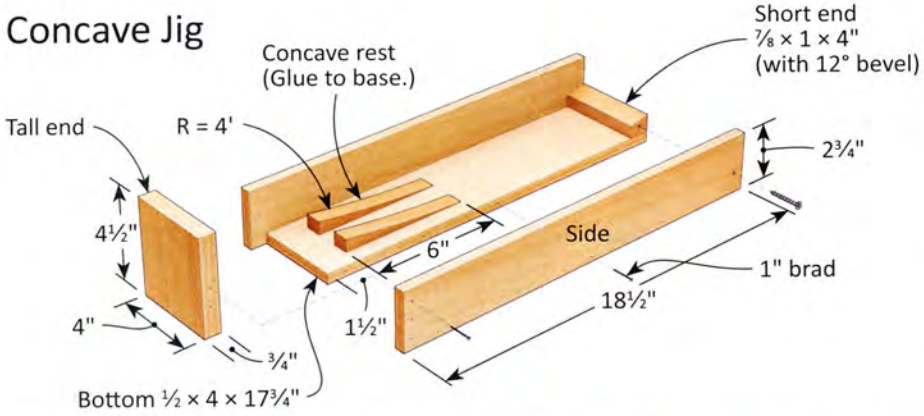
Center the back splat laminations in the jig and against the vertical supports. Beginning in the middle, apply clamps to compress the bundles.

Figure 8: Slat Tenon Cutting Jigs

Convex Jig



Concave Jig



Place the concave jig containing a back slat against the spacer and miter gauge. Now, cut the tenon shoulder and waste on the back face.

Using the spacer block, miter gauge, and convex jig, complete cutting the tenons on the back slats.

cutting the tenon shoulders. Center a back slat in the concave tenon-cutting jig, and adjust the saw fence and spacer to align the dado set with the shoulder cutline. Cut the back face tenon shoulders, as shown in **Photo N**. Remove the cheek waste, and rotate the piece end for end to cut the other back face cheek. Cut the back face cheeks on all of the back slats at this time. The goal is to cut ¼"-thick offset tenons that fit snugly into the mortises of the back uprights (K).

9 Using the convex tenon-cutting jig, cut the tenon shoulders and cheeks on the front faces of the back slats (L, M), as shown in **Photo O**. Cut the tenon shoulder along the edges of the slats with a handsaw and chisel. Test-fit the slat tenons in the mortises in uprights (K). Adjust if needed.

10 Make two simple back assembly clamping jigs, like the one in **Figure 9**. Using these ensures that the back uprights (K) align perfectly during the glue-up and that the resulting chair back is not racked or crooked.

11 Apply glue and clamp the back rest assembly (K/L/M) together, as shown in **Photo P**.

12 Start with two turning blanks that measure 1¼ × 1¼ × 13". Now, using the dimensions in the **Pivot and Back Rest Pins Detail** in **Figure 6**, turn two pivot pins (N) and two back rest pins (O), as shown in **Photo Q**. (I used a gouge, skew chisel, and parting tool for this.) Note that each blank yields one pivot pin and one back rest pin.

13 To make the two washers (P), glue up three layers of ⅛"-thick cherry, orienting the grain of the middle layer at 90° to the other pieces. This cross-grain

approach makes plywood-like washers that won't snap. Now cut two 2 × 2" squares from the laminations. Lay out 1⅞" circles on the squares, and drill ⅝" holes through the centers. Disc-sand the washers round to the lines.

Add the buttons, finish, back, and cushions

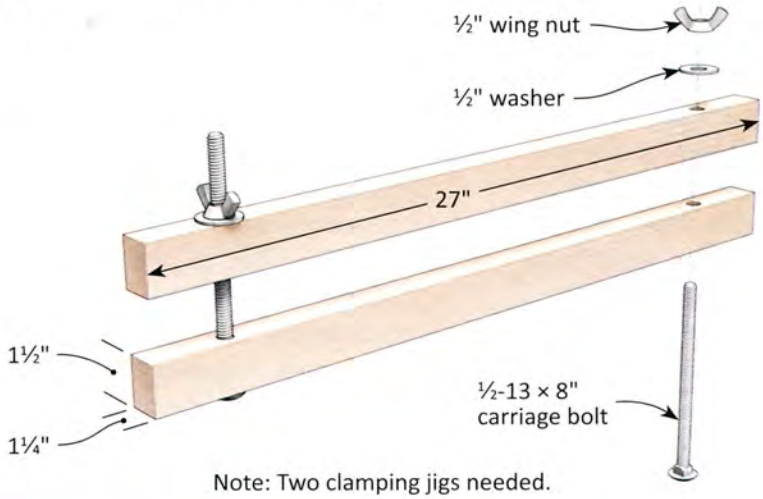
Note: I make the three sizes of button stock for the Morris chair at the tablesaw and thickness planer using walnut, which contrasts nicely with cherry. The process is simple, and the end result makes for eye-pleasing accents all around.

1 Cut 18"-long pieces of walnut to 1/16" over the finished dimensions in the **Cut List** for the side stretcher buttons (Q), corbel buttons (R), leg buttons (S), and arm buttons (T). Now, plane the adjacent faces of the lengths to the final sizes.

2 Working with one walnut length and button size at a time, shape the beveled ends at a disc sander, forming a pyramid end. Now, cut two buttons to length, as shown in **Photo R**. Repeat beveling the ends and cutting buttons until you've made the needed number cited in the **Cut List**. Note in the photo that the ⅝" pegs for the arms should be pillowed and not display sharply beveled facets. Sand the pillows by hand after establishing the bevels. The arm buttons will be felt by anyone that sits in the chair, so they should be soft and tactile.

3 Apply a small bit of glue inside the mortises and tap the buttons in place with a smooth-faced metal hammer. Try to avoid any squeeze-out or glue marks that will spoil the finish. Keep a moist rag handy, just in case.

Figure 9: Back Assembly Clamping Jig



Note: Two clamping jigs needed.

Fit the glue-up into the clamping jigs, and tighten its arms to align the uprights. Pull the assembly snugly together with bar clamps.

Turn one pivot pin and one back rest pin from one blank, checking the diameters with a caliper.

Quality Custom-Made Upholstery

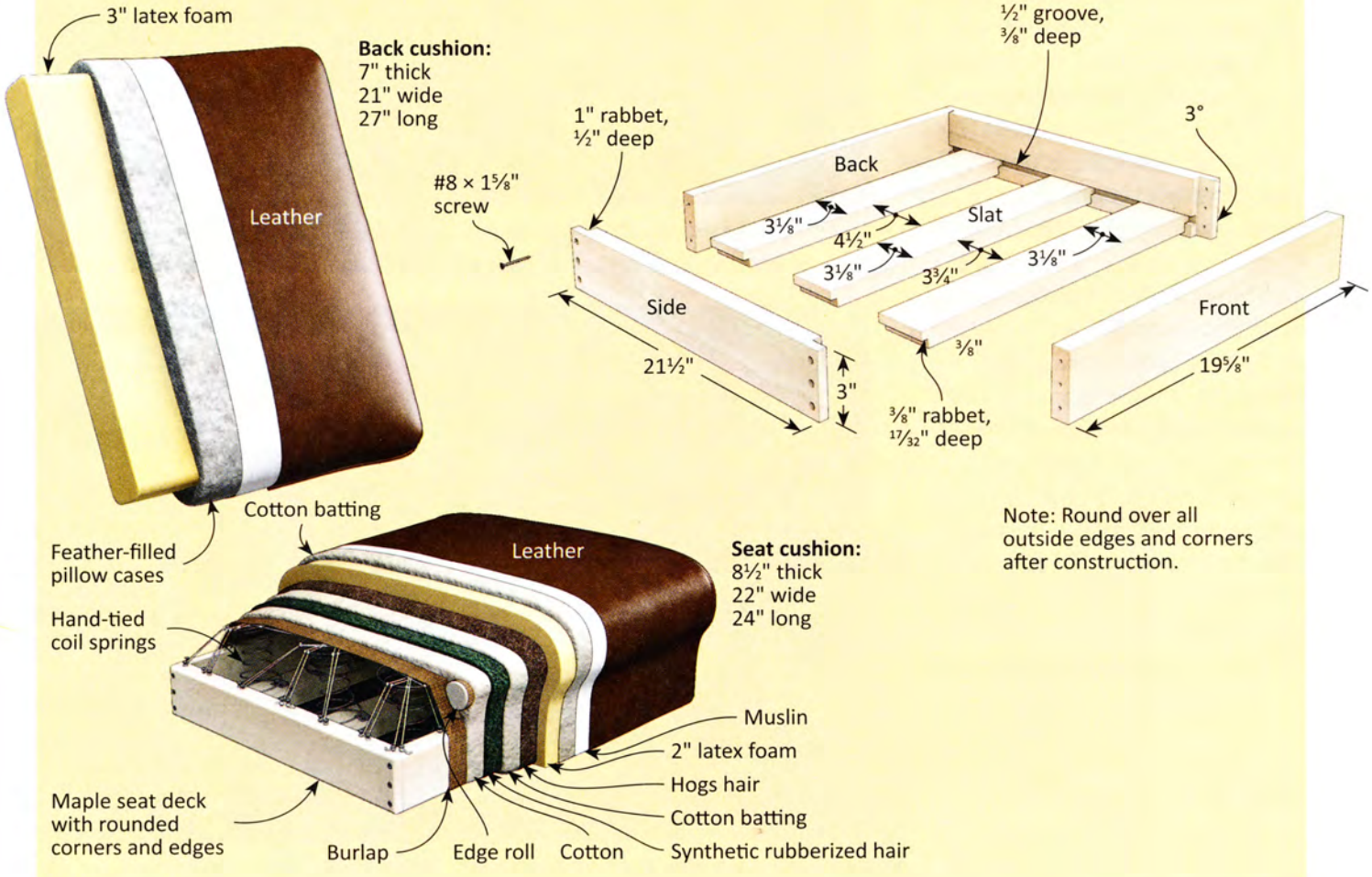
Making the leather-covered seat and back cushions for the chair is beyond the scope of this story and skill set of most woodworkers. To help you provide the appropriate cushions for the chair, I'll give you the basic information for the cushions, as well as a source for the cushions used in the Morris chair shown. To save on costs and shipping (which can run $1,000), choose a local upholsterer and different cover material.

Note in the **Cushion Cutaways** that the upholstery begins with the maple upholstery deck, shown in the **Seat Cushion Deck** drawing. Build as shown, angling the deck front and back at 5°. Round over the deck's exterior edges and corners to prevent them from tearing the cover material. Provide the completed deck to the upholsterer.

The upholsterer will then attach 5" springs to the seat deck with hardware and tie each one to the other to enable the springs to move in concert. Burlap is stretched over the springs, and an edge roll is applied to establish the shape of the seat. Various layers of synthetic hogs hair, cotton batting, and latex foam are applied. It is finally covered in your choice of leather or upholstery fabric. The back cushion is filled with feathers (in pillow cases) and latex foam, and then covered with your choice of leather or upholstery fabric.

Cushion Upholsterer:
Ann Brandenburg
Renaissance Upholstery
658 Pennfield Dr.,
Hatfield, PA 19440
renaissanceupholstery.com
(215) 362-5642

Cushion Cutaways



Seat Cushion Deck Exploded View

Note: Round over all outside edges and corners after construction.

4 After installing all of the buttons, go back and buff the arm buttons with #0000 steel wool to bring them to a shiny mirror finish.

5 Cut and install the two ledgers (U) that support the cushioned seat (see **Figure 1**). Note that the ledgers are notched to go around the legs and beveled on the top faces to angle the seat cushion slightly. Should you want to elevate the front end of the seat, you can cut a 1" square stick to sit loosely on the front ledge.

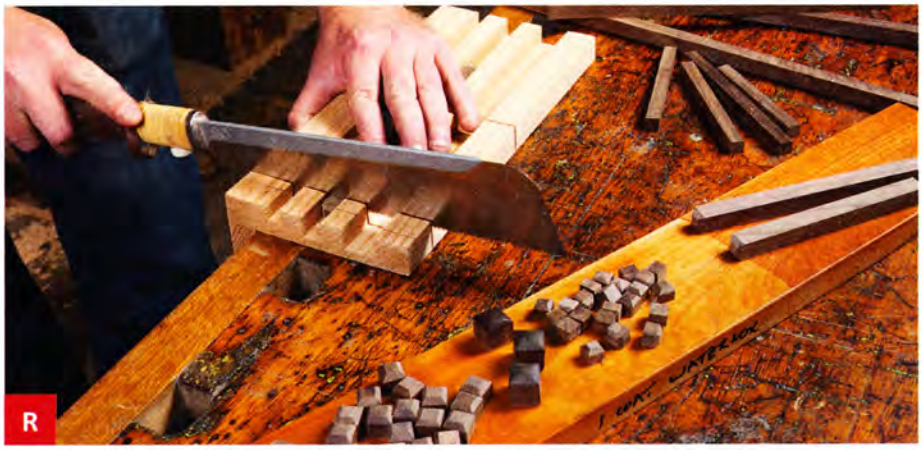
6 Make sure that all of the chair parts have been finish-sanded to 220 grit. Break all exposed edges so they feel nice to the touch and create soft shadow lines. Then, finish the chair following my recommended approach on pages 56 and 57.

7 After finishing, attach the back to the chair base, and drop in the cushions. Then, relax in your heirloom recliner. (In a 2014 issue, I'll show how to build the matching ottoman.) ■

Convenience-*PLUS* BUYING GUIDE

☐1.	#144010	$59.99
	Mortising Chisel and Bit Set, ¼", 5/16", ⅜", ½" Bits	
☐2.	#829232	$629.99
	General International ⅝" Hollow Chisel Mortiser, ½ hp, tilting head, 9" stroke, includes sleeves for ⅝" and ¾" chisel shanks, as well as ¼", 5/16", ⅜", ½" Chisels and Bits	
☐3.	#151223	$289.99
	(Alternative) WoodRiver Benchtop Mortiser, ½ hp, (2) Roller Bearing Work Supports, with ¼", 5/16", ⅜", ½" Chisels and Bits,	

Above items are available at Woodcraft stores, *woodcraft.com* or by calling (800) 225-1153. Prices subject to change without notice.



Using a shop-made jig with grooves sized to match the button stock, crosscut the buttons to length with a fine-tooth handsaw.

About our Builder/Author

Mentored by renowned craftsman Jeffry Lohr, founder of the J.D. Lohr School of Woodworking in Schwenksville, Pennsylvania, Robert Spiece is an established furnituremaker and woodworking teacher at the school. He also designs and builds furniture for sale. For more on the school, go to *JDLohrSchoolofWoodworking.com*.

Morris Chair Cut List

	Part	Thickness	Width	Length	Qty.	Mat'l
A	Front legs	2¼"	2¼"	22⅞"	2	C
B	Rear legs	2¼"	2¼"	20⅝"	2	C
C	Front stretcher	⅞"	6"	24"	1	C
D	Rear stretcher	⅞"	5"	24"	1	C
E	Bottom side stretchers	⅞"	4¼"	23½"	2	C
F	Top side stretchers	⅞"	4½"	23½"	2	C
G	Front and rear side splats	⅝"	2½"	13½"	4	C
H**	Center side splats	⅝"	5⅝"	13½"	2	C
I**	Arms	1 1/16"	5"	34⅞"	2	C
J	Corbels	1⅛"	2⅛"	10⅛"	4	C
K	Back uprights	1⅛"	1¾"	29¼"	2	C
L	Wide back slat	⅜"	3½"	18⅞"	1	C
M	Narrow back slat	⅜"	2½"	18⅞"	4	C
N	Pivot pins	⅝"	1" dia.	5¾"	2	C
O	Back rest pin	⅝"	1" dia.	4¼"	2	C
P**	Wood washers	⅜"	1⅞" dia.		2	C
Q*	Side stretcher buttons	⅜"	⅜"	⅜"	12	W
R*	Corbel buttons	⅜"	⅜"	⅜"	8	W
S*	Leg buttons	½"	½"	½"	16	W
T*	Arm buttons	⅝"	⅝"	¾"	12	W
U	Ledgers	1⅛"	1¼"	22⅝"	2	C

*Indicates parts are initially cut oversized. See instructions.
** Indicates parts are made of more than one piece.
Materials: C = Cherry, W = Walnut
Hardware/Supplies: (8) #8 × 1" flathead wood screws; (8) #8 × 2" flathead wood screws; (12) #8 × 3" flathead wood screws.

Finishing Cherry at the Lohr School of Woodworking

Discover a multilayered approach for a feel-good surface.

By Rob Spiece

After just one day in direct sunlight, the coins on this piece of milled cherry—once moved—left shadows on the wood.

Cherry is my favorite wood to finish. The closed grain nature of the wood allows me to polish it to a silky smooth surface. Beyond that, it develops a richness of color as it reacts to light. But because cherry is a photo-reactive wood, you must be careful while working with it. If one piece is left on another in even moderate sunlight, the exposed area will darken while the covered area remains light. (See the photo at right.) When I'm done working for the day at the Lohr Woodworking School in Schwenksville, Pennsylvania, I drape all of my workpieces so they aren't exposed to light. While this can be bothersome, it makes the finished cherry piece reach an even, beautiful depth of color. Of course, the piece will continue to change for about three to five years until it reaches its final tone.

The storyboard finishing steps

To best tell how I finish cherry at the school, I've created the storyboard below to show the finishing steps at a glance. My process always begins by sanding the wood to 220 grit and then wiping it clean. Before using any finishing products, be sure to slip on protective gloves.

Next, apply boiled linseed oil to pop the color and grain. First, flood the surface and let the oil soak in, as shown in **Photo A**. After 10 minutes, wipe the piece dry and use compressed air to blow any excess out of nooks and crannies.

After the boiled linseed oil has thoroughly dried, apply a film finish. Use a sealer/finish, such as Waterlox Original, to build a nice satin finish. Allow 24 hours of drying time between coats. After a coat cures, rub it out to a dull sheen with #0000 steel wool, as shown in **Photo B**. This smooths the previous coat,

Disposal Of Oily Rags

Take serious care of your oily rags. Those saturated with any oily finishing product, such as linseed oil, can and will spontaneously combust. I overcome this problem by hanging the rags out on a wash line or over the rungs of a ladder. Opening the rag up so that air can touch all surfaces allows the heat reaction of the curing oil to dissipate in a nonviolent manner.

preparing it for the next one. Repeat the process to build the finish to the desired thickness–around four to five coats. Let them cure. Once you're satisfied with the final coat, begin rubbing out the surfaces with the steel wool for the final finish.

To achieve a silky smooth feel and an even sheen, use rottenstone as a rubbing compound. It works well on closed grain woods, like cherry or maple. I don't use it (as some do) on open-grained woods, like oak, where the fine black particles become lodged in the wood's deep grain and serve as filler.

Applying rottenstone is a laborious process, so focus on using it on the most tactile parts of a furniture project. For instance, with the Morris chair on page 42, I used rottenstone on the top surfaces of the arms, where fingers and hands will be in regular contact. I used #0000 steel wool and mineral oil on the rest of the chair.

Start by mixing a batch of rottenstone and mineral oil in a lidded jar. The consistency should be that of a thick salad dressing. Stack three clean, lint-free rags in the jar and shake it up to saturate the rags. Make square, hand-wide pads from the rags, and rub the arms in the direction of the grain, as shown in **Photo C**. Disperse even pressure using the wide pads.

Finally, use compressed air to blow any remaining rottenstone from the nooks and crannies, and then wash the piece down with a dampened rag and dish detergent to remove the oily residue. You're done. ■

Convenience-*PLUS* BUYING GUIDE

☐ 1.	Waterlox Original Sealer Finish, 1 qt.	#37J21	$29.99
☐ 2.	Briwax #0000 Steel Wool	#844337	$11.99
☐ 3.	Klean Strip Boiled Linseed Oil, 1 qt.	#85050	$13.99
☐ 4.	Behlen Rottenstone, 1 lb.	#38C31	$11.25

Above items are available at Woodcraft stores, *woodcraft.com* or by calling (800) 225-1153. Prices subject to change without notice.

A

Flood the surface with boiled linseed oil. Let it soak in. Wipe up any excess. Let it sit for five days.

B

Rub out the dry wiping varnish surface with fine steel wool. Repeat to build up the finish layers.

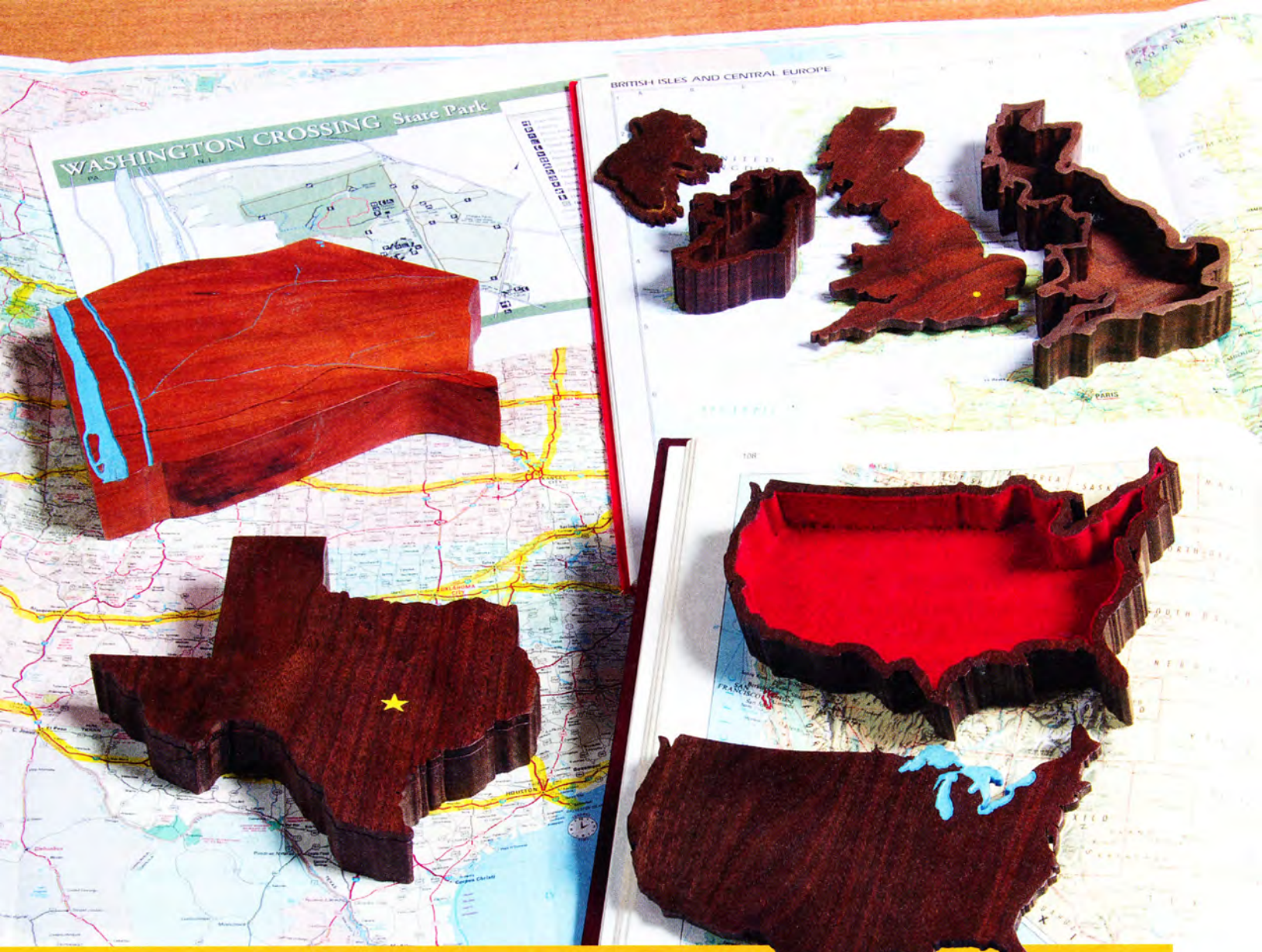
C

Start with the bottom rag, the grittiest one, and rub. Switch to the less gritty rags in order.

Waterlox Original

Mineral oil and rottenstone

Opener photo: Larry Hamel-Lambert; Technique photos: Donna Chiarelli



Geo Boxes

The perfect gift for anyone from anywhere.

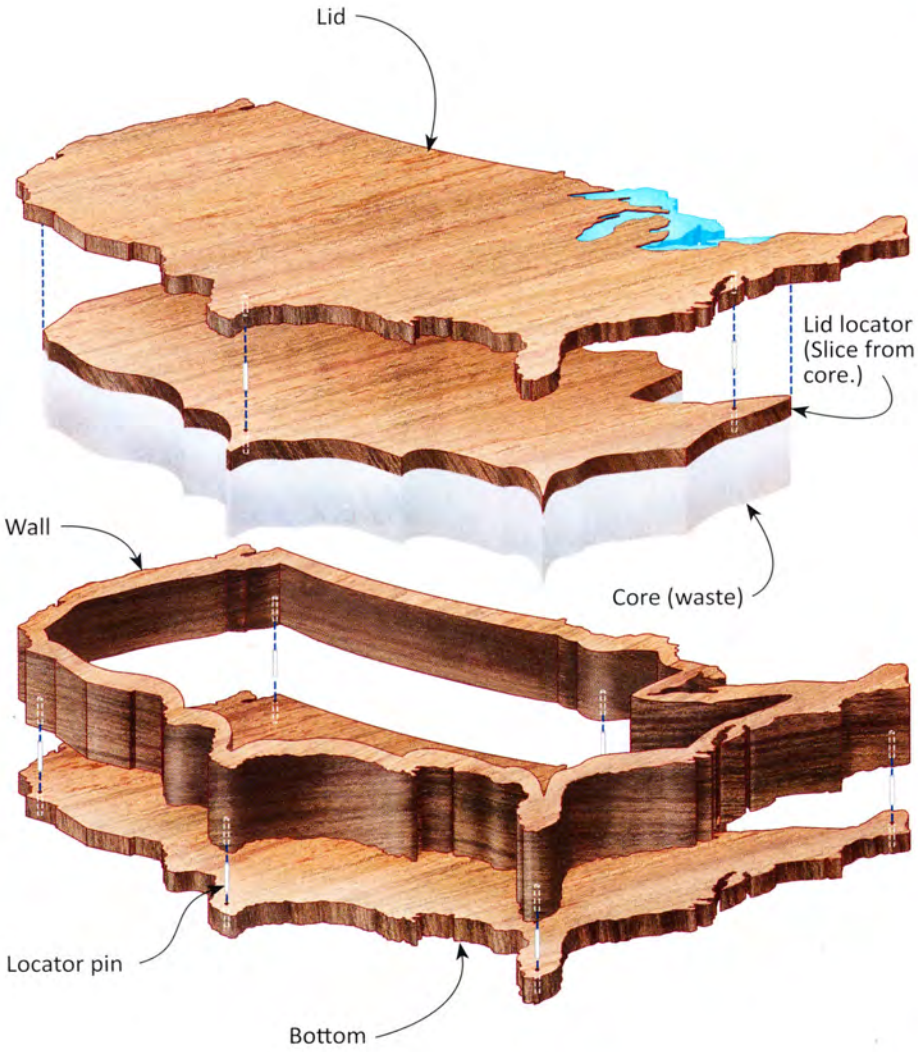
By Geoffrey Noden

Personalized presents are the best presents. Unfortunately, you may not always be able to target someone's particular personality or interests. However, you can always honor their geographical roots with a geo box.

This concept of geo boxes arose when I wanted to make a special present for a Hungarian woodworker friend. I had been making bandsaw boxes at the time and figured Frank might appreciate a box of his native country. However, I soon realized that my bandsaw blades just weren't capable of finessing the detail of Hungary's borders. (If only he hailed from Colorado.) No problem; the box was small enough that I could cut its neatly detailed profile on my scrollsaw. I augmented the lid by insetting a star for Budapest and painting in a knifed Danube river. When I presented the box to Frank, he happily recognized his mother country.

Here, I'll provide the road map for you to send a bit of treasured wood for a ride across the scrollsaw and bandsaw into someone's birthplace, adopted home, or other well-loved land. Bon voyage!

Figure 1: United States Geo Box Parts View



Prepare the pattern and blank

1 Select your map pattern and size it, keeping in mind that the widest part should be at least ⅛" less than the resaw capacity of your bandsaw.

2 Select an appropriate wood for the project. I've had the best success with walnut, which is beautiful, not too dense, and not prone to burning. Cherry is also pretty and only moderately hard, but it tends to burn, so I don't use it for boxes with complex edges that would be hard to sand.

3 Dress the stock to 1⅜" thick, and use spray adhesive to attach the pattern. Orient peninsulas or other narrow projections to follow the grain as much as possible. In some cases, areas of short grain will be unavoidable; just keep them to a minimum. (Leaving the interior solid in these areas adds strength, too.)

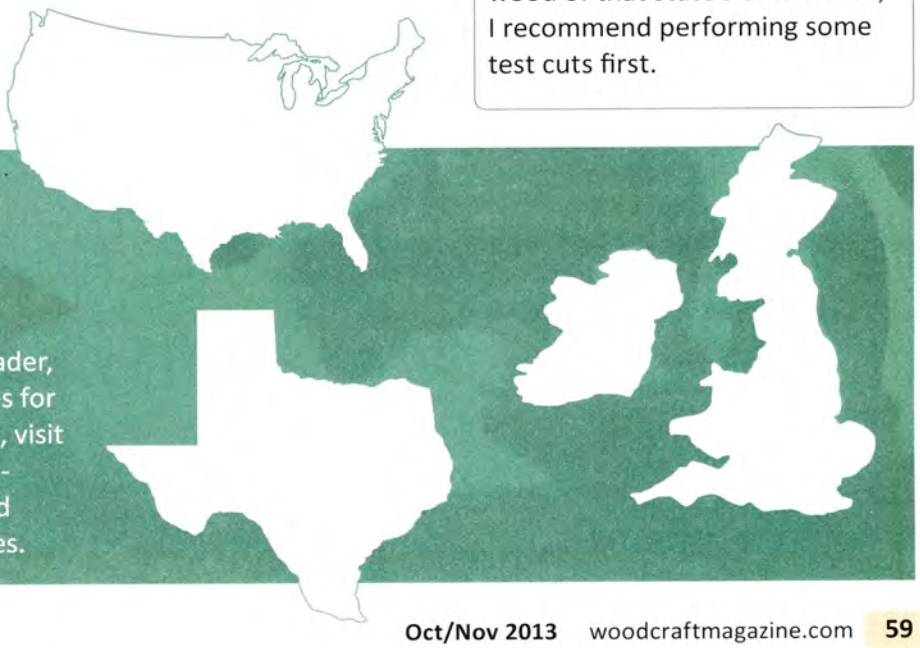
4 Saw out the rough blank. Maintain at least one reasonably straight edge on the blank for safe slicing on the bandsaw later.

Tip Alert

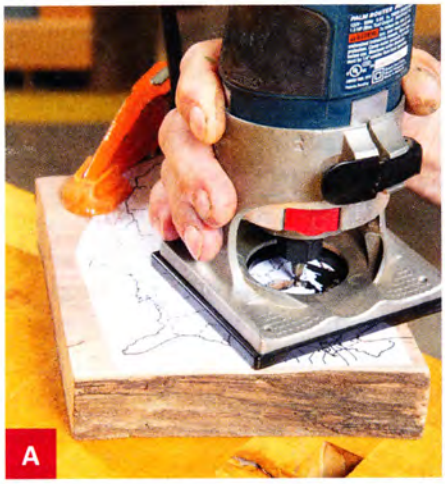
If you want to try something like making a state box from the wood of that state's official tree, I recommend performing some test cuts first.

Scouting Land

Millions of maps are available on the Internet. Just type "Map of (your choice)" into your search engine. Free software, like Adobe Reader, allows you to easily resize the pictures for printing to suit your needs. If you like, visit our Patterns page to download ready-made patterns for the U.S., Texas, and British Isles boxes seen on these pages.



Photos: Paul Anthony; Illustrations: Frank Rohrbach III



For nimble routing of shallow recesses, outfit a laminate trimmer with a 1/16"-diameter straight bit.

Make the box

1 If you choose to detail the lid, do it now, while the box blank is at its largest. This allows for easy clamping in a vise and provides maximum footing for a router base when cutting recesses (**Photo A**). (For more tips on detailing, see the sidebar at right.)

2 Outfit your scrollsaw with a 13 TPI, #9 skip tooth, or other blade suited to smooth cuts in thick wood.

3 Saw out the exterior profile (**Photo B**).

4 Mark out locator pin hole locations on the underside of the box. The location isn't critical, but begin at the extremities, spacing the holes a few inches apart, roughly equidistant from each other, and inset about 3/32" from the outside edge.

Detailing the lid

Augmenting the lid of a geo box affords the opportunity to further personalize it, to teach geography, or even to show the paths of history. For example, you may choose to feature the recipient's home town, a state capital, or perhaps major cities. In the upper photo at right, a 1/4"-diameter paint-filled recess indicates London, England, while a series of 1/16"-diameter painted holes denotes Ireland's major port cities. Austin, Texas, is represented by a carved star. Instead of filling holes with paint, you can plug them with shop-made dowels (see page 22) or the same plastic side dot material used for the box locator pins.

To portray large bodies of water, I rout a 1/16"-deep depression, color it with several coats of paint, and then sand the surface of the box lid. (*Note: If a recess borders the box, it's wise to first saw that section of the box perimeter before routing away the border cutline.*)

Very narrow rivers, streams, and creeks can be knifed in, painted, and then sanded over. You can even include historical highlights, such as the dark line on the Washington Crossing Park box, shown in the lower photo above, indicating the path that General Washington and his troops traversed during the Revolutionary War. Use your imagination to come up with more ideas.

Whenever possible, saw the exterior profile in long, uninterrupted cuts so that the waste can be used later as a support on the bandsaw.

Drill the locator pin holes through the 3/8"-deep bottom section and into the wall section.

When slicing away the bottom, stabilize the blank on edge by resting it on a full-length offcut.

Drill the lid locator pin holes through the core and lid locator sections and into the lid section.

Tip Alert

A ¼" or wider bandsaw blade with 4-6 TPI cuts easily and produces a surface that requires very little smoothing.

5 Drill 1/16"-diameter × 3/8"-deep holes at the marked locations (**Photo C**).

6 Guiding the work off a bandsaw fence, slice the 3/16"-thick bottom from the block (**Photo D**).

7 Hand-plane the sawn surfaces or scrub them against 150-grit sandpaper adhered to a dead-flat surface.

8 On the underside of the blank, lay out the locations for three or four lid locator pins, insetting them at the extremities about ½" from the box perimeter.

9 With the box upside down, drill 1/16"-diameter holes through the core section and lid locator section and into the lid section, stopping about 1/8" shy of exiting through it (**Photo E**).

10 Slice away the lid (**Photo F**), and then smooth the sawn surfaces as before.

11 Draw the wall thickness on the wall/core section, offsetting the line about 3/16" in from the box perimeter (**Photo G**). The

Survey Your Alternatives

A person's native country or state is always a popular choice for a geo box. Unfortunately, the shape or proportions of the land can make for a difficult job. But don't let that stop you. If a person's state isn't suitable, for example, consider using their county, city, or town. In fact, I recently made a box of Washington Crossing State Park on the Delaware River. And (I cannot tell a lie), I chopped down a cherry tree for the wood.

Slice away the lid using exactly the same setup you used to slice away the bottom.

When drawing the wall thickness along fairly straight sections, use your fingers as a marking gauge.

The more carefully the inner wall is cut to mimic the outer wall, the cooler the box will look when open.

Slice the lid locator from the core. If necessary for solid footing (not here), temporarily attach scrap to the piece to prevent it from rocking.

inner wall doesn't have to be perfectly parallel to the outer wall, but try to keep it relatively consistent as you freehand it. If you like, you can create a reduced size pattern to do the job.

Fine-Tuning From The Guitar World

A while ago, I made a geo box for my friend Darin Lawrence, who used to make guitars. He decided to put his hand to making a couple boxes of Japanese prefectures (provinces) to give to his hosts during an upcoming trip there.

He showed me later how he used plastic side-dot material (made for guitar finger board inlays) as locator pins to keep box parts aligned during glue-up. At first, I suspected this was unnecessarily fussy, but when I tried it myself and realized how much easier and cleaner this made the glue-ups, I was just as delighted as Darin's Japanese hosts were when they received their gifts from him.

12 Drill a scrollsaw blade starter hole just inside the inner wall line, preferably at a corner or other junction. Then saw out the core (**Photo H**).

13 At the bandsaw, use the same setup as before to slice the lid locator from the top of the core (**Photo I**).

14 Insert a length of side dot material into a wall hole, pressing it in firmly, then nip it off about 1/16" proud of the surface (**Photo J**). Repeat for all other wall holes.

15 Judiciously brush glue onto the bottom edge of the wall,

Press the wire-cutter section of needle-nose pliers against the box wall when snipping off the side dot strand. This leaves the necessary 1/16" projection.

Wash away excess glue squeeze-out on the box exterior using a wet toothbrush, dipping it in clean water frequently as you work.

Spring clamps placed at the perimeter of the lid locator do a good job of pinching it to the lid as the glue dries.

Sandpaper wrapped around a rubber contour sanding pad makes for effective smoothing of detailed edges.

and then clamp the bottom to the wall using lots of clamps. After about 10 minutes, remove one clamp, and use a wet toothbrush to scrub away any glue squeeze-out on the exterior in that area (**Photo K**). Shift an adjacent clamp to the cleaned area, and repeat the washing process. Clean your way around the entire box in this manner. Replace the first clamp removed, and let dry thoroughly.

16 Firmly insert side-dot material into the lid holes, nipping it off to a 1/16" length as before. Then, apply glue judiciously to the lid locator to prevent squeeze-out at the edges, and clamp the lid locator to the lid (**Photo L**).

Finish up

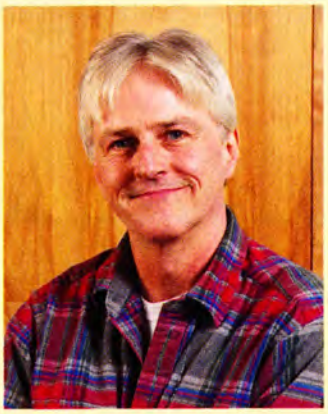
1 Fill the locator holes with a mix of 5-minute epoxy and fine sanding dust.

2 After the epoxy cures completely, sand the box through 220 grit. I begin by hand-sanding the edges (**Photo M**). Then I move to the top, first carefully power-sanding the pattern off while taking care not to erode away any recessed detailing.

3 Apply the finish of your choice. I applied several coats of a wiping varnish. (If you intend to flock the interior surface, don't apply finish there–only to the top edges of the wall.)

4 For a nice final touch, flock the interior. Simply paint the surfaces with undercoat adhesive, shake flocking fibers inside the closed box, let the adhesive dry, and then tap out the loose fibers. ■

About Our Author/ Builder & Designer



Geoffrey Noden has been working wood for over 30 years. The first American graduate of the John Makepeace School for Craftsmen in Wood in Dorset, England, Noden now builds custom furniture in Trenton, New Jersey. He is also the inventor of the Adjust-A-Bench and the Inlay Razor. For more info, visit *adjustabench.com.*

Convenience-*PLUS* BUYING GUIDE

☐ 1.	Freud 04-096 Double Flute Straight Router Bit 1/4" SH 1/16"D 1/4"CL	#828805	$14.97
☐ 2.	Pegas 90.410 No.9 Skip, 13 tpi, Scroll Saw Blade (12 pk)	#852651	$2.70
☐ 3.	Complete Sanding Pad Set, 4-piece	#145958	$6.50
☐ 4.	Donjer Flocking Fibers, 3oz., Bright Red	#14X41	$13.49
☐ 5.	Donjer Undercoat Adhesive, Bright Red	#14X62	$13.49
Above items are available at Woodcraft stores, *woodcraft.com* or by calling (800) 225-1153. Prices subject to change without notice.			
☐ 20.	Plastic Side Dot Material; white, 1/16" diameter	#0483	$1.15
Above item is available at Stewart-MacDonald, *stewmac.com* or by calling (800)-848-2273. Prices subject to change without notice.			

Pen Presentation Box

Elevate the turned pens you give away with this fetching container.

By Marlen Kemmet

Overall Dimension: 7⅛"w × 1½"d × 1¼"h

A finely crafted turned pen deserves an equally impressive presentation box. This easy-to-build scrap project requires minimal stock but yields spectacular results. The key is to use a ⅝" core box bit and a pair of stops at the router table to form the pen-holding coves. For thick pens or those longer than 5½", see the note in **Figure 1** to make any needed adjustment.

Start with the box blank

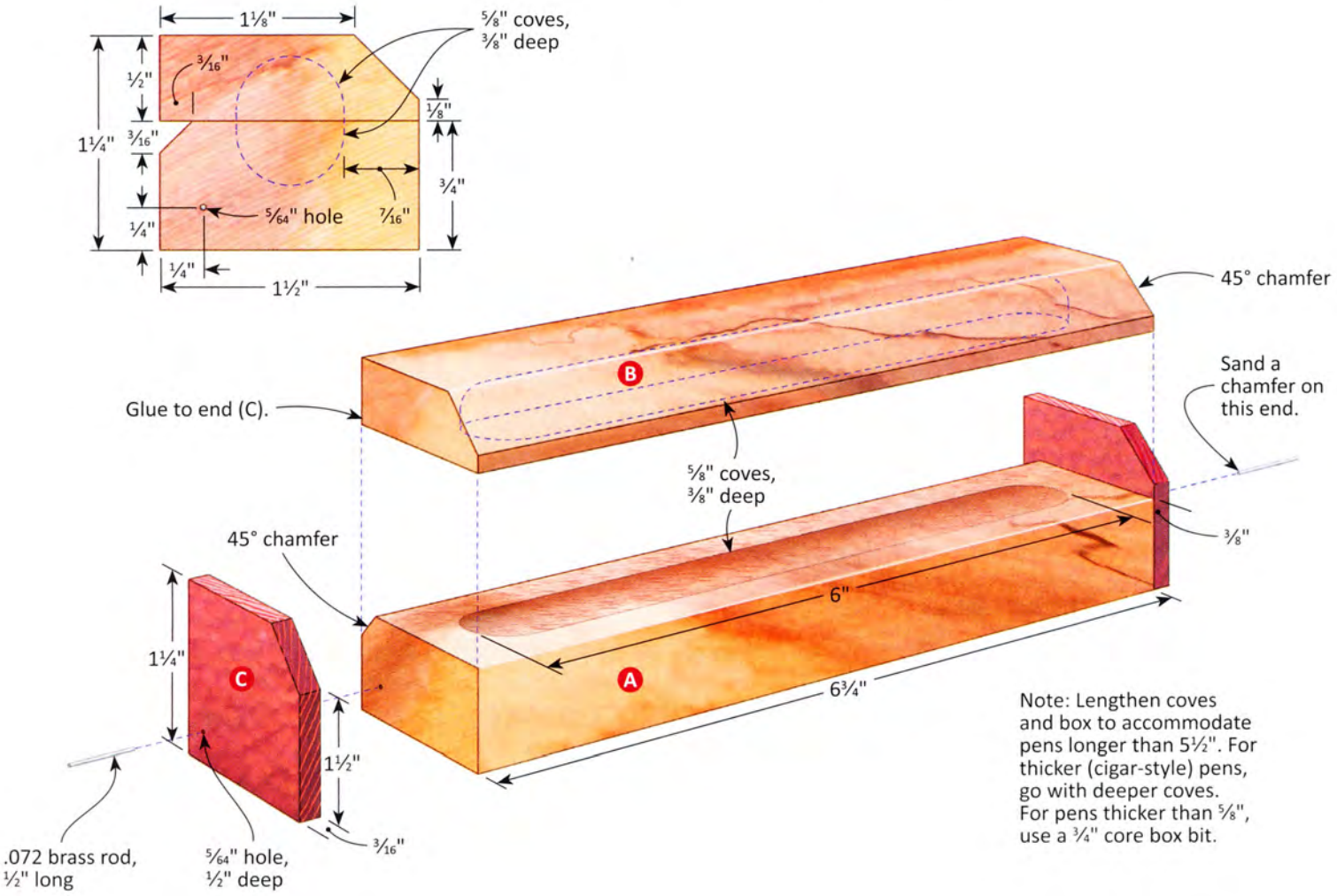
1 Mill and cut a piece of straight-grained stock to 1⅜ × 1½ × 7¾". (For safety when routing the coves, we started with a blank 1" extra in length. You'll crosscut it to final length after routing the coves.) Now, resaw a ¾"-thick piece from the blank for the box bottom (A) so that the grain in the box top (B) and bottom match nicely.

2 Fit your table-mounted router with a ⅝"-diameter core box bit. Raise it to full height. Position the back fence 7/16" from the bit's cutter. Clamp a pair of stops on the fence at 3⅜" from the bit's cutter with one on each side of the bit. The goal is to cut identical coves in the bottom (A) and top (B). Clamp on a second fence to the table, making it parallel to the table fence. Its function is to keep the blanks over the bit and guarantee straight cove cuts. Allow just enough clearance to slide the blanks between the fences. Mark an "X" on one edge of each blank. For perfectly aligned coves in the bottom and top, keep the marked edge against the table fence for each pass. Lower the bit height to 1/16".

3 Rout mating ⅜"-deep coves in the box bottom (A) and top (B), raising the bit in 1/16" increments in hard woods or ⅛" increments in softer woods. Start with a blank against the right-hand stop. Then, lower the left end onto the spinning bit using a notched pullstick. Move the blank to the left, switching to a

End View

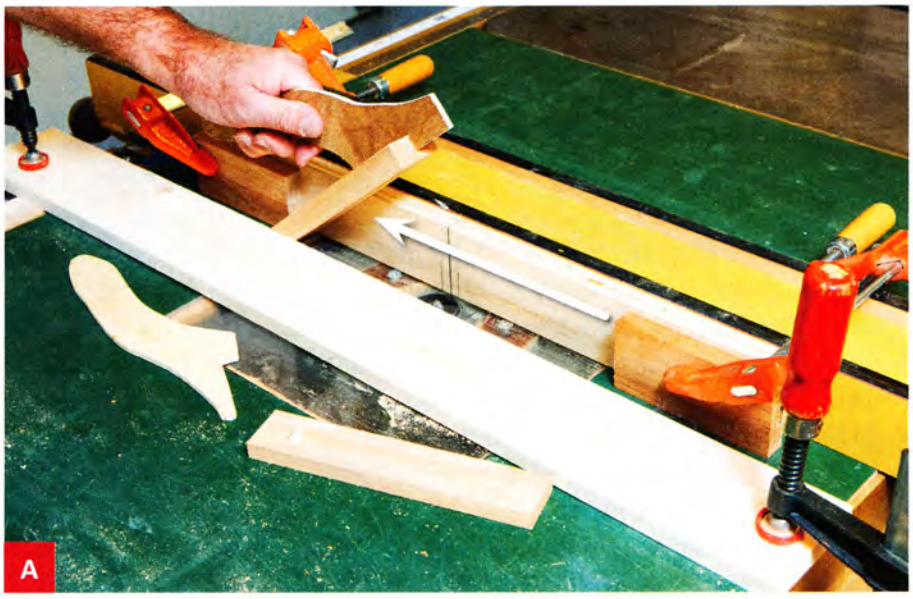
Figure 1: Pen Box Exploded View



shoe-style pushstick or pushpad to apply downward pressure. Turn off the router after each pass and allow the bit to stop before lifting the blank with the pullstick from the router table, as shown in **Photo A**.

4 Rip a chamfer along the back edge of the bottom (A), where shown in **Figure 1, End View**. The chamfer creates clearance, allowing the top (B) to open and close.

5 Adhere the bottom (A) and top (B) together with double-faced tape. Rip a 45° chamfer across the top front edge of the box top, where shown in **Figure 1** and as shown in **Photo B**. Clamp a



Lower the workpiece onto the bit with a pullstick; use a pushstick or pushpad to advance it to the left-hand stop. After making the cut, stop the router and raise the workpiece with the pullstick.

Opening photo: Jim Osborn; Project photos: Doug Hetherington; Illustration: Melanie Powell

Use a pushblock to move the taped-together bottom and top pieces along the fence and through the blade.

Drill the hinge-pin holes in the ends of the taped-together box assembly, using a simple right-angle jig.

stopblock in a mitersaw extension fence, and cut exactly ½" from each end of the assembly. *Do not* separate the pieces at this time.

6 Mill and plane a 12"-long piece of contrasting stock to 3/16" thick. From it, cut a pair of slightly oversized ends (C) to the shape in **Figure 1**. Tape them to the ends of the taped-together bottom (A) and top (B), making them flush with the back and bottom of the assembly.

7 Carefully mark and lightly indent the hole center points on each end of the taped-together assembly, where shown in **Figure 1**. (*Note: For a smooth opening and closing action, the holes must be perfectly aligned from end to end. The indentations keep the bit from wandering when drilling the hinge-pin holes.)*

8 Using a right-angle jig on your drill press for alignment and the depth stop on your drill press, drill a 5/64" hole ½" deep through both ends (C) and into the bottom corners of the box, as shown in **Photo C**. Remove all of the tape from the box assembly.

9 From a length of .072 solid brass rod, crosscut two pieces to ½" long using a hacksaw. Sand a chamfer on one end of each piece for easier insertion through the ends (C) and into the box bottom (A). (I bought the brass rod at a local hobby store.)

10 Finish-sand the box bottom (A), top (B), and ends (C). Trim 1/32" off one end of the box bottom so that the lid assembly (B/C) doesn't bind. Glue the ends to the box top only, wiping off any excess glue with a damp cloth. Let dry.

11 Tap the brass rods through the end pieces and just far enough into the box bottom to check the fit. Sand the proud edges of the ends (C) flush with the bottom (A) and top (B). Pull the pins and do any final sanding. Add finish to the disassembled box bottom (A) and lid assembly (B/C). (I used a wiping oil, but spray lacquer would also work.)

12 Fit the parts together, lightly tapping the brass pins in place with a small hammer to hinge the box lid assembly (B/C) to the bottom (A). The pins should be flush with the outside faces of the box ends (C). Sand, if necessary, and refinish. ■

Convenience-*PLUS* BUYING GUIDE

☐ 1.	Whiteside 1405 Round-Nose (Core Box) Router Bit, ¼" SH, ⅝" D, 2" CL	#813115	$25.99
☐ 2.	Mahoney's Walnut Oil, 16 oz.	#146022	$15.99

Above items are available at Woodcraft stores, *woodcraft.com* or by calling (800) 225-1153. Prices subject to change without notice.

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- Clamp Mechanism Adjusts Quickly Without Tools
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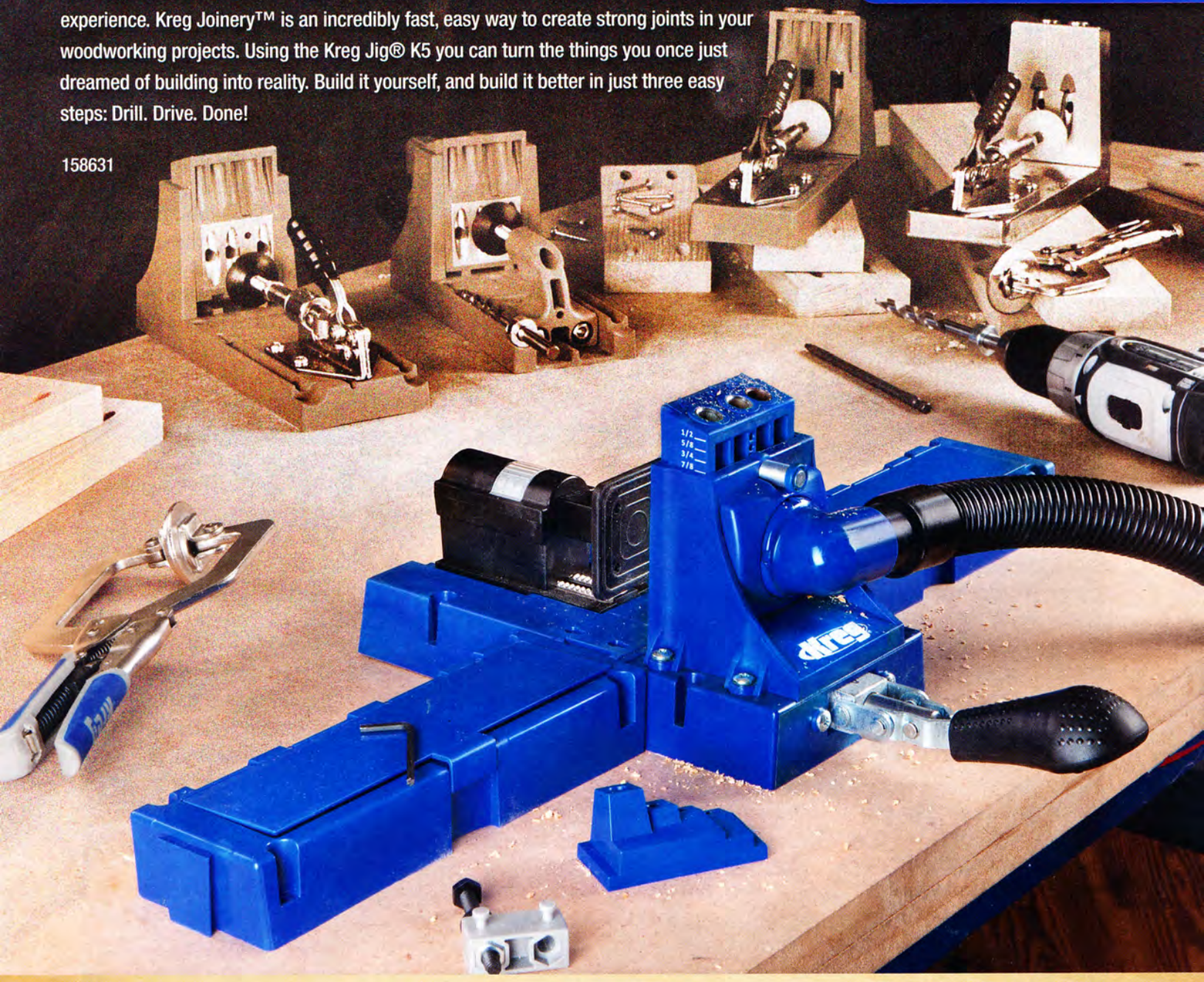

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Precision Tapering by the Numbers

Micro Jig MICRODIAL Tapering Jig (Model TJ-500)

If you have ever tried using your tablesaw to taper a post or leg, you may already know how most tapering jigs make the cut a lot harder than it needs to be. Those inexpensive but ever popular hinged-bar contraptions make it difficult to follow a line, and they require a tricky-two step to complete a cut. Simultaneously holding the blank against the jig while guiding the jig along a fence can get dicey. These cuts often necessitate post-cut cleanup work.

Micro Jig's MICORDIAL Tapering Jig claims to solve both problems and offers a few additional advantages. To see if the jig could earn its keep in my shop, I gave it a try.

Ready, Set, Saw

The MICRODIAL comes almost entirely assembled. Simply attach the handle and a couple of other minor parts, and you're ready to taper.

Don't be swayed by your first impressions of the jig's apparent complexity. After watching the DVD, I referred to the full-color manual for the first few cuts, but after that I found the jig intuitive to use. As I soon discovered, making the cut isn't that different from other jigs. Set the pivoting fence for the desired taper, place the jig against your tablesaw's fence, and then register the end of your workpiece against the trailing hook and the workpiece edge against the pivoting fence. Next, adjust the saw's rip fence so the taper starts right where you want it to, grab the handle, and slide the jig along the fence to cut the taper.

Tip-Top Tapering

The biggest difference with the MICRODIAL is in the details. Woodworkers who are not content with "close enough" will be impressed by the jig's ability to dial-in tapers in three different ways (see photo, left): by the degree, rise (inches per foot), and, of course, simple layout. The rise and run gauge dial measures taper angles in 1/16" per foot. The degrees scale–calibrated in 0.125° increments–almost seems better suited for metalworking than woodworking, but it ensures line-splitting accuracy.

Both scales are set in the same manner: align the color-coded MICRODIAL with the appropriate setting on the scale, and drop the dial's registration pin into the corresponding hole. Whichever method you choose, your settings can be preserved using the jig's built-in locking stops. These stops help when tapering opposite sides of a workpiece, as each side requires its own setting.

Bottom Line

This is not an inexpensive jig. However, if you cut tapers on a frequent basis, the jig's

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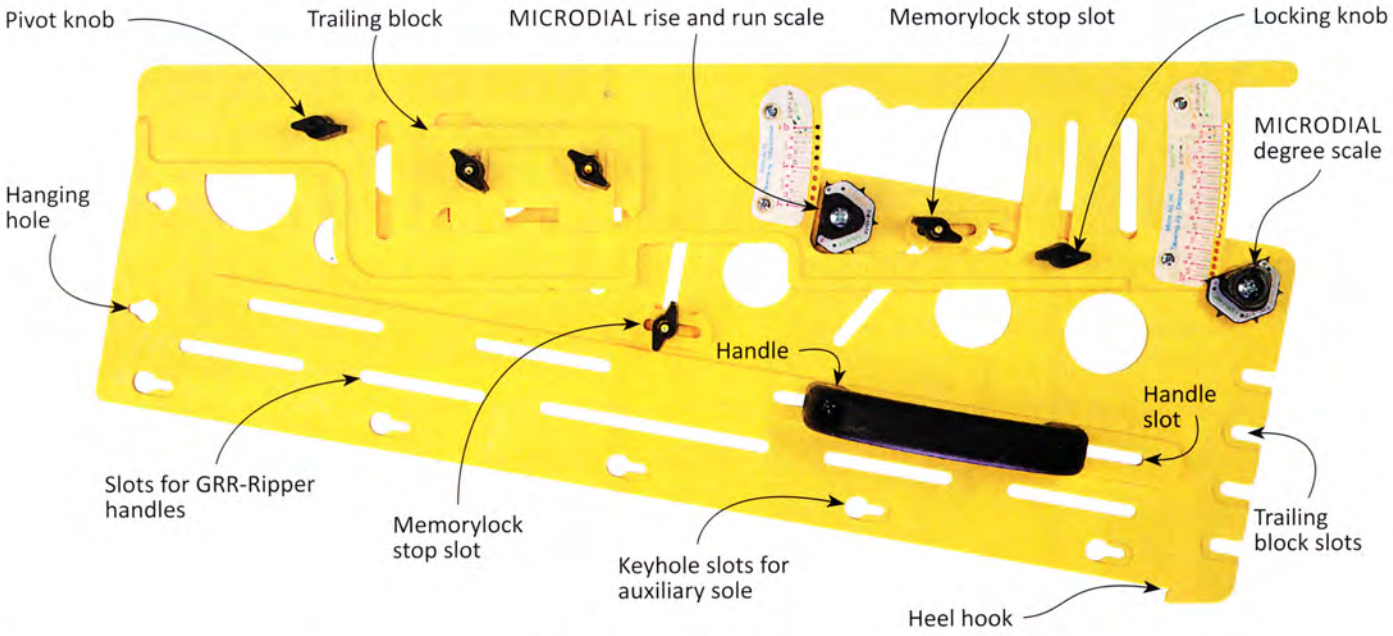
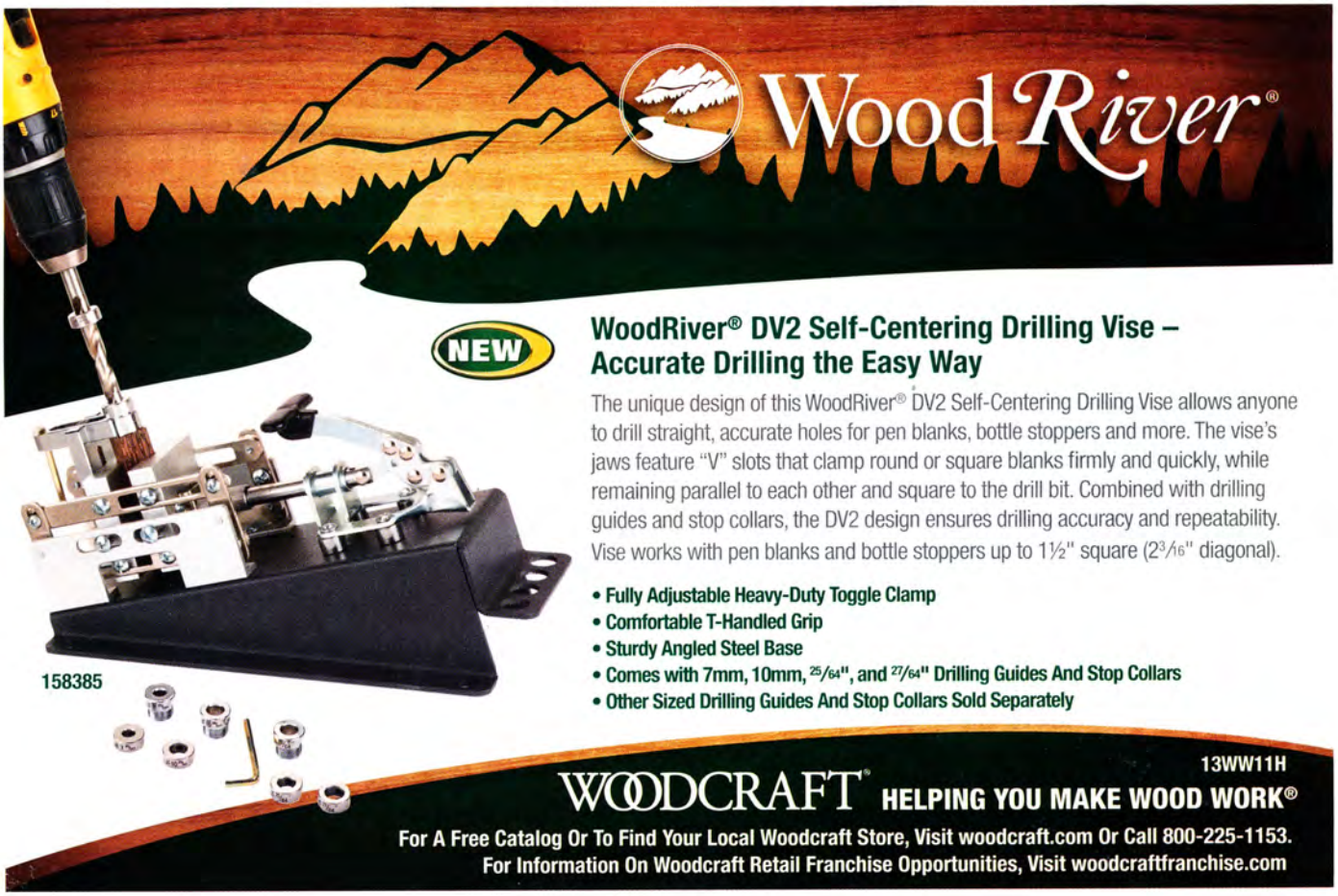


precision, ease of setup, and repeatability justify the expense. If it saves a few legs of choice stock, the jig could quickly earn its keep. As an added bonus, you can use the jig to create octagonal tapered legs or posts (a feat that is nearly impossible with other tapering jigs).

For relatively wide pieces, you can hold the workpiece in place by hand. For narrow stock, you may want to add one or two GRR-Ripper 3D Pushblocks (also from Micro Jig) to help hold the workpiece down as you feed it over the blade.

Micro Jig MICRODIAL Tapering Jig #856320 **$139.99**
Tester: Ken Burton



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Soft Nano Silver Micro-Knit Fabric

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Spotlight on Zebrawood

You can't always tell a wood by its stripes.

By Pete Stephano
Technical consultant: Larry Osborn

So-called "zebrawood" was first mentioned in international trade in 1773 when it showed up in British customs records. At that time, it came from the Caribbean coastal region of what is now Honduras and Nicaragua and may have been a different species than the zebrawood we know today. The wood became an immediate hit with English cabinetmakers, and it continued to be imported until 1786, when the British settlers could no longer supply the wood.

Because of the demand for this wood, another source had to be found, and one was in Brazil. The wood here, however, proved to be a species we now call goncalo alves. Still, European and American furnituremakers called it zebrawood until about 1860. It wasn't until the early 1920s that the "zebrawood" term used in North America applied to *Microberlinia brazzavillensis,* a tree from West Africa, which today is the only source.

African zebrawood comes from trees that grow up to 150' tall with trunk diameters of 4' to 5' feet. These have thick bark and produce heavy, hard, coarse-textured heartwood of wonderful color and luster that's also resistant to termites and other insects. Zebrawood's dark stripes can range from shades of brown to black. The lighter background generally ranges from cream to soft golden yellow. The stripes may be relatively consistent in some pieces but not others. Some zebrawood has highly variable stripes with some lines much thicker than others. Quartersawing the logs always adds to the striped appearance.

History in woodworking

As a decorative wood, zebrawood has been used in a limited way for veneer, wall paneling, custom furniture, inlay bandings, marquetry, specialty items, boxes, and turned objects. It's also seen in handgun grips and exotic guitars.

In the not too distant past, it clad the dashboards of Cadillac and Mercedes-Benz vehicles. Because of its hardness, it has been fashioned into skis and tool handles.

Where the wood comes from

As mentioned earlier, there are a number of tree species around the world that can produce lumber that resembles and is locally called zebrawood. But the authentic zebrawood in the market comes from trees in the *Microberlinia* genus of the West African countries of Gabon and Cameroon. In other than North American trade, wood from these trees may also be called "zebrano," "African zebrawood," and "zingana."

What you'll pay

Due to the tree's relative inaccessibility and intense labor needed at the logging site, zebrawood tends to be fairly expensive. However, it is far more plentiful and not nearly as pricey as exotics ebony or rosewood. Zebrawood boards in 4/4 thickness sell for about $24

It's a fact that...
The zebrawood tree species has bark that averages a whopping 1' thick! To facilitate hauling, the bark is stripped off the logs at the logging site, which adds to the wood's cost.

Quartersawn zebrawood

per board foot in Select & Better grade. Stock in 8/4 thickness is usually available, as is FAS grade at higher prices. Turning squares measuring 1½ × 1½ × 18" run about $15; ¾ × ¾ × 5" pen blanks cost about $2. Bowl blanks and thin stock are also available. A 4 × 8 sheet of 1/42"-thick, paper-backed veneer costs about $160.

You won't find zebrawood at home centers or large lumberyards, as it's mostly sold by retail specialty wood suppliers both at their stores and online.

How to select the best stock

Suppliers sell both flatsawn and quartersawn zebrawood. When buying several pieces, be sure the color and striping match. You'll find the most consistent and dramatic striping in quartersawn zebrawood.

Working zebrawood in the shop

Zebrawood's interlocked grain makes machining somewhat difficult, so go with carbide bits and cutters, slow feed rates, and light passes. The wood also tends to tear out when planed. Feeding the stock at a slight angle and using light cuts can reduce or eliminate damage. Jointing can also be challenging, so do it lightly, or simply rely on smooth rips at the tablesaw.

All adhesives work well, but because the wood tends to be oily, first wipe the joining surfaces with a solvent. The wood sands normally, but large and sharp splinters are a possibility. Progress through the grits to bring out zebrawood's natural luster. For a glass-like smoothness, consider filling the open pores and grain.

Due to its natural oils, film finishes provide mixed results with possible failure. A penetrating oil with added driers, such as polymerized tung oil, works better. ■

Zebrawood Quick Take	
Cost	High
Weight	High
Hardness	High
Stability	Moderate
Durability	High
Strength	Moderate
Toxicity	A sensitizer: it can cause minor rash/ eye irritation
Tool Type	Power tools with carbide blades and cutting edges
Common Uses	Acoustic guitar parts, decorative boxes, electric guitar bodies, furniture, cabinet decoration, pens, and vases

Photos: Larry Hamel-Lambert

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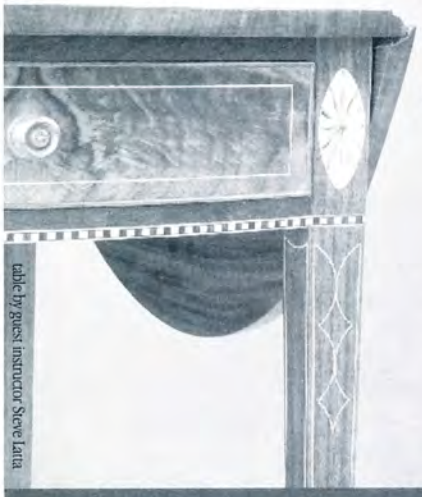

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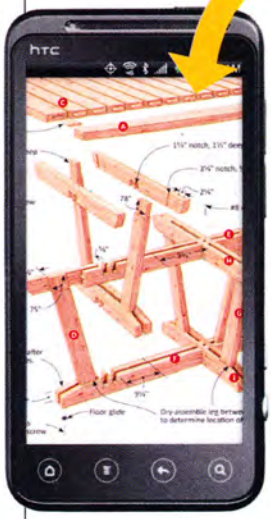

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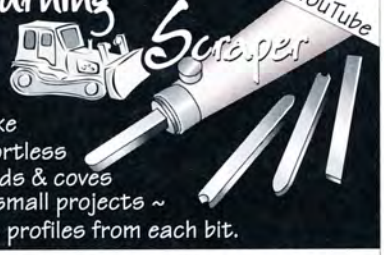
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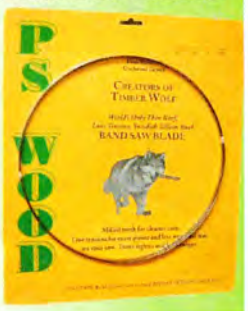

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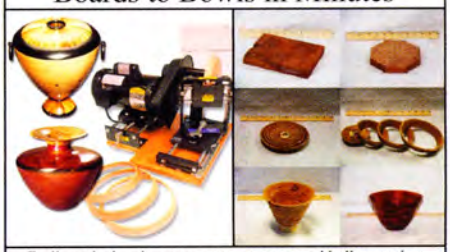
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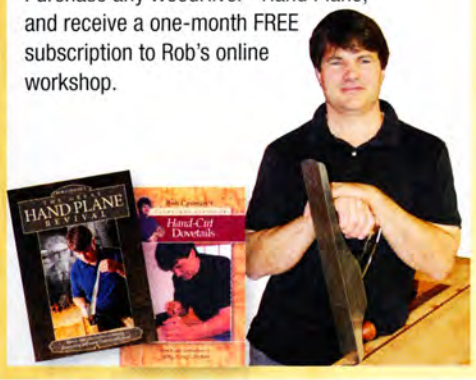

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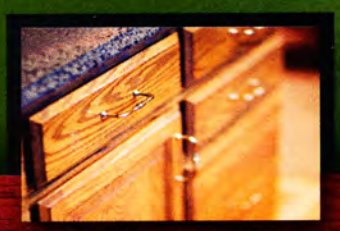

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