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- Motor: 1½ HP, 110V, 3450 RPM, 15A
- Intake hole size: 6"
- Impeller: 12¾" welded steel
- Collection drum size: 35 gallons, max. capacity: 20 gallons
- Suction capacity: 868 CFM @ 2.6" SP
- Max. airflow: 868 CFM
- Max. static pressure: 9.7"
- Approx. shipping weight: 375 lbs.

2 HP

- Motor: 2 HP, 220V, 3450 RPM, 9A
- Intake hole size: 7"
- Impeller: 13" welded steel
- Collection drum size: 35 gallons, max. capacity: 20 gallons
- Suction capacity: 1023 CFM @ 2.6" SP
- Max. airflow: 1023 CFM
- Max. static pressure: 10.9"
- Approx. shipping weight: 397 lbs.

3 HP

- Motor: 3 HP, 220V, 3450 RPM, 18A
- Intake hole size: 8"
- Impeller: 15" welded steel
- Collection drum size: 55 gallons, max. capacity: 35 gallons
- Suction capacity: 1941 CFM @ 2.6" SP
- Max. airflow: 1941 CFM
- Max. static pressure: 11.0"
- Approx. shipping weight: 419 lbs.

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G0861 ONLY \$1095⁰⁰

G0862 ONLY \$1395⁰⁰

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10" SLIDING TABLE SAWS

EXTREME SERIES

- Motor: 5 HP, 230V, single-phase, 19A (G0623X) or 7½ HP, 220V/440V*, 3-phase, 18A/9A (G0623X3)
- Main table size: 14¾" x 27"
- Sliding table size: 12¼" x 63"
- Main blade arbor: 5/8"
- Main blade speed: 4000 RPM
- Scoring blade size: 3½"
- Scoring blade arbor: 22mm
- Depth of cut: 3½" @ 90°, 2¼" @ 45°
- Max. rip capacity: 33"
- Approx. shipping weight: 688 lbs. (G0623X), 670 lbs (G0623X3)

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SP[®] US
C 181721
G0623X ONLY



5 HP, SINGLE-PHASE G0623X ONLY \$3395⁰⁰

7½ HP, 3-PHASE G0623X3 ONLY \$3375⁰⁰

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8" X 72" JOINTER WITH BUILT-IN MOBILE BASE

- Motor: 3HP, 230V, single phase
- Total table size: 8" x 72"
- Fence size: 4½" x 38"
- Max depth of cut: 1/8"
- Rabbeting capacity: 1/2"
- Cutterhead knives: 4
- Cuts per minute: 22,000
- Power transfer: Poly V-belt drive
- Switch: standard push button type switch with large off paddle for safety
- Fence size: 4½" x 38"
- Approx shipping weight: 373 lbs.

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New!



G0855 ONLY \$1195⁰⁰

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14" 1 HP DELUXE BANDSAW

- Motor: 1 HP, 110V/220V (prewired 110V), single-phase, 11A/5.5A
- Cutting capacity/throat: 13½"
- Max. cutting height: 6"
• Table size: 14" x 14" x 1½"
- Table tilt: 10° left, 45° right
- Floor-to-table height: 43"
- Blade length: 92½"–93½"
- Blade width: 1/8"–3/4"
- Blade speeds: 1800 & 3100 FPM
- Overall size: 27" W x 30" D x 67½" H
- Approx. shipping weight: 246 lbs.

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C 177335



G0555LX ONLY \$625⁰⁰

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EXTREME SERIES

- Motor: 3 HP, 230V, single-phase
- Max. cutting width: 15"
- Max. cutting height: 6"
- Min. stock thickness 3/16"
- Min. stock length: 6"
- Max. cutting depth: 1/8"
- Feed rate: 16 FPM & 28 FPM
- Cutterhead speed: 5000 RPM
- Table size with extension rollers: 15" x 50"
- Approx. shipping weight: 553 lbs.

New!

MADE IN AN ISO 9001 FACTORY

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C 175370



G1021X2 ONLY \$2050⁰⁰

\$175⁰⁰ SHIPPING
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10" HYBRID TABLE SAW W/ RIVING KNIFE

- Motor: 2 HP, 115V/230V (prewired 115V), single-phase, 16A/8A
- Table size with extension wings: 40½" W x 27" D
- Floor-to-table height: 34¼"
- Arbor speed: 4000 RPM
- Max. depth of cut @ 90°: 3½"
- Max. depth of cut @ 45°: 2½"
- Max. rip right of blade: 31½"
- Max. rip left of blade: 11¾"
- Overall dimensions: 63" W x 40" D x 48" H
- Footprint: 20½" L x 19½" W
- Arbor: 5/8"
- Approximate shipping weight: 449 lbs.

New!



G0899 ONLY \$1275⁰⁰

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17" HEAVY-DUTY BANDSAW 35TH ANNIVERSARY EDITION

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- Motor: 2 HP, 110V/220V, prewired 220V, single-phase, TEFC capacitor 110V start induction, 60 Hz, 1725 RPM
- Amps: 20A at 110V, 10A at 220V
- Power transfer: belt drive
- Precision-ground cast-iron table size: 17" x 17" x 1½"
- Table tilt: 10° left, 45° right
- Floor-to-table height: 37½"
- Cutting capacity/throat: 16¼" L of blade
- Max. cutting height: 12½"
- Blade size: 131½" long
- Blade width range: 1/8"–1" wide
- Footprint: 27" W x 17¾" D
- Blade speeds: 1700 and 3500 FPM
- Fully-balanced cast aluminum wheels
- Overall size: 32" W x 73" H x 32" D
- Approx. shipping weight: 342 lbs.



G0513ANV ONLY \$1075⁰⁰

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3 HP SHAPER

- Motor: 3 HP, 240V, single-phase, with reversing switch, 12A
- Table with extension wing attached: 30½" x 28¼"
- Floor to table height: 34"
- Spindle travel: 3"
- Spindle size: 1/2", 3/4", 1"
- Table spindle openings: 1½", 3", 4", 7"
- Maximum cutter height: 2½"
- Spindle speeds: 7,000 and 10,000 RPM
- Overall size: 30½" L x 30" W x 39½" H
- Footprint: 20" L x 21" W
- Approx. shipping weight: 392 lbs.

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C 177335



G1026 ONLY \$1295⁰⁰

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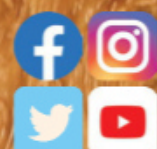
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Let's get it started

Last summer we moved our daughter, Katie, into her first apartment, which, thankfully, followed her getting her first full-time job. It was the first time she would live in a place where she had to provide everything for herself, from linens to kitchen utensils to furniture. About the only things she had of her own were clothes and a flat-screen TV.

In the couple of weeks between signing the lease and move-in day, she managed to acquire a small dining room table with three chairs from one family friend, a decent sofa from another, and a third-hand bedroom set from our house. Throw in a box of hand-me-down pots, pans, and leftover dishes, a collection of mismatched plastic drinkware, and she was pretty well set.

The TV was a bit of a problem, though. Because the lease banned even those temporary adhesive hooks for hanging pictures and posters, I didn't think the landlord would appreciate me installing a full-motion, articulating wall-mount for it. And, although Katie appreciates good furniture construction more than most millennials, she wasn't going to get a Stickley stand with first-job finances. So, to the ever-growing superstore-shopping list of shower curtain, shelf liner, and RG-6 cable, I reluctantly added "TV stand."

Now, here's where you expect a sanctimonious rant from the woodworking editor condemning flat-pack furniture for the poor quality of its materials and construction.

Can't do it.

Of course, particleboard furniture will never last long enough to be passed down to the next generation. But the unit Katie chose

was better than expected, and certainly exceeded the stuff I put together in my first apartment 35 years ago.

As I drove the last brad into the cardboard back of the TV stand later that evening, I felt a twinge of guilt. Not because I'd failed woodworkers everywhere by trading the quality of solid-wood construction for convenience and a low price tag. No, I felt a little guilty for getting that little rush of satisfaction that comes from completing a project, even though it didn't require piston-fit mortise-and-tenon joinery or dovetailing drawers.

And it got me wondering: Will the next young lady in her first apartment get that same rush when she assembles her first furniture project, albeit painted particleboard and Confirmat screws? Is flat-pack furniture her gateway into "real" woodworking? I sincerely hope so.

Katie interrupted my pondering by asking if I could help her make a bed next. My spirits came back to ground level again when I realized she meant putting sheets on the air mattress that Annette and I would be sleeping on that night.

But if I know my daughter, we'll be building the real thing before long.

See you in the shop!



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PUT SOME SHIP-SHAPE INTO YOUR SHOP



TUNE

Master Craftsman Jim Heavey couldn't carry a tune if he added handcrafted handles. But he can sure tune a tool. Tune in to his tune-up videos.

Tune up your mittersaw.

woodmagazine.com/mitersawtuneup

Tune up your bandsaw.

woodmagazine.com/bstuneup

Tune up your tablesaw.

woodmagazine.com/tstuneup

Tune up your router.

woodmagazine.com/routertuneup



CLEAN

Spring will soon... spring. And as the world thaws, it's time to shape up your shop for woodworking season. Let's start with a deep-clean.

Clean your blades and bits.

woodmagazine.com/cleanblades

Clean your tablesaw.

woodmagazine.com/cleantablesaw

Clean your spray gun.

woodmagazine.com/cleanspraygun

Clean away rust.

woodmagazine.com/cleanrust



SHARPEN

Before you start, your blades and bits should be as sharp as you are. A high bar, we know, but we'll show you how.

Sharpen your chisels.

woodmagazine.com/sharpenchisels

Sharpen your Japanese pull saw.

woodmagazine.com/sharpenpullsaw

Sharpen your mortising chisels.

woodmagazine.com/sharpenmortise

Flatten your sharpening stones.

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Anvil Pen Kit



Bolt Action Pen Kit



DuraClick EDC Pen Kit

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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.



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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.

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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.

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DuraClick EDC Pen Kit

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5 DuraClick EDC Pen Kit Starter Set

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5 Aromatherapy Necklace Kit Starter Set

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SOUNDING BOARD

YOUR VOICE

Double table trouble?

I'm a hobbyist woodworker who makes several serious projects every year. The majority of my work is furniture-quality, using hand-cut joinery and rarely fasteners. But I'm having trouble understanding the logic behind the Table for Two router table in issue 264 (November 2019).

First, unless you set the thing up once for a particular application and never change it after that, it takes the same amount of time to set up two routers as it would to set up one router for successive operations. Second, to use the third router, you have to break down the fence setup for the other two routers. Finally, this thing takes up valuable floor space that most of us don't have.

I'll say to you what I say to the young engineers that I mentor: Just because it can be done doesn't mean that it should.

Regardless, please keep doing what you do. I read every issue of your magazine from cover to cover, and, although most of the projects are at a different level than what I prefer to do, there have been many articles that helped me with making tools and fixtures for my work.

—Ray Gastonguay
Palm Bay, Fla.

We may have to agree to disagree on this, Ray, as we have found this table to be a huge time-saver in our own shop. Through dovetails, for example, require a perfect bit-height relationship between the straight and dovetail bits. So, after you cut test joints to match the second bit height to the first, you lose the fit you just perfected with your test joint. As for the third router, it's designed for simple bearing-guided edging bits, such as round-overs or chamfers, and you simply work from the end of the table instead of the sides, so no need to remove the fences.

When I saw the picture of Table for Two in issue 264, it looked interesting. But after reading the approximate materials cost of \$900 I said, "No thanks." It might save a few minutes of setup time on rare occasions, but do you really think I'm going to spend \$900, plus hours of time, to make it? Couldn't you at least have used poplar instead of maple?

—Steve Stroder
Missouri City, Texas

Sure, Steve, we could have made that router table out of poplar; we could have used pallet wood. We could have skipped the casters and router-bit racks, too. And swapped MDF for the plastic laminate tabletop.

As a magazine, one of our charges is to inspire woodworkers, so we often add unique touches



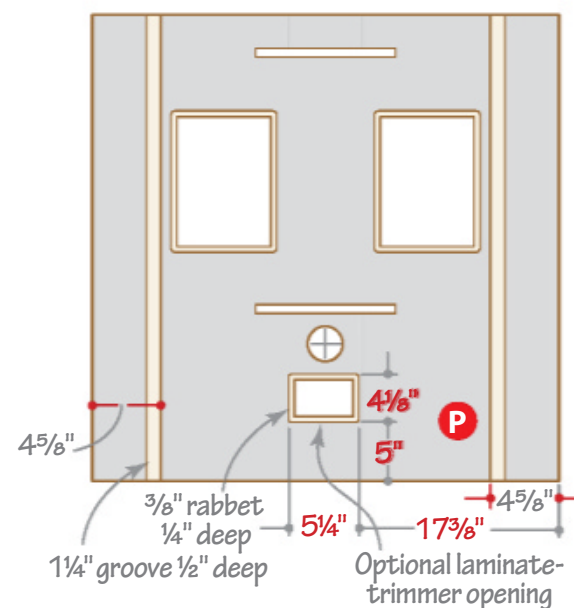
to projects that we hope will spark an idea in your mind—without losing sight of practicality. Many of our readers won't build that router table, but they may find the quad-rail fences or laminate-trimmer insert to be solutions for their own router tables. Some readers will build a project in the magazine exactly according to our plan, while others will take a design as the inspiration it's intended and make it their own. And when they do, we hope they share pictures.

In the Table for Two router table plan in issue 264, something doesn't add up: The dimensions of the small router plate in Drawing 3 don't match the dimensions of the acrylic subbase mentioned in the note on page 47. Also, you say to bevel-rip stock for the bit holders, but you don't provide an angle for the bevel. Any help?

—Joe Hunsaker
Mount Pleasant, Iowa

Either set of dimensions for that insert plate and opening should work, Joe, but, yes, they need to be the same, and you may need to adjust them to suit your router. (We used the 4 $\frac{1}{8}$ ×5 $\frac{1}{4}$ "

dimensions in the note, and as shown in the updated drawing, *below*.) The bevel angle for the bit holders—15°—somehow ended up on the cutting-room floor and should have been shown on Drawing 2. Finally, the 4 $\frac{5}{8}$ " dimension for locating the miter slots should go to the far edge of the slots, not the near edge, when measured from the edge of the top (P).



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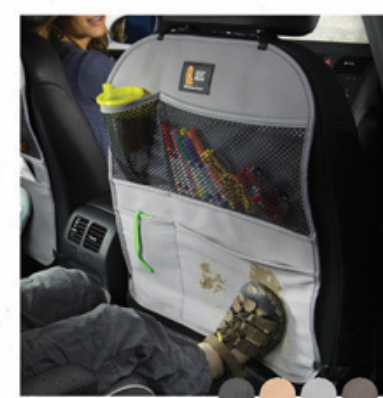


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SOUNDING BOARD

YOUR VOICE



Off-the-wall spray booth

After seeing your article “Spray Finishing Made Simple” in issue 262 (September 2019), I have concerns about the use of the box fan in the small-project spray booth. I know you say to use water-base finishes with this setup, but the danger of exposed-spark motors on this type of fan can’t be emphasized enough. People tend to use what they have, and if it works for water base, they might think, “maybe I could use it for other finishes I have,” but the only safe solution is an explosion-proof fan.

I also wanted to show you the “temporary” spray booth in my shop. Basically, it is a swinging wall that, when opened, isolates a 12x12’ area from the rest of the shop. I installed a 3,200-cfm explosion-proof fan that vents finish fumes outside. (It’ll practically pull the drywall off the ceiling!) When the wall is stowed, it returns that space to normal shop use.

—**Bruce Malone**
Kalama, Wash.



Sister salvages

While cleaning the other day, I came across a page I tore out of issue 241 (September 2016). It was Dave Campbell’s column titled “Retreat!” and I always meant to respond to it because in the late 50s and early 60s, I was one of those teachers in the Catholic schools with the funny-looking clothes. Remember them, the Sisters? Well, I didn’t last too long as a teacher, but became a nurse and a missionary, and have been a Sister of Charity now for 63 years. Along the way, I picked up woodworking.

I still love reading about it and make some very simple things like this cork board made from wine corks I’ve been given. The oak for the frame was salvaged from old pew kneelers.

—**Sister Eileen Judge**
Bronx, N.Y.

No shop, no problem

I’m a longtime reader of WOOD magazine but had never built anything until recently, when I bought an air compressor and needed a way to keep all of the accessories handy. Your Compressed-air Workstation, at right, in issue 190 (May 2009) was a perfect fit for me. So here it is: my first woodworking project. I didn’t like the look of the home-center plywood, so I used Baltic-birch ply instead—I really like that material.

I have very few woodworking tools of my own, so I joined a local training organization, Community Woodshop (communitywoodshopla.com), which gave me access to all the necessary tools, equipment, and expertise. It’s a really great fit for me as a rookie woodworker. I’m already working on plans for a custom console table for my newly remodeled living room. Thanks for the great plans.

—**Brian Queen**
Pasadena, Calif.



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SOUNDING BOARD

YOUR PROJECTS



For this red-oak cabinet, **Rick Green**, of Eugene, Ore., free-hand-routed the socket for the sand-shaded ebony-and-zebrawood inlay on the door. He also crafted hickory cleats and guides for the dovetailed drawer.



This hall table, built by **Gerald Nusbaum**, of Homosassa, Fla., features a spectacular ambrosia maple top and apron. The tabletop trim and legs are mahogany.



After making a Zigzag Box from issue 243 (November 2016), **Gary Fader**, of Marietta, Ga., added a tray and supports to a second box to organize jewelry. Using leftover pieces from both boxes, he then fashioned a matching serving tray.

Steve Bishop, of Pinellas Park, Fla., designed and built this drill-press storage cabinet that wraps around the column to maximize its capacity. Besides the seven drawers, the mobile unit sports two "vertical drawers" that glide out on 24" full-extension slides.



SOUNDING BOARD

YOUR PROJECTS



Tim Kuhn, of Rochester, N.Y., credits his father-in-law for sparking his interest in woodworking, which led to this boat shelf, Tim's first big project. The bentwood sides are made from three thin layers of cold-bent cedar.



James Pate, of Hamilton, Ohio, designed and built this cherry shoe armoire, which he calls armadio da scarpe (Italian for "shoe cabinet"). The work of Gustav Stickley and Harvey Ellis inspired his design. The trim includes 28 separate pieces.



For his granddaughter's 16th birthday, **Jim Bailey**, of Everett, Wash., built this blanket chest from plans in issue 262 (September 2019). Cherry rails and stiles wrap ambrosia maple panels. Jim also substituted aromatic cedar for the plan's plywood bottom.

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Using 1x12 redwood salvaged from an old house on his property, **Jeff Kunde**, of Kenwood, Calif., built this garden gate that also features a flower made from old horseshoes he welded together. 🌿

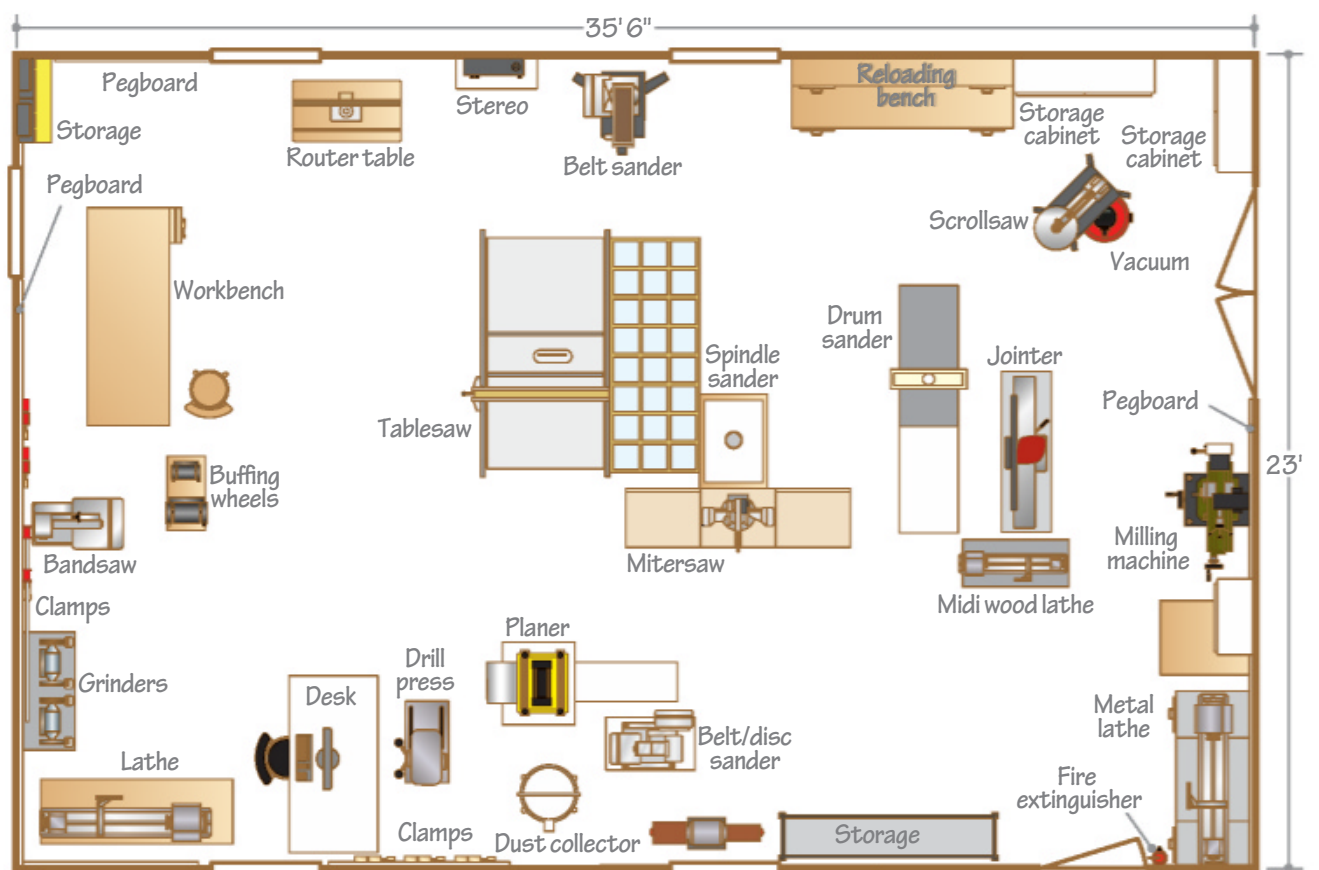
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Hobby Heaven



After retiring from John Deere, Dean Feight knew he wouldn't be content sitting in a rocker enjoying sunsets. Rather, he designed and built a workshop that accommodates his many hobbies, including woodworking and target shooting. He insulated and covered the 9'-high, 2×6 stud walls with drywall, then added ¼" pegboard over ½"-thick wood strips. Over the concrete floor, he laid furring strips with foam insulation between, then topped them with ¾" plywood and vinyl tiles.

Power to tools in the center of the shop runs beneath the floor. A ceiling-mounted heater warms the shop in winter, and a window air-conditioner keeps humidity down during the summer. His air compressor resides in a nearby machine shed, so he ran a supply line underground to the woodshop. He even placed a skylight above the tablesaw location to provide plenty of natural light.



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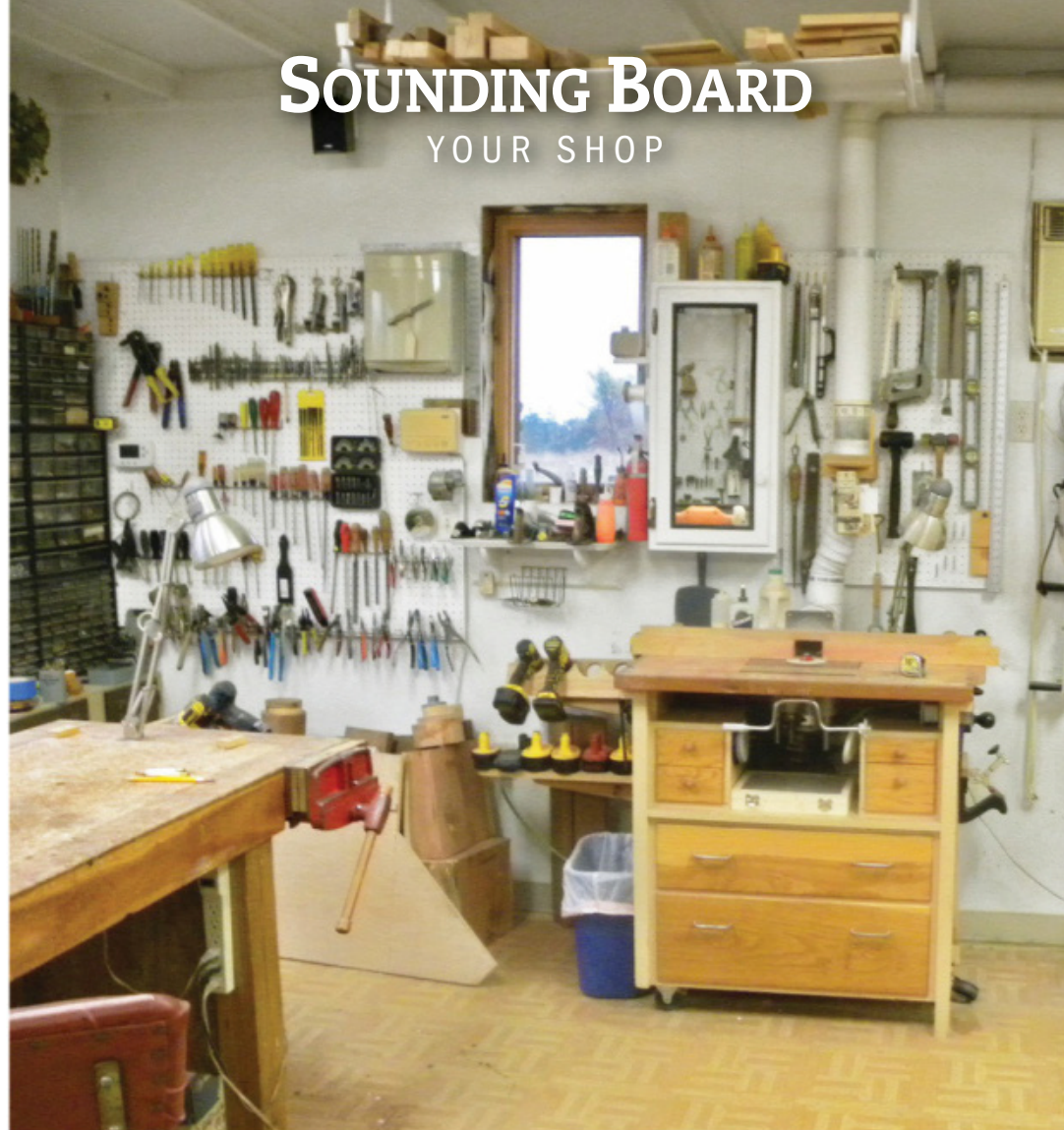


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SOUNDING BOARD

YOUR SHOP



Pegboard lines much of the wall space in Dean's shop, providing flexible storage for organizing tools, jigs, and accessories. The white walls and ceiling reflect light, helping visibility.



This handy bench for reloading ammo features a 1½"-thick solid-wood top. Walnut drawer fronts contrast with the maple cabinet. Dean created drawer pulls from spent shotgun shells.



Dean converted an old drill press into an oscillating spindle sander by turning the head upside down. He also made the cam mechanism that raises and lowers the spindle during use.



Part of Dean's 80 acres includes a shooting range. So, beside the usual woodworking equipment, he tucked in a workbench with a sturdy top and plenty of storage dedicated to reloading rifle and pistol shells.

Dean also owns a metal lathe and milling machine. Besides making and repairing parts for his guns, he has made several tools such as hammerheads, mallets, and turning tools. "These machines are invaluable to me. There's hardly a week goes by that I don't use one or both," he says.

Dean chose thin-wall PVC drainpipe for the ductwork on his dust-collection system, and says he's never had a problem with static discharge in 40 years of using the system. He switches the dust collector off and on with a Long Ranger remote. He supplemented a commercial air cleaner with a shop-made box that houses furnace filters and connects to his dust collector.

When Dean isn't in his shop, you'll find him on the shooting range or out fishing on his 2-acre pond. The rockers on the porch don't get used much around his place. 🌲



A lifetime woodworker, Dean bought his first wood lathe at the age of 14. He never lacks for anything to do on his 80-acre property.

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Q The best food-safe finish

I make a lot of cutting boards and typically apply an edible oil, such as pure tung oil or food-grade mineral oil, to enhance the appearance of the wood and protect it. Are there other oils, waxes, or film-forming finishes that would offer more protection and still be food-safe?

—Chuck Wagner, Raleigh, N.C.

A As you've discovered, Chuck, any natural oil that won't go rancid works fine, including walnut, linseed (not the "boiled" variety), or extra virgin olive oil. Although mineral oil is derived from petroleum, the food-grade version proves popular because it's colorless, odorless, flavorless, and inexpensive. Such oils beautify the wood and offer some resistance to liquid penetration but need to be reapplied regularly.

A film-forming finish, such as polyurethane, provides maximum protection and proves safe for food contact after complete curing—a process that can take several weeks. But it's not suitable for cutting boards, salad bowls, or other surfaces that

come into contact with knives and other hard utensils. Moisture and bacteria will penetrate any cuts and get trapped under the finish. With that said, if a film-forming finish suits your needs but you want to avoid any chance of ingesting plastic, try shellac. Made from a natural secretion of the lac bug mixed with alcohol, shellac even finds its way into pharmaceuticals. Just don't let it contact alcohol, which will dissolve it.

To increase the water resistance of edible oils, try mixing them with beeswax. Simply mix small chunks of wax into heated mineral oil (about one part beeswax to five parts oil) to make a highly effective, food-safe finish. To avoid a fire hazard, just be sure to heat the oil in a container placed in boiling water.

On today's market you'll find many pre-mixed, food-safe products, most containing the edible oils mentioned earlier. Some include wax, too, saving you the heating/mixing work.

No matter which product you choose, before applying it thoroughly clean the cutting board with soap and water. Never wash the cutting board in a dishwasher or allow it to soak in water—the board may delaminate or warp. After allowing the board to dry, apply the oil or oil/wax blend and let it soak into the wood for several hours before wiping off any excess. 🌲

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SHOP TIPS

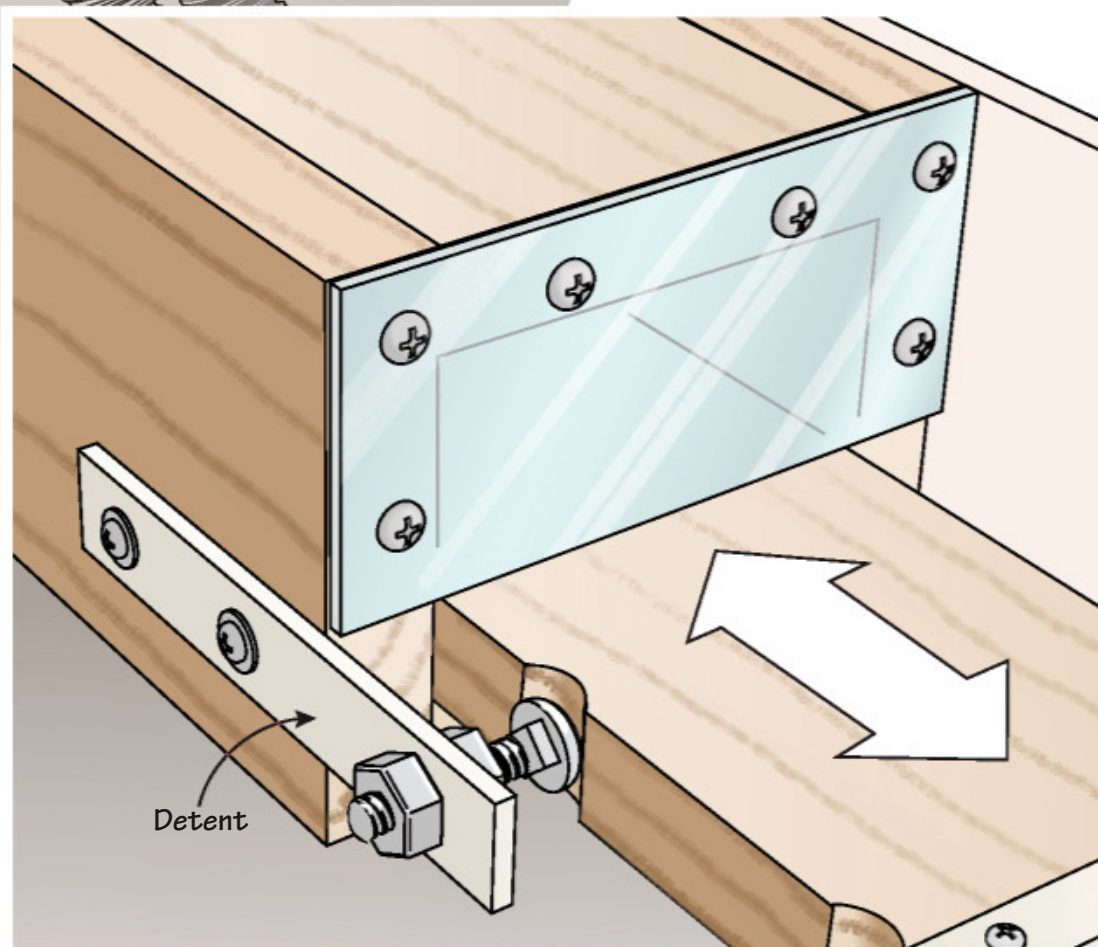
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**TOP
SHOP
TIP**

“Selector” blast gate controls air from multiple machines

Because my shop has several dust-producing machines close to each other, space for, and access to, individual dust-collection blast gates proved problematic. So I came up with a selector-type box that controls airflow from these machines. Its sliding gate has a single hole that lines up with a port leading to each machine, as well as a solid portion of the box's bottom (the “off” or closed position). Clear acrylic ends hold the slide in place and provide a peek inside. Clear acrylic ends hold the slide in place and provide a peek inside.

To choose the machine that will receive dust collection, simply move the slide until the arrow on its end aligns with the machine's mark on the wall. A simple detent, made from a strip of PVC plastic with a carriage bolt in its end, ensures proper location of the slide. I find this arrangement perfect for a one-person shop because opening the port to one machine simultaneously closes airflow to the others.



For smooth operation, coat the slide and the inside of the box with polyurethane, and wax the slide. You could also make smaller versions, such as a two-port selector controlling just a tablesaw and the router built into its extension table.

—Doug Plank, Beaufort, S.C.

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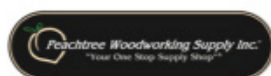
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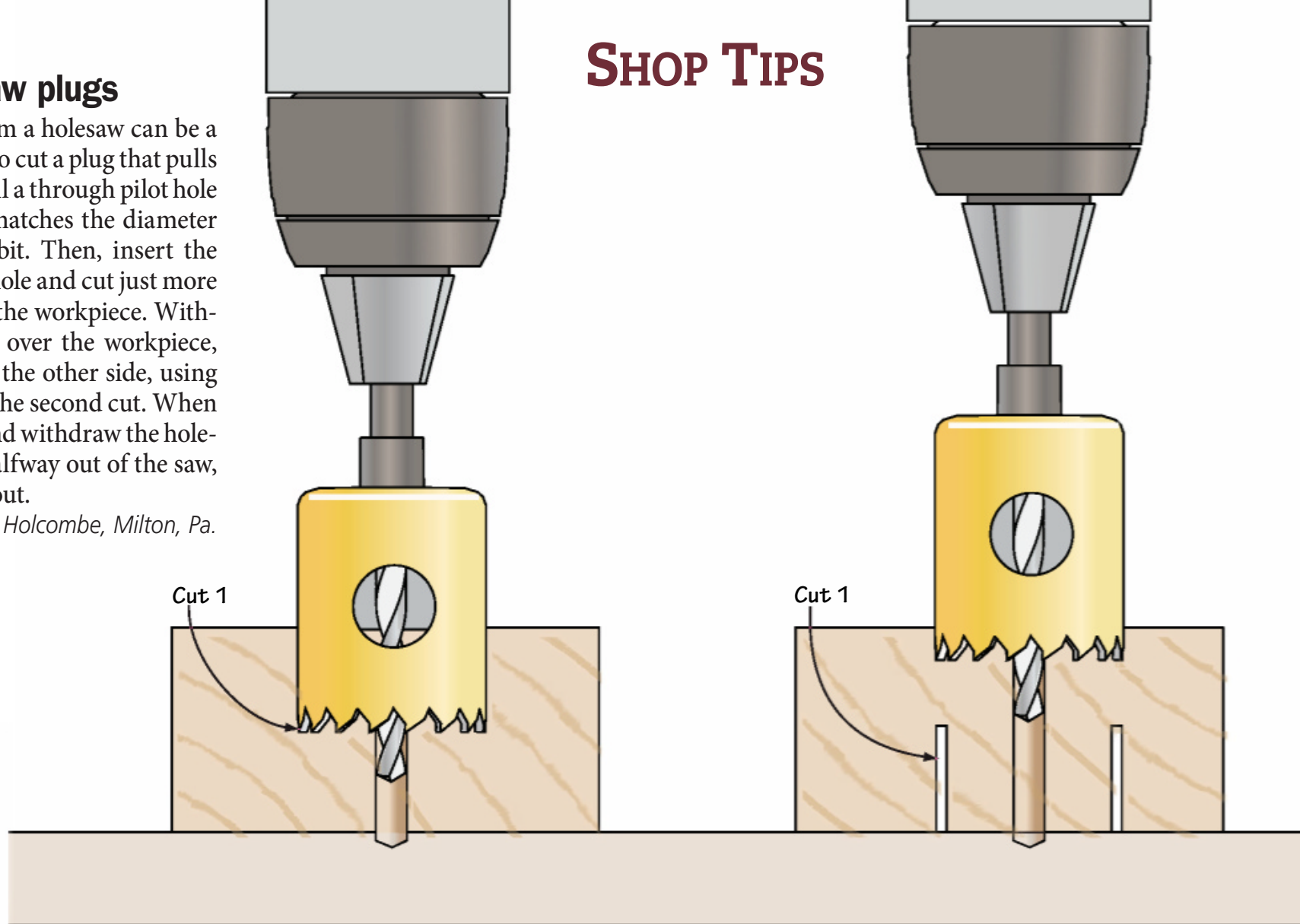
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Easy-pull holesaw plugs

Removing the plug from a holesaw can be a real chore. Here's how to cut a plug that pulls out with ease. First, drill a through pilot hole using a twist bit that matches the diameter of the holesaw's drill bit. Then, insert the holesaw's bit into that hole and cut just more than halfway through the workpiece. Withdraw the holesaw, flip over the workpiece, and saw the hole from the other side, using the pilot hole to guide the second cut. When you complete the cut and withdraw the holesaw, the plug will be halfway out of the saw, making it easy to pull out.

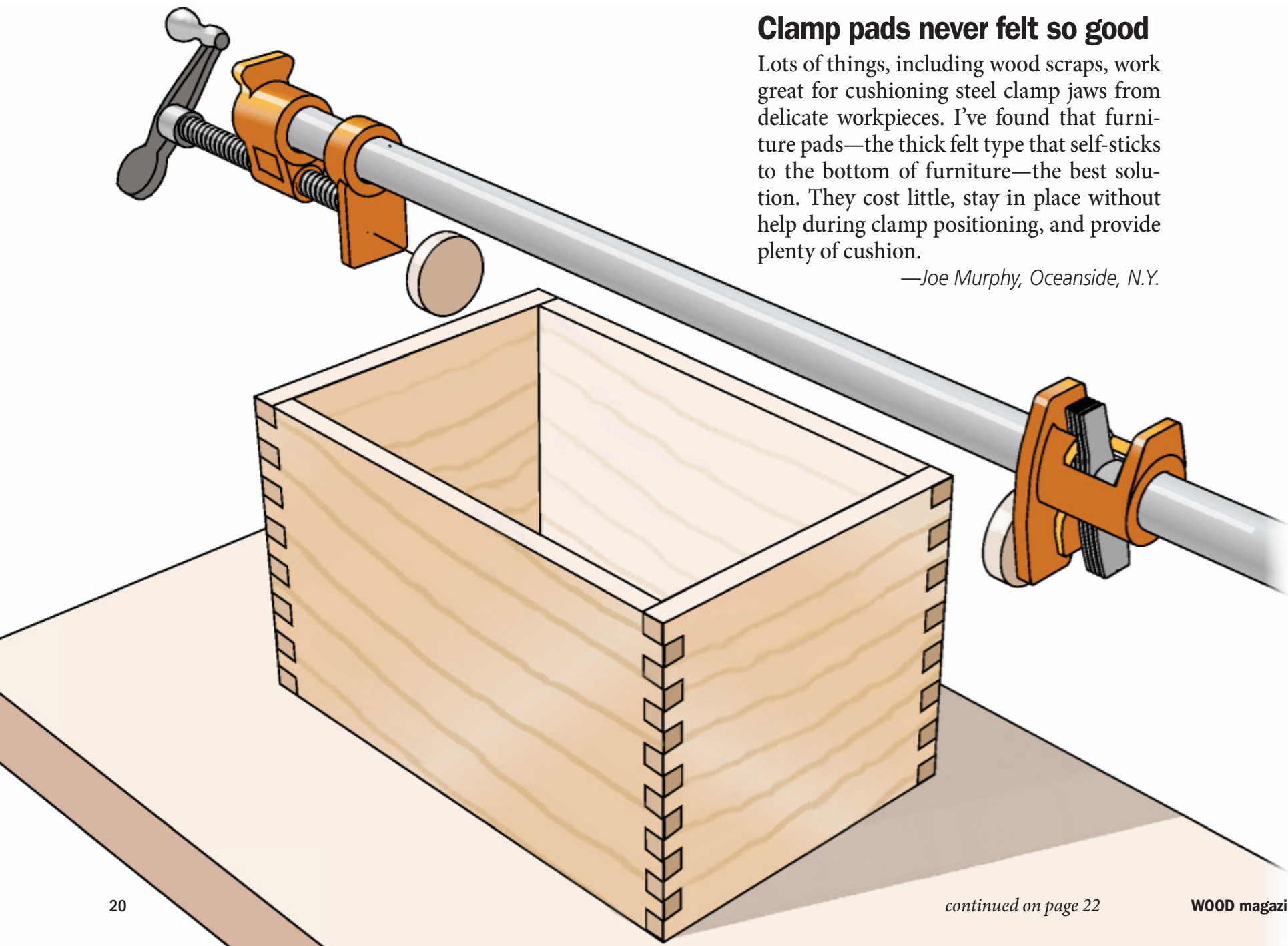
—Vell Holcombe, Milton, Pa.



Clamp pads never felt so good

Lots of things, including wood scraps, work great for cushioning steel clamp jaws from delicate workpieces. I've found that furniture pads—the thick felt type that self-sticks to the bottom of furniture—the best solution. They cost little, stay in place without help during clamp positioning, and provide plenty of cushion.

—Joe Murphy, Oceanside, N.Y.



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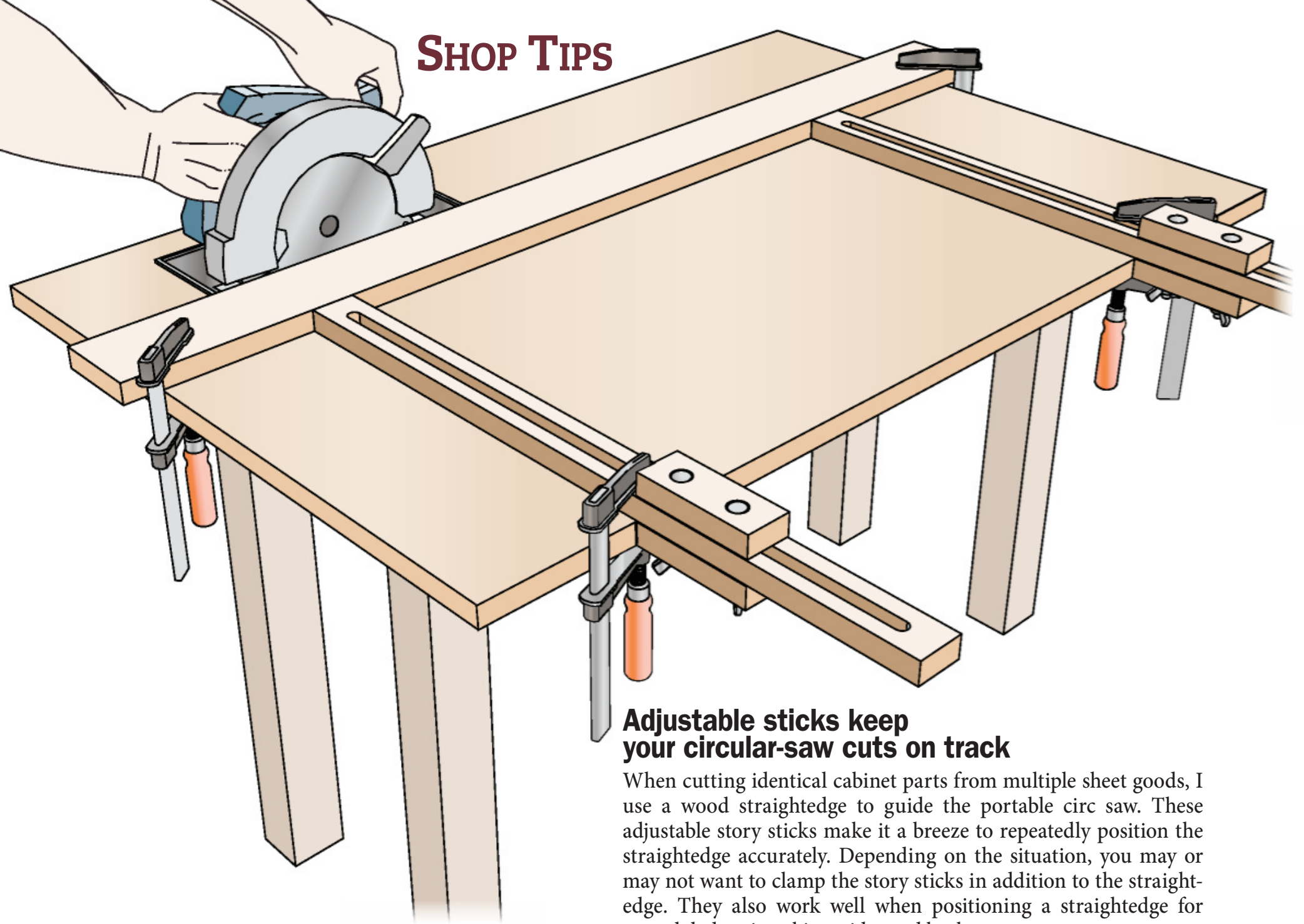
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SHOP TIPS



Adjustable sticks keep your circular-saw cuts on track

When cutting identical cabinet parts from multiple sheet goods, I use a wood straightedge to guide the portable circ saw. These adjustable story sticks make it a breeze to repeatedly position the straightedge accurately. Depending on the situation, you may or may not want to clamp the story sticks in addition to the straight-edge. They also work well when positioning a straightedge for routed dadoses in cabinet sides and backs.

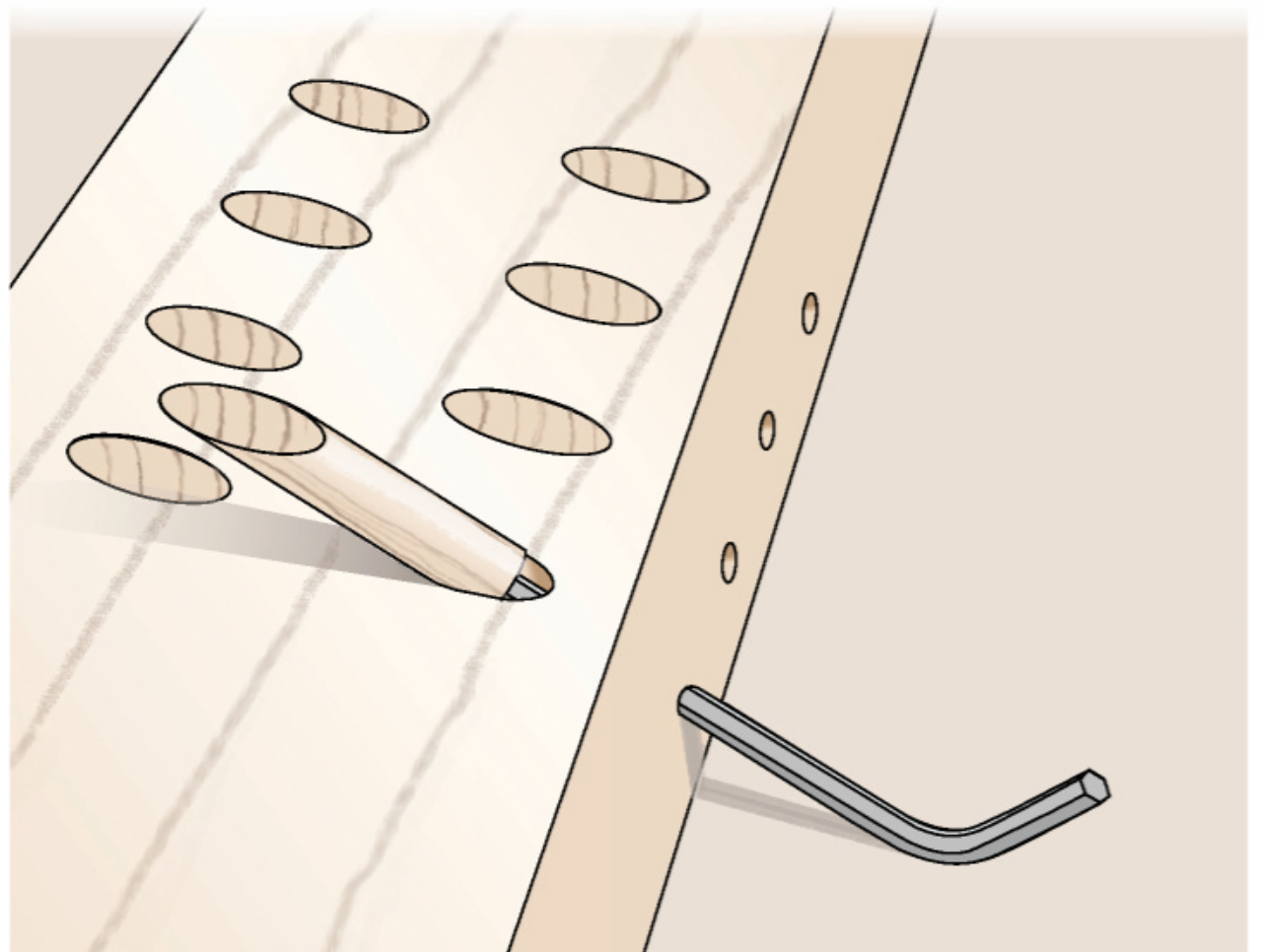
—Jeremy Shilling, Bryan, Texas

Sand pocket-hole plugs before gluing them in place

Like most folks, I generally sand pocket-hole plugs flush with the surrounding surface after gluing them in. But some pocket-hole placements make it impossible to get to the plug with a sander. And, you risk sanding through the veneer when working with plywood. At those times, sand the plugs before gluing them in place.

First, drill a series of pocket holes into the face of a holder made from hardwood scrap. Insert a plug into each hole. Then, sand the plugs flush, being careful to not sand into the face of the holder. Push a narrow pick, such as a long-necked hex wrench, through the screw hole on the edge of the holder to free each plug. Now, insert the sanded plug into the project's pocket hole—it should sit flush, with little or no sanding required.

—Errol Koehn, Montezuma, Kan.



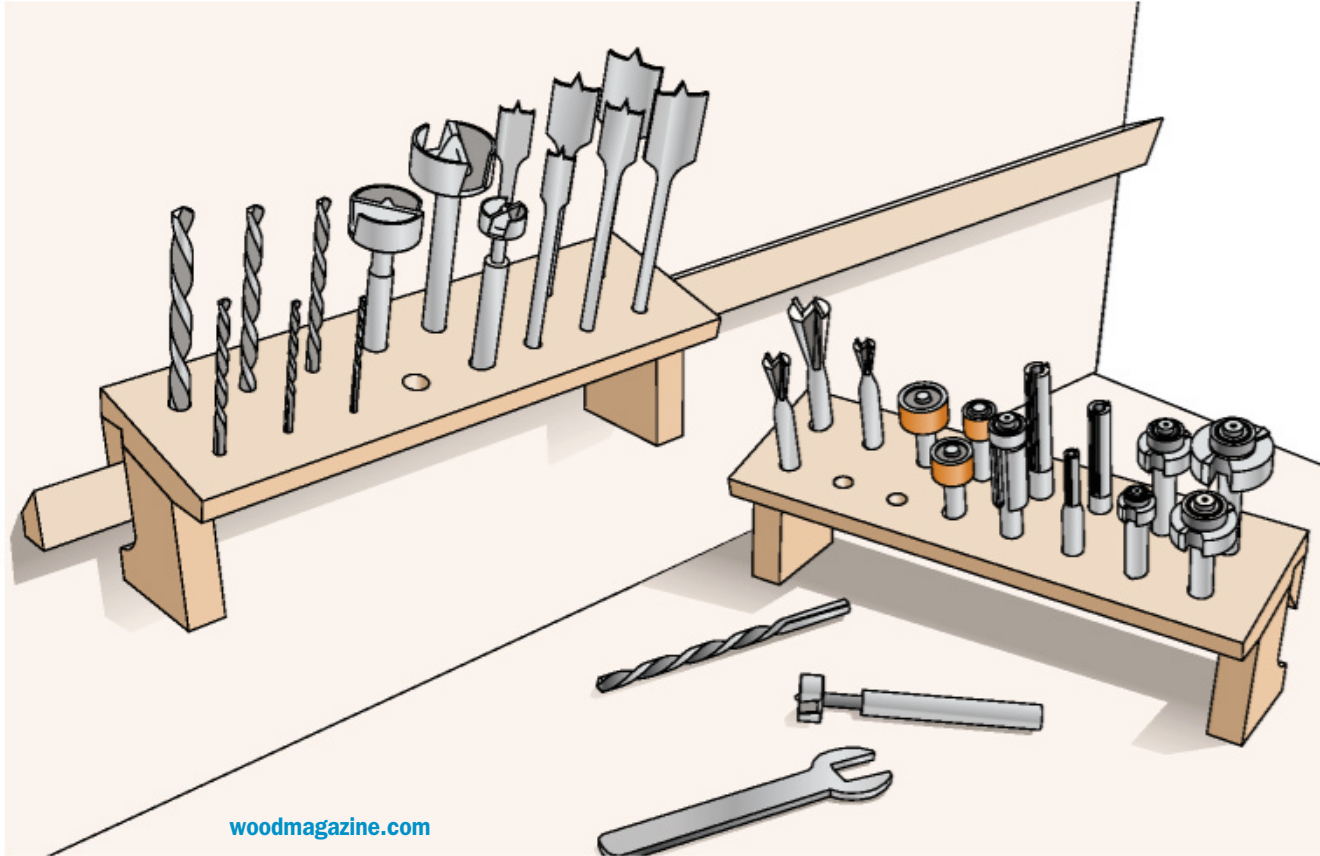
SHOP TIPS

Stand-up tool holders for wall and bench

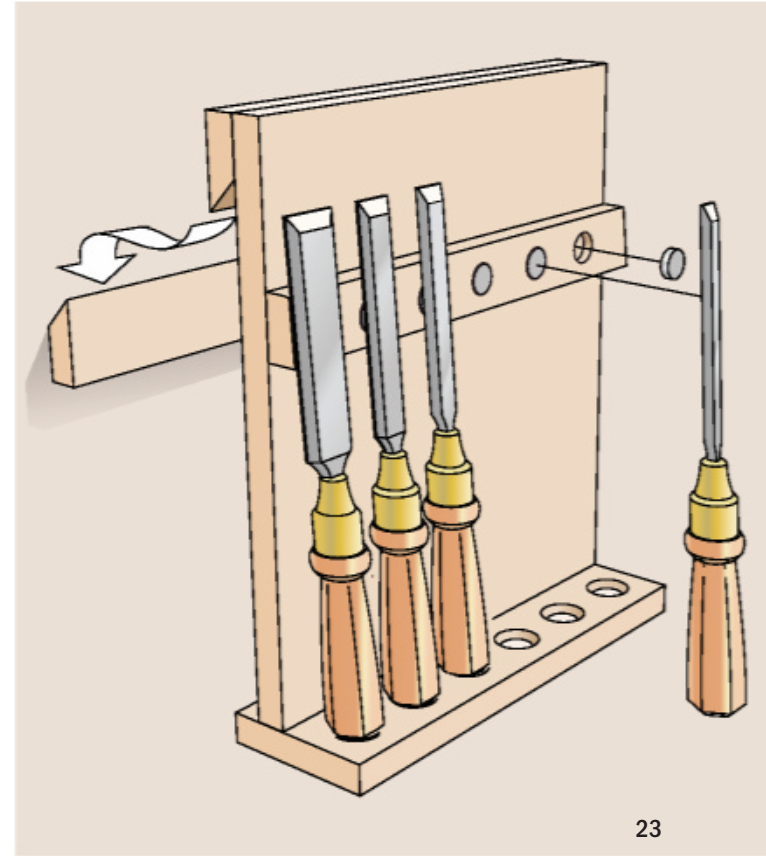
Build your tool holders so they work well hanging on a wall *or* standing on a bench. Add a French cleat to the back of the holder—the cleat's 45° beveled edge will hold tight to a matching wall cleat while allowing you to lift the holder off. For bench

use, add a base, like that shown *below right*, or a pair of legs. Angle the top of the bit holder 15° for easier access to its contents. Likewise, angle one face of the magnetic chisel holder strip 10°.

—Mike Elliott, Ottumwa, Iowa



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Easy-build Workbench

Biscuits, glue, and a few screws; a high-performance workbench doesn't get much easier than this.

Build this rock-solid bench in a weekend, then go to *page 50* and add a double-screw end vise, a leg vise, or both and turn it into an all-around work center.

D I M E N S I O N S :
74½" W x 30" D x 34½" H

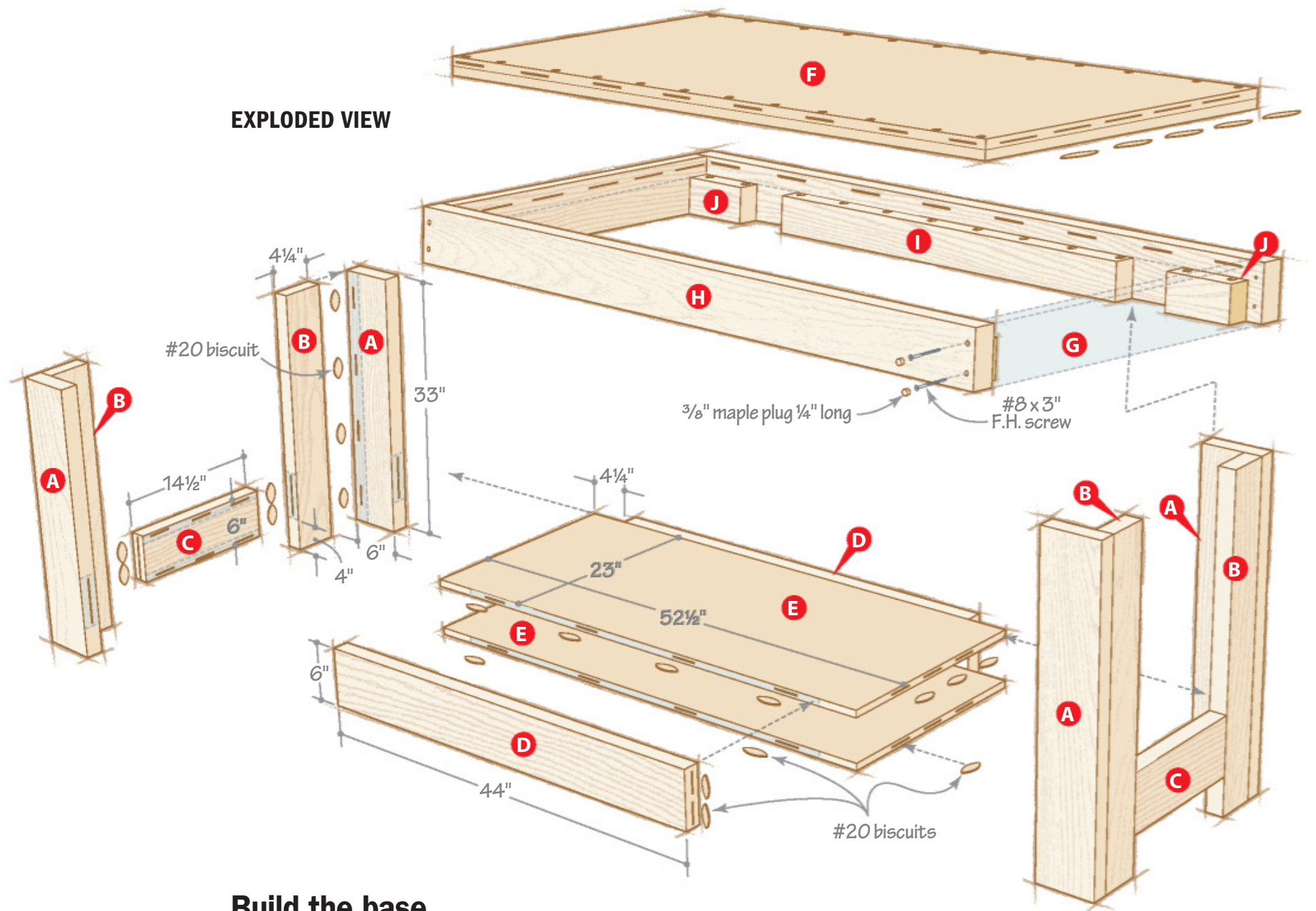
Approximate materials cost:

\$335

15

sq. ft. of heavy-duty, dead-flat benchtop

EXPLODED VIEW



Tip! When cutting the wide uprights (A), saw four 3"-long spacers to use when making the workbench top.

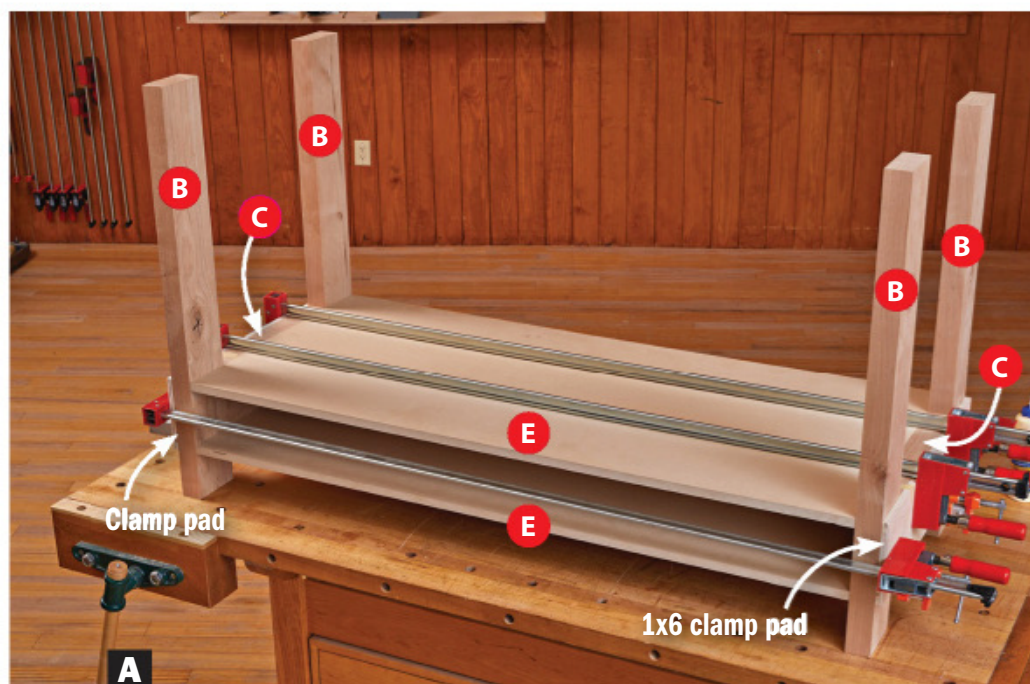
Build the base

- 1 Cut the uprights (A, B) and rails (C, D) [Materials List, Exploded View]. Cut biscuit slots in the rail ends and upright edges. Then glue and biscuit the end rails (C) between the narrow uprights (B), and the side rails (D) between the wide uprights (A).
- 2 Cut the lower panels (E) to size. Cut biscuit slots in the panel ends and end rail

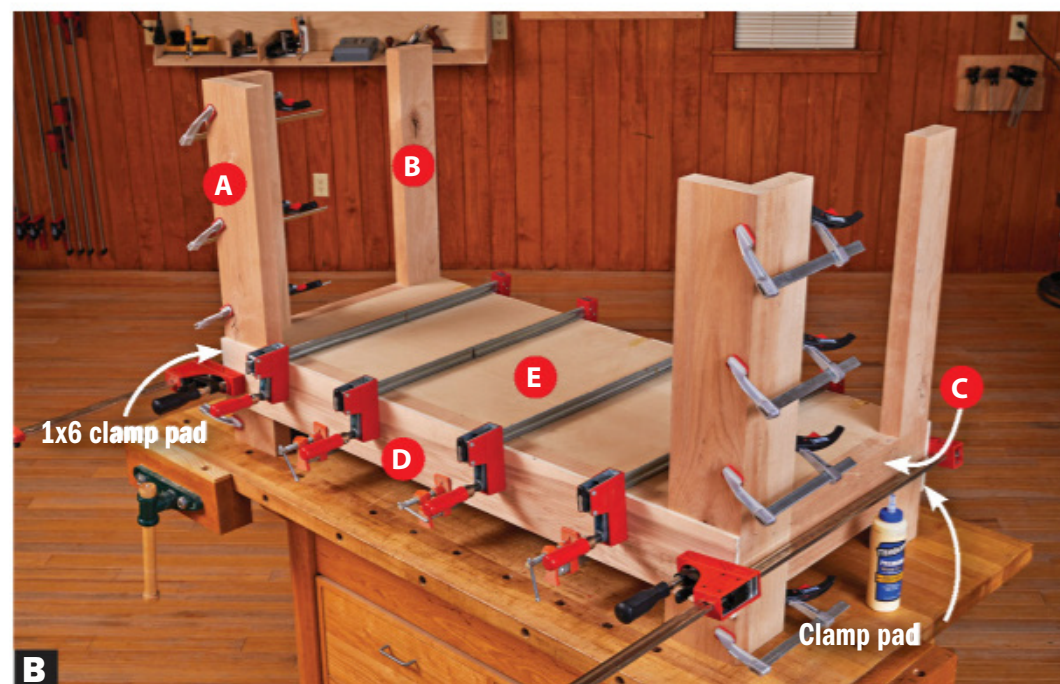
(C). Join the panels to the end assemblies (B/C) [Photo A].

- 3 Cut biscuit slots in the lower panel edges, inside faces of the side rails (D), and inside faces of the wide uprights (A). Join one side assembly (A/D) to the end/panel assembly (B/C/E) [Photo B]. Repeat with the remaining side assembly.

► Learn all about biscuit joinery.
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A Glue, biscuit, and clamp the lower panels (E) between the narrow upright/end rail assemblies (B/C). Scrapwood clamp pads protect parts from damage.



B Glue, biscuit, and clamp one side assembly (A/D) to the end/panel assembly (B/C/E). Work on a flat surface to avoid racking the base.

Tip! To laminate the top panels, elevate one panel on a flat surface and spread ample glue with a roller. Position the second panel and place heavy objects at the center. Then clamp with moderate pressure around the perimeter.

Tackle the top

1 Cut the upper panels (F) [Drawing 1] $\frac{1}{2}$ " wider and longer than listed. Laminate the panels face-to-face and trim them to finished size.

2 Cut the skirts (G, H). Cut biscuit slots in the upper panel ends and end skirts (G), and glue them together. Repeat for the side skirts. Drill counterbored pilot holes at the corners and screw the side skirts to the end skirts. Glue in plugs and sand them smooth.

3 Cut the blocking (I, J). Glue and clamp them to the upper panels (F/F) and side skirts (H), inserting 6" spacers to center the

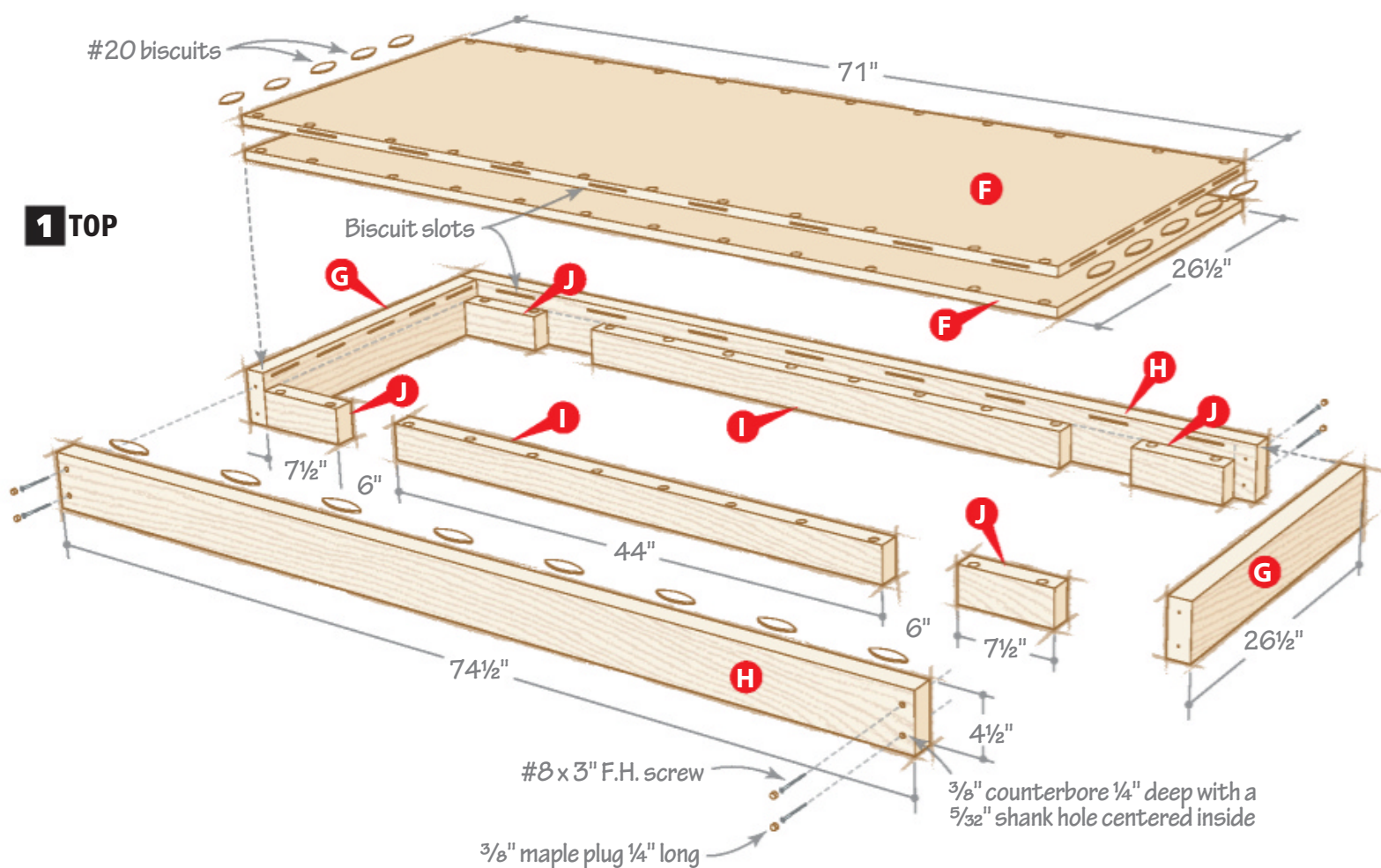
long blocking and provide space to accept the wide uprights (A) [Exploded View].

4 Finish-sand the base and top, easing sharp edges with a sanding block. Apply a finish. (We applied two coats of wipe-on polyurethane to the base and three coats of Danish oil to the top.) With finishes dry, install the top on the base, fitting the wide uprights (A) into the spaces between the blocking (I and J). The weight of the top keeps it in place without fasteners.

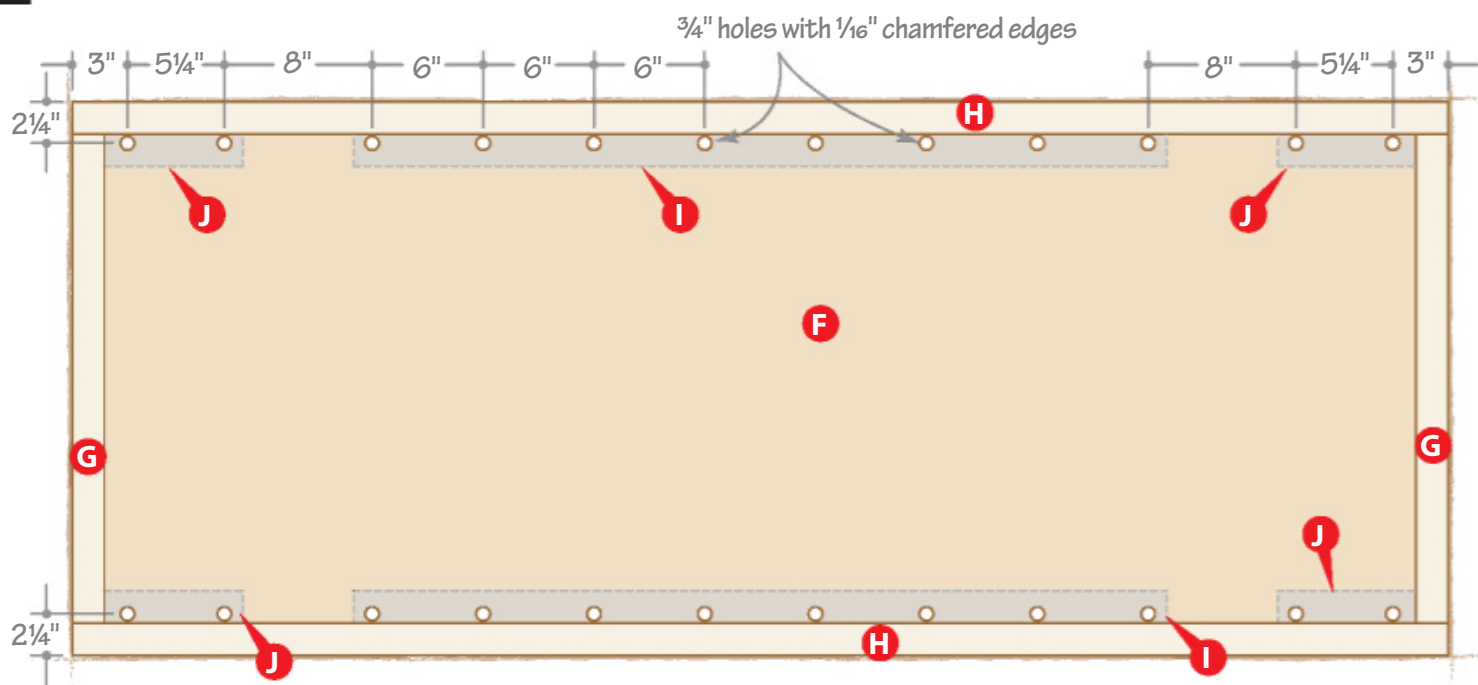
5 Mark bench-doghole centerlines on the top [Drawing 1a]. Make the drill guide [Drawing 2] and press in the doghole bushing

Note: Finishing the top with Danish oil allows refinishing anytime with only light sanding to clean up the surface.

Tip! Flood the dogholes with Danish oil using an old toothbrush and catching drips below with a plastic cup.



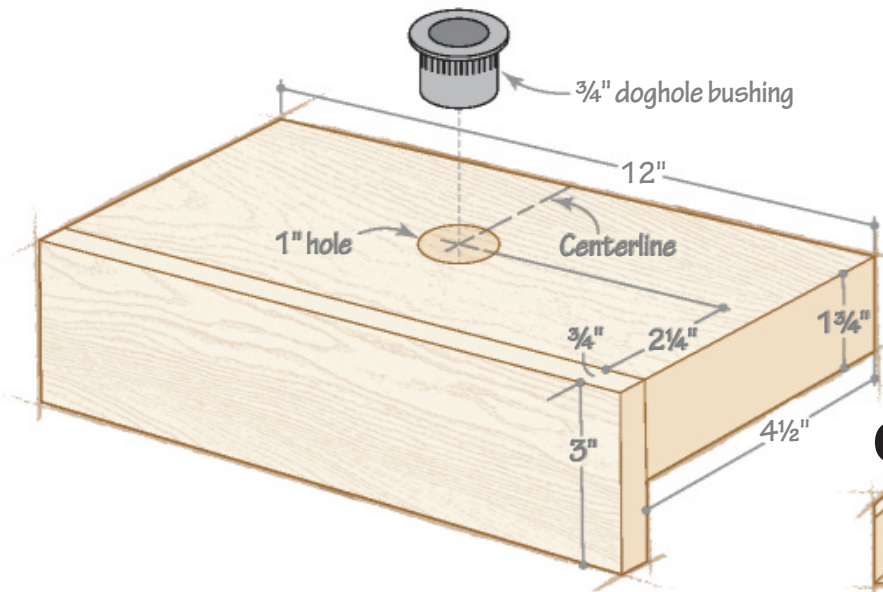
1a TOP ASSEMBLY TOP VIEW



[Source]. Drill the dogholes using a 3/4" brad-point bit [Photo C, Source]. Rout chamfers around the hole edges and touch up the finish. To add a vise or two to the bench, see page 50. 🌲

Produced by Jan Svec with Brian Bergstrom
Project design: John Olson
Illustrations: Roxanne LeMoine, Lorna Johnson

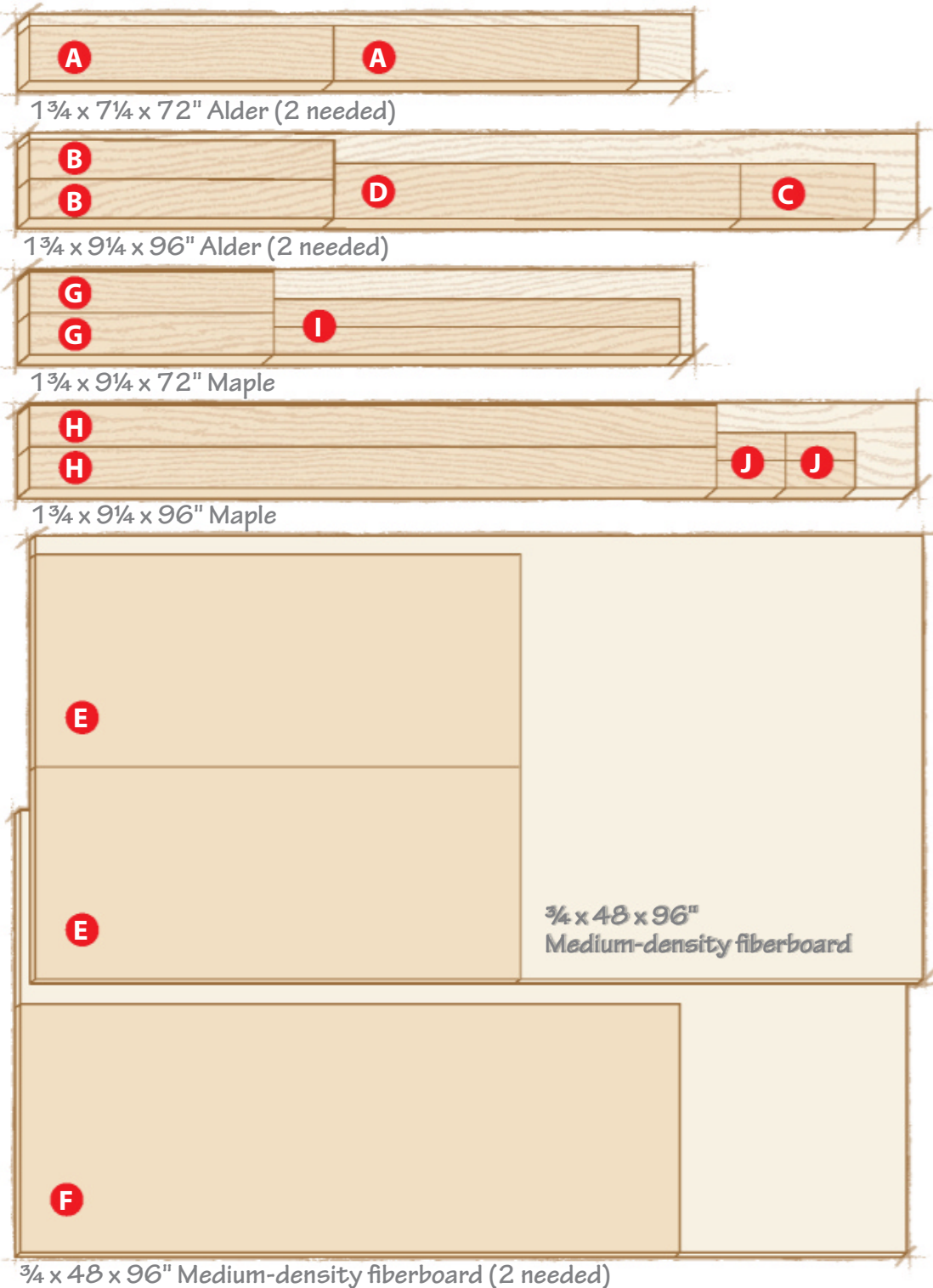
2 DRILL GUIDE



Drill dogholes using the drill guide clamped and aligned with hole centerlines. A scrap block clamped underneath prevents tear-out.

Cutting Diagram

This project requires 43 board feet of 8/4 alder and 37 board feet of 8/4 hard maple.



Materials List

Part		FINISHED SIZE			Matl.	Qty.
		T	W	L		
Base						
A	wide uprights	1¾"	6"	33"	A	4
B	narrow uprights	1¾"	4¼"	33"	A	4
C	end rails	1¾"	6"	14½"	A	2
D	side rails	1¾"	6"	44"	A	2
E	lower panels	¾"	23"	52½"	MDF	2
Top						
F*	upper panels	¾"	26½"	71"	MDF	2
G	end skirts	1¾"	4½"	26½"	M	2
H	side skirts	1¾"	4½"	74½"	M	2
I	long blocking	1¾"	3"	44"	M	2
J	short blocking	1¾"	3"	7½"	M	4

*Parts initially cut oversize. See the instructions.

Materials key: A-alder, MDF-medium-density fiberboard, M-maple.

Bits: 45° chamfer router bit, 3/8" plug cutter.

Supplies: #20 biscuits, #8 x 3" flathead screws.

Source: 3/4" doghole bushing no. 15J79.03, \$12.50; 3/4" brad-point drill bit no. 07J02.48, \$44.70, Lee Valley, 800-871-8158, leevalley.com.



Airtight Joints from Your



by Jim Heavey

My recent move to a new home halfway across the country was made even more nerve-wracking by relocating a complete woodworking shop to a new basement location with just a single 15-amp outlet. Given the limited power options, top priority went to getting my most versatile and indispensable tool—the tablesaw—up and running. In addition to ripping, crosscutting, beveling, and mitering, it also does a great job cutting a straight edge square to the face of a board, known as *jointing*. You need to do this when preparing boards for edge-gluing, where the mated surfaces must align precisely.

It's easy to imagine jointing the edge of a 2×4 on a tablesaw because the board already has two fairly straight edges. Guide one edge against the rip fence for the first cut, then flip the board around to joint the opposite edge.

But what about a large slab with irregular edges, or a board with bowed edges [Photo A]?



A

A curved edge must be straightened before edge-gluing boards to form a panel, or creating other project parts.



Tablesaw

Even if you have a jointer, the size and weight of a slab makes it difficult to handle on edge. And removing only $\frac{1}{16}$ " or less at a time takes many passes to true up a rough or severely bowed edge. In contrast, a tablesaw removes a wide swath in a single cut, while supporting the face of the board. The secret lies in a well-tuned saw, a sharp 40–50 tooth combination blade set precisely at 90°, and a jointing sled.

► Tune your tablesaw for top performance.
woodmagazine.com/tstuneup

The simplest of jigs

A 12–16" wide medium-density fiberboard (MDF) panel makes a perfect jointing sled. The MDF provides what rough-edge stock lacks: a straight edge to ride against the rip fence. Cut the sled as long as, or slightly longer than, the workpiece.

First, affix the workpiece to the sled [Photo B]. Hang just enough of the workpiece edge over the sled edge to provide a cut down its full length [Photo C]. The sled also acts as a backer board, preventing chip-out.

Tip! MDF shelving found at big box stores and lumberyards works perfectly.

Straight and true, and tapers, too

Find yourself jointing on your tablesaw more than occasionally? This shop-made jig includes holddowns to quickly secure a workpiece, and doubles as a taper jig to boot. Get the plan to build it, then watch Jim demonstrate its use.
woodmagazine.com/tsjointingjig
woodmagazine.com/taper-jointingsled



Double-faced tape secures the board to the sled. A 2"-wide strip every foot or so should suffice. Use fresh tape each time to guarantee a strong bond.



Joint the edge that requires removing the least amount of material. This allows the most flexibility when cutting the stock to final width.

After the first pass, remove the workpiece, and peel off the tape. Joint one edge on any other workpieces you have, then set the sled aside. Finally, run the jointed edge of each board against the fence and rip them to final width. The result: boards with both edges jointed and parallel. You can't do that with just a jointer.

A tablesaw can't take the place of a jointer when it comes to creating flat faces on twisted stock. But, for putting a dead-straight edge on stock of nearly any size and shape, I prefer a jointing sled and tablesaw. Now that I have a place to plug it in, of course. 🌲

Swingin' Quilt Display



► Our colleagues at *American Patchwork & Quilting* magazine provided the quilt shown. Take a look at their treasure trove of quilt patterns, tips, and techniques.

allpeoplequilt.com

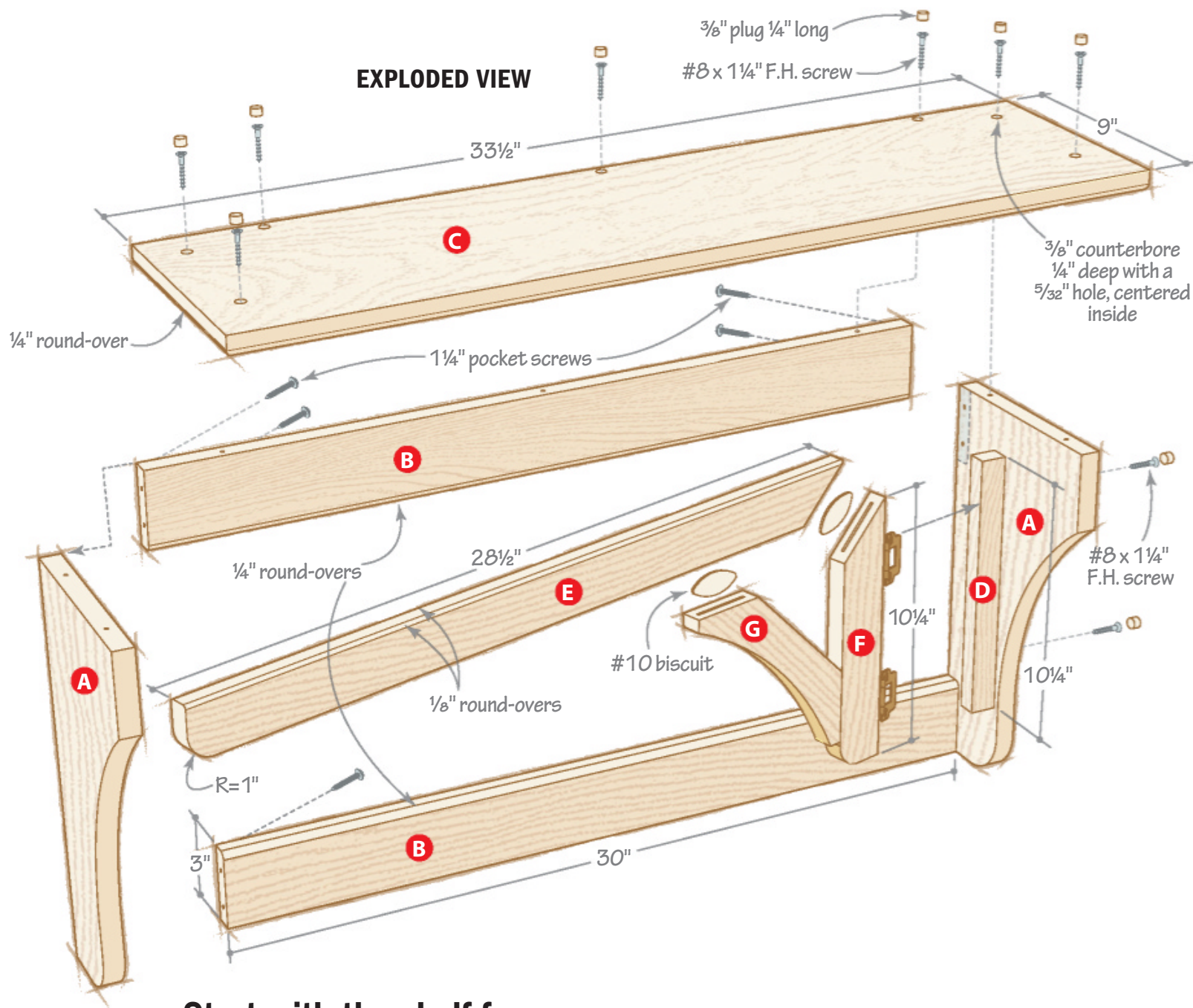
D I M E N S I O N S :
33½" W x 9" D x 15¾" H

Approximate materials cost:

\$50
including hardware

32"
depth with arm fully extended

Swing-out arm provides easy access.



Start with the shelf frame

1 Cut a pair of 8x15" blanks for the sides (A) [Exploded View, Materials List]. Cut and sand the curved edge to shape [Drawing 1].

2 Cut the rails (B) to size, and round over the edges [Exploded View]. Drill pocket-screw holes on the back of each. Rout slots for the metal keyhole hangers on the top rail [Drawing 2] and drill holes to create a recess for the heads of the mounting screws you'll drive into the wall.

► You can skip the metal keyhole hangers by routing your own keyhole slots.
woodmagazine.com/keyholes

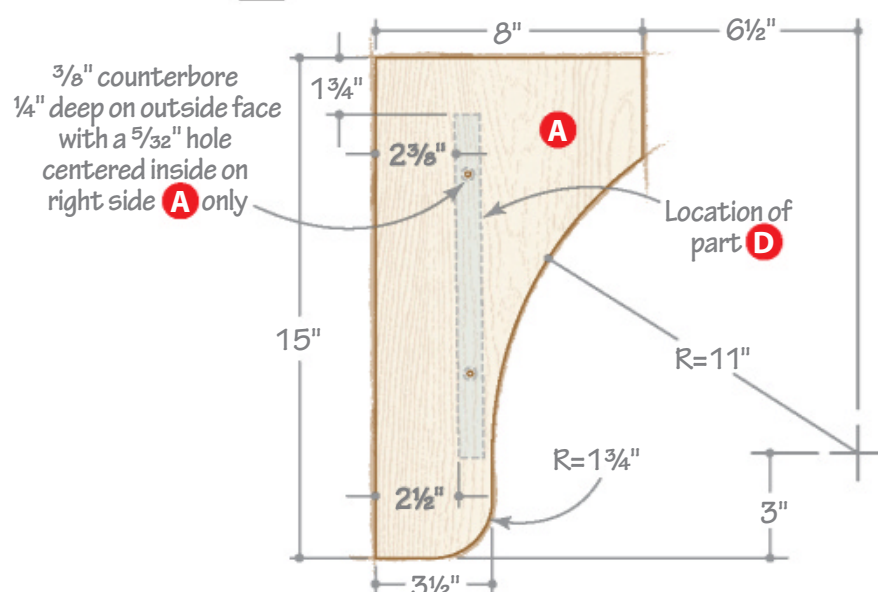
3 Cut the top (C) to size, and round over the bottom front edge and ends [Exploded View]. Drill counterbored pilot holes for the screws to connect the sides and upper rail.

4 Finish-sand parts A–C. Clamp the rails between the sides flush at the top and bottom. Secure with pocket screws.

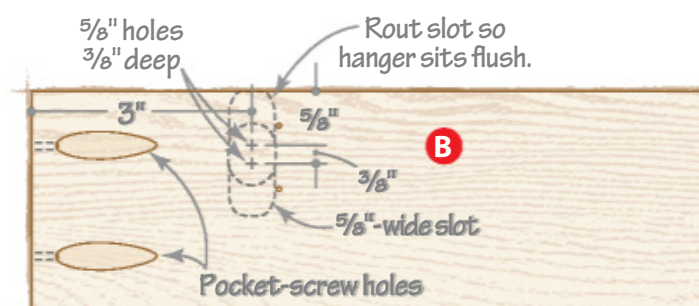
5 Glue and screw the top to the side/rail assembly (A/B). Using a 3/8" plug cutter, cut face-grain plugs to fill the counterbores. Glue the plugs in place, saw or shave flush when dry, and sand smooth.

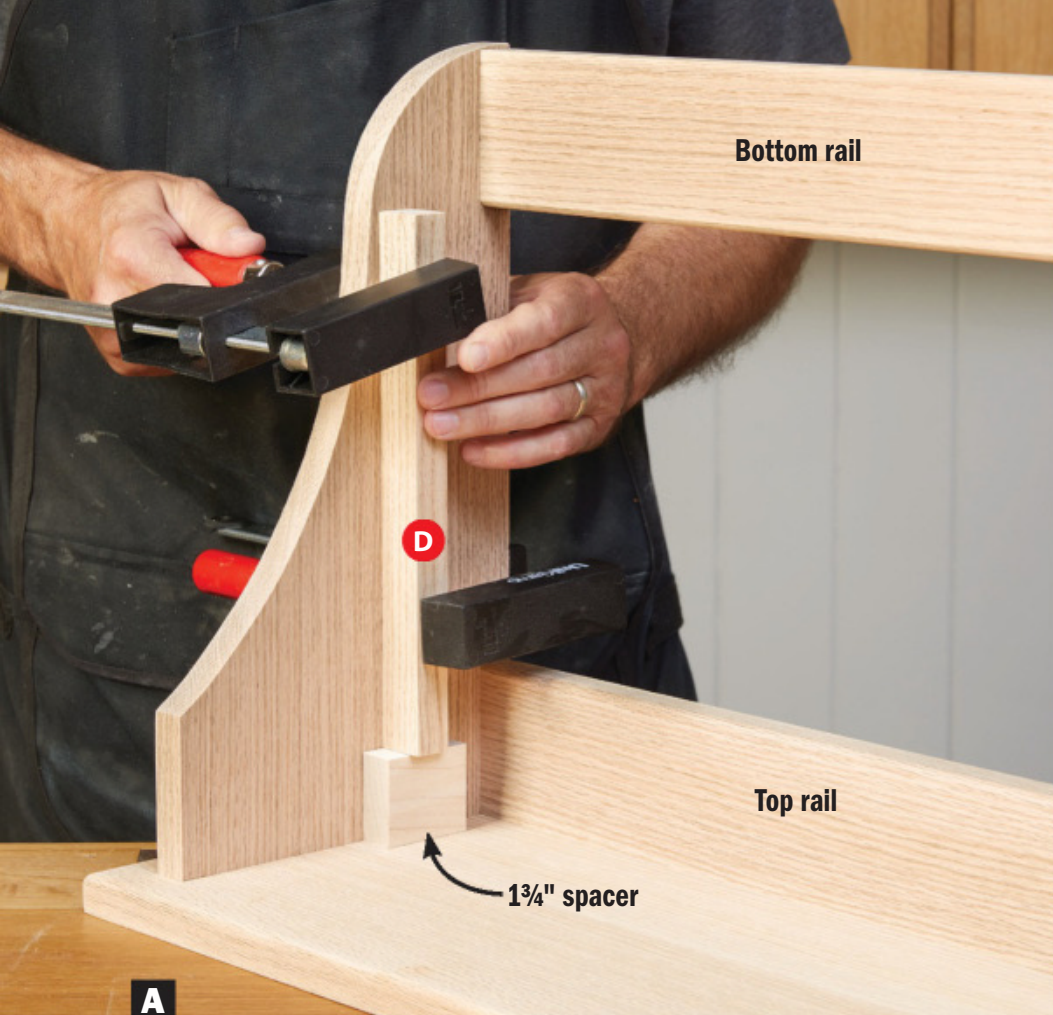
► Learn how to conceal screw holes with wood plugs.
woodmagazine.com/plugscrews

1 SIDE ASSEMBLY



2 HANGER DETAIL (Back face)





A

Clamp the arm mount (D) to the side so it's $\frac{1}{8}$ " farther from the bottom rail than from the top rail. This helps the arm stay in the closed position, but not so much as to prevent it from hanging open when you want.



B

Clamp the arm assembly as shown to keep all joints tight. When dry, sand smooth, and then round over the top edge of the arm.

Add the quilt arm

1 Cut the arm mount (D) to size, finish-sand, and glue and screw it to the shelf assembly [Exploded View, Drawing 1, Photo A].

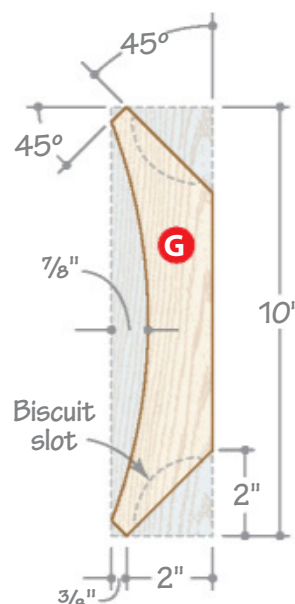
2 Cut the arm (E) and arm upright (F) to thickness and width [Exploded View]. Miter-cut one end of each, crosscut to final length with a 90° cut at the other end, then cut the radius at that end.

3 Lay out and cut the arm brace (G) to size [Drawing 3]. Cut biscuit slots to join all three parts, sand them smooth, and glue together [Photo B].

4 Apply a finish of your choice. We sprayed on two coats of lacquer, rubbing out each coat with a 320-grit sanding sponge.

5 Attach the hinges to the arm assembly, and then to the shelf assembly. Install the keyhole hangers on the back. Now mount your quilt rack to a wall, hang up that quilt you love, and sit back and admire it! 🌳

3 ARM BRACE



Produced by **Bob Hunter** with **Kevin Boyle**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine**, **Lorna Johnson**

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A sides	$\frac{3}{4}$ "	8"	15"	R	2
B rails	$\frac{3}{4}$ "	3"	30"	R	2
C top	$\frac{3}{4}$ "	9"	33 $\frac{1}{2}$ "	R	1
D arm mount	$\frac{3}{4}$ "	1"	10 $\frac{1}{4}$ "	R	1
E arm	$\frac{3}{4}$ "	2"	28 $\frac{1}{2}$ "	R	1
F arm upright	$\frac{3}{4}$ "	2"	10 $\frac{1}{4}$ "	R	1
G arm brace	$\frac{3}{4}$ "	2 $\frac{3}{8}$ "	10"	R	1

Materials key: R-red oak.

Supplies: 1 $\frac{1}{4}$ " pocket-hole screws, #8 $\times$ 1 $\frac{1}{4}$ " flathead screws, #10 biscuits.

Bits: $\frac{1}{8}$ " and $\frac{1}{4}$ " round-over and $\frac{5}{8}$ " straight router bits; $\frac{3}{8}$ " plug cutter.

Sources: Antique brass, ball-tip, partial wrap-around hinges, no. 31482, \$9.99 (pair), Rockler Woodworking and Hardware, 800-279-4441, rockler.com.

Single-hole keyhole hanger, no. 125505, \$1.75 (pair), Woodcraft, 800-225-1153, woodcraft.com.

Cutting Diagram



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woodstore.net/bundleofjoy

DEEPER POURS

UNRIVALED CLARITY



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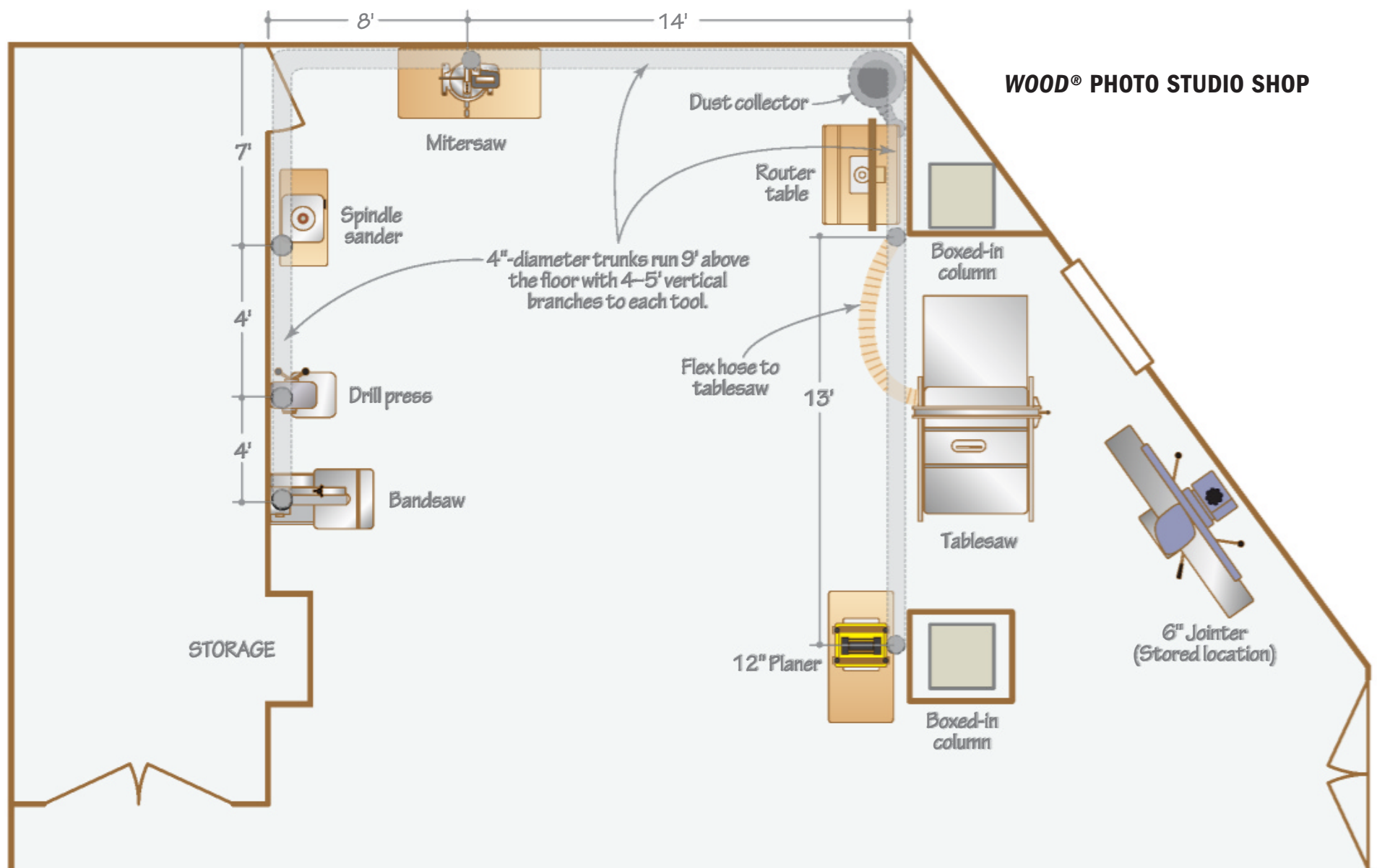


MADE IN LACEY,
WASHINGTON 98503



Plan a Whole-shop Dust-collection System

Collecting dust at its source not only makes you a *tidy* woodworker, it can keep you a *healthier* one, too. A well-planned dust-collection system traps the tiniest of particles—the ones that can cause the most lung damage—before they become airborne. Consider these pointers to keep your shop and your lungs in great shape.



Start with a layout

The first step in setting up an effective whole-shop system involves selecting the dust-collector location and from there, laying out duct runs to each tool, providing the air a path with the least resistance possible. Every foot of ductwork adds friction to the airflow, creating resistance, as do changes in duct direction, a reduction in duct diameter, and the rough surfaces of flex hose. So, plan your layout with short duct runs, minimal turns, and the least flex hose needed to connect tools to the ductwork. Typically, one or two main trunk lines should cover most of the shop with branches to individual tools.

Locating the collector centrally in the duct run, rather than at one end, helps minimize duct-run lengths. In the *WOOD* photo studio shop, we placed the collector in a corner with two trunks running from it [photo, previous page; Drawing]. This puts it out of the way, yet close to the chip-producing tools that demand the most of a dust collector: the tablesaw and planer. (In our shop, the jointer, another chip-producer, rolls into position to use the planer's port, when needed.) The bandsaw, a less-demanding tool, sits at the end of the longest trunk.

Just as a car can negotiate a large-radius curve faster than a sharp corner, a gradual

transition in direction allows air to keep moving quickly, preventing dust from falling out of the flow. So when placing turns and connecting branches, opt for elbows that provide the longest-radius turn possible. That may mean a wye or two 45° elbows rather than a 90° fixture with a tighter turn.

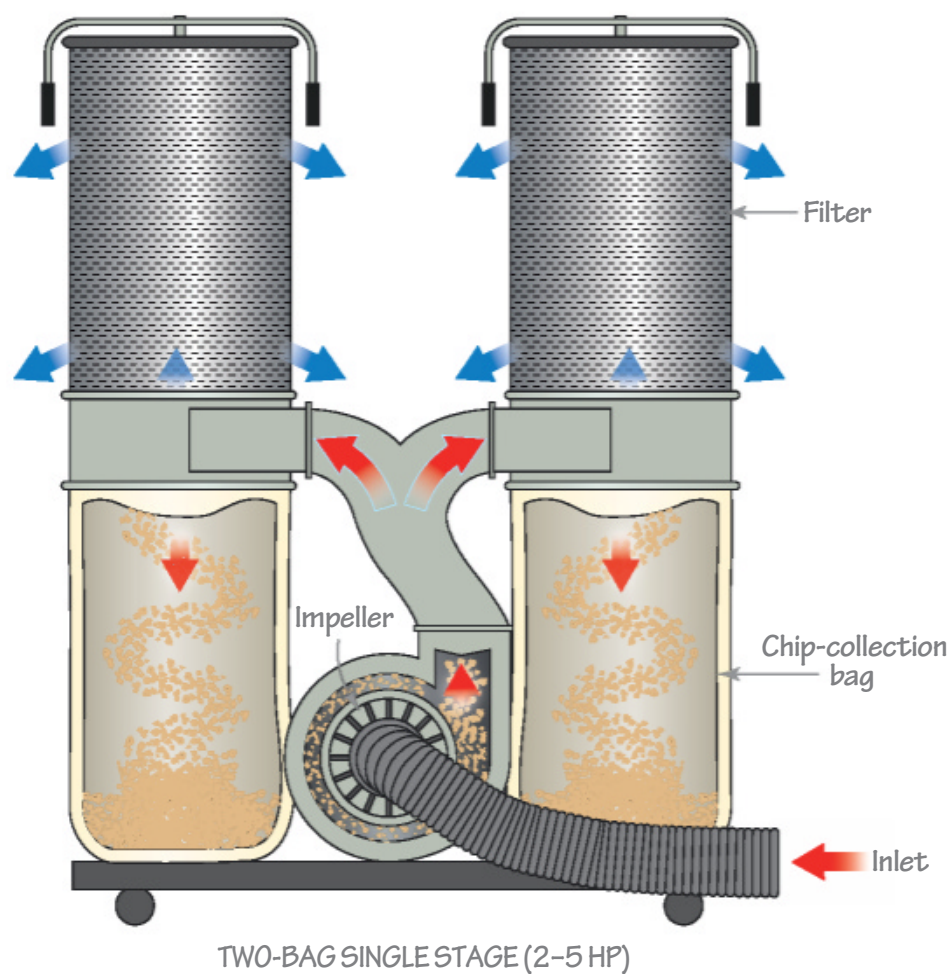
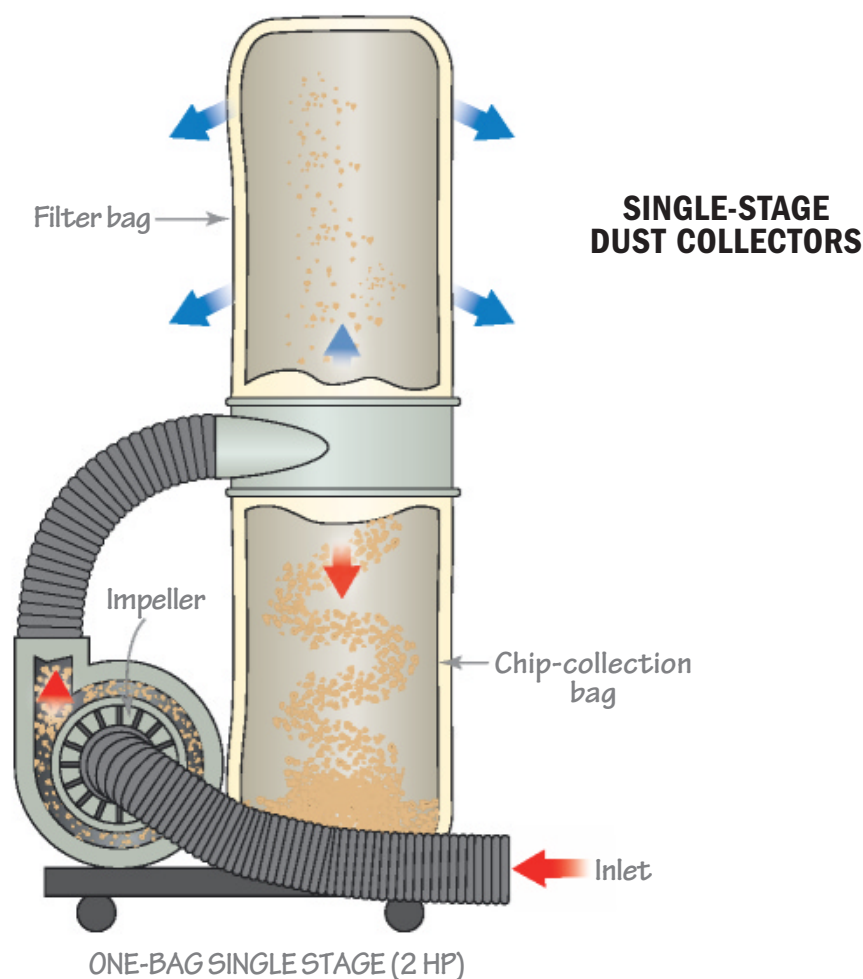
Overhead trunk lines keep ducts out from underfoot. But running ductwork up before routing it back down increases a run's length, adding resistance. A single-stage collector with a low inlet [Drawing, next page] will benefit from ductwork placed at floor or knee level. But if this puts ducts in walking paths and work areas, vertical branches may be required.

Run the largest pipe you can as close to the tool as possible. For example, to connect a 5" duct to a 4" tool port, place a reducer on the tool port rather than between the duct and a length of 4" flex hose. Or better yet, modify the tool port to match the duct size.

Every layout involves compromises. For example, in our shop, a diagonal trunk to the bandsaw and router table would have reduced duct length and eliminated two elbows. But we had to route the duct along the walls because the shop's drop ceiling provides no solid structure from which to hang the ductwork.

► Placing tools that require the greatest airflow closest to the collector reduces the amount of ductwork, allowing faster-moving air that better collects dust and debris.

► Oneida Air Systems, which provided technical advice for this article, provides a free design service for customers. oneida-air.com



Find the right-size collector

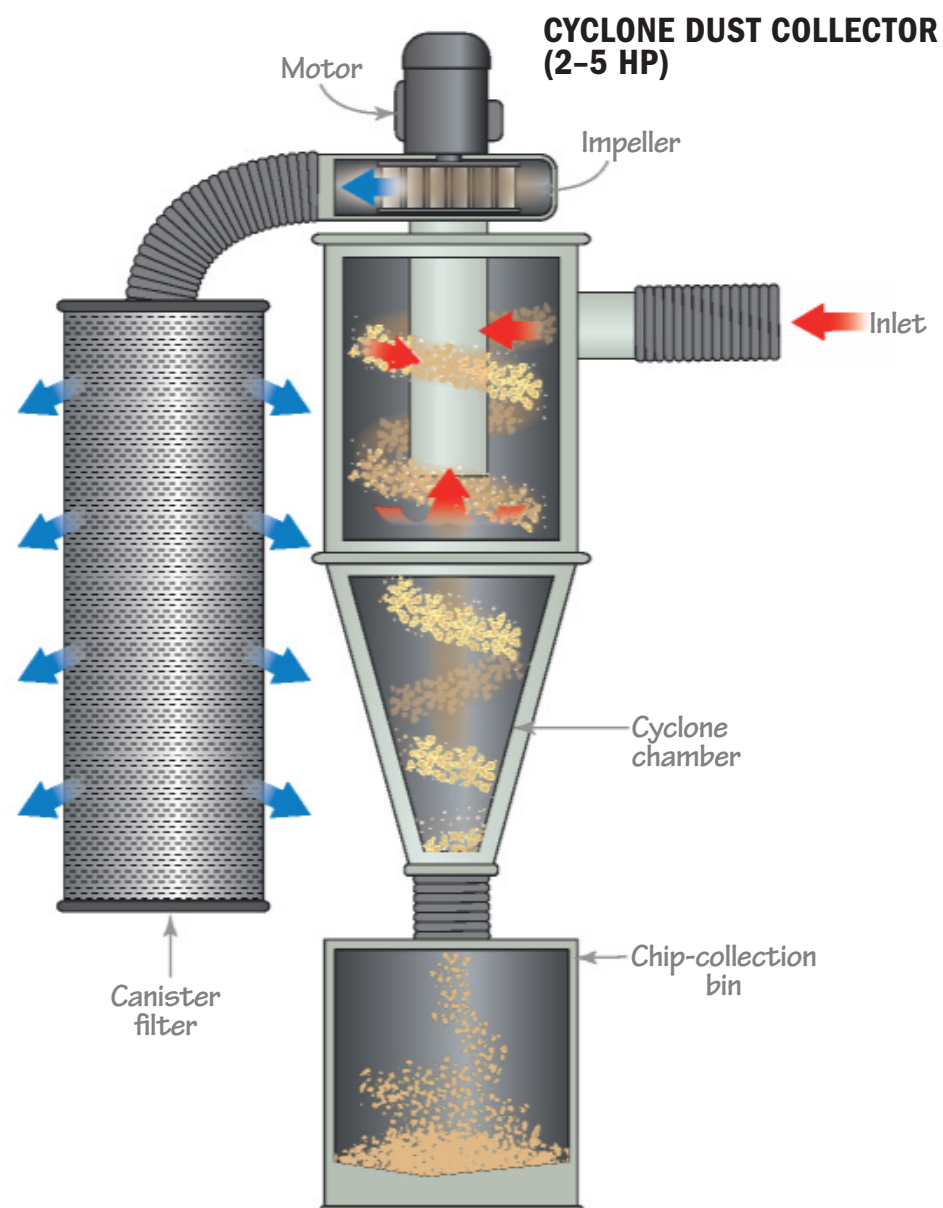
► Manufacturers determine cfm in a variety of ways. Our testing shows that in most cases, halving the claimed cfm provides a truer measure of performance when attached to ductwork.

► Some 2-hp dust collectors run on 110-volt circuits. Anything larger requires 220 volts.

The typical method for determining what size dust collector to purchase involves finding the static pressure (sp) of your ductwork, the airflow in cubic feet per minute (cfm) required to move dust from your tools, and plotting those two numbers on the fan curve for a given dust collector. The problem is finding a fan curve: Most manufacturers don't provide them. However, most list a cfm number. Our recommendation is to find a collector with a minimum of 2 hp, a 12" or larger impeller, and a rating of at least 1,300 cfm. If you have more than 20' of ductwork in any one run, you plan to open more than one branch at a time, or use lots of flex hose, bump up to a higher cfm, which may mean a 3-5 hp model. This may inflict a temporary hit on your budget, but a too-weak collector simply won't do the job.

Dust collectors come in two types: single-stage, *above*, and cyclone, *right*. Either can serve a whole-shop system. In both styles, a motor-driven impeller pulls debris-laden air through an inlet. In a single-stage collector, the debris passes *through* the impeller before the heaviest waste drops into a collection bag, while the filter bag captures smaller particles as the air exhausts. Airflow drops as dust coats the filter bag interior, but filtration typically improves. Wood chunks or metal debris drawn into the airflow can damage the impeller as they pass through. Two-bag collectors typically have more power and airflow than a single-bag.

In a cyclone, the airflow pulls dust into a conical chamber where it spins around,



gradually losing velocity so the majority of the material falls into a collection bin. Only the smallest particles pass through the impeller and on to the filter, so the filter stays cleaner, and airflow remains constant.

► Learn more about choosing a dust collector. woodmagazine.com/choosedc



► Read reviews of whole-shop dust collectors.

woodmagazine.com/dcreviews

The importance of the filter

If a collector spews fine dust back into the air, it's doing more harm than good [Photo A]. To protect your health, seals throughout the system must be tight and the filter must trap the smallest particles. Look for filters labeled HEPA (high-efficiency particulate air). They have been certified by a third-party tester to trap at least 99.97 percent of .3-micron particles. Avoid filters labeled "HEPA-type" or "HEPA-like," or that make vague claims such as "removes up to 99 percent of the smallest particles." Upgrading to an aftermarket filter [Photo B, Sources] can improve a collector that offers sufficient cfm but poor filtration.

The chicken-or-egg conundrum: Until the dust collector is in use, you don't know how effective it truly is at capturing dust. A simple test device [Photos C, D] measures air quality in real time. Consistently high read-

► It takes 1300 .3-micron particles side by side to span $\frac{1}{64}$ ".



A

Leaks around filters, collection bags, fittings, and ducts reduce a collector's effectiveness. Seal them with weather stripping, tape, or caulk.

ings indicate you should inspect your system for leaks. After sealing them, you'll know whether the dust-collector filter does its job well or requires an upgrade.

Tip! Eliminate raising dust with a broom by using a shop vacuum with a floor-sweep attachment and a HEPA filter.



B

In addition to better filtration, an aftermarket filter with more surface area can decrease resistance to air exiting the collector, improving cfm.



C

Before starting work for the day, the shop air quality measures "very good." After just a few seconds of brooming the floor, the reading jumps into the "poor" category, below. Using this air-quality meter [Sources] couldn't be simpler. Just plug it in and power it on.



D

Ductwork and connections

Choose ductwork in a diameter that matches the inlet on your dust collector [Photo E]. Options for ductwork include PVC and several types of metal piping. When calculating the full cost of a system, save money on ductwork, if needed, to invest in a better collector and filter.

► Get more info about the types of ductwork. woodmagazine.com/deducting

Of the options shown here, PVC pipe [Photo F] costs the least, about \$25 for a 10' section of 6" pipe, and many home centers stock it. The 4" and 6" diameters match the inlets on many collectors, but collectors with 5" inlets require adapters, and the mismatched duct reduces system performance. Wye fittings with 45° branches are suitable, but the tight radii of 90° elbows reduce system efficiency. Attaching flex hose requires adapters.

Snap-lock pipe [Photo G], typically used in home heating and cooling applications, offers elbows that can be adjusted to create broader radii, but the joints need to be sealed with tape. A 5' section of 24-gauge 6" pipe costs about \$25.

Spiral duct [Photo H] and Quick-Clamp pipe [Photo I] and their fittings are purpose-



E A larger port may be hiding behind a wye adapter. Match your duct to the inlet size, not the wye.

built for dust collection. Diameters of 4" and up ensure that you find the size best suiting your system. Elbows have smooth interiors and large radii, and heavy-gauge construction ensures durability. For 5' lengths of 6" pipe, spiral duct costs about \$35, and Quick-Clamp costs about \$45. You'll probably need to have these bulky items shipped.

F

Thin-wall PVC costs less than schedule 40 and proves plenty sturdy for dust-collection use.



G

The high volumes of air a whole-shop dust collector moves can collapse 26-gauge and thinner snap-lock pipe, so look for heavier-gauge pipe and fittings.



H

Spiral pipe requires pop rivets or sheet-metal screws to connect fittings, and joints must be caulked or taped.



I

Quick-Clamp uses snap-tension clamps that latch onto the lip at the end of each pipe and fitting. A gasket in the clamp creates an air-tight seal.





J A channel routed around the opening in this bracket cradles a Quick-Clamp gasket to secure the duct. (See **Sources** for the bit we used.) Cut the 4" hole in a 1½×6×7" block, drill screw pilot holes, then bandsaw the block in half.



K Place blast gates in easily accessible spots. They need not be right next to the tool's dust port.



L A hood behind the blade of a radial-arm saw directs sawdust up to the dust-collection duct.

Buy or make hangers to secure duct from walls and ceilings. *WOOD*® magazine Design Editor John Olson fabricated a holder [Photo J] to secure vertical duct runs.

Blast gates control airflow to branch lines, directing airflow to only the tool in use, helping the dust collector operate most efficiently. Operate gates [Photo K], whether shop-made or purchased, by pulling or pushing the gate open or closed.

Connecting most stationary tools is straightforward. Clamp a short section of flex hose to the tool port and then to the duct. If the port doesn't match the hose, use an adapter [Sources].

Collecting dust from mitersaws, radial-arm saws, and lathes can prove difficult because their open design lets material fly all over. Large hoods, purchased or shop-made, can corral and direct dust to your collector [Photo L].

Handheld tools, such as random-orbit sanders and routers, don't easily connect to

► Find ideas for collecting dust from your mitersaw and radial-arm saw.
woodmagazine.com/mitersawdust
woodmagazine.com/rasdc



M A dust extractor connected to the port of a random-orbit sander pulls dust through the holes in the sanding pad and traps it.

the large ductwork of a whole-shop system, and the small dust port on such tools chokes off airflow. Instead connect them to a shop vacuum or dust extractor with HEPA filtration [Photo M].

Super suction moves lots of air fast

As we worked with Oneida Air Systems to design a dust-collection system for our photo shop, they asked us to try the Supercell cyclone [photo, page 34], a new, small-shop approach to sucking up dust. Rather than a 3,450 rpm induction motor spinning a vaned impeller, three high-speed universal motors [photo right], like those found in a shop vacuum, sit atop the unit, pulling air through a HEPA filter rather than pushing. Our initial testing shows that the three motors create nearly ten times the suction of a standard collector, and two to three times the cfm of a shop vacuum.

The higher cfm proves sufficient for drawing dust through 4" duct connected to stationary tools. The high suction provides plenty of velocity through 2½" hose connected to smaller ports, such as on a router table or random-orbit sander. It also overcomes far more resistance, reducing the need to minimize sharp turns, duct length, and flex hose.

The Supercell requires 220 volts, and lists for \$2,400 to \$2,500, depending on the drum size. Look for a more complete review in an upcoming issue. 🌱



Sources:

Filters:
 American Fabric and Filter, 877-742-3653, americanfabricfilter.com.
 Metal duct:
 Oneida Air Systems, 800-732-4065, oneida-air.com;
 Rockler, 800-279-4441, rockler.com.
 Dust-collection fittings, adapters, and accessories:
 Woodcraft, 800-225-1153, woodcraft.com,
 Rockler.
 Freud ⅛"-radius flute bit no. 99-029, \$48, Woodcraft.
 Dylos DC-1100 Pro air quality monitor, \$260, woodmagazine.com/dylos.

Produced by **Craig Ruegsegger**

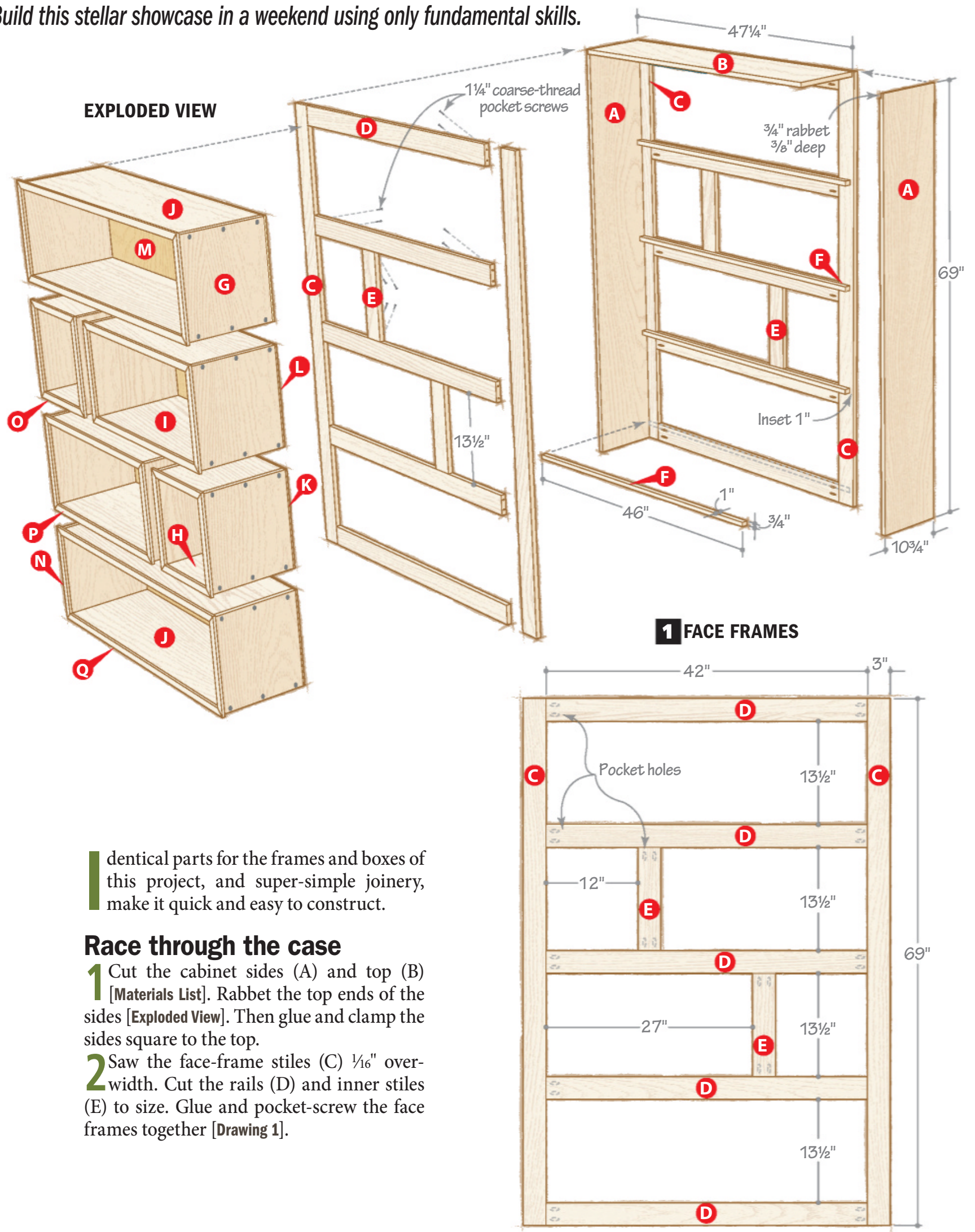


D I M E N S I O N S :
48" W x 12⁵/₈" D x 69" H

Approximate materials cost:
\$340
with oak boxes and trim

Display Shelves

Build this stellar showcase in a weekend using only fundamental skills.

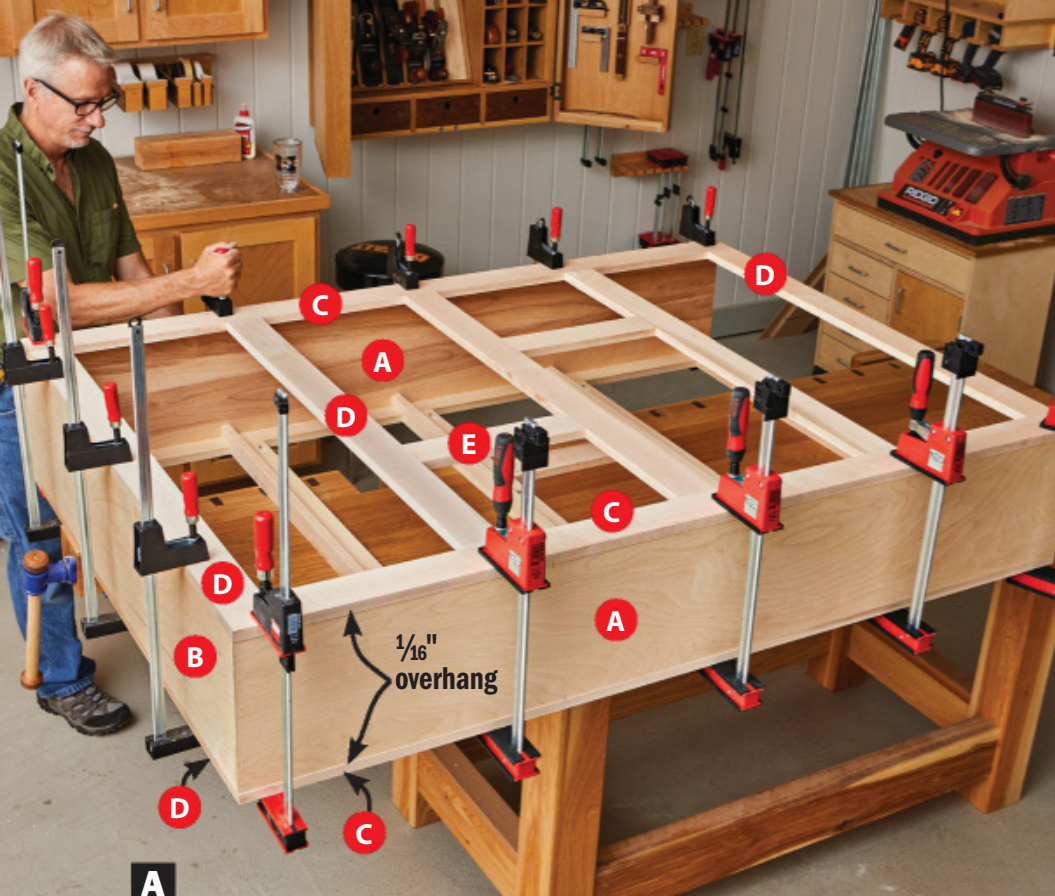


Identical parts for the frames and boxes of this project, and super-simple joinery, make it quick and easy to construct.

Race through the case

1 Cut the cabinet sides (A) and top (B) [Materials List]. Rabbet the top ends of the sides [Exploded View]. Then glue and clamp the sides square to the top.

2 Saw the face-frame stiles (C) 1/16" over-width. Cut the rails (D) and inner stiles (E) to size. Glue and pocket-screw the face frames together [Drawing 1].



A $\frac{1}{16}$ " overhang of the frame stiles (C) on the sides (A) makes it easy to flush-trim the stiles.

Tip! For more control over such a large glue-up, attach one frame at a time to the sides (A) and top (B).

3 Cut the support cleats (F) and glue them to the inside face of the rear frame, flush at the top of the rails (D) and centered between the stiles (C) [Exploded View].

4 Glue the face frames (C–E) to the case (A/B), overhanging the sides [Photo A]. Rout the stiles (C) flush with the cabinet sides (A), and finish-sand the assembly.

Slide in the shelf boxes

1 Cut box parts G–M to size [Materials List] and mark the outside faces. Sand the inside faces, then glue and screw the sides (G) to the tops and bottoms (H–J) [Drawing 2]. Set the backs (K–M) aside.

2 Cut the box trim (N–Q) 2" overlength. Miter-cut the trim to length [Photo B]. Glue and clamp the trim flush with the



B For each trim piece, miter-cut one end, rest the inside edge flush with the inside face of a box panel, and mark the opposite end to be cut.

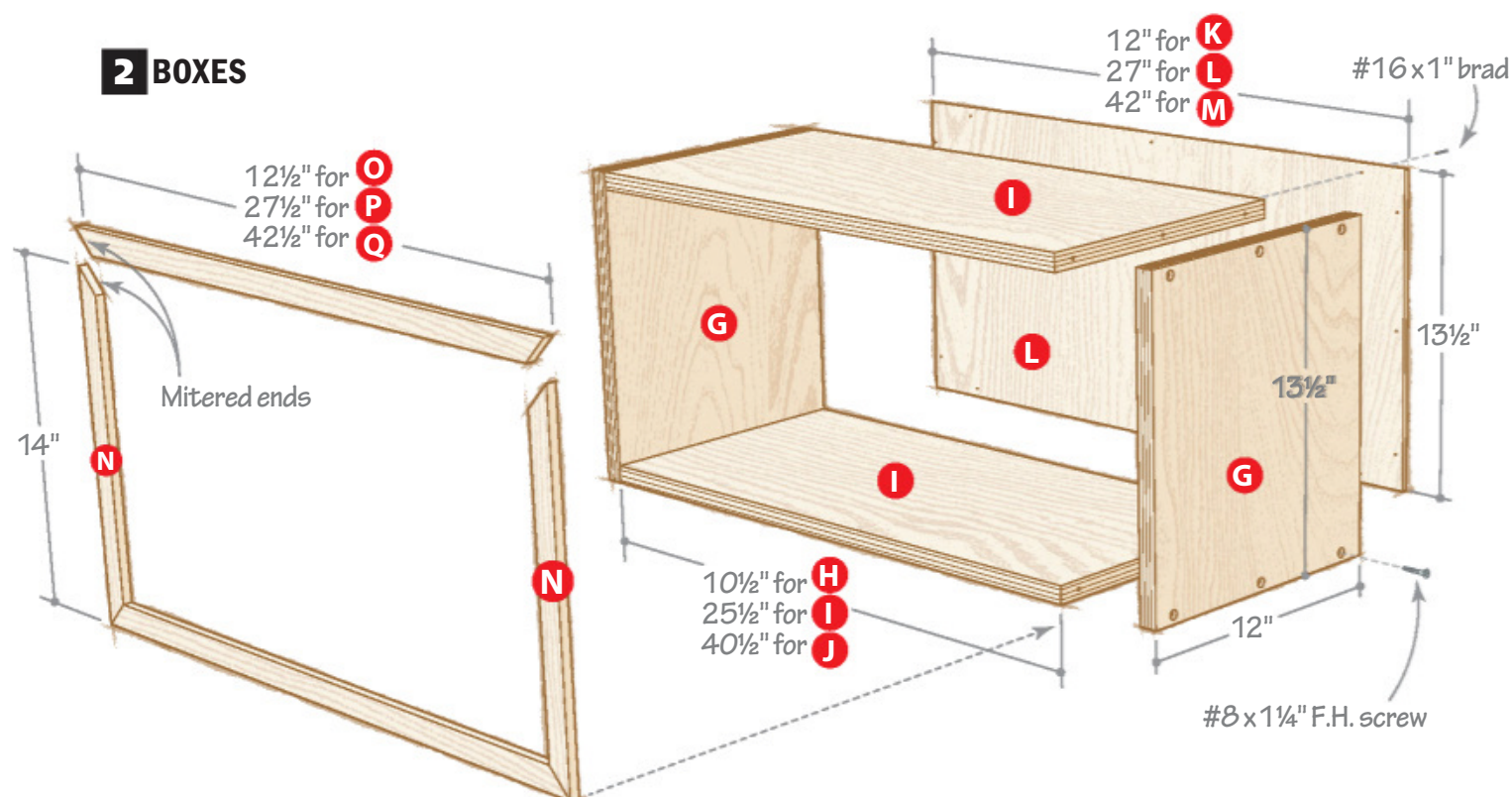
inside faces of the box (G and H, I, or J). Repeat for each box.

3 Apply a clear finish to the insides of the boxes and box backs (K–M), then paint the case [Sources].

4 Starting at the top, slide a box in until the box trim rests flat against the frame and screw the box bottom to the rear support cleat (F). Working down, repeat for the rest of the boxes and nail on the backs (K–M). 🌲

► Cut gap-free frame miters.
woodmagazine.com/miters

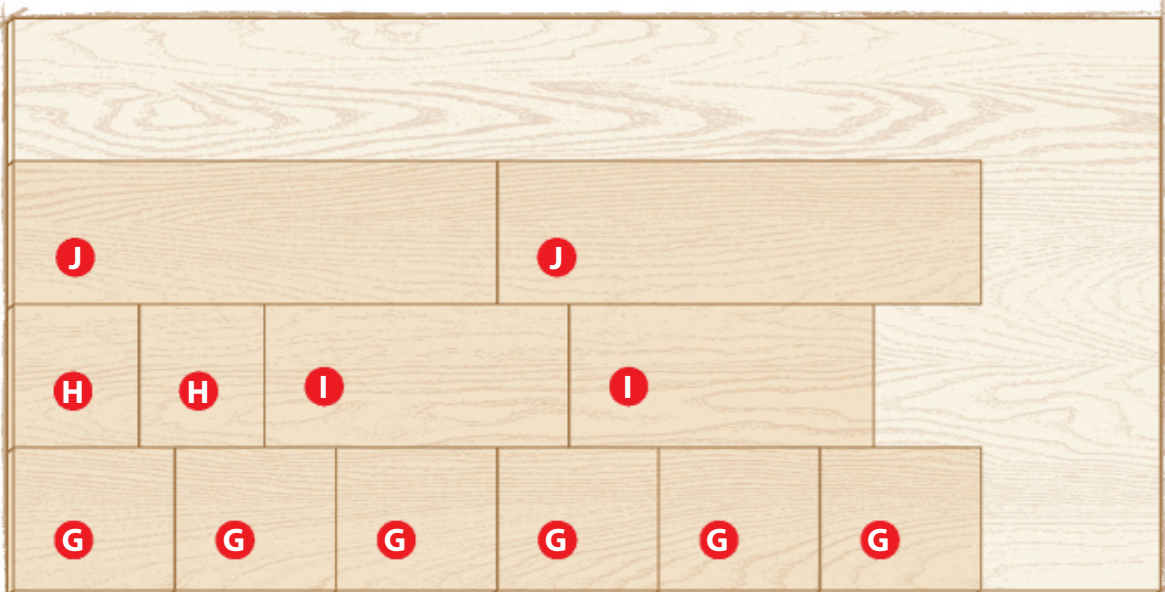
2 BOXES



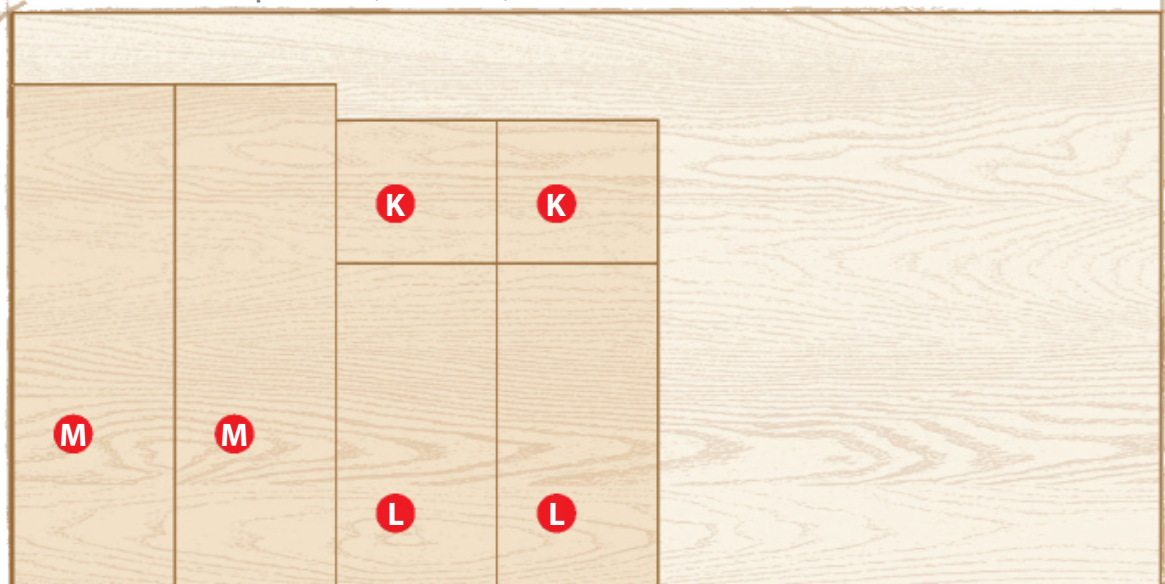
Cutting Diagram



3/4 x 48 x 96" Birch plywood



3/4 x 48 x 96" Oak plywood (2 needed)



1/4 x 48 x 96" Oak plywood



3/4 x 9 1/4 x 96" Pine (2 needed)



3/4 x 7 1/4 x 96" Pine (2 needed)



3/4 x 3 1/2 x 96" Pine



3/4 x 7 1/4 x 96" Oak *Plane or resaw to the thickness listed in the Materials List.

Materials List

Part	FINISHED SIZE			Matl.	Qty.	
	T	W	L			
Cabinet						
A	sides	¾"	10¾"	69"	BP	2
B	top	¾"	10¾"	47¼"	BP	1
C*	stiles	¾"	3"	69"	P	4
D	rails	¾"	3"	42"	P	10
E	inner stiles	¾"	3"	13½"	P	4
F	support cleats	¾"	1"	46"	P	4
Boxes						
G	sides	¾"	12"	13½"	OP	12
H	short top/bottom	¾"	12"	10½"	OP	4
I	medium top/bottom	¾"	12"	25½"	OP	4
J	long top/bottom	¾"	12"	40½"	OP	4
K	short backs	¼"	12"	13½"	OP	2
L	medium backs	¼"	27"	13½"	OP	2
M	long backs	¼"	42"	13½"	OP	2
N*	vertical trim	⅜"	1"	14"	O	12
O*	short horizontal trim	⅜"	1"	12½"	O	4
P*	medium horizontal trim	⅜"	1"	27½"	O	4
Q*	long horizontal trim	⅜"	1"	42½"	O	4

*Parts initially cut oversize. See the instructions.

Materials key: BP-birch plywood, P-pine, OP-oak plywood, O-oak.

Supplies: 1 1/4" coarse-thread pocket-hole screws, #8 x 1 1/4" flathead screws, #16 x 1" brads.

Bit: 1/2"-dia. flush-trim router bit.

Source: Sherwin-Williams satin latex paint in Denim (SW 6523), available from local retailers and sherwin-williams.com.

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



SHOP TEST

Compact Cordless Drills

No longer a luxury, these tools prove invaluable in the shop, home, and job site.

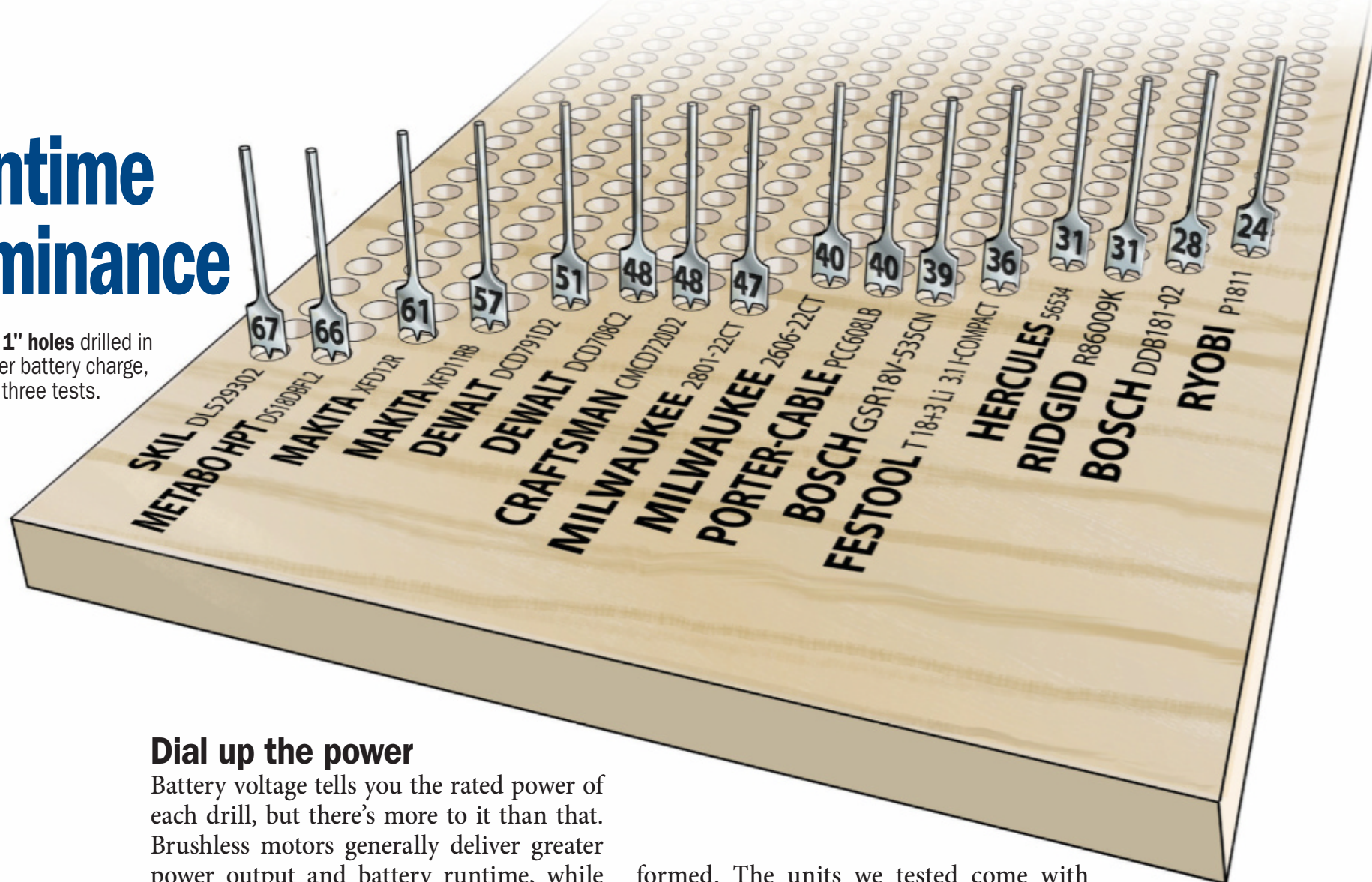
Although you can buy larger (and smaller) drills, a compact 18- or 20-volt tool handles any job in the shop with ease. These tools have plenty of power, yet come in a size much easier to use building projects than bulkier full-size

models. To find the best of the compact cordless drills, we tested 16 popular models head-to-head in the *WOOD*® shop. Spoiler alert: Even the lowest-ranked drill will perform adequately in your shop, but several models really stand out.



Runtime dominance

Number of 1" holes drilled in 2x6 pine per battery charge, average of three tests.



Dial up the power

Battery voltage tells you the rated power of each drill, but there's more to it than that. Brushless motors generally deliver greater power output and battery runtime, while generating less motor- and battery-killing heat, than standard carbon-brush motors. Eleven of the 16 tested drills use brushless motors. (See the chart on page 48.)

All of the test models have enough power to drill holes in hardwood and drive screws, but some pack more power than others. To compare each tool's torque, we drove successively larger-diameter 2"-long lag screws into pressure-treated pine 4x4s. All the models easily seated a 1/4" lag, and only two failed to drive a 3/8" lag to full depth (Festool T 18+3 Li 3.1 I-Compact and Ryobi P1811); another failed to seat a 1/2" lag (Hercules 56534). At the top of the range, six models proved capable of fully seating 5/8" lags: Bosch GSR18V-535CN, DeWalt DCD791D2, Makita XFD12R, Metabo HPT DS18DBFL2, Milwaukee 2801-22CT, and Ridgid R86009K. You might never need that much torque, but it's good to know they're capable of it.

Each model has two speed ranges and a variable-speed trigger. You'll get the most torque in the lower range, which is best for driving screws and drilling holes 1 1/2" or more in diameter. The high-speed range works best for drilling smaller holes and powering accessories, such as wire wheels and sanding flap wheels.

Most tools run on and on

Several factors determine a drill's runtime per battery charge: battery amp-hours, motor efficiency, electronic controls, and the strenuousness of the task being per-

formed. The units we tested come with battery packs ranging from 1.3 to 4.0 amp-hours each; we tested all drills with their supplied packs only. Each model will also run on larger battery packs within that company's voltage platform, giving you longer runtimes.

To gauge runtime, we drilled 1" full-depth holes in 2x6 pine boards, using a new spade bit for each test, drilling until the battery gave out. (See the chart above.) The Skil DL529302 topped that test with an average of 67 holes per charge, followed closely by the Metabo HPT. Long runtimes are important, especially on a job site where outlets can be scarce. But in a woodworking shop, you really only need enough runtime so that you don't run out of juice before the second battery pack is charged. Longer runtimes may also mean longer battery life, assuming you can get only a certain number of charge cycles on each pack. (Most come with two packs, but the Skil comes with one pack. The Bosch GSR18V-535CN and Hercules sell as bare tools with no battery packs.)

Battery charge times vary. The Makita packs charged fastest at 24 minutes, almost challenging you to expend a pack before a second one recharges. The Milwaukee 2606-22CT and Festool packs also charged in 30 minutes or less. By contrast, the Metabo HPT and Porter-Cable PCC608LB packs needed 99 and 109 minutes, respectively, to charge fully. For many of us, a full charge could last a week or two, so charge time might prove less important to you.

▶ A battery pack's amp-hour rating equates to the amount of gas in a car's tank: The more amp-hours, the longer the runtime—and the larger the pack size.

▶ Despite marketing claims, 20-volt lithium-ion battery packs essentially equal 18-volt packs in terms of power. That's because both battery packs consist of five cells, each outputting 3.6 volts—a total of 18 volts. But some manufacturers claim a brief output of 20 volts with a fully charged five-cell pack. That's why those packs say "20 volts max," or something similar.



Charge-level indicators on the battery pack (shown on the Bosch Core 4.0 amp-hour pack) prove easiest to gauge. Five LEDs give a more refined reading than three- and four-cell indicators.



A USB port on Skil's battery pack allows you to plug in and charge a cell phone or similar device, with the battery pack attached to the drill or not.



Clutch position determines its ease of use. On models with carbon-brush motors, the clutch ring sits forward of the handle and trigger. But on brushless-motor models, the clutch ring is farther back, where the handle and trigger interfere.

Our favorite drills have a charge-level indicator on the battery pack (*above*), so you can check it without installing it on the tool. Eleven models have this feature. The Metabo HPT indicator is located on the drill, so the pack must be attached to read it. Festool has indicators on both the battery pack and drill. Disappointingly, the Bosch DDB181-02, DeWalt DCD708C2, Porter-Cable, and Ryobi have no indicator at all.

Clutches vary in ergonomics

Each test drill features an adjustable clutch for varying the degree of torque applied at the chuck to prevent stripping out fasteners. Set it to a low number to drive small screws (especially brass), and adjust up as needed for larger screws. For drilling, set the clutch at the maximum setting. Each clutch performed its job well enough, but the best clutches rotate easily with good grip points and easy-to-read increments. We found the clutches on

the drills with brushless motors more difficult to operate, as shown *above, right*.

Festool's clutch dial, our favorite, adjusts from the rear of the tool and automatically changes motor speed as you adjust the clutch. The Bosch GSR18V-535CN has anti-kickback protection built in, preventing the tool jerking your hand unexpectedly should the bit bind.

Discover more drill details

■ **Switches and controls.** We found no significant issues with the power triggers on any of the drills. But the speed-range selectors on the Craftsman, DeWalt DCD708C2, and Milwaukee 2606-22CT models operated stiffly.

■ **Task lights.** Each drill has at least one LED to light up the area in front of the chuck, *below*. We like lights mounted near the battery, rather than those mounted beneath the chuck and clutch.

► Learn more about battery-powered tools for a woodworking shop. woodmagazine.com/cordlesstools



LEDs located beneath the clutch assembly cast a chuck shadow in the work area, sometimes blocking light from exactly where you want it.



LEDs mounted on the drill base better illuminate the work area without shadows. This DeWalt has three brightness settings, with the brightest staying on for 20 minutes (so it acts as a flashlight).



Ridgid's drill has a trigger for the LED that activates when you grip the tool. The LED stays on for 10 seconds after you release the trigger.



Festool's drill uses a quick-connect system for swapping detachable chucks.

■ **Warranty.** Except for the Hercules, all of the drills offer at least a 3-year warranty for the tool itself. The Metabo HPT has a lifetime warranty for the drill; Ridgid offers a lifetime service agreement upon registration for the drill and batteries. All but two models have 2- or 3-year warranties for their batteries, a big plus for the part most likely to fail.

■ **Accessory chucks.** Festool's drill comes with two chucks (*above*): a 3-jaw chuck for drilling, and 1/4" hex chuck for driving screws. You can also buy three optional chucks for specific screw-driving applications: right angle, offset eccentric, and depth stop.

■ **Storage cases.** Seven drills come with a plastic storage case, and six have a canvas bag. The Bosch GSR18V-535CN, Porter-Cable, and Skil models have neither.

■ **Belt hook.** Thirteen of the test drills provide a removable belt hook, handy when working on a ladder or job site.

■ **Wireless connectivity.** The Bosch GSR18V-535CN provides the option to add a Bluetooth connectivity module (\$40) to monitor the tool and affect some controls via a smartphone app, a feature more beneficial for pros on a job site. Festool's battery packs can trigger their Bluetooth-connected dust extractor.

18- and 20-volt cordless drills:

MODEL	PERFORMANCE RATINGS (1)								
	PRIMARY		SECONDARY						
	OBSERVED TORQUE	RUNTIME PER CHARGE	BATTERY CHARGE TIME, MINUTES	EASE OF USING CHUCK	EASE OF USING CLUTCH	EASE OF USING POWER SWITCH	EASE OF USING SPEED-RANGE SELECTOR	OVERALL FEEL AND BALANCE	LED EFFECTIVENESS
BOSCH DDB181-02	B+	C-	48	A-	C-	A	A-	A	B+
BOSCH GSR18V-535CN	A	B-	72	A	B	A-	B	B+	A-
CRAFTSMAN CMCD720D2	A-	B	57	A-	B-	A-	C	B	A-
DEWALT DCD708C2	B+	B	69	A	C	A	C+	A	A-
DEWALT DCD791D2	A	B+	57	A	B	A	B-	A	A
FESTOOL T 18+3 Li 3.1 I-COMPACT	B-	C+	30	A	A	A	A	B	C
HERCULES 56534	B	C	54	A	A-	B	A-	B	C
MAKITA XFD11RB	B+	A-	24	A	C-	A	B	A	B+
MAKITA XFD12R	A	A	24	A	C+	A	B	A	B+
METABO HPT DS18DBFL2	A	A	99	A	C	A	B+	B	B+
MILWAUKEE 2606-22CT	A-	B-	29	A	A	A	C	B	B-
MILWAUKEE 2801-22CT	A	B	40	A	B-	A	B	A	B+
PORTER-CABLE PCC608LB	A-	B-	109	B+	B-	A	B	B	B+
RIDGID R86009K	A	C	50	A	B	A	B+	B	A
RYOBI P1811	B-	C-	50	B	A-	B-	B+	B	B-
SKIL DL529302	A-	A	33	A-	A	B+	A	A	C



DeWalt DCD791D2



Makita XFD12R



Milwaukee 2801-22CT



Bosch DDB181-02

A woodworker's best friend

MOTOR		BATTERY PACKS						WARRANTY, YEARS (4)				CONTACT INFORMATION
TYPE (2)	MAXIMUM SPEED PER RANGE, RPM	NUMBER OF PACKS INCLUDED	LISTED VOLTAGE	AMP-HOURS	CHARGE-LEVEL INDICATOR ON PACK? (YES, NO)			DRILL	BATTERY PACKS			
C	400 / 1,300	2	18	1.5	N	B, H	3-2	3	2	M	\$100	877-267-2499, boschtools.com
B	600 / 1,900	0	18	4.0	Y	H	3-12	3	2	M	\$130*	877-267-2499, boschtools.com
B	600 / 2,100	2	20	2.0	Y	B, H	3-8	3	3	U	\$160	888-331-4569, craftsman.com
B	450 / 1,650	2	20	1.5	N	B, H	3-2	3	3	C	\$160	800-433-9258, dewalt.com
B	550 / 2,000	2	20	2.0	Y	C, H	3-6	3	3	U	\$200	800-433-9258, dewalt.com
C	450 / 1,500	2	18	3.1	Y	C, H	3-12	3	1	C/P	\$660	888-337-8600, festoolusa.com
C	600 / 2,000	0	20	2.5	Y	C, H	3-10	90 days	90 days	C	\$50**	800-423-2567, harborfreight.com
B	500 / 1,700	2	18	2.0	Y	C, H	2-14	3	3	C	\$200	800-462-5482, makitatools.com
B	500 / 2,000	2	18	2.0	Y	C, H	3-8	3	3	C	\$170	800-462-5482, makitatools.com
B	400 / 1,800	2	18	3.0	N	B, H	3-11	L	2	C	\$200	800-829-4752, metabo-hpt.com
C	450 / 1,800	2	18	1.5	Y	C	3-13	5	3	C	\$180	800-729-3878, milwaukeetool.com
B	450 / 1,800	2	18	2.0	Y	C, H	3-7	5	3	C	\$200	800-729-3878, milwaukeetool.com
B	430 / 1,700	2	20	1.3	N		3-3	3	3	C	\$120	888-848-5175, portercable.com
B	500 / 2,000	2	18	1.5	Y	A, B, H	3-15	3*	3*	C	\$120	866-539-1710, ridgidpowertools.com
C	400 / 1,600	2	18	1.3	N	B	3-11	3	3	C	\$80	800-525-2579, ryobitools.com
B	480 / 1,800	1	20	2.0	Y	H	3-6	5	2	C	\$130	877-754-5999, skil.com

1. **A** Excellent 2. (B) Brushless 3. (A) Auxiliary handle 4. (L) Limited lifetime warranty 5. (C) China 6. Prices current at time of article production and do not include shipping, where applicable.
B Good (C) Carbon brush (B) Canvas bag (*) Lifetime service agreement upon registration (C/P) Drill: Czech Republic; Battery: Poland
C Fair (C) Plastic case (M) Malaysia
D Poor (H) Belt hook (U) United States
 (*) Drill only; 4.0 Ah batteries and charger \$185
 (**) Drill only; 2.5 Ah battery and charger \$65

How to spend your drill dollars

Three drill/drivers rose to the top of this talent-rich pool: the DeWalt DCD791D2 (\$200), Makita XFD12R (\$170), and Milwaukee 2801-22CT (\$200). They share Top Tool honors.

If you're looking to save a few bucks, consider the Skil DL529302. It's a great performer, but comes with just one battery pack for \$130. For our money, the Bosch DDB181-02 at \$100 (with two battery packs) is our Top Value. 🌳

Produced by **Bob Hunter** with **Peter Kasper**
 Illustration: **David Kallemyn**

► Build a handy storage shelf for your cordless drills and chargers.
woodstore.net/drillstation



Improve job security with Two Vises



Either of these vises will ease your woodworking life; adding both will *change* your life.

The twin-screw vise [Sources] accommodates wide or long pieces between the screws for slip-free holding: just the ticket when hand-cutting dovetails. The long jaws steady a board for edge jointing with a hand plane, and bench-dog holes at each end align with rows on the benchtop.

The leg vise features a deeper throat (distance from the top of the bench to the vise screw) and a larger jaw opening than just about any other vise. Leverage provided by the long jaw means more clamping pressure. With most parts made of wood, you'll buy only the screw assembly, saving dough.

Manufacturer's instructions included with the vises cover installation for different workbench configurations. We'll use the Workbench on *page 24* to demonstrate the installation of these two vises. But workbenches are as unique as the woodworkers who use them, so you may need to adapt the technique and dimensions to suit your own bench. *Read the manufacturer's instructions for part identification and details concerning adjustment and troubleshooting.* Note that in our installation the workbench end skirt acts as the rear jaw for the twin-screw vise, eliminating the need for the rear-jaw mounting hardware and steel dowel pins listed on the Vise Components drawing in the manufacturer's instructions.



Twin-screw end vise

Make the jaw

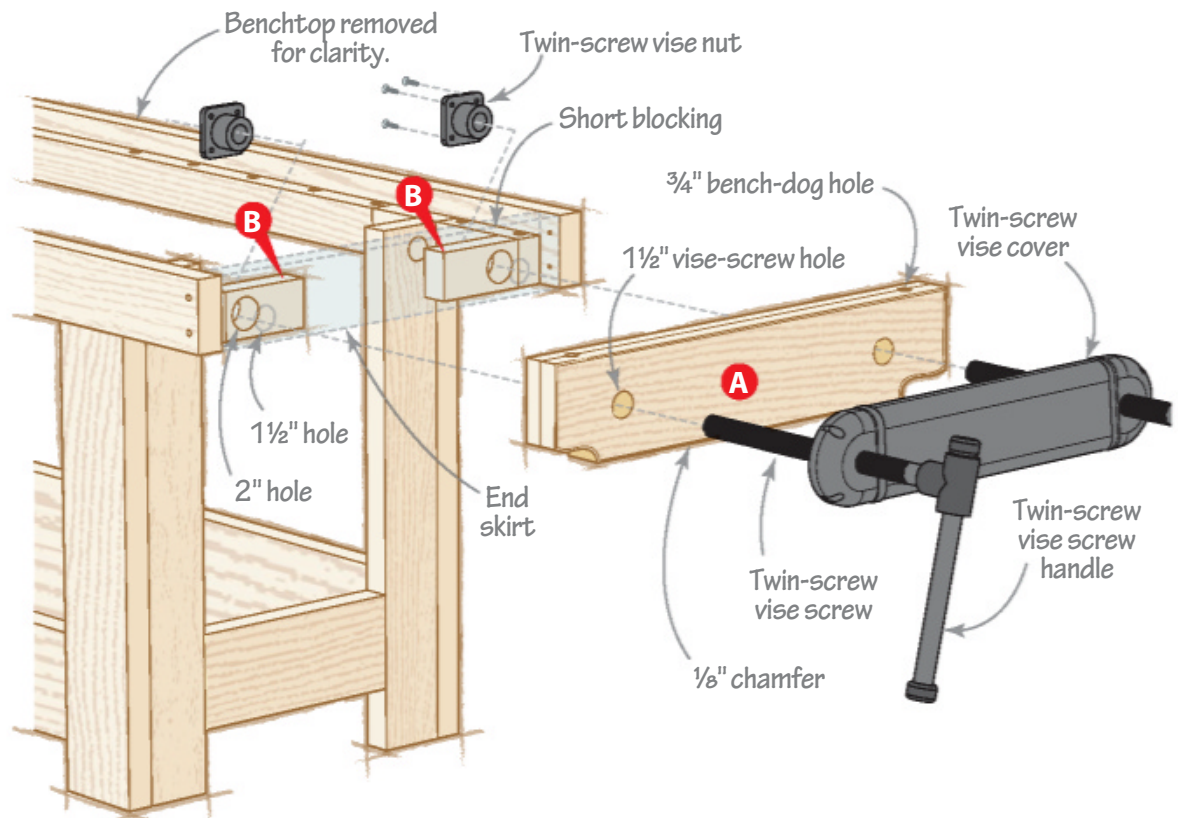
1 Laminate an over-size blank for the front jaw (A) [Materials List, End-Vise Exploded View] and cut it to size. On the drill press, drill the vise-screw holes and bench-dog counterbores and holes [Drawing 1]. Shape the bottom corners and chamfer the front edges.

2 Clamp the front jaw to the workbench end skirt, flush at the top and ends, capturing scrap backer blocks on the inside face of the skirt. Drill vise-screw holes through the skirt [Photo A]. Remove the clamps, front jaw, and backers.

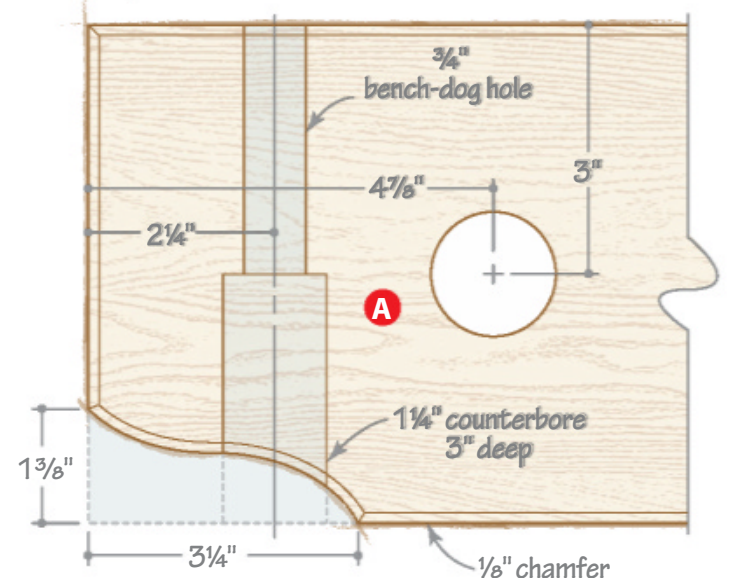
3 Remove the benchtop from the base and position the top upside down. Cut the vise-nut blocks (B) [Exploded View] and clamp them into the corners where the short blocking meets the end skirt. Using the 1½" bit and the vise-screw holes in the skirt as guides, mark hole centers on the vise-nut blocks. Mark the blocks for re-installation, remove them, and drill the 2" holes at the drill press.

4 Insert the vise nuts into the block holes, drill pilot holes, and fasten the nuts with the provided #14×1½" screws. Install the blocks [Photo B].

END-VISE EXPLODED VIEW



1 JAW

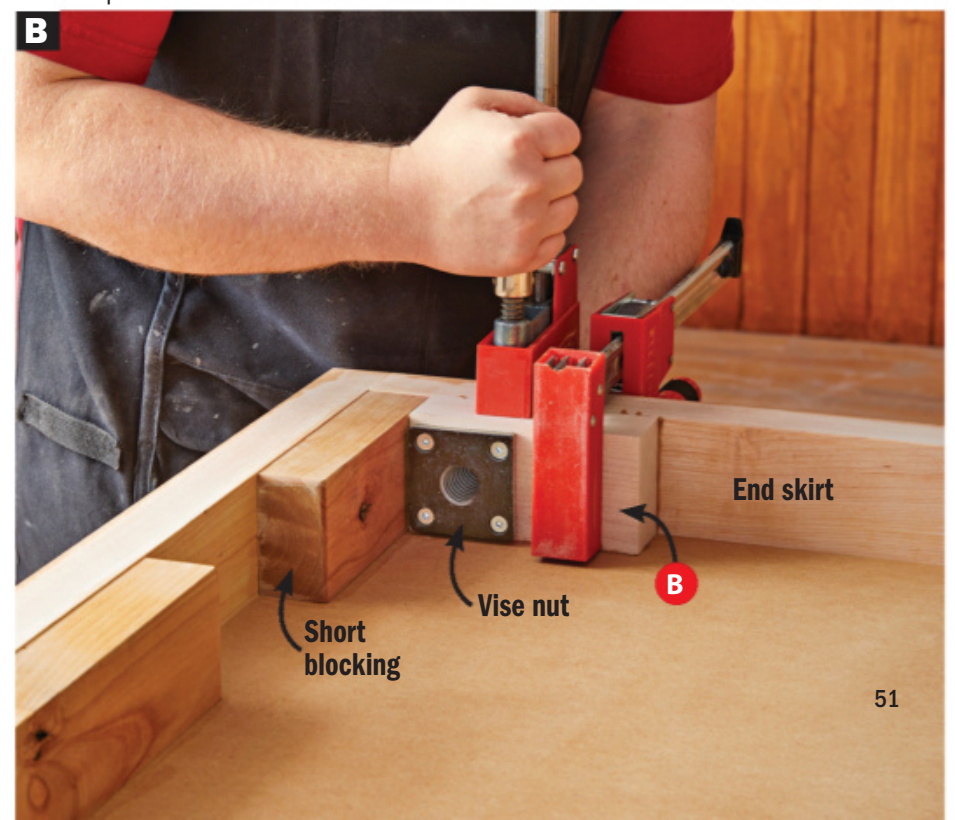


Tip! To prevent binding and ensure smooth vise-screw operation, check the perpendicular alignment of the drill press table and drill bit before drilling any parts.

Extend 1½" vise-screw holes through the bench skirt with a Forstner bit, using the holes in the jaw (A) as guides.



Glue and clamp the vise-nut blocks (B), with nuts installed, into the benchtop corners.





C Drill vise-screw pass-through holes in the leg narrow uprights, clamping a scrap backer block to the back face to prevent tear-out.

Note: Slightly tapering the front jaw (A) ensures equal holding power across the width of the jaw under full clamping pressure.

Note: We installed the driving screw with the spring-loaded pin on the right and the follower screw on the left. You may reverse this orientation if you wish.

5 Drill 1½" holes where the vise screws pass through the legs [Exploded View, Photo C]. Reinstall the benchtop on the base.

6 Form a 2° taper on the inside face of the front jaw by double-face taping a spline to the jaw [Drawing 2] and running the jaw spline-side-down through a surface planer.

Add the hardware

1 Remove the rust-inhibiting wax coating from the vise screws with mineral spirits and an old toothbrush. With the chain wrapped around the sprockets and the spring-loaded pin engaged in the right-hand sprocket, slide the front jaw onto the vise screws. Then, thread the vise screws into the vise nuts in the benchtop, keeping the front jaw parallel to the benchtop skirt. Tighten the screws enough to hold the jaw in place. Align the jaw ends and top edge with the

end of the benchtop and orient the vise-screw thrust plates vertically [Drawing 3]. Using the thrust-plate holes as guides, drill pilot holes and secure the plates with the provided lag bolts and washers. Do not over-tighten.

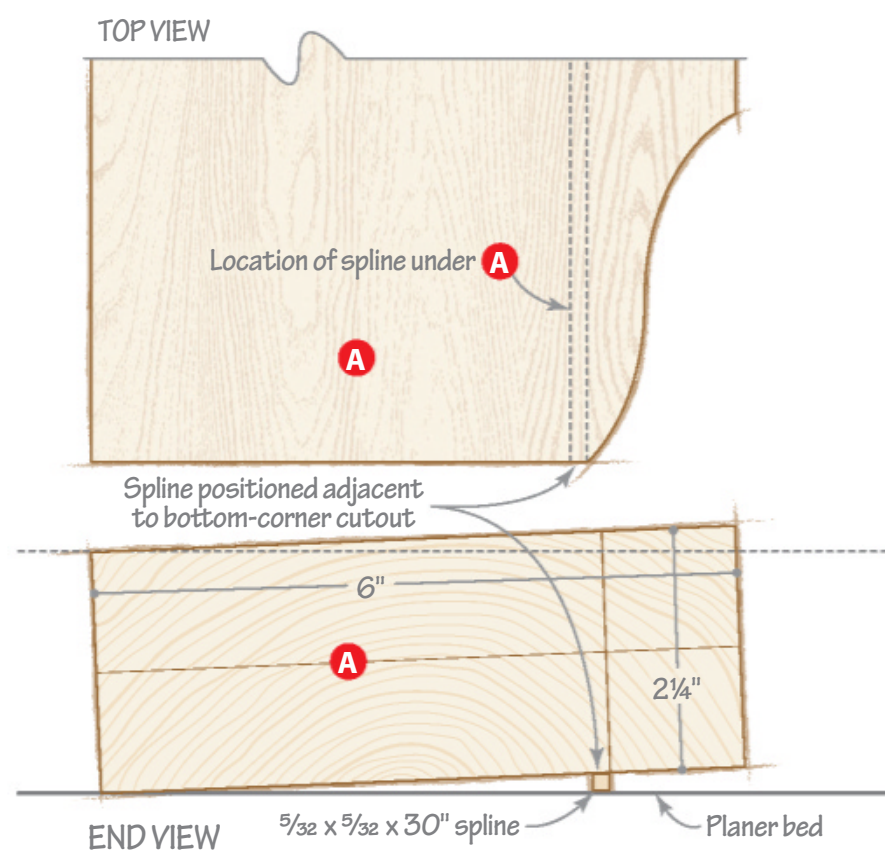
2 Make sure the spring pin engages the right-hand sprocket and "zero" or permanently align the vise jaws [Drawing 3].

3 Cut the main cover to length [Drawing 4] and insert it between the end caps with its ends under the end-cap flanges. Mark the mounting holes onto the front jaw. Remove the cover, drill pilot holes, and install the cover with the provided screws.

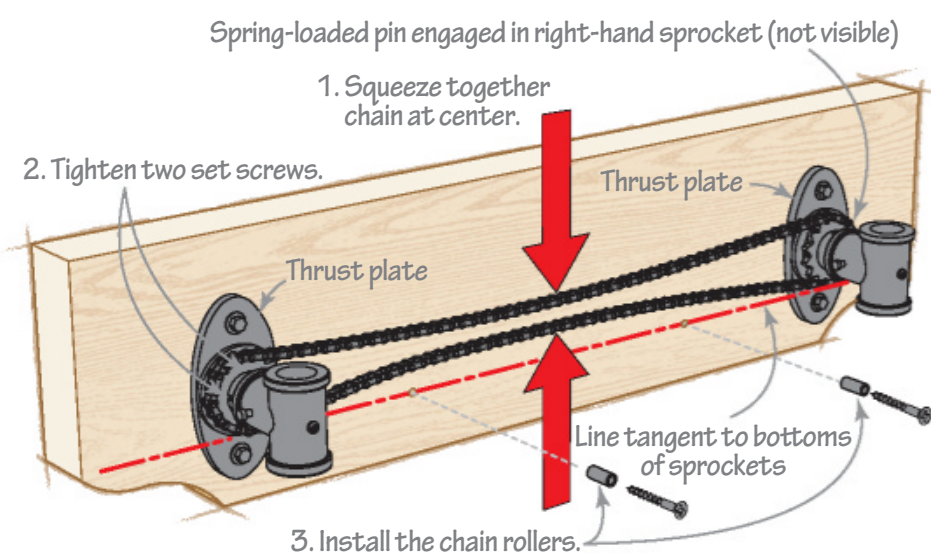
4 Assemble and install the vise handles, following the manufacturer's instructions. Lubricate the screws with grease. Wipe any excess off the thread crown, leaving grease only in the thread grooves.

Note: To accommodate the vise screw center-to-center distance for this installation, shorten the supplied chain to 62 links, following the manufacturer's instructions.

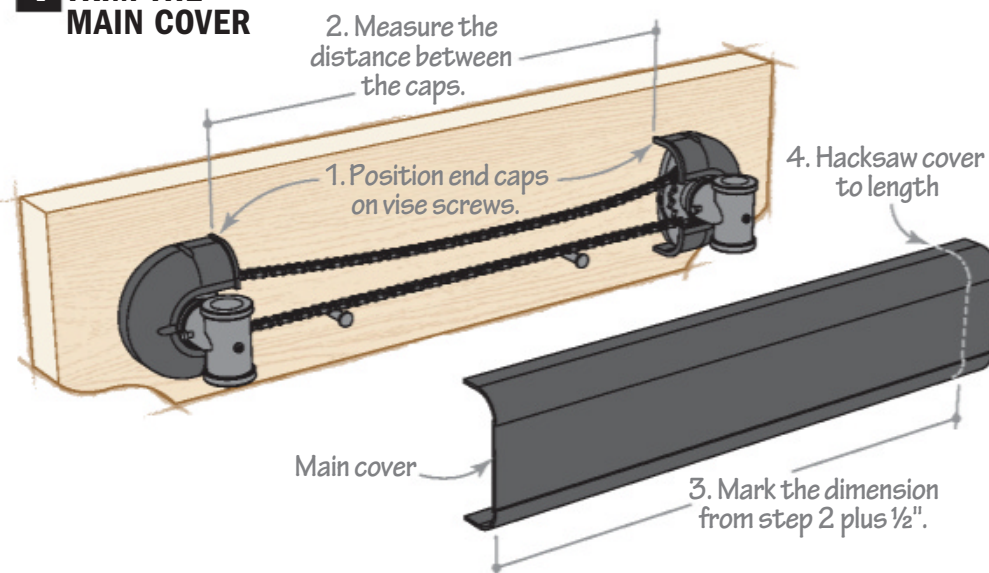
2 FRONT JAW TAPER



3 CHAIN

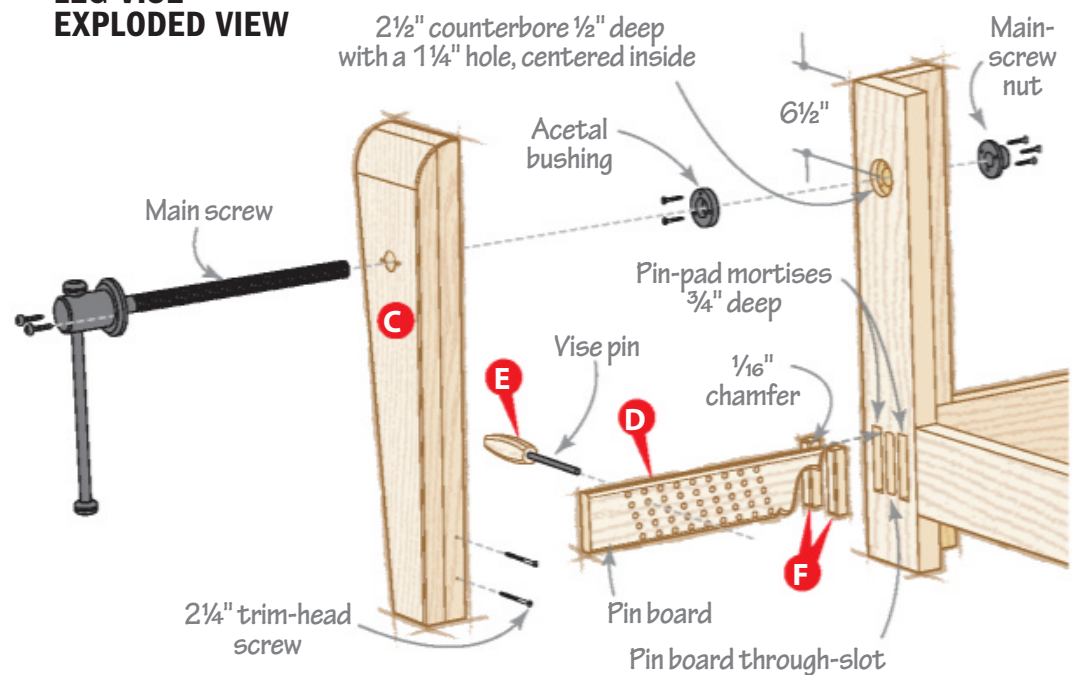


4 TRIM THE MAIN COVER

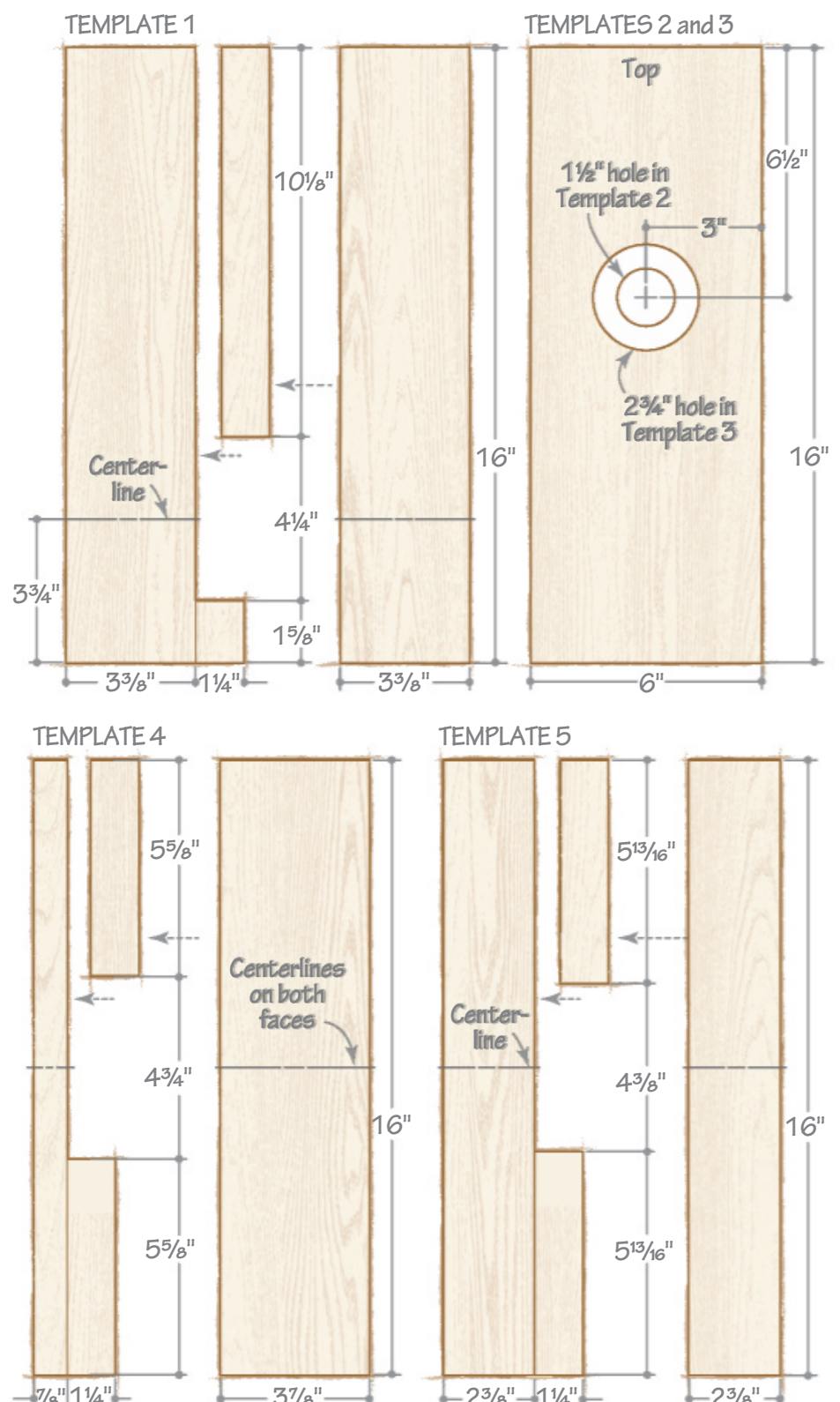




LEG-VISE EXPLODED VIEW



6 ROUTING TEMPLATES



Leg vise

Form the vise jaw

1 Laminate an oversize blank for the jaw (C) and cut it to size [Materials List]. Lay out the mortise and its horizontal centerline [Drawing 5]. Then lay out the main-screw hole and a larger concentric circle for aligning the main-screw flange.

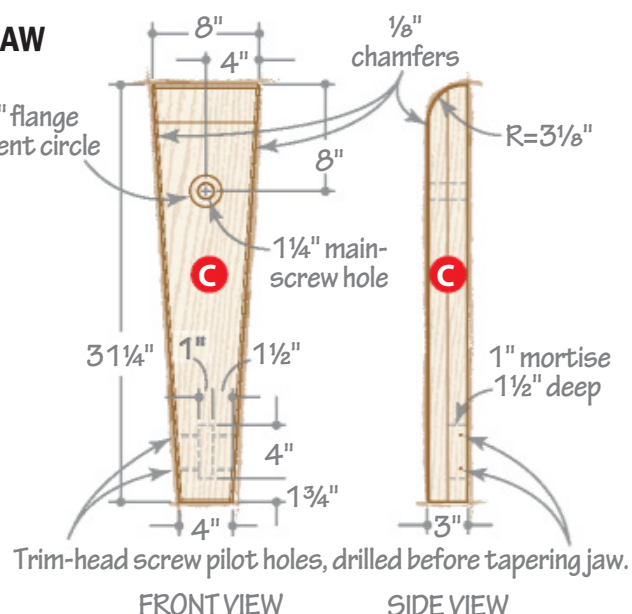
2 At the drill press, drill the main-screw hole and pilot holes for trim-head screws that secure the pin board in the mortise.

3 Make Template 1 [Drawing 6] from 1/2 inch plywood, edge-joining the parts. Install a 3/4 inch guide bushing and 1/2 inch up-cut spiral bit in a plunge router. Clamp the template to the inside jaw face, edges flush and horizontal centerlines aligned, and rout the mortise.

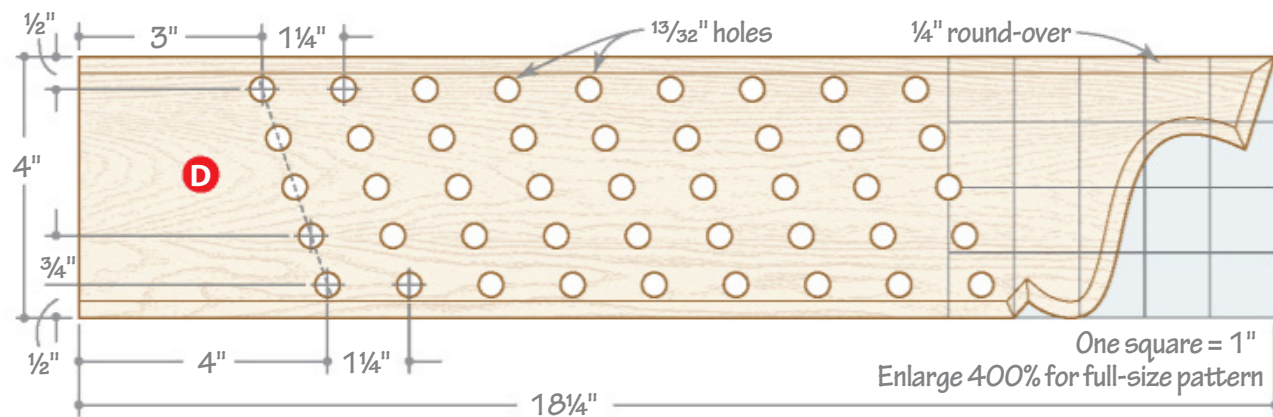
4 Bandsaw and sand the radius at the top of the jaw [Drawing 5]. Lay out the side tapers and bandsaw and joint the jaw to final shape. Chamfer the edges.

Note: Check the length of your guide bushing before making the templates. Ours allowed using 1/2 inch plywood, some may require 3/4 inch plywood.

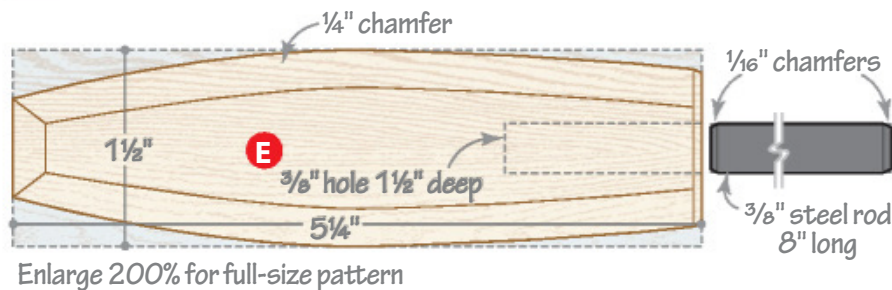
5 LEG JAW



7 PIN BOARD



8 PIN-HANDLE PATTERN



► Download full-size pin-board and pin-handle patterns.
woodmagazine.com/266patterns

5 Cut the pin board (D) to shape [Drawing 7] and drill the holes at the drill press. Round over the edges. Clamp the pin board into the jaw mortise [Leg-Vise Exploded View], and drive the trim-head screws.

6 Cut the pin handle (E) [Drawing 8] and drill the hole. Make two copies of the pattern, apply them to adjoining faces, and form the handle profile. File and sand the chamfers. Cut a steel rod to length, grind or file chamfers on the ends, and epoxy it into the handle.

7 Place the jaw horizontally on sawhorses and slide the main screw into the hole. Center the screw flange in the circle drawn on the jaw. Using the holes in the flange as guides, drill pilot holes and drive the supplied screws. Set the jaw assembly aside.

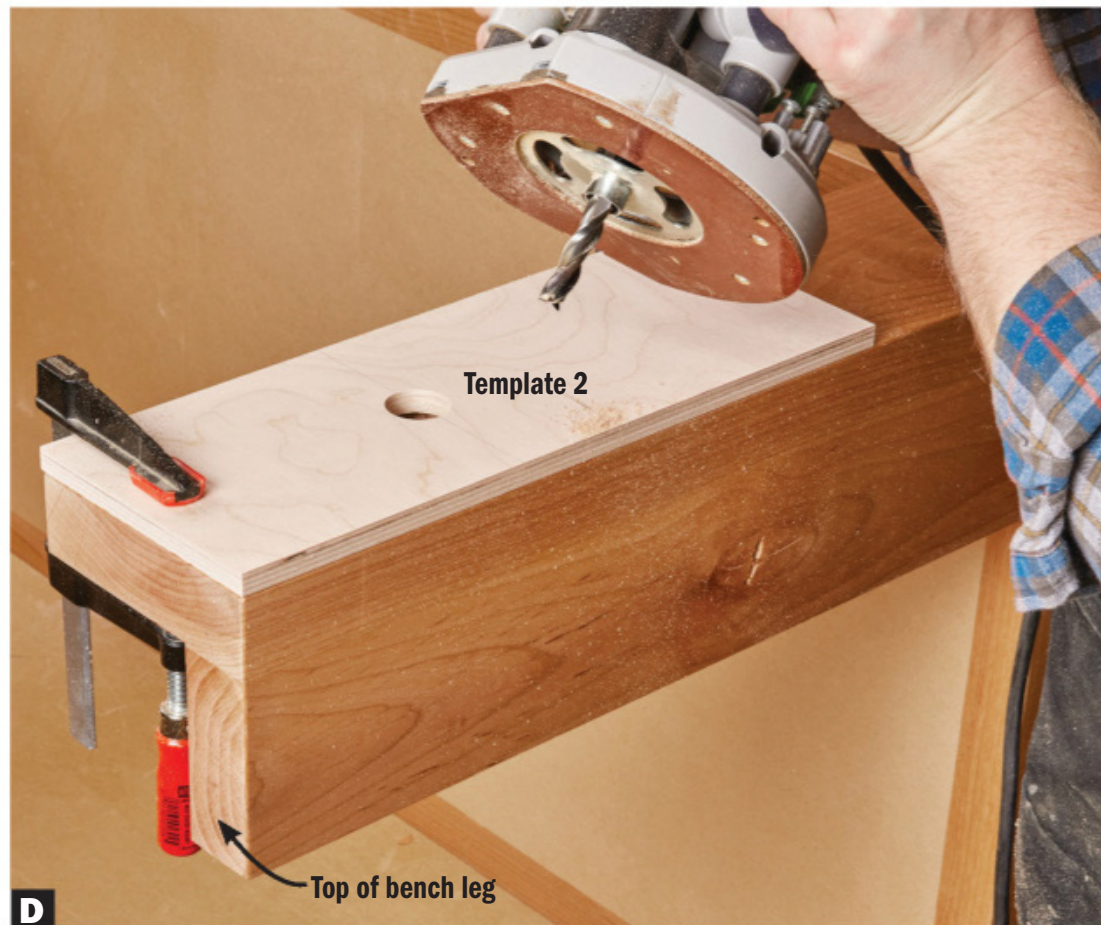
Modify the bench leg

1 Make Templates 2–5 [Drawing 6]. Drill the holes in Templates 2 and 3 with Forstner bits or holesaws at the drill press. Mark horizontal centerlines on both faces of Template 4 and one face of Template 5.

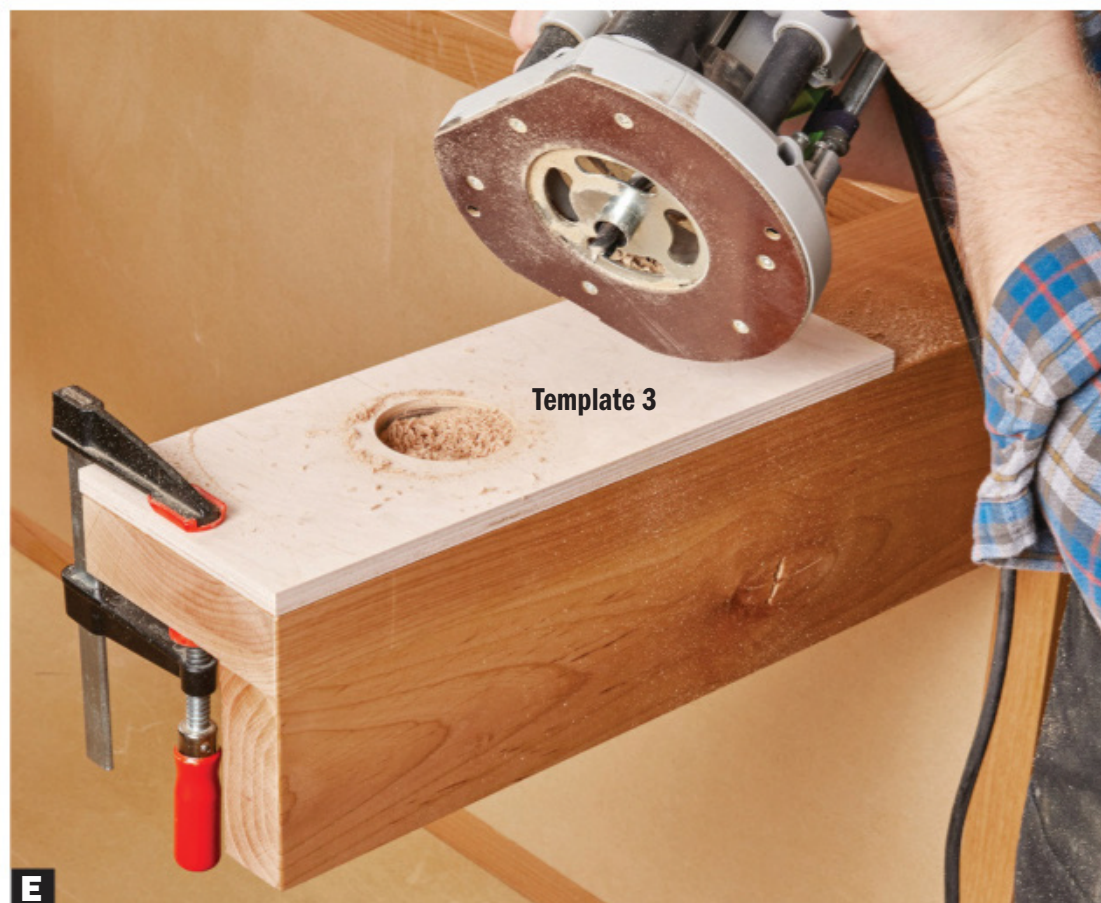
2 Remove the benchtop from the base and position the base on its side. Form the main-screw hole and counterbore in the bench leg [Leg-Vise Exploded View, Photos D and E] with the same guide bushing and bit used for the jaw mortise.

3 Rout the pin-pad mortises [Photos F and G] and the pin-board through-slot [Photo H]. Square the corners of the pin-pad mortise with a chisel.

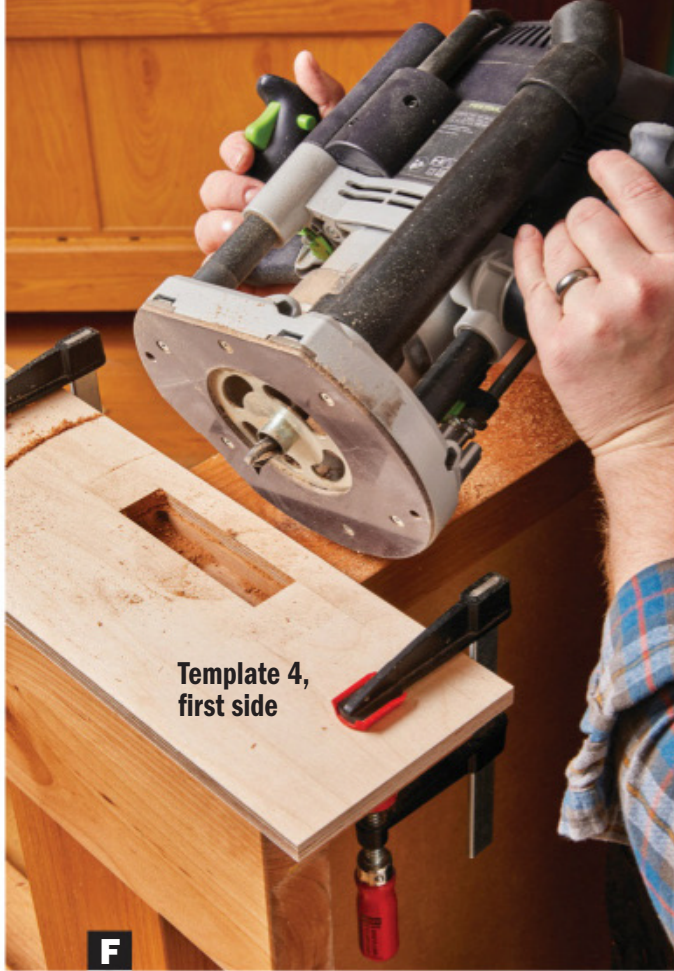
Note: Your plunge router acts as a portable drill press, keeping the holes in the leg perpendicular to the surface.



D Plunge and rout the main-screw hole in the bench leg using Template 2, clamped to the leg flush at the top and sides, as a guide.



E Plunge and rout the counterbore using Template 3, clamped to the leg flush at the top and sides.



Template 4,
first side

F

Rout the first pin-pad mortise, guided by Template 4 clamped to the leg flush at the edges, and aligning the centerlines of the template and bench-base lower rail.



Template 4,
second side

G

Rout the second pin-pad mortise, flipping Template 4 and aligning and clamping it as for the first mortise.



Template 5

H

Rout the pin-board slot, guided by Template 5 clamped to the leg flush at the edges and with the template and bench-base lower rail centerlines aligned.

4 Cut and chamfer the pin pads (F), and glue them into the leg mortises.

5 Apply Danish oil to the jaw, pin board, pin handle, pin pads, jaw hole and counterbore, and pin-board slot.

Assemble the vise

1 Wipe the rust-preventative oil off the vise parts. Follow the manufacturer's instructions for assembling the hub, main screw, and flange.

2 Position the acetal bushing in the bench-leg counterbore, orienting the elongated opening vertically. Drill pilot holes and fasten the bushing with the included screws. *Note the positions of the screws [Leg-Vise Exploded View].*

3 Mount the jaw assembly, sliding the pin board into its slot as you slide the main screw through the acetal bushing. Thread the main-screw nut onto the screw, snug-ging it against the inside of the bench leg. Move the nut and screw up and down to find the extents of the bushing opening and center the screw vertically in the bushing. Tighten the main screw, making sure the holes in the nut do not align with the bushing screws. Drill pilot holes and fasten the nut with the included screws.

4 Back off the main screw, opening the jaws. Re-install the benchtop on the base. To use the vise, position the vise pin in the pin-board so the top edge of the jaw grips the workpiece as the jaw slightly tips out at the bottom. 🌲

Tip! For replaceable, no-mar work holding, double-face tape leather to the mating jaw faces.

Produced by **Jan Svec** with
John Olson
Project design: **John Olson**
Illustrations: **Roxanne LeMoine,**
Lorna Johnson

Materials List

Part	FINISHED SIZE			Matl.	Qty.	
	T	W	L			
Twin-screw end vise						
A* jaw	2¼"	6"	30"	LM	1	
B vise-nut blocks	1¾"	3"	6"	M	2	
Leg vise						
C* jaw	3"	8"	31¼"	LM	1	
D pin board	1"	4"	18¼"	M	1	
E pin handle	1"	1½"	5¼"	M	1	
F pin pads	⅞"	1"	4½"	M	2	

*Parts initially cut oversize. See the instructions.

Materials key: LM-laminated maple, M-maple.

Twin-screw vise bits: ¾, 1¼, 1½" and 2" Forstner bits; 45° chamfer router bit.

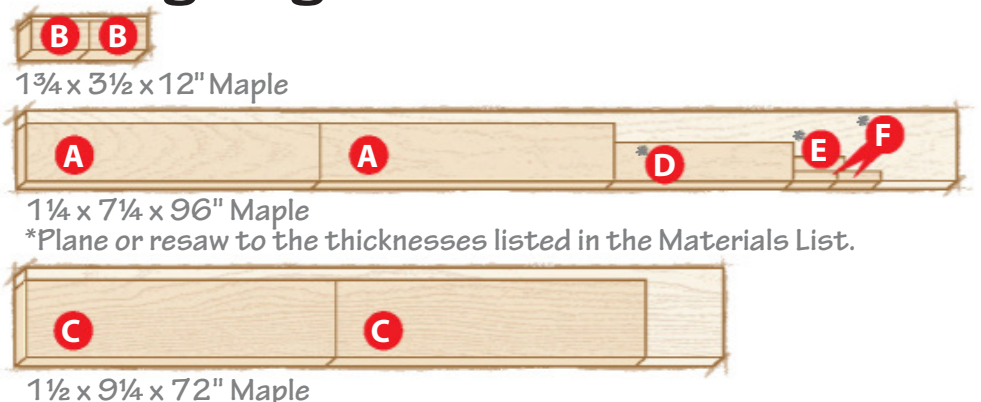
Leg-vise supplies: 2¼" trim-head screws, ⅜" steel rod 8" long.

Leg-vise bits: 1½" and 2¾" Forstner bits or holesaws, ½" up-cut spiral, ¼" round-over, 45° chamfer router bits.

Sources: Twin-screw vise, up to 24" center no. 05G12.22, \$329, Lee Valley, 800-871-8158, leevalley.com.

Classic leg vise without crisscross, \$210. Benchcrafted, no telephone contact for product inquiries—email info@benchcrafted.com, benchcrafted.com.

Cutting Diagram



*Plane or resaw to the thicknesses listed in the Materials List.

Optical illusion Cutting Board

Build a prep surface as visually delectable as the meals that spring from it.



If you've sanded a board's end grain you know how tough it can be—all that elbow grease generates more heat than sawdust. That same toughness makes an end-grain cutting board hold up well to food cutting and chopping. To make this eye-popping cutting surface, you glue up several identical blanks, slice them into small slabs, glue the slabs into strips, and then glue the strips together. Voilà: a geometric masterpiece.

Make your cutting board larger or smaller than ours by simply varying the number of squares. The building process is even simpler than it sounds, but does require attention to making precise cuts—we'll provide tips for spot-on results.

► Learn more about end-grain cutting boards, and how to maintain them, on page 16.

First, build the blanks

The cutting board shown here requires three glued-up blanks. Before you cut the blank parts, use a good-quality square to adjust your tablesaw's blade to exactly 90°. Make test cuts to verify the accuracy.

1 Cut the centers (A) $\frac{1}{16}$ " wider and thicker than shown [Materials List, Drawing 1]. Cut the wedges (B), three in cherry and three in walnut. Chamfer one edge of each wedge [Photo A].

DIMENSIONS:
 $1\frac{1}{2}$ " T x $9\frac{1}{16}$ " W x $14\frac{9}{16}$ " L

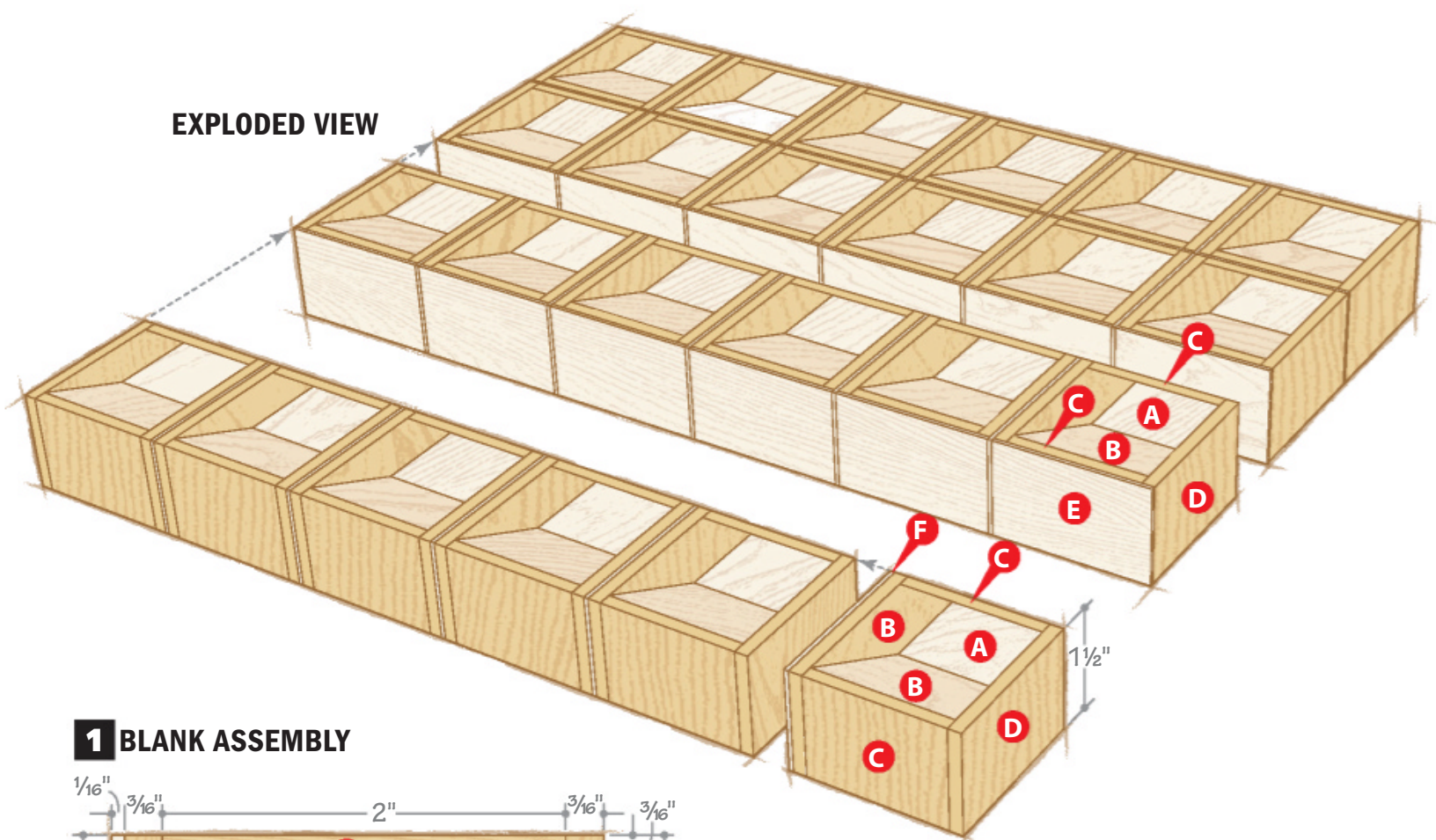
Approximate materials cost:

\$50

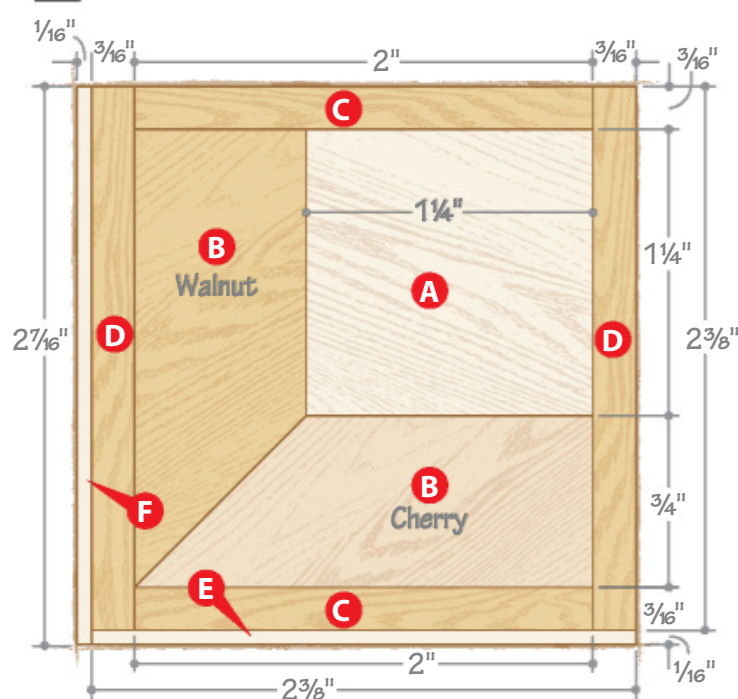
or much less if you utilize your scrap bin

With proper care this board will last a lifetime.

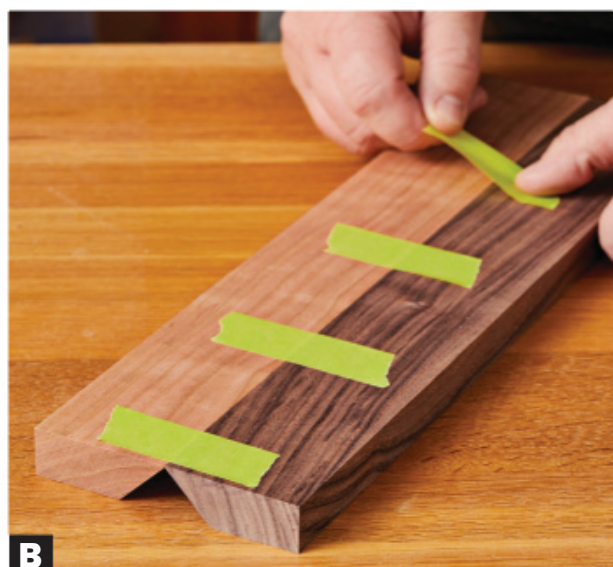
Tip! For best results when adjusting a tablesaw blade 90° to the table, place the square's blade in full contact with the body of the sawblade (not touching the teeth).



1 BLANK ASSEMBLY



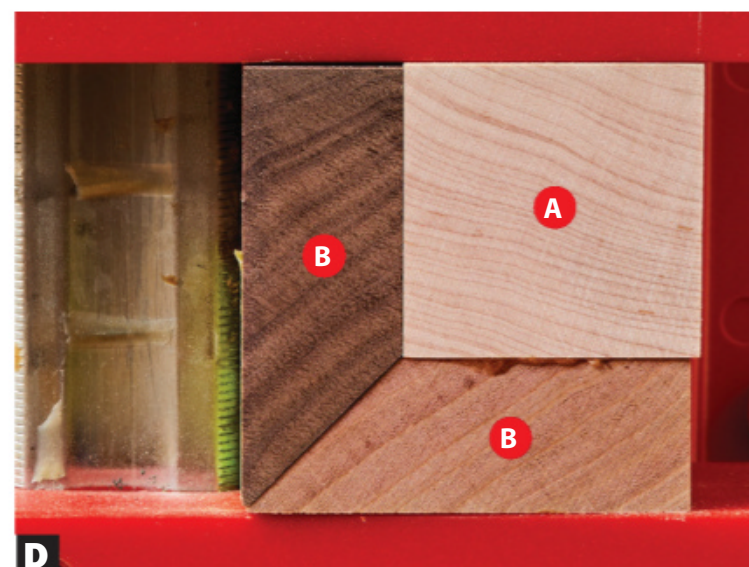
A Use a chamfer bit for spot-on 45° cuts. Gradually raise the bit to precisely sneak up on the cut depth.



B Use painter's tape to make a hinge joining a cherry wedge to a walnut wedge.



C The tape holds the "toes" of the chamfers tightly together and aligned while you add glue.

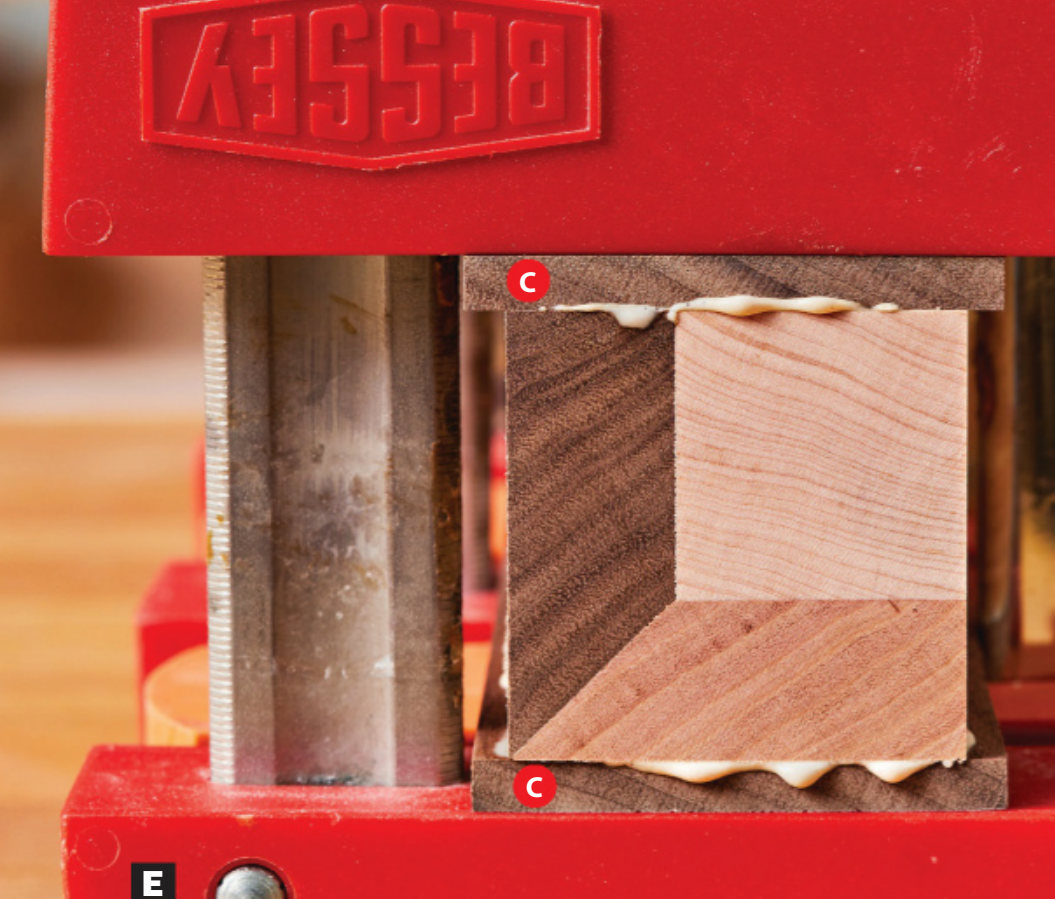


D The center (A) should fit in the wedge assembly (B/B) without gaps. The outside edges of the center should be slightly proud of the wedges.

Note: Dry-fit the blank pieces before applying glue.

2 Pair each cherry wedge with a walnut one and tape across the chamfers [Photo B]. Apply glue to the chamfered edges and fold each wedge assembly at the tape hinge. Apply glue to the inside faces of each assembly [Photo C], add a center, and clamp [Photo D].

3 After the glue dries, peel off the tape and scrape away any glue squeeze-out. Run the assemblies through a planer, taking light cuts to bring all surfaces flush. The final assembly should measure 2" square.



E Glue on the narrow edging (C) positioned with roughly the same amount of overhang all around.



G Glue on the narrow veneer (E) blank with equal overhang on both edges.

4 Cut the narrow and wide edging (C, D) $\frac{1}{4}$ " wider than listed. Then, glue the narrow edging to the A/B assembly [Photo E]. After the glue dries, scrape away any squeeze-out. Flush-trim the edges of the narrow edging to the A/B assembly.

5 Glue, clamp, and trim the wide edging (D) to the A/B/C assembly [Photo F] as you did in the previous step. The A-D assembly should now measure $2\frac{3}{8}$ " square.

6 Cut two $\frac{3}{4} \times 2\frac{1}{2} \times 15$ " blanks for the veneer (E, F). Then, glue the narrow-veneer blank to the A-D assembly [Photo G]. After the glue dries, scrape away any squeeze-out.



F Glue on the wide edging (D) just as you did the narrow edging (C).



H Glue on the wide veneer (F) blank just as you did the narrow veneer (E) blank, with slight overhang on both edges.

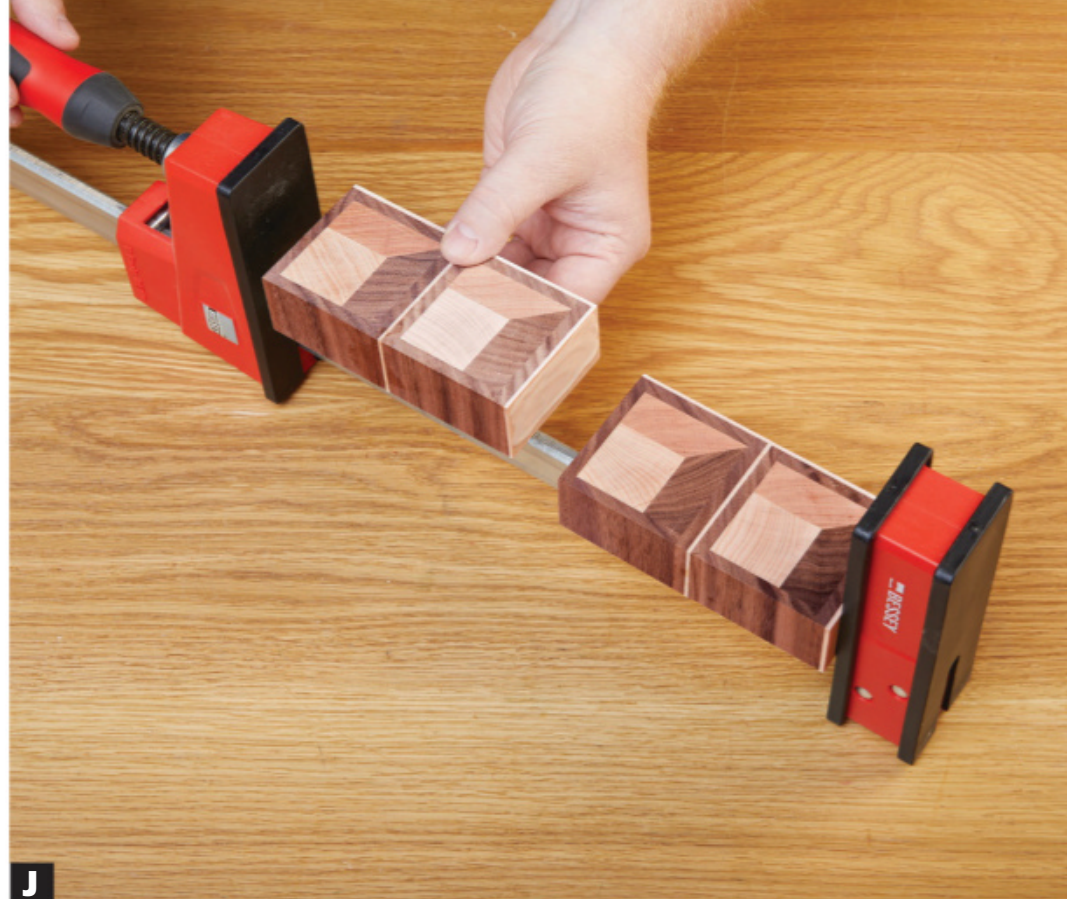
Using double-faced tape, attach a $\frac{1}{4} \times 2 \times 15$ " carrier board to the wide edging (D) adjacent to the narrow-veneer blank. With the carrier board on the table of your bandsaw, resaw the narrow veneer to make the portion glued to the A-D assembly $\frac{1}{8}$ " thick. Then flush-trim the remaining overhang at the router table.

Save the "waste" side of the narrow veneer for the second and third blanks. The veneer will be about $\frac{1}{16}$ " thick for the second blank and $\frac{3}{8}$ " thick for the third blank.

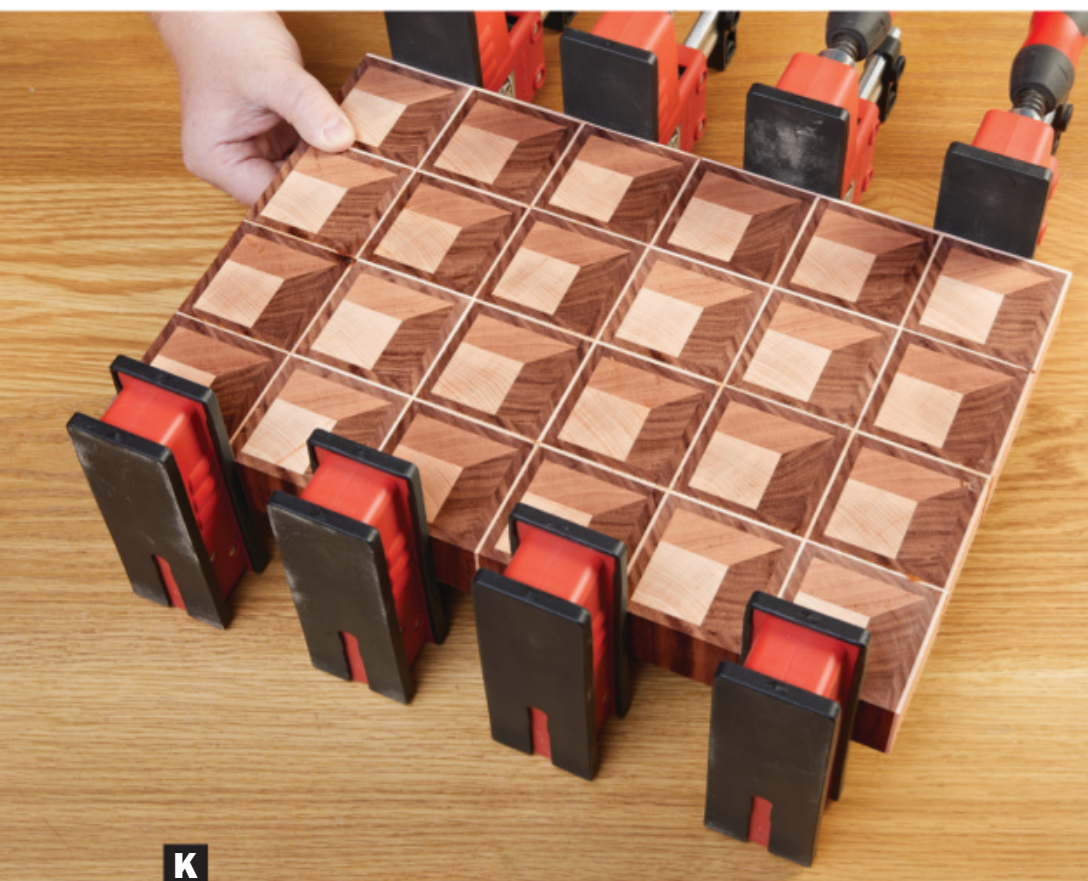
7 Glue on the wide-veneer blank (F) [Photo H]. Trim and resaw it as you did with the narrow veneer.



I Glue the squares in pairs, being careful to keep them all in the same orientation, with all surfaces aligned flush.



J Glue dried pairs to other pairs. After those dry, add a third pair to each glue-up to make four strips of six squares each.



K Glue up the board, checking carefully for flatness. After the glue dries, saw away the maple veneer on two edges of the board.

8 After all three blanks receive their narrow and wide veneers, run the completed blanks through the planer to bring the veneers down to $\frac{1}{16}$ " thickness. The blanks should now measure $2\frac{7}{16}$ " square.

Assemble the cutting board

1 Crosscut the blanks to create $1\frac{1}{2}$ "-long squares. From the resulting 27 squares choose the 24 best ones. Glue together the squares [Photos I-K].

2 Finish-sand the board to 220 grit and ease any sharp edges. Seal the wood with mineral oil, wax, or a specialized cutting board finish [Source]. 🌲

CUTTING DIAGRAM



Materials List

Blank Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A* centers	$1\frac{1}{4}$ "	$1\frac{1}{4}$ "	15"	M	3
B wedges	$\frac{3}{4}$ "	2"	15"	W/C†	6
C* narrow edging	$\frac{3}{16}$ "	2"	15"	W	6
D* wide edging	$\frac{3}{16}$ "	$2\frac{3}{8}$ "	15"	W	6
E* narrow veneer	$\frac{1}{16}$ "	$2\frac{3}{8}$ "	15"	M	3
F* wide veneer	$\frac{1}{16}$ "	$2\frac{7}{16}$ "	15"	M	3

*Parts initially cut oversize. See the instructions.

†3 walnut wedges and 3 cherry wedges. See the instructions.

Materials key: M-maple, W-walnut, C-cherry.

Source: Howard Cutting Board Oil, woodmagazine.com/cuttingboardoil.

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

Versatile classic Demilune Table

A half-moon top that unfolds to a full circle highlights this 18th-century French design.



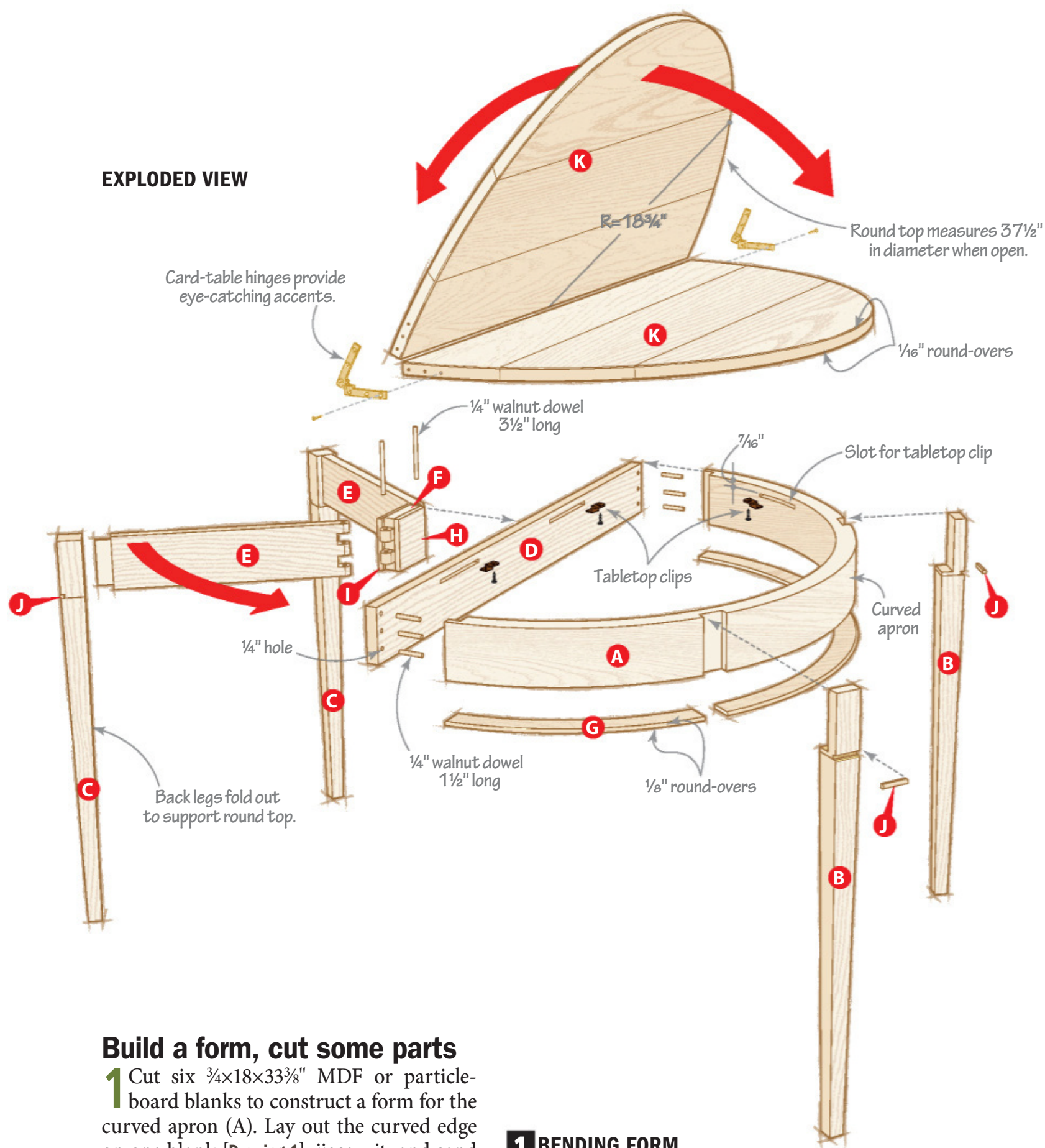
D I M E N S I O N S :
37½" W x 18¾" D x 27¾" H

Approximate
materials cost:

\$400

Make the
curved
apron easily
with
bending
plywood.





Build a form, cut some parts

1 Cut six 3/4x18x33 3/8" MDF or particle-board blanks to construct a form for the curved apron (A). Lay out the curved edge on one blank [Drawing 1], jigsaw it, and sand to the line.

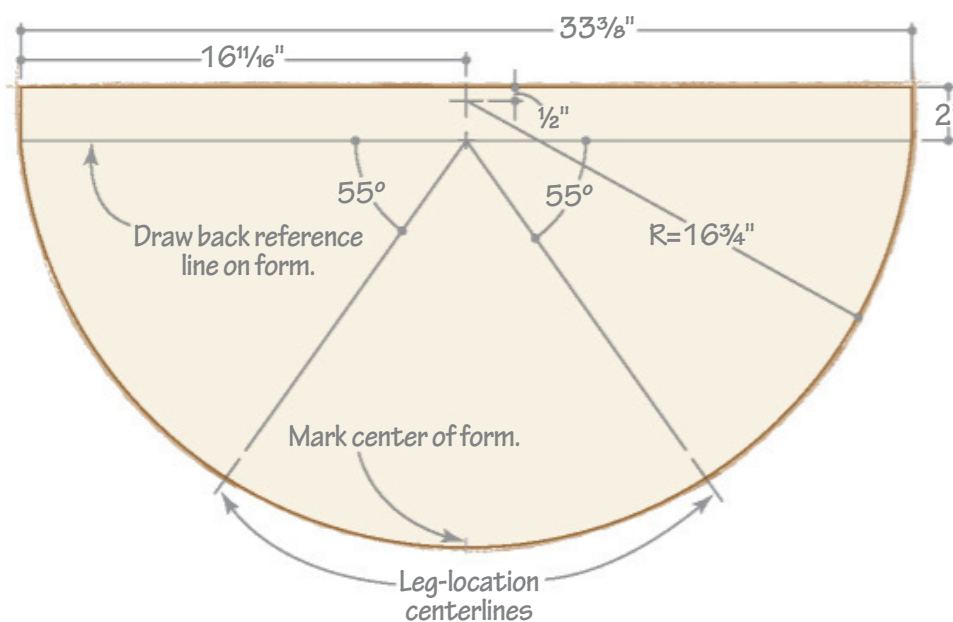
2 Tack the shaped piece to another blank, flush along the straight back edge, and flush-trim it to match. Repeat for the remaining blanks.

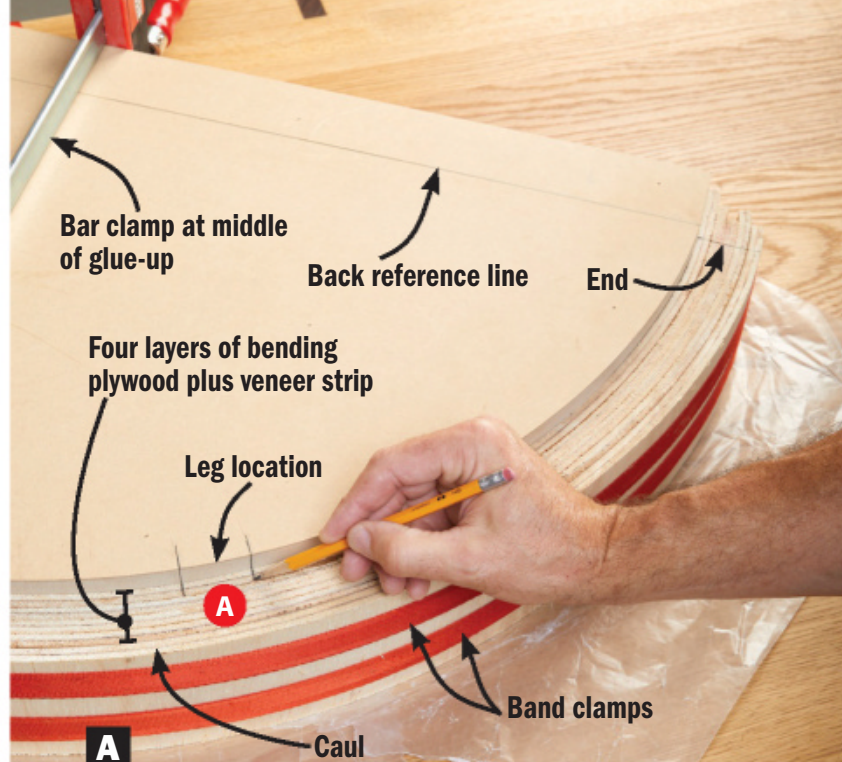
3 Glue and nail the form together, keeping the curved edges flush. Lay out the back reference line and leg locations on the form top [Drawing 1].

4 Cut two 54x4" and three 56x4" strips of 3/8" bending plywood and one 4x56" strip of walnut veneer for the apron (A). Mark a centerline on the top edge of each plywood strip and on the face of the veneer.

► Buy bending plywood for the long strips that has its grain running in the short direction so it would roll into a 4'-tall column. If you can't find bending plywood locally, see **Sources**, page 66.

1 BENDING FORM





A Make sure the lamination presses fully against the form without gaps. Then, transfer the leg location and end marks to the edge of the lamination.



B Keep the lamination's face solidly on the table and its edge firmly in contact with the tall fence as you rip the apron.



C Align the lamination end mark with a kerf sawn through your auxiliary fence. After positioning, clamp the part to the fence to ensure a clean cut.

5 Cut the legs (B, C) and back rail (D) to size [Materials List]. Drill a hole in the bottom of each leg [Drawing 3]. Set the parts aside.

Tip! Lay waxed paper under the form and lamination to prevent squeeze-out from gluing the lamination to your benchtop.

► Hover your phone's camera over the smart code below to watch a video of laminating the apron, or go to woodmagazine.com/apronlamination.



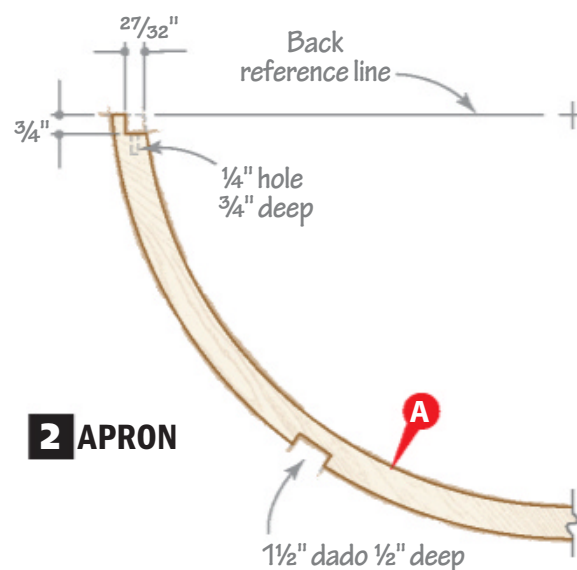
Laminate the apron

1 Glue the two short bending-ply strips together, aligning the center marks, then add two of the long strips, followed by the veneer strip. Save the third long strip to use as a caul.

2 Stand the lamination on edge with the veneer facing you. With the center marks aligned, press the lamination against the form, position the caul on the outside, and clamp the lamination to the form near the top with a bar clamp.

3 Wrap a band clamp around the lamination below the bar clamp. Remove the bar clamp, add another band clamp, and reapply the bar clamp. Mark the leg locations [Photo A].

4 After the glue dries, remove the lamination from the form, transfer the leg location and end marks to the inside face, and clean the glue off one edge. Install a tall auxiliary rip fence on your tablesaw and rip away



2 APRON

the uncleaned edge [Photo B], leaving enough to rip the other edge to finished width.

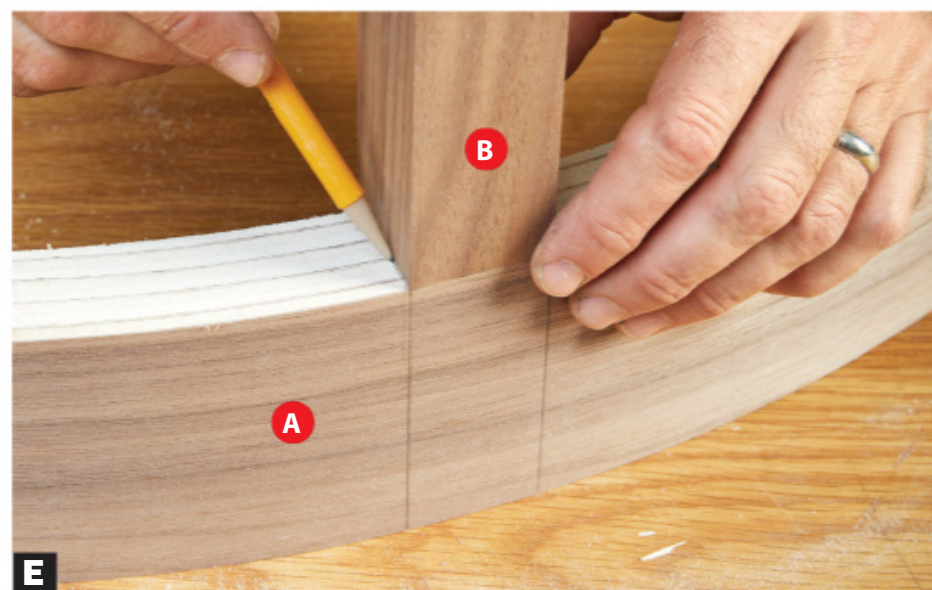
5 Install a tall auxiliary fence on your miter gauge, and trim the lamination [Photo C]. Then, rabbet the ends [Drawing 2, Photo D].

6 Cut the leg dados in the apron [Drawing 2, Photos E, F, G].

Tip! Enlist a helper (not shown in photo for clarity) to support the end of the apron for increased stability as you rip it.



D Set up a dado blade to cut the apron rabbets. The tall auxiliary miter-gauge fence steadies the apron for a safe and accurate cut.



E Stand a leg (B) on the apron (A) and extend the marks for the dados. Keep the leg corners as flush as possible to the apron face to mark the dados accurately.



I Insert a $\frac{1}{8}$ " spacer between the stretcher and the index key to make the first pass. Clamp the part to the jig fence for greatest accuracy.



J Fit the notch from the first pass over the index key for the second cut. Saw the other stretcher the same way.

► Watch a video that shows setting up and using a simple box-joint jig. woodmagazine.com/boxjointvideo

Tip! Slip the shank of a $\frac{1}{16}$ " twist drill between the pivot block and stretcher to set the gap.

Tip! Drilling the deep hole from both ends toward the center reduces drill wander and results in a truer hole.

2 Mark the top edge of a $\frac{3}{4} \times 3\frac{1}{2} \times 40$ " walnut board. Cut a 17" length from each end for the stretchers (E) [Drawing 4]. Cut the remaining piece to $4\frac{7}{8}$ " for the pivot block (F) [Drawing 5]. Round over where shown.

3 Box-joint each stretcher and both ends of the pivot block [Photos I, J, K], keeping the top edge of the board toward the same side of the jig for all cuts.

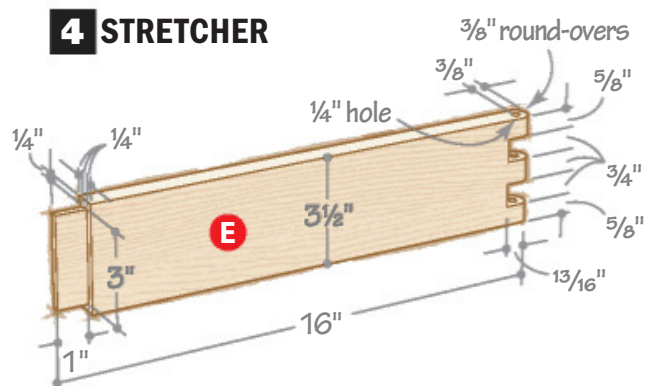
4 Mark the pivot-hole locations on the stretchers (E) [Drawing 4]. Assemble one stretcher and the pivot block, spacing them $\frac{1}{16}$ " apart.

5 Attach a plywood sacrificial overlay to the drill-press table. Place the stretcher/pivot block on the plywood, line up a $\frac{1}{4}$ " bit over the pivot-hole mark, and position the fence. Drill about halfway through [Photo L]. Then, drill the remaining stretcher and the other end of the pivot block.

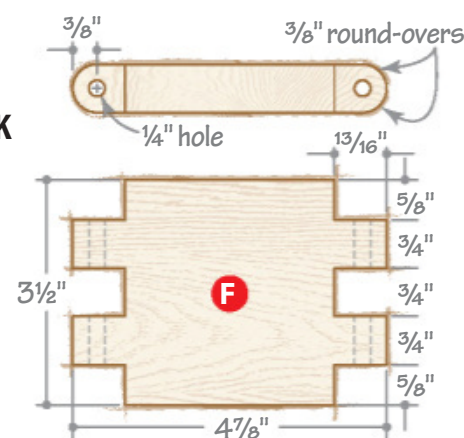
6 Remove the stretcher/pivot block, drill into the plywood, and install an index dowel [Photo M].

7 Cut the stretchers (E) to length and tenon the ends to fit the leg (C) mortises.

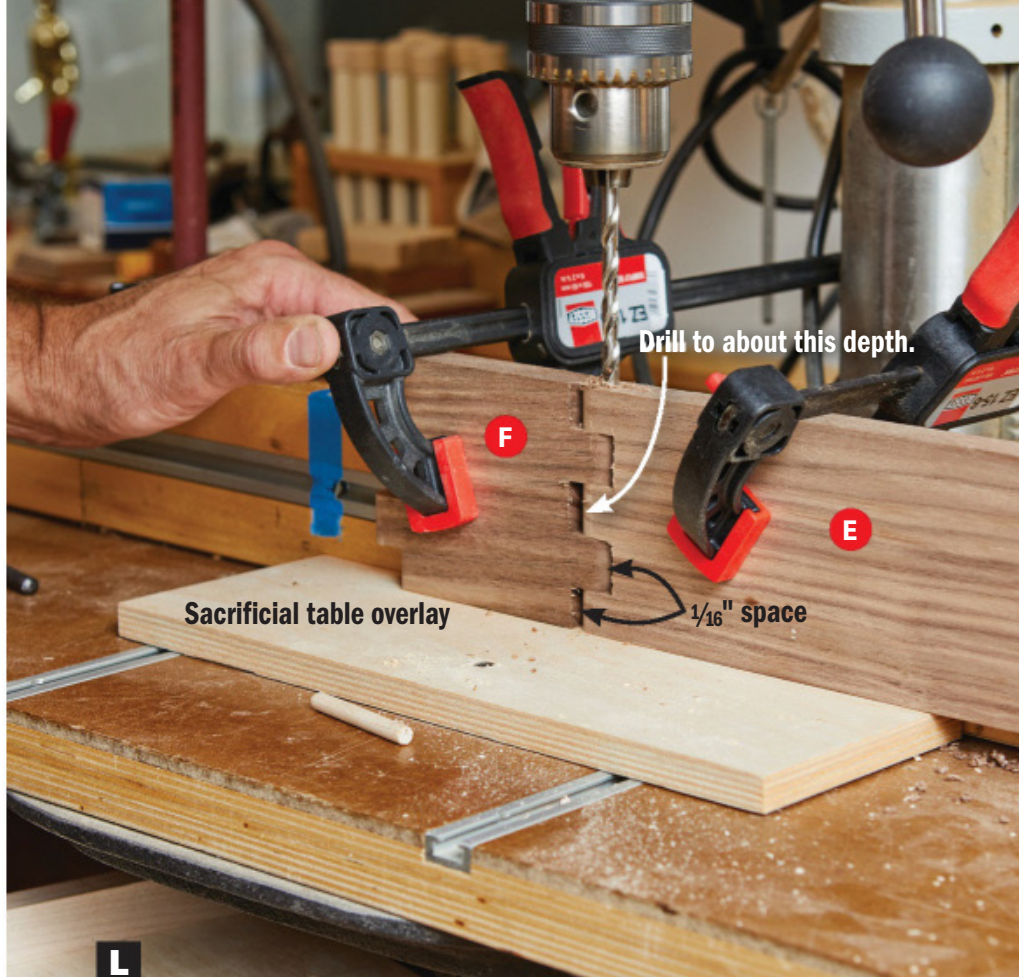
4 STRETCHER



5 PIVOT BLOCK



K Space the pivot block (F) $\frac{7}{8}$ " from the key for the first cut. For subsequent cuts on each end, put the notch from the previous pass over the key.



L Clamp the stretcher and pivot block to the drill-press fence to keep the parts aligned as you drill. Drill partway into the center knuckle on the stretcher.

Tip! Push the dowels into the holes leaving about $\frac{1}{8}$ " exposed at the top. Apply glue to the exposed portion and push the dowels in flush.

Finish-sand the legs, stretchers, and pivot block. Glue the legs to the stretchers.

8 Assemble the legs/stretchers (C/E) and the pivot block (F) with $\frac{1}{4}$ " walnut dowels [Exploded View].

Complete the base

1 Cut the blanks for the apron fillets (G) to size. Place one under the front of the apron and scribe lines flush on the inside and $\frac{1}{8}$ " from the outside [Photo N]. Similarly, lay out the end fillets.

2 Cut out the fillets, round over the outer edges, and finish-sand. Fit and glue them in place. Glue the front legs (B) to the apron.

3 Cut the pivot-block spacer (H) and pivot stop (I) to size [Drawing 6]. Mark the center

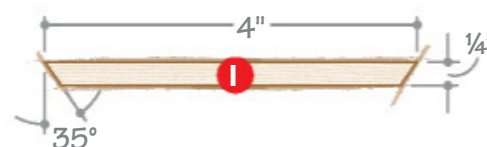


M Insert a $\frac{1}{4}$ " dowel about 2" long into the hole in the plywood table overlay. Place each partially drilled E/F assembly over the dowel and complete the hole.

on the bottom edge of the back rail (D), pivot block (F), spacer, and stop. One piece at a time, glue the spacer to the rail, the pivot block to the spacer, and the stop to the pivot block, keeping the centers aligned.

4 Cut an oversize blank for the leg fillets (J) and round over its edges [Drawing 3a]. Trim the fillets to size and glue them into the legs.

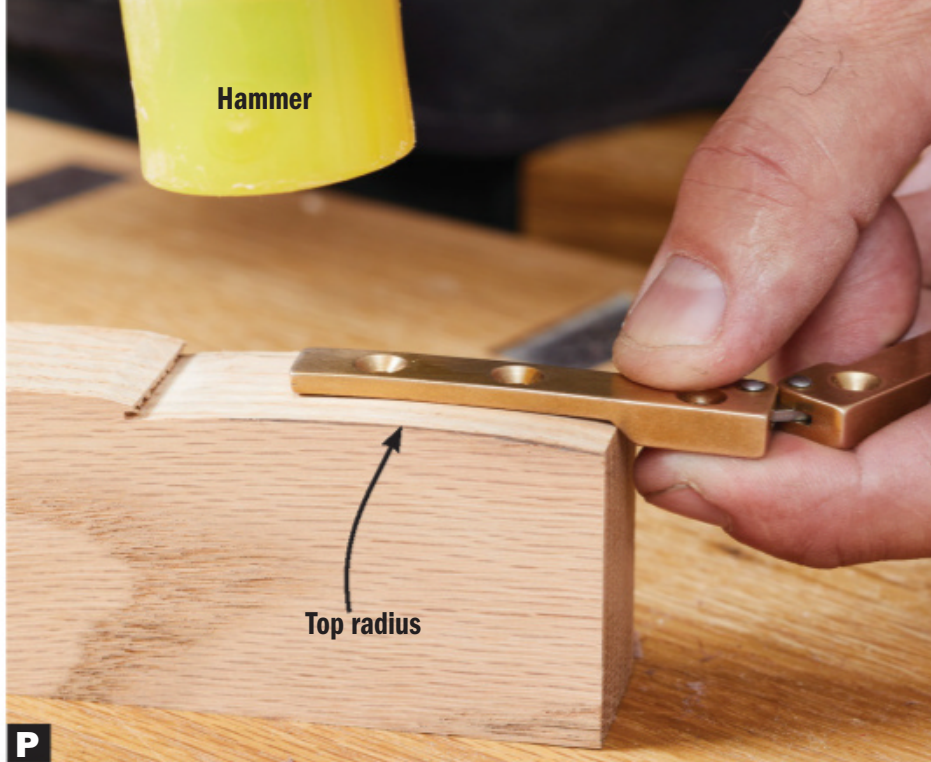
6 PIVOT STOP



N Trace the apron curvature with a compass for the fillets. Mark the ends of the fillets inside the leg dadoes with a marking knife.



Scribe the hinge locations centered on the edges with a knife or pencil. Rough out the recesses with a trim router and 1/8" bit; fine-tune them with a chisel.



Shape the hinge to match the top's curvature with a soft-faced hammer. A piece of scrapwood cut to the top's radius serves as an anvil.

Tackle the top

Tip! Mark the facing surfaces when you trace the top panel. Then, you can maintain their original orientation.

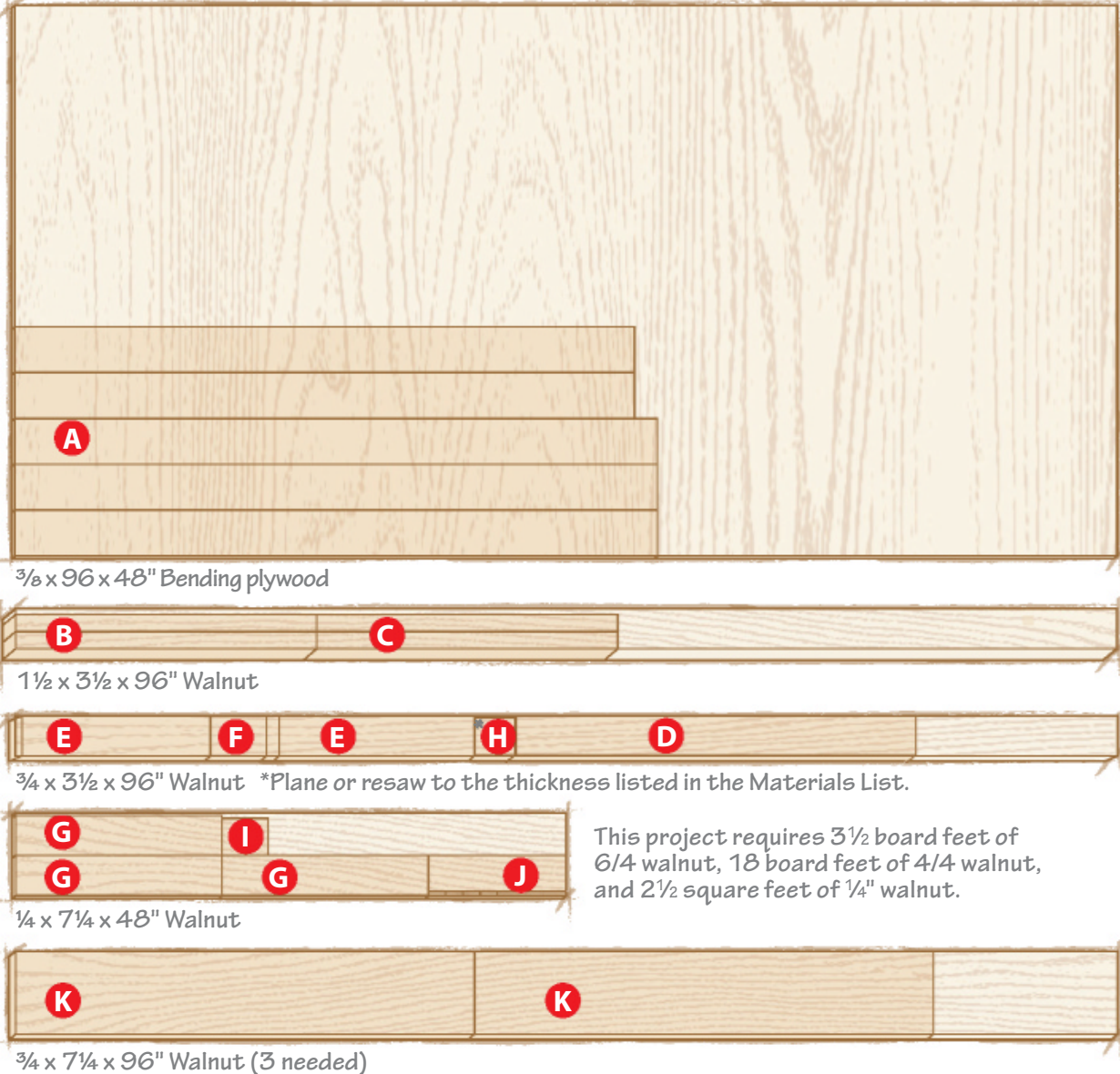
- 1 Glue up two blanks about 20×40" for the top panels (K) and lay out the top radius on one of them [Exploded View].
- 2 Bandsaw and sand to the line. Place this half-top facedown on the other blank, trace around it, and bandsaw just outside the line.
- 3 Clamp the first half facedown on top of the second half with the back edges flush. Flush-trim the second part to match the top.

- 4 Clamp the top halves together, and fit the card-table hinges [Sources, Photos O and P].
- 5 Round over and finish-sand the top. Touch up the sanding as necessary on the base (A–J), and apply a clear finish.
- 6 Attach the fixed half of the top to the table base with tabletop clips. Position the folding half of the table and install the hinges before setting the table in place. 🌲



► Watch a video about installing the hinges.
woodmagazine.com/tablehinge

Cutting Diagram



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

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A* apron	1 1/4"	3 1/2"	52"	BP, WV	1
B front legs	1 1/2"	1 1/2"	26 1/4"	W	2
C back legs	1 1/2"	1 1/2"	26 1/4"	W	2
D back rail	3/4"	3 1/2"	34 7/8"	W	1
E** stretchers	3/4"	3 1/2"	16"	W	2
F** pivot block	3/4"	3 1/2"	4 7/8"	W	1
G apron fillets	1/4"	3 1/2"	18"	W	3
H pivot-block spacer	3/8"	3 1/4"	3 1/2"	W	1
I pivot stop	1/4"	3 1/2"	4"	W	1
J** leg fillets	1/4"	1/4"	1 1/2"	W	4
K** top panels	3/4"	18 3/4"	37 1/2"	EW	2

*Bent laminated part. See the instructions.
**Parts initially cut oversize. See the instructions.

Materials key: BP-bending plywood, WV-walnut veneer, W-walnut, EW-edge-glued walnut.
Supplies: 4×56" walnut veneer, 1/4" walnut dowel rod, 1 1/2" finish nails, tabletop clips.
Blade and bits: Dado set; top-bearing flush-trimming, 1/8" straight, 1/16", 1/8", and 3/8" round-over router bits.
Sources: Bending plywood, 3/8"×8×4' (4' tall column), no. 375BEND84, \$36, Plywood Company of Fort Worth, 817-831-4206, plywoodcompany.com. Card-table hinges, no. H-53 semi-bright brass, pair \$28, Horton Brasses, 800-754-9127, horton-brasses.com. High-back white armchair available at ashleyfurniture.com. Weathered concrete floor is available at usfloorsllc.com.

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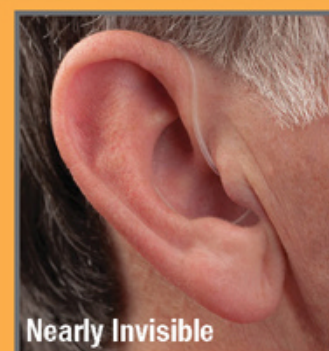
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and wood species. Here, you'll learn to make knobs in three profiles. One knob mounts to its door, drawer, or lid via a tenon; the others attach with a screw. Let's get started.

Note: We provide dimensions for all knobs for reference. Adjust these to suit your projects.

End grain vs. face grain—what's the difference?

With any knob, you'll need to decide whether its cap will show end grain or face grain. You turn an end-grain knob with its grain running the length of the blank (inline with the lathe spindle). This results in the annual growth rings running across the cap in mostly parallel lines. That means it will soak up more stain and finish, making it darker than a face-grain knob. You can counter this effect by sanding

to 400 grit and applying a light sealer coat of dewaxed shellac before staining or coating further.

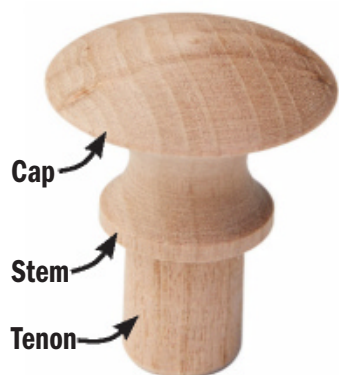
A face-grain knob, turned with grain running perpendicular to the lathe spindle, doesn't soak up as much finish and darken. But, in the case of this red oak, more stain pigments will settle into the coarse grain, highlighting the arched grain pattern.



End grain



Face grain



Classic mushroom cap with tenon

This knob, commonly identified with Shaker-style furniture, has a tenon for gluing in place. Create a square blank slightly larger in width

than the desired final diameter, and $\frac{3}{4}$ " longer than the desired final length. For this $\frac{7}{8}$ "-diameter knob, we made a 1×1" blank 2" long.

Tools needed:

- four-jaw chuck
- spindle roughing gouge
- $\frac{1}{2}$ " spindle gouge
- parting tool

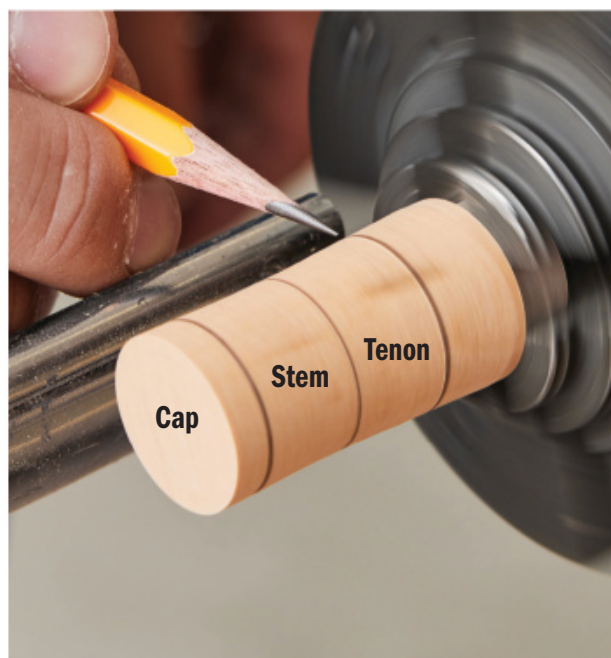


Install the blank in the chuck, set the lathe for 1,800 rpm, and turn a tenon (about $\frac{3}{4}$ " diameter and $\frac{3}{8}$ " long) on one end. Flip the blank end for end and chuck the tenon tightly in the jaws.



Note: Don't turn this section any further.

Turn the rest of the blank round to the final diameter of the cap.



Mark the key diameters that transition to smaller sizes.



Round the end of the blank to the first layout line to get a smooth cap.



Use a parting tool to turn the tenon to diameter between the stem and tenon layout lines. Match the diameter to a drill bit you have so you can drill a perfect-fitting hole in the drawer or door.



Turn the stem to a diameter about $\frac{1}{16}$ – $\frac{1}{8}$ " long. Then cut a cove from the cap line toward the stem. Cut "downhill" (from large diameter to small).



Finalize the cove's shape with light cutting passes to blend with the stem. The cap line should be a crisp edge. Then part it off as shown on *previous page*.

SKILL BUILDER

Make a screw chuck

To turn a knob that mounts flush to the drawer or door using a screw, you must first create a screw chuck to hold the knob blank while turning. Start with a 2×2×2" blank of dense hardwood, such as hard maple.

Tools needed:

- four-jaw chuck
- spindle roughing gouge
- parting tool
- skew chisel
- drill chuck



With the blank held in the chuck and the lathe set to 1,800 rpm, turn the end round and create a $\frac{3}{8}$ "-long tenon. Reduce speed to 500 rpm, then counterbore the end deep enough that your screw's threads will protrude $\frac{1}{2}$ " from the chuck when installed (left photo).



Remount the blank by the tenon, reset the speed to 1,800 rpm, and turn the rest of the blank round. Use a parting tool to create a tenon $\frac{3}{4}$ " in diameter about $\frac{3}{8}$ " long.



Shape a large cove that blends into the tenon using the roughing gouge.



Flatten the end of the blank with a skew chisel.



Drill through the chuck blank a pilot hole sized to match the screw's shank.



Mark both edges of the chuck's no. 1 jaw. This will help you realign the blank in the next step.



Remove the screw chuck from the jaws, thread the screw fully into the screw chuck until the head seats in the counterbore, and then remount it into the lathe chuck, aligned with the no. 1 jaw. Drill a pilot hole in the knob blank and thread it onto the screw snug against the chuck.

Three-fillet screw-on knob

This simple knob has a full bead and cove as well as three $\frac{1}{16}$ "-wide fillets.

Tools needed:

- four-jaw chuck
- screw chuck
- spindle roughing gouge
- $\frac{1}{2}$ " spindle gouge
- parting tool



Turn the knob blank round, then mark the locations for each end of the bead. With a parting tool, cut equal-diameter fillets to the outside of each line.



Round the front of the knob with a $\frac{1}{2}$ " spindle gouge.



Mark the center of the bead with a pencil. Then use the $\frac{1}{2}$ " spindle gouge to shape each side of the bead to the fillet.



Turn the stem fillet to its final diameter using a parting tool; in this case, the same as the screw chuck ($\frac{3}{4}$ ").



Shape the cove between the two back fillets with the spindle gouge, cutting downhill from each side to meet at the low point in a smooth transition. Sand smooth when finished.

Large screw-on mushroom cap



Tools needed:

- four-jaw chuck
- screw chuck
- 1/4" bowl gouge

This relatively large knob measures 1 3/4" in diameter, but the techniques differ depending on whether you're making an end-grain or face-grain knob.

You turn an end-grain knob in the same manner as the three-fillet knob, rounding the cap with a spindle gouge and then cutting a half-cove on the back side. Turn all end-grain knobs as if they were spindles, cutting downhill from large diameter to small.

But a face-grain knob requires a different approach. In this case, cut a 2x2" square blank 3/4" thick, with the face grain running across one of the 2" dimensions. Drill a centered pilot hole 1/2" deep for the mounting screw, and cut the blank round on the bandsaw. Then, follow the steps in these photos.

Produced by **Bob Hunter** with **Brian Simmons**



With the blank mounted to the screw chuck, turn it to final diameter with the bowl gouge.



Lay out the location for the cap rim (1/4" from the front), and round the cap to this line. Cut from the center upward, scraping with the gouge's wing.



Create a half-cove that transitions smoothly from the back face, sized the same diameter as the screw chuck, to the cap rim. Cut with the gouge's wing in a scraping cut. Sand smooth when finished. 🌲



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TOOLS & MATERIALS

SHOP-TESTED

Squarely on the mark

For nearly every project you build, you'll need at least one reliable square to ensure accurate dimensioning and joinery. A 12" combination square proves most useful for general wood-working because of the many tasks it performs, but we also like to keep a 6" model on hand for times when a 12" model is simply too large. Here are four of our favorites.



Starrett 6", no. 11H-6-4R, \$75; 12", no. 11H-12-4R, \$90

►Rule scales: 1/8", 1/16", 1/32", 1/64"

Although these require a significant investment, we've been using Starrett squares for decades without any loss of accuracy or function—they're that good. Three of the scales read easily (you'll need exceptional eyesight for the 1/64" scale), the rigid rules don't flex, the cast-iron head locks securely, and we found the overall fit and finish exceptional. We have better levels in the shop, so we can live with the smallish, clear-fluid vials in these.

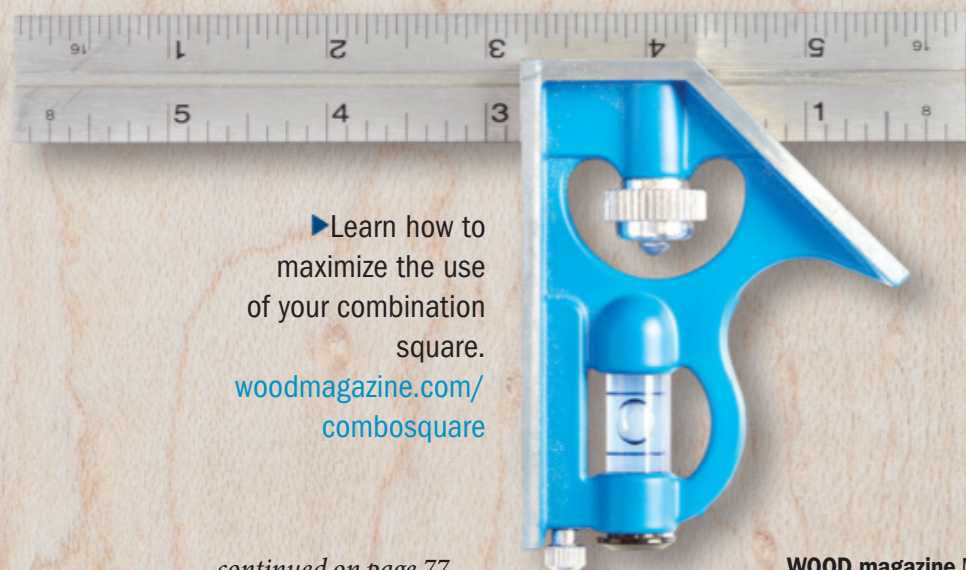
888-674-7443, starrett.com

Empire True Blue 6", no. E255, \$10; 12", no. E250, \$11

►Rule scales: 1/8", 1/16", 1/32"

Despite lacking the fit and finish of the Starrett squares—sharp edges on the rules and machining marks on the zinc-alloy heads—these two prove a great value. We found the rules dead accurate, and the heads lock perfectly square. Rather than a 1/64" scale, each rule has a 1/16" scale on each face, one reading left to right, the other right to left. That's handy. And the blue-fluid vials prove easy to read.

800-558-0722, empirelevel.com



►Learn how to maximize the use of your combination square.

woodmagazine.com/combosquare

continued on page 77

WOOD magazine March 2020



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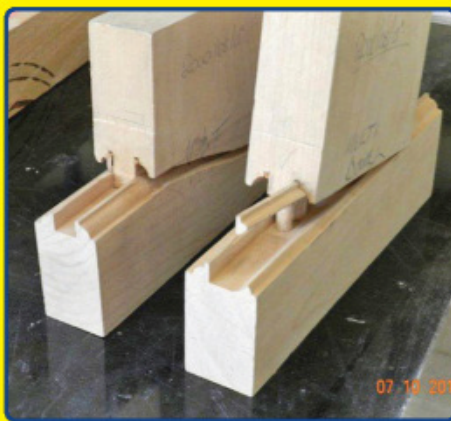
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TOOLS & MATERIALS

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Get all the impact without all the noise

M12 Fuel 12-volt Surge hydraulic driver, no. 2551-22, \$200

An impact driver works great at driving screws, especially in tough materials, because it provides about four times as much torque as a comparable drill/driver. But the hammering mechanism can be annoyingly noisy, especially in a small shop. That's where Milwaukee's M12 Fuel Surge driver shines: It has nearly as much torque as Milwaukee's regular impact driver—it can fully seat a $\frac{1}{2} \times 3$ " lag screw—while producing 15–20 decibels less noise. That's merciful for my ears!

Like other oil-impulse drives (all in the 18-volt class), the motor spins the $\frac{1}{4}$ " quick-connect chuck until the fastener begins to take hold. Then, an internal pump rapidly pulses hydraulic oil—rather than using a traditional hammer-and-anvil hammering mechanism—to produce bursts of greater twisting torque to power in the fastener. This driver has a four-speed gearbox, letting you choose the best speed range for each application.

The kit comes with a single battery pack, charger, and canvas bag. You can also buy the driver as a bare tool (no. 2551-20) for \$150 if you already own batteries.

—Tested by Bob Hunter, Tools Editor

Milwaukee
800-729-3878, milwaukeetool.com



Drill pocket holes quickly, easily, and affordably

Pocket-hole drilling jig, no. KPHJ320, \$40

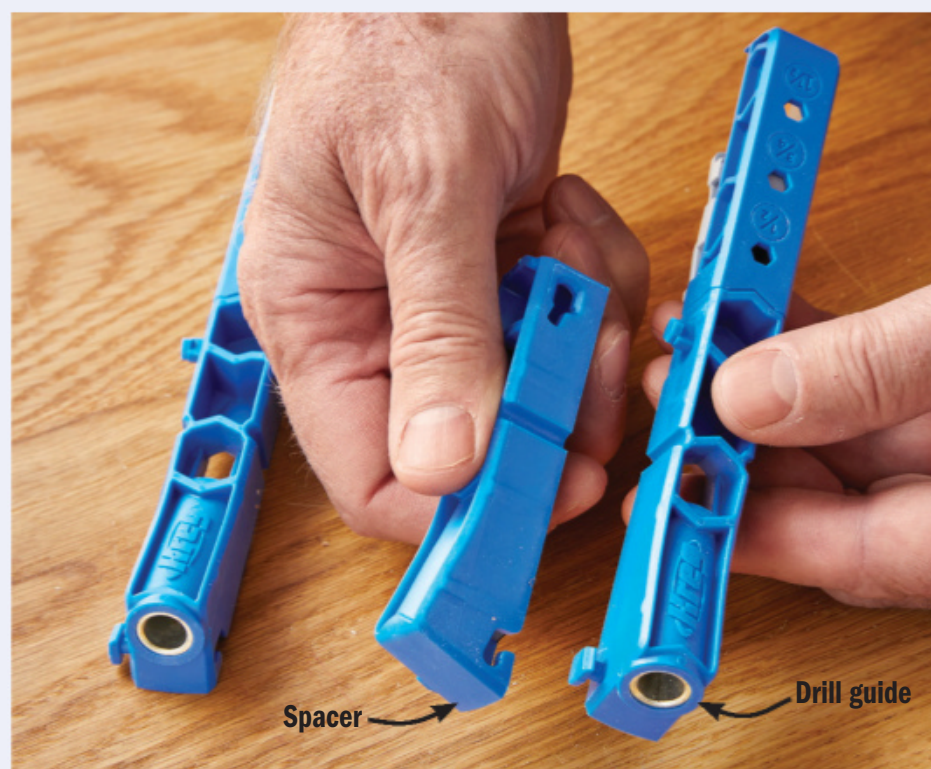
I've used a lot of pocket-hole jigs over the years, and they're all capable of creating joints that hold. But some, such as this new 320 jig from Kreg, simply prove easier to use than others. The three-piece jig comes apart (*right photo*), so it serves as both a single- and double-hole guide. Just twist and slide to remove or add the included spacer; purchase additional spacers and drill guides, if needed.

Stops register the jig against the workpiece edges, with detents for $\frac{1}{2}$ ", $\frac{3}{4}$ ", and $1\frac{1}{2}$ " thicknesses. Likewise, markings on the bit locate the stop-

collar for those same dimensions, ensuring perfect drilling depth. The included hex wrench (for adjusting the stop collar) has a handy scale for quickly identifying workpiece thickness. Overall, it's easy to use, accurate, and affordable—a hard-to-beat combination.

—Tested by John Olson, Design Editor

Kreg Tool
800-447-8638, kregtool.com



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Laguna Tools
800-234-1976, lagunatools.com



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800-437-3635, dremel.com



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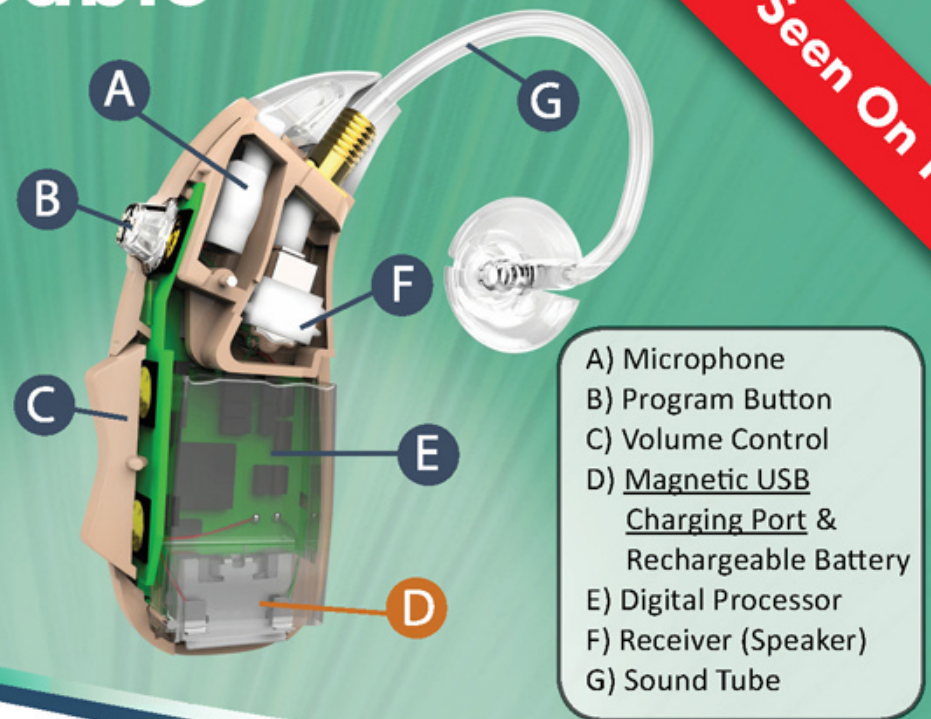
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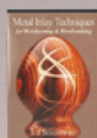
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