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ISSUE 268 JULY 2020

Better Homes & Gardens.

WOOD

The World's Leading Woodworking Resource

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As I write this, the world struggles with the worst health crisis in more than 100 years. Schools shut down; graduations, weddings, and funerals banned; entire sports seasons at all levels suspended or ended; churches, restaurants, and government offices made off-limits; factories shuttered. All to prevent the spread of a virus through “social distancing,” a term that didn’t even exist two months ago but became a way of life literally overnight.

In the midst of this pandemic (some folks argue you could leave “dem” out of that word), I realize how much I take for granted every day. Unlike health-care professionals and first responders, I can avoid contact with total strangers about whose health history I know nothing. Unlike those who staff gas stations, grocery stores, and restaurants, I can do my job from home. I *have* a home to “shelter from.”

If you’re like me, you find solace these days in your shop—perhaps the original form of social distancing. As woodworkers we almost always fly solo, building furniture, toys, and cabinets, and jigs to build more things better. We don’t sit in front of a big screen drinking beer with buddies and debating who has better chisel game, Norm or Tom. We don’t get a foursome together at the crack of dawn to drill 18 holes. And when we work out, there are no signs reminding us to wipe down the machines when we finish.

Between the total absence of normal activities and the constant stream of dire discussion bombarding us from our TVs and phones lies the shop, which provides the

perfect escape. Call it “mental distancing,” if you will. It’s as necessary as the social kind. (And useful, too: This may be the first—and last—time I’ll have my Christmas gifts built before Labor Day!)

That’s my socially distanced home office, *above*, cobbled together from my work laptop, a formerly dust-covered computer monitor, and our first flat-screen TV, called out of its attic retirement and pressed into emergency service. About 15 feet away from me, my wife, Annette, works from her ad hoc office that until recently was her quilting workstation. (She reluctantly admits that my propensity to hoard things that “may come in handy some day” has finally paid off.)

But it’s no summer vacation, working from home. The *WOOD* team is pulling out all the stops, despite the out-of-office handicap, to make sure you get your fix of reliable wood-working information in print, video, and digital, delivered reliably on schedule.

The virus-related ban on large-group gatherings did affect a large group of, ironically, woodworkers. Our Weekend With *WOOD* conference had to be postponed from May to October, which may open up a spot for you. Learn more on *page 9*, and I hope to see you in the fall. I’d like to shake your hand.

See you in the shop!

Dave Campbell
dave.campbell@meredith.com
Facebook and Twitter: @WOODeditor
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THE LUMBER LOWDOWN

It's simple: Woodworking only works with wood. But it's not so simple: Wood is complicated by board feet, a variety of grades, milling operations ...the list goes on. We'll prep you with the knowledge to get the most board for your bread.

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A comparison graphic on an orange background. On the left, a large tortoise is shown with a curved arrow pointing to the text 'PIN METERS'. On the right, a cheetah is shown in a pouncing pose with a curved arrow pointing to the text 'ORION METERS'. In the center, between the two animals, is a blue Orion 950 moisture meter with a digital display showing '72'.

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One good turning deserves another... and another...



After refurbishing a rusty old lathe for a neighbor, he and I tested it out by turning a pen from a kit. My 8-year-old son, Danny, was in the shop when we did and was just fascinated by the process. So much that the next day he asked if we could make another and if he could help. We went back out to the shop and made another pen, with Danny doing some of the sanding.

Over the past weeks, Danny has asked to do more and more of the work, and is extremely safety-conscious. We work the tool together on the things he lacks confidence in, so he can get a feel for how it's supposed to work.

Danny has sold several pens already and is donating the money from his first 30 to a ministry in our church called Boys and Girls Missionary



Challenge (bgmc.ag.org) that is giving away audio Bibles in native languages in Africa. His goal is to raise \$600 for that and then start saving money so he can attend extracurricular events. Call me a proud father.

—**Jeremy Rakowski**
Wisconsin Rapids, Wis.

Dusting off the ground rules

In your article about setting up a whole-shop dust-collection system in issue 266, I noticed you didn't mention grounding the ductwork system. Do you think it's necessary to ground a small-shop collection system? The system I have now has a ground wire running inside the ductwork, causing chips to get caught and plug the system often. If I could eliminate that ground wire, it would save a lot of headaches and downtime. Thank you.

—**Bill Doemel**
Oconto Falls, Wis.

The primary reason for grounding a home-shop dust-collection system isn't to prevent explosions,

as is commonly thought, but to prevent a static shock to you. An excellent (and extremely thorough) article on this subject can be found at woodmagazine.com/PVCgrounding. The article provides extensive reasoning about why and how to ground a system, but these sentences sum it up: "If you use PVC [ductwork], the primary issue is to protect yourself from a shock. For this, I recommend either a bare grounded wire in the duct, or grounded screws through the pipe spaced every 4 inches."

In my home shop, I wrapped the PVC ducts with a bare copper wire around the exterior, as shown below, with no screws penetrating the pipe. This has eliminated the static shock I used to get when

opening blast gates and such, and also the "static cling" that attracted dust.

Grounding metal ductwork is far simpler. Simply attach a wire or other conductor from the duct to a grounded bit of metal.

Craig Ruegsegger, Deputy Editor

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SOUNDING BOARD

YOUR VOICE

Defending the double play

I found it funny that some people complained about the cost of woodworking projects in issue 266 (Sounding Board, March 2020). If you don't want to make it, then don't.

As you can see in the photo below, I made the double-router table in issue 264 (November 2019) and I love it. Mine cost only about \$500 (including a new router) because I used reclaimed lumber and recycled door hardware. I even upgraded to a 4" dust port to work with my dust-collection system. Thanks for the inspiration.

—Melvin Woodard
Pendleton, N.C.



I was completely blown away by the negative feedback you received in issue 266 about your router table design. I have to say that your response—that the purpose of your magazine is to inspire your readership—was spot-on.

I have subscribed to WOOD® magazine for decades and am amazed at how I still find new ideas between its covers. You consistently cover most major aspects of woodworking at beginner to expert levels and manage to keep it new.

That isn't to say that all of your projects are to my particular taste, but I take away a lot of valuable information from even those that aren't. I have learned so much from your magazine over the years that I felt it was time to express my appreciation to you and your staff for a quality publication that has always been an inspiration in my work. Keep up the good work.

—Ted Sarasin
Racine, Wis.

After reading Sounding Board in issue 266, I'd like to comment on your response to the reader who balked at the \$900 cost of the double-router table. I, too, am a hobbyist woodworker who often adapts the plans in WOOD magazine.

For example, I made the entertainment center in issue 224 (March 2014) that you built from dimensional Douglas fir. After several months of scouring home centers for the better cuts and not finding anything suitable, I went a different way. Using a scrap piece of birch plywood for the case and some old oak flooring for the facing, I made the entertainment center shown below.

Using your plans and adapting to the materials I had, the finished product—though not perfect—is something that gives me great satisfaction. You and I may see the flaws, but treating each project as a learning experience makes me a better woodworker.

—Tom Chadwick
Glen Rock, N.J.



Serendipity saves a sub

I've subscribed to WOOD magazine for several years and enjoyed many of your plans, whether I've gotten around to building them or not. But to be honest, the thought of letting my subscription lapse crossed my mind, as I recently decided to transition woodworking from a hobby to a more

serious commercial endeavor and have been looking to reduce spending.

And then, issue 266 arrived in my mailbox.

As I looked through the table of contents and saw the lineup of workbenches, vises, and dust-collection design (essentially everything I'm going

to need to build up-front), I was reminded why I subscribed in the first place. Call it serendipity or WOOD's consistent content, but my 2-year subscription renewal is in the mail.

—Kyle Durham
Norborne, Mo.

At Weekend With **WOOD**, **YOU** are our top priority.

Because of the effects of the coronavirus pandemic, the 8th annual **Weekend With WOOD** conference, originally scheduled for May, has been postponed until October 29–November 1, 2020.

Although we know this rescheduling is an inconvenience, the health and safety of our attendees comes first.

Because some registrants had conflicts with the new dates, we have a *limited number* of openings at this previously sold-out event.

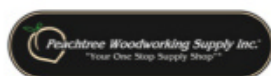
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SOUNDING BOARD

YOUR PROJECTS



Talk about project creep: What started as the need to store a 22"-wide serving dish turned into this Federal-inspired sideboard, designed and built by **Nick Vaneria**, of Romeoville, Ill. Made primarily of sapele, it features handmade tiger-maple inlays, and bubinga-veneered sides, doors, and drawer fronts. (The serving dish hides behind the center doors.)



This Art Deco-inspired display case, designed and built by **Christopher Schmitz**, of Milwaukee, showcases the history of the Chevrolet Camaro through scale-model cars in factory-original colors. The base of the case incorporates the bumper from Chris' 1973 Chevy Caprice (with working marker lights).

When his son needed to upgrade his drum kit, **Eric Olson**, of Wausau, Wis., decided to make the shells himself using maple staves. For the 13" snare drum, at far right, Eric checkerboarded 128 pieces of purpleheart and maple, then built a special router jig to turn the exterior round.



SOUNDING BOARD

YOUR PROJECTS



Wiley Cotton, of Waynesville, N.C., built this modified version of our Limbert Rocking Chair (issue 258, Dec/Jan 2018/2019) for his chairmaking class at Haywood Community College. Last May, Wiley graduated with honors... at age 71.



Hover your smartphone's camera over this code to buy plans for this rocker, or visit woodmagazine.com/limbertrocker.



Jerry Weedon, of Bonfield, Ill., salvaged old wood fencing to make this quilt-look door for a cabinet in his wife's sewing room. The design is inspired by "barn quilts" Jerry worked on years ago. All of the pieces are their natural colors—no stain or dye was used.



Combining a cutting-board technique he'd recently completed and a YouTube video he ran across, **Mike Hanan**, of Shady Cove, Ore., turned this three-pointed bowl. The bowl comprises 36 maple, walnut, and teak segments.



After discovering doorknobs from his great-grandparents' 1898-built house, a friend asked **Jay Hilgenberg**, of Columbia City, Ind., to make a coat rack that incorporates them. Screws driven through the keyholes secure the knobs to the quartersawn white-oak rack. Jay mounted the escutcheon plates upside down to provide clearance below the shelf. 🌲

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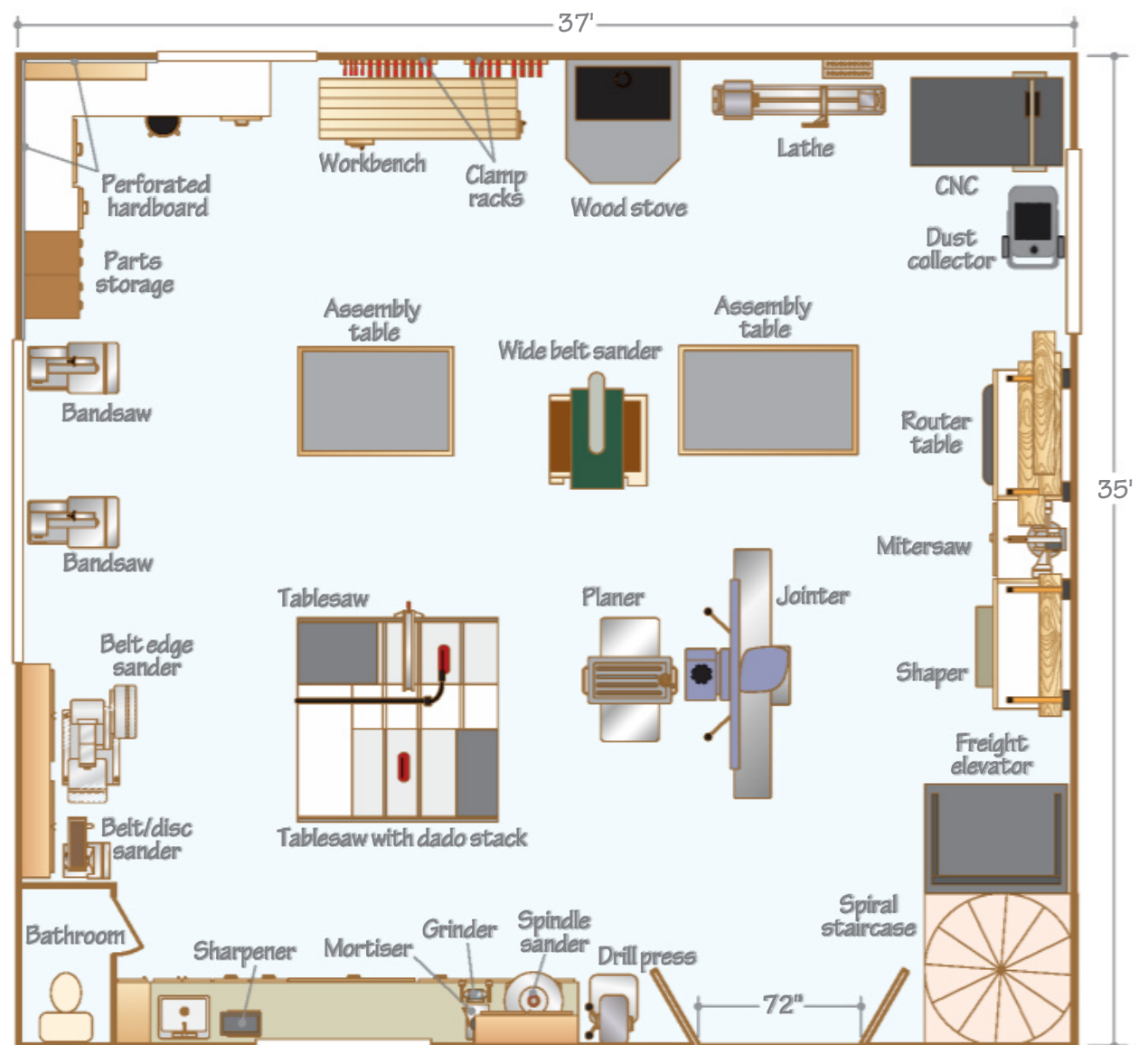


Handsome Hillside Two-story

Back-to-back tablesaws provide a large surface for cutting sheet goods. Ken dedicated one of the saws to cutting dados. A pair of strategically placed assembly tables include storage underneath.

When Ken Balatgek built his new workshop, he put a lot of thought into the design. Embedded in an embankment, with the upper-level shop accessible from the main driveway, he uses the lower level for storage and parking his truck. The bottom floor also houses a finishing room, cyclone dust collector, air compressor, and furnace. Between both levels, Ken has about 2,600 square feet of space. A custom-made open freight elevator helps move lumber and projects between floors. Foot traffic uses a spiral staircase.

Blast gates in the floor route dust from the stationary tools, including dual bandsaws and tablesaws, as well as a wide-belt sander, to ductwork in the lower level. Ken ran ethernet cable from each blast gate to a panel with an array of LEDs. Magnetic door- and window-alarm sensors at each blast gate complete a circuit when a gate opens, and a corresponding light glows on the panel. One glance tells Ken how many and which blast gates are open.





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Ken designed his two-story shop to fit the topography. Windows provide plenty of natural light, and the double doors make it easy to get projects and materials in and out.



The bulk of the dust-collection system hides in the lower level of the building. Ductwork leads to ports in the floor of the shop near each machine. Ken designed a lighted panel to tell him which blast gates are open (inset photo).

For storing hardware, such as screws and other fasteners, Ken was fortunate to obtain some heavy-duty card-catalog cabinets from a library auction. He repainted them and added dividers. Ken built much of the other cabinetry using lumber milled from a beech

tree felled by a friend. He made his traditional workbench from soft maple using plans and hardware from Benchcrafted. "It was my first 'big' project," he says.

A heavily insulated ceiling and 2×6 walls allow an air conditioner to cool the shop in

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SOUNDING BOARD

YOUR SHOP

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Among all the machinery, Ken maintains a "hand-tool corner" where he works at his traditional workbench.

the heat of summer without stressing Ken's wallet. Wintertime heat comes from a wood stove or the furnace.

Ken recently acquired a Digital Wood Carver 2440 CNC router. He's having a lot of fun exploring its potential for creating signs, plaques, inlay work, and whatever else he can dream up. 🌲



Ken Balatgek stays busy with his dental practice and raising three girls. His woodworking ventures started less than a decade ago. He enjoys building furniture and woodturning while discovering new potential for his CNC router.

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Q What makes rare-earth magnets so rare?

I can't open a woodworking magazine, catalog, or website without seeing rare-earth magnets used in everything from tool organizers to shop jigs to jewelry boxes. They seem to be everywhere, and not too expensive, so where does the term "rare" come from?

—Andrew Rhinehart, Dearborn, Mich.

A The magnets you refer to, Andrew, get that name because they contain neodymium or samarium, two of 17 rare-earth elements. Despite that designation, some of those elements can actually be as abundant in the earth's crust as lead or tin. The word "rare" applies to them because they don't appear in concentrations or seams, as do elements such as copper or silver. Instead, rare-earth elements occur widely dispersed in ores; low concentrations often make mining them economically unviable.

The rare-earth magnets you find widely available are an alloy of neodymium, iron, and boron. Neodymium magnets were invented in the 1980s, but it wasn't until their prices dropped significantly in the 1990s that they made a splash in the woodworking world. Today, you'll find them in many applications that benefit from strong magnetism in a compact form, including cordless-tool motors, hard-disk drives, magnetic hold-downs, jewelry clasps, cabinet latches, tool holders, speakers, MRI machines, and wind turbines.

Compared with other types of permanent magnets, such as ferrite (also called "ceramic" and composed mostly of iron with a few other elements) or alnico (iron with aluminum, nickel, cobalt, and other elements), rare-earth magnets can be 10 times stronger.

All rare-earth magnets receive an "N" rating (N stands for neodymium), designating their strength. The strongest—N52 magnets—are noticeably stronger than N35 magnets. But that doesn't mean N52 magnets are best for all applications. An N42 magnet that's slightly larger than an N52 magnet may have the same pull but be less brittle and cost less.

Rest assured that your rare-earth magnets will perform long into the future; neodymium magnets lose less than 1 percent of their magnetism every 10 years (provided you don't expose them to temperatures exceeding 175 degrees F).

With all that power comes possible health hazards, however. Rare-earth magnets can

interfere with pacemakers or other implantable devices. Swallowing them can lead to serious health problems or death if they attach to each other through intestinal walls. When using neodymium magnets in your projects, always secure them within a sealed cavity or attach them solidly with screws or epoxy. Rare-earth magnets will corrode readily, so don't subject them to applications that wear down their factory-applied plating or coating. They're also brittle, so avoid having them forcefully collide with each other or ferrous surfaces.

Today, the majority of rare-earth elements are mined in China, partly due to that nation's low cost of production. (It was China's entry into the market that brought down prices in the 90s.) Because these elements occur in low concentrations, extracting them from ore can be especially damaging to the environment. For strategic and ecological reasons, research is underway to find substitute materials. 🌱

Note: The other type of rare-earth magnet, a samarium/cobalt alloy, costs more and has less magnetic strength, but finds use in certain high-temperature applications.



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SHOP TIPS

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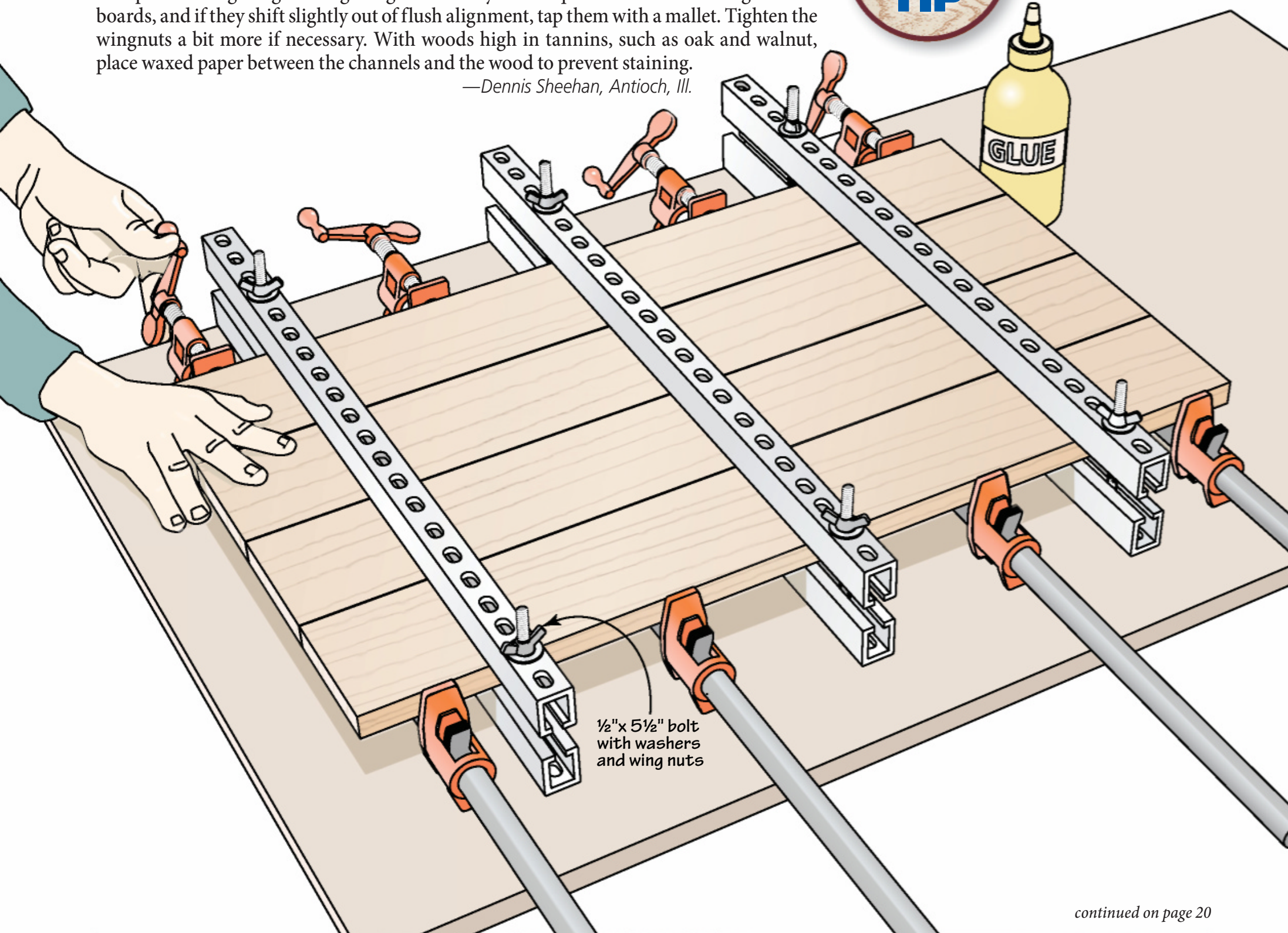
For flat panels, strut's your stuff

I used to struggle gluing up flat panels. Now I use common strut channel (often referred to as Unistrut, a major brand), to hold boards in the panel perfectly flat as I clamp them.

Home centers sell the U-shaped steel channels in 10' lengths costing about \$20 each. Cut those into pieces a few inches longer than your widest glue-ups, arrange the channels and hardware as shown, then tighten the wingnuts just enough to flatten the glue-up. Add clamps and bring the glued edges together until you see squeeze-out. Feel the edges of the boards, and if they shift slightly out of flush alignment, tap them with a mallet. Tighten the wingnuts a bit more if necessary. With woods high in tannins, such as oak and walnut, place waxed paper between the channels and the wood to prevent staining.

—Dennis Sheehan, Antioch, Ill.

**TOP
SHOP
TIP**



continued on page 20

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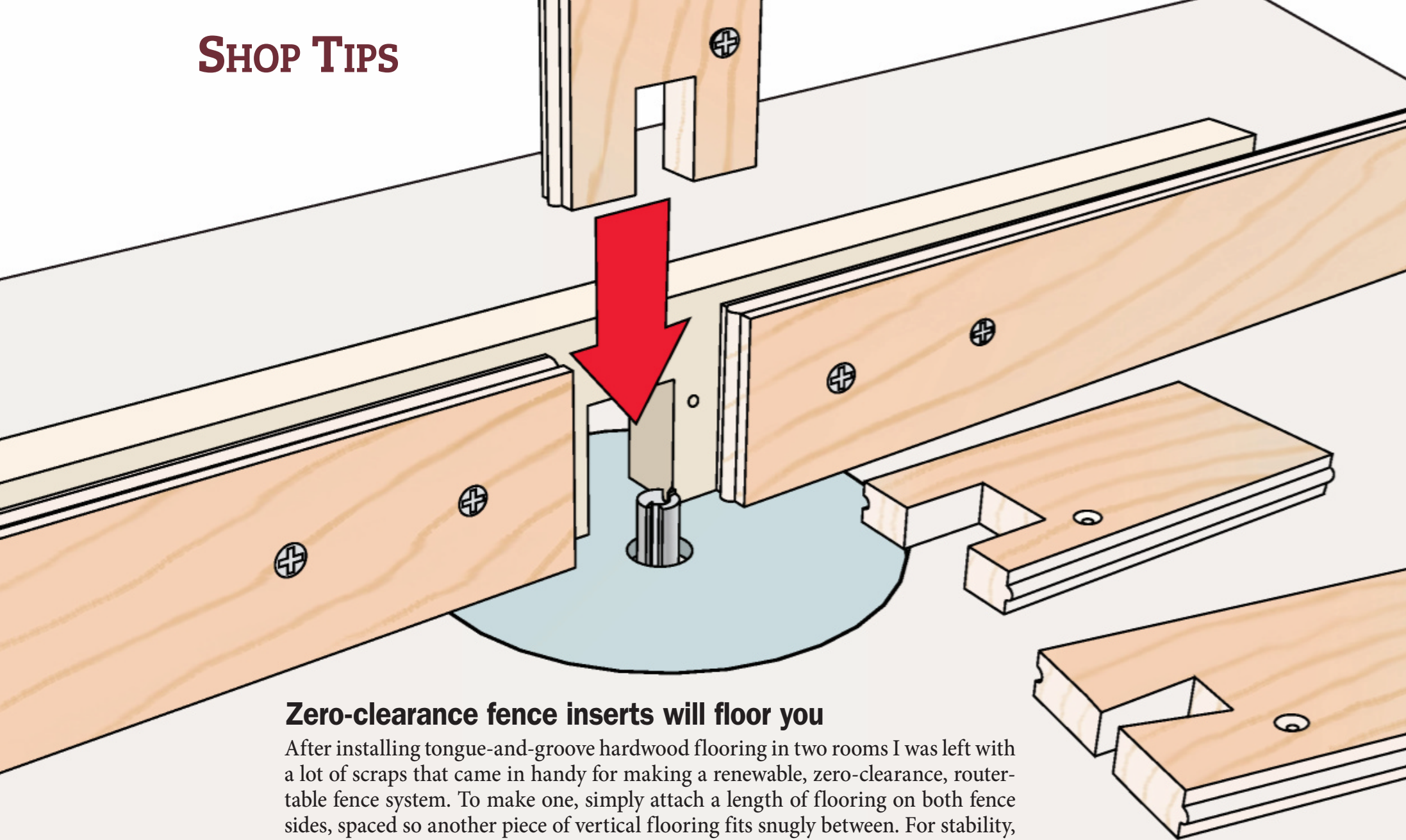
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Zero-clearance fence inserts will floor you

After installing tongue-and-groove hardwood flooring in two rooms I was left with a lot of scraps that came in handy for making a renewable, zero-clearance, router-table fence system. To make one, simply attach a length of flooring on both fence sides, spaced so another piece of vertical flooring fits snugly between. For stability, secure the vertical piece with a screw, locating the screw well away from the cutting area. Now slide the fence up to a spinning bit to make a zero-clearance fence.

Save the vertical piece for the next time you use the same bit. Many hardwood-flooring installers will have these scraps available to you at little or no cost, but you could rout your own, too.

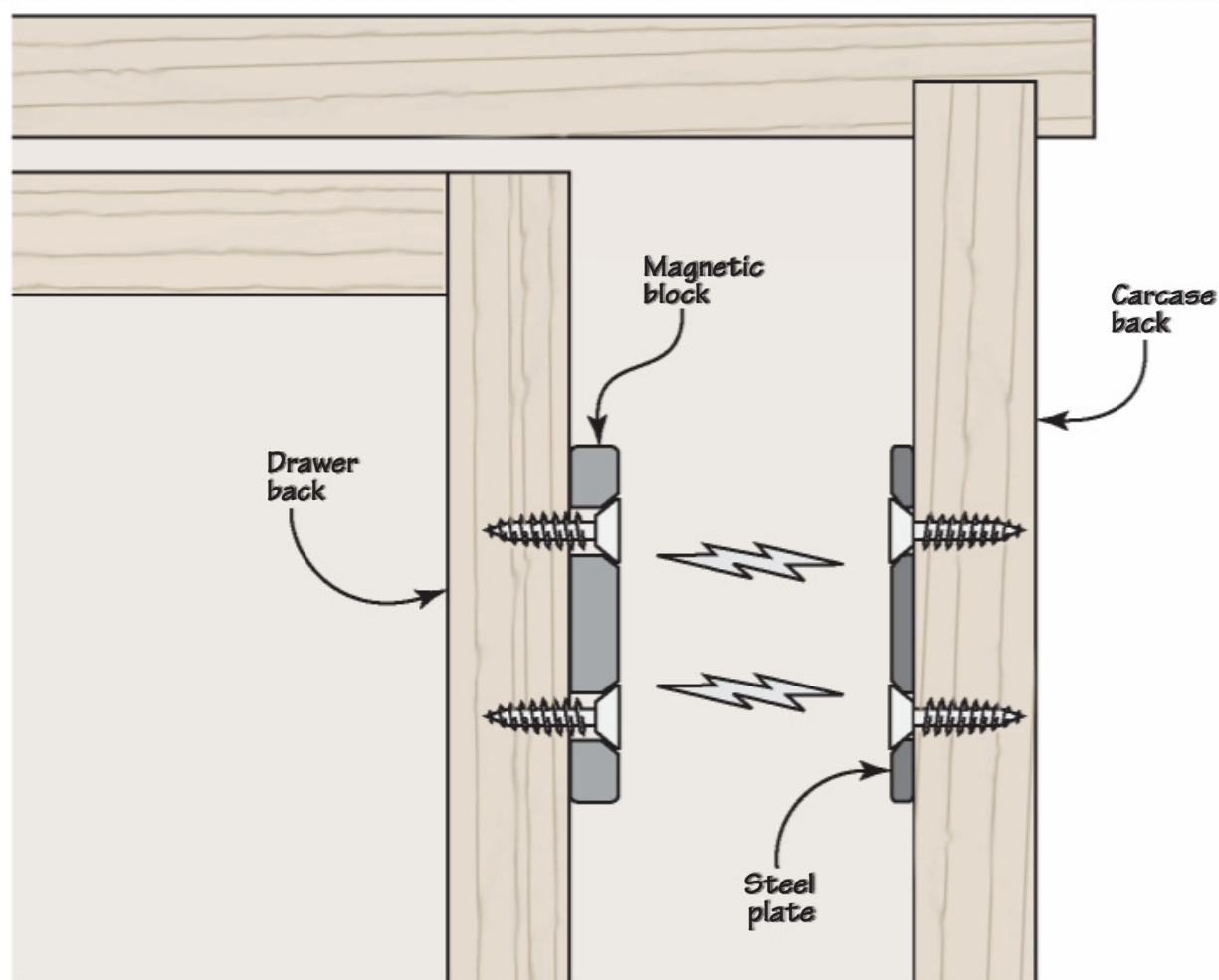
—Bill Carlson, Butler, Pa.

An attractive idea to stop unwanted drawer movement

After 20 years of daily use, the drawers in our bedroom chest began to creep forward when another drawer was closed, due to trapped air trying to escape. I could have replaced the slightly worn drawer slides, but at considerable hassle and expense. Instead, I mounted a pair of magnets to each drawer back, and similarly sized steel plates on the carcass back.

With the drawers completely closed, a $\frac{1}{32}$ " gap between the magnet and plate provides just enough attraction to keep the drawers shut without an excessive amount of resistance when opening one. You may have to experiment with that spacing depending on the size and strength of your magnets.

—Tony Rush, Springfield, Ore.



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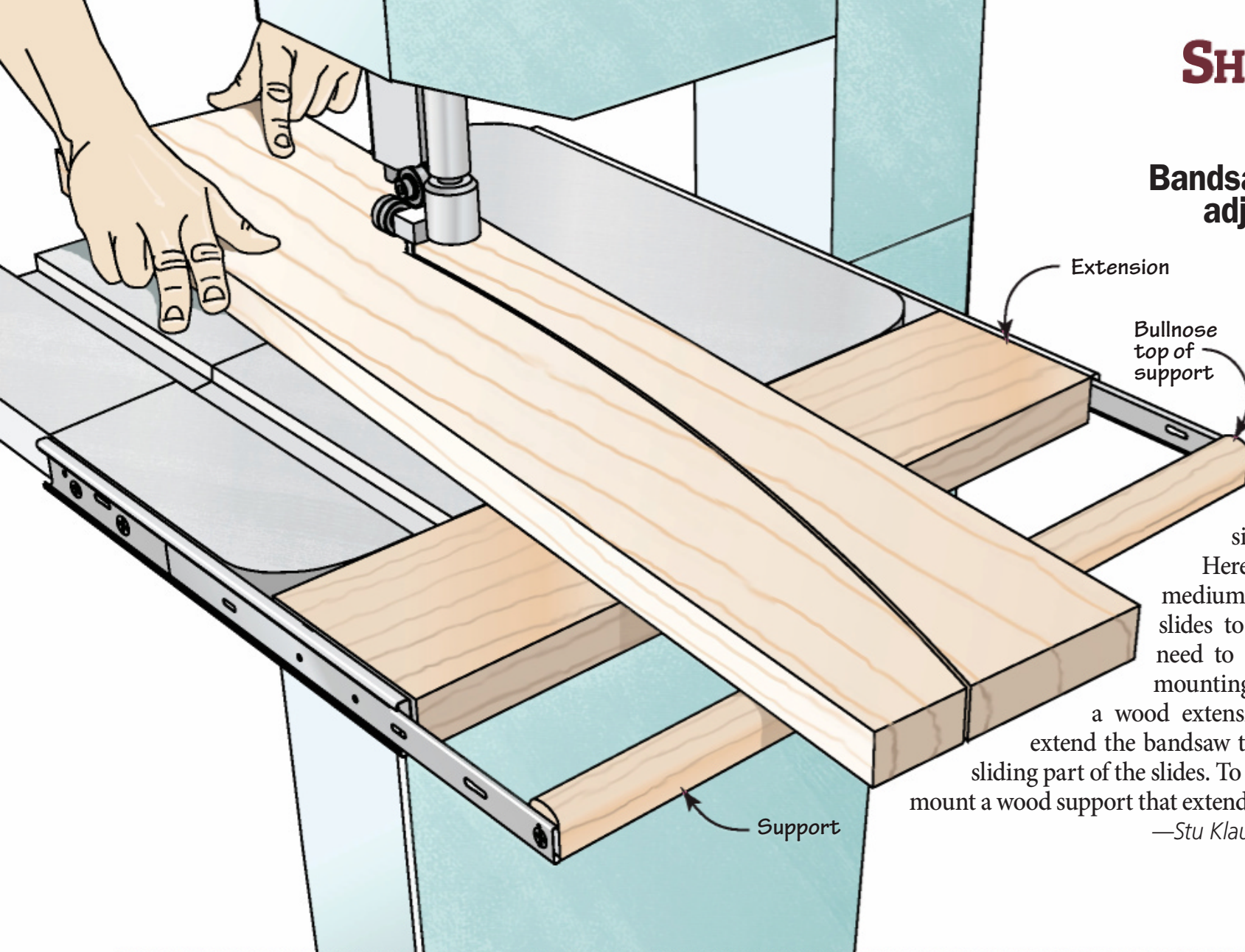


Bandsaw extension table adjusts to your needs

Most bandsaw tables provide little support for long workpieces. You can use an outfeed stand or clamp on a temporary extra-large table, but why hassle with those when you can add a permanent and adjustable extension table?

Here's how. Attach a pair of medium- or heavy-duty drawer slides to the bandsaw table. You'll need to drill and tap the table for mounting screws. Attach to the slides a wood extension that's wide enough to extend the bandsaw table to the end of the non-sliding part of the slides. To the ends of the sliding arms mount a wood support that extends in or out as needed.

—Stu Klausner, Hilton Head Island, S.C.



Auxiliary fence

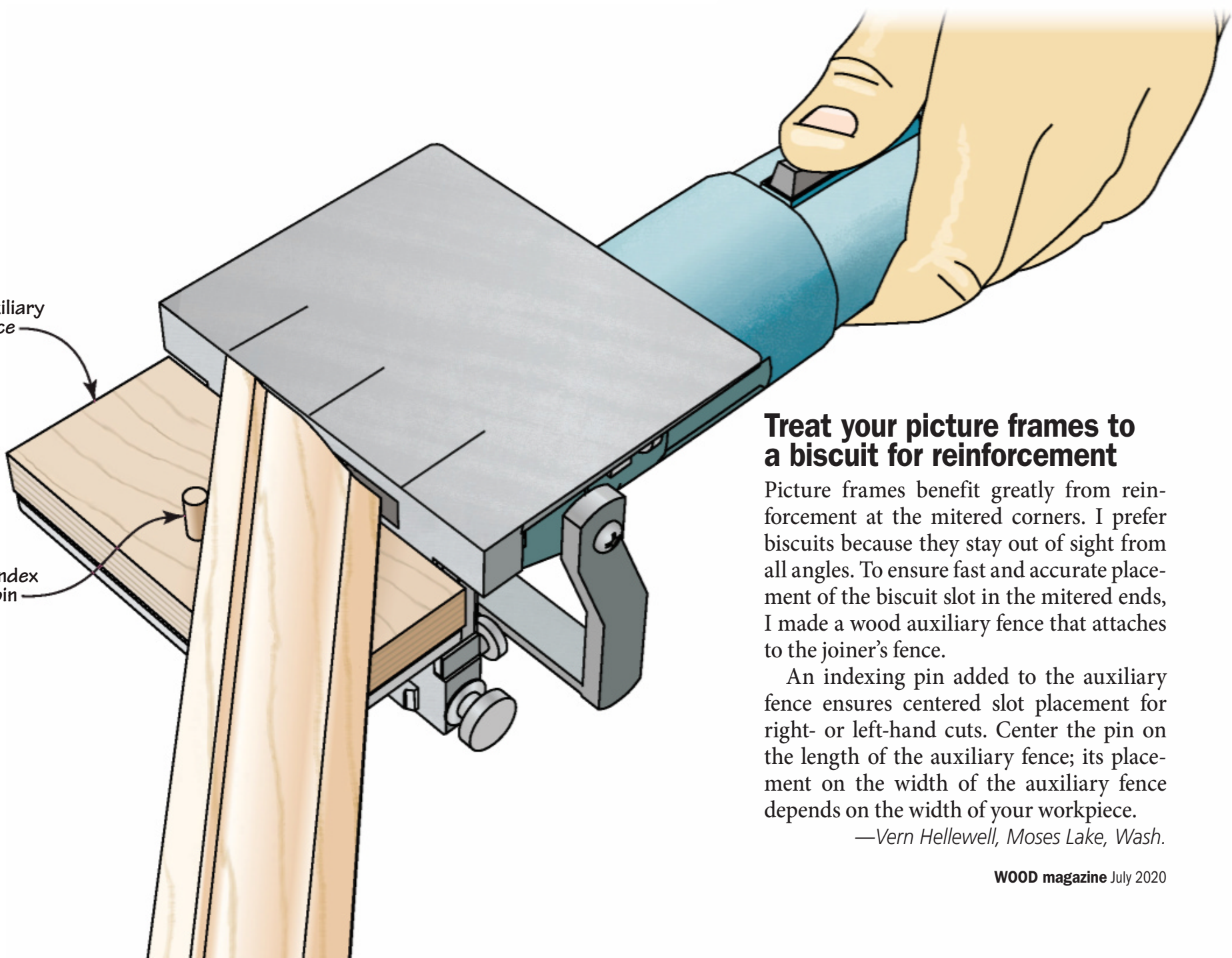
Index pin

Treat your picture frames to a biscuit for reinforcement

Picture frames benefit greatly from reinforcement at the mitered corners. I prefer biscuits because they stay out of sight from all angles. To ensure fast and accurate placement of the biscuit slot in the mitered ends, I made a wood auxiliary fence that attaches to the joiner's fence.

An indexing pin added to the auxiliary fence ensures centered slot placement for right- or left-hand cuts. Center the pin on the length of the auxiliary fence; its placement on the width of the auxiliary fence depends on the width of your workpiece.

—Vern Hellewell, Moses Lake, Wash.

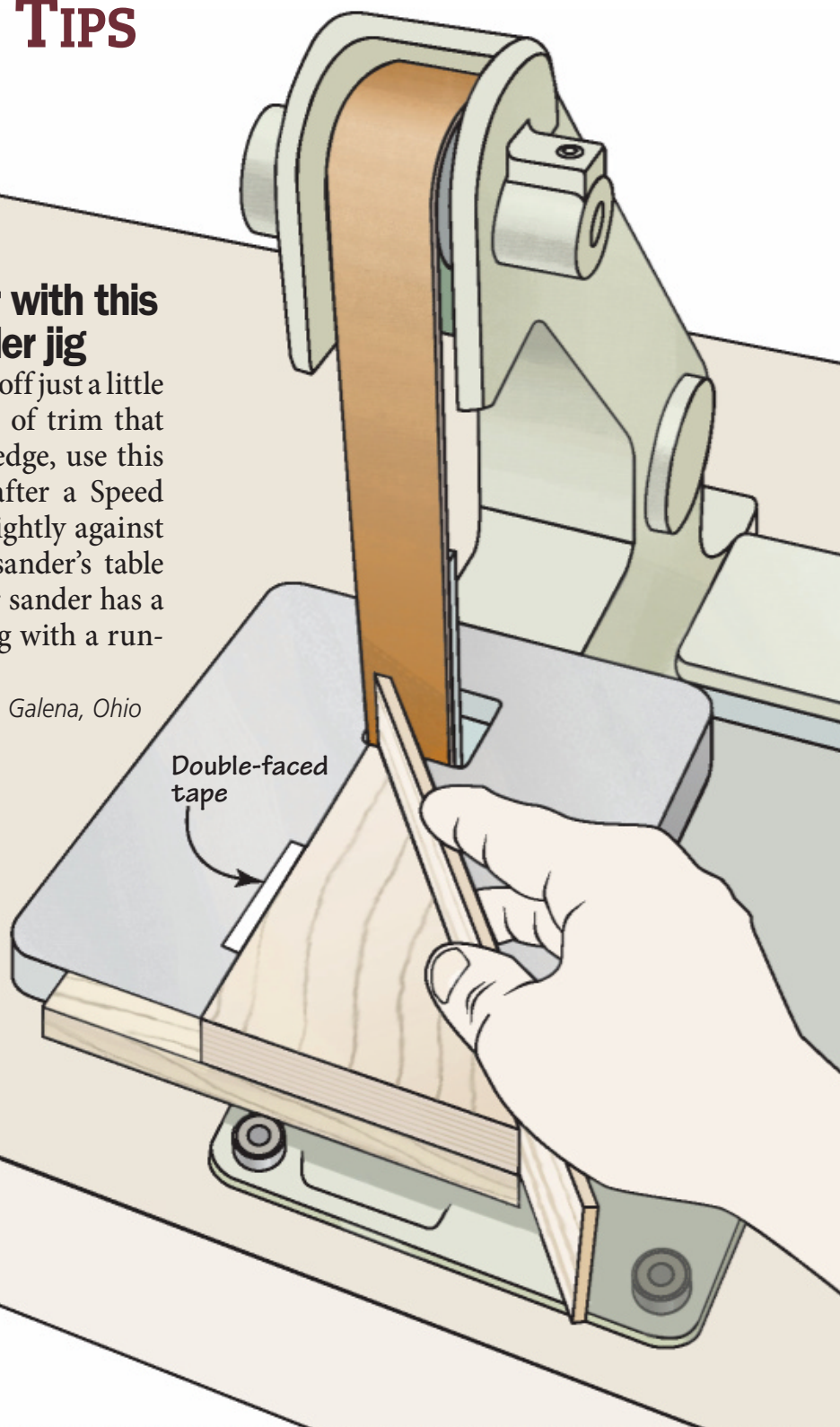


SHOP TIPS

Shave a whisker with this simple belt-sander jig

When needing to take off just a little material from a piece of trim that has a mitered or 90° edge, use this simple jig, modeled after a Speed Square. Hold the jig tightly against the edge of the belt sander's table during use. Or if your sander has a miter slot, build the jig with a runner to fit the slot.

—Dan Martin, Galena, Ohio

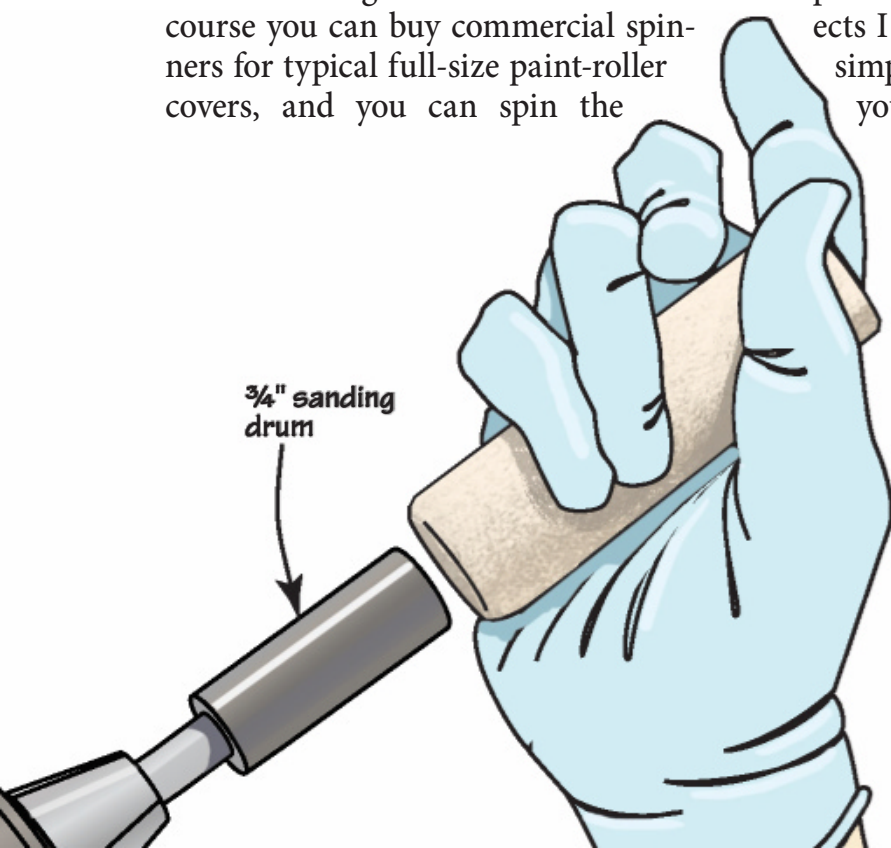


New spin on cleaning ¾" roller covers

I like the brush-mark-free results achieved using rollers to apply finishes. The only issue: cleaning the covers for reuse. Of course you can buy commercial spinners for typical full-size paint-roller covers, and you can spin the

really small ¼" inside-diameter (I.D.) covers using a ¼" drill bit in a drill/driver. But for putting down clear finishes on wood projects I prefer ¾"-I.D. covers. To clean them, simply fit them over a ¾" sanding drum in your drill/driver. Works like a champ! 🌲

—Brian Flynn, Overland Park, Kan.



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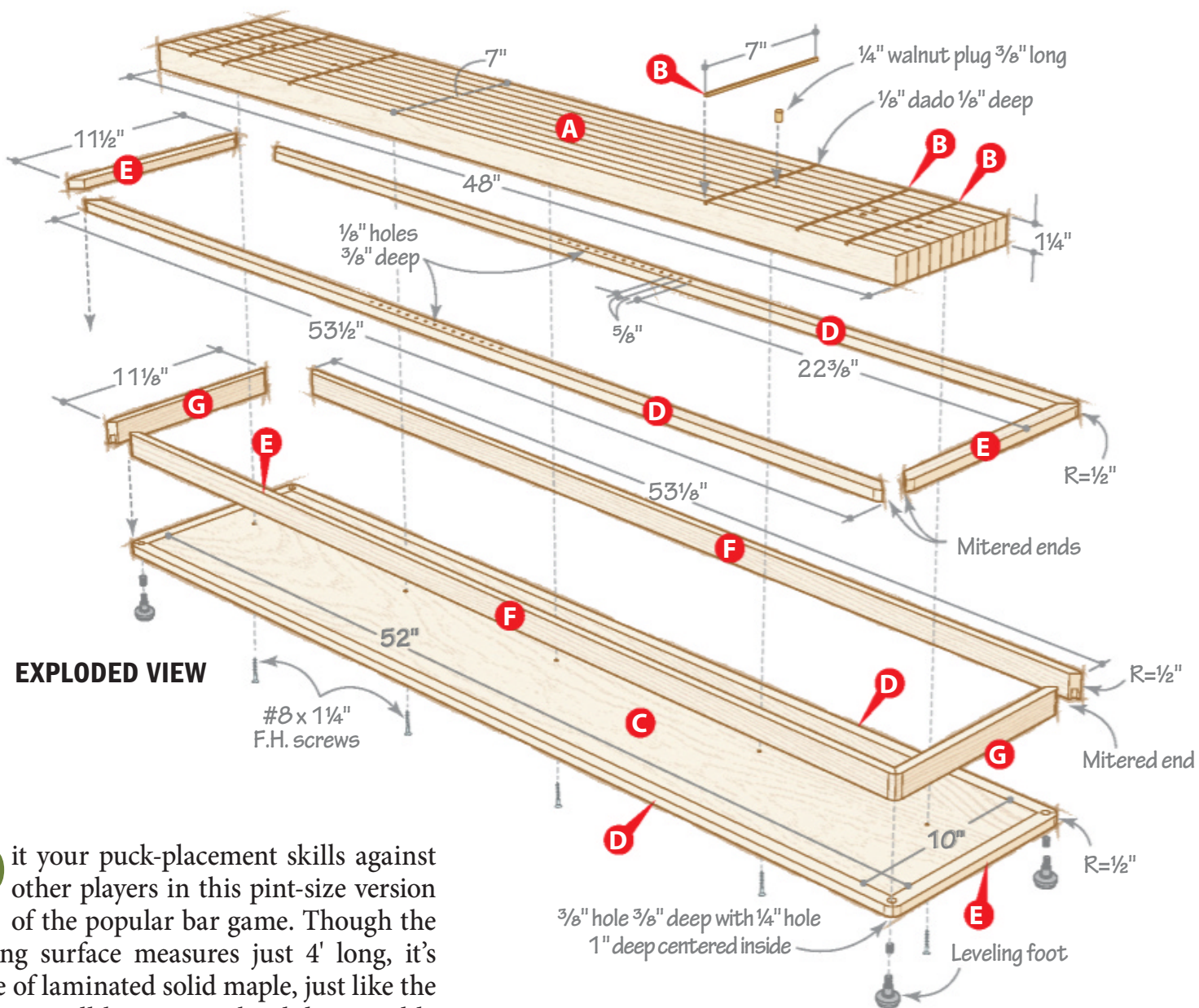


► Learn the rules for many different shuffleboard games by pointing your smartphone's camera at this code, or visit woodmagazine.com/shufflerules.

DIMENSIONS:
11½" W x 53½" L x 2⅝" H

Approximate materials cost:
\$75

Including lumber, feet, pegs, and pucks; all but lumber available from one convenient source.



EXPLODED VIEW

Pit your puck-placement skills against other players in this pint-size version of the popular bar game. Though the playing surface measures just 4' long, it's made of laminated solid maple, just like the big boys. Ball-bearing pucks glide smoothly without the lubrication of messy powder, and four easy-adjust feet ensure a dead-level playing surface.

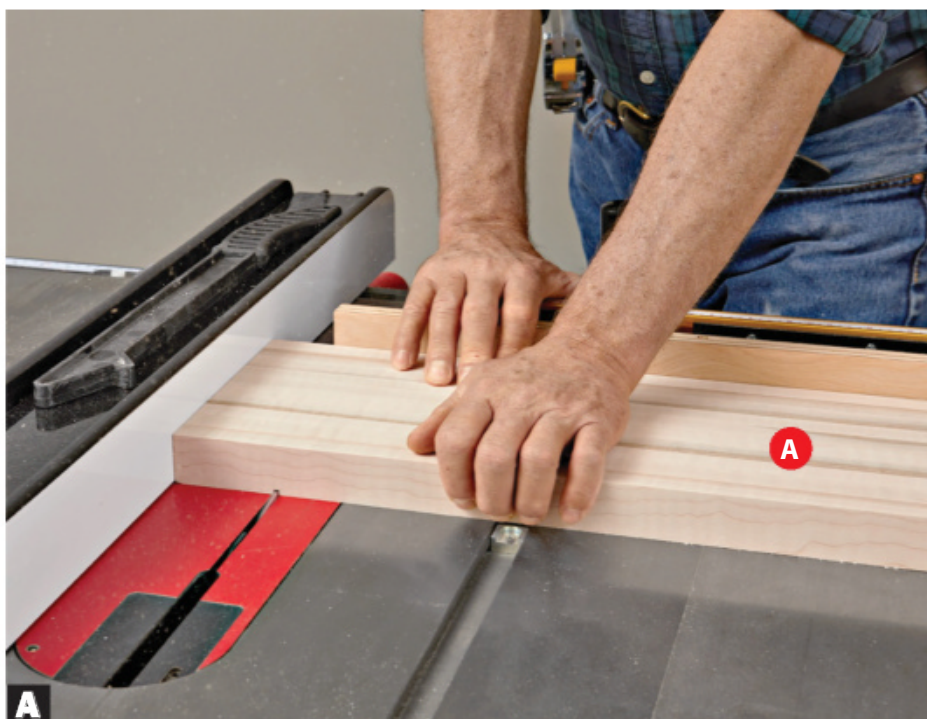
First, get on the board

1 Glue up 1½"-wide maple strips to make a slightly oversize blank for the board (A) [Materials List, Exploded View]. (We glued strips of ¾" stock face-to-face.) Joint and plane the

blank to finished thickness, then trim to width and length.

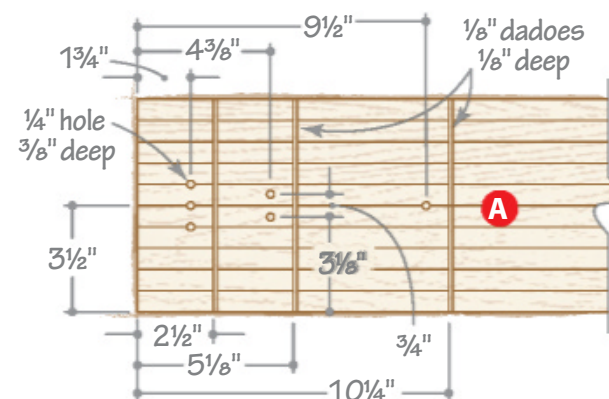
2 At the tablesaw cut three dados at both ends of the board [Drawing 1, Photo A]. Crosscut score-zone strips (B) to length from a ⅝"-thick, 7¼"-wide walnut blank. Glue them into the dados.

► Joint glue-ups wider than 6" on a 6" jointer. woodmagazine.com/jointwide

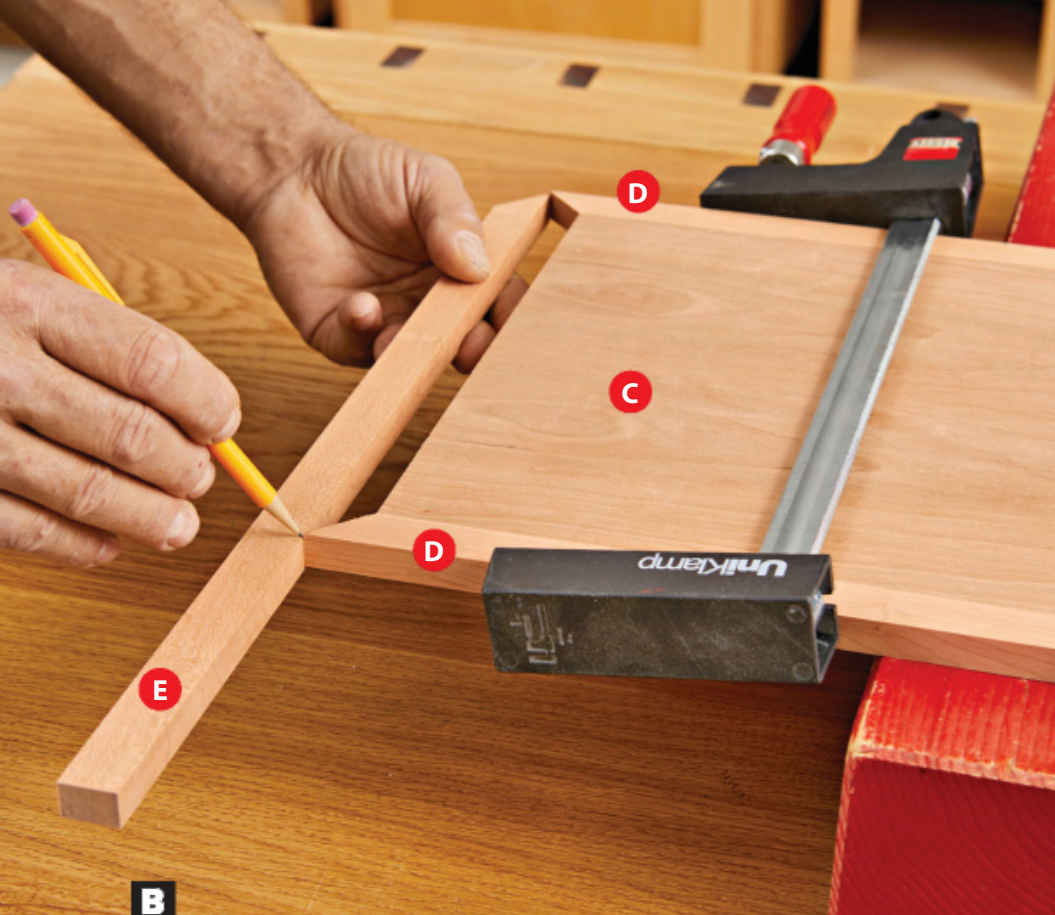


A Cut the end dados first, using the fence as a stop. Move the fence and cut the middle dados. Then move the fence again to cut the innermost dados.

1 SCORE ZONE



Tip! To cut flat-bottomed dados for the score-zone strips (B), use a full-kerf combination blade with flat-top raker teeth.



To mark the end trim for length, position its toe against the toe of the attached side trim. Mark the opposite toe, then make the miter cut.



Overhang the side trim (D) on the gutter (F), $\frac{1}{16}$ " on the inside. Line up the miters of the trim and gutter.

3 To number the score zones, mark and drill the $\frac{1}{4}$ " holes [Drawing 1] at both ends of the board. Cut walnut plugs to fit the holes, then glue them in place.

4 Trim the score-zone strips and plugs flush, then sand the board to 220 grit, checking that it stays flat. Apply a finish to all surfaces of the board. (We sprayed lacquer—a film finish that won't yellow the maple. A water-based poly works well, too.)

Now, let's rock the cradle

1 Cut the bottom panel (C) to size. Make parts D–G from $\frac{1}{2}$ " cherry ripped to width and cut at least 1" longer than listed. Clamp two side trim (D) to the long edges of the bottom panel and scribe the miter heels on them. Miter-cut all four of the side trim based on the scribed dimension. Glue two of those pieces to the bottom panel and set the other two aside for now.

2 Miter-cut one end of all four end trim pieces (E). Miter-cut the other ends to fit [Photo B]. Glue two end trim to the panel and set aside the other two. After the glue dries, sand a radius on each corner of the C–E assembly [Exploded View].

3 Miter-cut the gutter sides and ends (F, G) to finished length. Glue together those pieces using masking tape at the corners to clamp them. Sand a radius on each corner [Exploded View]. Glue the gutter assembly (F/G) to the bottom assembly (C–E) with equal spacing all around.

4 Retrieve the extra side trim (D) and glue them to the top of the gutter sides [Photo C]. Similarly, glue on the two remaining end trim pieces (E). After the glue dries, sand the

corners of these trim pieces to match the radius on the bottom trim pieces.

5 Drill the holes for scoring pegs along the top edge of the side trim (D) [Exploded View]. (We show enough holes to score to 15; drill more holes if you prefer to score to 21.) Drill holes and counterbores for leveling feet [Source] at each bottom corner.

6 Apply finish to the cradle (parts C–G assembly). Then, screw the board (A) to the cradle. Finally, drive threaded inserts into the leveling-feet holes, and screw in the feet. Level the board and give the pucks [Source] a few good slides. 🌲

► Centering the screws holding the board to the cradle allows the board to expand and contract with seasonal changes in humidity.

► Like a pointy-toed boot, the “heel” of a miter refers to its 135° angle; the “toe” refers to the 45° point.

► Watch a video on how to cut perfect-fitting mitered panel corners. Point your smartphone's camera at this code, or visit woodmagazine.com/miteredcorners.



Produced by **Bill Krier** with **John Olson** and **Brian Bergstrom**
Project design: **John Olson**
Illustrations: **Roxanne LeMoine**, **Lorna Johnson**

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A* board	1 $\frac{1}{4}$ "	7"	48"	LM	1
B* score-zone strips	$\frac{1}{8}$ "	7"	$\frac{1}{8}$ "	W	6
C bottom panel	$\frac{1}{2}$ "	10"	52"	CP	1
D* side trim	$\frac{1}{2}$ "	$\frac{3}{4}$ "	53 $\frac{1}{2}$ "	C	4
E* end trim	$\frac{1}{2}$ "	$\frac{3}{4}$ "	11 $\frac{1}{2}$ "	C	4
F* gutter sides	$\frac{1}{2}$ "	1 $\frac{1}{4}$ "	53 $\frac{1}{8}$ "	C	2
G* gutter ends	$\frac{1}{2}$ "	1 $\frac{1}{4}$ "	11 $\frac{1}{8}$ "	C	2

*Parts initially cut oversize. See the instructions.

Materials key: LM-laminated maple, W-walnut, CP-cherry plywood, C-cherry.

Supplies: #8×1 $\frac{1}{4}$ " flathead screws (5).

Bit: $\frac{1}{4}$ " plug cutter.

Source: Blue and red pucks (4 each), blue and red pegs (1 each), leveling feet (4), kit no. RS-01259, \$22.95 plus shipping, 888-636-4478, woodstore.net/shuffleboard.



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Don't Replace— Reface!

Save money, time, and the disruption of ripping out old cabinets by giving them a new skin instead.



BEFORE

If you like the layout of your kitchen or bathroom, refacing the built-in cabinets maintains that arrangement while making the room look like new. And because refacing costs less than new cabinets, you can use the savings to add new touches of luxury, such as self-closing drawers and soft-close doors.

Evaluate the current cabinets

Not every set of cabinets is worthy of refacing, so don't waste time and money trying to

rejuvenate excessively out-of-square boxes, or ones that have moisture damage, split frame members, or broken joints that can't be repaired. Dings, deep scratches, and chip-out on the face frame can be filled in before applying the new veneer. Ignore damaged doors and drawer fronts as you'll build new ones to match the revitalized face frames. Broken drawer boxes can also be replaced. If your cabinet boxes pass muster, move on to evaluating your hardware.

► We worked with Hartman Construction of Des Moines, Iowa, to get expert advice on refacing. Look for their "Pro Tips" throughout this article.

Specialty tools ease the job

The veneer used to reface cabinets comes in 24×96" sheets in a variety of species and with a pressure-sensitive adhesive (PSA) backing [Sources]. To accurately cut sheets this long, use a laminate slitter [Photo A, Sources]. Slide the veneer along the fence and between two bearing-mounted cutters. Adjust the distance between the bearings to accommodate sheets of different thicknesses, and set the fence to cut strips of different widths.

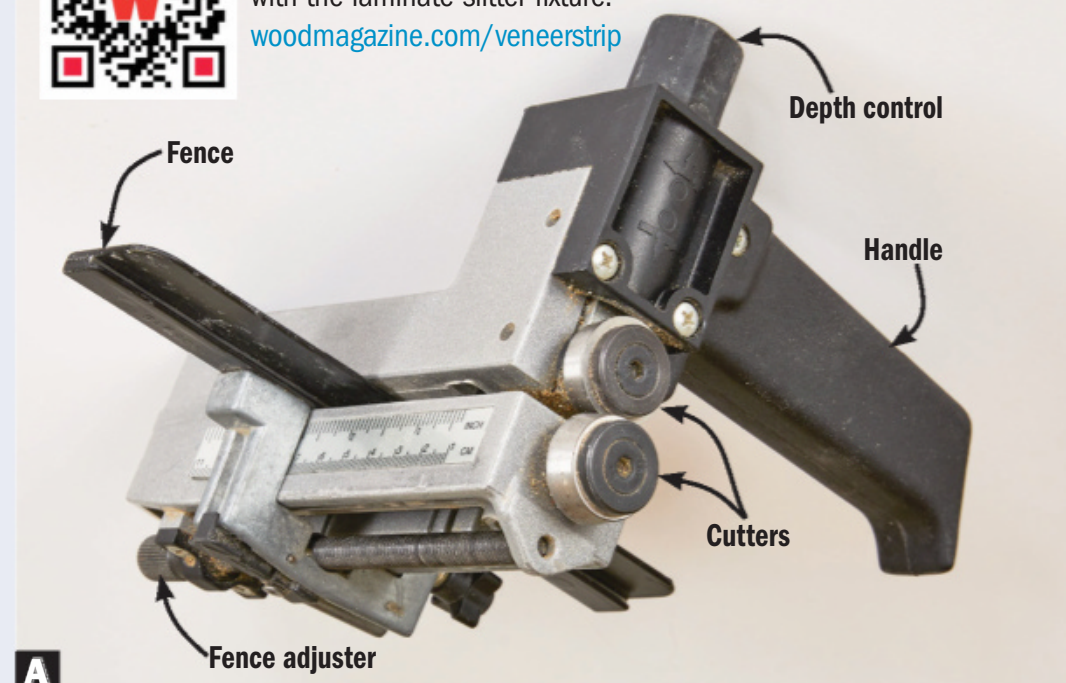
You can use the trimmer handheld, or purchase a clamp that secures it to the edge of a bench or countertop. But for best control and accuracy, make a simple fixture like the one used by Hartman Construction [Photo B] that both secures the tool, and provides a larger worksurface and longer fences.

For crosscuts, a guillotine-style paper cutter [see Photo J, page 31] creates clean, square cuts and makes it easy to trim off small slivers when fine-tuning the length of a strip. Find paper cutters at office supply stores. A small one suffices.

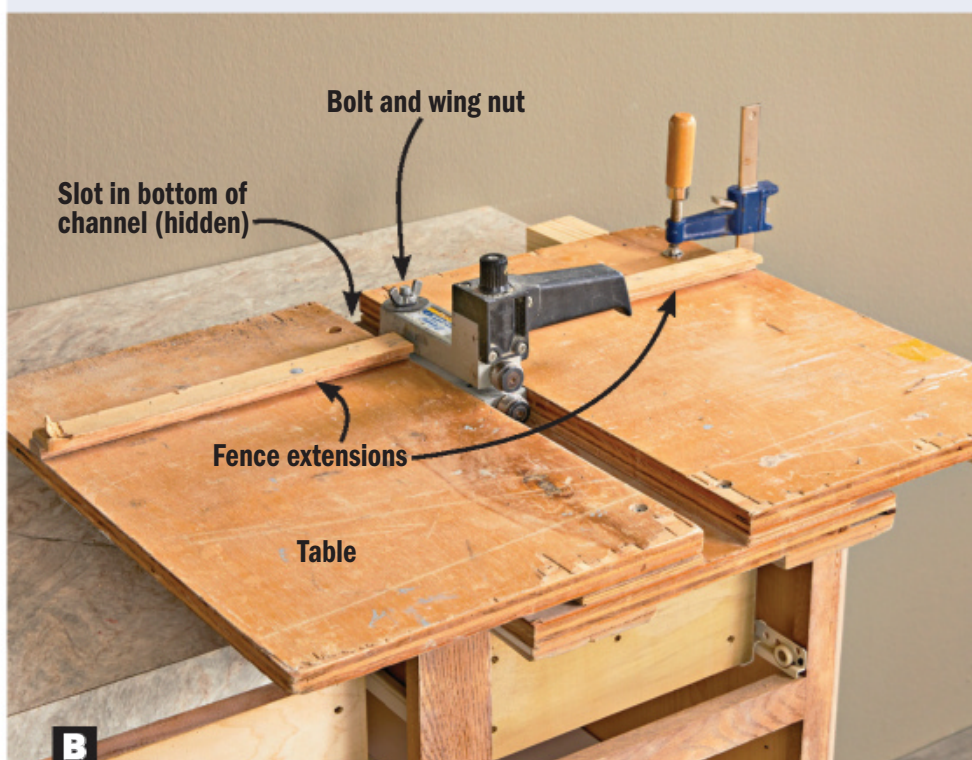
A laminate bevel-trim bit [Photo C, Sources] routs away overhanging edges and creates a slight chamfer on the installed veneer. Its small diameter allows it to reach almost fully into corners, minimizing the need to square them up after routing.



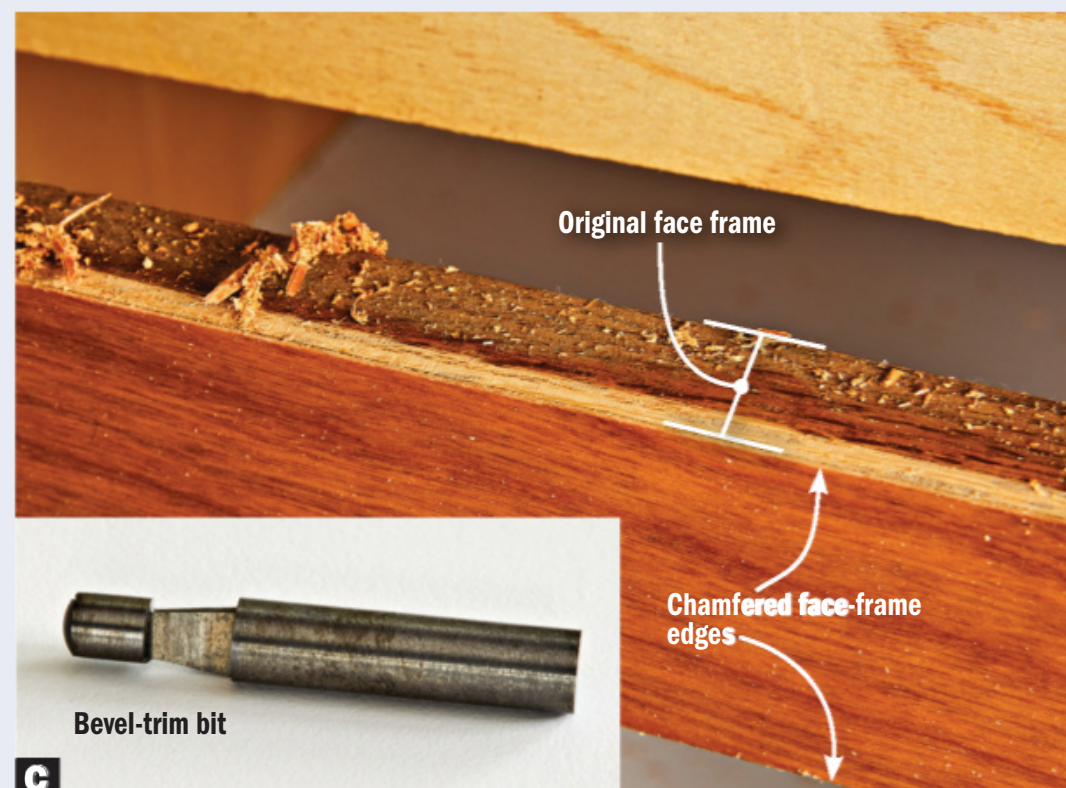
► Watch a short video of cutting veneer with the laminate-slitter fixture.
woodmagazine.com/veneerstrip



A Set cutting depth using the top knob. Adjust the fence-to-cutter distance with the knob on the rear.



B The slitter rests in a channel between two plywood tables with aligned fence extensions. A bolt through the back of the slitter (you'll need to drill a hole) slides in a slot in the channel to set the veneer width. Lock the slitter in place by tightening a wing nut.



C A chamfered edge prevents snagging a veneer edge when moving items in and out of a cabinet. Touch up areas where bare wood shows if you like—they'll be hidden behind doors and drawers.

► Learn more about types of slides and how to install them.
woodmagazine.com/slideoptions
woodmagazine.com/drawerslides

► Build drawers with a simple, strong lock rabbet, or with dovetails.
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Hardware: Upgrade? Reuse?

Although it's economical to stick with the existing hardware, upgrading hinges and drawer slides can make refaced cabinets feel as new as they look. Full-extension ball-bearing slides allow easy access to a drawer's full depth. Bottom-mounted slides provide a clean, uncluttered look with the drawer open. With self-closing slides, you give the drawer a gentle push, then it slows the last inch or so of travel and softly closes on its own. Soft-close hinges do the same for doors, preventing slams.

Side-mount slides require $\frac{1}{2}$ " of clearance on each side between the face frame and drawer box, and bottom-mount slides typically require drawer sides that extend $\frac{5}{8}$ " below the drawer bottom. Either of these choices may require building new drawer boxes to accommodate them. Build the boxes before you begin refacing to minimize your kitchen or bath downtime.

Mounting doors with hidden 35mm hinges provides three-way adjustability for aligning door fronts. (See page 52 for more about selecting 35mm hinges.)

Reusing pulls and knobs can save you money, but choosing new (or no) hardware will update the look even further. You'll find

a wide selection of pulls and knobs online and at home centers.

Finish before you start

To determine door and drawer-front sizes, measure each opening and add 1" to allow for a $\frac{1}{2}$ " overlay all around. Measure the face-frame rails and stiles and add $\frac{1}{4}$ " to their widths and 1" to their lengths to determine how much veneer you'll need. Then measure the exposed end panels and toekick faces; purchase enough $\frac{1}{4}$ " plywood to cover them. If you can't find a good color match between your veneer and plywood, buy extra veneer and apply it to birch plywood.

Using these measurements, build doors and drawer fronts to suit your desired style. For this job, we made doors with stub-tenon-and-groove joinery, and $\frac{1}{4}$ " plywood panels. Lightly sand the sharp edges of the doors and drawer fronts. Drill 35mm holes for hinges, but drill holes for pulls only after installing the doors. This ensures the pulls align and eliminates drilling a hole in the wrong end.

Cut the end panels to length, and at least $\frac{1}{4}$ " overwidth to allow for scribing to the wall if needed. Cut overlength pieces of cove molding to finish the tops of wall cabinets, and base shoe to fit along the floor. Then

Pro Tip! Overlay doors and drawer fronts hide slight out-of-square discrepancies in a cabinet box.

► Make stub-tenon-and-groove doors step-by-step.
woodmagazine.com/easycabinets

► Dress up flat-panel doors to look like raised panels.
woodmagazine.com/raisedpanel



D Insert a pencil through a router-bit bearing or a washer, then roll the bearing along the wall to transfer the wall contour onto the panel.



E Apply a thin bead of construction adhesive just inside the panel's perimeter, then pin-nail around the edges with $\frac{1}{2}$ "-long nails.



F Set a flush-trim bit to expose only enough cutter to trim the plywood. Before routing, check for a smooth surface on the face frame for the bit bearing.

apply any stain and finish to the moldings, panels, doors, drawer fronts, and full sheets of veneer in your shop before taking them to the job site. We refaced our cabinets in cherry, and applied Minwax Cherry stain topped with precatalyzed lacquer.

Time for a breakdown

With all the components ready, remove the old doors and drawer fronts. If you'll be reusing the pulls, bag them up and set them aside. Empty the cabinets so the contents don't get dusty or damaged. If you are upgrading slides, remove and discard the old ones from the cabinets and drawers. Store the drawer boxes you'll reuse inside the cabinets to reduce workspace clutter.

Install the end panels first to allow covering their exposed edges with veneer later. To get started, hold an end panel in position, and scribe the back edge of the panel [Photo D]. With a belt sander, shape up to the line. For base cabinets, hold the scribed panel in place, trace the outline of the toekick, jigsaw it, and sand it smooth.

Glue and pin-nail the side panel in place [Photo E]. Flush trim the front edge of the panel [Photo F], and square up the inside corners [Photo G].

Using 100-grit sandpaper on a random-orbit sander, sand the face frames to remove contaminants, such as built-up grease, and any loose finish. (You do not need to remove all of the old finish.) Hand-sand with a sanding block next to walls and appliances, and under countertops. To prevent transmitting old imperfections through the new veneer, fill chips, holes, or dents [Photo H], and sand them smooth. Then, apply a lacquer finish to the faces of the rails and stiles only [Photo I].

Now the facelift

Rip strips of veneer about $\frac{3}{16}$ " wider than the width of the face-frame stiles. Then crosscut them about 1" longer than each stile [Photo J]. Where two stiles butt together, cut one piece of veneer wide enough to cover both. Apply the veneer to each stile [Photo K]. Where a short cabinet butts against a tall one (as in Photo H),

Pro Tip! Construction adhesive won't run or drip and provides an instant tack.

Pro Tip! Apply a strip of painters tape to walls and appliances next to the cabinets to avoid scuffing them while sanding.

Pro Tip! Provide plenty of ventilation and remove pets from the area while applying lacquer.

Pro Tip! After peeling off the protective backing, handle the veneer only by its edges to avoid contaminating the adhesive and compromising its bond.



G Use a multitool or flush-cut saw to remove waste where the router can't reach.



H An auto-body filler, such as Bondo, works well for filling imperfections and leveling surfaces. It cures quickly and sands easily.



I Brush on two coats of lacquer. This seals the surface and allows you to peel away the veneer in the next steps should you need to reposition it.



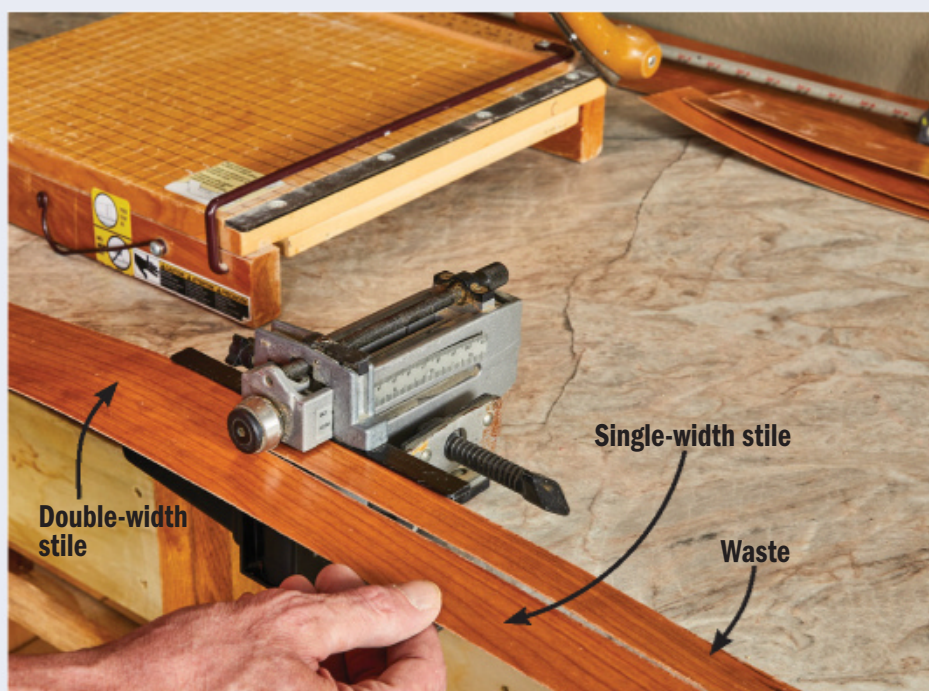
J From the 96"-long strips, crosscut lengths for each stile.



K Use your fingertips to gauge when the veneer is centered on the stile, then lightly press it in place, working from one end to the other.

Notching eliminates seams

With a double-width stile at the top and a single-width stile to the bottom, you might consider butting two strips side by side, one for each stile. However, notching one piece to cover the full length of both stiles provides a seamless fit [Photos below].



Notch a strip to fit the double stile above and the single stile below. First, slice the veneer along its length to match the length of the single stile plus $\frac{1}{2}$ ".



Next, complete the notch on the paper cutter for a perfectly square notch.



Align the notch so it just overlaps the stiles and the rail of the cabinets, and press in place at the middle, then work toward each end.



Square up one end of a length of veneer for the rail. Butt that end against the stile veneer, mark the opposite end for length, then sneak up on a perfect fit between the stiles.

cut and apply an L-shape veneer strip [Notching eliminates seams, left]. The PSA backing allows you to peel off and reposition a strip if it gets applied slightly off kilter, but aim to get it right the first time. On outside stiles adjacent to an end panel, leave as little overhang as possible along the panel to reduce sanding later, minimizing your chances of marring the panel.

Next, fit and apply the rail veneers [Photo L], and press all the veneer against the face frame [Photos M, N]. Using a laminate bevel-trim bit, rout the overhanging veneer flush with the face frame, except by the end panel, where you should hand-sand a chamfer [Photo O]. Remove excess in any areas the bit couldn't reach with a sharp utility knife.

Touch up the exposed veneer edges with the same stain used on the veneer. Fill any small gaps between rail and stile veneers with colored putty [Photo P].

Pro Tip! A gap up to $\frac{1}{64}$ " at each end can be filled with putty.

Note: The pressure-sensitive adhesive takes several days to reach full strength.

Install doors and drawers

Retrieve the doors and drawer fronts. Install the doors first [Photo Q], aligning their top edges. Apply double-faced tape to the front of each drawer box and install the false fronts next [Photo R]. Miter-cut and pin-nail cove molding to the top of the wall cabinets [Photo S]. Cut and pin-nail $\frac{1}{4}$ " plywood to the toekicks, then complete the cabinet boxes with base shoe along the floor to hide gaps. Putty the nail holes, then step back and admire your "new" cabinets. 🌲

Pro Tip! Spanning two doors allows the spacer to stay in place above the hinged side when you open the door.



M

Roll the faces firmly with a J-roller to strengthen the bond. Tilt the roller slightly to press the edges tight, but work carefully to avoid breaking the veneer.



N



O

Hold 150-grit sandpaper 45° to the end panel and carefully sand the veneer flush while creating a slight chamfer.



P

You may need to mix two or more colors to match the veneer. After rubbing putty into gaps, clean the face frames with a paper towel and mineral spirits.



Q

Cut a spacer to position a door at the proper height. Hold it in place with double-sided tape, and press the hinge against it. Drill pilot holes in the face frame, and screw the hinges in place. Use the spacer to position the remaining doors.

Sources: 24×96" PSA-backed veneers, price varies by species, veneersupplies.com.
Tridon AT-109 laminate splitter, \$115, tools4flooring.com.
Freud 66-100 bevel-trim router bit, \$10, no. 49466, J-roller \$20, no. 43174, 800-279-4441, rockler.com.

Produced by **Craig Ruegsegger**



R

With the doors aligned, cut a spacer long enough to span two doors. (A ¾" space between door and drawer is typical.) Rest a false front on the spacer, press the drawer box against the false front, then pull the drawer out and secure the front with screws from the inside.



S

Cove molding provides a finished look, and hides any unevenness at the tops of the cabinets. Cut a spacer to position the cove molding parallel to the doors.

Modern Desk

Just right for the way you work today.

Beautiful waterfall grain wrapped from the top to the sides, three roomy drawers, and a large worksurface make this desk perfect for any den or office. The lidded compartment conceals a power strip and keeps cords under control. The three drawer faces, cut from a single board, display more beautiful, dramatic grain across the front.



D I M E N S I O N S :
50" W x 24" D x 30" H

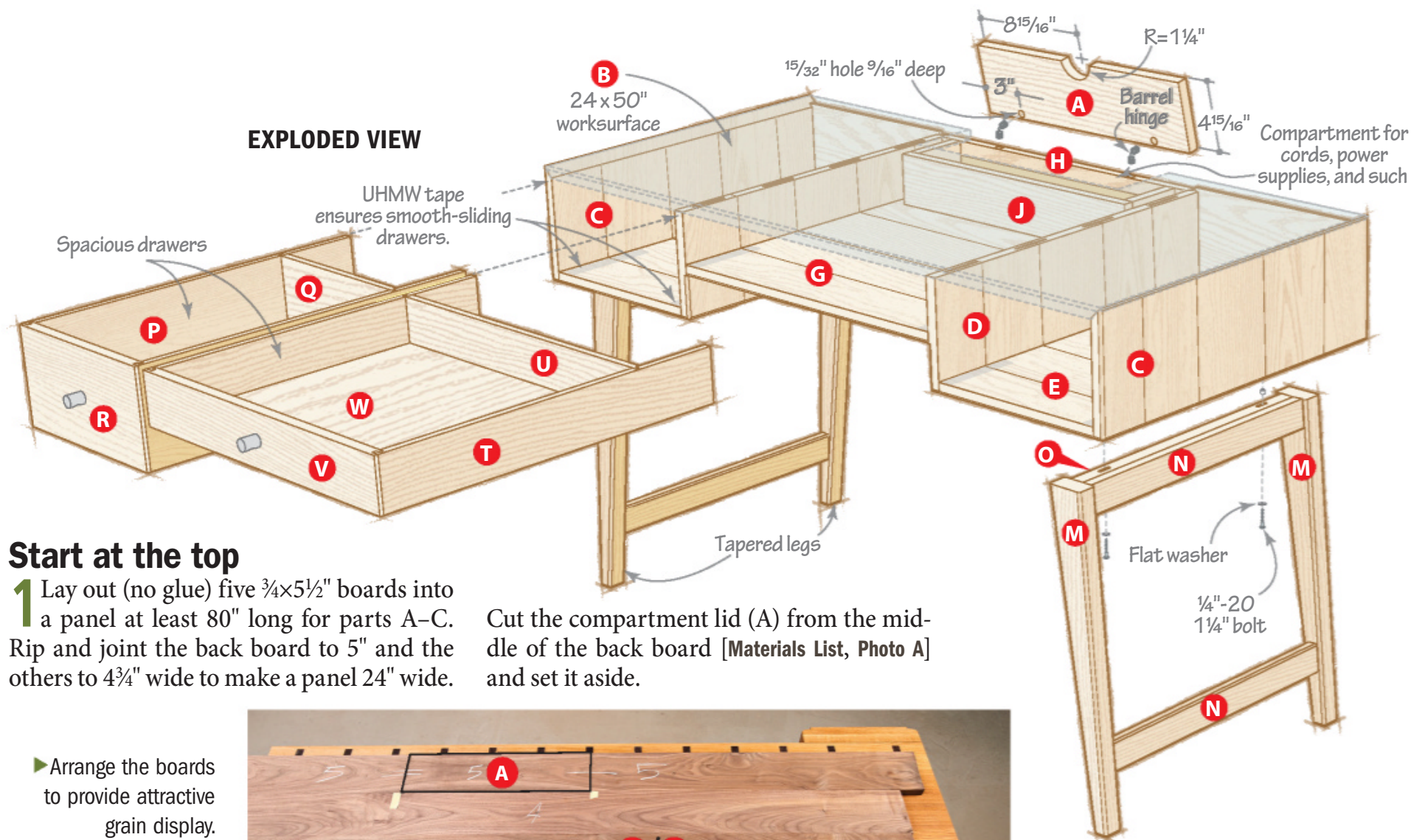
Approximate materials cost:

\$575

More than

8

square feet of work area

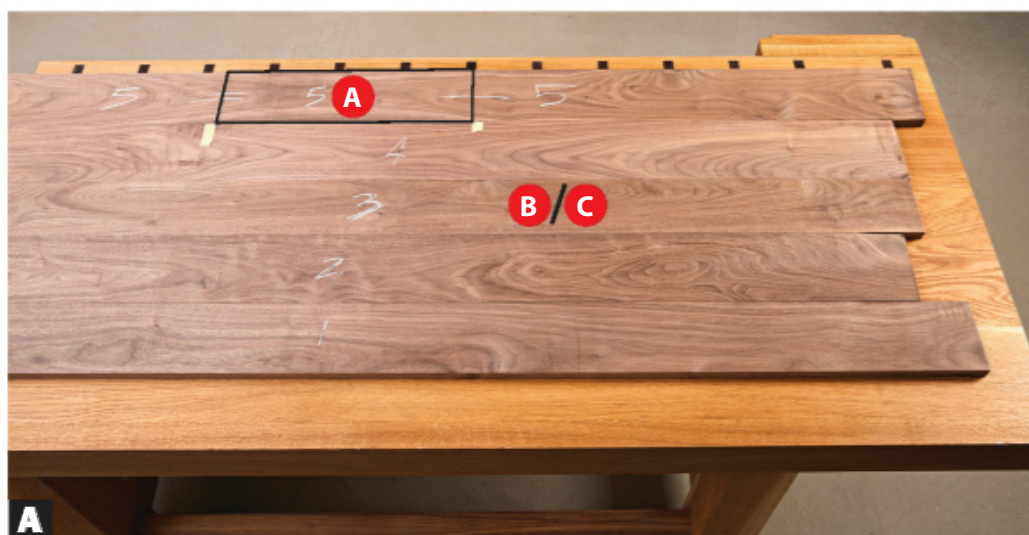


Start at the top

1 Lay out (no glue) five $\frac{3}{4} \times 5\frac{1}{2}$ " boards into a panel at least 80" long for parts A–C. Rip and joint the back board to 5" and the others to $4\frac{3}{4}$ " wide to make a panel 24" wide.

Cut the compartment lid (A) from the middle of the back board [Materials List, Photo A] and set it aside.

- Arrange the boards to provide attractive grain display.
- woodmagazine.com/woodgrainselection



Mark the boards for position in the panel. Center part A on the rear board and ensure there's at least 40" from the middle of the panel to each board end.

SKILL BUILDER

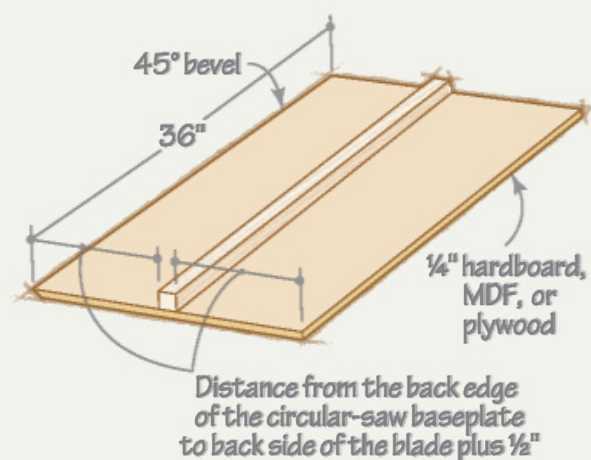
Sawing waterfall joints

Instead of trying to cut the unwieldy glued-up blank for the top (B) and case outer sides (C) on your tablesaw, do the job with a portable circular saw and a simple guide. (The photo shows a slab, but the process is the same.)

Equip your saw with a 60-tooth crosscut blade to ensure a clean cut. Then, make the circular-saw guide [Drawing right].

Set the circ saw for a 90° full-depth cut, and trim one edge of the jig to provide zero-clearance support. Turn the jig around, tilt the saw to 45°, and trim the other edge.

Clamp down the blank securely with support near the ends and on both sides of the cutline. Set the saw to 90°. Align the square edge of the guide with the marked line, clamp the guide, and cut [Photo right].



- A tracksaw works great for sawing and bevel-cutting the blank.

Tilt the saw blade to 45° and reposition the guide with the bottom of the beveled edge along the edge of the just-cut end. Clamp the guide, and make the cut. In the same way, bevel the end of the cut-off section to make the outer side. (You may be able to cut this smaller piece on your tablesaw, instead.) Repeat the process at the other end.



7 Assemble the case sides (C, D) and bottoms (E) [**Drawing 2, Photo B**].

toms (E) [Drawing 2, Photo B].

24"

5"

18"

16"

50"

B

Mitered end

Mitered end

1 CARCASE

$\frac{1}{4}$ " grooves $\frac{1}{4}$ " deep
 $\frac{1}{2}$ " from back edge

$\frac{3}{16}$ " round-overs
cut after assembly

Exploded view diagram of a wooden cabinet showing parts C, D, E, F, G, H, I, J, K, L and their assembly with #20 biscuits. Dimensions include 22 1/2 inch, 23 1/4 inch, 22 inch, 3 inch, 1 1/2 inch hole, 3 3/4 inch, 1 inch, 2 inch, 3/16 inch round-overs, and 3 inch. Arrows indicate the assembly sequence.

Diagram illustrating the assembly of a wooden box. The top panel (labeled I) is shown being placed onto the side panel (labeled H). The side panel features a 1/4" groove and a 1/4" deep slot. The top panel is 1/4" thick.

5 ⁵/₁₆"

5 ⁵/₁₆"

15 ¹⁵/₃₂" hole 9 ⁹/₁₆" deep

H

Bottom face of

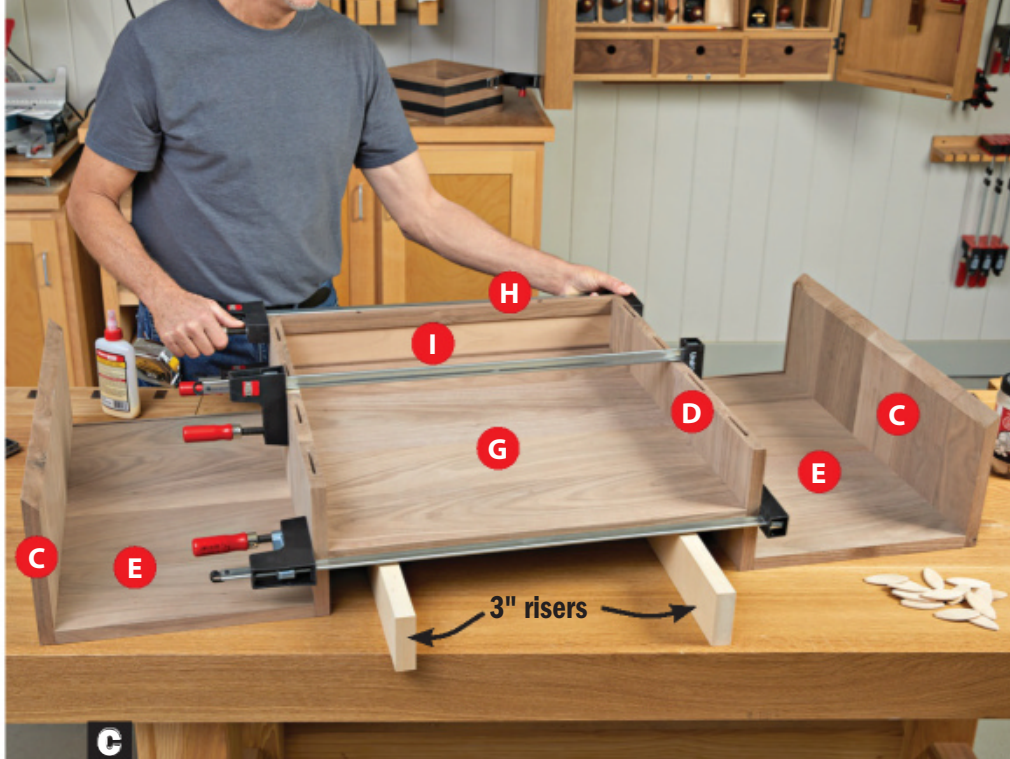
E

← Outside edge

Hole sized for a $\frac{1}{4}$ "-20 threaded insert

$4\frac{1}{2}$ "

$4\frac{3}{4}$ "



C Support the center bottom (G) on risers to glue and biscuit the cases to it. The back stretchers (H) and compartment back (I) fit into the case grooves.



D Insert biscuits without glue for the dry assembly. Capture the case backs in the grooves and make sure the front surfaces are flush and the miters are tight.

Build the carcase

1 Glue up and cut to size the center bottom (G) [Drawing 1]. Cut biscuit slots, drill the cord-access hole, and finish-sand.

2 Cut the back stretchers (H) and compartment back (I) to size. Form tenons and a groove on the stretchers (H) [Drawing 1a] and drill hinge holes [Drawing 1b] in the top stretcher. Finish-sand the parts.

3 Retrieve the compartment lid (A), plane it to width, and cut out the half-circle finger grip [Exploded View]. Transfer the hinge-hole locations from the stretcher (H) to the lid and drill the holes in the underside. Finish-sand the lid.

4 Dry-fit (no glue) the cases (C–E) and center bottom (G), and lay the top in

place to make sure the mitered ends meet properly. Glue the cases to the center bottom [Photo C]. Glue the stretchers (H) and compartment back (I) in place.

5 Cut the compartment front (J) and sides (K) to size, finish-sand them, and glue them to the center bottom (G) [Drawing 1].

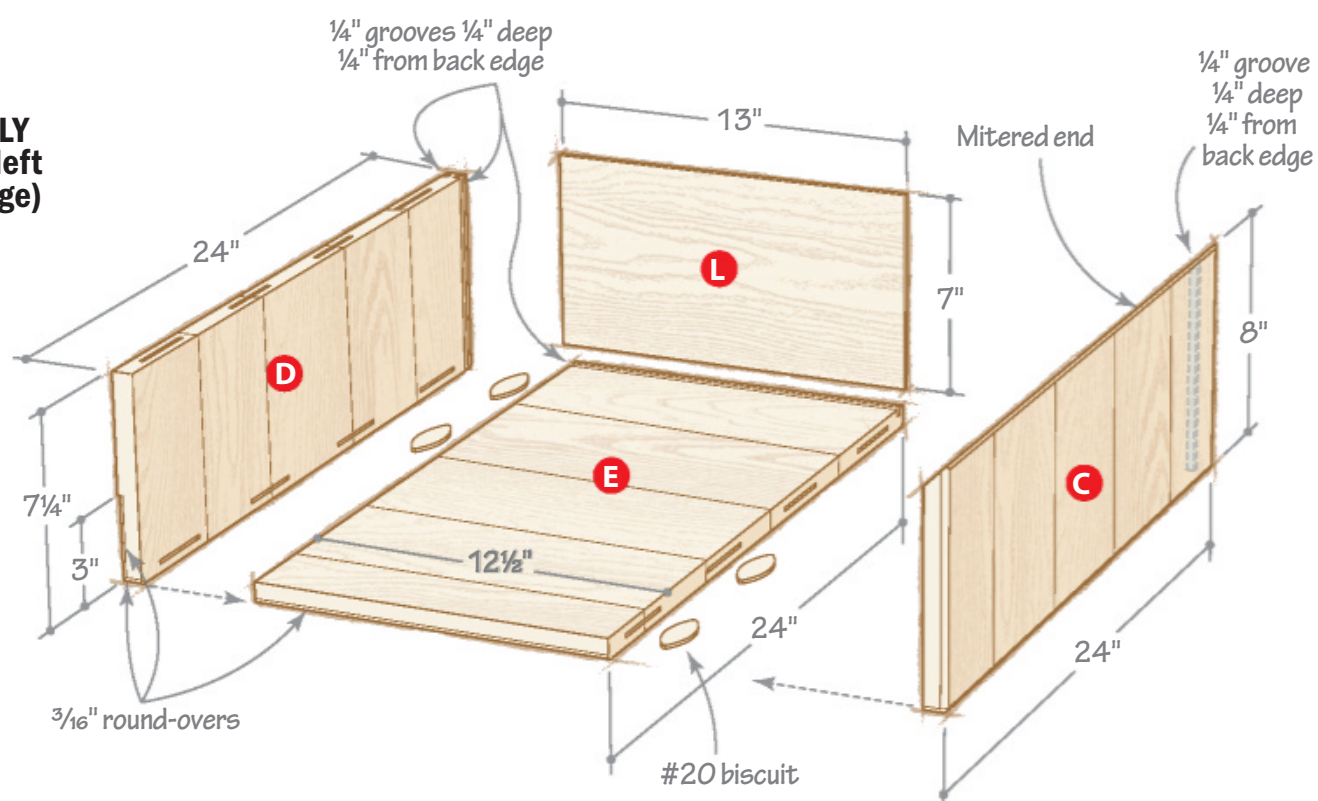
6 Cut the case backs (L) to size, finish-sand them, and glue them in place.

7 Dry-assemble the top (B) and the C–L assembly [Photo D]. When satisfied with the fit, glue and clamp the top to the carcase.

8 Round over the front outside edges and the mitered joint [Drawing 1]. On the bottom, drill holes and install threaded inserts [Drawing 1c]. Finish-sand the carcase.

► Drive in the threaded inserts to sit slightly below the surface.

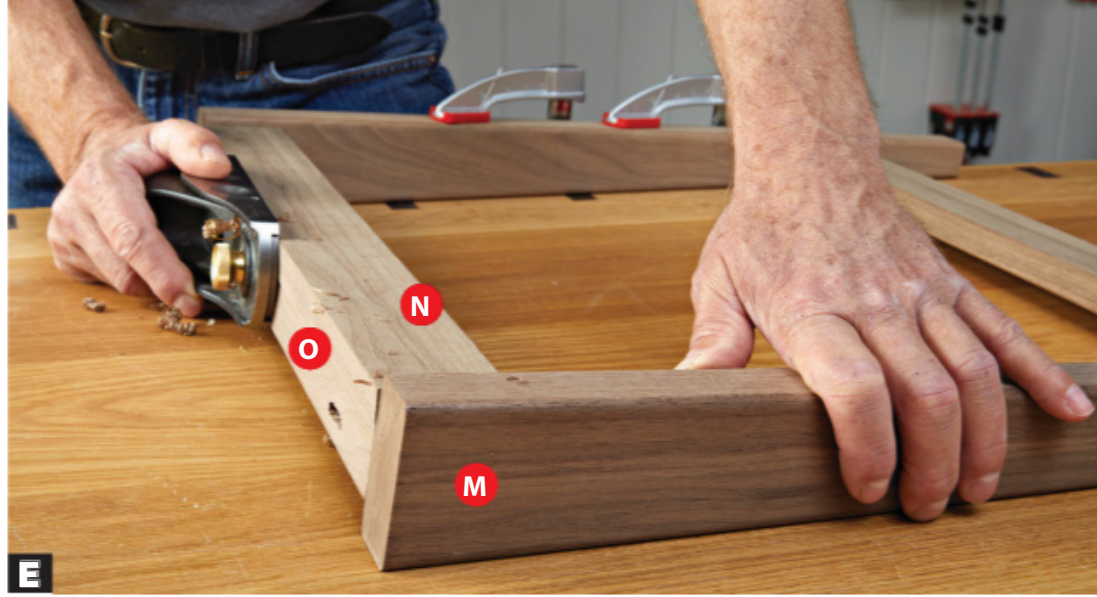
2 CASE ASSEMBLY (Right shown, left is a mirror image)



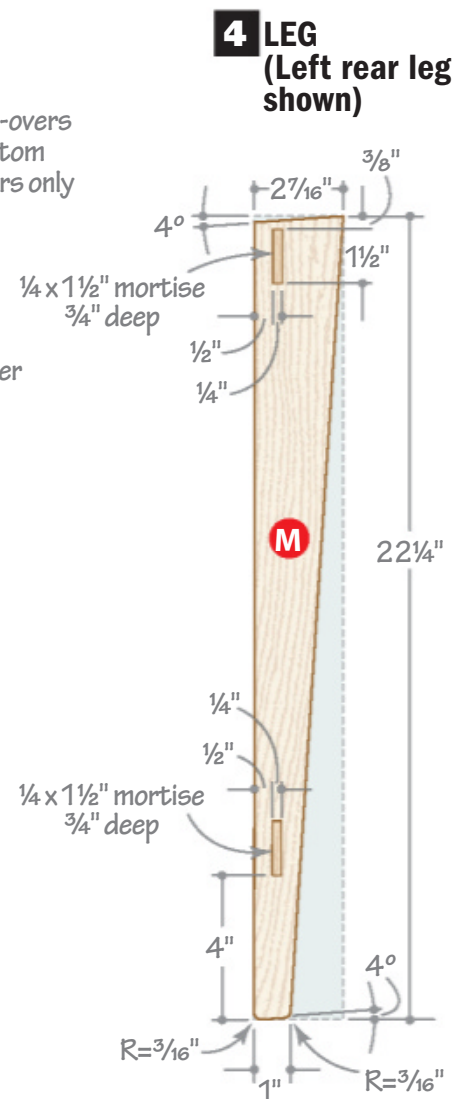
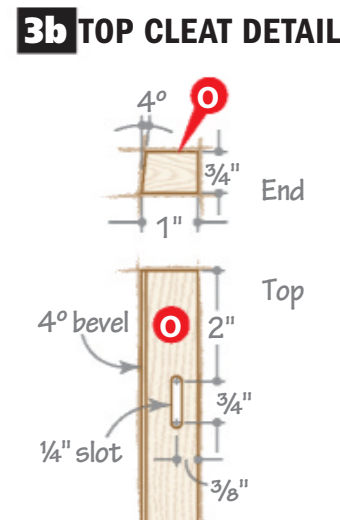
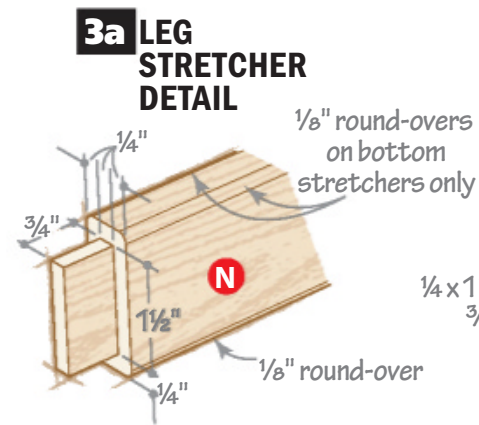
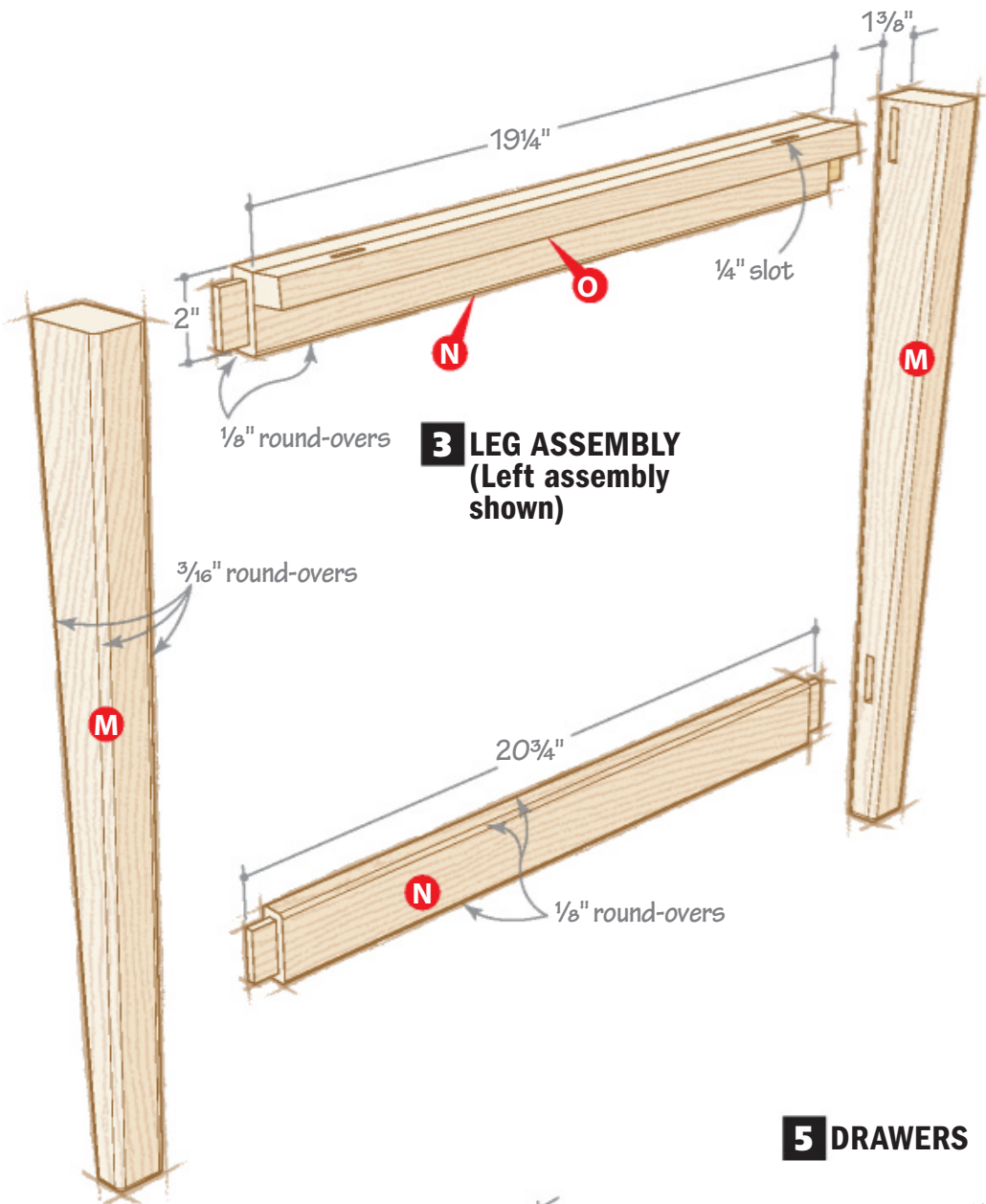
Give it legs to stand on

- 1 Cut the legs (M), stretchers (N), and cleats (O) to size [Drawing 3].
- 2 Form the mortises in the legs, taper the legs, and bevel the ends [Drawing 4]. Round over the edges and finish-sand.
- 3 Cut tenons on the stretchers (N) [Drawing 3a]. Bevel-rip the top cleat (O) and form slots for top-attachment screws [Drawing 3b].
- 4 Glue the legs (M) and stretchers (N) together [Drawing 3]. Glue the cleats to the top stretchers, flush with the top of the legs [Photo E].

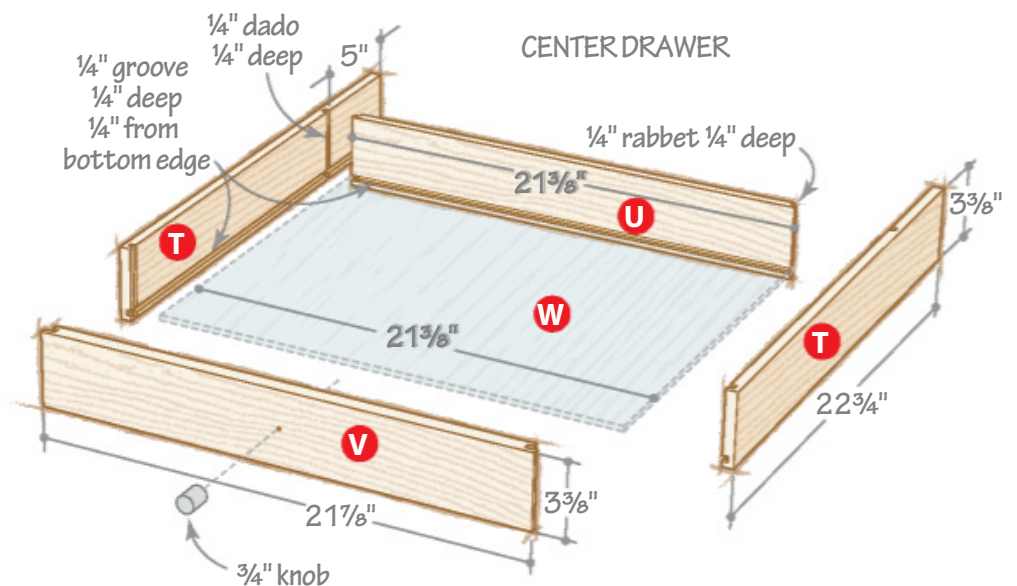
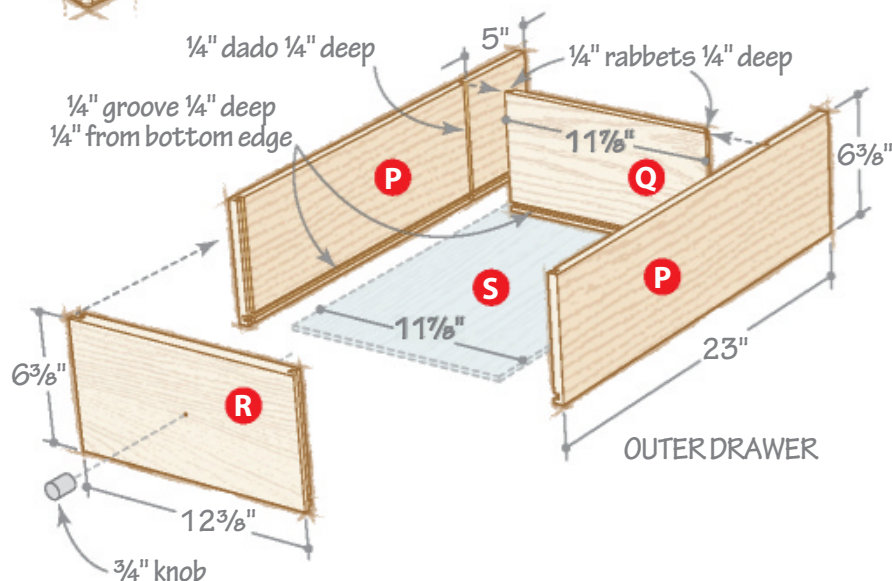
Tip! Make the slotted screw holes quickly with a Saw Drill [Source], a 1/4" drill bit that also cuts sideways.



E The top stretcher (N) stands proud of the legs when assembled. Plane the stretcher flush with the leg (M) tops and the cleat (O).

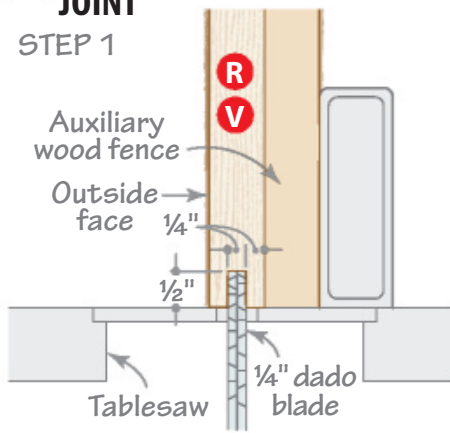


5 DRAWERS

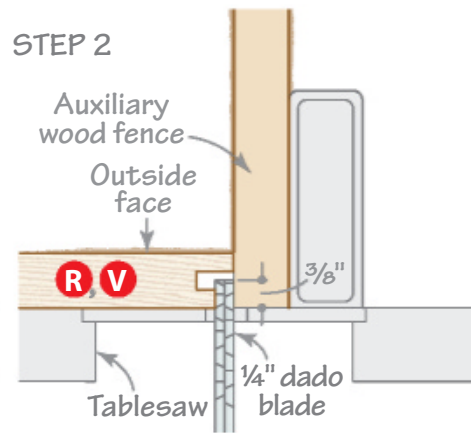


6 LOCK-RABBET JOINT

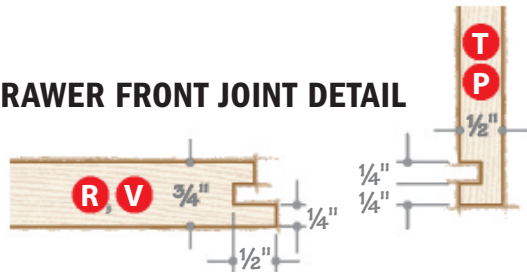
STEP 1



STEP 2



6a DRAWER FRONT JOINT DETAIL



Materials List

		FINISHED SIZE				
Part		T	W	L	Matl.	Qty.
Carcase						
A*	compartment lid	¾"	41⅝"	17⅞"	W	1
B*	top	¾"	24"	50"	EW	1
C*	case outer sides	¾"	24"	8"	EW	2
D*	case inner sides	¾"	24"	7¼"	EW	2
E*	case bottoms	¾"	24"	12½"	EW	2
F	fillers	¼"	¼"	3"	W	2
G*	center bottom	¾"	23¼"	22"	EW	1
H	back stretchers	¾"	1"	22½"	W	2
I	compartment back	¼"	2¾"	22½"	WP	1
J	compartment front	¾"	3½"	20"	W	1
K	compartment sides	¾"	3½"	4"	W	2
L	case backs	¼"	7"	13"	WP	2
Legs						
M	legs	1⅜"	2⅞"	22¼"	W	4
N	stretchers	¾"	2"	20¾"	W	4
O	cleats	¾"	1"	19¼"	W	2
Drawers						
P	outer sides	½"	6⅜"	23"	P	4
Q	outer backs	½"	6⅜"	11⅞"	P	2
R	outer fronts	¾"	6⅜"	12⅜"	W	2
S	outer bottoms	¼"	11⅞"	17¾"	WP	2
T	center sides	½"	3⅜"	22¾"	P	2
U	center back	½"	3⅜"	21⅜"	P	1
V	center front	¾"	3⅜"	21⅞"	W	1
W	center bottom	¼"	21⅜"	17½"	WP	1

*Parts initially cut oversize. See the instructions.

Materials key: W-walnut, EW-edge-glued walnut, WP-walnut plywood, P-poplar.

Supplies: #20 biscuits, 1/4"-20 threaded inserts, 1/4"-20x1 1/4" bolts and flat washers, UHMW tape 1" wide.

Blade and bits: Dado set; 1 1/2" Forstner bit, 1/8" and 3/16" round-over router bits.

Source: Saw drill, no. 72J2001, \$10; 18x24mm dimpled stainless steel knobs (3), no. 01W6518, \$7; SOSS 12mm concealed barrel hinges (2), no. 00H3612, \$3, Lee Valley, 800-871-8158, leevalley.com.

A trio of drawers finishes it

1 Cut drawer parts P-W to size [Drawing 5]. Prepare the front joints in the fronts and sides [Drawings 6 and 6a].

2 Dado the sides (P, T) and rabbet the backs (Q, U). Groove parts P-R and T-V for the bottom panel [Drawing 5].

3 Glue the drawer boxes together, taking care to square them. Drill holes for the knobs, and finish-sand the drawers.

4 Apply a finish. (We rubbed on Watco medium walnut oil and sprayed on two coats of water-based clear topcoat.)

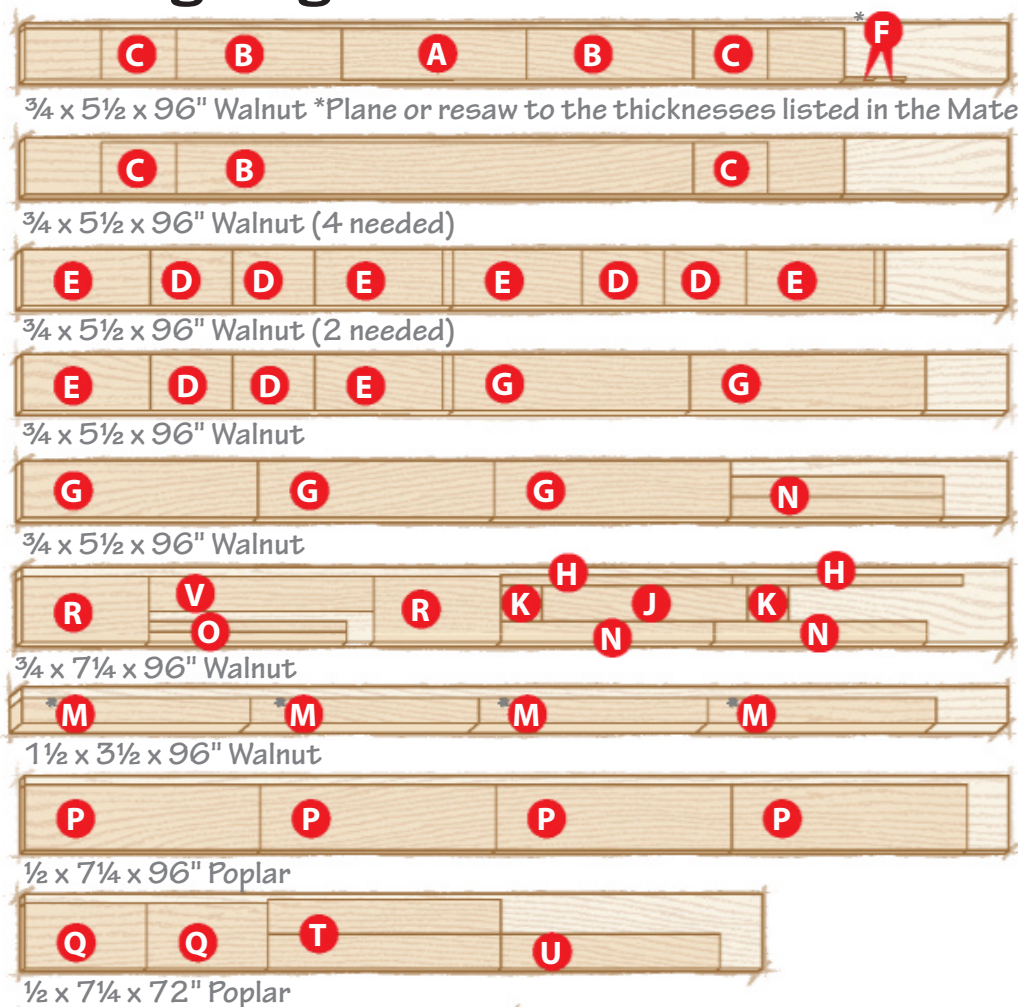
5 Attach the leg assemblies (M-O) to the carcass (B-L) [Exploded View]. Install the compartment lid (A) with barrel hinges [Source], and apply UHMW tape in the drawer openings. Install the knobs [Source] and slide the drawers into the carcass. Then, pull up a chair and get to work. You've been playing in the shop too long now. 🌳



►To watch a video about cutting the drawer joints, point your smartphone's camera at this code, or visit woodmagazine.com/lockrabbetvideo.

Tip! If the plywood for your drawer bottoms (S, W) measures 1/4" thick, cut the grooves with a dado set. Otherwise, use a regular 1/8" blade and sneak up on the groove width.

Cutting Diagram



This project requires 42 board feet of 4/4 walnut, 6 board feet of 6/4 walnut, and 10 square feet of 1/2" poplar (or 10 board feet of 4/4 poplar to plane).

Produced by **Larry Johnston** with **Brian Bergstrom**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine, Lorna Johnson**

SHOP TEST

Trim Routers

These pint-size power tools prove handy and effective for light-duty tasks.





► Watch a video overview of this field of trim routers by pointing your smartphone's camera at the code, below (no app required!), or visit woodmagazine.com/trimrouters

► Not sure if you need a trim router versus a larger router? woodmagazine.com/chooseroater

► Despite marketing claims, 20-volt lithium-ion battery packs essentially equal 18-volt packs in terms of power output. That's because both battery packs consist of groupings of five cells, each outputting 3.6 volts—a total of 18 volts. The same is true with 12-volt packs (which use three cells); these essentially output 10.8 volts.

For smaller kitchen tasks, you'll get more control and better results using a paring knife rather than a large butcher knife. And likewise, a paring knife would be a poor choice to carve a roast. It's the same with routers. Use a big router for the biggest jobs, and for most light-duty jobs—flush trimming plywood edging, routing hinge mortises, or shaping edges—a trim router excels with its small size and nimbleness. And because it costs a third to half the price of a big router, you can own multiple trim routers and dedicate some to bits and setups you use often, such as $\frac{1}{8}$ " or $\frac{1}{4}$ " round-overs.

Not much has changed among *corded* trim routers in the past five years, but the growing field of *battery-powered* trimmers intrigued us. So we tested 15 popular models—nine corded and six cordless—head to head in the WOOD® magazine shop. Here's what we found.

It all starts with power

We know the capabilities of a corded trim router, but our biggest question entering this showdown was how much power and battery runtime the cordless models would have. Thanks to lithium-ion battery technology and high-efficiency brushless motors—all six cordless models use both—most of the cordless trimmers perform as well, in terms of power, as the top corded models. (See the chart on page 44 for full comparison ratings.)

But how long will that power last? We measured battery runtime by routing a deep chamfer until the battery exhausted its charge. (See the chart below for results.) Granted, this was a hefty cut, so runtime will be longer when making lighter cuts. The good news: If you're routing shallow round-overs or chamfers, you'll likely not exceed a

battery's capacity unless you're doing a big job. (All the cordless models sell bare—without a battery pack or charger. We used an optional 2- or 3-amp-hour pack with each router in testing. Optional larger amp-hour packs will deliver longer runtime.)

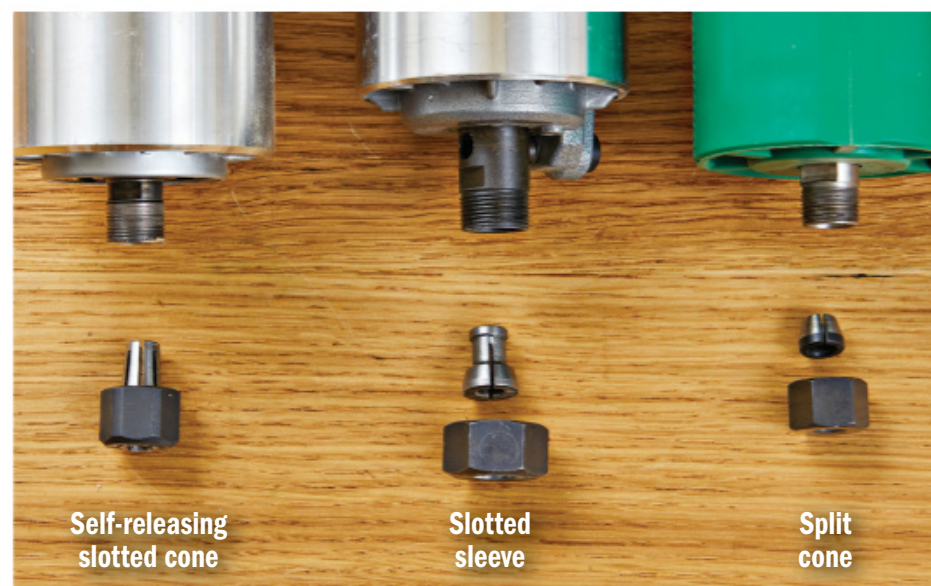
Small collets = small bits

All 15 trim routers we tested come with $\frac{1}{4}$ " collets. That—as well as bit openings in the subbases that range from $1\frac{3}{16}$ to $1\frac{1}{16}$ " in diameter—limits you to small, $\frac{1}{4}$ "-shank bits that won't overwork the motor. The Makita cordless router also comes with a $\frac{3}{8}$ " collet; it's optional for Makita's corded trimmer. But $\frac{3}{8}$ "-shank bits are relatively rare, so it delivers minimal value.

These trimmers come equipped with one of three types of collets, as shown below. We prefer the one-piece self-releasing collets on the Bosch Colt, and the Bosch, DeWalt, and Milwaukee cordless models.

► For a level playing field, we used new Freud router bits with each trim router in all testing.

► Need help getting a stuck collet loose? woodmagazine.com/stuckcollet



Trim-router collet styles. The self-releasing slotted cone releases tension on the bit shank as you loosen the collet nut. The two-piece slotted-sleeve and split-cone collets work similarly, but remain in the spindle when you remove the nut. Sometimes, a bit can get stuck when a two-piece collet fails to release the shank.

Cordless routers show surprising runtime

Model	Battery voltage	Battery amp-hour rating	Total runtime* (min:sec)	Runtime per amp-hour
DeWalt DCW600B	20	2.0	4:52	2:26
Ryobi P601	18	3.0	7:14	2:24
Makita XTR01Z	18	2.0	4:02	2:01
Milwaukee 2723-20	18	2.0	4:00	2:00
Bosch GFK12V-25N	12	3.0	5:43	1:54
Ridgid R86044B	18	3.0	3:24	1:08

* We routed with a 45° chamfer bit, set for a $\frac{3}{8}$ "-deep cut, in red oak until the battery shut down. Average of three tests.

Bit depth requires finesse

With all the tested routers, the motor slides out of the base for better access to change bits. That's also how you make coarse bit-depth adjustments. All but the Grizzly H7790 also have a fine-adjust mechanism to dial in a precise bit depth, which proves most helpful when setting a perfect round-over. We like the Milwaukee and Ryobi adjusters best.

Five models provide at least 2" of collet travel, giving you greater flexibility when setting bit depth, especially for long bits. The DeWalt tops the group with a maximum travel just over 2¹⁷/₆₄"; the Milwaukee has the least at 1¹/₁₆".

Watch where you're routing

For bearing- or bushing-guided cuts, bit visibility proves less critical. But for freehand routing, such as for inlay mortises, you need to see clearly. A clear-plastic subbase improves both your sightline and light transmission to the work area. The black subbases on the MLCS Rocky 30 and Bosch and Makita cordless routers make the area around the bit even darker.

LED illumination increases visibility around the bit. All but the Bosch and MLCS routers have this feature. The LED on Makita's cordless router, *next page*, helps to offset the visibility issues caused by the black subbase and metal base.

Ergonomics, balance matter

In most cases, trim routers can be used with one hand. But doing so sometimes creates balance issues. The top-mounted batteries on



The Bosch 12-volt router has an offset design, with the battery (on top) angling away from the spindle (far right). This unusual shape makes it awkward to grip.

cordless routers can make them top-heavy, especially when using a high-amp-hour battery pack. When balancing a trimmer on a narrow surface, such as flush-trimming plywood edging, it's best to steady the base with your other hand, as shown on *page 40*.

Other noteworthy items regarding ergonomics:

■ **The cordless DeWalt's 3¹/₂"-diameter base** is the largest in the test; small hands might struggle to grip it.

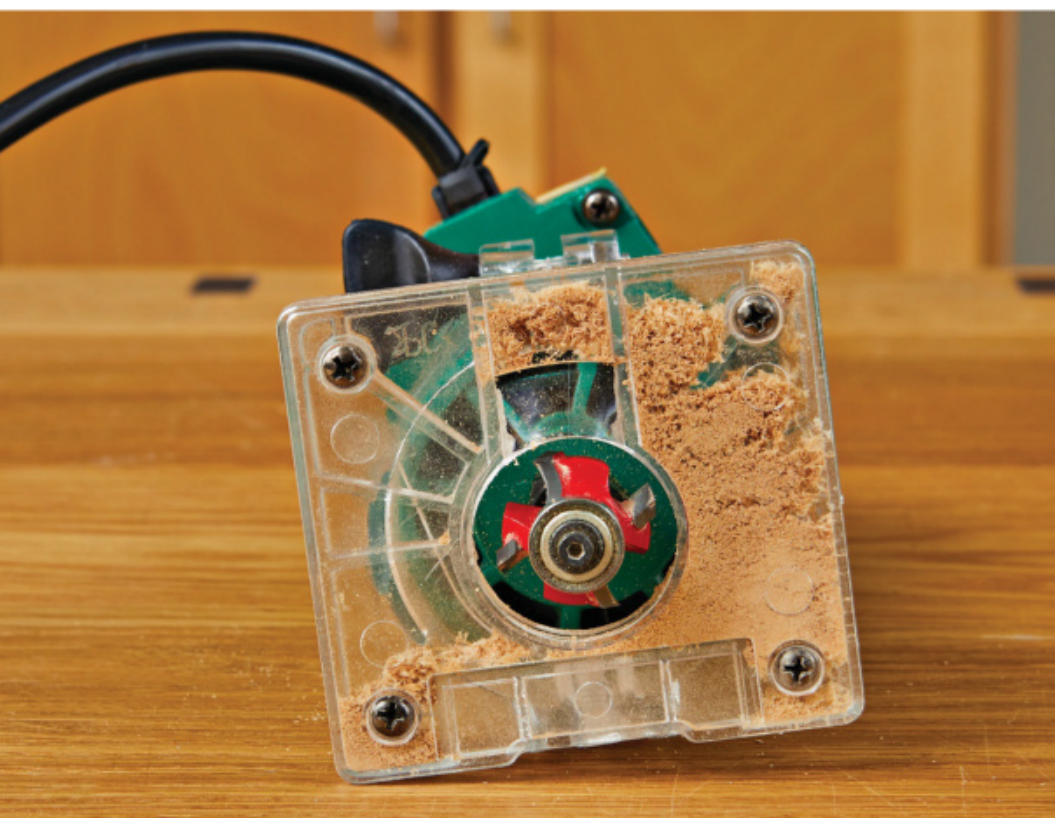
■ **Bosch's cordless router, *above***, differs from the other battery-powered models because its motor and battery are not in line with the spindle.

► Get more use from your trim router. woodmagazine.com/trimrouteruse

More trimmer tidbits

■ **Bit changes.** You tighten and loosen the collet nuts on these routers in two ways. Four models require two included wrenches, and eight use one wrench and a spindle lock. Three models provide for both methods, letting you choose which you prefer. We find it easier to change bits with the base removed, but the motor can roll when using one wrench and the spindle lock. That's not a worry with two wrenches; but it's one more wrench to store (or potentially lose).

■ **Speed ranges.** More than half of the 15 models have variable-speed motors, letting you adjust the speed for each application. For example, when routing cherry or maple—species prone to friction burning—it helps to slow the bit speed to prevent burn marks. You don't have this option with the single-speed models, six of which run 26,000 rpm or more. The Bosch cordless router runs at 13,000 rpm, a speed that



Wood dust builds up inside the two-piece subbases on the Drill Master and Grizzly models, impeding visibility of the cutting area.



Before you can start Makita's cordless router, you must first unlock the power. This gives you 10 seconds to turn it on before it locks out power again.

maximizes runtime from its lower voltage, and also avoids issues with burning. We did not find the slow speed to be a problem.

■ **Power switches.** We experienced no problems with any of the switches. The two-part safety switch on the Makita cordless model, *above*, requires an extra step.

■ **Guide bushings.** You might want to use a guide bushing to follow a template with these routers, but not all will accept them out of the box. Four models (the corded DeWalt and Porter-Cable and the cordless Makita and Milwaukee) come with a sub-base that accepts standard two-piece guide



Two routers come with an extra subbase. The Milwaukee has 4" and 5 3/4" round versions; the Ridgid has 3 1/2" square and round versions.

bushings. Subbases on the corded Makita and both Grizzlys won't accept two-piece bushings, but each comes with a single proprietary 3/8" bushing that fits their subbases. (No other bushing sizes are available for these models.)

■ **Accessory attachments.** Most of these routers come with an edge guide, shown *below left*. And five of those models also include a bearing-guided attachment for flush-trimming edges, as shown *below*. This proves helpful if you don't own a bearing-guided flush-trim bit. (See the chart on *page 44* for the models with these accessories.)



An edge guide attached to a trim router's base lets you rout parallel to a workpiece edge or end.



With a bearing-guided attachment, you can flush trim edging with a non-bearing straight or downcut spiral bit.

Trim routers: Tiny workhorses that make

MODEL	PERFORMANCE RATINGS (1)							MOTOR			BATTERY PACK (2)			COLLET				
	PRIMARY				SECONDARY			SPEED x 1,000, RPM (MIN.-MAX.)	SOFT START? (YES, NO)	LED? (YES, NO)	RATED VOLTAGE	AMP-HOURS	CHARGE TIME (HOURS:MINUTES)	STYLE (3)	TIGHTENING METHOD (4)	MAXIMUM TRAVEL, INCHES		
	POWER	EASE OF SETTING BIT DEPTH	BIT VISIBILITY	BALANCE/ CONTROL/ERGONOMICS	EASE OF CHANGING BITS	EASE OF USING POWER SWITCH	EASE OF REMOVING/REPLACING BASE											
CORDLESS																		
BOSCH GKF12V-25N	B	B	C	B		A	A	N/A	13	N	N	12	3.0	2:04	R	1	1 1⁄16	
DEWALT DCW600B	A	A-	A	A-		A	A	A	16–25	Y	Y	20	2.0	:51	R	1	2 1⁄4	
MAKITA XTR01Z	A	B	B	A		A	B+	A	10–30	Y	Y	18	2.0	:26	S	1, 2	1 41⁄64	
MILWAUKEE 2723-20	A	A	A-	A		A	A	A	10–31	N	Y	18	2.0	:40	R	1, 2	1 1⁄16	
RIDGID R86044B	B	B+	A	A		A	A	B	17–25	Y	Y	18	3.0	:46	C	1	1 31⁄64	
RYOBI P601	A	A	A	B		A	A	B	29	N	Y	18	3.0	1:44	S	1	1 37⁄64	
CORDED																		
BOSCH COLT PR20EVS	A	B+	C+	A-		A	A	A-	16–35	Y	N				R	1, 2	1 3⁄32	
DEWALT DWE6000	B+	A-	A	A		A	A	B	31	N	Y				C	1	1 13⁄16	
DRILL MASTER 62659	B	B	B-	B		A-	A-	A	26	N	N				C	2	1 9⁄16	
GRIZZLY H7790	A	B	B-	A		A-	A-	A	30	N	Y				C	2	2 5⁄64	
GRIZZLY H7791	B	B	B-	B		A-	A-	A	30	N	Y				C	2	2 5⁄64	
MAKITA 3709	A	B	B	B		A-	A-	A	30	N	Y				C	2	2 15⁄64	
MLCS ROCKY 30	A	B+	C	B+		A	A	A	10–30	Y	N				S	1	1 27⁄32	
PORTER-CABLE PCE6435	A	A-	A	A		A	A	A	16–30	N	Y				C	1	2 5⁄64	
RIDGID R24012	B	A-	A	A		A	A	B	20–30	Y	Y				C	1	1 15⁄16	

Put your trimmer dollars here

You won't find any duds in this group, but some models do stand out. Among the corded trim routers, the Porter-Cable PCE6435 (\$120) earns the Top Tool award. It's excellent ergonomically, has a variable-speed motor, a guide-bushing-ready clear-plastic subbase, an LED for excellent visibility, and comes with an edge guide.

In the cordless category, the Milwaukee 2723-20 (\$180 without battery or charger) grabs Top Tool honors. It balances nicely with either a 2.0 or 5.0 amp-hour battery pack, provides respectable run-time, has a clear subbase with LED, and comes with lots of extras.

For great bang for the buck, get the metal-bodied Grizzly H7790 at \$35. It's a good performer and comes with a one-year warranty, so we named it our Top Value. 🌲



Porter-Cable PCE6435



Milwaukee 2723-20



woodworking easier

SUBBASE			ACCESSORIES (7)		NOISE LEVEL, DECIBELS (HIGH SPEED, NO LOAD)	WEIGHT, POUNDS-OUNCES (8)	CORD LENGTH, FEET	WARRANTY, YEARS	COUNTRY OF ASSEMBLY (9)	SELLING PRICE (10)			
MATERIAL (5)	BIT OPENING, INCHES	GUIDE-BUSHING READY? (YES, NO) (6)	STANDARD	OPTIONAL						ROUTER	SMALL BATTERY PACK, AMP-HOURS	LARGE BATTERY, AMP-HOURS	CHARGER
B	1 ¹ / ₁₆	N			77	2-12		3	H	\$150*	3 Ah - \$55	6 Ah - \$80	\$50
C	1 ¹ / ₂	N		D,P	78	4-4		3	X	\$199*	2 Ah - \$80	6 Ah - \$149	\$74
B	1 ³ / ₈	Y	C,G	D,F,O,P,T	81	3-15		3	C	\$130*	2 Ah - \$70	5 Ah - \$130	\$100
C	1 ¹ / ₄ , 1 ¹ / ₂	Y†	D,E,S	G,O,P	80	3-15		5	C	\$180*	2 Ah - \$80	5 Ah - \$125	\$60
C	1 ³ / ₈	N	B,E,S		79	3-14		3	C	\$130*	3 Ah - \$90	5 Ah - \$120	\$60
C	1 ³ / ₈	N			83	3-12		3	C	\$70*	3 Ah - \$60	6 Ah - \$120	\$40
C	1 ¹ / ₁₆	N		D,E,F,G,O,P,S,T	84	3-6	13	1	M	\$90			
C	1 ³ / ₁₆	Y	E		82	2-14	9	3	C	\$100			
C	1 ³ / ₈	N	E,F		77	3-2	6	90 days	C	\$30			
C	1 ³ / ₈	Y*	E,F,G		84	4-1	7	1	C	\$35			
C	1 ³ / ₈	Y*	E,F,G		81	4-1	7	1	C	\$54			
C	1 ³ / ₈	Y*	E,F,G	C	82	3-5	8	1	C	\$120			
B	1 ³ / ₁₆	Y**	D,E,F,G	P	90	3-12	6	3	C	\$70			
C	1 ³ / ₁₆	Y	E	G	81	3-2	9	3	C	\$120			
C	1 ³ / ₈	N	B,E,S		85	3-2	8	3	C	\$130			



1.

A

 Excellent

B

 Good

C

 Fair

N/A

 Base not removable
2. Batteries and chargers sold separately from routers.

3. (C) Two-piece split cone
(R) One-piece self-releasing slotted cone
(S) Two-piece slotted sleeve

4. (1) Spindle lock & 1 wrench
(2) 2 wrenches
5. (B) Black plastic
(C) Clear plastic

6. (*) Opening not made for standard two-piece guide bushings, but does come with a proprietary single-piece bushing.
(**) Opening made for standard two-piece guide bushings; one proprietary single-piece guide bushing included.
(†) One of two included subbases has an opening for standard two-piece guide bushings.

7. (B) Canvas storage bag
(C) 3/8" collet
(D) Dust-collection shroud
(E) Edge guide
(F) Flush-trimming attachment

(G) Guide bushing(s)
(O) Offset base
(P) Plunge base
(S) Extra subbase
(T) Tilting base

8. Including optional slim-pack battery (2 or 3 amp-hours)

9. (C) China
(H) Hungary
(M) Malaysia
(X) Mexico

10. Prices current at time of article production and do not include shipping, where applicable.
(*) Does not include battery or charger
- Produced by Bob Hunter with Randy Zimmerman



Long-lived Lounge

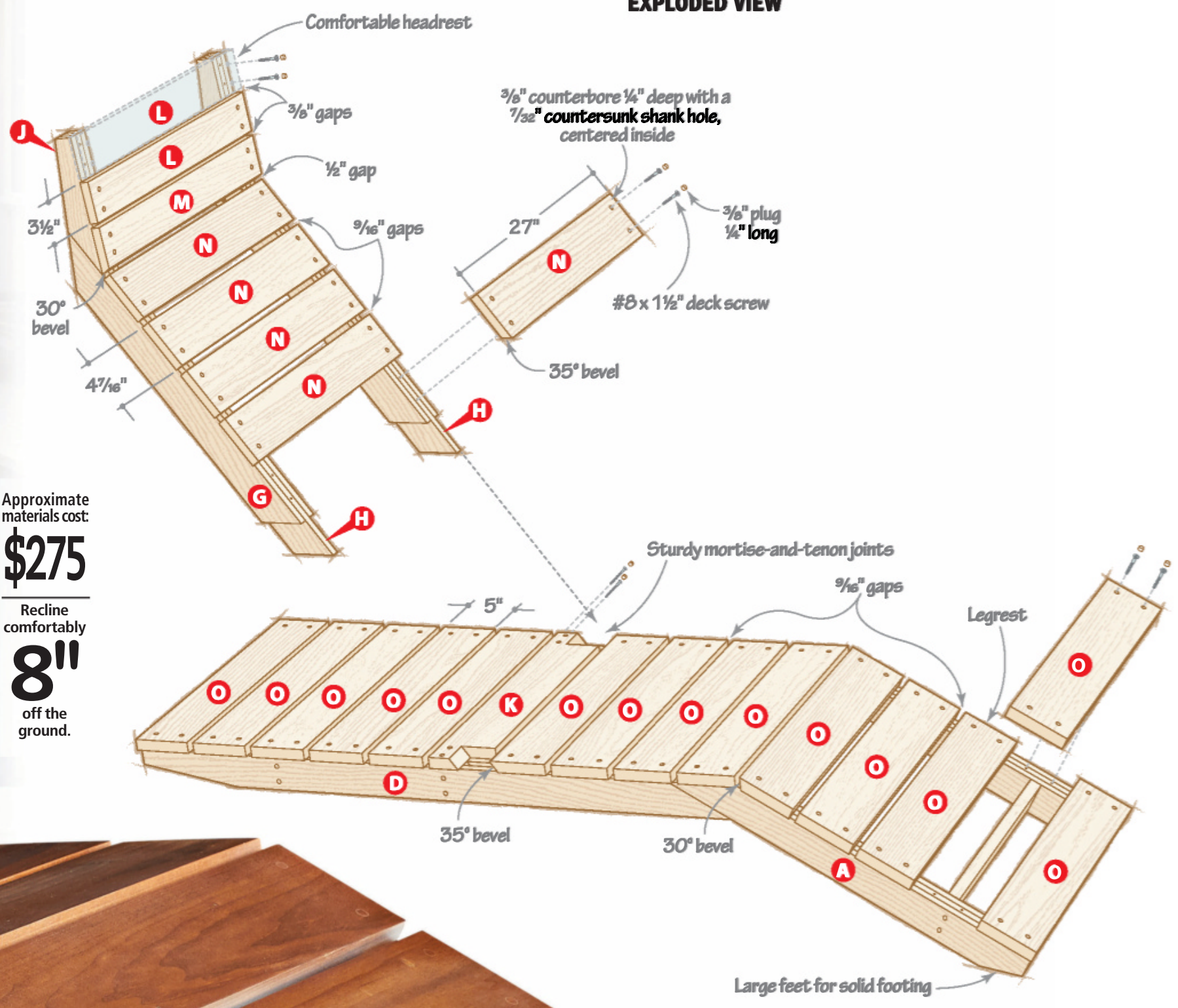
If you're tired of lawn furniture that blows around in the breeze and barely lasts through a season, this lounge is for you. Stout but simple construction guarantees that the little time you spend building it will be repaid with years of relaxation.

We cut the slats for our lounge from Cambia, heat-treated ash or poplar lumber that resists decay without chemical infusion and looks like expensive tropical hardwood (cambiawood.com). Cedar or redwood would also work.

► Learn more about thermally modified lumber. woodmagazine.com/heatedwood



EXPLODED VIEW



D I M E N S I O N S :
27" W x 80 1/4" D x 37 1/4" H

Approximate materials cost:
\$275
Recline comfortably
8"
off the ground.



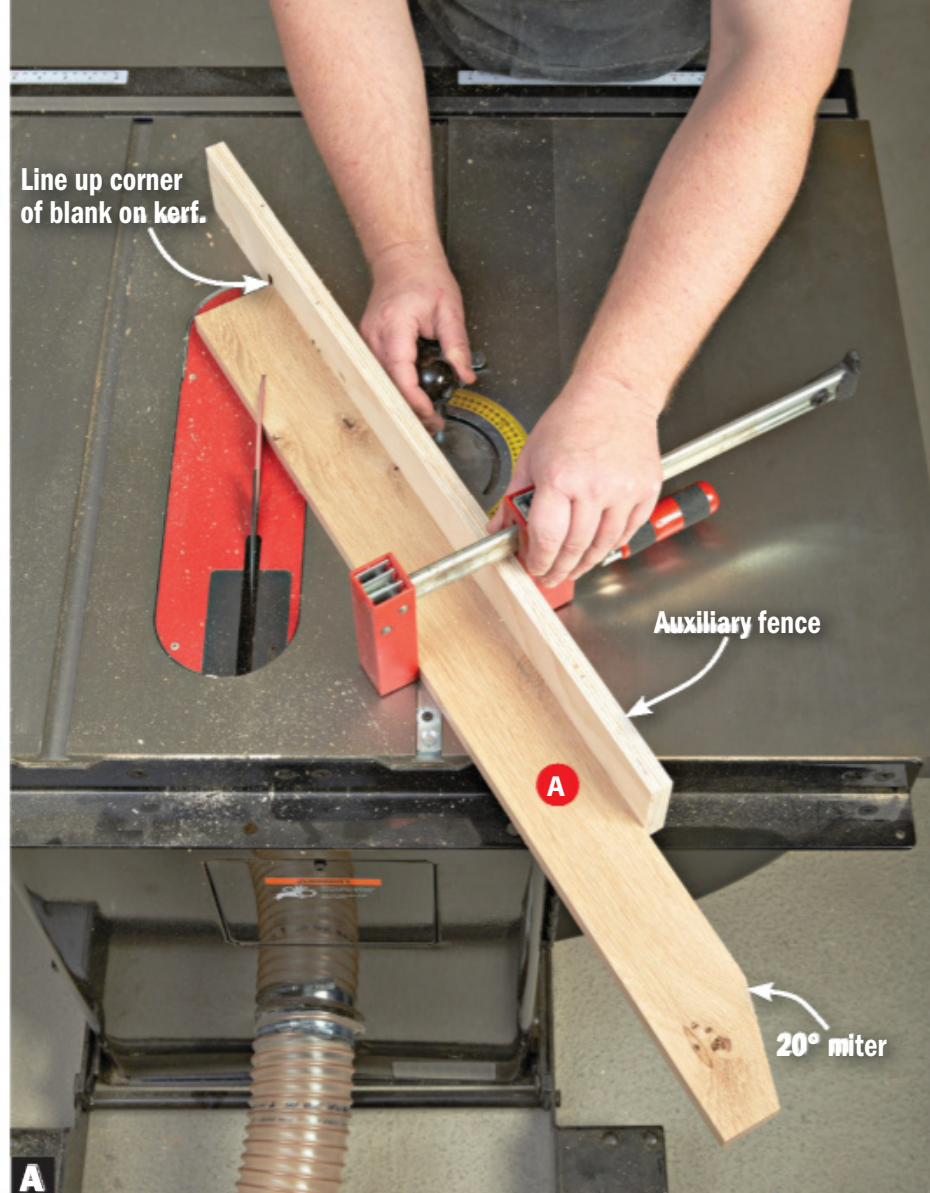
Tip! Cut the 10° and 20° miters, which form the front and back feet on the legs, with a jigsaw or bandsaw, then sand them flush after gluing up the legs.

Start with a firm footing

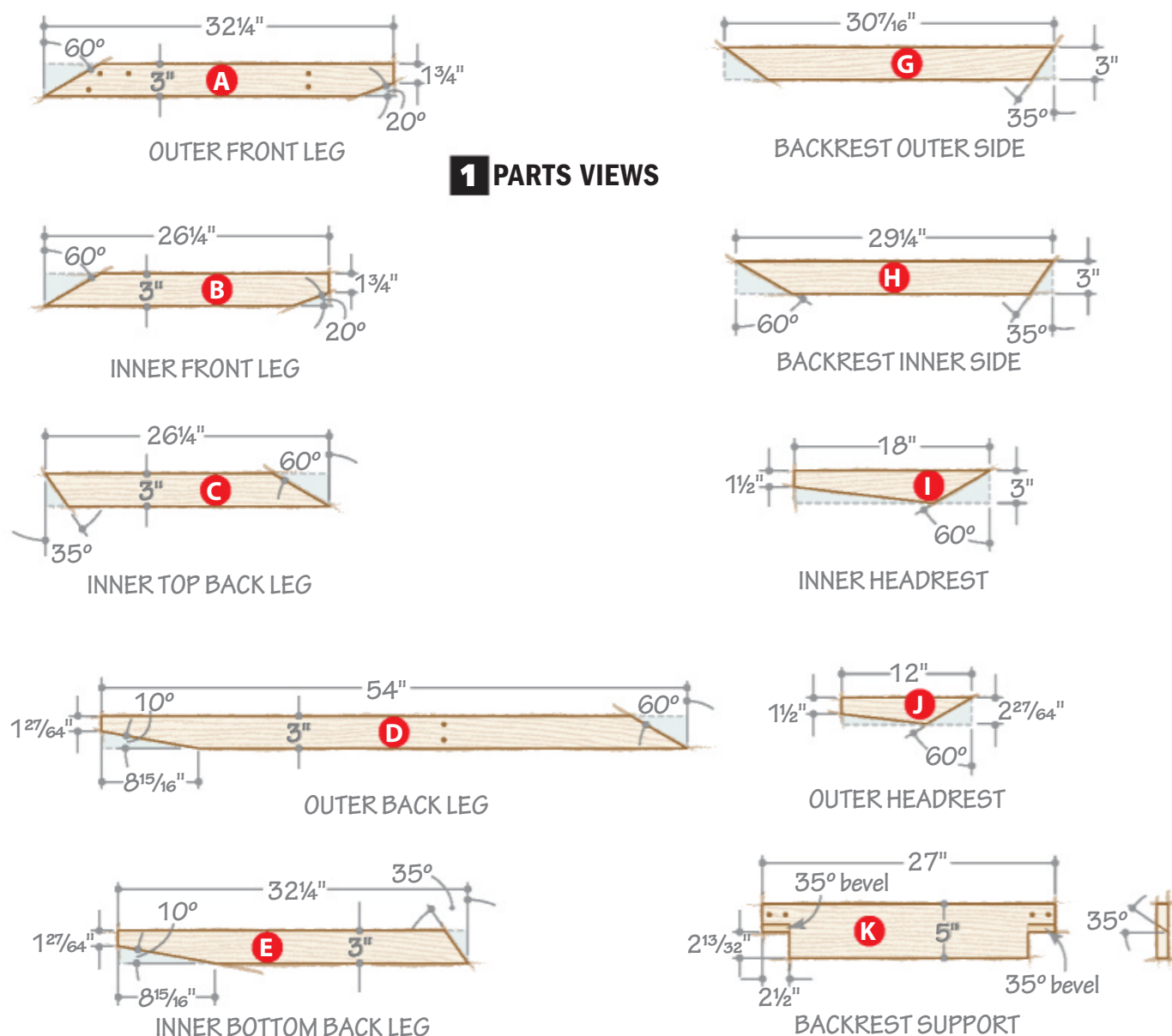
- 1 Cut to size leg parts A–F [Materials List]. Cut the 20° miters on parts A and B and the 10° miters on parts D and E [Drawing 1].
- 2 Miter-cut parts A–D to 60° [Photo A] and parts C and E to 35°.
- 3 Glue an outer front leg (A) to an inner front leg (B), flush at the 20° mitered end [Drawing 2]. Then glue on a back inner leg top (C) [Photo B]. Repeat to make a mirror-image leg for the opposite side.
- 4 Glue an outer back leg (D) to each A/B/C assembly [Photo C]. Then glue on the back inner legs (E) [Photo D].
- 5 Complete the legs by gluing the remaining parts A and D to the A–E assemblies. Sand the miter-cut ends flush, and finish-sand the legs.
- 6 Join the two leg assemblies (A–E) with three braces (F) [Drawing 2]. Counterbore the screw holes, and plug them after assembly. For best appearance, cut plugs from scraps of white oak.

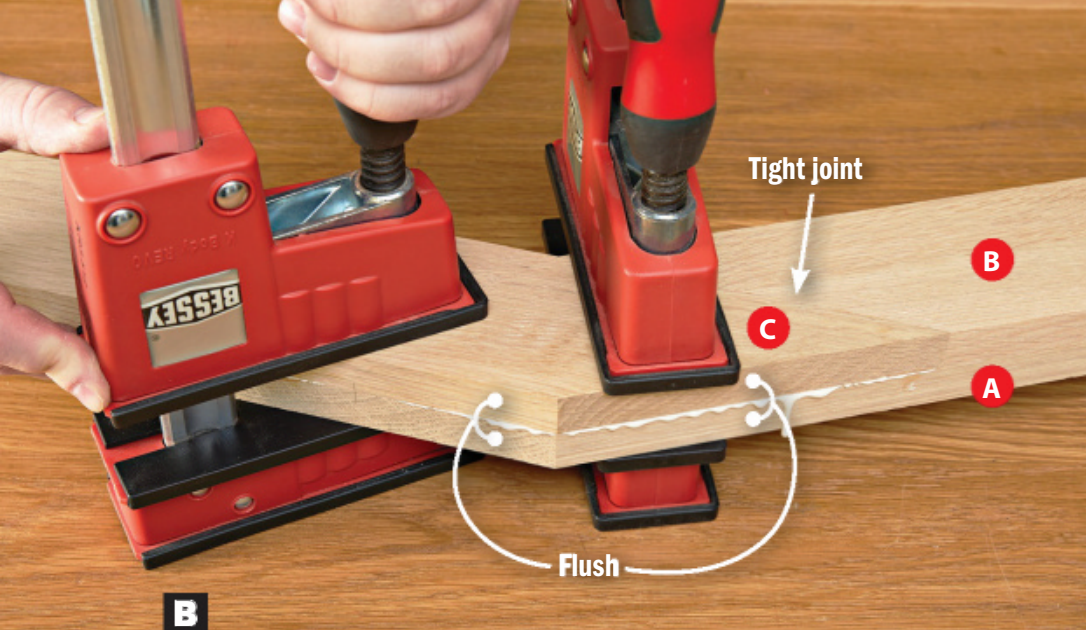
Build the backrest

- 1 Cut parts G–I to size and part J 3" wide and to the length shown. Test-fit the

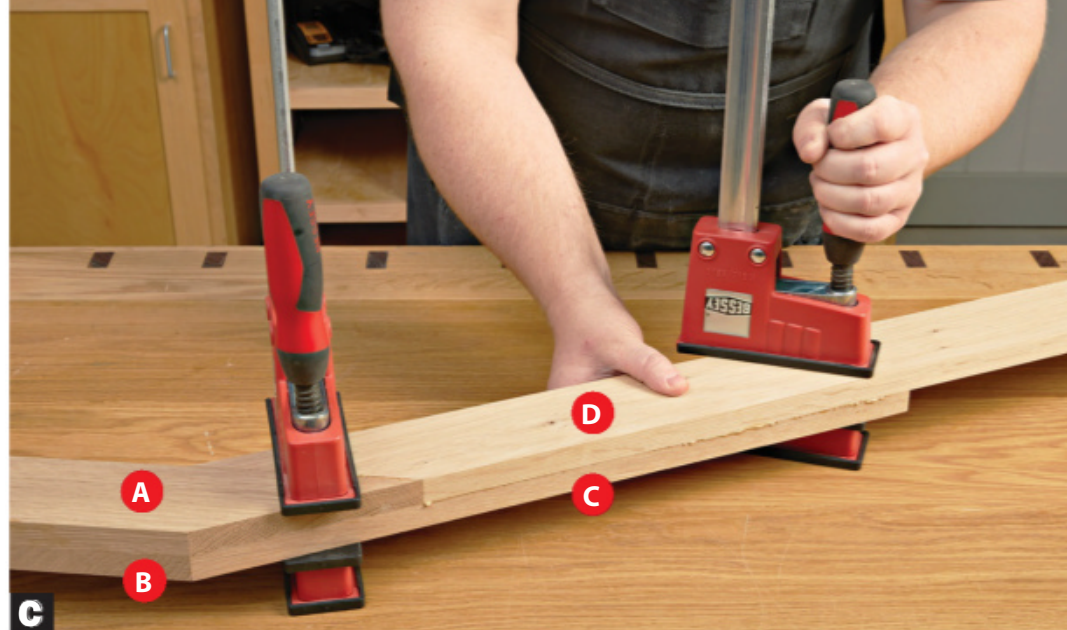


A Cut the miters on a tablesaw for precise fit. A long auxiliary miter-gauge fence with a blade kerf makes lining up the cuts easy.





B Keep the 60° miters flush at the corner. Glue with an adhesive that meets ANSI/HPVA Type 1 water-resistance standards (waterproof), such as Titebond III.



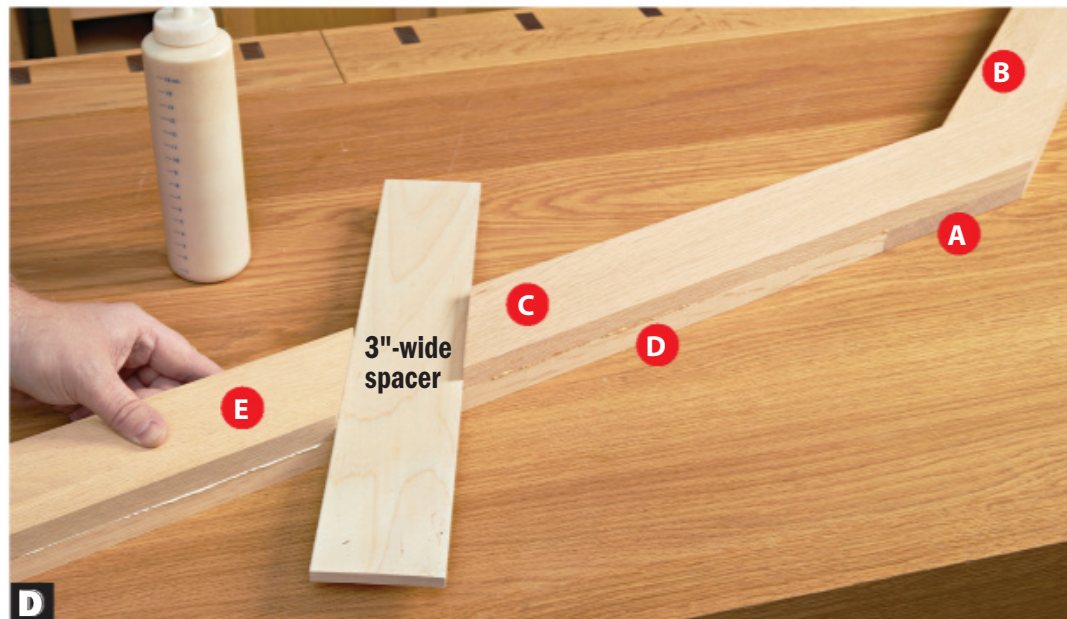
C Fit the back outer leg (D) tightly to the front outer leg (A). Make sure the edges of C and D remain flush as you tighten the clamps.

inner sides (H) in the leg mortises to make sure they fit snugly.

2 Miter-cut the 35° ends on parts G and H and the 60° ends on parts H–J [Drawing 1]. (You will bandsaw the remaining miters and tapers on parts G, I, and J after assembly.)

3 Glue an outer side (G) to an inner side (H) with the 35° mitered ends offset to fully seat in the leg mortise [Drawing 2]. Repeat for a mirror-image backrest side.

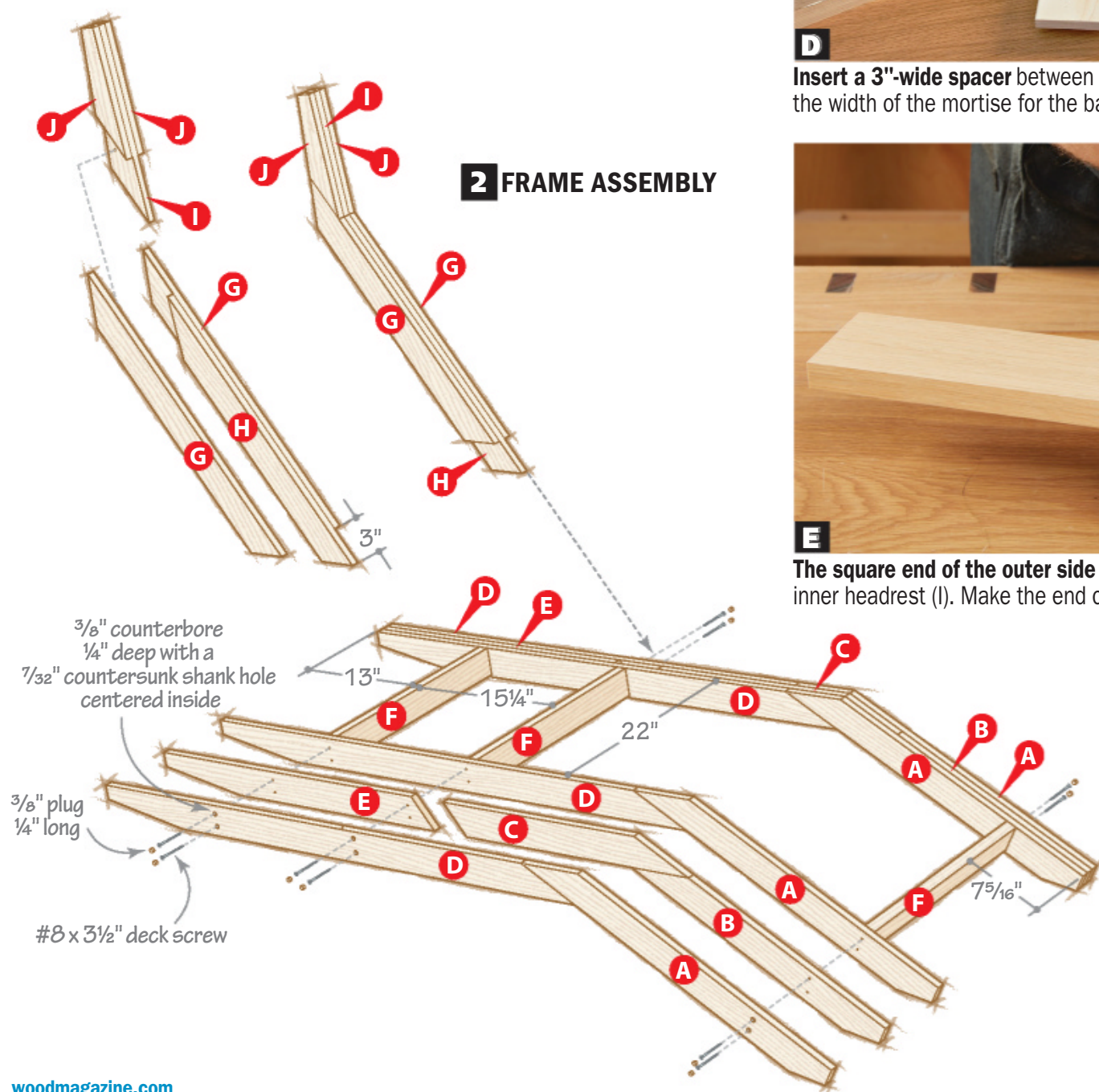
4 Glue parts I to the G/H assemblies [Drawing 2, Photos E, F]. Then, add the remaining outer sides (G) and the outer headrests (J).



D Insert a 3"-wide spacer between the inner legs (C and E) to accurately establish the width of the mortise for the backrest.



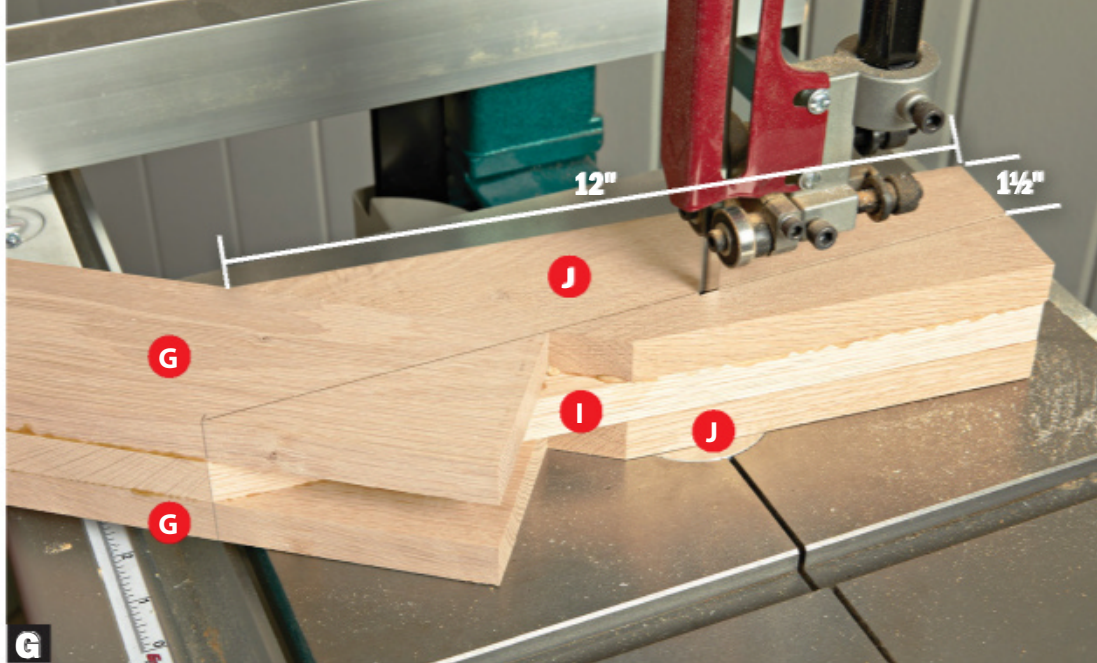
E The square end of the outer side (G) extends past the inner side (H) and the inner headrest (I). Make the end of I flush with the edge of G.





F

Keep the I/J edges flush and the G/J joints tight as you glue and clamp the backrest sides together. The gaps and overhangs will be cut away later.



G

Bandsaw the back of the headrest (G–J) to shape. Then, sand the edges of the backrest assembly (G–J) straight and smooth.

5 Lay out the taper on the back of the headrest and bandsaw to shape [Photo G].

6 Place the backrest (G–J) into the mortises in the frame (A–F) [Drawing 2]. Finish-sand the frame and backrest assembly.

► Glue the backrest in place if you wish.

Tip! Measure the outside width of your frame and add ½" for overhangs to verify the length of the slats before you cut them all.

Cover the seat

1 Cut the backrest support (K) and slats (L–O) to size. Notch two corners of the backrest support [Drawing 1]. Bevel-rip at 30° one edge of the lower headrest slat (M) and one edge of one base slat (O) [Exploded

View]. Rip a 35° bevel along one edge of one backrest slat (N) and one base slat (O).

2 Drill the screw pilot holes and counter-bores [Exploded View] in the slats.

3 Install the backrest support (K) followed by the base slats (O). Screw the headrest slats (L), lower headrest slat (M), and backrest slats (N) in place.

4 Glue in screw-hole plugs and trim them flush with the slats. Finish-sand, and apply an outdoor finish. (We used a water-based spar varnish.) 🌲



► Go to woodmagazine.com/cambiaplugs or hover over the QR code above to see a video about cutting plugs from Cambia wood.

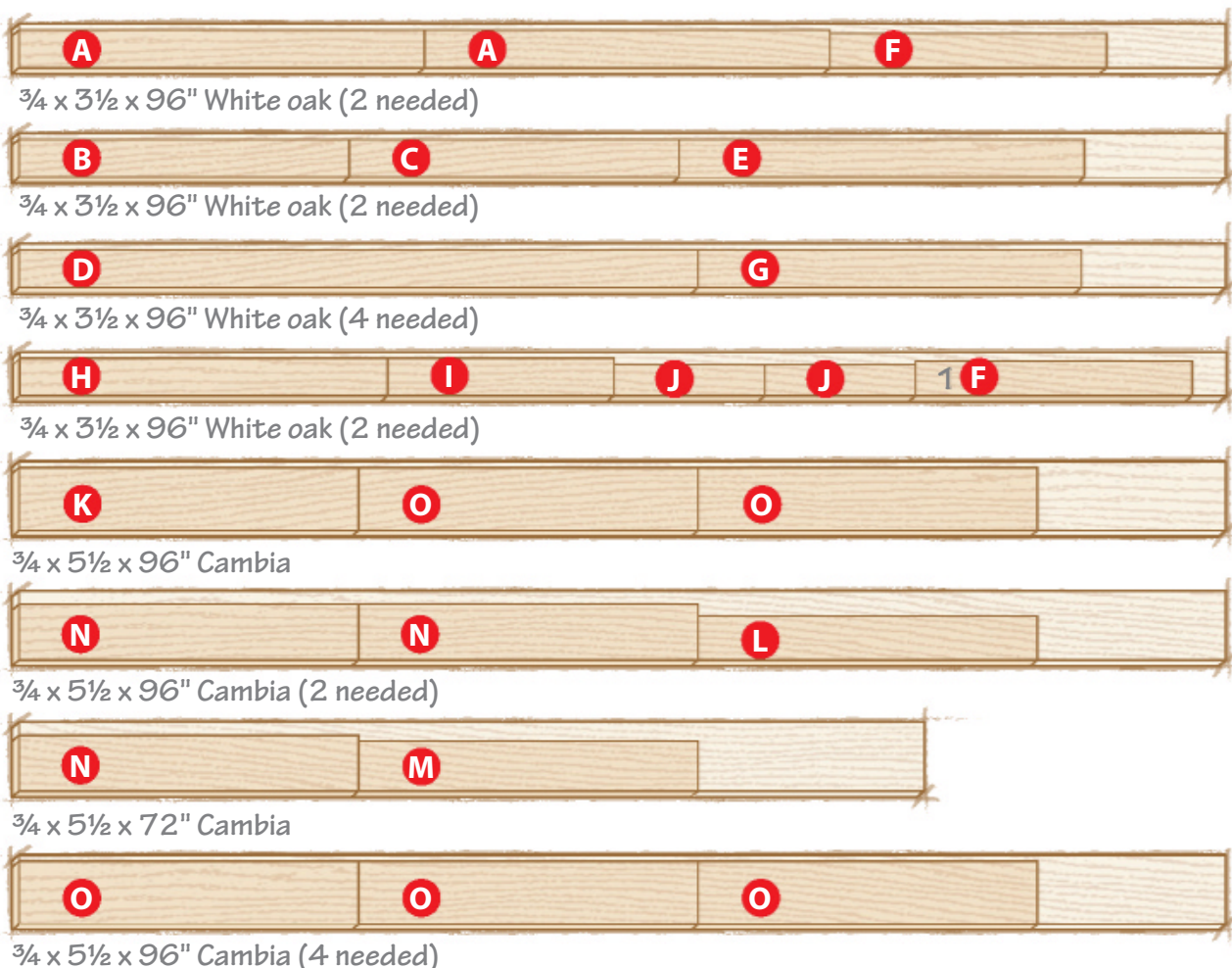
Produced by **Larry Johnston** with **Brian Bergstrom**

Project design: **John Olson**

Illustrations: **Roxanne LeMoine, Lorna Johnson**

Cutting Diagram

This project requires about 27 board feet of 4/4 white oak and 31 board feet of 4/4 Cambia.



Materials List

		FINISHED SIZE				
Part		T	W	L	Matl.	Qty.
Legs						
A	outer fronts	¾"	3"	32¼"	WO	4
B	inner fronts	¾"	3"	26¼"	WO	2
C	inner top backs	¾"	3"	26¼"	WO	2
D	outer backs	¾"	3"	54"	WO	4
E	inner bottom backs	¾"	3"	32¼"	WO	2
F	braces	¾"	2¾"	22"	WO	3
Backrest						
G	outer sides	¾"	3"	30⅞"	WO	4
H	inner sides	¾"	3"	29¼"	WO	2
I	inner headrests	¾"	3"	18"	WO	2
J*	outer headrests	¾"	22⅞"	12"	WO	4
Slats						
K	backrest support	¾"	5"	27"	C	1
L	upper headrest	¾"	3½"	27"	C	2
M	lower headrest	¾"	4"	27"	C	1
N	backrest	¾"	4⅞"	27"	C	5
O	seat/base	¾"	5"	27"	C	14

*Parts initially cut oversize. See the instructions.

Materials key: WO–white oak, C–Cambia.

Supplies: #8×3½" and #8×1½" deck screws.

Bit: ⅜" plug cutter.

Source: Cambia wood, U.S. and Canada sales, 603-702-0563, bthomas@northlandforest.com.

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A simple guide to choosing and installing European Hinges

These secrets cut through the confusion and make you an expert.



by Jim Heavey

Door hinges sure have changed since I began building cabinets shortly after the earth cooled. I used to pick a style to match the current fad, and then chose black, chrome, or antique brass. Mounted to the face frame of the cabinet, these hinges became part of the “look.” They allowed little, if any, adjustment, making final door alignment a potential nightmare.

The introduction of European-style (also called Euro or 35mm) hinges changed everything. You could conceal the hinge inside the cabinet, placing the focus on the beauty of the door. Installation proves easy, and you can adjust the door up and down, in and out, and side to side with just the turn of a screw [Adjusting door position, *next page*]. However, shopping for them can be a dizzying experience with so many types and makes to choose from. Here’s what you need to know to select and install these hidden hinges.



Adjusting door position

Euro hinges allow for simple adjustment in three axes with just a screwdriver [Photo]. Align overlay door heights with adjacent doors or balance the reveal at the top and bottom of inset doors, and bring them flush with the face frame.

Loosen screws A to adjust the door up or down. Turn screw B to move the door toward or away from the cabinet face. Use screw C to move the door side-to-side.

Pick the right hinge

Euro hinges have two components: The hinge arm has a cup that fits in a 35mm-diameter recess drilled in the door. The mounting plate, or clip, attaches to the cabinet side or face frame depending on the cabinet construction. The hinge arm then snaps onto the clip.

Some vendors sell the hinge arm and clip as a unit; others let you select them individually to match your application—and that's where things can get confusing. But don't worry. Work through the following checklist to select the correct hinge cup and clip.

■ **Select for cabinet type.** Face-frame cabinets have horizontal rails and vertical stiles attached to the face of the cabinet box. Clips for this type of cabinet attach to a frame stile [Photo A and above].

European-style cabinets, sometimes called full access, are simply boxes without a face frame. In this case, the clips attach to the inside face of the cabinet [Photo B].

■ **Determine the door style.** *Inset* doors sit flush with the front of the cabinet box or face frame [Photo C].



A

Clips for inset doors attach to the rear face of the stile. Clips for overlay doors attach to the edge of the stile.



B

Frameless-cabinet clips mount to the cabinet side. Positioning depends on whether the doors are inset or overlay.



C

Inset doors require an even gap, or reveal, all around for best appearance. Most Euro hinges allow adjustments of between $\frac{3}{64}$ " and $\frac{5}{64}$ " in each direction, invaluable when fine-tuning the reveal.

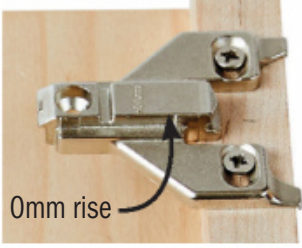
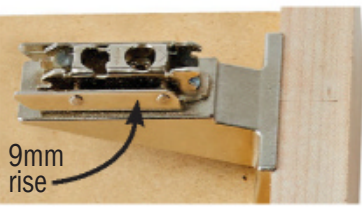
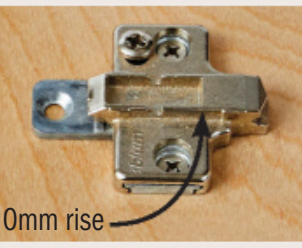
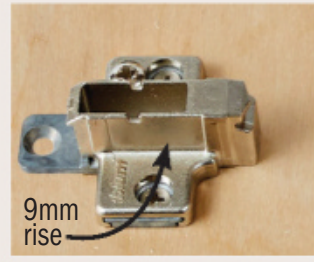


D

On a full-overlay door, the door rests against the cabinet face frame (left), or the cabinet box (right). Adjacent doors should align along their top and bottom edges.



E

	OVERLAY COMPONENTS	INSET COMPONENTS
Face Frame	 0mm rise	 9mm rise
Frameless	 0mm rise	 9mm rise
Hinge Arm		 Half-crank

Four clip styles and two hinge styles will accommodate the vast majority of your cabinet-making needs. The hinge arm works for either clip shown above it.

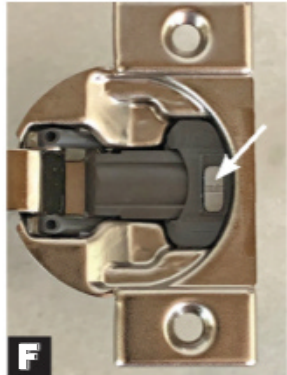
Overlay doors close against and overlap the front of the cabinet box or face frame [Photos D, E], with the most common overlays being $\frac{3}{8}$ " and $\frac{1}{2}$ " on each edge.

Hinges for overlay doors have a near-flat clip (0mm rise) and a straight arm [chart at left]; hinges for inset doors have a taller clip (9mm rise) and a rise (called a *half-crank*) to the arm.

■ **Pick an opening angle.** For the vast majority of applications, a hinge that opens between 95° and 110° provides clear access to the full cabinet width. You can find hinges that swing further, even up to 270°, which allows the door to fold back against the cabinet side if you need it out of the way as you access the cabinet contents.

■ **Determine the closing action.** A soft-close hinge eliminates annoying slams by slowing the door just before it shuts completely. Some hinges offer a way to adjust the speed of the closing action [Photo F], so you can dial in more resistance on heavier doors, and less on lighter doors. Or, to save a bit of money, use one soft-close hinge and one less-expensive standard hinge.

■ **Narrow the field even more.** You can further focus your choices by choosing screw mounting for clips and hinges. This eliminates those that require specialized jigs or additional hardware for mounting.



F

Moving the small gray switch turns the closing action on or off—especially useful when balancing the self-close feature of multiple hinges on the same door.

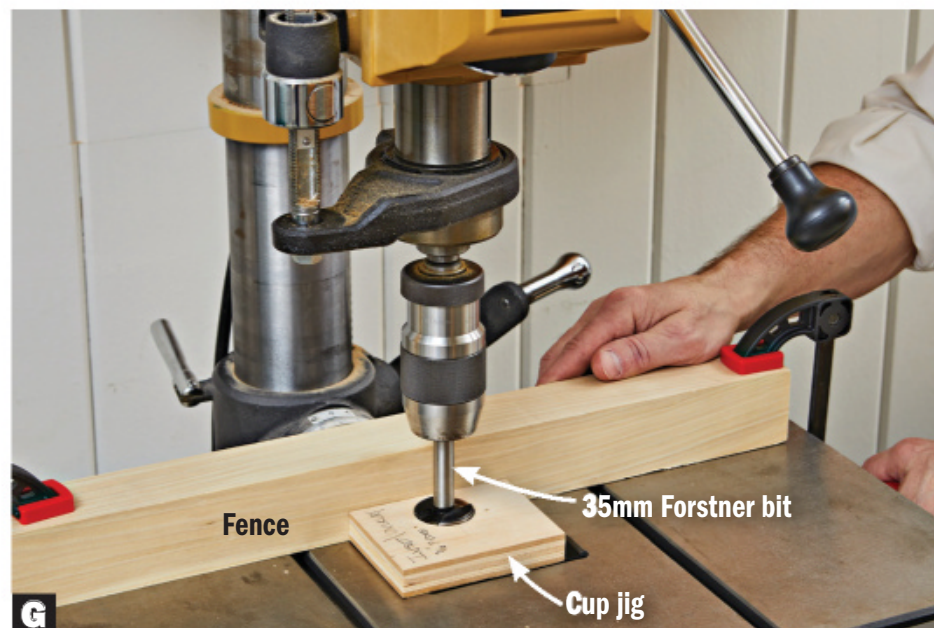
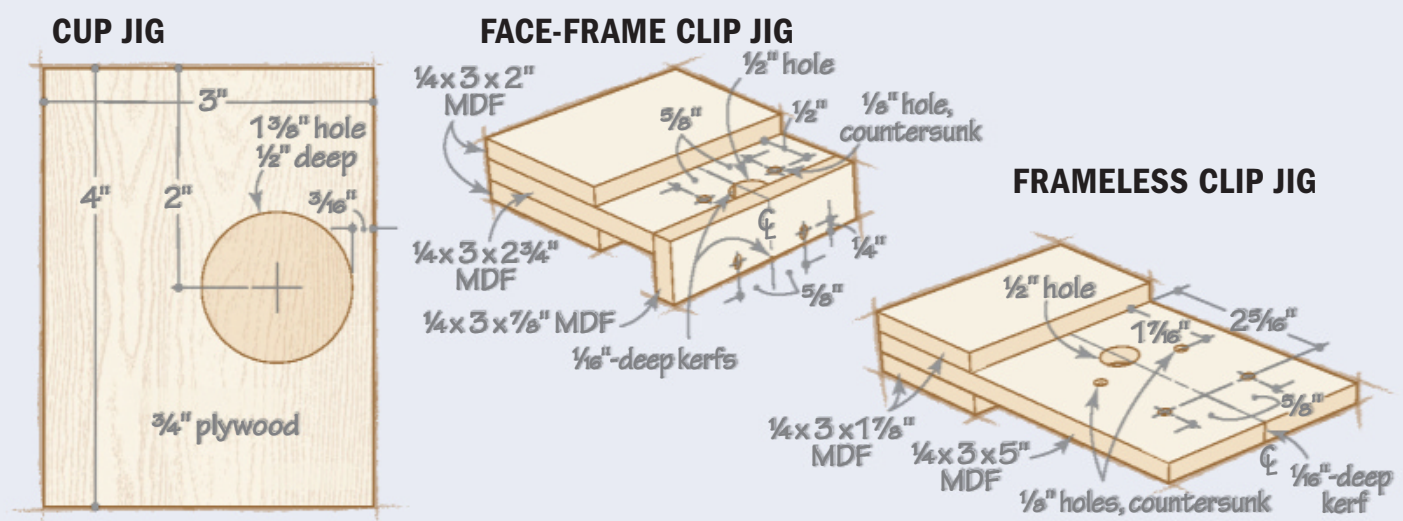
Tip! Because of its universal fit, you can easily replace an existing Euro hinge with a soft-close hinge.

Jigs speed installation

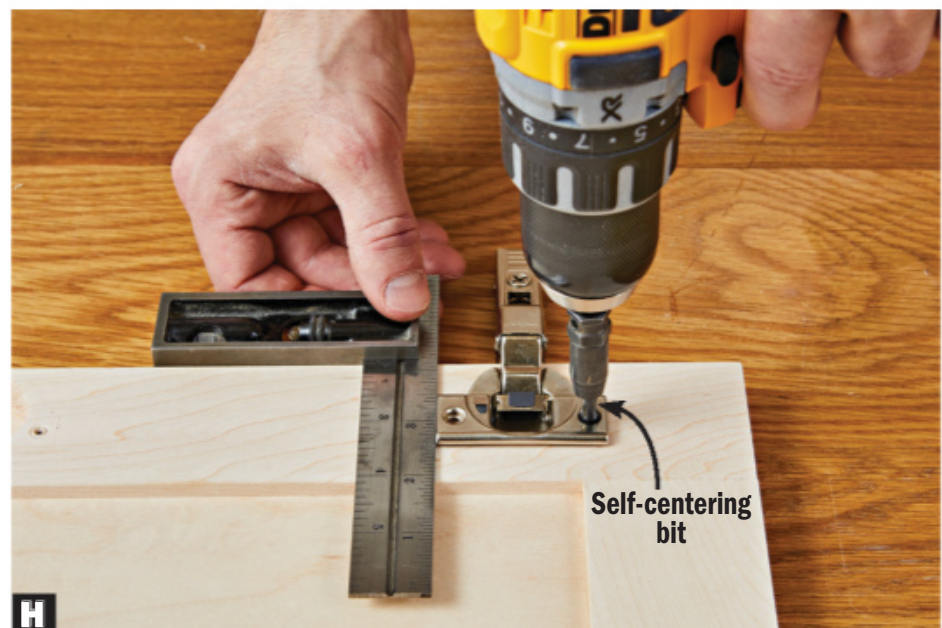
These three hinge jigs eliminate repetitive measuring while ensuring holes get drilled exactly where needed.

Use the cup jig to set up your drill press for drilling the cup holes in the doors.

The face-frame and frameless clip jigs guide your drill bit for installing the clips for both inset and overlay doors. Countersink the holes in each jig to fit the tip of a self-centering (Vix) bit. Short hand-sawn kerfs help you align the jig with the clip centerlines on the cabinet.



G With the Forstner bit in the hole, bring the drill-press table fence against the jig edge and lock the fence in place. Set the depth stop for a 1/2"-deep hole.



H Use a self-centering bit to center the screw holes. The #3 and #5 bits accommodate most Euro hinge-screw sizes.

Installing hinges

While most hinges come with drilling guides or templates that provide hole locations for both halves of the hinge, *WOOD*® magazine's Senior Design Editor, Kevin Boyle, developed a system that uses three simple jigs to locate screw and hinge-cup holes for almost all applications [Jigs speed installation, above].

▶ A 1 3/8" bit is 34.925mm—close enough.

First, set up your drill-press fence position with the cup jig [Photo G]. Mark cup locations on each door 3" from each end, and drill the holes. Place the cup in the hole, square it to the door edge, and drill the screw pilot-hole locations [Photo H]. Screw the cups in place.

To mount the clips to the cabinet, mark centerlines for the clips. For overlay doors, subtract the amount of the overlay from 3"; so for a 1/2" overlay, mark the centerlines 2 1/2" from the top and bottom of the door opening. For inset doors, add 1/16" to the 3" measurement. Align the appropriate clip jig with the centerline and drill pilot holes [Photos I, J]. Screw the clips in place.

Position the door in the opening, snap the hinge arms to the clips, then adjust the hinges to align the doors. 🌳



I For frameless cabinets, use the far set of holes for an inset door, the near set for overlay doors.



J On face-frame cabinets, drill holes on the edge of the stile for overlay doors, and on the rear face of the stile for inset doors.

Chisel Case

This handsome box provides convenient storage, portability, and access.

Take your chisels to the work in a case that protects both you and the sharpened blades. The lid folds back to prop up the case vertically on a base that stores inside the case. Or fold the lid further and rest the case horizontally.

We used leftover walnut for the case, and scraps of butternut veneer to dress up the panels.

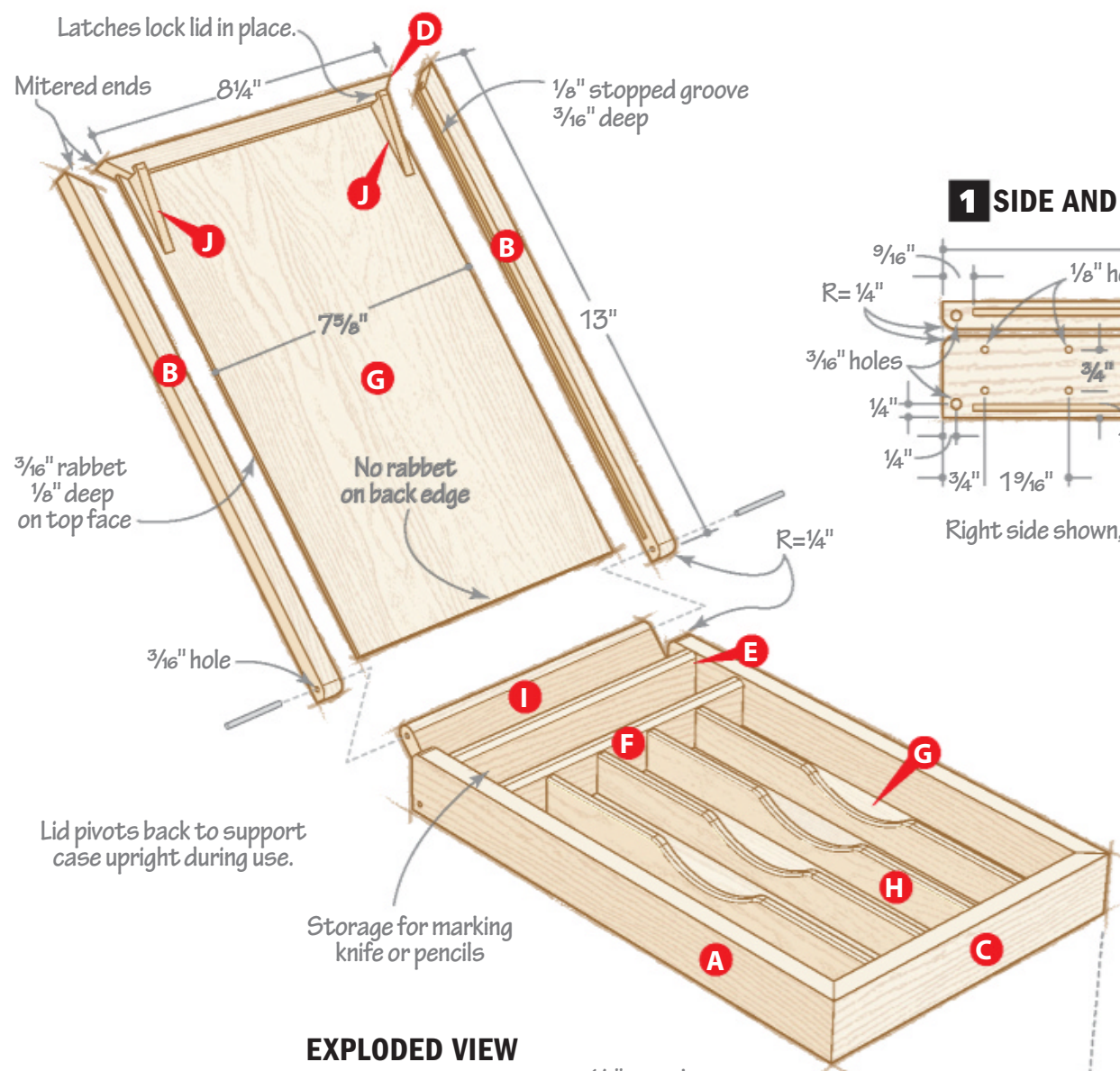
D I M E N S I O N S :
8 1/4" W x 13" D x 2" H

Approximate materials cost:

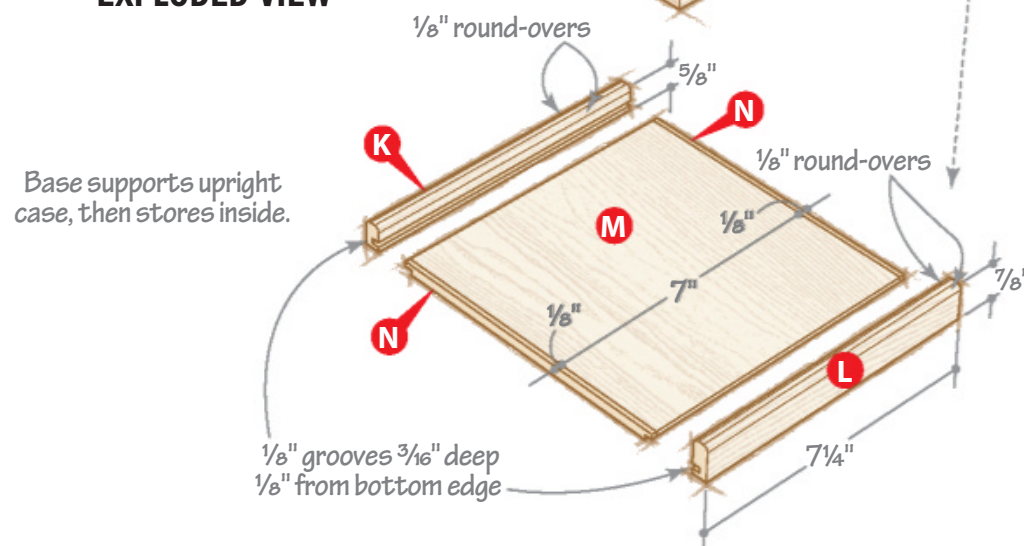
\$15

Store
5
chisels as shown or make a wider box and add more dividers.

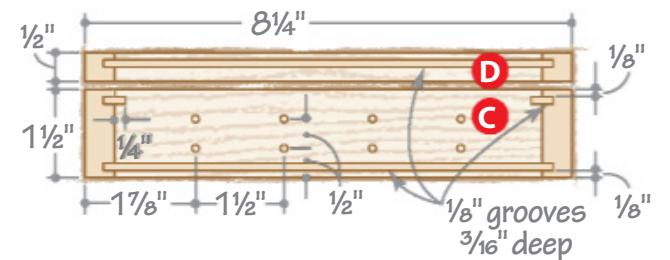
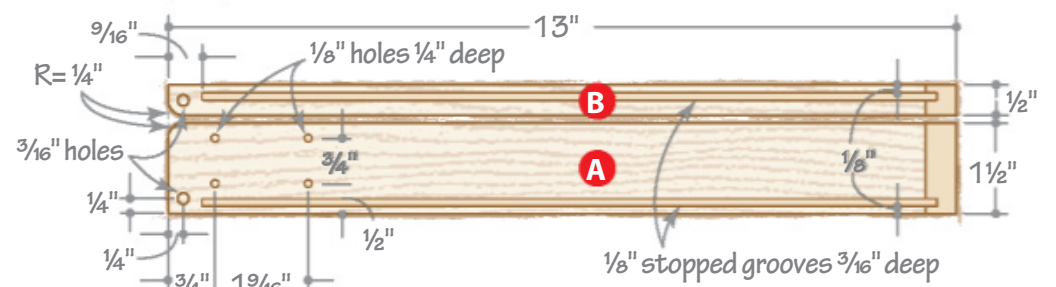




EXPLODED VIEW



1 SIDE AND FRONT BLANKS



Cut the box parts

1 Prepare two $\frac{1}{2} \times 2\frac{1}{8} \times 13$ " blanks for the box and lid sides (A, B) and a $\frac{1}{2} \times 2\frac{1}{8} \times 8\frac{1}{4}$ " blank for the box and lid front (C, D). Rout the grooves for the box and lid panels (G) [Exploded View, Drawing 1, Photo A]. Save the router setup for later.

2 Miter-cut both ends of the C/D blank and one end of each A/B blank [Photo B].



A Secure the blank between bench dogs. Mount an edge guide to your router and cut the grooves.



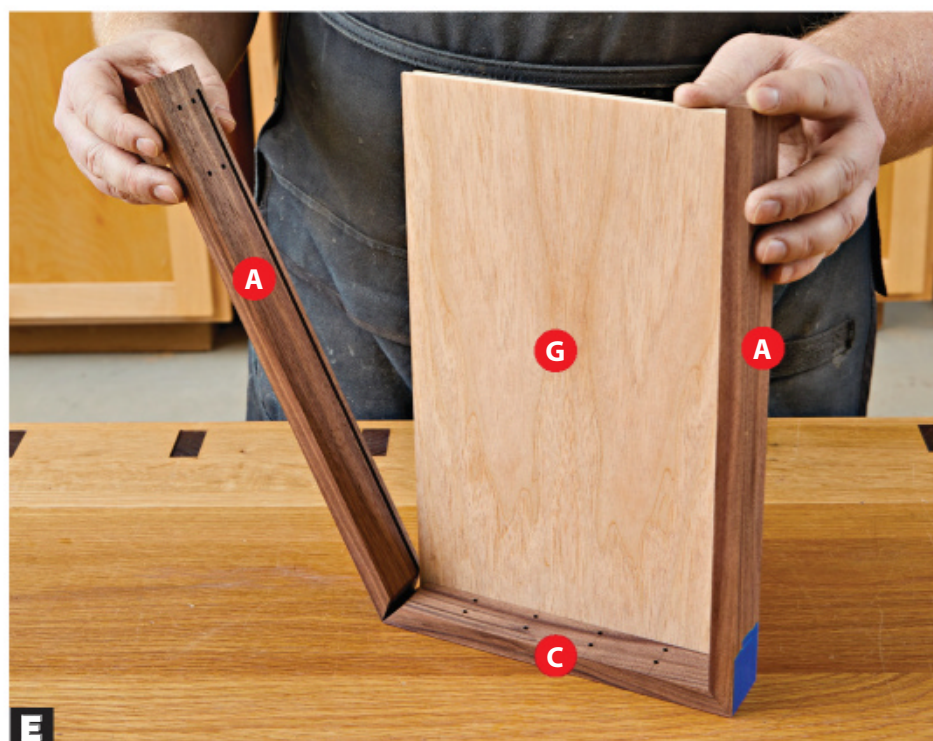
B Attach an auxiliary fence to your miter gauge, and tilt your tablesaw blade to 45°. Make a pass through the fence to help you align the workpieces.



C Secure the box front (C) to a scrap with double-faced tape and clamp the scrap to your bench. Rout the latch grooves.



D To steady the divider as you drill, clamp it to a square screwed or clamped to your drill-press table.

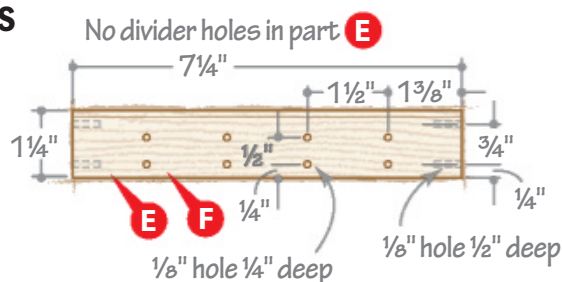


E Align the box front (C) between the box sides (A), apply tape across the joints, and fold the assembly around a panel (G) to test the fit of the tongues in the grooves. Repeat to check the fit of the lid panel.



F Glue each chisel divider (H) to the mid divider (F). This assembly floats above the box panel (G), providing additional strength to the box.

2 END/MID DIVIDERS

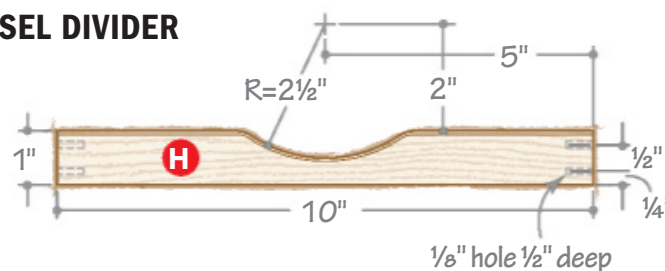


3 Drill the holes on the inside faces of the A/B and C/D blanks [Drawing 1]. Then rip the blanks into parts A–D. In the box front (C) rout stopped grooves to accept the lid latches (J) later [Photo C].

4 Cut the end and mid dividers (E, F) to length to match the heel-to-heel dimension of the box front (C). Drill the dowel holes in the ends of the dividers, and in one face of the mid divider [Drawing 2, Photo D]. Glue dowel pins into the holes.

5 Veneer the panels (G), then cut them to size and rabbet the edges and one end

3 CHISEL DIVIDER



[Exploded View] to fit the grooves in the box and lid. Test the panel fit [Photo E].

6 Dry-assemble the box with the mid divider (F) and measure for the length of the chisel dividers (H). Cut the chisel dividers to size, and bandsaw and sand the radius [Drawing 3]. Finish-sand the dividers smooth, easing the top edges.

7 Drill holes in the ends of the chisel dividers and glue in dowel pins. Then glue the dividers to the mid divider (F) [Photo F].

8 Cut the pivot block (I) to size. Clamp it between the dry-assembled box and lid

Tip! Get identical radii by stacking the chisel dividers, and shaping them at the same time.



► Watch a video of creating a book-matched veneer pattern.

woodmagazine.com/chiselveneer

and mark the holes through the lid and box sides onto the ends of the pivot block. Drill the holes and round over the edges of the block [Drawing 4].

Assemble the box

1 Glue the F/H assembly to the box front (C). After the glue dries, add the box sides (A), panel (G), and end divider (E). Glue together the lid sides (B), front (D), and panel (G). While the glue dries, cut the lid latches (J) to shape [Drawing 5, Photo G], then glue them in place.

2 After the glue dries, radius the top back corners of the box sides (A) and bottom back corners of the lid sides (B) [Exploded View].

3 Cut four 1 1/4" lengths of 3/16" aluminum rod (brass would also be a good choice) and dry-fit the pivot block (I) to the lid and box [Exploded View and Drawing 4]. Test the operation and fit of the lid. It should fold back as seen in the opening photo on page 56.

Make a base

1 For the base rear and front trim (K, L), make a 3/8 x 1 5/8 x 7 1/4" blank. Rout grooves 1/8" from each edge [Exploded View], then rip the trim pieces from the blank. Round over the edges opposite the grooves.

2 Cut the base panel (M) and side trim (N) to size. Glue the side trim to the panel. After the glue dries, rabbet the M/N assem-



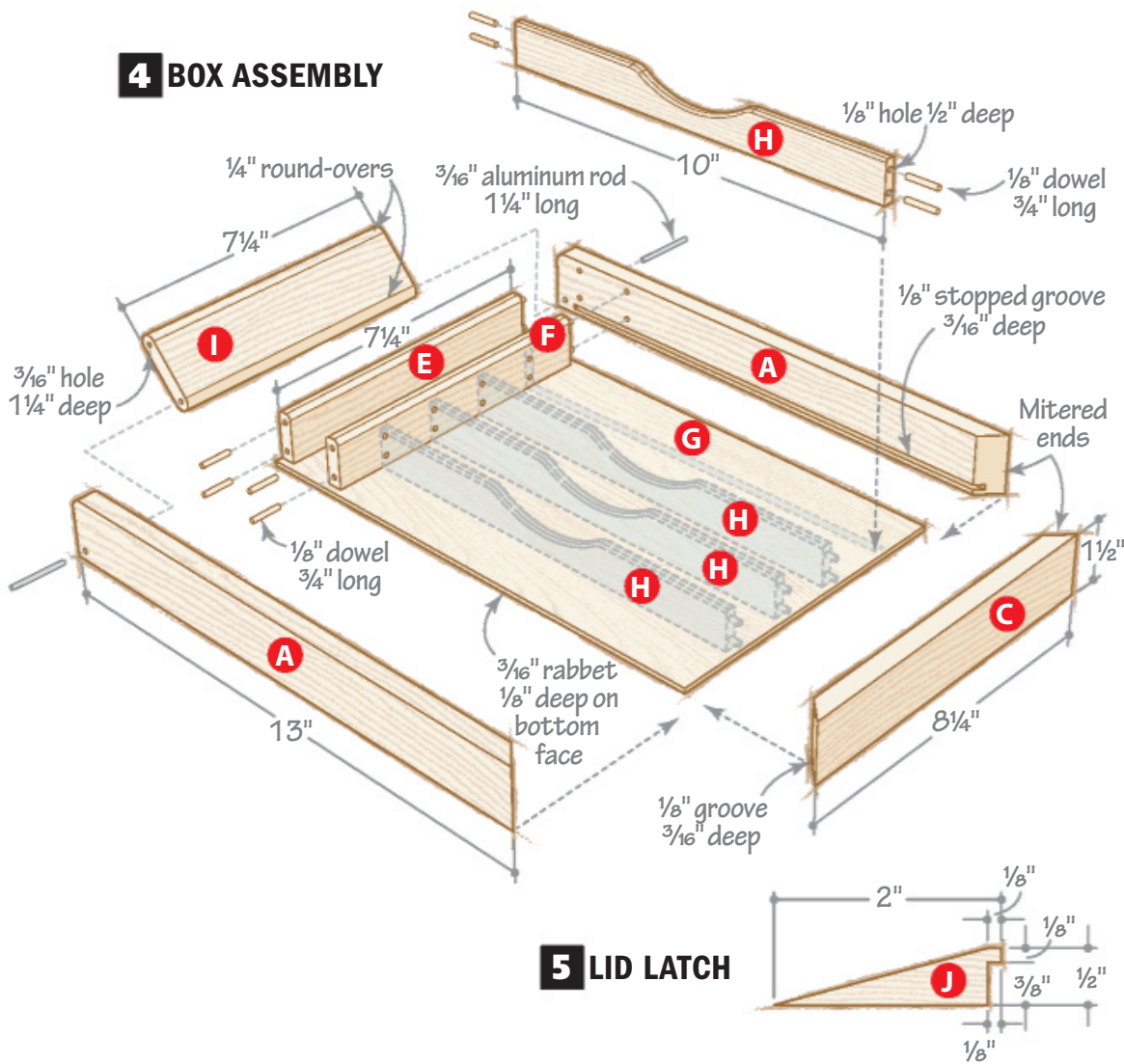
Notch the end of a 6"-long blank to make a tongue that fits the grooves in the box front (C). Then bandsaw the angle.

bly to create tongues that fit the grooves in the front and rear trim (K, L). Then, glue the front and rear trim in place.

Finish time

1 Apply a finish to the box and base. (We sprayed on semi-gloss aerosol lacquer.)

2 Dry-fit the pivot block. Working on one hole at a time, place a drop of cyanoacrylate glue in the hole of the pivot block only and tap in an aluminum pin through the lid or box sides. Trim and sand the pins flush and touch up any finish. Place your chisels in their new sharp-looking home. 🌲



Produced by **Craig Ruegsegger**
with **John Olson**
Project design: **John Olson**
Illustrations: **Roxanne LeMoine,**
Lorna Johnson

Materials List

Part		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A	box sides	1/2"	1 1/2"	13"	W	2
B	lid sides	1/2"	1/2"	13"	W	2
C	box front	1/2"	1 1/2"	8 1/4"	W	1
D	lid front	1/2"	1/2"	8 1/4"	W	1
E	end divider	3/8"	1 1/4"	7 1/4"	W	1
F	mid divider	3/8"	1 5/32"	7 1/4"	W	1
G	box/lid panels	1/4"	7 5/8"	12 1/8"	Ply	2
H	chisel dividers	1/4"	1"	10"	W	4
I	pivot block	1/2"	2"	7 1/4"	W	1
J	lid latches	1/4"	1/2"	2"	W	2
K	base rear trim	3/8"	5/8"	7 1/4"	W	1
L	base front trim	3/8"	7/8"	7 1/4"	W	1
M	base panel	1/4"	7"	7 1/16"	Ply	1
N	base side trim	1/8"	1/4"	7 1/16"	W	2

Materials key: W-walnut, Ply-butchernut-veneered plywood.
Supplies: 3/16" aluminum rod, 6" long, 1/8" dowel, 36" long.
Bits: 1/8", 1/4" round-over router bits.

Thin is In Minimalist Wallet

Lighten your load by carrying cash and cards without the usual back-pocket bump.

Actual size

Note: The standard credit or ATM card measures $3\frac{3}{8} \times 2\frac{1}{8}$ ".

To make the halves of this wallet, create your own plywood from pieces of veneer. Contrasting veneers, such as birch and walnut, show off the layering.

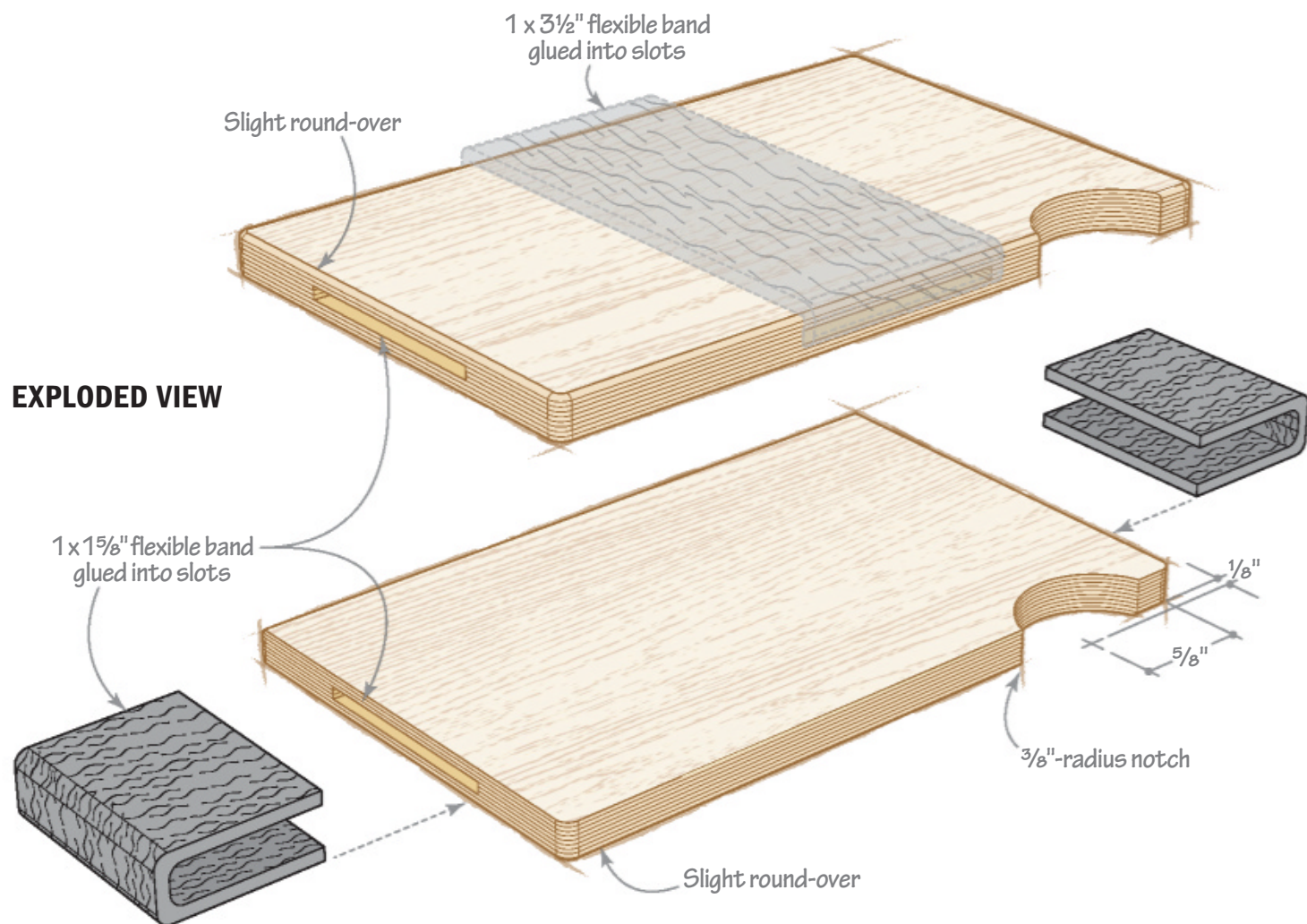
► Veneers commonly measure .020" thick. Check the thickness of your material before cutting.

D I M E N S I O N S :
 $3\frac{1}{2}$ " W $\times$ $2\frac{1}{4}$ " D $\times$ $\frac{3}{8}$ " H

Approximate materials cost:

\$16

provides enough material for multiple wallets



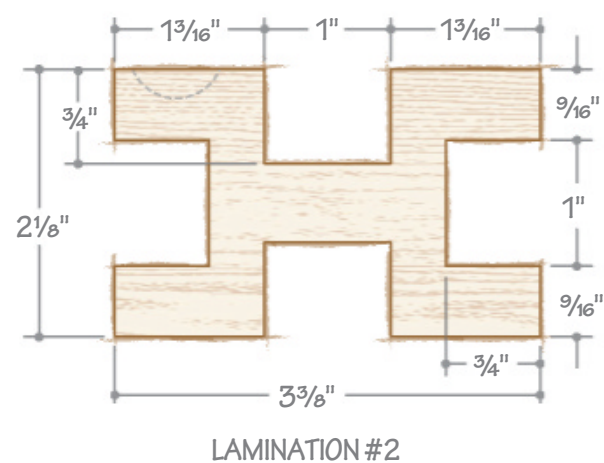
Laminate the blanks

1 Cut 12 $2\frac{1}{4} \times 3\frac{1}{2}$ " pieces of veneer with the grain running the $3\frac{1}{2}$ " dimension. Cut six $3\frac{1}{2} \times 2\frac{1}{4}$ " veneers with the grain running the $2\frac{1}{4}$ " dimension.

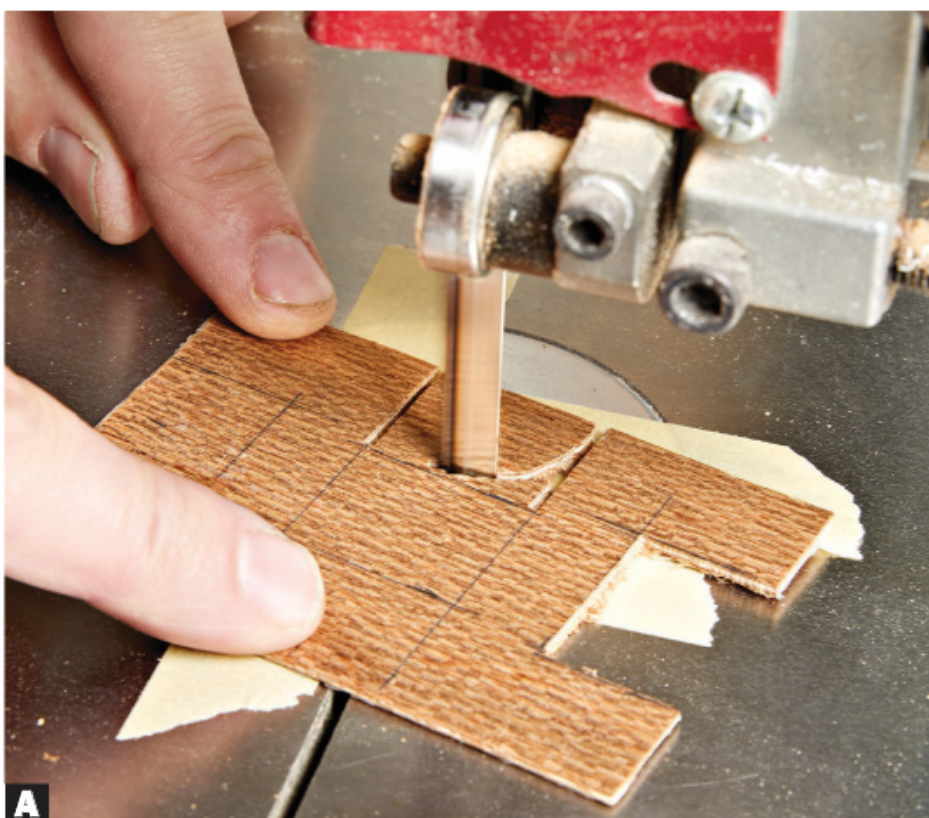
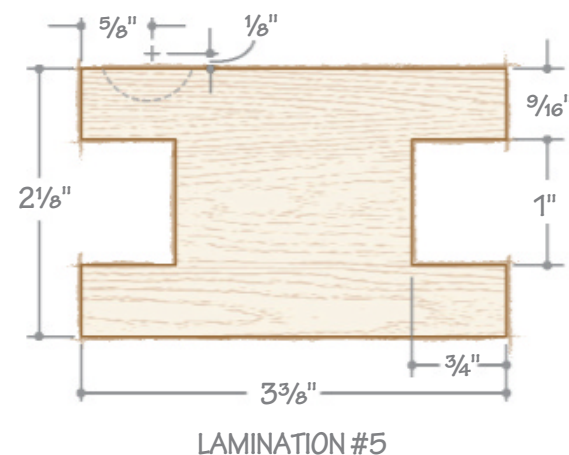
2 Organize six groups of three veneers each in alternating grain directions. Cut four pieces of $\frac{3}{4} \times 4 \times 4$ " plywood and eight 4×4 " pieces of waxed paper. Laminate each group of veneer, stacking three groups separated by waxed paper, between a pair of plywood plates. Clamp both stacks.

3 After the glue dries, lay out and cut the notches on the middle laminations (2 and 5) [Drawings 1 and 2, Photo A].

1 TOP CENTER LAMINATION



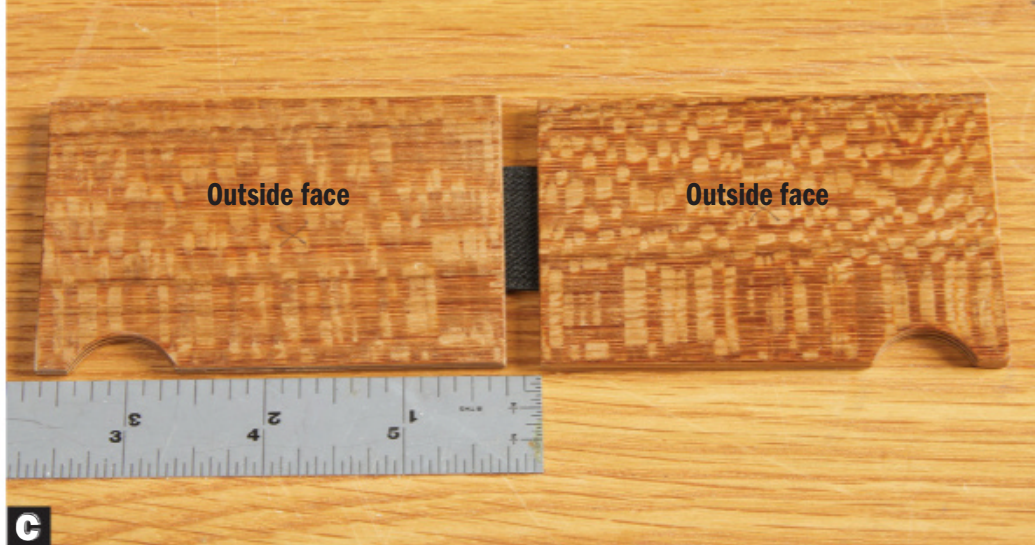
2 BOTTOM CENTER LAMINATION



A Masking tape on the bandsaw table around the blade creates a zero-clearance surface for notching the thin middle laminations.



Sandpaper taped to a metal ruler lets you enlarge slots in the laminations until the elastic band easily slides into place.



Leave a 1/4" gap between the wallet halves with the first elastic band glued in place.

4 Glue and clamp the middle laminations (2, 5) between the outside laminations (1, 3, 4, 6) [Drawing 3] for the top and bottom.

5 Join the two halves with double-faced tape, and trim to finished size. Notch one edge [Exploded View] using a drum sander, and round the corners. Separate the halves and sand, rounding the edges slightly. Apply three coats of clear polyurethane.

Enter the home stretch

1 From 1"-wide elastic [Sources], cut two 1 5/8"-long pieces and one 3 1/2"-long piece. Check that the ends slide easily into each opening in the wallet halves [Photo B].

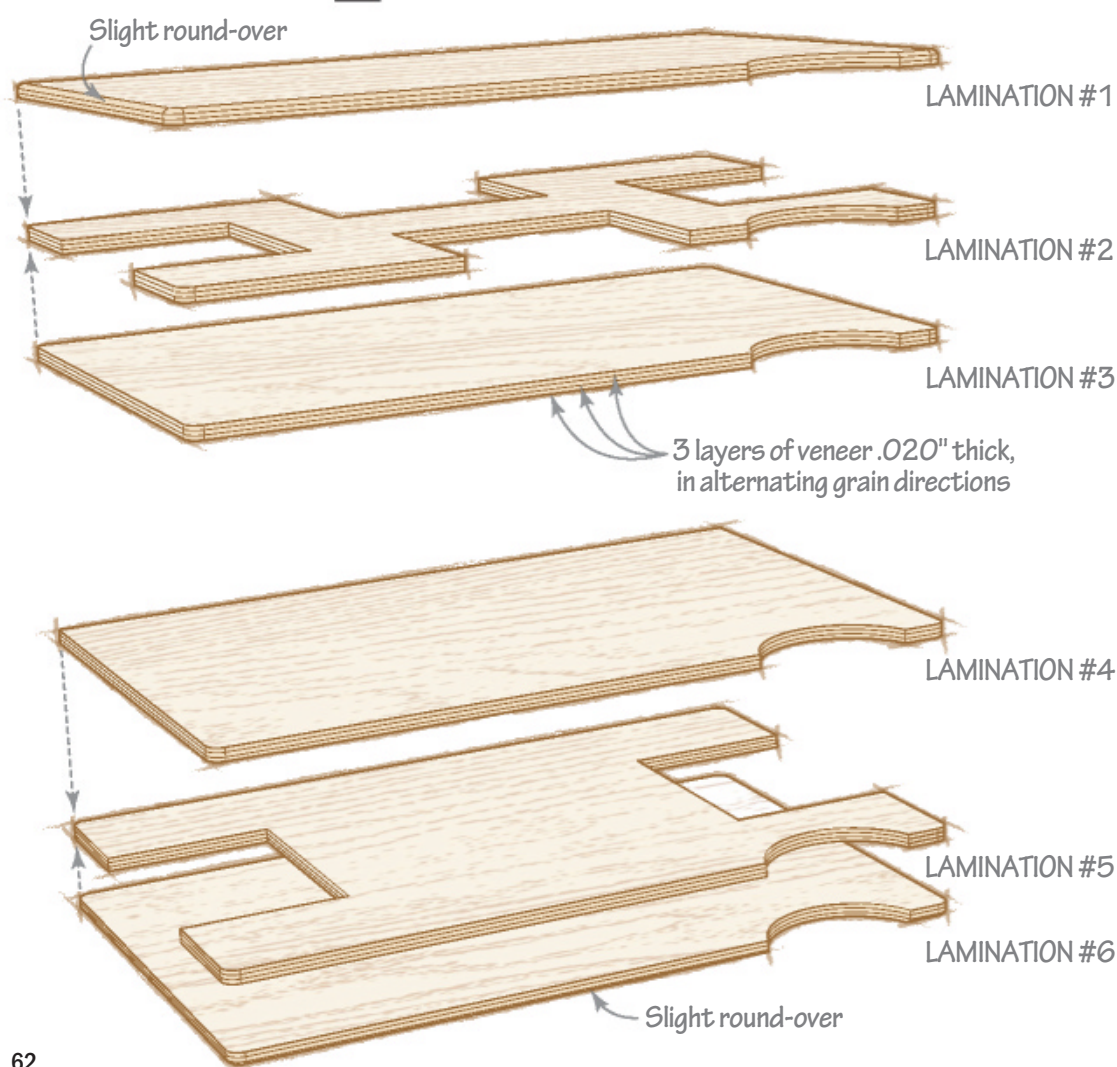
2 Drip cyanoacrylate glue into an end slot of each wallet half and immediately insert a 1 5/8" band [Photo C]. Fold the wallet halves together with a roughly 1/16" gap and glue the second band into the slots.



The outside elastic band will be stretched when gluing the final end. Use a metal ruler to push the band into the slot, then hold the band in place while the adhesive dries.

3 Glue one side slot of the top lamination and slide the 3 1/2" band into the slot. Repeat for the other side [Photo D] and hold the band in place. Now add only the cash and cards you need, and say goodbye to the old rump bump. 🌲

3 LAMINATION ASSEMBLY



Sources: 1" elastic band in the color of your choice available at most fabric stores, or Dritz 1"x5' non-roll black elastic, no. 563761150, \$4, walmart.com. Mixed-species veneer pack totaling 3 square feet, no. 44841, \$12, 800-279-4441, rockler.com.

Produced by **Robert Wilson** with **Kevin Boyle**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine, Lorna Johnson**



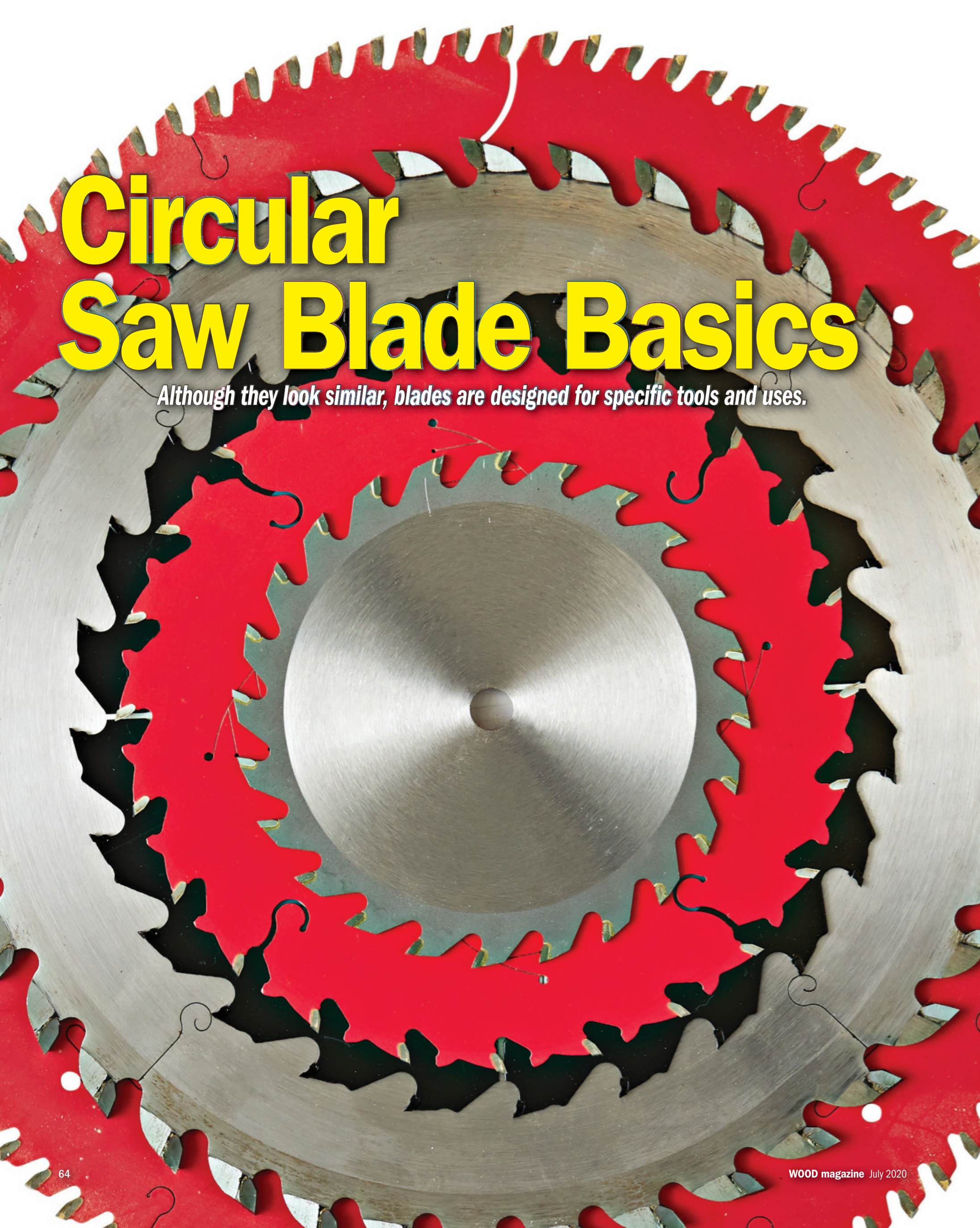
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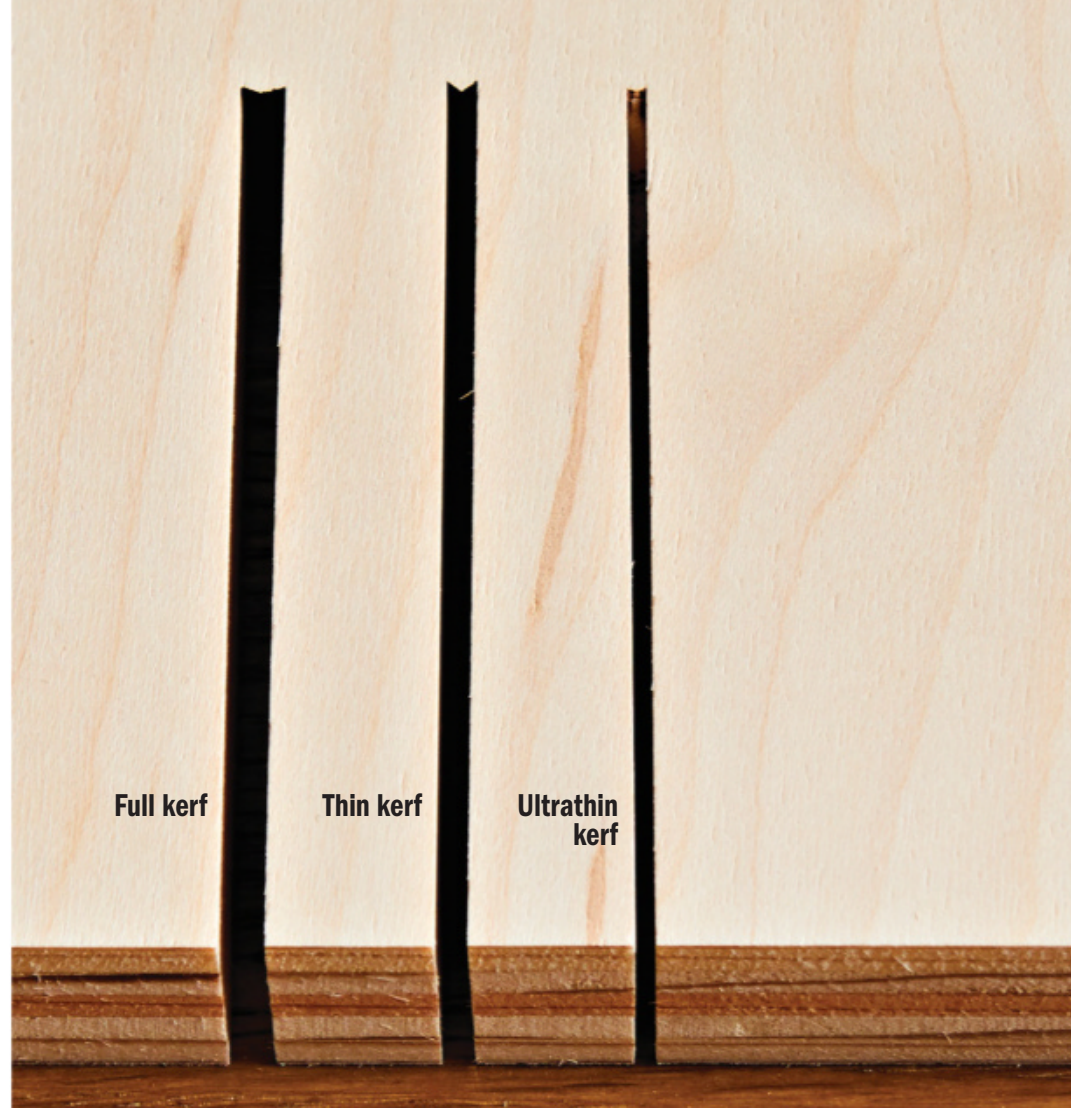
Circular Saw Blade Basics

Although they look similar, blades are designed for specific tools and uses.

More so than the *brand* of saw blade, getting the correct *type* of blade determines whether you'll get a quality cut. And in most instances, your new tool's factory-supplied blade may be better suited for job-site cutting than woodworking. Here are eight things you need to know to get the right blade for the job.

■ **Diameter.** Okay, this one's easy. Each tool generally accepts a specific size blade: typically 10" for tablesaws, 6½" or 7¼" for handheld circular saws, 10" or 12" for miter-saws and radial-arm saws. Some tools can use a smaller blade (see dado blades, *next page*), but never attempt to use a larger one. It might be difficult to find replacement blades in some sizes; your tool-buying decisions may hinge on the availability of blades.

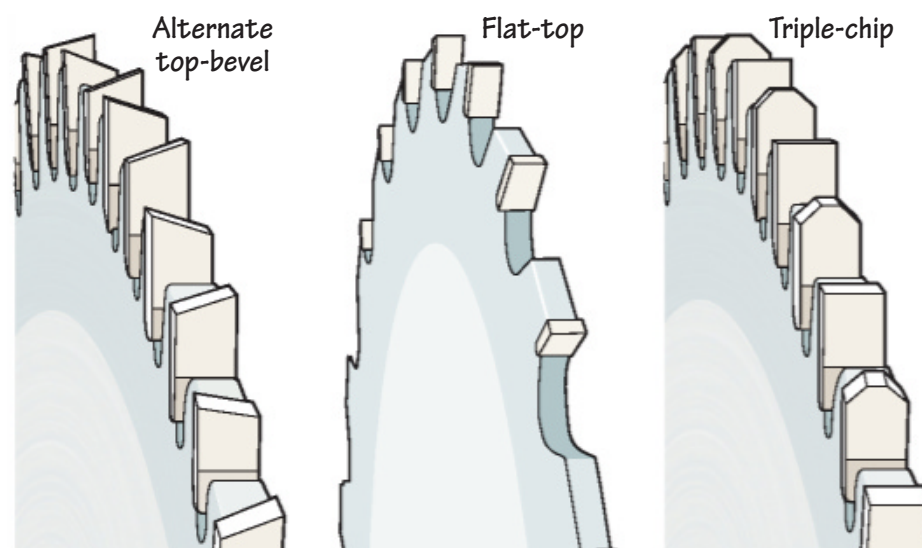
■ **Kerf.** This refers to the width of the cut made by a blade. The thicker the blade, the less likely it is to flex (and the wider the kerf). So, heavy-duty stationary tablesaws generally use ⅛"-kerf blades because those saws can easily power that blade through dense hardwoods. Tablesaws with motors rated at 1½ hp or less, as well as mitersaws and radial-arm saws, get more apparent power with thin-kerf blades (about ⅜").



Portable circular saws—especially battery-powered ones—use even thinner blades; it's almost impossible to find ⅛"-kerf blades for portable saws. These ultrathin blades put less strain on the saw motor and because of their smaller diameters don't flex noticeably.

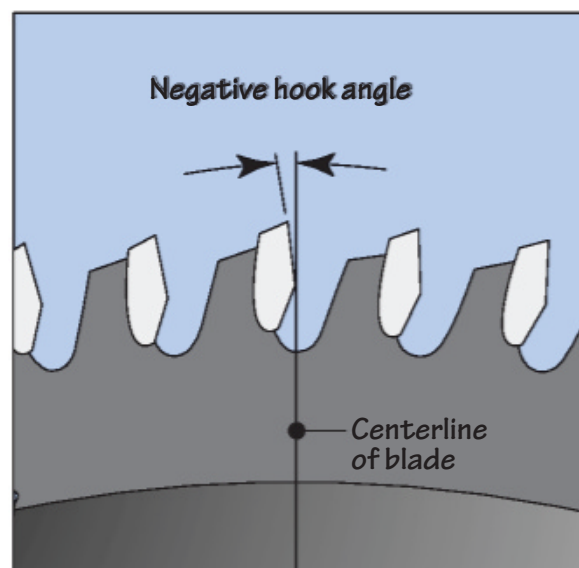
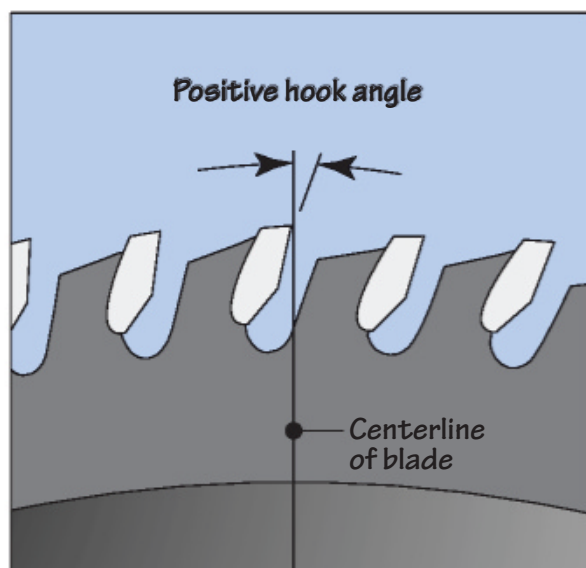
■ **Tooth grind.** Almost every blade used today has carbide teeth, which stay sharp far longer than all-steel blades. Manufacturers grind the teeth to the shape best suited for a specific cutting action. If you look into the face of the teeth (as shown at *right*), you'll see the tooth grind. An *alternate-top-bevel* (ATB) grind has teeth with alternating left- and right-pointing tips, made to minimize tear-out in wood and veneered plywood. General purpose, crosscutting, and plywood/melamine blades use this grind.

Rip blades, used to cut wood parallel to the grain, have *flat-top* teeth with no bevel. This helps clear debris from the kerf. Combination blades use a mix of ATB teeth and flat-topped teeth, and do better at crosscutting than general-purpose blades, but don't



rip as well. Blades used primarily to cut solid-surface countertops and melamine-coated particleboard use a *triple-chip* grind to prevent tear-out.





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■ **Hook angle.** This refers to the angle of the tooth face, as viewed from the side. As shown *above*, if you draw a line from the center of the arbor hole to the leading edge of a tooth, you'll see its positive (leaning forward) or negative (leaning backward) hook angle. The more positive the angle, the more aggres-

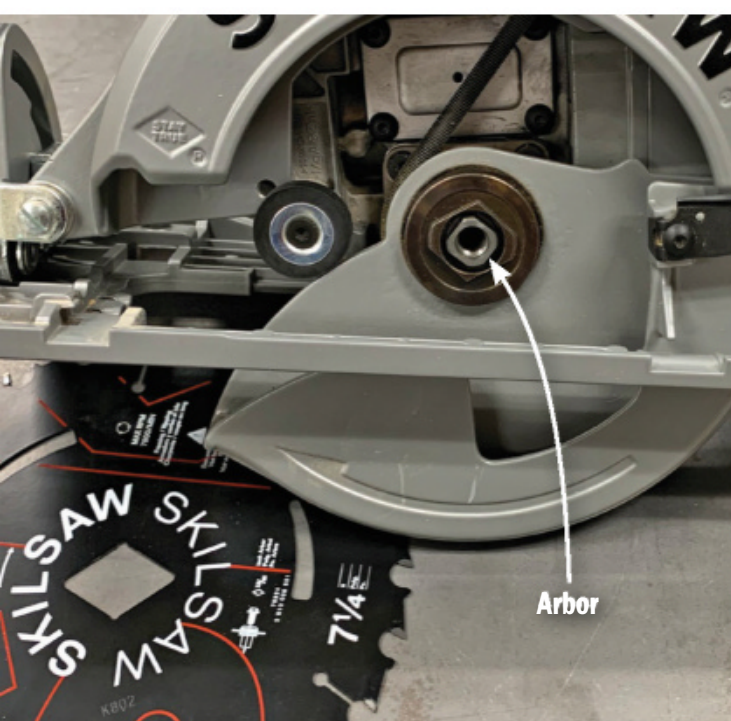
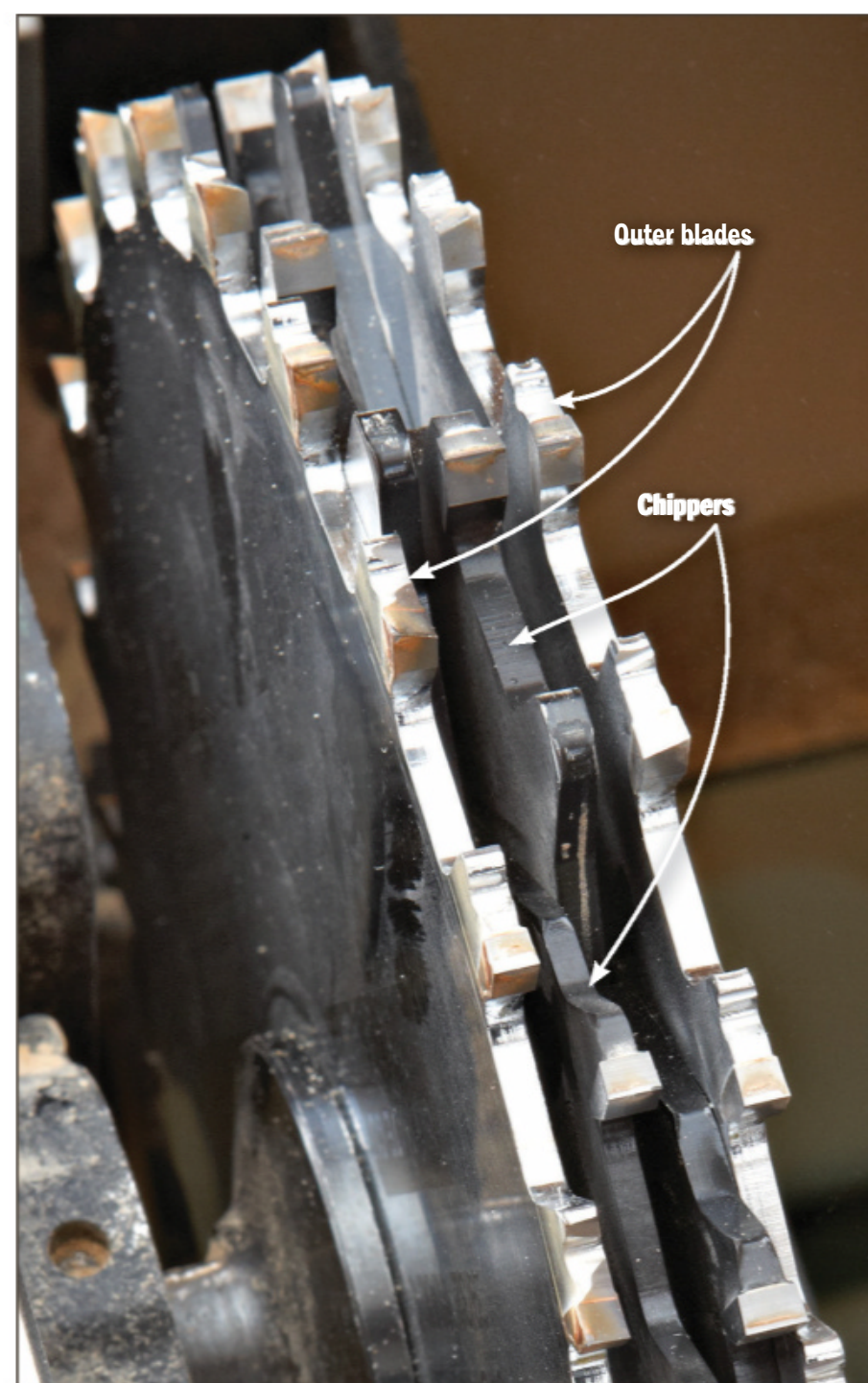
sively the blade cuts. Use a high positive hook angle (5° to 20°) on a tablesaw for general crosscutting and ripping, and a steeper angle (up to 30°) for cutting melamine-coated particleboard and veneered plywood.

Sliding mitersaws and radial-arm saws require a negative hook angle (-5° to -10°) to

reduce the saw's tendency to lurch forward too quickly during a cut. Portable circular saws and non-sliding mitersaws work best with blades that have a hook angle of 5° to 0° . But be aware: Not all blade manufacturers list the hook angle on their blades or packaging, so do your research before buying.

■ **Tooth count.** Although general-purpose and combination blades work well at multiple tablesaw tasks, you'll get the best results by choosing the right blade based on its number of teeth. Tablesaw rip blades have 24–30 teeth with deep gullets for waste removal. Crosscutting blades have high tooth counts: 60–80 are best for tablesaws, 10" mitersaws, and radial-arm saws; 80–100 for 12" mitersaws and radial-arm saws. Cutting plywood on a tablesaw calls for an 80-tooth blade. Portable circular saws rip best with 10–12-tooth blades, crosscut best with 40 teeth, and cut veneered plywood best with 60 teeth.

■ **Dado blades.** Tablesaws (and some radial-arm saws) accept a stacked dado set, shown *right*, for cutting one-pass dadoes, grooves, and rabbets up to $\frac{7}{8}$ " wide, depending on the machine. These sets consist of two outer blades (one with left-beveled teeth and the other beveled to the right) and inner chipper blades (with flat topped teeth). Stack any combination of chippers between the outer blades to get the channel width you need.



■ **Arbor hole.** The hole in the center of each blade is sized to match the arbor (blade-drive shaft) of your saw. Most blades 10" or less in diameter mount on a $\frac{5}{8}$ " arbor, but 12" blades use a 1" arbor. And many saws manufactured by Skilsaw use a proprietary diamond-shaped mounting system, *left*.

■ **Blade coating.** Some blades come with a coating on the plate meant to reduce friction, rust, and resin buildup. Don't make this aspect a high priority when buying blades. 🌲



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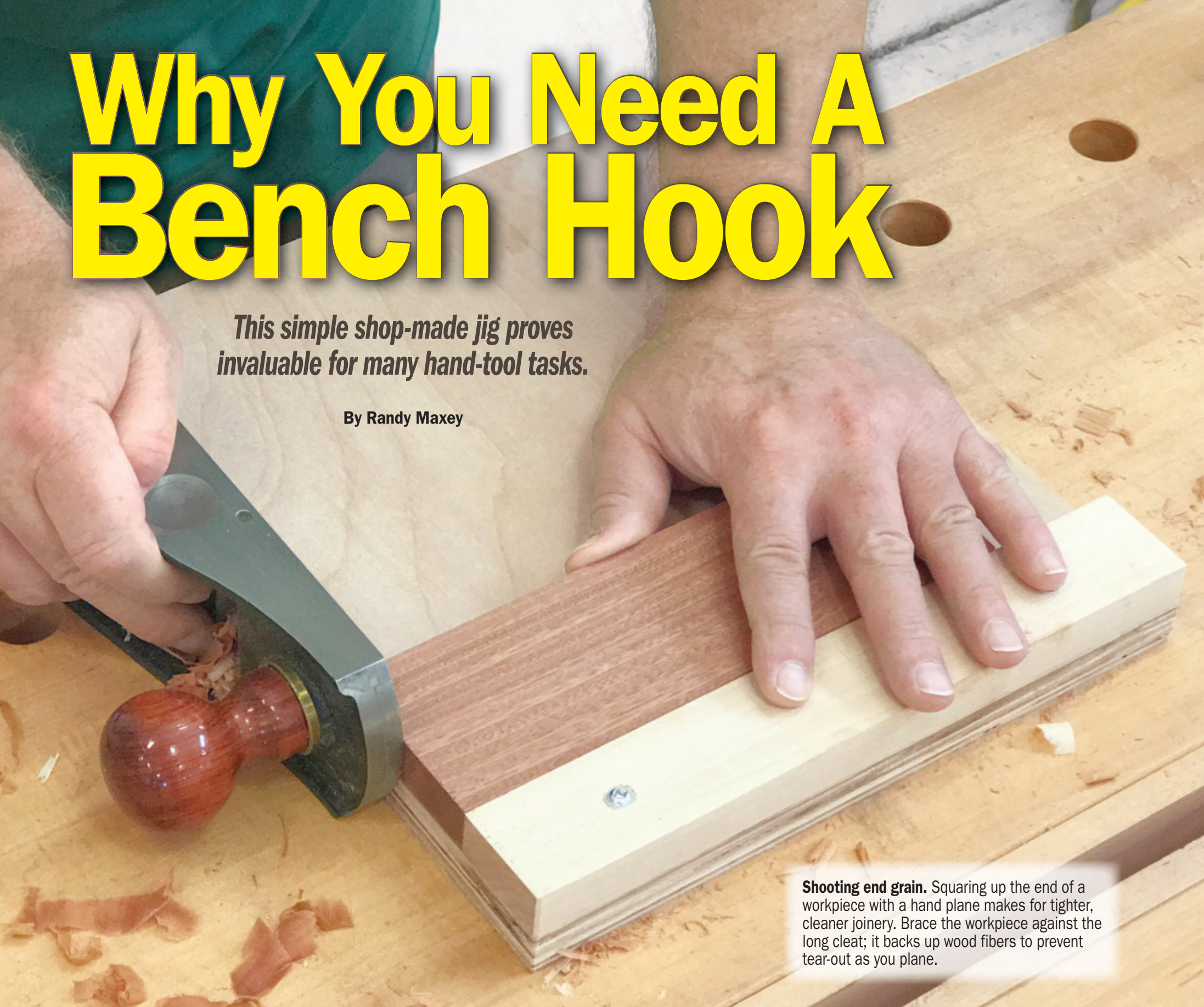
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Why You Need A Bench Hook

This simple shop-made jig proves invaluable for many hand-tool tasks.

By Randy Maxey



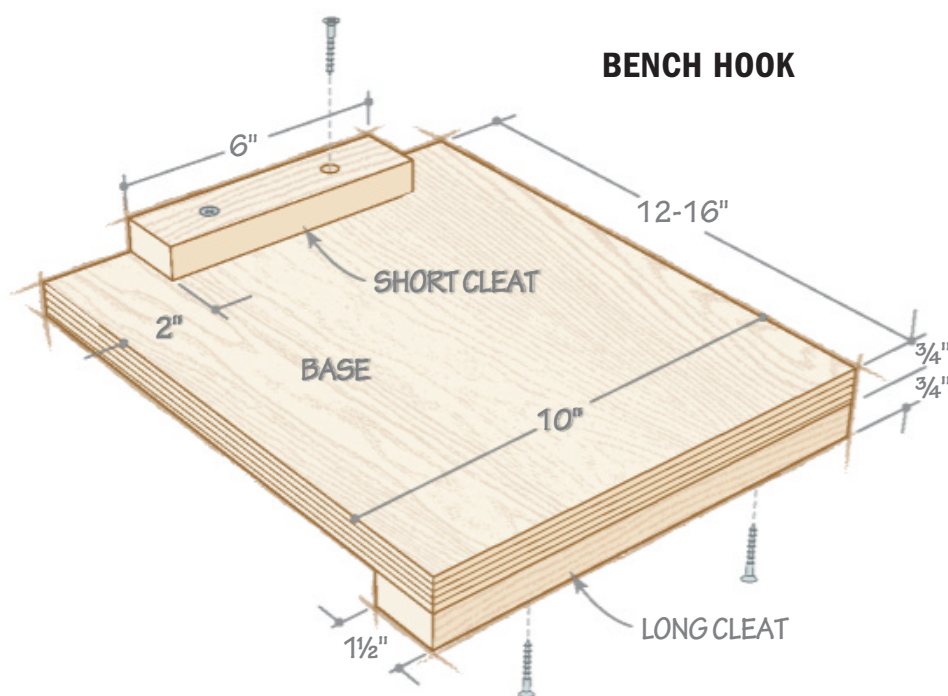
Shooting end grain. Squaring up the end of a workpiece with a hand plane makes for tighter, cleaner joinery. Brace the workpiece against the long cleat; it backs up wood fibers to prevent tear-out as you plane.

When teaching hand-tool joinery at the Florida School of Woodwork, the first thing I have students make is a bench hook. They soon discover how indispensable this simple reversible jig can be for joinery and sizing project parts.

Using the drawing at right, cut the base to size, making the edges square to the ends. If you plan to plane stock 12-16" long, make your bench hook 16" long. If you'll use it primarily for shooting end grain or trimming tenons, make it 12" long. Your arm length might also factor into the depth of the jig. You can also make one hook of each size.

Glue and screw the cleats square to the edges of the base. When using, press the bottom cleat against the edge of your workbench; the cutting action will keep it secure.

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Edge jointing. Use the bench hook to joint an edge of a small workpiece square to a face and end. Butt the end of the workpiece against the long cleat. To avoid tear-out, position the board's edge grain so it runs "downhill."



Crosscutting. To cut parts to length with a handsaw, align the cutline with the end of the short cleat and register the saw blade against the end of the cleat. The base of the bench hook protects the benchtop from saw cuts.



Illustration:
Roxanne LeMoine,
Lorna Johnson

Trimming tenons. Fine-tune the fit of a tenon with a shoulder plane. Simply press the workpiece against the short cleat as you plane.



Chisel work. Trap a workpiece on the bench hook when you need to use a chisel for paring a joint or removing waste. The bench hook acts as a backer when removing waste from dovetails.



Face planing. For this task, remove the cleat screws or place the workpiece where there's no danger of the plane iron contacting a screwhead. If the cleat is thicker than the workpiece, elevate the workpiece with spacers. Another option: Make another bench hook with thinner cleats. 🌲



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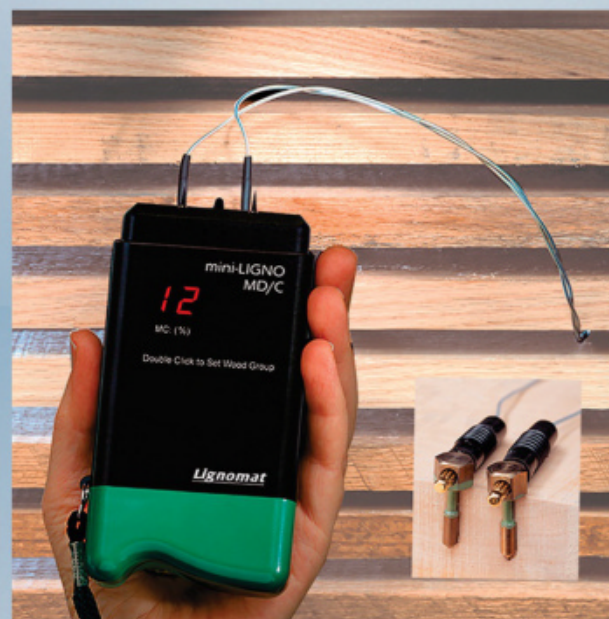


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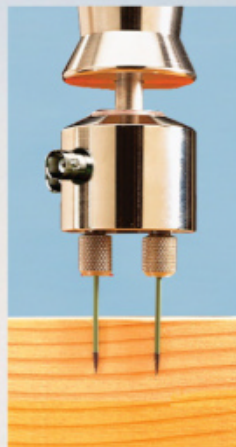
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Small, versatile benchtop sanders

For sanding small workpieces, a scaled-down belt/disc combo sander fits the bill perfectly. These easy-to-lift machines have 1–4" belts and 6" or 8" discs, helping you sand with more control and finesse. We tested several models in the *WOOD*® magazine shop, and recommend these.

To connect to the unusual-sized dust ports—each machine has separate ports for the belt and disc—you might have to buy a new shop-vacuum hose, or pull out the duct tape for a quick fix. Once connected, we enjoyed excellent dust collection on all models. All machines come with toyish miter gauges; you'll need to use a reliable square or angle gauge to set them accurately.

1×42" belt/8" disc

Rikon 50-144, \$300

Shop Fox W1850, \$300

Grizzly H8192, \$255

Belt dust port: 1¾" OD, 1½" ID

Disc dust port: 1⅞" OD, 1½" ID

Each of these nearly identical machines has a cast-iron table that reduces vibration. The ⅜×⅞" miter slot in each table works only with the included miter gauge; we found a sloppy fit in the Grizzly and Shop Fox models. The 1" belt works great for sanding small or delicate workpieces, and for smoothing contours above the platen where the belt flexes. The nicely sized disc runs at 1,725 rpm, a slower speed that lessens friction burning.

877-884-5167, rikontools.com

800-840-8420, shopfox.biz

800-523-4777, grizzly.com

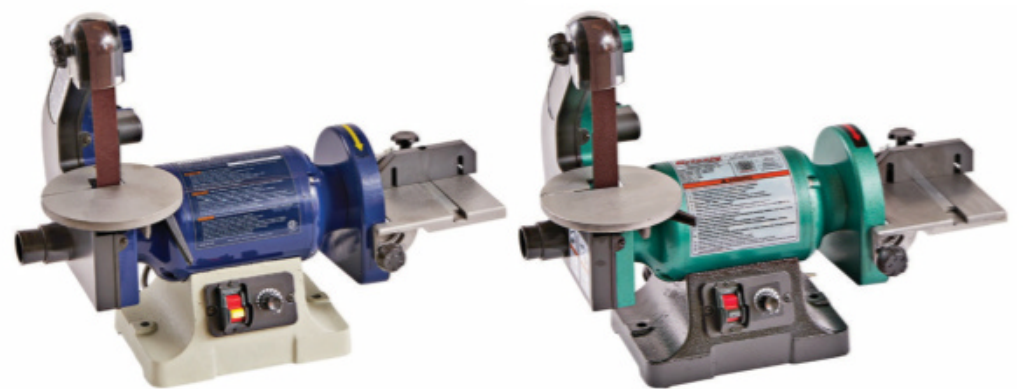


4×36" belt/8" disc

Rikon 50-114, \$230

Belt and disc dust ports: tapered 1⅜" to 1½" OD, with tapered reducer

This model delivers most of the functionality of a bulky 6×36" belt/12" disc sander, but with a smaller footprint (and price). The belt platen has 8¼" of sanding surface, and the belt can be positioned vertically, horizontally, or anywhere in between. We like the disc size, but at 3,450 rpm, it quickly heats up workpieces.



1×30" belt/6" disc

Rikon 50-161VS, \$200 (left)

Grizzly G0864, \$155 (right)

Belt dust port: 1¾" OD, 1½" ID, with tapered insert 1⅞" OD, 1¼" ID

Disc dust port: 1½" OD, 1¼" ID

These nearly identical sanders have variable-speed motors, which we prefer to use at the slowest speed—especially the disc—to minimize burning and maximize control. We like the 1" belt on each, but wish the 6"-diameter tables were larger.

HaulMaster **SUPER COUPON**

72" x 80" MOVING BLANKET

Customer Rating ★★★★★

NOW \$5.99

~~\$8.99~~

COMPARE TO BLUE HAWK \$19.99 MODEL: 77280 **SAVE 70%**

ITEM 69505/62418/66537 shown

12853995

LIMIT 1 - Coupon valid through 7/1/20*

CHICAGO - ELECTRIC POWER TOOLS **GOOD** Standard Features and Accuracy **SUPER COUPON**

12" DUAL-BEVEL SLIDING COMPOUND MITER SAW

3-1/2" VERTICAL CROWN MOLDING CAPACITY

2-5/8" TALL SLIDING FENCES

LASER GUIDE LIGHT

\$129.99 ~~\$159.99~~

COMPARE TO PROFESSIONAL WOODWORKER MODEL: 8637 **SAVE \$88**

Blade sold separately. Not available in AZ, OH, OK and VA.

ITEM 61970/56597/61969 shown

12858570

LIMIT 1 - Coupon valid through 7/1/20*

BETTER Superior Features and Accuracy **ADIRAL** **SUPER COUPON**

12" DUAL-BEVEL SLIDING COMPOUND MITER SAW WITH LED AND LASER GUIDE

6-1/2" VERTICAL CROWN MOLDING CAPACITY

4-1/2" TALL SLIDING FENCES

LASER GUIDE LIGHT & LED WORK LIGHT

\$179 ~~\$199.99~~

COMPARE TO RYOBI MODEL: TSS120L **SAVE \$90**

FREE BLADE INCLUDED \$19.99 VALUE

ITEM 64686

12861072

LIMIT 1 - Coupon valid through 7/1/20*

BEST Jobsite Features and Accuracy **HERCULES** **SUPER COUPON**

PROFESSIONAL 12" DUAL-BEVEL SLIDING COMPOUND MITER SAW WITH LED SHADOW GUIDE

7-1/2" VERTICAL CROWN MOLDING CAPACITY

4-3/4" TALL SLIDING FENCES

LED PRECISION SHADOW GUIDE LIGHT

\$329 ~~\$349.99~~

COMPARE TO DEWALT MODEL: DWK190 **SAVE \$270**

FREE BLADE INCLUDED \$44.99 VALUE

ITEM 56682/63978 shown

12864192

LIMIT 1 - Coupon valid through 7/1/20*

CENTRAL MACHINERY **SUPER COUPON**

14" OSCILLATING SPINDLE SANDER

Customer Rating ★★★★★

NOW \$109.99

~~\$147.99~~ **SAVE \$43**

COMPARE TO TRITON TOOLS MODEL: TSPS450 **SAVE \$152.99**

ITEM 62146/69257 shown

12865636

LIMIT 1 - Coupon valid through 7/1/20*

HARDY **SUPER COUPON**

POWDER-FREE NITRILE GLOVES PACK OF 100

5 mil thickness

NOW \$5.99

~~\$7.99~~ **SAVE 59%**

COMPARE TO VENOM MODEL: VEM145 **SAVE \$14.97**

AVAIL. IN SM, MED, LG, XL, XXL

ITEM 37050, 64417, 61363, 68496, 68497, 61360, 61359, 68498, 64418 shown

12868332

LIMIT 1 - Coupon valid through 7/1/20*

ADIRAL **SUPER COUPON**

12", 80 TOOTH FINISHING SAW BLADE

Customer Rating ★★★★★

NOW \$19.99

~~\$26.99~~ **SAVE 66%**

COMPARE TO DEWALT MODEL: DW3232PT X **SAVE \$59.98**

ITEM 64911/62725 shown

12869792

LIMIT 1 - Coupon valid through 7/1/20*

CHICAGO - ELECTRIC POWER TOOLS **SUPER COUPON**

MOBILE MITER SAW STAND

Supports 16 FT.

NOW \$99.99

~~\$124.99~~ **SAVE \$69**

COMPARE TO HITACHI MODEL: HU240F **SAVE \$169**

ITEM 63409/62750 shown

12871179

LIMIT 2 - Coupon valid through 7/1/20*

HaulMaster **SUPER COUPON**

18" x 12" MOVER'S DOLLY

1000 lb. capacity

Customer Rating ★★★★★

NOW \$7.99

~~\$10.99~~ **SAVE 65%**

COMPARE TO BUFFALO TOOLS MODEL: HOFDOLLY **SAVE \$22.99**

ITEM 60497/62399/63095/63096/63097/63098 shown

12873267

LIMIT 1 - Coupon valid through 7/1/20*

McGRAW **SUPER COUPON**

8 GALLON, 150 PSI OIL-FREE AIR COMPRESSOR

Air delivery: 4.1 SCFM @ 90 PSI

Customer Rating ★★★★★

NOW \$119.99

~~\$137.99~~ **SAVE \$39**

COMPARE TO KOBALT MODEL: 300841 **SAVE \$159**

ITEM 56269/64294 shown

12880390

LIMIT 1 - Coupon valid through 7/1/20*

drillmaster **SUPER COUPON**

1/4", 2.5AMP TRIM ROUTER

Cutting depth adjusts easily for accurate cuts

Customer Rating ★★★★★

NOW \$19.99

~~\$29.99~~ **SAVE \$79**

COMPARE TO MAKITA MODEL: RT0701C **SAVE \$99**

ITEM 62659/44914/61626/64314 shown

12882825

LIMIT 1 - Coupon valid through 7/1/20*

CENTRAL MACHINERY **SUPER COUPON**

12" x 33-3/8" WOOD LATHE WITH REVERSIBLE HEAD

Customer Rating ★★★★★

NOW \$299.99

~~\$399.99~~ **SAVE \$140**

COMPARE TO NOVA MODEL: 572255875 **SAVE \$440**

ITEM 34706

12892181

LIMIT 1 - Coupon valid through 7/1/20*

CENTRAL MACHINERY **SUPER COUPON**

16" VARIABLE SPEED SCROLL SAW

Customer Rating ★★★★★

NOW \$69.99

~~\$99.99~~ **SAVE \$129**

COMPARE TO PORTER-CABLE MODEL: PCB375SS **SAVE \$199**

ITEM 62519/63283/93012 shown

12901756

LIMIT 1 - Coupon valid through 7/1/20*

PITTSBURGH **SUPER COUPON**

9 PIECE FULLY POLISHED COMBINATION WRENCH SETS

Customer Rating ★★★★★

NOW \$5.99

~~\$7.99~~ **SAVE 66%**

COMPARE TO HUSKY MODEL: HCW10PCSAE **SAVE \$17.97**

Item 42304 shown

TYPE ITEM

SAE 69043/63282/42304

METRIC 69044/63171/42305

ITEM 42304 shown

12903340

LIMIT 1 - Coupon valid through 7/1/20*

WINDSOR DESIGN **SUPER COUPON**

60" HARDWOOD WORKBENCH WITH 4 DRAWERS

Customer Rating ★★★★★

NOW \$119.99

~~\$149.99~~ **SAVE \$279**

COMPARE TO GRIZZLY MODEL: H7723 **SAVE \$399.95**

Tools sold separately.

ITEM 63395/93454/69054/62603 shown

12916754

LIMIT 1 - Coupon valid through 7/1/20*

PITTSBURGH **SUPER COUPON**

12" RATCHETING BAR CLAMP/SPREADER

LIFETIME WARRANTY

Customer Rating ★★★★★

NOW \$2.99

~~\$4.29~~ **SAVE 85%**

COMPARE TO IRWIN MODEL: 1954718 **SAVE \$19.98**

ITEM 62123/46807/63017 shown

12924604

LIMIT 1 - Coupon valid through 7/1/20*

PITTSBURGH **SUPER COUPON**

6" DIGITAL CALIPER

Includes two 1.5v SR44 button cell batteries.

Customer Rating ★★★★★

NOW \$9.99

~~\$17.99~~ **SAVE 66%**

COMPARE TO HUSKY MODEL: 1467H **SAVE \$29.97**

ITEM 63711/61585/62387/47257 shown

12927137

LIMIT 1 - Coupon valid through 7/1/20*

CENTRAL MACHINERY **SUPER COUPON**

4" x 36" BELT/6" DISC SANDER

Powerful 3/4 HP motor

Customer Rating ★★★★★

NOW \$64.99

~~\$77.99~~ **SAVE \$84**

COMPARE TO RYOBI MODEL: 804601G **SAVE \$149**

ITEM 5154/64778/97181 shown

12932485

LIMIT 1 - Coupon valid through 7/1/20*

VOYAGER **SUPER COUPON**

15" TOOL BAG WITH 14 POCKETS

Customer Rating ★★★★★

NOW \$6.99

~~\$10.99~~ **SAVE 46%**

COMPARE TO HUSKY MODEL: 823035N12 **SAVE \$12.97**

Tools sold separately.

ITEM 94993/62348/62341/61469 shown

12933202

LIMIT 1 - Coupon valid through 7/1/20*

HYDROSTAR **SUPER COUPON**

50 FT. ELECTRIC DRAIN CLEANER

Customer Rating ★★★★★

NOW \$199.99

~~\$249.99~~ **SAVE \$229**

COMPARE TO COBRA PRO MODEL: CP3020 **SAVE \$429**

ITEM 61856/68285 shown

12936592

LIMIT 1 - Coupon valid through 7/1/20*

TOOLS & MATERIALS

SHOP-TESTED



Diminutive dust collector stacks, separates

Compact dust extractor, no. CLEANTEC CT SYS, \$395;
Dust separator, no. CT CYCLONE CT-VA-20, \$375

Festool's CLEANTEC CT SYS packs a 106 cubic-feet-per-minute (cfm) dust extractor into a Systainer-size storage box for the most compact collector we've ever used. Its airflow and 1"×6' hose make it perfect for fine-dust-making tools, such as a sander or tracksaw. However, it struggled to keep up with a router making a hefty cut, due to the volume of larger chips. Its HEPA-rated filter trapped dust exceedingly well in our testing, and it's quiet at 70 decibels.

For even better performance, you might want to pair this extractor—or any other vacuum, for that matter—with the CT CYCLONE CT-VA-20 separator. This unit comes with everything needed to

connect it to a vac, along with a Systainer base for connection to similar containers. In our tests, the separator dropped nearly all of the debris out of the airstream and into the bin, making it easier to empty. Only the finest dust made it to the extractor/vacuum, where it was captured in either the collection bag or filters. (This separator improved the CLEANTEC CT SYS's performance with a router, but it's still not as effective as using a larger extractor.)

—Tested by Tom Brumback and Kevin Boyle, Senior Design Editor

888-337-8600, festoolusa.com

Big brother is the strong, (nearly) silent type

3-gallon portable air compressor, no. JC20, \$330

Seven years ago, I gave Rolair's quiet, oil-free, JC10 2½-gallon compressor a great review. Now, the JC20 comes along as its more-accomplished bigger brother. Its 3-gallon tank and 2-hp motor deliver 4.5 cubic feet per minute (cfm) of airflow. That means more air when you need it—for blowing out dust filters, for example—and a larger amount of usable air before the motor kicks on to top off the tank (which takes only 11 seconds). I drove an average of 30 1½" brad nails into red oak before the motor kicked on, and the hose pressure never dropped below the needed 90 psi, so I didn't have to wait for the tank to catch up.

And thanks to the JC20's slow-speed (1,700 rpm) twin-cylinder motor, it makes only 70 decibels of noise. That's fantastic for an oil-free model. This model is heavy, though, weighing 65 pounds because of its steel tank, pump, and roll cage.

—Tested by Bob Hunter, Tools Editor

920-349-3281, rolair.com



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(*Each when you buy a pair)

The new Advanced HearClear™ GO rechargeable hearing aid combines advanced technology with a low price to provide you with outstanding value.

5 Star Reviews! ★★★★★

Outstanding Product! "This product is outstanding. Dad loves it, my mom loves it, and I am grateful! Don't believe that you have to spend a lot of money to get a quality hearing aid"

- Gilmore B.



GO Features!

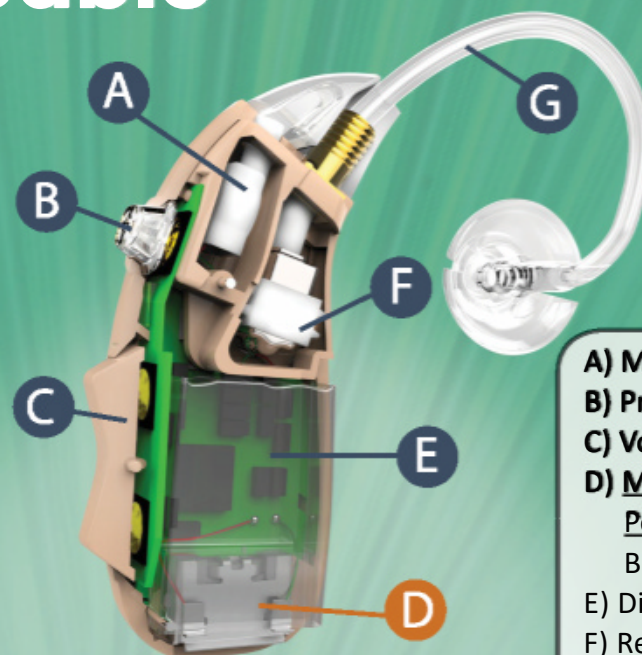
- ✓ Digital sound processing chip provides **crystal clear sound and makes speech easier to understand** with less feedback than old analog technology
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HearClear hearing aids have been clinically proven to show **significant improvement in speech understanding.** (University of Memphis, 2018)



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The new HearClear GO Rechargeable Digital Hearing Aids feature **advanced digital technology** at an unbelievably affordable price! The GO utilizes the key technologies of high-end digital hearing aids while leaving out fancy bells and whistles that increase cost and require expensive adjustments. With the GO, **you'll hear more clearly while saving a lot of money!**

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You can spend thousands on an expensive hearing aid or you can spend just \$239 for a hearing aid that's great for most mild to moderate hearing losses (**only \$199 each when you buy a pair – hear up to 3 times better than wearing just one**). We're so sure you'll love your hearing aids we offer a **100% Money Back Guarantee - Risk Free** if you are not satisfied for any reason.

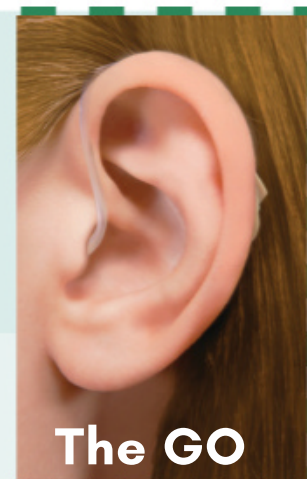


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TOOLS & MATERIALS

NEW AND UNTESTED



New machinery brand enters the marketplace

Harvey Industries, a Chinese-owned company, recently launched a new brand of woodworking machinery under its own name. For years Harvey served as a custom manufacturer for other brands; the company will no longer do that, according to Mark Strahler, president of Harvey's U.S. division. Instead, Harvey will sell its machinery directly to customers through its website.

Harvey officially entered the U.S. market a few years ago by selling its professional-level Gyro dust collector (no. G700), shown *right*, through traditional distributors for \$4,245. You can now buy that unit directly from Harvey for \$3,495.

Now the company has launched the Ambassador series—a consumer-level machinery line targeted to home woodworkers—with a 14" bandsaw and three 10" tablesaws, shown *above*. The C-14 steel-frame bandsaw sells for \$1,399. The C200-30 tablesaw (prewired for 110 volts), with 30" rip capacity, sells for \$969. The C300-30 tablesaw, with a 3-hp, 220-volt motor and 30" rip capacity, sells for \$1,399; a 50"-rip version (no. C300-50) sells for \$1,499.

Harvey Industries also purchased the hand-tool company Bridge City Tool Works two years ago. Strahler says that because these hand tools are now being manufactured in China and Harvey is selling to a larger worldwide market, the company can lower prices without losing the quality for which Bridge City has been known. 🌳

Harvey Industrial
888-211-0397, harveywoodworking.com

Bridge City Tool Works
800-253-3332, bridgecitytools.com



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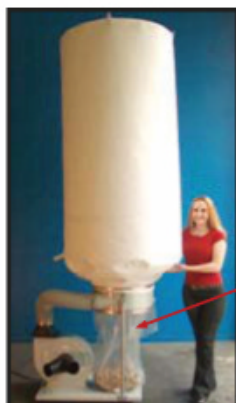


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WHAT'S AHEAD

A GLIMPSE INSIDE THE SEPTEMBER ISSUE (ON SALE JULY 10)



Farmhouse-style sideboard

Don't let pricey barn-door hardware scare you off; we'll show you how to make your own and save money.



Hone your chisel skills

Furnituremaker Jeff Miller shares experience-won tips on getting the best, most accurate cuts.



Long, low lacewood box

Dive into your stash of prized exotic-wood scraps to build this beautiful gift.



Shop test: 110-volt tablesaws

No need to rewire the garage. These saws cut like crazy and plug into any wall outlet.



Two-sided trivet

Give your CNC a starring role in creating this handy hot-dish holder.



Cat Pen Kit



Anvil Pen Kit



Bolt Action Pen Kit



DuraClick EDC Pen Kit



Aromatherapy
Necklace Kit



Measuring Spoon Kits

Discover the joy of making stunning lathe turned projects. From pens to crochet hooks to seam rippers to measuring spoons, the creative possibilities are endless. These small projects are easy to make on a woodturning lathe and are great to sell at craft shows or give them to friends and family as one of a kind gifts. We supply all the metal kit components and you make the project kit with any wood or plastic material and in any color you want.



“Wow! You Made Those?”

Cat Twist Pen Kit A great gift for cat lovers! Features a tail clip, sleeping cat on top, cat silhouettes on the center band and paws on the tip.

3 Cat Twist Pen Kit Starter Set

You get one of each Cat pen kit in Chrome (shown above), 24kt Gold and Antique Pewter. Plus, you get the bushings and drill bit you need to make the pens.

#PKCATSS SAVE \$15 LIMITED TIME SALE Only \$56.93

Anvil EDC Click Pen Kit With a sleek, modern yet industrial style and incredibly durable performance, this Anvil click pen is perfect for everyday use. Features an ultra-reliable, 100% all metal German engineered Schmidt click mechanism with smooth, quiet performance.

3 Anvil EDC Pen Kit Starter Set

You get one of each Anvil EDC Click Pen Kit in Gun Metal (shown above), Stainless Steel, Aluminum, Black Anodized Aluminum and Brass. Plus, you get the drill bit and bushings you need to make the pens.

#PKANVSS SAVE \$16 Only \$62.65

Bolt Action Pen Kit This completely original and irresistibly fun Bolt Action pen will be hard for any hunting or target-shooting enthusiast to put down. The realistic bolt-action handle smoothly advances and retracts to securely lock the refill in place.

3 Bolt Action Pen Kit Starter Set

You get one of each Bolt Action Pen Kit in Gun Metal (shown above), Chrome and 24kt Gold. Plus, you get the bushings and drill bit you need to make the pens.

#PKCPBAPAK SAVE \$17 Limited Time Sale Only \$33.95

DuraClick EDC Pen Kit

This durable, well-balanced, everyday carry click pen will last for years and years. Solidly crafted from raw materials and features an ultra-reliable, all metal Schmidt click mechanical assembly which is precision engineered in Germany.

5 DuraClick EDC Pen Kit Starter Set

You get one of each DuraClick EDC Pen Kit in Brass (shown above), Black Anodized Aluminum, Aluminum, Burnt Bronze Anodized Aluminum and Stainless Steel. Plus, you get the drill bit and bushings you need to make the pens.

#PKEDCSS SAVE \$18 Only \$69.95

Aromatherapy Necklace Kit Enjoy the benefits of Aromatherapy everywhere you go. Just add a few drops of your favorite essential oil to the cotton wick to absorb the oil. Unscrew the top of the kit and add the wick inside. Each kit Includes 5 wicks, a 28" chain, gift pouch and an empty 2ml sample jar (essential oil not included).

5 Aromatherapy Necklace Kit Starter Set

You get one of each Aromatherapy Necklace Kit in Satin Chrome (shown above), Chrome, 24kt gold, Rose Gold and Raw Brass. Plus, the bushings and drill bit to make the kits.

#PKATHNSS SAVE \$10 Only \$57.65

Measuring Spoon Kits - Set of 4 Create these must-have kitchen essentials for a fun and useful gift. Spoon set includes four of the most common measuring spoon sizes; 1/4-tsp, 1/2-tsp, 1-tsp and 1-Tbs. They sit on a handy chrome ring and you can detach them for individual use. Plated with durable, food safe chrome.

#PKMSPN Only \$19.95

Penn State Industries

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