

PERFECT DOVETAILS AT THE TABLESAW p.40

WOODCRAFT[®]

Projects, Techniques, and Products

magazine

Build this
Heirloom Tool Chest p.22

MORE PROJECTS

- **Bentwood Music Stand**
- **Toy Dump Truck**
- **Simply-Made Spice Box**

SKILL BUILDERS

- **Making Bread-Board Ends**
- **Flattening Boards by Hand**

VOL. 9/NO. 51 FEB/MAR 13

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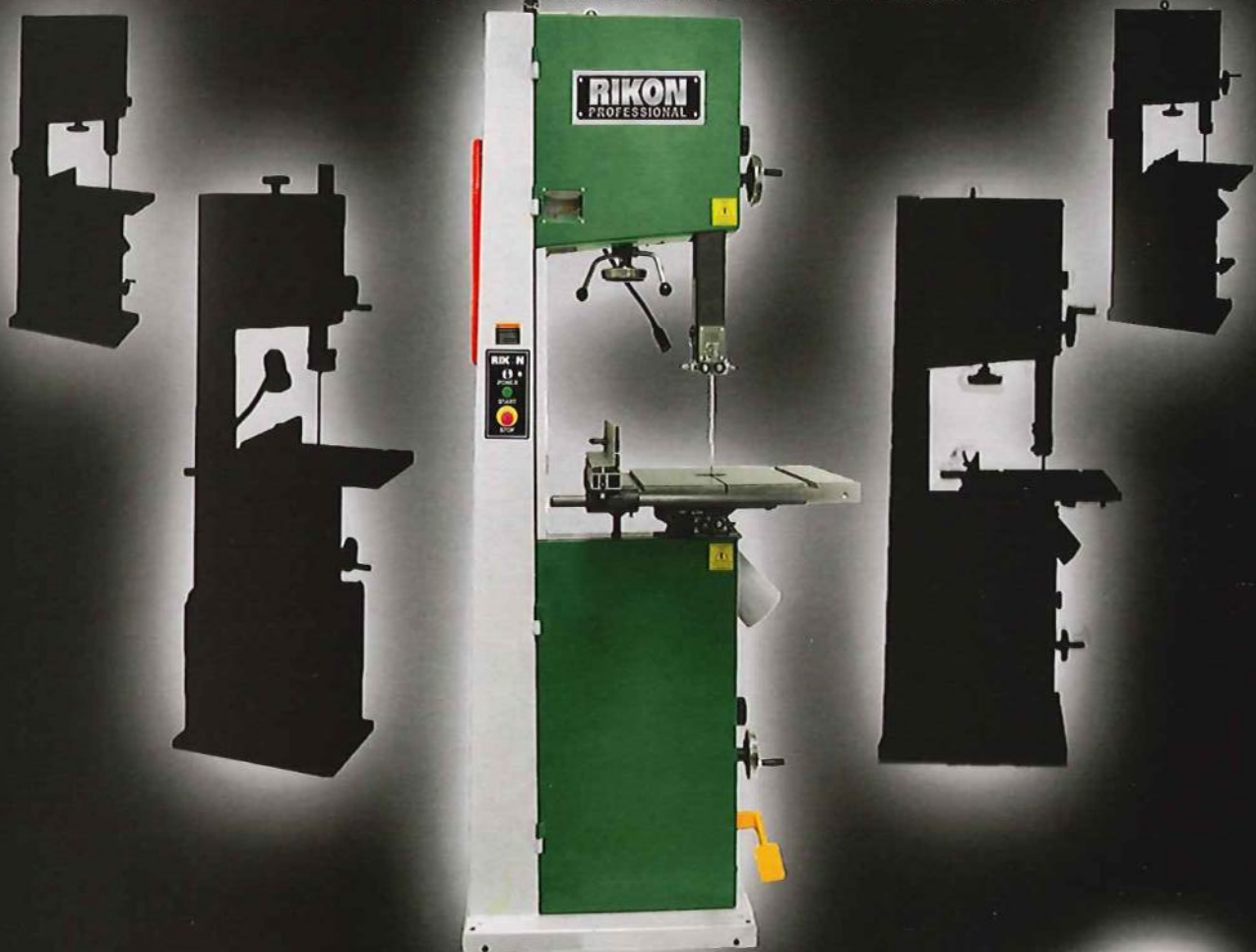
23 TIPS
and JIGS

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22 Tool Chest

Build a fine home for worthy tools while showcasing your woodworking skills. This capacious chest, with its dovetail joinery, lidded upper compartment, and full-extension drawers, is one for the generations.



36 Sugar 'n Spice Cabinet

Sharpen your joinery skills as you make this compact seven-drawer case. Built by Scott Phillips, co-host with his wife Suzy of public television's *The American Woodshop*, its construction includes basic dado joints and screws.



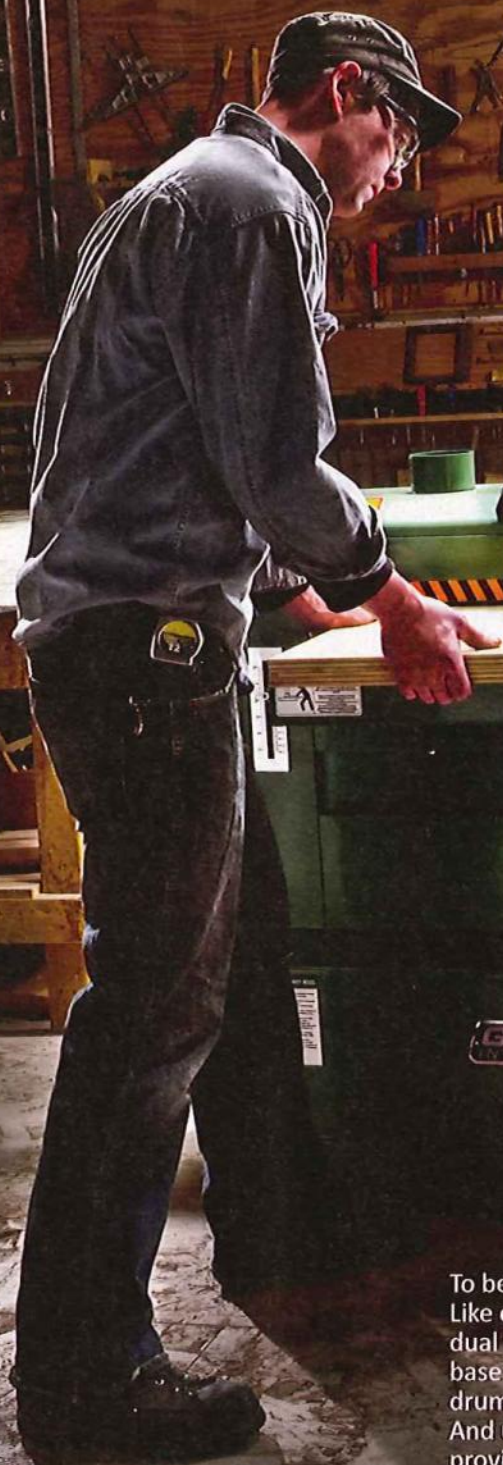
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58 Tough-Enough Toy Truck

Steer your budding builder into the construction world with this rugged hauler designed by Ohioan Chuck Hedlund. Discover safe ways to machine small parts and a clever jig to fashion treaded tires.

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Contents: Tools & Techniques



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Learn how to design and make spiffy stiffeners that give solid wood panels room to move and keep them from cupping.



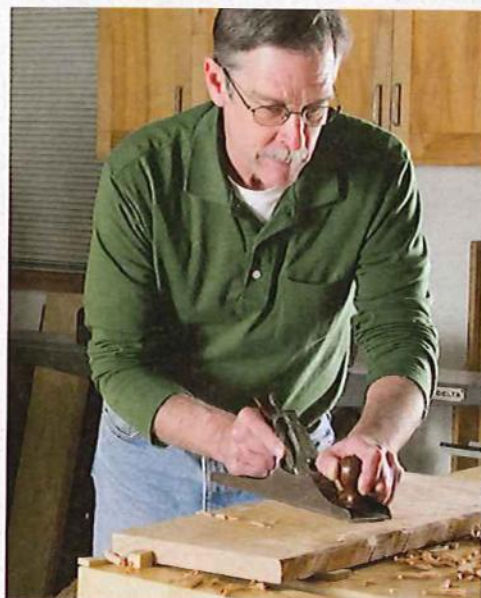
32 Rust Busters

Check out our side-by-side survey, and then select the best rust fighter to help win back your hand tools and machinery.



40 Tablesaw Dovetails

Looking for a fast, easy, and inexpensive way to get that hand-cut dovetail look? Put down your saw and read this.



53 Flattening Boards by Hand

Have you ever wrestled with a board that's too wide for your jointer? Discover how a pair of planes can quickly and efficiently lend a hand.

74 Well-Stocked Shop: Gloves

Different tasks—from handling rough boards to finishing—require different gloves. See which mitts you need in the shop for maximum protection.

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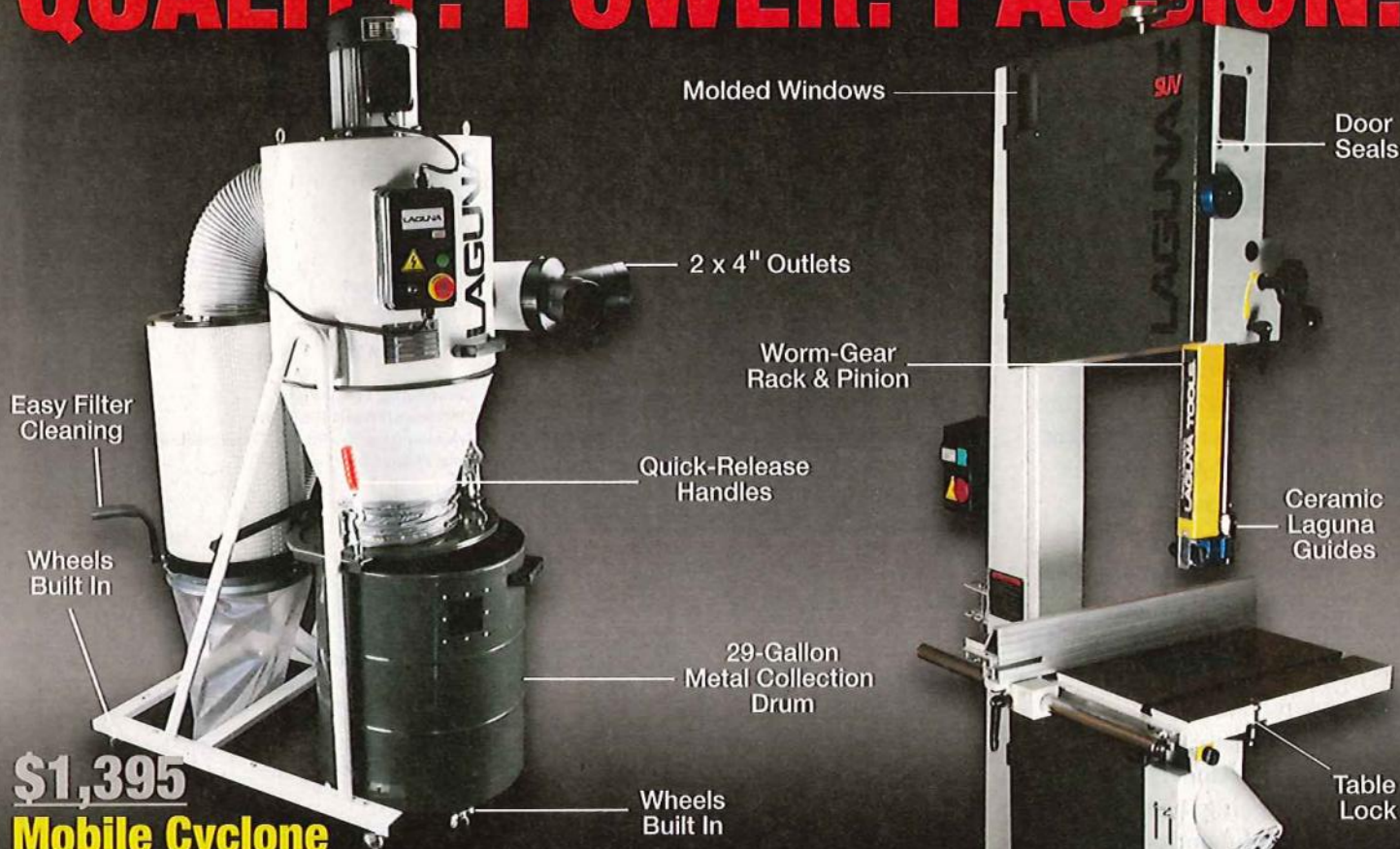
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A site to behold

In the world of computer technology and websites, if you are not updating, you're quickly fading into the past with the likes of T-Rex and Apatosaurus. Over the last several weeks, *Woodcraft Magazine's* business/production manager Linda Rowe and graphic designer Shayne Hiles teamed up to redesign our website to make the content found there much more accessible and functional, in addition to vastly improving its appearance.

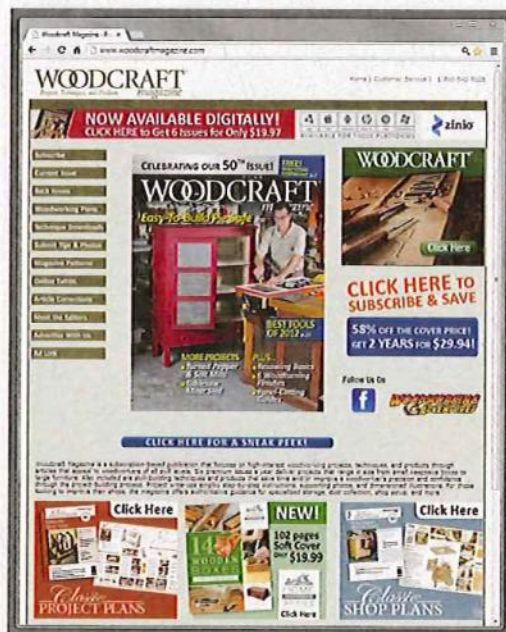
By going to woodcraftmagazine.com, you will encounter a variety of helpful options, all aimed at satisfying your ever-growing woodworking appetite and interests. If you're a newsstand buyer and have thought about subscribing, you can easily purchase a one-year subscription for \$19.97 or a two-year subscription for just \$29.94 by clicking the "Click here to subscribe and save" link at right. Navigation links at the left include a place to submit a tip (and receive cold cash if it's accepted), download project patterns, and find corrections for projects. One thing that we are particularly proud of is our new magazine article index. With this tool, you can peruse a list of articles for each issue, purchase the back issue, and download a particular project or technique or the paper plan of our most popular projects.

This, however, only scratches the surface. Below the latest issue, you'll find instant access to our libraries of Classic Project Plans, Classic Shop Plans, downloadable techniques, free stuff, and how-to and product videos. It is quite easy to lose yourself browsing through the offerings.

Elsewhere on the home page are links to the Woodcraft website and *Woodworking Adventures*, Woodcraft's own blog. You'll stay up-to-date with the latest tools, never miss exclusive interviews with master woodworkers, tool manufacturers and more by visiting our website regularly.

If you haven't visited the site lately, by all means, go there and enjoy exploring its many offerings. You'll be glad you did and may find yourself returning again and again.

Jim Harold



Feb/Mar 2013
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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.

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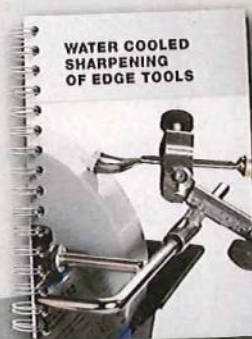
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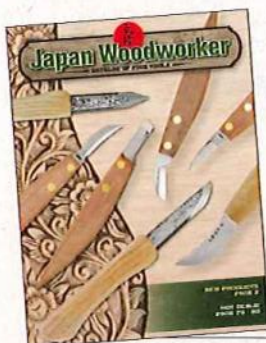
Japan Woodworker, a fitting purchase

It's official: Woodcraft Supply, LLC, has purchased Japan Woodworker, a California-based company that sells woodworking equipment and supplies. The 34-year-old retailer will remain a separate company within the Woodcraft organization, with Woodcraft employees continuing to provide catalog and Internet customer service.

Woodcraft president and *Woodcraft Magazine* publisher Jody Garrett announced the acquisition

on Nov. 16. "Our two companies share many similarities," he said. "Both have built strong brands, and pride ourselves in providing professional quality woodworking tools and exceptional customer service. The two companies are a good fit."

—Jim Harrold



A TV table that sounds as good as it looks

Your "Arts & Crafts TV Table" in the June/July 2011 issue inspired my own similar design. Made in white oak, my table incorporates side compartments for speakers. The side slats facilitate the sound more fully with the speaker areas enclosed with acoustic cloth. The shelves adjust. I also changed the dimensions to 45 $\frac{3}{8}$ " W x 16 $\frac{3}{4}$ " D x 35" H. Note that I carved white oak leaves on the drawer front.

After building a 16 x 30' timber-frame extension to our home, I have turned to making furniture in the Arts & Crafts style, which allows me to continue working with mortise-and-tenon joinery.

—Ann Bodnyk, Kutztown, Pennsylvania



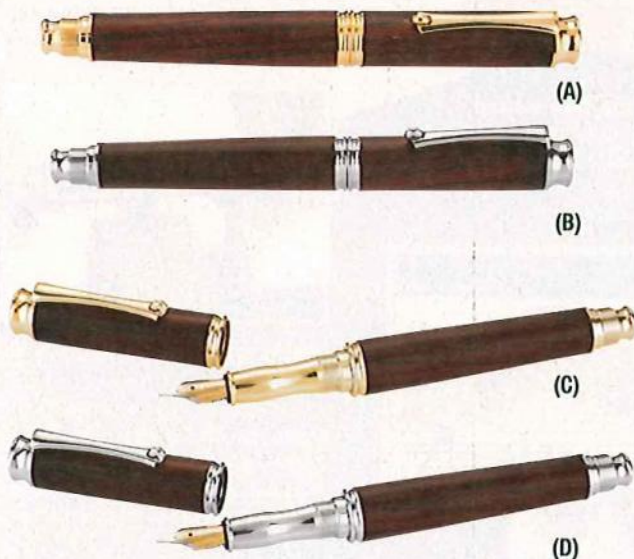
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Hot New Tools

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After reinventing turning tools, it was only a matter of time before Easy Wood Tools (EWT) turned its attention to the lathe chuck. The simplicity and speed of mounting blanks and changing jaws of this time-saving accessory will turn the heads of serious turners.

The secret lies in EWT's Zoom Ring, which works like the keyless chuck on your drill-twist to tighten, and then cinch it tight with the chuck key. Similarly, the Snap-Lock Easy Jaws makes changing jaws a no-brainer. To

install the jaws, just snap them in place. To release, depress the keeper latch and slide them out. Unlike other geared chucks with sequential jaws, the Easy Chuck jaws fit into any position on the body.

For added versatility, the chuck has double set screws so that it can be secured to the spindle for reverse sanding operations.

With the included 1 3/8" dovetail jaw set, the Easy Chuck is good

for medium-sized projects such as hollow vessels, bowls, and platters up to 8" in diameter. The 7/16"-long jaws are designed to grip 1 3/8"-dia. tenons and expand into 2"-dia. spigots. Additional jaws, sold separately, will allow you to use the Easy Chuck for a wider range of turning projects.

#154689, \$499.99

Tester: Ben Bice

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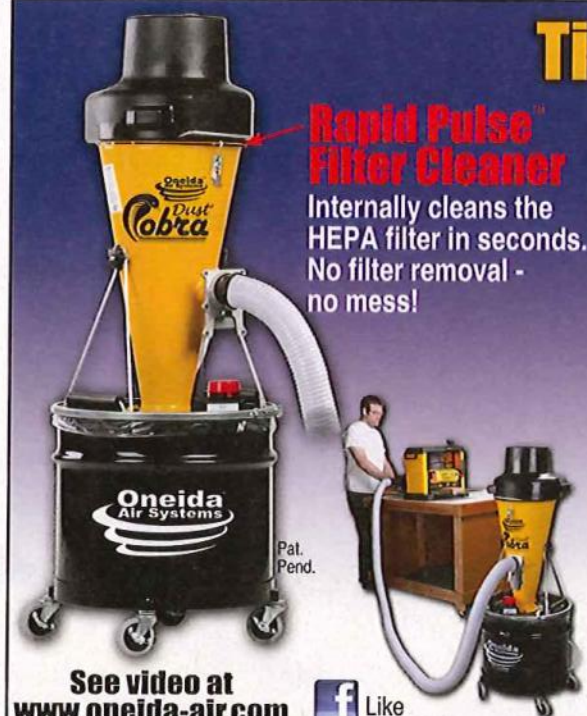
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Hot New Tools

Serious sawyer

Bosch T1044DP 10" Jigsaw Blade

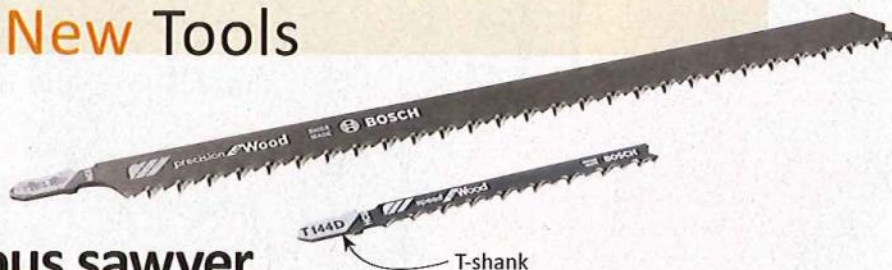
For the times when you can't take the work to the bandsaw, Bosch's 10"-long jigsaw blade enables you to take a saw to the work. With its shark-like profile, I expected the 6TPI blade to be brutally-aggressive, but was surprised by the quality of the cut. With the tool's orbital action set at zero, the blade sliced through stacked 4x4s with negligible splintering on either side and produced a cut nearly as straight and clean as what I could get from my bandsaw.

For best results, you'll need to pair this blade with a higher-end jigsaw. It's important that your saw has variable speed to start the cut slowly and sufficient power (at least 5 amps) to handle the load. The blade's T-shank design provides a more efficient power transmission than U-shank blades, but it does not fit some saws.

A three-pack runs about \$22. To find a local dealer, visit boschtools.com

Tester: Joe Hurst-Wajszczuk

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angle when working with a wide variety of project materials.

Compared to the cast-iron bench vises, the BENCHJAWS offers greater clamping capacity for a fraction of the weight. You can easily reposition the 20-pound unit or remove it from your bench and take it wherever you need it. (I only wish Rockwell had included a second mounting bracket for off-site use.)

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Tester: Brian Renner



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154031 letter "O" (.314")

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Tips & Tricks

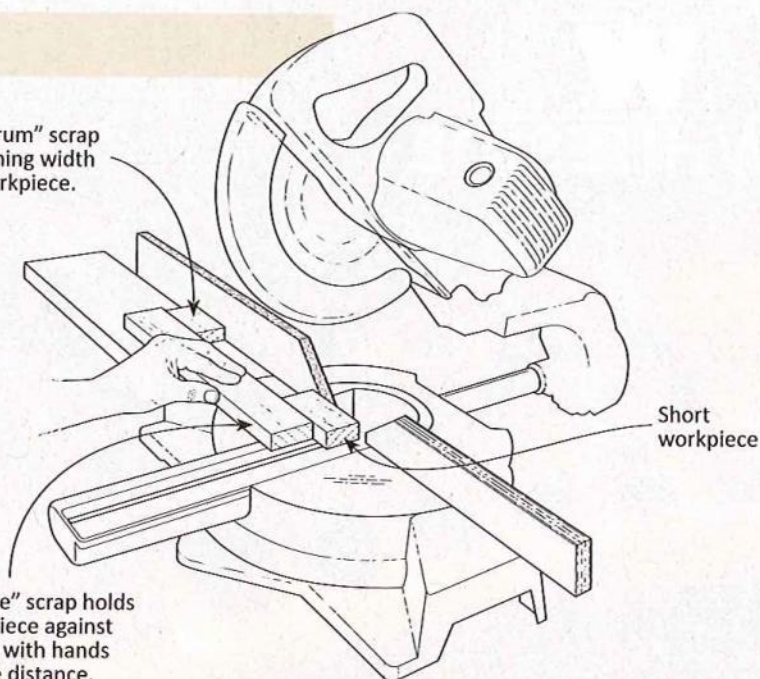
TOP TIP

Crosscutting short pieces

Over the years, I've seen a variety of jigs for holding short pieces to be crosscut on a power miter saw. Some incorporate toggle clamps and other hold-downs to secure the work while keeping your hands a safe distance from the blade.

These setups are fine for guys who love to make jigs. Me, I like to keep things simple. I usually crosscut small pieces using a technique I call "bridge-clamping." All you need is a short piece of wood the same width as the one you're cutting and a stout stick at least 12" long.

"Fulcrum" scrap matching width of workpiece.



"Bridge" scrap holds workpiece against fence, with hands at safe distance.

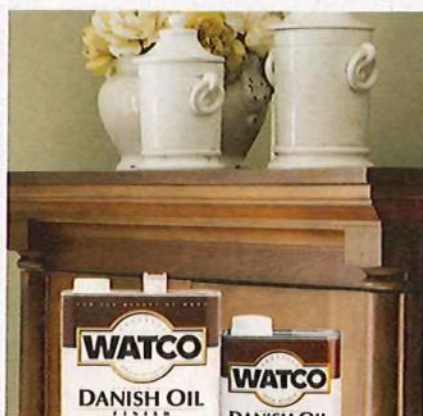
Position your workpiece for the cut, and then firmly hold it in place by bridging over from the fulcrum scrap as shown, keeping your hand a safe distance from

the blade. This same technique works on a crosscut sled or miter gauge extension fence.

—Peter Ashton,
Sacramento, California



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Cantilevered planing platform

Cantilevered board provides secure platform for planing or sanding.

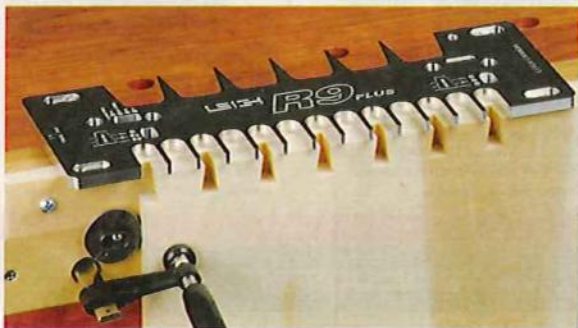
Planing or sanding case or drawer sides works best when the surface being smoothed is fully supported on its underside.

The easiest way to provide the support is to clamp a cantilevered board or panel to your workbench. For heavy cases, use a stout board. For most drawers, a 3/4"-thick scrap plywood panel works fine. You can secure the work to the platform with clamps, removing them when they get in the way, or you can size the support panel for a tight fit in the unit opening, in which case you often don't need clamps.

—Paul Anthony, senior editor

Share a Slick Tip. Win Cash or a Prize!

Next issue's Top Tip will receive a **LEIGH R9 Plus Router Table and Bench Joinery System**, for a total value of **\$159.00**. 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: 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.



Illustrations: Chris Glowacki



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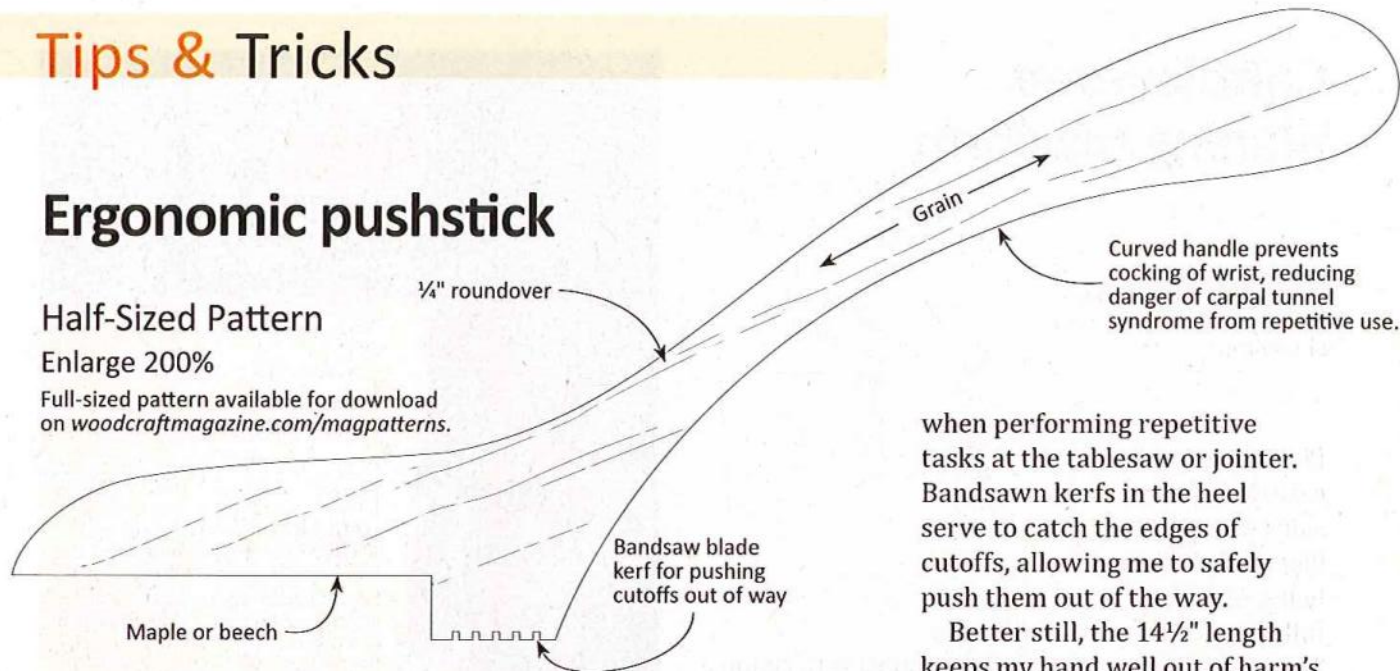
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when performing repetitive tasks at the tablesaw or jointer. Bandsawn kerfs in the heel serve to catch the edges of cutoffs, allowing me to safely push them out of the way.

Better still, the 14½" length keeps my hand well out of harm's way without compromising control. To cover a variety of needs, I make my pushsticks in batches from ¼", ½", ¾" and 1"-thick material.

—Tom Svec, Lock Haven, Pennsylvania

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Tips & Tricks

Ripping thin strips

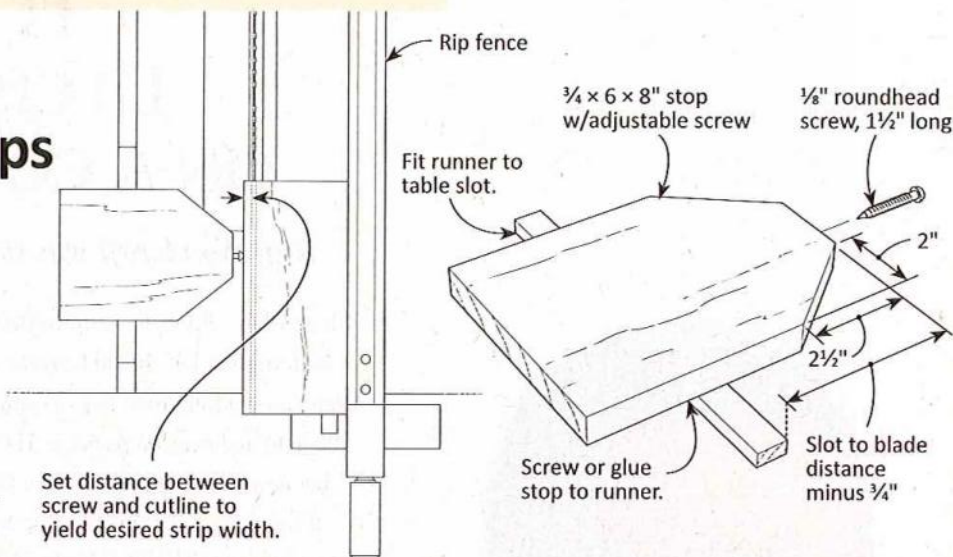
Ripping multiple thin strips on the tablesaw in traditional ripping fashion can be dicey. The blade is so close to the fence that it tends to chew up your pushstick, which is also usually too thick to bypass a splitter. This is when it's better to rip from the outer edge of the board. But the trick is being able to quickly and accurately reset the fence for subsequent identical cuts. Here's how it works:

Adjust the rip fence so that the blade will slice your desired width of cut from the edge of the board that's opposite the fence. With the board at the ready for cutting, set up a stop

Set distance between screw and cutline to yield desired strip width.

of some sort against the edge that's being trimmed. Make the cut, and then set up for the next cut by resetting the fence with the board pinched between it and the stop. For a stop, I use a simple jig like the one shown. It's just a small piece of wood

glued or screwed to a runner that rides in the table slot. The screw allows fine adjustment for the cut. Instead, you could use a stout featherboard or a stick clamped to your miter gauge. —Harold Coverson, Salt Lake City, Utah



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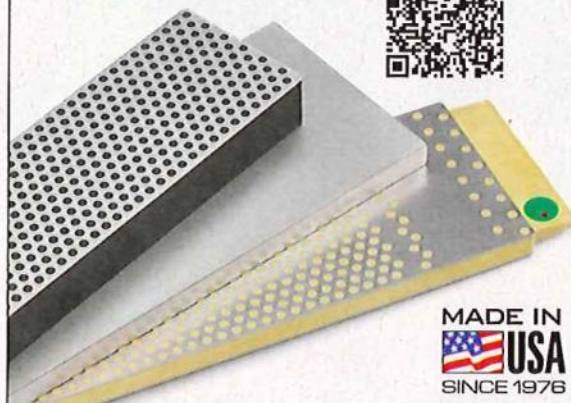


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Tool Chest

*A stately home
for your hand tools*

By Paul Anthony

Overall dimensions: 28"w x 14 $\frac{7}{8}$ "d x 15"h

There comes a point when you realize that dumping planes, squares, chisels, and other hand tools into some box or drawer is just plain abusive. It's this kind of disregard that leads to nicked cutting edges, imprecise measuring tools, and time lost to disorganization. Good tools deserve a good chest built specifically to house, protect, and organize them.

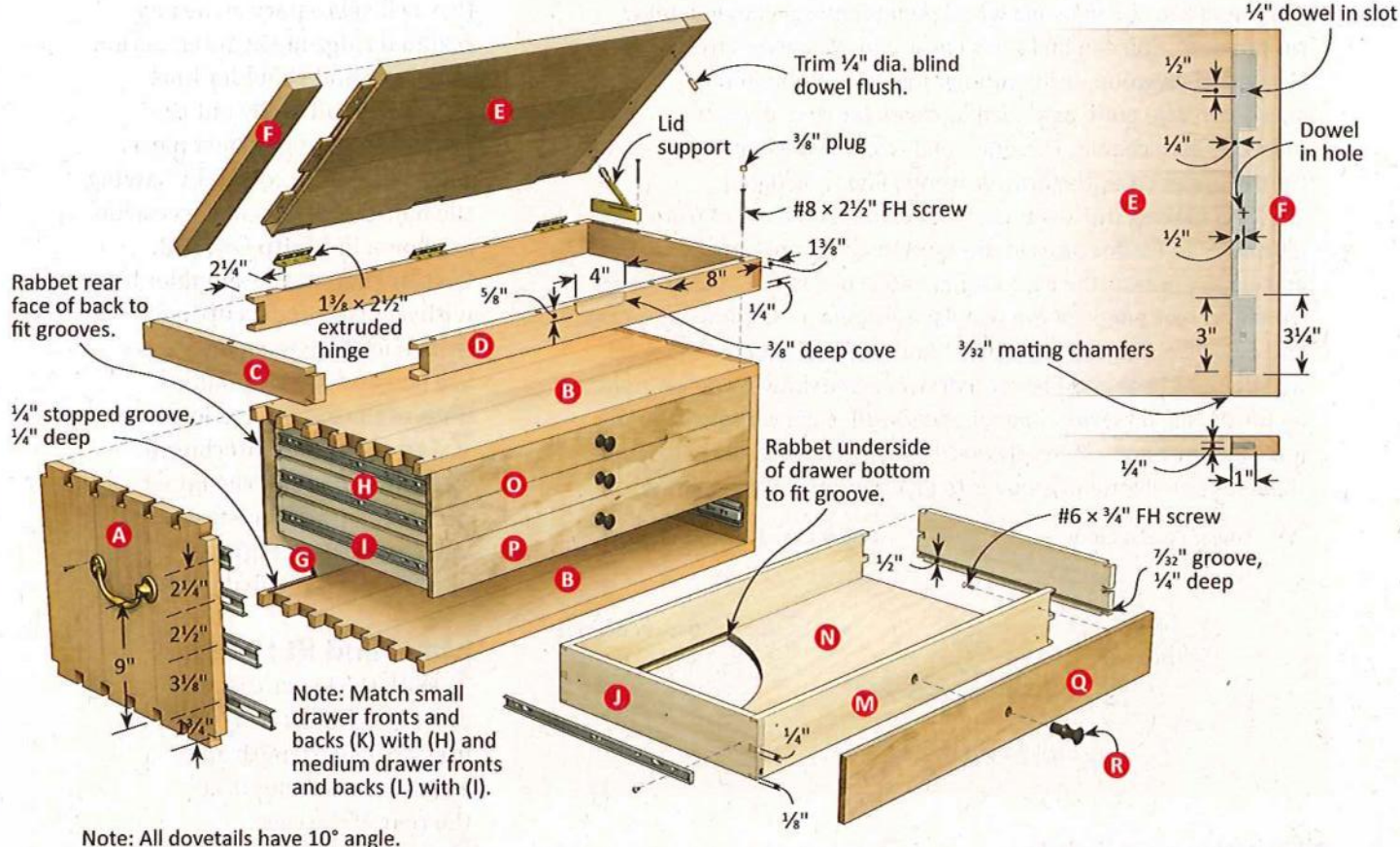
Here's a chest that's designed

to accommodate a good-sized collection of common woodworking tools. Four judiciously sized drawers will hold everything from small squares and chisels to screwdrivers and smoothing planes without wasting space. Full-extension slides allow easy access to items at the rear of the drawer, and a hinged top lifts to reveal a shallow upper case at the top of the chest

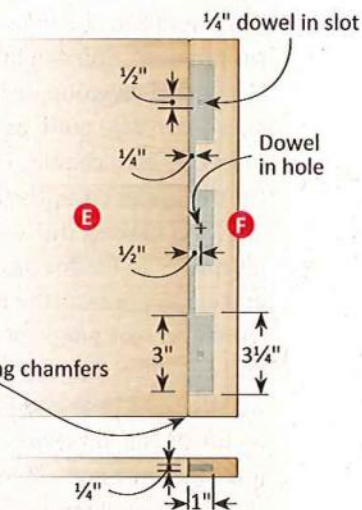
for tools that can remain in the open all day if you like.

The construction itself is fairly simple, consisting of a lower case and upper case attached by screws. I used through dovetails for the case joints because they're virtually indestructible. The upper case consists of the lid and a frame that screws to the bottom case. To prevent the lid from cupping, I outfitted it with breadboard ends.

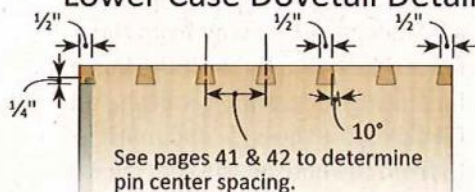
Figure 1: Tool Chest Exploded View



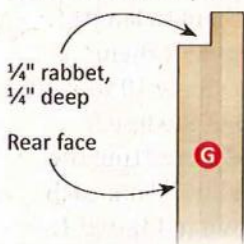
Breadboard End Detail



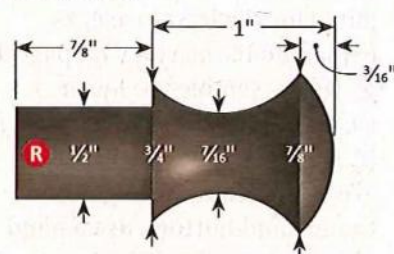
Lower Case Dovetail Detail



Back Panel Detail



Pull Detail



Make the case parts

1 Using roughsawn stock, lay out boards to create oversized panels for the lower case and lid (A,B,E). Referring to the **Cut List**, aim to make each glued-up panel about 1/32" oversized in thickness, at least 1/4" oversized in width, and a few inches longer than the finished panel dimensions. It's important to make at least one of the case pieces 3-4" oversized in length to yield a test piece for saw setup when dovetailing.

2 Lay out the upper case sides, front, and back (C,D) and breadboard ends (F), also leaving them oversized for now.

3 Joint and plane all the aforementioned pieces flat and square, thicknessing each one to 25/32".

4 Edge-glue the panel pieces to make the panels (A,B,E) to the sizes mentioned in **Step 1**.

5 Thickness all the parts (A-F) to 3/4", and then rip and crosscut them to the sizes shown in the **Cut List**, with these exceptions: Leave

the upper case sides (C) at least 1/4" oversized in length for now, and leave the lid panel (E) and breadboard ends (F) oversized in both width and length for now.

Tip Alert

For accurate thicknessing, one face of a workpiece must be flattened before planing the opposite face. If your jointer is too narrow to flatten a panel, you can do the job with hand planes (see page 53).

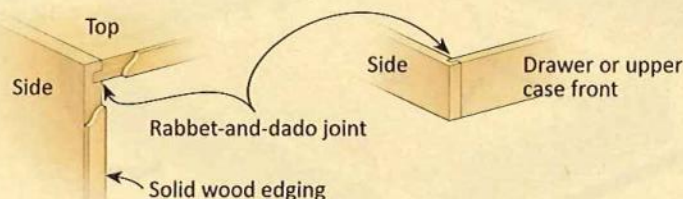
The Plywood Alternative

Don't feel like making solid wood panels and sawing dovetails? No problem. You can build this chest and its drawers from hardwood plywood, using simpler joinery. Although the chest won't be quite as strong or classy looking, it will be perfectly serviceable. The only solid wood you'll need will be for the upper case, the drawer fronts, and the edging.

When making the lower case sides, top, and bottom from plywood, adjust the sizes in the **Cut List** to accommodate rabbet-and-dado joints at the case corners and solid wood edging on the front and rear edges of the panels, as shown in the drawing below, left. Likewise, you can use rabbet-and-dado joinery for the solid wood upper case and plywood drawers (see drawing below right). As for the lid, a plywood panel edged with solid wood will do the job. One final note: With plywood construction, it's wise to glue the back panel into its grooves to give the case extra rigidity.

Lower Case Joinery

Upper Case & Drawer Joinery



Make the case joints

1 Lay out and cut the dovetail joints for the lower case, as explained in the story on page 40.

2 Dry-assemble the lower case sides, top, and bottom (A,B). If the edges of the sides are offset from the edges of the top and bottom, use a hand plane to trim them flush.

3 Lay the two upper case sides (C) in place on top of the lower case, mark them to length, and then crosscut them.

4 Lay out a single 10° dovetail on each end of the upper case sides (C), inseting the end of the tail 1/4" from each edge as shown in **Figure 1**.

5 Saw the dovetail cheeks as

shown in **Photo A**, and then trim to the shoulder line (**Photo B**). Use a chisel to pare away any residual ridge at the intersection of the tail and shoulder line.

6 Use the tail to lay out the dovetail socket on a test piece. Then create the socket by sawing the half-pin cheeks in succession, as shown in **Photo C1 & C2**.

Pare or chop to the shoulder line with a chisel, undercutting in from each face to ensure there are no gaps at the shoulder lines of the assembled joint.

7 Lay out the counterbored clearance holes on the upper case walls (C,D) for #8 screws, where shown in **Figure 1**. Then bore them on the drill press.

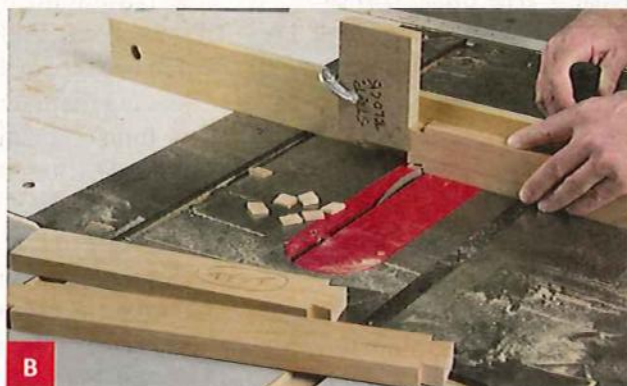
Make and fit the back

1 With the lower case still dry-assembled, record the precise inside length and width measurements at the rear of the case.

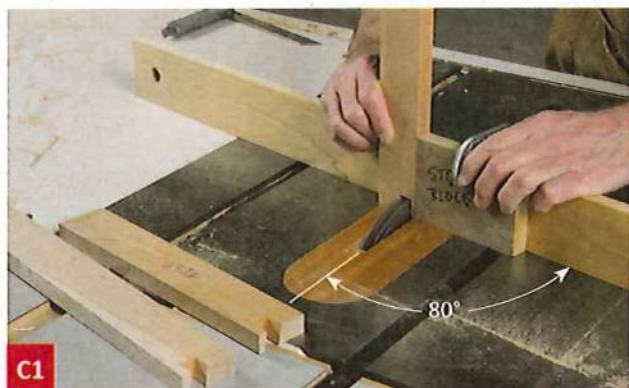
2 Outfit your router table with a 1/4" up-cut spiral bit, setting it for a 1/4"-deep cut 1/4" away from the fence. Mark two lines on the fence indicating the perimeter of the bit. Disassemble the case and mark 1/2" in from the ends of the rearmost pins to serve as termination points for the stopped grooves in the pin boards (B).



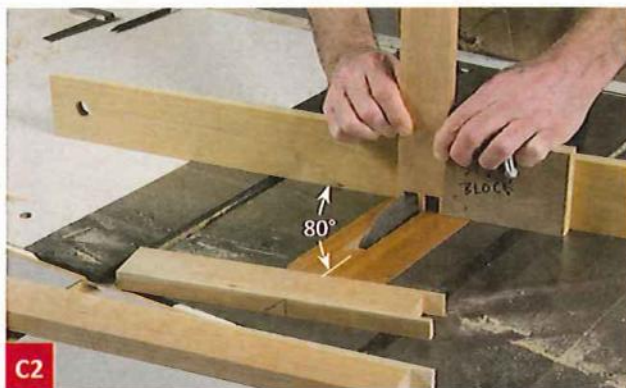
With the blade tilted at 10°, saw the upper case dovetail cheeks by rotating the workpiece edge-for-edge against a stop block.



Set the blade to 90° and saw the shoulders. Register the work against a raised stop block to prevent jamming up the freed offcut.



C1 With the miter gauge angled at 80° to the left of the blade, saw the left-hand half-pin cheeks.



C2 Then set the gauge at 80° to the right of the blade, reset the stop, and cut the opposite cheeks.

3 Rout the grooves for the back panel (G). For the stopped grooves in the case top and bottom (B), align the reference mark on the leading end of the workpiece with the left-hand reference mark on the fence, and drop the piece onto the spinning bit (**Photo D**).

At the end of the cut, lift the board when its trailing reference mark meets the right-hand mark on the fence.

4 Square the ends of the stopped grooves with a chisel.

5 Lay out and cut the back panel (G). To size it, add $\frac{7}{16}$ " to each of the inside back measurements you recorded earlier.

6 Rout or saw a $\frac{1}{4}$ "-wide rabbet in the rear face of the panel, adjusting the depth of the cut to create a snug but

easy fit in the case grooves.

When viewed from the back, you should expect to see a slight gap at the rabbet shoulder.

7 Rehearse the lower case (A,B,G) assembly, checking the fit of the panel (G) at the same time. Make sure that it slides in its grooves easily and that the dovetail joints pull together completely. Begin by laying one case side (A) on the bench, and attaching the top and bottom (B) to it. Splay the uppermost ends of the top and bottom apart just enough to slide the back panel in place, and then attach the opposite case side (A). Now, using clamps and cauls to pull the tail boards (A) against the pin boards (B), completely dry-clamp the assembly (**Photo E**).

Assemble the cases

1 Disassemble the dry-fit lower case (A,B,G), correct any panel misfits, and then glue up the case using white glue or other slow-setting glue like Titebond Extend. (With case dovetails, there's no need to glue the back panel in its grooves.) Make sure that the case is square under clamp pressure.

2 Glue up the upper case (C,D), again ensuring that it's flat and square under clamp pressure.

3 When the glue is dry, plane or sand the tails and pins flush to each other.

4 Use a $\frac{3}{8}$ " cove bit to rout the finger lift in the upper case. Then attach the upper case to the lower case, drilling $\frac{5}{16}$ "-diameter pilot holes first. Plug the holes.



D For the stopped grooves, align the leading reference mark on the pin board with the left-hand mark on the fence, and lower the work onto the spinning bit.



E While dry-assembling to check the fit of the joints, rehearse your clamping procedure, including the squaring of the case.



F Pull the drawer dovetails into their sockets, keeping the clamp body parallel to the drawer side to maintain square.



G Align the drawer slide's mounting holes with a centerline on the drawer side, and poke screw starter holes with an awl.

Make the lid

1 Rip and crosscut the oversized lid panel (E) and breadboard ends (F) to the sizes shown in the **Cut List**. One exception: leave the breadboard ends about $\frac{1}{16}$ " oversized in width for now.

2 Referring to the **Breadboard End Detail in Figure 1** and the article on page 28, make the breadboard end joints.

3 Crosscut six $\frac{1}{4}$ "-diameter dowels to about 1" long, and very slightly chamfer one end using a pencil sharpener to ease insertion.

4 Apply glue to the centermost 8" or so of the joint, attach the breadboard ends, and install glued dowels. When tapping the dowels to seat them, make sure the breadboard end is fully supported on its underside

to prevent blowing out the opposite face. (Don't ask...)

5 When the glue is dry, trim the dowels flush with the surface.

Make the drawers

1 Cut the drawer sides (H,I,J) to the sizes shown in the **Cut List**. At the same time, cut the drawer fronts and backs (K,L,M).

Note: Instead of trusting the lengths in the Cut List, measure the inside width of the case and subtract 1" to determine the actual length of the fronts and backs.

2 Lay out and cut the joints. I used through dovetails, but you could join the drawers with rabbet-and-dado joints instead, as shown in the sidebar on page 24.

3 Dry-assemble the drawers, plane any misaligned bottom

edges flush with each other, and then disassemble them and saw the grooves for the bottom panels on the tablesaw, registering the bottom edges against the rip fence.

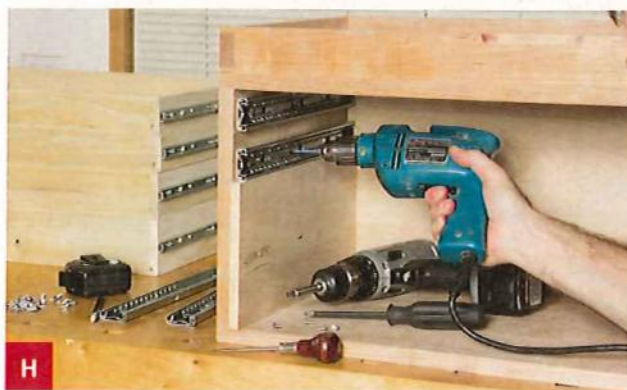
4 Rabbet the drawer bottoms to create a tongue to fit in the grooves.

5 Glue up the drawers on a flat surface (**Photo F**), spot-gluing the grooves to add strength.

Install the drawers

1 Attach the drawer halves of each slide set to each drawer (**Photo G**), setting the front end of the slide about $\frac{1}{16}$ " back from the front edge of the drawer.

2 Measuring up from the inside bottom of the case, mark off the drawer slide centers, where



H Using a squared spacer panel for support ensures that each slide is square to the case face and at the same height as its partner.



I When mortising for the lid support, clamp scrap to the upper case side to prevent router tip, and use stops to limit the router travel.

shown in **Figure 1**, extending the lines fully across the inside face of the side. Center a slide on the uppermost line, and then measure from the bottom edge of the slide to the inside bottom of the case. Rip scrap plywood to that dimension, and use it as a spacer against the case side for mounting each of the top slides, setting the front end of each slide $\frac{3}{8}$ " back from the front edge of the case.

3 Follow the same measuring procedure for the next slide down, and rip the spacer panel to support it and its partner for installation (**Photo H**). Finish mounting all the slides in this manner.

4 Mount the drawers in the case, and check for smooth operation. If necessary, joint or sand the sides to reduce the width of a drawer, or shim the slides out with matboard or other hard cardboard stock if a drawer is too narrow.

5 Rip the false drawer fronts (O,P,Q) to the sizes shown in the **Cut List**, and squarely crosscut them to the width of your case opening minus $\frac{1}{16}$ ".

6 Put the bottom false drawer front (Q) in place, shimming it on the sides and bottom to create a consistent gap. Clamp the false front to the drawer, and then attach it with countersunk $\frac{3}{4}$ "-long screws. Do the same for the other drawers in ascending order. For the top drawer, use double-faced tape to register the alignment. After all the fronts are attached, plane their edges as necessary to create consistent gaps all around.

7 Turn the pulls. (See **Figure 1 Pull Detail**.)

Finish up

1 Lay out and cut the hinge mortises in the upper case back and the underside of the lid, locating them where shown

in **Figure 1**. Temporarily install the hinges and trim the edges of the breadboard ends (F) flush to the case.

2 Lay out and rout the $\frac{3}{8} \times \frac{3}{4} \times 4\frac{5}{16}$ " mortise for the lid support (**Photo I**). Also drill the $\frac{7}{16}$ "-diameter, $\frac{1}{2}$ "-deep blind hole in the underside of the lid to accept the barrel on the arm of the lid support. Locate its center $\frac{3}{8}$ " in from the end of the lid and $1\frac{1}{2}$ " in from the rear edge of the lid.

3 Sand everything through 220-grit, and apply the finish of your choice. I wiped a total of five coats of oil-based varnish

onto all exposed surfaces. To obtain a smooth, protective build, I let each coat dry without wiping it off, then scuff-sanded between coats with progressively finer sandpaper, finishing up with 0000 steel wool.

4 Drill the holes for the pulls, and glue them in place.

5 Screw on the chest handles where shown in **Figure 1**, and attach the hinges and lid support, epoxying the barrel into its hole.

6 Install the drawers, and fill the chest with tools. I suggest trying various layouts for awhile, then outfitting the drawers with appropriate dividers. ■

Tool Chest Cut List

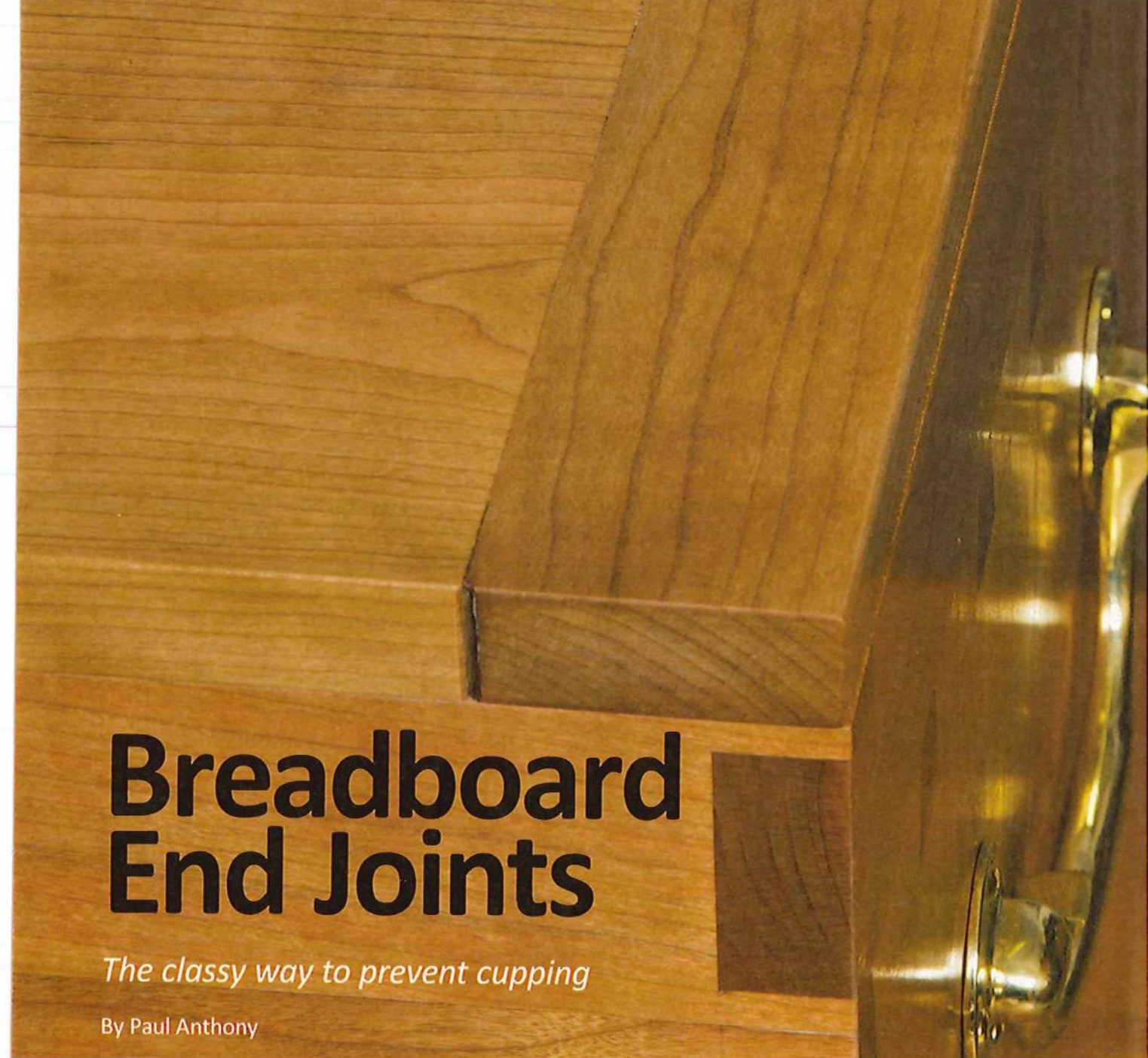
	Part	Thickness	Width	Length	Qty.	Mat'l
A*	Lower case sides	$\frac{3}{4}$ "	$14\frac{7}{8}$ "	$12\frac{1}{4}$ "	2	C
B*	Lower case top/bottom	$\frac{3}{4}$ "	$14\frac{7}{8}$ "	28"	2	C
C*	Upper case sides	$\frac{3}{4}$ "	2"	$14\frac{7}{8}$ "	2	C
D*	Upper case front/back	$\frac{3}{4}$ "	2"	28"	2	C
E*	Lid panel	$\frac{3}{4}$ "	$14\frac{7}{8}$ "	26"	1	C
F*	Breadboard ends	$\frac{3}{4}$ "	2"	$14\frac{7}{8}$ "	2	C
G*	Back panel	$\frac{1}{2}$ "	$11\frac{1}{16}$ "	$26\frac{15}{16}$ "	1	BP
H	Small drawer sides	$\frac{1}{2}$ "	2"	$13\frac{3}{8}$ "	4	P
I	Med. drawer sides	$\frac{1}{2}$ "	$2\frac{1}{2}$ "	$13\frac{3}{8}$ "	2	P
J	Large drawer sides	$\frac{1}{2}$ "	$3\frac{1}{4}$ "	$13\frac{3}{8}$ "	2	P
K	Small drawer fronts/back	$\frac{1}{2}$ "	2"	$25\frac{1}{2}$ "	4	P
L	Med. drawer front/back	$\frac{1}{2}$ "	$2\frac{1}{2}$ "	$25\frac{1}{2}$ "	2	P
M	Large drawer front/back	$\frac{1}{2}$ "	$3\frac{1}{4}$ "	$25\frac{1}{2}$ "	2	P
N	Drawer bottoms	$\frac{1}{2}$ "	$13\frac{1}{2}$ "	25"	4	BP
O	Small false drawer fronts	$\frac{3}{8}$ "	$2\frac{1}{4}$ "	$26\frac{1}{2}$ "	2	M
P	Med. false drawer front	$\frac{3}{8}$ "	$2\frac{1}{4}$ "	$26\frac{1}{2}$ "	1	M
Q	Large false drawer front	$\frac{3}{8}$ "	$3\frac{1}{2}$ "	$26\frac{1}{2}$ "	1	M
R	Drawer pull	$\frac{7}{8}$ "-dia.		$1\frac{1}{8}$ "	4	R

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

Materials: C=Cherry, BP=Birch plywood, P=Poplar, M=Maple, R=Rosewood

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☐ 3.	Large lid support	01B06.05	\$35.50
☐ 4.	5" Large Chest Lifting Handle, qty. 1 pr.	00A21.03	\$64.50/pr.
Above items are available at leevalley.com, or by calling 800-871-8158. Prices subject to change without notice.			



Breadboard End Joints

The classy way to prevent cupping

By Paul Anthony

The traditional breadboard end joint is, to my mind, one of woodworking's slickest solutions for managing wood movement. It's often used on tabletops, blanket chest lids, and other solid wood panels such as the lid for the tool chest on page 22.

The purpose of the joint is to prevent a solid wood panel from cupping, while still allowing it to expand and contract across

the grain in response to ambient humidity. The breadboard ends are essentially rails that are mortised to accept tenons on the ends of the panel. They serve the same basic purpose as cleats screwed to the inside face of solid wood panels on rustic furniture, except that breadboard end joints are a lot more elegant and forgiving of wood movement. The time spent making the joint

pays off in spades, ensuring projects with strength and beauty to last generations.

There is a variety of approaches to making this classic joint. Over the years, I've developed a simple strategy using a modicum of machinery and hand tools and a jig built from extra stock. My method can be adapted for use with large and small panels.

Designing the joint

As shown in **Figure 1**, a breadboard end joint consists of multiple mortise-and-tenon joints separated by a haunched section. The tenons reach deeply into the cantilevered rails to give them strength. The space between the tenons allows structural integrity for the rail, which would otherwise be weakened by a deep mating mortise running the entire length. The haunched section keeps the parts aligned between the tenons.

To allow the panel to expand and contract across its width, the rail is glued only at its center section. The outermost sections are anchored in place with dowels that extend through slots, allowing the panel to move while still holding the rail's outer ends against the tenon shoulders. The outermost mortises are also slightly oversized in length to allow panel movement.

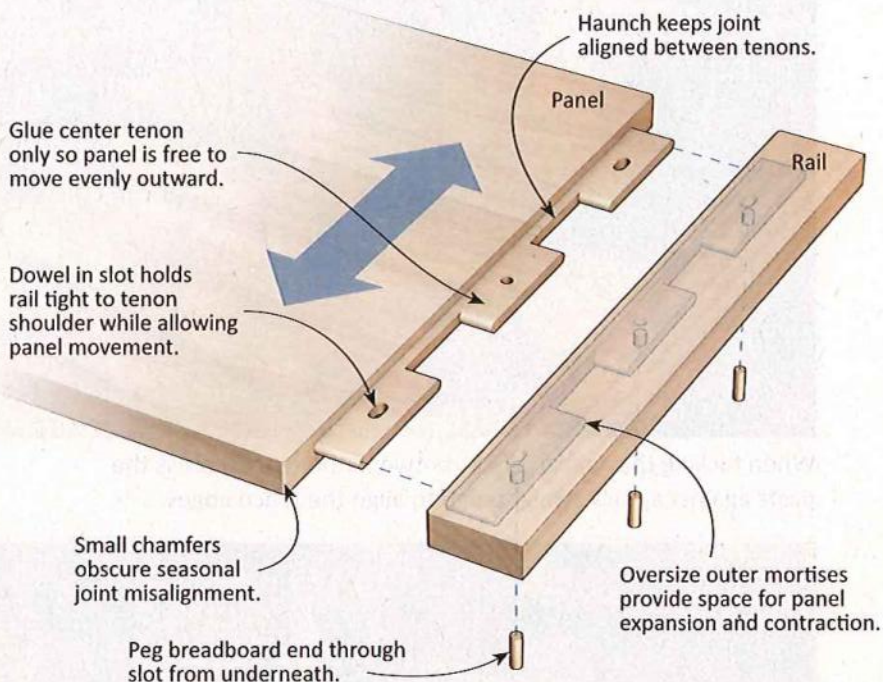
Although there are no hard-and-fast rules on proper tenon width and spacing, I limit the width of my tenons to no more than about 4". I find that three tenons work nicely on an 18"-wide panel, and four on a 24"-wide panel, but use your own judgment as to the specific spacing. I typically make the tenons one-third the stock thickness, but have bent this rule to accommodate available bits.

Make and mortise the rails

Mill your stock, and cut the rails to final size. For consistency, dress the rails and panel to final thickness at the same time. Also, initially make the rails about 3" oversized in length. You'll use the excess as spacers for your fences when routing the panel tenons.

Mark the ends of the mortises on the edges of the rails. Lay

Figure 1: Exploded View Breadboard End Joinery



out the center mortise for a tight fit, but provide extra space on both ends of the outermost mortises. (If need be, I'll adjust the tenon width so that the mortises stop about $\frac{1}{2}$ " in from the ends of the panel.)

Next, outfit your router with an upcut spiral bit and edge guide. Using the excess from a rail as a test piece, set up the edge guide to rout a mortise

that's perfectly centered across the stock thickness. (I use a dial caliper to check the offset between the face of the stock and the mortise wall.)

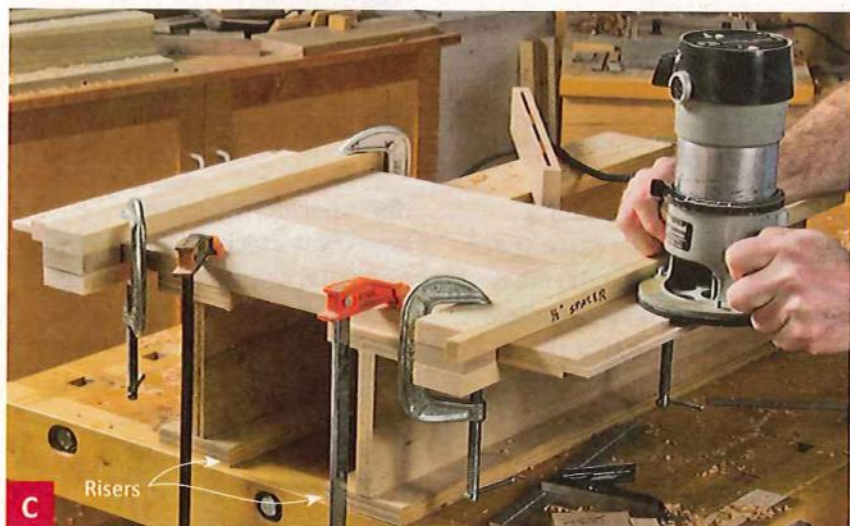
Rout the mortises (**Photo A**) $\frac{1}{16}$ " or so deeper than the tenon length. Now, leaving the edge guide setting as is, adjust the depth of cut for the haunch groove, and rout it out between the mortises.



Plunge an upcut spiral bit to full mortise depth at each end of the cut, and then remove the waste between in subsequently deeper passes.



B When tacking the spacer blocks between the fences, press the parts against a thick straightedge to align the fence edges.



C Rout the tenons using a spacer against the fence for the first cut, with the spacer matching the bit diameter. Remove the spacer for the second pass.



D Round the tenon edges using a chisel and file. Also pare the outermost shoulders flush to the shoulder line.

Cut the panel tenons

Before cutting the panel tenons, you'll need to make a pair of double fences to guide the router. Mill four pieces of straight-grained stock to about 2" wide and a few inches longer than the width of your panel. Most importantly, joint the edges absolutely straight.

Crosscut each excess section of rail into two, and tack each half between the ends of a pair of fences, as shown in **Photo B**. Afterward, use a square to check the fence edges for parallelism. Run the assembly over a jointer if needed to square the edges and bring them into perfect alignment. (This is important to ensure tight rail contact at the shoulders of the joint.)

Now mark the tenon shoulders fully across one face of the panel using a sharp pencil, and install a wide straight bit in your router. Adjust its depth of cut so that routing in from both faces yields a tenon that's a hair too fat for its mortise. (Make the cuts on a piece of scrap the same thickness as your panel, and test the fit in a mortise.)

Secure the panel to a couple of risers on your benchtop. Clamp the fences in place, offsetting them from the tenon shoulder line a distance equal to the offset between the edge of your router sub-base and the perimeter of your bit.

Make the cuts as shown in **Photo C**. The most efficient approach is to use spacers whose

Tip Alert

To prevent exit tearout at the end of the cut, deeply knife the tenon shoulder lines into the edges of the panel before routing.

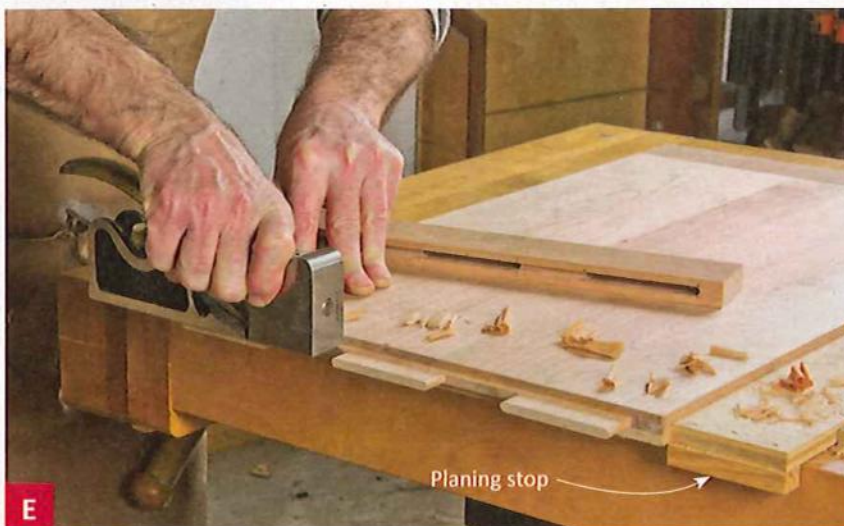
width equals the diameter of your router bit. For example, here I'm using a $\frac{1}{2}$ "-diameter bit, so I place a $\frac{1}{2}$ "-wide spacer against the fence and make a complete end-to-end cut. Next, I remove the spacer and make a second $\frac{1}{2}$ "-wide cut to yield my 1"-long tenon. For longer tenons, use more spacers.

After routing, lay the individual tenons out to width; then use a jigsaw to cut out the haunched area between them. Round the edges of the tenons to approximately match the ends of the mortises (**Photo D**).

Now adjust the tenons to fit. For this I use a shoulder plane (**Photo E**), but you can also use sandpaper wrapped around a hardwood block. (Remember to remove the same amount from each face to keep the rail centered across the thickness of the panel.)

Pin it together

Mark out the dowel hole locations on the undersides of the rails, and clamp them in place. To do this, I crosscut two stout clamping cauls of identical width to a length about 8" longer than my panel



Fine-tune the tenon thickness with a shoulder plane, trimming equal amounts from each face until the tenons fit their mortises snugly.

width. (The cantilevered ends of the cauls keep the clamps from interfering with the edge guide when routing.)

Set up a router edge guide to align the bit with the dowel hole locations. Then set the plunge depth to bore through the rail and the tenon, stopping short of creating a through hole (unless you want the look of exposed pegs on the top of the panel assembly). Now plunge the holes into the underside of the panel, as shown in **Photo F**.

Remove the rail, adjust your edge guide, and then widen

the outermost holes into slots (**Photo G**). Pare small chamfers at the ends of the joint, where shown in **Figure 1**.

Assemble the parts, gluing only the centermost 6" or so of the joint, and glue short dowels into the holes. After the glue dries, saw and pare the dowels flush to the surface, and then plane or sand both faces of the panel assembly to flush up any discrepancies.

Take a bow. You've just created a flat panel that should stay that way forever. ■



Use a router outfitted with an upcut spiral bit and edge guide to bore the dowel holes into the underside of the assembled panel.



Reset the edge guide, and elongate the outermost tenon holes to allow seasonal wood movement of the panel.



Rust Busters

A little science can help you pick the product that packs the hardest punch.

By Joe Hurst-Wajszczuk

Rust needs no introduction. Woodworkers with unheated basement and garage shops are all too familiar with this uninvited “guest” that regularly stops by to snack on their shops’ contents. Those working in climate-controlled shops are likely to find rust blooms sprouting from the oils and acids left by fingerprints or born of condensation rings left by a casually-placed drink.

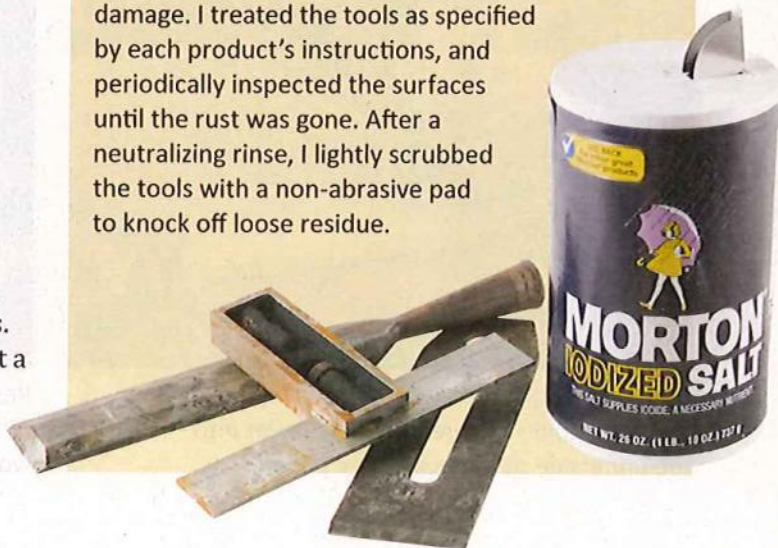
Whether restoring hand tools or reclaiming metal machinery, you have to arm yourself for the fight. The challenge is finding the right weapon. To help you choose, I gathered the top rust busters in the market and conducted my own side-by-side test.

The test revealed that no product is a perfect weapon. Selecting the right product starts by reading the label and understanding some of the science behind a few key rust-busting ingredients. Armed with this knowledge, you’re likely to select a few different strategies. Let’s face it, rust will eventually win the war. But after reading this, you’ll have what it takes to win a few battles.

About The Test

Against every woodworking instinct, I invited rust into my workshop. To do this, I first used acetone to remove any oils or protective coatings from my test tools, and then dipped them into salt water and set them aside to deteriorate.

Two weeks later, I attempted to undo the damage. I treated the tools as specified by each product’s instructions, and periodically inspected the surfaces until the rust was gone. After a neutralizing rinse, I lightly scrubbed the tools with a non-abrasive pad to knock off loose residue.

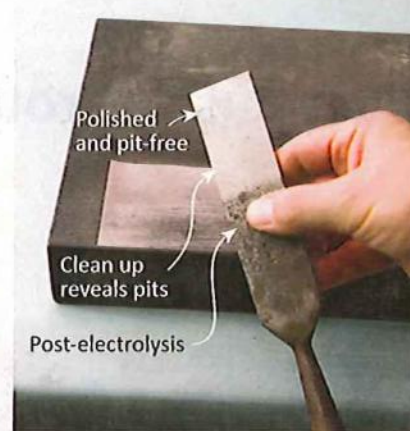




After a quick acid dip, rust revisited a cleaned tool. A longer bath resulted in a protective coating.



Selective chelants remove rust and produce a protective patina, but can compromise good metal.



Electrolysis won't replace missing metal. Pitted chisels and blades require further smoothing.

Choose your weapon

Despite the multitude of products, rust removers can be categorized according to a few key ingredients. Within a category, each treatment works in the same basic manner.

Acids

Nearly any acid can remove rust. The process can take from a few minutes to several hours, depending on the acid's strength and the amount of rust.

Phosphoric acid is the fastest acting, but the least forgiving, especially when cleaning tools with either painted parts or components made from various metals. Phosphoric acid, in liquid or jelly form, is not recommended for use on painted steel, chrome, or even stainless steel. And these acids will quickly dissolve aluminum components.

Acid does not differentiate between rust and good metal. Even milder acidic solutions will etch sound steel. (Under a microscope, etching resembles millions of tiny pits—each a fast-food restaurant for future rust.) Unless dried and oiled immediately after treatment, freshly cleaned surfaces will begin to “flash-rust” within minutes. (See photo above, left).

Phosphoric acid was the only exception to the flash-rusting rule. Leaving a plane blade in phosphoric acid for an hour produced a black, fairly uniform coating of ferric phosphate. This coating can prevent corrosion, but it's not as reliable or convenient as other corrosion inhibitors. (See “Keeping Rust at Bay” on page 35.)

The greatest dangers relating to acid are to the user. Phosphoric acid can cause burns or blindness upon contact, so gloves and goggles are a must. Kitchen-grade products containing oxalic and citric

acids can be used without gloves, but prolonged exposure to bare skin will leave your hands raw.

Selective chelants

Chelants are compounds designed to steal the iron from iron oxide, inactivating it and holding it in solution so that the resulting residue can be rinsed off. This selective process does not affect steel, copper, brass, aluminum, plastic or rubber. All the products listed are non-acidic, water-soluble, biodegradable, and safe to handle without gloves. (The manufacturers don't divulge the ingredients. I grouped the products together because they perform similarly.)

Unlike the acids, chelants don't require rinsing; in fact, remaining residue offers some protection (see photo above, center). The solution can be reused, but in time it will leave a darker deposit on your derusted tools. (I save the used stuff for heavy removal and employ a fresh batch for final cleanup.)

We Have Met The Enemy, And He Is Rust...

There are two forms of iron oxide—one red and one black. It's the reddish version, Fe_2O_3 , that you need to worry about. Because red iron oxide is larger than the surrounding molecules, it causes the affected steel to “puff,” creating cracks and voids that expose more bare metal.

Unlike red iron oxide molecules, those in black iron oxide (Fe_3O_4) are the same size as neighboring metal molecules. These oxidized areas will not grow or flake. Black iron oxide is safe; in fact, it's what makes up most of the patina on old tools. Some hardware is deliberately treated with black oxide to keep red oxide from getting a toehold.

Rust busters roundup



Agent	Cost	Type	Time (Suggested)	Restrictions/Uses*	Personal Safety	Notes
Phosphoric Acid	128 oz. (1 gallon) \$16	Phosphoric Acid	10 minutes	Not suitable for paint, chrome, or aluminum. Will etch paint.	Caustic enough to burn skin. Gloves and goggles mandatory. Fumes hazardous. Use in ventilated space.	Fastest rust-eater. Prolonged immersion results in a protective coating.
Naval Jelly	16 oz., \$7	Phosphoric Acid	5-10 minutes	Not suitable for paint, chrome, or aluminum. May etch paint.	Less likely to splash, but still caustic. Gloves and goggles mandatory.	More prone to rust-flashing than other acids tested.
Rust Free	8.45 oz., \$12	Phosphoric Acid	30-60 seconds	OK for chrome, but not suitable for aluminum.	Gloves and goggles recommended.	Short application time offers convenience and ease of control.
Krud Kutter	8 oz., \$10	Phosphoric Acid	30 minutes to 1 hour	Only acid of this type that can be used on aluminum.	Gloves recommended.	Contains rust inhibiting agent to control flash-rust.
Ready Strip	32 oz., \$12	Citric and Oxalic Acid	10 minutes	No restrictions listed, but does react with aluminum.	Gloves and goggles recommended.	Convenient, but didn't perform better than cheaper agents.
Citric Acid	7.5 oz. (dry), \$2	Citric Acid	10 minutes	Reacts slowly with aluminum, but safe for painted surfaces and chrome.	None	Commonly available canning agent. Performed almost as well as more caustic acids.
Bar Keeper's Friend	21 oz. (dry), \$2	Oxalic Acid	2 minutes, but required some scrubbing	Safe for aluminum and painted parts.	None	Non-abrasive, but scrubbing produced the shiniest surfaces.
Metal Rescue Evapo-Rust Restore** Restore Gel	128 oz., \$17 32 oz., \$7.50 250 ml., \$28 250 ml., \$28	Selective Chelant	30 minutes-24 hours	Safe for non-ferrous metals and painted parts.	None	Coatings resist corrosion. Products not 100% selective; may react with good steel.
Battery Charger, Baking Soda	\$30 16 oz., \$.69	Electrolysis	2-24 hours	Safe for all metals. Won't affect bluing.	Some electrical risk. Hydrogen is produced by electrolysis. Provide ventilation.	Slowest, but self-limiting reaction affects only rust.

*Unless otherwise noted, products may affect bluing.

**Concentrate mixed with water to make 4.75 liters of solution.

Although safer for you and your tools, chelants don't always discriminate between good and bad metal. In a few instances, the chelants selected sound steel, etching into the lamination boundary lines on my older plane blades, and even creating pits that required grinding.

Electrolysis

This process uses electrical current to convert red rust to black. All you need is an energy source (battery charger), a sacrificial anode (iron scrap), a dip tank, and a tablespoon of baking soda to get the current flowing. Attach the negative lead to the tool, the positive lead to the anode, and plug in the charger. (You can't see electrons making the jump, but bubbles indicate that the reaction is underway.)

Of the options addressed in this article, electrolysis requires the greatest initial expense. However, once you've made the investment, that's it. And, unlike the other chemical treatments, this plug-powered process is not temperature-sensitive, which is a plus when working in an unheated shop.

Unfortunately, electrolysis isn't suitable for tools with non-removable wooden or electronic parts. And despite some claims to the contrary, it doesn't "reverse rust". Lost steel is lost. When restoring plane and chisel blades, you'll need to grind or hone any pits down to clean steel (see photo on page 33).

Summary

Phosphoric acid-based cleaners may rank as some of the fastest rust busters, but they're not much quicker than less caustic acids. There's no shame in sticking with citric and oxalic acids, especially if you prefer keeping products bearing skulls and crossbones out of your shop. Bar Keeper's Friend remains my favorite for light rust treatments and final polishing, but I plan to keep a small bottle of Rust Free for spot repairs.

Selective chelants cost more than acids, but prove safer for both skin and steel. They provide the best solution for the widest assortment of tools, especially those with non-detachable, non-ferrous parts, or those difficult to disassemble and oil afterward. As long as you keep your eye on the clock to prevent unwanted etching, these products offer the best convenience.

Electrolysis requires more time and money, as well as a tank large enough to submerge your work. Despite these obstacles, its ability to attack rust while leaving steel unscathed makes it the best method for prized antiques. ■

Keeping Rust At Bay

In order to oxidize, iron must be exposed to oxygen and water.

Lathering tools in Cosmoline or relocating your shop to the moon might work, but neither solution is terribly practical. The best defense requires a combination of products.

Moisture-displacing coatings provide decent front-line defense. In my informal tests, the products shown above helped abate rust after the derusting treatments. In addition, these products coexist with the adhesives and finishes I use in my shop.

When coatings fail (and they will), you need a reliable second line of defense. Room-sized dehumidifiers work in basements, but in my garage the protection disappears the instant I lift the door. Instead, I rely on small-space sentries. Designed for closed compartments such as cabinets and drawers, dessicants absorb moisture before it reaches metal surfaces. Select a model that provides a clear indication that its working (many have color-changing crystals), and that can be easily recharged when it's saturated. The least expensive models can be reactivated by heating them in an oven. Some have built-in heating elements so that they can be recharged without baking.

If you have access to a power source, a low-temperature heating rod will keep air circulating so that moisture can't condense on metal surfaces. Originally designed to provide constant climate control in gun safes, rods are available in different sizes to suit larger spaces, such as tool cabinets.

WD-40
8 oz., \$5



GlideCote
10.75 oz., \$12,

CRC Industrial
3-36, 11 oz., \$7

Moovit
10 oz., \$10

Indicator crystals



Self-drying
Dehumidifier, \$27



Oven-reactivated
Dehumidifier, \$25

Sugar 'n Spice Cabinet

Everything nice in a home accent

By Scott Phillips



Overall dimensions:
11" w x 7" d x 20 3/8" h

Spice cabinets have served a variety of needs over the centuries, storing everything from spices to herbs to medicines. Because of the value of the quantities stored, the drawers remained small. Over time, however, the cabinets transitioned into quaint home accents, holding keys, pencils, stamps, and other miscellany in their drawers.

Typically made of hardwoods such as oak and poplar, spice cabinets—antiques or ones you buy or make—bring a charm that recalls their original purpose. This design features deeper sides and drawers (for better storage). You can stand it on a table or hang it. Serving as a good beginner weekend project, the cabinet requires precision joinery in cutting identically spaced dados for accepting the shelves and divider that must snugly fit into them. One time-saving design element is that all parts but the drawer bottoms are of 1/2"-thick stock. Now let's make sawdust!

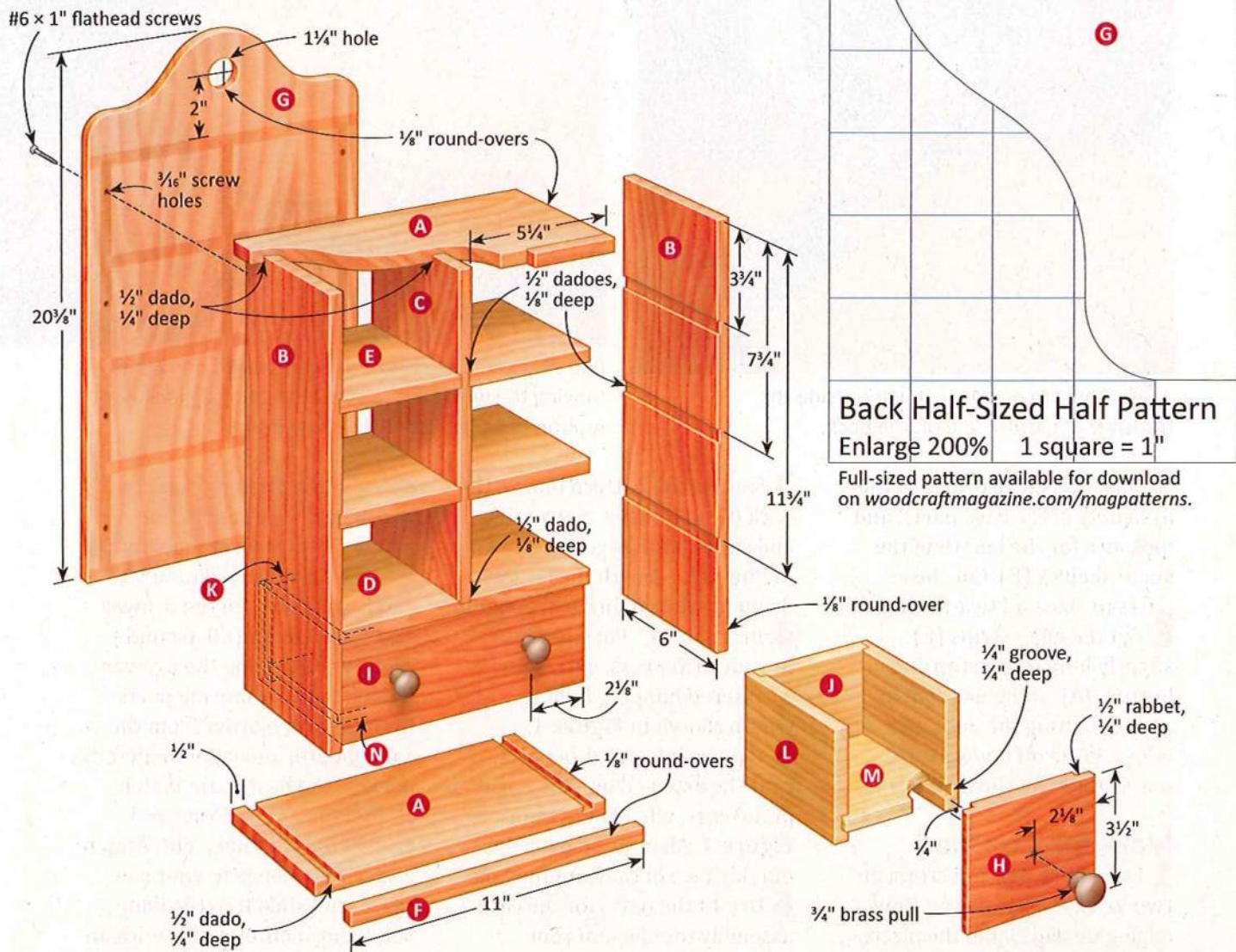
Start with the case

1 Mill enough 7"-wide red oak stock precisely to 1/2" thick (I started with 11 linear feet). Now cut the top and bottom (A), sides (B), divider (C), and large shelf (D) to the sizes in the Cut List. Cut an extra side and top for spot-on setups.

2 Referring to Figure 1, precisely lay out the dado locations on the top and bottom (A), sides (B), divider (C), and large shelf (D), as well as on the

Note: Watch Scott build the spice cabinet on video in episode #2005 starting in 2013 on WBGU TV's The American Woodshop.

Figure 1: Spice Cabinet Exploded View



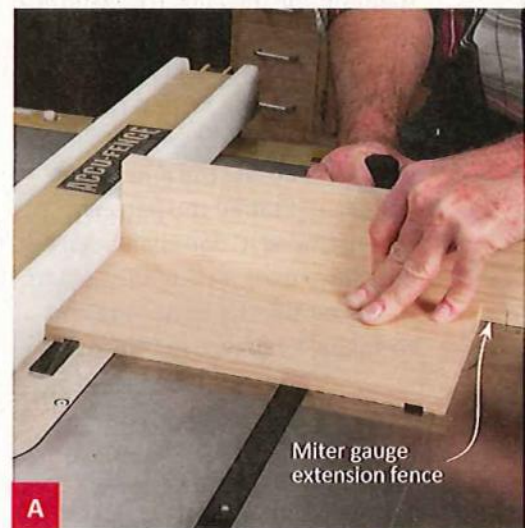
setup pieces. To avoid mistakes when cutting, mark the faces receiving dados on the case top and bottom and large shelf; also mark the dado faces on the sides and divider. You will cut dados on both faces of the divider.

Note: Make test dado cuts in the scrap setup parts to establish the desired depths and fence locations and to test-fit the thickness of the mating stock.

3 Install a 1/2" dado set in your tablesaw, and raise it for a 1/4"-deep cut. Adjust the fence to align the dado set with the end dado marks in the top and bottom (A). Make the cuts, as shown in **Photo A**. For

consistency, dado one end of the case top and bottom, and then flip the pieces end for end to cut the opposite dados. Adjust the fence as needed, and cut the centered dado in the top's bottom face.

4 Lower the dado set for a 1/8"-deep cut. Adjust the fence to align the dado set with the top layout lines on the sides (B) and divider (C). Test the cut on a setup piece. Now, cut the dados. Flip the sides end for end and cut the bottom dados in the sides only. Next, adjust the fence and cut the center dados in the sides and divider. Do the same for the centered dado in the large shelf (D).



Using a miter gauge extension fence to avoid tear-out, dado both ends of the top and bottom.



B Beginning at one edge, cut just outside the transferred pattern line on the back.



C Use an oscillating spindle sander to sand off waste, moving the workpiece against the counterclockwise motion of an appropriately sized drum.

5 On a flat surface, test-fit the assembly of the case parts, and measure for the length of the small shelves (E). Cut these parts to size and test-fit them.

6 Cut the edge strips (F) slightly long for the top and bottom (A), and glue them in place, aligning the ends and edges. Wipe off any squeeze-out. Later, trim flush and sand.

Make the case back

1 Edge-joint, rip, and crosscut two $\frac{1}{2} \times 5\frac{1}{2} \times 21$ " pieces. Now, edge-glue and clamp the pieces together for the back (G). After the glue dries, trim the part to $20\frac{3}{8}$ ".

2 Make a copy of the **Half-sized Pattern** on page 37, and cut it out. Trace or spray-adhere the pattern onto the top end of the back (G). (I taped the pattern down, traced it, and then peeled it off.) Now, using a $\frac{1}{4}$ " blade in your bandsaw, cut the back's top end to shape, as shown in **Photo B**.

Tip Alert

I widened the countersunk screw holes in the back to $\frac{3}{16}$ " to allow for wood movement across the part's width.

3 Sand to the pattern line on the back (G) to remove saw marks, and smooth the edges, as shown in **Photo C**. Go with the largest drum possible to prevent gouging.

4 Install a $1\frac{1}{4}$ " Forstner bit in your drill press, and drill a centered hanging hole, where shown in **Figure 1**.

5 Using a $\frac{1}{8}$ " round-over bit, rout the exposed outside edges of the case, where shown in **Figure 1**. Also round over the outside face of the hanging hole.

6 Dry-fit the parts for the case assembly to rehearse your glue-up, and check the overall fit. Now, using glue with a long open time (I used Titebond's Extend glue), apply glue in the dadoes and assemble the case, adding clamps over joint locations. Check for square. Allow the assembly time to dry, and then locate and drill countersunk holes in the back (G). Clamp the back to the case, and drill pilot holes, guiding off the screw holes. Screw on the back.

Make the drawers

1 Cut the small drawer fronts (H), large drawer front (I), small drawer backs (J), large drawer back (K), and drawer sides (L) to the sizes in the **Cut List**. (I

checked the opening sizes in the case first to confirm or adjust the measurements for the drawer parts. I tried for a $\frac{1}{32}$ " clearance between the drawer and case opening all around.) Also, when cutting the drawer fronts, cut neighboring parts in consecutive order from the same board, and label them to achieve the best grain match.

2 Install a $\frac{1}{2}$ " dado set and raise it for a $\frac{1}{4}$ "-deep cut. Attach a sacrificial fence to your saw fence, and slide it to the dado set. Using a miter gauge with an extension fence, cut the rabbets in the ends of the drawer fronts (H, I) and drawer sides (L), where shown in **Figure 1** and as shown in **Photo D**.

3 Install a $\frac{1}{4}$ " dado set, and cut the grooves for the drawer bottoms (M, N), where shown in **Figure 1** in the small drawer fronts (H), large drawer front (I), small drawer backs (J), large drawer back (K), and drawer sides (L).

4 Dry-fit the drawers and measure for the drawer bottoms (M, N). Cut these to size from $\frac{1}{4}$ "-thick birch plywood.

5 Locate the drawer pulls on the drawer fronts and drill the holes.



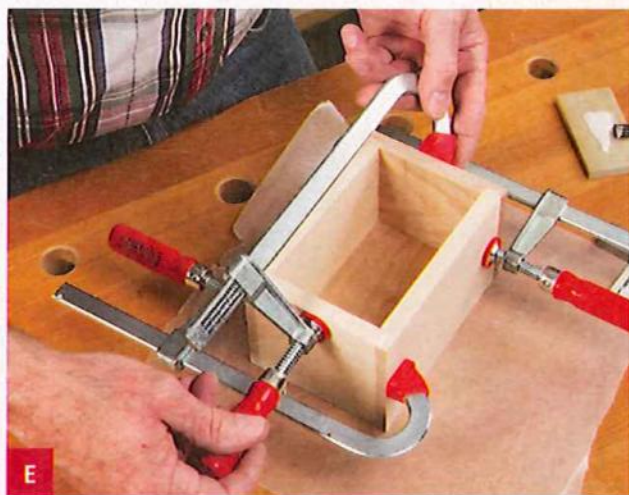
D Press the workpiece against the sacrificial fence using a pushpad, and then rabbet the drawer front and sides.

6 Assemble the drawers with glue and clamps, as shown in **Photo E**. Remember to run consecutively cut pieces side by side for the best look.

7 Unscrew the back, pull out the drawers, and sand the spice cabinet parts up through 220 grit. Now apply your choice of

finish (I added a TransTint honey amber to a General Finishes Enduro-Var satin, water-based urethane and sprayed the mix. You also could go with a

wipe-on stain of your choice and a spray-can polyurethane and achieve equally good results.) Reassemble, add the pulls, and put your cabinet on display. ■



Glue and clamp the drawer parts together, locating the clamp jaws over the joint locations at the sides, with one clamp holding in front and back.

How To Age Brass Pulls

Here's a neat trick that I used for aging overly bright brass pulls. Touch them with the flame of a blow torch for about 45 seconds. Line up the pulls side by side so you can torch them evenly for a vintage well-worn look.

Spice Cabinet Cut List

	Part	Thickness	Width	Length	Qty.	Mat'l
A	Bottom and top	1/2"	6"	11"	2	O
B	Sides	1/2"	6"	16"	2	O
C	Divider	1/2"	6"	12"	1	O
D	Large shelf	1/2"	6"	9 1/4"	1	O
E	Small shelves	1/2"	6"	4 1/2"	4	O
F*	Edge strips	1/2"	1/2"	11"	2	O
G*	Back	1/2"	11"	20 1/2"	1	O
H	Small drawer fronts	1/2"	3 1/2"	4 1/4"	6	O
I	Large drawer front	1/2"	3 1/2"	9"	1	O
J	Small drawer backs	1/2"	3 1/2"	3 3/4"	6	P
K	Large drawer back	1/2"	3 1/2"	8 1/2"	1	P
L	Drawer sides	1/2"	3 1/2"	5 3/4"	14	P
M	Small drawer bottoms	1/4"	5 1/16"	3 1/16"	6	BP
N	Large drawer bottom	1/4"	5 1/16"	8 1/16"	1	BP

* Parts are cut oversized and then trimmed to final size. See instructions.

Materials: O=Oak, P=Poplar, BP=Birch Plywood

Hardware/Supplies: (8) #6 x 1" flathead screws

Convenience-PLUS BUYING GUIDE

☐ 1.	Titebond II Extend, 16 oz.	#140442	\$8.39
☐ 2.	TransTint Dye, Honey Amber	#128481	\$19.99
☐ 3.	General Finishes Enduro-Var Water-Based Urethane, Satin, 1 pt.	#151029	\$19.99
☐ 4.	Brass Knobs, 3/4" qty. 8	#02U24	\$7.99 ea.

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



About Our Author
Scott Phillips is the co-host with his wife Suzy of *The American Woodshop*

television show, now in its 19th season on PBS. Learn more at www.wbgu.org/americanwoodshop.



Tablesaw Dovetails

Perfect fits, simply sawn

by Ken Burton

Whether deserved or not, there is a certain mystique surrounding dovetails. Between the checkerboard contrast of end grain versus side grain and the subtlety of the interlocking angled cuts, the joint practically screams “craftsmanship.”

For woodworkers, hand-sawing and chopping out a set of dovetails is almost a rite of passage. But getting to this point takes a fair amount of practice. And once you’ve mastered the technique, cutting dovetails still takes time and involves some risk. Personally, I am a little more results-oriented

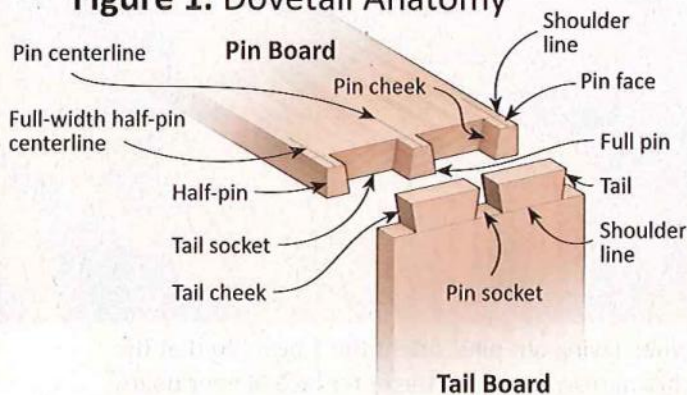
than process-oriented. After discovering how easy it is to use my tablesaw to cut clean pins and tails, my dovetail saw spends a lot more time in its till.

With a minimum of fuss—you don’t even need some special jig—you can use your tablesaw to quickly and efficiently cut through dovetails that are indistinguishable from hand-cut. The “secret” lies in setting the tablesaw to cut precise angles, and in using a set of custom spacer blocks to position your boards for each cut. Once your saw is set, you can dovetail the next identical part in a

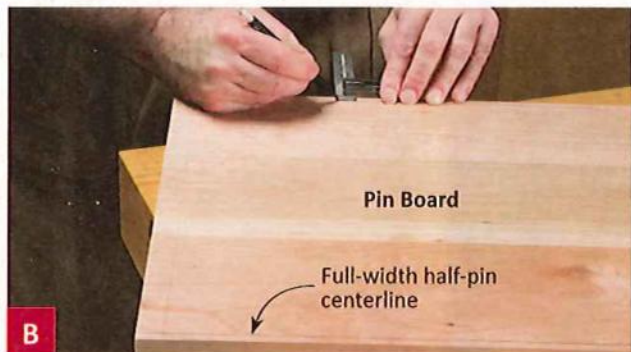
fraction of the time it took to do the first. (Note that using this spacer block technique always yields consistently-spaced dovetails. If you want variably-spaced dovetails, you’ll have to take a different approach.)

This companion article to the “Tool Chest” on page 22 shows you exactly how to lay out and cut the dovetails for the chest, while also providing the information you need to cut dovetails for any project.

Figure 1: Dovetail Anatomy



Scribing shoulders with a marking gauge helps prevent tear out and serves to register a chisel when paring.



When working with "full-width" half pins, use a pencil to lay out lines indicating their center on the pin board's show face.



Angle the rule to find an easily divisible number. Then mark and extend the center lines for the full pins.

Layout: Pins, then tails

1 Mill your stock to size. While you're at it, prepare two extra pieces of material the same thickness and width as your good stock to use for test pieces (length isn't critical).

2 Referring to **Figure 1**, above, establish shoulder lines on the ends of your pin boards, tail boards, and scrap. Before scribing my lines, I set my marking gauge to $\frac{1}{32}$ " less than the thickness of my material (**Photo A**). (Scribing a line a hair shy keeps the ends of the tails and pins from protruding past the joint and interfering with clamping blocks during assembly.)

3 Pick a dovetail angle. The angle, or slope, of a dovetail is often expressed as a ratio of rise over run—somewhere between 8:1 and 5:1. This translates to

an angle between 7° and 14° . (Here, I'm using a 10° slope.)

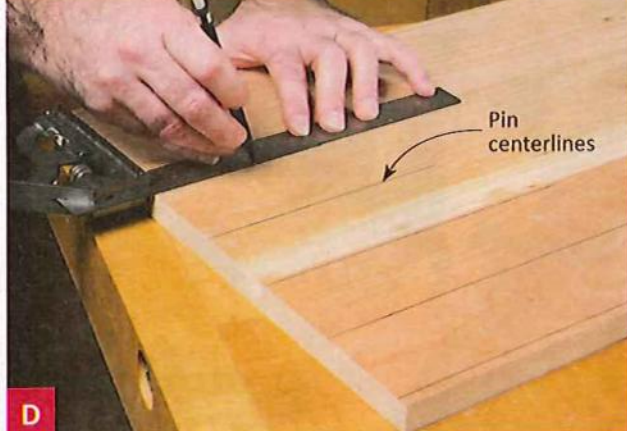
Whatever angle you choose, set your T-bevel and leave it that way for the rest of the process.

4 Now determine how many full pins you want in the joint and the width of the each pin. (This width must be the same for each full pin.) As for the half-pins, the narrow face can be either the same width as the full pins, which I'll refer to as "full-width" half pins, or half that measurement—"true" half-pins. (See "Full-Width or True?" on page 42 for a more detailed explanation.) For this $14\frac{7}{8}$ "-deep tool chest, I wanted two full-width half pins and five full pins, all $\frac{1}{2}$ "-wide on the narrow face.

5 Determine the spacing of the pins working on the outside face of a pin board. Start by measuring inward from both

edges of the pin board by a distance equal to half the width of a pin. Draw a line along each edge to indicate this measurement ($\frac{1}{4}$ " in this example), as shown in **Photo B**. (If you are using "true" half pins, don't bother with these lines. Simply reference the edges of your board.)

6 Measure the distance between your layout lines, and divide by the number of pins, plus one. That is, if you want four pins, you should divide by five. In all likelihood, the center-to-center measurement won't be an easy number to work with. In this case, hold a ruler at an angle across the face of the board, adjusting its position until you do get an easily divisible number (**Photo C**). (With "true" half-pins, reference the rule against the edges of



D Transfer the marks to the end of the board with a square.



E When laying out pins, orient the T-bevel so that the pin's narrow face is on the outer face of your board.



F Stand the pin board on the tail board, and transfer the marks indicating the pin cheeks onto the end of the tail board.



G Use the pre-set T-bevel to extend the tail lines onto both faces of your tail board.

Full-Width Or True Pins?

Traditionally, the narrow faces of half-pins are not as wide as full pins. With tablesawn dovetails, making "true" half-pins follows this tradition. Your other option here is laying out the narrow faces of the half-pins the same width as the narrow faces of the full pins, creating "full-width" half-pins.

There are times when even half a pin matters. For example, using a "full-width" half-pin for the tool chest case allows the groove for the back panel to fit within the pin, rather than grooving the adjacent tail. With the drawers, using "true" half-pins allows the bottom to run through the end of the tail board without interfering with the pins.

the board.) Mark the divisions, and then use a square to extend the lines to the end of the board, as shown in **Photo D**.

7 Lay out the pin cheeks on the face of the board, centering them on either side of the pin centerlines. Then use your pre-set T-bevel to carry the lines across the end of the pin board, as shown in **Photo E**.

8 Hold the pin board on top of the tail board in their assembled orientation, and transfer the pin cheek lines, as shown in **Photo F**. Use your T-bevel to extend the lines down to the scribe line, as shown in **Photo G**. Mark both faces of the board. (The first few times you cut dovetails this way, you may also find it helps to mark the waste areas with an "X.")

To Lay Out, Or Not To Lay Out

With hand-cut dovetails, you need accurate layout lines to ensure your joints fit well. With tablesawn dovetails, not so much. The accuracy of the joint comes from the spacers. In fact, if you look closely at the photos, you may see that some of the cuts I made are a little off from the lines. If this happens to you, don't worry about it. As long as your spacers are cut accurately, your cuts will land where they need to be.

Once you become comfortable with the technique, you may discover that you only need to lay out the center-to-center spacing of the pins and the placement of one of the half-pin sockets on the tail board. The spacers will take care of the rest.



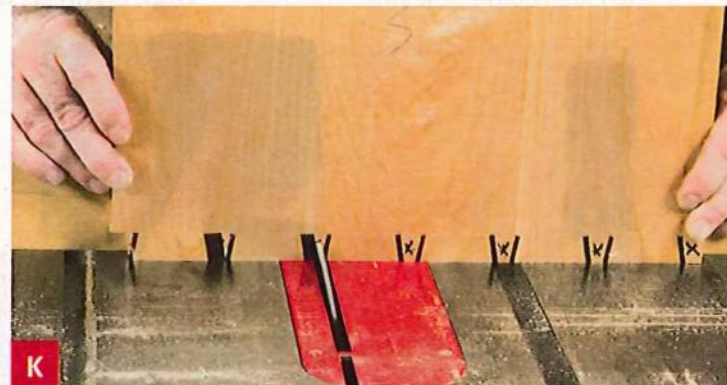
H With all the stops in place to the left of the workpiece (on a right-tilt saw), clamp a stopblock to the fence to serve as a fixed reference point.



I After making the two outside cuts with all of the spacers in place (pivoting the board in between cuts), remove one spacer and repeat, as shown here.



J Work your way across the board, making cuts and removing spacers as you go.



K Remove most of the waste by making repeated passes, positioning the cuts by eye.

Make the spacers then cut the tails

1 You'll need one spacer for each full pin in your joint. Make the spacers as wide as the center-to-center measurement of your pins and about 3" long. (An easy way to make accurate spacers is to rip a long strip of MDF to width, and then cut it into the needed number of spacers.)

2 Screw an auxiliary fence to your miter gauge. Make the fence 3" tall and about 3" longer than twice the width of your workpieces. Center the fence on the blade.

3 Using your T-square as a guide, tilt the blade to match your dovetail angle. Adjust the blade height so the top corner of the blade just barely kisses the scribe line.

4 Stand the tail board against the fence. If you have a right-tilt

saw, align the board so that the blade will cut along the left-hand side of the left-hand half pin socket. Place all of the spacers in a row against the fence and the left-hand side of the workpieces. Clamp a stopblock to the fence at the left-hand end of the row of spacers, as shown in **Photo H**. With a left-tilt saw, do just the opposite: align the blade with the right-hand side of the right-hand half pin. Put the spacers in place, and clamp the stop to the right of the workpiece.

5 Keep the spacers in place and push the board through the cut. Next, pivot the board, reposition it against the spacers, and make the second cut. Remove one of the spacers, and slide the board to the left to position it for the third (and fourth) cut, as shown in **Photo I**.

6 Remove the next spacer and make the next two cuts, and so on, as shown in **Photo J**. The last cuts will be made with the workpiece against the stop. **7** Once all the cuts are made, keep the blade tilted, and widen the cuts to remove more of the waste, positioning the workpiece by eye, as shown in **Photo K**. Cut all of the tail boards, and widen the cuts as detailed above. You'll be making any adjustments to the fit when you cut the pins.

8 If you cut dovetails with a regular saw blade, you'll need to pare the shoulders flat with a chisel, as shown in **Photo L**. Clean up the corners of the sockets with a knife, as shown in **Photo M**. (This is where having a special "dovetail" blade comes in handy. See, "Dovetail Blades" on page 44.)



L Pare or chop to the scribe line to clean up the saw cuts.



M Once you have trimmed the shoulders, clean out the corners with a knife.



N Use your pre-set T-bevel to adjust your miter gauge before cutting the pin board.



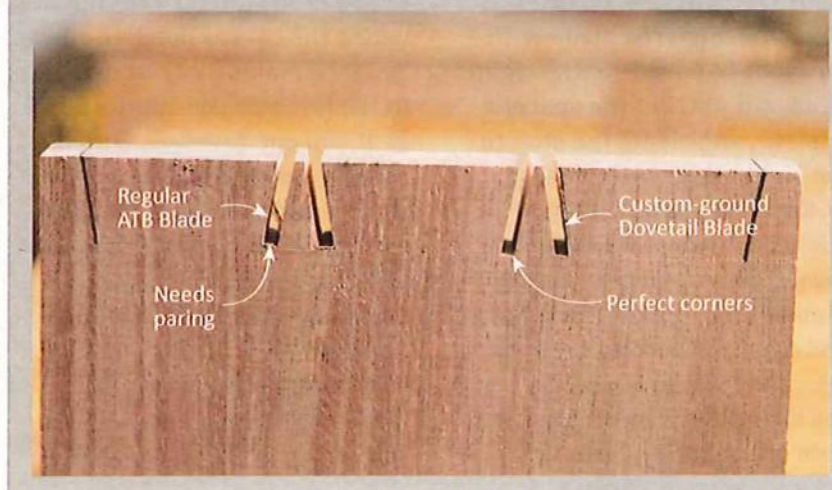
O Set up the first pin cuts by aligning the left-hand half-pin with the left side of the blade. Then locate the spacers and stopblock to the left.



P Cut the left-hand half pin with all the spacers in place against the stopblock.

Dovetail Blades

If you do much dovetailing on the tablesaw, having a designated dovetail blade can save time spent paring tails. Some blade companies, such as Forrest Manufacturing, will custom grind a blade with all the teeth beveled in the same direction. The kerf these blades make then aligns perfectly with your scribe line. Forrest dovetail blades cost \$144. When ordering one, specify which way your saw tilts and your desired tooth angle.

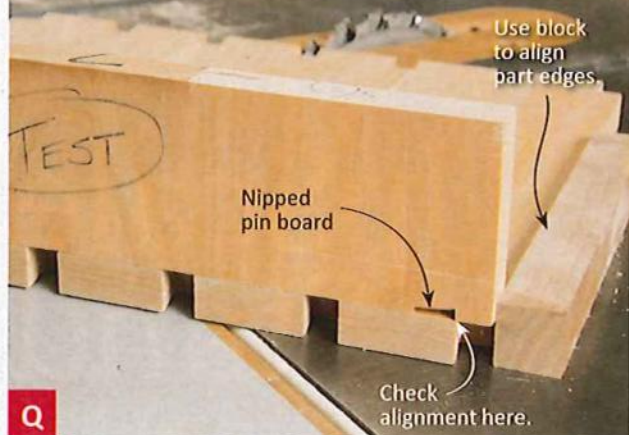


Dado out the pins

1 Set up a dado blade on your saw. The exact width isn't critical; I find $\frac{1}{2}$ " to $\frac{5}{8}$ " is generally about right. Set the blade perpendicular to the table, and adjust the height so the cut just kisses the scribe line.

2 Adjust the miter gauge (along with the auxiliary fence) to match the dovetail angle when measured to the left of the blade, as shown in **Photo N**.

3 Stand the laid out pin board on end against the fence so that the lines are facing out. Slide the board along the fence until the line for the left-hand half pin is aligned with the left-hand side of the dado blade. Place all of the spacers in a row to the left of the workpiece, and clamp a stopblock to the auxiliary fence, as shown in **Photo O**.



Q Check the cut's placement by aligning the edge of the test pin board with the edge of the tail board and scrutinizing the alignment of the two cheeks.



R Remove the spacers after each pass until the pin board rests against the stop.



S Set up for the second round of pin cuts by aligning the cutline with the blade and then locating the spacers and stop block to the right of the blade.



T Insert paper shims between the stopblock and the spacers to make the pins thinner.

4 Make the first cut in your test piece with all the spacers in place, as shown in **Photo P**. (Just nip the edge of the board at first and check the alignment of the cut against the tail board, as shown in **Photo Q**.)

5 Once you are happy with the stopblock's position, complete the first cut. Then remove a spacer and make the second cut. Proceed completely across the test piece, removing a spacer prior to each cut. Then make this first series of cuts on each pin board, as shown in **Photo R**.

6 To set up for the second round of pin cuts, reset the miter gauge so it matches the dovetail angle when measured to the right of the blade.

7 Hold the pin board in place against the fence, and align the right-hand half pin with the

right-hand side of the dado blade. Locate the spacers and stopblock to the right of the workpiece, as shown in **Photo S**. (This series of cuts will determine how well the joint fits together. If anything, err to the side of making the pin too fat, that is, position it slightly too far to the right.)

8 Finish cutting the pins on the test piece, again removing a spacer after each cut. If necessary, trim away any excess waste by repositioning the pin board by eye. Test the fit in the tail board. If the joint is too tight, add a shim or two between the stopblock and

the spacers, as shown in **Photo T**, and recut. Go easy adding shims, as you don't want to create a joint that's too loose. Once you are happy with the fit of the test joint, make the remaining cuts on the rest of the pin boards.

9 At this point, your pin boards and tail boards should fit hand-in-glove. Glue and clamp the sides together, and then plane the parts to flush up the ends of the pins and tails. ■

Tip Alert

Playing cards make excellent shims. For even finer adjustment, use Post-it notes.

About Our Designer/Builder

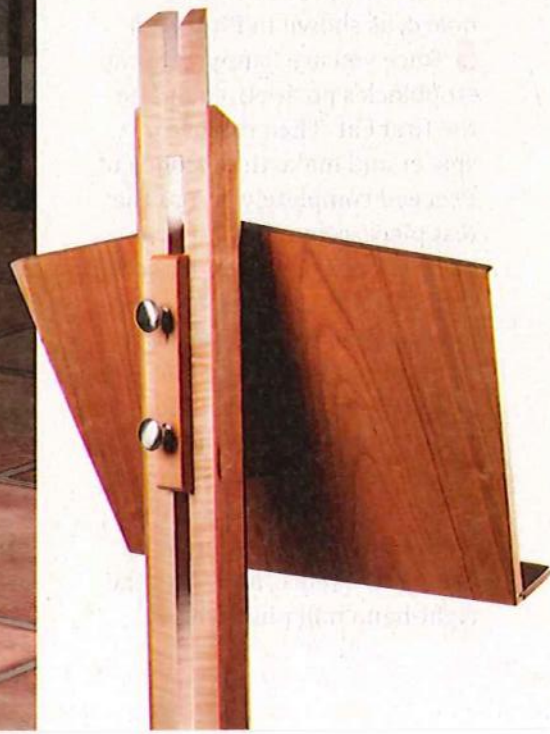
Ken Burton has been working with wood for more than 30 years and writing about it nearly as long. His latest book, *Crafting Wooden Lamps*, is now available from F&W Media. Check out his website at www.woodworks.com.

UpScale Music Stand

Take a lesson in bending wood.

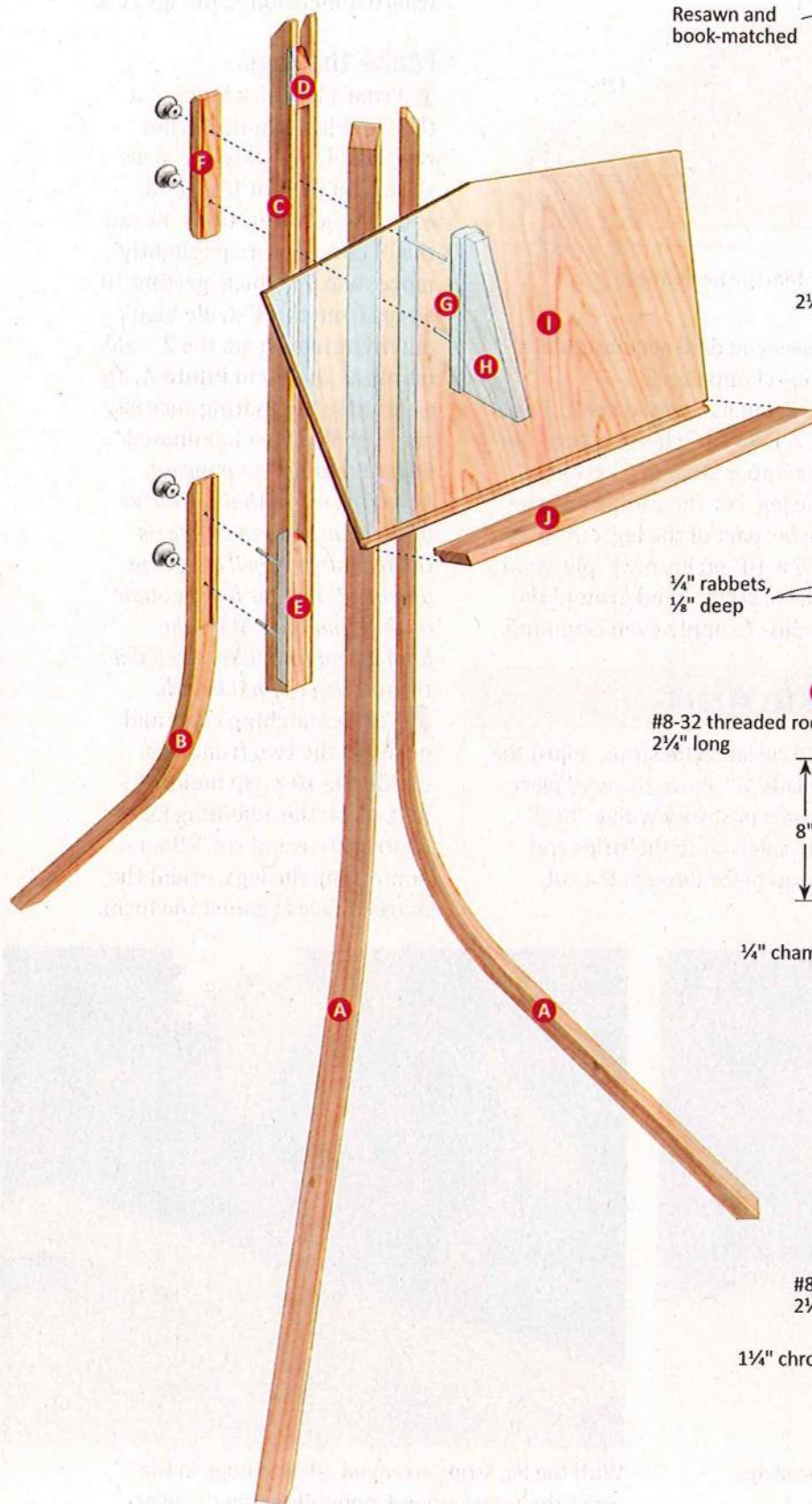
By Tom Svec

While you can't make music in a shop full of loud tools, you can make items for those who play. This graceful cherry and maple stand allows musicians to adjust the music rest up or down for standing or sitting. And when not in use, it serves as a handsome home accent for displaying art books or drawings. For easy transport, both the music rest and rear leg detach. (See **Figure 1**.) Building techniques include a lesson in cold lamination for bending the leg parts and creating a simple book-matched music rest.

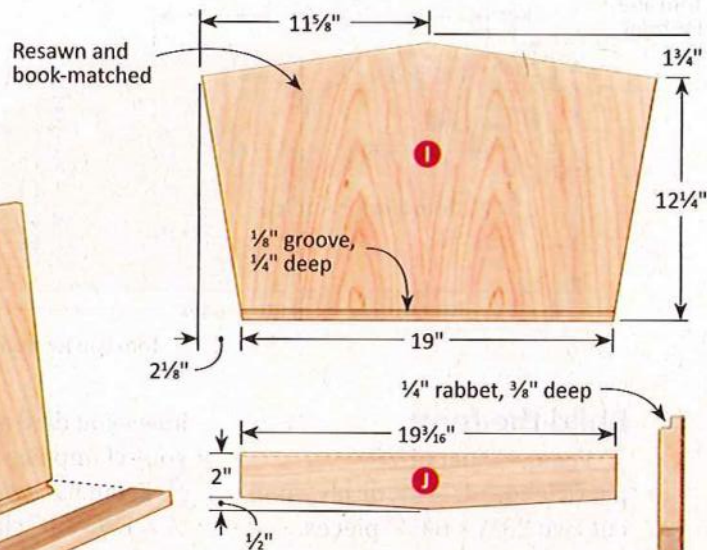


Overall dimensions: 29"w x 28½"d x 62"h

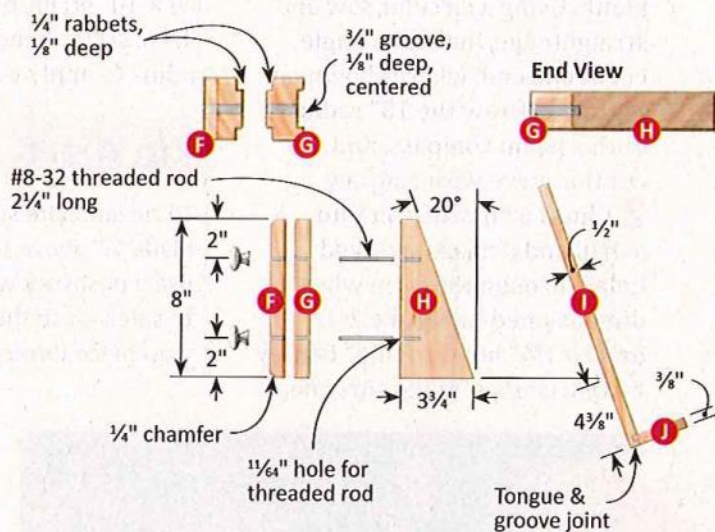
Figure 1: Music Stand Exploded View



Music Rest Detail



Music Rest Clamp Detail



Leg Clamp Detail

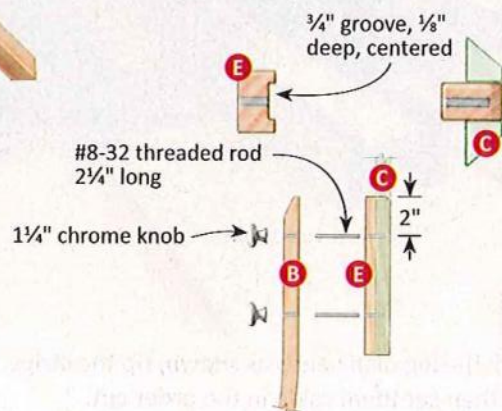
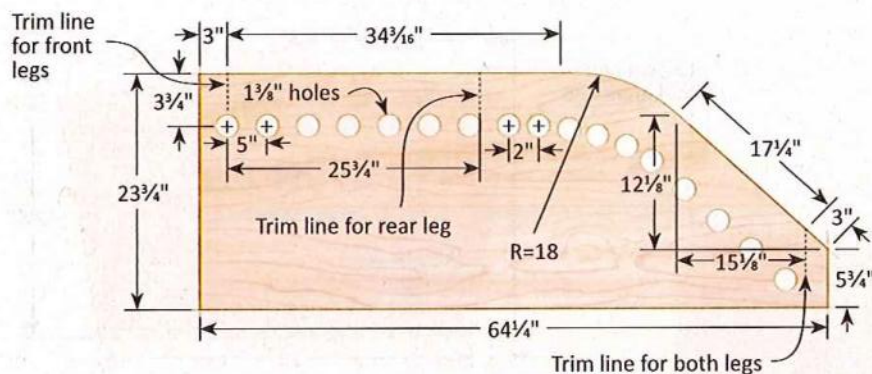


Figure 2: Bending Form



Build the form

1 From a sheet of $\frac{3}{4}$ " particleboard, MDF, or plywood, cut two $23\frac{3}{4} \times 64\frac{1}{4}$ " pieces. Laminate them face to face with the ends and edges flush to form a $1\frac{1}{2}$ "-thick form blank. Using a circular saw and straightedge, make the angle cut at one end, where shown on **Figure 2**. Draw the 18" radius with a beam compass, and cut the curve with a jigsaw.

2 Chuck a Forstner bit into a drill and drill clamp-head holes through the form where dimensioned in **Figure 2**. I drilled $1\frac{3}{8}$ " holes to fit 6" Bessey F-style clamps. Make sure the

holes you drill accommodate your clamp heads.

3 From hardwood scrap, cut a $\frac{3}{4} \times 1\frac{1}{2} \times 30$ " clamping caul for the upper straight section of the leg. For the radius and the lower part of the leg, cut three $1\frac{1}{2} \times 40$ " strips of $\frac{1}{4}$ " plywood. These strips bend around the radius to apply even clamping.

Tip Alert

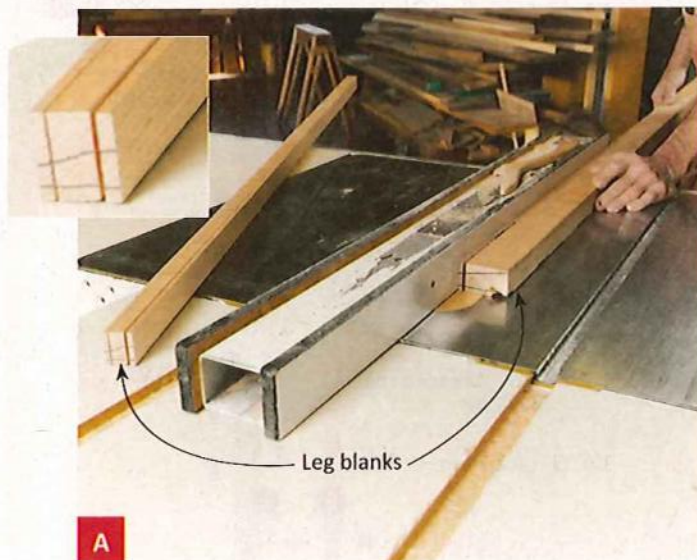
To rip laminate strips, adjust the blade $\frac{1}{4}$ " above the workpiece; use a pushstick with a "heel" to safely push the strips and workpiece through the cut.

4 Sand the "working" edges of the form smooth. Mark the leg-trim lines on the bending form, where dimensioned in **Figure 2**.

Make the legs

1 From $1\frac{3}{4}$ "-thick stock, cut the front legs blank (A) and rear leg blank (B) to the sizes shown on the **Cut List**. Mill each blank to $1\frac{1}{2}$ " thick. Resaw the blanks into strips slightly more than $\frac{3}{16}$ " thick, getting 10 strips from the 4"-wide blank and five strips from the 2"-wide blank, as shown in **Photo A**. To guarantee laminating success, see "Get The Best Laminated Parts Possible" on page 49. *Note: To ensure that the curve of the rear leg is the same as the front legs, you'll cut strips and bend the rear leg the same as the front ones. With the laminating complete, you'll trim the rear leg to final length.*

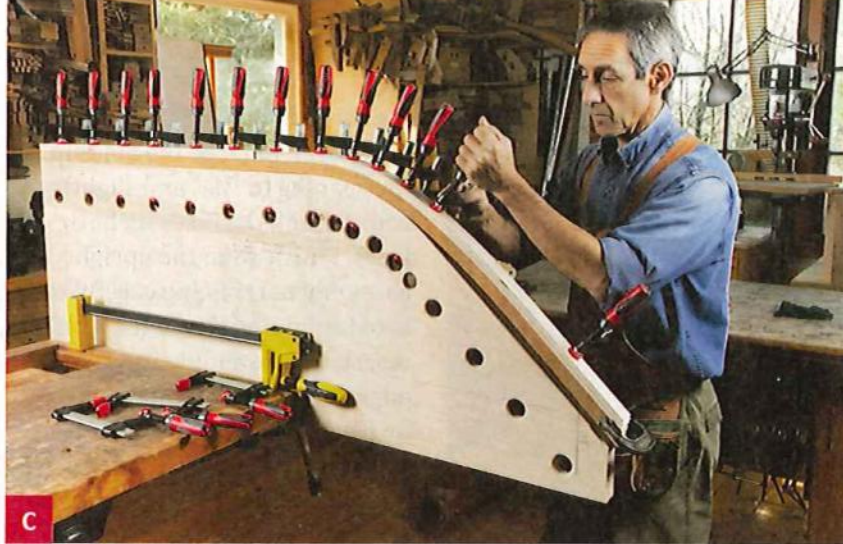
2 To get matching color and grain on the two front legs, divide the 10-strip bundle in half. Mark the adjoining faces of strips five and six. When laminating the legs, orient the marked faces against the form.



Mark the leg blank ends as shown, rip the strips, and then set them aside in the order cut.



With the leg strips arranged edge to edge in the order they were ripped, apply glue using a roller.



C With the plywood-strip caul clamped at the top, loosely clamp the bottom end of the lamination to keep the glued surfaces together. Add more clamps.



D To joint the legs, move the fence back for full support when feeding the bend over the cutterhead.

Tip Alert

When clamping the laminations, only snug the clamps until all are in place. Straighten the stack of strips side to side with C-clamps. Then tighten the clamps.

3 Lay out the strips for one leg on your workbench, separating from the others the strip farthest from you as a reminder not to apply glue to this strip. Apply glue to the other strips, as shown in **Photo B**. Restack the strips in order and position the bundle on the form.

4 Starting with all the strips in the bundle flush with the top end of the form, position the solid caul and start applying clamps. Position the ends of the three 1/4" plywood strips against the end of the solid caul and apply two clamps. Continue clamping the lamination, as shown in **Photo C**. Let the glue dry for 24 hours. Repeat **Steps 3** and **4** with the remaining strip bundles.

5 Scrape excess glue from the edges of the legs. Joint one edge of each leg as shown in **Photo D**. Then plane the legs to finished width at the thickness planer.

Get The Best Laminated Parts Possible

Successful bent lamination occurs when the part's resulting glue lines between individual strips are almost invisible. The part will appear to be made from solid stock. Sawing high-quality strips is key. Here's how to guarantee the best results:

- Select a wood species with coarse-to-moderate grain, such as ash, oak (white or red), walnut, and cherry. Glue lines don't "hide" as well in fine-grained species such as maple.
- Use straight-grained stock without knots or other blemishes.
- Make a "V" mark across one end of the blank so you can reassemble the strips in the same order they were sawn. (See **Photo A**.)
- Use a sharp, high-quality saw blade. (For cuts clean enough for gluing, we used a 3/2"-kerf 40-tooth Forrest Woodworker II blade.)
- All laminated parts will "spring back" slightly when removed from the form. Here, for uniform spring back, make sure all three legs dry on the form for the same amount of time.

6 Mark cutlines on each leg, as shown in **Photo E**, and trim them to length, making a straight cut at the top and an angled cut at the bottom. Cut bevels at the top of each leg, where shown on **Figure 1**.

7 Chuck a 3/4" straight bit into your table-mounted router and position the fence to center the width of the rear leg on the bit. Clamp a stopblock to the fence so the distance from the block to the far edge of the bit is 8". Rout the stopped groove in the leg, as shown in **Photo F**. Square the end of the groove with a chisel.



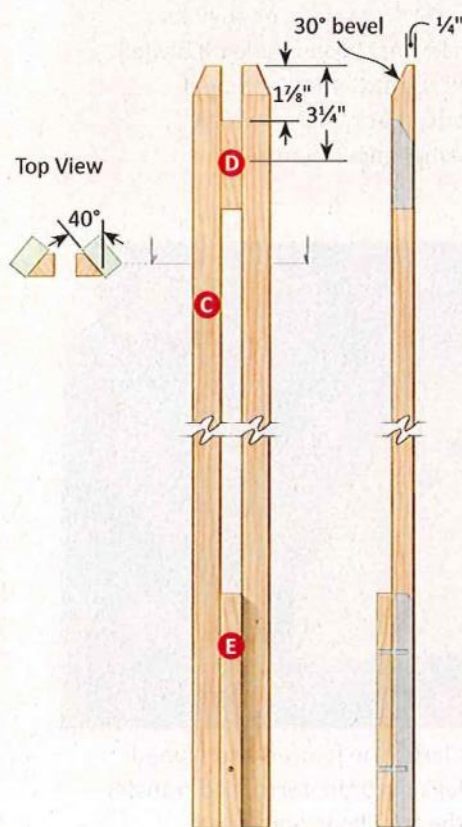
E Clamp the jointed and planed legs onto the form, and transfer the trim lines onto them.



With the top of the rear leg against the stopblock, lower the leg onto the running bit. Use a good pushstick (see page 18) to feed the leg over the bit.

8 Carefully mark the locations of the holes for the threaded rods in the rear leg. Drill $\frac{1}{4}$ " holes on the drill press, making sure they are centered in the leg width. Finish-sand all the legs.

Figure 3: Upright Detail



Build the upright assembly

1 Cut the rails (C), upper spacer (D), and lower spacer (E) to size. Cut a bevel at the top of the upper spacer, where shown on **Figure 3**. Clamp the lower spacer into the stopped groove in the rear leg with the top ends flush. Using the holes in the leg as guides, mark the hole locations on the spacer with an $\frac{1}{16}$ " drill bit. Separate the parts and use the drill press to drill $\frac{1}{4}$ " holes for

the threaded rods 1"-deep into the spacer. Enlarge the holes in the rear leg to $\frac{13}{64}$ " and slightly countersink the holes on both faces. Finish-sand the upright assembly parts being careful to avoid rounding the edges. Don't worry about sanding the outside edges of the rails as these will be beveled after assembly.

2 Glue and clamp the spacers (D, E) between the rails (C) with the bottom ends and front faces of the rails and lower spacer flush and the upper spacer positioned where dimensioned on **Figure 3**. Note that the upper spacer bevel faces the front and the lower spacer protrudes at the rear. The rear edge of the lower spacer has the holes for the threaded rods.

3 Cut 30° bevels across the tops of both rails (C) at the miter saw. (The rails are beveled opposite the direction of the upper spacer bevel.) Then on the tablesaw bevel-rip the edges of the rails 40°, as shown in **Photo G**.

4 Apply a thin bead of glue to the middle of one leg and clamp it, centered, to the beveled edge of one rail (C), as shown in



Align the saw blade with the up-facing corner of the rail (C) and rip a 40°-bevel along the edge.

Tip Alert

Place cardboard pads along the clamped corners of the rails to prevent the jaw pressure from crushing the wood.

Photos H. Use a micro-pinner to fix the position of the leg on the rail. Repeat to attach the second leg. Carefully remove excess glue with a moistened rag.

Construct the music rest clamp

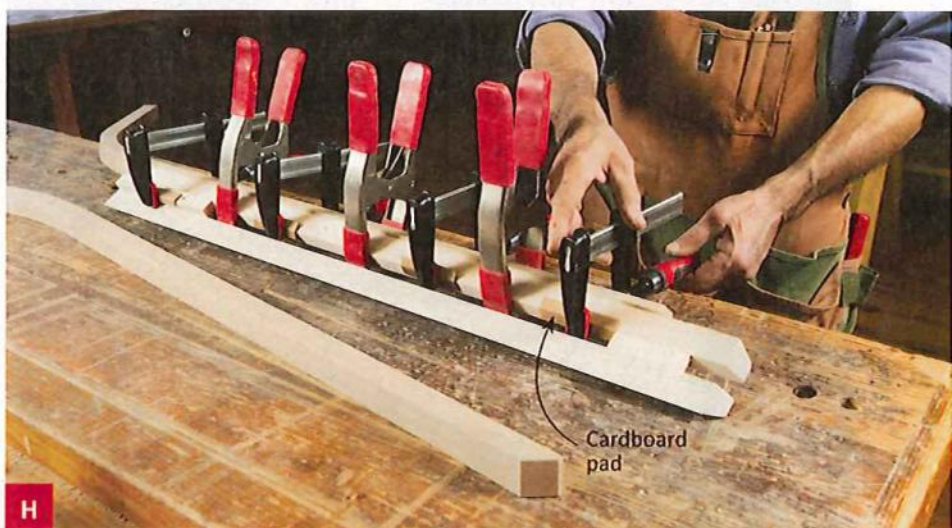
1 Cut the clamp block (F) and cleat (G) to size. Tape the parts together with masking tape with the ends and edges flush. Mark hole centers for the threaded rods, where shown on **Figure 1** and drill $1\frac{1}{4}$ " holes through both parts. Separate the parts and cut rabbets, where shown. Test the fit of the parts between the rails of the upright assembly, and then increase the size of the rabbets as necessary. The parts should easily slide along the rails. Chamfer the ends of the clamp block and cut the groove in the cleat. Enlarge

the holes in the clamp block to $1\frac{3}{4}$ ", and slightly countersink the holes on both faces.

2 Cut the standoff (H) to size. Adhere the cleat (G) to the standoff with double-faced tape. Employing the holes in the cleat as guides, use the drill press to extend the $1\frac{1}{4}$ " holes into the standoff so the combined depth of the holes in both cleat and standoff is 1". Separate the parts. Using a miter gauge equipped with an extension fence and stop, cut the taper on the standoff. Finish-sand

the parts and glue and clamp the cleat to the standoff.

3 From $\frac{1}{2}$ " stock, edge-glue an oversized blank for the back (I), as shown in **Photo I.** (To learn how book-matching can turn ordinary wood into an extraordinary project part, see sidebar, below.) With the glue dry, sand both faces smooth. Trim the bottom edge straight, and lay out the side and top tapers, where dimensioned on **Figure 3.** Cut the back to shape.

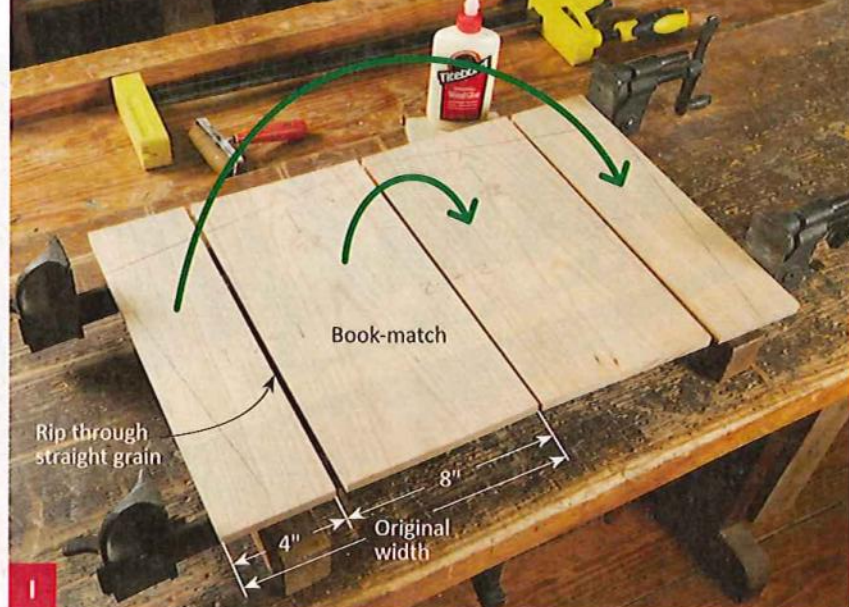


Apply glue and then center and clamp the rail to the leg. Consider using a micro-pinner to lock in its position.

Book-Matching Turns Scrap Into Treasure

The back of the music rest features a grain pattern that may look exotic, but actually is made from a quite ordinary piece of wood. The back started as a cutoff from the end of a roughsawn 5/4 board 12" wide and 15' long. The cutoff displayed a broad cathedral grain pattern, a feature difficult to use in most furniture projects. Although the rough-sawn stock was thick enough to resaw and plane into two $\frac{1}{2}$ "-thick boards, it was too wide for the capacity of the bandsaw. To reduce the width, I ripped the board through the straight grain adjacent to the cathedral pattern. (Mating straight grain to straight grain makes the glue joint almost disappear when reassembling the panel.) The resulting 8"- and 4"-wide pieces were resawn on the tablesaw, using a thin-kerf blade and cutting from both edges. We finished resawing the 8"-wide piece with a handsaw. The individual boards were planed to thickness and edge-glued to form the back blank.





To keep the part flat, apply even clamp pressure to both sides of the panel.

On the tablesaw, cut a $\frac{1}{8}$ " groove, $\frac{1}{4}$ " deep across the front face with the top edge of the groove $\frac{3}{16}$ " from the bottom edge of the back. Finish-sand the back.

4 To keep the cleat/standoff assembly (G/H) in position on the back (I) while gluing, clamp an end-stop block to the back with an edge $4\frac{3}{8}$ " from the bottom edge of the back, and a side-stopblock $\frac{3}{8}$ " from the back centerline. Apply glue to the standoff, position it against the end and side stops, and clamp it in place. When the glue has firmly grabbed, but before it is completely dry, remove the stopblocks and any excess glue.

5 Cut the base (J) $\frac{1}{2}$ " longer than listed. Then bevel-cut the ends to length, matching the taper of the back (I) sides. Cut the front-edge tapers, where dimensioned on **Figure 1**. Form a tongue to fit into the groove in the face of the back (I) by cutting a $\frac{1}{4}$ "-deep rabbet along the bottom back edge. Initially make a slightly too-tight fit, and then form a snug fit by finish-sanding the part. Apply glue to the center 4" of the back groove and clamp the base in place.

Fit the hardware and apply the finish

1 Cut two pieces of steel #8-32 threaded rod $2\frac{1}{4}$ " long for the lower spacer (E) and two $2\frac{5}{8}$ " long for the cleat/standoff assembly (G/H). File slight bevels on both ends of each rod. Test-fit the lower spacer rods to ensure they protrude $\frac{3}{8}$ " from the

rear leg and the cleat/standoff assembly rods to ensure they protrude $\frac{3}{8}$ " from the clamp block (F). To protect the wood around the holes, apply masking tape. Then insert slow-set epoxy into the holes and insert the rods, turning the rods and pumping them in and out to work the epoxy into the threads.

2 Examine all parts and assemblies and finish-sand where necessary. Apply a clear finish.

3 Assemble the music stand by slipping the rear leg onto the threaded rods protruding from the lower spacer (E) and threading on two $1\frac{1}{4}$ " cabinet knobs. Then position the rabbeted portion of the cleat (G) between the rails (C). Slip the clamp block (F) onto the threaded rods, rabbeted face first, and secure the music rest with two more knobs. Now go make music. ■

Music Stand Cut List

	Part	Thickness	Width	Length	Qty.	Mat'l
A*	Front legs blank	$1\frac{3}{4}$ "	4"	70"	1	C
B*	Rear leg blank	$1\frac{3}{4}$ "	2"	70"	1	C
C	Rails	$\frac{3}{4}$ "	1"	37"	2	M
D	Upper spacer	$\frac{3}{4}$ "	$\frac{3}{4}$ "	3"	1	M
E	Lower spacer	$\frac{3}{4}$ "	$1\frac{1}{4}$ "	8"	1	M
F	Clamp block	$\frac{3}{4}$ "	$1\frac{1}{4}$ "	8"	1	C
G	Cleat	$\frac{3}{4}$ "	$1\frac{1}{4}$ "	8"	1	C
H	Standoff	$\frac{3}{4}$ "	$3\frac{3}{4}$ "	8"	1	C
I*	Back	$\frac{1}{2}$ "	$23\frac{3}{4}$ "	14"	1	BC
J*	Base	$\frac{3}{8}$ "	$2\frac{1}{2}$ "	$19\frac{1}{16}$ "	1	C

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

Materials: C = Cherry, BC = Book-matched Cherry, M = Maple

Hardware/Supplies: #8-32 $\times$ 12" threaded steel rod; slow-set epoxy.

Convenience-PLUS BUYING GUIDE

☐ 1.	Laurey Celebration Knob, $1\frac{1}{4}$ " dia., Satin Chrome, qty. 4	#836193	\$2.75 ea.
☐ 2.	General Finishes Arm-R-Seal Semi-Gloss Oil/Urethane Top Coat, 1 qt.	#85F07	\$15.99

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Flattening Boards by Hand

Hand tools lend a hand when machines fall short.

By Craig Bentzley

I remember the day my seventh grade shop class teacher handed me a plane and rough-sawn plank and tried to teach me how to flatten a board. Needless to say, my efforts fell short of his expectations. For a long time, I assumed the man was clinically obsessed with flat, straight, and square, or else dreamed of becoming a drill sergeant. Many years later, the lesson finally sank in. Flattening stock may not be elementary, but it is an

essential woodworking skill.

Most woodworking starts with a flat reference face. A shop full of heavy machinery can help, but there are instances when you must rely on muscle power. For example, should you ever score a clear 24"-wide plank for a tabletop, it would be crazy to rip it into smaller boards to fit your jointer and then glue them back together. On a similar (and more practical) note, when a board's only a few

inches wider than your jointer, you may not want to rip it to fit.

As much as I love using hand planes, my mama raised no fool. Like electricity, I always take the path of least resistance. My favorite approach to flattening wide boards involves a combination of hand and power tools. By practicing my technique, you'll be able to tackle boards that are too wide for your jointer as well as flatten wide boards and tabletops with ease.



A Using a pair of metal or wooden winding sticks, sight across the top of the sticks to reveal any twist.



B Mark the high spots with chalk. Insert wedges to keep the board from rocking or deflecting when planing.

Getting started

Of course, you'll need a few hand planes. The sizes of the planes you use partially depend upon the size of your stock, but I find I can get by with a jack (#5) and jointer (#6 or #7). For final smoothing, I like using my #4½ (see "Smoothing Savvy," page 56).

To check for cup and bow, and to assess your progress while planing, you'll need a couple of straightedges. For long boards, I use a straight ¼ × 1½ × 60" piece of cold-rolled steel. For shorter boards, I use a 24" straightedge. To check for twist, you'll need a pair of winding sticks. They can be made from straight-grained wood or plywood, but an aluminum angle from the

hardware store works just as well. (The ⅛"-thick stock is straighter than the thinner stuff.)

Last but not least, you'll need a flat and stable work surface equipped with a vise and stops to secure your boards, and a variety of wedges and shims to keep the board from shifting or rocking during the flattening process. (If your bench is a featherweight, use cast-iron weights or sandbags to keep it from sliding around your shop.)

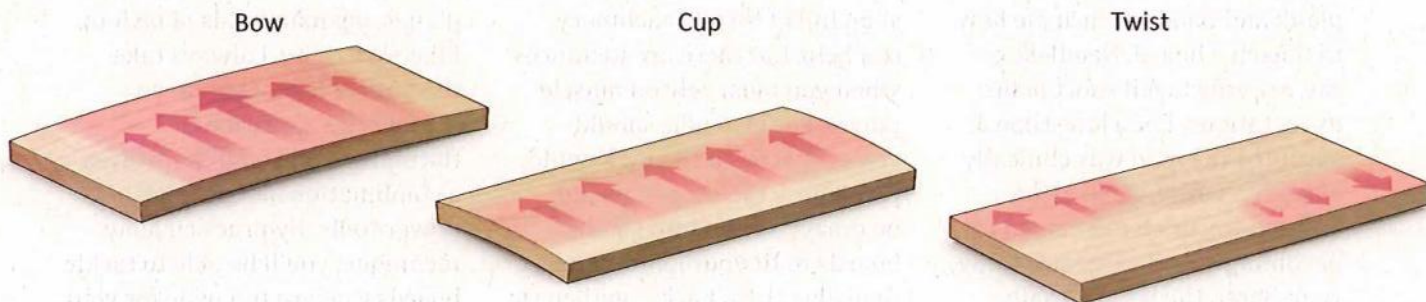
Assess the material

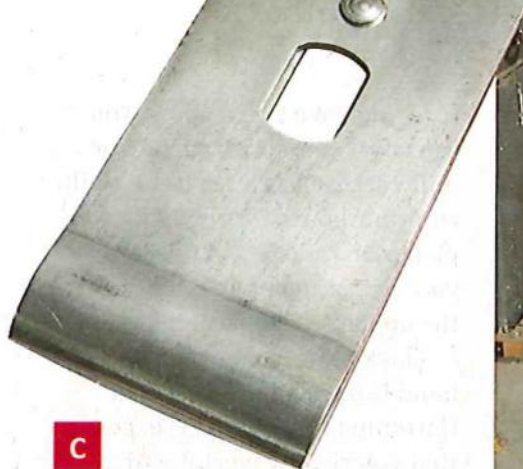
After cutting boards to rough size, the next step is to evaluate your material. Tackle the biggest defects first. I try to start on the board's "show side."

Cupped and bowed boards are the easiest to identify. Simply lay a straightedge along the length and width of the board in a few spots, and look for light underneath. Mark the high spots with chalk.

Twisted boards are a little trickier. An easy way of identifying twist—assuming that your bench top is flat—is by pushing down on opposing corners and seeing if the board rocks. If it does, I use a pair of winding sticks to tell exactly how much twist I'm dealing with. I center a stick on each end of the board, crouch a few feet away from my bench, and sight across the tops of the sticks (Photo A). Once you get the hang of it, you'll be amazed at how

Figure 1: Flattening Strategies





C Grind a slight crown, set the chip breaker $\frac{1}{16}$ " back from the edge, and your jack plane is ready for scrub work.

accurate this method is. Mark the high corners with chalk or a pencil, as shown in **Photo B**.

Flatten the face

Before you begin flattening, it's important to secure the board to your bench. When using a tail vise and bench dogs to secure your work, apply just enough pressure to keep the board from moving. If you crank down too hard, you risk bowing the board and you'll never get it flat.

To level the high spots, some woodworkers use a scrub plane, a narrow-bodied plane with a heavily cambered blade designed to remove large scallops of wood. I find a scrub plane to be a bit too aggressive



D Plane across the board to quickly level high spots. Use shims and wedges to steady the stock when doing the heavy work.

for most purposes. Instead, I usually use a #5 jack plane outfitted with a cambered, or crowned blade (see **Photo C**). The crowned blade allows fast stock removal without leaving hard-edged tracks which require you to remove even more stock to make the face smooth. Plane perpendicularly or diagonally across the high spots using overlapping strokes, as shown in **Photo D**. This step requires some muscle, but it usually goes surprisingly fast. Check your progress frequently with both a straightedge and winding sticks. Depending on the defects you're addressing, you may not need to plane the whole surface of the board. (See **Figure 1**).

When the winding sticks indicate that twist has been removed and the straightedge makes contact with the tops of most of the scallops, you can move on to the next step.

Here, I'll use a #6 or #7 jointer plane (depending on the size of the board) outfitted with a lightly cambered blade—about .008". Adjust the blade for light full-width shavings, and plane along the length of the board, as shown in **Photo E**. This work will go a bit more slowly because the shavings should be much thinner. When scallops are leveled off and you get full width shavings, check the board with winding sticks (**Photo A**) and a straightedge (**Photo F**).



E Run a jointer plane along the board's face to skim off any remaining high spots. Skewing the plane can help reduce tear-out.



F Periodically check your progress by laying a straightedge along the board and looking for light underneath.



Set the marking gauge to the desired thickness, and then scribe a line across all four edges. Reference the head against the flattened face.

If there are any remaining high spots or twist, these areas can be quickly addressed by a few additional diagonal strokes of the jointer plane. At this point, your board should be reasonably flat.

Power up or keep planing

If your thickness planer can handle your board, you're set. Simply flatten the opposite

face with the planer, and then continue to flip the board over after each pass until you reach the desired thickness. (Removing material from each side helps maintain moisture equilibrium. This minimizes future cupping, bowing, or twisting.)

If your planer is not large enough to handle the opposite

face, you have two choices. You can check with local cabinet or millwork shops to see if they will run your board through their planer or wide belt sander. Or you can flatten and thickness the opposite face by hand.

Thicknessing a board by hand is basically the same as flattening the first face, except that you're now working to a specific thickness. To do this, set a marking gauge to the desired finished thickness of the board and scribe a line all the way around the board, as shown in **Photo G**.

Starting with your #5, scrub the face just shy of your marking gauge lines. Next, switch to your jointer plane to remove the scallops. When you approach the desired thickness, the marking gauge lines will produce a small flap of wood. A few more passes will remove the flap. ■

Smoothing Savvy

Even when I've used my planer, I prefer to do a final smoothing with my #4½ plane. Hand-planing not only leaves a polished surface, it erases planer marks faster than a sander. Like my jointer planes, I grind a very slight camber on the blade (about .002). I set the blade tight to the mouth and adjust the depth to take gossamer-thin shavings.

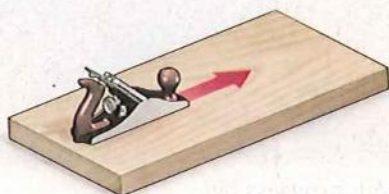
When planing by hand or

machine, it's important to pay attention to the grain. (See **Figure 2**). If your board exhibits any tear-out, try planing from the opposite direction. If all else fails, switch to a card scraper or cabinet scraper. Just be sure not to dwell in any area too long or you may create a hollow. Gradually work your way out of the trouble spot, feathering the depression out as far as you can.

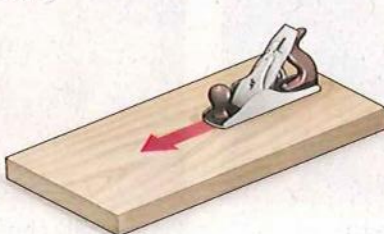


Set the blade to make whisper-thin shavings, and skew the plane to limit tear-out. Change planing direction as needed to go with the grain.

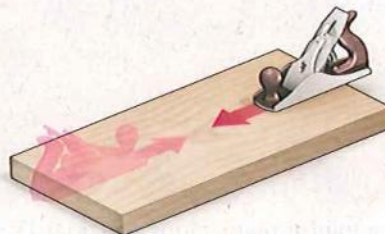
Figure 2: Going With The Grain



On the pith side, plane in the direction of the peaks.



On the bark side, plane against the peaks.



When grain changes direction, take shorter strokes from both directions.



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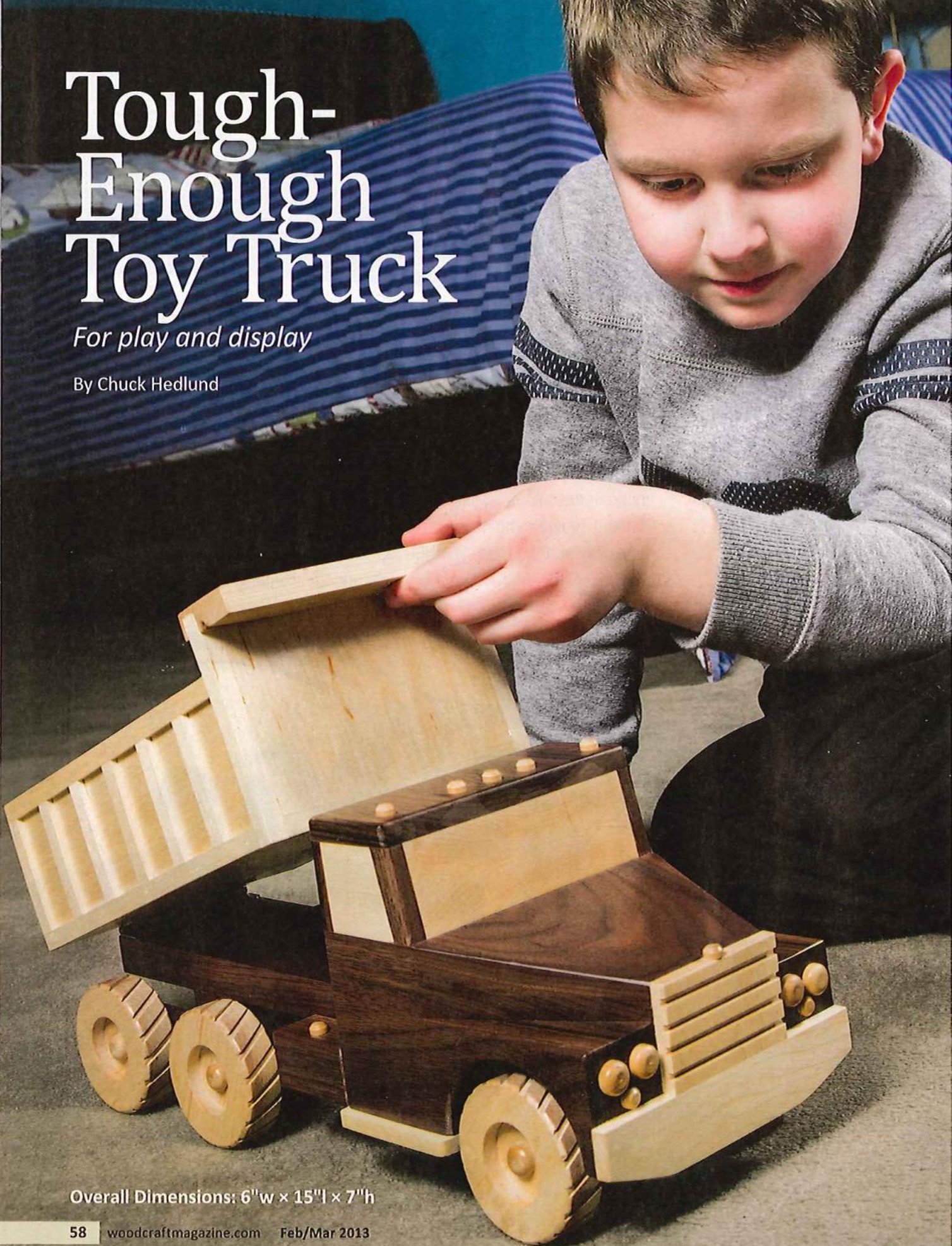
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13WD03P3

Tough-Enough Toy Truck

For play and display

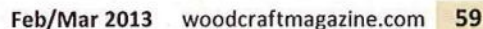
By Chuck Hedlund



Overall Dimensions: 6" w x 15" l x 7" h

Walnut and maple serve as the primary woods, while

Figure 1: Truck Exploded View





Use a handscrew clamp to safely bevel-cut the cab motor hood blank at the bandsaw.



Clamp on a spacer block to the front of the lower cab assembly to locate the front axle support.



Bore into both ends of the front axle support to complete the through axle hole.

First, make the lower cab assembly

Note: Two designated parts in the lower cab assembly consist of glue-ups of more than one piece of wood. See Figure 2.

1 Mill one 4'-long piece of 1×6 walnut to $\frac{3}{4}$ " thick and a 2'-long piece of 1×6 to $\frac{3}{8}$ " thick.

2 Cut one piece of $\frac{3}{4}$ " walnut and one piece of $\frac{3}{8}$ " walnut to $5\frac{5}{8}$ " wide by 6" long. Glue the pieces face to face, and then trim the lamination to the size in the **Cut List** for the cab motor hood (A).

3 Strike a line across the top face of the cab motor hood (A) blank $2\frac{1}{4}$ " from one end and another line along the front end, where shown in **Figure 2**. Connect the lines on both edges to establish the tapered hood. Using a $\frac{3}{4}$ " blade with at least 3 TPI at the bandsaw, bevel-cut the blank (**Photo A**).

4 Use a random-orbit sander and 80- to 120-grit sandpaper to sand to the cutlines and remove saw marks.

5 Mark the angled cuts on the cab motor hood blank for part (A), where shown in **Figure 2**.

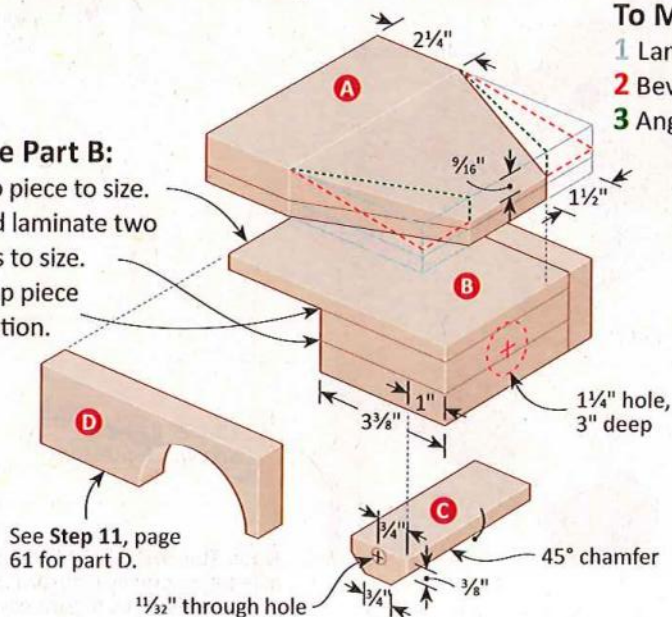
Bandsaw off the waste, cutting just outside the line. Now, sand to the line at the disc sander.

6 To form the cab bottom (B), cut two pieces of $\frac{3}{4}$ " walnut stock to $4 \times 3\frac{3}{8}$ ". Laminate them together, flushing the edges and ends. Now, from $\frac{3}{8}$ " stock, cut a $4 \times 5\frac{5}{8}$ " piece, and glue it to the top of the laminated walnut block, flushing the edges and one end, as shown in **Figure 2**.

Figure 2: Lower Cab Exploded View

To Make Part B:

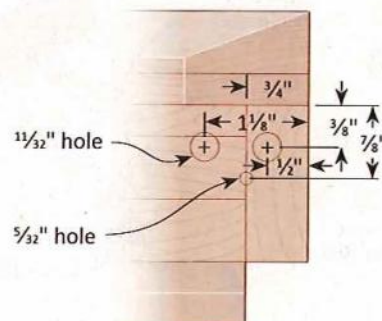
- 1** Cut top piece to size.
- 2** Cut and laminate two $\frac{3}{4}$ " pieces to size.
- 3** Glue top piece to lamination.



To Make Part A:

- 1** Laminate hood blank
- 2** Bevel-cut hood blank
- 3** Angle-cut hood blank

Headlights Details



Note: Drill holes for lights $\frac{1}{2}$ " deep.



Bevel-cut the windshield block, using a shoe-style pushstick with an abrasive edge or rubber sole to keep it down on the table and snug to the fence.



With the beveled edge of the windshield block against the saw fence, make several passes at the proper angle to cut the rabbets.

Sand the cab bottom as needed.

7 From $\frac{3}{4}$ " stock, cut the front axle support (C) to size. Bevel-cut the edges at 45° , where shown in **Figure 2**.

8 Cut a 1"-wide spacer and clamp it flush along the front edge of the lower cab assembly (A/B). Now, apply glue to the top face of the front axle support (C), and clamp the part against the spacer, flushing its ends with the lower cab assembly (**Photo B**).

9 After the glue dries, bore an $\frac{1}{32}$ " through hole in the front axle support (C), where shown in **Figure 2** and as shown in **Photo C**.

10 Apply glue to the mating surfaces of the cab hood (A) and lower cab (B), and clamp the parts together, carefully flushing the edges and front ends. Later, remove the clamps and sand smooth.

11 Cut a $\frac{3}{4}$ " piece of walnut to $3\frac{7}{8} \times 5\frac{5}{8}$ " for the fender (D) blank. Mark a centered hole $1\frac{3}{4}$ " from one end. To drill the hole, use a circle cutter.

Note: Position the cutter so its tip faces outside. At the drill press, clamp the workpiece in position, and then use the circle cutter to bore a $2\frac{7}{8}$ "-diameter

hole. Sand the hole with an oscillating spindle sander to remove burn marks.

12 Ripcut the blank for the fenders (D) to create two $1\frac{1}{8}$ "-wide parts. Now glue the fenders to the uncompleted lower cab assembly (A/B/C), where shown in **Figure 2**, flushing the ends and edges. Sand the completed lower cab assembly smooth.

13 Mark the center points for the headlights and turn signal lights, where shown in the **Headlights Detail** in **Figure 2**. Using the correct bits, drill the holes to $\frac{1}{2}$ " deep.

14 Switch to a $1\frac{1}{4}$ " Forstner bit, secure the lower cab assembly (A/B/C/D) to the drill press table and fence, and bore a 3"-deep hole into the front to remove waste, where shown in **Figure 1**. (Hollowing out the cab makes it lighter.) Later, you will cover the opening with the grill (I) and bumper (J).

Add the cab top, bumper, and grill

1 Mill one 3'-long piece of 1×6 " maple to $\frac{3}{4}$ " thick, a second 3'-long piece to $\frac{1}{2}$ " thick, a 30"-long piece to $\frac{3}{8}$ " thick, and a 1'-long piece to $\frac{1}{4}$ " thick.

2 Cut and laminate two pieces of $\frac{3}{4}$ "-thick maple to create a blank that measures $1\frac{1}{2}$ " thick $\times$ $5\frac{5}{8}$ " wide $\times$ $2\frac{1}{4}$ " long for the windshield block (E).

3 From $\frac{3}{8}$ " walnut, cut the cab back (F) $\frac{1}{16}$ " long. Now, glue and clamp the piece to one edge of the windshield block (E). Let dry, and then trim the assembly to $5\frac{1}{2}$ " wide. With the tablesaw blade angled at 10° from vertical, bevel-cut the front maple edge of the assembly, as shown in **Photo D**.

4 Adjust the tablesaw fence to $\frac{3}{8}$ " from the outside edge of the blade, and raise the blade to $\frac{3}{8}$ " high. Lock in a miter saw extension fence at 90° . Now, with the front face of the windshield block assembly (E/F) face down, cut a kerf at one end. Flip the piece and kerf the other end. Next, adjust the miter gauge to 80° , and, with the windshield block on end, complete the rabbet cut where shown in **Figure 3**. Adjust the miter gauge to 80° in the opposite direction and repeat the process to complete the remaining rabbet, as shown in **Photo E**. (A $\frac{3}{8}$ " dado set would let you cut the rabbets on one pass.)



F Cut $\frac{1}{16}$ "-deep kerfs to create the grill face, using pencil erasers to move the piece safely over the blade.

5 From $\frac{3}{8}$ "-thick walnut, cut the cab top (G) to size, plus $\frac{1}{16}$ " wider than the final dimension. Glue and clamp it to the windshield block assembly (E/F), flushing the piece at the ends and along the back edge of the cab back. (The piece should extend slightly over the front edge of the windshield block.)

6 Cut a $\frac{3}{8} \times \frac{3}{8} \times 12$ " strip of walnut. Measure the length of

the rabbets in the uncompleted windshield block assembly (E/F/G) for cutting the cab front corners (H) to length. Using a mitersaw or tablesaw and a miter-gauge extension fence adjusted at 10° from square, bevel-cut the cab front corners. Test their fit in the windshield block, and then glue them in place. Sand their bottom ends flush with the assembly.

7 Similar to Step 3, angle the saw blade 10° from vertical, and make a fine bevel skim cut across the front face of the cab top assembly, flushing the cab top (G) with the beveled face of the windshield block. As an alternative, you could sand the pieces flush on a sheet of sandpaper adhered to a flat surface.

8 Mark the locations of the cab top lights, referring to the Cab Top Boring Detail in Figure 3. Drill the $\frac{5}{32}$ " holes $\frac{1}{2}$ " deep at these locations.

9 Using a 1" Forstner bit, bore out the waste in the cab top assembly, drilling overlapping holes $1\frac{1}{4}$ " deep into its bottom face, where shown in the Cab Top Boring Detail in Figure 3.

10 Next, apply glue to the bottom of the cab top assembly (E/F/G/H), and clamp it in place to the lower cab assembly (A/B/C/D), flushing it along the back edge and ends. Remove any glue squeeze-out with a moistened rag.

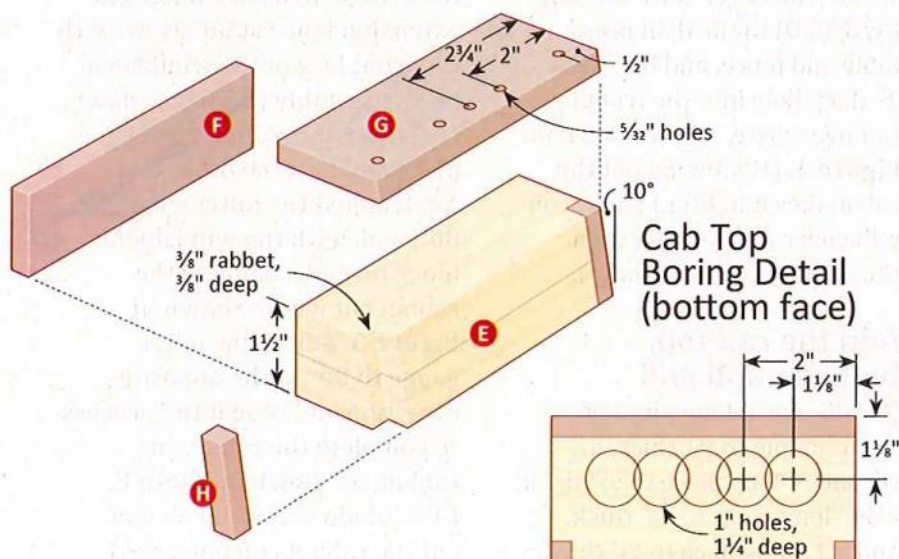
11 Hand-sand $\frac{1}{8}$ " round-overs on all exposed edges on the cab assembly (A/B/C/D/E/F/G/H). Do not round over mating edges for the grill (I), and bumper (J) at the front end of the cab hood or the bottom edges of the cab assembly.

12 From $\frac{1}{4}$ " maple, cut the grill (I) to size. Referring to Figure 1, adjust the tablesaw fence, and cut the four kerfs (Photo F). Glue the grill to the front of the cab and flush with the hood.

13 From $\frac{1}{4}$ " maple, cut the bumper (J) to $1\frac{1}{8} \times 5\frac{1}{2}$ " at the tablesaw. Referring to Figure 1, lay out the angled cuts along the bottom edge. Bandsaw along the angled cutlines and sand smooth. Glue the bumper to the cab, flush with the fenders (D) and grill (I).

14 Cut the running boards (K) to size, rounding the outside corners. Glue and pin the running boards to the cab, where shown in Figure 1, flushing their inside edges with the fenders (D).

Figure 3: Cab Top Exploded View



Build and add the frame

1 Cut the frame (L) to size, checking its fit within the assembled cab. Drill centered $\frac{1}{2}$ "-deep holes for the taillights $\frac{3}{8}$ " in from the edges.

Tip Alert

Use pin nails of various lengths when gluing parts together to ensure proper positioning and to prevent slippage.

2 Glue two pieces of $\frac{3}{4}$ " walnut face to face, and then trim the laminate to the size in the **Cut List** for the rear axle support (M). Bevel-cut chamfers on the edges, where shown in **Figure 1**. Then glue the axle block to the bottom face of the frame $2\frac{1}{2}$ " from its rear end, using a spacer similar to **Photo C**. Now, drill the centered $1\frac{1}{32}$ " through hole $\frac{5}{8}$ " from the bottom face.

3 Cut the wheel pivots (N) to size. Mark and drill the three centered $1\frac{1}{32}$ " peg holes, where shown in **Figure 1**. Then mark the $\frac{1}{2}$ " radii, and sand them to shape at the disc sander.

4 Cut the spacer block (O), gas tanks (P), and gas tanks bracket (Q) to size. (Note that the spacer block thickness equals that of the hinge.) Drill the holes for the gas caps in the gas tanks, and round over their edges. Center and edge-glue the tanks to the bracket. Let dry, and then secure the assembly (P/Q) to the frame, where shown in **Figure 1**, with glue.

5 Fit the front end of the frame (L) into the opening of the cab assembly, and secure it in place with glue and three $\#8 \times 2$ " countersunk flathead screws. With the cab secure, glue and pin-nail the spacer block (O) in place.

Make and install the tires

Note: You can make $2\frac{1}{2}$ "-diameter tires using the method described here, or save time by buying tires using the source in the Convenience-Plus Buying Guide. To ensure free movement of the tires, drill an $1\frac{1}{32}$ " test hole in scrap and fit an axle peg into it.

1 Lay out the centerpoints for seven $2\frac{1}{2}$ "-diameter tires (R) on a $\frac{3}{4} \times 3\frac{1}{2} \times 24$ " maple blank. (While you only need six tires, use the seventh as a test piece.)

2 Install a $1\frac{1}{4}$ " Forstner bit,



Align the blank with the circle cutter, centering its $\frac{1}{4}$ " bit in the $1\frac{1}{32}$ " recess; clamp it in position, and cut out the tire.

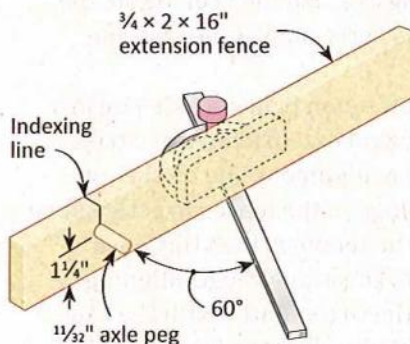
adjust the fence to center the bit on the tire (R) center points, and bore a $\frac{1}{4}$ "-deep recess at each one. Switch to an $1\frac{1}{32}$ " brad-point bit, and drill a $\frac{1}{8}$ "-deep starter hole below the recess. Next, switch to a circle cutter and adjust it to make a $2\frac{1}{2}$ "-diameter cut. Clamp the workpiece to the drill-press fence. Then, using a slow-speed (about 300 rpm), cut out the tires (**Photo G**) drilling a centered $\frac{1}{4}$ " axle hole at the same time.

Note: Be sure to orient the cutter to face the center of the opening.

3 Insert a $\frac{1}{4}$ " bolt or length of all-thread through a tire's axle hole, locking it in place between a washer and jam nut. Then, install the bolt into the drill chuck. Turn on the drill and sand away any burn marks. Repeat for the remaining tires.

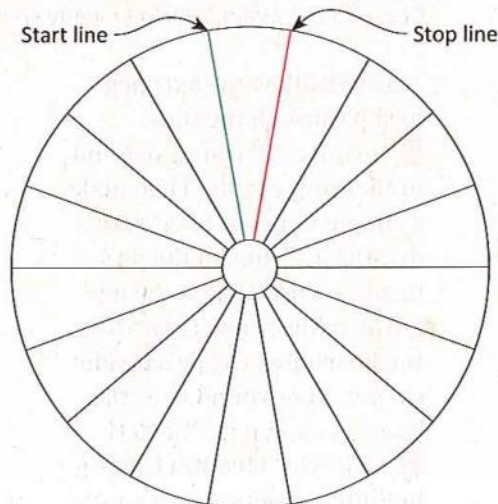
4 Switch to the $1\frac{1}{32}$ " bit and, using a stopblock and fence, widen the $\frac{1}{4}$ " axle holes, guiding off the $\frac{1}{8}$ "-deep starter hole drilled earlier.

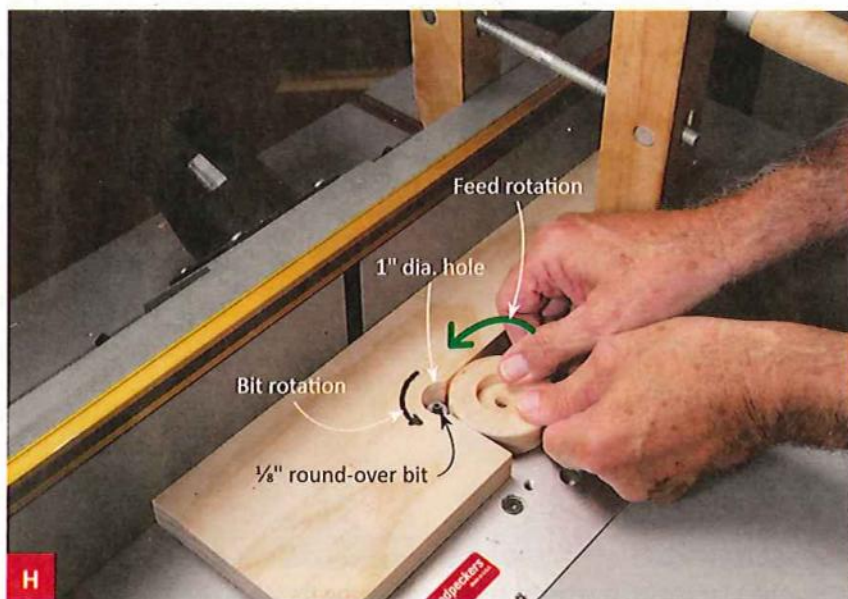
Figure 4: Tire Kerfing Jig



Note: To make kerfs on left and right tires, angle the extension fence at 60° to the left of 90° , and then at 60° to the right. Adjust the fence location so the tire (when on the peg tenon) centers over the blade.

Kerfing Template
100% size (make 7 copies)





Fit a sanded tire into the jig's corner, and turn it against the bit's rotation to safely round the edges.



Align the template's start line with the jig line, and then cut, rotate the tire, and cut again, making evenly spaced kerfs. Stop at the stop line.

This will allow the axle peg to slip through the tires.

5 Install a $\frac{1}{8}$ " round-over bit in the router table. Then make a simple L-jig out of $\frac{3}{4}$ " scrap, drilling a 1" hole in the jig's inside corner. Clamp the jig to the table or fence, locating the bearing at the jig's inside corner. Now, round over the tires, as shown in Photo H.

6 Make the Tire Kerfing Jig in Figure 4, gluing in a sawed-

off tenon from an axle peg in a wood extension fence. Strike an alignment line on the top edge of the fence, directly above the tenon. Attach the fence to the miter gauge, aligning the tire's center with the saw blade when the fence is angled at 60° to the left or right of 90° . Next, make seven copies of the Kerfing Template and adhere a paper template to the inside face of each tire.

7 Angle the miter gauge kerfing jig at 60° to the left of 90° . Slip a test tire onto the peg tenon, aligning the indicated start line on the template with the line on the top edge of the jig, clamping it to the fence. Raise the saw blade $\frac{1}{16}$ ", and, cut the tire's tread, rotating and aligning the template lines as you go. Check the tread after reaching the stop line. The kerfs should be evenly spaced. Now, cut three tires this way for one side of the truck, as shown in Photo I. Adjust the jig at 60° to the right of 90° , move the fence as needed, and similarly cut the tread on the opposing three tires. Sand and finish the tires.

8 Note the tread orientation in Figure 1, and then slip a tire and nylon washer onto an axle peg and glue and pin-nail the peg to the front axle support (C). (I used $\frac{3}{4}$ " pin nails, shooting through the axle support and into the peg.) Do the opposing tire. Similarly, secure the rear tires to the rear axle support (M). Test-fit the rear tires, washers, and axle pegs into the wheel pivots. Mark the protruding axle pegs and cut them to length. Glue and pin-nail the rear wheel axle pegs in place.

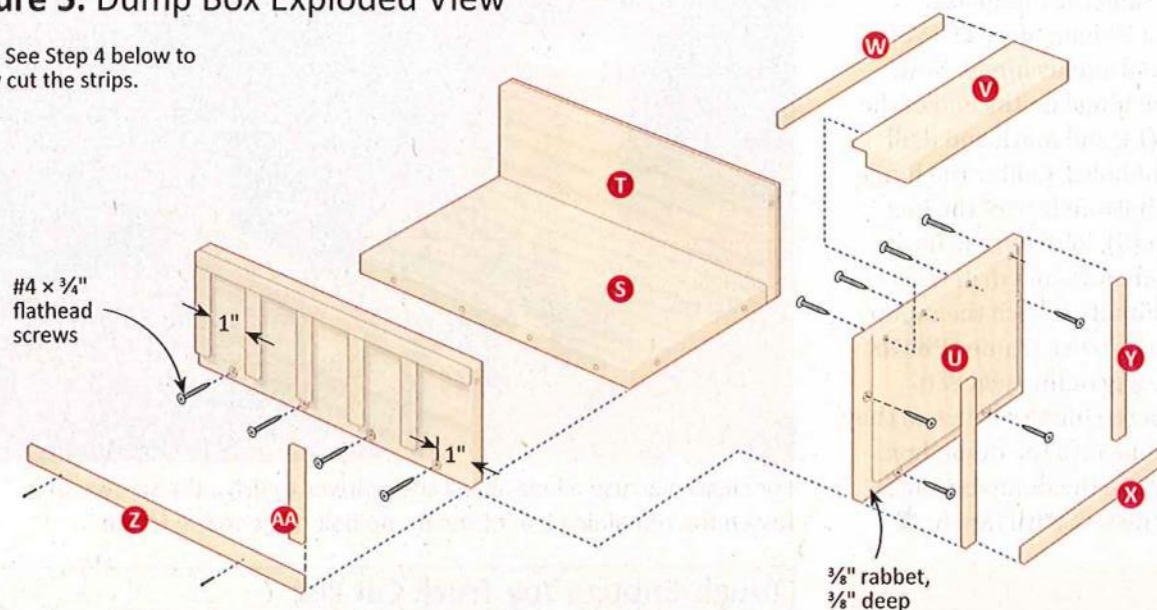
9 Finish-sand the cab and then glue in the headlights, signal lights, running lights, rear brake lights, and gas tank and radiator caps, cutting the peg tenons to length as needed.

Tip Alert

Test the pin-nail depth by shooting through a piece of $\frac{1}{8}$ " maple and into a $\frac{3}{8}$ " piece. You want to sink the pin-nail below the surface to hide it. Fill the holes with a color-matching filler prior to finishing.

Figure 5: Dump Box Exploded View

Note: See Step 4 below to safely cut the strips.



Build the dump box

1 From the $\frac{3}{8}$ " and $\frac{1}{2}$ " maple stock, cut the dump box bottom (S), box sides (T), box front (U), and cab protector (V) to the sizes in the **Cut List**. Cut a $\frac{3}{8} \times \frac{3}{8}$ " rabbet on one edge of the cab protector. Cut $\frac{3}{8}$ " rabbets $\frac{1}{8}$ " deep on the outside face of the box front. Sand the faces of box parts.

2 Drill the countersunk holes, where shown in **Figure 5**, and then assemble the box with #4 $\times \frac{3}{4}$ " screws and glue, checking all corners for square.

3 Drill countersunk holes and glue and screw the cab protector (V) to the box front (U). Before adding the strips, finish-sand the box.

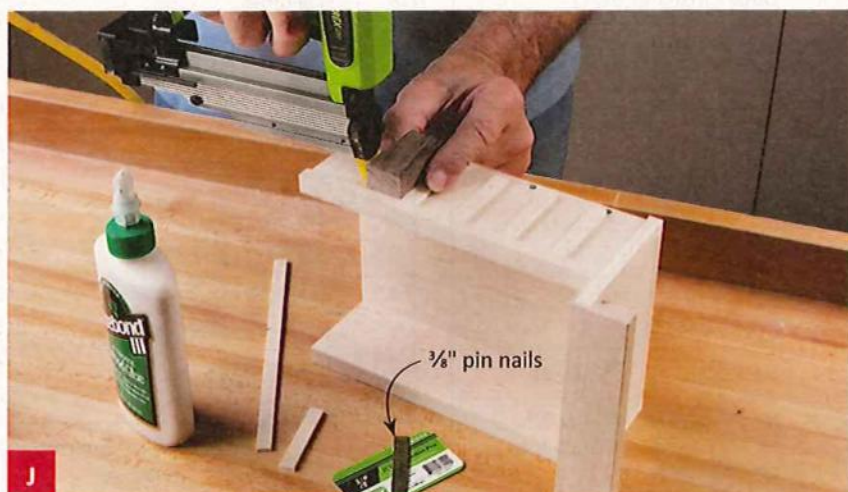
4 Install a zero-clearance insert in your tablesaw with a 50- or 60-tooth blade to make a glue-line cut. Then, adjust the square end of your miter gauge extension fence to be $\frac{1}{8}$ " from the outside face of the blade. Pull the miter gauge back toward the front of the saw, and use the extension fence end to serve as a stop. Now, joint both edges of a 2' long piece of $\frac{3}{8}$ "-thick maple stock having

straight grain. With the piece against the fence, adjust the fence so the opposite edge contacts the end of the extension fence. Turn on the saw and rip a $\frac{1}{8}$ "-thick strip. Flip the piece, adjust the fence again, and rip a second $\frac{1}{8}$ "-thick strip. Joint both edges of the workpiece, and repeat the process to rip two more $\frac{1}{8}$ "-thick strips.

5 Mark and cut the box front top rail (W), box front bottom rail (X), and box front stiles (Y) to fit. Now apply them, where shown in **Figure 5**, using glue

and $\frac{3}{8}$ " pin nails. Note that the strips provide a realistic detail and cover up the screw heads.

6 Cut the box side rails (Z) to length. Glue and pin-nail the top box side rails (Z), where shown on **Figure 5**. Temporarily place a bottom side rail in place, and measure the distance between the top and bottom rails. Now, cut the box ribs (AA) to length. Remove the bottom rails, and starting at the box front, glue and pin the box ribs, as shown in **Photo J**.

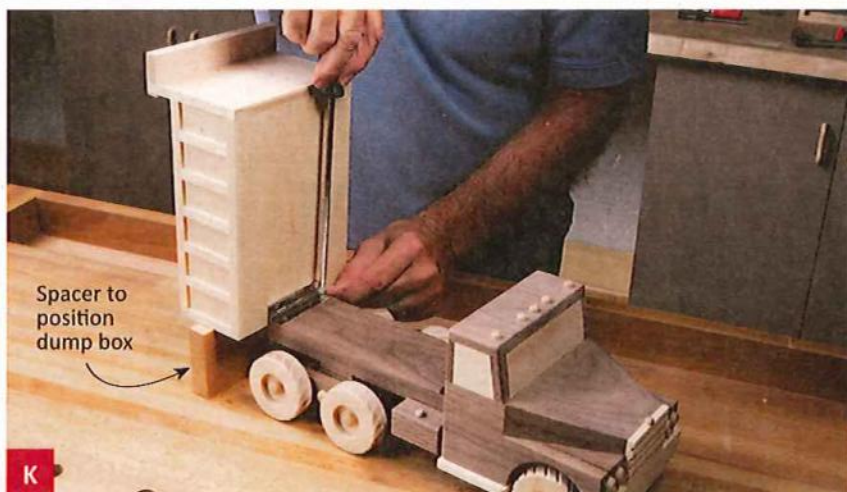


Cut a spacer block, and use it to evenly space the box ribs when gluing and pinning them in place.

Finish-sand the dump box.

7 Cut a 3"-long piece of $1\frac{1}{16}$ "-wide continuous hinge. Now, hold the hinge on the end of the frame (L), and mark and drill the pilot holes. Center the hinge on the bottom face of the box bottom (S), $\frac{1}{4}$ " from the back end, and mark and drill pilot holes. Finally, attach the dump box to the truck frame (**Photo K**). Use a grinding wheel to shorten the hinge screws so they don't poke into the dump box.

8 Remove the dump box and finish the box with finish. ■



For clearance, use a long shank screwdriver to drive the screws and fasten the remaining leaf of the dump box hinge to the frame.

About Our Designer/Builder
Westerville, Ohio, resident Chuck Hedlund began his woodworking life as a cabinetmaker. Beginning in 1993, he began serving the needs of several woodworking publications as a builder and designer. He is a regular contributor to *Woodcraft Magazine*.

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□ 4. TWT250 \$3.00 ea.

(Optional) Treaded Toy Wheels, $\frac{3}{4}$ " x $2\frac{1}{2}$ " dia., 4 wheels/pkg., qty. 2 pkgs.

Above items are available at Woodworks Ltd., craftparts.com or by calling (817) 581-5230. Prices subject to change without notice.

Tough-Enough Toy Truck Cut List

	Part	Thickness	Width	Length	Qty.	Mat'l
A*	Cab motor hood	$1\frac{1}{8}$ "	$5\frac{1}{2}$ "	$5\frac{1}{8}$ "	1	W
B*	Cab bottom	$1\frac{1}{8}$ "	4"	$5\frac{1}{8}$ "	1	W
C	Front axle support	$\frac{3}{4}$ "	4"	$1\frac{1}{2}$ "	1	W
D*	Fenders	$\frac{3}{4}$ "	$1\frac{1}{8}$ "	$5\frac{1}{8}$ "	2	W
E*	Windshield block	$1\frac{1}{2}$ "	$5\frac{1}{2}$ "	$1\frac{1}{8}$ "	1	M
F	Cab back	$\frac{3}{8}$ "	$5\frac{1}{2}$ "	$1\frac{1}{2}$ "	1	W
G*	Cab top	$\frac{3}{8}$ "	$5\frac{1}{2}$ "	2"	1	W
H*	Cab front corners	$\frac{3}{8}$ "	$\frac{3}{8}$ "	$1\frac{1}{8}$ "	2	W
I	Grill	$\frac{1}{4}$ "	$1\frac{3}{4}$ "	$2\frac{1}{2}$ "	1	M
J	Bumper	$\frac{1}{4}$ "	$1\frac{1}{8}$ "	$5\frac{1}{2}$ "	1	M
K	Running boards	$\frac{1}{4}$ "	1"	$2\frac{1}{8}$ "	2	M
L	Frame	$\frac{3}{4}$ "	3"	$11\frac{1}{4}$ "	1	W
M*	Rear axle support	$1\frac{1}{2}$ "	3"	$1\frac{1}{2}$ "	1	W
N	Wheel pivots	$\frac{1}{2}$ "	1"	$4\frac{1}{2}$ "	2	W
O	Spacer block	$\frac{3}{16}$ "	1"	3"	1	W
P	Gas tanks	1"	1"	2"	2	W
Q	Gas tanks bracket	$\frac{3}{4}$ "	3"	$1\frac{1}{8}$ "	1	W
R	Tires	$\frac{3}{4}$ "	$2\frac{1}{2}$ " dia.		6	M
S	Box bottom	$\frac{1}{2}$ "	5"	$8\frac{1}{4}$ "	1	M
T	Box sides	$\frac{3}{8}$ "	3"	$8\frac{1}{4}$ "	2	M
U	Box front	$\frac{3}{8}$ "	6"	4"	1	M
V	Cab protector	$\frac{1}{2}$ "	$1\frac{1}{2}$ "	6"	1	M
W*	Box front top rail	$\frac{1}{8}$ "	$\frac{3}{8}$ "	6"	1	M
X*	Box front bottom rail	$\frac{1}{8}$ "	$\frac{3}{8}$ "	$5\frac{1}{4}$ "	1	M
Y*	Box front stiles	$\frac{1}{8}$ "	$\frac{3}{8}$ "	4"	2	M
Z*	Box side rails	$\frac{1}{8}$ "	$\frac{3}{8}$ "	$8\frac{1}{4}$ "	4	M
AA*	Box ribs	$\frac{1}{8}$ "	$\frac{3}{8}$ "	$2\frac{1}{4}$ "	12	M

* Indicates parts are initially cut oversized. See instructions.

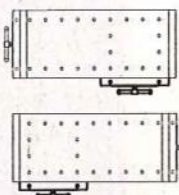
Materials: W=Walnut, M=Maple

Hardware/Supplies: (8) $\frac{3}{8}$ " nylon flat washers; (1) $\frac{1}{4}$ " x 3" hexhead bolt; (3) $\frac{1}{4}$ " nuts; (2) $\frac{1}{4}$ " washers; (1) continuous hinge, nickel, $1\frac{1}{16}$ " x 30"; (12) #4 x $\frac{3}{4}$ " flathead screws; (3) #8 x 2" flathead screws.

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154706 Template



154704 Belcerebon Kit



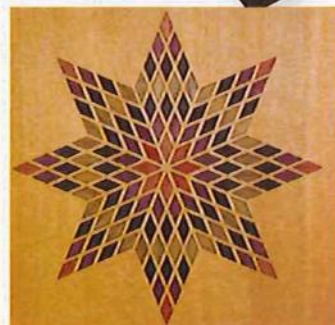
154702 Aldebaran



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154704 Belcerebon



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Spotlight on Yellowheart

A Brazilian specialty wood that packs a real color punch

By Pete Stephano

Technical consultant: Larry Osborn

It makes for occasional confusion, but in the world's lumber trade yellowheart sometimes goes by different names. It can be called *satina*, *pau amarelo* (Portuguese for yellow wood), Brazilian satinwood (which it is not, although it is in the same family as Ceylon and Indian satinwoods) and Brazilian boxwood. Wood dealers in the United States, though, seem to agree on yellowheart (*Euxylophora paraensis*) of the family *Rutaceae* that includes citrus trees such as orange, lemon, and lime.

The popularity of yellowheart stems from its uniform, nonfading yellow color, which offers woodworkers a distinctive

accent for their projects. That said, it can just as easily serve as the primary wood. And unlike the true satinwoods, it's much less costly!

History in woodworking

Where it grows, yellowheart has been and still is employed for everything from boats to framing lumber to flooring, carvings, cabinets, furniture, and musical instruments (woodwinds). The fact that it's available in sizeable widths and lengths helps explain its numerous applications.

American woodworkers, however, principally use the colorful wood for dramatic inlay and small craft items, such as turned pens, bowls, and boxes. Recently, yellowheart has served as flooring material.

Where the wood comes from

Although yellowheart is generally considered as a Brazilian hardwood, its actual range is limited to only a section of the country's Eastern coastline south of the equator known as the State of Para. There yellowheart reaches heights of 130' with diameters of around

30". Because of its abundance and size, the tree has a significant economic impact on the local forest products industry. When it blooms, yellowheart becomes a tree of splendor with a profuse showing of creamy white flowers.

What you'll pay

You'll find yellowheart at specialty wood mills and suppliers, as well as online. For FAS boards in 4/4 thickness, widths to 10" and lengths to 12', expect to pay about \$6 per board foot. Yellowheart pen blanks sell for less than \$2 each. And thin stock (1/4" thick) sells for about \$12 per square foot. Veneer is also available for marquetry and sells for \$2 to \$2.50 per square foot.

How to select the best stock

Yellowheart is a heavy, hard, close-grained wood with straight, barely discernible grain, although some curly figured stock does occur. (Be aware that its interlocking grain may require special care in the workshop.) Quartersawn stock may display ribbon figure that could prove desirable for a tabletop or panel.

The wood's color can vary.

It's a fact that...

Yellowheart is quite capable of making beautiful music when put to good use by instrument makers. Instruments where yellowheart has found a home include stave-construction snare drums, flutes, psalteries, and guitars. Guitar makers favor the wood for electric guitar bodies, acoustic guitar sides and back, as well as the neck.



Figured Yellowheart

Straight-grained
Yellowheart

$\frac{3}{4} \times \frac{3}{4} \times 5$ "
pen blanks

With lumber obtained from different trees of the same species you may find stock that ranges in color from yellow through light orange to red. For the best color match in a project, try to select boards from the same tree if possible.

Working yellowheart in the shop

This close-grained, fine-textured hardwood can be worked with hand or power tools, although its hardness will dull cutting edges. Planing and jointing yellowheart requires attention to grain direction in relation to the cutters as the wood has a slight tendency to tear out. Running the wood through the planer at an angle may prove beneficial. Curly yellowheart or ribbon figure requires taking

very light passes. A drum sander may yield better results for final smoothing and thickening.

Take care when sanding yellowheart, progressing through successive grits until you arrive at desired smoothness. Due to its hardness, the wood will take a lustrous polish with fine abrasives. Caution is in order here. Yellowheart is classified as an irritant, meaning its dust can cause a skin rash if you have sensitivity, so always wear a dust mask and long sleeves when sanding, and wash thoroughly afterwards.

Don't worry about gluing—all types of adhesives work because yellowheart has no natural oils. You will, though, have to predrill for screws. The wood carves and turns well.

Finally, yellowheart poses no problems in dyeing or staining (if

you choose to do that), and final finishing. However, exposure to sunlight will darken it slightly, so a clear finish with ultraviolet protection may be warranted, depending on the project. ■

Yellowheart Quick Take

Cost	Moderate
Weight	Slightly heavier than red oak
Hardness	Equal to hickory
Stability	Moderate
Durability	Resistant to decay
Strength	Moderate
Toxicity	Irritant (skin rash from dust)
Tool Type	Hand and power tools
Common Uses	Boxes, carving, flooring, furniture, inlay, turnings, and musical instruments

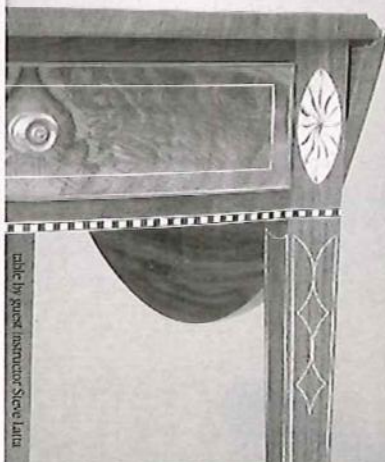
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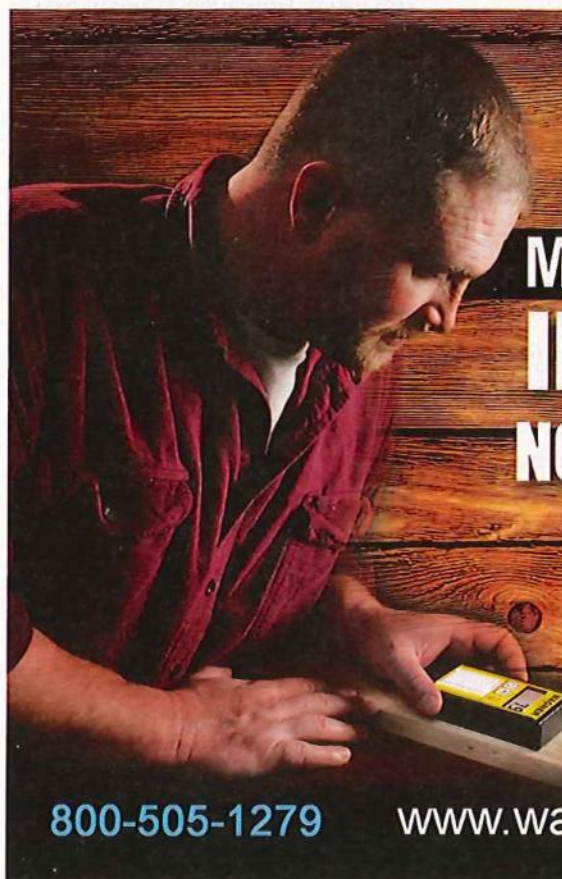
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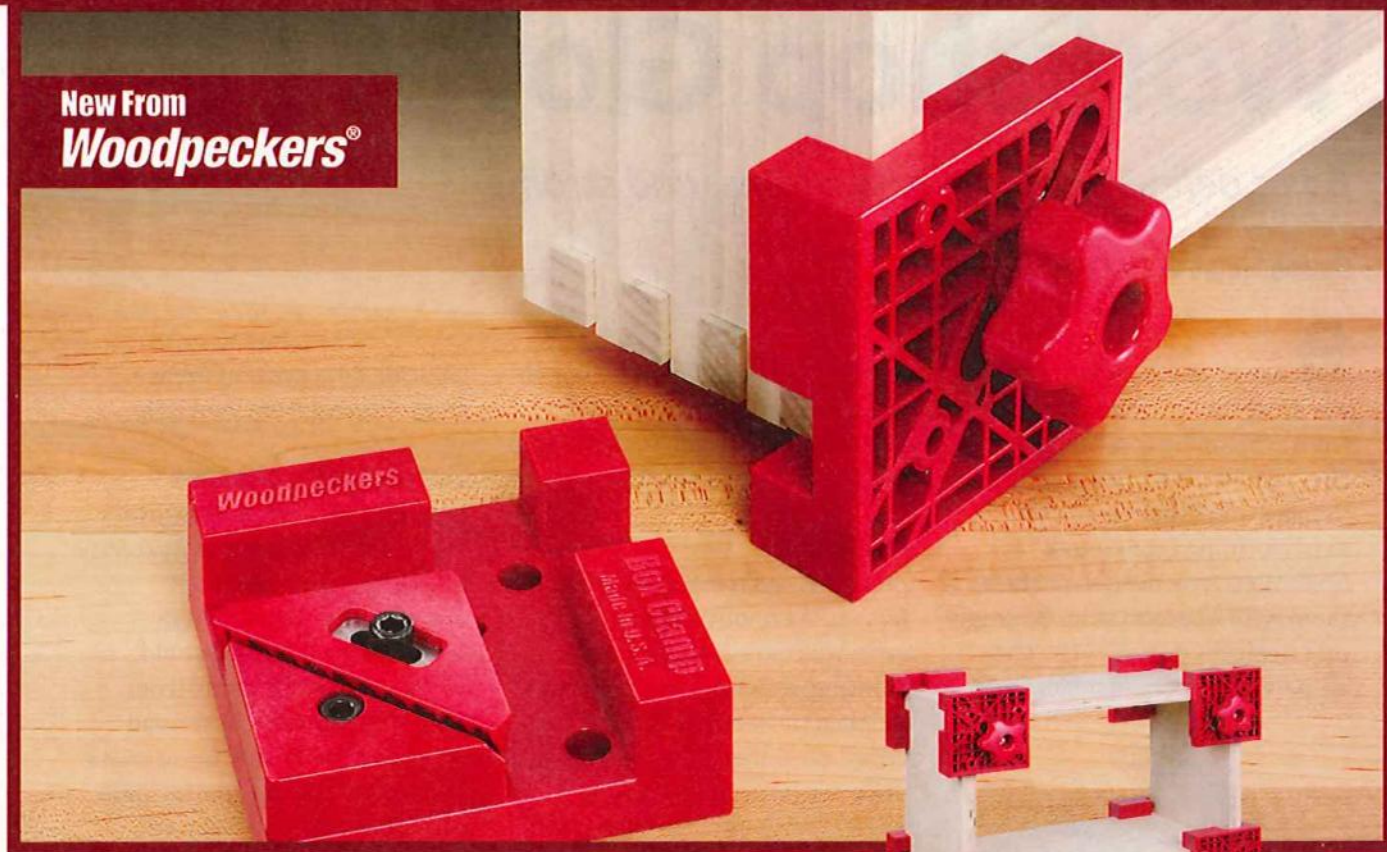
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Workshop Gloves

Basic defense against cuts, stains, and strains

By Joe Hurst-Wajszczuk

Because your hands play such a critical role in woodworking, from schlepping lumber and sheet goods, to working with finishes and other chemicals, to performing certain tool operations, you need to protect them with a second skin. No single pair of gloves provides the end-all-be-all solution. Instead, you'll

want a few special pairs to match the job at hand. Here's a quick overview to help you find the right protection for the work you do.

Cotton

Also referred to as canvas or Jersey, heavy-duty cotton gloves are a welcome accessory for painting, or when moving stock, finished projects, or sharp-edged machinery. Besides the price, cotton's best attribute is its flexibility. You can keep a few extra pairs on hand with the confidence that they'll fit well enough to get the job done. Cotton does not offer chemical resistance, but serves as a basic barrier against paint splatters and stains. Textured gloves are worth the minor up-charge. The polyvinyl

chloride dots prevent items from slipping from your grip.

Carpenter's choices

Like woodworkers, carpenters require protection and dexterity. Fingerless gloves protect the palm, but leave thumb and forefingers free to hold screws and nails. Made from a combination of leather and synthetic materials, these mitts are pricey, but are comfortable enough for all-day wear and provide the best defense against scrapes and splinters.

New contenders, latex- and nitrile- "dipped" gloves are lightweight, machine washable, and inexpensive, yet offer exceptional grip and dexterity. Latex-coated gloves are thicker,



Cotton/Canvas
(around \$2)

Fingerless
#149298-300 (\$23-25)



FastCap Nitrile-dipped
(around \$6)



When to take the gloves off

Wearing gloves around spinning blades, bits, and turnings—including, but not limited to the jointer, tablesaw, drill press, and lathe—can harm more than help. Here the danger lies in the potential for the gloves to catch and pull you into a machine operation. Not good.

offering better puncture resistance, and better defense against cold temperatures. Nitrile-coated gloves are slightly less durable, but so thin that it's easy to forget that you're wearing them. You can even cut through the coated fingertips for added dexterity.

Sizes vary from one manufacturer to the next, plus the coatings limit the gloves' ability to stretch. You'll need to try on several before finding a pair that fits.

Anti-vibration

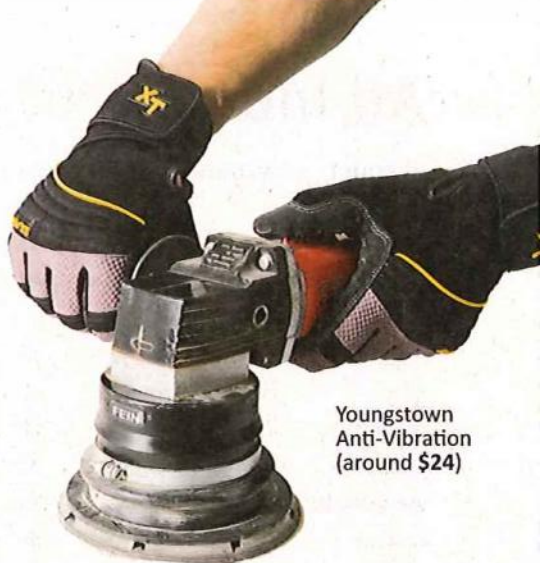
Prolonged vibration from sanders, nailers, and grinders can contribute to a host of hand-related ailments including Carpel Tunnel Syndrome and Raynaud's Syndrome (white

finger). Strategically placed memory foam deadens bad vibes, protecting your hands and wrists from pain and/or numbness.

Carver's glove

Made from a knife stopping combination of Kevlar, Spectra, and stainless steel, this "clothmail" mitt can save you from needing stitches when doing handheld carving. The loose-fitting glove doesn't provide much dexterity, but is comfortable enough to wear on either hand, and stretchy enough to fit multiple users. You'll still want to try on a few different sizes to find one that fits. (Stainless steel chain mail gloves are also available, but cost three times as much.) ■

Featured products available at Woodcraft Supply or local home centers.



Youngstown
Anti-Vibration
(around \$24)



Woodworker's
Safety Glove
#06161-4 (\$24.99)

Chemical Defenders

Don't call them "rubber" gloves. Made from neoprene, latex, nitrile, vinyl, and more, each mitt offers varying degrees of defense against a host of shop chemicals.

For small jobs, disposable gloves are fine for keeping your hands clean and safe. Vinyl gloves (\$12/100) offer decent defense against alcohols, wipe-on finishes (including tung and linseed oil), and mild solvents such as mineral spirits, but tear easily. Latex gloves (\$14/100) provide longer lasting protection, especially against alcohols, dyes, and acids, but don't stand up to oil-based products. Nitrile gloves (\$20/100) provide better all-round defense than latex, superior dexterity, and decent puncture resistance.

Reusable gloves are your best bet for heavy-duty chores, but thickness doesn't guarantee protection. For example, polyvinyl alcohol (PVA) gloves (about \$30) resist strong solvents, including methylene chloride (used in furniture

stripper), but the PVA-coating is water soluble. For cleaning, mild acids, and most finishing chores, general purpose latex gloves (\$5-10) are your best bet. To protect wrists and forearms from spills, choose a pair with long cuffs.

Latex, 29 mil.
(around \$5)



Nitrile, 6 mil.
#152807-9
(\$15.99/100)



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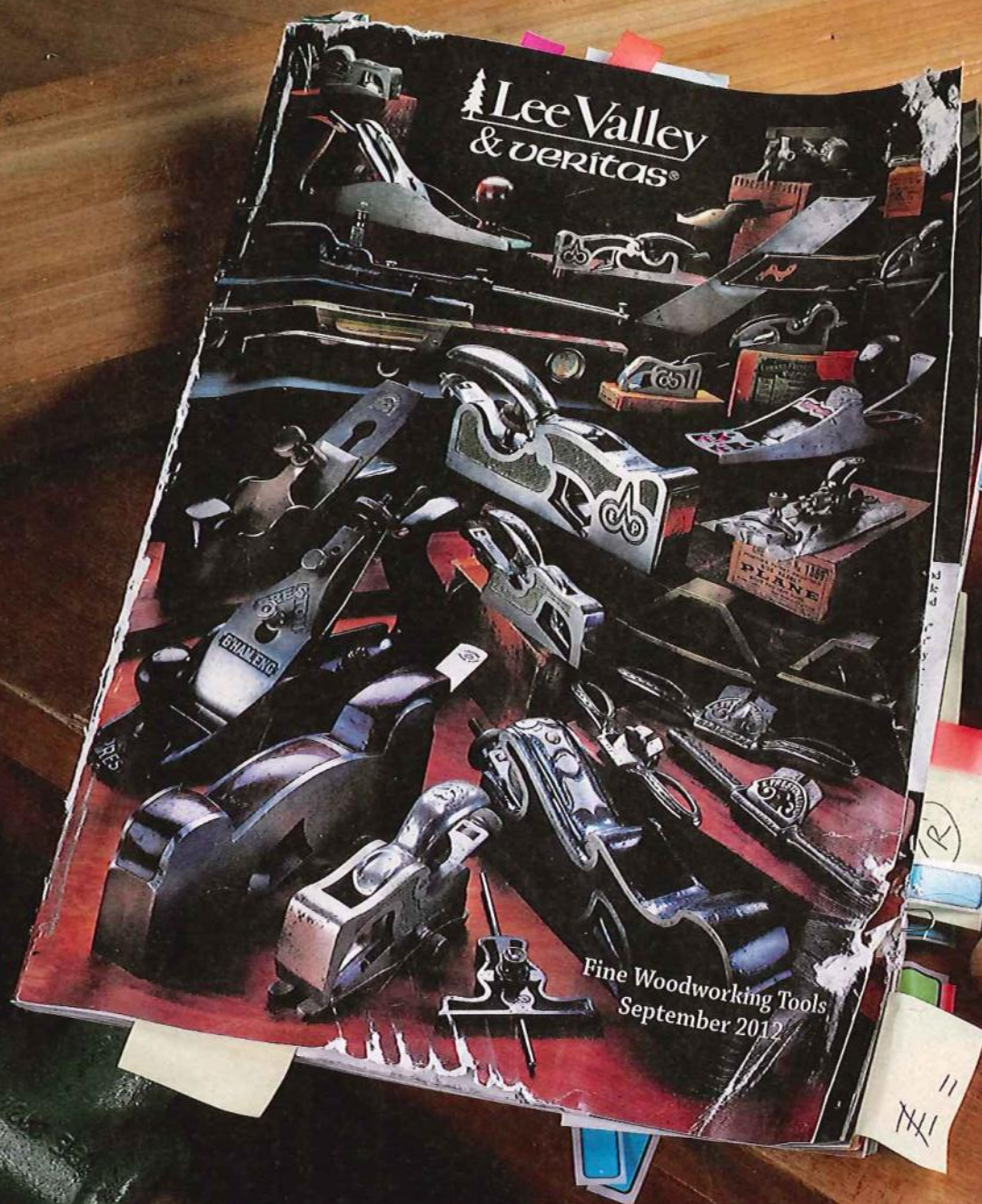
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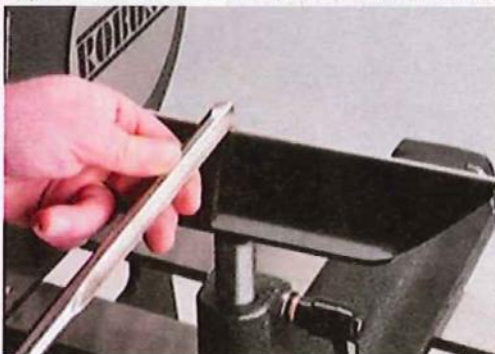
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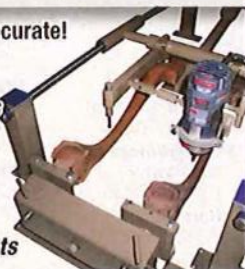
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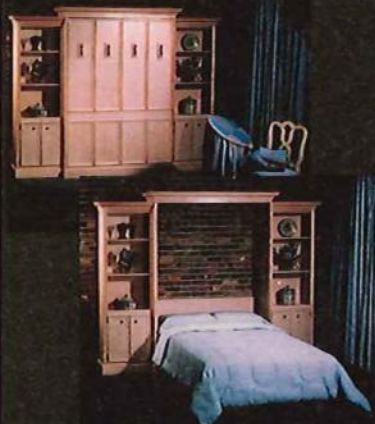
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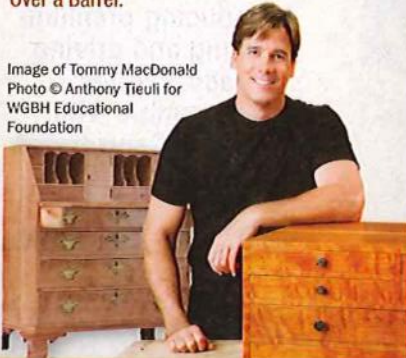
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