8 COOLEST NEW TOOLS FOR 2014 p.45

ISSUE 223 DEC/JAN 2013/2014

Better Homes and Gardens®

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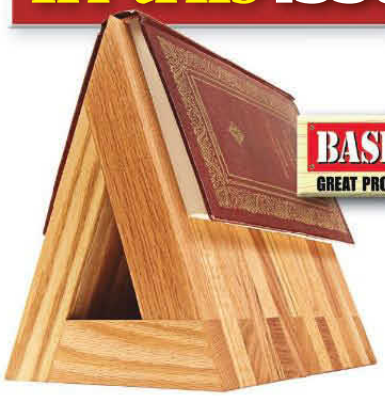

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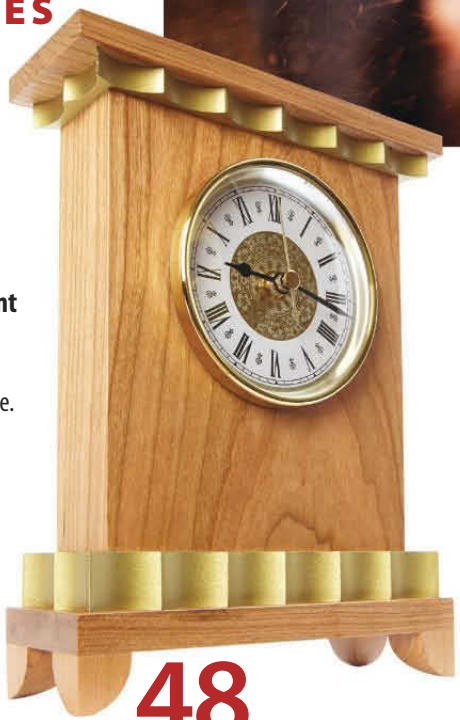

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DEPARTMENTS

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November 14–20

November 21–27

November 28–December 4

LET REAL REVIEWS SHAPE YOUR TOOL WISH LIST

You've heard the expression "Be careful what you wish for..." Before dropping hints about what you want for Christmas, check the reviews from real-world woodworkers and the tool experts at *WOOD*. Browse by tool category, or search for a specific model at **toolreviews.woodmagazine.com**.

Jorgensen Cabinet Master Parallel Clamp
Category: Bar & Pipe Clamps
4.8
4.9 (5)

iVac Switch Box
Category: Dust Collection Accessories
5.0
5.0 (4)

Kreg K4MS Pocket-Hole Master System
Category: Pocket-Hole Jigs
5.0
4.9 (4)

Bosch GCM12SD 12" Glide Mitersaw
Category: Sliding Compound Miters
4.8
4.6 (4)

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Dec/Jan 2013/2014 **Vol. 30, No. 7** **Issue No. 223**

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- **Updates to previously published projects:** For an up-to-date listing of changes in dimensions and buying-guide sources from issue 1 through today, go to **woodmagazine.com/editorial**.

Editor's Angle

Woodworkers care and share

I don't know why, exactly, but woodworkers are among the most charitable people I know, especially at this time of year. Throughout the year, we hear about clubs and guilds using their collective tools, hands, and hearts to aid nonprofits in need. Greenville (S.C.) Woodworkers Guild, for example, lists on its website nearly 50 organizations that have benefited from their members' skills or mentoring. Others take care of their own, like Delaware Woodworkers Guild, which raffled a member-built Windsor chair for a fellow member battling leukemia. And let's not forget the countless individual woodworkers who see a need at church or school and simply step up to the saw to fill it.

Maybe it's because we recognize our talents for the gift they are, and feel a responsibility to use them for good. Maybe it's because, after months of working solo in our own shops, we enjoy the camaraderie of a group project. Or maybe it's because we'll take any excuse to get out in the shop and make dust.

Whatever the reason, thanks for your service to the community.

Photograph by: Mike Mullen / Whittier Daily News

As a group and in their individual shops, Woodworkers of Whittier (Calif.) each year build nearly 1,000 wooden cars and trucks, which then get distributed to needy children.

Care to share a little more?

I'd love to hear about your personal charity project or one done by your club or guild. E-mail me with photos and a summary or link to the project, and we'll share it with other woodworkers on the Community page at woodmagazine.com. Or post it on our Facebook at facebook.com/woodmagazine.

Happy holidays from the *WOOD*® family to yours!

Dave Campbell
dave.campbell@meredith.com

Sounding Board

Our bulletin board for letters, comments, and timely updates

Woodworking really floats this high schooler's boat

In my years as a high-school woodworking instructor, I've been fortunate to teach many excellent young woodworkers. But this year a student truly stunned me: Eliot Alpert built *The Pursuit*, a 16' mahogany runabout! Though the project plans estimated the boat would take an adult 24 months to complete, Eliot built it in only eight. When submitted to our district's research-and-development forum in competition with five other schools, judges described Eliot's boat as "epic." He received top honors and a $1,500 scholarship for his work. Obviously, Eliot has a bright future in woodworking.

—Mark Schirmer, Shawnee Mission, Kan.

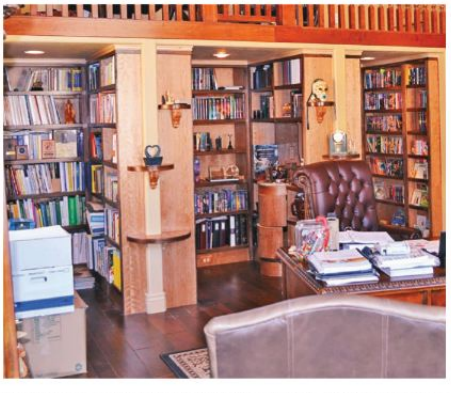
A library fit for a king, complete with secret passage

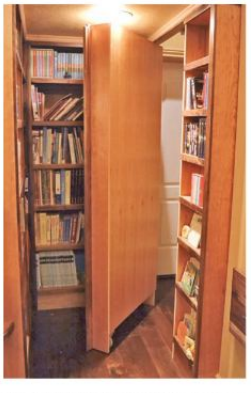
After more than 400 work-hours spread over 10 months, I've finally completed my library/home office, complete with a secret swing-out bookcase that leads to our master bedroom's closet, and a sink (a major convenience since I spend all my working hours in this room).

I used cherry-veneer plywood for the bookcases' side panels and shelves, and walnut for the face frames. I also explored some techniques new to me, such as kerf-cutting to bend wood for the vanity's curved doors.

I'm a CPA, not a professional cabinet builder, so if I can do it, other hobbyists can certainly tackle these kinds of challenging projects, too.

—Marty Wagoner, Eagle Mountain, Utah





Article Update

▶ Construction-grade Scraper

In issue 219 (July 2013), Drawing 2 on page 28, Drawing 3 on page 29, and the sourced hardware kit list a 5/32" axle peg 1/2" long. The axle peg should be 7/32" in diameter. The kits available in the *WOOD* Store (woodmagazine.com/cgtoys) come with the correct axle pegs, and the patterns have the correct axle-peg locations.

Product recall: Festool TS 55 Plunge-Cut Circular Saw

The Consumer Product Safety Commision has released a recall notice for the Festool TS 55 Plunge-Cut Circular Saw. The plunge lock can engage when not intended, causing the saw blade to remain exposed following completion of a plunge cut. If you own one of these saws, contact Festool USA (festoolusa.com, 855-784-9727) for details on how to get a free repair or replacement product, or how to receive a refund.

Watch out, boys: She's armed!

My daughter, Mags, and I built the "loads of fun" trebuchet in issue 204 (May 2011), and it lives up to its name. Mags decided it needed a little extra flare, though, so we dyed it pink. It turned out so well, she plans to enter it in the county fair!

Thank you for including plans like this one in your magazine—they encourage young woodworkers to spend time in the shop, and give us something to bond over.

—Mike Encinias, Napa, Calif.

To purchase trebuchet plans, visit woodmagazine.com/trebuchetplans.

—WOOD® *Editors*

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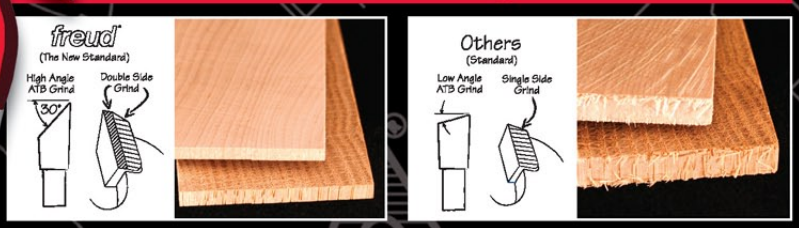

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Support table pulls triple duty as support, fence, and storage

In my tiny shop, space efficiency is the name of the game. By building the top of my mitersaw's extension table in three segments, and hinging the two rear segments as shown, I created a collapsible fence that, when positioned upright, provides access to additional storage space beneath the tabletop. Folded flat, it provides a broad worksurface.

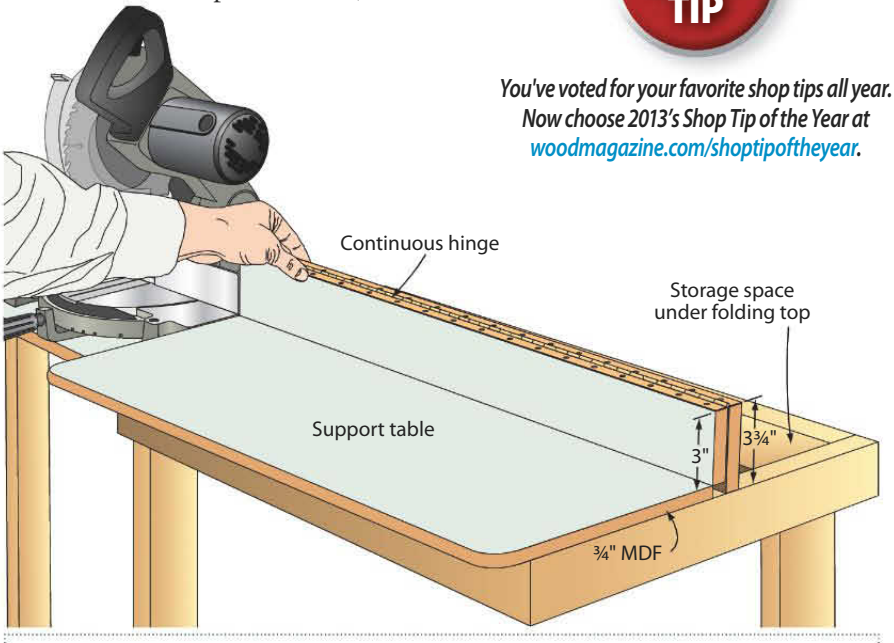
—Jake Lee, Amery, Wis.

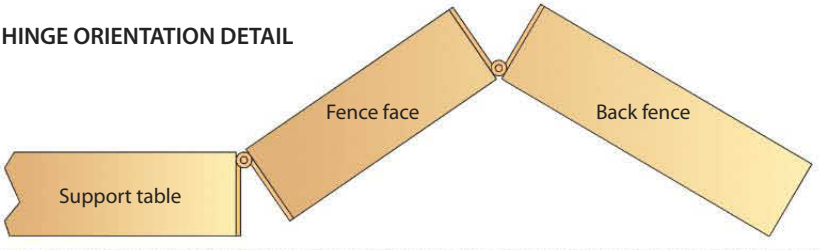
TOP SHOP TIP

You've voted for your favorite shop tips all year. Now choose 2013's Shop Tip of the Year at woodmagazine.com/shoptipoftheyear.

Photograph by: Jake Lee

For sending this issue's Top Shop Tip, Jake receives a Jet 10" bandsaw worth $375.





HAVE A WOOD-WORTHY TIP?

Tell us how you've solved a workshop stumper. If we print your tip, you'll receive up to $150. And, if the idea garners Top Shop Tip honors, we'll also reward you with a tool prize from Jet Tools worth at least $300!

Send your best ideas, along with photos or drawings and contact info, to **shoptips@woodmagazine.com** or **Shop Tips, WOOD magazine, 1716 Locust St., LS-221, Des Moines, IA 50309-3023.**

Because we try to publish original tips, please send yours only to *WOOD*® magazine. Sorry, submitted materials can't be returned.

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24kt Gold shown with refill retracted

Black Enamel with Gun Metal tip and clip

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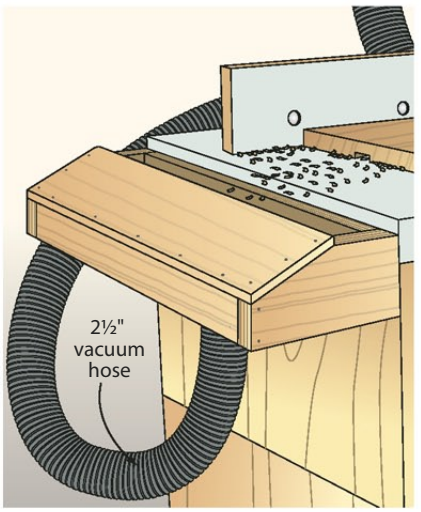
Shop Tips

Router-table outfeed bin eats errant chips

Even with a dust-collector hose attached to my router table's fence, chips and sawdust still manage to escape—generally toward the outfeed side of the table. To collect that debris, I built a simple plywood bin with an opening on top to catch the chips and a hole in the bottom to fit a 2½" vacuum hose. By joining that hose with the one already attached to the router-table fence, I only have one dust-collector hookup to concern myself with.

—Thomas Freh, Newfane, N.Y.



Get buff using your oscillating spindle sander

To quickly buff out a wax finish on small projects, turn to your oscillating spindle sander. Just cut a thick-nap paint roller in half and slide it over a spindle drum. It fits perfectly and works quickly to bring out a wax luster.

—Sam Johnson, Covington, Ga.

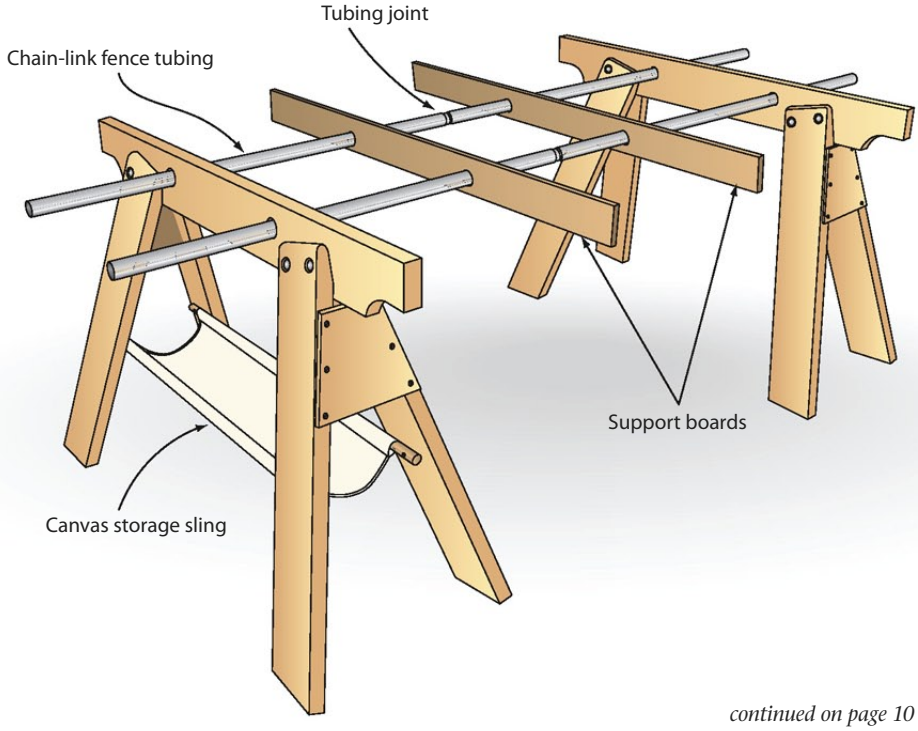
A collapsible work support made entirely of scrap

Working in the surplus and salvage business, I come across plenty of perfectly reusable materials. So when designing a collapsible worksurface that assembles in the field and breaks down into easily stored components, I integrated found 2×6 stock, chain-link fence tubing, and scrapwood.

The tubing slides through holes drilled in the sawhorse rails and the center support boards to act as stretchers. To hold smaller tools and parts, I made a canvas storage sling by wrapping a piece of canvas around a pair of dowels and attaching them to the inside of a sawhorse's legs.

This support works especially well for cutting down sheet goods and other long or large pieces, and becomes a large, rock-solid worksurface by adding a sheet of ¾" OSB or plywood as a top.

—Bob Folty, Tonica, Ill.



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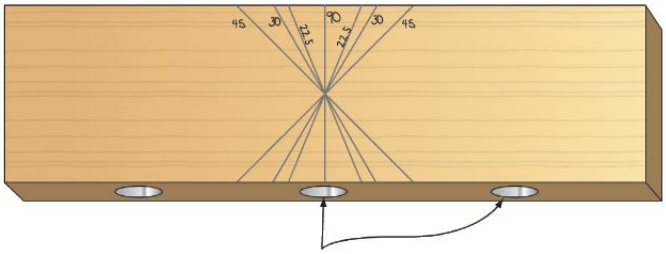
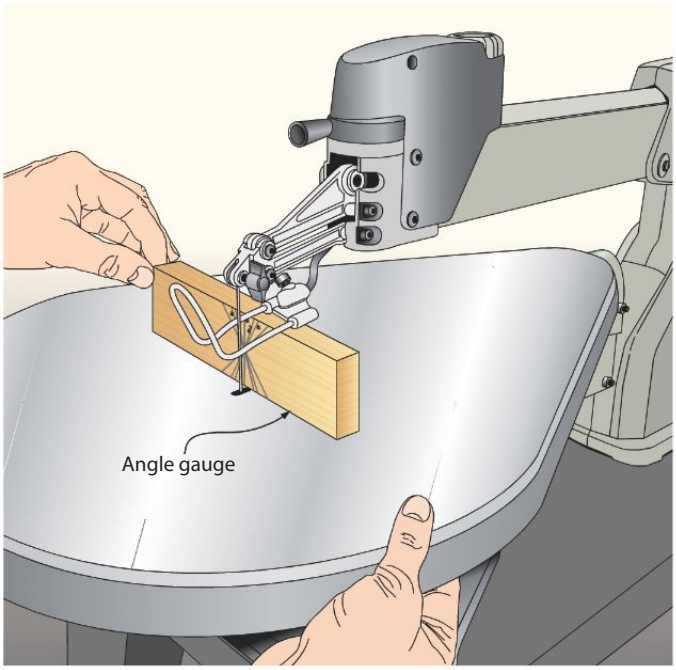
Shop Tips

A sticky angle block for quick adjustments

To save time when adjusting the blade angle on my scroll-saw, portable jigsaw, and bandsaw, I made this simple angle block, marking it with the angles I use most often. Epoxying rare-earth magnets into countersinks on one edge helps the block stick to the saw's table or sole plate during blade adjustments, and makes storing it a breeze: Just stick it on the saw until needed.

—Kenneth Falk, Camas, Wash.



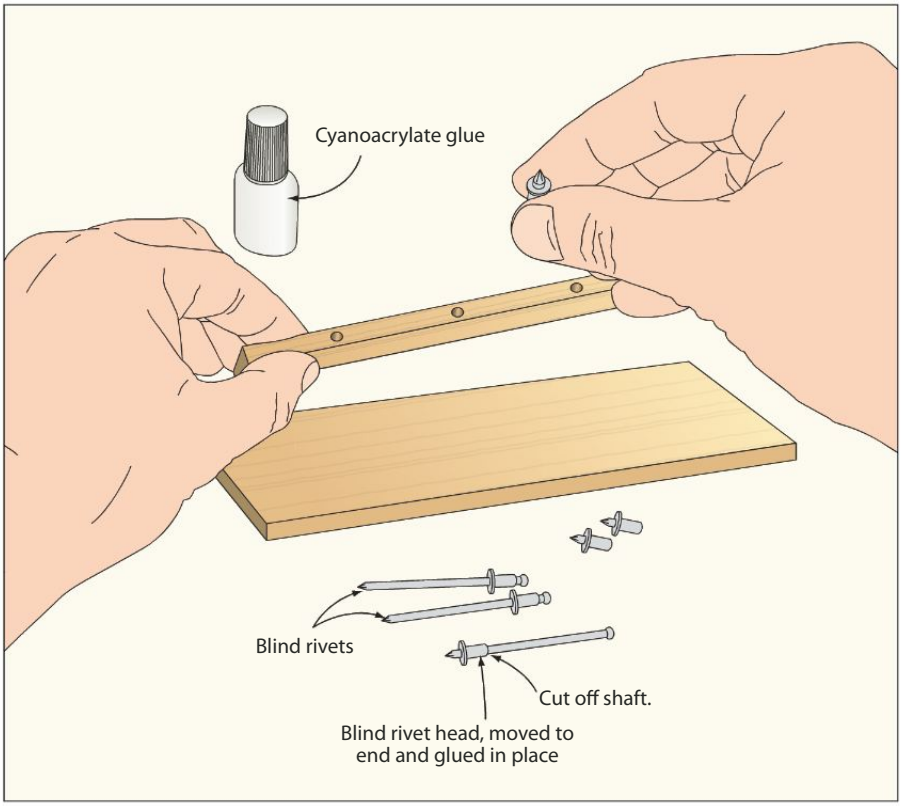


A riveting idea: Make mini dowel centers

When building a toy project, I wanted to use ⅛" dowels to join two small pieces. A dowel center would take the guesswork out of drilling the mating holes, but the smallest dowel center I could find was only ¼". So I made my own from blind rivets.

First, select a blind rivet the same diameter as your dowel. Push the rivet's head down the shaft until it rests 1/16" from the end and glue it in place with a dab of cyanoacrylate glue. When the glue dries, cut off the rivet's shaft flush with the head. Drop the rivet/dowel center into a hole in your workpiece, clamp the two pieces you want to join together, release the clamp, and drill on the indentation.

—Stan Warmath, Tallahassee, Fla.



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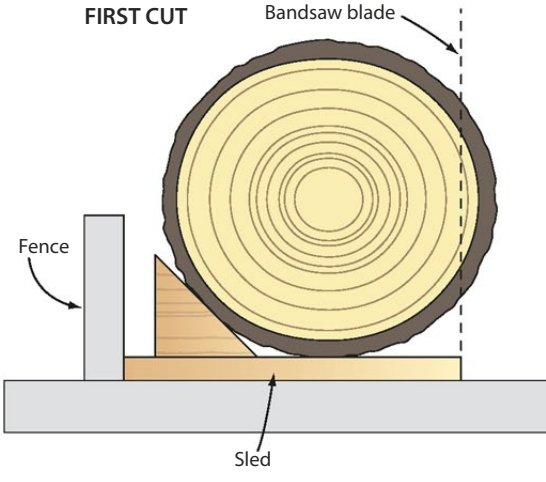
Shop Tips

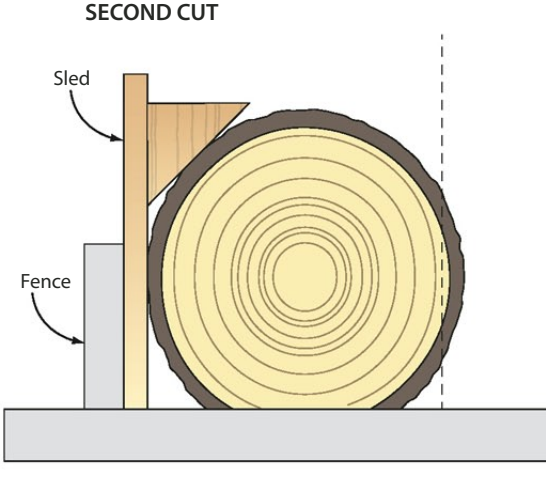
Slice short logs with this simple scrapwood sled

I don't have a lumber mill, but that doesn't stop me from making lumber on my bandsaw. To build the required sled, first cut a series of scrapwood triangles from 2×4 stock. You'll also need a piece of plywood large enough to support the log.

Position the log on the plywood sled so it just overhangs the edge. Hot-glue the triangles to the sled, snug to the log. Then, hot-glue the log to the triangles. Make the first cut; then, rotate the sled and log 90° (with the newly flattened side against the table) and cut again. You now have two square faces to register against the bandsaw's table and fence for subsequent cuts.

—Mike Goldfine, Kleppe, Norway

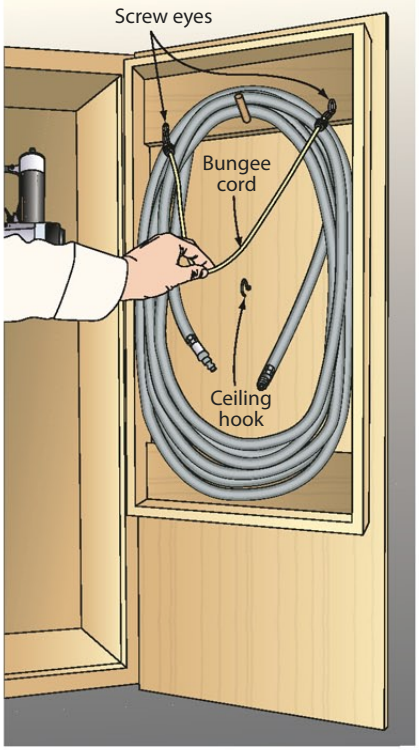




Bungee cord stretches secure hose storage

By storing air hoses and extension cords inside cabinet doors, I maximize my wall space. However, the cords and hoses flopped around each time I opened the door. My solution? Mount two screw eyes and a ceiling hook in a triangular pattern inside the cabinet—the screw eyes outside the air hose, the ceiling hook in the center of the hose coil—and stretch a bungee cord between them. To free the hose, I just slip the bungee out from the ceiling hook and lift it above the hose.

—Russell McLennan, Tyler, Texas



3 Plenty-strong Plywood Joints

Plywood's multiple layers (or plies) make it more economical and resistant to seasonal movement than solid wood, especially for large panels. But those plies also weaken butt joints in project construction. These three joinery methods maximize the strength of plywood joints.

1 Full-width dado or groove

Strong, reliable, and easy to make, a full-width dado (across the grain) or groove (along the grain) perfectly captures the mating workpiece with glue surface all around. As a general guideline, cut a dado to a depth about half the thickness of the plywood. A cabinet, bookcase, or dresser built with snug-fitting, glued-together dado joints will last for decades.

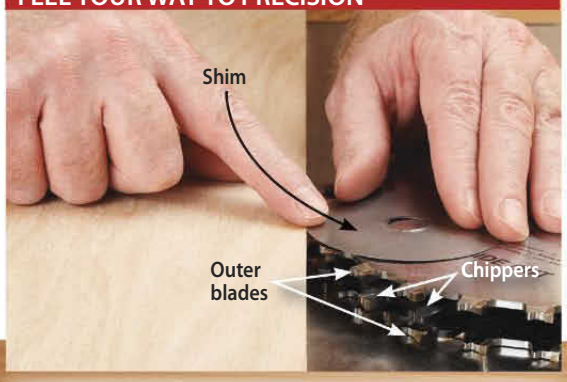
You can cut dadoes and grooves with a tablesaw or router. We like using a stacked dado set on a tablesaw because it's quick and easily repeatable.

Stack the right combination of chippers, shims, and outer blades, shown *below left,* to match the plywood thickness, and install that setup on your tablesaw. Make test cuts in scrap until you get the right fit—the inserted workpiece should slide in and out of the dado with moderate hand pressure but not fall out when held upside down. Add or remove shims as needed.

Once you get your stack set up, you can cut all your dadoes for stock of that thickness. Registering against the rip fence, as shown *below,* guarantees that all cuts made on matching workpieces will be perfectly aligned.

For corner joints, this channel becomes a rabbet. Because you lose one of the glue surfaces of a dado, it's best to use a rabbet in conjunction with an additional form of support, such as screws or a solid-wood face frame covering the exposed edges.

FEEL YOUR WAY TO PRECISION



Stack the dado set's outer blades, chippers, and shims next to the plywood and feel for a combination equal in thickness.

USE THE RIP FENCE AS A STOPBLOCK

You can safely use both the rip fence and miter gauge for making dadoes because you're not cutting through the board.

Watch a FREE video showing an easy method for matching a dado blade to plywood thickness at woodmagazine.com/perfectdadoes.

continued on page 16

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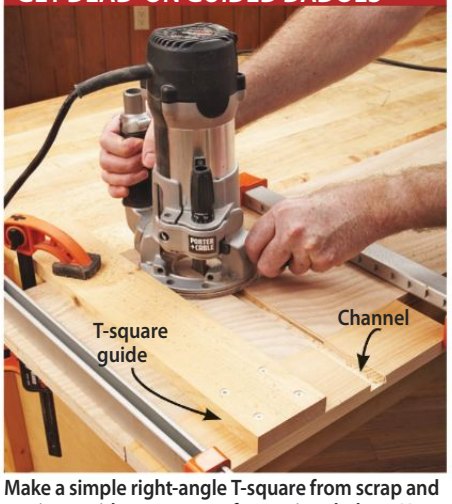
2 Shouldered dado

This joint matches a narrow dado with a tongue, created by cutting a rabbet on the insert workpiece. And when you use this joint at a corner—where it shines best—it becomes a lock-rabbet, providing more glue surface, greater strength, and superior rigidity to a standard rabbet joint.

Cutting a shouldered dado requires machining both mating pieces. First, cut the dado with your tablesaw's dado blade or a router with a straight or downcut spiral bit, as shown *below left*. Next, cut the rabbet on the mating piece (*center* photo) so the tongue fits precisely in the dado. (Make cuts in test scrap to fine-tune the fit.)

GET DEAD-ON GUIDED DADOES



Make a simple right-angle T-square from scrap and use it to guide your router for cutting dadoes. Use the channel in the arm to line up the next dado.

ROUT RIGHT-ON RABBETS

Use a rabbeting bit to cut a precise tongue length; change bearings for different lengths. Adjust the bit's cutting depth to control the fit of the joint.

QUICK TIP: AVOID TONGUE ON TOP

For maximum strength, place the tongue on the bottom of the insert piece. This joint split when weight was placed on it.

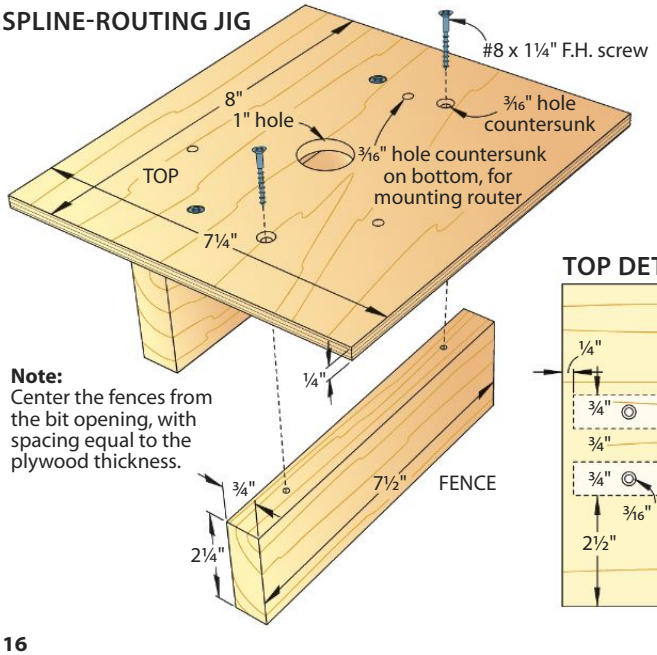
3 Splined butt

To avoid the problem of inconsistent and nonstandard plywood thicknesses, go with this can't-miss joint. Because you custom-make it to suit your stock, plywood thickness proves irrelevant. For never-fail matching channels, cut both with a router and the same straight or spiral bit. Make a router jig from scrap based on the one shown *below,* sized to match your plywood's thickness. (The dimensions of the jig components can vary, but the fences must straddle the plywood snugly while allowing smooth movement.)

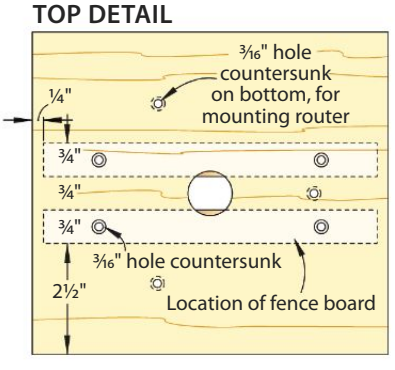
You could also cut the dado easily on a tablesaw with a dado set, but cutting the groove in the mating piece's edge can be tricky, especially for workpieces longer than 2', because you stand them on edge where they can be wobbly. So a router works best.

For maximum strength, size your dado and groove width one-third the thickness of the plywood and the depth half the thickness. With the channels cut, plane a length of hardwood to fit snugly in each, rip it to width, and crosscut to length. Glue all sides of each channel for a strong joint.

SPLINE-ROUTING JIG



TOP DETAIL



CAN'T-MISS CENTERED SLOTS

Make and use the router-mounted jig to ensure perfectly centered grooves on ¾" plywood ends and edges. Then fill with a made-to-fit spline.

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158001

#4½ Bench Hand Plane, V3

The WoodRiver® V3 #4½ Bench Hand Plane is 2⅞" long, 10⅜" wide, has a 2⅜" blade, and weighs just over 6 lbs. Commonly referred to as a smoothing plane, the #4½ offers the user more heft, size and a larger tote than a traditional #4. Features include soles and sides machined flat and square, and minimal tune-up required before use.

158002

#5½ Bench Hand Plane, V3

The WoodRiver® V3 #5½ Bench Hand Plane is 2⅞" long, 14 15/16" wide, has a 2⅜" blade, and weighs slightly over 7 lbs. The #5½ is generally thought of as an all-purpose plane capable of performing the smoothing tasks of the smaller planes and the jointing tasks of the larger planes. Features include soles and sides machined flat and square, and minimal tune-up required before use.

Router-table Pushblock

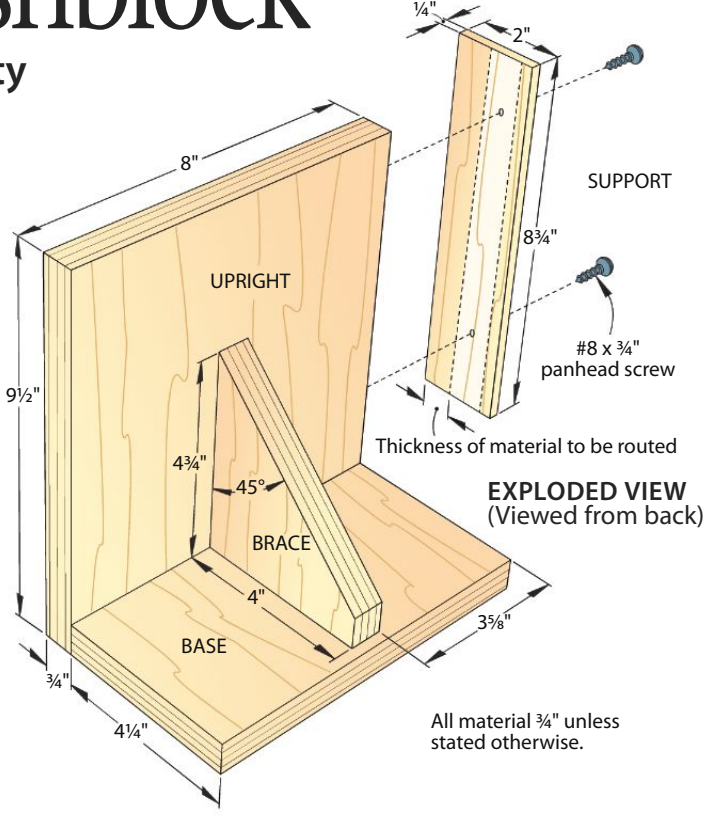
Use it vertically or horizontally for safety and maximum support.

Vertical panel-raising bits don't have the large diameters of their more common horizontal counterparts, so you can use them with single-speed, lower-powered routers. The tradeoff? You have to stand panels on edge, rather than laying them flat on the router table, to cut the profile. That means you have to hold the board tight to the fence with no wobble, which would ruin the cut. To get that secure control, *WOOD*® magazine contributor Tom Iovino designed and built the router pushblock shown here.

When building yours, screw the ¼"-thick support to the back edge of the assembly to limit tear-out and serve as a push cleat. Skipping the glue allows you to replace the support once it gets chewed up from routing.

Use the pushblock by sandwiching the workpiece between the router-table fence and pushblock as shown *above*. Turn the router on and feed the workpiece past the bit to make the cut. In addition to keeping the upright square to the base, the brace serves as a handle.

By making the support as tall as the upright, you can also use the pushblock for routing horizontal pieces as shown *inset*.



EXPLODED VIEW
(Viewed from back)

Project design: **Tom Iovino**, Tampa Bay, Fla.

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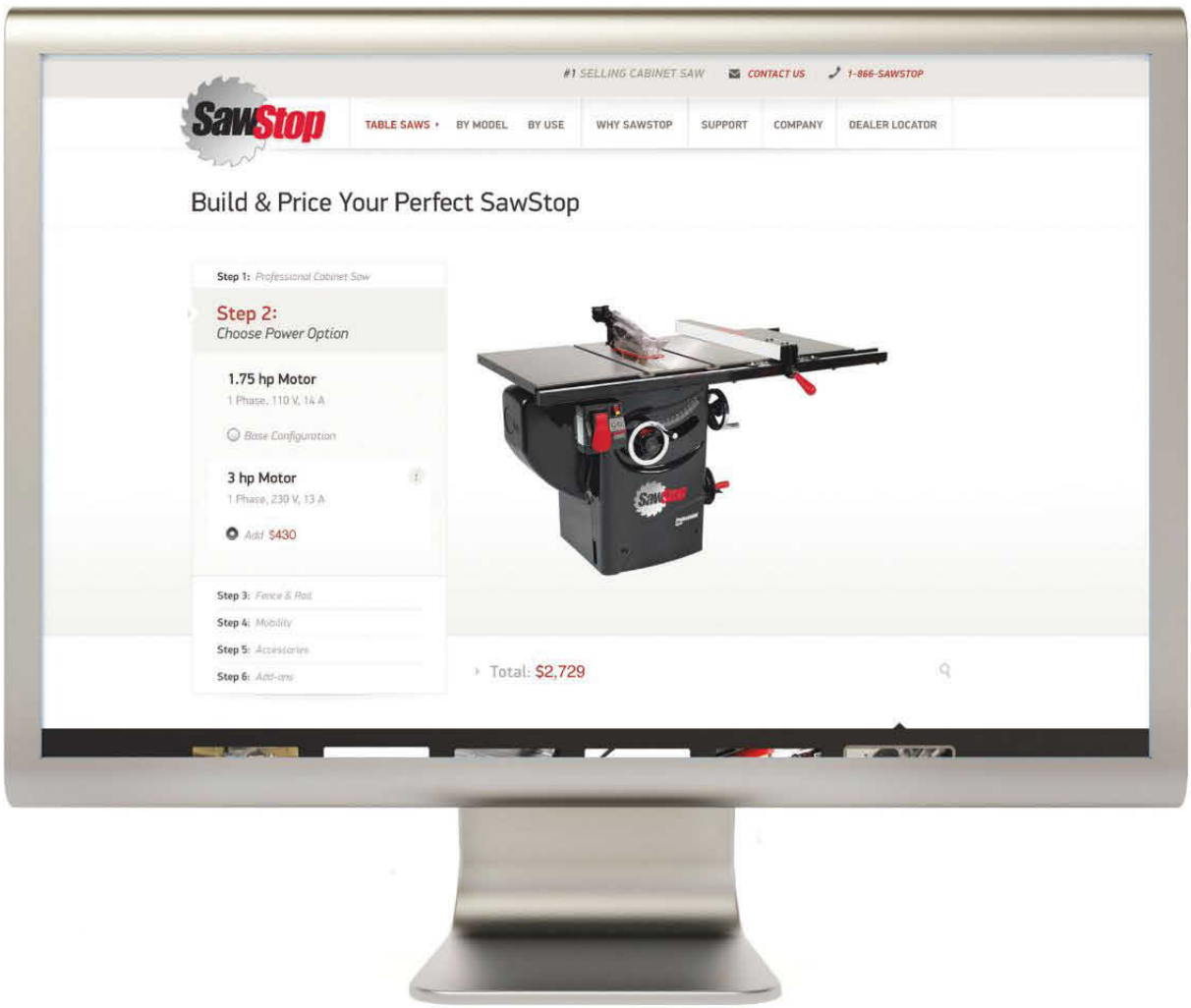

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Build Confidence With Simpler Built-ins

Jennifer Lawrence Photography

If you're early in the woodworking learning curve, you need to know that amazing cabinetry does not require years of experience, an arsenal of complicated joinery techniques, or a workshop full of expensive tools. All one really needs is a strong work ethic (building huge built-ins is a big task!), access to some basic tools, and the following "Sawdust Girl Fundamentals."

Do your own cutting

Because large sheet goods and long lumber are cumbersome, difficult to transport, and heavy, it's often tempting to have the lumberyard break down your lumber for you. But unless they are VERY particular about accuracy, trusting your own cuts will save you time in the long run.

My "must-have" tools for cutting: a circular saw with a decent rip guide and a mitersaw. That's it! Well-tuned, the mitersaw handles lumber for face frames while a circ saw set up as shown *below* cuts sheet goods as accurately as a tablesaw for one-tenth the price.

Choose simple joinery

Dadoes, rabbets, tongue-and-groove, mortise-and-tenon, dowels, biscuits—these joints require precision, equipment, and skills that may overwhelm a beginner. Instead, opt for simple butt joints, securing them with glue and screws, *below center*. They're plenty strong for most cabinet applications, especially once they're stiffened by face frames and bolstered by neighboring cabinet boxes.

Use a pocket-hole jig to build and attach face frames to the cabinet. Where it's impossible to build a face frame separately and attach it, I fasten it to the cabinet piece by piece with glue and nails.

Keep things square and level

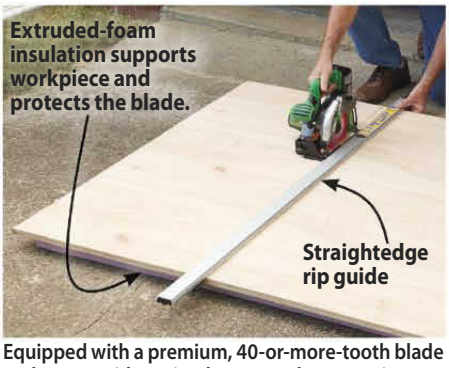
Two places to avoid skimping: squaring and leveling during assembly and installation.

Out-of-square cabinets cause gaps, leaning, and can weaken the units. Make sure each box is perfectly square before moving on. Corner clamps and right-angle braces, *below right*, double as an extra set of hands while squaring the case during assembly.

Installing your built-ins perfectly level is just as important. Level and plumb your cabinets in every direction. You might have to get "shim-happy" but that's OK! No house is exactly level; there will be imperfections in your floors, walls, and ceiling. So use as many shims as you need.

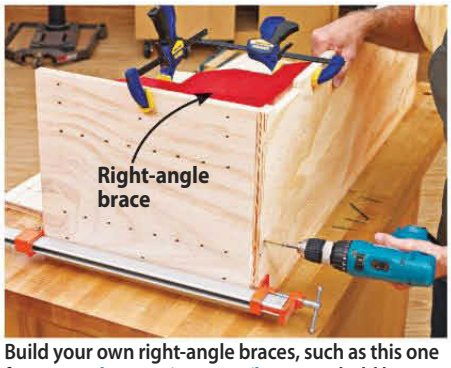
Once you've built some confidence in these basic skills, you'll be ready to take on an entire houseful of amazing built-ins. Now if you'll excuse me, I have some cabinets to build!

*A DIY coach, Sandra "Sawdust Girl" Powell, above, mentors homeowners in design and carpentry skills both in person and through her blogs at **sawdustgirl.com** and **thesawdustdiaries.com**. She encourages beginning woodworkers to find a mentor, and advanced woodworkers to pass on their skills.*



Equipped with a premium, 40-or-more-tooth blade and a saw guide, a circular saw makes a precise, tear-out-free cut.


Self-drilling, multi-material screws, such as these from Spax, prevent splitting while eliminating the time-consuming job of drilling pilot holes.



Build your own right-angle braces, such as this one from woodmagazine.com/brace, to hold large workpieces square during assembly.

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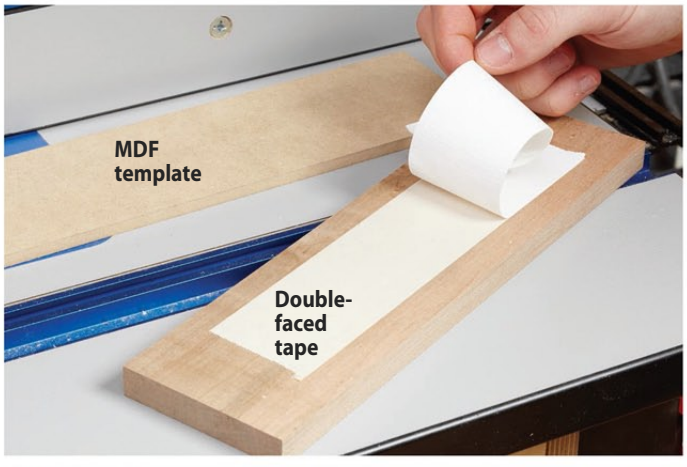
Begin by cutting your workpieces to final width and length. At the same time, also cut a plywood or MDF template to the same dimensions. (Because this technique calls for removing the flat edge of the workpiece, the template provides a surface to ride against the bit's bearing.) Double-face tape the template to the "good" face of the workpiece (*right*), keeping the ends and edges flush.

Adjust the router-table fence so it sits flush with the bit bearing, and the bit height to cut the full thickness of the workpiece, leaving the template untouched. With the help of a scrapwood backer block to keep the workpiece steady during machining, make the cut. Rotate the workpiece and cut the opposite end. Reuse the MDF template for identical pieces. ***Note:*** *If your router lacks the power to make a full-depth chamfer cut, make a template for each workpiece and cut all the workpieces at partial depth. Adjust the bit depth and cut all the parts again, creeping up to the final depth.*



More Resources

- Strengthen those miters with splines. See the jig at **woodmagazine.com/splinejig**
- Find tons of router tips at **woodmagazine.com/routingtips**

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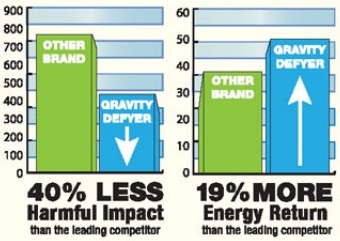

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When to Finish Before Assembly

Most of us apply linear thinking to project building: Cut parts to size, fasten them together, and then apply finish. But good woodworkers don't always finish last. In some cases, it makes sense to apply finish before you glue parts together.

For example, in the assembly shown *above*, the spindles will be less than 1" apart after being joined to the rails. Brushing on the stain (and later, the topcoat) before glue-up gives you easy access to all sides of the spindles, as well as the full edges of the rails, and avoids uneven coloring from stain stuck in confined places. Painter's tape keeps finish off the tenons, preserving a clean surface for glue-up.

It often makes sense to finish partial assemblies, too. As shown at *right,* staining the cabinet carcase before attaching the back or face frame allows you to work from both the front and rear to reach all surfaces. Staining with those pieces omitted also reduces shadows that mask areas of uneven coverage and eliminates corners where three surfaces meet. Stain, especially a gel type, collects in those hard-to-reach areas, creating a blotch.

Some projects may have parts with different shades of finish, or stained parts next to unstained parts. Staining before assembly ensures each piece gets only the proper color, *below.*

It also pays to finish solid-wood pieces when expansion and contraction could reveal unfinished borders, such as with a raised panel in a frame-and-panel assembly, or the ship-lapped cabinet back *bottom right.* With stain applied to the full width of their front faces, an unfinished edge will never show as the boards swell and shrink across their widths.

STAIN WHEN ACCESS IS EASY

Staining a partial assembly provides better access to its interior. Painter's tape masks glue surfaces for the face frame added later.

KEEP THE CONTRAST

Staining these shelves before screwing them in place gives easy access to all sides of them and eliminates stain creeping onto unstained parts.

PREVENT ACCIDENTAL REVEALS

Overlapping rabbets let these boards expand and contract. Applying finish before placing them prevents unstained edges from showing as they move.

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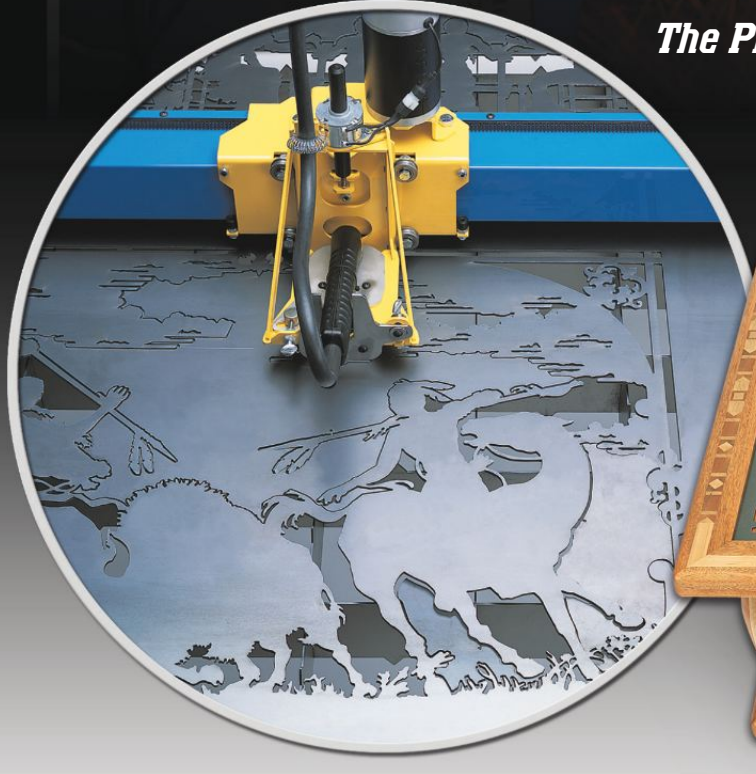

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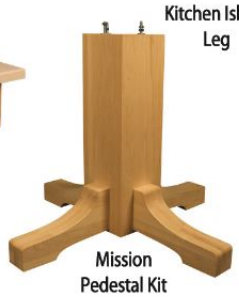
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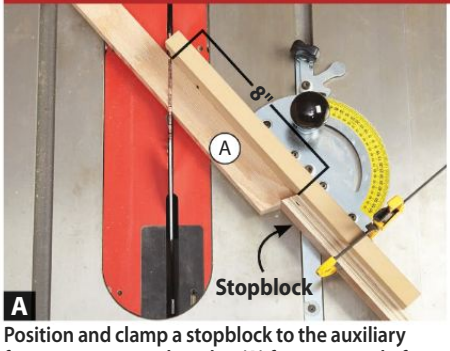
1 From ¾" stock, cut eighteen 1½×15¾" strips. Note: *Machine and cut these strips carefully. Variations in width or wavy edges could throw off the angles of the members when you miter-cut and assemble them.* Set five strips aside for now.

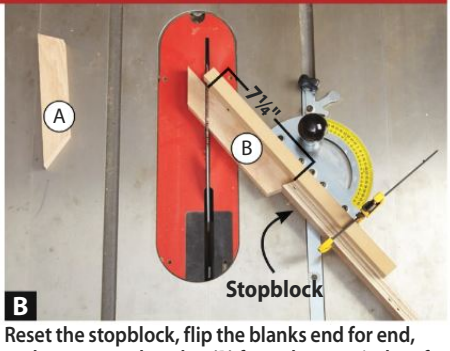
2 Attach an auxiliary fence to your tablesaw's miter gauge, set it to 20°, and trim the ends of 13 of the strips to form parallelogram-shaped blanks for the long legs (A) and short legs (B). From scrap, cut a stopblock with a 20° end.

3 Reset the miter gauge to 50° and, using the stopblock cut previously, cut a long leg (A) and short leg (B) from each of the 13 blanks [**Photos A, B,** and **Drawing 1a**]. Note: *Our aftermarket miter gauge extends beyond the 45° common on some stock miter gauges. If your miter gauge doesn't rotate to 50°, consider creating a simple angle-cutting tablesaw sled. See* **More Resources**.

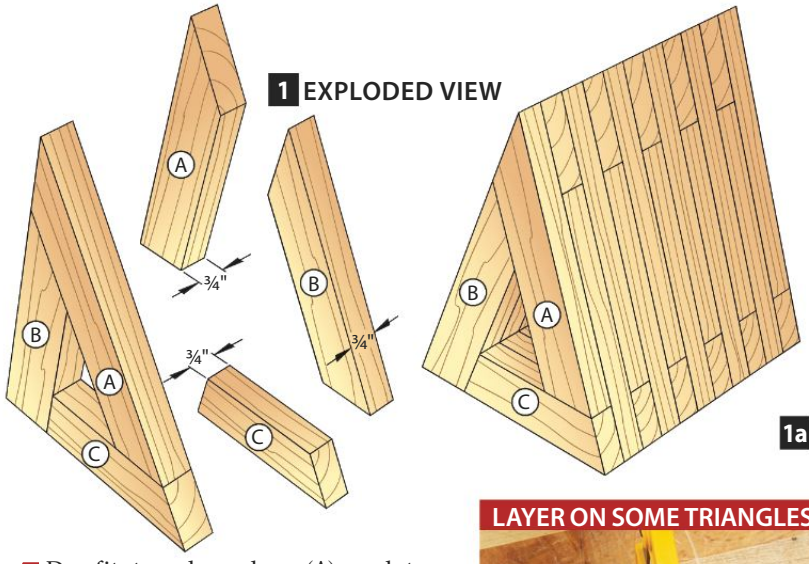
ONE SETUP CUTS TWO LEGS



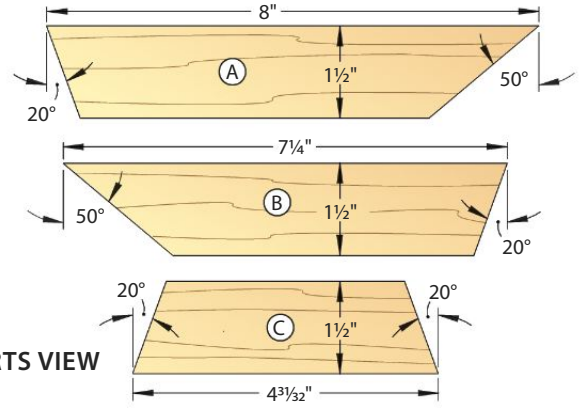
Position and clamp a stopblock to the auxiliary fence to crosscut a long leg (A) from one end of each leg blank.



Reset the stopblock, flip the blanks end for end, and crosscut a short leg (B) from the remainder of each of the 13 blanks.



1 EXPLODED VIEW



1a PARTS VIEW

4 Dry-fit two long legs (A) and two short legs (B), alternating their positions as shown in **Drawing 1**. Measure to find the length for the base (C) pieces. (Dimension noted on **Photo E**. Ours were 4³¹⁄₃₂".) Reset your miter gauge to 20°. Retrieve the remaining five strips and miter-cut one end. Then, position the stopblock to cut 13 bases to length from the strips. Note: *To make the tablet-easel version, cut two of the base pieces 1" longer than the others.*

5 Follow the steps in **Photos C–G** to create six wedge subassemblies (A/A/B/B/C/C). Glue and clamp the subassemblies together (**Photo H**). Then, glue and clamp the final long leg (A), short leg (B), and base (C) to one end of the stand, taking care to continue the alternating leg pattern.

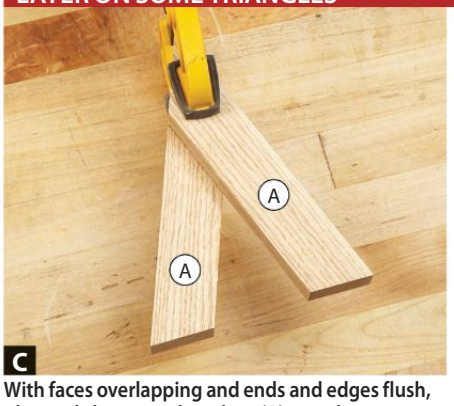
6 Sand the sides through 220 grit and apply a clear finish (we used three coats of aerosol lacquer). If you've built the tablet-stand version, cut PSA friction pad (leevalley.com item no. 88K59.01, $3.60, 800-871-8158) to size and apply it to the top of the two rests. Now, kick up your feet with a good book.

Produced by **Lucas Peters** with **John Olson**
Project design: **John Olson**
Illustrations: **Lorna Johnson**

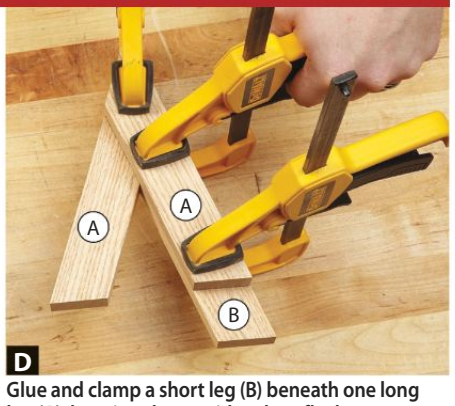
More Resources

▶ Build a simple crosscut sled that can be used to cut angles. Find the plans at **woodmagazine.com/crosscutsled**.

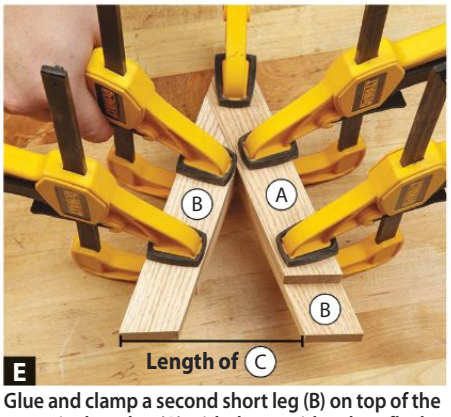
LAYER ON SOME TRIANGLES



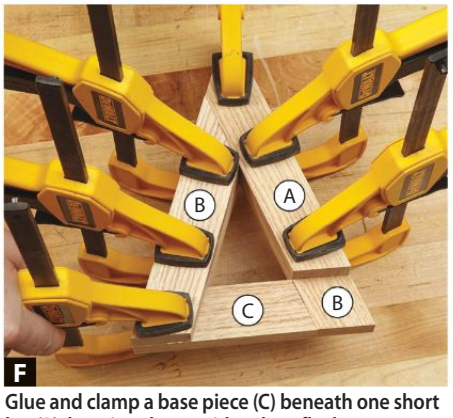
C With faces overlapping and ends and edges flush, glue and clamp two long legs (A) together.



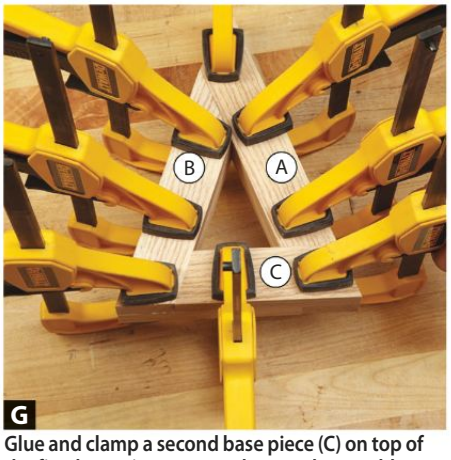
D Glue and clamp a short leg (B) beneath one long leg (A), keeping the outside edges flush.



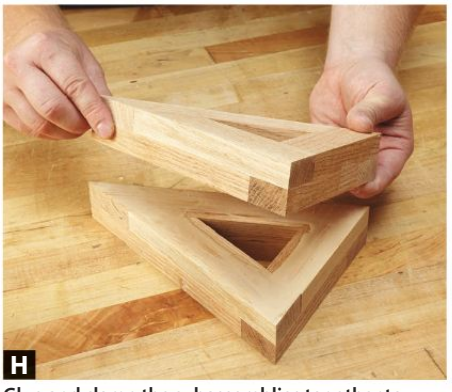
E Glue and clamp a second short leg (B) on top of the opposite long leg (A) with the outside edges flush.



F Glue and clamp a base piece (C) beneath one short leg (B), keeping the outside edges flush.



G Glue and clamp a second base piece (C) on top of the first base piece to complete a subassembly.



H Glue and clamp the subassemblies together to create the stand. For the tablet-stand version, position the subassemblies with extended bases as shown on the previous page.

Handsome Hutch

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Hardware, mirror, tiles—$310

Mission-style furniture remains popular even after more than a century. This hutch, designed in that tradition, will retain its charm for many years to come, thanks to elements such as quartersawn figuring and hand-hammered copper hardware.

First, build the side assemblies

Note: *For best results, and to break up the tedium of sanding, finish-sand parts to 220 grit as you complete them and before assembly.*

1 To create 2"-square legs (A) with quartersawn figure on all four faces, glue two quartersawn white oak boards face-to-face to form each 36"-long leg core [**Drawing 1a**]. Rip the plainsawn edges to bring the quartersawn faces to a width of 1¾". Glue ⅛×2¼×36" quartersawn veneers to the plainsawn faces; then trim away the excess veneer [**Photo A**]. Crosscut the legs to finished length [**Materials List,** *page 36*].

2 Orient the legs with their best grain to the front and label each one (right front, left front, etc.). Using a plunge router outfitted with an edge guide and a ¼" upcut spiral bit, cut stopped grooves ½" deep in each leg. Note that the grooves are positioned toward the outside face of each leg [**Drawing 1**]. Square up the ends of the grooves.

3 Cut the side top rails (B) and side bottom rails (C) to size [**Materials List**]. On each one saw a ¼" groove ½" deep centered on one edge [**Drawing 1**].

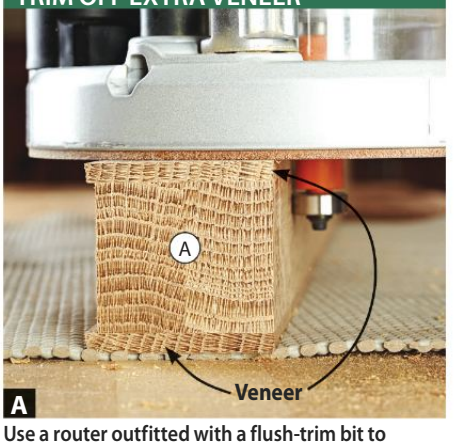
4 Cut ½"-long tenons on the ends of the rails (B, C) to fit the grooves in the legs (A) [**Drawing 1**]. Then, with the same setup, cut ¼" off the bottom of the tenons on each side bottom rail (C).

5 For each side panel (D) prepare two ½×4×25" boards and two ½×4⅜×25" boards. On the outside-facing long edges, rout 1/16" chamfers. Then glue up two panels with the 4⅜"-wide boards on the outside of each panel and the chamfers on the same faces [**Drawing 1**]. This way, all the boards appear the same width once installed. After the glue dries, trim the panels to finished length.

6 Using a router outfitted with an edge guide and a ¾" straight bit, mill a ⅝" rabbet ¼" deep around the back face of the side panels (D) [**Drawing 1**].

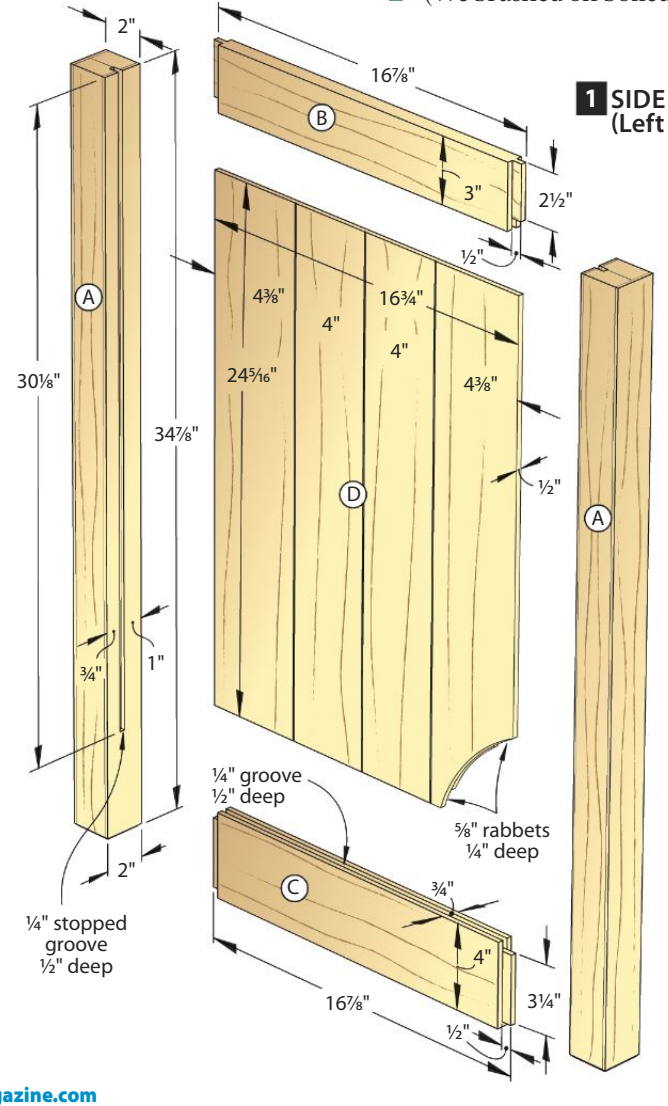
7 Apply a finish to the side panels (D). (We brushed on boiled linseed oil for color followed by three light coats of blonde dewaxed shellac.) Once dry, glue up the side assemblies (A/B/C/D), keeping the legs oriented as you marked them. ***Note:*** *Do not apply glue to the side panels; they must float within the grooves.*

TRIM OFF EXTRA VENEER



Use a router outfitted with a flush-trim bit to remove the excess quartersawn veneer from the legs (A).

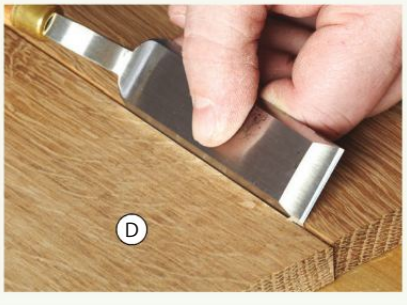
1 SIDE ASSEMBLY (Left side shown)



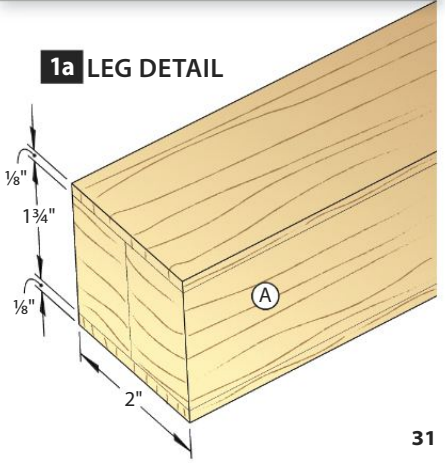
SHOP TIP

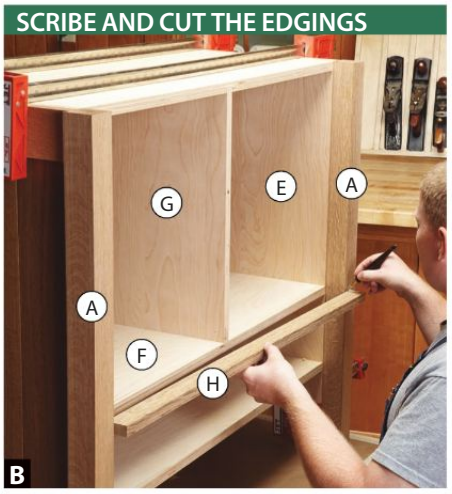
How to get your groove back

The chamfered edges of the boards in the side panels (D) create V-grooves that accent, rather than hide, the joint lines. The grooves also collect glue squeeze-out. To remove it cleanly, let the adhesive set for about 20 minutes; then, gently shave it away. A bench chisel will work, but the blade of a crank-neck chisel, *below*, rests flat against the panel, reducing the chances of digging into the boards.

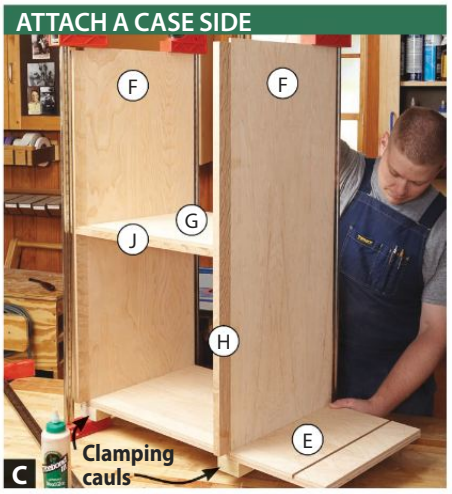


1a LEG DETAIL





Hold each of the dust-panel edgings (H) and the lower rail filler (I) in place. Scribe them with a knife; then, cut them to their finished lengths.



When clamping the first case side (E) to the carcase assembly (F/G/H/J), place cauls beneath the dadoes to distribute clamping pressure.

Spread glue along the inside faces of the top and bottom rails of the side assemblies (A/B/C/D) and then clamp them in position to the case sides (E).

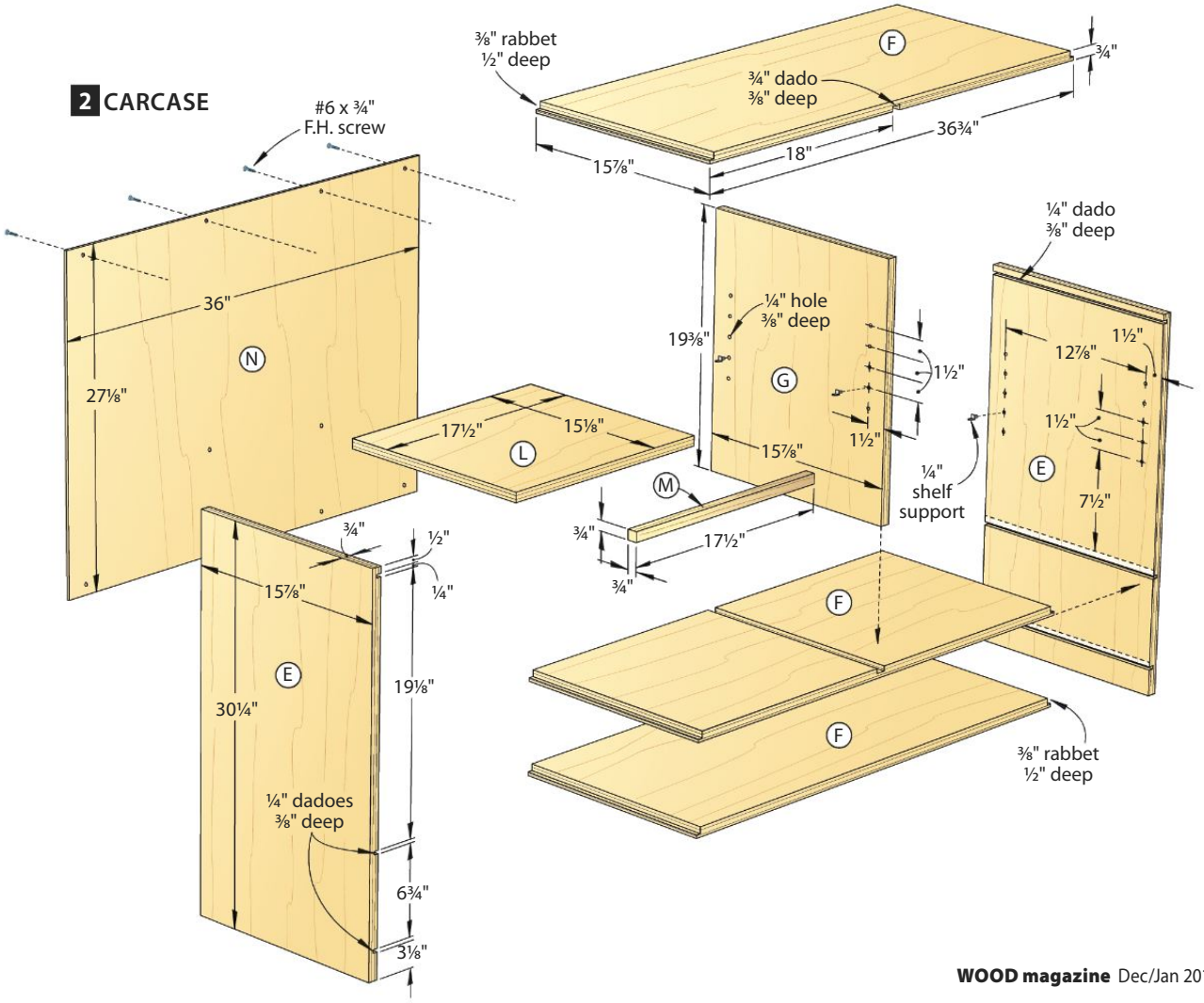
Next, build the carcase

1 From ¾" plywood, cut the sides (E) and the dust panels (F) to size [**Drawing 2, Materials List**]. Check that the sides fit between the legs (A) of a side assembly and rest flush with the inside faces of the legs [**Drawing 3**]. Remove the sides and cut three ¼" dadoes where shown [**Drawing 2**].

2 Rabbet the ends of the dust panels (F) [**Drawing 2**]. Then, cut centered dadoes to accept the divider (G) in the bottom face of the top dust panel and the top face of the middle dust panel.

3 Dry-fit the sides (E) and the dust panels (F), measure for the length of the divider (G), and cut it to size from ¾" plywood. Dry-fit the divider between the dust panels.

4 Clamp the side assemblies (A/B/C/D) to the outside of the dry-fit carcase



assembly (E/F/G). Mark the lengths of the dust-panel edgings (H) and the lower rail filler (I) [**Photo B**] and cut them to size. Then, disassemble all the dry-fit components. Glue and clamp the dust-panel edgings to the front of the top and middle dust panels (F). Then, glue the lower rail filler to the front edge of the bottom dust panel, flush to the top face.

5 Glue the divider (G) between the top and middle dust panels (F). Cut the divider edging (J) to size and glue it to the divider [**Drawing 3**]. After the glue dries, place clamping cauls beneath one of the sides (E), and glue and clamp the dust panel/divider assembly (F/G/H/J) to that side [**Photo C**].

6 Cut the lower front rail (K) to size to match the length of the lower rail filler (I) [**Drawing 3**]. Mark its curve with a fairing stick [**More Resources,** *page 36*], and cut and sand it to shape.

7 Glue the bottom dust panel (F/I) to the carcase assembly; then, glue the other side (E) in place. Glue the lower front rail (K) to the lower rail filler (I), flush at the top. Then, glue the side assemblies (A/B/C/D) to the carcase assembly [**Photo D**].

8 Drill ¼" shelf-pin holes in the sides (E) and both sides of the divider (G) where shown [**Drawing 2**]. Cut the shelves (L) to fit their openings. From ¾"-square stock, cut the shelf edging (M) to the same length as the shelves and glue them in place. Sand the faces flush.

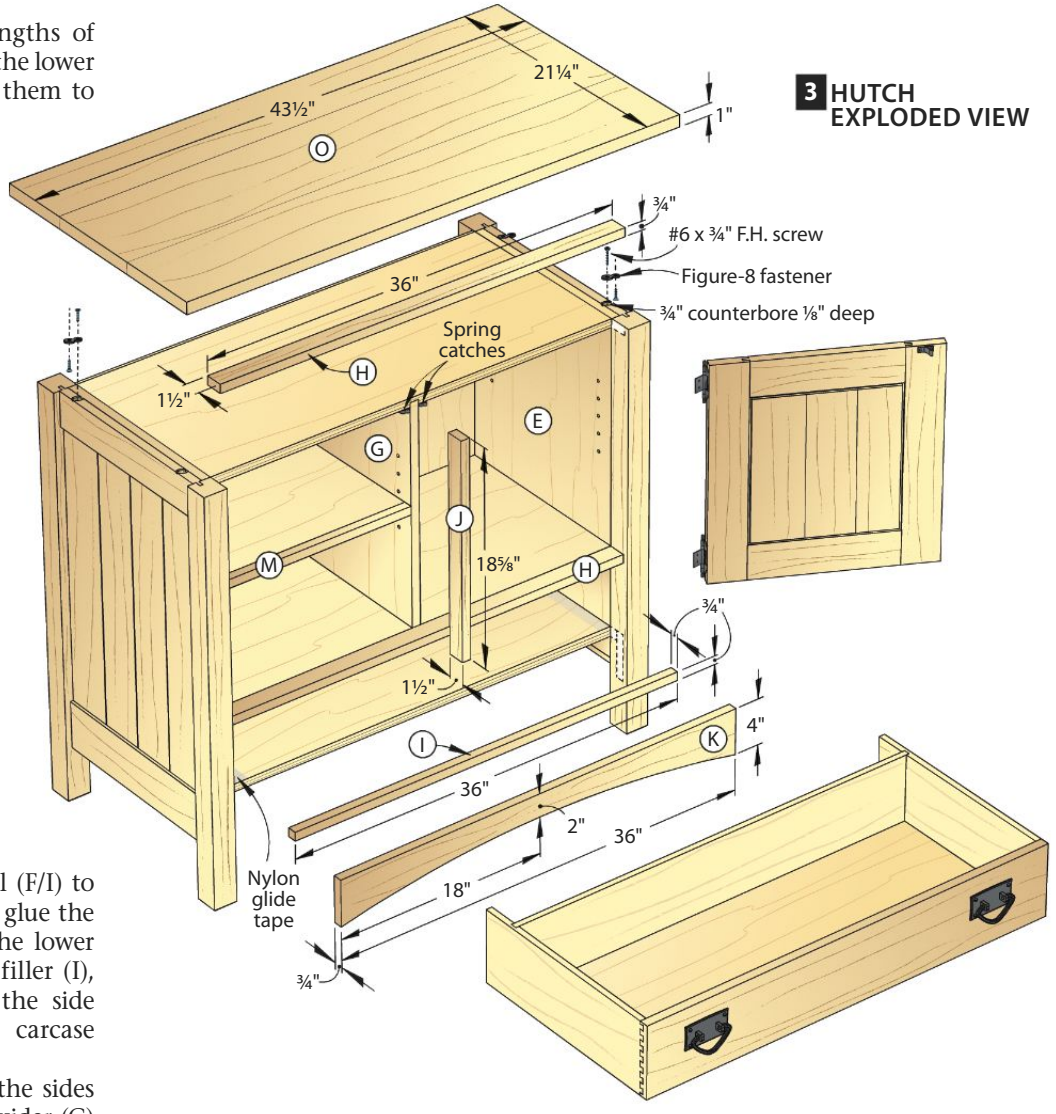
9 From ¼" plywood, cut the back (N) to fit in the rear of the carcase, and screw it in place [**Drawing 2**]. Mill the boards for the top (O) from 1" stock and glue up the panel. After the glue dries, cut the top to size, then set it aside.

Build the doors and drawer

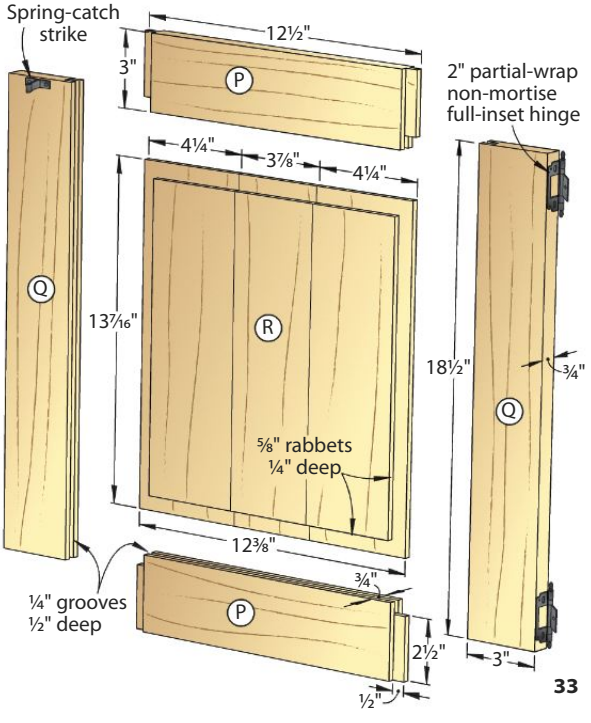
1 From ¾" stock, cut the door rails (P) and stiles (Q) to size [**Drawing 4**]. Cut centered ¼" grooves along the inside edges of the rails and stiles, and cut ¼"-thick tenons on the ends of the rails.

2 Cut the boards for the door panels (R) [**Drawing 4**], chamfering their edges as you did for the side panels (D); then glue up the panels. After the glue dries, rabbet around the panel backs. Apply finish to the panels before assembling the doors. Trim the doors for an even reveal (gap) as shown on the *next page*.

3 To build the drawer, start by cutting the drawer front (S) to size so that when it rests in its opening, you have a 1/16" gap above and at each end of the drawer front. Cut the



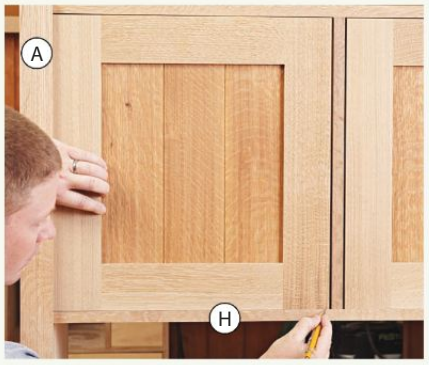
3 HUTCH EXPLODED VIEW



4 LEFT DOOR ASSEMBLY (Inside view)

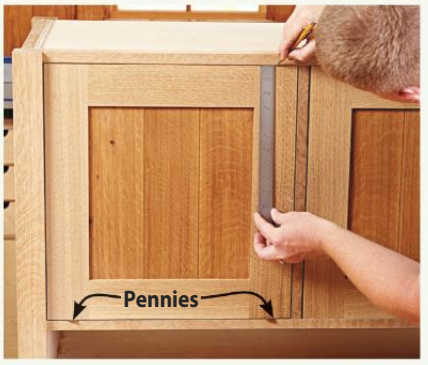
3 easy steps to true doors

To trim doors for an even reveal all around, use a shooting board (see **More Resources**) and this technique:



Step 1 To true the door's bottom edge, start by placing the door into its opening. Pull the hinge side of the door tight against the leg (A) and mark the door bottom to create a 1/16" gap above and parallel to the dust-panel edging (H).

Step 2 Set the door onto the shooting board and use a plane to trim the door edge to the marked line. To avoid damaging the end grain, work from the end of a stile to the middle of the rail, and then flip the door over and plane it from the other direction.



Step 3 Rest the door on two pennies in its carcase opening. Measure the bottom gap, transfer that measurement to the top of the door, and then plane to the line. Finally, trim the edge of the door for a matching even reveal at the case divider.

drawer sides (T), back (U), and bottom (V) to size [**Drawing 5**].

4 Cut half-blind dovetails on the drawer front (S) and sides (T) with a dovetail jig or by hand. (We hand-cut ours with the spacing shown in **Drawing 5a**. If you'd rather, use lock-rabbet joints; see **More Resources** for details.) Cut in the drawer sides and front ¼"-deep grooves to fit the thickness of the drawer bottom. Then, dado the drawer sides to accept the drawer back.

5 Glue up the drawer, checking it for square and that it rests flat. Plane a 1/16" chamfer along the bottom front edge of the drawer front.

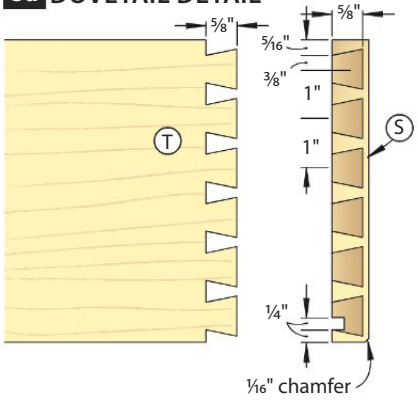
Create the gallery

1 Build up blanks for the gallery posts (W) as you did for the legs (A) and cut them to size [**Drawing 6**].

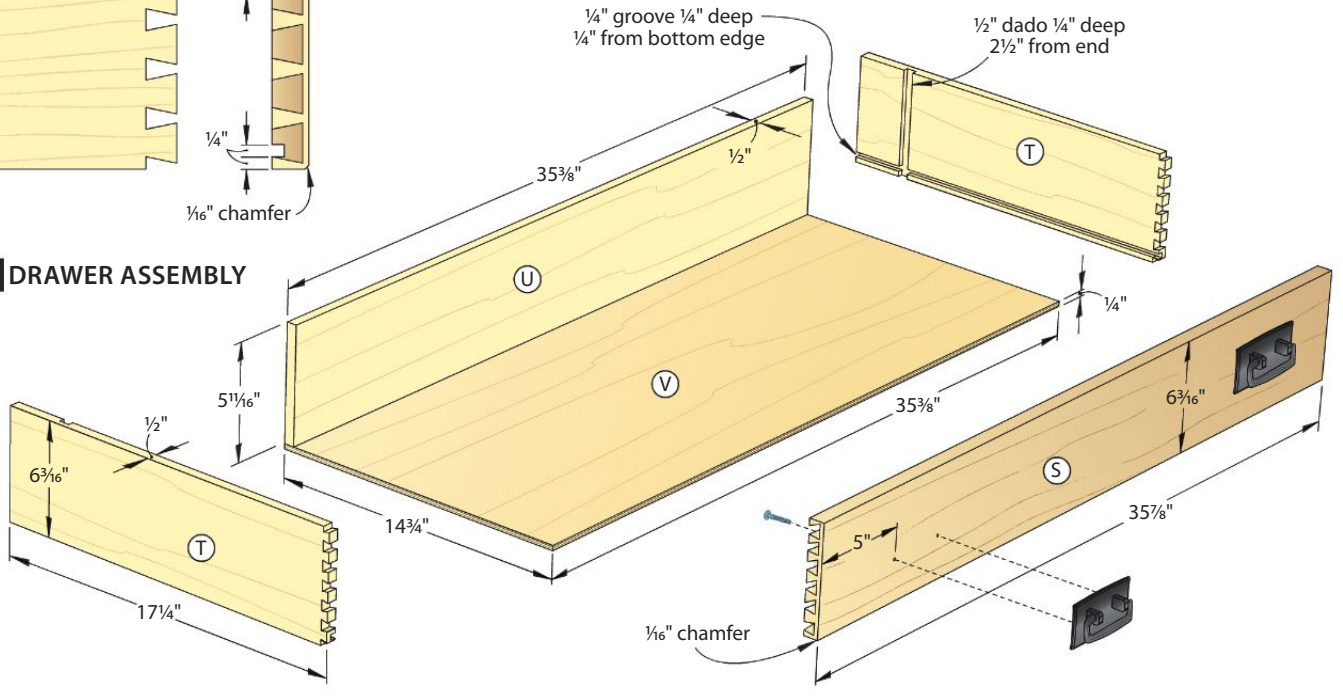
2 Cut to size the gallery rails (X), end stiles (Y), mid stiles (Z), and tile backers (AA). Cut ⅜" rabbets ¼" deep along one edge of the rails [**Drawing 6**]. Cut ¼" rabbets ⅜" deep along one edge of the end stiles, along both edges of the mid stiles, and on the ends of both the end and mid stiles [**Drawing 6a**].

3 With the parts front face down on your bench, glue the gallery rails (X), end stiles (Y), and mid stiles (Z) together, using the tile backers (AA) as spacers between the stiles. Remove the backers after clamping the assembly.

5a DOVETAIL DETAIL



5 DRAWER ASSEMBLY



4 Use silicone adhesive to secure 4×8" decorative tiles [**Sources,** *page 36*] to the tile backers (AA), centering the tiles on the backers, then set them aside.

5 Cut the gallery back (BB) to match the size of the X/Y/Z assembly. To properly position the posts (W) against the end stiles (Y), lay the back on your bench and place the X/Y/Z assembly on it. Glue and clamp the posts to the end stiles with their ends flush and with the posts resting on the bench.

6 Cut the gallery top (CC), brackets (DD), and mirror back (EE) to size [**Drawings 6** and **6b**], and bandsaw and sand the brackets to shape. Set the mirror back aside for now. Glue and clamp the top to the posts (W) and top rail (X) flush with the back face of the posts. Then glue the brackets to the posts, centered on the width of the posts.

Finish it off

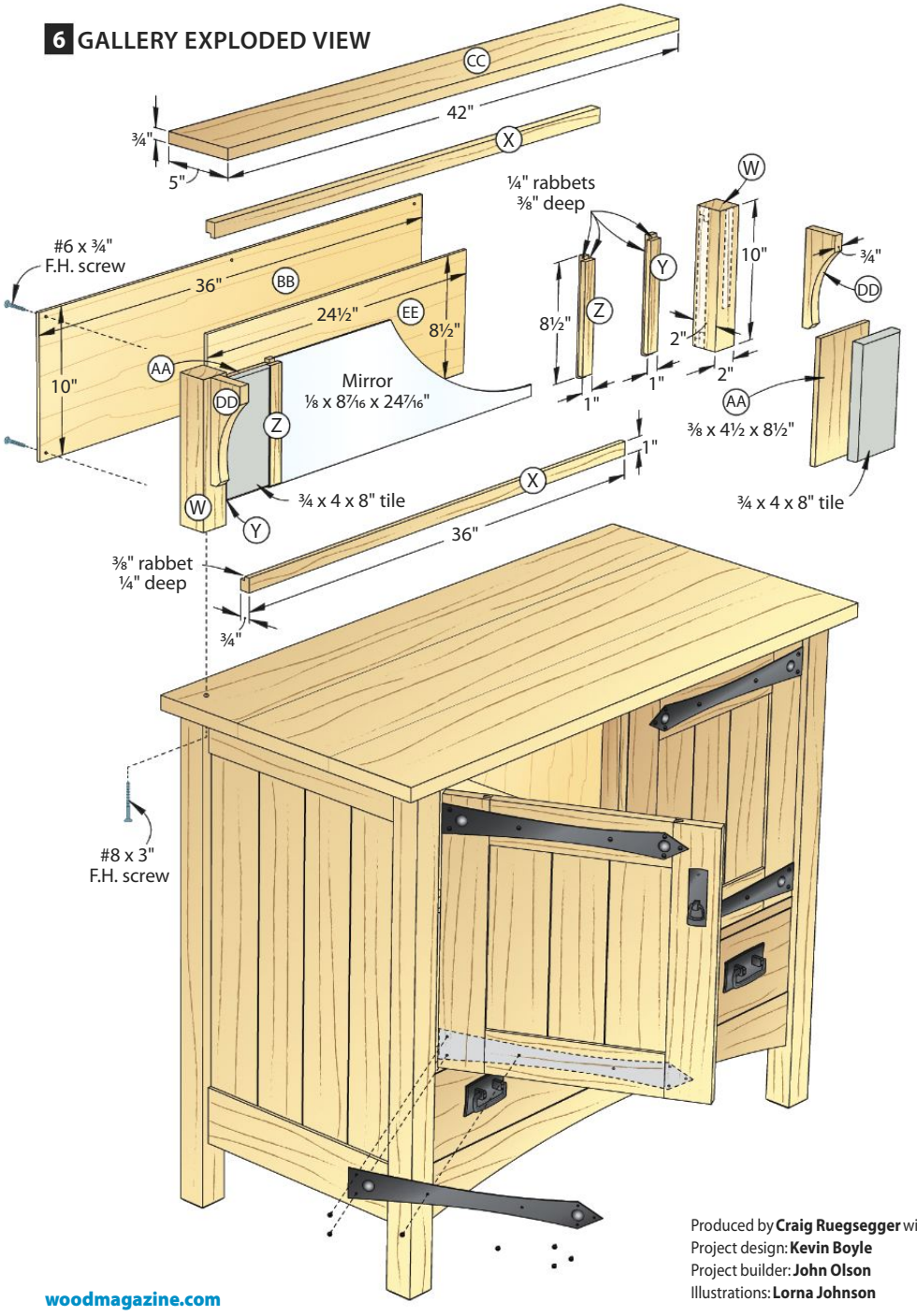
1 Sand all the components to 220 grit. Apply a coat of boiled linseed oil to all surfaces not previously finished; then, apply three light coats of blonde dewaxed shellac.

2 To secure the gallery to the top (O), drive 3" screws through the top into the posts (W) [**Drawing 6**].

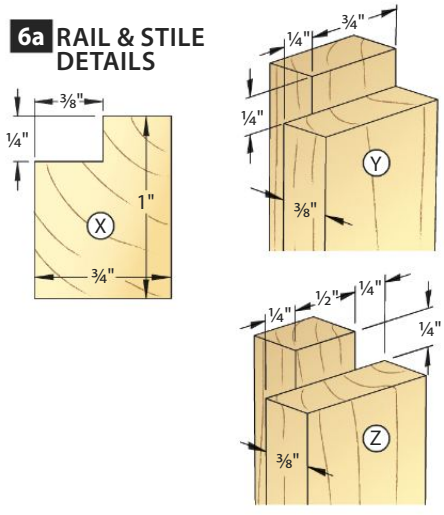
3 Drill counterbores in the side top rails (B) and use figure-8 fasteners to attach the top (O) to the carcase [**Drawing 3**]. As described on the *next page*, age, then attach the door and drawer hardware [**Sources**]. Install the doors in the carcase, and screw the door catches in place. Apply UHMW glide tape [**Sources**] to the bottom dust panel (F), and insert the drawer.

4 Use silicone adhesive to glue the mirror to the mirror back (EE). Place the mirror and tiles/backers into their openings and then screw the gallery back (BB) in place [**Drawing 6**].

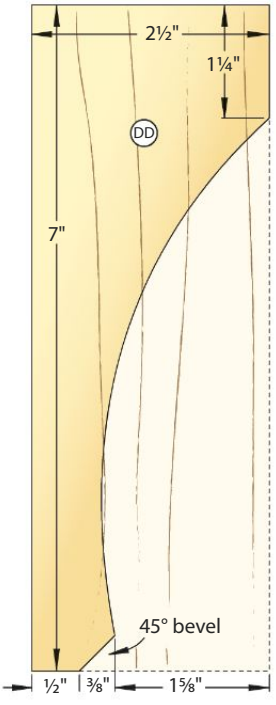
6 GALLERY EXPLODED VIEW



6a RAIL & STILE DETAILS



6b BRACKET DETAIL



Produced by **Craig Ruegsegger** with **Mike Berger**
Project design: **Kevin Boyle**
Project builder: **John Olson**
Illustrations: **Lorna Johnson**

Hand-hammer and instantly age faux strap hinges

This touch of period ornamentation really dresses up the doors.

Step 1 Make a template [**Drawing**] from ¼" hardboard or plywood and trace its shape onto four 14-ga. (40 lb.) 2×16" copper blanks [**Sources**]. Cut the straps to shape using your bandsaw outfitted with an old ¼" blade with 8 or more teeth per inch.

Step 2 Use a ball-peen hammer to work inside the perimeter of the traced circles. Leave the center of the circles untouched.

Step 3 Cut a block of hardwood and drill a ⅞" hole at one end and a ⅜" hole at the opposite end. Insert a ⅜" carriage bolt in the smaller hole. Turn the straps upside down and hammer the domes down into the ⅞" hole.

Step 4 Flip the straps over again, place the hammered domes over the head of the carriage bolt, and work the areas on top of and around the edges of the domes.

Step 5 At your machinist's vise, carefully hammer the remaining areas of the strips.

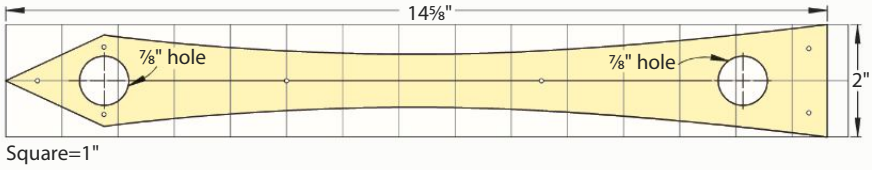
To create the aged patina, follow these steps. Experiment on scrap copper before working on the hinge straps, pulls, and nails.

First, protect your hands with nitrile gloves, and your eyes with safety glasses. Then, clean the copper with denatured alcohol.

Using a foam brush, apply Aluminum Black [**Sources**] to the copper, let it set for one minute, then rinse it off in a bucket of water. Pat the parts dry with towels, then allow them to air-dry completely.

Repeat this procedure with Perma Blue [**Sources**]. To protect the finish, spray the hardware with satin-finish lacquer.

To attach the straps, clip ⅛" from the length of ¾" copper rose-head nails [**Sources**] to prevent them from going through the doors. Drill through the straps and into the doors [**Drawing 6**], then drive the nails with a plastic-head hammer.



Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
Case						
A	*legs	2"	2"	34⅞"	LWO	4
B	side top rails	¾"	3"	16⅞"	WO	2
C	side bottom rails	¾"	4"	16⅞"	WO	2
D	*side panels	½"	16¾"	24⅝16"	EWO	2
E	sides	¾"	15⅞"	30¼"	BP	2
F	dust panels	¾"	15⅞"	36¾"	BP	3
G	divider	¾"	15⅞"	19⅜"	BP	1
H	dust-panel edging	¾"	1½"	36"	WO	2
I	lower rail filler	¾"	¾"	36"	WO	1
J	divider edging	¾"	1½"	18⅝"	WO	1
K	lower front rail	¾"	4"	36"	WO	1
L	shelves	¾"	15⅛"	17½"	BP	2
M	shelf edging	¾"	¾"	17½"	WO	2
N	back	¼"	36"	27⅛"	BP	1
O	top	1"	21¼"	43½"	EWO	1
Doors and drawer						
P	door rails	¾"	3"	12½"	WO	4
Q	door stiles	¾"	3"	18½"	WO	4
R	door panels	½"	12⅜"	13⅞16"	EWO	2
S	drawer front	¾"	6⅜16"	35⅞"	WO	1
T	drawer sides	½"	6⅜16"	17¼"	M	2
U	drawer back	½"	5¹⅛16"	35⅜"	M	1
V	drawer bottom	¼"	14¾"	35⅜"	BP	1
Gallery						
W	*gallery posts	2"	2"	10"	LWO	2
X	gallery rails	¾"	1"	36"	WO	2
Y	end stiles	¾"	1"	8½"	WO	2
Z	mid stiles	¾"	1"	8½"	WO	2
AA	tile backers	⅜"	4½"	8½"	WO	2
BB	gallery back	¼"	10"	36"	BP	1
CC	gallery top	¾"	5"	42"	WO	1
DD	brackets	¾"	2½"	7"	WO	2
EE	mirror back	¼"	8½"	24½"	BP	1

*Parts initially cut oversize. See the instructions.

Materials key: LWO–laminated white oak, EWO–edge-glued white oak, WO–white oak, BP–birch plywood, M–maple.

Supplies: #6×¾" flathead screws (24), #8×3" flathead screws (2), ¼" shelf pins (8), figure-8 fasteners (4), silicone adhesive, ⅛×8⅞16×24⅞16" mirror.

Blade and bits: Dado set; ¼" self-centering, ¾" Forstner drill bits; ¼" upcut spiral, ¾" straight, ¼" dovetail, flush-trim router bits.

Sources

Hardware: 3⅝×1¾" bail pulls, no. 01G60.11, $10.60 (2); 1¼×3¾" door pulls, no. 01G60.21, $7.90 (2); Partial-wrap oil-rubbed bronze ball hinge, no. 01H31.92, $4.30 (4); Small spring catch, no. 00W11.01, $1.30 (2); ¾"×14-ga. copper rose-head nails, no. 91Z30.02, $34.50/lb. Lee Valley Tools, 800-871-8158, leevalley.com.

Copper plates: .062×2×36", no. 8963K136, $28.93 (2), McMaster-Carr, mcmaster.com.

Aluminum Black and Perma Blue: woodmagazine.com/agecopper.

UHMW ("slick") tape: 1"×18 yards, $14.83, woodmagazine.com/slicktape.

Decorative tiles: Find a variety of 4×8" tiles at motawi.com. We selected Long Stem in denim, $49.

More Resources

- To download a free cutting diagram for this project go to: woodmagazine.com/hutchcd.
- Learn how to make and use a fairing stick: woodmagazine.com/fairing.
- Download a plan for a shooting board for a small fee at woodmagazine.com/shootboard.
- Get free instructions for cutting a lock-rabbet joint at woodmagazine.com/lockrabbet.

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CHICAGO ELECTRIC POWER TOOLS

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Hidden-compartment Wall Shelf

Some things belong on display, some things don't. This handsome piece has you covered both ways.

Overall dimensions: 10⅛" W × 25" L × 3" H

Simply slide off the outer shelf to reveal a support frame with storage for valuables.

Build the shelf-support frame

1 From ¾" poplar, cut the frame front and back (A) and frame sides and center (B) to size [**Materials List, Drawing 1, Photo A**]. Mark screw locations on the frame front and back, locating the holes at least ⅜" from the bottom edge of the frame to prevent interference with flush trimming the frame bottom (C) later. Drill countersunk pilot holes on these marks [**Drawing 1, Photo B**].

2 Glue and screw together the frame assembly [**Photo C**], centering the frame's center support (B).

Quick tip! Screws don't have self-drilling tips? Run your drill bit through the pilot holes in the front and back (A) and into the frame sides (B) to prevent splitting.

3 From ¼" maple plywood, cut an oversize frame bottom (C) to 8¾×23½". Glue and clamp the frame bottom to the frame assembly (A/B) leaving an overhang on all sides. When the glue dries, trim the overhanging edges of the bottom [**Photo D**].

4 From ¾"-thick poplar, cut two frame blocks (D) to size. (They help create an air gap to prevent the shelf from clinging to the frame.) Glue the blocks to the front of the frame assembly (A/B/C) where shown in **Drawing 1**.

Cut and assemble the shelf

1 From ¾" maple, cut a 3×48" blank for the shelf front (E) and sides (F).

Quick tip! Because this piece will "wrap" around the wall shelf, cut it from a section of board with impressive figure—we used quilted maple—to make the final result even more stunning.

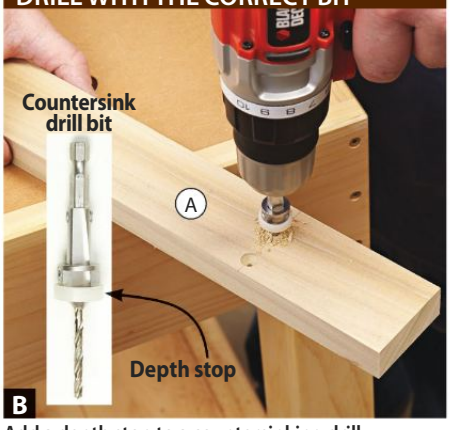
Cut rabbets along both edges of the blank [**Drawing 2, Photo E**]. See "**A quick bit on routing rabbets**," *page 40*.

USE A STOPBLOCK FOR REPEAT CUTS

A

Clamp a stopblock on your miter-gauge extension when cutting the frame parts to ensure consistent, repeatable lengths.

DRILL WITH THE CORRECT BIT



B

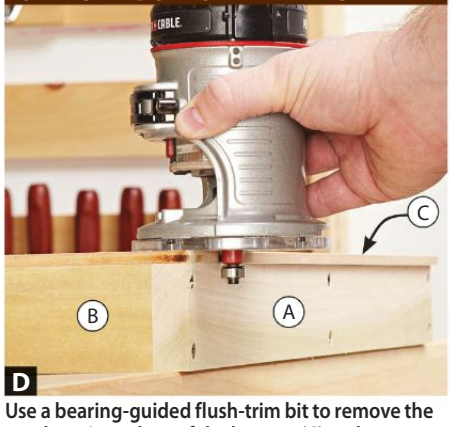
Add a depth stop to a countersinking drill bit—sized for a #8 screw—when drilling the countersunk wall-mounting holes.

SCREW TOGETHER THE FRAME

C

Drive screws through the frame front and back (A), into the two frame sides (B), before screwing the frame center in place.

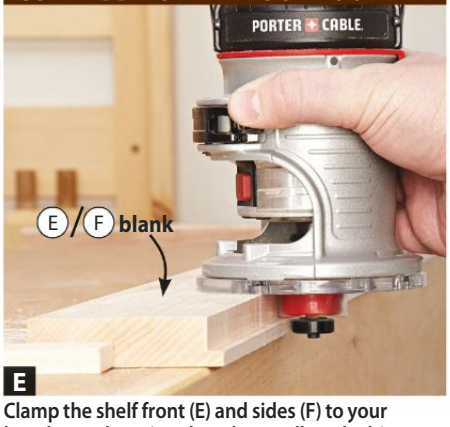
OVERSIZE BOTTOM = PERFECT FIT



D

Use a bearing-guided flush-trim bit to remove the overhanging edges of the bottom (C) and create a perfectly tailored fit.

CUT RABBETS WITH YOUR ROUTER



E

Clamp the shelf front (E) and sides (F) to your bench, overhanging the edge to allow the bit bearing to extend below the workpiece.

ACCURATE CUTS NEED SUPPORT

F

Add support when crosscutting a long workpiece, such as the rabbeted blank, by adding an extension to span the majority of the workpiece.

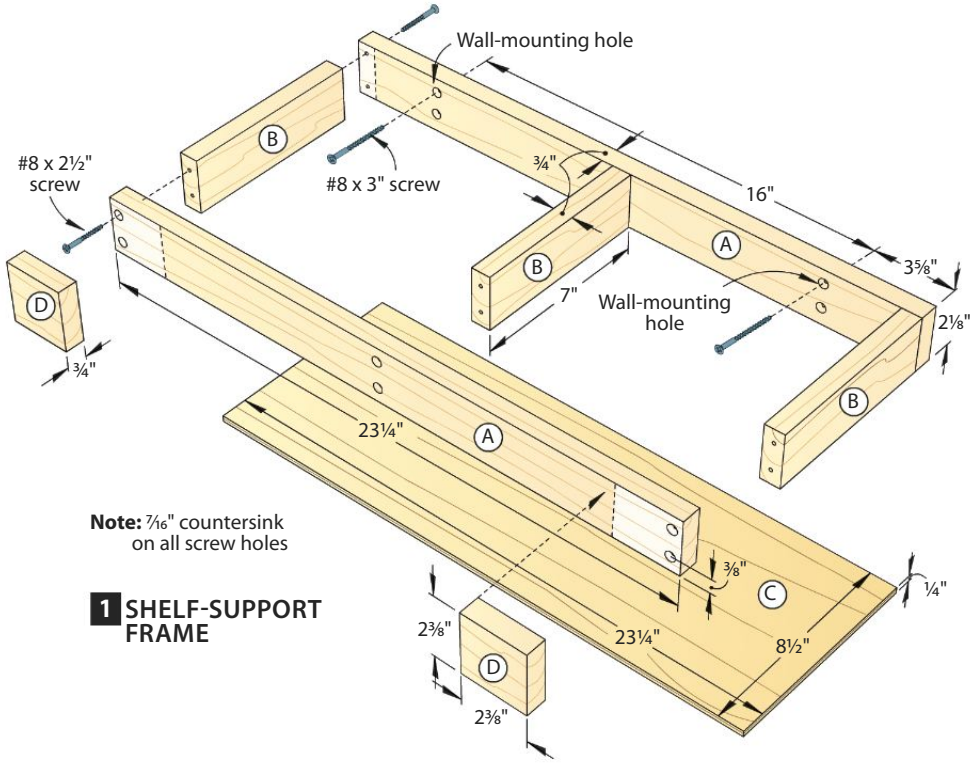
STOP ENSURES EQUAL LENGTHS

G

When crosscutting the shelf sides (F) to final length, clamp a stop to your saw's miter-gauge extension to ensure both sides match.

2 With your tablesaw's blade tilted to 45°, cut the shelf front (E) from the middle of the rabbeted board, leaving enough material on both ends to yield the sides (F) [**Drawing 2, Photo F**]. Return the blade to 90° and cut both shelf sides to length [**Photo G**].

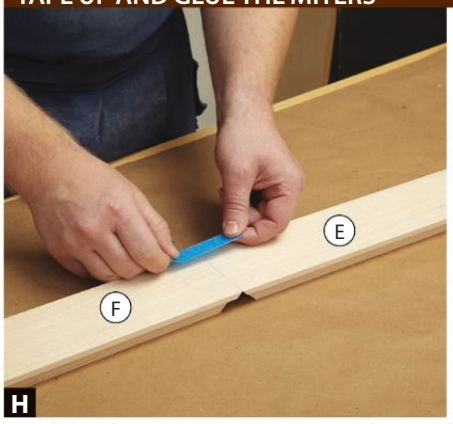
3 Glue the shelf front (E) and shelf sides (F) together [**Photos H, I**].



Note: 7⁄16" countersink on all screw holes

1 SHELF-SUPPORT FRAME

TAPE UP AND GLUE THE MITERS

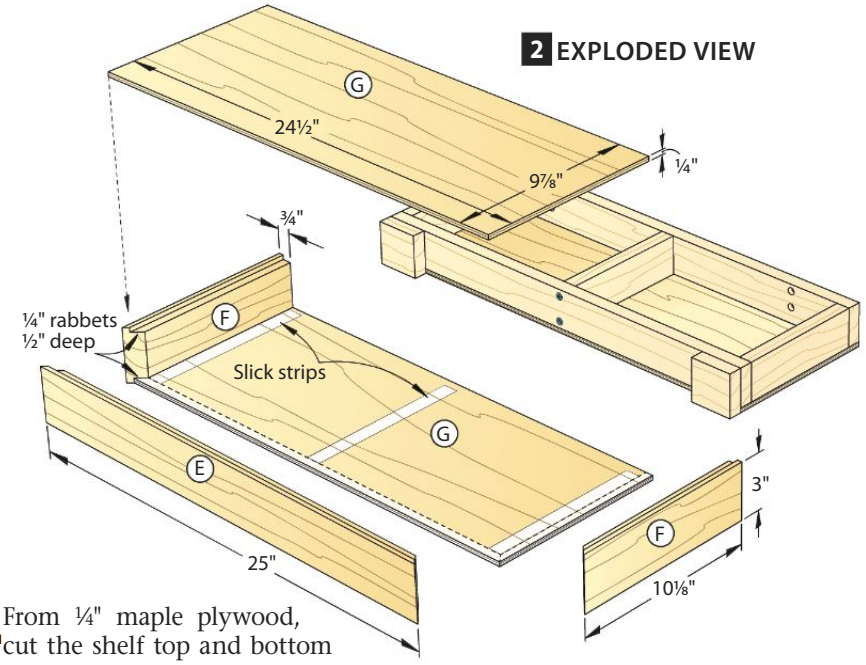


On a flat surface, butt the mitered edges of the shelf front (E) and shelf sides (F), then tape across the joints. Flip the taped assembly inside face up, apply glue to the joints, and fold them together. Stand the assembly on edge, and clamp it to a flat surface until dry.

SLICK UP THE SLIDING SHELF

Apply slick strips to the bottom face of the shelf top (G) where shown, and to the top face of the shelf bottom.

2 EXPLODED VIEW



4 From ¼" maple plywood, cut the shelf top and bottom (G) for a snug fit in the rabbets of the shelf front and sides (E/F). Glue the shelf top and bottom in place.

5 Apply slick strips [**Source**] to the shelf (E/F/G), where shown *above*, to make sliding the shelf onto the frame (A–D) smoother [**Photo J**].

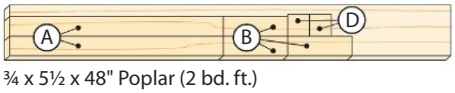
Finalize with finish

1 Apply a stain to the frame (A–D) that contrasts with the finish on the shelf (E/F/G). We brushed on an oil-based cherry stain to the frame; then topcoated with Zinsser's Seal Coat dewaxed blonde shellac. Then, we applied to the shelf three coats of the same shellac with a foam brush, sanding lightly between coats with 320-grit sandpaper.

2 Mount the frame (A–D) to the wall with screws driven into studs. Tuck your valuables inside, and slide the shelf (E/F/G) onto the frame.

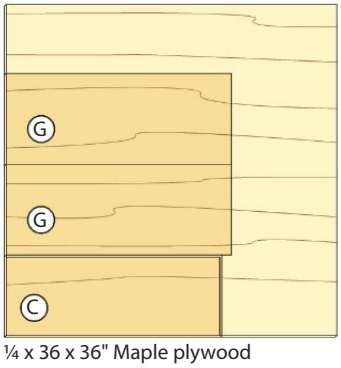
Produced by **Nate Granzow** with **John Olson**
Project design: **John Olson**
Illustrations: **Lorna Johnson**

Cutting Diagram



¾ x 5½ x 48" Poplar (2 bd. ft.)

¾ x 3½ x 48" Maple (1.3 bd. ft.)



¼ x 36 x 36" Maple plywood

A quick bit on routing rabbets

A rabbeting bit set offers excellent versatility when it comes to cutting accurate, clean rabbets. Each set comes with either a 1¼"- or 1⅜"-diameter cutter and an assortment of bearings ranging from ⅜" to 1⅛" in diameter. To change the width of a rabbet, simply swap the bearings. To determine the rabbeting bit's cutting width, subtract the guide bearing's diameter from the bit's diameter and divide in half.

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	frame front and back	¾"	2⅛"	23¼"	P	2
B	frame sides and center	¾"	2⅛"	7"	P	3
C*	frame bottom	¼"	8½"	23¼"	MP	1
D	frame blocks	¾"	2⅜"	2⅜"	P	2
E	shelf front	¾"	3"	25"	M	1
F	shelf sides	¾"	3"	10⅛"	M	2
G	shelf top and bottom	¼"	9⅞"	24½"	MP	2

*Part initially cut oversize. See the instructions.

Materials key: P–poplar, MP–maple plywood, M–maple.
Supplies: #8×2½" screws (12), #8×3" screws (4).
Bits: #8 countersink drill bit; rabbeting and flush-trim router bits.

Source

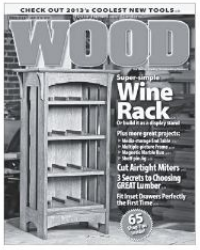
Slick strips: #16L64, $7.99 per 10.5 ft. roll, 800-225-1153, woodcraft.com.

More Resources

- Bonus: FREE floating shelf plan at **woodmagazine.com/floatingshelf**
- Shop for rabbeting bit sets here: **woodmagazine.com/rabbetset**

2013 WOOD® INDEX Issues 216 thru 222

For quick tips on using this index, see *page 44*.



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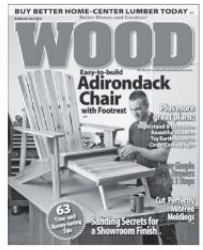

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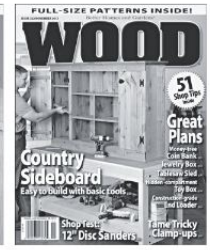

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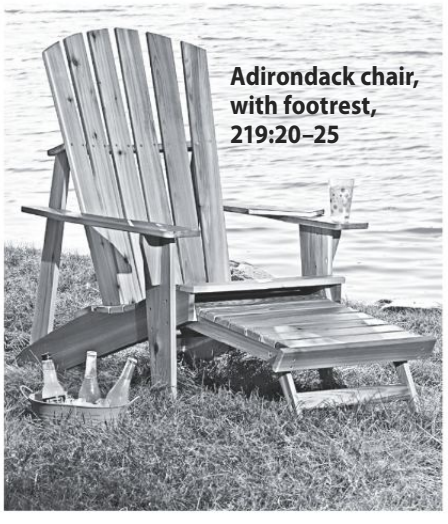
PROJECTS



Adirondack chair, with footrest, 219:20–25

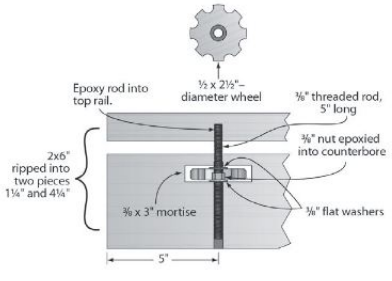
Accent table, 221:30–33

Bookcase, revolving, Danner, 220:60–63

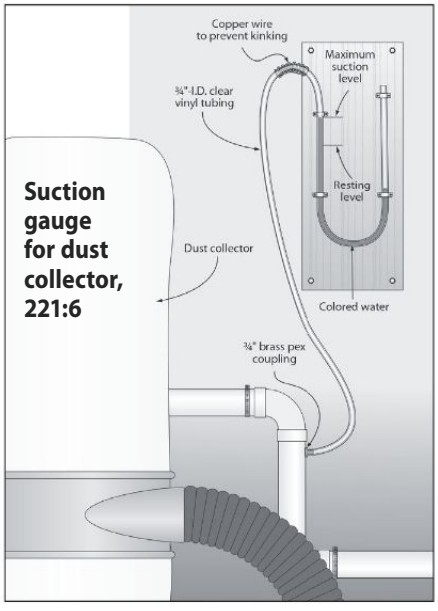
continued on page 42

TOOLS AND MATERIALS

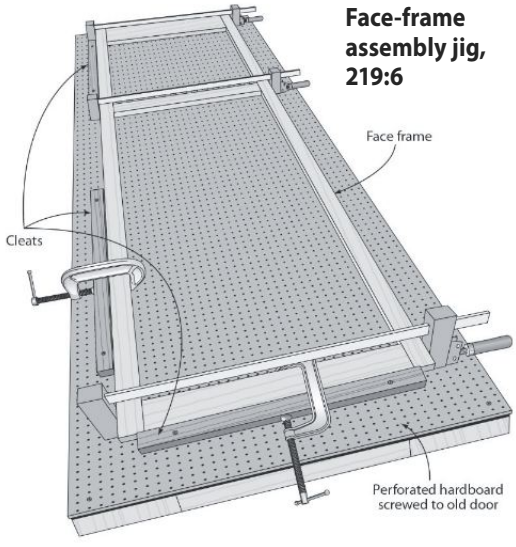
TECHNIQUES AND FEATURES



Sawhorse: leveling adjusters, 222:6



Suction gauge for dust collector, 221:6



Face-frame assembly jig, 219:6

HOW TO USE THIS INDEX

This annual index includes every article and Shop Tip that appeared in *WOOD*® magazine from the December/January 2012/2013 issue through the November 2013 issue. To quickly find the article you're looking for, first identify the major index category most likely to contain the article:

- Projects (plans with step-by-step instructions)
- Tools and Materials (product reviews and guidance on using tools, accessories, hardware, and wood products)
- Techniques and Features (specific skills and articles of general interest such as safety tips)
- Shop Tips/Skill Builders (quick ideas you can put to use in your shop today)

Then look for the one word that best describes the project, technique, tool, or shop tip. Articles with two strong descriptors, such as a mission table, may be found under both descriptors—"mission" and "table."

Three steps to find any article, from issue 1 to present, using the online index

1 You also can quickly search the comprehensive online index of all *WOOD* magazine articles at **woodmagazine.com/index**.

2 In the Keyword Search box, type the *one word* that best describes the article subject, avoiding plurals. For example, to locate a tablesaw review, type "*tablesaw*," (or simply "*table*") but not "*review*." Click on the button marked **Search**. If you want to narrow the search to tablesaw jigs, type "*tablesaw*" in the box, then click on the button next to the words: **Jigs, fixtures, & organizers** under Category Search. Next, scroll down and click on **Search** under Keyword and Category Search.

3 The Web page now displays a list of articles related to your search term, including the cover date of the issue, issue number, and the page number. If you don't have the issue, most articles published in *WOOD* magazine can be downloaded for a minimal cost. This list indicates downloadable articles with the blue words **WOOD Store**, which, when clicked on, give you more details about buying the article. Otherwise, some back issues are available for $7.95 (plus S&H) by calling 888-636-4478.

Keyword Search 'tablesaw'

134 articles from WOOD magazine matched the search criteria you entered.

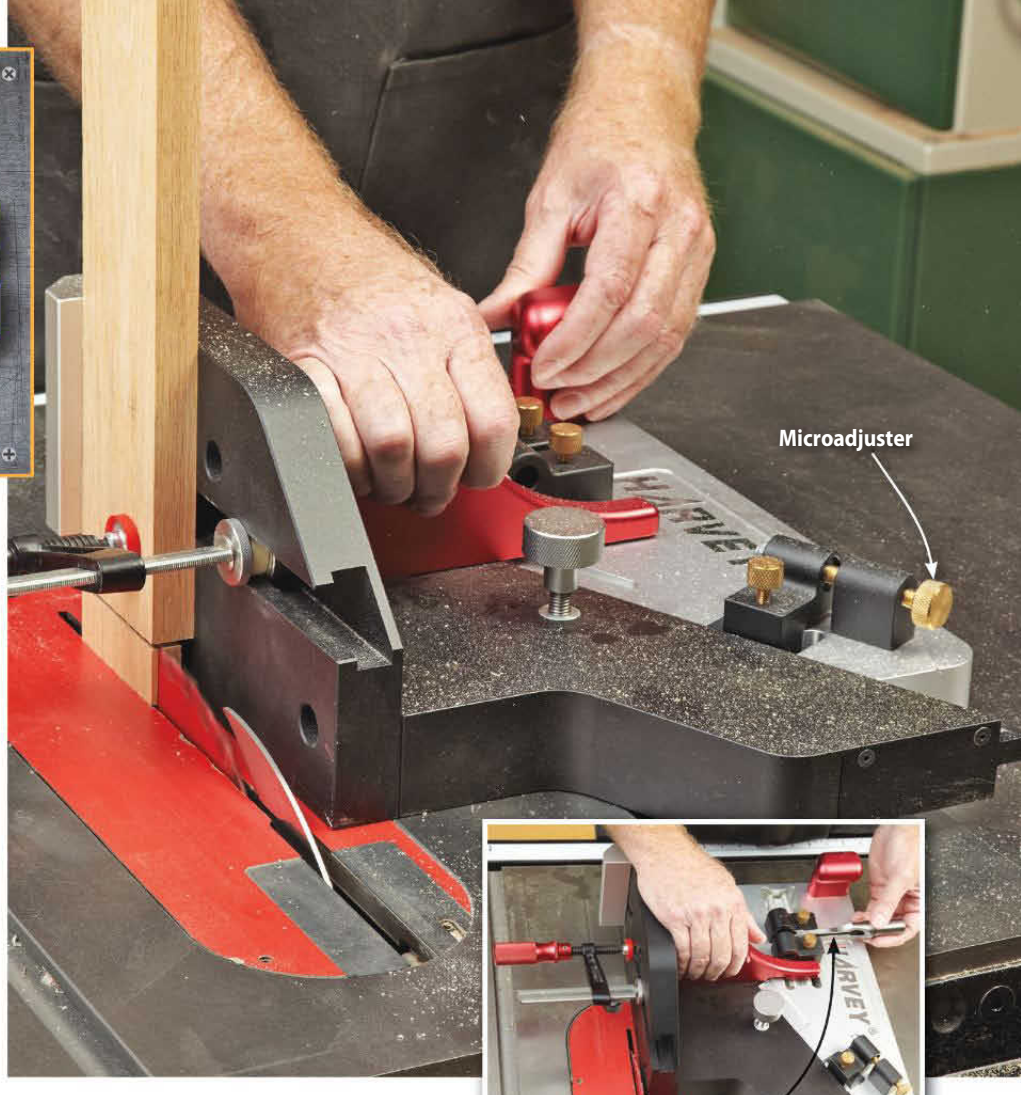
Article	Month	Year	Issue No.	Pa
Kicking Kickback	Dec/Jan	2012	216	46
This article is now available at the WOOD Store on the Complete WOOD Magazine Coll DVD				
Start square to finish square	Oct	2012	214	64
This article is now available at the WOOD Store on the Complete WOOD Magazine Coll DVD				
Tall-Parts Tablesaw Saddle	Oct	2012	214	16

2014 WOOD® MAGAZINE INNOV8 AWARDS

We're always on the lookout for woodworking tools and products that make life in the shop easier, safer, and more precise. Here are eight game-changers that fill the bill for the new year.

Toss the tape, get tight tenons

Measuring for perfect-fitting tenons is *sooo* last year: This jig helps you cut perfectly centered tenons on the tablesaw without using a measuring rule. To set the tenon thickness, simply insert the hollow-mortise chisel, router bit, or drill bit used to cut the mortises; the workpiece itself sets the spacing from the jig fence to the blade. The black front section of the jig slides on linear bearings, while the silver rear half remains fixed to a slot-adjustable miter bar. (For offset tenons, you will need to measure to set up the jig.)



TTJ Trigonometric Tenoning Jig,
no. TTJ-100, $250
Allied industries
tenonjig@alliedindustries.com

Double the power, double your fun

Manufacturers have been powering tools with pricey 36-volt battery packs for years, but Makita has created a shortcut for folks who use its far-more-common 18-volt system. By linking two packs, you get 36 volts of power without buying into another battery platform. So, you can purchase only the bare 36-volt tool with built-in adapter and use packs you already have. Currently, Makita offers a 12" chainsaw, concrete rotary hammer, and blower, with more tools to come. We're eager to see where this goes from here (a 36-volt router or mitersaw, maybe?).

36-volt tools, prices vary by tool
Makita
800-462-5482, makitatools.com

Sliding sleeve spurs safer turning

The spurs on a lathe's spur center have always been exposed, creating the potential for injury or damaged turning tools. But the spring-loaded sheath on Badger spur centers covers the spurs during use, allowing you to turn spindles closer to them than you'd dare with a regular spur center. The center point also retracts, which, when you back off the tailstock force, releases the spurs' grip but keeps the blank mounted. The Badger Pro adds removable spurs that can be sharpened and replaced.

Badger spur centers, Badger $40, Badger Pro $80
Big Tree Tools
888-887-6464, bigtreetools.com

Jigsaw sports top-notch features

Brushless motor technology is not new, but Festool earns kudos for bringing it to the jigsaw category. Festool says the Carvex's brushless motor weighs less and works more efficiently than a standard motor. We also like its innovative 4-LED light system surrounding the blade, as well as its three-point blade guides for perpendicular cuts. Available in top handle, barrel grip, corded and cordless, this saw also uses a tool-free base-changing system with six different bases (five of which are optional, including the angle base shown *below*), to suit various applications.

Carvex jigsaw, no. 420, $350
Festool
888-337-8600, festoolusa.com

Hex-drive screws use one bit for all sizes

Do we *really* need another type of screwdriving system? Hex yeah! Outlaw screws have stepped, hexagonal sockets on their heads that match up perfectly with the included UniGrip driver bit—and one bit fits all sizes of these screws. The multiple mating hexagons create a positive lock between the bit and screw for a solid, slip-free drive. Outlaw screws will hit the market in early 2014, available initially for decking and drywall installation; more types and sizes of screws will follow.

Outlaw screws, prices to be determined
Outlaw Fasteners
704-904-7427,
outlawfasteners.com

"Smart" tools enhance digital capabilities in the shop

Digital drill press impresses

Teknatool launched its innovative direct-drive-motor lathe in 2001, and now applies that same technology to a drill press. This digital-variable-reluctance (DVR) technology allows the 1¾-hp motor to "talk" with the internal microcomputer to optimize performance and conserve energy. Among this machine's features are: load sensing, which optimizes bit speed; chuck proximity sensors to stop the machine if your hand gets too close; a breakthrough sensor to prevent bottom-side tear-out of your workpiece; and sensors that indicate dull or damaged bits. The onboard computer stores programmed tasks, and can receive future software updates.

DVR drill press, price to be determined
Teknatool International
866-748-3025, teknatool.com

Compact CNC router saves space

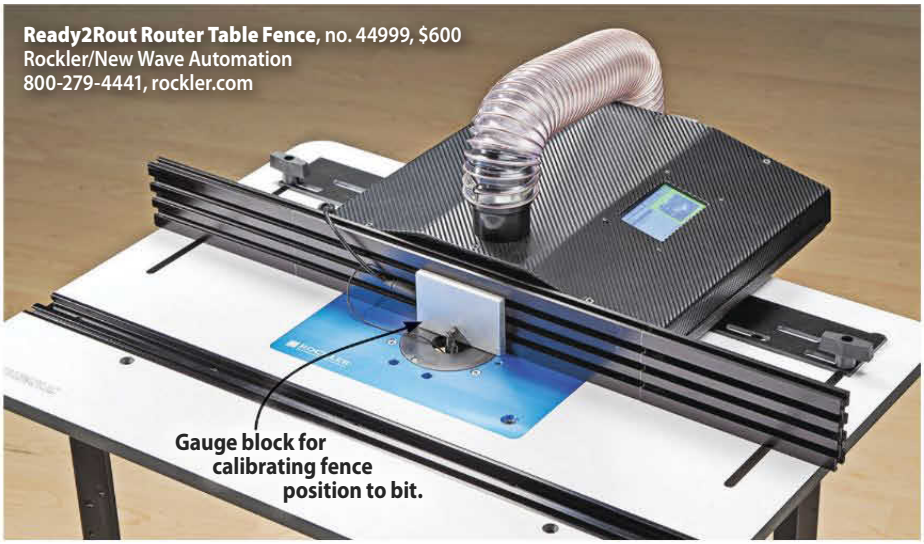
The Handibot—a portable CNC machine about the size of a benchtop planer—can be used on a benchtop or taken to a workpiece or jobsite. The HandiBot uses a computer-controlled compact router or laminate trimmer (not included) to carve, cut, drill, and shape any design you program it to. If the task proves larger than the HandiBot's 6×8" capacity, create your own indexing system to step and repeat until the job is done. The HandiBot runs apps from a personal computer, smartphone, or tablet, and ShopBot plans to have an online network where users can create and share apps and designs.

HandiBot portable CNC machine, $2,500
ShopBot
888-680-4466, handibot.com

Add robotlike repeatability to your router table

Rockler's Ready2Rout fence brings computer-controlled precision to any router table, storing repeatable fence settings for joinery (box joints, dovetails, dadoes) or decorative jobs, such as flutes, with this motorized, leadscrew-driven fence. With preprogrammed operations, such as those mentioned above, and the ability to add your own via a USB port, the electronic keypad automatically (or manually) adjusts the fence forward and back. You still set bit height manually. Fence adjustments can be made within .001", giving you accurate repeatability never before possible.

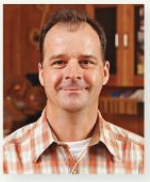
Ready2Rout Router Table Fence, no. 44999, $600
Rockler/New Wave Automation
800-279-4441, rockler.com



Neoclassical Clock

Woodworking may be an age-old skill, but that doesn't mean we can't integrate modern materials into traditional designs. To achieve the classical, gilded appearance of this clock's scalloped accents, we turned to metallic spray paint. The contrast between the gold paint and the natural glow of cherry makes this project stand out, and it'll look as good on your mantel as it would in a French castle.

Kevin Boyle
Senior Design Editor



Machine the parts

1 From 1½"-thick cherry (solid stock looks best, but you could laminate two pieces of ¾" stock), cut the clock body (A) to size [**Materials List**]. Locate the centerpoint of the clock movement hole [**Drawing 1**]; then, bore a 3¼" hole on that point using a Forstner bit or circle cutter. (If you don't own a cutter that size, see **More Resources** for an alternate technique.)

2 From a ¾×2×13⅛" birch blank, cut the subtop (B) and subbase (C) to length. Plane the subtop to ⅜" thick.

3 From a ½×2¼×13⅛" cherry blank, cut the top (D) and base (E) to length. Plane the base to ½" thick.

4 Make two copies of the **Subtop and Subbase Pattern** [**Drawing 2**]. Apply the patterns to the subtop (B) and subbase (C) with spray adhesive; then, bandsaw and sand those pieces to shape [**Photo A**].

Paint and assemble

1 Sand all parts to 220 grit. Apply a primer coat to the subtop (B) and subbase (C), let dry, and spray on two coats of metallic gold paint [**More Resources**].

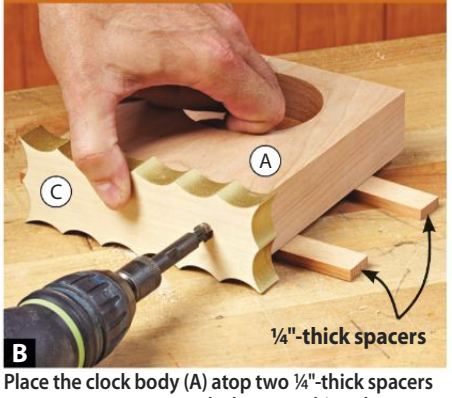
2 Drill countersunk ⅛" pilot holes and drive #8×1" screws through the subbase (C) and into the body (A) [**Photo B**]. Repeat for the subtop (B).

3 Center the top (D) and base (E) on the clock (A/B/C), and then glue and clamp both in place [**Drawing 1, Photo C**].

CUT THE SUBS TO SHAPE

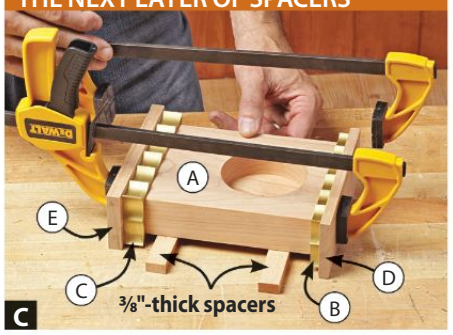
We used a bandsaw equipped with a ¼" blade to shape the subtop (B) and subbase (C), but a #7 blade in a scrollsaw works well, too.

SPACERS GET THE REVEAL RIGHT



Place the clock body (A) atop two ¼"-thick spacers to ensure an even reveal when attaching the subbase (C) and subtop (B).

THE NEXT LAYER OF SPACERS



Make two ⅜"-thick, 7"-long spacers and lay the clock (A/B/C) atop them to keep an even reveal when gluing on the top (D) and base (E).

RADIUS THE CLOCK FEET

Mark a radius on two adjoining faces of the feet (F) blank's ends. Bandsaw along the lines and repeat on the opposite end of the blank.

4 Cut a ¾×¾×12" cherry blank for the clock's feet (F), and cut the feet to shape [**Drawing 1**, **Photo D**]. Sand the feet to 220 grit, and then cut them to length and glue them to the base (E). Repeat this process to make the last two feet.

5 Finish the clock by spraying it with three coats of lacquer, sanding between coats with a 320-grit sanding sponge. Insert the clock movement [**Sources**] and take some time to admire your craftsmanship.

Produced by **Nate Granzow** with **Kevin Boyle**
Project design: **Kevin Boyle**
Illustrations: **Lorna Johnson**

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	body	1½"	5¼"	6"	C	1
B*	subtop	⅜"	2"	6"	B	1
C*	subbase	¾"	2"	6"	B	1
D	top	⅜"	2¼"	6½"	C	1
E	base	½"	2¼"	6½"	C	1
F*	feet	¾"	¾"	¾"	C	4

*Parts initially cut oversize. See the instructions.

Materials key: C–cherry, B–birch.
Supplies: #8x1" flathead screws (4), metallic spray paint.
Bits: 3¼" Forstner bit or circle cutter, ⅛" drill bit.

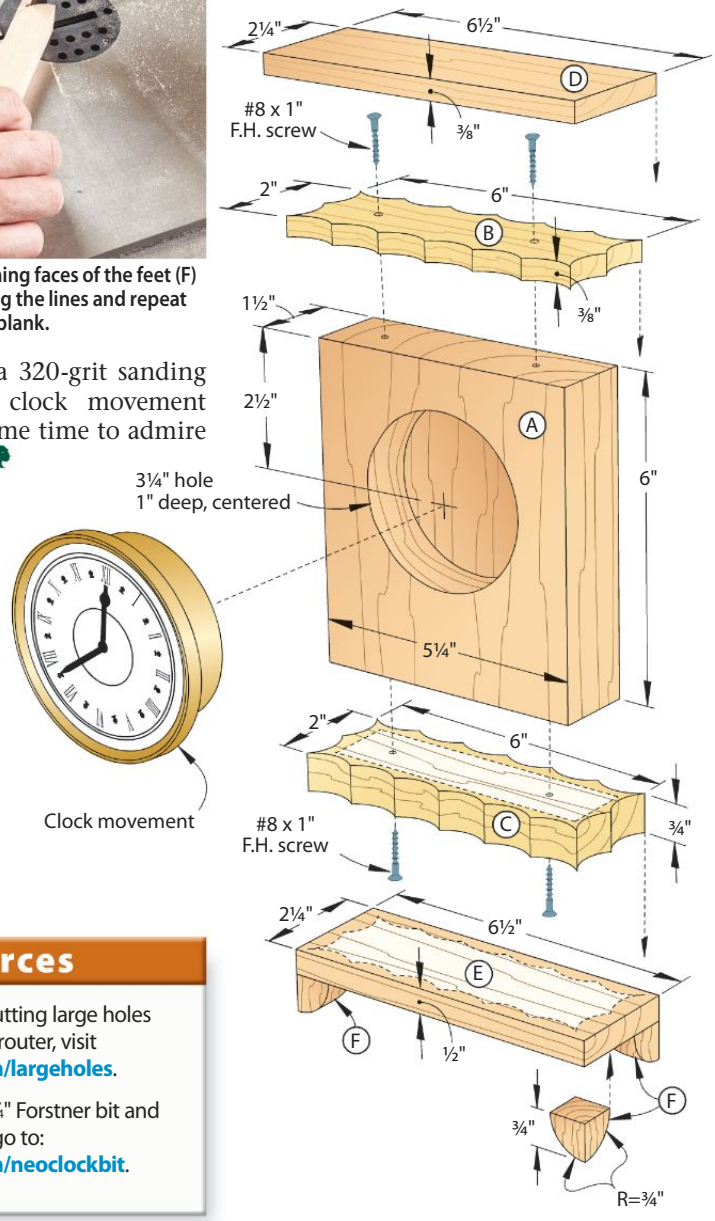
Sources

Clock movement: 3½" Fancy Roman Executive Series Insert, no. 15015, $14.99, 800-556-2548, klockit.com.

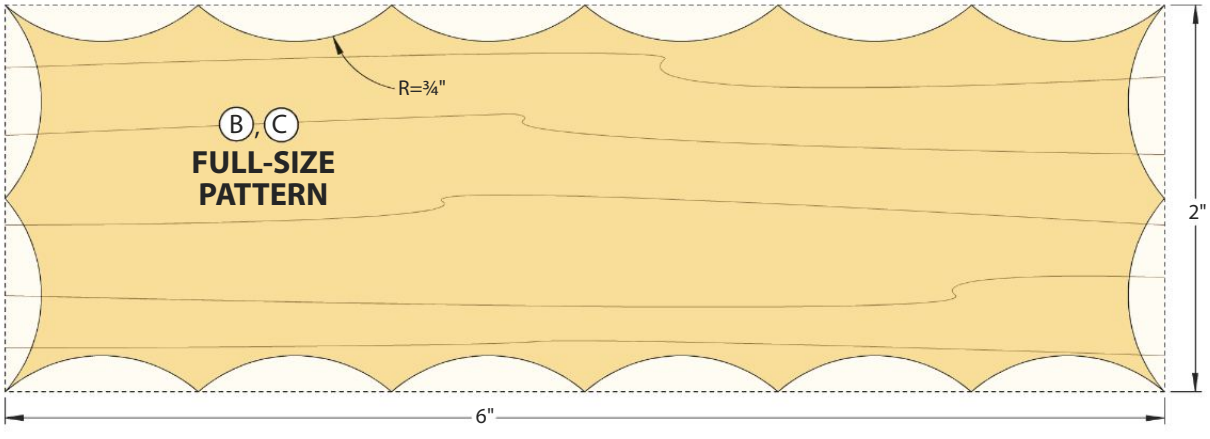
More Resources

- For a free article on cutting large holes with a drill press and router, visit **woodmagazine.com/largeholes**.
- For help locating a 3¼" Forstner bit and metallic spray paint, go to: **woodmagazine.com/neoclockbit**.

1 EXPLODED VIEW



2 SUBTOP AND SUBBASE



Wall-hung Wine Rack

Keep up to eight bottles within easy reach on this simple display.

1 From ¾" stock, cut the sides (A) and top and bottom (B) to size [**Drawing, Materials List**].

2 Install a ¼" stacked dado blade in your tablesaw and raise it to make a ⅜"-deep cut. Position the rip fence ½" from the edge of the dado stack. Using a miter gauge with an extension to back up the workpiece and prevent tear-out, butt the end of each side (A) against the fence and cut the dadoes [**Drawing**].

3 Secure an auxiliary fence to the tablesaw's rip fence and position it next to the blade so it just touches. Reposition the miter-gauge extension so it touches the auxiliary fence. Raise the dado blade to ½", and test-cut a rabbet in a scrap of stock the same thickness as

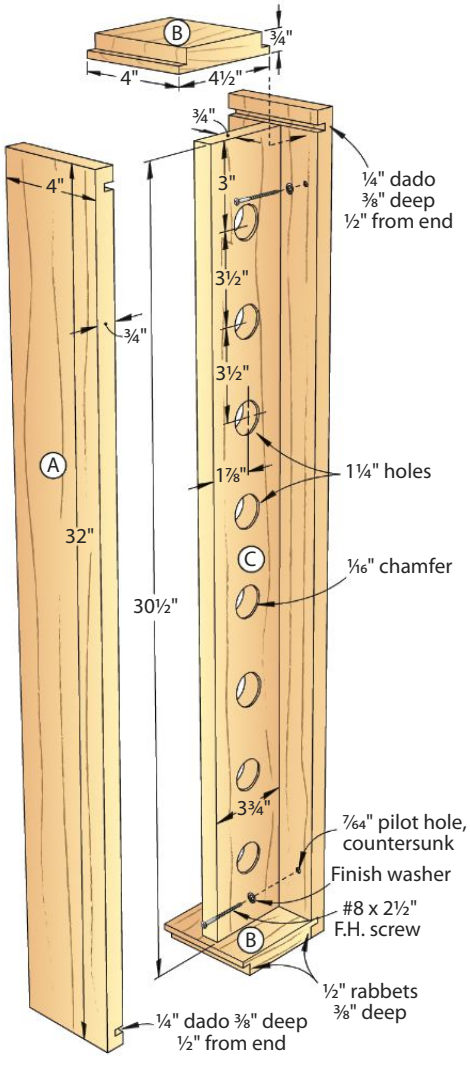
RABBET THE TOP AND BOTTOM

Cut a rabbet on each end of the top and bottom (B) in two passes. Cut ¼" of the rabbet's width on the first pass, then reposition the fence to cut the remaining ⅛".

Lay the center (C) onto a side (A) butted against the top (B); then, use a marking knife to transfer the location of the inner wall of the dado.

Adjust a combination square so the blade touches the center (C) at one end. Slide it to the other end to confirm the location.

EXPLODED VIEW



the top and bottom (B) as shown [**Photo A, Drawing**]. When the rabbet's tongue fits snugly in the dadoes in the sides (A), make the same cut on both ends of the top and bottom. Next, slide the fence ⅛" away from the blade and again make test cuts on the scrap piece until the tongue seats fully in the side dadoes. Complete the rabbet cuts in the top and bottom.

4 From ¾" stock, cut a blank for the center (C) at least ½" wider and longer than shown in the **Materials List**. To determine the center's exact length, place the top (B) in one of the dadoes in a side (A), and mark the center to fit between the dadoes [**Photo B**]. Cut the center to finished length.

5 To determine the width of the center (C), clamp the top and bottom (B) into both sides (A); mark the center as you did the length in **Step 4**. Rip the center to fit between the sides.

6 Lay out the hole locations on the center (C) [**Drawing**] and drill them with a 1¼" Forstner bit. Rout a 1/16" chamfer around the hole rims on each face. Finish-sand the inside faces of the sides (A), top and bottom (B), and both faces of the center to 220 grit.

7 Place one side (A) on your workbench with the dadoes up and glue in the top and bottom (B). Apply glue to one edge of the center (C) and center it on the side's width [**Photo C**]. Repeat for the remaining side, clamp the assembly tight, and let it dry.

8 After the assembly dries, finish-sand the outer faces and edges to 220 grit. Gently soften any sharp edges by hand-sanding. Apply a stain and protective clear coat of your choice. (We used Varathane Gunstock stain followed by three applications of Rust-Oleum water-based polyurethane.)

9 To attach the rack to a wall stud, drill countersunk pilot holes where shown [**Drawing**]. Mount to the wall with 2½"-long screws.

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A	sides	¾"	4"	32"	R	2
B	top and bottom	¾"	4"	4½"	R	2
C*	center	¾"	3¾"	30½"	R	1

*Part initially cut oversize. See the instructions.

Material key: R–red oak.
Supplies: #8x2½" F.H. screws (2), finish washers (2).
Blade and bits: Stacked dado set, 1¼" Forstner drill bit, 45° chamfer router bit.

Produced by **Bob Hunter** with **Kevin Boyle**
Project design: **Kevin Boyle**
Illustration: **Lorna Johnson**

More Resources

- For a FREE downloadable plan of a cantilevered-bottle-holder, go to **woodmagazine.com/bottleholder**.
- Purchase a tasteful tabletop wine rack plan at **woodmagazine.com/tablewine**.
- For the refined woodworker: How to open your wine bottles with power tools—**woodmagazine.com/powercorkscrew**.

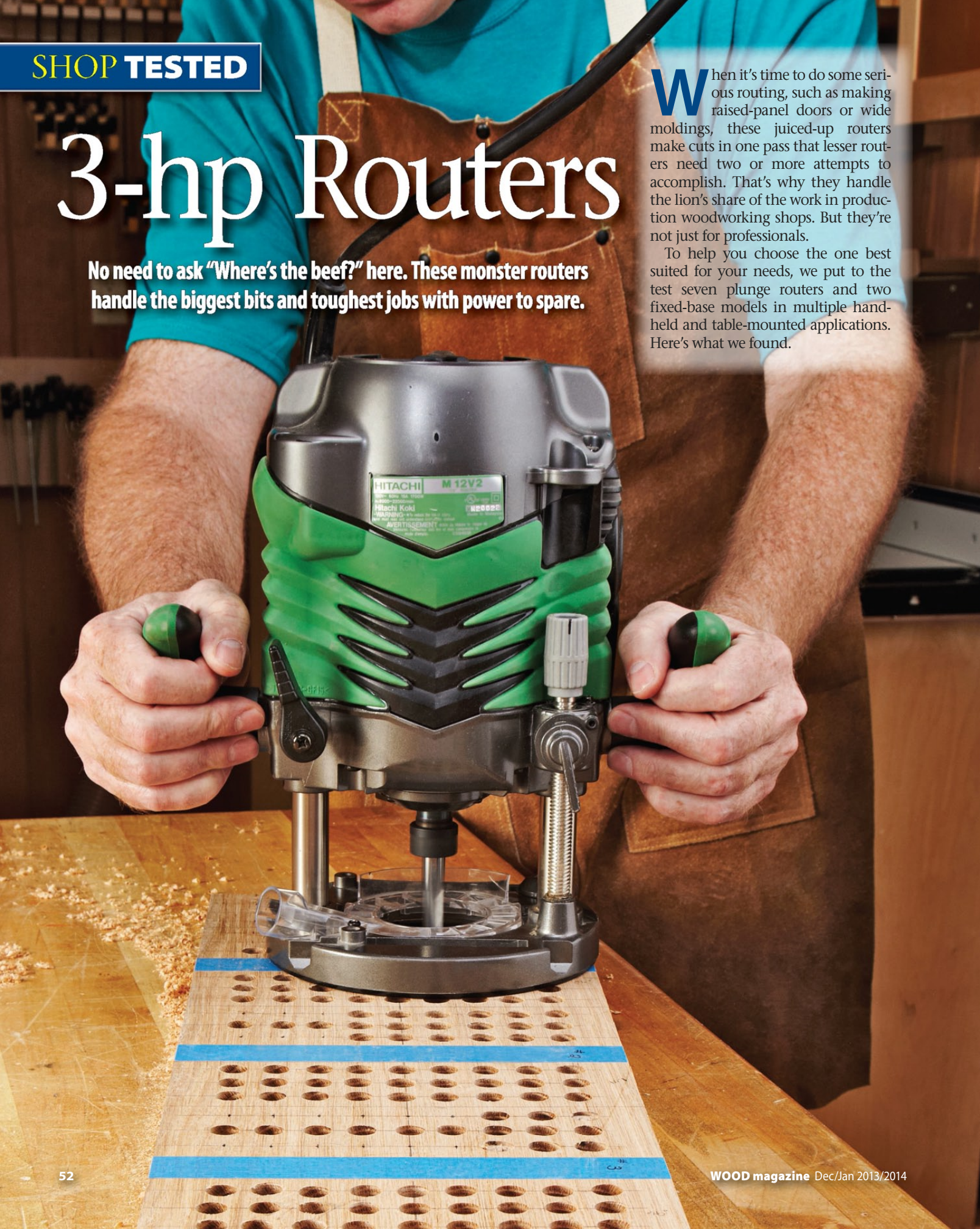
SHOP TESTED

3-hp Routers

No need to ask "Where's the beef?" here. These monster routers handle the biggest bits and toughest jobs with power to spare.

When it's time to do some serious routing, such as making raised-panel doors or wide moldings, these juiced-up routers make cuts in one pass that lesser routers need two or more attempts to accomplish. That's why they handle the lion's share of the work in production woodworking shops. But they're not just for professionals.

To help you choose the one best suited for your needs, we put to the test seven plunge routers and two fixed-base models in multiple handheld and table-mounted applications. Here's what we found.



Controlling all that power proves crucial

After hand-routing deep mortises, rabbets, and edge profiles in red oak, we pushed each router to make a full raised-panel-profile cut in one pass. None of the routers bogged down enough to be a concern.

Next, we tested the electronic speed control on each router to see how well it maintained speed under load—vital to motor longevity. Seven of the nine routers held a tight spindle-speed range throughout all cuts. However, the speed of the two Porter-Cable routers—a 7518 fixed-base and 7539 plunge—repeatedly ramped up and down, searching for the no-load speed but seldom finding it during a 4' routing pass. This did not cause problems with overheating or cut quality, but it's an annoying trait.

The Porter-Cable models are also the only tested routers with five preset speeds on a slide-style switch located on top of the motor; the switch is easy to adjust in handheld mode, but more difficult to see the settings when upside down in a router table. The other routers have infinitely variable speed controls. The Festool OF2200EB, Makita RP2301FC, and Milwaukee 5625-20 conveniently include a small chart next to the speed dial that lists speeds for each dial position. With most of the others, you have to refer back to the owner's manual; the Hitachi M12V2 provides no guidance.

Need a lift? Not so fast, plungers

Only two test routers—the fixed-base Milwaukee and Porter-Cable units—will work in an aftermarket router lift. That's because you can remove their motors and mount them in the wraparound collars of most lifts. For plunge routers without a built-in lift, the only aftermarket option is the Router Raizer (routertechnologies.com), a $100 accessory that replaces your router's leadscrew and gives you the ability to make through-the-table bit adjustments. However, it won't add the ability to change bits above the table if your router isn't already capable.

The biggest, baddest routers on the market

Bosch 1619EVS, $325

877-267-2499, boschtools.com

High Points:

⬆ A built-in plunge-spring bypass eases router-table height adjustments, and reengages quickly for handheld use.

⬆ Well-balanced with comfortable, easy-to-grip handles and good bit visibility during handheld routing.

⬆ The spring-loaded plunge-lock lever locks when released—our favorite system.

Low Points:

⬇ The speed dial, marked in increments from 1 to 6, requires using a reference chart in the owner's manual to translate to actual speeds.

⬇ The depth stop rod allowed the most slippage in our testing (1/32" over 25 holes).

More Points:

➡ An extension handle attaches to the leadscrew height adjuster to make cutting-depth changes easier than most, even in a router table.

DeWalt DW625, $300

800-433-9258, dewalt.com

High Points:

⬆ A well-balanced tool with clear bit visibility for handheld routing.

Low Points:

⬇ To use the included ¼" collet, you must first remove the ½" collet from its nut, then install the ¼" one, a headache we wish DeWalt would avoid by providing separate nut-and-collet assemblies.

⬇ The base opening prohibits the use of bits larger than 2½" in diameter.

⬇ The speed dial, marked in increments from 1 to 5, requires using a reference chart in the owner's manual to translate to actual speeds.

More Points:

➡ Although this router plunges smoothly, you must manually engage the plunge-lock lever to stop plunging. It's a system that's not as easy to use as the Bosch and Porter-Cable 7539.

Festool OF2200EB, $850

888-337-8600, festoolusa.com

High Points:

⬆ Three included hoods give this router the most effective dust collection in our test.

⬆ The unique ratcheting spindle lock means you don't have to remove the wrench from the collet nut while tightening or loosening for quicker bit changes.

⬆ A chart on the router body translates speed-dial markings to actual speeds.

⬆ The only router to come in something other than a cardboard box: The plastic Systainer organizes accessories and stacks neatly with other Festool products.

Low Points:

⬇ Scales are marked in metric only, and with no leadscrew height adjuster, you rely solely on the turret-stop system for making fine adjustments.

⬇ When mounted in a router table, you must work against the plunge spring's tension.

⬇ Does not come with a ¼" collet or adapter for ¼"-shank bits.

⬇ Instead of a plunge-lock lever, the OF2200EB has a rotating knob on the top of the left handle that takes a lot of getting used to.

More Points:

➡ Despite weighing more than 18 lbs, it felt balanced and never created control or tipping issues.

➡ All adjustable components on this router have a distinctive neon-green color for easy location.

Some work better in a router table than others

Besides power, what makes a good table router? Easy bit-height adjustments and bit changes top the list. Of the tested routers, only the Milwaukee, shown *near right*, and Triton TRA 001 include a tool that extends through the tabletop to raise and lower the bit from above. This saves you from having to stoop. (You do, though, have to reach below the table to operate the base lock on the Milwaukee before making any adjustments.)

The Bosch 1619EVS (*middle*), Hitachi, and Makita include extension handles for their elevation-changing leadscrews that, although you still have to reach below the table, make height changes easier than the remaining routers.

THREE WAYS TO CHANGE BITS AND THEIR HEIGHTS IN A ROUTER TABLE

You adjust bit height with the Milwaukee 5625-20 fixed-base router by using the included T-wrench to reach through a hole in the insert plate.

Although you still have to reach below the table, Bosch's extension handle makes it easy to raise and lower the router as you eyeball the bit.

Hitachi M12V2, $230

800-829-4752, hitachipowertools.com

High Points:

⬆ Comes with more accessories than any other tested router.

Low Points:

⬇ With the second-stiffest plunge action of all tested routers and a plunge lock that defaults to free-plunge until you manually secure the lever, this router takes some getting used to for handheld jobs.

⬇ Although its subbase has a 3⅞" opening, the 3⅞16" base opening limits the use of larger bits.

⬇ The depth-stop lock allowed 1⁄64" of slippage over 25 test plunges.

⬇ The speed dial is marked in increments from 1 to 6, with no reference chart for actual speeds.

More Points:

➡ The leadscrew extension makes bit-height changes easier than most, handheld or table-mounted.

➡ The owner's manual instructs you to remove the plunge spring for use in a router table—an easy job—but it needs to be replaced for handheld routing.

Makita RP2301FC, $320

800-462-5482, makitatools.com

High Points:

⬆ With LED lights surrounding the spindle to brighten the cutting area, a low profile for good balance, nice handles, smooth plunge action, and good bit visibility, this router excels in handheld use.

⬆ A chart on the router body translates speed-dial markings to actual speeds.

Low Points:

⬇ The depth-stop lock allowed 1⁄64" of slippage over 25 test plunges.

⬇ No included dust-collection hoods, although a dust shield diverts chips.

⬇ The 2⁷⁄16" base opening limits the use of larger bits.

⬇ The leadscrew adjuster proved finicky to use, even with the extension handle; we preferred using the plunge lock and turret stops alone for adjustments.

⬇ When mounted in a table (and still under spring tension), coarse adjustments proved difficult unless the insert plate was screwed to the table or held in place by the fence.

More Points:

➡ A sleeve inserts into the ½" collet for ¼"-shank bits.

Milwaukee 5625-20, $350

800-729-3878, milwaukeetool.com

High Points:

⬆ The lightest router in this class (12 lbs), the 5625-20 feels almost like a midsize router when compared to the other 3-hp heavyweights. Its nimbleness and large handles make it excellent for non-plunging tasks.

⬆ Coarse and fine adjustments prove easy when setting bit depth in handheld mode.

⬆ A chart on the router body translates speed-dial markings to actual speeds.

⬆ Call us old school, but we still prefer changing bits with two wrenches, and Milwaukee's beefy wrenches are our favorites.

Low Points:

⬇ No included dust-collection hoods or ¼" collet.

⬇ No flat edge on the subbase makes routing against a straightedge more prone to slight discrepancies.

More Points:

➡ The included T-wrench makes through-the-table height adjustments a snap, but you must first reach below the table to unlock the router base. You can change most bits above the table, but large-diameter bits block wrench access.

➡ With just less than 1¾" of collet adjustment up and down, you might have trouble with bit profiles longer than 2".

Some routers have no easy method for making adjustments or changing bits; with these it's best to simply lift the router from the table for these jobs.

Only the Triton lets you change all bits above the table. With the Milwaukee, you can change most bits above the table, but large-diameter bits, such as panel-raisers, can block wrench access, depending on the size of the insert-plate opening. With the other routers, you change bits either by wrenching the collet below the table—not an easy task—or, if the router is mounted on an insert plate, by lifting it onto the tabletop (*left*).

The Hitachi and Triton owner's manuals specify removing the plunge spring (*right*) if mounting in a table for easier adjustments without the tension. The Bosch has a built-in spring bypass that also works well. The other plunge routers make no stipulations for table-mounting, so we tested them with springs intact.

"SPRING" INTO TABLE MODE

On the Triton TRA 001, an easily accessible twist cap makes removing—and for handheld use, reinstalling—the plunge spring a simple task.

Porter-Cable 7518, $350

888-848-5175, portercable.com

High Points:

⬆ At 4 9/16", this router's base opening is largest in the test group.

⬆ We like its two-wrench bit-changing system.

Low Points:

⬇ Electronic controls ramp the motor up and down under load trying to maintain the preset speed, with little success.

⬇ Does not come with a ¼" collet or adapter or any dust-collection hoods.

⬇ No flat edge on the subbase makes routing against a straightedge more prone to slight discrepancies.

More Points:

➡ The five-speed slide switch on top of the motor, marked in rpm, was easy to set when handheld, but difficult in a router table.

➡ You rotate the motor in the base for height adjustments, but each movement changes the location of the power switch and speed selector.

Porter-Cable 7539, $370

888-848-5175, portercable.com

High Points:

⬆ The spring-loaded plunge-lock lever locks when released—our favorite system because you won't plunge accidentally.

⬆ We like its two-wrench bit-changing system.

Low Points:

⬇ Like the 7518, this model's motor ramped up and down under load trying to maintain the preset speed, and its speed-selector switch is difficult to read in a router table.

⬇ You get no ¼" collet or any dust-collection hoods, although a dust shield diverts chips.

⬇ The 7539 is top-heavy, and the stiff plunge action makes fine adjustments difficult.

⬇ When mounted in a table (and still under spring tension), coarse adjustments proved difficult unless the insert plate was screwed to the table or held in place by the fence.

⬇ The 3 15/32" base opening prohibits the use of larger bits.

⬇ No flat edge on the subbase makes routing against a straightedge more prone to slight discrepancies.

Triton TRA 001, $250

800-624-2027, tritontools.com

High Points:

⬆ Through-the-table height adjustment, with automatic spindle lock when fully raised (or plunged in handheld mode), makes for easy bit changes above the table.

⬆ A spring-loaded cover on the power switch prevents accidental start-ups because you must slide it open to start the router.

Low Points:

⬇ This router is top-heavy and tippy when routing handheld, especially on narrow stock, and its round, ratcheting plunge controls built into the right handle proved clumsy and distracting.

⬇ The speed dial, marked in increments from 1 to 6, requires using a reference chart in the owner's manual to translate to actual speeds.

⬇ It does not have a scale for measuring bit depth.

⬇ The 3 5/32" base opening limits the use of larger bits.

⬇ No flat edge on the subbase makes routing against a straightedge more prone to slight discrepancies.

More Points:

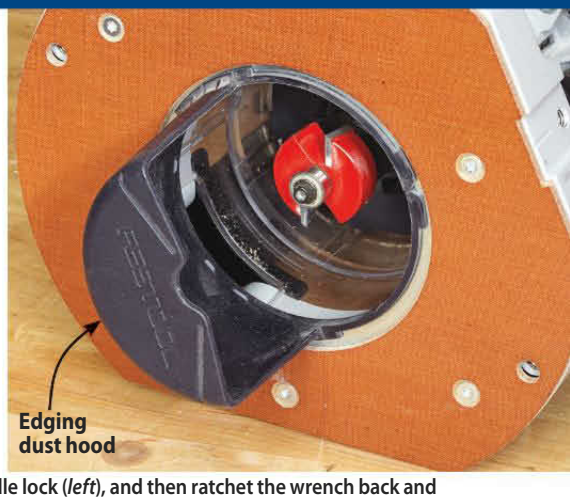
➡ The owner's manual instructs you to remove the plunge spring for use in a router table—an easy job—but it needs to be replaced for handheld routing.

Only the Bosch, Festool, Milwaukee, and Porter-Cable 7518 have base openings wide enough to retract a common 3½"-diameter panel-raising bit. To use a bit this size with the other routers, you have to set the bit's final height from the start, and then position the fence in front of the bit's bearing, moving the fence backward in intervals until you get the profile you want.

Sure, you *can* rout by hand, but prepare for a workout

Given a choice, we'd rather not use these routers for handheld jobs simply because of their size and awkwardness. Instead, we prefer a midsize router (1½ to 2¼ hp). That said, the Bosch, Festool, and Makita routers stood out from the test field in

FEATURES MAKE FESTOOL STAND OUT



To change bits in the Festool, you hold down the spindle lock (*left*), and then ratchet the wrench back and forth on the collet nut—no need to remove the wrench from the nut until you're done. The concentric dust-collection hoods that slide inside one another above the base, and the snap-on edging hood (*right*), helped gather in nearly all dust and chips created by this router.

BIG AND BEEFY: 3-HP ROUTERS HANDLE THE MOST DEMANDING JOBS

MANUFACTURER	MODEL	PERFORMANCE RATINGS (1)															MOTOR SPEEDS (MIN.–MAX.), RPM x 1,000
				ROUTER-TABLE USE			HANDHELD USE								DUST CONTROL (USING INCLUDED DUST HOODS)		
		POWER	RESPONSIVENESS OF ELECTRONIC SPEED CONTROL	EASE OF CHANGING BITS	EASE OF SETTING BIT HEIGHT	EASE OF USING ROUTER CONTROLS	EASE OF CHANGING BITS	EASE OF SETTING BIT DEPTH	EASE OF USING ROUTER CONTROLS	OVERALL COMFORT AND CONTROL	DEPTH-SCALE ACCURACY	PLUNGE SMOOTHNESS	EASE OF USING PLUNGE LOCK	DEPTH-STOP RELIABILITY		
BOSCH	1619EVS	A-	A-	B	B+	B	A	A	A	A	A-	A	A	B	B	8–21
DEWALT	DW625	A-	A	B-	C	B	A	B+	A	B+	A	A	B	A	B	8–22
FESTOOL	OF2200EB	A	A	B+	C-	B	A	A-	A	A	A	A	B-	A	A	10–22
HITACHI	M12V2	A	A	B-	B+	C	A-	A	C+	A-	A-	B	A-	B+	B-	8–22
MAKITA	RP2301FC	A	A-	B	B-	B	A-	B	A	A	A-	A	B-	B+	NA	9–22
MILWAUKEE	5625-20	A	A	A-	A	B+	A	A	B+	A	A	NA	NA	NA	NA	10–22
PORTER-CABLE	7518	A-	C	B	B	B-	A	A-	B+	B	A	NA	NA	NA	NA	10,13,16,19,21
	7539	A-	C	B	C-	B-	A-	C	B+	C	A	C	A-	A	NA	10,13,16,19,21
TRITON	TRA001	A-	A-	A	A	B-	A	C+	B-	B-	NA	A	C	A	B	8–20

1. A Excellent; B Good; C Fair; NA Not available or applicable on this model
2. (F) Fixed (P) Plunge
3. (*) For use with optional proprietary guide bushings
4. (1) Spindle lock and one wrench (2) 2 wrenches

handheld use. Here, plunge routers have a big advantage on the fixed-base models because they handle all edge- and joinery-routing as well as jobs where you need to lower the bit into the workpiece.

Routers that include dust hoods did a good job of collecting chips and dust on closed-cut routing, such as mortises and dadoes, but not nearly as well when edge-routing. Only the Festool includes a hood for edge-routing, and it works great.

More Resources

▶ Post your own review of these routers and read reviews from other woodworkers at **toolreviews.woodmagazine.com**.

A router in the hand is worth... another in the table

What makes a router great for handheld use often works against it when table-mounted, and vice versa. So we picked a Top Tool for each use. For mounting in a table, we recommend the Milwaukee 5625-20 because of its responsive electronic speed control and power, no-fuss adjustments, and easy bit changes.

For handheld use, the Festool OF2200EB vaulted to the front of the line with quick-response power, the smoothest plunge action, easy bit changes, and exceptional dust collection. Granted, its $850 price is nearly as hefty as the router itself, but this well-engineered tool will not disappoint.

If you need one router for both handheld and router-table use, then get the Bosch 1619EVS.

Our Top Value award goes to the Hitachi M12V2. This $230 router proved capable in all aspects, and comes with a lot of helpful accessories.

Produced by **Bob Hunter** with **Pat Lowry**

BASE CONSTRUCTION							ACCESSORIES (5)		NOISE LEVEL, NO LOAD (DECIBELS)						
TYPE OF BASE (2)	SUBBASE OPENING, INCHES	BASE OPENING W/O SUBBASE, INCHES	GUIDE BUSHING COMPATIBLE? (YES, NO) (3)	COLLET TIGHTENING METHOD (4)	MAX. COLLET TRAVEL, INCHES	NUMBER OF TURRET DEPTH STOPS	STANDARD	OPTIONAL	AT SLOWEST SPEED	AT FASTEST SPEED	WEIGHT, LBS-OZ	CORD LENGTH	WARRANTY, YEARS	COUNTRY OF ASSEMBLY (6)	SELLING PRICE (7)
P	2 1/32	3 3/4	Y*	1	2 9/16	6	2,4,A,D,W	C,D,E,G,S	74	96	13-6	8'6"	1	X	$325
P	3 13/32	2 5/8	Y	1	2 7/16	3	2,4,A,D	E,G,W	73	94	13-12	9'	3	I	300
P	3 13/16	3 13/16	Y	1	3 5/32	4	2,A,D	E,G,S	77	96	18-6	13'	3	G	850
P	3 7/8	3 7/16	Y	1	2 9/16	3	2,4,A,C,D,E,G,W		70	90	15-5	7'6"	5	M	230
P	2 3/4	2 7/16	Y	1	2 3/4	3	2,4,A,G,W	E	72	91	14-1	8'	1	J	320
F	2 1/2	4 1/8	N	2	1 21/32	NA	2,W	4,A,G,S	74	94	12-0	8'	5	C	350
F	1 3/16	4 9/16	Y	2	2 5/8	NA	2,A	4,E,G	78	96	15-15	9'6"	3	X	350
P	1 3/16	3 15/32	Y	2	2 7/8	6	2,A	4,E,G,W	80	96	17-8	10'	3	X	370
P	3 5/32	3 5/32	N	1	2 1/2	2	2,4,D,E,W	A,D,G	72	92	14-3	6'6"	1	T	250

5. (2) ½" collet
(4) ¼" collet or adapter
(A) Subbase/adapter for guide bushings
(C) Centering cone
(D) Dust-collection hood
(E) Edge guide
(G) Guide bushings
(S) Additional subbases
(W) Depth-adjustment wrench/extension

6. (C) China
(G) Germany
(I) Italy
(J) Japan
(M) Malaysia
(T) Taiwan
(X) Mexico

7. Prices current at time of article production and do not include shipping, where applicable.

Darling Doll Bed

A classic favorite any little girl will love.

Dimensions:
21" W×13" D×22⅛" H

My wife and I just brought a little girl into the world, and with her arrival came the realization that I'd soon have to shelve most of my "adult" woodworking projects in favor of ones like this doll bed. And if my daughter turns out anything like me, I know those projects will need to be tough to keep her from reducing them to toothpicks in short order. Fortunately, this doll bed is built from tough (and inexpensive) poplar!

Nate

Nate Granzow
General-Interest Editor

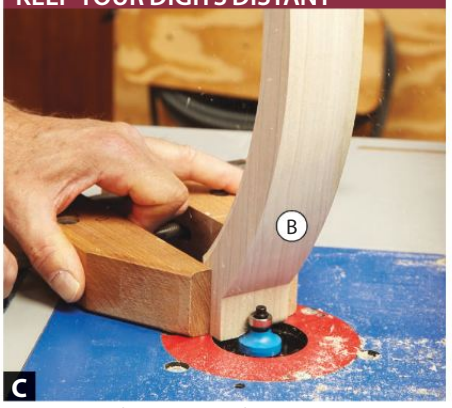
TRACING CREATES CONSISTENCY

When transferring the arch, pair up and label each of the end panels (A) with an end cap (B) in case their arches are slightly different.

USE A COMPASS TO TRANSFER CURVES

Keep the compass point and pencil aligned perpendicular to the arch as you scribe the upper arch 1" from and parallel to the lower arch.

KEEP YOUR DIGITS DISTANT

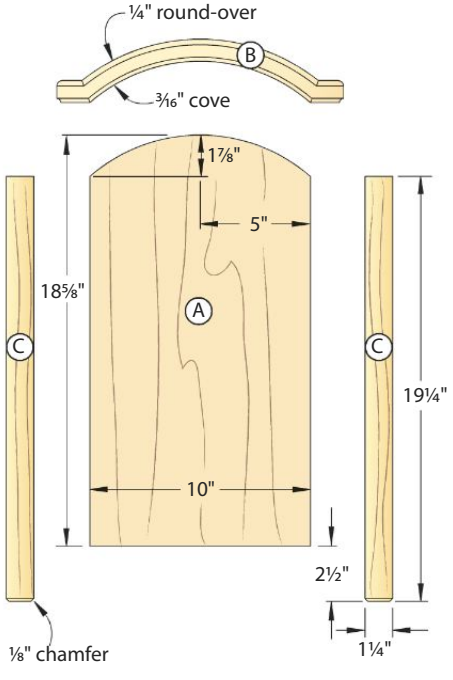


To keep your fingers clear of the router bit while profiling the ends of the end caps (B), use a wooden handscrew clamp to grip the piece.

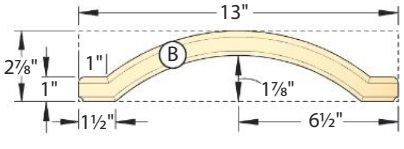
Head- and footboard first

1 From ½" birch plywood, cut the two end panels (A) to size [**Materials List**]. Use a fairing stick to lay out the top curve on one of the end panels [**Drawing 1**]. Cut the top curve, keeping your kerf slightly proud of the pencil line; then, sand to the line. Use this completed end panel to lay out the other end panel; then, cut and sand that one to shape, too.

1 END ASSEMBLY



1a END CAP

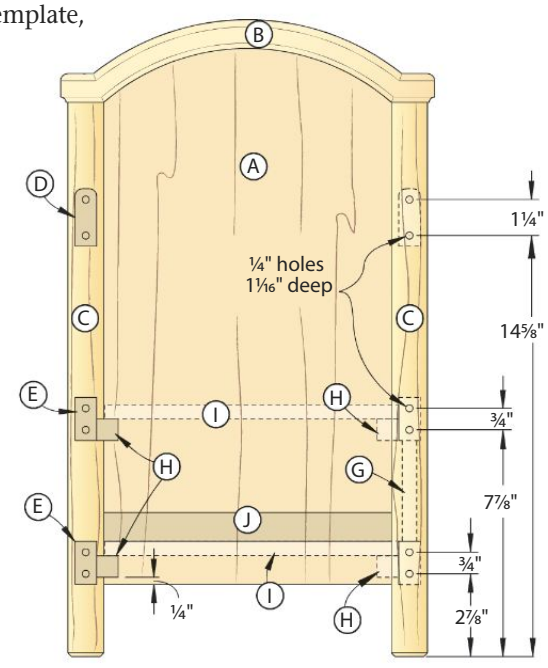


2 From 1¾" poplar, cut the two end caps (B) to size. (If you don't have 1¾" stock, laminate thinner boards.) On the bottom edge of each end cap, mark 1½" in from the ends [**Drawing 1a**]; then, using an end panel (A) as a template, align it between the marks and transfer the arch to the bottom edge of the end caps [**Photo A**].

3 Cut and sand to shape the bottom arch on each of the end caps (B), making sure that it fits tightly against the curve of its paired end panel (A). On the top edge of each end cap, mark 1" in from the ends [**Drawing 1a**]; then use a compass to transfer the curve for the top arch [**Photo B**]. Cut and sand to shape the top arches, and then rout a 3⁄16" cove on the end caps' bottom edges and a ¼" round-over on the end caps' top edges [**Photo C**].

4 From 1¼" poplar, cut the legs (C) to size. ***Note:*** *You can forgo the dowels when attaching the bed's side panels to the end assemblies and instead use countersunk screws disguised by wood plugs.* Clamp the legs together, ends flush, and mark the locations for the dowel holes [**Drawing 2, Photo D**]. For screw counterbores, mark the leg's outside face, instead. Then, drill the holes: Use either a doweling jig [**Sources**] or a drill press outfitted with a fence to center the holes [**Photo E**]. Mill a ⅛" chamfer on the bottom ends of the legs and sand the legs to 150 grit.

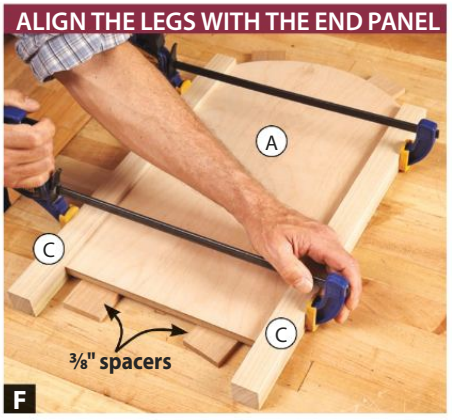
2 END SECTION VIEW



LINE 'EM UP, MARK IT DOWN

By clamping the four legs (C) together and marking the dowel locations simultaneously, you'll ensure that all the dowel holes align precisely.

If you opt to use your drill press instead of a doweling jig, clamp a stopblock to your fence to get accurate, repeatable results.



When clamping the panel assembly, be sure that the top ends of the legs (C) are flush with the ends of the arch on the end panel (A).

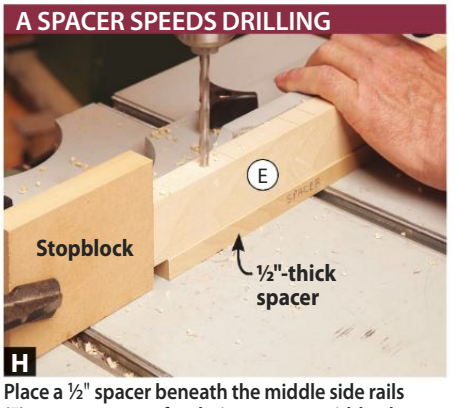
When using your drill press to drill a dowel hole, a brad-point bit's center tip makes aligning the bit with the dowel hole location much easier.

5 Lay the end panels (A) facedown on four ⅜"-thick spacers. Apply glue to the edges of the panels and clamp them to the legs (C) [**Photo F**]. Complete both assemblies by gluing and clamping the end caps (B) to the tops of their respective ends (A/C) [**Drawing 2**].

Slatted sides come next

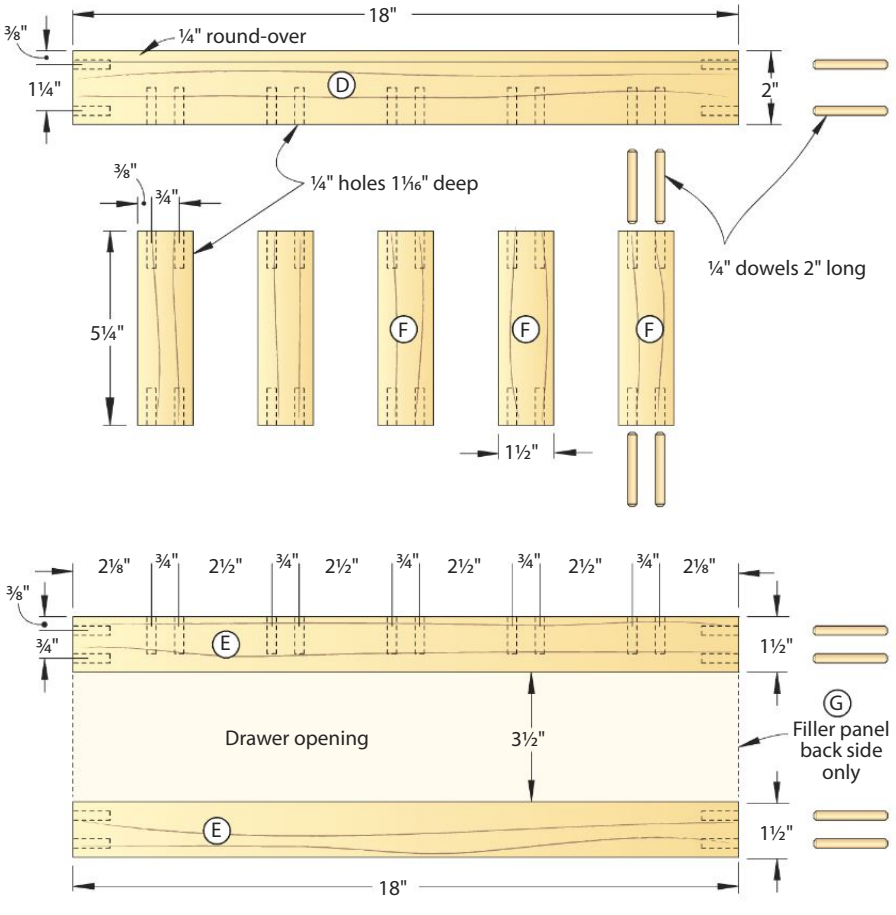
1 From ¾" poplar, cut the top side rails (D) and the middle and lower side rails (E) to size [**Drawing 3**]. From ½" poplar, cut the side slats (F) to size.

2 Clamp the top side rails (D) together with their ends flush and mark the dowel hole locations on their bottom edges [**Drawing 3**]; then, do the same for the two middle side rails (E). To drill the dowel holes, set the drill-press depth stop to drill 1 1/16" deep; then, starting with the two top side rails, drill the outermost holes on both parts [**Photo G**]. Add a spacer [**Photo H**] and drill the outermost holes in the two middle side rails. Reposition the stopblock to center the drill bit on the next dowel hole location and continue with the drilling process, alternating between the top side rails and the middle side rails and working inward until all the dowel holes are drilled. ***Note:*** *If you'd rather use countersunk screws to attach the side rail assemblies (D–G) to the end assemblies (A/B/C), skip step 3.*



Place a ½" spacer beneath the middle side rails (E) to compensate for their narrower width when drilling the dowel holes.

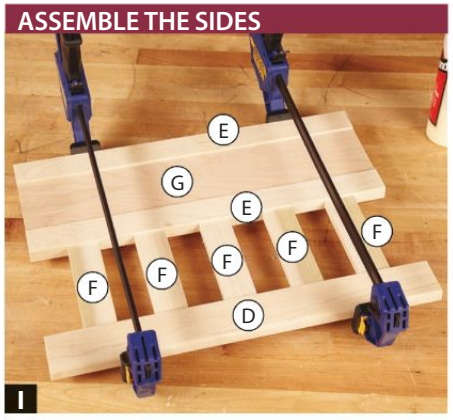
3 SIDE ASSEMBLY



3 Mark the locations of the dowel holes in the ends of the side rails (D, E) [**Drawing 3**]; then, use a doweling jig to help drill the holes.

4 Rout a ¼" round-over on the inside and outside top edges of the top side rails (D).

5 From ½" birch plywood, cut the side filler panel (G) to size [**Drawing 3**]; then, sand the side assembly parts (D–G) to 150 grit. Glue and assemble the back side assembly (D–G) [**Photo I**]. Glue and



When gluing up the back side assembly (D–G), position the side filler panel (G) flush to the inside faces of the middle and lower side rails (E).

Use bar clamps to draw the bed components together, checking for square as you tighten; then, allow the glue to dry before final sanding.

clamp the front side assembly (D/E/F) in the same manner.

Bring the bed together

1 If you drilled dowel holes for attaching the side rail assemblies (D–G) to the end assemblies (A/B/C), spread glue on the dowels and insert them into the end holes of the side rails (D, E). Apply glue and clamp the two side rail assemblies and the remaining lower side rail (E) between the two end assemblies [**Photo J**]. If you chose to screw the bed together, drill pilot holes in the center of the already drilled counterbores, and then drive #8×2" flathead screws.

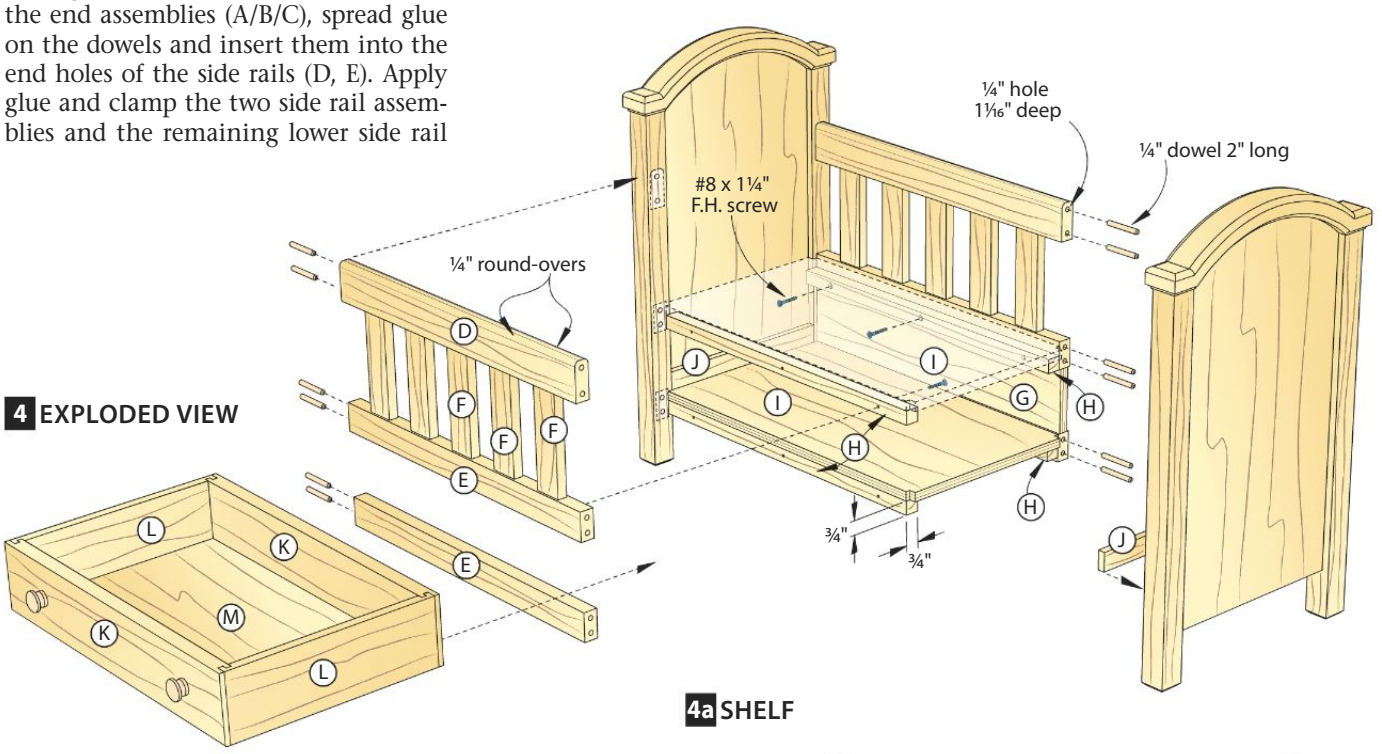
2 From ¾" poplar, cut the four support cleats (H) to fit between the legs [**Drawing 4**]; then from ½" birch plywood, cut the shelves (I) to size, notching their corners to accommodate the legs (C) [**Drawing 4a**]. Finally, cut the two filler strips (J) to size.

3 Glue and screw a cleat (H) to each of the lower side rails (E), ½" down from the rails' top edges [**Drawing 4**]. Glue and tack one of the shelves (I) to the tops of the cleats; then, with the filler strips (J) resting on top of the shelf, glue them to the end panels (A). Attach the remaining cleats to the middle side rails, flush with the rails' bottom edges; then, glue the second shelf to the cleats.

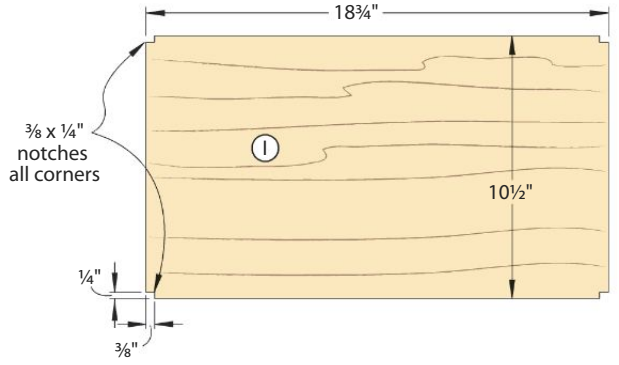
Build the drawer and finish

1 From ¾" poplar, cut the drawer front and back (K) to size, and from ½" poplar, cut the drawer sides (L) to size

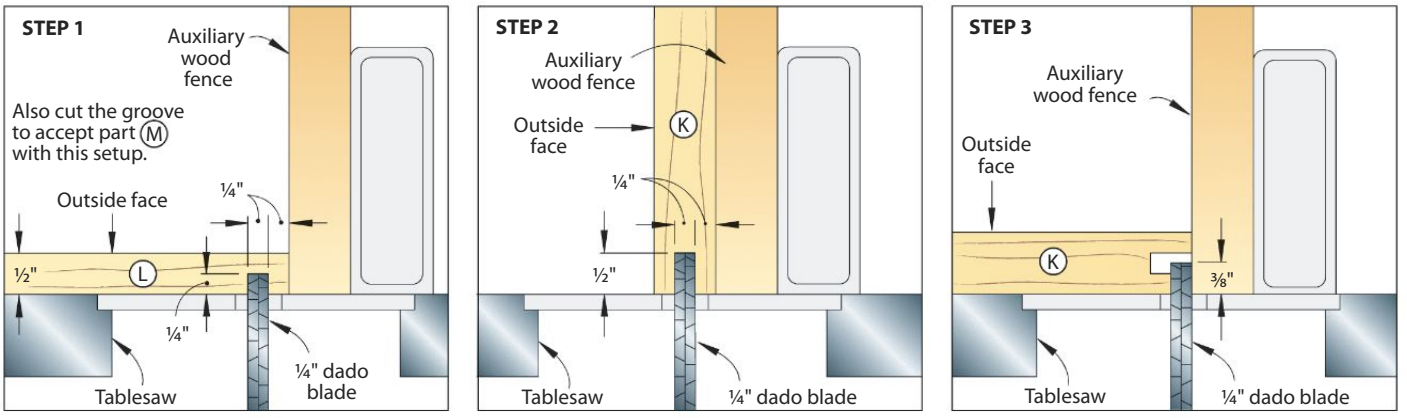
4 EXPLODED VIEW



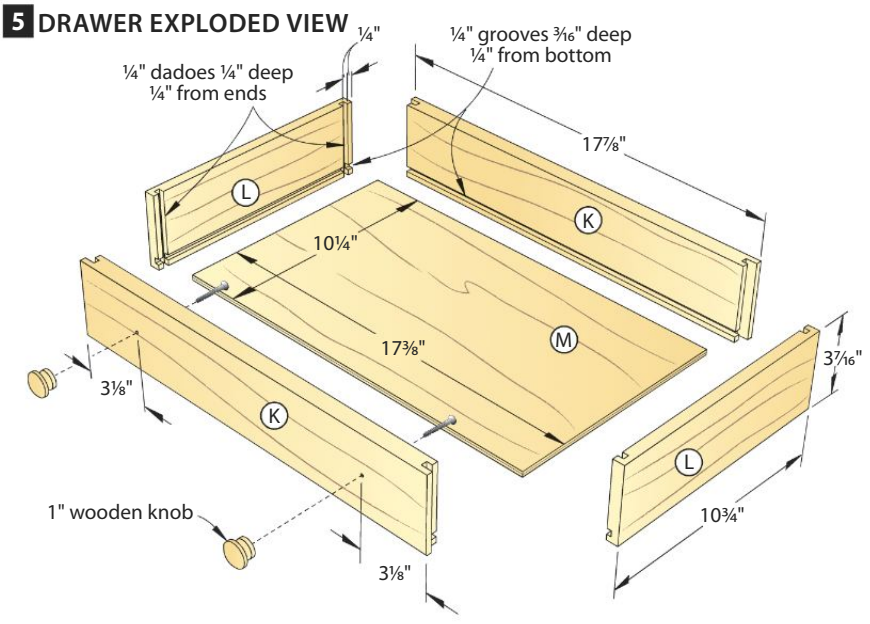
4a SHELF



5a DRAWER JOINT DETAIL



5 DRAWER EXPLODED VIEW



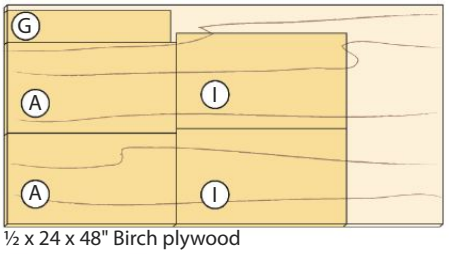
[**Drawing 5**]. From ¼" birch plywood, cut the drawer bottom (M) to size.

2 Cut a ¼" groove near the bottom edges of the inside faces of the drawer front and back (K) and sides (L) [**Drawing 5**]. To create the drawer joinery, start by cutting a ¼" dado ¼" deep ¼" from the ends of the drawer sides [**Drawing 5a, Step 1**]. Next, cut a ¼" dado ½" deep centered on the ends of the drawer front and back [**Drawing 5a, Step 2**]. ***Note:*** *Use a tall auxiliary fence when cutting the dadoes on your tablesaw to safely support the workpiece.* Lay the front and back inside face down on the tablesaw, and then remove ¼" from the inside tongue of the dado [**Drawing 5a, Step 3**].

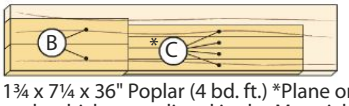
3 Apply glue to the grooves and dadoes of the drawer front and back (K) and the drawer sides (L). Insert the drawer bottom (M) into the grooves and clamp the drawer together, checking for square.

4 Sand all the parts to 150 grit. Then, drill holes and install the drawer knobs [**Drawing 5**]. Apply finish to the bed. We primed and then painted our doll bed with two coats of Sherwin-Williams Dover White semigloss interior latex paint.

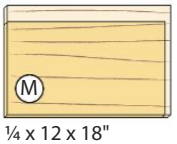
Cutting Diagram



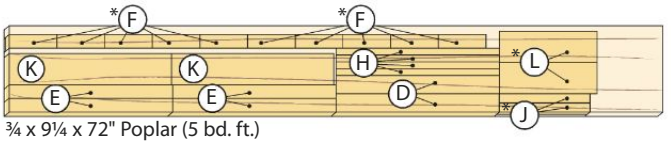
½ x 24 x 48" Birch plywood



1¾ x 7¼ x 36" Poplar (4 bd. ft.) *Plane or resaw to the thicknesses listed in the Materials List.



¼ x 12 x 18" Birch plywood



¾ x 9¼ x 72" Poplar (5 bd. ft.)

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A*	end panels	½"	10"	18⅝"	BP	2
B*	end caps	1¾"	2⅞"	13"	P	2
C	legs	1¼"	1¼"	19¼"	P	4
D	top side rails	¾"	2"	18"	P	2
E	middle/lower side rails	¾"	1½"	18"	P	4
F	side slats	½"	1½"	5¼"	P	10
G	side filler panel	½"	3½"	18"	BP	1
H	support cleats	¾"	¾"	18"	P	4
I	shelves	½"	10½"	18¾"	BP	2
J	filler strips	⅜"	1"	10"	P	2
K	drawer front/back	¾"	3⅞6"	17⅞"	P	2
L	drawer sides	½"	3⅞6"	10¾"	P	2
M	drawer bottom	¼"	10¼"	17⅜"	BP	1

*Parts initially cut oversize. See the instructions.

Materials key: BP–birch plywood, P–poplar.
Supplies: #8×1¼" flathead screws (12), #8×2" flathead screws (optional) (24), 1" brads (16), ¼×2" dowels (64), 1" wooden knobs (2).
Blade and bits: ¼" dado blade, ¼" round-over, ⅜6" cove router bits; ⅛" countersink drill bit.

Sources

Doweling supplies: ⅛" doweling jig, $66.19, no. 124315, Woodcraft, 800-225-1153, woodcraft.com; ¼×2" fluted birch dowel pins (64), no. DP1420, $1.50 [pack of 25], Klingspor's Woodworking Shop, 800-228-0000, woodworkingshop.com.

Written by **Mike Berger**
Produced by **Nate Granzow** with **Kevin Boyle**
Project design: **Brian Simmons**
Illustrations: **Lorna Johnson**

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SCAN TO BUY TICKETS

Planning for seasonal wood movement

Wood expands and contracts with changing humidity. You can't stop it, but you can accommodate it.

In the days before plywood and other man-made sheet goods, when solid-wood construction was the only option, craftsmen had to understand, anticipate, and compensate for wood movement. What they knew then proves just as valuable today.

Why wood moves

Just as they did in a growing tree, wood cells absorb and release moisture. Absorbing moisture causes the wood to expand; as it releases moisture, the wood contracts. Expansion and contraction is most pronounced across a board's width, so the wider the board or panel, the greater the change. Wood moves negligibly along its length and thickness.

Ignoring this basic property of wood can cause joints to pull apart, drawers and doors to stick, panels to split, and gaps to open and close.

8 strategies for dealing with movement

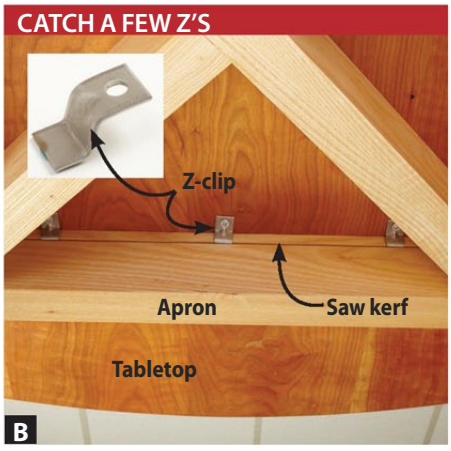
1. Avoid cross-grain construction. As you design a project, keep your eyes open for places where the grain of one piece runs perpendicular to a joined piece. For example, the grain direction of a cabinet top and the side panels should match [**Photo A**]. In the piece shown, because the front-to-back dimension of the side is greater than the top-to-bottom dimension, you might be tempted to orient the grain direction along the longest dimension. Don't—gluing together pieces in that way would inhibit the top from moving across its width, and eventually the top *will* break its glue bond or crack.

WATCH YOUR GRAIN DIRECTION

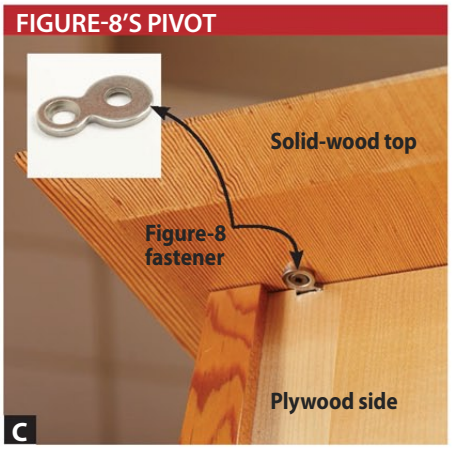
A

With the grain direction of the top and side running the same direction, the two panels expand and contract together.

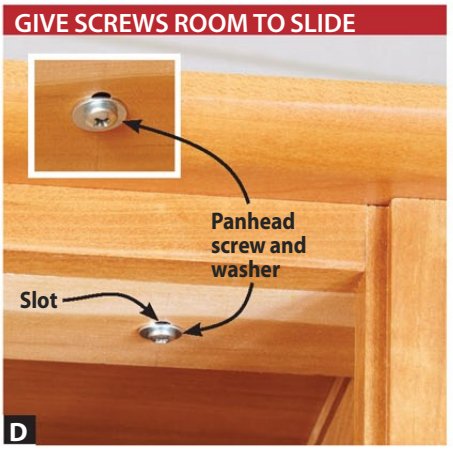
However, you can't avoid cross-grain construction in every instance. Or you may need to join solid wood to sheet goods. The following strategies will help you address these situations.



Z-clips fit into a saw kerf cut near the top of the aprons and get screwed to the tabletop. As the top expands or contracts, the clips slide along the kerf.



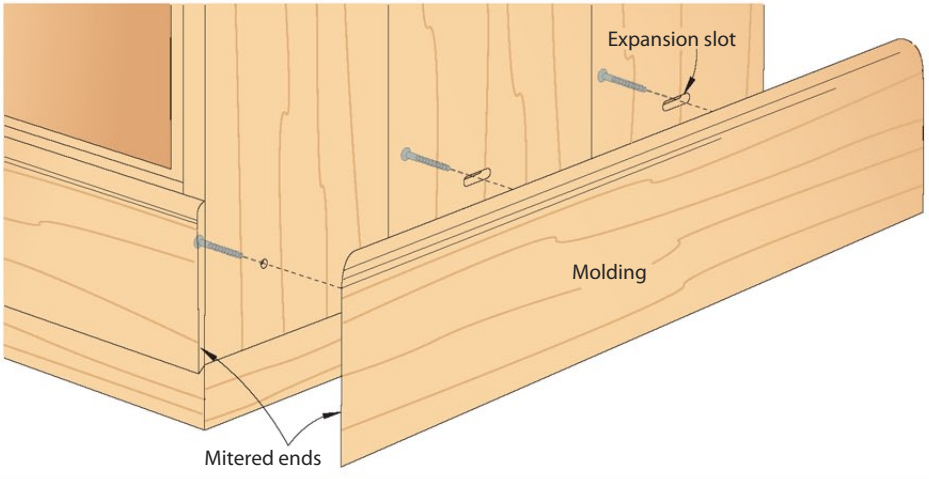
The plywood sides of this table won't expand but the solid-wood top will. Figure-8 fasteners join the two and pivot slightly as the top moves.



Elongated screw holes allow room for the screws securing the top of this table to slide within the rails as the top expands and contracts.

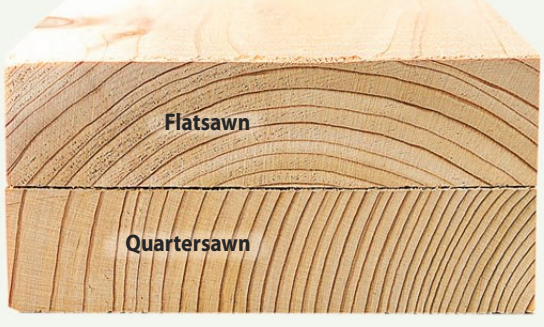
2. Choose fasteners that can move. The wider a tabletop, the more dramatic its change in width with different seasons. Use Z-clips, figure-8 fasteners, or slotted screw holes [**Photos B, C,** and **D**] to hold the top securely while allowing for expansion.

3. Get a hold of moldings. Anchor molding along a solid-wood side panel at the front. This prevents movement of the panel from pulling apart the mitered joint. As shown in the **drawing** at *right*, drill a pilot hole for the front screw, and a slot or slots for additional screws toward the middle and rear.



Know how much your wood will move

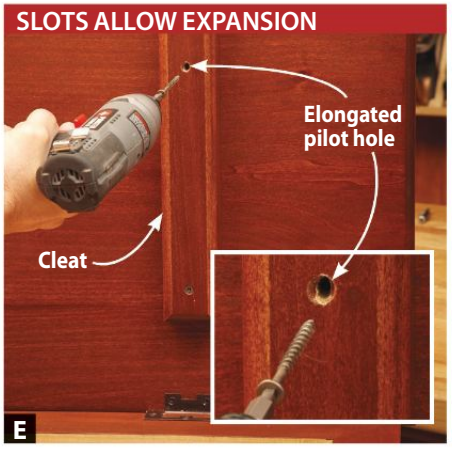
In some climates, lumber moisture content may change from 12–14 percent in the humid summer months to 6–8 percent in drier winter months. Using the values and formula found in the chart at *right,* you can calculate how much expansion and contraction to expect from your lumber. Use that information to determine, for example, how much room to allow around inset doors or drawer fronts, or how long to make a molding so it covers the full width of a cabinet side, no matter the time of year.



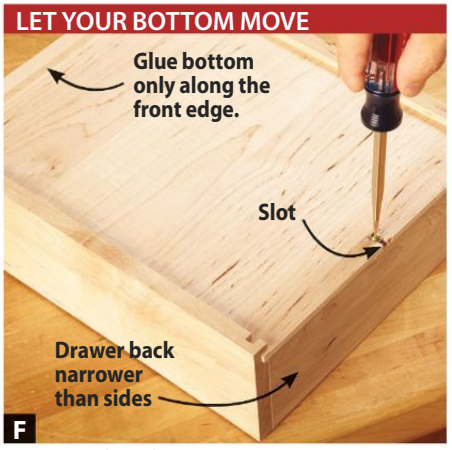
The way in which a board was cut from the log affects how much it will move with changes in humidity. Quartersawn boards move less across their width than do flatsawn boards. Viewed from the end, the growth rings on a flatsawn board curve from edge to edge or edge to face. On a quartersawn board they run vertically, from face to face.

Species	Width in inches at 14-percent moisture content	Width in inches at 6-percent moisture content		Change per inch of width*	
		Flatsawn (See photo at *left.*)	Quartersawn (See photo at *left.*)	Flatsawn	Quartersawn
Ash	12	11.74	11.84	.0027	.0017
Black cherry	12	11.76	11.88	.0025	.0013
Black walnut	12	11.74	11.82	.0027	.0019
Mahogany	12	11.77	11.83	.0024	.0017
Pine	12	11.79	11.87	.0022	.0013
Red oak	12	11.65	11.85	.0037	.0016
Sugar maple	12	11.66	11.84	.0035	.0017
Western red cedar	12	11.77	11.89	.0023	.0011
White oak	12	11.65	11.83	.0037	.0016
Yellow birch	12	11.67	11.75	.0034	.0026

*Multiply width of board in inches by "change per inch of width" to determine how much it will expand or contract per 1 percent change in moisture content.
For example, for a 12"-wide flatsawn ash board:
12" x .0027=.0324"
.0324" x 8 percent change in moisture content = .2592"
12" - .2592" = 11.7408" (round to 11.74")
So, an ash board that started 12" wide at 14-percent moisture content will shrink to about 11¾" wide at 6-percent moisture content.

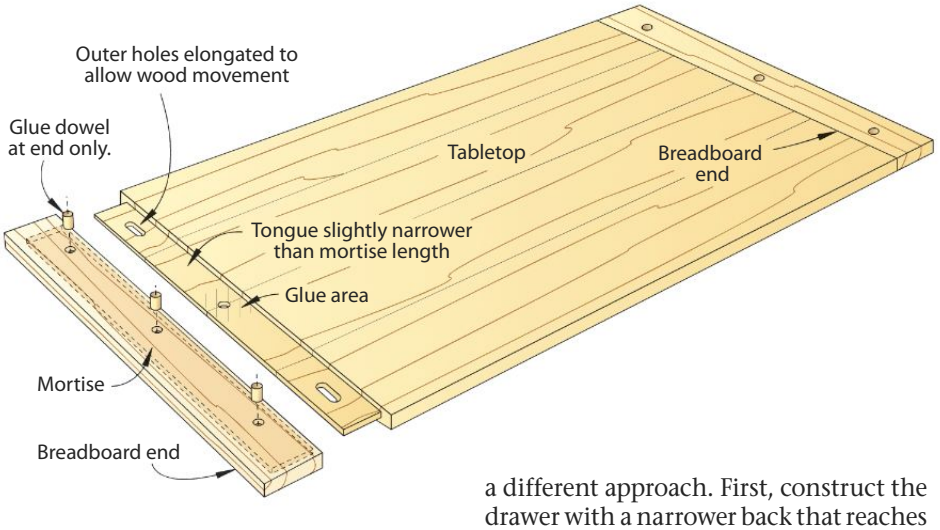


Secure cleats to a panel with screws, but no glue. The screws pull the panel flat to the cleat, but allow the panel to move along the cleat as needed.



Glue at the front forces expansion to the rear. A slot in the drawer bottom provides support while allowing the bottom to move across its width.

As each slat expands or contracts, the rabbets slide over each other, preventing see-through gaps from opening up between slats.



When sizing a solid-wood panel to fit within a frame, allow about ⅛" between the edge of the panel and the groove bottom.

4. Anchor breadboards properly. Running along the ends of a tabletop or panel, breadboard ends hide end grain and help keep the glue-up flat. As shown in the **drawing** *above*, dowel pins hold the breadboards to the tabletop. A small glue area and a pin in the center of the assembly force expansion to each side. Outside pins are glued to only the breadboard. Slots in the tabletop allow it to move freely along the pins. (See **More Resources** to learn how to make breadboard ends.)

5. Let screws slide within cleats. Like breadboard ends, cleats help keep the lid of a chest flat. Secure a cleat with a screw driven through a pilot hole near one end of the cleat. Elongate the other pilot holes by rocking the bit back and forth as you drill [**Photo E**]. This allows the screws to move with the lid.

6. Allow drawer bottoms to slide. Because of its cross-ply construction, plywood moves little, so you can trap it between all four sides of a drawer box. But solid-wood drawer bottoms require a different approach. First, construct the drawer with a narrower back that reaches only to the top of the groove in the drawer sides. This allows the bottom to extend below the drawer back [**Photo F**]. Second, the grain direction of the bottom panel must run from side to side so the bottom can expand and contract freely under the drawer back. To better secure the bottom, cut one or more slots in its rear edge. Apply glue to only the front edge of the bottom and drive a roundhead screw and washer through the slot(s). Snug the screw only enough to prevent the bottom from rattling.

7. Divide and conquer back panels. A wide solid-wood back panel trapped between a cabinet's sides would either split itself or force the sides of the cabinet apart. To prevent that, divide the back into several narrower boards that move independently of each other. On the 56"-wide country sideboard from issue 222 (November 2013), we used twelve 5½"-wide slats with rabbeted edges to span the rear of the cabinet [**Photo G**]. A screw near one edge anchors each slat, trapping the rabbet of the adjacent slat beneath it. A slight gap between slats allows each one to expand freely toward the opposite edge.

8. Use frame-and-panel construction. Confining a solid-wood panel within a frame isolates the panel's expansion and contraction from the rest of the cabinet. However, you must leave room within the frame to allow the panel to move [**Photo H**]. A dab of glue on the center of the top and bottom edges of the panel allows it to expand equally to each side, keeping the raised field centered within the frame.

Produced by **Craig Ruegsegger**
Illustrations: **Lorna Johnson**

More Resources

- Learn how to make breadboard ends in issue 186 (October 2008). If you don't have that issue, you can watch a free slideshow of the process at **woodmagazine.com/breadboard**.
- Purchase *WOOD*'s Complete Guide to Choosing and Using Wood at **woodmagazine.com/allaboutwood**.

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Save time sanding by starting smarter

Q In project articles, you often say "sand to 220 grit." But how do I know which grits to use before 220? And should I *always* sand to 220?

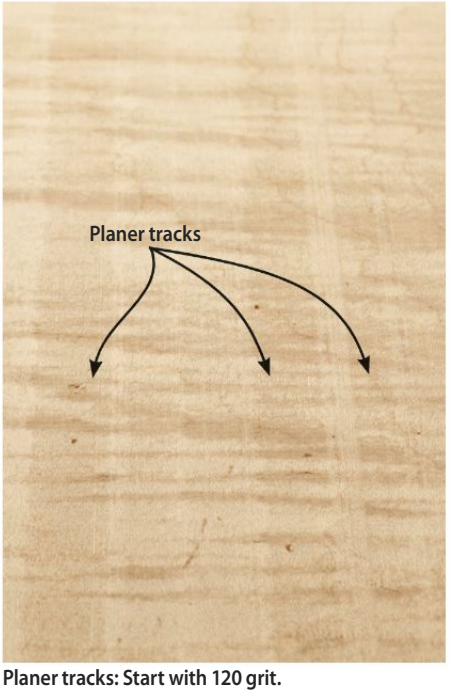
—Leonard Tucker, Brainerd, Minn.

A Before getting into specifics, Leonard, let's clarify how sandpaper works. Sharp grains of various materials (grit) attached to the backing paper scratch, or "abrade," the wood surface to remove high spots and render the board smooth with a uniform scratch pattern. Coarser-grit abrasives remove material quickly, but make deeper, more visible scratches. So you need to follow with sequentially finer grits to remove the scratches left by the previous grit, stopping when the wood feels smooth and the scratches no longer show.

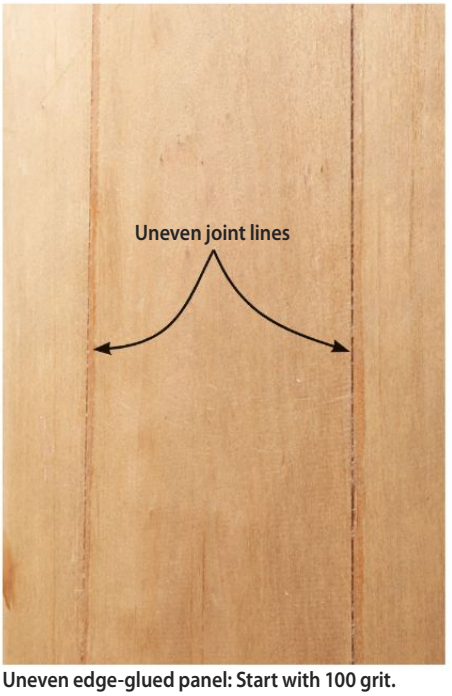
The grit you start with depends on the surface quality of your workpiece. On a board just milled to thickness with a well-tuned planer, you can usually start sanding with 150 grit. If you bought a presurfaced board, you might have to start with 120 grit to remove incidental scratches that were on the board when you got it. Typically, the only times to start with coarser sandpaper (80 or 100 grit) are on boards with deep scratches or gouges or uneven joints after gluing.

When determining which grit best follows the one just used, remember that the next grit should be no more than about 50 percent higher than the one before it; 100, 150, and 220, for example.

Now, when should you stop sanding? Fine grits close up the pores of the wood, so if you sand to too fine a grit, less finish will soak into the surface. Generally, if you're using an oil or clear finish, you can stop sanding at 180 grit. Continue on to 220 grit if you're using a stain or dye. (These colorants tend to amplify swirl or scratch marks.) Sanding to 320 grit creates a glasslike surface, but also one that accepts little stain, if that's your goal.



Planer tracks: Start with 120 grit.



Uneven edge-glued panel: Start with 100 grit.

Sanded to 150 grit: Stain highlights unsightly scratches, especially on lighter grain.

Sanded to 220 grit: No visible scratches visible after staining.

continued on page 70

The facts are hard to ignore.

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Ask WOOD

Never heard of frake? It grows on trees...

Q While reading a yachting magazine, I came across an article discussing the use of a wood called "frake" in a ship's interior. Where does this wood come from, and where can I get some to work with?

—Jeffrey B, from the WOOD® Online *forums*

A The author of that article called frake by one of its less-familiar names, Jeffrey. It is more commonly known as limba or black limba. (It's also sometimes called afara, ofram, akom, and korina.) Growing in equatorial Africa, limba has both creamy white and brownish-black colors, but they're not simply sapwood and heartwood. The darker wood, shown *below*, features streaking tones and sells for about $18–$22 per board foot in the U.S. It's desirable for making furniture as well as moldings, and is a popular veneer. The lighter wood has significantly less value and demand.

Limba works well with tools and has few issues with shrinkage and warping, but splits easily when screwed without predrilled pilot holes. It also proves susceptible to beetles and termites when stored.

If you'd like to try limba on a project, contact Woodworker's Source at 800-423-2450 or online at woodworkerssource.com.

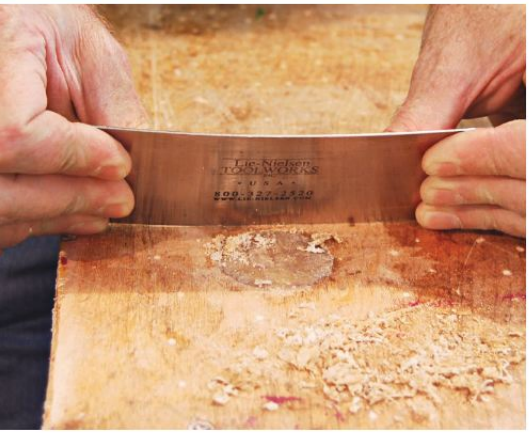
$5 fix for a holey workbench top

I accidentally drilled through a workpiece into my workbench with a 1½" Forstner bit. The hole is about ⅛" deep. What can I do to restore the flatness of the bench?

—Robert Carlson, San Mateo, Calif.

You can fill that shallow hole with two-part epoxy, Robert. For a small job like this, pick up a syringe of epoxy at the hardware store. (Any type of epoxy will work, but quick-set varieties will take less time to complete the task. Be sure to read the directions on the package.)

Begin by cleaning out the hole with compressed air to ensure good adhesion. Next, squeeze out a dollop of epoxy, mix it thoroughly, and slather it into the hole. Spread it evenly with a putty knife or scrap of wood. Let it dry according to the instructions. Then, sand or scrape away any excess to return your benchtop to a flat—albeit visibly patched—state.



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Ask WOOD

Clearing up confusion in the caulking aisle

Recently I went to a home center for a tube of silicone to seal up some cracks in an Adirondack chair I built years ago. (I plan to repaint it.) But I was overwhelmed by the number of products labeled as caulks, sealants, and adhesives, many containing varying degrees of silicone. A store clerk couldn't provide much insight into the differences among these similar products. Can you help?

—Jerry Wise, Boston

A

It can be confusing, Jerry, so we turned to the experts from DAP, Liquid Nails, and Franklin International, manufacturers of these products, to get answers. We learned that the product categories are defined by two properties: gap-filling ability and adhesion.

- **Caulks** fill voids, at a cost less than sealants and adhesives. Because they dry to a fairly rigid texture, use caulks on static joints or to fill gaps that won't shrink or swell due to moisture or temperature changes. But caulks can shrink over time and need to be replaced. Caulks usually are latex-based and not intended to adhere things together.
- **Sealants**, like caulks, fill gaps and create a moisture barrier—but adhere better than caulks and remain more flexible when dry. So sealants work well on joints that move with moisture changes, and adhere better than caulks to materials other than wood, such as glass, ceramic, brick, stone, and metal. Most sealants are silicone-based, but some also use rubber or polyurethane. Sealants provide better adhesion than caulks, but less than true adhesives, and can hold small objects in place where significant bonding strength is not needed.
- **Adhesives** have one purpose: to bond two materials securely. Primarily used in construction and industry, adhesives have a high bond strength that, depending on the formula, works well with wood, metal, glass, ceramics, and building products, such as drywall, insulation, and flooring. Typically made from latex, rubber, or polymers, such as polyurethane and silicone, adhesives dry rigid; they don't work well at sealing joints or filling voids subject to seasonal movement.

Chicago Doctor Invents

Affordable Hearing Aid

Amazing new digital hearing aid breaks price barrier in affordability

Reported by J. Page

Chicago: Board-certified physician Dr. S. Cherukuri has done it once again with his newest invention of a medical grade **ALL DIGITAL affordable hearing aid.**

This new digital hearing aid is packed with all the features of $3,000 competitors at a mere fraction of the cost. **Now, most people with hearing loss are able to enjoy crystal clear, natural sound—in a crowd, on the phone, in the wind—without suffering through "whistling" and annoying background noise.**

New Digital Hearing Aid Outperforms the Expensive Ones

This sleek, lightweight, fully programmed hearing aid is the outgrowth of the digital revolution that is changing our world. While demand for "all things digital" caused most prices to plunge (consider DVD players and computers, which originally sold for upwards of $3,000 and today can be purchased for less then $100), yet the cost of all digital medical hearing aids remained out of reach.

Dr. Cherukuri knew that many of his patients would benefit but couldn't afford the expense of these new digital hearing aids, which are generally *not* covered by Medicare and most private health insurance.

SAME FEATURES AS EXPENSIVE HEARING AIDS

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Can a hearing aid delay or prevent dementia?

A study by Johns Hopkins and National Institute on Aging researchers suggests older individuals with hearing loss are significantly more likely to develop dementia over time than those who retain their hearing. They suggest that an intervention—such as a hearing aid—could delay or prevent dementia by improving hearing!

"Satisfied Buyers Agree AIR Is Best Digital Value"

"I am hearing things I didn't know I was missing. Really amazing. I'm wearing them all the time" —Linda Irving, Indiana

"Almost work too well. I am a teacher and hearing much better now" —Lillian Barden, California

"I have used many expensive hearing aids, some over $5,000. The AIR's have greatly improved my enjoyment of life" —Som Y., Michigan

"I would definitely recommend them to my patients with hearing loss" —Amy S., Audiologist, Munster, Indiana

Shop-Proven Products

These woodworking wares passed our shop trials.

About our product tests

We test hundreds of tools and accessories, but only those that earn at least three stars for performance make the final cut and appear in this section. The products shown here, and those that don't make the cut, are also reviewed at toolreviews.woodmagazine.com. Prices shown are current at the time of article production and do not include shipping, where applicable.

Half-sheet orbiter cuts sanding time

With about one-third more pad-surface area than a 6" random-orbit sander, Bosch's OS50VC half-sheet orbital sander earned a spot in my shop for handling big jobs. Its surprising aggressiveness makes the often-tedious task of sanding go quickly without sacrificing surface quality.

I sanded multiple samples from the same red oak and pine boards with this sander and a top-performing random-orbit sander using identical abrasives, and then stained the boards. The OS50VC smoothed the test samples nicely and left a scratch- and swirl-free, furniture-quality finish equal to that of the ROS. Impressive. Plus, its 9½"-long pad helps ensure flat panels compared to smaller-pad sanders.

It's easy to install sanding sheets tightly with the clever spring-loaded clamps (*inset*). And the included punch plate pokes holes in fresh sheets so the sander can suck up dust. This sander wowed me with its excellent dust collection, both with the included canister filter and when attached to a shop vacuum. I also like the noticeably lower vibration on this sander compared to other half-sheet models I've used.

—Tested by Bob Hunter, Tools Editor

Half-sheet orbital sander (OS50VC)

Performance	★★★★★
Price	$380

Bosch
877-267-2499; boschtools.com

WISE BUYS: 12-VOLT IMPACT DRIVERS

We love these compact tools because they deliver about four times the torque of a comparable 12-volt drill/driver, enough to drive large lag screws. Yet they'll finesse tiny hinge screws. Of 10 tested models, we recommend these three.

MOST VERSATILE

Rockwell 3RILL, $130
866-514-7625, rockwelltools.com

This 3-in-1 tool switches easily from impact driver mode to drill to screwdriver, giving you lots of options without changing tools. Although the 3RILL demonstrated the least torque in our testing, it still had enough to fully sink a ⅜×2½" lag screw in treated pine. The charger restored spent battery packs in 29 minutes—fastest overall—and includes a USB port for charging your mobile phone and iPod. Rockwell also guarantees its battery packs for life.

MOST ERGONOMIC

DeWalt DCF815S2, $150
800-433-9258, dewalt.com

By mounting the battery pack below the handle rather than inside it, DeWalt's engineers created a slimmer grip contoured to comfortably fit the hand. That's a big bonus, especially when driving lots of screws. Plus, it stands upright on the pack. The DCF815S2 turned in the second-best torque and per-screw drive speed, the battery charges in 44 minutes, and it has the best LED lights (three surrounding the chuck). Its chuck sleeve allows for one-handed bit insertion, another nice touch.

MOST POWERFUL

Milwaukee 2453-22, $170
800-729-3878, milwaukeetool.com

The first 12-volt impact driver with a brushless motor, this M12 Fuel model delivered test-topping benefits: the greatest torque, fastest per-screw drive speed, longest per-charge run time (double the runner-up DeWalt), and the coolest operating temperature. Its two-mode gearbox lets you choose the best torque and speed for the fasteners you're using without having to rely on the trigger alone. It comes with a 5-year warranty on the tool and 2 years for the battery packs.

continued on page 76

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Shop Proven Products

Drive screws with a twist of the wrist

When I first saw DeWalt's gyroscopic screwdriver, I was skeptical that it would be practical in the shop. But after using it on multiple project builds, as well as some DIY jobs around the home, it's become my go-to power screwdriver. The tool doesn't have a traditional switch or trigger, but rather an internal gyroscope that, when tilted right or left, engages the motor. The farther you twist your wrist, the faster the chuck turns, up to 430 rpm. It also has a lock-out feature so you can use the tool as you would a regular screwdriver.

The handle swivels from pistol grip to straight, giving you options for grip and fitting into tight spaces. Twin LED lights around the chuck illuminate dark areas nicely. Its 8-volt lithium-ion battery holds a charge for a long time, so you don't have to buy the tool with two battery packs; still, at only $10 more for the second battery, it just makes sense to double up.

—John Olson, Design Editor

8-volt gyroscopic screwdriver

Performance		★★★★★
Price	w/1 battery (DCF680N1)	$89
	w/2 batteries (DCF680N2)	$99

DeWalt
800-433-9258; dewalt.com

Rout circles large and small with this compact router jig

Rockler's circle-cutting jig works great with compact routers (less than 1½ hp) for cutting diameters from 6" to 36". When assembled, this setup proves easier to use than a similar jig attached to a larger router. It adjusts easily, and doesn't scratch the workpiece when routing circles in multiple passes.

Made of durable ¼"-thick phenolic, the jig comes predrilled for the plunge bases of the Bosch Colt PR20EVSPK, DeWalt DWP611PK, and Porter-Cable 450PK compact routers. You use the router's subbase screws for mounting. (You can drill holes to accommodate different routers.)

With the jig you get two pivot pins: one with a ⅛"-diameter stub to slip into a hole you drill in the workpiece's bottom (where it will remain unseen), and a sharp-pointed pin for times where you can't drill a pivot hole. I prefer the stub for its positive "lock" position; the pointed pin sometimes slipped from its location on hardwoods, but held dependably in softwoods.

—*Tested by Bob Hunter, Tools Editor*

Compact router circle-cutting jig (48871)

Performance	★★★★★
Price	$37

Rockler Woodworking & Hardware
800-279-4441; rockler.com

continued on page 78

Readers rate their own tools on WOOD MAGAZINE'S REVIEW-A-TOOL

Read the full summaries by these woodworkers and others, and post your own reviews at toolreviews.woodmagazine.com.
(Star ratings are on a scale of 1 to 5 stars.)

WorkSharp WS3000 sharpener, $250
"...I have never sharpened a chisel in my life, but within an hour of purchase I had all my chisels and plane irons back to razor-honed edges..."

— Reviewed by Brian Kinnear

Overall rating ★★★★★ 5

DeWalt DW618B3 3-base router kit, $260
"...If I could only have one router, this would be it (because it's really like having three routers)..."

— Reviewed by William

Overall rating ★★★★★ 4.8

Lie-Nielsen medium shoulder plane, $195
"Classic design...it keeps my tenon shoulders square to the cheeks and flushes tenon cheeks quickly and accurately."

— Reviewed by Vince Szymczak

Overall rating ★★★★½ 4.3

Minwax Antique Oil Finish, $17/quart
"...You just brush it on and get the coloring of oil and the varnish to seal it, all together in one mix...a nice finished look without a lot of hassle."

— Reviewed by Rick Miller

Overall rating ★★★★★ 4.8

Grizzly G0715P tablesaw, $795
"I bought all Grizzly equipment for my new shop...and this saw performs up to the tasks I do on it without a problem."

—Reviewed by Sid

Overall rating ★★★★½ 4.5

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  - (2) In-County Paid/Requested Mail Subscriptions stated on PS Form 3541. (Include direct written request from recipient, telemarketing, and Internet requests from recipient, paid subscriptions including nominal rate subscriptions, employer requests, advertiser's proof copies, and exchange copies.): 0
  - (3) Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Paid or Requested Distribution Outside USPS®: 24,954
  - (4) Requested Copies Distributed by Other Mail Classes Through the USPS (e.g., First-Class Mail®): 0
- c. Total Paid and/or Requested Circulation (Sum of 15b (1), (2), (3), and (4)): 409,960
- d. Nonrequested Distribution (By Mail and Outside the Mail):
  - (1) Outside County Nonrequested Copies Stated on PS Form 3541 (include Sample copies, Requests Over 3 years old, Requests induced by a Premium, Bulk Sales and Requests including Association Requests, Names obtained from Business Directories, Lists, and other sources): 26,520
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  - (4) Nonrequested Copies Distributed Outside the Mail (Include Pickup Stands, Trade Shows, Showrooms, and Other Sources): 1,291
- e. Total Nonrequested Distribution (Sum of 15d (1), (2), (3) and (4)): 27,811
- f. Total Distribution (Sum of 15c and e): 437,771
- g. Copies not Distributed (See Instructions to Publishers #4, (page #3)): 121,229
- h. Total (Sum of 15f and g): 559,000
- i. Percent Paid and/or Requested Circulation (15c divided by f times 100): 93.65%

16. NA Total circulation includes electronic copies. Report circulation on PS Form 3526-X worksheet.
17. Publication of Statement of Ownership for a Requester Publication is required and will be printed in the December 2013/January 2014 issue of this publication.
18. Signature and Title of Editor, Publisher, Business Manager, or Owner: Darren Tollefson, Business Manager. Date: 09/06/13. I certify that all information furnished on this form is true and complete. I understand that anyone who furnishes false or misleading information on this form or who omits material or information requested on the form may be subject to criminal sanctions (including fines and imprisonment) and/or civil sanctions (including civil penalties).

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