

BODYBUILDING WITH WIPING VARNISH *p.62*

WOODCRAFT[®]

Projects, Techniques, and Products

magazine

Make this elegant

**Shaker
Dining
Table** *p.42*

MONEY \$AVERS

■ **20 Oddball
Shop Aids**

MORE PROJECTS

■ **Wall-Hung
Quilt Rack**
■ **Rolling Pin**

Tugboat Toy *p.36*



MUST-HAVE SKILLS

■ **Combo Square
Master Class**

VOL. 11/NO. 63 FEB/MAR 15

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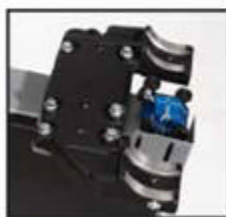
INTRODUCING **THE UNEXPECTED** 14TWELVE



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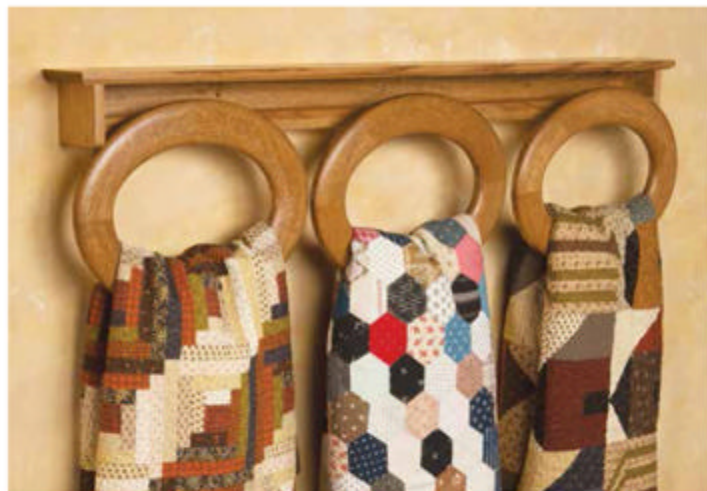
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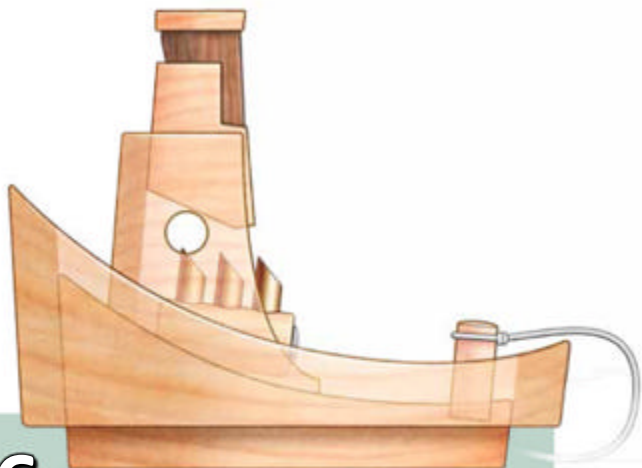


*SHOWN WITH OPTIONAL INDUSTRIAL FLOOD LIGHT



24 Oval-Rings Quilt Rack

Display heirloom quilts with this unique wall-hung design. Three removable ovals let you switch out patterns as seasons change. Use the shelf and plate groove for added touches.



36 Pop-Up Tugboat

Wait 'til you see the clever "telescoping" approach to making this fun floor toy using just a bandsaw, a block of wood, and a bit of brass tubing!



42 Shaker-Style Dining Table

Build this statement piece that seats up to six diners. Techniques include loose- and through-tenon joinery and making breadboard table ends. Build a simple jig to rout the mortises quickly and cleanly.



56 Rockin' Rolling Pin

Turn the cylinder and handles for this kitchen essential. Assemble the wood parts using the featured kit components that include bearings, a steel rod, and nylon washers.



69 Single-Cup Container Rack

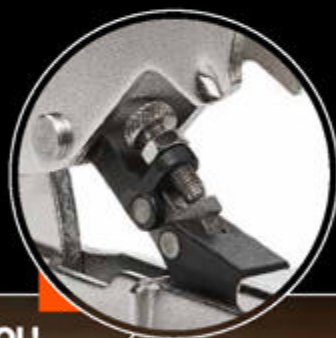
Park this K-cup holder alongside your hot beverage appliance. It stores up to 18 containers and can be crafted in a day or less.

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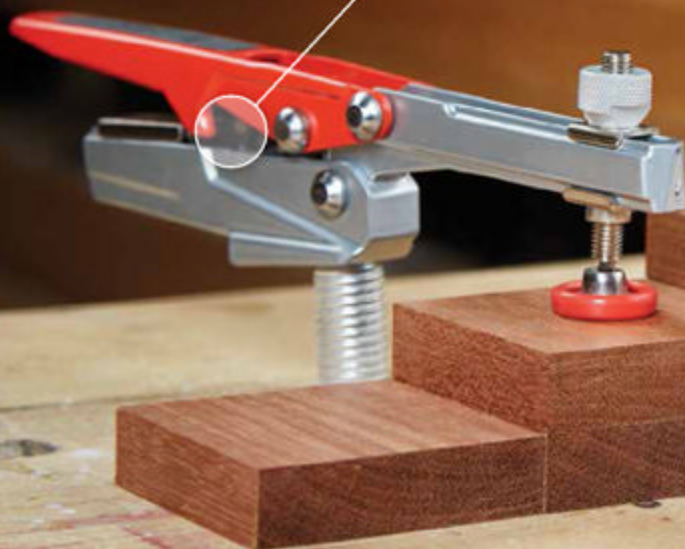
INTRODUCING THE AUTO-PRO AUTO-ADJUST HORIZONTAL DOG CLAMP, BY ARMOR TOOL **EVEN PRESSURE. ODD SIZES.**

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Contents: Tools & Techniques



31 Oddball Aids for Woodworking

Save money by diving into the recycle bin, rummaging through the house, or visiting the art store for items you can repurpose for woodworking.

62 Bodybuilding with Wiping Varnish

Dissatisfied with thin and pretty, but vulnerable, finishes? We'll walk you through every step for creating a lovely hand-applied coating that's as tough as it is lustrous.



50 The Multitalented Combination Square

If you only use your combo square for checking square and mitered cuts, you're missing out on its remarkable performance of shop tricks. Here's your ticket for the show.



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- Big Tree Badger Safety Spur
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Projects for a harder working shop

The commitment we share in making our home workshops efficient, safer, and more capable never seems to end. We want reliable accuracy from our power tools and ways to be more productive. We

want a workbench that goes beyond just being a tabletop sitting on four legs. In short, we want jigs, fixtures, stands, and other accessories that help us achieve a harder working shop. And if we can build these items from materials we have sitting around, we save big money.

Now, with *Home Workshop Jigs & Fixtures*, the latest book in our Home Woodworker Series, you have a selection of fully explained and illustrated project plans (46 in all) aimed at bettering your workspace.

For your tablesaw alone, you'll find 10 jigs and fixtures. They range from a dead-accurate crosscut sled to a box-joint jig to an adjustable outfeed roller stand. You'll discover aids that make your router do more, including a dovetail jig, guides for dadoes, rabbets, and grooves, and a precision mortising jig. In addition to these are a super versatile drill-press table for horizontal and vertical boring, a bandsaw resaw jig, and three separate sawhorse plans to suit your needs.

While this listing of projects highlights the book's offerings, it falls short of painting the entire picture. For that, consider browsing through a copy at your local Woodcraft store, or pick up a copy for **\$19.99** by visiting *Woodcraft.com*, or by calling (800) 225-1153. Ask for *Home Workshop Jigs & Fixtures*, #160078, the first step in taking your workspace to the next level.



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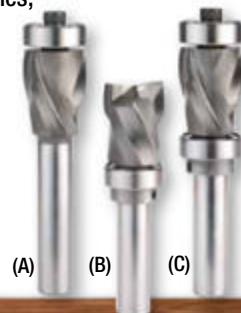


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Holiday gift boxes

I came across your Aug/Sept 2014 issue of *Woodcraft Magazine* while sitting in the “man cave” at the Laughing Ladies Quilt Shop in Berthoud, Colorado. My wife and aunt were looking for quilting ideas, and I was killing time. I found the article for making these recipe boxes, thought they would make great Christmas gifts, and here they are. I couldn’t find quartersawn sycamore, so I used curly maple with walnut for the splines, lifts, and guides. I was so impressed with your magazine that I promptly subscribed to it. Thank you for the inspiration. I look forward to many more.

—John T. McCormick, Jr., Berthoud, Colorado

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.**

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BEST OVERALL **2007** **2007** **TOP TOOL**

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The future is already here

I enjoyed the game-changing tools article in the Dec/Jan 2015 issue. However, when referring to the “Motors with brawn AND brains,” you say that we could expect digital variable resistance (DVR) motors in table saws in the future. I would like to draw your attention to the Shopsmith Mark 7, which has had this feature for a couple years and it works quite well.

—Ben Roberts, Helena, Montana

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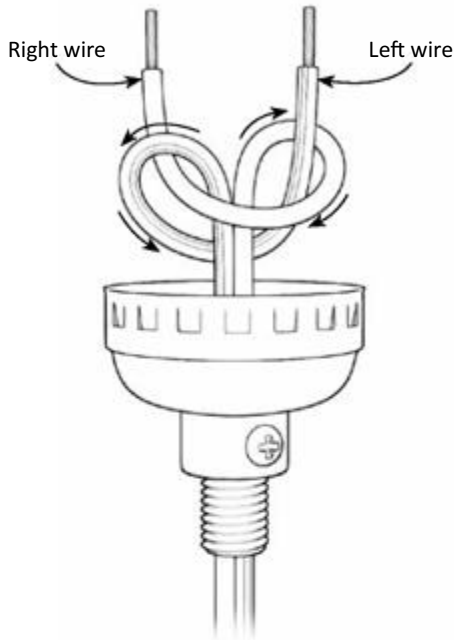
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Tying the knot



I saw the article on tying a UL knot in the Oct/Nov 2014 issue of *Woodcraft Magazine* and thought you might like to know how I explained tying one to my seventh graders at Pleasant Valley Junior High. In my shop class where we made lamps out of anything from liquor bottles to stuffed animals, I came up with a saying that helped students remember how to tie the UL knot at the socket and in the plug. It was "LAB RAT." With regard to the cord's two insulated wires, that stands for "Left, Around, and Behind" for one wire, and "Right, Around, and Through" for the other. See figure, at left. Hopefully, your lamp-making readers will find it handy.

—Bill Grothus, Bettendorf, Iowa

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 and click on "corrections."



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High fives for top ten

I thoroughly enjoyed reading your 10 best tips in the 10th Anniversary *Woodcraft Magazine* issue for Dec/Jan 2015. You did a good job picking through all of those back issues for the best ones. Then I jumped to the 10 game-changing tools story. That also hit the sweet spot. You, the experts, have chosen the most “innovative” tools for the last ten years. Though I don’t have a lathe, what holds me back from buying one as a novice woodworker is the cost of the machine and the various cutting tools. I’m intimidated when I think about the sharpening processes involved. Then I read about the Easy Wood turning tools with carbide-tipped cutters that don’t require sharpening. You simply rotate the cutter for a fresh edge. That in itself diminishes my objection to laying out the cash for turning wood.

—John Beeler, Grant Pass, Oregon.

Illustration: Christopher Mills

NEW! Router Table Dovetail Jig

by Leigh



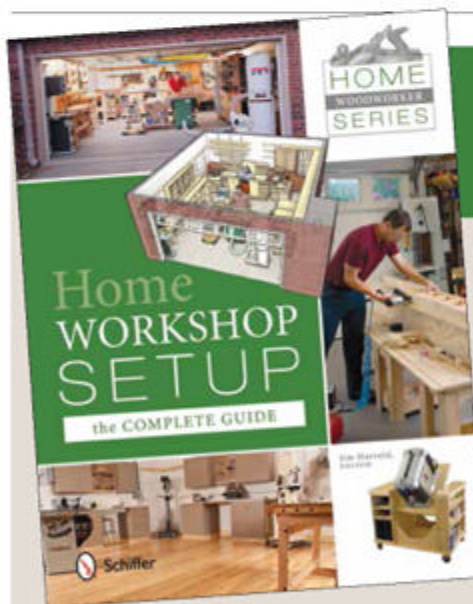
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88
pages

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Hot New Tools

Guides you can roll with *JessEm Clear-Cut TS Stock Guides*

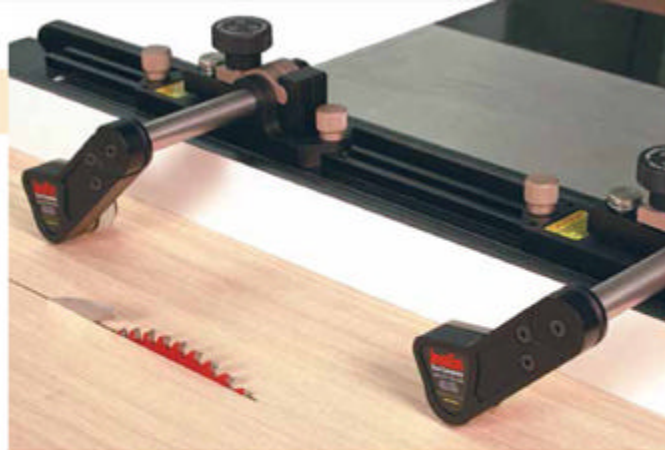
Most of us have experimented with an assortment of shop-made jigs and store-bought accessories promising to make ripping boards safer and/or more accurate. These add-ons work, but all suffer some limitations. At long last, your tablesaw might have found its perfect match.

Simply set the Clear-Cut Precision Stock Guides on the infeed and outfeed ends of the fence, start making a cut, and watch them roll. Operating like the stock feeder rollers used on larger machinery, the guides steer stock in three ways. First, the roller

arms employ spring pressure to hold the work down against the top of the saw.

Next, the angled urethane wheels grip and steer stock inward to keep it registered against the fence. Last but not least, the one-way roller bearings within the wheels prevent kickback. When they're not needed, the rollers pivot out of the way and tuck behind the side of your fence.

The rollers can be quickly and easily mounted to most commercial tablesaw fences using the T-track provided in the kit.



These guides cost more than other options, but by improving accuracy and cut quality and eliminating the need for an assistant when breaking down sheet goods and long boards, they can earn their keep. The only disadvantage is that the guides can only accommodate stock thicknesses up to $1\frac{3}{16}$ ".

#159902, **\$249.99**

Tester: Peter Collins

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Safer, smoother spur drive

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Turners know the importance of maintaining a safe distance from standard-issue spur drives, but accidents still happen, especially when attempting to turn small blanks. The exposed sides of the spurs are the culprit; the briefest chance encounter can damage a pricey turning tool or cause injury. The Badger eliminates the risk of accidental contact by shrouding the sides of the drive spurs within a spring-loaded sheath. By enabling you to safely cut all the way up to



the sheath, you make the most of even the smallest blanks. The spurs, which can be replaced or resharpened, accommodate spindle diameters as small as 1/2".

As if safety isn't enough, the second reason to consider this premium spur is improved performance. For those lathes

that suffer from minor headstock-tailstock misalignment, the Badger's keyed centerpoint can be adjusted to align with the tailstock center even while the machine is running.

#861207, \$79.99

Tester: Ben Bice

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Hot New Tools

Control-Cut Multi-Tool

Festool Vecturo OS 400 Multi-Tool Set

These days, contractors are rarely seen without their oscillating multi-tools. With the right accessories, this talented multi-tasker tackles sanding, scraping, and cutting chores that once required a half-dozen trips back to the truck. Although a time-saver on the jobsite, this tool hasn't made as much of an impact in the workshop because it lacked the control and precision required for fine woodworking. Leave it to Festool to refine the oscillating tool by adding power, reducing vibration, and inventing three

new bases that deliver a new level of cutting precision.

The smallest base works like the base on your circular saw, limiting cutting depth when making long plunge cuts. For shorter plunge cuts, the mid-sized base shoe stops the blade with a simple adjustable foot. The largest base offers the greatest control. It employs a pair of plunge rods (much like the plunge base on a router) to control vertical movement and a magnet that

draws the blade against the guide, eliminating the blade wander and skating that typically happen when making plunge cuts.

The Vecturo is available with and without the additional bases. The cutting options and control provided by these bases more than justify the price of the complete kit.

#563007, \$575

Tester: Andrew Bondi



NOVA DVR XP

The Smartest Lathe on the Market

A white and grey NOVA DVR XP lathe is shown on a wooden surface. The lathe has a motor on the left and a spindle on the right. The motor has a red label with the NOVA logo. The spindle has a black handle. The lathe is mounted on a base with a red and yellow graphic. The NOVA logo is also visible on the base.

The NOVA DVR XP has the ability to measure the weight of the work piece & adjust the performance accordingly, ability to sense faults in set up and advise, sense safety issues such as chisel dig-ins and spindle lock and instantly shuts down power to the spindle. Contact your local retailer for more information.

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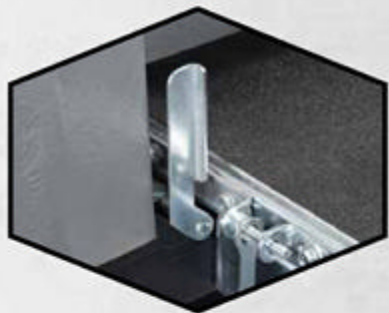
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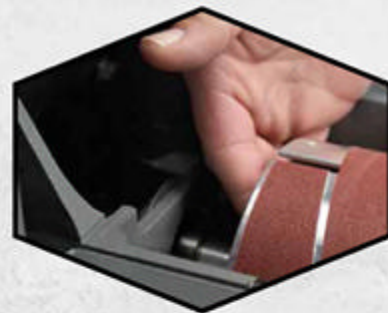
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Woodcraft now offers Thermally Modified Maple in two flavors: Honey Roasted (HR) and Dark Roasted (DR) (the darker color is a result of more time in the kiln) in

a variety of sizes for turning anything from pens, to tool handles, to pool cues.

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Tester: George Snyder



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Tips & Tricks

TOP TIP

Double-slot ZCI hold-down

For my tablesaw, I like to use a two-slot zero-clearance insert (ZCI) that will accommodate both a standard blade and a thin-kerf blade. As with any ZCI, it's best to secure the rear end of the insert to prevent it from lifting. With a single-slot insert, a flat washer screwed to the underside at the rear will do the job. However, that won't work when you rotate a ZCI like this to use the opposite slot.

To solve the problem, I screwed a figure-8 tabletop fastener to each end of the insert. Now, depending on which blade I'm using, I rotate the rear fastener outward to catch the underside of the saw table and rotate the front fastener inward, out of the way of the slots.

—Father Chrysanthos Agiogregorites,
Etna, California

Underside of a zero-clearance insert (ZCI)

Standard blade slot

Thin-kerf blade slot

Rotate the forward tabletop fastener out of the way of the kerfs and saw table.

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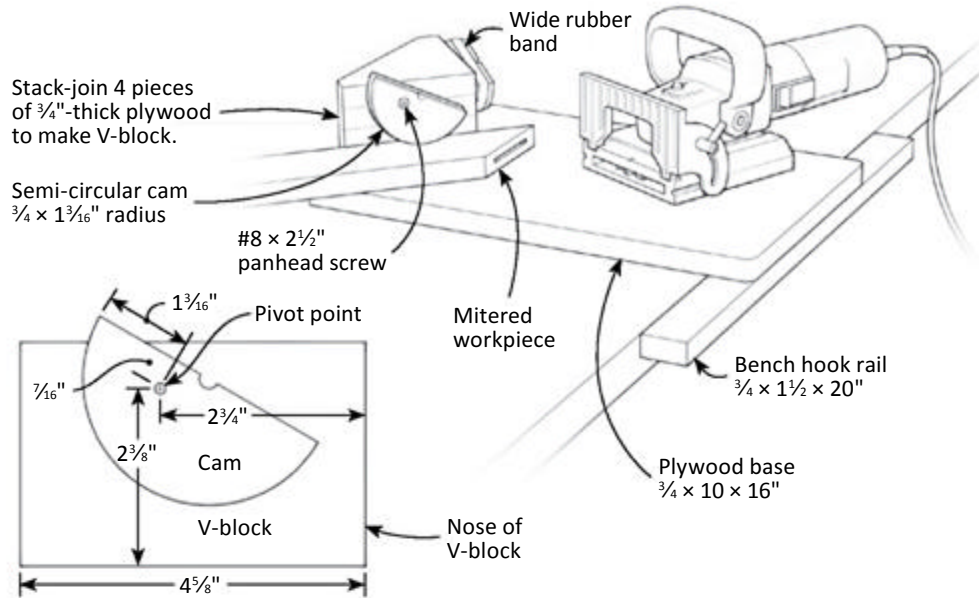
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Miter-biscuiting bench hook

Cutting biscuit slots in the ends of mitered pieces can be a hassle because of the setup time required to clamp every piece for safe, accurate cutting. As a solution, I came up with this production hold-down jig to quickly secure mitered pieces for slotting. It works with stock up to 1 3/8" thick.

Because the base is constructed like a bench hook, it doesn't need to be clamped to the bench. The business end consists of a V-block to which I screwed two half-discs that serve as cams to hold the mitered end of the

workpiece. (I used a bandsaw to bisect a 3 3/8"-diameter disc cut with a holesaw.) These are each wrapped with wide rubber bands or PSA sandpaper to grip the work when it's forced backward underneath a cam. Locate the pivot holes where



shown in the drawing. To allow the cams to spin freely, attach them using screws with unthreaded upper sections of the shanks. When using the jig, position the workpiece miter close to the V-block for stability. —Serge Duclos, Delson, Québec

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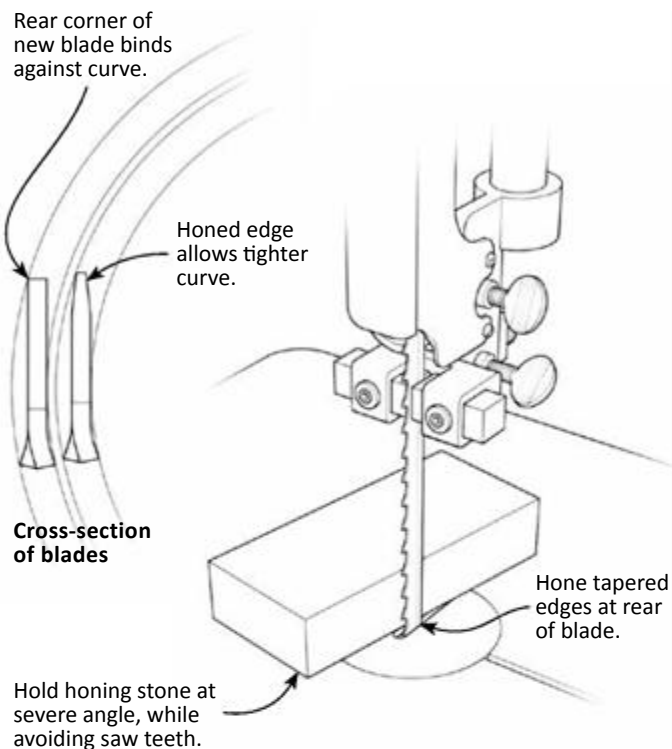
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Tips & Tricks



Tighter turns from a bandsaw blade

Demanding the tightest turn from a bandsaw blade can cause it to bind and burn. One way to provide more maneuverability is to make relief cuts in the waste, so that those outer parts can fall away to give the rear of the blade wiggle room.

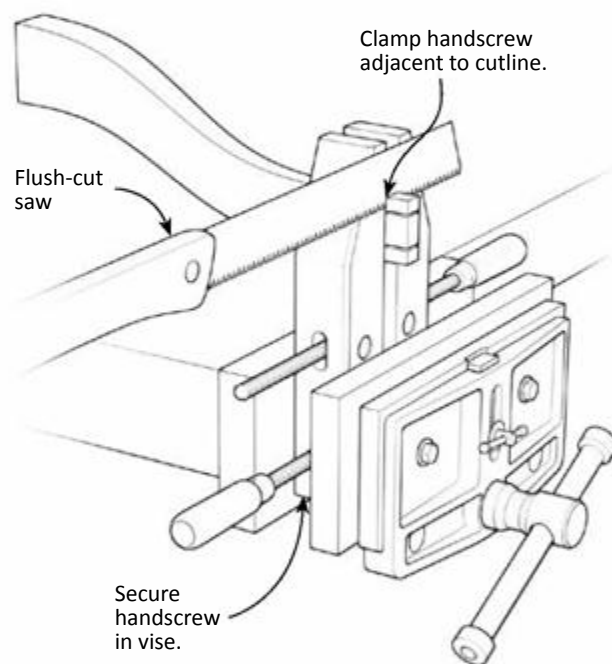
However, sometimes you want to keep the entire workpiece intact, such as when cutting the pieces for the tugboat on page 36. In those cases, tapering the trailing edge of the blade will give it more clearance in the curved kerf, allowing a tighter turn, as shown in the drawing. To create the taper, slowly slide an 80-grit carborundum honing stone back and forth against each side of the running blade. Hold the edge of the stone at a low angle to the blade, avoiding the teeth and keeping your fingers a safe distance from the blade. Be patient, and make sure to leave a flat on the rear edge of the blade because a knife edge would be hard on the thrust bearing. For fire safety, vacuum the saw interior before honing to prevent sparks from igniting sawdust.

—Ric Hanisch, Quakertown, Pennsylvania

Ironing in the shop

Although I'm not one for ironing my clothes, I do own an electric iron. It lives in my shop, where it helps me perform chores like removing old veneer or plastic laminate for repair jobs. Just set it to "medium," and slowly push it across the surface as you peel up the material. It will release contact cement, white glue, hide glue, and other adhesives. (Cover finished surfaces with paper to prevent contaminating the iron with softened finish.) Similarly, you can use it to remove PSA sandpaper from its metal backing disc, to flatten rolled patterns, to apply edge banding, or partner it with a wet rag to raise minor dents.

—Marvin Gatlin, Birmingham, Alabama



Handscrew saw guide

I was trying to cut tenon shoulders on the end of an odd shaped workpiece, and I was having a hard time keeping my handsaw on target. Then it occurred to me that I could use a wooden handscrew as a saw guide, clamping the jaws of the tool adjacent to my cutline opposite the waste side. To prevent scarring the jaws with the saw teeth, I used a flush-cutting saw, which worked great. As a bonus, the jaws also served as a chisel guide for cleaning up any sections afterward where necessary.

—Dean Laughren, Winnipeg, Manitoba

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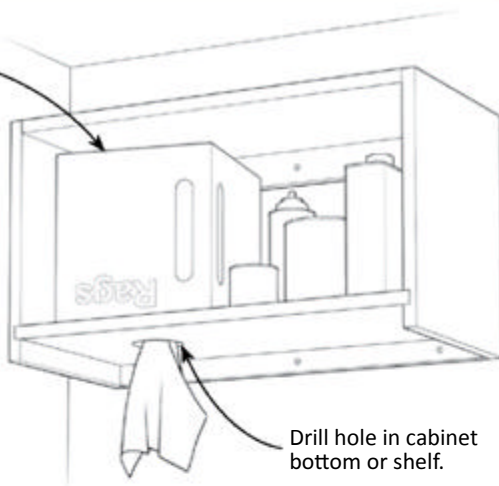
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Tips & Tricks

Paper rags at the ready

For cleanup around the shop, I use paper rags like those sold in boxes at home supply stores. They're convenient to use, but tearing off a perforated section can be a two-handed hassle, with one hand (often already fouled with finish) to hold the box, and the other to rip away the necessary rags. The easy fix is to store the box upside down in a cabinet whose bottom has been drilled to create a dispensary hole for the rags. A

Invert box over hole.



quick, one-handed sideways pull is all it takes to free up whatever length you want. If you don't have a suitable cabinet, you can create a simple shelf for the job, mounting it to a wall or perhaps between overhead joists.

—Carl Rettiger, Billings, Montana

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Oval-Rings Quilt Rack

Create a special display for your family heirlooms.

By Bill Sands

Overall dimensions: 60"w × 5"d × 17"h

Show off a trio of beautiful handcrafted quilts with this clever wall-hung design. Three neighboring wood ovals attach to a stepped support bar to provide broad viewing of the colorful quilt patterns when hung. A top shelf with its plate groove provides room for an added decorative touch.

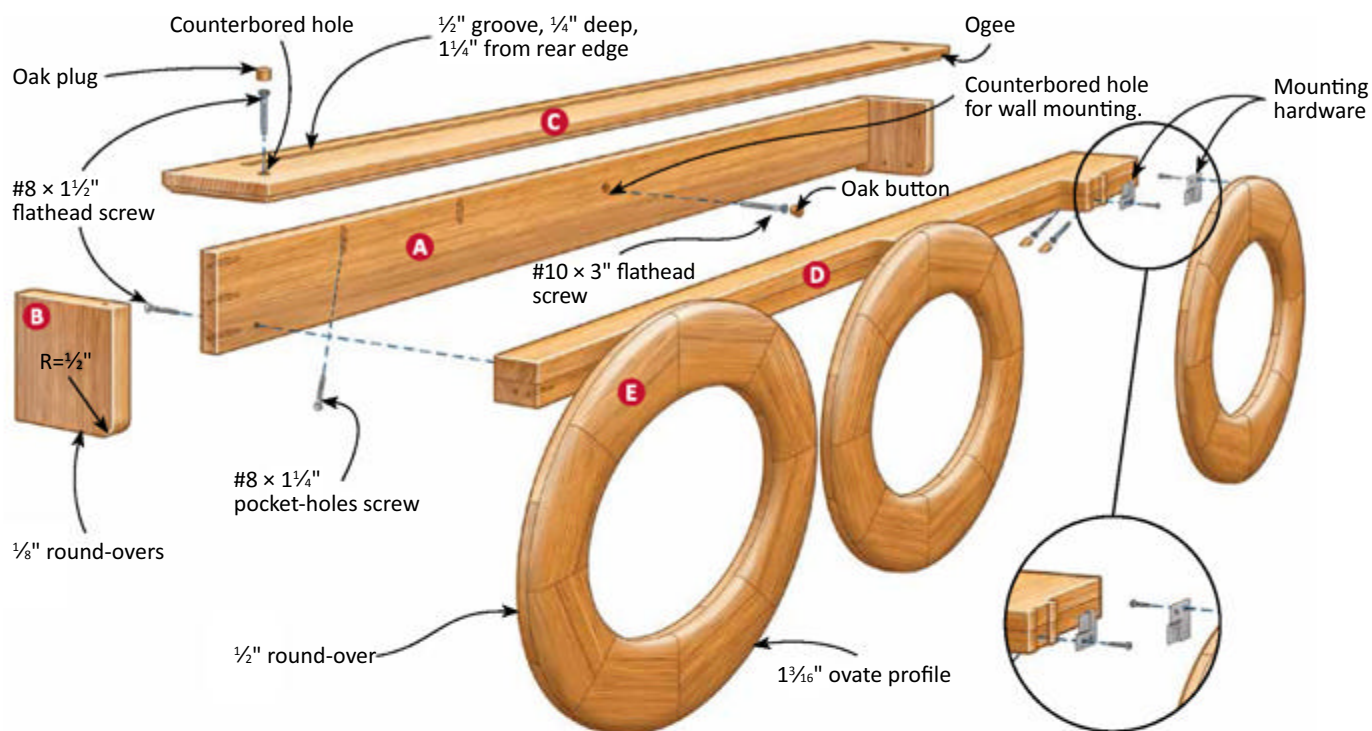
I chose pocket-hole and flathead screws to join the rack parts. I also built the oval rings with double layers of segments that are offset and face-glued together. A quarter-oval pattern helps you make the plywood template that is used to lay out and flush-trim the ovals to final shape. Surface-mounted metal

fasteners let you securely hang the ovals on the rack and easily remove them to change quilts.

Make the rack parts first

1 Referring to the **Cut List**, mill enough flatsawn and quartersawn oak for the back (A), brackets (B), shelf (C), and ovals support (D). Note in

Figure 1: Quilt Rack Exploded View



Ogee Profile



Mortise Detail

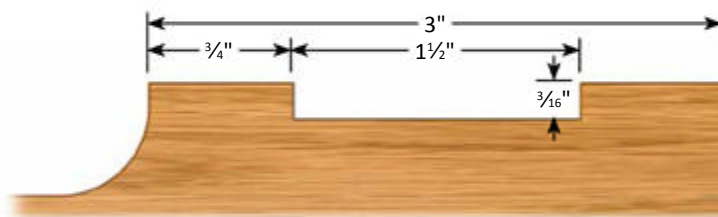


Figure 1 that the ovals support is a face-lamination made from two 3/4"-thick pieces of flatsawn oak.

2 Cut the back (A), brackets (B), and shelf (C) to size. Face-glue two oversized flatsawn boards together for the ovals support (D). Trim the lamination to 5" wide to allow for drilling. Crosscut one end square, and set it aside.

3 Adhere the brackets (B) together with double-faced tape, flushing the edges and ends. Now, bandsaw the 1/2" radius shown in **Figure 1**, cutting just outside the line. Disc-sand the curved edges to the line. Separate the parts.

4 Using a 1/8" round-over bit at the router table, rout round-

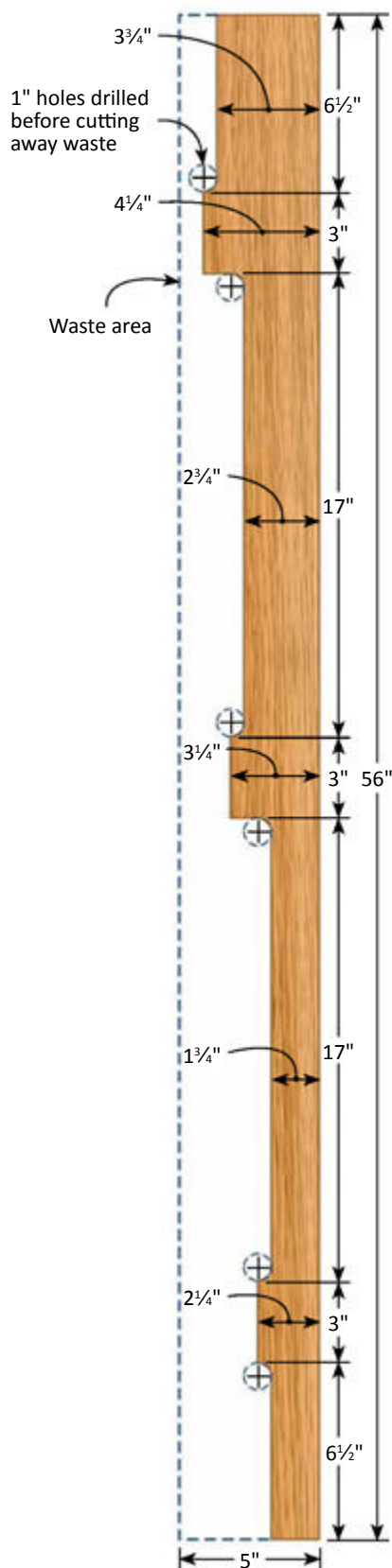
overs on the outside front and bottom edges of the brackets (B). Switch to a decorative profile bit of your choice (I used a Roman ogee bit), and rout the ends and front edge of the shelf (C).

5 Switch to a handheld router equipped with a 1/2"-diameter core box bit and an edge guide. Clamp the shelf (C) to the edge of your workbench, and rout a 1/4"-deep plate groove centered



Using a pocket-hole jig at the workbench, bore holes in the quilt rack back.

Figure 2: Ovals Support Layout



Jigsaw out the waste of the ovals support, cutting towards the holes. Use a rafter square to guide the saw along the crosscut cutlines.



Rout the mortise to the thickness of the table leaf hardware; trim to the layout lines with a sharp chisel.



Use a block to flush the hardware with the edge of the oval support; drive the mounting screws.

1 1/4" in from the back edge and stopped 3" from the ends.

6 Lay out and drill the pocket holes in the back face of the back (A), as shown in **Photo A**. I drilled three equally spaced holes for securing the brackets (B) first, and drilled the pocket holes for securing the shelf (C), spacing them approximately 8" apart. I also drilled countersunk holes at this time for securing the ovals support (D) to the back.

7 Retrieve the lamination for the ovals support (D), and lay out its shape, referring to **Figure 2** and working from the square end. At the drill press, drill the holes where marked using a 1" Forstner bit.

8 Jigsaw the ovals support (D) to shape, cutting just outside the

lines, as shown in **Photo B**. Use a wood-cutting blade with at least 14 teeth per inch. Sand the sawn edges smooth (I used random-orbit and spindle sanders).

9 Clamp the ovals support (D) to the bench. With the oval-hanging table-leaf hardware and **Figure 1** as guides, lay out the three mortises where shown (I used a marking knife for this). With a trim router and straight bit, rout the mortises, staying just within the layout lines. Clean up the mortises with a chisel (**Photo C**).

10 Place the table-leaf hardware in the mortises, mark and drill the pilot holes, and then screw just one of the two mating leaves in place, as shown in **Photo D**. (The opposing leaves will be surface-mounted to the ovals later.)



Drill centered pilot holes into the top edges of the brackets, and then drive the screws.

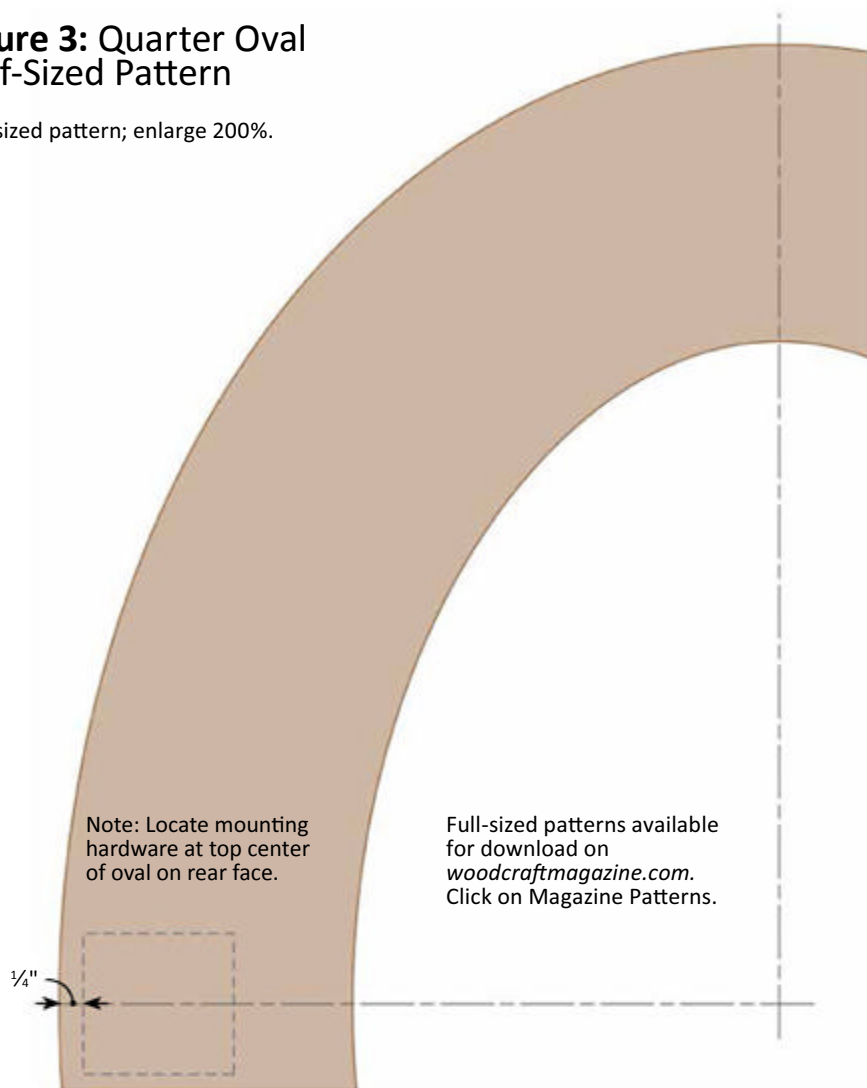
Assemble the rack

1 At the bench using pocket-hole screws, fasten the back (A) to the brackets (B), flushing the top edges. Measure the distance between the brackets, and crosscut the ovals support (D) at the unsquared end to that length. Drill a pocket hole at the narrow end of the ovals support on the bottom face. Drill two pocket holes on the bottom face of the wide end. Now, clamp the ovals support between the brackets and flush with the back's bottom edge. Fasten the part in place, screwing through the back with flathead screws and into the brackets with pocket-hole screws. Plug and flush the pocket holes with pocket-hole plugs at this time.

2 Center the shelf (C) on the rack assembly, flushing the back edge with the back (A). Mark the hole locations on the ends of the shelf, ensuring they are centered on the brackets (B). At the drill press, drill counterbored holes in the shelf. Clamp the shelf against the rack assembly. Now, drive the pocket screws through the back and into the shelf. Remove the clamps, and use the counterbored holes in the shelf to drill pilot holes in the brackets,

Figure 3: Quarter Oval Half-Sized Pattern

Half-sized pattern; enlarge 200%.



as shown in **Photo E**. Now, drive the flathead screws through the top and into the brackets.

3 Apply glue in the counterbored holes in the shelf (C). Then tap in the oak plugs, being sure to orient their grain with the shelf's grain. Flush-trim the plugs using a block plane going with the grain.

Now, make the ovals

Note: Each oval is made up of two layers, or rings, of oak that are face-glued, with the front or "show" layer quartersawn red oak and the rear layer flatsawn red oak. (I used flatsawn here to save on costs, though making the rings completely out of quartersawn

stock may be more effective at combating wood movement.) Each layer, or ring, consists of eight segments, with the grain following the circular contour of the shape. When you laminate layer on layer, offset the joints of the front layer from those of the rear layer for maximum strength. I used two $\frac{3}{4} \times 8 \times 96$ " boards for each ring. After planing, assembling, and sanding, the double-layered ovals should measure $1\frac{1}{4}$ " thick.

1 Mill enough $\frac{3}{4}$ " stock for three ovals (E). Plane the boards to $\frac{11}{16}$ " and then rip them to $6\frac{1}{2}$ " wide.

2 Make a cut mark every 12" along one edge of all of the boards (six in all). Also, mark the eight segments to come off



F

With the stop in place, miter-cut the segments to final size, maintaining the sequence order.

Righting A Ring

If a gap exists during the ring dry-fit, glue-join two sets of four sequential segments using dowel spacers, as shown in **Photo 1**. Wipe up any squeeze-out with clean moistened rags.

Next, prepare a makeshift sled to true the half rings, starting with a piece of scrap plywood that measures at least 14 × 24". One 24" edge should be straight. Set the tablesaw fence at 13" and guiding off the straight edge, cut the opposite edge parallel to the guide edge. The plywood serves to secure and guide the ring halves for truing. Adhere a half ring to the plywood with the half ring ends just proud of the plywood's edge. If the miter angles are accurate, very little stock removal is required to make the ring halves. Make the cut as shown in **Photo 2**. Now, glue-join the mating half rings to form a whole ring.



Apply glue to the ends of the joining segments of the ring halves (three joints for each ring half), and, using 1" dowel spacers between the halves, tighten the hose clamp.



Adhere a half ring to a piece of plywood with the half ring ends just proud of the plywood's edge. With the plywood against the fence, trim the half ring ends.

each board in sequence. This ensures the best grain match at assembly time. Now cut the eight approximately 12"-long pieces from the board, and stack them in the order cut. Do the same with the other five boards, and set these stacks aside.

3 Set up your miter saw for a 22½° cut to the left. Cut a scrap piece to verify the accuracy of the angle. Then, angle-cut the right-hand ends of the ring segments, again, keeping the stacks in order.
4 Swing the miter saw blade to 22½° right, and check the cut with scrap. Set up a stop to cut the left-hand ends of the segments at 11½" from toe to toe (the pointy ends of the resulting trapezoid). Keeping the same edge of the segments against the fence, as in **Step 3**, cut the segments to final size (**Photo F**). Maintain the same segment stacks as before.

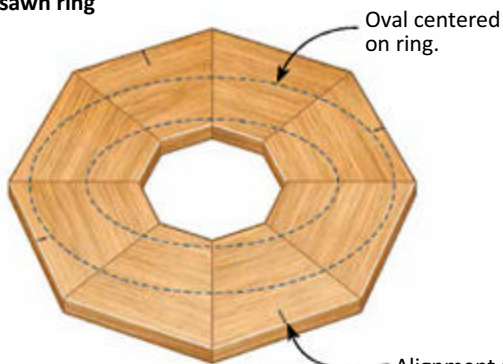
5 Working on a flat surface, dry-fit the eight sequential segments from the same board to determine if the parts join without any miter gaps. If they do, glue up the segments end to end into a ring, using a strap or hose clamp for tight joints all around. If a gap exists, see "Righting a Ring" in the sidebar at left. Repeat the segment-joining process to make all six rings.

6 Sand the rings dead flat on both faces. (If you own a drum sander, use it to flatten the rings and speed the work.) Ideally, the sanded thickness of the rings should end up at ⅝".

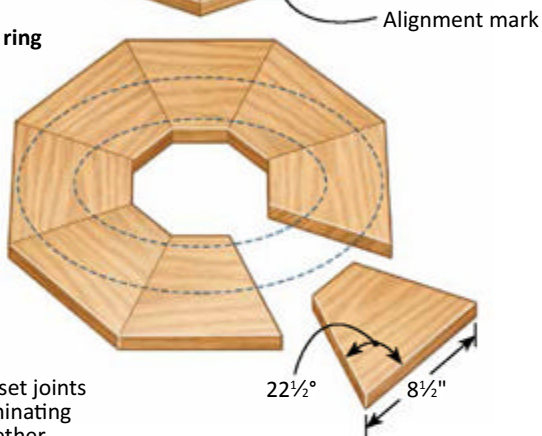
7 Mark the center on the outside edges of the front (quartersawn ring) segments. Apply glue to one face of a flatsawn ring, and place the quartersawn ring on top of it, aligning its marks with the joints of the flatsawn

Figure 4: Oval Exploded View

Quartersawn ring



Flatsawn ring



Note: Offset joints when laminating rings together.



After applying glue, align the centered segment marks of the quartersawn ring with the joints of the flatsawn ring for maximum strength in the assembled ring blank.

ring (**Photo G**). Add clamps for a firm bond. Repeat to form the three oval ring blanks.

8 Make four copies of the quarter oval pattern (**Figure 3**). Cut out the patterns, and spray-adhere them to a ½" plywood panel, aligning their ends to form an oval shape. Bandsaw and scrollsaw the oval template, cutting just outside the lines. Sand to the lines with disc and spindle sanders to remove the saw marks.

Tip Alert

I made a universal clamp-on dust-collector guard that shields the bit and helps to keep my fingers safely away from the cutter during the routing operations. Removing the debris also maintains a clear view of the machining.

9 Adhere the template on the quartersawn face of a ring blank, aligning the pattern joint lines with the corresponding segment joints. Trace the template on the blank (**Figure 4**). Remove the template. Bandsaw the oak blank to shape, cutting on the waste side. Cut the other ring blanks.

10 Reattach the template to a ring blank with double-faced tape, aligning it with the traced oval. Install a flush-trim bit in your table-mounted router. Now, for safety and better control, brace the oval against a starter pin when first contacting the bit to prevent kickback. Proceed



With the template guiding off of the bit's bearing, flush-trim edges of the oak oval. Brace the oval against the starter pin when first contacting the bit.

flush-trimming the oval, as shown in **Photo H**. Feed the work slowly at short grain joint locations when rounding the edges to avoid tear-out. Now rout the remaining two blanks.

11 Install a 1/2" round-over bit, and rout the rear (flatsawn) edges of the three ovals in several passes. Switch to a table edge bit, and rout the ovate profile on the front (quartersawn) edges of the

ovals. Note: be sure to drop the speed down to around 12,000 with the wider bit. If you don't own a variable-speed router for your router table, use the 1/2" round-over bit on both front and back edges.

Finish and hang the quilt rack

1 Referencing the location of the table leaf hardware in **Figure 1**, drill the needed pilot

holes and surface-mount the table leaf mating hardware parts on the three ovals (E) with screws. Test their fit with the hardware on the ovals support. Remove the hardware.

2 Decide where you want to mount the quilt rack on the wall. Then locate the studs, and measure and mark the screw locations on the front face of the rack's back (A), between the shelf (C) and the ovals support (D), so they're centered over the studs. Drill the counterbored screw holes for the oak buttons.

3 Finish-sand the rack and ovals through 220-grit, and then apply a stain. (I used General Finishes Danish Teak Oil Stain.) Let dry, and then apply a clear finish. (I used three coats of General Finishes Polyurethane Satin and sanded lightly between coats). Let dry.

4 Re-install the hardware, and screw the rack to the wall. Hide the screws with stained oak buttons. Place a quilt in each oval, and hang the ovals on the rack. Splay the quilts so they pleasingly overlap one another, and add a few decorative items on the shelf. Voilà! ■



About Our Designer/Builder

An accomplished woodworker from Lubeck, West Virginia, Bill Sands is a regular contributor to *Woodcraft Magazine*, having built several projects. In addition, he teaches woodworking classes at the Parkersburg Woodcraft store.

Oval-Rings Quilt Rack Cut List

	Part	Thickness	Width	Length	Qty.	Mat'l
A*	Back	3/4"	3 3/4"	56"	1	QRO
B	Brackets	3/4"	4 1/2"	4 1/4"	2	QRO
C	Shelf	3/4"	5"	60"	1	QRO
D**	Ovals support	1 1/2"	4 1/4"	56"	1	FRO
E***	Ovals	1 1/4"	14 5/8"	20"	3	FRO/QRO

*Indicates parts that are initially cut oversized. See instructions.

**Indicates that the part is made up of two or more pieces.

***Oval segments measure 6 1/2" w x 8 1/2" l. See instructions.

Materials: FRO = Flatsawn Red Oak, QRO = Quartersawn Red Oak

Hardware/Supplies: (11) #8 x 1 1/2" flathead wood screws;
(3) #10 x 3" flathead wood screws.

Convenience-PLUS BUYING GUIDE

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☐ 2.	Buttons, Oak, 3/8" Dia. Tenon, 1/2" Dia. Head, 100/pkg.	#17O21	\$5.29
☐ 3.	Kreg Pocket-Hole Screws, #8 x 1 1/4", coarse, 100/pkg.	#142246	\$4.69
☐ 4.	Kreg Pocket Hole Plugs, Oak, 50/pkg.	#141947	\$8.99
☐ 5.	Core Box Bit, 1/2" D, 3/8" CL, 1/4" R, 1/4" SH	#144119	\$15.99
☐ 6.	Whiteside Over-Under Flush-Trim Router Bit, 7/8" D, 1 1/2" CL, 1/2" SH	#149528	\$36.49
☐ 7.*	Whiteside Thumbnail Table Edge Bit (3294), 2 1/2" D, 3/4" CL, 1/2" SH	#148768	\$78.99
☐ 8.	Freud 34-126 Quadra-Cut Round Over Bit, 1/2" R, 1/2" SH	#828713	\$51.97
☐ 9.	Highpoint Table Leaf Aligners, 2-pc. Set (3 pkgs. needed)	#159302	\$3.49
☐ 10.	General Finishes Danish Teak Oil Stain, 1/2 pt.	#828516	\$8.99
☐ 11.	General Finishes Polyurethane Top Coat, Satin, 1 pt.	#85T59	\$16.50

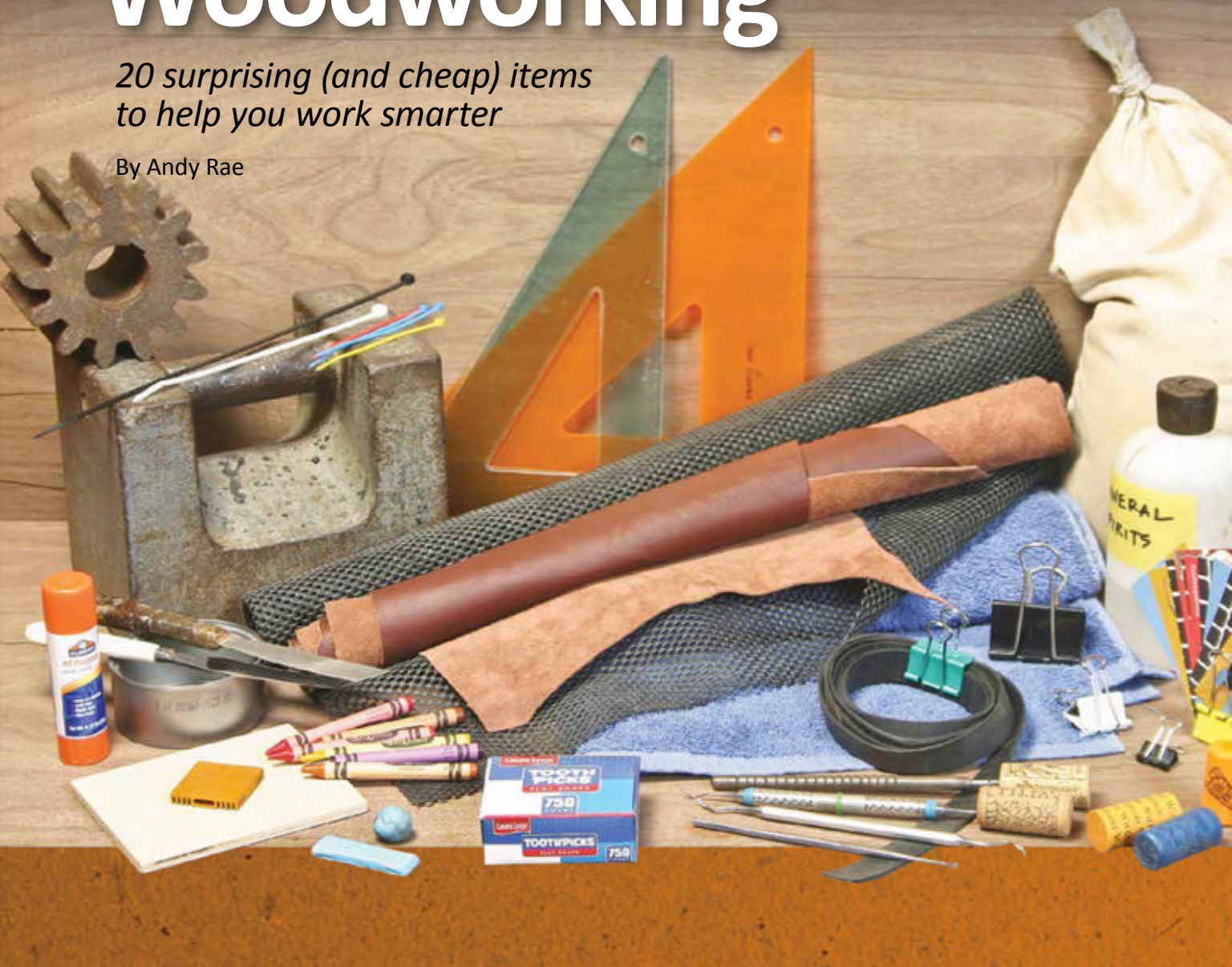
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*Bit is optional. See instructions.

Oddball Aids for Woodworking

20 surprising (and cheap) items to help you work smarter

By Andy Rae



I'm betting that the fellow who first said "one man's trash is another man's treasure" was a woodworker. After more than three decades of woodworking, I've come to rely on dozens of different objects that were never intended for furnituremaking—including a few bits and pieces of salvaged

items from the local dump—that I wouldn't want to work without.

Dumpster-diving is encouraged, but it's not a necessity. A quick rummage through your house, and perhaps stops at a few stores, can reward you with a wealth of low- and no-cost shop helpers.

In this article, I'll describe
20 of my favorite non-

traditional shop aids. Many are stone-simple, and a few are downright odd. But don't be fooled by appearances. These humble items can make you more comfortable and organized in the shop, bring a higher level of woodworking precision, and, ultimately, lead to better-looking projects.

From the Recycle Bin

Woodworkers were finding new uses for junk long before upcycling became hip. Many such items began life with different intended purposes, but later were reassigned as a woodworking aid. Still other useful items hailed from such unlikely sources as the local friendly dentist.



Bicycle and motorcycle inner tubes

These elastic strips apply pressure where ordinary clamps can't, making them invaluable for nonlinear assemblies, such as curved or twisted work. To turn a trashed tube into a valuable clamp, simply cut away the valve stem and then slice it into $\frac{3}{4}$ "- to $1\frac{1}{4}$ "-wide strips to suit your needs. If you don't have a few old tubes hanging in your garage, check out your local bike or motorcycle shops. Regular tubes are stretchy; heavy-duty tubes, made from thicker material, stretch less but are more durable.

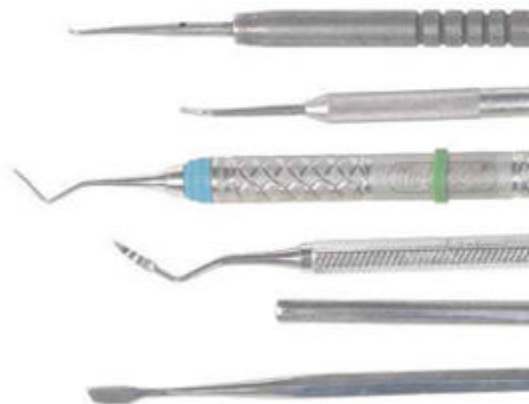


Zip ties

Named for the zippy sound they make when cinched tight, these toothed strips of plastic tie together just about anything, including dust-collection and air fittings; they're also great for keeping cord clutter to a minimum. You can borrow a few from the kitchen drawer, but in time, you should buy a selection of ties in different lengths. Unlike the trash-bag variety, better-quality zip ties can be released and reused.

Heat sink

Check your local computer store, or ask your neighborhood whiz kid, for a used motherboard and its attendant heat sink (a small square of metal with grooves etched into the underside). Attach the sink to a square of plywood, grooved side down, using hot-melt glue or double-sided tape, and keep it near your grinder. When your tool starts to get hot, holding it against the sink will remove the heat in seconds, without any risk of damaging the steel.



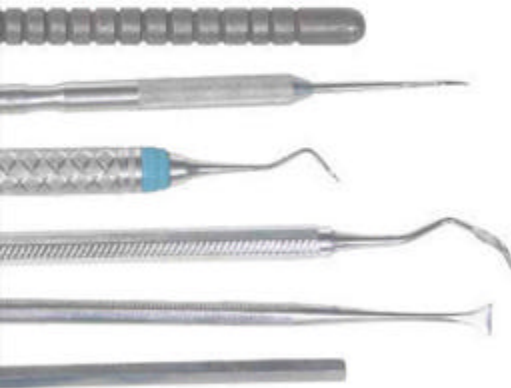
Dental tools

Make your dental visits more amenable by asking for any leftover or used prodding and poking tools. Made from high-tensile stainless steel, dental tools are highly durable and available in a variety of



Leather scraps

Leather is good for making shop accessories and for adding final touches to fine furniture. For example, gluing a thick leather piece to a wood block (regular PVA works fine) creates a persuader that's great for hammering parts together without dents. Attaching leather pads to the bottom of chair and case legs protects the furniture and hardwood floors. Thinner leather can be attached to a wood block as an elegant and soft drawer or door stop or cut into tabs and used instead of metal pulls or hinges. In addition to old belts, you can pick up an assortment of thick ($\frac{1}{4}$ ") and thin ($\frac{1}{64}$ " or less) scraps of leather at a tack (horse) shop or craft supplies outlet.



shapes and sizes. The small scraper-style tips are perfect for removing glue in tight spots, cleaning up the edge of a recess to fit an inlay, or scraping small parts to shape. Hook-edged tools let you reach around corners and into hidden pockets.



Scrap iron

I keep an assortment of heavy metal for a variety of chores. Stacking free weights on milled wood can help keep the material flat until you're ready for joinery. Stashing a few weights under vibration-prone machines, such as lathes, can provide smoother operation. Metal weights can also serve as an extra hand when laying out dovetails.

Sandbags

Sandbags can easily drape over the leg rail of a floor-standing machine to dampen vibration. As clamps, sandbags can conform to curved work and apply pressure where a standard clamp can't reach, like in the middle of a wide panel. You can buy bags from photography and sporting goods stores or make your own from play sand and canvas.

Food containers

Tuna fish and yogurt containers rank as some of the best glue and finish containers money can't buy. Besides putting products close at hand, smaller containers keep larger bottles fresh and minimize cleanup if there's a spill. Don't worry about the labels. Select containers with low centers of gravity (so parked glue brushes won't tip them over) and wide mouths (so that you can easily dip a brush or wiping pad). Reserve resealable plastic containers from your local take-out for jobs that span several days.



From Around the House

Who said a home couldn't supply a woodshop? Take a look around, and see if you can snag a few of these useful household items.

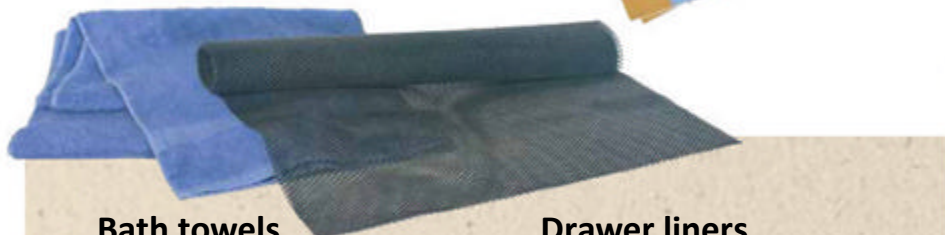


Corks

Natural cork stoppers (easily identified by cracks, fissures and other irregularities) make great point protectors. Stab the end of a cherished knife or other pointed tool into the end of a cork. Your edge stays sharp—and you stay safe. Synthetic corks (look for even texture) are highly effective at removing dust buildup from sanding discs, drums, and belts.

Playing and business cards

Business and playing cards make great shims. I use them when adjusting setups by incremental amounts, such as when setting or adjusting a machine's or jig's fence. Ranging from 0.011" to 0.014" thick (a bit less than $\frac{1}{64}$ "), you can fine-stack cards to get a perfect fit, and then deduce the amount you need to cut away or add to by "counting" the cards.



Bath towels

Did you accidentally add bleach to the laundry? Here's some good news: discolored or old (but clean) bath towels protect unfinished and finished surfaces without scratching or leaving an unsightly embossed pattern. I keep a few towels handy for sanding between finish coats or polishing the final coat.

Drawer liners

This rubbery, pliable mat is terrific as a cushion when sanding, preventing dings and scratches. It even works as a clamp of sorts, offering friction to keep parts in place as you rout or sand. The softer varieties grip better, but tend to leave impressions that require further sanding before finishing.

Squeeze bottles

Save your empty plastic shampoo, soap, or detergent bottles, and recycle them as glue, finish, and solvent dispensers. (Test the bottle with your solvent to be sure that the plastic doesn't melt or soften, and label the contents clearly.)

Toothpicks

You drilled a hole in the wrong place and must fill it before anyone finds out? Try dipping a round or square toothpick (depending on the hole's shape) in glue and then pushing it into the hole. Once the glue dries, pare the pick flush with a chisel.

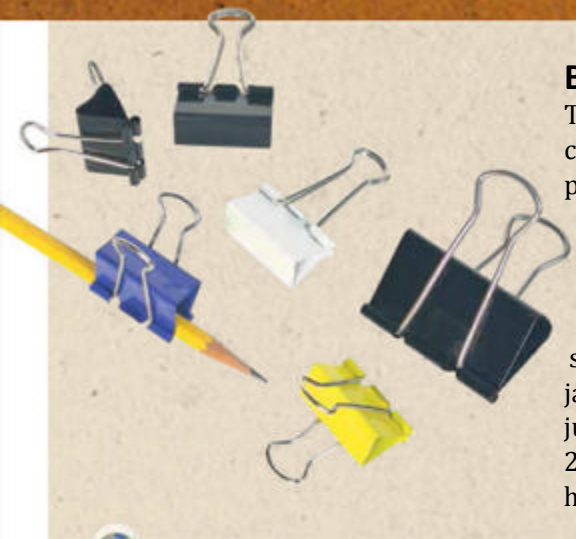
Bamboo skewers

When grilling season's over, relocate the $\frac{1}{8}$ "-diameter skewers from the kitchen to the shop. Skewers are good for spreading glue or removing it in tight spots with the super-pointy tip. Bamboo's tensile strength also makes it a good choice for pinning parts, such as when pegging small mortise-and-tenon joints. Use a fine-toothed handsaw for cutting the needed pieces cleanly.



From the Art Store

You don't have to be an artist to appreciate some of the goodies you'll discover inside the average art store. Much of the offerings cater to the drawing and drafting trade, so precision and exactitude are the order of the day.



Binder clips

These inexpensive plastic clips offer a surprisingly powerful grip, and their small size makes them great for a myriad of positioning or clamping tasks when working on small shop items. The smaller clips have a maximum jaw opening of $\frac{1}{4}$ ", while jumbo clips open as much as 2". The mid-sized "large" clip has an opening of about 1".



Palette knives

Although intended to spread paint, enlist palette knives to spread all sorts of gooey stuff better than your finger. For example, you can use a knife to push putty into holes and cracks with surgical precision or heat the blade to melt a shellac stick, and then push the shellac into a blemish. For making pinpoint repairs or for reaching into corners, simply grind the tip to suit. (Note that painter's palette knives tend to be floppy; look for a stiff blade to better handle stiffer mixes, such as putty and epoxy.)

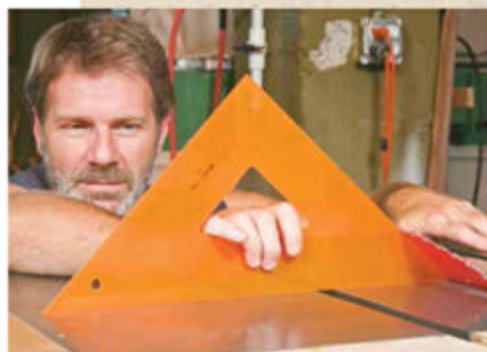


Crayons

Crayons can help minor blemishes disappear. First, apply a couple coats of your favorite finish to the work, and then fill any small blemishes by rubbing the appropriate crayon—or a combination of colors—into and over the hole. Remove most of the excess with a sharp chisel, and then level and buff it with a clean cloth. (If you plan to apply a finish, seal the patch under a coat of shellac, and then apply your desired topcoat.)

Glue stick

The sticky stick used by 10-year-olds is also good for light-duty chores, such as holding paper patterns to wood parts, attaching leather to wood, and even joining small wood pieces, as when making models. The lipstick-style tip makes application quick and clean, and the glue reaches full strength in only five minutes. Uncured glue cleans up with water.



Triangles

Looking for a dead-accurate setup tool? Often called an artist's triangle, or drafting triangle, these thin plastic triangles come in 30°/60° or 45°/90° configurations (the numbers refer to the angles on each triangle). Don't be fooled by the low price; plastic

triangles are manufactured to strict tolerances and remain true—even when dropped. A 45°/90° triangle (I prefer the larger 12" model) is a handy tool for calibrating machine fences, bits and blades for square, and setting mitersaws or miter gauges for making perfect 45° miters. ■



Pop-Up Tugboat

Get under way with this bandsaw-built telescoping toy.

By Ric Hanisch

When deciding on a toy to make for my grandson, I found myself considering the kind of “pop-up” construction used to manufacture spiral-cut Shaker baskets and the collapsible camping cup I had as a Boy Scout. The technique allows tapered telescoping pieces to lock in place when spread apart, and it worked well for making this toy boat. (Although the project won’t telescope after it’s assembled, the tapered cuts are a quick and easy way to create a boat with curved parts that automatically fit into each other.)

Building procedures and patterns are provided here for this specific design, but once

you understand the approach, you can take the helm and get inventive. The trick to making any caricature like this is to observe and distill the characteristics that define the subject. For this project, I studied various boats to identify the elements that said “tug,” and then exaggerated the forms and curves to arrive at this design.

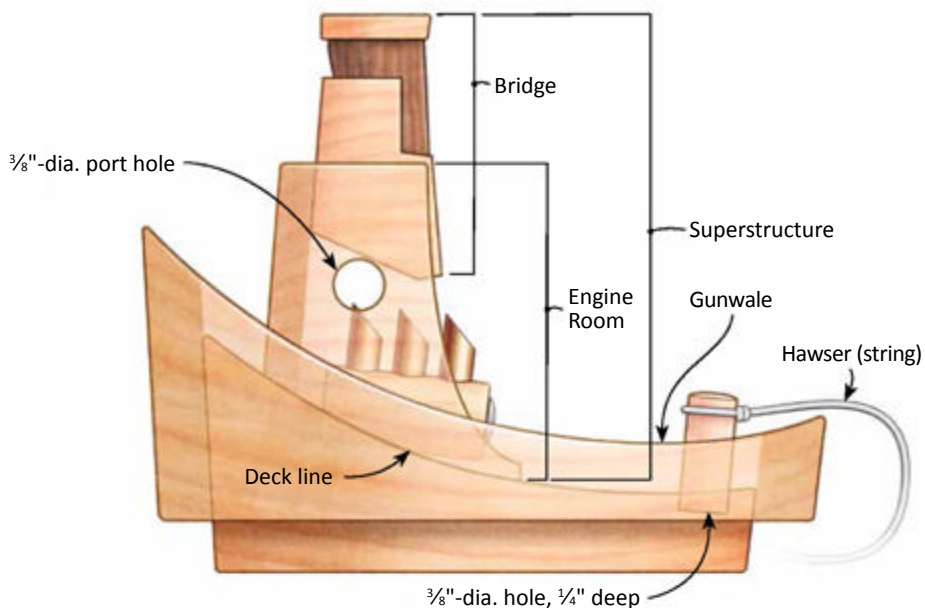
Creating the engine is particularly fun. Use a cartoonist’s eye when looking through your miscellaneous parts boxes or the small parts drawers at the hardware store. Bits of tubing, odd washers, and doohickeys of uncertain provenance can

suddenly become intake manifolds, newkular fusion condensers, and carbuncle pumps! (This supercharged three-banger engine sports carburetors of brass tubing.)

After adding any of your own refinements, such as capstans, winches, bumpers, ventilators, ladders, or perhaps a figurehead, it’s time to release your tug from dry dock. However, note that this is a DL-class (Dry Land) tugboat. She’ll float beautifully on hardwood harbors where a keel would just get in the way. In water, she’ll capsize. Add a weighted keel and some marine varnish if you want a bathtub-worthy version.



Figure 1: Tug Boat Sections



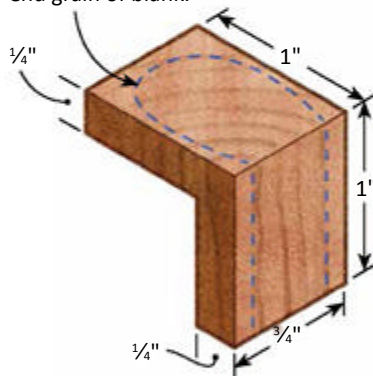
Prepare the patterns and block

1 Enlarge and copy the patterns on page 41, use spray adhesive to adhere them to manila folder stock, and then carefully knife them out. (The patterns are also available at WoodcraftMagazine.com. Click on "Patterns.")

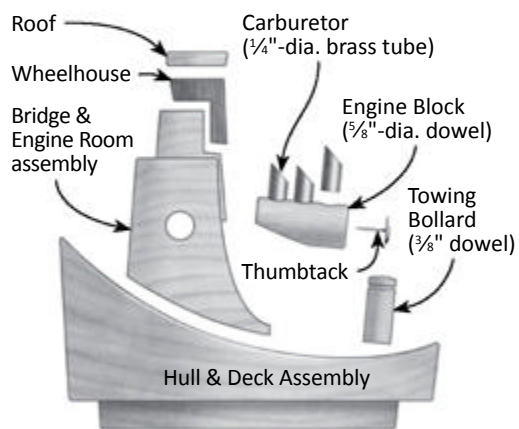
2 Cut a block of wood to $3 \times 3\frac{1}{2} \times 6\frac{1}{2}$ ". I used poplar, but soft maple, clear pine, basswood, or other mild-grained wood that's not too dense will work well.

Wheelhouse Blank

Trace "roof" piece onto end grain of blank.



Exploded View



Blades, Test Blocks, And Pop-Up Construction

"Pop-up" construction works because tapered telescoping parts lock up when slid apart a certain distance. That distance is determined by both the amount of saw table tilt and the blade kerf width. Therefore, it's wise to make test blocks with your chosen blade, especially if you're experimenting with various designs.

For this boat, I used a $\frac{1}{4}$ " 4-TPI blade that cuts a .050"-wide kerf. (A narrower blade will cut a smaller radius, but it won't sweep curves

as smoothly.) Before starting on the project, I used the blade to make two telescoping blocks, as shown in the photo at right. These showed me the amount of projection I could expect using different saw table angles and revealed the smallest radius the blade would cut. Whatever blade you choose, make sure it's very sharp, and take some test cuts in scrap to check the results before committing to your project.





A Trace the curve of **Pattern A** onto the side of the block, marking the Length Overall (LOA) and Superstructure (SS) locations.

3 Place **Pattern A** on a 3" side of your block, aligning the straight sides of the pattern flush with the top and end of the block. Now carefully trace along the gunwale curve while holding the pattern



B Trace the Hull on both sides of the centerline. Use the **Deck Pattern D** to check that the pinned Hull Pattern isn't distorted.

securely. Mark the Length Overall (LOA) and Superstructure (SS) locations (**Photo A**), and then use a square to extend the marks fully across the edge of the block. **4** With the bandsaw table set square to the blade, carefully cut the curve. This is cut #1 in the sequence shown in **Figure 2**, and it will create the Hull and Superstructure blanks. Put the Superstructure block aside for now.



C Saw to the outermost Hull line with the bandsaw table tilted at 4°. Aim to leave just the pencil line on the outer perimeter.

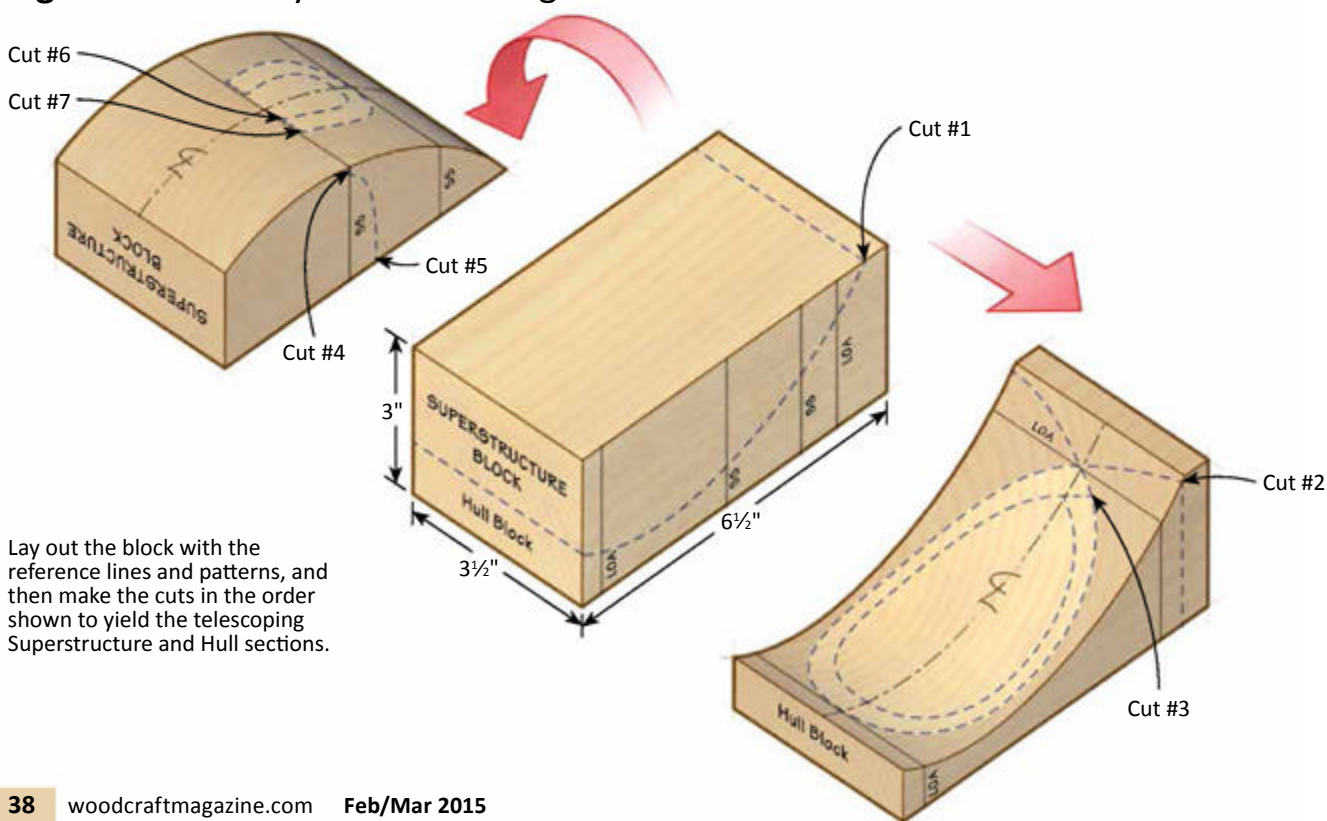
Make the Hull

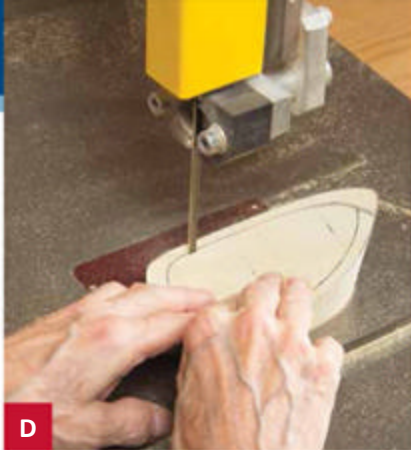
Note: From this point forward, all angled cuts should be made with the table tilting downward at its outer edge and the part being cut on the lower side of the table.

1 Scribe a centerline on the curved surface of the Hull block. Carry the LOA and SS locations across the curve.

2 Pin **Pattern B** to the Hull blank so that it abuts the centerline and fits between the LOA lines.

Figure 2: Block Layout and Cutting Order





Saw as smoothly as possible to the innermost Hull line, leaving just the pencil line on the Hull piece. Don't back up to correct an errant cut.

Trace the inner and outer Hull lines, and then flip the pattern over and trace the opposite half of the Hull (**Photo B**).

3 Extend the outer Hull curve to the right-hand edge of the block, where shown in **Figure 2** to create a lead-in cutline. Now, tilt your bandsaw table to 4°, and make the outer Hull cut (#2), as shown in (**Photo C**). Then sand away any fuzz on the bottom surface.

4 Leaving the table at 4°, make the inner Hull cut (#3), as shown in **Photo D**. Since a good fit between the Hull and Deck depends on a kerf of consistent width, don't back up to try to correct. At the end of the cut, carefully hold both parts in place while you turn off the saw, and then maneuver the blade free of the kerf.

5 Press the Deck piece downward so that its bottom surface projects about $\frac{3}{8}$ " from the Hull's bottom edge. The Hull should squeeze the Deck in place when the kerf at the bow is pinched closed. If the kerf doesn't quite close, sand a wee bit off the Deck perimeter (being careful to maintain the cut angle), or plan on gluing in a sliver later to fill the gap. Any offset at the closed kerf can be sanded off after glue-up.



Make sure the open end of the centered engine room pattern (C), is aligned with the upper SS line, and carefully trace the shape.



Make the short, straight cut of the Engine Room curve first, and then begin the long curve from the other side of the block.

Make the Superstructure

1 Scribe a centerline along the convex surface of the Superstructure block where shown in **Figure 2**. Then square the SS lines across the block to create intersecting lines for locating the horseshoe-shaped **Engine Room Top Profile Pattern C**. Align the pattern with the centerline and SS lines, pin it in place, and then carefully trace around the pattern, using your fingers as additional hold-downs, as shown in **Photo E**.

2 Place **Pattern E** on the side of the Superstructure block, and trace along the aft curve, as shown in **Photo F**. Set the saw table square to the blade,



Align the blunt tip of **Pattern E** with the upper SS line on the Superstructure block, and trace along the Engine Room curve.



After making the innermost cut to free the Bridge, saw the outer line to shape the Engine Room. In both cases, enter at the side shown.

Tip Alert

To allow a blade to cut a slightly tighter radius, use a honing stone to ease the trailing corners, as explained on page 20.

and make the cuts (**Photo G**), beginning with cut #4, and then following up with cut #5, where shown in **Figure 2**.

3 Set the saw table to 3°, and make the two U-shaped cuts that will free the Bridge and Engine Room (**Photo H**). Start the cuts (#6 and #7) where indicated in **Figure 2**, with the cutouts on the lower side of the table to ensure correct telescoping.



Tape over your saw throat opening to prevent the freed Bridge Roof from falling into it.

Make the Bridge

1 To make the Bridge Roof, slice about $\frac{1}{8}$ " off the top of the Bridge section, with the saw table remaining at a 3° angle. Feed the piece, as shown in **Photo I**, to ensure a Roof of consistent thickness.

2 Raise the Bridge until it's snug within the Engine Room section. Clamp the two pieces in a handscrew, as shown in **Photo J**, and then mark the curved profile of the Engine Room onto the rear wall of the bridge, offsetting the line about $\frac{1}{8}$ ". Also mark a cutline about $\frac{1}{4}$ " up from the bottom edge of the Bridge to make room for the Engine below. Finally,



Trace the shape of the Roof onto the end-grain section of the L-shaped Wheelhouse block.



Mark the profile of the Engine Room onto the Bridge, mark a cutline $\frac{1}{4}$ " from the bottom end of the Bridge, and mark the Wheelhouse notch on the top end.

lay out a $\frac{1}{4}$ "-deep notch for the Wheelhouse, marking its lower end about $\frac{1}{4}$ " up from the top end of the Engine Room section.

3 Use a handsaw to rough out the cuts, and then sand a slight crown on the aft face of the Bridge.

Make the Wheelhouse

1 Make the L-shaped Wheelhouse block. The dimensions shown in **Figure 2** are approximate, so amend them as necessary to match the measurements of your particular Bridge. Use the Roof piece you sliced off the Bridge to mark the shape on the end-grain



Use a handscrew to support the Engine Room section so its bottom is square to the table for drilling the portholes one at a time.

leg of the Wheelhouse (**Photo K**). Then belt-sand the curved face of the Wheelhouse to inset it a bit from the Bridge and Roof, as shown on the boat in **Figure 1** and the lead photo on page 36.

2 Use a $\frac{3}{8}$ " brad-point bit in the drill press to bore the portholes in the Engine Room (**Photo L**). Clamp the piece, keeping its centerline horizontal if you use a drill press. Using the same bit, drill a $\frac{1}{4}$ "-deep hole for the Towing Bollard about $\frac{1}{4}$ " in from the aft end of the Deck.

3 Cut a $\frac{3}{8}$ "-diameter dowel to length to make the Towing Bollard. When inserted in its Deck hole, it should project about $\frac{1}{4}$ " above the gunwale (the upper edges of the Hull). Chuck it in the drill press, and sand a shallow dome on the top end. Then use a small file to turn a groove for the hawser string.

Sand and assemble the parts

1 Lightly sand the Deck, taking care not to completely remove the SS lines, as you'll need them to locate the Superstructure. (If necessary, use the pattern to reestablish them.) Slide the Hull section up, and mark along its lower edge to demarcate the gluing area on the sides of the Deck section. Apply glue to the section, and clamp the Hull to the Deck with one clamp extending bow to stern, and another clamp perpendicular to the first, pulling the sides in. After the glue cures, sand the top edge and outside of the Hull, easing any corners in the process.

2 Sand the outside of the Engine Room section, and ease any sharp edges on it and the Bridge. Mark the gluing area on the Bridge, apply glue, and slide the Bridge upward into position. If necessary, clamp sideways across the Engine Room to pinch the Bridge in place until the glue dries.

3 Glue the Towing Bollard into its hole in the Deck.

4 Apply glue to the unsanded bottom edge of the Engine Room, and press it onto the Hull between the SS lines. Let the glue cure.

Make the Engine

1 To make the Engine Block, begin with a $\frac{5}{8}$ "-diameter dowel about 6" long for safe handling. Referring to the **Figure 1 Exploded View**, saw off a $\frac{3}{4}$ "-long wedge that approximates the curve of the Deck. Use **Pattern A** as a rough guide, and then sand and test-fit. Crosscut the dowel to $1\frac{1}{4}$ " long to create the Engine Block.

2 Outfit your drill press with a $\frac{1}{4}$ " Forstner or brad-point bit. Mount the Engine Block and support pieces in a drill press vise (or handscrew), as shown in **Photo M**, and drill $\frac{1}{4}$ "-deep holes for the brass tubing.

3 Cut the end of a length of $\frac{1}{4}$ "-diameter brass tubing at 45° , as shown in **Photo N**. Then crosscut the piece so it protrudes $\frac{3}{8}$ " from the Engine Block. Repeat to make two more lengths. Finish up with a light sanding to chamfer the sharp edges, and then epoxy the pieces into the Engine Block.

4 Chuck a $\frac{1}{2}$ " thumbtack in the drill press, and sand it with 220-grit paper to produce a brushed finish. Then drill a hole in the



Bore the holes for the brass tubing with the Engine Block dowel and its waste wedge placed on a support block and clamped in a drill press vise.

aft end of the Engine Block, and epoxy the tack in place. Finally, apply glue to the underside of the Engine Block, press it in place, and let the glue cure.



Clamp the brass tubing within a slotted hole to hold it while you use a cutoff wheel in a rotary tool to slice the end at an angle.

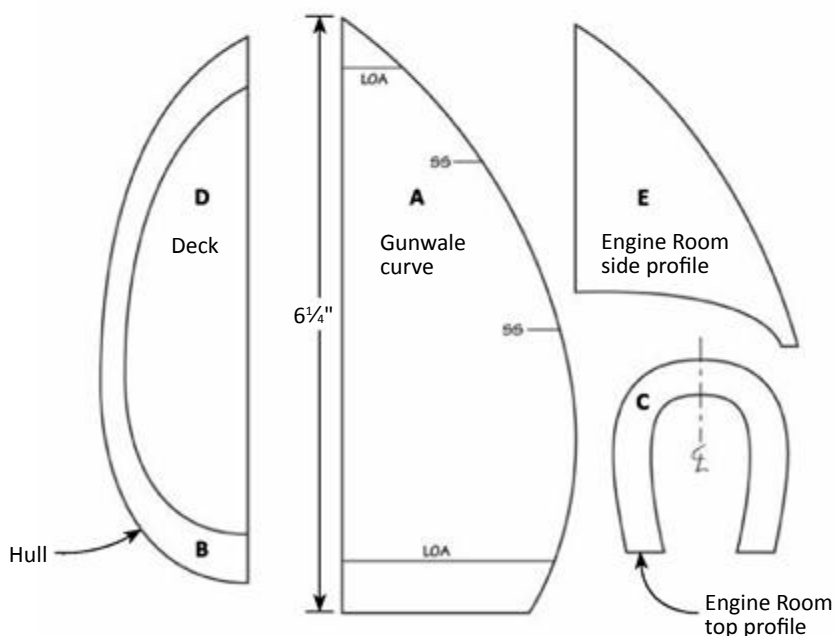
5 Tie one end of a stout string to the Bollard, tie a loop in the other end, and get underway. *Something* needs towing. Just watch out for giant lobsters! ■

About Our Author

Ric Hanisch is a designer who enjoys being part of the process, from idea to finished project. He resides at Last Resort in Bucks County, Pennsylvania, where he is an active partner in Art Farm, a collaborative community.

Pop-Up Tugboat Patterns

Half-sized patterns; enlarge 200%.



Full-sized patterns available for download on woodcraftmagazine.com. Click on Magazine Patterns.

Shaker-Style Dining Table

Tackle the mortise work with a simple shop-made jig.

By Chris Hedges



Overall Dimensions: 35"w × 72"l × 29½"h

Trestle tables are one of the oldest and most popular furniture designs for many solid reasons. Homeowners love how a trestle table's clean lines complement almost any interior décor and appreciate the way the I-beam base provides more leg room for diners than traditional four-legged tables with aprons. Woodworkers gravitate to the design for more practical reasons. Compared to other designs, trestle tables are simple to build and make surprisingly efficient use of material. In addition, the top can

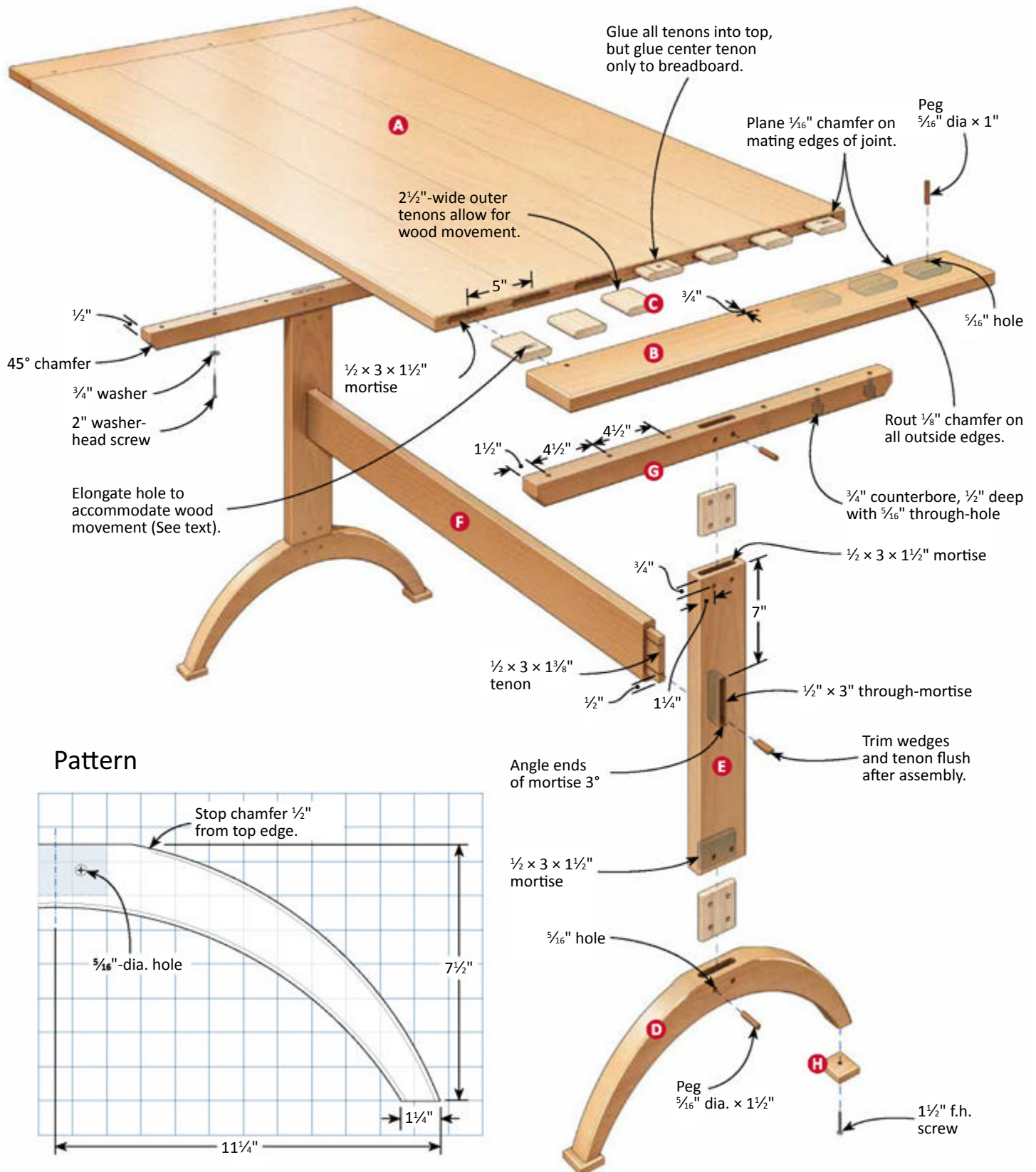
be removed, enabling this large project to be easily shuttled from the workshop to the dining room.

My table is solidly rooted in eighteenth-century Shaker design, but I made a few changes to suit a modern woodshop. Most noteworthy is my use of loose tenons to attach the breadboard ends and to assemble the table's base. With help from a plunge router equipped with a spiral bit and my multipurpose mortising jig, you can quickly and accurately make the needed joints while bypassing more time-consuming traditional methods.

Despite its airy appearance, this table is built to last, so take your time when selecting stock and pay close attention to symmetry and grain flow when laying out parts. Odds are good that your kids will pass this table down to your grandkids.

Builder's note: To avoid the hassles that come from mid-construction wood movement, mill all stock to rough dimensions (about 1-2" longer and ½" wider) prior to working on each subassembly. Mill and assemble each subsection before moving to the next.

Figure 1: Table Exploded View



1 Square = 1"
For full-sized patterns, visit woodcraftmagazine.com.

Make the top

1 Select your most attractive 5/4 material for the top (A) and breadboard ends (B), and match your boards edge to edge. (When working with rough-sawn stock, I take a few passes with a hand plane to reveal the grain.) After orienting the boards in their desired configuration, number the end-grain surfaces for reorientation after final planing.

2 Joint and plane the boards for the top (A) (see "Tabletop Tips," below) and breadboard ends (B). Referring to the **Cut List**, rip the middle boards to width, but leave the two outer boards 1/4" wider. (At this point, leaving the boards long allows you to slide them back and forth to achieve the best grain match.) Mill the breadboard ends to match the top's thickness, and cut them 2" longer than final length.

3 Arrange the boards in their original orientation, and glue up the top. Position the clamps every 16", alternating them on either face to prevent bowing.

4 After the glue joints have cured, rip 1/4" off of each side at



A track saw excels at trimming wide tabletops. If you don't have one, make a plywood straightedge for use with a standard circular saw.

the tablesaw. Using a router, cut a 1/8" chamfer on the long edges of both the top and bottom faces. Next, crosscut the top panel to 63" long. To do this, I used a track saw (**Photo A**). Alternatively, you can use a standard portable circular saw and a store-bought or shop-made straightedge guide.

Add the breadboard ends

1 Make the mortising jig shown in the sidebar on the facing page.

2 Clamp the breadboard ends (B) face to face to the top (A) so that the inner edges are flush

with the ends of the top and the breadboards are centered across the width of the top. Then lay out the mortises on the adjacent parts, where shown in **Figure 1** and as shown in **Photo B**. Mark the parts so that they remain paired with their mate and maintain the same orientation throughout the assembly process.

3 Using a plunge router equipped with a 3/4" guide bushing and a 1/2" spiral upcut bit (see the **Buying Guide**), rout the 1 1/2"-deep mortises on the top and breadboard end, as shown in **Photos C** and **D**. (Note: To

Tabletop Tips

Even on a well-matched panel, a glue line running down the middle of a tabletop can attract unwanted attention. To avoid this, make the top from an odd number of boards. For a 6" jointer, this means seven 5"-wide boards, or five 7"-wide boards if you own an 8" jointer. When thicknessing, consider leaving your stock 1/32" thicker than final thickness in case the top requires flattening after assembly.

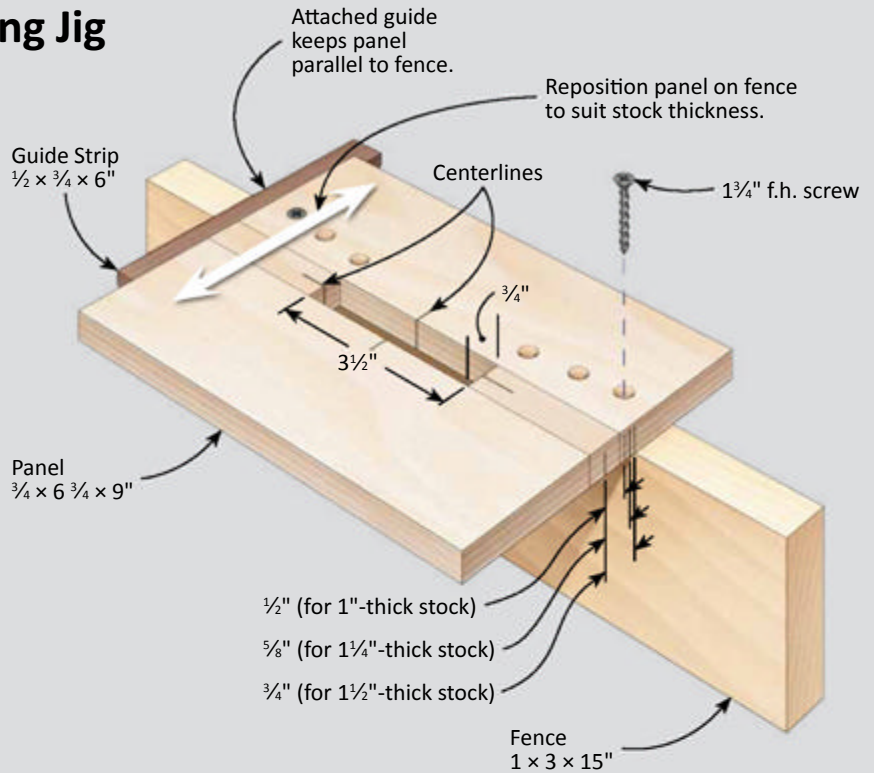


To save time and ensure joint alignment, stack the breadboard on the top and lay out the both rows of mortises at once.

Multipurpose Mortising Jig

Partnering this jig with a plunge router, an upcut spiral router bit, and a guide bushing creates the loose-tenon mortises used to assemble the tabletop and base, as well as the through mortises in the posts, for the stretcher. To accommodate different stock thicknesses, simply reposition the template panel according to the reference lines on its edge.

To use the jig, lay out centerlines for each mortise. Then screw the jig panel to the fence, aligning the two for the desired stock thickness. Now align the panel cutout's reference lines with the centerline of a mortise location, and clamp the jig to the stock. Adjust the bit depth, set the router on the panel, and plunge the ends of the mortise to full depth. Continue routing out the remaining material in $\frac{1}{4}$ " increments. (For a cleaner cut, remove the router and vacuum out the debris about midway through each mortise.)

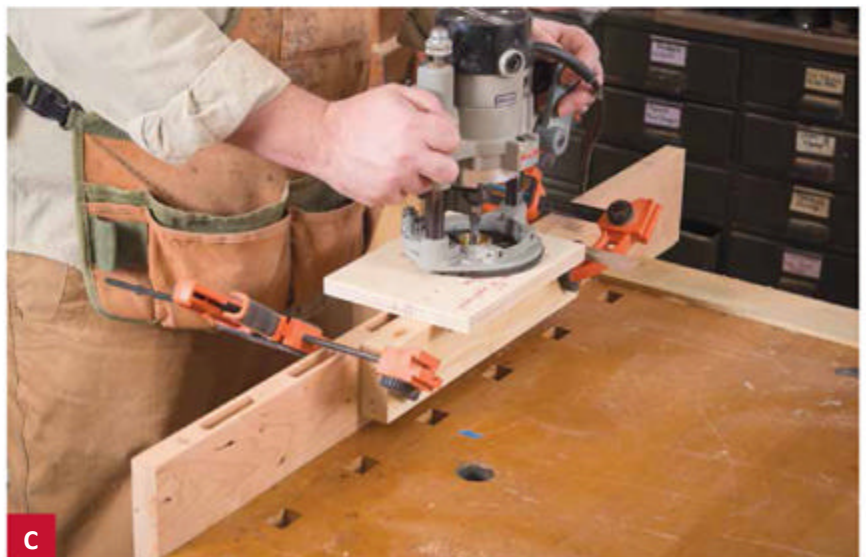


If your stock isn't thickened precisely, or if the panel isn't perfectly set on the fence, the mortise may wind up a hair off-center. To help ensure

that mortises mate perfectly, simply orient the jig so that the fence registers against a common face (top/bottom, or inside/outside) of both parts.

ensure that the mortises line up, orient the jig so that the fence registers against the same face of the top and breadboard end through the routing sequence.)

4 To make the loose tenons (C), first thickness hardwood strips to $\frac{1}{2}$ ". (Test the stock on the actual mortise. Aim for a friction fit.) Then, rip the strips to 3" wide. To allow the top (A) to move independently of the breadboard end (B), rip enough material to make twelve 2 $\frac{1}{2}$ "-wide outer tenons for the top (A). Next, round over the edges of the strips to match the mortises. (I used a $\frac{1}{2}$ " half-round bit in the router



Align the jig's crosshairs with the centerlines on the breadboard end, clamp the jig in place, and then rout the breadboard end mortises.



D

Clamp the tabletop firmly to the bench and the jig to the tabletop's edge; elevate yourself as shown and plunge-rout the mortise.

table; alternatively, you can use a $\frac{1}{4}$ " round-over bit and finish each edge in two passes.) Now, cut the tenons to length.

5 Apply glue to the mortises in the top (A), and insert the loose tenons (C). Next, draw centerlines across the width of the center and two outermost tenons, and

Tip Alert

Grooves in the faces of the 3"-wide loose tenons allow excess glue a means of escape. To create these grooves, I used a V-gouge; you can also saw shallow kerfs in the strips prior to cutting the tenons to length.

extend mortise centerlines onto the top face of the top (A).

6 Dry-fit the breadboard ends (B) to the top (A), and extend the centerlines you made in the previous step onto the top faces of both breadboards. Referring to **Figure 1**, mark out the holes for the pegs. Using a drill and $\frac{5}{16}$ " brad-point bit, bore both center peg holes through breadboard ends and center tenons. Next, remove the breadboards, and then drill the outermost peg holes through just the breadboard ends.

7 Reassemble the top, and apply clamping pressure to draw the breadboard ends tightly against the ends of the top. Now mark the holes in

the outermost tenons by first inserting a handheld $\frac{5}{16}$ " brad-point bit into each outermost hole in the breadboard ends, and twisting the bit while pressing it against the tenon. Then remove the breadboard ends, and mark a point on each tenon inward $\frac{1}{16}$ " from the drill point mark. Use the $\frac{5}{16}$ " bit to bore a hole through each tenon at this new point. Referring to **Figure 1**, lay out a pair of lines tangent to each outermost hole and parallel to the ends of the top. Using these lines as guides, carefully create the $\frac{3}{4}$ "-long slots using a round file or chisel (**Photo E**).

8 Plane a slight ($\frac{1}{16}$ ") chamfer along both ends of the top and inside edges of the breadboards. Then, brush glue onto the center tenon only, and put the breadboard ends (B) back in

Tip Alert

To ensure perfectly perpendicular holes, stand the bit against the edge of a squared scrapwood block when drilling.



E

Elongating outermost tenon holes allows cross-grain movement of the top. Stay inside the lines so that the breadboard remains tight to the top.

Seasonal Considerations

Because the top moves independently from the breadboard ends, it's important to consider the time of year when trimming the ends. When building during the humid months, it's OK to cut the ends flush because the top is likely to shrink. In drier months, trim the breadboard ends $\frac{1}{8}$ " to $\frac{3}{16}$ " longer (on both sides) so that the top will not expand past the breadboard end when the weather changes.

place. Cut six pegs about $\frac{1}{2}$ " longer than the thickness of the breadboard ends, and use a pencil sharpener to chamfer the ends for easier insertion. Drive the center peg completely through the top (A). Next, drive the outer pegs halfway in, coat the holes on the underside of the table with glue, and then drive the pegs through the joint. Finally, saw and then sand the pegs flush with the top.

9 Trim the breadboard ends (B) to length. To do this, I clamped a straightedge parallel to the top's edge and routed the overhanging portion with a bearing-guided spiral bit. Alternatively, you can saw and plane the ends. Just make sure to plan for future wood movement (see "Seasonal Considerations", facing page).

10 Rout a $\frac{1}{8}$ "-wide chamfer along the outside edges of the breadboard ends to match the top. Set the assembled top (A/B) aside for now.

Make the base

1 From 8/4 stock, mill two pieces of wood to $1\frac{1}{2} \times 7\frac{1}{2} \times 24$ ". Mark a centerline across the width of each board, and extend that line across the top edge. Using the pattern on page 43, make a half-pattern of the foot. Align the pattern with the centerline on the face of a foot blank, trace the pattern, and flip the pattern on the centerlines to draw the complete foot (D).

2 Set the mortising jig fence to rout a centered slot in $1\frac{1}{2}$ "-thick stock. Next, align the centerline on the jig panel with the mortise centerline, clamp the fence to the top edge of one of the foot blanks, and then plunge-rout a $\frac{1}{2} \times 3 \times 1\frac{1}{2}$ " mortise (**Photo F**). Repeat with the other foot blank.



Register the mortising jig on the upper edge of the foot blank and rout the mortise.

3 Using a bandsaw, cut each foot to shape, staying just outside the lines. Finish shaping the feet using a combination of hand tools and machinery. (As much as I enjoy using a spokeshave, as shown in **Photo G**, there's nothing wrong with using a disc sander on the convex edges and a spindle sander to tackle the concave sections.) Rout $\frac{1}{8}$ " chamfers along the outer edges, where shown in **Figure 1**. Leave the bottom-most edges unchamfered.

4 From 5/4 stock, mill the material to make the posts (E) and stretcher (F). Cut the parts to the sizes listed in the **Cut List**. Put the stretcher aside for now.

5 Referring to **Figure 1**, lay out centerlines on the ends of both posts (E) for the blind mortises. Also lay out (on the outside face of each post) the through mortises that will accept the stretcher (F) tenons. Include centered crosshairs to aid in the placement of the jig when setting up to cut the through mortises.

6 Adjust the jig to rout a centered mortise on $1\frac{1}{4}$ "-thick stock, and then rout the $\frac{1}{2} \times 3 \times 1\frac{1}{2}$ " mortises on both ends of each post.

7 Remove the jig's panel from the fence, and apply double-sided

tape to its bottom face. Now align the panel's crosshairs with the crosshairs on the outside face of a post (E), and clamp the panel to the post to ensure a good bond. Rout the through mortise, and then carefully pry off the panel (**Photo H**). Repeat with the remaining post.



A spokeshave will quickly remove saw marks on the feet, although you could use a power sander to do the job instead.



H Remove the tape-held jig panel after routing a mortise through the post. Note that the post is securely clamped atop scrap to back up the cut.



I Flare each end of the post mortises about $\frac{1}{8}$ " outward by guiding a chisel against an angled block clamped to the outside face of the post.

8 Using a mitersaw, crosscut a small block to 87° . Clamp the block to one end of the mortise on the outer face of a post, and use it as a chisel guide to flare the ends of the mortise (**Photo I**) so that the wedges will lock the stretcher (F) to the posts (E).

9 Using a handsaw (**Photo J**), or else a dado set and miter gauge outfitted with an auxiliary fence, cut the $\frac{1}{2} \times 3 \times 1\frac{5}{8}$ " tenons on both ends of the stretcher (F). (Note: You want the tenons to

stick through the posts by at least $\frac{1}{8}$ ".) Referring to **Figure 1**, kerf the tenons for the wedges. Finally, rout a $\frac{1}{8}$ " chamfer along the outside edges of the stretcher.

10 From $8/4$ stock, cut the braces (G) to the dimensions in the **Cut List**, and saw a 45° chamfer on the ends, where shown in **Figure 1**. Rout $\frac{1}{8}$ " chamfers along the ends and bottom edges of both braces.

11 Lay out mortise centerlines on the top face of each brace (G). Adjust the mortising jig fence to rout a centered slot in $1\frac{1}{2}$ "-thick stock, and then rout the mortise in each brace. Finally, use a drill press to bore the $\frac{3}{4} \times \frac{3}{8}$ "-deep blind holes and the $\frac{5}{16}$ " through holes used to attach the base to the top (A/B).

Finish and assemble the table

1 Brush glue into both end mortises on one post (E), and insert a loose tenon (C) in each. If needed, use a bar clamp to ensure that the tenons seat completely in the mortises. Wipe away any excess glue that squeezes from the joints that may interfere with future assembly. Allow the glue to dry, and then apply glue to the

foot (D) mortise, and clamp the pieces tightly together. Repeat with the other post and foot. Drill $\frac{5}{16}$ " holes for dowels, where shown in **Figure 1**, insert dowels, and then trim flush. (Note: A properly glued loose-tenon joint doesn't need reinforcement, but I used pegs in case the glue should fail sometime in the future.)

2 Referring to **Figure 1**, saw out four wedges to secure the leg assemblies to the stretcher (F). (When selecting a contrasting wood, choose a split-resistant stock such as oak or ash.) Apply glue onto the cheeks of the stretcher's tenon, position the stretcher between the two foot/post assemblies (D, E) and then use clamps to draw the tenon shoulders against the posts. Apply glue into the kerfs and onto the wedges. Then, tap the wedges in, as shown in **Photo K**. When dry, trim the wedges flush.

3 Brush glue into a brace (G) mortise, place it onto the loose tenon projecting from the top end of a post (E), and then clamp the two together. (To avoid denting your project, position a block of softwood or rigid foam between the clamp and bottom edge of the foot.) Repeat with the remaining



J Measure the length of the mortise along the inside face post, and then saw the tenons to fit.



K

Clamp the stretcher between the posts, and then tap the wedges into the kerfs in the stretcher's tenons.

brace. Drill $\frac{5}{16}$ " holes for dowels, where shown in **Figure 1**, insert dowels, and then trim flush.

4 Cut the footpads (H) to the dimensions listed in the **Cut List**. Plane or rout a $\frac{1}{8}$ " chamfer along the top edges, and then attach the pads to the ends of the feet with glue and $1\frac{1}{2}$ " screws. (Countersink the shank holes so that the screw heads can't scratch.)

5 Sand the assembled top (A/B) and base (D-G) through 220

grit, and then apply the finish of your choice. (I applied two coats of General Finishes Enduro-Var on the base [sanding between coats with 360-grit Abralon sanding pad], and four on the top. After allowing time for the



L

Center the base on the underside of the top, and then assemble using 2"-long washer head screws.

finish to cure, I finish-sanded the surfaces with a 500-grit pad, and then applied a coat of wax.)

6 Center the base on the underside of the top, and attach it using $\frac{3}{4}$ " washers and 2" washer-headed screws (**Photo L**). ■

Shaker-Style Dining Table Cut List

	Part	Thickness	Width	Length	Qty.	Mat'l
A*	Top	1"	35"	63"	1	C
B*	Breadboard end	1"	4½"	35"	2	C
C*	Loose tenon	½"	3"	2⅞"	18	P
D	Foot	1½"	7½"	22½"	2	C
E	Post	1¼"	4"	19"	2	C
F*	Stretcher	1"	4"	47¾"	1	C
G	Brace	1½"	1½"	30"	2	C
H	Footpad	½"	1⅞"	1⅜"	4	C

* Indicates that parts are initially cut oversized. See instructions.

Materials: C=Cherry, P=Poplar

Hardware: $\frac{5}{16}$ " cherry dowel, (12) $\frac{3}{4}$ " washers, (12) #8 × 2" washer head screws, (4) #8 × 1½" f.h. wood screws.

Convenience-PLUS BUYING GUIDE

☐ 1.	Whiteside 2305 Chamfer Router Bit, ½" SH, ⅝" CL × ⅞" CH- 2¼" OL	#24L18	\$28.49
☐ 2.	Whiteside 5150 Spiral Upcut Router Bit, ½" SH, ½" D, 1 ½" CL, 3" OL	#03K35	\$56.99
☐ 3.	Brass Router Bushing, ¾" OD × ⅜" ID	#144693	\$8.09
☐ 4.	Bushing Lock Nut	#144695	\$8.09
☐ 5.	Freud 82-510 Half Round Bit with Bearing, ½" SH, ¼" R, 1" CL	#830678	\$64.47
☐ 6.	General Finishes Enduro-Var, Satin, quart	#151030	\$29.99
☐ 7.	Mirka Abralon 6" Sanding Disc, 2-pack	#153542	\$12.99

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

About Our Author

Chris Hedges discovered his passion for furnituremaking after beginning a career as a sociology professor. He then enrolled in the University of Rio Grande's woodworking program, and soon thereafter won the 2007 Freshwood

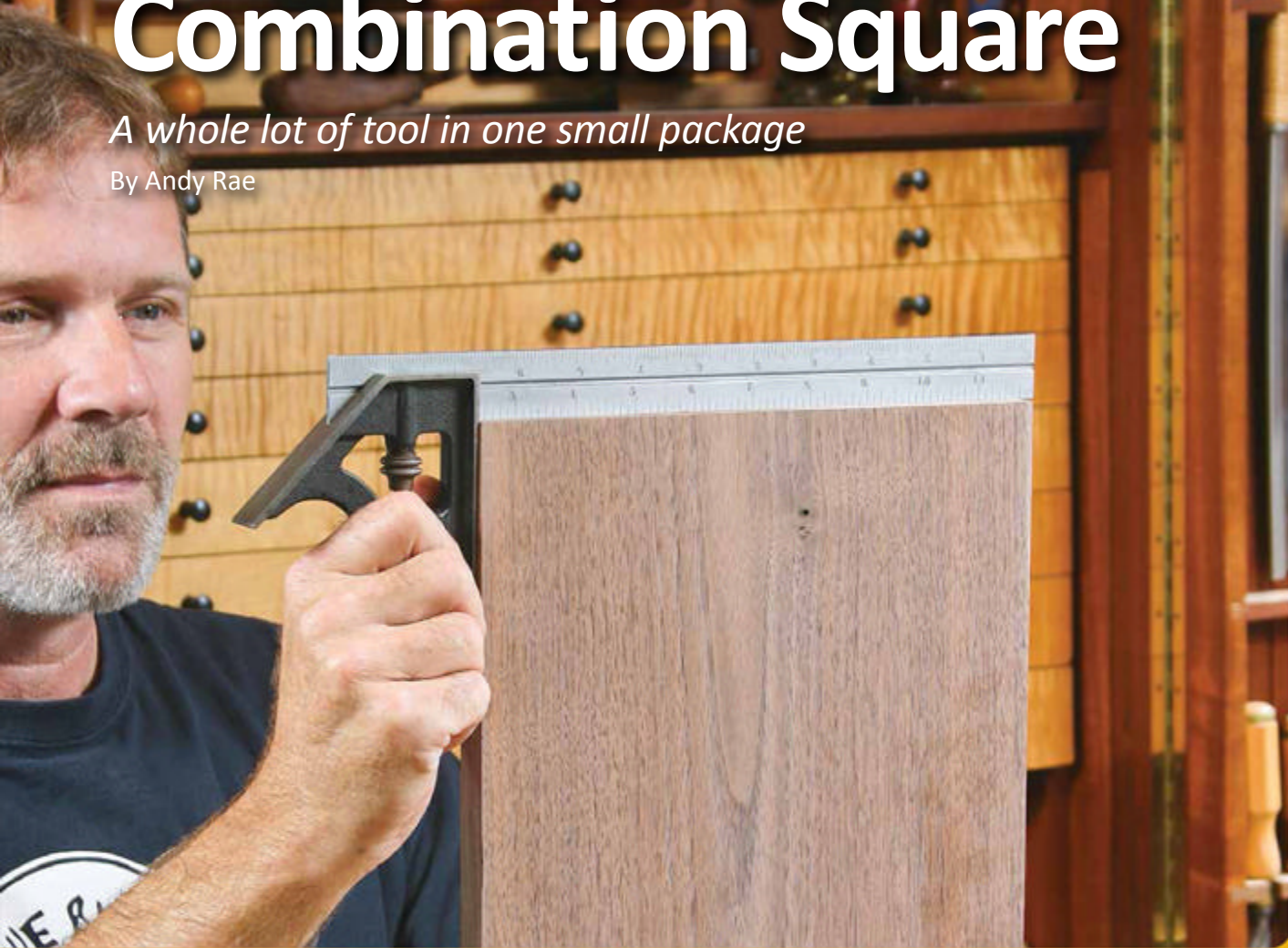
Competition for his highboy secretary. Chris now runs AedanWorks from his home in Athens, Ohio, and works at the Woodcraft retail store in Parkersburg, West Virginia.



The Multitalented Combination Square

A whole lot of tool in one small package

By Andy Rae



Far more than just a tool for checking “square,” the combination square is a do-all shop tool. With its sliding ruler locked to the head, you can use it as a depth gauge, a marking gauge, a miter square, and a try square. Loosening the lock in the head releases the rule for use as a straightedge or ruler. In a pinch, you can employ the head as a small level, and a sharp awl tucked inside is always at the ready for marking. Thanks to these attributes, you can turn

to a combo square to true up workpieces, lay out joints, and set up shop machines—all with a degree of precision that elevates its status over other tools.

To ensure this level of accuracy, the first order of business is to acquire a square that’s worthy of your work. Not all combination squares share the same quality and ease of use. In this article, we’ll take a look at the parts and nomenclature of combination squares, and I’ll describe what to look for in a good tool. Following

that, I’ll discuss the two arenas in which the tool excels: measuring and laying out. Measuring includes performing machine setups, such as squaring bits and blades to tables and fences, as well as checking joints and assemblies for accuracy. Laying out involves making marks on your work, from drawing parallel lines and angles to marking centerlines and pinpointing hardware locations. Read on to find out how to put this extremely versatile tool to good use.

Sizing up a square

If you want precision and predictability in your work, you'll need an accurately made tool. Referring to **Anatomy of a Combination Square** (right) keep the following features in mind when shopping for a combination square.

The best squares are made from forged or tempered steel or a combination of both, and should last beyond your lifetime. Look for smoothly-machined contact faces on the head and a ruler with finely etched markings that increase accuracy and allow you to target even $\frac{1}{64}$ " increments (**Photo A**). A satin chrome finish is preferable to a shiny surface, as it reduces glare under bright light, making reading easier.

The ends of the ruler on a high-end tool are ground square, for precise measuring and layout, and for verifying parallel and square. Cheaper versions are chopped, often leading to rough, out-of-square ends that inhibit accuracy.

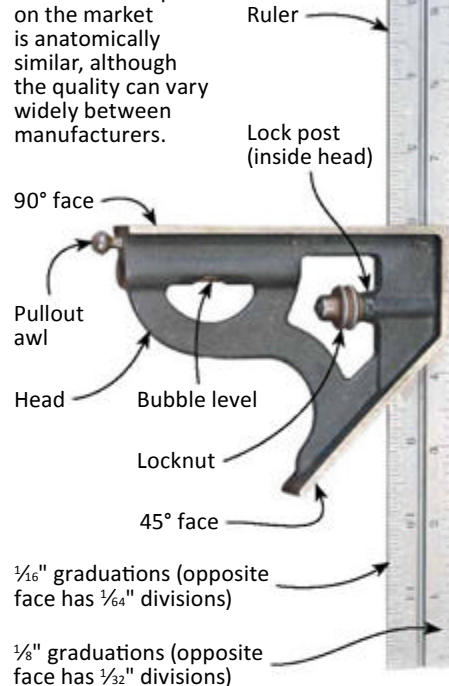
Because the ruler on a combination square is graduated

differently on all four edges, you'll often need to reverse it in the head for the measuring needs at hand. So look for a rule that slides out smoothly, and a lock post that rotates easily inside the head so you can flip the ruler over and then reinstall it without struggle. With the locknut tightened, the ruler should feel solid and never slip or creep in the head during use. Last, but not least, a good tool will lock dead square and stay that way at any point along the ruler. This degree of accuracy comes at a cost, though: quality squares are two to five times the price of cheap hardware-store versions.

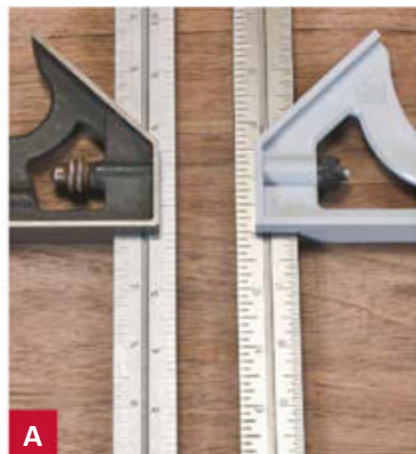
Before relying on any square, first check its precision at 90°. If you have a reference square that you know to be accurate, simply nest it against the square in question, inside-to-outside and then outside-to-inside, holding them up to a strong backlight to ensure that they mate exactly.

Anatomy of a Combination Square

Virtually every combination square on the market is anatomically similar, although the quality can vary widely between manufacturers.



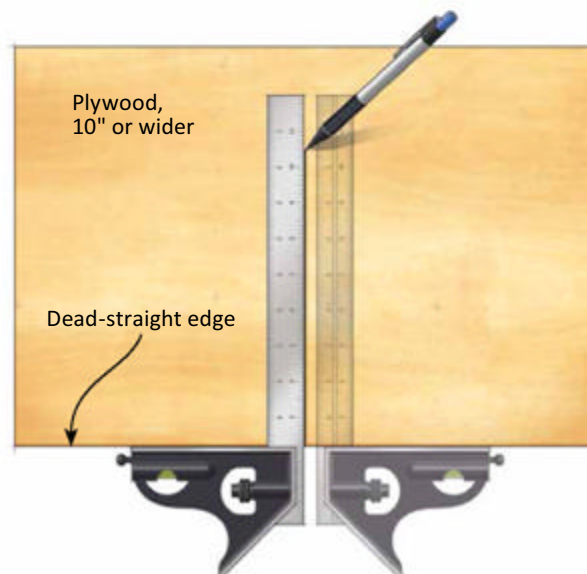
Alternatively, you can check a square using a mechanical pencil or knife, and a panel with a dead-straight edge, as shown in **Figure 1**. If you're square is out of whack and you paid more than \$40 for it, I recommend returning it.



Unlike the square at right, with its plastic head and stamped increments, the all-steel square at left has a smooth-sliding ruler with clear, etched markings.

Figure 1: Checking a Square for Square

1. Place square against straightedge and mark a line.
2. Flip square and move close to mark. If ruler is parallel with mark, square is square.



Measuring

A combo square really shines when it comes to determining dimensions. This includes calculating distances, such as the depth of a mortise or the thickness of a board, as well as measuring relative surfaces, like the angle on the end of a board or the squareness of a drawer or other box construction.

As for simply checking inside and outside corners, a combination square mimics a traditional brass-and-wood try square in every way, except that the sliding ruler on a combo square adds a lot of versatility. And thanks to its tempered and forged-steel construction, a combo square can withstand more knocks and dings than its softer brass counterpart.

The “try” in the tool’s name refers to offering the tool up to the work to test whether adjacent surfaces are flat and square. Perhaps the uncertainty of the word “try” stems from the fact that misreadings are common due to poor technique. The key is

to place the head onto the work first, and then slide it firmly along the surface until the rule contacts the adjacent surface. Look for any light (or shadow, depending on your situation) between the work and the rule. If you see even a tiny glimmer, the work is out of square.

To measure inside corners, use the outside of the square. Retract the ruler about $\frac{1}{16}$ " into the head, and then position the square so that the blade and body touch the work (**Photo B**).

To read outside corners, extend the rule so it’s at least as long as the surface being measured, and position the head on one surface before sliding the rule against the other surface (**Photo C**). The best scenario is to view the work directly in front of a strong light source, with your eyes level with the ruler. This arrangement lets you see even the tiniest light leaks at the rule, as shown in the photo on page 50.

Because most miter cuts result in a 90° joint when assembled, it’s prudent to make a final



For inside corners of drawers and casework, check at the top, bottom, and middle of the construction to gauge both square and twist.

check by holding two miters together and then checking for square on the inside or outside corner. Nevertheless, testing the miter itself is the first step, and the miter square will get you there. To check for 45°, hold the angled face against the work (**Photo D**). Because the head’s 45° face is relatively small when used for larger work, you can balance the tool by sliding the ruler past center to help counter the weight of the head.

As an adjustable end gauge, a good combo square offers the advantage of having a sliding rule



Use the outside of the head and rule to square a miter gauge to the tablesaw blade, touching the rule to the plate instead of the teeth.



Check a miter cut for 45° by holding the angled face against the work, and then sliding the tool until the rule touches the adjacent surface.



Inspect tenon cheeks for parallelism to the work face by extending the rule to the cheek and sighting for intimate contact.



F A combo square can take a measurement of a router base-to-bit distance as reference for setting fences and jigs for dado and groove work.



G Check a mortise's depth by holding the head on the work while sliding the rule into the recess until it bottoms out. Lock the rule, and then read the distance.

with precision-ground, square ends. You can use the ends in several ways. The best technique is to register the head first, slide the ruler until the end touches the work, and then lock the rule to take a reading. For example, to gauge parallelism of tenon cheeks, hold the head against the stock, and push the rule until the end contacts a cheek. Look for full contact between the rule and the cheek, as the slightest gap tells you the cheek isn't parallel with the face of the stock (**Photo E**).

You can measure between nonlinear surfaces—such as

the distance from the edge of a router baseplate to the perimeter of a bit—by registering the head against the router base, and extending the rule to touch the bit (**Photo F**).

Checking the depth of mortises and other stopped recesses is easy. Simply register the head on the work, and then slide the rule until it bottoms out in the mortise (**Photo G**). Smaller, 6" combo squares, with their $\frac{3}{4}$ "-wide rules, are most convenient for typical woodshop mortises and other common excavations.

You can also use a combo square to check if your boards are the same thickness from side to side and end to end—good info during the machining and dimensioning stage. Lock the ruler so its end is even with one corner of a board, and then check the other three corners using the same setting (**Photo H**).

Of course, you can also use the ruler on its own to measure distance. On a good square, the marks are accurately milled to the end of the rule, allowing you to butt the end to a surface and read from there (**Photo I**).



H To check a board for consistent thickness, extend the blade to one corner, and then compare at the other corners, feeling for flush with your finger.



I Set up a marking gauge by butting the rule against the gauge's fence and aligning the knife or pin to the desired increment.

Laying out

Accurate layout is an equally important aspect of the combination square's talents. In addition to drawing square and 45° lines across your stock (and other angles, as I'll describe), a combination square lets you lay out dimensions, thanks to its graduated ruler. And using the end of the rule as a guide, you can draw lines at precise distances from the edges of your work.

For making long layouts, manufacturers offer accessory blades in lengths of 18", 24", and 36", all of which will fit their 12" combo square head. These allow the precise layout of dadoes and grooves in cabinetry and other large-scale work (**Photo J**).

Another very useful accessory is a protractor head, which is handy for projects that involve a lot of angles. Starrett's protractor head, to name one, allows pivoting the rule to any angle from 0° to 180°. Fitting a long ruler to the head increases the versatility of the tool.

A combo square is commonly used as a substitute for a



J A 24" accessory ruler makes laying out and squaring dadoes and other long joints easy and accurate.

marking gauge when drawing parallel lines. Just set the ruler to the desired distance, place the head against the work, and draw the square towards you while pressing a pencil against the end of the rule (**Photo L**).

When marking multiple, identical hardware locations, such as those for drawer and door pulls, employ two (or more) squares set to key offset dimensions (**Photo M**).

By mounting an accessory centerhead on your rule, you can quickly and easily mark center on round or square stock. To find center on a round object, just press the head against the stock, and draw or scribe a line along the inside edge of the rule.



K Precise angles are a snap to lay out with a protractor head. The easy-to-read scale on this Starrett model is marked in 1° increments (inset).

Rotate the square approximately 90° and repeat to make a cross mark at dead center (**Photo N**). As a bonus, the head doubles as a miter square for marking 45° angles on the ends of mitered stiles, rails, and other parts. ■

About Our Author

Andy Rae is an award-winning furnituremaker whose career spans several decades. He has authored a number of books on woodworking, including *Choosing & Using Hand Tools* (Sterling Publishing) and *The Complete Illustrated Guide to Furniture and Cabinet Construction* (Taunton Press).



L A combo square has a longer reach than most marking gauges, allowing layout of parallel lines at a greater distance from the board edge.



M Set two squares to key dimensions for locating hardware on a series of identically sized drawer fronts or other parts.



N Use a centerhead to find the axis of round stock, marking two lines approximately perpendicular to each other.

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Rockin' Rolling Pin

Lay down the dough with this kitchenware essential.

By Nick Cook



Rolling pins have been around for thousands of years. They're used to flatten and shape dough in making cookies, pastas, pizzas, specialty breads, and pie crusts. They come in a variety of shapes and sizes and can be made of wood, metal, clay and glass. They can be long and skinny or short and fat, with and without handles. I have been turning rolling pins for more than 25 years. My father always referred to them as a HAT, or Husband Alignment Tool.

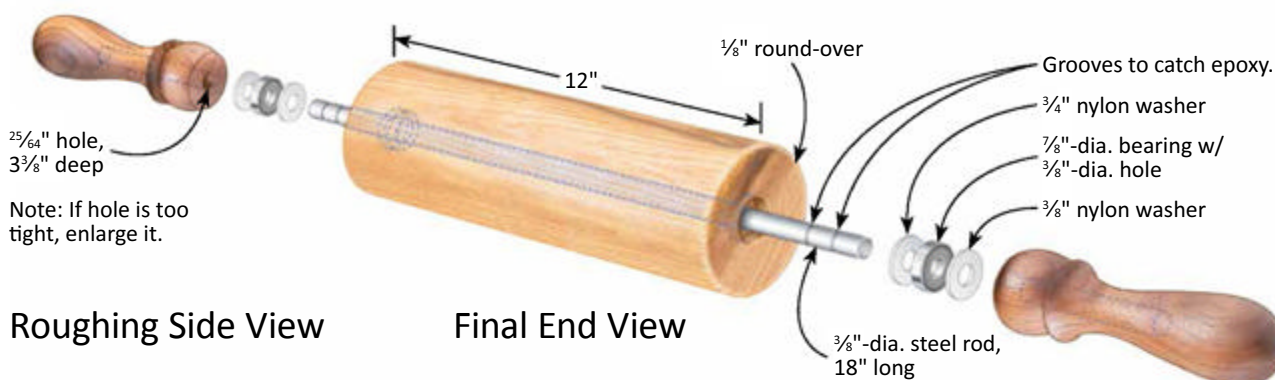
Indeed, in early cartoons, rolling pins were shown as weapons wielded by angry housewives.

I began making handled rolling pins when I started working with master turner Rude Osolnik. He made laminated pins with short round handles. While I served as his assistant in many demonstrations, he would frequently turn most of the pin and then ask me to duplicate the handle on the opposite end. Most of the time it worked out.

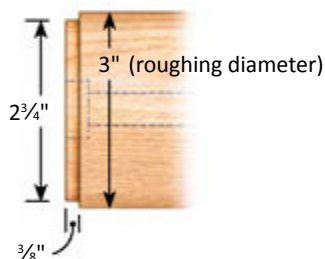
There are two basic types of rolling pins: rod-style rolling pins, which are long, thin, and usually made of wood; then there is the roller style. These are shorter, fatter, and with thinner handles. In the next few pages, I'll show you how to make the latter, employing a kit for the rolling mechanism and attaching the handles. (See "What You Need to Get Started" at right.) You'll learn the basics for turning a perfect cylinder and duplicate handles.



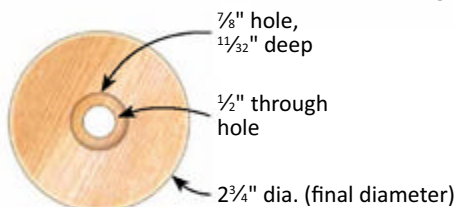
Figure 1: Rolling Pin Exploded View



Roughing Side View



Final End View



Prep the rolling pin cylinder

1 Before drilling the holes in the blanks for the roller pin and handles at the lathe (my preferred method, since this approach centers the holes and makes them straight and true), properly square up the blank material. Now, locate the centers on each end of the blanks (I used a center finder), and mark them with an awl or punch. Set the handle blanks aside.

Note: When turning the rolling pin blank, use a 12"-long tool rest. You can buy one and a post that matches your lathe's rest assembly at Woodcraft.

2 Mount the roller blank between a spur center and cone center. (For the prepared



What You Need To Get Started

For the roller-style rolling pin shown, you need three separate pieces of wood. The first is a 3"-square × 12"-long tight-grained hardwood blank for the roller. The other two blanks should be of a contrasting hardwood and measure 1 1/2" square × 6" long for the handles.

If you want to skip drilling through the long roller cylinder, buy a pre-drilled rolling pin blank as seen above (walnut, #158782, **\$29.99**; maple, #158780, **\$22.99**; cherry, #158779, **\$19.99**; and curly maple, #158781, **\$29.99**). These blanks include both the through hole and 7/8" recess, allowing you to skip **Steps 1, 5, and 6** under **Prep the Rolling Pin Cylinder**. Regardless of which way you go, you'll also need the Rolling Pin Hardware Kit below, #158761, **\$19.99**. For these items, visit a local Woodcraft store, go to woodcraft.com, or call (800) 225-1153.

Tip Alert

Sand or grind the corners off the jaws of your caliper so they don't catch when checking a diameter.





blank, use the roller jam chuck in **Figure 2** and cone center.) Turn it to a 3" cylinder with a $\frac{3}{4}$ " roughing gouge at 1,500 rpm.

3 Switch to a parting tool or bedan, and turn a $\frac{3}{8}$ "-long $\times$ $2\frac{3}{4}$ "-diameter tenon at each end of the roller (**Photo A**).

4 Replace the spur center (or jam chuck) in the headstock with a scroll chuck. Tighten the jaws on the tenon at one end of the cylinder. Adjust the tool rest, and true up the end of the cylinder by shaving it with a spindle gouge.

5 Lower the speed to 500 rpm, and turn off the lathe to prepare for drilling. Install a Jacobs chuck

and a $\frac{7}{8}$ " Forstner bit in the tailstock. Now, drill a $\frac{7}{8}$ " recess, $1\frac{1}{32}$ " deep, in one end, checking with a depth gauge (**Photo B**).

6 Switch to a $\frac{1}{2}$ " brad-point bit, and drill into the roller end for the through hole. (I start the through hole with a short bit because it flexes less than the longer bit.) Then install a longer bit (see the **Buying Guide**) to achieve the needed depth, as shown in **Photo C**. A piece of tape $6\frac{1}{2}$ " from the end of the bit establishes the needed depth. Turn the blank end for end and repeat **Steps 5** and **6**. The holes should meet in the center.

1,500 rpm, making a tenon that fits your chuck. Reverse the jam chuck blank in the scroll chuck, and turn this exposed end to match the roller jam chuck shape in **Figure 2**. You want the stepped tenon to fit snugly in the $\frac{7}{8}$ " and $\frac{3}{8}$ " holes in the roller blank (**Photo D**).

2 Fit the tailstock with a conical live center, and mount the roller blank between centers. Start with a parting tool or a bedan, and with the lathe running at 1,500 rpm, make a cut about 1" from each end to establish a $2\frac{3}{4}$ " final diameter. Check the cut depth with either a caliper or a vernier scale (**Photo E**).

3 Position the tool rest parallel to the axis of the lathe and as close as possible to the workpiece. Rotate the material by hand before turning on the lathe to ensure the rest does not

Tip Alert

When drilling deep holes, back the bit out often to cool it and clear the flutes of debris.

Turn and finish the roller

1 Turn a roller jam chuck to drive the roller blank. To do this, mount a $2 \times 2 \times 2$ " block in the four-jaw scroll chuck, and turn the exposed end round at





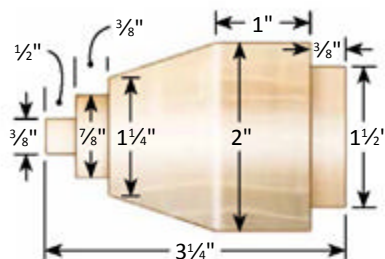
contact the turning. Now, with a $\frac{3}{4}$ " spindle roughing gouge at 2,000 rpm, roughly turn the blank to remove the waste and any lumps and bumps. Guide your index finger along the tool rest to accurately turn a true cylinder, one that is the same diameter from end to end. Continually check the diameter along the cylinder with a caliper.

4 Make a light planing cut with the skew, as shown in **Photo F**, to remove any imperfections and leave a surface that requires very little sanding. If uncomfortable using a skew, use a sanding block with 80-grit sandpaper to even out the high areas, or make an extremely light cut with a spindle roughing gouge while riding on the bevel. You want to maximize the length of the bevel to support the cutting edge and avoid tear-out. Check the diameter with a caliper.

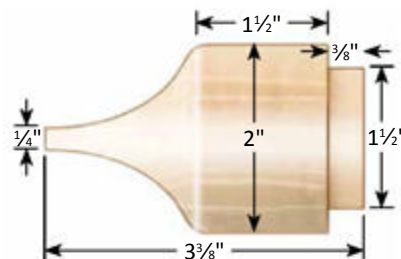
5 Use a straightedge (**Photo G**) to check the end-to-end trueness of the roller. Touch up

Figure 2: Jam Chucks

Roller Jam Chuck



Handle Jam Chuck



if needed, recheck, and then cut a $\frac{1}{8}$ " round-over on the edges with $\frac{3}{8}$ " spindle gouge.

6 Next, sand the roller through 220 grit. Wipe it clean, and finish. I use paper towels to apply any finish on the lathe. The finish should be food-safe and easily refreshed. I first apply mineral oil without the

lathe running and then turn the machine on at a moderate speed and burnish the oil into the wood with a fresh paper towel. I then use a block of beeswax and rub the surface with the lathe running at a slow speed, as seen in **Photo H**, followed by a dry paper towel to polish. This creates a satiny smooth finish.

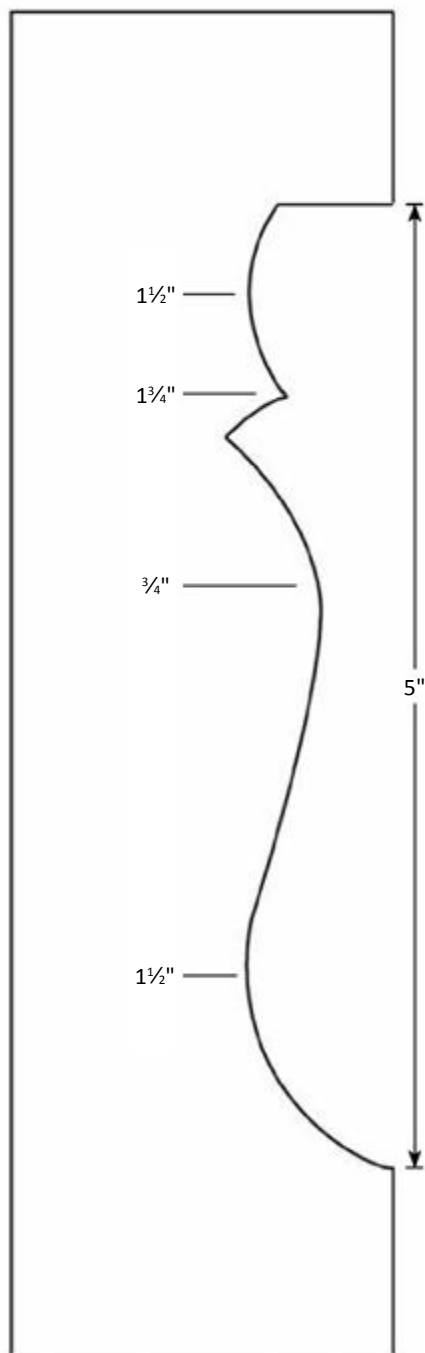
Tip Alert

When applying finish, always use paper towels. Cloth applicators can shred. A single strand of thread can wrap around your fingers and cause injury.



Figure 3: Handle Pattern and Template

(Full-Sized Pattern)



Patterns available online; visit woodcraftmagazine.com.

Turn the handles

1 Retrieve the handle blanks, and mount one of them between a spur center and a live cone center. Turn a short tenon at one end to fit into your scroll chuck. Repeat for the remaining handle blank.

2 Fit the tenon for one handle blank into your scroll chuck, and turn the blank to a 1½"-diameter cylinder at 1,000 rpm. Repeat for the other handle blank.

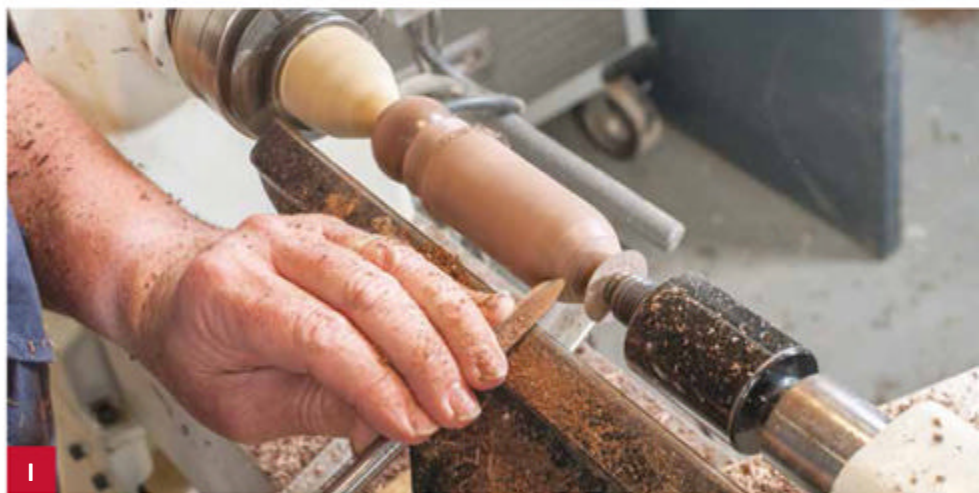
3 With one handle blank still mounted in the chuck, increase the lathe speed to 1,500 rpm, and true up the opposite end with a spindle gouge. Repeat for the remaining handle blank.

4 Using a Jacobs chuck and 25/64" brad-point bit, drill a hole 3 3/8" deep in each handle blank. (A 25/64"-diameter hole allows for the epoxy and makes it easier to insert the steel rod.)

5 Make the handle jam chuck in **Figure 2** from a 2 × 2" block to drive the handles at the headstock. Use a live center at the tailstock. Mount a handle blank between centers.

6 Make a full-sized copy of the **Handle Pattern and Template** in **Figure 3** and spray-adhere it to a piece of cardboard. Use a craft knife to trim the template to shape. Use the template to lay out the handle shape and a parting tool to establish the depths.

7 Use a spindle roughing gouge to remove waste and a 3/8" spindle gouge and skew (if comfortable) to shape and detail the handle (**Photo I**). I begin by defining and shaping the large bead at the roller end of the handle and then work on the grip portion.



8 Check the shape against the template (**Photo J**). Repeat the procedure to create an identical handle.

9 Sand the handles through 320 grit and finish. To give the handles a more durable and protective finish than the roller, I apply three coats of a wipe-on polyurethane and then beeswax used in a stick form. Buff the surface. After finishing the handles, part them off with a parting tool. Sand and touch up the unfinished ends.

Assemble your rolling pin

1 Assemble the rolling pin by first making a mark 3" from each end of the stainless steel rod in the rolling pin kit. This indicates where the outside edge of the bearing will need to stop.

To simplify installation of the steel rod, bearings, and washers, I bored a $\frac{7}{16}$ " hole

through a $2 \times 2 \times 3\frac{3}{4}$ " wood block and used it, along with a dead-blow hammer, to drive the tight-fitting bearing into place.

2 Referencing **Figure 1**, slide a nylon washer on the steel rod, followed by a bearing. Insert that end of the rod into the wood block with a hole in it, and tap the rod's upper end to drive the bearing into place. Add the roller, a nylon washer, and the second bearing. Tap this bearing

in place (**Photo K**). The bearings and washers should bottom out in the $\frac{7}{8}$ " holes. The rod ends should protrude 3" beyond the roller ends. Slide a nylon washer onto each end of the rod.

3 Mix a batch of five-minute epoxy, and work it into the handle holes (**Photo L**). Fit the handles onto the steel rod, and tap them into place, snug to the outside nylon washers. Let the epoxy cure before use. ■

About Our Author

Nick Cook is a full-time professional turner whose home and commercial shop are located in Marietta, Georgia. In addition to turning anything from bottle stoppers to porch posts, he is one of the founders of the American Association of Woodturners (AAW). He's also an established teacher and demonstrator who travels the country conducting woodturning workshops.



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Bodybuilding with Wiping Varnish

All the instructions you won't find on the label

By Paul Anthony



Wiping varnish is one of the most popular finishes available to the small shop woodworker, and for good reason. It's easy to use, attractive, and versatile, allowing you to create any sort of build that you like. For example, you can wipe on a series of light coats, buffing off the excess between each one to create a thin "in the wood" look, which is fine for decorative items that won't suffer abuse. On the other hand, you can build it up pretty much as thick as you like for tough, durable protection on tables, chairs, and other furniture that sees a lot of use.

However, building up a truly protective coating with wiping varnish requires a lot more finesse than the relatively simple "wipe-on, buff-off" approach appropriate for a thin decorative finish. Unfortunately, the product label only has room for the basic instructions, often leading to a lot of head-scratching and disappointing results. Here, I'll walk you through a process that yields a beautifully lustrous finish that scoffs at liquids and abrasion, and begs to be touched.

The 4-Day Schedule

Day 1: Brush on a thinned coat, let it soak in, and then wipe off the excess.

Day 2: Wet-sand with 400-grit wet/dry paper lubricated with mineral spirits. Then wipe on the first full-strength coat.

Day 3: Wet-sand with 600-grit wet/dry paper. Then apply a second full-strength coat, and let it cure for at least 3 days.

Final Day: Rub out with 0000 steel wool.

Then wipe on a thin coat and buff it off almost immediately. Let dry overnight, and you're done.

To watch a short video featuring some of the moves in this story, visit woodcraftmagazine.com, and click on "Online Extras."



A Along with the wiping varnish of your choice, you'll need a brush and rag for application and either wet/dry paper or synthetic abrasive pads for sanding and rubbing out between coats.

What is "wiping varnish"?

Wiping varnish is basically a thinned version of brushing varnish that has been modified with a relatively small amount of oil (often tung oil). Because of its high-solids content, it dries hard and can be built up. This is in contrast to many oil and oil/varnish formulations that contain larger amounts of oil, and which result in a softer finish that won't build well. Unfortunately, vague product labeling can make it difficult to distinguish between wiping varnish and softer oil-heavy formulations. To identify wiping varnish, apply a few drops to a piece of glass, and then let the finish dry for a day or two. If it then resists fingernail pressure without leaving an indent, it's likely a wiping varnish.

There is a variety of good solvent-based wiping varnish products on the market, some of which are shown in **Photo A**. I'm partial to General Finishes' Seal-A-Cell and Arm-R-Seal, but other brands can be applied in the same manner.

Preparing to finish

Sand the work through 220 grit, brush or blow away the dust, and then inspect the surfaces for flaws under a strong, raking light. Ensure that your shop environment is between 65-80°, with only moderate humidity. Cold impedes drying, and heat can accelerate it before the varnish has a chance to level properly.

Clean your finishing area, and don dust-free clothes. Set up a lamp for reflection, or work near a window with light banking off the workpiece toward your eyes. Prepare appropriate work supports, such as triangular sticks or screw boards. Finally, plan your finishing sequence to maximize accessibility and to ensure that the most visual surfaces are left for last.

Day 1



B Use a brush to slather on the first coat of thinned varnish, and then let it soak in before wiping off the excess.

Day 1

Apply the first coat

The first coat serves as a sealer, so it needs to be thin enough to soak into the wood. This is where I use Seal-A-Cell, which has a watery viscosity compared to the more syrupy Arm-R-Seal topcoat. If you're using a different product, you'll need to thin it for the first coat. Just pour some into a jar, and thoroughly stir in enough mineral spirits to create a watery consistency that easily runs off your stir stick. For most products, add about 50%. For thicker formulations, such as Tried and True varnish, I add as much as 100%.

Flood the varnish on using a brush (**Photo B**), which works faster than a rag. Let the finish sit, reapplying it to any thirsty areas where it has soaked in. When it just starts to get tacky, thoroughly wipe off the excess with a clean, soft cotton rag. Then let the piece dry overnight.

Making a Rag Pad

Back-folding a rag creates a smooth face for applying varnish without leaving track marks. Simply fold the rag back onto itself several times, and then pinch it closed to create a smooth, slightly convex application surface.



Day 2



C Wet-sand the dried first coat using 400-grit wet/dry silicone carbide paper lubricated with mineral spirits. Use a foam backer block for flat surfaces.



D Dip only the face of the rag pad into the finish. To get into complex areas, form the rag to suit the intersection (inset).

Day 2

Wet-sand the first coat

To prepare the surface for applying the second coat, wet-sand it with 400-grit wet/dry silicone carbide paper, lubricating it liberally with mineral spirits to keep it from clogging up (**Photo C**). For curved or narrow surfaces, use folded paper, dipping it frequently in spirits. For broader flat surfaces, wrap the paper around a soft backer. (I use a pliable foam block I cut from material sold as a kneeling pad for gardening.)

Your objective is to remove any dust nibs and minute hardened air bubbles, and to further smooth the wood. Feel free to sand fairly aggressively except on edges and corners, which should receive just enough pressure to knock down any coarseness. When you're done, thoroughly wipe off the slurry of sanding dust and mineral spirits.

As an alternative to wet-sanding, you can rub the surfaces down with a synthetic non-woven abrasive pad, as shown in **Photo A**. In that case, work dry, using the least coarse pad that will smooth out any roughness. Afterward, wipe down the surfaces with mineral spirits to remove any dust.

Apply the second coat

Pour some well-stirred undiluted varnish into a dipping container, and then form a wiping pad from soft cotton cloth as shown in the sidebar (above). Dip the pad into your finish just deep enough to cover its face, as shown in **Photo D**.

Begin wiping the finish onto the work, moving swiftly and smoothly while applying just enough pressure to transfer the finish to the surface without wiping most of it away. I usually begin with the edges, following up with the faces. To

avoid drips, don't pull inward against corners and edges; always wipe along them or away from them.

On broad surfaces such as tabletops, work in long strokes, partially overlapping each previous swath. Rather than trying to begin a stroke at the very edge, swoop in a couple of inches away from it, and then pull the finish outward toward the edge to complete the swath. At joint intersections and other complex areas, form the pad to allow it to tuck into the spot, as shown in the **Photo D inset**.

This second coat will start to tack up much faster than the sealer coat did, so work small sections until you get a feel for the timing. While the varnish is still fluid in a dedicated area, use the pad to very lightly wipe over the entire section to even out the thickness of the coat. Then inspect it under reflected light to check for consistency. If all looks good, leave it alone; don't re-wipe an area that has started to tack up because it will cause streaks. (If that happens, apply more finish to re-wet the surface and smooth it out.) When you're done with the entire piece, let it dry overnight.

Safety Alert

Crumpled up, finish-soaked rags can spontaneously combust. Always hang or spread used rags out flat as soon as you're done with them.

Day 3

Wet-sand the second coat

Wet-sand the second coat (**Photo E**), as you did the first. However, this time you can use 600-grit paper, since this coat will probably be smoother than the sealer coat. Use 400-grit paper only if needed on particularly rough areas, and then revisit those areas with 600-grit. Thoroughly wipe off any residue with a clean, soft cloth.

Apply the third coat

Wipe on another full-strength coat of varnish in the same manner as you did for the second coat (**Photos F & G**). Again, work in dedicated sections, thoroughly covering each area and then leveling off the fluid finish with very light pad strokes before moving on. Make sure to scrutinize the surface for imperfections under reflected light.

At this point, set the work aside for at least three days to let the finish cure hard enough for the final rub-out and topcoat.

Day 3



E Wet-sand the dried second coat using 600-grit paper. Notice here the second-coat sheen already starting to build on the unsanded right-hand side.



F Apply finish to edges first, using light pressure, and wiping on just enough varnish to coat them without causing dripping on the underside.



G Cover the surface thoroughly, using light pressure to transfer the varnish to the work, slightly overlapping previous swaths.

Final Day



H Vigorously rub out the cured third coat with steel wool to remove dust nibs and reduce the high gloss seen on the top here.



I When rubbing out broad surfaces, use a folded pad under your knuckles (or palm) to minimize hand strain.



J Immediately after applying a thin final coat, vigorously buff off the excess using the same application pad.

Final Day

Rub out the third coat with steel wool

At this point, you should have a sufficiently protective build of varnish on the work. It should feel fairly smooth, but look a bit too glossy. To smooth out any remaining dust nibs and take down the gloss, scrub the surface vigorously with 0000 steel wool (**Photos H & I**). Work in the direction of the grain wherever possible, and expect to get some exercise.

When the steel wool stops biting, refold it to expose a fresh cutting surface. Pay particular attention to edges and corners. When done, wipe all surfaces with a clean, dry cotton cloth, and then scrutinize them for a consistent luster under reflected light. Finally, run your fingers across the work. If any nibs remain, target them with dry 600-grit paper, applying only enough pressure to level them. Then re-scrub that area with steel wool.

Apply the final coat

Now for the crowning touch. Finishing up with a very thin “wipe-on, buff-off” final coat will fill in the steel wool scratches and bring the sheen back up enough to create the kind of beautifully lustrous finish shown on page 62.

Apply the coat as before, using a rag pad, but loaded with less finish this time (since most of it will be wiped away anyway). Apply just enough to cover the surface, wait a few minutes for it to start tacking up, and then use the application rag to vigorously buff off the excess (**Photo J**). Work at it until the rag doesn't catch at all on the surface. Inspect everything under reflected light for any cloudy streaks that require additional buffing. After the piece dries overnight, it's ready for service. Prepare for compliments. ■



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Single-serving plastic containers, often called K-cups, include the ingredients for making coffee, tea, hot chocolate, iced tea, and fruit drinks. Keep your favorites close at hand with this countertop organizer.

Start with the ends

1 From ½"-thick stock (I used cherry), cut two side blanks to 5" wide by 13¼" long. Cut a couple of pieces of ½"-thick scrap stock the same size as the blank's center section (2 × 13¼") for use as test pieces when verifying the angled dados cut in **Step 5**.

2 Mark reference lines across one face of each side blank. This lets you to realign the grain later when edge-joining the side pieces back together in **Step 7**.



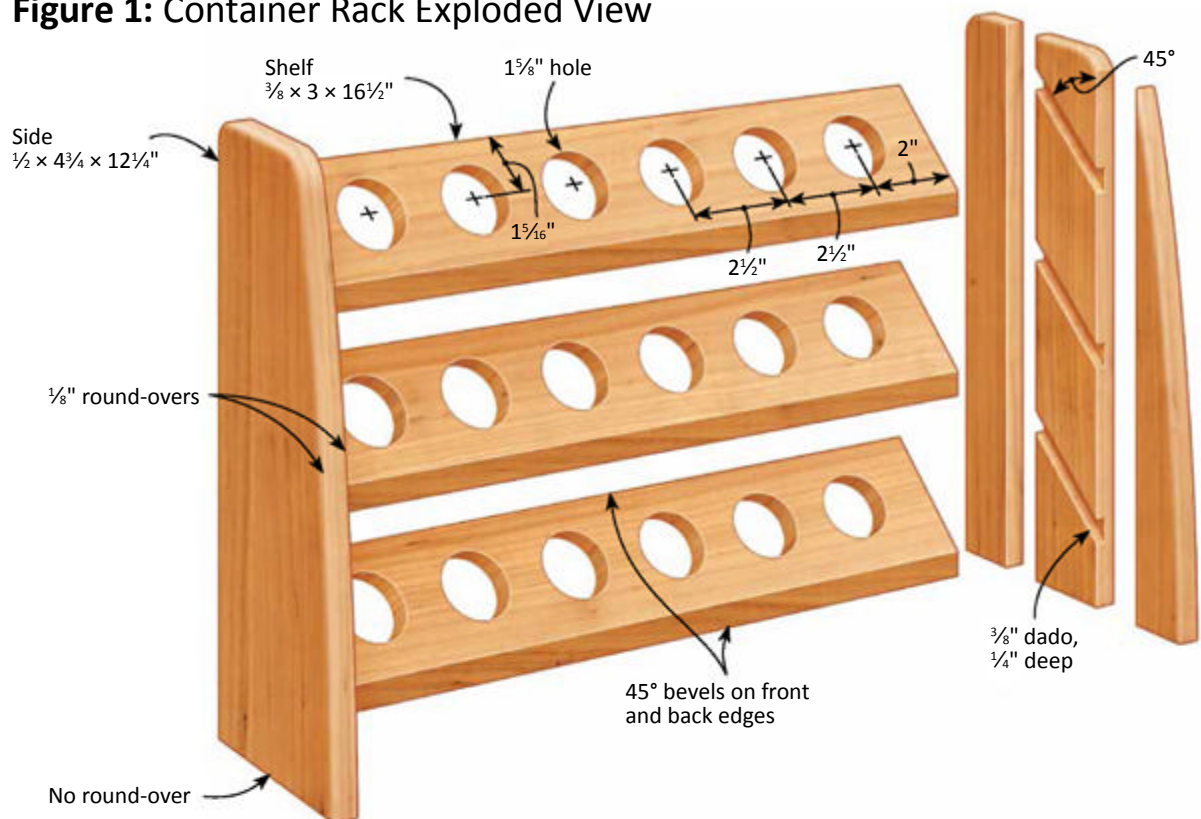
Use a square to mark the bottom edges of the dado locations on the front edge of each side center section.

3 Rip 1⅜" from the front and back edge of each side blank, referring to **Figure 2**.

4 Clamp the two middle side sections face-to-face with the edges and ends flush. Using the

dimensions in **Figure 2**, mark the bottom ends of the dado locations on the front edges (**Photo A**). Mark an X on the side of these reference lines where the dado will be cut. Also, mark angled

Figure 1: Container Rack Exploded View



reference lines on the outside faces as a reminder where to cut the angled dados later. The side pieces need to be mirror images of each other so the outside

(marked) faces will be up when cutting the angled dados.

5 Fit your tablesaw with a $\frac{3}{8}$ " dado blade and zero-clearance insert. Use a straightedge and

pencil to mark reference lines, noting the location of the edges of the dado blade on the insert (**Photo B**). Temporarily attach a long auxiliary miter-gauge extension (mine measured 30" long) to your miter gauge. Angle the miter gauge 45° to the right of the dado blade. Position a side piece (outside face with the angled reference marks up) against the extension and two 4"-long spacers and a stop. Align the bottom edge of the top angled dado reference line with the right-hand edge of the dado blade location lines. Make the first angled dado cut. Remove a spacer and make the second cut. Remove the second spacer and make the third angled dado.

6 Rotate the miter gauge to 45° in the opposite direction. Repeat the process in **Step 5** to cut the three angled dados in the opposite side center section.



Use a stopblock and two 4"-long spacers when cutting the angled dados in the side center section. (The left-hand side is shown.)

7 With the surfaces and ends flush and the grain realigned, glue and clamp the three pieces that make each of the two sides.

8 Cut three alignment blocks to $\frac{3}{8} \times \frac{1}{2} \times 2$ " and sandwich them between the two side pieces within the angled dados. Use double-faced tape to hold the two side pieces together inside-face to inside-face. (This ensures the angled dados in the sides will align with each other at final assembly.) Mark the front edge on the sandwiched pieces to ensure that you cut the profile along the front edge in **Step 9**.

9 Enlarge and copy the side pattern in **Figure 2**, and apply it to one side. Crosscut the bottom ends flush, bandsaw both sides to shape, and sand the edges smooth to remove the bandsaw marks. Separate the pieces, and remove the double-faced tape and alignment blocks. Rout or sand a $\frac{1}{8}$ " round-over on all but the bottom edges of each side.

Add the shelves

1 Cut the three cherry shelves to $\frac{3}{8} \times 3 \times 16\frac{1}{2}$ ", bevel-cutting the edges at 45° to fit snugly within the stopped dados in the sides.

2 Mark six container-hole centerpoints on each shelf, where shown in **Figure 1**. Outfit your drill press with a $1\frac{5}{8}$ " Forstner bit. Position your drill-press fence for perfectly aligned holes, and bore a hole at each marked centerpoint until just the tip of the bit breaks through the bottom surface of the shelf. Do this for all six holes. Flip the piece over and with the same edge against the fence, center the bit over each break-through hole and finish drilling through the shelf to complete the holes. (This two-step drilling process

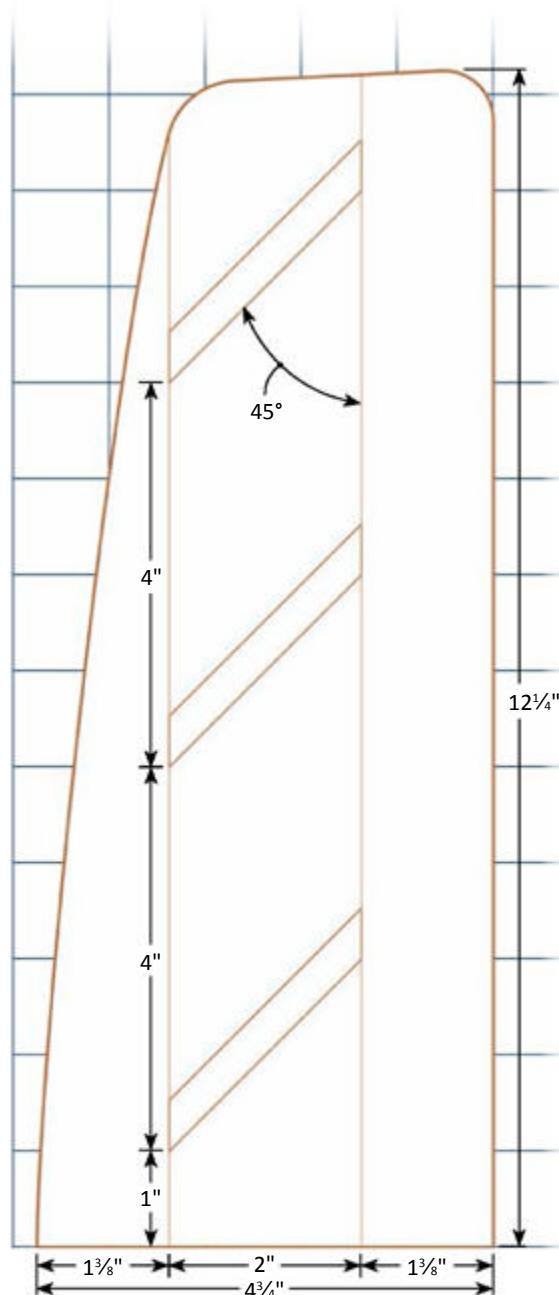
Figure 2: Left Side Half-Sized Pattern

(Right side is mirror image of left)

1 square=1"

Half-sized pattern, enlarge 200%.

Pattern is also available for download at woodcraftmagazine.com; click on Magazine Patterns.



eliminates tear-out on both faces of the shelf.) Repeat the process for the remaining two shelves.

Complete the assembly and add the finish

1 Finish-sand the sides and shelves through 220 grit. Glue and clamp the shelves between the sides. Check that the bottoms of the sides are flush with each other and that the shelves are

square to the sides. (To help catch any excess glue, I placed a piece of painter's tape above and below each angled dado.)

2 Lightly sand the beveled edges of the shelves to soften them.

3 Apply finish to the assembly (I used Watco's Wipe-On Poly, Gloss, Woodcraft #140848, \$19.99 for one quart), and you're ready to brew your favorite refreshment. ■

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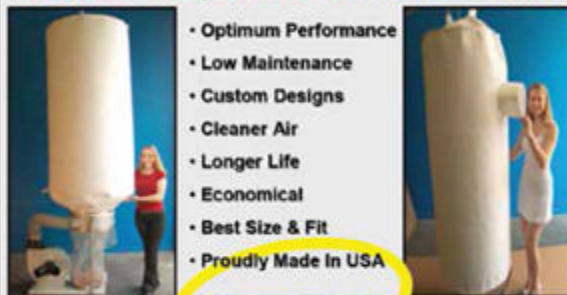


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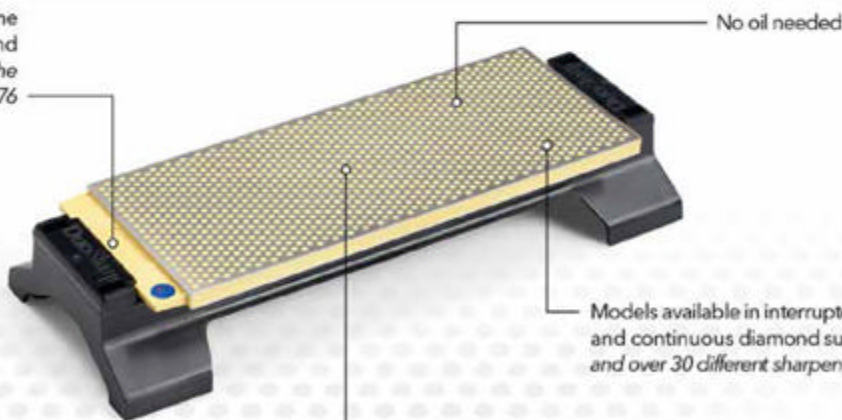
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Spotlight on Purpleheart

Plainsawn purpleheart

A distinctive color makes it an ideal accent wood.

By Robert J. Settich
Technical consultant: Larry Osborn

Except for a handful of vegetables, flowers, and minerals, purple is one of the scarcest colors found on the planet. For that reason, it is no wonder that purpleheart (*Peltogyne spp.*) is the only commercial wood of that color, captivating woodworkers who scout for something eye-catching. Like other distinctive exotic hardwoods, it holds a valued place in the woodworking project world.

Although the lumber is not so expensive that similar large-scale projects are prohibitive, two factors work against purpleheart. The first is the color. In small doses, purple projects positive associations, such as nobility, creativity, and peace. But in a large dose, a large purple cabinet, for example, the color purple can be overwhelming.

It's a fact that...

The full-sized reproduction of the 129' slave ship *Amistad*, which was launched in May of 2,000 in Mystic, Connecticut, featured a sturdy keel made of purpleheart from Guyana.

The second factor: the wood changes colors over time.

History in woodworking

Within its native range of Central and South America, purpleheart (sometimes referred to as Amaranth) has served as a common building material for applications such as dock pilings, boat decks, planking, bridge timbers, and even railroad ties. It excels in many of these uses because of its strength and natural resistance to decay and insects.

In the United States, the first documented use of purpleheart lumber was for the 1928 installation of a library in the Lindsley mansion in the Berkshire Mountains, Massachusetts. Now that's a lot of purple.

Today, hobby woodworking projects made exclusively from purpleheart tend to be of small scale: bottle stoppers, pens, bowls, knife scales, and jewelry boxes. Woodworkers sometimes introduce purpleheart as an accent color in inlays and laminations. You find it in multi-species cutting boards.

Where it comes from

The genus *Peltogyne* encompasses more than a dozen species of hardwoods native to tropical rainforests. Brazil's equatorial region of the Amazon River basin is a prime growing area, as well as Suriname and Guyana.

Purpleheart trees grow from 100' to 170' tall, with trunk diameters up to 4'. It is not a threatened wood. Freshly harvested timber displays a dull gray purple and brown, with a creamy gray sapwood. Over time, the sapwood doesn't change, but the heartwood transforms to a rich purple, and then dark brown.

What you'll pay

Online and specialty wood dealers sell purpleheart by either the piece or board foot. For example, one online retailer sells a $\frac{3}{4} \times 4 \times 48$ " board for \$26, while another sells purpleheart for \$10.50 a board foot. Thinner and shorter boards are available. For instance, one specialty woodworking store sells a $\frac{1}{8} \times 3 \times 24$ " board for \$9.50 and a $\frac{1}{4}$ "-thick piece for \$12.00. The thickest chunks of purpleheart will likely be bowl and spindle blanks. A $3 \times 3 \times 6$ "



Aged purpleheart

Figured purpleheart

square, costs about \$20. Expect to pay about \$2 for either a $\frac{3}{4} \times \frac{3}{4} \times 5$ " pen-turning blanks or a $1\frac{1}{2} \times 1\frac{1}{2} \times 3$ " bottle-stopper blank. A 4' x 8' sheet of paper-backed veneer will set you back \$225. The lesson: shop around and factor in shipping costs with online dealers. Finally, while most purpleheart lumber is relatively straight-grained with uniformly distributed pores, you'll sometimes find curly wood, which commands a premium price.

How to select the best stock

Lumber dealers identify purpleheart as *Peltogyne*, omitting identification of the many species grouped under that name. Therefore, you could encounter substantial color variations, ranging from wine-red to eggplant to true violet. So if your project is to require several boards, try to choose them in person. If that's not feasible, acquire all of them from one

dealer, requesting consistency of color throughout the order.

Because of the changing color of purpleheart over time, visualize the wood in its eventual deep brown stage, not its purple stage, to avoid future disappointment. For the same reason, avoid laminating purpleheart next to a brown-toned wood to maintain contrast.

Working purpleheart in the shop

Purpleheart presents a number of challenges in the shop. Because of the hard-to-detect interlocking grain, hand-planing, chiseling, and working purpleheart with carving tools can prove trying. Routing this dense wood can result in burning, which is hard to sand out, and gouging can unexpectedly occur when jointing. Purpleheart turns cleanly with sharp tools, and it sands well. As with other woods, work through a progression of grits to produce smooth results.

If fastening purpleheart project parts with screws, drill pilot holes to avoid splitting. Avoid using nails, as they can sometimes bend when driven.

Common woodworking glues work fine when bonding

Purpleheart Quick Take

Cost	Moderate/high
Weight	Moderate/high
Hardness	High (comparable to hickory and pecan)
Stability	Very good
Strength	Very good
Durability	Very high
Toxicity	Skin, eye, and respiratory irritation possible. Has been reported to induce nausea
Tool Type	Power tools preferred, except for turning
Common Uses	Pens, handles, bowls, jewelry boxes, inlays and laminations, knife and tool handles

purpleheart in an assembly. However, because of the resins found in such tropical woods, a little prep work may be in order. To ensure a good bond, wipe freshly machined mating edges with acetone, lacquer thinner, or naphtha until color no longer transfers to your cleaning cloth.

Purpleheart responds to exposure to air and UV (ultraviolet) light that produce the unavoidable color shift. Employ one or more of these strategies to slow the process:

- Use only film-building finishes, and apply several coats to minimize oxidation.
- Apply waterborne finishes to darken the wood less than oil-based finishes; they won't yellow with age.
- If you prefer oil-based, consider one with a UV inhibitor.
- Keep your project out of bright light, especially sunlight. ■

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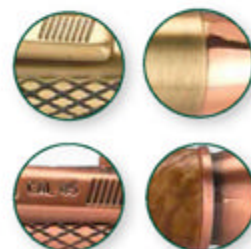
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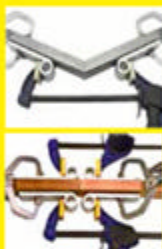
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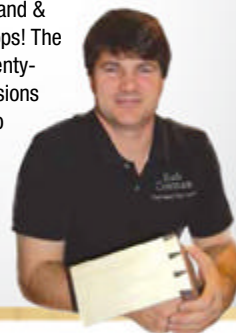
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