STEP UP TO SPRAY-FINISHING p.56

WOODCRAFT® magazine

Projects, Techniques, and Products

Compact, Comfortable Kitchen Table p.22

MORE GREAT PROJECTS

- Tile-Top Keepsake Box
- Live-Edge Bowl
- Box-Maker's Miter Sled
- Dovetail Slot Jig

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23 TIPS and JIGS

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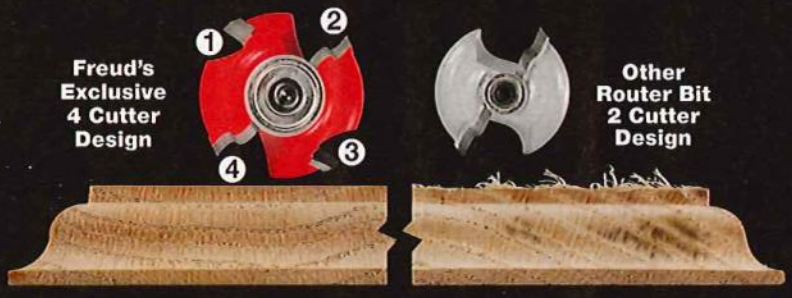

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Contents: Projects

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Aug/Sept 2012

Cover photo: Paul Anthony

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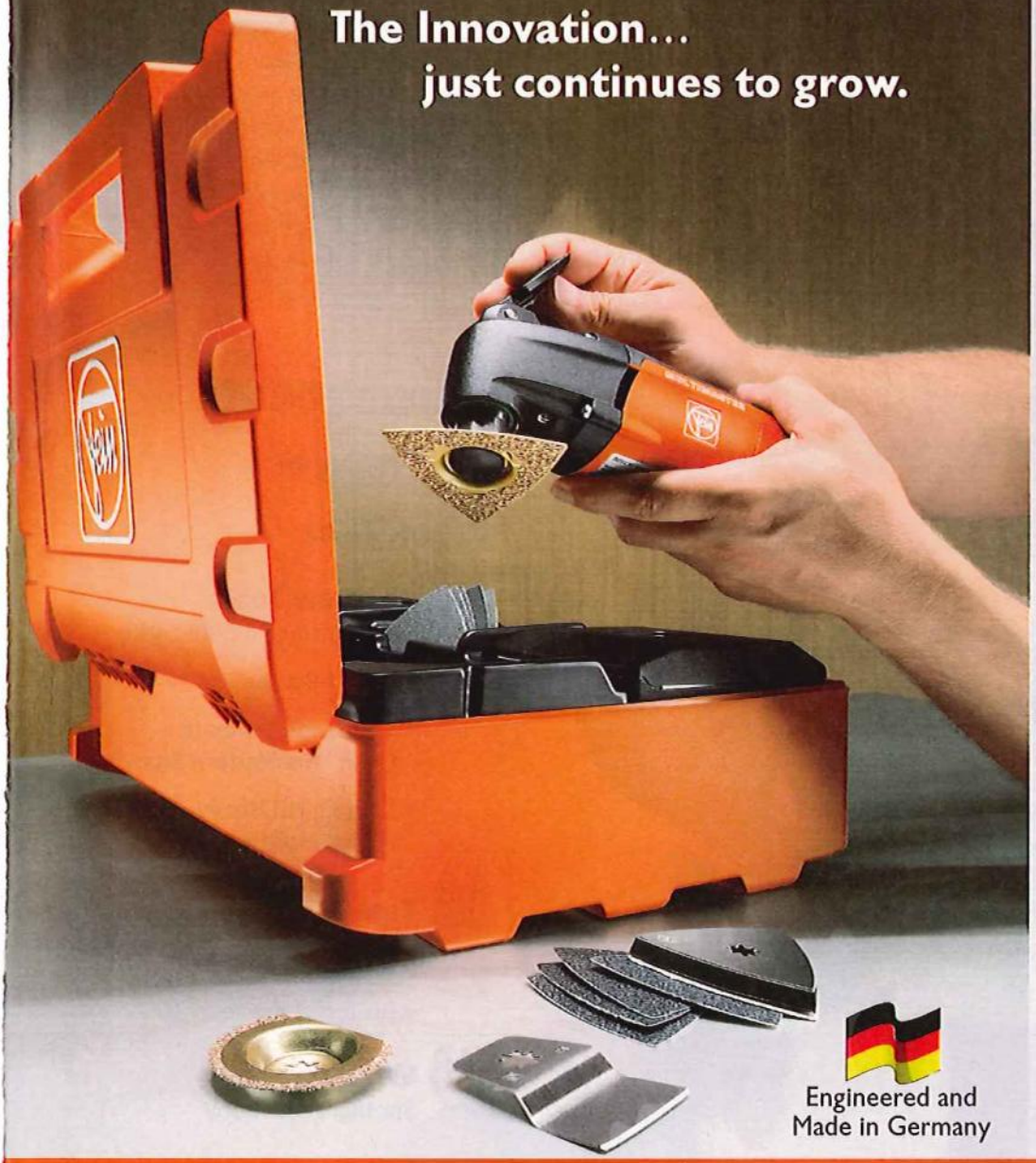

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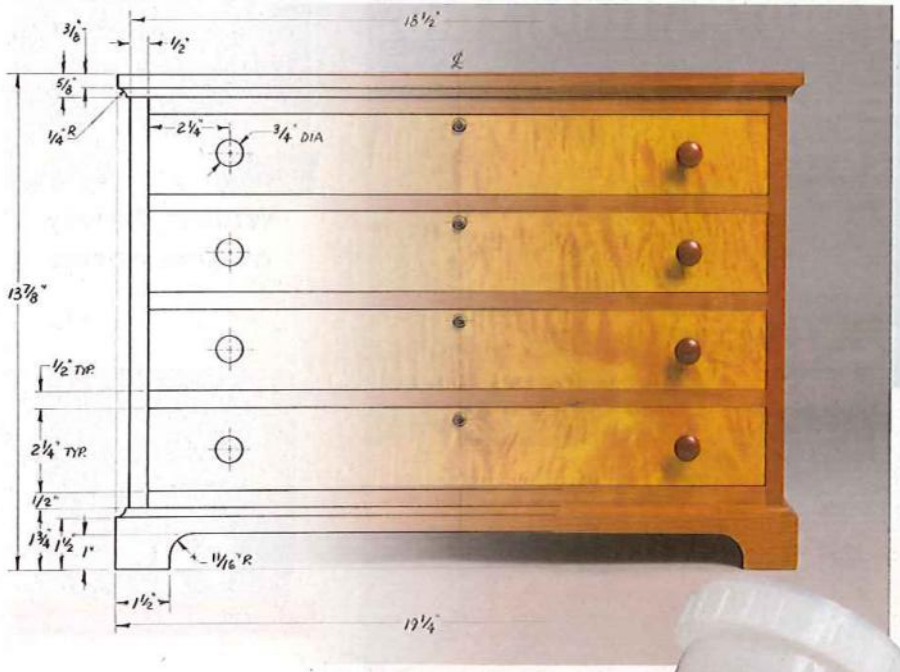
Contents: Tools & Techniques



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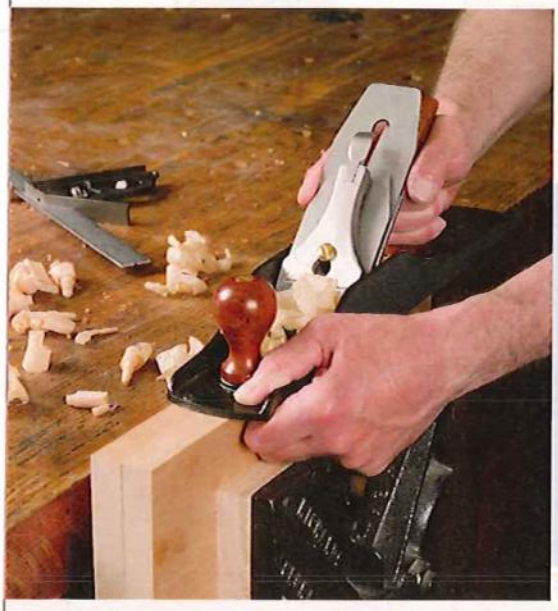

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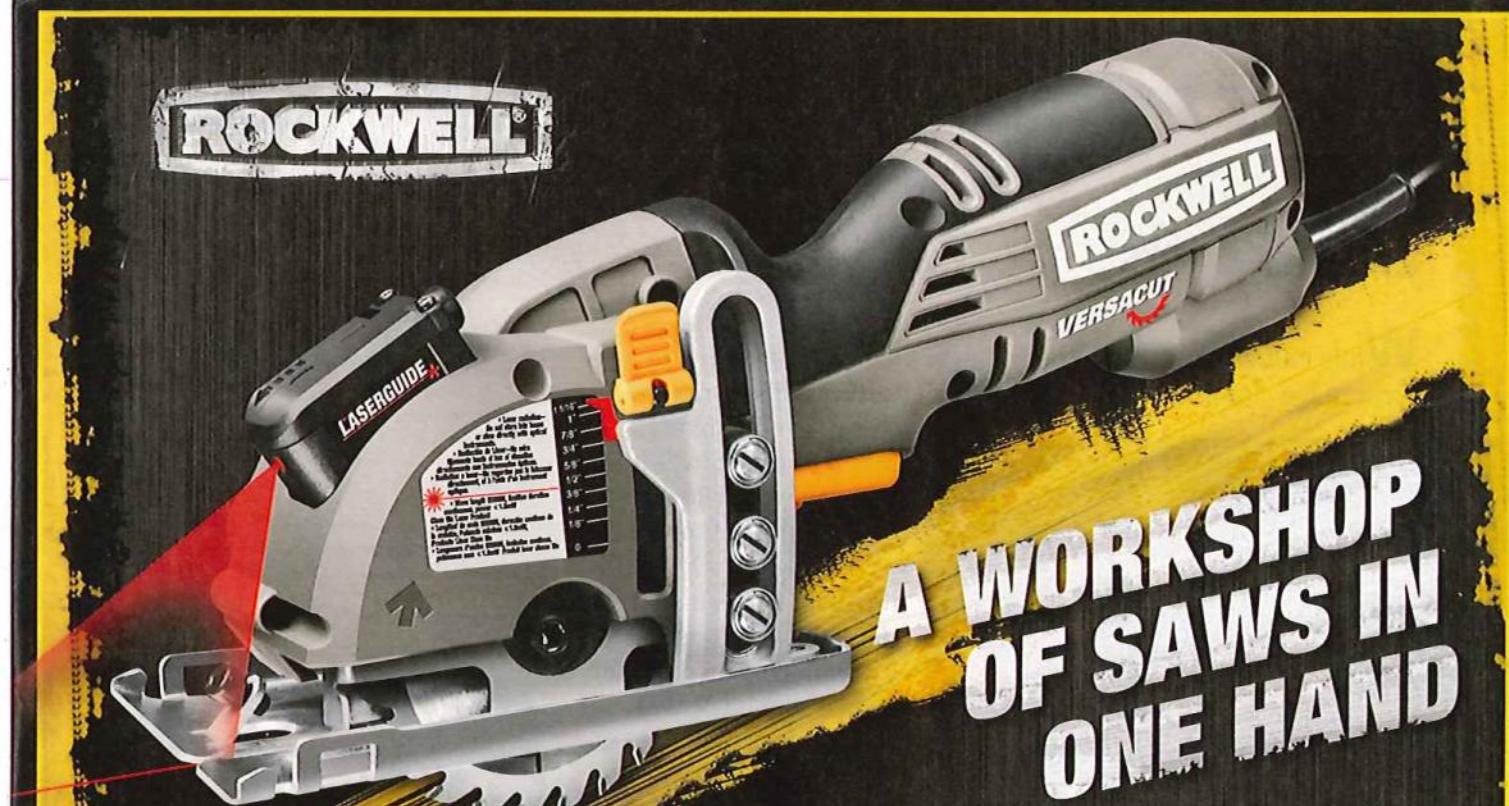
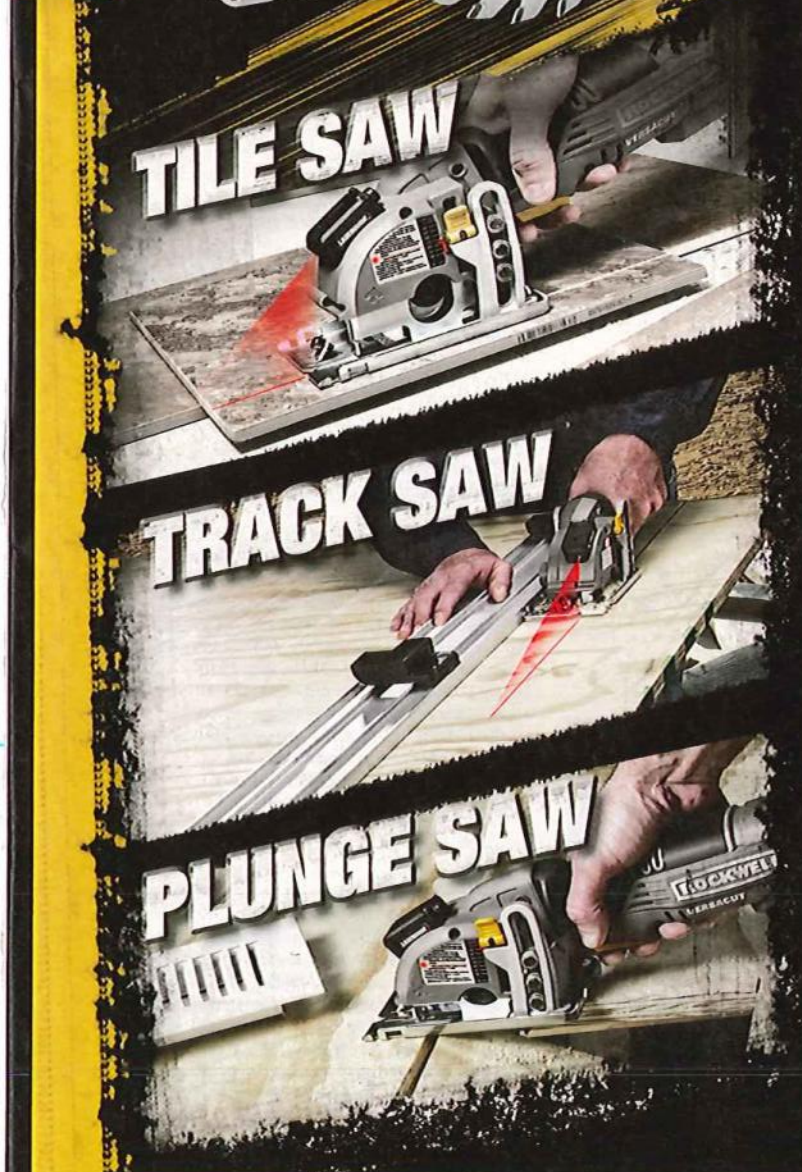


A WORKSHOP OF SAWS IN ONE HAND



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Lifetime jigs

While building the tile-top box on page 46, I found the need to create a few jigs to nail down the joinery-related precision needed.

(Note that the mitered corners of the box feature showy dovetail keys.) Serving as a personalized wedding gift with the tile top displaying an image of the couple, I expected the box would be on constant display and inspected closely by a great many people. As such, the execution demanded perfection, both in the machining and in the assembly. That translated into time-consuming setups and fussing–a lot of work for just one box.

Then the thought occurred to me: Why not make several boxes? Other members in my extended family had recently married or plan to tie the knot soon, so I have gifts to make. That led me to another thought: Should I develop the jigs to be more than one-time-use versions? Should I make them to work for a variety of box sizes? Should they be "lifetime jigs" that a box maker can turn to whenever he wants to make one or 10 boxes and do so accurately while saving time? My conclusion: a resounding "Yes!"

With this as my compass heading, I went with quality jig materials and tricked out the box-maker's miter (and crosscut) sled and dovetail/spline jig shown here with stops and hold-downs. I also splurged and got a Brusso hinge-mortising jig to help with the Brusso hinge installation. Now, whatever the occasion, I can dust off my arsenal and go to town, feeling the time and money invested all worthwhile. May your experience be the same.

Jim Harrold

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

Photo: Jim Osborn

YOU KNOW THIS GUY, AND HE'S GOOD

Most woodworkers know someone with life-changing saw injuries like this guy. That's because it's common, with one table saw injury every 9 minutes. These woodworkers are often skilled and careful. Then, in a microsecond, something goes wrong. **Take action. Protect yourself.**

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Cart with the checkered past

I'd like to thank Sam Correa for sharing the plans of his butcher-block cart with the readers of *Woodcraft Magazine* in the Feb/March 2012 issue (no. 45). When I saw it, I quickly decided I wanted to build it, even though I'd never crafted mortise and tenons, raised panels, or dovetail drawers. From the beginning, I made a few incorrect estimates that prevented me from following your dimensioned plans. (I intended the top to be a complete checkerboard like the one pictured in the article, but I unexpectedly ran short of walnut.) Still, the finished product was a work that I'm proud of, and I have received many compliments. Thanks.
—Ted Greenfield, Lakeport, New York

Spraying made even simpler

As an experienced user of high quality waterborne spray finishes, I thought the "Spraying Made Simple" article in the April/May 2012 issue (no. 46) effectively described the process. One tip not in the article is to leave cabinet backs off for finishing whenever possible. This makes spraying the inside and back of the face frame far easier, with far less bounce back. The backs can be sprayed in a horizontal position and installed after finishing is complete.
—Barry Burke Jr., Middletown, Connecticut

Errata

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

A tool worth turning

When I saw the carpenter's mallet in the April/May 2012 issue (no. 46) of *Woodcraft Magazine*, I just could not help myself. After paying a visit to my local Woodcraft store and speaking with Jerry the owner, I left with a nice blank for the project. I did modify the handle somewhat to help my hand hold it better, since I have a hard time gripping anything in my right hand. Otherwise, I followed the dimensions pretty closely, and I am very happy with the way it turned out. After sanding it up to 1,200-grit, it is almost a shame to use it in my shop.
—Robert D. Rose Jr., Gray, Tennessee

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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Lathe envy

Powermatic 4224B Lathe

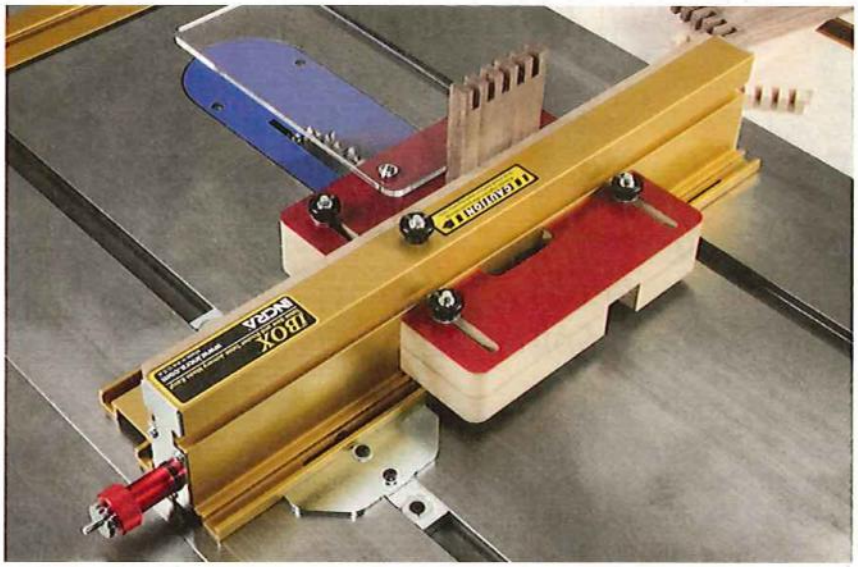
Powermatic has added a battleship to its fleet of professional-grade machines for turners dreaming of creating colossal columns and behemoth bowls. The 950-pound brute sports a 24" swing over the bed and a 42" working distance between centers (20" and 63" beds are also available). Powered by a 3 HP, three-phase motor with a built-in converter for single-phase power, the lathe features electronic variable speed (EVS), providing infinite spindle speed adjustment between 40 and 3,500 rpm, plus a reverse-mode for sanding. The machine offers a host of other features as well, including a headstock that slides the full length of the bed to facilitate outboard turning of pieces up to 88" in diameter, a built-in vacuum system for chucking bowls, and even an air nozzle for clearing chips.

#854112, **$7,499.99**
Tester: Andrew Bondi

Featured products available from Woodcraft Supply unless otherwise noted.

Better box joints – and beyond

INCRA I-Box Jig



Shop-made box joint jig designs abound, so why would you want to buy one? The problem is that most shop-made jigs don't allow the kind of fine-adjustability that makes for precise joints. And any tiny error in the jig setup multiplies with each successive cut, making for sloppy work.

Enter the INCRA I-Box. Within minutes after setting up a blade or bit, you can start cutting box joints. Designed for use on a tablesaw or router table, the jig has adjustable miter bars to ensure that the unit won't shift in use, a pair of fingers to set the pin width, and a dual-pitch lead screw that enables users to dial in perfectly-fitting joints.

The I-Box can cut pin widths ranging from ⅛" to ¾" wide in stock ranging from ⅛" to 1¼"-thick. In addition to box joints, the jig can also be used to cut key joints and dentil moldings. Setup and operation are explained in the included DVD.

#854034, **$169.95**
Tester: Peter Collins

Powermatic photo: Manufacturer; Photos: Bob Etter

Fresh twist on bits

Whiteside Ultimate Flush Trim, Pattern, and Combination Spiral Bits

If you plan to do a lot of pattern routing, you need to see these bits. Compared to standard straight-flute bits, these feature a *compression grind*, which combines an upcut and downcut spiral flute configuration to produce tear-out-free top and bottom surfaces. The ⅞"-diameter cutter (most spiral bits are only ½" diameter) allows for a higher shear angle for smoother cuts, even when routing against the grain.

Up to now, it has been difficult to find anything other than bottom-bearing (flush-trim) spiral bits; now, Whiteside offers three bearing configurations to suit your work. In addition to the flush-trim bit, there's a top-bearing (pattern cutting) bit that's suitable for template routing and making plunge cuts. With bearings on both ends, the combination bit (sometimes called an "over-under" bit), can be guided by a template on either side of your work.

#154274, Combination Bit, **$149.99**
#154275, Flush Trim Bit, **$139.99**
#154276, Pattern Bit, **$149.99**
Tester: Brian Renner

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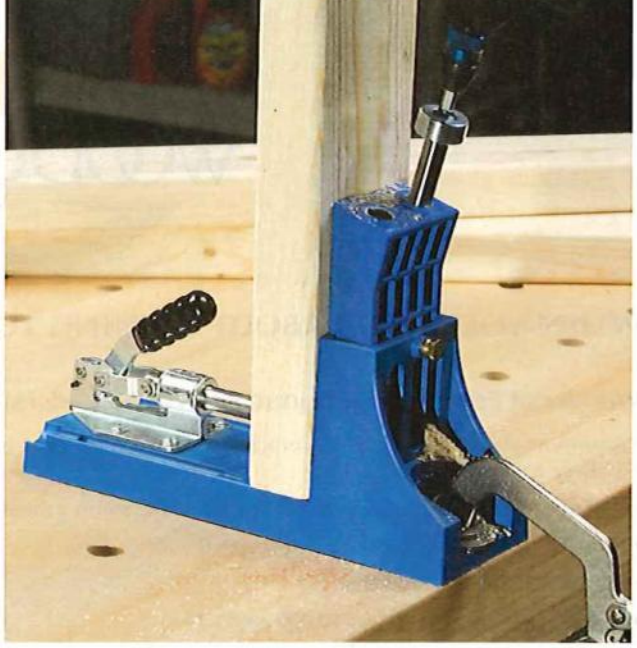
Pocket-screw joints with more muscle

Kreg Jig HD Heavy-Duty Pocket-Hole System

Imagine your pocket-hole jig on steroids. Kreg's HD (Heavy-Duty) jig creates joints as quickly and easily as standard-sized jigs, but utilizes larger screws that can create joints 50% stronger than those made using a standard-sized jig. The HD screws are perfect for 2-by construction. Now, assembling outdoor furniture, fences, and trellises can be as easy as building a pocket-screwed plywood cabinet box.

The HD Starter Kit includes a drill guide, a stopblock, a ½" step-drill bit with stop collar, a 6" #3 square driver bit, and a sample of #14-size HD screws.



Note: Check your local building codes before using pocket screws to construct load-bearing objects such as interior walls or deck railings.

#154345, Kreg Jig HD starter kit, **$59.99**
#154349, #14 × 2½" HD screws, 125-ct. **$19.99**
Tester: Peter Collins

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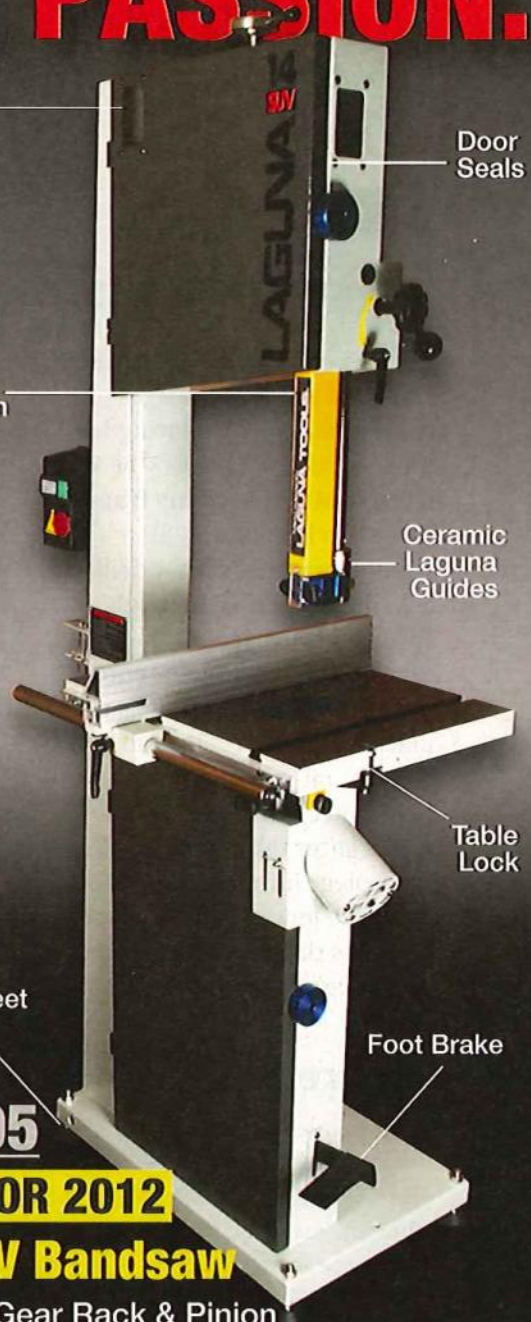

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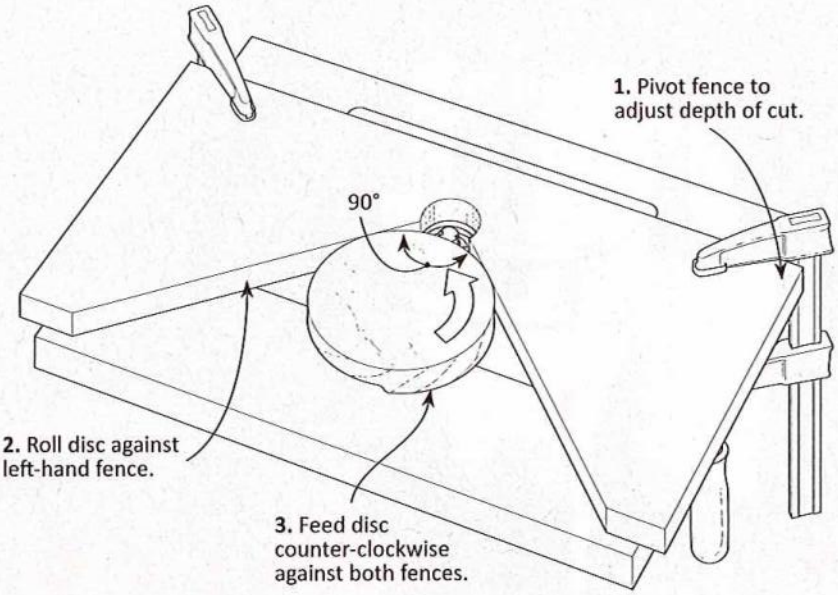
TOP TIP

Angled fence for routing discs



Here's a router table fence that I devised to rout the edges of circular discs with bearing-less bits. Starting with a ¾ × 12 × 21" piece of MDF, I used my framing square to lay out a right triangle with 12" legs. I drilled a 2"-diameter hole through the inside corner, and then removed the triangular cutout.

To set the V-shaped fence, place it on your router table so that the bit rests in the center hole, and clamp one end to your router table. Position the workpiece into the V, and then pivot the fence until the piece contacts the bit. Then clamp the fence's other end. (For safe feeding when cutting a heavy profile, plan on taking a series of shallow cuts, readjusting the fence after each one.)

To rout, place the disc against the right-hand fence, and then roll it forward to make contact with the left-hand fence. With the disc touching both fences, spin it counter-clockwise until you have completed the cut. (For routing thick material, use a fence that's thick enough to provide bearing for the unrouted section.)

—Serge Duclos, Delson, Quebec

Share a Slick Tip. Win Cash or a Prize!

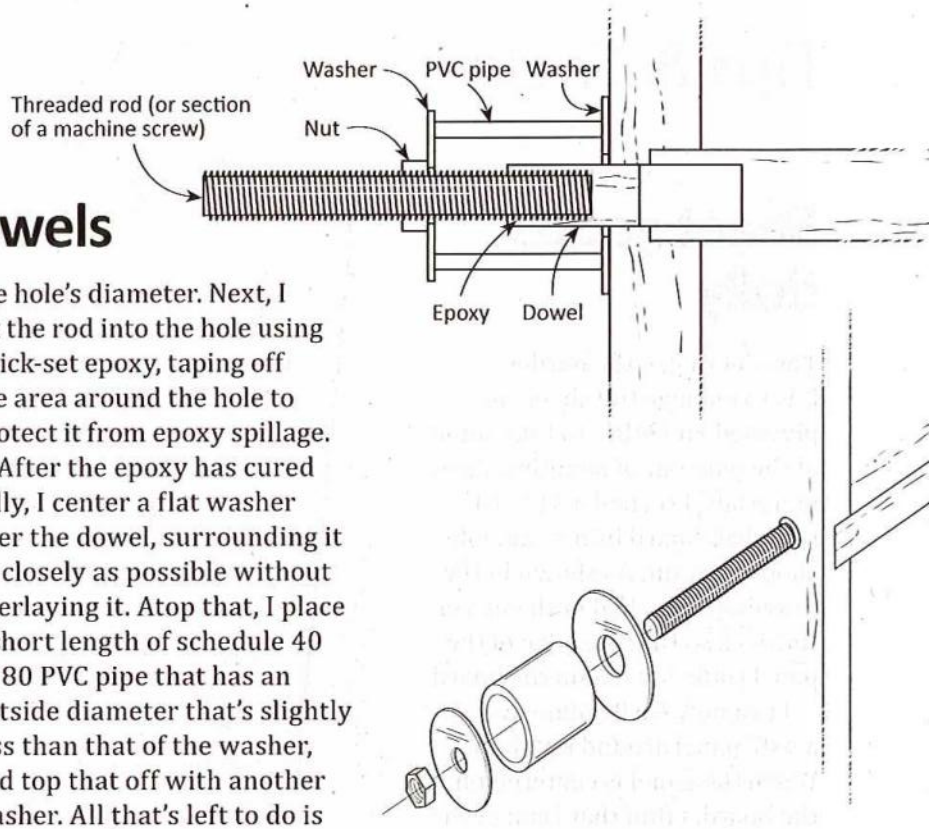
Next issue's Top Tip winner will receive a **Kreg K4 Pocket-Hole Master System, Micro-Pocket Drill Guide, Shelf Pin Jig, Multi-Mark** and **Pocket-Screw Kit** valued at **$300**. Runners-up will receive **$125** for an illustrated tip; **$75** for an unillustrated one. Winning entries become the property of *Woodcraft Magazine*. Send your original ideas to: **Tips & Tricks, *Woodcraft® Magazine*, P.O. Box 7020, Parkersburg, WV 26102-7020 or email editor@woodcraftmagazine.com.** *Important: Please include your phone number, as an editor will need to call you if your tip or trick is considered for publication.*

Releasing double-faced tape

I've read how woodworkers sometimes struggle with the removal of parts adhered together with double-faced tape. I learned at our local furniture school to just put some acetone in a liquid storage bottle and add a couple of drops to each point of attachment. Wait a few seconds and a small child could pull the pieces apart.

—Jake Jacobs, Pryor, Oklahoma

Extracting blind dowels



When restoring antique doors, cabinets, and other projects, I often need to disassemble a joint that was secured with either half-blind dowels or with through-dowels that can only be accessed from one end. Here's a technique that I've found works very well on most older joints (although new joints with some modern adhesives may prove problematic).

To extract the dowel, I first drill a hole through its axis, leaving some wood at the perimeter. I then cut a length of threaded rod (or section of machine screw), whose diameter is slightly less than the hole's diameter. Next, I fix the rod into the hole using quick-set epoxy, taping off the area around the hole to protect it from epoxy spillage.

After the epoxy has cured fully, I center a flat washer over the dowel, surrounding it as closely as possible without overlaying it. Atop that, I place a short length of schedule 40 or 80 PVC pipe that has an outside diameter that's slightly less than that of the washer, and top that off with another washer. All that's left to do is thread on a nut and tighten it to pull the dowel out of its hole.

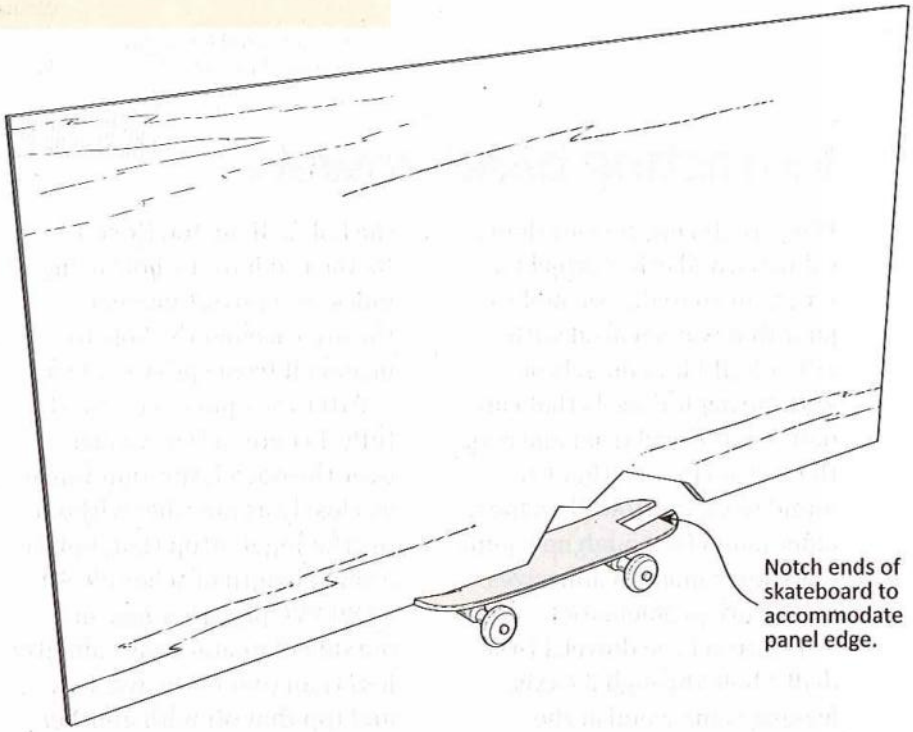
—Alan Bowes, Alna, Maine

Illustrations: Chris Glowacki

Sheet goods dolly

The older I get, the harder it is to manage full sheets of plywood and MDF. To take some of the pain out of handling sheet materials, I turned a $1 yard sale skateboard into a valuable shop assistant. As shown in the drawing, I notched both ends of the deck so that the edge of the panel could lay flat on the board.

I can now easily maneuver a 4×8' panel around my shop. When the panel is centered on the board, I find that I can even rock the skateboard enough to skip over electrical cords. (If you need to traverse gravel, grass, or other rough terrain, look for an all-terrain board with oversized wheels.)



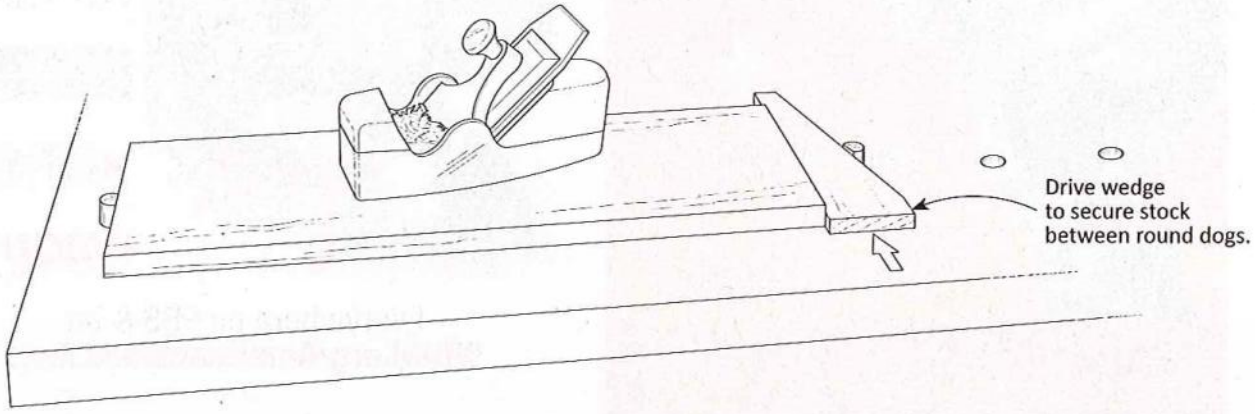
—Leslie Bradshaw, Hartsville, South Carolina

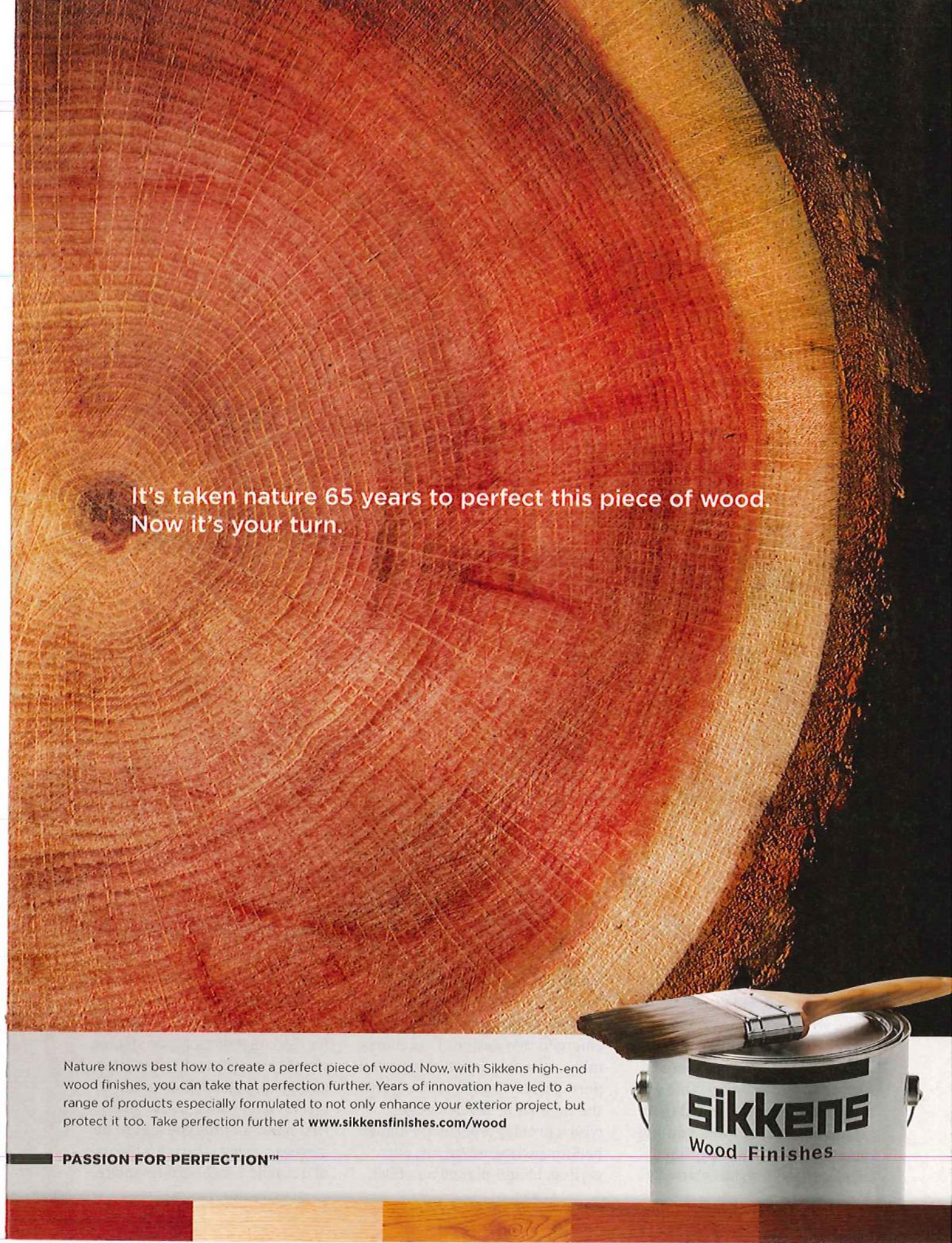
Tap-'n-lock vise

To secure a board to your workbench without a standard vise, all you need is a pair of round dogs (in matching dog holes, of course) and a wooden wedge. Place your board between the two dogs, insert the wedge, and give the end a light tap. As it's driven in, the wedge will rotate the adjacent dog to redirect pressure against the end of your stock and lock the board to your bench.

You can easily make wedges of different widths and thicknesses as needed to suit different lengths and thicknesses of stock. The taper angle isn't critical, but I find that a shallow angle works best.

—Alejandro Balbis, Longueuil, Quebec





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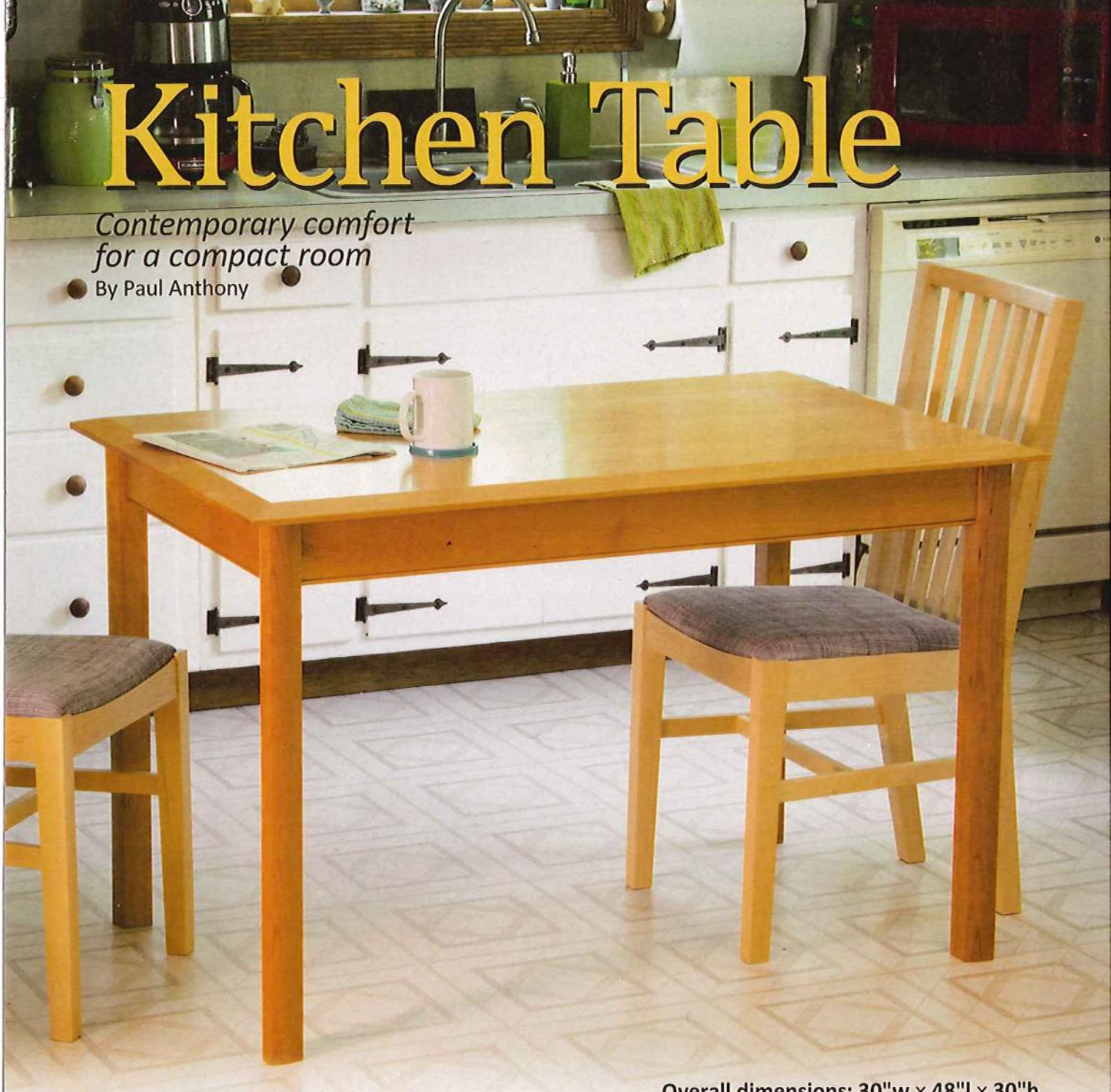
Kitchen Table

Contemporary comfort for a compact room

By Paul Anthony

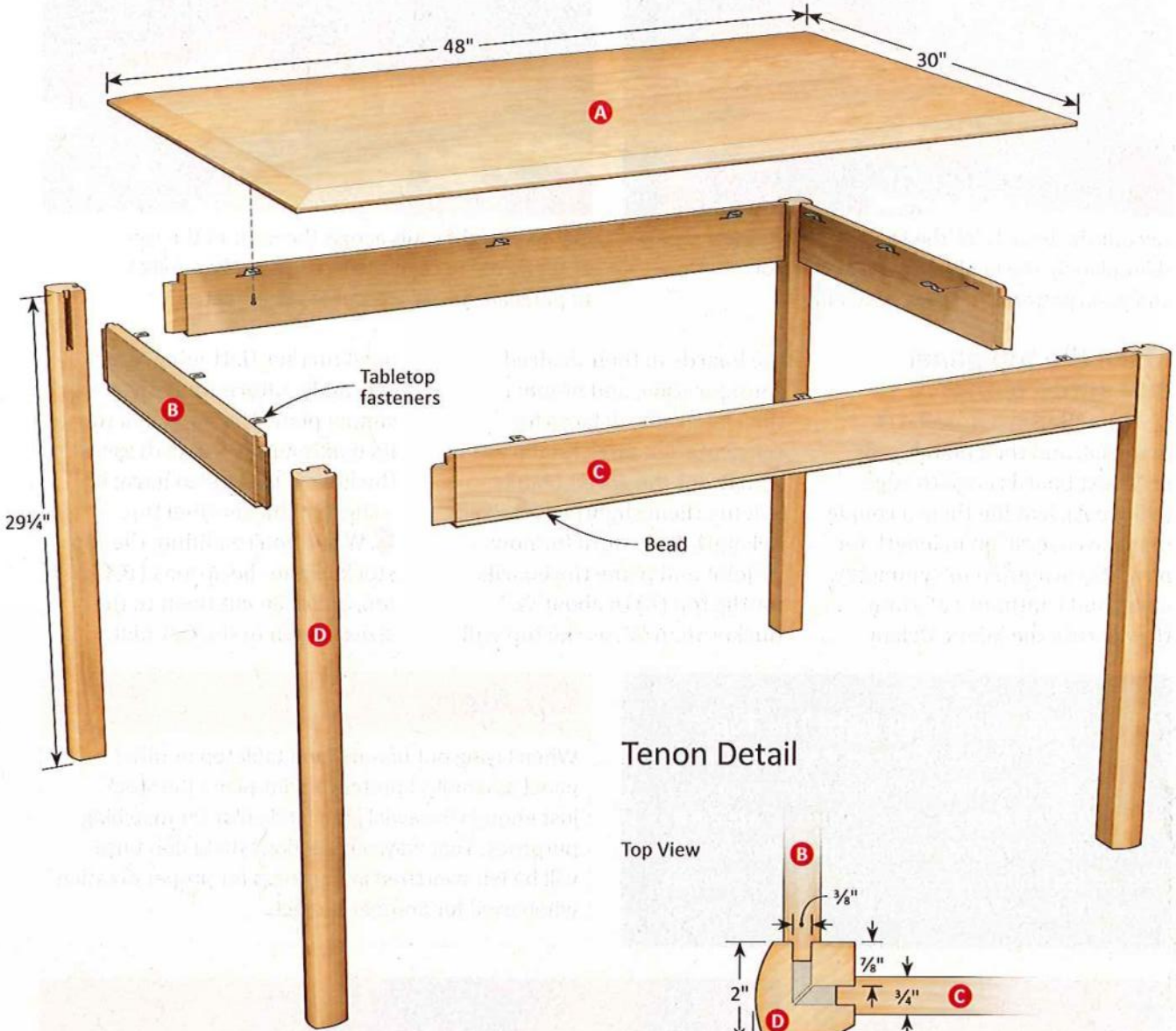


Overall dimensions: 30"w × 48"l × 30"h

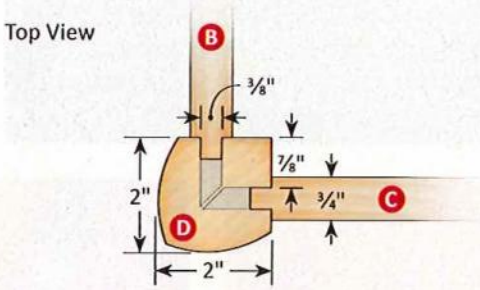
We were long overdue to replace our sad, old kitchen table, so my wife and I discussed our options. The new table needed to suit the size of the small room, and it had to be comfortable with a bit of style. It didn't need to be expandable, as we have a dining room to accommodate groups. I also wanted it to be relatively quick and easy to build so we wouldn't be waiting weeks for it.

From those parameters emerged this design. This cherry table seats four comfortably, and part of that comfort stems from the top's wide beveled edges, which provide a perfectly angled bed for resting forearms. For styling, I hand-planed an offset radius onto the two outer faces of each leg and routed a bead along the lower edge of the aprons. As for the construction, the strong, simple mortise-and-tenon joinery is easy to make and destined to last for generations. And you'll find hand-planing the legs to be a breeze, especially with the use of a simple cardboard template.

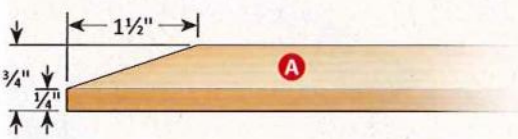
Figure 1: Kitchen Table Exploded View

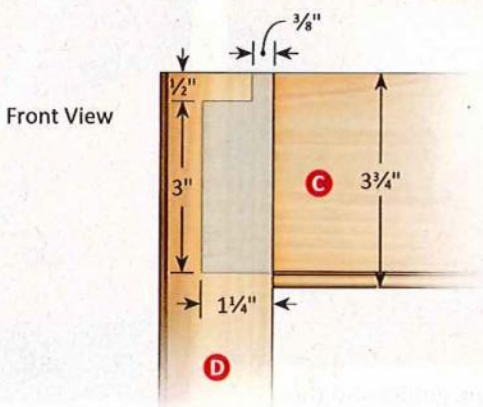


Tenon Detail



Bevel Detail





Photos: Paul Anthony; Illustrations: Christopher Mills

Lay out the boards for the top and aprons after skim-planing the lumber to reveal its color and grain patterns for good matching.

Clamp straight cauls across the ends of the top at the joints to align them. Use a rubber mallet to persuade other areas into alignment.

Make the top panel and apron blanks

1 Skim-plane your best 4/4 material, and then match your prettiest boards edge to edge (**Photo A**), leaving them a couple of inches oversized in length for now. Pay attention to symmetry, color, and continuity of grain flow across the joints. Orient the boards in their desired configuration, and number the end-grain surfaces for reorientation after final planing.

2 Lay out the apron blanks, leaving them slightly oversized in length and width for now.

3 Joint and plane the boards for the top (A) to about 1/32" thicker than 3/4", as the top will need further flattening after assembly. Alternatively, you can simply plane the 4/4 stock to its maximum possible dressed thickness. There's no harm in a slightly thicker final top.

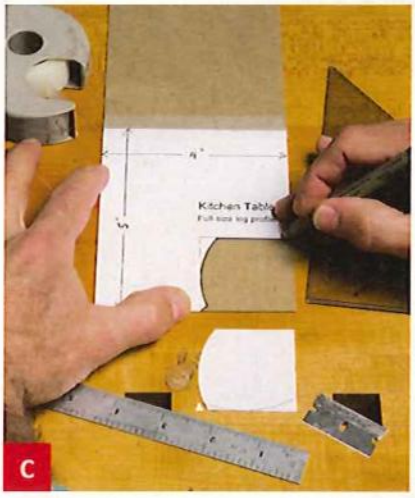
4 While you're milling the top stock, plane the aprons (B, C), too, and then cut them to the sizes shown in the **Cut List**.

Why Begin (And End) With The Top?

When I glue up a tabletop, I let it sit for a day or two before flattening it to allow water from the glue to fully evaporate. If you flatten it while the joints are somewhat swollen with water, they may shrink back afterward, creating valleys. So, I start with the top, and while it dries, I work on the base.

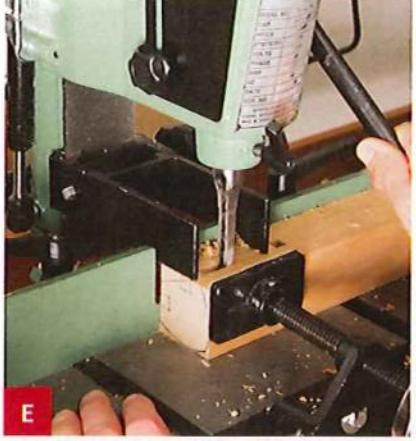
Tip Alert

When laying out boards for a tabletop or other panel assembly, I prefer to skim-plane the stock just enough to reveal grain and color for matching purposes. That way, any sections that I don't use will be left oversized in thickness for proper dressing when used for another project.



Cut the shaping gauge and the leg profile template from the same piece of stiff cardboard.

Trace the leg profile pattern onto both ends of each leg using a fine-tipped marker.



Plunge at each end of the deep mortise; then remove the waste between in overlapping passes.

In preparation for hand-planing, first rip away most of the waste at the corner of the curved face adjacent to the mortise.

5 Reorient the top boards, and mark a triangle across their faces for reference during glue-up.

6 Glue up the top (**Photo B**); then set it aside for now.

Lay out the legs

1 Lay out the legs (D) from straight-grained sections at the edges of thick plainsawn stock to yield diagonal grain on the ends, thereby producing straight grain on all faces. (If you lack thick enough stock, laminate the leg blanks from thinner pieces, taking pains to match the grain slope at the mating edges.) Dress the leg stock to the size shown in the **Cut List**.

2 Mark the leg blanks for position, orienting the most attractive faces outward. Place the blanks together in their desired orientation; then span all four ends with a triangle.

3 Use the full-sized leg profile pattern at right to make a cardboard contour gauge and leg profile template (**Photo C**).

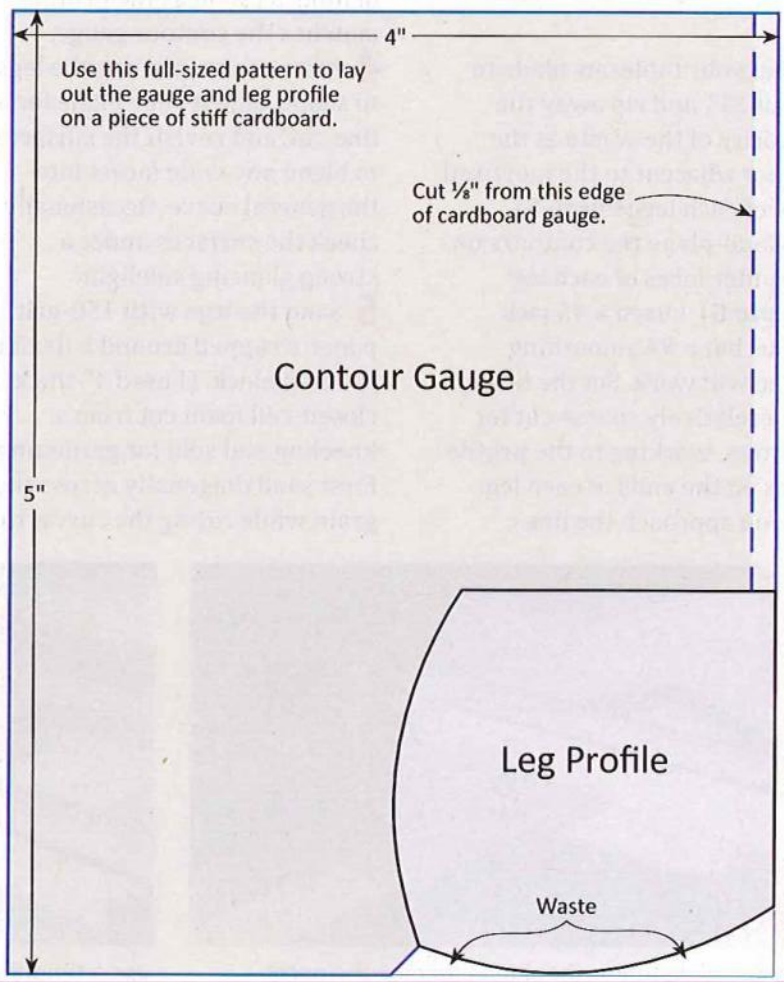
4 Lay out the leg profile on both ends of each leg, orienting the point toward the outside corner (**Photo D**).

5 Fully lay out the haunched mortises on one leg, and then simply mark off the ends of the 1¼"-deep by 3"-long mortises on all the other legs.

Mortise and shape the legs

1 Using the leg with the fully laid out mortises, set up the fence on a hollow chisel mortiser, and cut all of the deep mortises (**Photo E**). Then reset the depth stop and cut each haunched section. Alternatively, you can cut the mortises with a router outfitted with an upcut spiral bit and edge guide.

Figure 2: Contour Gauge and Leg Profile Pattern



Extending a finger against one edge of the leg helps maintain the angle of the plane throughout its stroke.

Register the shaping gauge against a mortised leg face to check your planing progress on the curved face.

Tip Alert

Lightly swipe the sole of your plane with paraffin to help it glide along the work. (I use a small block of canning wax from the grocery store, but a candle stub will work.)

2 Set your tablesaw blade to about 21°, and rip away the majority of the waste at the corner adjacent to the mortised face of each leg (**Photo F**).

3 Hand-plane the contours on the outer faces of each leg (**Photo G**). I used a #5 jack plane, but a #4 smoothing plane will work. Set the blade for a relatively coarse cut for starters, working to the profile lines on the ends of each leg. As you approach the lines, check your progress with the contour gauge (**Photo H**). At this point, abide by the gauge rather than the profile layout lines. Also check your progress occasionally with a straightedge. Aim to leave the legs as thick as possible, stopping your planing as soon as the profile matches the contour gauge.

4 After coarse-planing the legs to shape, adjust your plane for a fine cut, and revisit the surfaces to blend any wide facets into the general curve. Occasionally check the surfaces under a strong glancing sidelight.

5 Sand the legs with 150-grit paper wrapped around a flexible sanding block. (I used 1"-thick closed-cell foam cut from a kneeling pad sold for gardening.) First sand diagonally across the grain while riding the curve; then follow up by sanding with the grain. As you work, check for fair curves under a glancing sidelight. Sand the inner faces of the legs with a flat block wrapped with 150-grit paper, and ease the edge at the inner corner of the leg, but not the remaining corner edges.

6 Sand the legs to 220 grit, easing all of the edges in the process.

Complete the aprons

1 Working with the apron pieces (B,C) that you cut earlier, arrange them for attractive grain composition; then strike triangles across the top edges for proper reorientation later.

2 Lay out a single haunched tenon on one of the pieces, and use it to set up your tablesaw. Then cut the 3/16"-wide tenon shoulders across the broad faces of each piece (**Photo I**). Next,

Saw the wide tenon shoulders, feeding the apron with a miter gauge and using the fence as a stop.

Use a tenoning jig to cut the tenon cheeks. A backer on the jig prevents exit tear-out.

Use a shoulder plane set for a very fine cut to trim each tenon for a snug fit in its specific mortise.

Use the router table to cut a bead on the outside bottom edges of the aprons.

raise the blade to ¼" high, and cut the narrow tenon shoulder across the bottom of each apron. Finally, raise the blade to ½", readjust the fence, and saw the vertical haunch shoulder.

3 Set up a tenoning jig and saw the tenon cheeks (**Photo J**). Make the tenons a few hairs too fat to fit in their mortises for now.

4 On the bandsaw, rip the tenons to their finished 3" width.

5 Fit each tenon into its particular mortise, trimming the tenon cheeks with a shoulder plane (**Photo K**). Alternatively, you can use 150-grit sandpaper wrapped around a hardwood block. Shave and test-fit until inserting the tenon requires hand pressure, but no beating with a mallet.

6 Using the tablesaw and a miter gauge, miter the ends of each apron, where shown in **Figure 1**. Cut the tenons about 1/16" shy of 1¼" so that their ends don't hit within the leg.

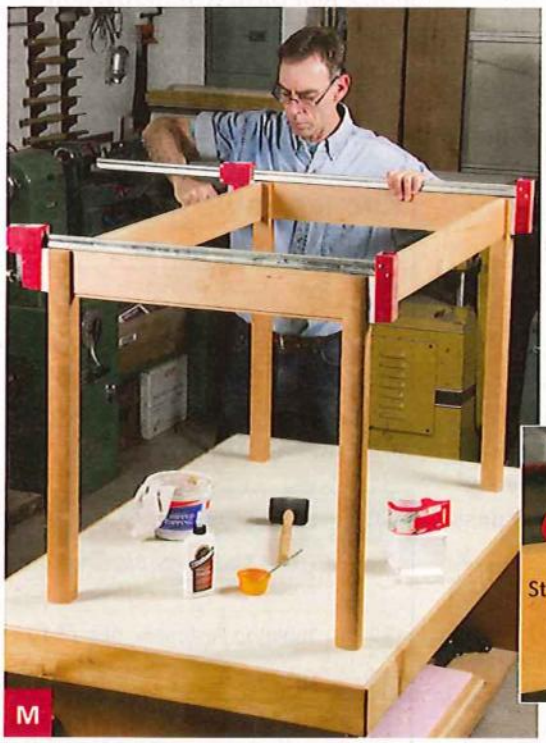
7 Rout a bead on the bottom edge of each apron (**Photo L**); then sand the aprons through 220 grit.

Assemble the base

1 Apply several coats of finish to the aprons and legs, avoiding the joint surfaces (I used an oil-based wiping varnish). Let the finish dry thoroughly.

2 Dry-fit the legs (D) and aprons (B, C) to ensure that all the joints seat well, and to rehearse your clamping procedure. To prevent marring the curved leg faces, attach thick, pliable material to your clamp jaw faces. I taped on pads made from styrene packing material, but leather or rubber pads would work.

3 Working on a flat surface, glue the legs to the short aprons (B), with the long aprons dry-fit in place to prevent the legs from cocking out of alignment under clamp pressure (**Photo M**).

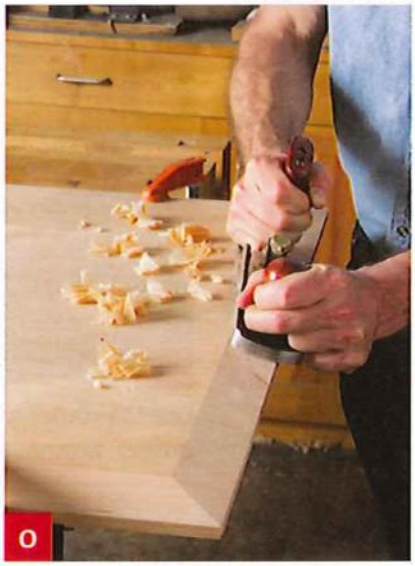


Glue the legs to the short aprons after attaching soft pads to your clamp faces. Partially insert the long-rail tenons to keep the legs from cocking.

The Benefits Of "Pre-Finishing"

Finishing project parts before gluing them up into assemblies has several advantages. For one, applying the finish is easier and cleaner when there are no intersecting parts to obstruct the brush, rag, or other applicator. Scuff-sanding and rubbing out between coats is also unimpeded. A final benefit is that dried excess glue squeeze-out can be effortlessly lifted and flicked off the finished surfaces after assembly.

Saw the bevel using a featherboard and tall auxiliary fence. This box-style fence fits over the rip fence.



When planing the end-grain bevels, work inward from each end to prevent exit tear-out.

To prevent excess glue from seizing the tenons on the long aprons, don't insert them fully. Give the glue an hour or so to cure, remove the long aprons, and pare away any excess glue inside the empty mortises. Then glue the legs to the long aprons (C).

4 Flick off any dried glue squeeze-out with a sharp chisel.

Complete the top

1 Flatten the top. I hand-planed, but you could carefully belt-sand or pay a friendly cabinet shop a few bucks to put it through their wide abrasive planer.

2 Rip the top to final width and then crosscut it to length using either a large tablesaw sled or a portable power saw guided by a straightedge.

3 Lay out the bevel on a piece of dressed scrap the same thickness as the top, and use it to set up your tablesaw to make the cuts. Saw the bevels using a tall auxiliary fence and featherboard (**Photo N**). A tilting splitter will also help hold the top against the fence. Feeding a large panel on edge like this isn't as dicey as it looks. Just push it steadily, don't rock it, and keep your fingers a safe distance from the blade.

4 Smooth the bevels. The cleanest, most efficient approach is to use a razor-sharp smoothing plane (**Photo O**). Alternatively, wrap sandpaper around a hard rubber block, starting with the finest grit possible that will remove the saw marks. Strive to keep the bevel edges crisp at this point, and make sure that the intersections line up with the corners.

5 Sand the top through 220 grit, gently easing the bevel edges. Then apply finish. I carefully wiped a total of six coats of oil-based varnish onto both faces. To obtain a smooth, protective build, I let each coat dry without wiping it off; then I scuff-sanded between coats with progressively finer sandpaper, finishing up with 0000 steel wool.

Attach the top with fasteners

1 Use a biscuit joiner or a slot-cutting bit in a router to cut the slots for tabletop fasteners, where shown in **Figure 1**.

2 Attach the top with tabletop fasteners, setting the dog leg back about ⅛" from the long aprons to allow for seasonal cross-grain movement. ■

Tip Alert

When sawing bevels like this, I use a good quality 80-tooth crosscut blade, which minimizes clean-up of the bevels afterward.

Kitchen Table Cut List

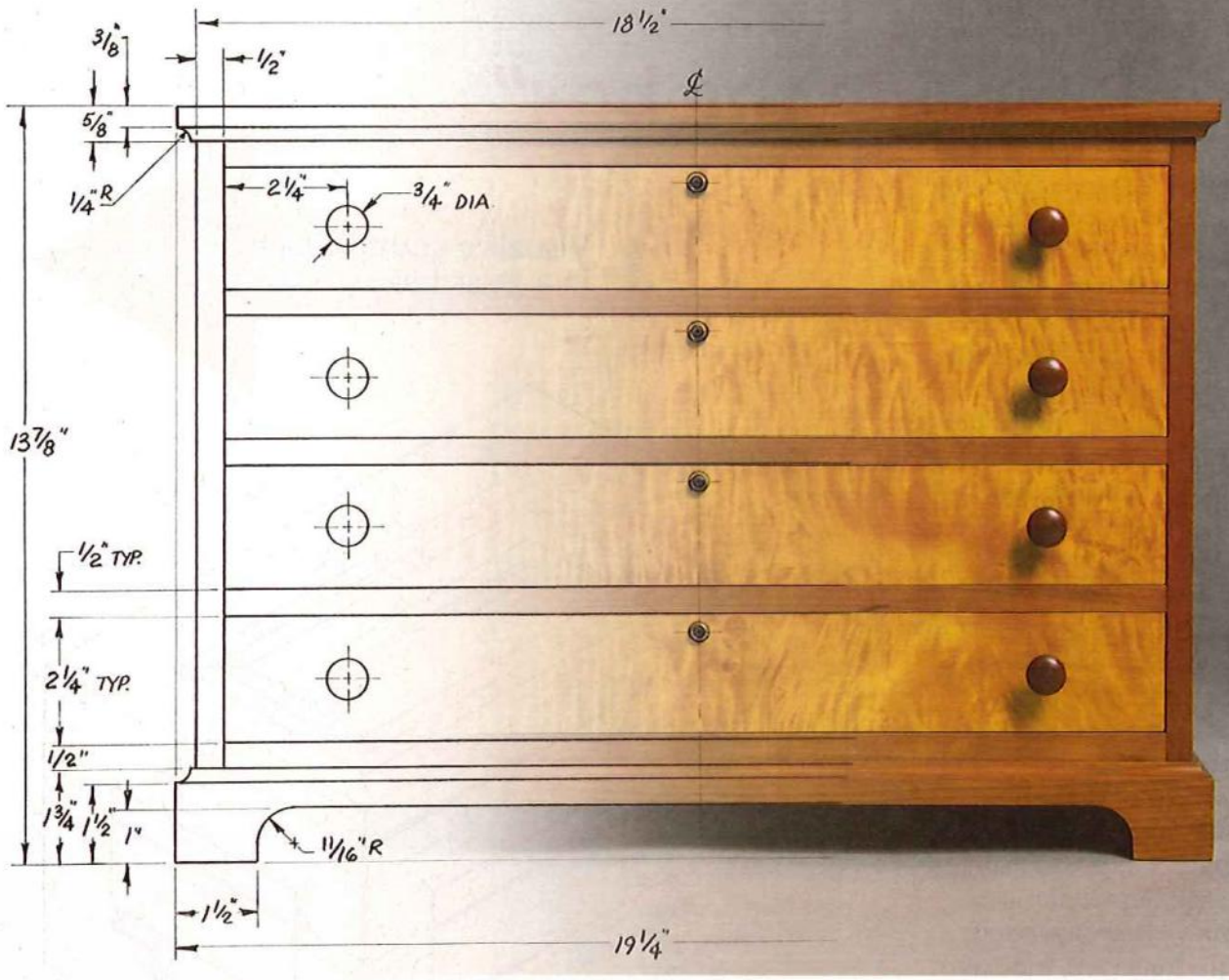
	Part	Thickness	Width	Length	Qty.	Mat'l
A	Top	¾"	30"	48"	1	C
B	Short aprons	¾"	3¾"	25½"	2	C
C	Long aprons	¾"	3¾"	43½"	2	C
D	Legs	2"	2"	29¼"	4	C

Materials: C=Cherry

Convenience-*PLUS* BUYING GUIDE

☐1.	Freud Traditional Beading Router Bit, ⅛" R (¼" SH), Freud# 80-102	#828782	$33.99
☐2.	Tabletop Fasteners, pkg. of 10	#27N10	$2.25
☐3.	General Finishes Seal-A-Cell Clear, qt.	#85S09	$16.99
☐4.	General Finishes Arm-R-Seal Satin, qt.	#85F08	$15.99

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



Orthographic Drawings

You don't have to be an artist to draw great furniture plans.

By Craig Bentzley

Woodworking requires a graphic language to convey building information. We can't do it without drawings that show component relationships, joint sizes, offsets, profile shapes, and a myriad of other details. Most published woodworking plan illustrations are presented in pictorial fashion–representing the three-dimensional way we normally perceive objects. That's great for a quick-hit understanding of construction, but it's not always the best way to present certain information, and it doesn't render the true profiles of the parts. Plus, pictorial representation probably doesn't help you design your own project plans since, let's face it, most of us aren't artists.

That's where *orthographic*, or *multi-view*, drawings come in. An orthographic drawing presents a "straight-on" two-dimensional view or views of an object as seen from, for example, its front, sides, and top. This shows parts in their proper shapes, proportions, and relationships while allowing easy dimensioning. Just as importantly, basic orthographic drawing is well within the reach of any woodworker who knows how to use a pencil, ruler, and drafting triangle, allowing you to create your own working drawings.

There's no great mystery to orthographic drawings. Once you grasp the basic principles that I discuss here, you'll be on your way to reading and writing one of woodworking's most revered languages.

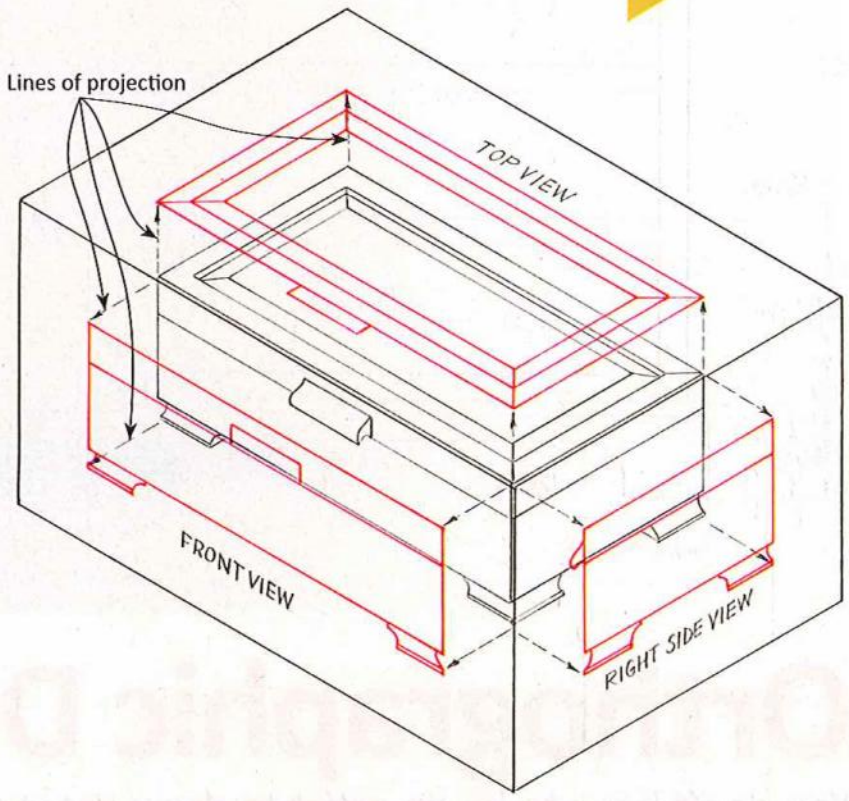
Photos: Paul Anthony; Illustrations: Craig Bentzley

Think "inside the box"

Surely you're familiar with the phrase "think outside the box." With orthographic drawings, the opposite is true. You need to visualize an object as being inside a glass box, with the object's various profiles projected onto the box's sides. As shown in the series of drawings at right, first imagine each view projected onto its respective side of the box. Then unfold the box to display the views in their proper relationship to each other when represented on the page.

Since a box has six sides, you have the opportunity to illustrate the object in six views or *elevations*. Most furniture projects require only a front view, a side view, and occasionally a top view. Usually, the most descriptive view is selected to be the front view, which is placed in the lower left quadrant of the drawing. The right side view is placed in the lower right quadrant, and the top view (if needed) is placed at top left.

1 Visualize your project in a glass box.



Construction lines

Several lines are commonly used to denote the outlines of parts and the location of holes. For the sake of discussion, I'll call these "construction lines." They include *object lines*, *hidden lines*, and *centerlines*, as shown in **Figure 1**.

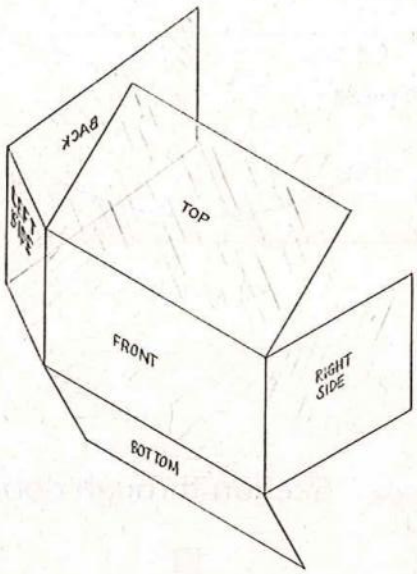
Object lines are the most important of these. They represent all of the visual aspects of an actual object when viewed straight-on. For example, object lines show the perimeter of a cabinet as well as all the edges of its face frame, door, moldings, pulls, and every other line that the eye actually sees. On a drawing, object lines are rendered the thickest and darkest of all.

Hidden lines are used to depict any internal elements or features that are obscured in normal view, such as joinery or interior surfaces. These lines are rendered lighter and thinner than object lines and consist of a series of short dashes of equal length that are separated by spaces of shorter distance.

Centerlines are used to show axial symmetry, in which one half of the object is a mirror image of the other. Like hidden lines, they are lighter and thinner than object lines. A centerline consists of a series of short dashes, each of which is separated by a much longer dash. Centerlines are also used to locate holes, in which

2 Visualize unfolding the box.

3 The unfolded box reveals the elevations to your project.



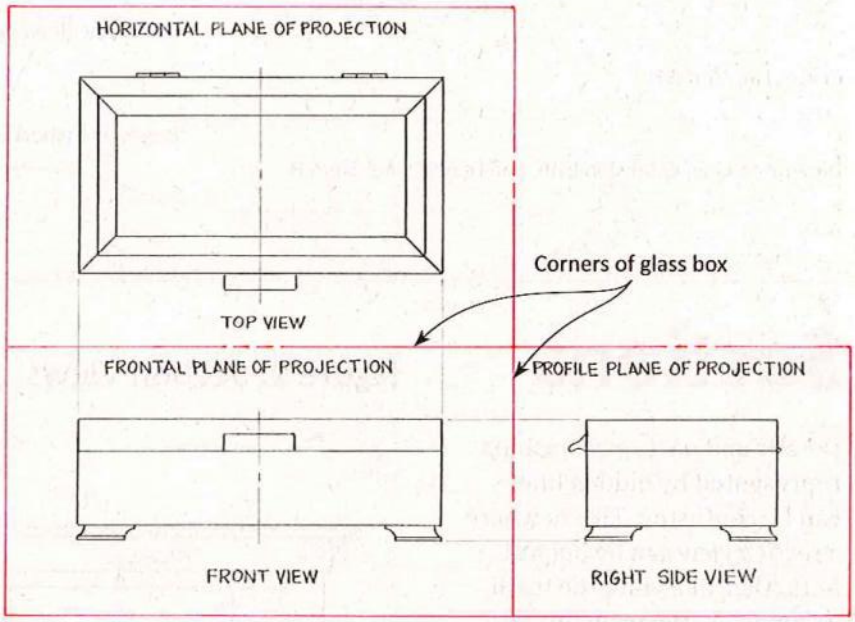
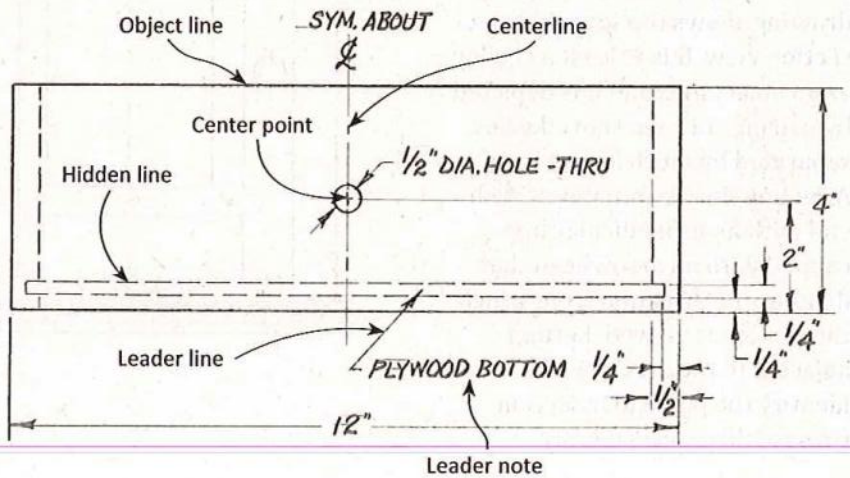


Figure 1: Construction Lines and Leaders

case the hole's center point is marked by the intersection of two short dashes, each flanked by longer dashes.

To help clarify construction elements, a *leader line* (consisting of an arrowhead line and note) can be helpful, as shown identifying the drawer bottom in **Figure 1**. A leader can also be used to call out special details, hardware, or any other ancillary information.



A library of lines

This basic vocabulary of lines can be expressed nicely by the layman using a 5mm and a 9mm mechanical pencil outfitted with H and HB leads, respectively. But don't let lack of the proper tools stop you; a regular pencil will get the idea across.

Object Line: 9mm HB

Hidden Line: 5mm H

Center Line: 5mm H

Dimension Line, Extension Line, and Leader Line: 5mm H

Section Line: 9mm HB

Break Line (long breaks): 5mm H

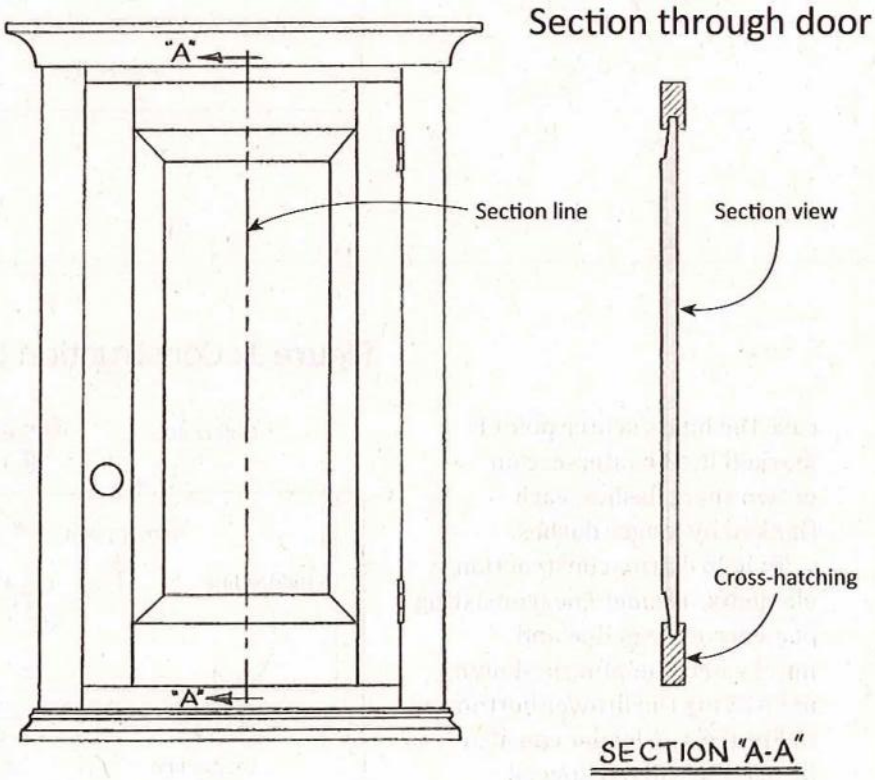
Break Line (short breaks): 9mm HB

Sections

Details and part relationships represented by hidden lines can be confusing. This is where a *section view* can be helpful to further illustrate the main drawing. As the term implies, a section view shows parts as sliced through in cross-section, as shown in **Figure 2.** Parallel diagonal lines (*cross-hatching* in drafting parlance) are often used to indicate the area that has been "cut."

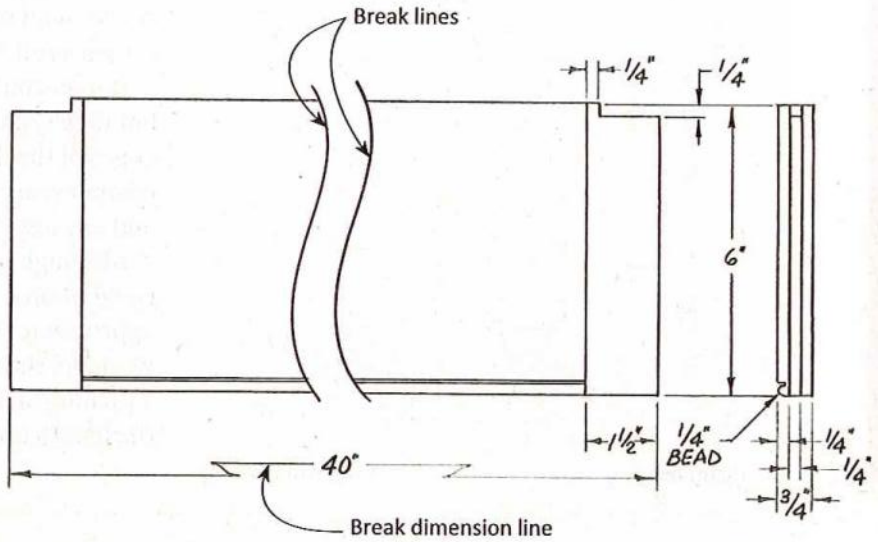
A *section line* on the main drawing shows the source of the section view. It is at least as heavy as an object line, and it is depicted by pairings of twin short dashes separated by much longer lines. A section line terminates at each end with a perpendicular line capped with an arrowhead that denotes the direction from which the section is viewed. Letters adjacent to the arrowheads identify the particular section (in case there are several).

Figure 2: Section Views



Breaks

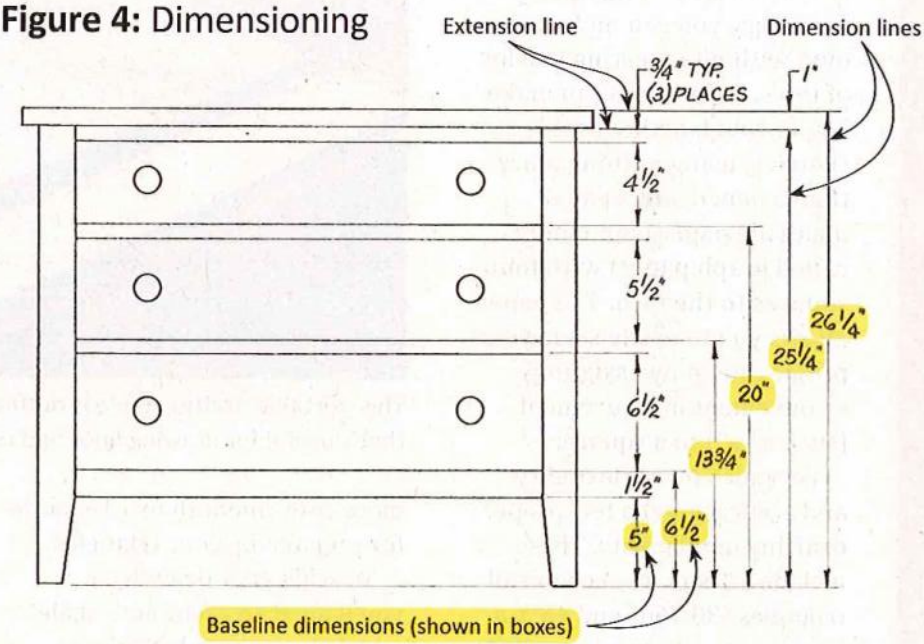
Figure 3: Breaks



If a part is very long (or very wide) with no unusual features along its expanse, break lines can be used to condense the amount of real estate given to the drawing. For wood parts, typical break lines are the same line weight as the object lines and are often shown as jagged edges (**Figure 3**). However, there don't seem to be any strict conventions regarding the style of break lines. A zigzag dimension line can be used to identify the entire length of the interrupted piece.

Dimensioning

Figure 4: Dimensioning



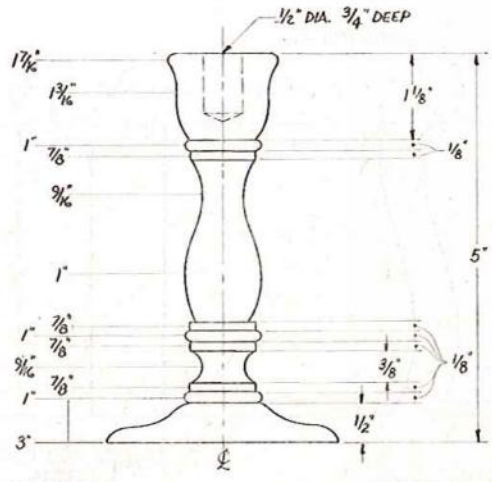
Once you complete your views, the next step is to dimension them. This is done using a combination of *extension lines* and *dimension lines*, as shown in **Figure 4**.

Extension lines project from the measurement's points of origin without actually touching the object lines. Dimension lines terminate with arrows and span the distance between the extension lines to provide the desired measurement, which is noted at the center of the line. Note that extension lines extend a bit beyond the dimension line arrowheads. Both types of lines are lighter in weight than object lines.

Height dimensions are usually placed to the right side of the front view, where they can be shared with the right-side view. (Note that the height dimensions on the hybrid illustration/photo on page 31 were placed to the left only to suit this particular graphic.) Width dimensions are usually placed below the front view unless there is a top view, in which case the dimensions can be located between the two views.

Baseline dimensioning is a good approach for a project such as a chest of drawers that has lots of stacked elements. With this method, all height dimensions are taken off a baseline (usually the floor), with subassemblies and components called out individually. This helps eliminate errors caused by adding various height measurements to achieve a total. However, I prefer to take a modified approach, calling out just the most important dimensions.

Figure 5: Dimensioning Turnings



Diameters

Length dimensions

For example, in **Figure 5**, I note only the distance to the top edge of each rail, which is all I need to lay out the leg mortises (or to create a full-scale story stick for the job).

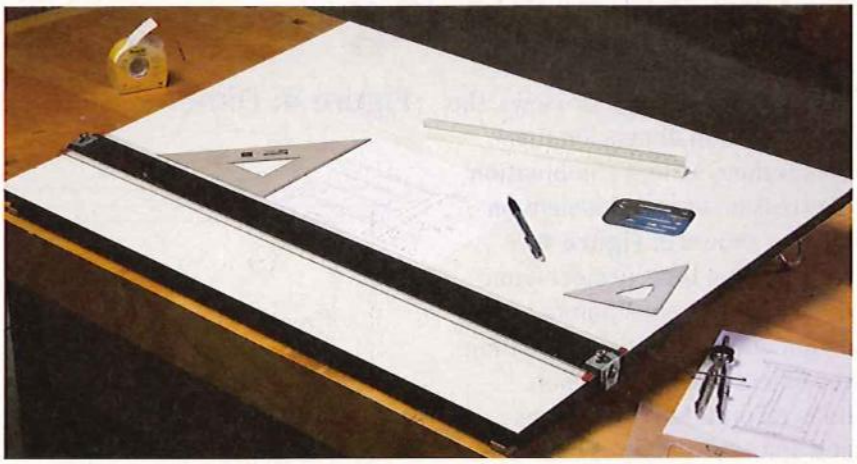
Dimension lines denote door and drawer openings, but they typically do not include the gaps at the edges of the doors and drawers. That's because these components are sized to suit the particular materials and any anticipated seasonal wood movement.

Although it doesn't necessarily comply with conventional drawing standards, I use a simple approach to dimensioning spindles and other turned work. As shown in **Figure 5**, I list the diameters of a turning on the left-hand side of the drawing and the length dimensions on the right-hand side.

Getting started in drafting

Now that you understand the basics of orthographic drawings, you can make your own without investing in a lot of tools. In fact, you can make lots of rough orthographic sketches using nothing more than a pencil and a pad of quadrille paper (commonly called graph paper) with four squares to the inch. The paper allows you to easily scale your project down by assigning a convenient measurement (such as 1") to a square.

For much more flexibility and accuracy, get a few proper drafting implements. These include a T-square, a couple of triangles (30°/60° and 45°), a couple of mechanical pencils (a 5mm with H lead and a 9mm with HB lead should handle most of your needs), and a compass. An impromptu drawing board can be made out of a piece of melamine board with perfect 90° corners. Better yet, outfit your table with a parallel straightedge, which is much more convenient than a T-square for registering your triangles.



This portable drafting table is outfitted with a parallel straightedge that's useful for drawing lines and registering tools.

To scale your drawings, you'll need an architect's scale, which is a triangular-shaped ruler with various scales on each edge. Don't worry–it's a very intuitive tool to use.

Oh, and don't forget a good eraser (I prefer white vinyl), as well as an erasing shield to target just the errant lines. As one of my mentors told me early on, "It's a lot easier to correct your mistakes on paper than it is to correct them on wood." ■

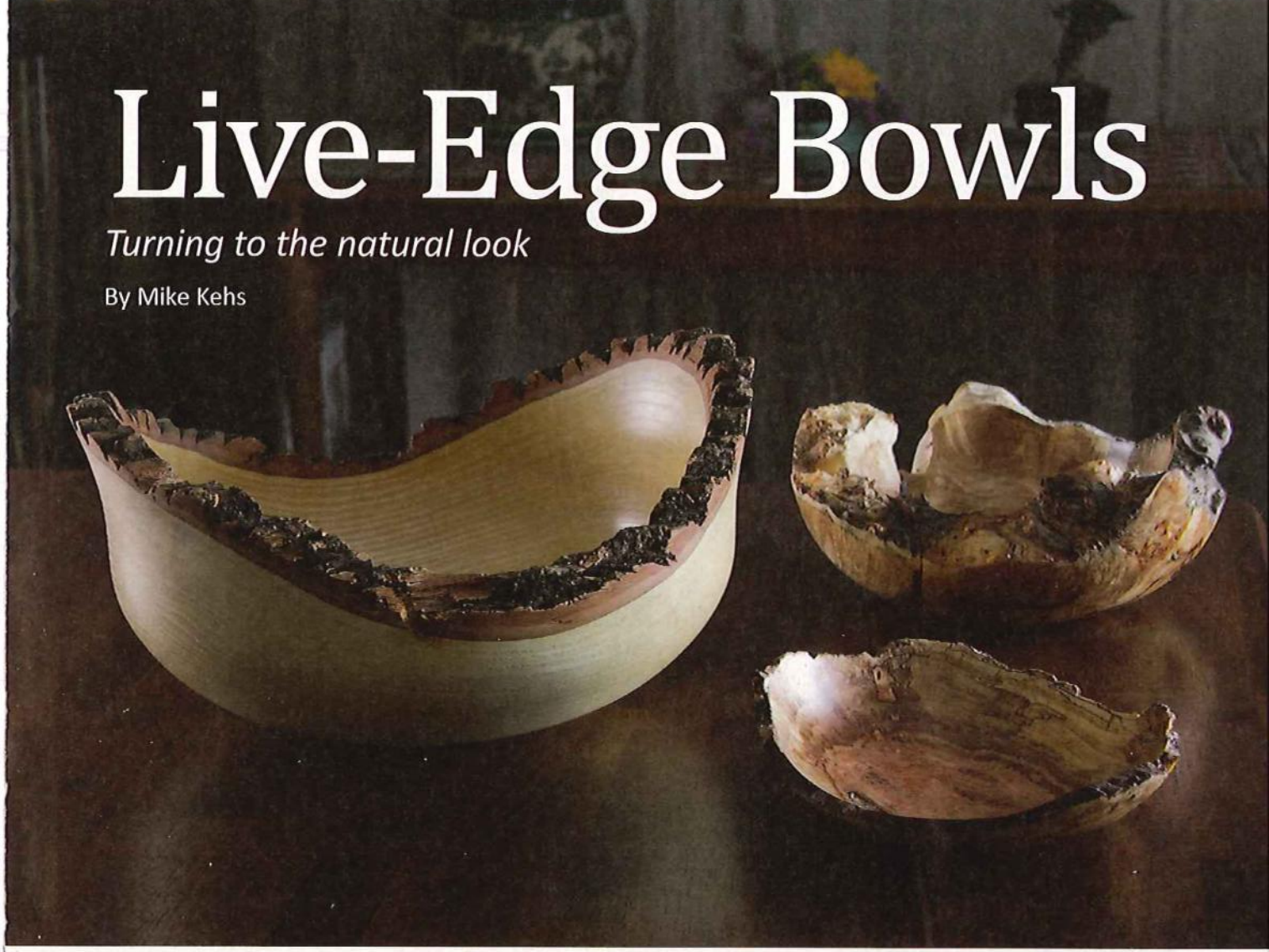
About Our Author

Craig Bentzley spent 10 years of his early life (in the pre-CAD era) hunched over a drawing board as a senior designer. When he's not writing about woodworking, he enjoys making period reproductions and restoring antique furniture in his Pennsylvania shop.

Live-Edge Bowls

Turning to the natural look

By Mike Kehs



There's something particularly satisfying about turning a "natural-" or "live-edge" bowl. First of all, the scalloped lip and the elongated grain on the bottom of the bowl give it a pleasing oval appearance, and the intact bark on the edge imparts a distinct character not seen on typical bowls. Secondly, there's a real joy in creating a bowl completely from its inception–beginning with selecting the log and "finding" the bowl within it, to bandsawing the blank and turning it into an object of beauty.

Many novice turners are mystified as to how the unusual shape is created, but there's no magic involved. It's really all in how the bowl blank is cut from the log (see **Figure 1** on page 40) and how it's oriented on the lathe. There's nothing particularly difficult to the technique, but there are a few tricks involved that I'll explain, including how to select and cut an appropriate turning blank and how to best orient it to maximize aesthetics. No special tools are needed–just a 4-prong drive center, a 4-jaw chuck, a cup center, and a few typical turning tools.

Select, prepare, and mount the blank

1 Select wood such as cherry, ash, oak, or box elder with an attractive bark. To ensure intact bark, harvest the log during late autumn through early winter, before the new cambium layer starts forming.

2 For a symmetrical bowl, select a section of the log that includes a broad surface that approaches a true arc. Then crosscut that section to a length slightly more than the diameter of your desired bowl. Next, rip the desired section of the bowl blank from the log, supporting it between wedged chocks, as shown in **Photo A**. It can help to first mark out the rough profile of the bowl on the end of the log and to strike a chalk line across the bark to guide your cut.

Photos: Paul Anthony

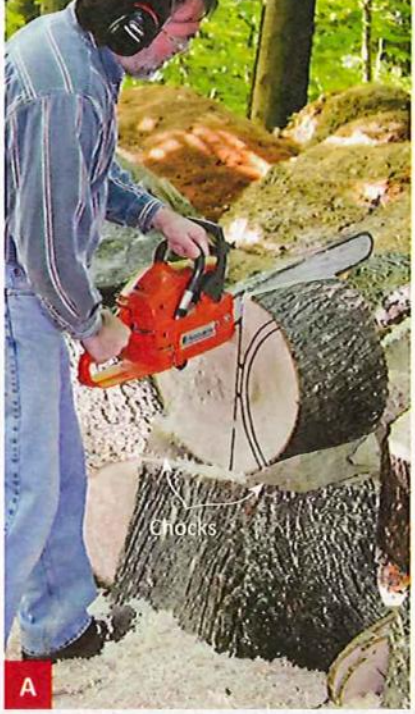
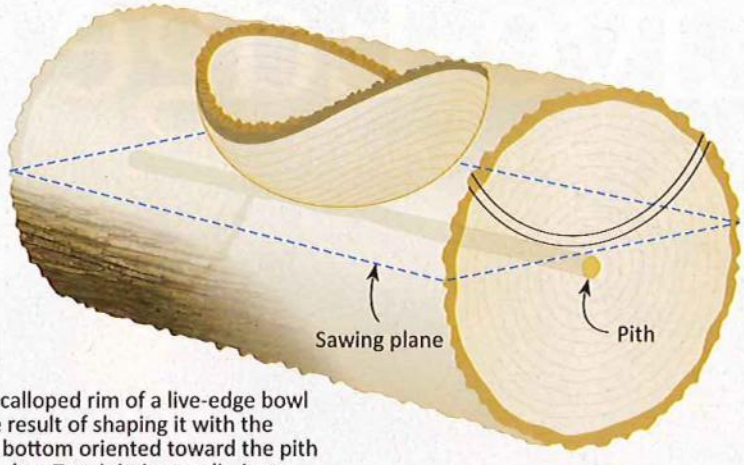


Figure 1: Alive in the Log



The scalloped rim of a live-edge bowl is the result of shaping it with the bowl bottom oriented toward the pith of the log. To minimize or eliminate cracking, avoid the log's pith.

3 Rough-out the blank's circular shape on the bandsaw. I guide the cut using a hardboard template centered on the half-round log. I use an awl to pin the template in place, sawing just outside its perimeter (**Photo B**).

4 Use a Forstner or multi-spur bit to drill a shallow blind hole through the bark at the former location of the awl to allow your 4-prong drive center to bite into solid wood.

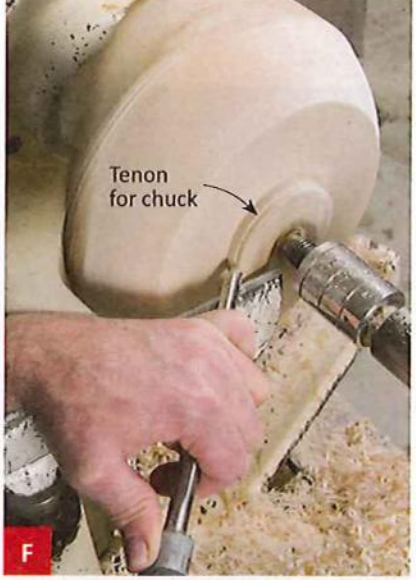
5 Mount the blank by placing the drive center into the blind hole, center-balancing the blank, and pressing the tailstock against the blank's sawn face using a live center. Use the locked tool rest as a reference for center-balancing the blank. With the tailstock pressed lightly enough against the blank to allow adjustment, begin by setting the opposing "low" walls of the bowl equidistant from the tool rest (**Photo C**). Follow up by adjusting the "high" walls in the same manner (**Photo D**). Then fully engage the tailstock center, and lock it in place. Check the balance of the mounting by running the lathe at a low rpm.

Turn the outside

Note: All of the shaping–inside and out–on this bowl was done with a ½" bowl gouge, except where noted in the text.

1 With the lathe spinning at a speed appropriate to the size of the blank, waste away much of the lower outside of

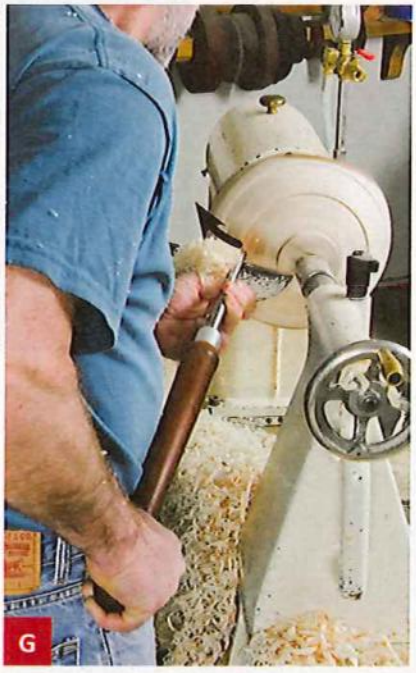
E



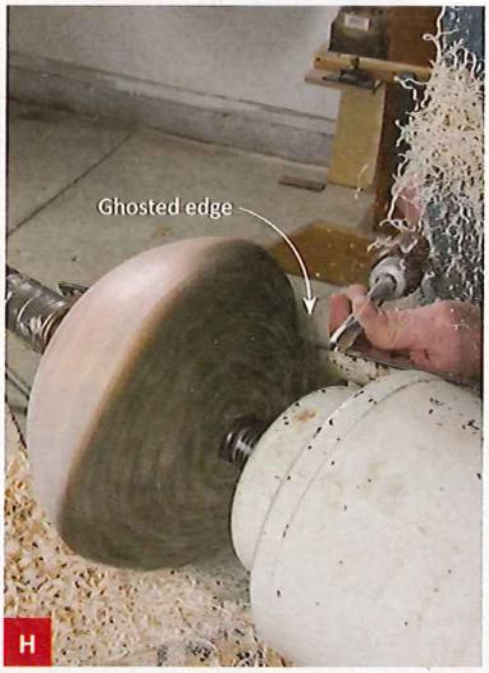
F

Tip Alert

Before taking the final outside cleanup cuts, carefully apply CA glue to the side (but not the top) edges of the bark to solidify it.



G



H

the bowl (**Photo E**). (For this 11"-diameter bowl, I began with a speed of 500 rpm.) Once the bowl is mostly concentric, you can increase your lathe speed.

2 Flatten the bottom of the bowl, and turn a tenon to suit your 4-jaw chuck (**Photo F**). Make the length of the tenon equal to the depth of your chuck recess minus about 1/16", refining the shape with a ½" spindle gouge.

3 Begin refining the outside shape of the bowl, working from the center outward (**Photo G**). When you reach the lip of the bowl, keep a very firm grip on the tool, as its tip will be suspended in midair during some of the bowl's rotation (**Photo H**). Keep an eye on the spinning ghosted form to monitor your tool travel.

Turn the inside

1 Remount the bowl, inverting it and securing the tenon in a 4-jaw chuck. Hold a long drill bit up against the "high" side of the bowl, with the tool's tip about ½" away from the intended bottom of the bowl. Wrap tape around the shank of the bit at the highest point of the bowl to serve as a depth gauge. Then drill a hole to that depth using a drill chuck on the lathe (**Photo I**).

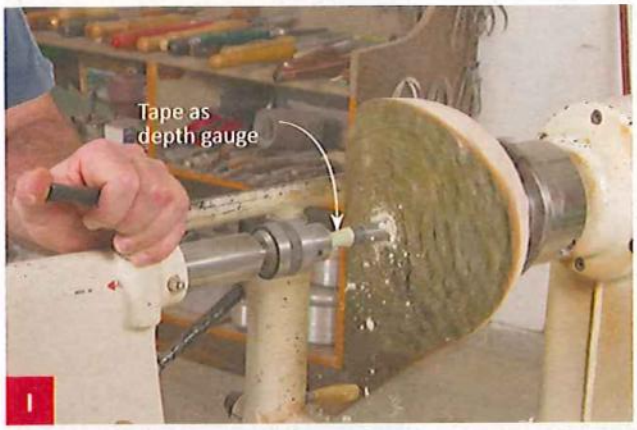
2 Begin shaping the inside of the bowl, moving inward toward the center in a series of successively wider passes (**Photo J**).

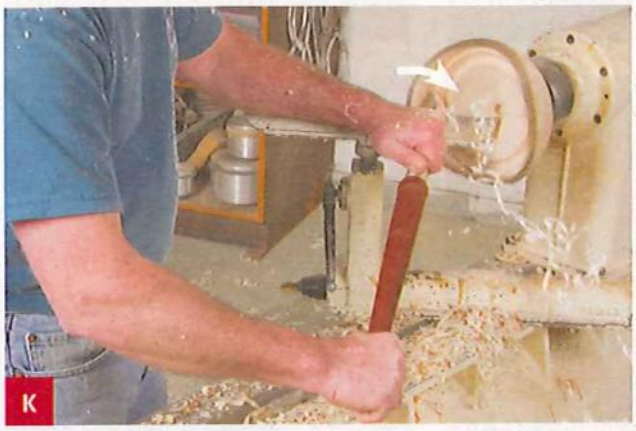
3 While removing most of the interior mass, leave the wall relatively thick. Then begin taking it down in sections to a final thickness of about ¼" (**Photo K**). The reason for taking it down in sections is that the uncut mass toward the bottom of the bowl helps support the projecting thin section of the wall as it is being finessed. Taking the wall down all at once would invite flutter and rough cuts.

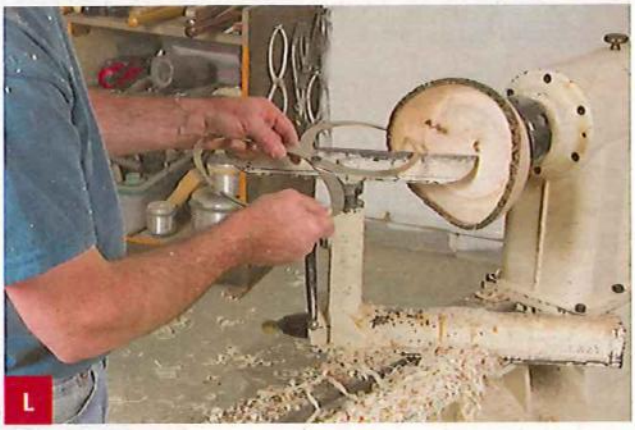
4 As you approach the final thickness of the first section, stop the lathe, and check the measurement with calipers (**Photo L**). Then refine the cut as necessary to bring the whole section to a consistent thickness.

5 Now move down into the bottom of the bowl in the same manner, bringing the wall to

Illustration: Mario Ferro







Twice-Turned Bowls

A bowl made of wet wood can either be turned to completion at once (and left to dry in finished form), or it can be turned oversized, left to season, and then re-turned afterward. Finishing a bowl in one shot is faster, but the piece is almost certain to warp some afterward, which may or may not make it more attractive. On the other hand, a "twice-turned" bowl is roughed out to expedite drying, then set aside wrapped in newspaper to slowly season before performing the final shaping, at which point the piece will retain its concentricity.

its final thickness (**Photo M**). Angle your tool rest as deeply as possible into the bowl to provide good tool support as you turn. When you've finished the wall as well as you can with the gouge, switch to a scraper to clean up (**Photo N**).

6 Finish-sand both the inside and outside of the walls through 220 grit (I use a foam-backed disc mounted in a drill). You can sand the spinning bowl up to the lip section, at which point you'll need to stop the lathe and sand the projecting sections of the lip individually (**Photo O**).

Turn the foot

1 Dismount the bowl, and make a jam chuck like the one in **Photo P**. It's nothing more than a turned concave cylinder covered with thin rubber. (I cut the rubber away here for a better view of the turned section.) In


M


N

general, the diameter of a jam chuck like this should be about half the diameter of the bowl.

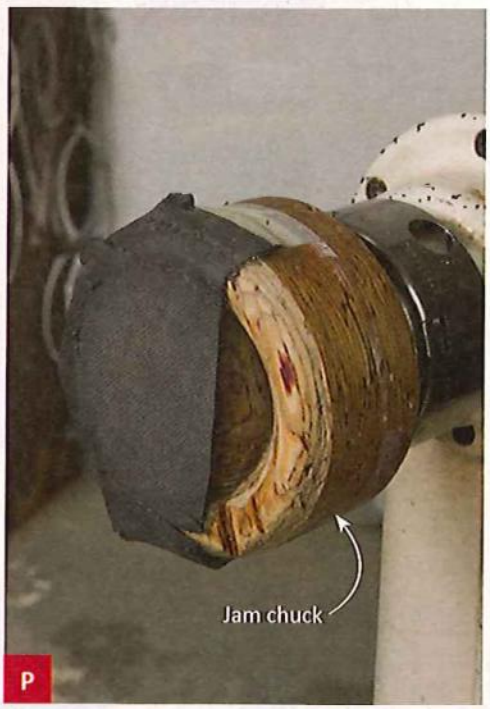
2 With the jam chuck mounted in your 4-jaw chuck, mount the bowl bottom-side-out, bringing a tailstock cup center against the residual divot in the bowl bottom.

3 Using a ¼" bowl gouge, reduce the tenon to the diameter of the cup center, creating a slightly concave "foot" in the process (**Photo Q**). Sand the freshly turned area with the lathe spinning.

4 Dismount the bowl, chisel off the remaining tenon waste, and sand any nub smooth.

5 Apply the finish of your choice. I wiped on two coats of Danish oil, buffing afterward to create a low-luster sheen. ■


O



P


Q

About Our Author

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

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- 150875 V3 #5 Bench
- 150876 V3 #6 Bench
- 153104 V3 #7 Bench
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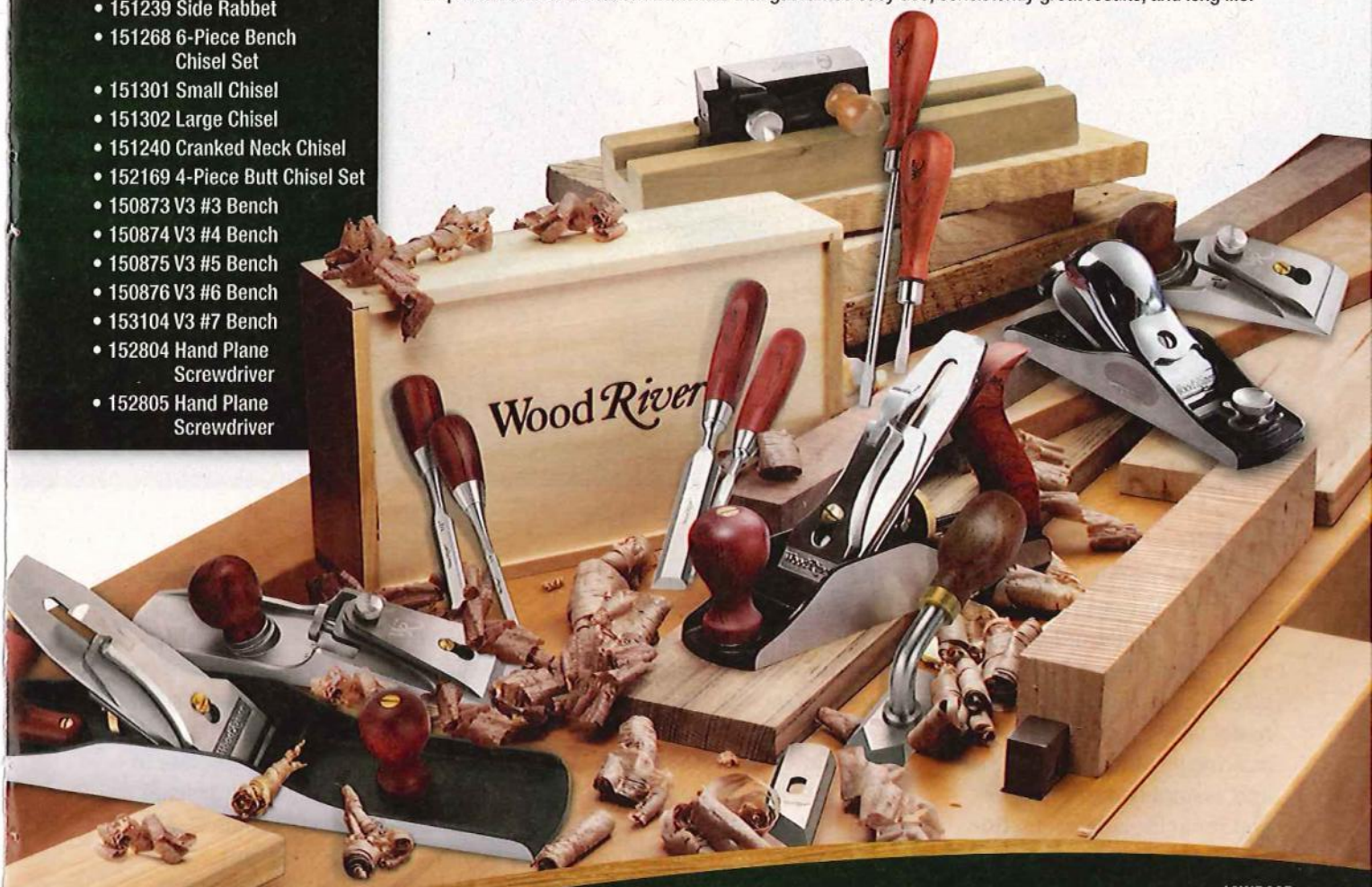

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Tile-Top Box

Keeper jigs make this construction spot-on accurate and repeatable.

By Jim Harrold

Overall dimensions:
12"w × 10"d × 5¾"h

Makers of decorative boxes forever seek novel ways to join box sides and present a special look using favorite–often figured–woods and other materials. They also want box-making jigs to speed the cutting and assembly assignments and for achieving perfection. This handsome container promises all that and more!

Here, a mix of quartersawn sycamore, walnut, and ebony creates visual contrasts, while dovetail keys lock in the mitered corners.

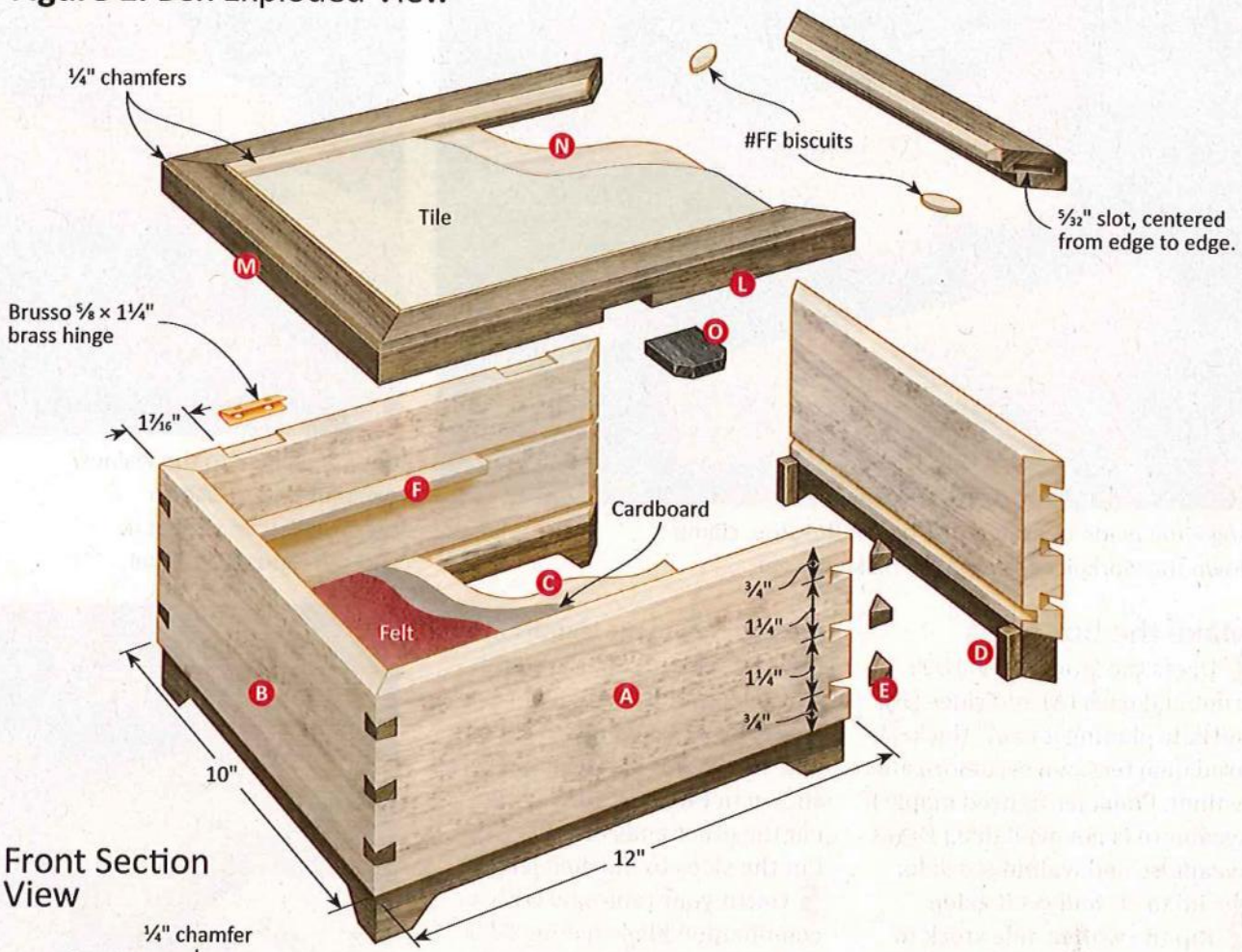
Adding to the uniqueness is the ceramic tile top that personalizes the box, making it ideal for gift giving. Instead of a wood panel in a lid's frame, an 8 × 10" tile displays a transferred photo image. Photos of a scenic landscape, favorite pet, or family members all make great subjects, and you can select from a matte, satin, or glossy finish. You also can order tiles in several sizes, but you'll have to adjust dimensions accordingly.

Better still, when you build the box, you'll encounter a super-accurate box-maker's miter sled, a router-table dovetail slot jig, and a butt-hinge mortising template to add to your box-making arsenal. Use these to mass-produce as many boxes as you want.

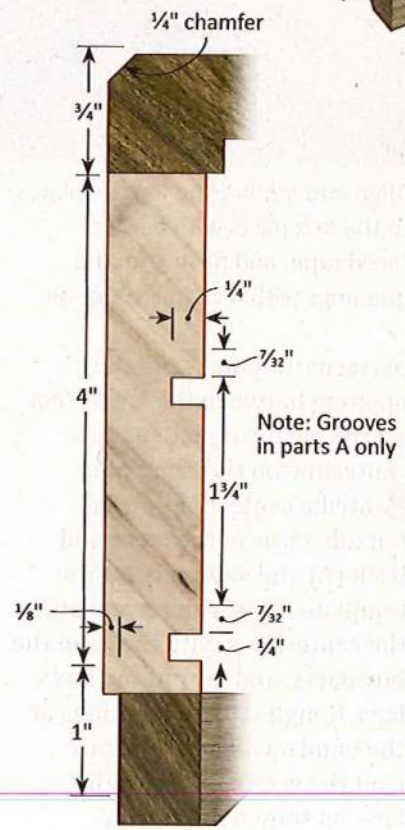
Note: Order the tile in advance, and measure it for the best fit in the lid's wood frame. My tile measured 7⅞ × 9⅞".

Opening photo: Chad McClung

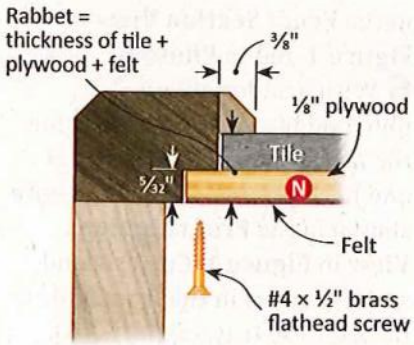
Figure 1: Box Exploded View



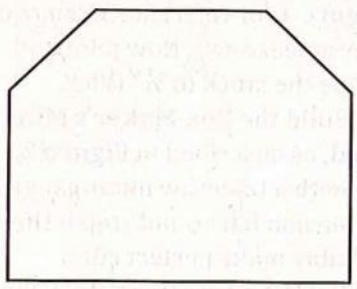
Front Section View



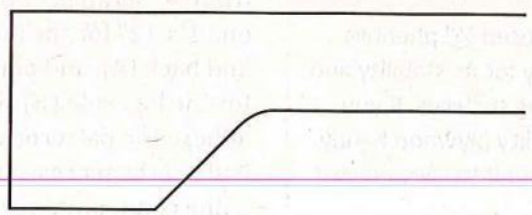
Lid Detail



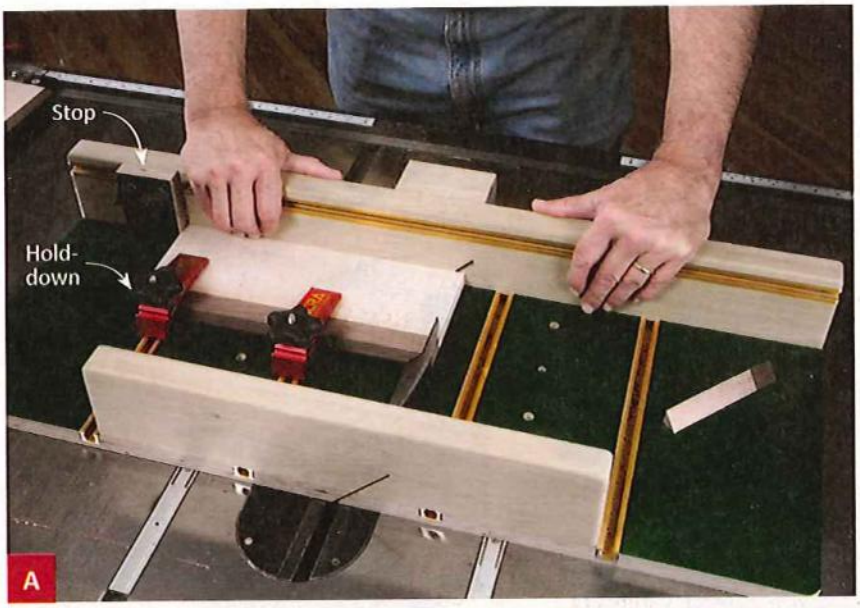
Lid Lift Pattern (full-sized)



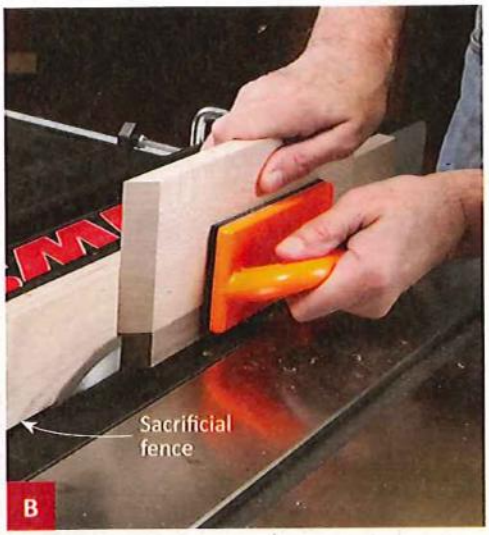
Foot Template Pattern (full-sized)



Photos: Jim Osborn; Illustrations: Frank Rohrbach III



Angle the blade to exactly 45°, adjust the stop, clamp down the workpiece, and safely make the cut.



Raise the blade to the walnut/sycamore seam, slide a sacrificial fence against it, and safely cut the rabbet.

Make the box sides

1 Dress the stock for the box front and back (A) and sides (B), initially planing it to ¾" thick. (I used quartersawn sycamore and walnut. Consider figured maple if sycamore is not available.) Dress sycamore and walnut stock for the lid to ⅞" and set it aside.

2 Rip the walnut side stock to 1" wide and the sycamore to 4". Edge-glue the contrasting woods for the box front and back (A) and sides (B). (See **Figure 1** for reference.) Remove the squeeze-out. Now joint and plane the stock to ⅝" thick.

3 Build the **Box-Maker's Miter Sled,** as described in **Figure 2**, or go with a tablesaw miter gauge, extension fence, and stop if they reliably make perfect cuts.

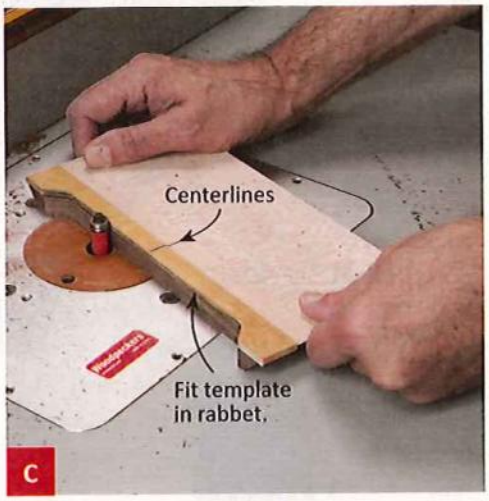
4 Cut the edge-joined stock for the box front and back (A) and the sides (B) to the lengths in the **Cut List**, plus 1". Set the sled's stop, clamp the box front or back piece in place, and miter-cut one end. Repeat for the other piece, as shown in **Photo A**. Now miter-cut the other ends of parts (A). Cut the sides to finished length.

5 Outfit your tablesaw with a combination blade having FTG teeth for a flat-bottom cut. Now, cut the ⅛" rabbet in the outside faces of the sides, where shown in the **Front Section View** of **Figure 1** and in **Photo B.**

6 With a dado set or 7/32" plywood bit, cut the grooves for the box bottom (C) in the front and back (A) and sides (B), where shown in the **Front Section View** in **Figure 1**. Cut a second set of grooves in the front and back for the tray supports (F).

7 Make four copies of the **Foot Template** pattern in **Figure 1**. Next, cut two template pieces from ¼" scrap plywood. Make one 1 × 12" for the box front and back (A), and one 1 × 10" for the box side (B). Spray-adhere the patterns onto the ends of the pieces, and strike a line connecting the end patterns. Cut and sand the opening between the ends. Peel off the patterns, and mark a centerline on the templates.

8 Strike centerlines on the outside faces of the front and back (A) and sides (B). Fit the template in the rabbet and align the centerlines with those on the box parts, and lay out the box legs. Rough-cut the openings at the bandsaw. Then template-rout the waste between the legs, as shown in **Photo C.**



Align and adhere the leg templates to the box parts with double-faced tape, and flush-trim the openings with a ½"-diameter bit.

Tip Alert

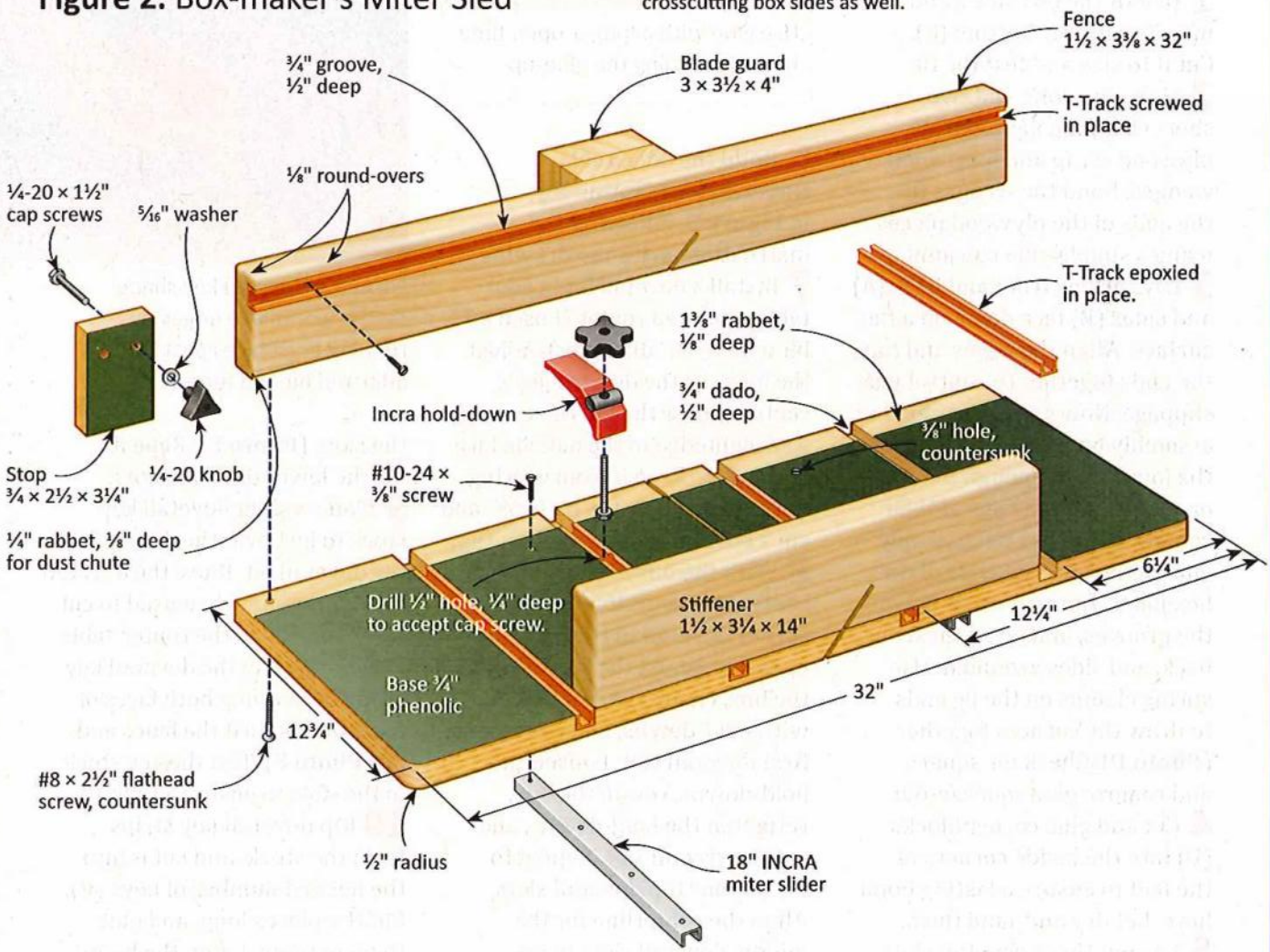
For the jigs, I used ¾" phenolic-faced MultiPly for its stability and smooth-gliding surfaces. If you have flat, quality plywood handy in the shop, use it to save on cost.

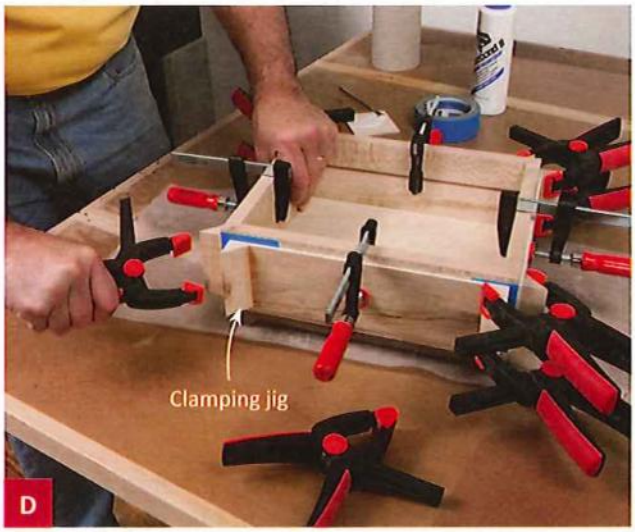
How To Build The Sled:

1 Cut the base and machine the dadoes and rabbet.
2 Radius the front corners, and cut the T-Tracks to length. Drill ½" holes in the tracks to accept the cap screws. Epoxy the tracks in place.
3 From dressed hardwood, cut the fence and stiffener. Cut the groove in the fence, round over the corners on both pieces, and screw them in place. Cut and screw in the fence T-Track.
4 Cut the blade guard from face-joined stock. Center it on the fence, and glue it in place.
5 Make the stop.
6 Install the miter slider hardware, using package instructions. Add the hold-downs and stop.

Figure 2: Box-maker's Miter Sled

Note: This jig can be used for crosscutting box sides as well.





With the clamping jigs held in place, apply spring clamps at the box corners, as shown, for snug miter joints all around.

With the box aligned and secured with hold-downs, move the jig along the fence to cut a clean, splinter-free dovetail slot.

Assemble the box

1 Dry-fit the box sides, and measure for the bottom (C). Cut it to size and test the fit.

2 Make two long and two short clamping jigs from ¼" plywood scrap and hardwood wedges. Bond the wedges to the ends of the plywood pieces using a simple glue rub joint.

3 Lay the box front and back (A) and sides (B) face down on a flat surface. Align the edges and tape the ends together to control glue slippage. Now stand the taped assembly up on its feet, leaving the joints open enough to brush on glue. Clamp the jigs at their centers to the box parts. Apply glue to the mitered ends of the box parts, fit the bottom (C) in the grooves, and wrap the front, back, and sides around it. Use spring clamps on the jig ends to draw the corners together (**Photo D**). Check for square, and remove glue squeeze-out.

4 Cut and glue corner blocks (D) into the inside corners of the feet to ensure a lasting bond here. Let dry and sand flush.

5 Lay out three dovetail slots at the box corners, using the dimensions in **Figure 1**.

Tip Alert

Use glue with a longer open time to avoid rushing the glue-up.

6 Build the adjustable **Dovetail Slot/Spline Jig** in **Figure 3**, following the instructions with the drawing.

7 Install a dovetail bit in your table-mounted router (I used a 7° bit with a 17/32" diameter). Adjust the fence so the dovetail jig is centered over the bit. Next, clamp a straightedge to the outside face of the jig to keep it from veering during use. Raise the bit to ½", and cut a dovetail slot through the jig.

8 With the box in the jig, center the centerline for the top corner dovetail in the jig's slot opening. Adjust the stop snug to the box, clamp the box in place with hold-downs, and rout the first dovetail slot. Loosen the hold-downs, rotate the box, retighten the hold-downs, and cut the second slot. Repeat to cut all four top dovetail slots. Align the centerline for the middle dovetail slots in the jig's slot opening, readjust the stop and hold-downs, and rout the slots (**Photo E**). Repeat for the lower dovetail slots.

Form the dovetail key shape on the workpiece edges by running both faces past the adjusted bit and fence.

9 Plane walnut dovetail key stock to just over the diameter of the dovetail bit. Raise the dovetail bit higher than when used to cut the slots. Adjust the router-table fence, and form the dovetail key shape by running both faces of the stock against the fence and bit (**Photo F**). Test the key stock in the slots to ensure a tight fit.

10 Rip dovetail key strips from the stock, and cut it into the needed number of keys (E). Cut the pieces long, and glue them in place. Later, flush-cut the waste and sand or plane the keys flush with the box.

How To Build The Jig:

1 Cut the sides, gussets, and cradle sides, bevel-cutting the latter where shown. Cut and sand the radii on the sides and gussets.
2 Rout two dadoes for the T-Track in the top face of one cradle side. Cut two T-Tracks to length, and use a twist bit to drill shallow ½" holes at one end of each track to accept the cap screws. Epoxy in place.
3 Drill countersunk pilot holes, and screw the cradle sides to the gussets. Screw the gussets to the sides.
4 Drill countersunk pilot holes, and screw the gussets to the sides.
5 Cut the adjustable stop, and drill the knob hardware holes.
6 Add the hold-downs and stop to the jig.

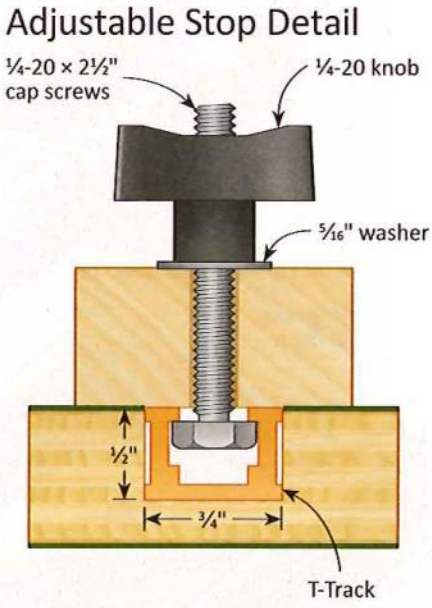
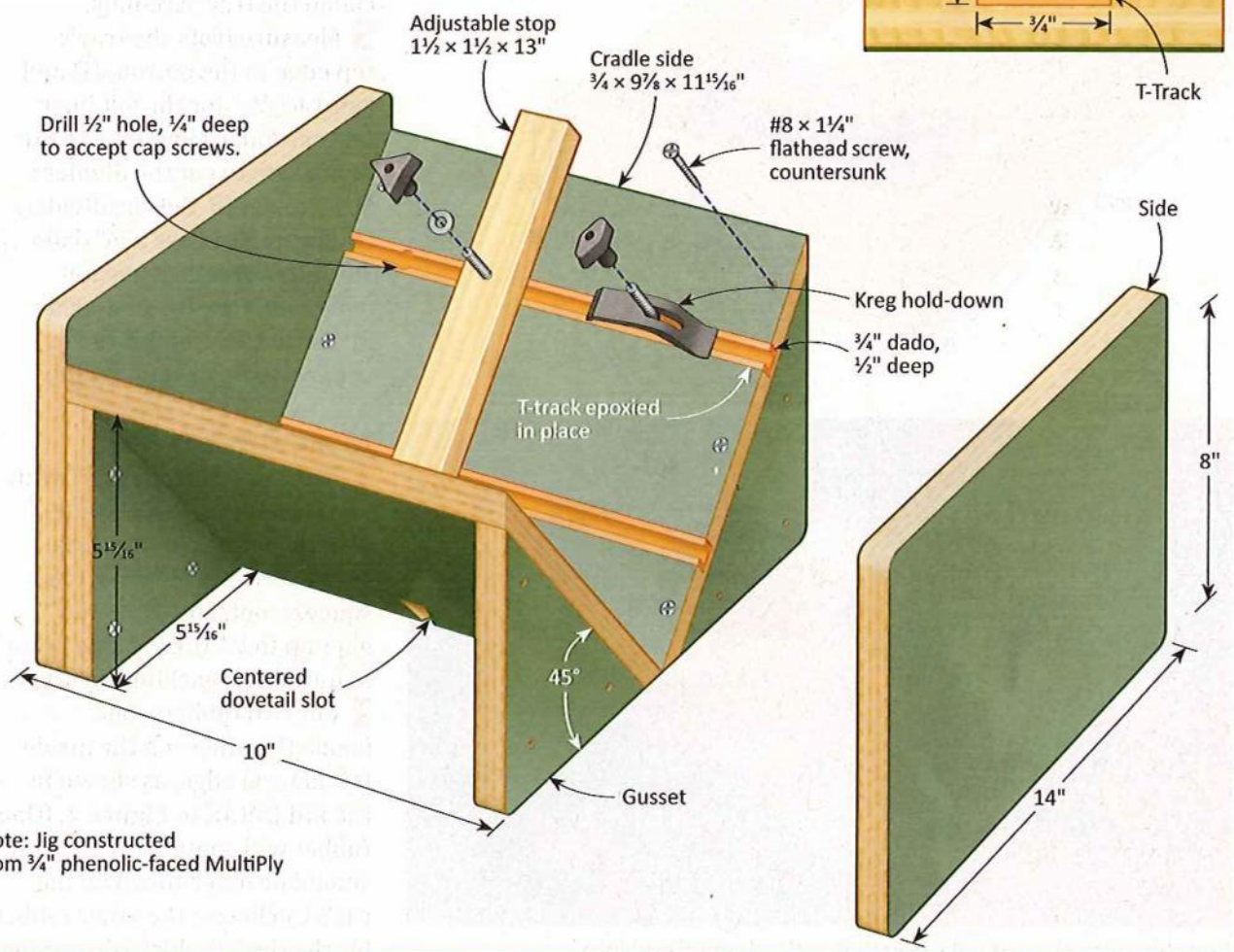
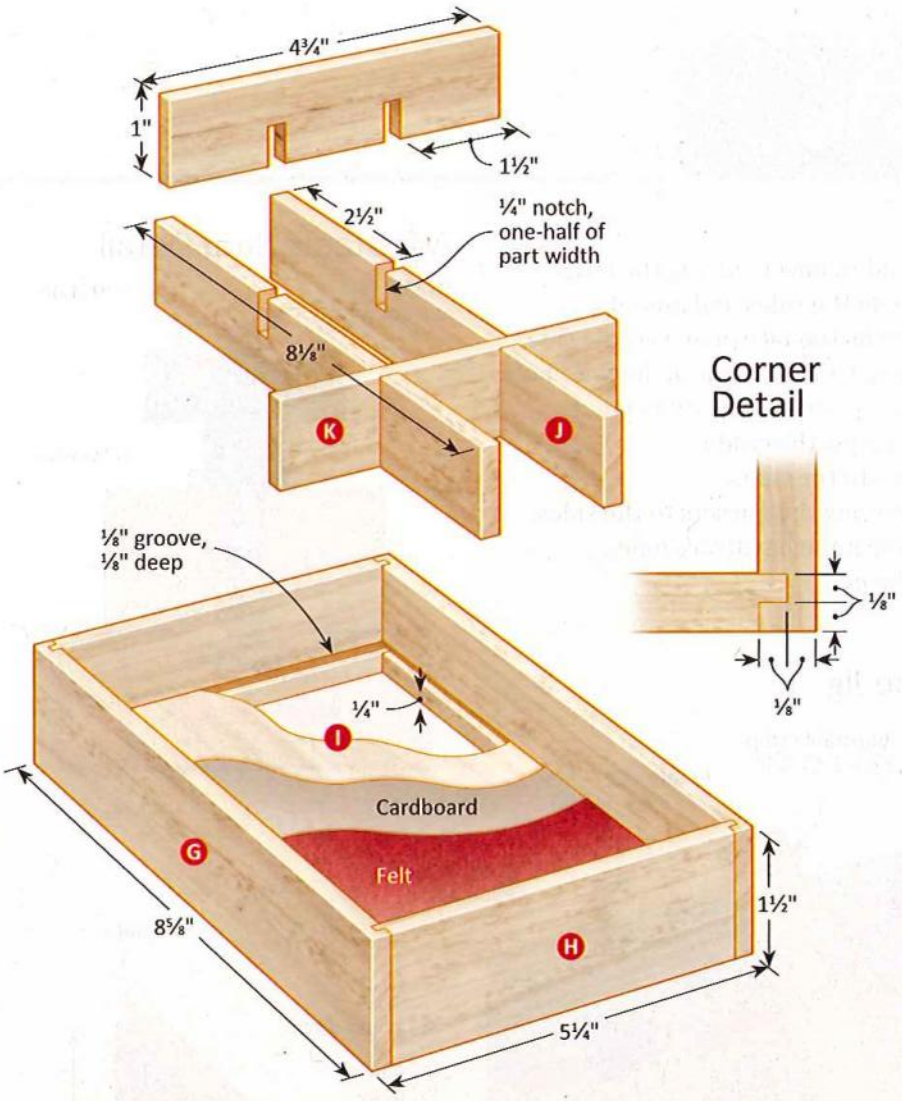


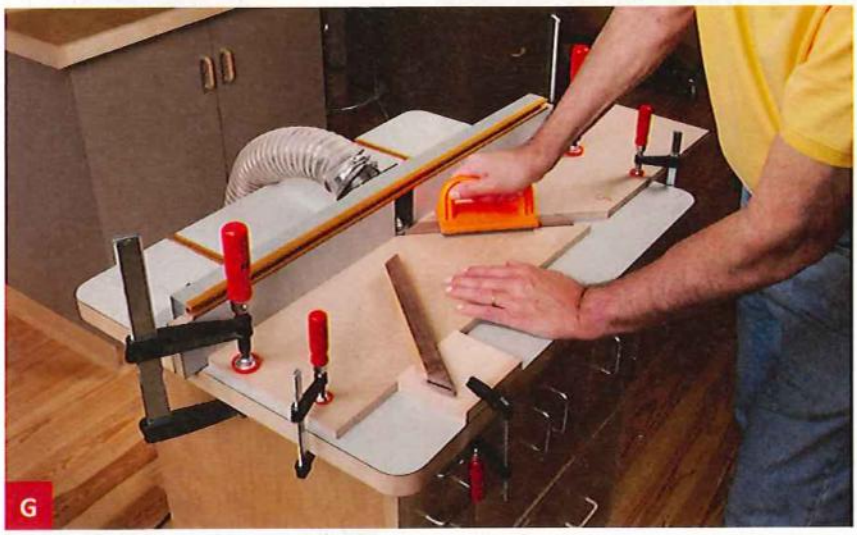
Figure 3: Dovetail Slot/Spline Jig



Note: Jig constructed from ¾" phenolic-faced MultiPly

Figure 4: Tray Exploded View





Run the miter-cut top rail through the 45° channel and into the slot-cutting bit, using the router fence as a stop.

Add the tray supports and tray

1 Rip, plane, and crosscut two tray supports (F) to 7/32 × ½ × 10¾". Test their fit in the groove in the box front and back (A), and set them aside.

2 Resaw and plane enough stock to ¼" thick for the tray's long sides (G), short sides (H), long dividers (J) and short dividers (K). Set the divider pieces aside, and cut the tray sides to size.

3 Cut a groove that matches the thickness of the tray bottom (I) in the sides (G, H), where shown in **Figure 4**. Now, rabbet and dado the ends of the tray sides for the joint shown in the **Corner Detail**.

4 Cut the tray bottom to fit, and then glue up and clamp the tray assembly.

5 Measure from the tray's top edge to the bottom (I) and subtract 1/16" for the felt liner and cardboard backer. Use this dimension to cut the dividers (J, K) to width. Cut the dividers to length. Now, use a ¼" dado set, miter gauge, extension fence, and stop to cut notches in the dividers. Set the tray supports (F) and tray aside.

Make the box lid

1 Rip and edge-glue a ⅜"-wide sycamore strip to a 1"-wide walnut strip from the stock dressed earlier. Remove the squeeze-out, and dress the glue-up to ¾" thick. Make extra material for machining setups.

2 Cut two rabbets–one inside the other–on the inside (sycamore) edge, as shown in the **Lid Detail** in **Figure 1**. (One rabbet will contain the tile and should be determined by the tile's thickness; the other rabbet for the the ⅛"–thick tile retainer (N) that holds the tile in place.)

3 Rout ¼" chamfers on the top inside edges of the stock.

4 Miter-cut the lid's long rails (L) and short rails (M) to lengths that match the box front and back (A) and sides (B), respectively. Cut an extra piece for use in **Step 5.**

5 Install a 5/32" slot-cutting bit in your router table for #FF biscuits, and raise it to cut in the center of the rails (L, M). Adjust the fence to cut a depth that is just over one-half the width of a biscuit. Next, cut two pieces of ½"-thick MDF to 12" wide, miter-cutting one end of each piece. Locate them against the fence, and clamp them in place to create a channel for slot-cutting the mitered ends of the rails. Now, slot-cut the test piece, keeping the slot ⅛" from the rail's outside edge. Cut the slots in one end of each rail (**Photo G**). Flip the MDF pieces, and set up a channel to cut the mating slots. Make the cuts.

6 Test-fit the lid rails (L, M) together, and fit the tile in place. You want 1/16" clearance all around in the rabbet. Measure for the tile retainer (N) and cut it to fit.

7 Biscuit-join the long rails (L) and short rails (M) to make the lid frame, using a strap clamp and checking for square.

8 Finally, align and adhere the lid frame (L, M) to the box with a few pieces of double-faced tape, testing the fit. If needed, sand or flush-trim the frame to the box. Label its front and back edge and remove it.

Install the hinges and finish up

Note: Instead of precisely laying out the hinge mortises and cutting them with a chisel–which you can do–I took a short cut by using the Brusso hinge template, a trim router, and corner chisel for the Brusso hinge mortise work.

Convenience-*PLUS* BUYING GUIDE

Tile-Top Box

☐1.	Freud Flush-Trim Router Bit, ½" D, 1" CL (¼" SH)	#828736	$27.99
☐2.	Freud 7° Dovetail Bit, 7/32" D (½" SH)	#834712	$27.99
☐3.	45° Chamfer Bit, ½" CL (½" SH)	#144123	$26.99
☐4.	Whiteside 3-wing Slotting Cutter Bit, 5/32"	#24D65	$20.49
☐5.	Whiteside Arbor with Bearing, 2⅜" (½" SH)	#24D69	$9.99
☐6.	Baltic Birch Plywood, ⅛ × 12 × 30"	#131405	$5.29
☐7.	Baltic Birch Plywood, ¼ × 12 × 12"	#131139	$2.09
☐8.	Milescraft #FF Biscuits, 110/pkg.	#153578	$5.50
☐9.	Brusso Hinges, ⅝ × 1¼" , 1 pr.	#145287	$30.99
☐10.	Brusso TJ-103 Hinge Mortising Jig (requires router with ¾" OD guide bushing and ¼" straight bit)	#154401	$36.00
☐11.	Whiteside Corner Chisel for Hinges	#24Z25	$30.50
☐12.	Cloth-Backed Felt Sheet, Maroon, Peel & Stick, 23 × 35¾"	#142216	$31.50
☐13.	Watco Lacquer Gloss, 1 qt.	#146947	$15.99

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

☐14.	Custom Photo Tiles, 8 × 10"		

Tiles are available through *changeyourart.com* (choose from a variety of finishes and sizes).

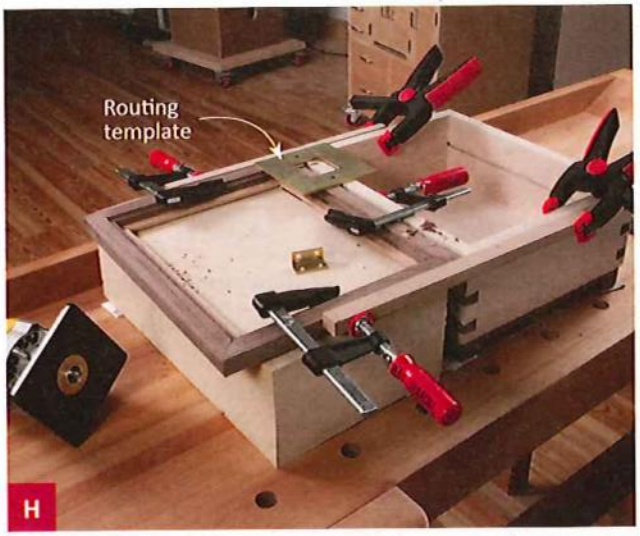
Box Maker's Miter Sled

☐1.	Phenolic Faced MultiPly, ¾ × 24 × 48"	#131170	$62.99
☐2.	Incra T-Track, 24", qty. 2	#142804	$11.50 ea.
☐3.	Incra T-Track, 36"	#142805	$14.69
☐4.	Incra Aluminum Miter Slider, 18", qty. 2	#14V59	$17.69 ea.
☐5.	Incra Build-It Knob Kit, ¼-20, 8 sets/pkg.	#148123	$11.50
☐6.	Incra Hold-Down Clamp, qty. 2	#148122	$12.50 ea.
☐7.	System Three 5-Minute Epoxy, ½ pt.	#124270	$20.99

Dovetail Slot/Spline Jig

☐1.	Phenolic Faced MultiPly, ¾ × 24 × 48"	#131170	$62.99
☐2.	Incra T-Track, 24"	#142804	$11.50
☐3.	Incra Build-It Knob Kit, ¼-20, 8 sets/pkg.	#148123	$11.50
☐4.	Kreg Track Clamp, qty. 2	#145831	$5.99 ea.
☐5.	System Three 5-Minute Epoxy, ½ pt.	#124270	$20.99

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



Using the Brusso brass hinge template, rout hinge mortises in the box and lid, moving the bit clockwise.

Fit the corner chisel into a mortised corner, and then smack its spring-loaded cutter pin for a crisp, square result.

1 Raise the box lid so it's even with the top edge of the box, using filler pieces. Check it with a straightedge. Also, align the box sides with the lid, clamping straight scrap pieces to fix them in place. Now, apply double-faced tape on the bottom face of the Brusso hinge template, and locate it snugly between the box and rear edge of the lid. Flush one template's edge with a box side, and press it in place.

2 Equip a handheld router with a ¾" guide bushing and ¼" straight bit, and make test cuts in scrap no deeper than the thickness of the hinge leaf. Now, rout the mortises for one hinge. Repeat at the other side of the box, as shown in **Photo H.**

3 Square the rounded corners of the hinge mortise with a corner chisel (**Photo I**).

4 Test-fit the hinges and drill screw holes with a self-centering bit. Make any fine-tuning adjustments, and then remove the hinges.

5 Use the pattern in **Figure 1** to cut the lift (O). Now use the lift's thickness to set the bit height at the router table. Set up stops and rout the centered recess in the lid. Test the lift's fit. Glue it in place. Sand.

6 Glue in the tray supports (F), and sand the box to 220 grit. Finish it. (I sprayed on three coats of lacquer thinned at five percent.)

7 Install the tile, holding it in place with the tile retainer (N) and screws.

8 Line the box bottom (C), tray bottom (I), and tile retainer (N) with peel-and-stick felt. Do this by cutting stiff cardboard pieces to fit. Adhere slightly oversized felt pieces to the cardboard pieces, trim, and drop in place. With the retainer, adhere the felt to its inside face and trim it. Reinstall the hinges, drop in the tray, and your box is gift-ready. ■

Tile-Top Box Cut List

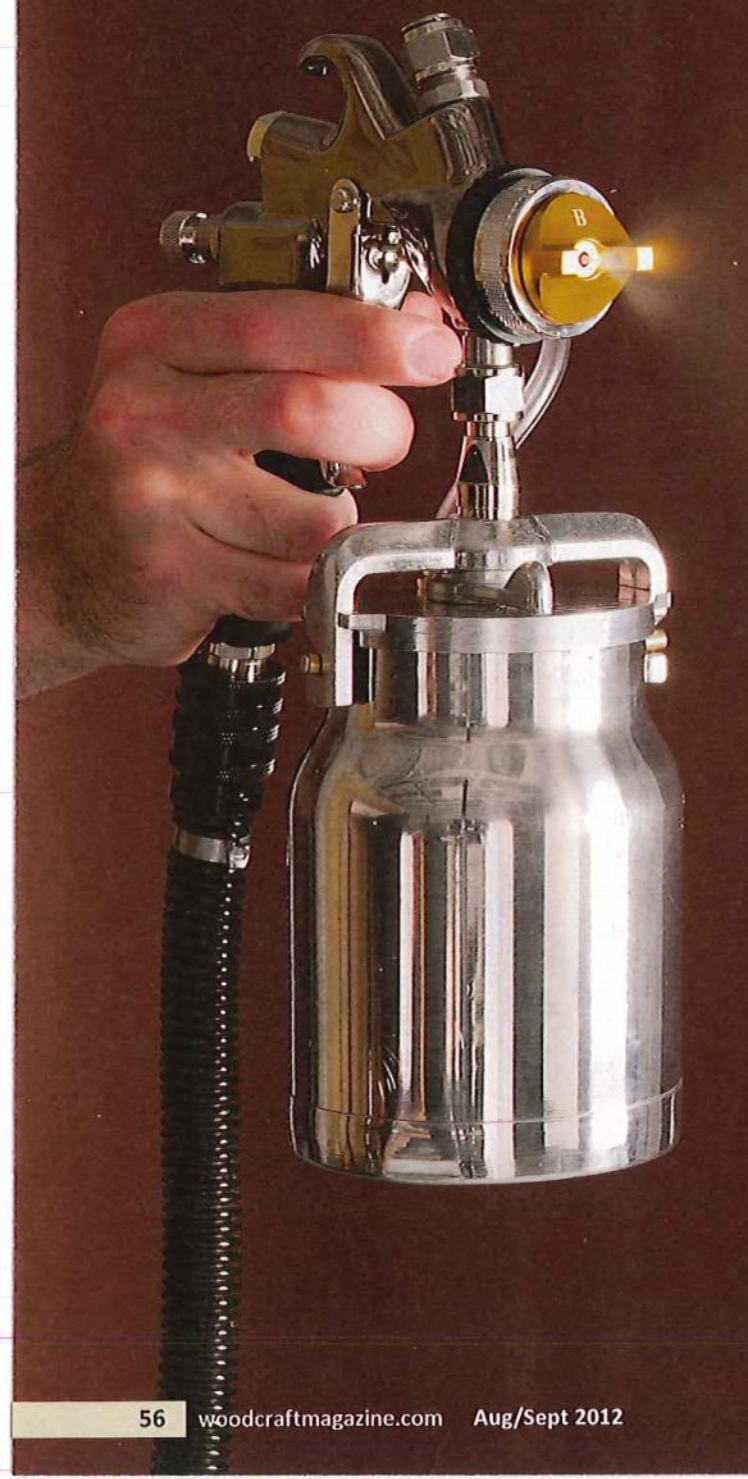
	Part	Thickness	Width	Length	Qty.	Mat'l
A	Box front and back	⅝"	5"	12"	2	S/W
B	Box sides	⅝"	5"	10"	2	S/W
C	Bottom	7/32"	9¼"	11¼"	1	BP
D	Corner blocks	¼"	¼"	1"	4	W
E*	Dovetail keys	9/16"	½"	¾"	12	W
F	Tray supports	7/32"	½"	10¾"	2	S
G	Tray long sides	¼"	1½"	8⅝"	2	S
H	Tray short sides	¼"	1½"	5¼"	2	S
I	Tray bottom	⅛"	5⅛"	8⅜"	1	BP
J	Tray long dividers	¼"	1"	8⅛"	2	S
K	Tray short dividers	¼"	1"	4¾"	2	S
L	Lid long rails	¾"	1⅜"	12"	2	S/W
M	Lid short rails	¾"	1⅜"	10"	2	S/W
N	Tile retainer	⅛"	8½"	10½"	1	BP
O	Lid lift	⅜"	1¾"	1½"	1	E

* Indicates parts are initially cut oversized. See instructions.
Materials: S/W=Sycamore/Walnut, BP=Birch Plywood, W=Walnut, S=Sycamore, E=Ebony
Hardware/Supplies: (14) #8 × 2½" flathead screws; (24) 8 × 1¼" flathead screws.

Step Up to Spray-Finishing

Weigh your choices for a system that meets your needs.

By Jim Harrold with Charles Neil



Woodworkers dream of the day when they can abandon their pad or brush and reach for a spray gun. Indeed, to achieve a showroom finish that feels as good as it looks, and particularly with larger furniture pieces, spraying may prove your best option for applying consistent color and a hardworking finish to lock it in. But before you take the big step, know what to look for so you can match a spray gun system with the type of woodworking you do, the amount of time you plan to spray-finish, and your budget.

The good news is that if you own a capable compressor, you can get into spray-finishing for as little as $40. At the other end of the spectrum, for the guy who wants a top-of-the-line turbine-powered spray system, you can pay over $1,000. What are the differences, what do you get for the money when you spend more, and what systems lie between the extremes? Here's a representative look at some HVLP spray gun systems and the choices that matter most.

What Does HVLP Mean?

HVLP stands for high-volume low-pressure and relates to a spray-finishing system that relies on a fan or vacuum blower-style motor or compressed air to move a dye, stain, or finish fluid from its pot or cup through a needle/nozzle and onto the project. Combined with the proper spray gun, these systems can provide a finer atomization of the fluid using less pressure, which results in reduced overspray (less airborne particles). This, in turn, means more finish product adheres to the surface than with older high-pressure spray systems. Today's HVLP "conversion" spray guns let you connect to a compressor to achieve similar results.

Spraying versus brushing

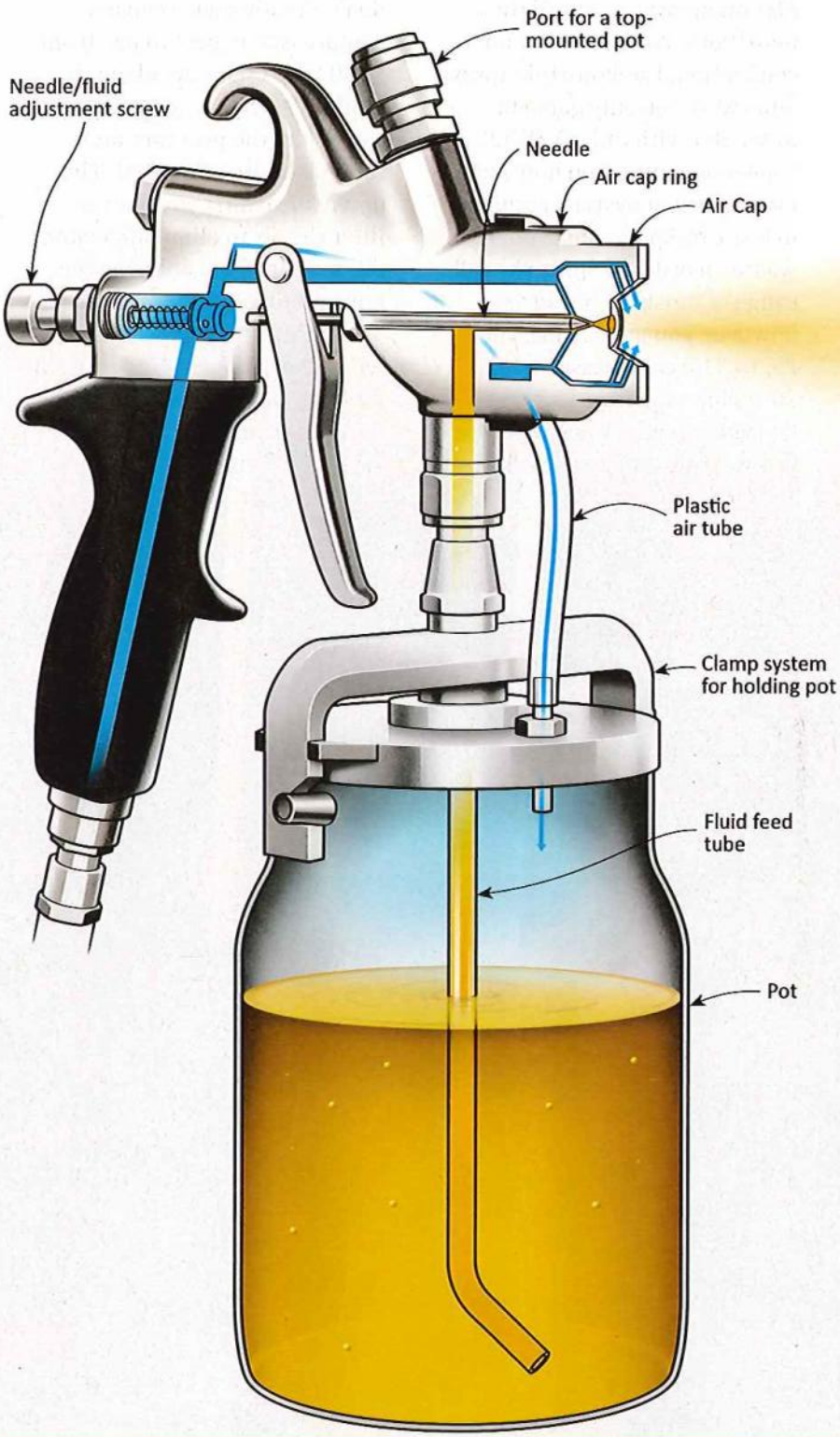
So why add a spray gun system to your finishing locker? Count the advantages:

- Spraying offers a level of speed and control impossible to match with brushing or padding.
- Spraying lets you add even color coats and move from a lighter to darker color for an overall desired look. Then it lets you lock in the color with a clear topcoat that doesn't mechanically disturb the color underneath in the way brushing and padding can.
- It lets you coat nooks and crannies better and more easily, as well as the neighboring hard and soft grain in wood parts.
- It reduces the blotchiness associated with brushing or padding stain on some woods.
- It reduces the darkening that can occur on end grain when brushing or wiping on a stain.
- Spraying avoids brush marks, streaks, bubbles, or remnant brush hairs.
- Spraying's speed lets you keep up with fast-drying water-based stains and finishes.

That said, trade-offs do exist, beginning with the initial equipment costs of spraying. Then there's the need for a spray booth to contain overspray, and good ventilation, particularly when using solvent-based products. Compared to brushing, spraying requires that you wear a chemically approved respirator to prevent airborne finish solids from entering your lungs. Finally, cleaning a spray gun and pot takes longer than simple brush cleanup.

What Is Atomization?

Atomization is the process of breaking down color or finish fluids from larger to smaller droplets–the finer the spray, the smoother the coating. Adequate air pressure and guns with the appropriate needle/nozzles provide the best results.



Opening photo: Shayne Hiles; Product photos: Jim Osborn; Illustration: James Provost

Choices in spray system components

Spray systems consist of four parts–an air power source, spray gun and components, pot, and hose. Let's look at each individually.

Air Power:

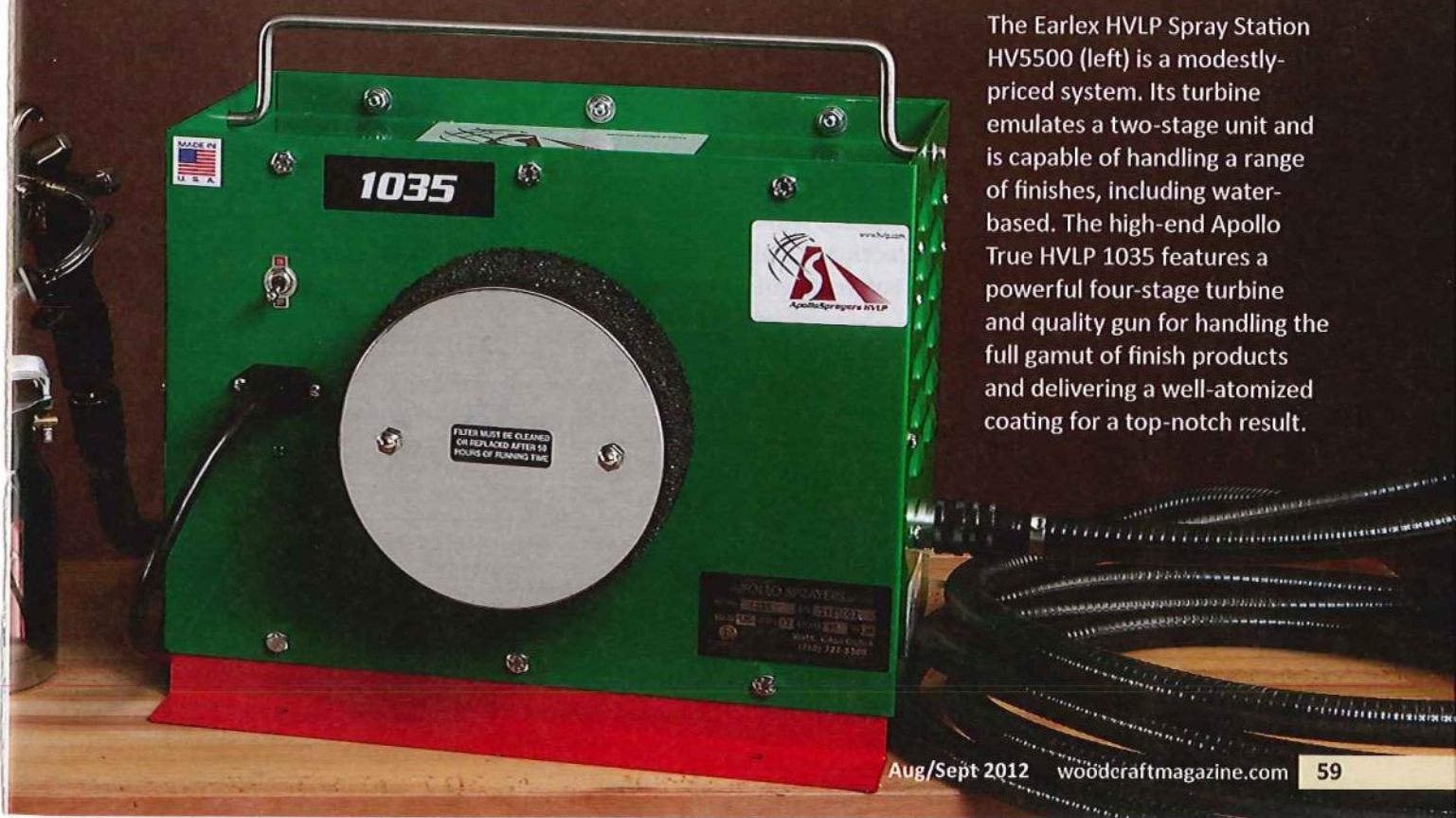
Air Compressor–Up until the mid-1980s, compressors and conventional siphon-style spray guns were the only game in town. But with today's HVLP conversion guns, you now have a more efficient system, resulting in less overspray and product waste. In order to spray the full range of finishing products, however, you need at least a 2½ to 3 hp compressor with a 20-gallon tank. One this size lets you effectively atomize the product and supply constant air pressure to the gun. (If you don't already own a capable compressor, expect to pay from $400 to $700 for an adequate model.) With this system, you can adjust the pressure and fluid viscosity as needed. The downside is that you have to filter the air to eliminate water, oil, and dirt from entering the gun and finish. When purchasing a compressor, consider a unit with wheels for moving it around the shop or outside. If you opt for a larger stationary unit, be sure to have plenty of hose.

Turbine–An HVLP turbine provides a fixed amount of air pressure and consistent fluid atomization in an efficient and dedicated delivery system. When shopping for a turbine spray system, you'll encounter units with two, three, four, and five stages. This simply means the number of fan blades used to drive the air–the more blades, the more powerful the unit. Typically, air power in turbines is defined in psi (pounds of [air] pressure/square inch) and cfm (cubic feet/minute). Note that

lesser priced units will have lower psi and cfm, and fewer stages–key differences. You always want to choose a turbine that matches up with the kinds of products you plan to spray. Lower-powered systems can certainly handle solvent-based products such as dyes, stains, lacquer, shellac, and oil-based clear finishes. But for thicker or higher viscosity products, such as latex paint, a more powerful turbine (or thinning) may be required. Note, too, that for water-based finishes, thinning is not an option, making application a challenge for some low-end HVLP turbines. These weaker units may produce a coarser coat when compared with the finer atomized coats of the same product laid down by units having more stages.

What Is Viscosity?

The thickness of a finish product is referred to as its viscosity. Your spray system's manual will help you determine the proper viscosity for the gun and needle/nozzle you are using and tell how to measure a fluid's viscosity using a special cup. Generally, if the product goes through a medium mesh strainer at the same rate as you pour it in, it will spray efficiently. If too thick, the product will not atomize and may require thinning. When just right, the atomized product exits the gun as a fine mist, leaving a smooth, level film on the workpiece surface.



The Earlex HVLP Spray Station HV5500 (left) is a modestly-priced system. Its turbine emulates a two-stage unit and is capable of handling a range of finishes, including water-based. The high-end Apollo True HVLP 1035 features a powerful four-stage turbine and quality gun for handling the full gamut of finish products and delivering a well-atomized coating for a top-notch result.

The WoodRiver Pro HVLP Spray Gun (left) is a good low-cost option. It features a gravity-fed, top-mounted plastic pot, and adjustments for air, fluid, and pattern. Spend more on Apollo's 7500QC spray gun for quality parts, fine adjustments for maximum control, and superior results. Both require a compressor large enough to spray a wide range of products.

Spray Guns:

Siphon Guns–These old-style guns (not shown) rely on a jet of high-pressure compressor air to pull or siphon fluid up the feeding tube and out of an under-mounted pot on its way to the nozzle where it is atomized. Unfortunately, spraying with more air creates more overspray, less control, and greater waste. Enter HVLP guns.

HVLP Conversion and Turbine Guns–Conversion spray guns connect to a compressor via a standard hose and have been modified to redirect some of the air to the fluid pot via a plastic air tube, thereby pressurizing it. With the gun's trigger squeezed, the pressure forces the fluid into the gun and main airstream. At the nozzle the fluid is atomized into a fine spray and dispersed. Requiring less air pressure to operate, such guns offer better control and reduced overspray.

Included here are low-end guns that have a gravity-feed fluid pot mounted on top. Also requiring less air to operate, these guns cost as little as $40 and can perform well right out of the box while handling a wide selection of finish products. What distinguishes higher-end guns from the other so-called HVLP guns comes down to quality, long-lasting parts and the ability to achieve a finer coat and reduced overspray.

While some guns can work with either compressed air or a turbine, others are designed to work only with turbines and hoses with which they are sold.

Another distinction lies in guns that are either bleeders or non-bleeders. With bleeders, air continually exits the nozzle, regardless of whether the trigger is pulled, a feature found in lower-priced guns. Non-bleeders contain the pressurized air until you squeeze the trigger.

Related to this are the adjustments for dialing down the amount of fluid you wish to spray. These appear at different locations, depending on the gun .

Needle/Nozzles–A needle/nozzle combination works to atomize and disperse the product fluid in an atomized spray. With a smaller needle/nozzle, you get a finer spray. A larger needle/nozzle lets more material pass, but not as much of it may be finely atomized. This can result in an orange-peel or coarse coating. Needle/nozzles in the 1.3 to 1.5 range work best for most furniture finishes, but not for heavy-bodied latex paints. For these you'll want 2.0 to 3.0. needle/nozzles. Buy additional

Water-Based Update

Over the last decade, water-based products have come into their own because of improved performance and environmentally friendly ingredients. Indeed, a movement is afoot worldwide to ban finish products with harmful materials. For instance, oil-based finishes are no longer available in California and in Europe. For safety reasons or because of where you live, you may want a system that effectively handles water-based finishes.

The needle/nozzles in spray guns come in a variety of sizes that determine the degree of atomization for a finish product.

needle/nozzles beyond those that come with the gun (from .8mm to 2.5mm) to handle all the finish products you plan to use.

Beyond the needle/nozzles are the spray caps. These adjust to spray in a vertical fan, horizontal fan, a cone shape, and in narrow and wide swaths. Different guns offer slightly different adjustments.

Pots:

Three types of product containers exist: plastic, steel, and Teflon-coated. With plastic, water-based finish can build up on the inside walls of the pot, making it hard to clean. Teflon-coated pots clean the easiest. Another option is to use disposable liners to avoid the pot-cleaning chore.

Hoses:

While spray guns connected to a compressor tend to have the longest hoses, anywhere from 20' to 100', HVLP turbines have shorter hoses, measuring anywhere from a limiting 9' to 24'. The more powerful turbines can support a longer hose. Shorter, bulkier air hoses offer more challenges when spraying large projects. That said, you can easily relocate the turbine to where you need it. ■

About Our Author

Charles Neil is an accomplished furnituremaker, finisher, and woodworking instructor residing in New Market, Virginia. Check out his Web site at *www.cn-woodworking.com* for more on his career, which has spanned over 30 years.

This Badger 350 Deluxe Airbrush Kit is an excellent, low-cost choice for spraying small projects such as turnings and boxes. Requiring only a pancake compressor, its siphon-style gun lets you spray an array of thinned solvent-based finishes and paints.

Spray System Matchmaker

To help you find the spray gun or system suited to your needs, I created this chart relating the models showcased here to the type and amount of woodworking you may do. Use it as a guide but note that there are other products in the brand lines and other brand lines than those listed.

*Systems/Guns	Pros/Cons	**Products	Type of Woodworking
WoodRiver Pro HVLP Spray Gun #149388, $39.99	Requires 2½ hp compressor; some overspray; good finish; cheap to replace.	D, S, W-B and S-B clear finishes, P	Hobby woodworking; all projects; occasional use.
Apollo 7500QT Spray Gun, requires hose connector, #154097, $329.00	Requires 2½ hp compressor or 3-stage or greater turbine; minimal overspray; fine atomization; quality parts.	D, S, W-B and S-B clear finishes, P	Hobby and professional woodworking; all projects; regular use.
Earlex HVLP HV5500 Spray Station, #152797, $359.99	Acceptable low-end HVLP system for most finish products; limited power, short hose, bleeder gun; entry-level price.	Thinner-viscosity or thinned products; D, S, W-B and S-B clear finishes	Hobby woodworking; all projects; occasional use.
Apollo True HVLP 1035, 7500 QT gun, #152654, $1,196.15	Four-stage HVLP system; ample power, long hose, nonbleeder quality gun and parts, fine atomization.	D, S, W-B and S-B clear finishes, P	Hobby and professional woodworking; all projects; regular use.
Badger 350 Airbrush Kit #153570, $49.99 Grex Genesis XT Airbrush Kit #845208, $419.99	Badger can be powered by small pancake compressor; easy to use and clean. Grex includes mini compressor and gun.	S-B finishes and P	Hobby woodworking, detailing, stenciling; small projects, turnings.

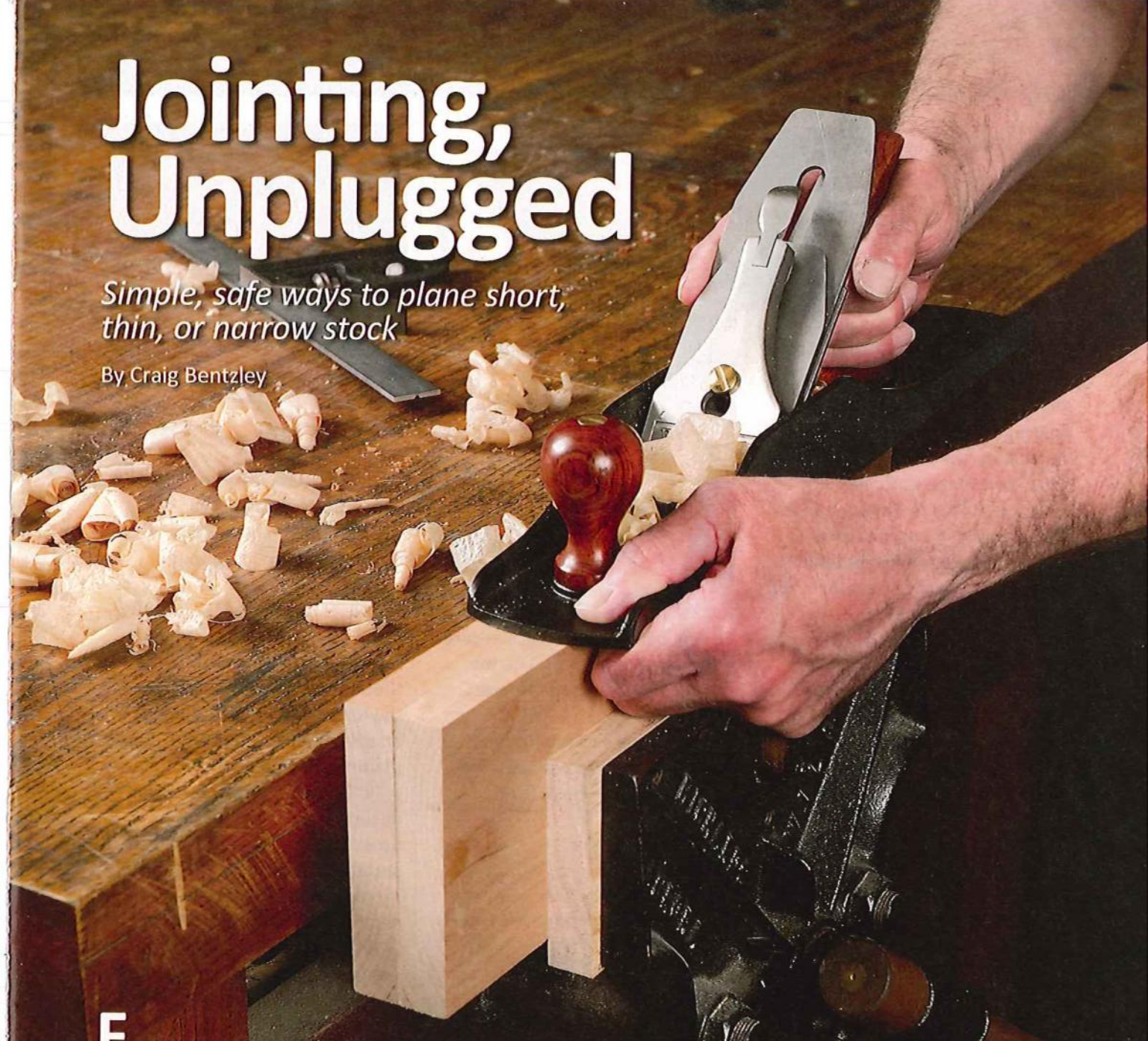
*Products available at Woodcraft stores and at *woodcraft.com*.

**Key: D=Dyes; S=Stains; W-B=Water-based; S-B=Solvent-based; P=Paints

Jointing, Unplugged

Simple, safe ways to plane short, thin, or narrow stock

By Craig Bentzley



For truing edges, nothing beats the speed and efficiency of a power jointer. But there are times when you need to pull the plug. For example, short stock (most manuals specify 12" long or under) can tip into the gap between the infeed and outfeed tables and kick back, leaving your hands with a clear path to the spinning knives. Similarly, narrow boards, thin boards, and veneers can bend into the opening, catch, and kick back, or deflect just enough to create a bowed edge.

For these reasons, I've marked my jointer's fence to remind me that stock must be at least 14" long, 2" wide, and ½" thick. Nothing under the "legal limits" touches the infeed table.

This rule doesn't render short boards useless, provided you have an alternate method for jointing them. When the going gets short, I simply reach for a hand plane. Once the only means of achieving a straight, square edge, a well-tuned plane still tackles boards a power jointer can't, and it does it quietly and safely.

With the tips and jigs shown here, the learning curve for truing short boards is surprisingly quick. If you can sharpen a plane blade, you're ready to start making great projects from small stock.

Note: Jointing an edge is the last step of the stock milling process. In order to join boards successfully, your stock should be dead-flat, meaning no bows, twists, or cups.

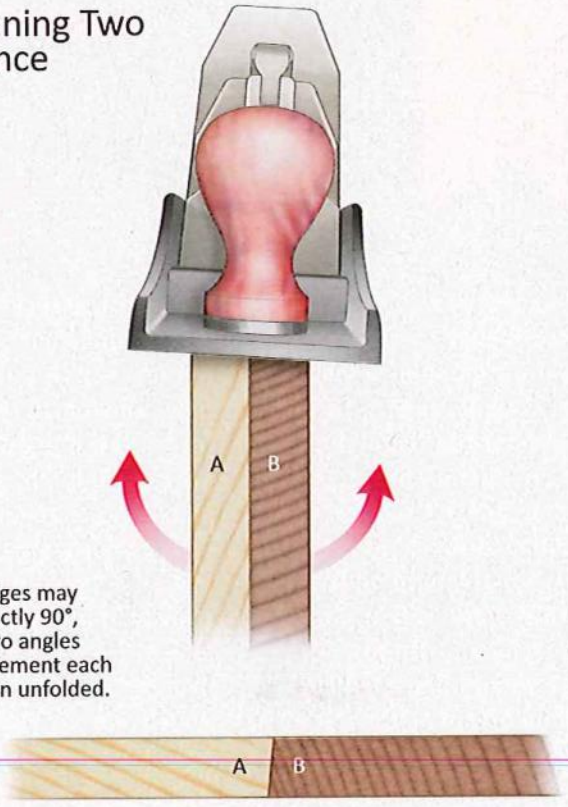
Jointing Short Stock – 3 Ways

If you want to glue up two boards edge to edge for a box or other small project, perfectly perpendicular edges aren't as important as a joint that mates perfectly along its length. The easiest way to ensure a tight joint is to match up the boards, unfold them so that the mating edges are side by side, and clamp the pair in your bench vise. Now plane both edges at once, as shown in **Photo A**. Even if the angle isn't precisely 90°, the two angles will complement each other when butted together, as shown in **Figure 1**.

Learn to read the shavings (**Inset**). For example, a broken shaving indicates a low spot; a narrow shaving indicates a low spot on one edge. A pair of full-length, continuous shavings should indicate that the boards are ready for glue-up, but check the gap between the mating edges to be certain.

Planing both edges at once ensures complementary edges. Use the shavings to check your progress.

Figure 1: Planing Two Boards at Once



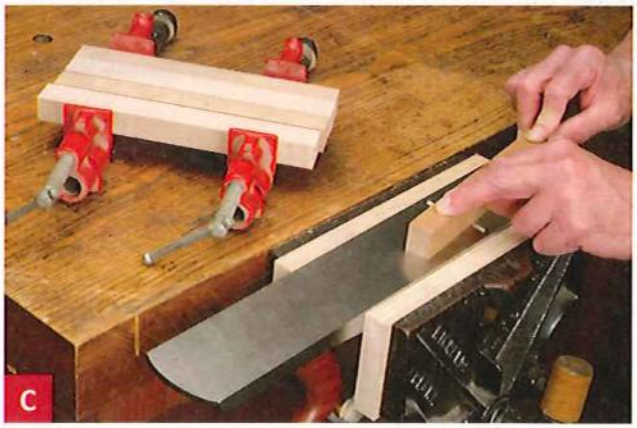
Jointed edges may not be exactly 90°, but the two angles will complement each other when unfolded.

Running a plane against a shooting board eliminates any tendency for the plane to tip.

For short, square edges, nothing beats using a shooting board. As long as you're planing with the slope of the grain, squaring the long grain edge of a short board can be even easier than planing end grain. My 16"-wide × 24"-long shooting board was designed primarily to tune up ends, but it's equally well suited for edge-jointing boards up to 14" long that are too short to ride on my jointer.

A little prep work can make the planing a lot easier. Before shooting, saw off any wavy or rough edges at the tablesaw. Squarely crosscut the back end so that the board can register solidly against the planing stop. Of course, orient your stock so that you're planing with the grain.

Set your plane for a fine cut and make certain that the blade is parallel to the plane's sole. Now run the plane on its edge as shown in **Photo B**. Once you achieve uniform, full-width shavings, check the edge with a double or combination square.



Clamping the plane in a bench vise creates a muscle-powered jointer of sorts. Skew the stock for a smoother cut.

If your stock is too short to plane in a bench vise, try clamping the plane instead. Turn your plane upside-down, and clamp it in the face vise, as shown in **Photo C.** Position the plane so that the clamping pressure is against the sides of the plane's sole. (If you exert too much clamping pressure on the upper edges of the sidewalls, you might crack or distort the casting.)

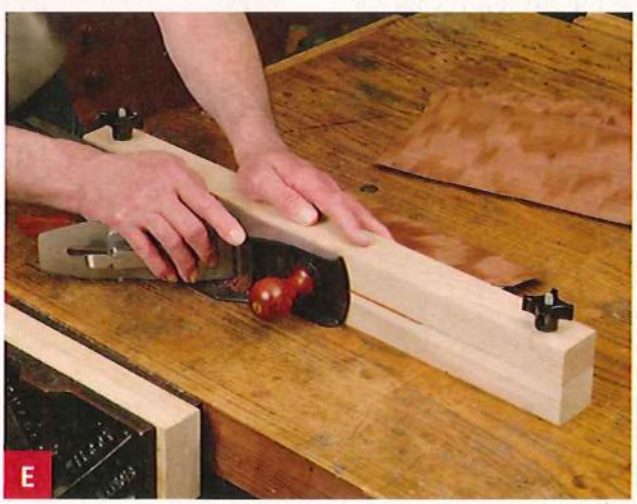
The only downside to this technique is that it isn't self-squaring. I find that it works best for cleaning saw marks off material that is already square. Set the blade for a very light cut, aim for full-length shavings, and watch your fingertips. Check your progress frequently with a square.

Jointing Narrow and Thin Boards

Positioning an auxiliary stop behind your handscrew clamp can prevent a plane-to-clamp collision when working with narrow stock.

Sometimes the best solutions are the simplest. If I have one or two narrow boards in need of a jointed edge, I'll often secure a piece in a handscrew clamp. If the stock is tall enough, the handscrew can be clamped directly to the benchtop. For narrow stock, I'll use an auxiliary stop board, as shown in **Photo D.**

The trickiest part of the operation is keeping the plane from tipping. I place my thumb in front of the knob and wrap my fingers around the underside of the plane. My fingers serve as a fence to help keep the plane centered on the board and to help guard against tool tilt or wobble.



A simple strongback jig reinforces thin veneer, stiffening it so that you can joint it like thicker stock.

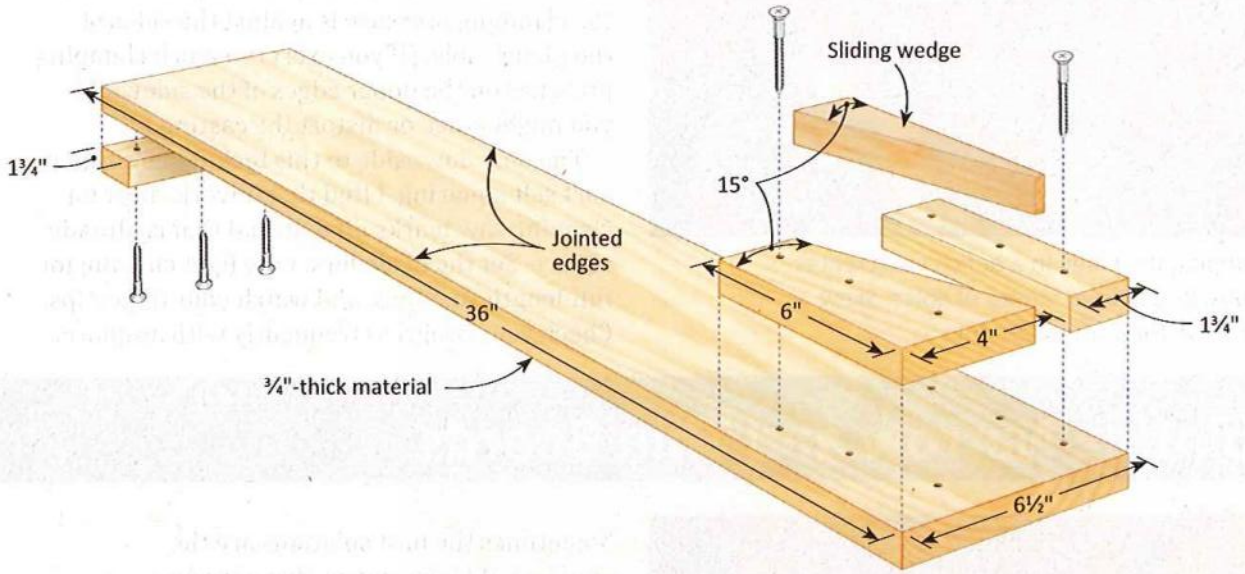
Getting perfect edge joints on veneer is easy with a strong-back jig as seen in **Photo E.** I made mine from two 1½ × 2 × 24" pieces of beech. Make the clamping faces slightly convex to provide even pressure along the entire length of the jig. After counterboring for carriage bolts and drilling the through-holes, I installed the nuts and ran the plane-bearing edges across my jointer.

To use the jig, simply fold over the two pieces to be joined, insert them into the jig so that only about 1/16" protrudes from the face, and then snug the nuts. Set your plane for a very light cut, and shoot both edges at once.

Photos: John Hamel; Illustrations: Melanie Powell

Multipurpose Shooting Board

Figure 2: Multipurpose Shooting Jig



Partnered with a sharp plane, this two-faced fixture successfully joints the boards that your power jointer shouldn't touch. If you do a lot of work with small pieces, or have a workbench with a top that isn't perfectly flat, investing a few minutes to make this fixture will be time well spent.

Use the top face for narrow stock. The wedge holds stock for jointing without additional clamps or stops. Simply position the stock between the fixed blocks and tap the wedge to lock the stock in place (**Photo F**).

Flip the fixture over, and the bottom cleat doubles as a stop for edge-shooting thin boards. Butt the stock against the cleat and shoot the edge, as shown in **Photo G.**

The fixture's dimensions aren't critical, but in order for it to work properly, the edges of the base must be perfectly straight.

In this position, the wedge-shaped stop on this shooting board holds the stock vertically for unimpeded edge-jointing of narrow stock.

Flip the fixture over to joint edges of thin stock. The plane's side uses the bench as a reference surface to ensure a square cut.

In theory, because the flat sole of a plane bridges low spots and shaves off high spots, the longer the plane, the better it will produce straight edges. For edge-jointing long boards for tabletops or chests, I recommend a 22"-long No. 7, or even a 24"-long No. 8 plane. But for boards shorter than 36" you can get along well enough with a 17¾"-long No. 6 plane (**Photo H**).

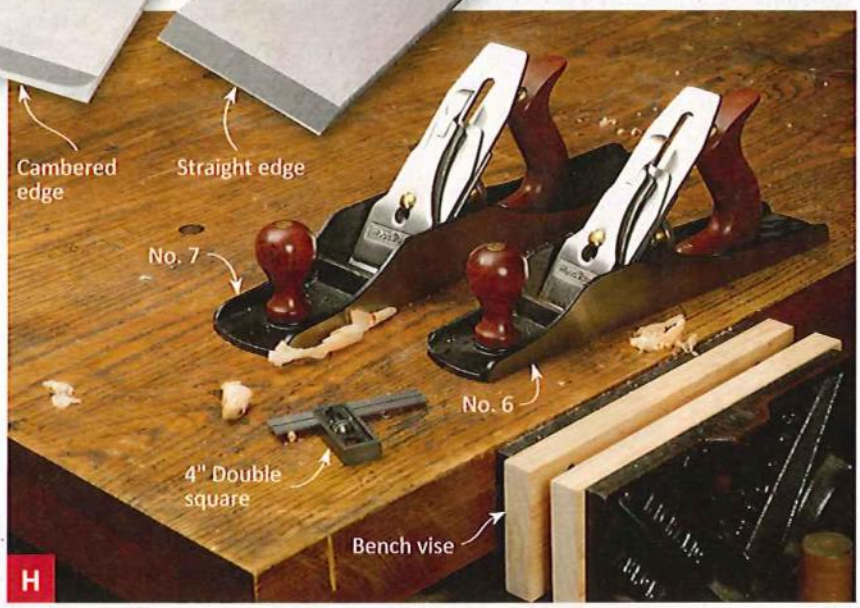
Regardless of the plane you use, it should be well-tuned. (For a tune-up guide, check out "Plane Truth" online at *woodcraftmagazine.com/onlineextras*.)

The shape of a plane blade's cutting edge deserves special mention. Although many craftsmen can successfully joint edges using a blade with a slightly convex *cambered* edge, I prefer a straight grind (see photo above). I often use a cambered edge for smoothing to prevent ridges at the edges of the cut, but I think the slight concavity introduced by a cambered edge adds an unnecessary curve when jointing edges.

You'll also need an accurate square to check your progress. You can get by with a 12" combination square, but I recommend a 4" Starrett double square. Compared to the larger tool, the smaller square is easier to handle and can be tucked into an apron pocket when it's not in use.

The most overlooked tool is the bench itself. For consistent results, your benchtop must be not only flat, but also level, and the rear jaw of your vise must be perpendicular to the top (**Photo I**). It may seem improbable, but your senses will reflexively compensate for a board that is tilted out of square to the benchtop. Should you find that your planed edges are consistently off by a few degrees, the problem is likely the bench and/or vise setup (presuming that your blade projection is consistent).

The last step before applying glue and clamps to panel assemblies is to place the prepared edges together in front of a bright light source to check for gaps. A couple of thousandths of an inch gap in the center is acceptable, but if you see gaps at the ends, reshoot and recheck the edges. ■



You can joint square edges without a major investment. All you need is a workbench, a square, and a plane with a straight-edge blade.

Make sure that your vise is square with the top. If it's not, shim the face or install a replacement.

About Our Author

Craig Bentzley has been restoring antiques and building furniture for nearly 40 years. In addition to writing, Craig also teaches at guilds, woodworking shows, and at Woodcraft stores.

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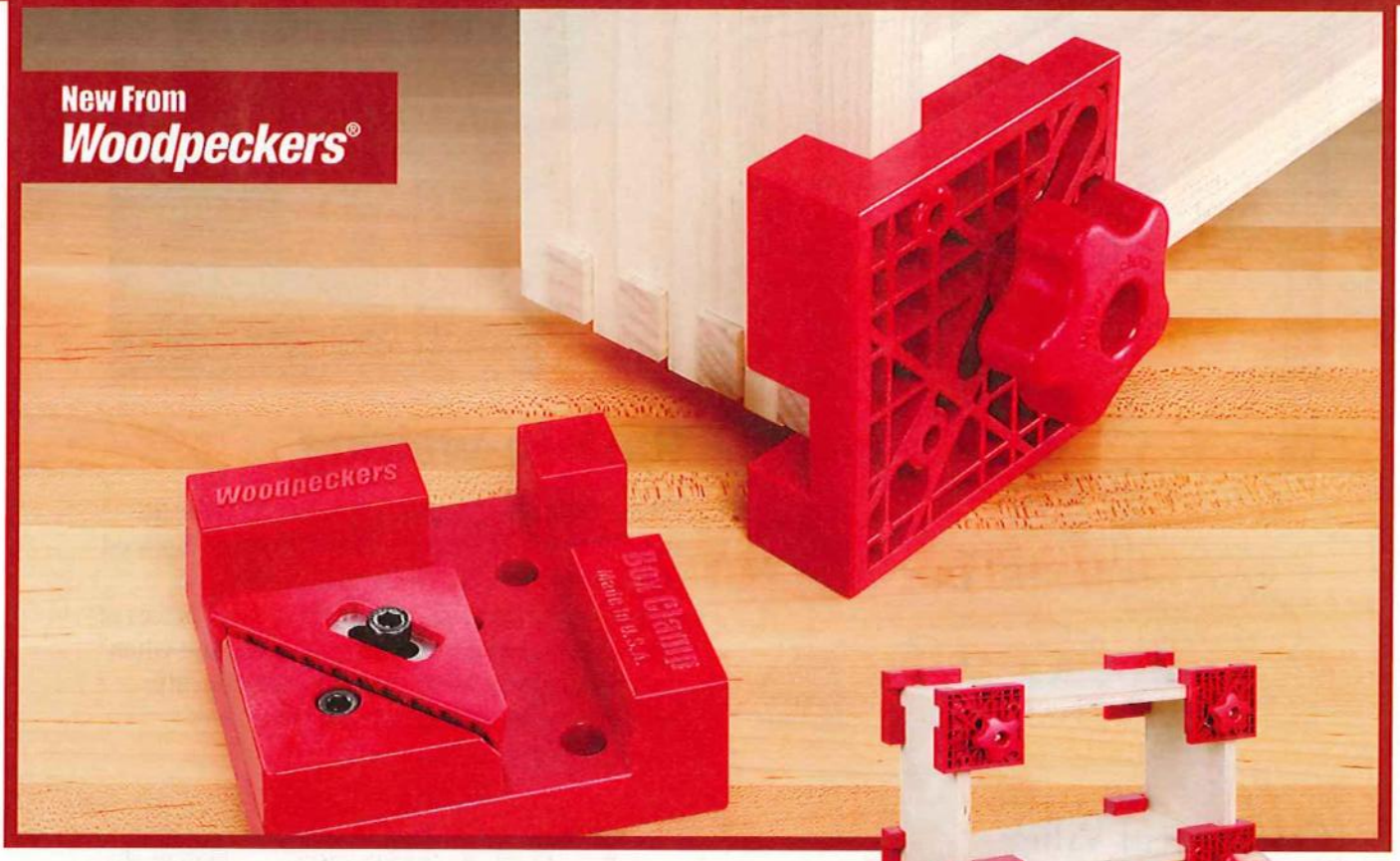

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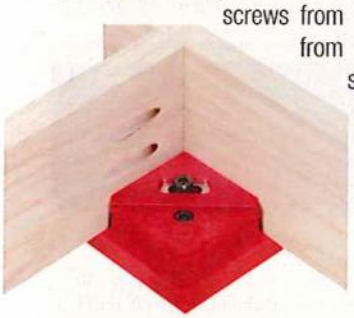

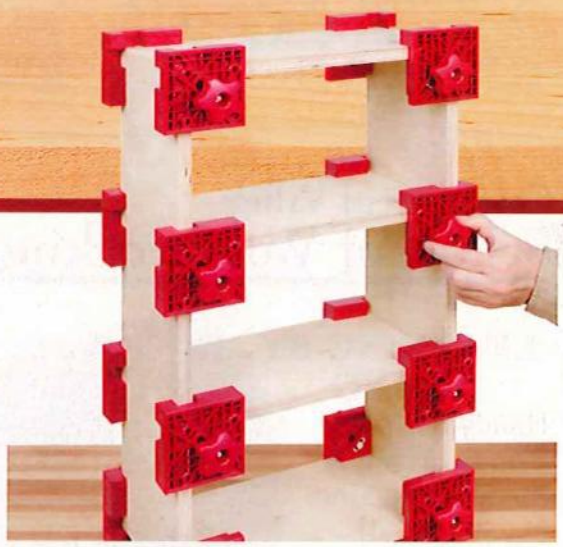

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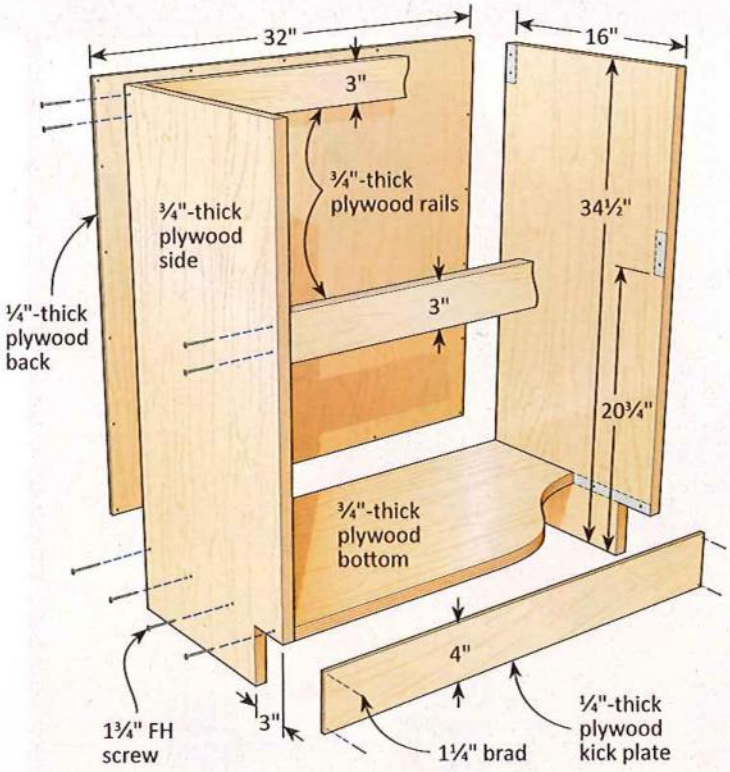

Rack-in-waiting

When outfitting my shop in preparation for the show, I made a few extra cabinet bases and placed them along the wall. These "benched" bases turned out to be perfect for storing short pieces of lumber and as racks for longer boards. And when I need storage relief, the boxes can be quickly put into play by adding doors and drawers.

Photo: Anthony Tieuli; Illustration: James Provost

Honing hardware to fit

Stamped hinges are often bowed across the face or distorted around the screw holes. This can complicate mortise layouts and can even interfere with precise installation. To correct problems before they occur, I hone my hardware before layout. Running the bottom face over a sharpening stone or mill file quickly identifies and then flattens minor bows or bumps.

Tommy MacDonald is host of *Rough Cut – Woodworking with Tommy Mac* on public television. To ask Tommy a question, go to *thomasjmacdonald.com/rough-cut-woodworking.*

Old dogs, new trick

Brass isn't as hard as steel, but it is still hard enough to dent wood. To protect finished edges from bench dog damage, I affixed strips of leather with contact adhesive to the checkered face. This "muzzle" provides a non-marring, nonslip face, much like commercial slip-on collars, but mine won't slip off and run away, even when the dog is set flush with the benchtop.

Photos: Brian Francis

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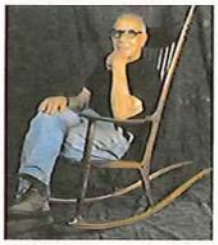

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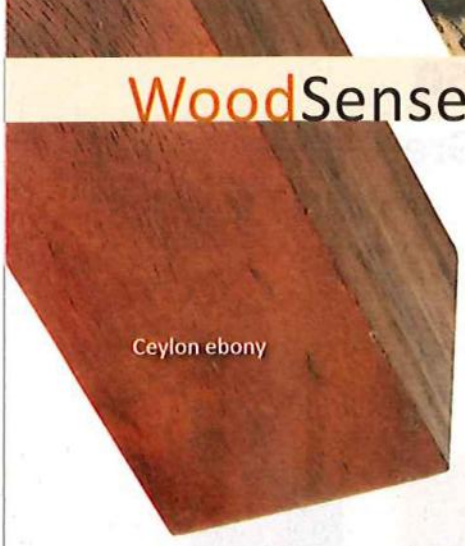
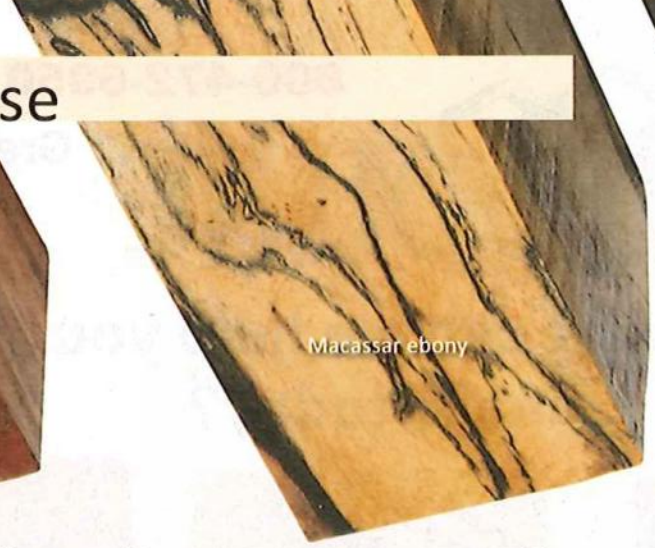

Ceylon ebony


Macassar ebony


Gabon ebony

Spotlight on Ebony

Once the favored hardwood of emperors, kings, and pharaohs

By Pete Stephano
Technical Consultant: Larry Osborn

The nearly 300 shrubs and trees of the ebony family (*Ebenaceae*) grow throughout the world's tropic and mild temperate regions. One of the world's darkest woods, ebony was highly prized even in ancient times and frequently offered as tribute to reigning monarchs. Even today's woodworkers have a special place in their heart for ebony. Famed craftsman Sam Maloof especially favored Macassar ebony for his signature rocking chairs.

History in woodworking

It was once believed that ebony was a poison antidote, so rulers fearing for their safety drank only from cups hewed from the wood. And at one time, India's royalty would reign with nothing less than scepters crafted from only the blackest ebony. And so it's been throughout the centuries with the darkest wood available used sparingly for small items and parts, such as piano keys, guitar fingerboards, pegs in Greene and Greene furniture, carvings, turnings, box accents, inlay, marquetry and such.

The only commercial wood in the ebony family in North America is persimmon (*Diospyros virginiana*), a tree that for decades provided the stock for golf club heads (drivers and putters). And due to its tight grain, density and hardness, this brownish persimmon was used to make shuttlecocks for weaving looms.

Where the wood comes from

By its lofty price you might assume that ebony is quite rare. Actually, it's somewhat abundant where it grows. The problem: Not all trees of the many ebony species are large-sized, and only the deepest colored heartwood has been sought by woodworkers. There is also a great amount of degrade (loss to twisting, warping, etc.) if ebony is taken too quickly through the drying process (usually air).

Most ebony species in world trade are called by names that relate to their country or region of origin. Three rank as the most common. African (Gabon) ebony (*Diospyros crassiflora*), the blackest hails from central west Africa; East Indian (Ceylon) ebony (*Diospyros spp.* meaning several types looking somewhat alike), black or dark brown with contrasting stripes from Asia and Indonesia; and Macassar (Indonesian) ebony (*Diospyros celebica*). This dark brown/black wood is streaked yellow-brown from large trees growing in the East Indies and Philippines. Many times wood dealers simply list their differing ebony stocks descriptively, such as black-and-white ebony (actually *Diospyros embryopteris*) or striped ebony

(normally a type of Macassar ebony). Persimmon comes from the southern parts of the U.S., east of the Missouri River.

What you'll pay

You'll only find ebony at wood specialty retail stores, by mail order, or from online sellers, and it's costly. Large boards are highly unusual, with the stock of most ebony 6" wide at most and rarely longer than 8' in Select & Better grade (Gabon ebony has a premium grade). The finest Gabon ebony can cost over $150 per board foot! Macassar ebony costs about half that and can be purchased as paperback veneer in a 4 × 8' sheet of book-matched pieces for about $500. American persimmon runs around $6 per board foot.

Due to its cost and somewhat limited availability of large-sized stock, typical ebony uses only require small amounts. Pen blanks, typically in ¾ × ¾ × 5" size, are readily available at around $2 to $4 each. Other small sized pieces and larger blocks for turnings, knife handles, pool cue butts, etc., are available as well. *Note: Small store-bought pieces may be coated in wax to keep out moisture during shipment and storage.*

How to select the best stock

If shopping by mail order or online, be sure to order all ebony of the same species unless you have the desire to mix and match. Remember, too, that even the blackest Gabon ebony can exhibit lighter-toned wood if bought in large batches; for pens that may not matter as much as it would for a set of ebony-handled steak knives.

If using ebony for larger projects, it makes sense to personally inspect the wood for flaws, splits, and desired color and grain. If that's not possible, ask for color photos of all views. Also, because ebony is quite unstable until thoroughly dry, inquire as to its dryness and drying method (air- or kiln-dried). Smaller logs are traditionally air-dried whole in their country of origin. Lumber from large logs may have been kiln-dried. This is important because ebony, once dried from six to nine percent, will remain stable in use.

Working ebony in the shop

Ebony is difficult to work. Its extreme hardness and density quickly dull cutting edges so they must be made of carbide to slow the effect. Ebony normally features finely textured, straight grain, but can sometimes exhibit interlocked grain. Coupling that with density and hardness, light passes in planing, jointing, and routing are advised. In sanding, progress through successive grits (up to 400), or you'll leave minute scratches that will show under a finish. The higher the grit, the more polish.

Ebony requires predrilling pilot holes for nails or screws. Gluing freshly sawn or abraded surfaces results in a good bond, but use adhesives with longer open time to allow the glue to better penetrate the surface. Surfaces not freshly sawn or sanded must be wiped with acetone to remove natural resins.

Also be aware of ebony's fine sanding dust, which poses respiratory problems. Ebony may also cause allergic reaction in the form of skin irritation (dermatitis), so wear a good-fitting dust mask or respirator and cover your arms with long sleeves.

Deciding on a finish

A dense wood, ebony takes dye better than stain. It looks wonderfully lustrous under a clear penetrating oil. There's no reason to hide its color with dye or stain, unless you're seeking to even the color or darken it. ■

Ebony Quick Take

Cost - Very high

Weight - High (one-third heavier than red oak)

Hardness - High (more than twice as hard as red oak)

Stability - High (when thoroughly dried)

Durability - High

Strength - Very high

Toxicity - High (fine dust in particular)

Tool type - Power tools with carbide-tipped blades and cutters

Common uses - Accents, boxes, inlay, musical instrument parts, small turnings, small chests, and cabinets

Photos: Shayne Hiles

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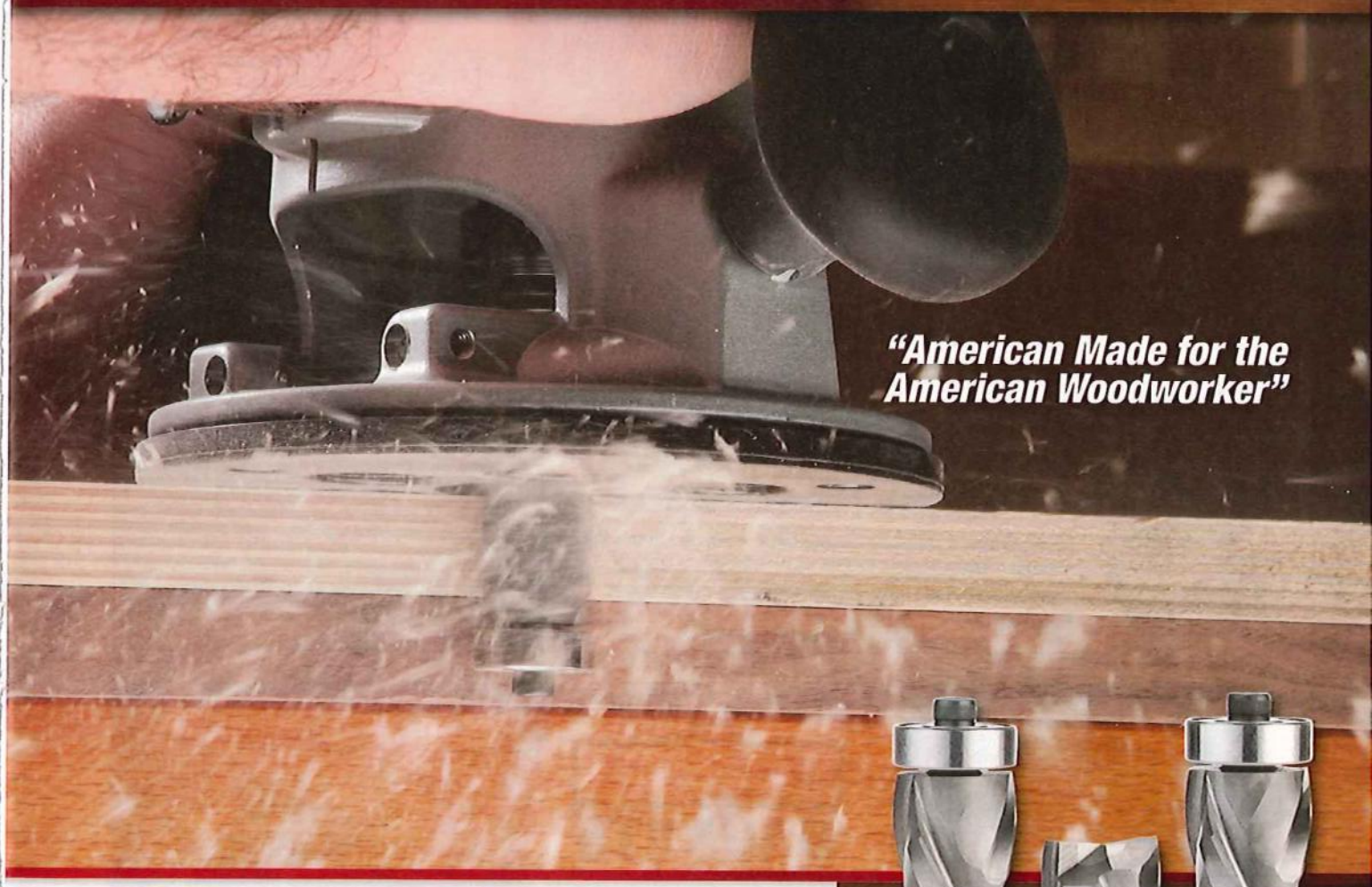

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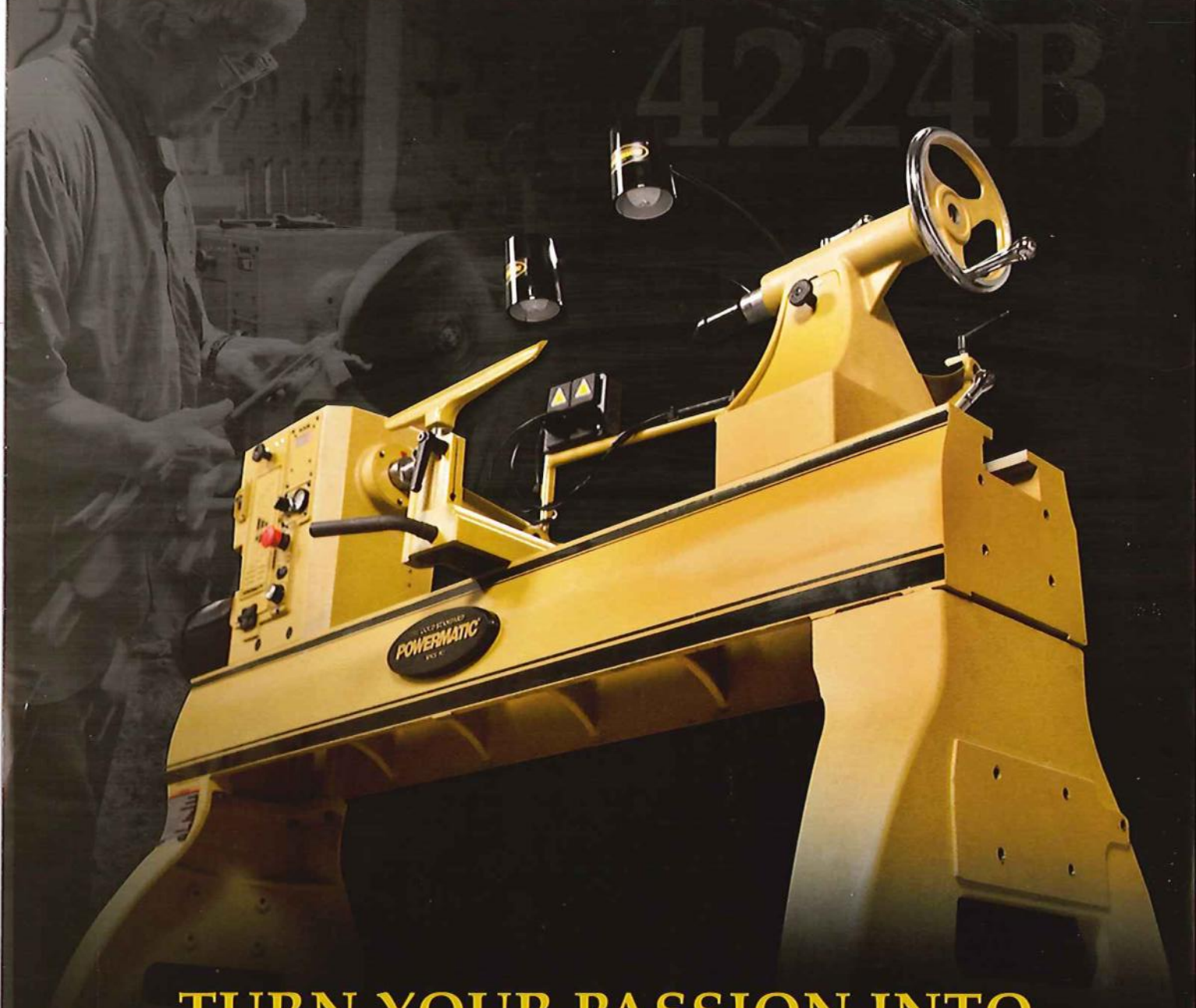

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