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ISSUE 264 NOVEMBER 2019

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Drawer-building Basics

p.50

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- Approx. shipping weight: 550 lbs. *(G1023RLW)*, 542 lbs. *(G1023RLWX)*

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- Cutterhead diameter: 3⅛"
- Floor-to-table height: 31"
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- Approx. shipping weight: 796 lbs.

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- Max. cutting size: 20" wide, 8" high, ⅛" deep
- Min. length of stock: 7"
- Feed rates: 16 FPM and 20 FPM
- Number of knives: 4 HSS; • Knife size: 20" x 1" x ⅛"
- Cutterhead diameter: 3¼"
- Cutterhead speed: 5,000 RPM
- Overall size: 39" wide, 58" deep (w/ extensions), 41" high
- Approx. shipping weight: 820 lbs.

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Shooting the breeze in the shop one day, we got on the subject of two-bit sets. That's not some pejorative for inexpensive or poorly made TVs but, literally, two matching router bits that create mating joints, such as tongue-and-groove, drop-leaf (rule), or cope-and-stick joints (like the ones in the Divided-light Hutch on *page 26*).

In order to get a precise fit, both bits need to be set up perfectly and test joints cut. No problem, but if you have only one router, you lose the setting of the first bit when you remove it to install the second bit. In most cases, you can use a sample of the second cut to reset the first bit, but it's not 100 percent reliable. And if you have to re-make one more joint after you're done, you have to start all over again.

The ideal solution would be two router tables, one with each bit installed, but who has room in their shop for two tables? Or... what if you could mount two routers in *one* table? It wouldn't have to be much larger than a typical router table, if you did it right.

So that's what we did.

John Olson's design, on *page 44*, includes two fences for bit sets that benefit from that, such as raised-panel or plywood edging sets. Yet there's plenty of room with the fences removed to set up a straight bit in one and a dovetail bit in the other to rout through-dovetail joints. (Never done this on a router table? Point your smartphone's camera at the code *below left* or visit woodmagazine.com/fastdovetails to see it done. It may forever change the way you rout dovetails.)

As John was finishing up the design work on the double router table, he realized he could go one better by installing a trim router in one end of the table to give that shop real estate even more value. Install a round-over, chamfer, or ogee bit, set it, and forget it—it will always be at the ready for your most common edge-routing tasks.

We tricked-out our table pretty well with a couple of nifty shop-made aluminum fences (even if you already have a router table, consider making one of these), remote-start switches, and router bit storage. You could certainly go more minimalist. Or kick it up a couple of notches with dual router lifts and dust-collecting enclosures around the routers. Take our idea and make it your own.

And when you're done, please send us a photo. Or two. Or three.

See you in the shop!

Dave Campbell
dave.campbell@meredith.com
Facebook and Twitter: @WOODeditor
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November 2019
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In This Issue of WOOD®

NOVEMBER 2019 · ISSUE 264

PLANS

TOOLS & TECHNIQUES

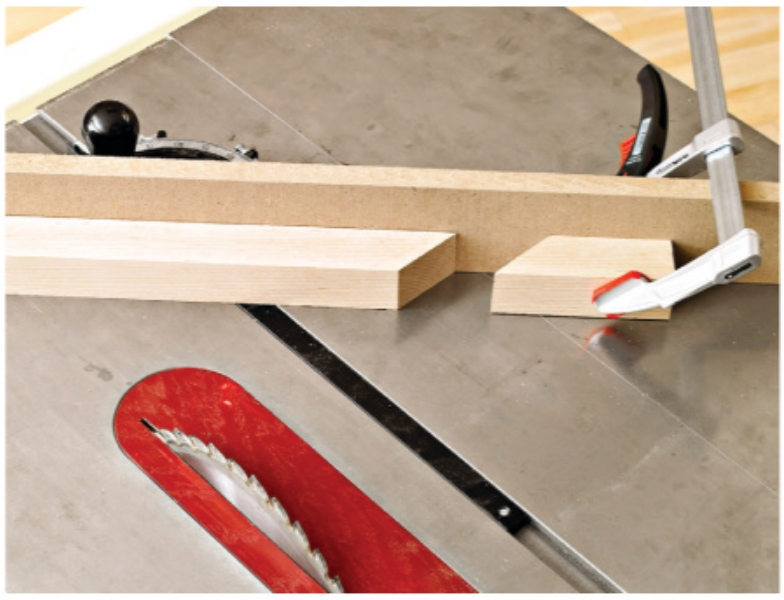
DEPARTMENTS

Our gift to you: This early reminder

OK. This year—*this year!*—is the year you're going to get way ahead on your holiday gift projects. No more Christmas Eves in the shop. No more lacquer fumes from under the tree. This is the year you'll finish ahead of time. And we're here to help you with some free, easy-to-replicate gift plans, some tips on working efficiently, and a reminder not to blame us if you run late. We reminded you.

Use the template routing tips at woodmagazine.com/template to speed your way through duplicating dozens of this Art Deco Desk Clock. Free plans can be found at woodmagazine.com/artdecoclock.

Stopblocks from woodmagazine.com/9stopblocks will come in handy for the repeated cuts needed for knocking out copious copies of this coatrack. Find the free plan at woodmagazine.com/coatrack.



Speed toward the end of the assembly line with a spray finish. Find tips at woodmagazine.com/simplespraying. Find free plans for this giftable bracelet at woodmagazine.com/bracelet.

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Carving out a new life together

As a WOOD® magazine subscriber, I have seen numerous wedding unity symbols lately, starting with Dave Campbell's version in issue 259 (March 2019). But I had never heard of them until my granddaughter asked that I make one for her wedding. Here's my version.

The cross itself is made from black walnut with maple caps. In the poplar base I carved my hands to represent the family holding up their marriage; I also hand-carved the couple in the middle out of a maple tree harvested from our yard. Likewise the coils, which represent the winding roads of life.

I call the mahogany ring in the center the "circle of life," and during the wedding ceremony, my granddaughter and her husband inserted into it the carved couple—it's held in place with rare-earth magnets.

She was so proud to announce that I had made their unity symbol, and I was proud to have made it for her.

—David Harper
Lebanon, Ind.

Is my smartphone too dumb?

While reading issue 262 (Sept. 2019) I wanted to watch the videos listed in that issue of William Ng demonstrating his great crosscut sled and the Perfect-miter Tablesaw Sled Attachment. But I couldn't get the smart code that links to those videos to work with my Android phone—it just takes a photo and doesn't link to anything.

So, I tried to type in the link shown and it just takes me to the woodmagazine.com home page. Is there another subscription necessary to access those videos over and above the magazine subscription?

—Ray Calkins
Sherwood, Ore.

Smartphones more than a couple of years old lack the built-in code reader, Ray, so you might have to install a free app that reads the codes, such as QR Code Reader. But if your Android is newer than that, make sure you have Google Lens activated, and just point at the code—don't click. You don't need to be too close: If the lens can't focus on the code, it can't read it. As for the URL for the videos, the smart code stupidly covered the rest of the web address for the videos. The complete URL is woodmagazine.com/ngsleds. No subscription or log-in is required to view.

Reader dings door installation

I enjoyed reading the Entry Door article in issue 260 (May 2019). It's a big and challenging project. But without some reference for fitting the door to your opening and actual installation after making the door and side light, the project is useless to me. As a woodworker, I enjoy the "wood" part of the project, but need the extra help to complete the overall project. Keep putting out those great woodworking challenges!

—Richard Lux
Wayandotte, Okla.

"Big and challenging" describes that project pretty well, Richard: But the biggest challenge was simply moving that door around the shop! As for the installation, we avoided most of the complexity of fitting by taking measurements for the new door directly from the one I was replacing, and building it to the same size. I also transferred the hinge and door hardware locations from the old door for a perfect fit. Although I expected a certain amount of fine-tuning, the new door fit perfectly on the first try.

Kevin Boyle, Senior Design Editor

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continued on page 8

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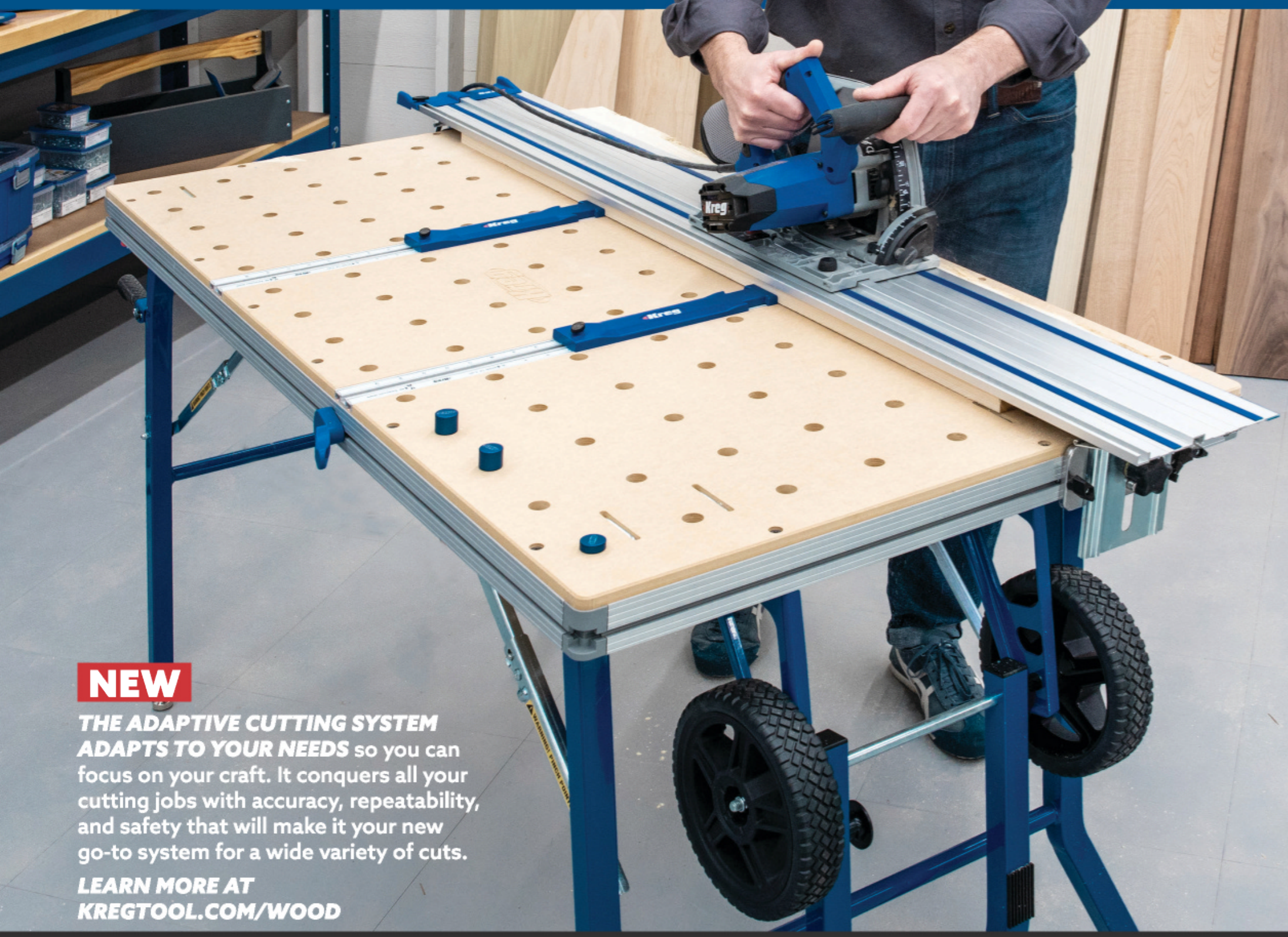

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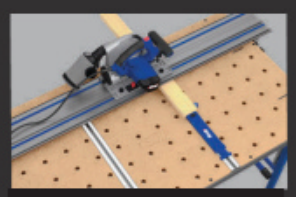

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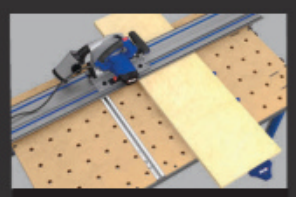

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Buddies build for betterment

Most Tuesdays, I get together with my friends William Sims and Byrle Brunton to form what we call the "Wood Waster's Club." The three of us gather in one fellow's shop, where we spend the day building items, such as cars, trucks, rocking horses, stools, and doll beds, for children and adolescents who are currently residing in group care while experiencing challenging circumstances. By doing so, we feel like the recipients can own something that is uniquely theirs, and conveys that somebody cares about them.

Sometimes, we produce an item requested by the organization. One example is this bench, inspired by the plans in issue 260, that we built for our local Ronald McDonald House. Our hope was to create an item of comfort for use in their meditation garden.

—George Blanton
Mobile, Ala.

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

Shellac can—and can't—take a licking

Jim Heavey's article about shellac in issue 260 greatly interested me but left me with a few questions. One, is it food-safe? I make bowls and spoons and wonder if I can use shellac instead of oil on items that may touch food. Also, how does a shellac finish hold up on outdoor projects? Thanks.

—Fred Roth
Rancho Cucamonga, Calif.

Shellac is used commercially to coat many medicines and candies, Fred, so I wouldn't worry about toxicity. But, I would avoid it—and any film-forming finish—on bowls or spoons intended for actual use as utensils. Once a film finish gets pierced or scratched, liquid can get under the finish and cause mold or mildew and ultimately cause that finish to fail. All the finish would then have to be removed and reapplied. Stick with the various mineral-oil products (salad-bowl oil, butcher-block oil, or other non-vegetable-oil penetrating finishes), which are easily reapplied as necessary. Secondly, shellac is not durable enough to be used on outdoor projects. Seasonal changes that cause wood to expand and contract will quickly degrade a shellac finish.

Jim Heavey, Contributing Craftsman

continued on page 10

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YOUR PROJECTS

Starting with "pretty good" plans he found online, ***Dave Michael****, of Waynesville, N.C., made major mods for this maple-and-mahogany rocking motorcycle. The wheels spin and the front fork pivots, just like the real thing.*

Don Kelm*, of Waterville, Minn., designed and built this mobile display case to house a fragment of his church's tower bell, which survived the church burning to the ground, and the bell being stolen and cut up for scrap. The fragment weighs more than 150 lbs.*

Frank Burger*, of Austin, Texas, learned how to make cockbeading trim at a Weekend With WOOD class taught by master craftsman Terry Moore. Thus inspired, he used the technique on the apron of this ambrosia-maple-topped hall table.*

When his daughter inherited her great-grandmother's antique sewing machine, ***Tom Edwards****, of Goldsboro, N.C., offered to repurpose it into something more useful. She loved the idea, so Tom harvested and restored all of the metal parts and used them to fashion this chair as a reminder of the four generations.*

continued on page 12

Cat Pen Kit

Steampump Pen Kit

Bolt Action Pen Kit

DuraClick EDC Pen Kit

Aromatherapy Necklace Kit

Measuring Spoon Kits

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

"Wow! You Made Those?"

Cat Twist Pen Kit

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

3 Cat Twist Pen Kit Starter Set

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

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Steampump Click Pen Kit

With its unparalleled level of detail and striking design, this a must have creation for any Steampunk enthusiast. Inspired by the steam engine, the pen reliably extends and retracts using a steampump action click mechanism. The pen also features an intricately casted Victorian clock surrounded by gears and pipes, machined through-holes and rivets to complete the steampunk look.

3 Steampump Pen Kit Starter Set

You get one of each Steampump Pen Kit in Oil Rubbed Bronze & Antique Brass (shown above), Antique Pewter & Antique Brass and Antique Brass & Antique Pewter. Plus, you get the drill bit and bushings you need to make the pens.

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Bolt Action Pen Kit

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

3 Bolt Action Pen Kit Starter Set

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

#PKCPBAPAK SAVE $8 **Only $42.75**

DuraClick EDC Pen Kit

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5 DuraClick EDC Pen Kit Starter Set

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

#PKEDCSS SAVE $18 **Only $69.95**

Aromatherapy Necklace Kit

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

5 Aromatherapy Necklace Kit Starter Set

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

#PKATHNSS SAVE $10 **Only $57.65**

Measuring Spoon Kits - Set of 4

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

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When he saw the sorry state of his father-in-law's side table, ***Michael Bonomo****, of Streetsboro, Ohio, decided to surprise him with an identical replacement. Michael made his from walnut stained to match the original.*

The Coulee Region Woodturners club (La Crosse, Wis.) held an egg-turning challenge, and ***Joshua Caldwell****, of Galesville, Wis., took a different spin on the idea. He turned the sunny-side up ones you see here from aspen and osage orange, and served them with black-walnut bacon and a side of pine planer shavings—seasoned with walnut pepper.*

Send us a photo of your work

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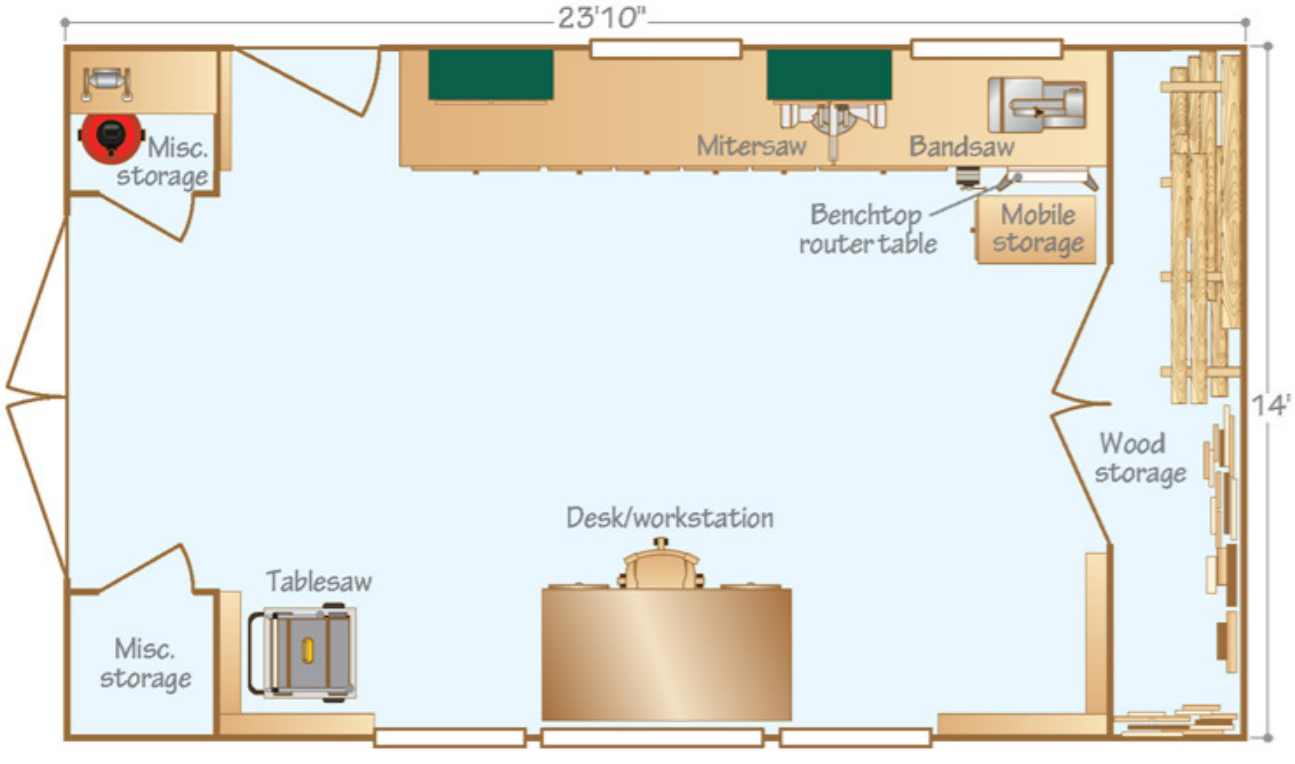
New England Hideaway

Dennis designed this 14×24' multipurpose building to exhibit New England charm.

When Dennis DiDonato decided to build a workshop, he looked to a site visible from his house and occupied by an old two-stall horse barn. He dismantled the barn, salvaging the lumber, then designed and built a traditional stick-framed structure on the same footprint for his shop and for entertaining friends and family. The double doors, cupola, gables, and other architectural details create the endearing character Dennis desired.

Dennis used 2×6 framing for the walls and 2×12s for the rafters. During the construction, he insulated the walls with rigid spray-on foam. He says he can heat the space comfortably with a 220-volt electric heater—pretty impressive for a Connecticut winter.



continued on page 16

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Insulated cedar double doors swing open to serve as the main entrance to the shop. From the original barn interior and horse stalls, Dennis reclaimed the wood that lines the walls and creates the trim. Pavers salvaged from an old retaining wall cover the floor.

Dennis purchased secondhand cabinet boxes and then created the drawers and doors from reclaimed pine.

At each corner beside the double entry doors, Dennis created a small 3×3' closet for storing hand tools, accessories, and supplies.

At the rear of the shop, a pair of doors hides a lumber-storage area. Benchtop and portable tools maximize space and make it easy to clear floor space for dart tournaments and wine-tasting parties.

Large windows furnish plenty of natural light; LED lamps provide auxiliary and task lighting. Dennis picked up the old desk for free. It serves as additional worksurface for projects when needed.

Inside, the multipurpose space features an inviting, open floorplan. Dennis used reclaimed materials for most of the interior construction, including the cabinets. Large windows and a vaulted ceiling emphasize the spacious atmosphere.

Dennis included lots of storage in his shop. In addition to the floor cabinets and cubbies, he incorporated wall cabinets, two small closets at the front of the shop, and a lumber-storage room at the rear. Those store most of his woodworking tools and supplies. Antique tools and decorative items hang on open wall space.

You'll notice that Dennis doesn't own any stationary power tools. He's perfectly happy with portable and benchtop tools that easily tuck out of the way. Those include a bandsaw, router table, mitersaw, and job-site tablesaw. With these basic tools, Dennis has built bookcases, tables, fireplace mantels, bookshelves, and toy boxes. "I also repurpose and rebuild furniture," he says. He's also designed and constructed four dedicated home theaters.

Dennis DiDonato recently retired as owner of a CNC manufacturing company. He's a lifelong, self-taught woodworker who enjoys making a wide variety of projects for his friends, family, and his home.

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How far should chisels pry open a wallet?

Q I'm ready for a new set of bench chisels, and am wondering if it makes sense to splurge on a high-priced set. Some brands cost 10 times as much as others! Will I find satisfaction in paying for top-quality chisels, or rue the day I overspent?

—Harley James, Arlington, Texas

A If you make frequent use of chisels, and depend on them for precise cuts, you'll feel good about investing in a quality set, Harley. Generally speaking, better chisels arrive ready to work properly out of the box, hold an edge longer and can be resharpened more times, take greater punishment, feel more comfortable in your hand, and look prettier. Now let's unpack each of those benefits.

Bench, paring, mortising: What's the difference? woodmagazine.com/allaboutchisels

Though you should hone any chisel before putting it to work, an expensive one will likely come with its back ground perfectly flat, and a cutting edge ground at the proper bevel and square to the blade sides. If you buy a low-dough set, be prepared to do a fair amount of grinding or sanding before any honing commences.

Make no mistake: You can hone any chisel, regardless of price, to razor sharpness. But a better chisel stays sharp longer, with an edge less likely to fracture or dull. Hard, durable steel requires higher-priced diamond stones or lapping plates, but you'll be rewarded with longer work sessions between resharpenings. Longer blades not only reach farther but they also provide a lifetime of sharpenings.

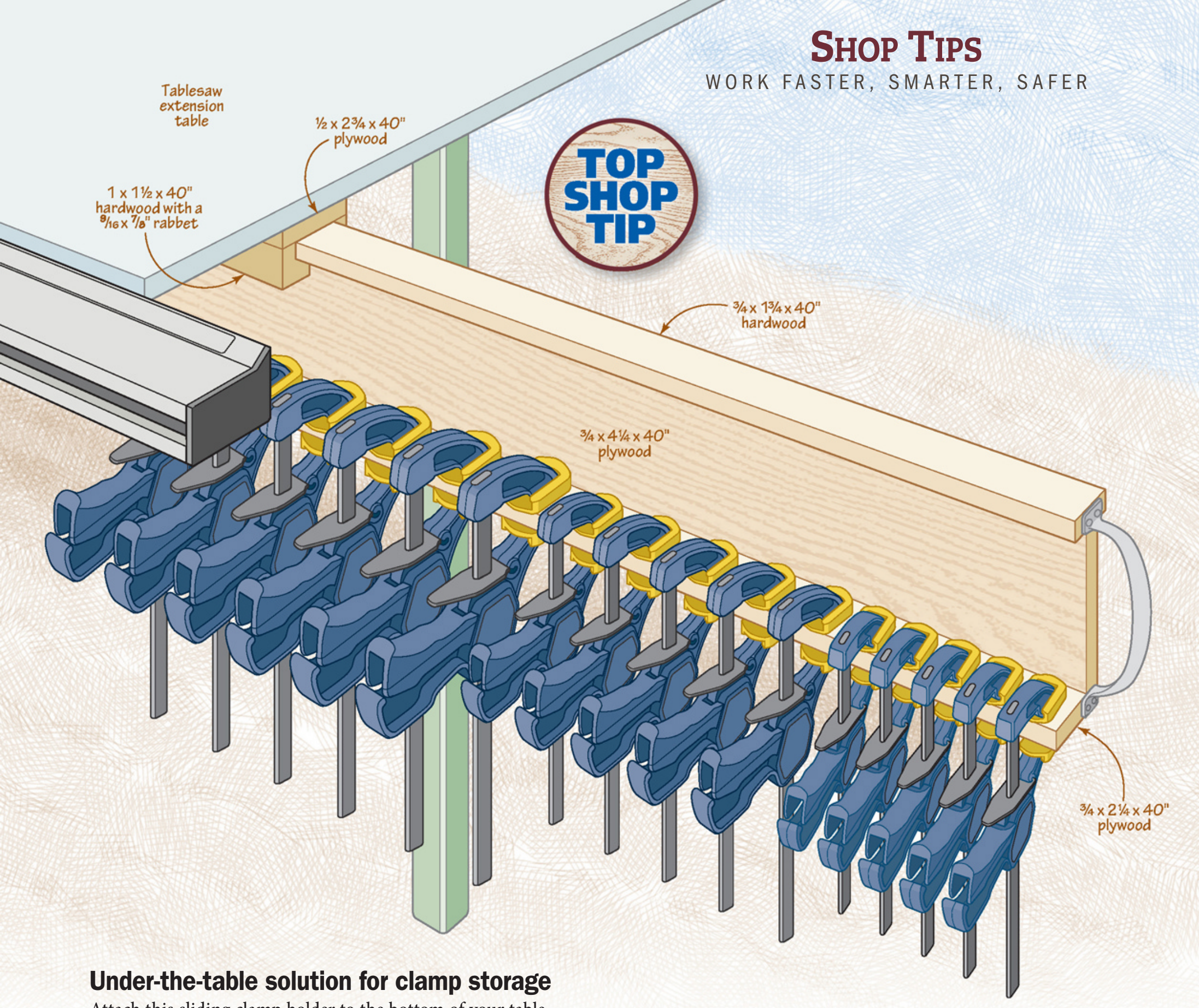
For long-term durability, better chisels have handles made of dense woods such as hornbeam or hard maple. You'll generally find blades with sockets (for accepting handles) only on better-quality chisels. Sockets readily absorb and evenly distribute the force of mallet blows. Good chisels may also have tangs on the handle end of the blade—with those, look for a metal ferrule at the top and bottom of the handle to prevent splitting.

Wood handles on better chisels feel comfortable in your hand and provide a firm grip. Their additional length, sized to provide proper balance with longer blades, also helps prevent striking your hand when using a mallet. And let's face it: An attractive wood handle, properly finished, looks great on your workbench.

If, despite these advantages, you still can't justify buying a good set of chisels, buy one chisel at a time and build a personalized set over time, as your budget allows. You may find you only need bench chisels in two or three sizes, one or two paring chisels, and perhaps one or two mortising chisels. And keep a few cheap bench chisels on hand—we all need a "beater" set for chopping into wood that might contain metal.

Longer handles and blades combined with higher-quality materials provide better chisels with improved balance, feel, reach, aesthetics, and working lifespan.

Have a question? Drop us an e-mail. askwood@woodmagazine.com



TOP SHOP TIP

Under-the-table solution for clamp storage

Attach this sliding clamp holder to the bottom of your tablesaw's extension table to keep bar clamps out of sight but close by for quick access. I sized mine for a 40"-long extension table; you can easily adapt the idea for a workbench.

—Dave Blatti, Grand Rapids, Mich.

Tips earn up to $150.

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Because we try to publish original tips, please send yours only to *WOOD*® magazine.

For sending this issue's Top Shop Tip, Dave receives an Orion model 950 smart pinless wood moisture meter from Wagner Meters, worth $480.

continued on page 22

Box Bonanza Bundle

25 downloadable box plans for $35!

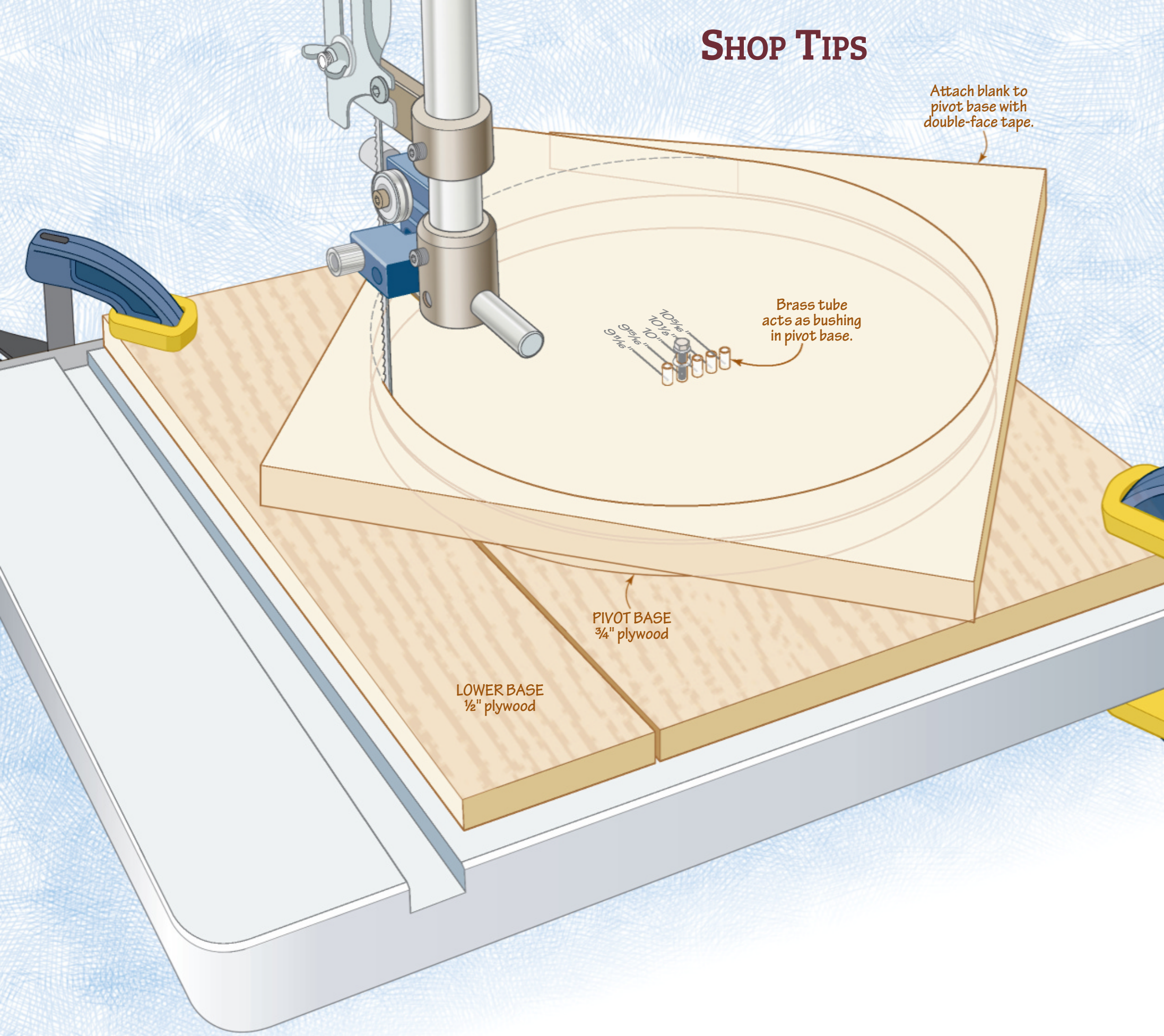





This holiday season, let the wrapper be the gift!

woodstore.net/boxbonanza

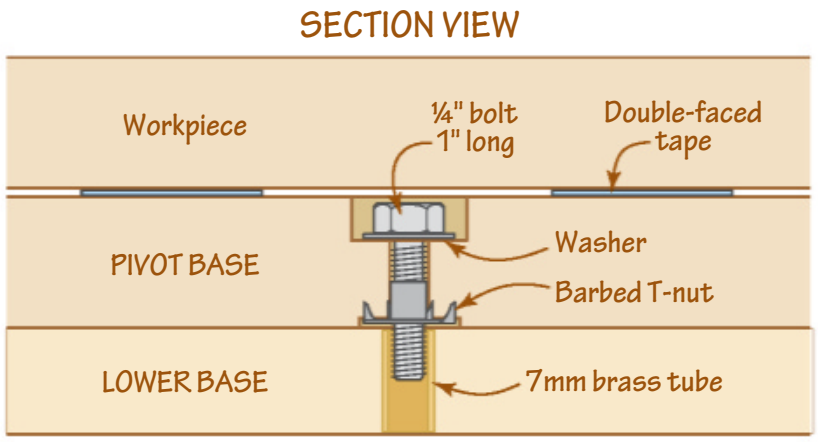




Cut perfect circles quickly using a bandsaw

With this jig you can accurately and repeatably cut circles of various diameters, even when months pass between work sessions. Simply mark and drill 7mm or 9/32" holes at various radii in the bottom base. Then, insert short lengths of 7mm brass tube, the kind sold for making slim pens, and secure them with cyanoacrylate (instant) glue. Install a ¼" bolt into the pivot base. The bolt fits snugly in the 7mm tube.

—Dave McGuffin, Louisville, Ky.

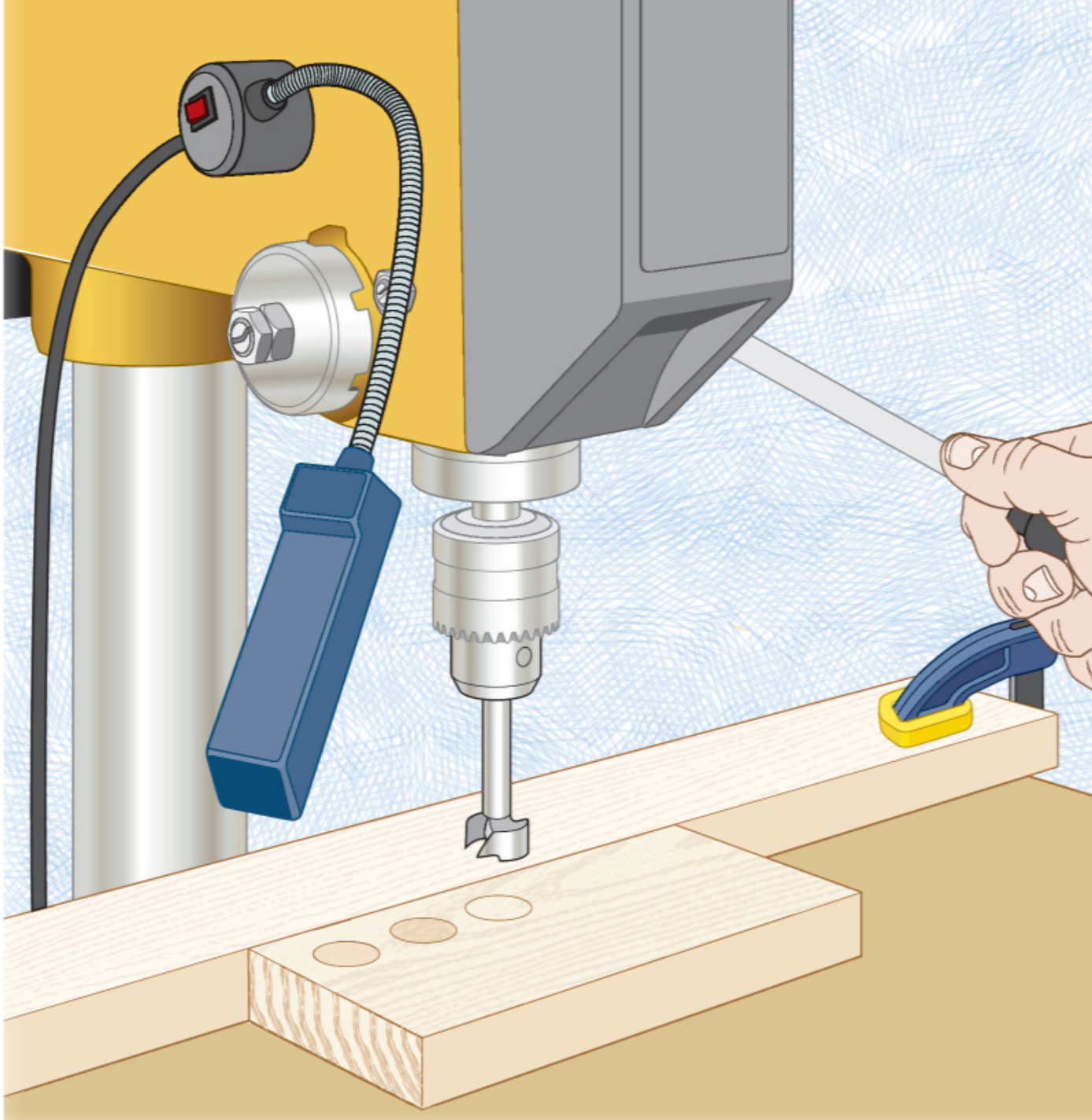


Low-cost way to put light where most needed

At some machines, such as a drill press, bandsaw, lathe, and scrollsaw, fine work requires clearly seeing what you're doing. Fortunately, those tools often have many ferrous surfaces for mounting a magnetic light. I place LED sewing-machine lights, available for less than $10 online, at several machines in my shop. Flexible necks allow you to precisely position the illumination, and removing the light fixture takes seconds when you need it out of the way.

—Dan Martin, Galena, Ohio

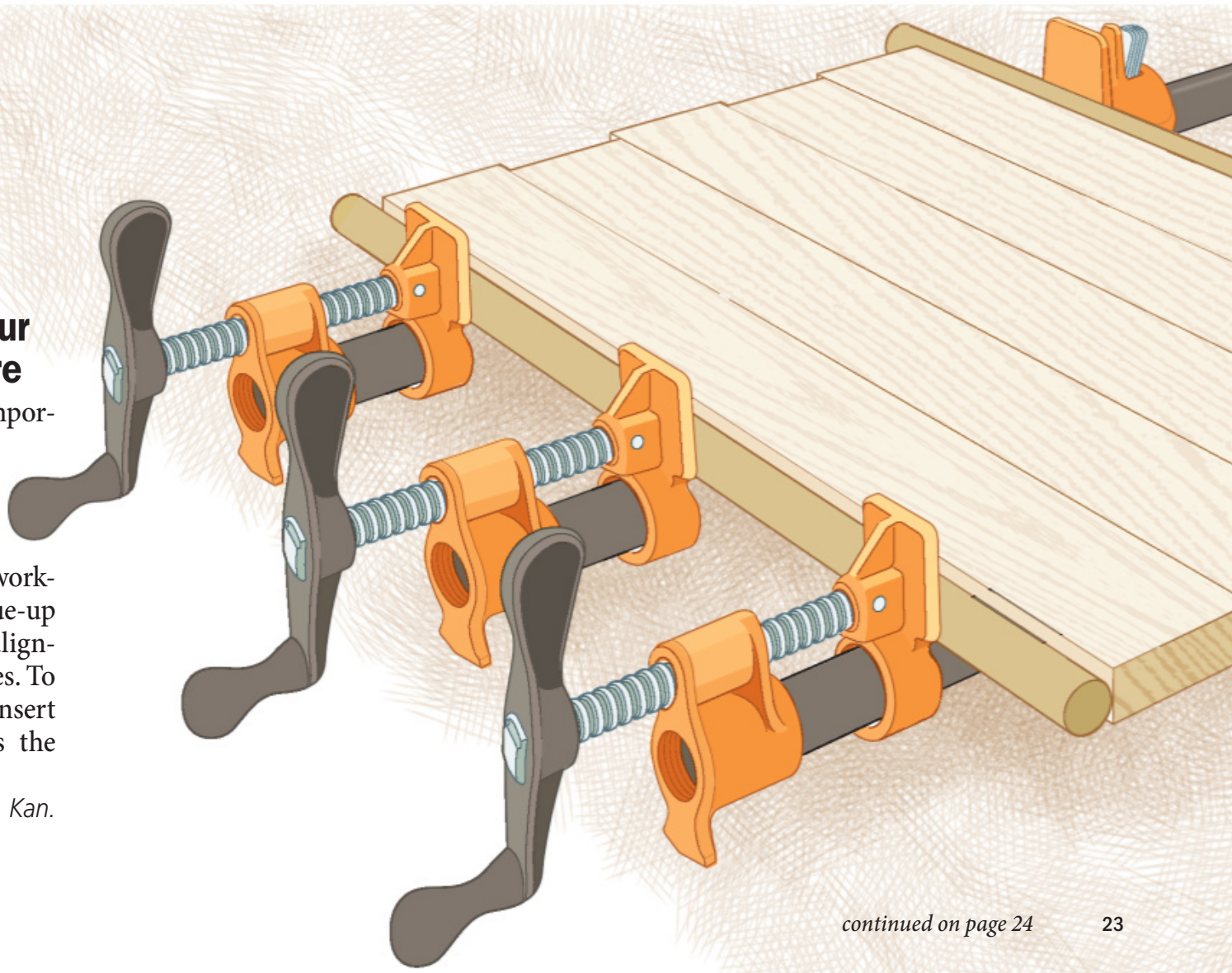
Hover your smartphone's camera over this code to buy this task light, or visit woodmagazine.com/tasklight



Journey to the center of your clamp-ups for even pressure

For good edge-to-edge glue-ups, it's important that the clamping pressure be evenly applied across the thickness of the workpiece edges. Unfortunately, many clamps exert more pressure near the bottom or top of workpiece edges. That can result in the glue-up bowing, the boards shifting out of alignment, poor glue bonds, or all three issues. To ensure centered clamping pressure, insert dowel rods of the same diameter as the board thickness, as shown.

—Frank Orth, Andale, Kan.



continued on page 24

Shop Tips

Drill acrylic without buying special bits

When a recent project called for drilling holes in acrylic, I turned to my regular twist bits. The result: cracks in the acrylic, and grabbing. A search for specialized bits revealed they have a steep cutting angle, like the pilot tip on spade bits. So, I tried using just the tip of the spade bits I already owned. Result: clean, no-grab holes, and I didn't have to purchase new bits.

—Michael Driver, Strongsville, Ohio

A tip for keeping track of tips

I prefer turning tools with carbide tips because I don't like to stop for frequent sharpening. But those tips need to be rotated or replaced occasionally. To help me know how many sharp edges remain on a tip and when it's time to order a new one, I made the chart *below*, and keep it in a binder next to the lathe. You could similarly keep track of planer and jointer knives with multiple carbide edges.

—Paul Bianchina, Bend, Ore.

CARBIDE TIPS – ROTATE / REPLACEMENT

Rougher-Small	Replaced 5-17	Rotated 90° 9-18				
Rougher-Medium	Rotated 90° 3-18	Rotated 90° 10-18	Rotated 90° 3-19			
Rougher-Large	Rotated 90° 5-17	Rotated 90° 2-18	Rotated 90° 4-19	Replaced 2-20		
Finisher-Small	Rotated 90° 2-18					
Finisher-Large	Rotated 90° 5-17	Rotated 90° 12-17	Rotated 90° 8-18			
Detailer-Mini	New Tip 8-17	Rotated 90° 3-18				
Detailer-Large	Rotated 90° 3-18	Rotated 90° 10-18				
Parting Tool	Rotated 90° 2-17	Rotated 90° 6-18				
Hollower-Straight	Rotated 90° 3-17	Rotated 90° 8-17				
Hollower-Curved	Rotated 90° 2-17	Rotated 90° 6-18	Replaced 4-19			

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Divided-light Hutch

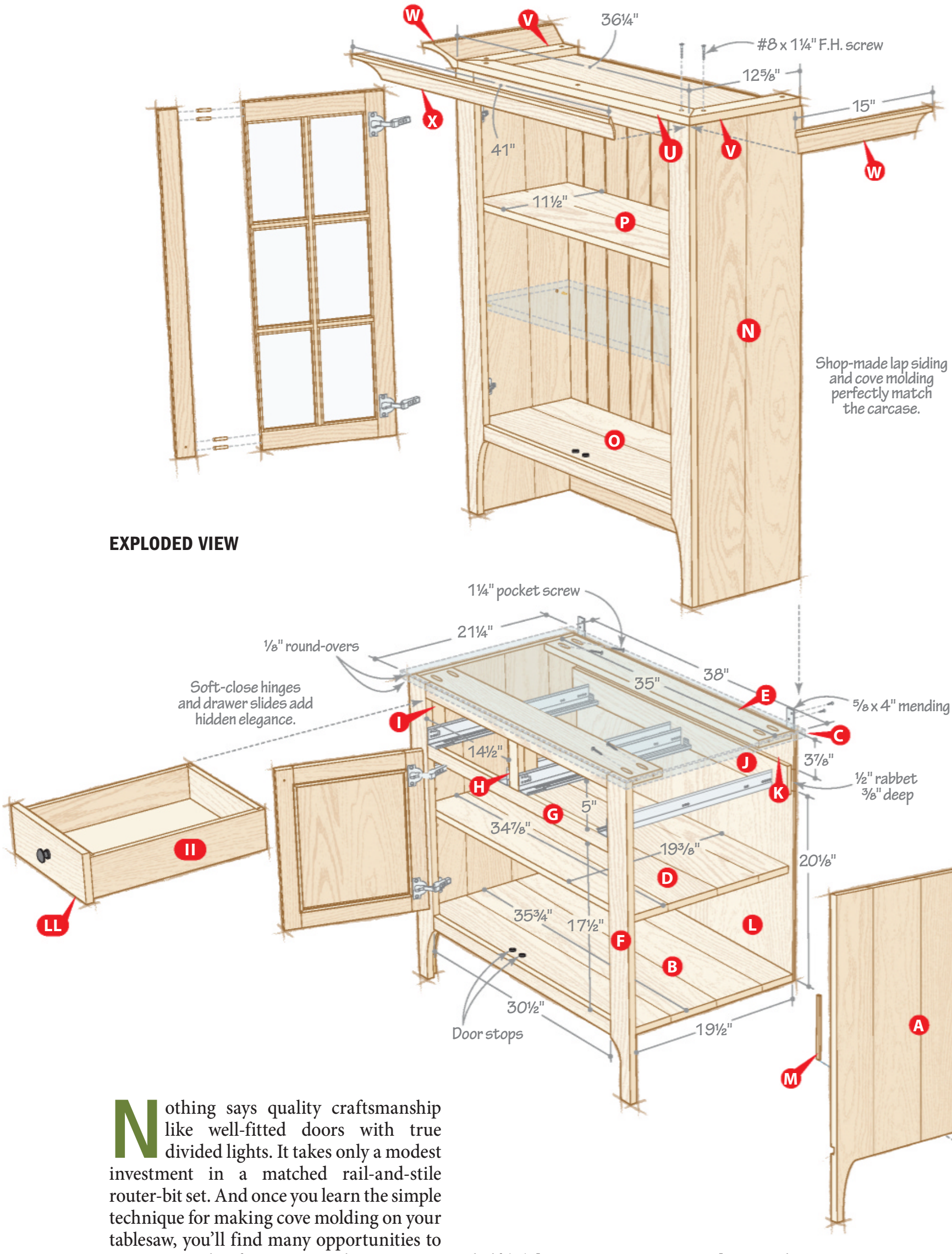
Learn to make cope-and-stick doors and cove molding.

DIMENSIONS:
41" W × 21¼" D × 81⅜" H

Approximate materials cost:
$685

9
sq. ft. of shelf behind glass up top

7
cu. ft. plus two drawers concealed storage below

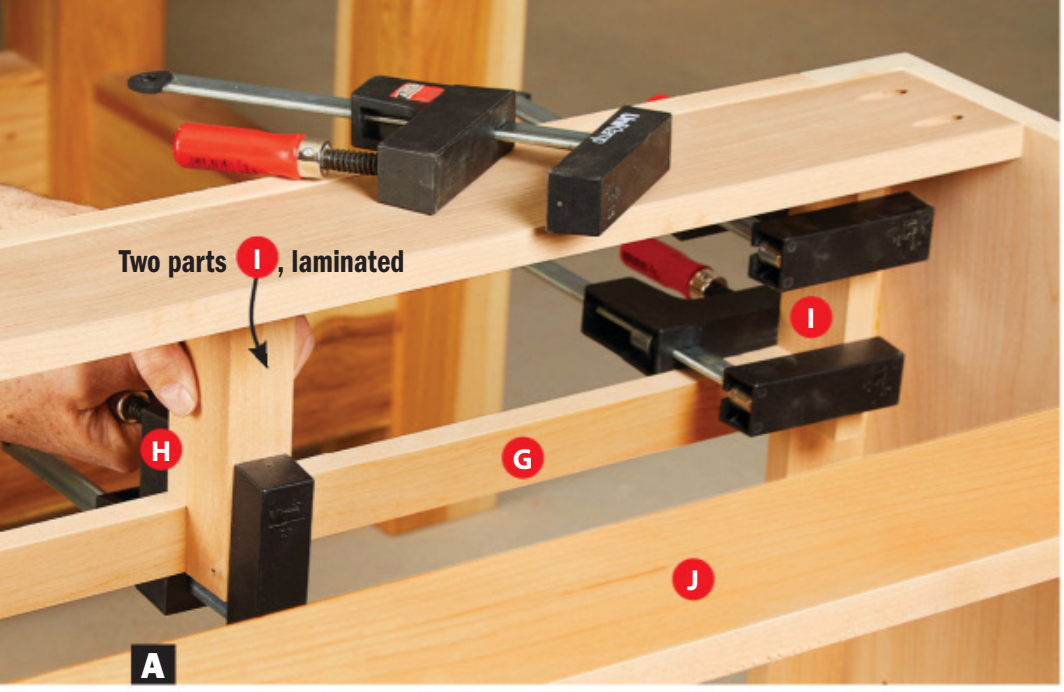


EXPLODED VIEW

Nothing says quality craftsmanship like well-fitted doors with true divided lights. It takes only a modest investment in a matched rail-and-stile router-bit set. And once you learn the simple technique for making cove molding on your tablesaw, you'll find many opportunities to incorporate that feature into other projects.

Start low

1 Edge-join oversize blanks for the lower case sides (A), bottom (B), top (C), and shelf (D) [**Materials List, Exploded View**]. Set aside the top and shelf blanks. Cut the sides and bottom to size. Dado, rabbet, and drill shelf-pin holes in the sides [**Drawing 1**], making mirror-image parts.



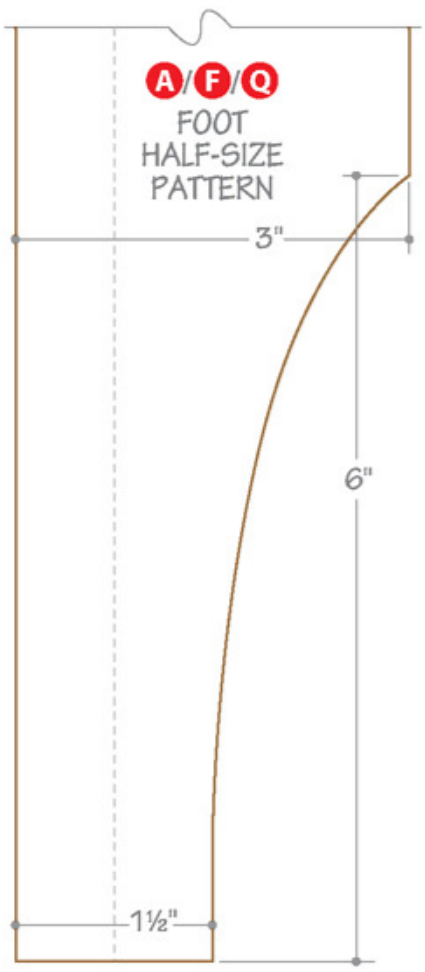
A

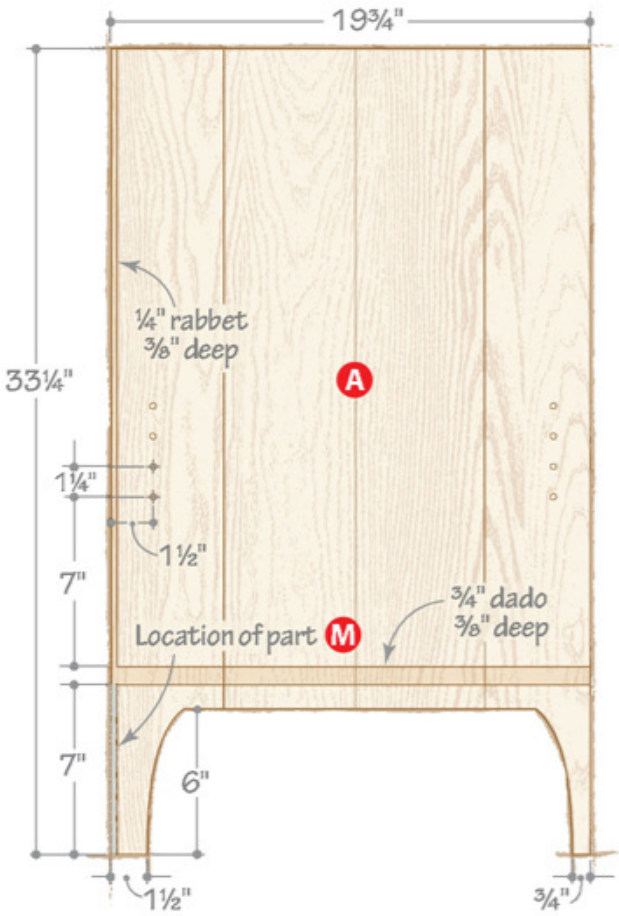
Glue the laminated drawer-slide blocks (I) to the divider (H) and the remaining blocks to the face-frame stiles (F), flush with the inside edges.

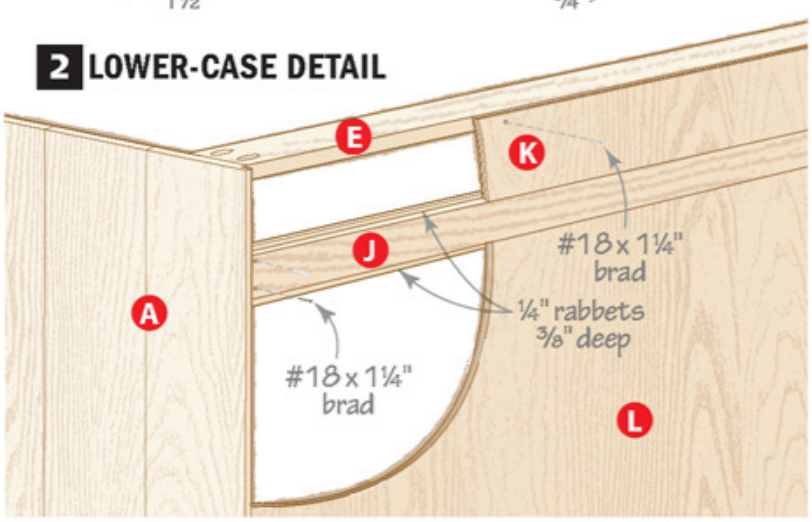
B

Glue and nail the drawer-slide rail (J) to the lower-case sides (A).

FOOT HALF-SIZE PATTERN







2 Enlarge the **Foot Half-size Pattern** and use it to make a hardboard template of the feet. Trace the foot profiles onto the sides and jigsaw and sand them to shape. (Save the template for tracing the face-frame profiles.) Finish-sand the sides and bottom.

3 Cut the stretchers (E) and drill pocket holes [**Exploded View**]. Glue and clamp the bottom (B) into the side (A) dadoes, flush at the front. Pocket-screw the stretchers to the sides flush at the front and aligned with the rabbets at the rear [**Drawing 2**]. Square the case.

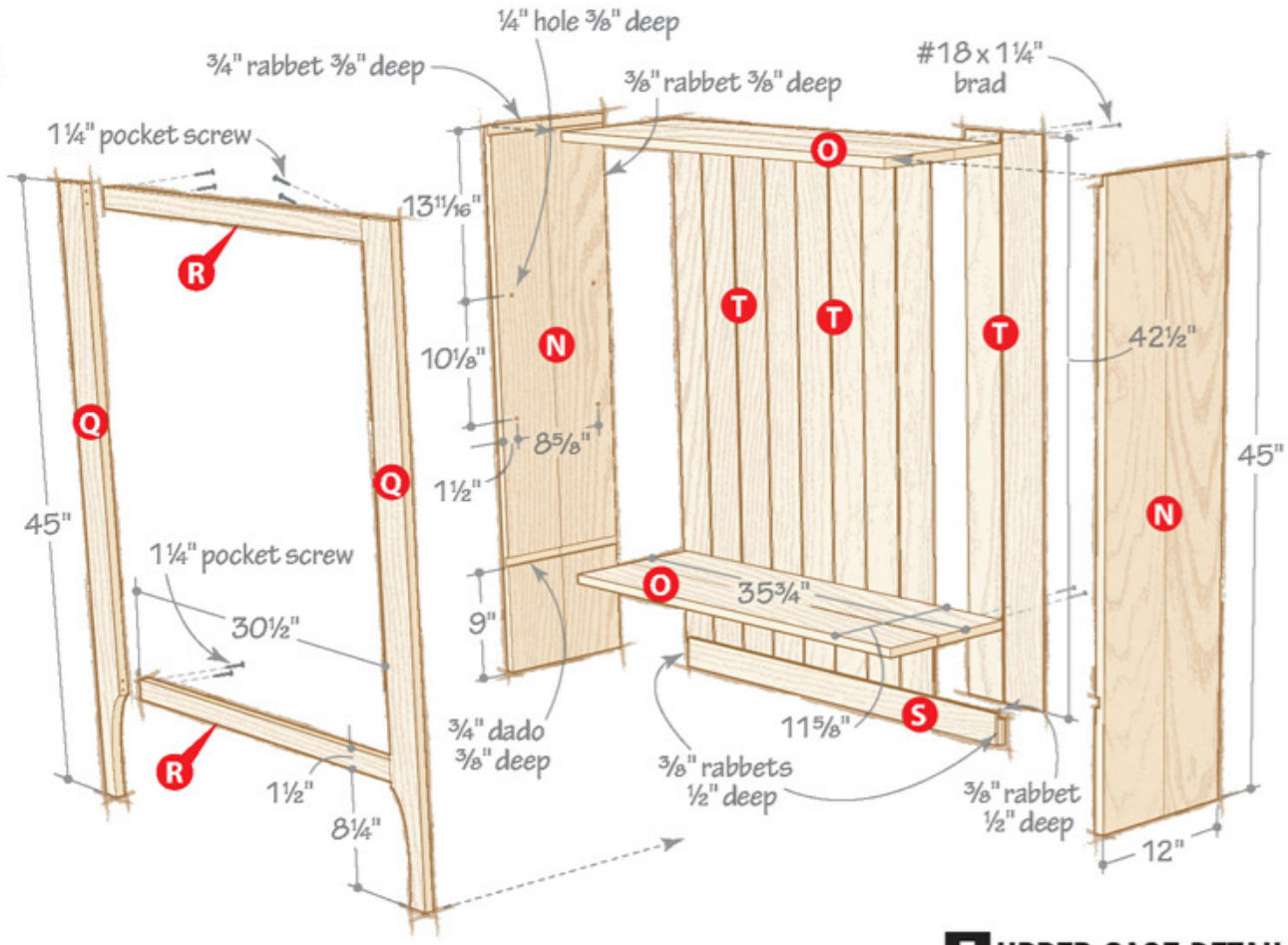
4 Cut the lower-case face-frame parts (F–H). Drill pocket holes and cut and sand the leg profiles. Assemble the face frame and glue it to the case, flush all around. Finish-sand the assembly.

5 Cut the drawer-slide blocks and rail (I, J). Laminate two blocks (I) with ends and edges flush. Glue the blocks to the back of the face frame [**Photo A**]. Rabbet the ends and edges of the rail (J) [**Exploded View** and **Drawing 2**] and install it [**Photo B**].

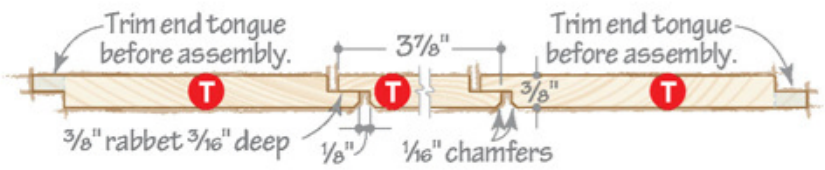
6 Cut the upper and lower backs (K, L) and set them aside. Cut the fillers (M) and glue them into the side (A) rabbets, flush at the bottom [**Drawing 1**]. Retrieve the top (C) and shelf (D) blanks and cut them to size. Round over the ends and edges of the top [**Exploded View**] and finish-sand the parts.

▶Laminate: Glue together parts face grain to face grain.

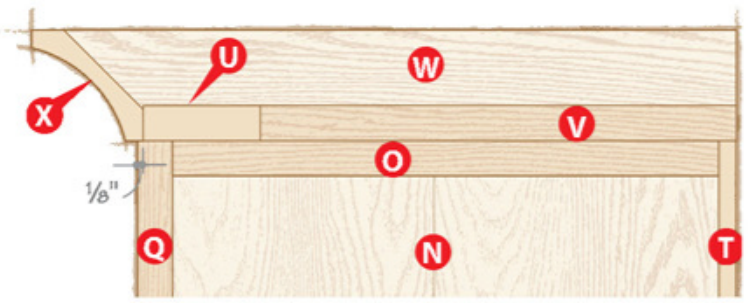
3 UPPER CASE



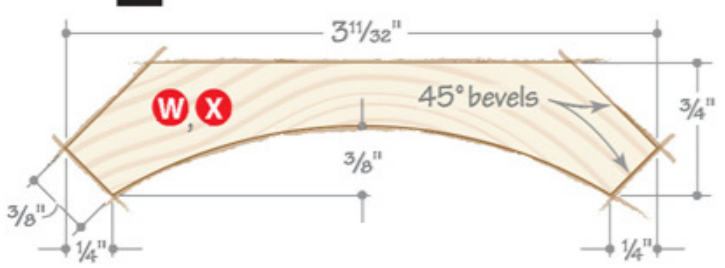
4 BACK SLATS (Top view)



5 UPPER CASE DETAIL



6 CROWN MOLDING END VIEW



Move up

1 Edge-join oversize blanks for the upper-case sides (N), top and bottom (O), and shelves (P) and cut them to size [**Exploded View, Drawing 3**]. Dado, rabbet, and drill shelf-pin holes in the sides. Finish-sand the parts and set the shelves aside.

2 Glue and clamp the top and bottom into the side dadoes and rabbets, all edges flush at the front. Square the case.

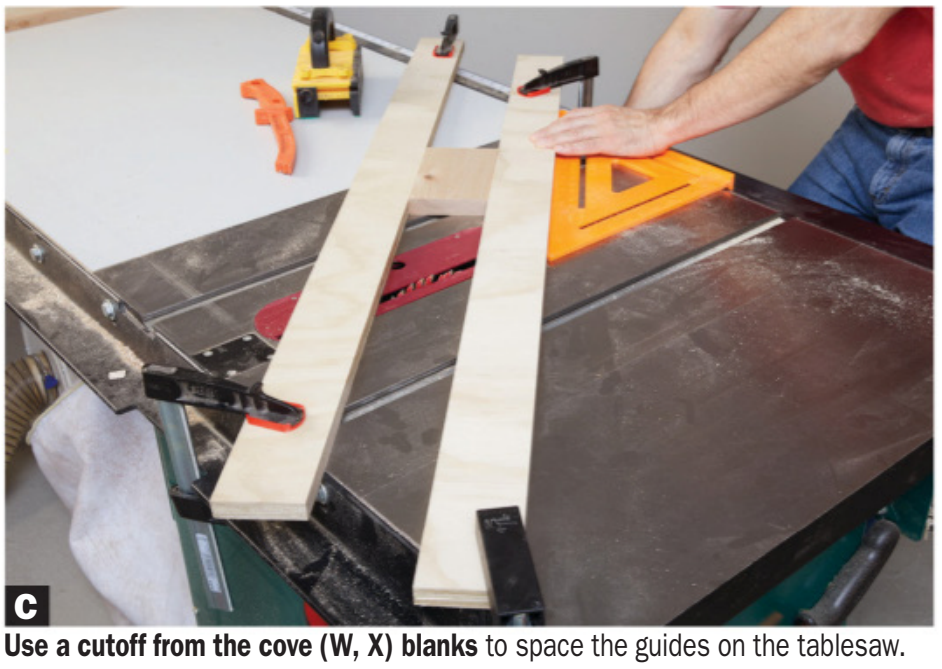
3 Cut the upper-case face-frame stiles and rails (Q, R) and drill pocket holes. Use the template to form the stile lower-end profiles. Assemble the face frame and glue it to the case, flush all around. Finish-sand the assembly.

4 Cut the case rail (S) and rabbet the ends and one edge. Glue and nail the rail to the sides, flush at the bottom.

5 Cut the back slats (T) and rabbet and chamfer them [**Drawing 4**]. Finish-sand the slats and set them aside.

6 Cut the cove backers (U, V) [**Exploded View, Drawing 5**]. Miter the corners and screw them to the top of the upper case.

7 Cut two ¾×3¾×42" blanks for the coves (W, X). Raise your tablesaw blade to ⅜". Clamp two wood guides to the top, 45° to the blade, with the blade centered between them [**Photo C**]. Lower the blade. Making multiple passes and raising the blade 1/16" for each pass, cut ⅜"-deep coves in the blanks [**Drawing 6**].



Use a cutoff from the cove (W, X) blanks to space the guides on the tablesaw.

Cut the blanks to finished width, centering the coves. Bevel the blank edges and finish-sand the coves. Cut and miter the coves to length and glue and pin them in place.

▶Watch a free video on making cove molding on your tablesaw. Hover your smartphone's camera over this smartcode, or visit woodmagazine.com/tscove.

Make the doors

1 Following the steps in the **Skill Builder**, *below*, make the upper- and lower-case door frames and the mullions.

2 Drill hinge-cup and knob holes in the stiles (Y, AA) [**Drawing 8a**] and finish-sand the door frames. Cut the door panels (DD)

SKILL BUILDER

Cope-and-stick the doors

There's more than one way to make a door. You could cut stiles, rails, and mullions without an edge profile, assemble the parts into a frame, and form and apply separate moldings. This requires making a lot of delicate molding and then laboriously mitering, gluing, and pinning each piece into the frame openings. An easier way: Rout the profile around the insides of the openings after assembly. But this leaves telltale rounded profiles in the corners—not a good look. Instead, for the best combination of speed and appearance, use a miniature rail-and-stile router-bit set [**Sources**] and your router table.

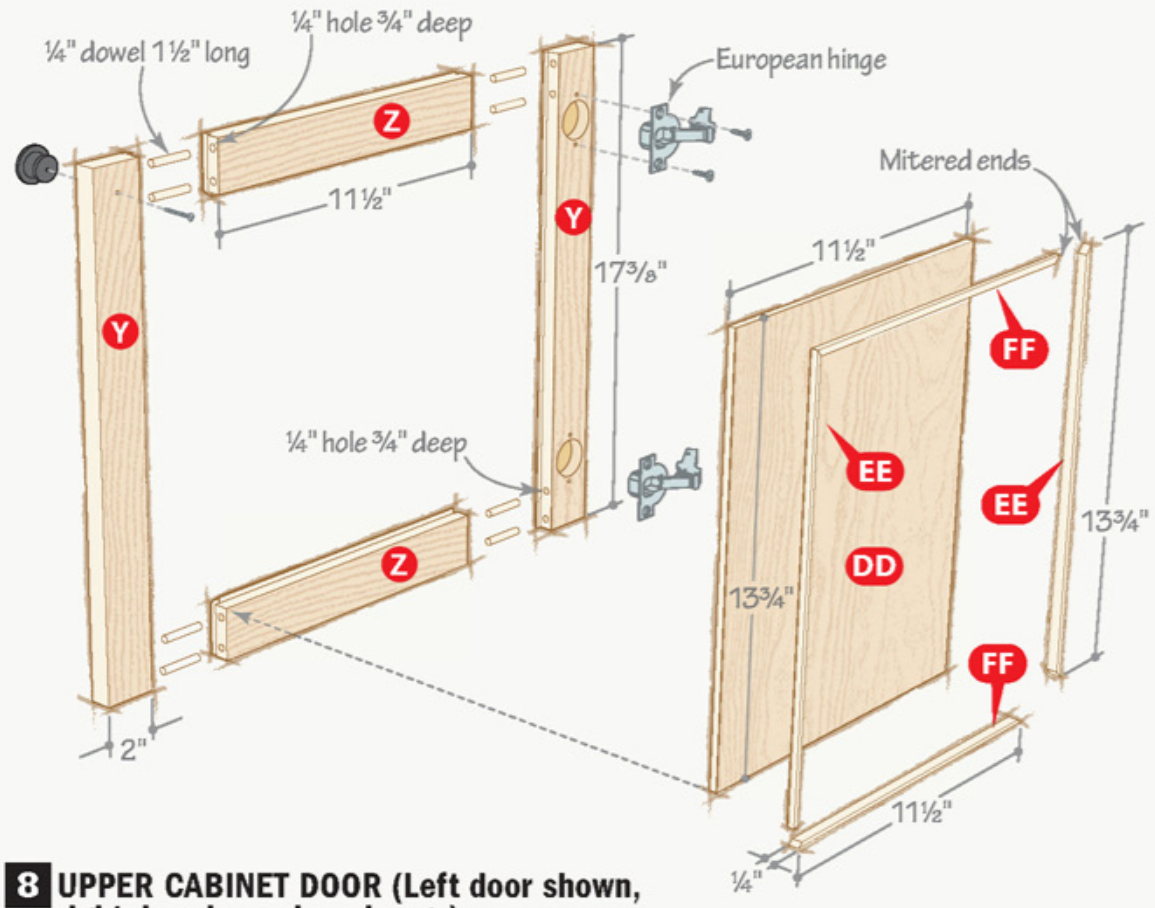
Cut the lower and upper door stiles and rails (Y–AA) [**Drawings 7** and **8**], plus two additional 6"-long pieces of the same stock for making setup blocks. Machine a ¾×3×31" blank for the vertical mullions (BB), two ¾×4×6" blanks for the horizontal mullions (CC), and a ¾×3×32" carrier board for forming the mullions.

Install the cope bit and rout the ends of the rails (Z) [**Photo D**], one end of one setup block, and one edge of the carrier board. Switch to the stick bit, using the cope on the setup block to set the height, and rout the inside edges of the stiles and rails (Y–AA) and one end of the second setup block. Reinforce the corner joints with dowels [**Photo E**] and assemble the frames. Set aside the lower-door frames.

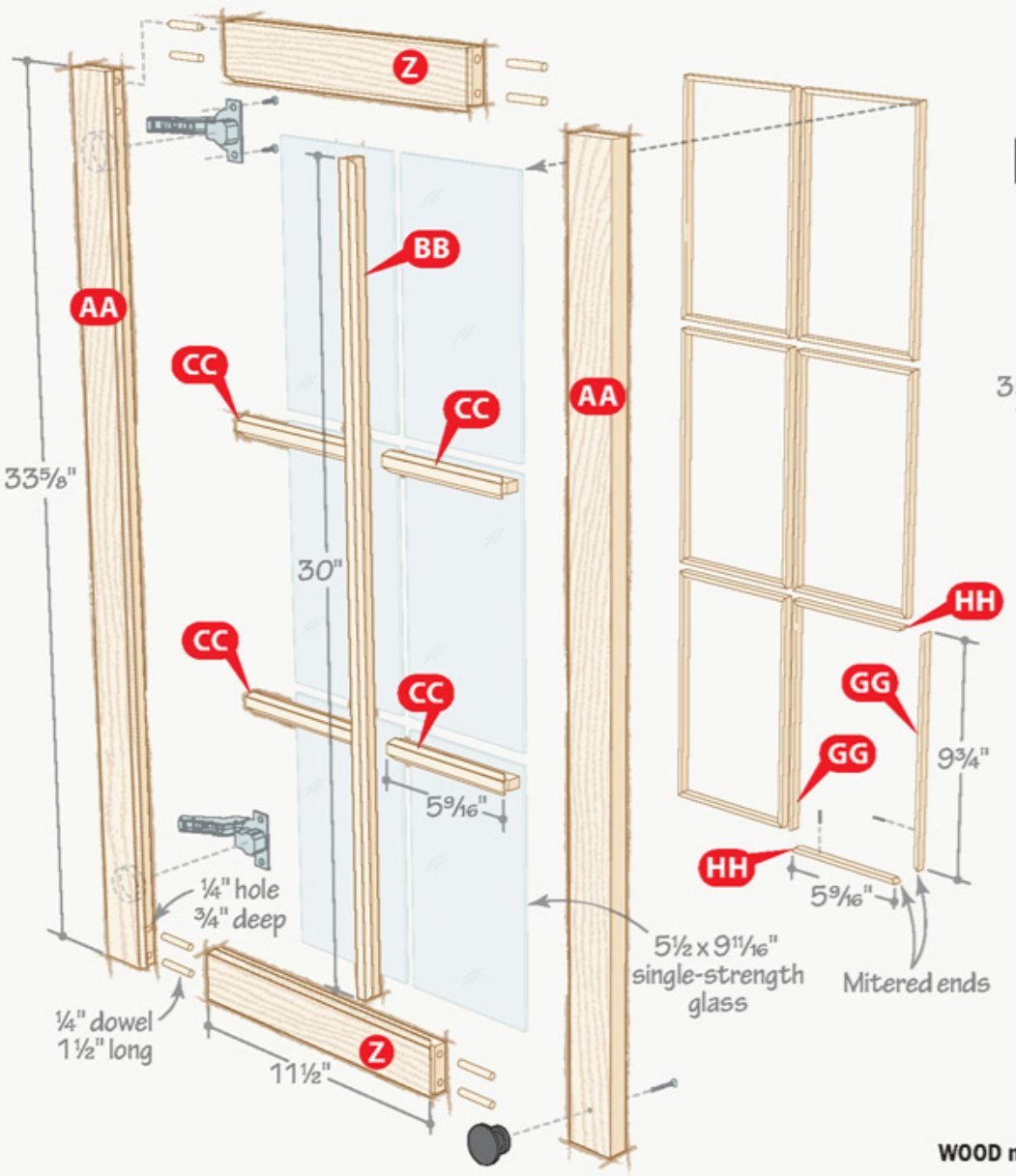
Verify the 11½×30" dimensions of the rabbeted openings in the upper door frames and cut the mullion blanks to finished length. Reinstall the cope bit, using the sticked setup block to set the height, and rout the ends of the mullion blanks. Switch back to the stick bit and set the height with the coped setup block. Begin routing the mullion blanks [**Photo F**].

Rip a ¾"-wide strip from the routed edge of each mullion blank. Rout the second edge of each strip [**Photo G**]. Repeat to form the remaining mullions. Mark centerlines on the rails (Z), stiles (AA), and mullions (BB, CC). Install the mullions [**Photos H** and **I**]. Secure the mullions with a pinner.

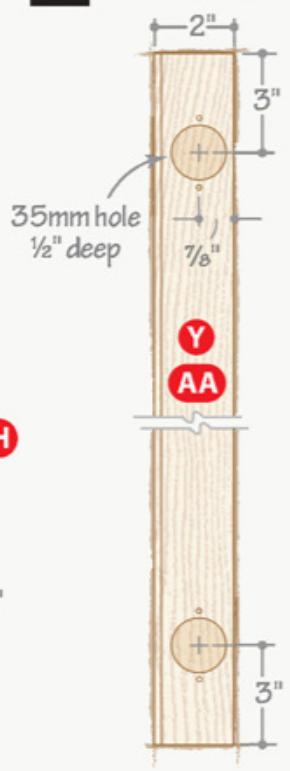
7 LOWER CABINET DOOR (Rear view, left door, right door is a mirror image)



8 UPPER CABINET DOOR (Left door shown, right door is a mirror image)

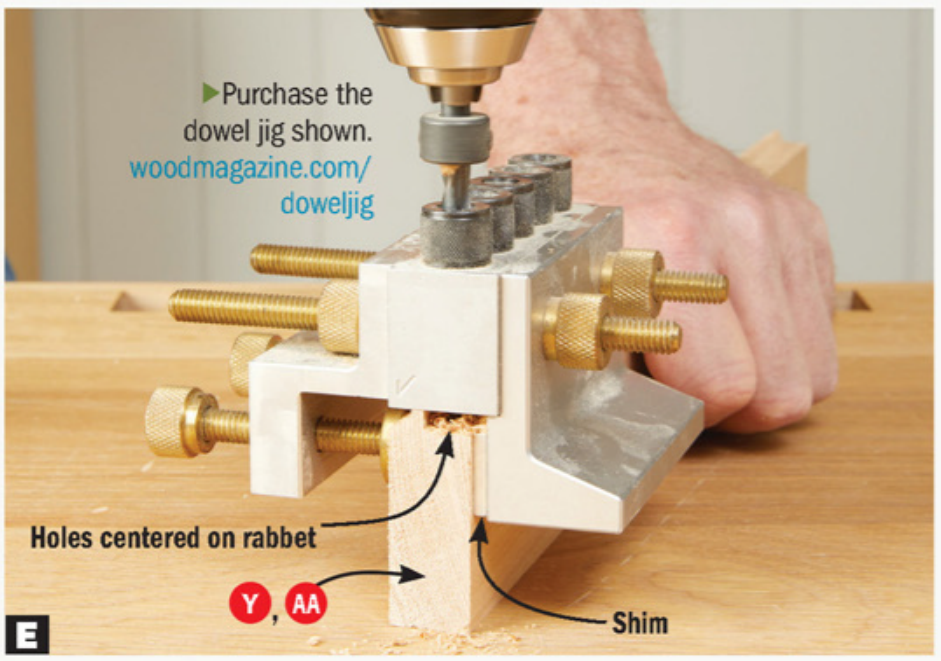


8a DOOR STILE

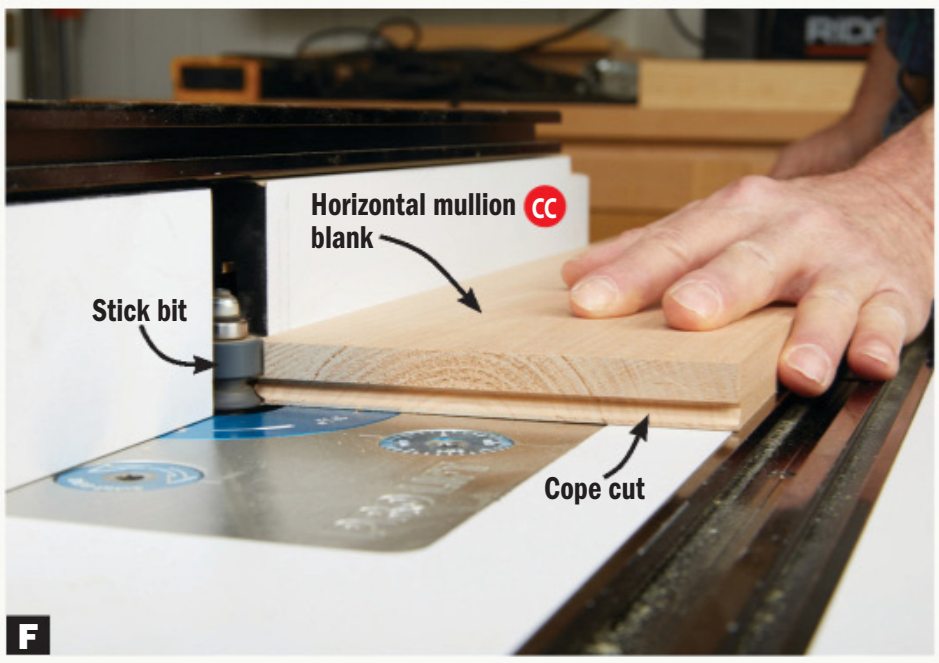


and miter-cut the stops (EE, FF). Finish-sand the panel and stops. Glue the panels into the lower-door frames and pin the stops in place. Miter-cut the glass stops (GG, HH), finish-sand, and set them aside.

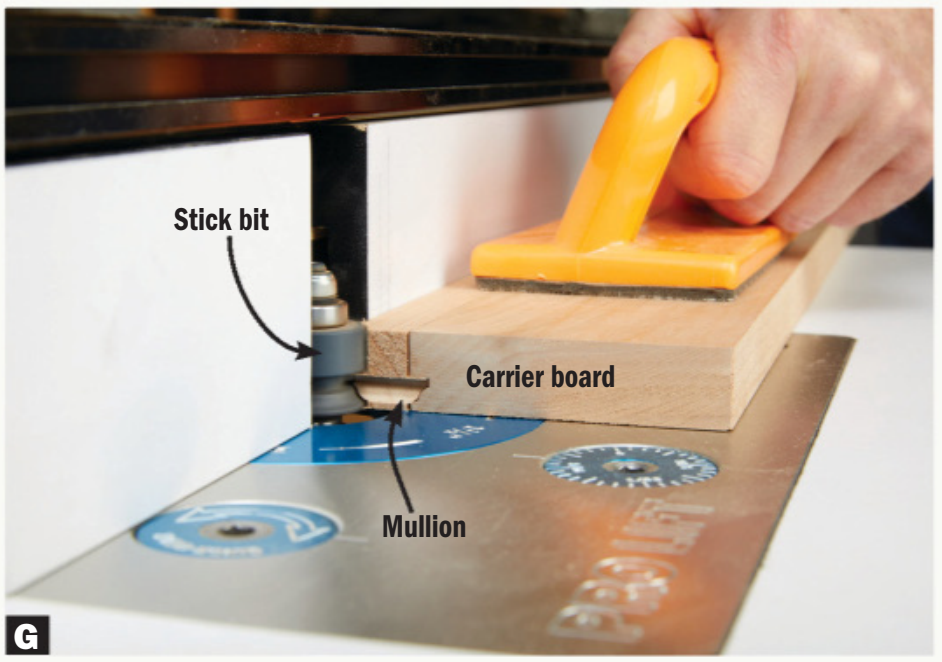
Rout the rail ends with the cope bit. Use a follower block to keep the rails perpendicular to the fence and prevent chip-out.



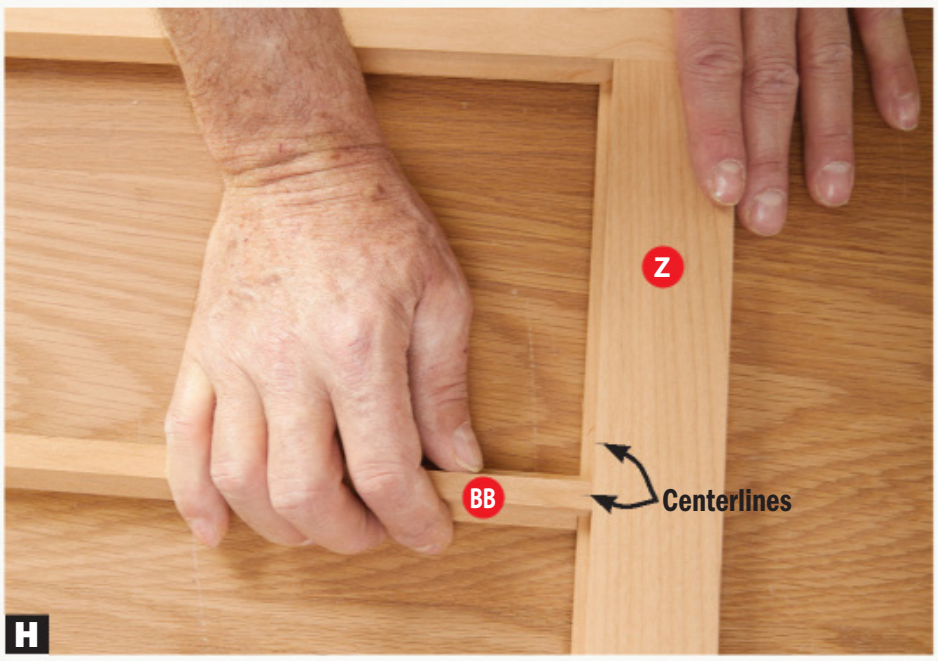
Drill holes for ¼" dowels in the stiles and rails using a dowel jig and brad-point drill bit. Insert a shim to center the holes on the rabbet rather than the workpiece.



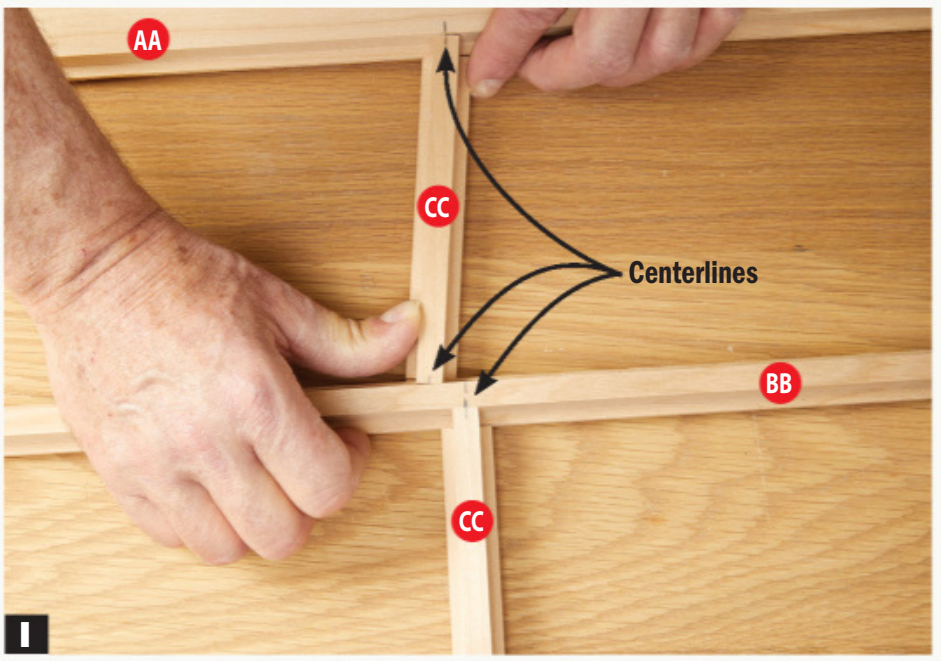
Rout the stick profile along one edge of each mullion blank.



Rout the stick profile in the second edge of the mullion, nesting the mullion in the carrier-board profile. Use a follower block to prevent the mullion from slipping.



Insert the vertical mullion (BB) between the rails (Z) at an angle and slide to align the marked centerlines.



Insert the horizontal mullions (CC) between the stiles (AA) and vertical mullion (BB) at an angle and slide to align marked centerlines.

Screw the drawer slides to the slide blocks (I) while resting the rear of the slide on a temporary support. Then screw the rear-mounting brackets to the rail (J).

Firmly press the drawer face (LL) onto double-faced tape applied to the front of the drawer box. Shims ensure equal gaps at top and bottom.

Screw the lower hinge-mounting plate to the face-frame stile, positioning it on a spacer resting on the case bottom.

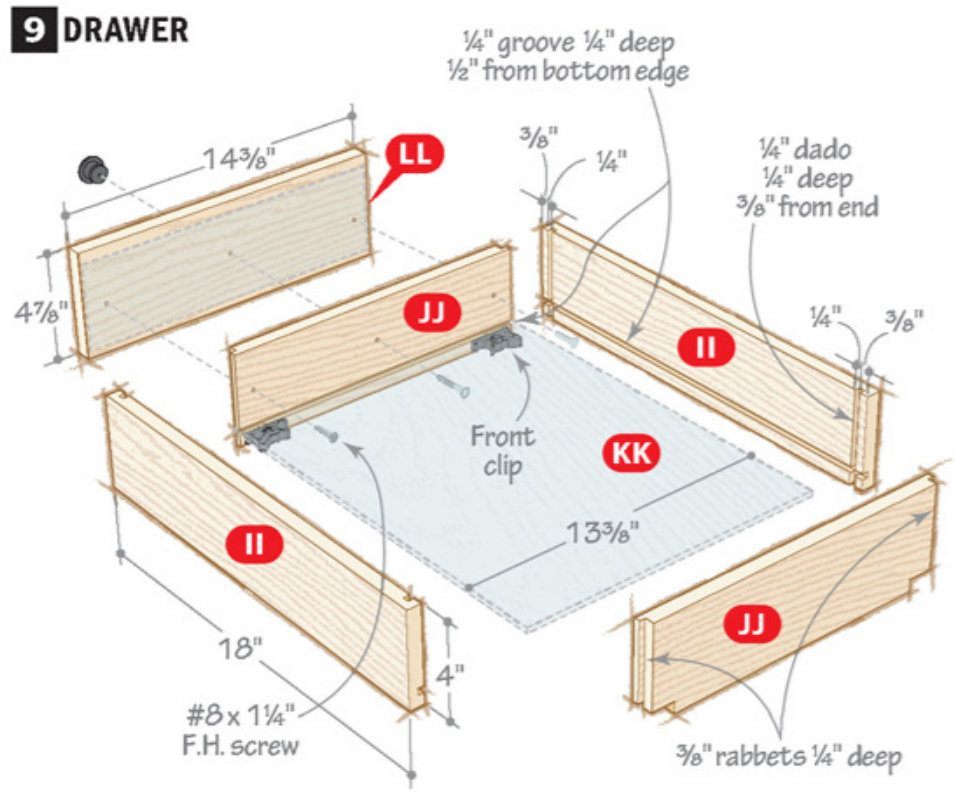
Build the drawers

1 Cut the drawer sides, fronts, and backs (II, JJ) [**Drawing 9**]. Dado, groove, rabbet, and finish-sand the parts. Cut and finish-sand the drawer bottoms (KK) and assemble the drawers, checking them for square. Notch and drill the drawer backs for the drawer slides [**Drawing 10**]. Attach the drawer-slide front mounting clips [**Sources**] to the drawers.

2 Attach the rear-mounting brackets [**Sources**] to the drawer slides [**Sources**]. Make a temporary support [**Photo J**] and install the drawer slides in the case.

3 Cut the drawer faces (LL), drill knob holes, and finish-sand. Install the drawer boxes in the case and attach the faces [**Photo K**]. Carefully remove the drawers, drill pilot holes from the inside, and secure the faces with screws. Extend the knob holes through the drawer-box fronts.

9 DRAWER



Finish up

1 Remove the drawers from the case and the drawer faces from the drawer boxes. As you remove them, mark the drawer-box and drawer-face locations on their backs. Remove all hardware. Inspect all parts and assemblies and finish-sand where needed. Apply finish. (We sprayed Magna Max pre-catalyzed lacquer, dull sheen, on the cases, doors, drawers, and plywood backs; and finished the back slats with Benjamin Moore no. HC-33 Montgomery white, eggshell sheen acrylic latex paint.)

2 Nail the backs (K, L) to the lower case. Screw the drawer faces to the drawer boxes and install the knobs [**Sources**]. Remount the drawer slides and install the drawers.

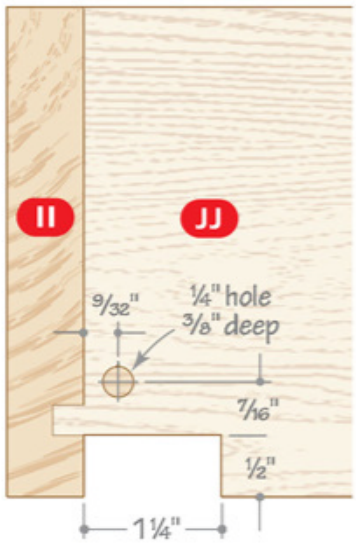
3 Install the hinges [**Sources**] in the lower-case doors and screw the lower mounting plates [**Sources**] to the face-frame stiles [**Photo L**]. Clip a mounting plate to the upper hinge of one door and clip the lower hinge into the lower plate. Hold the door open with the upper mounting plate against the stile and screw it into place. Repeat with the other door. Install the knobs and door stops [**Exploded View, Sources**].

4 Rip the tongues off the two end slats (T) [**Drawing 4**] and brad-nail the slats to the upper case.

5 Have glass cut for the upper-case doors, position the panes in the openings, and pin the glass stop in place. Install the doors in the upper case in the same manner as for the lower case. Install the knobs and door stops.

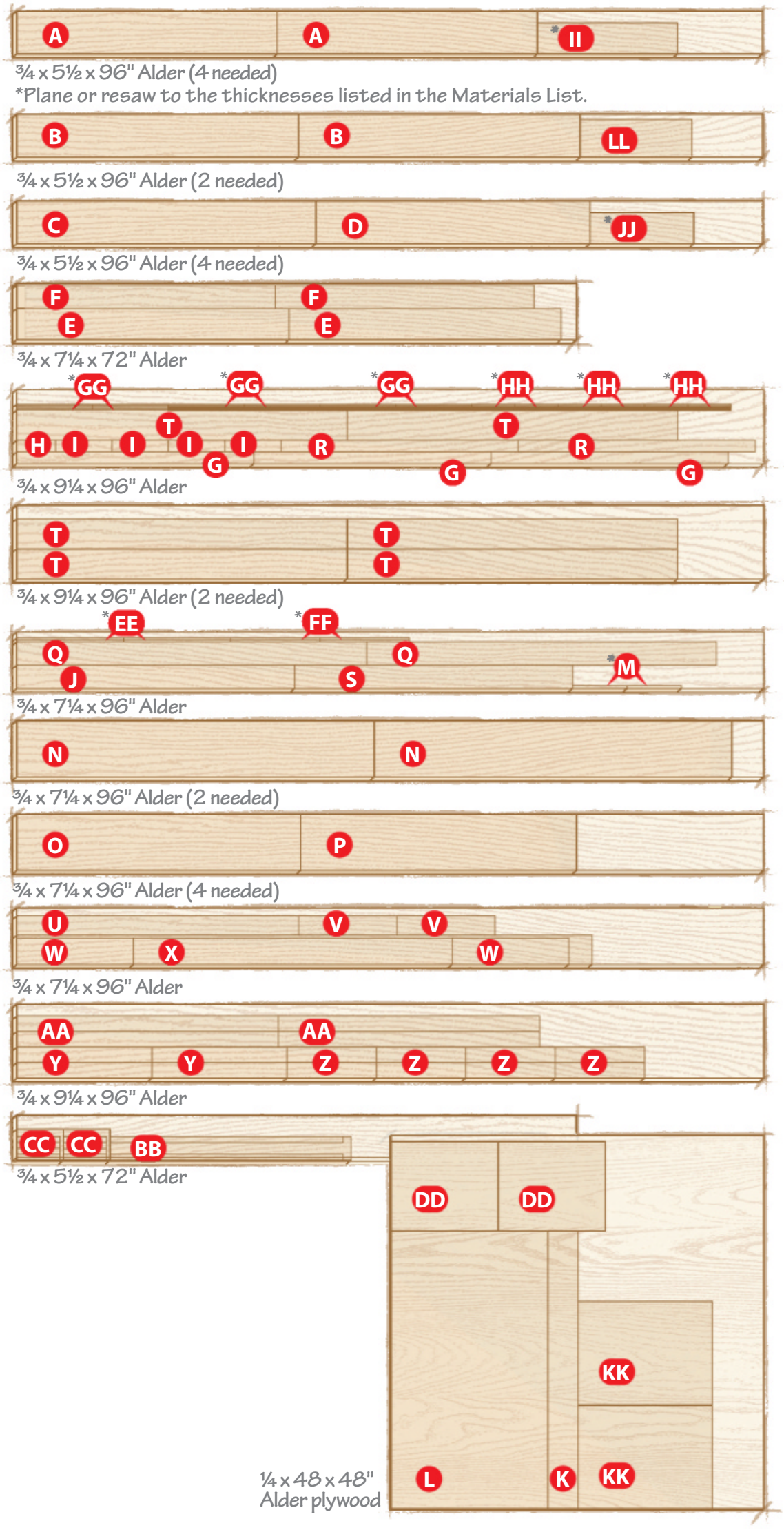
6 Move the lower case to the desired location but away from the wall. Position the upper case on the lower case and secure it with mending plates [**Exploded View**]. Move the hutch against the wall and install shelf supports [**Sources**] and the adjustable shelves. Load the hutch with family heirlooms and step back and admire your handiwork.

10 DRAWER BACK DETAIL



Cutting Diagram

This project requires 115 board feet of 4/4 alder.



Sources: Miniature matched rail-and-stile cutters for glass doors no. 8848, $85. MLCS, 800-533-9298, mlcswoodworking.com. Drawer slides no. HT9134339, $20 set (2 sets); front mounting clips no. HT9140413, $1.90 set (2 sets); rear mounting brackets no. HT1135181, $1.86 ea. (4); hinges no. B071B3650, $5.63 ea. (8); hinge-mounting plates no. B175H5030.21, $3.10 ea. (8); knobs no. A53005 FB, $1.53 ea. (6); door stops no. FCEURO brown, $1.72 pack of 10; ¼" shelf supports, nickel finish no. THB0144, $0.47 ea. (12). Woodworker's Hardware, 800-383-0130, wwhardware.com.

Produced by **Jan Svec** with **Kevin Boyle**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine, Lorna Johnson**

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
Lower case						
A*	sides	¾"	19¾"	33¼"	EA	2
B*	bottom	¾"	19½"	35¾"	EA	1
C*	top	¾"	21¼"	38"	EA	1
D*	shelf	¾"	19⅜"	34⅞"	EA	1
E	stretchers	¾"	4"	35"	A	2
F	face-frame stiles	¾"	3"	33¼"	A	2
G	face-frame rails	¾"	1½"	30½"	A	3
H	divider	¾"	1½"	5"	A	1
I	drawer-slide blocks	¾"	1½"	7¼"	A	4
J	drawer-slide rail	¾"	3"	35¾"	A	1
K	upper back	¼"	35¾"	3⅞"	Ply	1
L	lower back	¼"	35¾"	20⅛"	Ply	1
M	fillers	¼"	⅜"	7"	A	2
Upper case						
N*	sides	¾"	12"	45"	EA	2
O*	top and bottom	¾"	11⅝"	35¾"	EA	2
P*	adjustable shelves	¾"	11½"	34⅞"	EA	2
Q	face-frame stiles	¾"	3"	45"	A	2
R	face-frame rails	¾"	1½"	30½"	A	2
S	case rail	¾"	3"	35¾"	A	1
T	back slats	⅜"	3⅞"	42½"	A	10
U	front cove backer	¾"	2½"	36¼"	A	1
V	side cove backers	¾"	2½"	12⅝"	A	2
W*	side coves	¾"	3 11/32"	15"	A	2
X*	front cove	¾"	3 11/32"	41"	A	1
Doors						
Y	lower stiles	¾"	2"	17⅜"	A	4
Z	rails	¾"	2"	11½"	A	8
AA	upper stiles	¾"	2"	33⅝"	A	4
BB*	vertical mullions	¾"	¾"	30"	A	2
CC*	horizontal mullions	¾"	¾"	5 9/16"	A	8
DD	panel	¼"	11½"	13¾"	Ply	2
EE	vertical panel stops	3/16"	¼"	13¾"	A	4
FF	horizontal panel stops	3/16"	¼"	11½"	A	4
GG	vertical glass stops	3/16"	⅜"	9¾"	A	24
HH	horizontal glass stops	3/16"	⅜"	5 9/16"	A	24
Drawers						
II	sides	⅝"	4"	18"	A	4
JJ	fronts and backs	⅝"	4"	13⅜"	A	4
KK	bottoms	¼"	13⅜"	17¼"	Ply	2
LL	faces	¾"	4⅞"	14⅜"	A	2

*Parts initially cut oversize. See the instructions.

Materials key: EA-edge-joined alder, A-alder, Ply-alder plywood.
Blade and bits: Dado set, ⅛" round-over and 45° chamfer router bits, ¼" brad-point drill bit, 1⅜" or 35mm Forstner bit.
Supplies: 1¼" pocket screws, #8×1¼" flathead screws, ¼×1½" dowels, #18×1¼" brads, ½" and ¾" micro pins, 5½×9 11/16" single-strength glass (12), ⅝×4" mending plates (2).

SHOP TEST

Benchtop Oscillating Spindle Sanders

These often-underappreciated machines do one thing—smooth curves—better and quicker than any other machine.

If you've tried to sand a curve with a handheld sander, or attempted the task with a dust-clogged sanding drum in your drill press, you know why oscillating spindle sanders have become popular. These machines quickly smooth cutlines, and the spindle's up-and-down motion blends abrasive scratches, reduces heat buildup, and extends the life of the sanding sleeve.

Even though you can buy stationary machines with larger motors, tables, and sanding drums, a benchtop model handles most of the same workload. So we set out to find the best among the benchtop group, testing 14 spindle sanders, including three machines that combine spindle- and belt-sanding functions into one unit. The good news: You can't go wrong with any of the machines we tested, although some perform a little better than others.

Tool-selection criteria

Each machine considered for this review:

- rests on a benchtop or mounts to a metal stand;
- and comes with drums of at least three different diameters.

Centered spindles

LAGUNA SS/14

TRITON TSPS370

RIKON 50-300

GRIZZLY T26417

SHOP FOX W1846

GRIZZLY G0723

JET JBOS-5

2019 WOOD Magazine TOP TOOL Benchtop Oscillating Spindle Sander

You'll get less working surface on this shield-shaped table (shown on the Shop Fox W1831), about 3–4" of table surface between the largest sanding drum and table edge.

Five key aspects of a good spindle sander

■ **Power.** No issues here. Despite their small stature and fractional-horsepower motors (only the Jet JBOS-5 has a motor rated at 1 hp), all the test machines powered through aggressive sanding without bogging down. We were able to slow only the three combo machines by pushing them hard in belt-sander mode—which increases the surface area in contact with the abrasive. (In the chart on *page 36*, our power grades for these three machines are based on their spindle-sander performance.)

■ **Layout line visibility.** Good visibility results from a combination of optimum table height, effective dust collection, and the ability to easily see the layout line regardless of how aggressively you sand. Most of the sanders fared well here.

You want a table height at a level that's comfortable for you to work at. For example, the tables on stationary spindle sanders measure about 39–40" above the floor. With the benchtop units we tested, their table height will depend on what stand or workbench you place them on. See the chart for the heights of each model's table.

■ **A user-friendly table.** Table size matters less than the spindle location within the table. We prefer an off-center spindle that provides space to not only rest workpieces flat, but also room to slide long pieces side-to-side when sanding an edge. Most machines provide 6" or more table surface between the largest drum and table edge, which we found to be plenty. However, the three models with shield-shaped tables place that larger table surface behind the spindle, *above*, blocking the layout line from easy view (assuming you position the machine with the power switch in front).

Offset spindles

TRITON TSPS450

SHOP FOX W1831

WOODRIVER 157889W

GRIZZLY G0538

Combination spindle/belt sanders

TRITON TSPST450

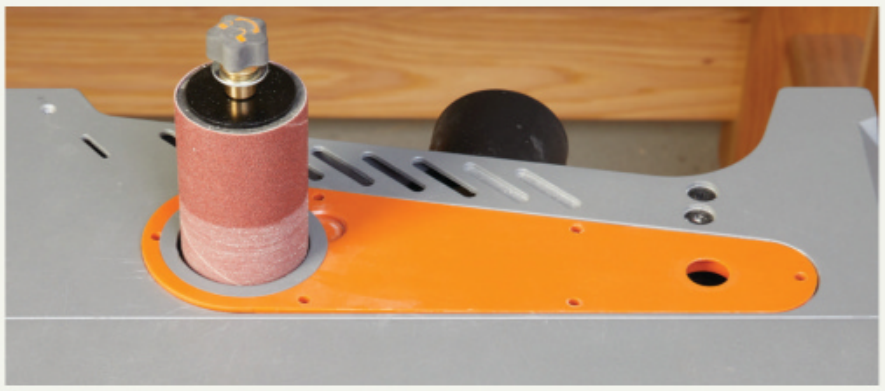
MLCS 9592

RIDGID EB4424

2019 WOOD Magazine TOP VALUE Benchtop Oscillating Spindle Sander

Quick-change combo sanders pull effective double duty

Three machines in our test quickly convert from a spindle to an oscillating 4×24" belt sander and excel at such tasks as sanding tapered legs, shaping convex curves, and shaping and smoothing small parts. They don't provide the sanding surface area or power of a benchtop or stationary belt/disc sander, but we find the functionality valuable enough to consider buying one of these rather than a dedicated spindle sander. All come with one 80-grit belt, but replacement belts of finer grits are readily available for jobs where you need more finesse.



Instead of a dedicated 3" drum, the spindle/belt sanders offer the use of the belt-drive drum (minus the workpiece stop) for curves of that size.

Although we don't do a lot of angled spindle sanding, the tables on eight models tilt up to 45°. On the Grizzly T26417, Jet, Laguna, Rikon 50-300, and Triton TSPS370, the entire table tilts, pivoting at the spindle; the spindle/belt combo sanders' split tables tilt only in the front, forward of the spindle/belt. We prefer the full-tilt tables.

■ A variety of drums. For the smoothest curves, you'll want to sand with a drum as close as possible in diameter to the curves you're sanding, so it makes sense to get a sander with a lot of drums. All but one test model come with five or six drums; the Grizzly T26417 comes with ¾", 1", and 2" drums. (The chart at *right* lists each machine's drum sizes.) We like the range of drums (¼–3" in six diameters) of the Laguna best.

To change drum sizes, most of the sanders have a single spindle onto which you slide the various drums, secured with a tool-free nut. But a few (Grizzly T26417, Jet, Laguna, and Rikon) have separate spindles for each drum, and you simply screw each spindle into the drive shaft and tighten with wrenches, included on all.

Typically, these machines come with 80- or 100-grit abrasive sleeves, which work well for shaping, but may not leave the smoothest surfaces. The Grizzly G0538, however, comes with three aggressive 80-grit sleeves and three smooth-sanding 150-grit sleeves. You can order replacement sleeves for all models from the manufacturer or any abrasive retailer.

■ Effective dust collection. Because these machines create a lot of dust, it's imperative to capture it before you can breathe it. Two factors come into play here: First, the dust ports lack standardization. Three units (Grizzly G0538 and T26417 and Ridgid

▶**Spindle:** the metal drive shaft that spins the sanding drum.

Drum: the rubber cylinder that fits onto the spindle.

Sleeve: the molded abrasive tube that fits onto the drum.

Stay ahead of the curve with a

MODEL	PERFORMANCE RATINGS (1) POWER	EASE OF SANDING TO A LINE	EASE OF CHANGING SPINDLES/DRUMS	EASE OF TILTING TABLE	DUST COLLECTION	ABSENCE OF VIBRATION
GRIZZLY G0538	A-	A	A	N/A	A	A
GRIZZLY G0723	A-	A	A	N/A	A	A
GRIZZLY T26417	A-	B	B	B	B	A
JET JBOS-5	A	A	A	A	B	B
LAGUNA SS/14	A	A	A	A	B	A
RIKON 50-300	A	A	A	A	A	A
SHOP FOX W1846	A-	B	A	N/A	A	A
SHOP FOX W1831	A-	A	A	N/A	A	B
TRITON TSPS450	A-	A	A	N/A	A-	B
TRITON TSPS370	A-	B	A	B	B	B
WOODRIVER 157889W	A-	A	A	N/A	A-	B
SPINDLE/BELT COMBO SANDERS						
MLCS 9592	A-	B	A	B	A-	B
RIDGID EB4424	A-	B	A	B	A-	A
TRITON TSPST450	A-	B	A	B	A-	B

1. A Excellent; B Good; C Fair; D Poor; N/A Table does not tilt

2. (D) Solid; (H) Holes; (S) Slots

3. (A) Aluminum; (C) Cast iron; (L) Laminate-covered particleboard

▶Can't afford a dedicated spindle sander? Then jig up your drill to serve as a portable sander. woodmagazine.com/drillstand

benchtop spindle sander

SPINDLES/DRUMS				TABLE													
SANDING SLEEVE DIAMETERS, INCHES	ABRASIVE GRIT	SANDING DRUM LENGTHS, INCHES	VERTICAL OSCILLATION TRAVEL, INCHES	INSERT RING STYLE (2)	DIMENSIONS, INCHES	HEIGHT ABOVE BASE, INCHES	TILT RANGE, DEGREES	TABLE MATERIAL (3)	DUST-COLLECTION PORT (OUTER DIAMETER), INCHES	STANDARD ACCESSORIES (4)	NOISE LEVEL, NO LOAD, DECIBELS	CORD LENGTH	WEIGHT, POUNDS	WARRANTY, YEARS (5)	COUNTRY OF ASSEMBLY (6)	SELLING PRICE (7)
½, ¾, 1, 1½, 2, 3	3@80 3@150	4½	⅝	H	20⅛ × 14	11⅜	N/A	L	2½	W	84	9'	37	1	C	$200
½, ¾, 1, 1½, 2, 3	100	4	1	S	18 diameter	15½	N/A	C	2	P	75	6'	46	1	C	$240
¾, 1, 2	100	3½, 4½, 5½	15⁄16	S	15 diameter	19⅛	0–45	C	2½	W	72	4'6"	73	1	C	$375
¼, ½, ⅝, 1½, 2	100	¼–⅝" @ 6 1½–2" @ 5½	1	S	14¾ × 14¾	18¾	0–45	C	2	W	67	5'6"	77	5	T	$500
¼, ½, ⅝, 1½, 2, 3	80	5½	1	D	14⅝ × 14⅝	18⅜	0–45	C	2	S, W	68	5'8"	77	2	T	$499
½, ¾, 1, 1½, 2	80	4½	1	H	14½ × 14½	19¼	0–45	C	2	W	70	7'6"	71	5	C	$500
½, ¾, 1, 1½, 2, 3	100	4½	1	S	18 diameter	15½	N/A	C	2	P	78	7'4"	46	2	C	$364
½, ¾, 1, 1½, 2, 3	80	4½	⅝	H	12 × 14¾	13	N/A	C	1½	W	97	7'4"	30	2	C	$197
½, ¾, 1, 1½, 2, 3	80	4½	⅝	H	12 × 14¾	13	N/A	C	1½	W	94	7'6"	32	3	C	$200
½, ¾, 1, 1½, 2	100	5½	¾	S	15 diameter	19	0–45	A	2		84	6'	30	3	C	$250
½, ¾, 1, 1½, 2, 3	80	4½	⅝	H	12 × 14¾	13	N/A	C	1½	W	99	7'6"	33	1	C	$250
½, ¾, 1, 1½, 2	80	4½	½	H	16¼ × 16¾	13⅜	0–45	A	1½	B, W	98	7'	27	3	C	$215
½, ¾, 1, 1½, 2	80	4½	¾	D	19 × 16½	13½	0–45	A	2½	B	74	7'4"	40	3*	C	$250
½, ¾, 1, 1½, 2	80	4½	½	H	16¼ × 16¾	13¼	0–45	A	1½	B	93	7'	28	3	C	$265

4. (B) Sanding belt
(S) Stand
(P) Power-cord wrap
(W) Spindle-changing wrenches

5. (*) Lifetime Service Agreement upon registration

6. (C) China
(T) Taiwan

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

EB4424) have a 2½" port that fits a common shop-vacuum hose. The others have either a 1½" or 2" port for which you must buy a different hose, an adapter, or a roll of duct tape to cobble together a solution.

Second, the machine needs optimal airflow from the drum to the port. Insert rings close up the throat around the drums to maximize workpiece support, but if the gap is too tight, airflow will be restricted. That's why we like insert rings with holes or slots in them, *right*, to provide the best of both worlds. Five machines excelled at dust collection when paired with a shop vacuum.

Dust evacuates easily into slotted insert rings, shown on the Grizzly G0723, when a shop vacuum provides adequate suction.

Pardon our candor, but here's a great sander

Because it scored top marks in all of our tests, has the mass to stay put during use, and comes with a 5-year warranty, the Rikon 50-300 earns our Top Tool award. We wish it came with a 3" drum, but you can buy that as an accessory for $40.

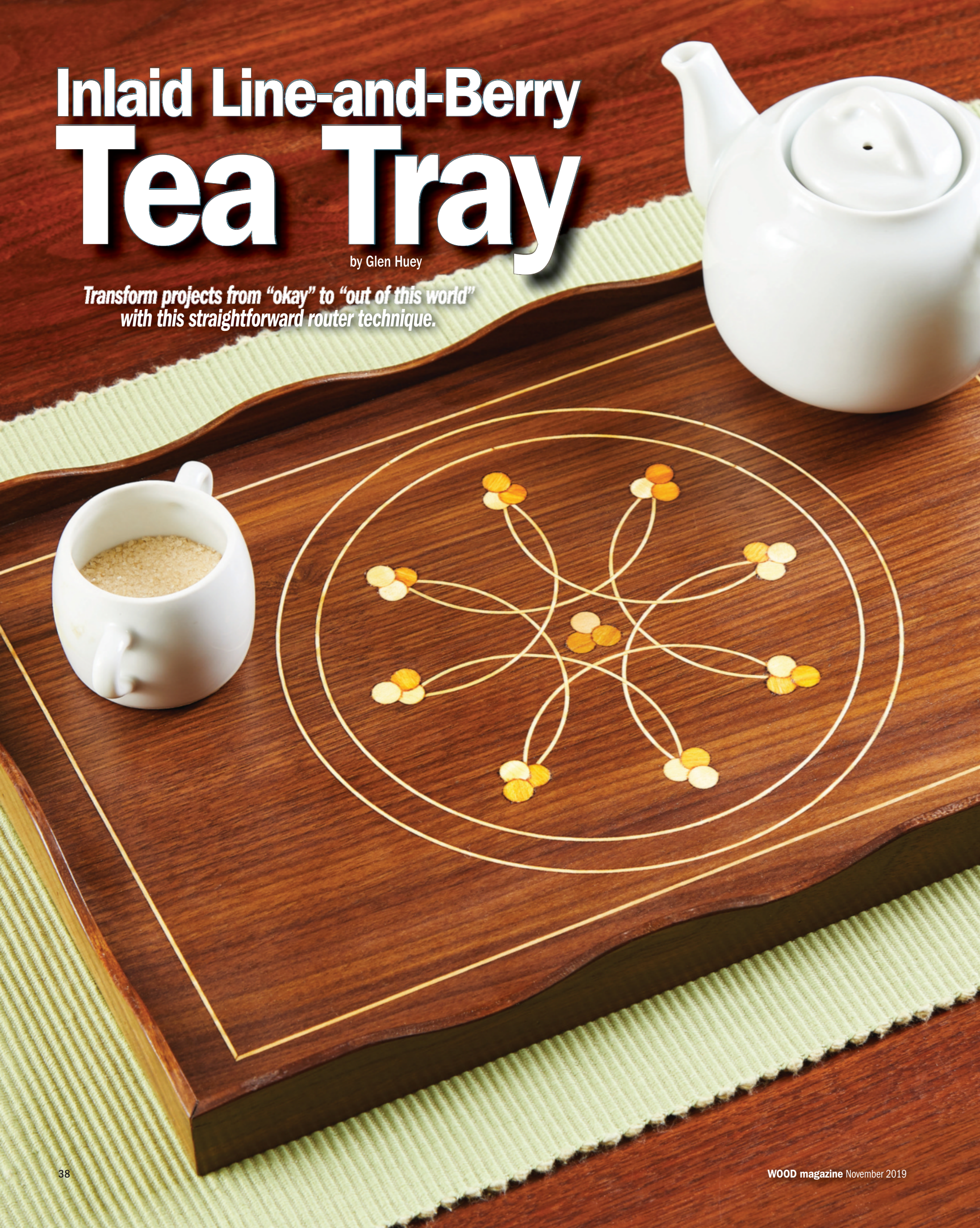
Our Top Value award goes to the dual-threat Ridgid EB4424 at $250. This unit boasts a large table, five sanding drums, and the added benefit of the oscillating belt sander.

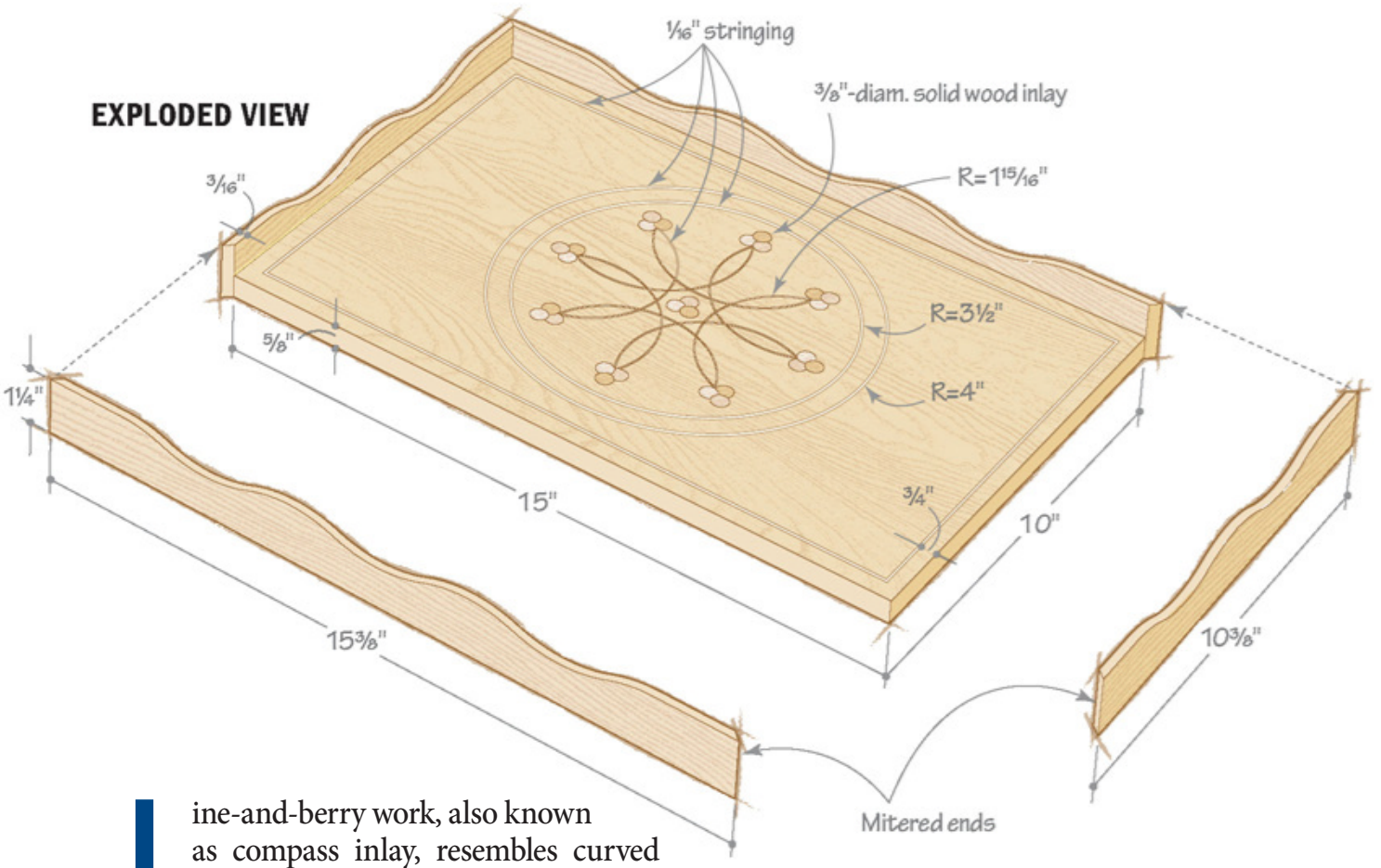
Produced by **Bob Hunter** with **Steve Feeney**

Inlaid Line-and-Berry Tea Tray

by Glen Huey

Transform projects from "okay" to "out of this world" with this straightforward router technique.





Line-and-berry work, also known as compass inlay, resembles curved branches ending in a cluster of berries. Often associated with furniture and spice boxes made in Chester County, Pennsylvania, this traditional pattern creates a beautiful focal point for a panel. I'll show how to create this pattern on a tea tray, but it's easy to apply the same techniques to a door or other furniture panel.

The design features eight overlapping arcs at the center of the tray with two circles surrounding them. Trios of berries hide the pivot points used to rout the outer rings and the arcs. While the end result may look complicated, you'll find the techniques simple, so let's get started.

Lay out the design

▶Choose quartersawn wood to minimize seasonal movement and accentuate the inlay work.

Begin by cutting your tray bottom to size [**Exploded View**]. Lay out the location of the perimeter stringing ¾" from the edges and ends. From the centerpoint of the panel, mark 2½"-, 3½"-, and 4"-radius circles.

Reset your compass to 1 15/16" and walk off the inner circle to mark eight equidistant points around its perimeter [**Photo A**]. This one-eighth-circumference dimension is also used to create the arcs.

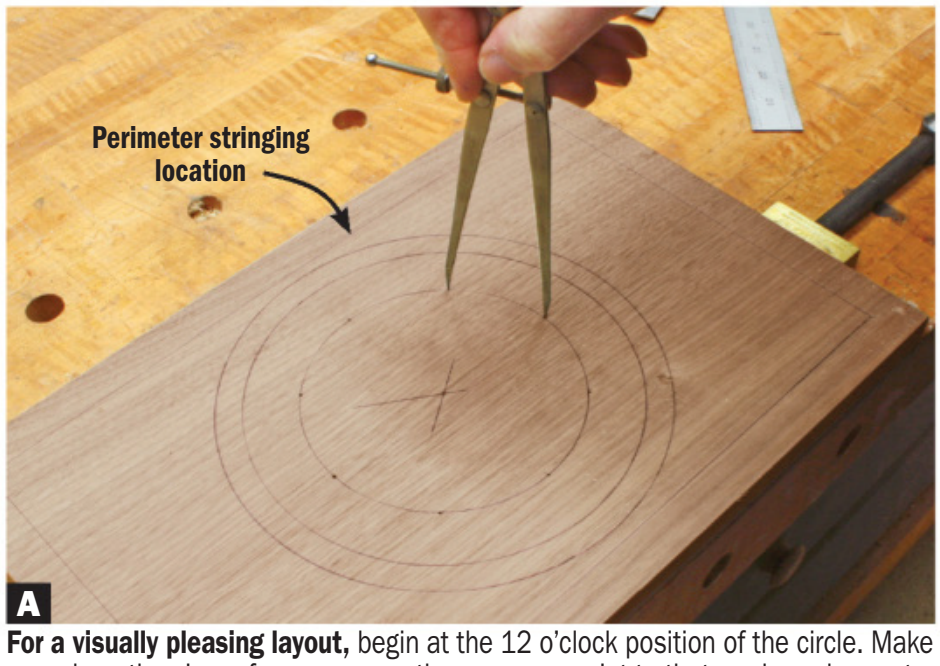
Rout the circles and arcs

Rout the 1/16"-deep channels for all of the stringing with a 1/16" bit. A plunge router works best, but with such a shallow cut, a standard base also works. Simply tilt the tool so the bit clears the workpiece, then lower it to start the cut. For the two outer circles mount the router on a trammel. Install a pivot pin at the centerpoint of the tray, set the cut radius on the jig, and make the cut. Repeat for the second circle.

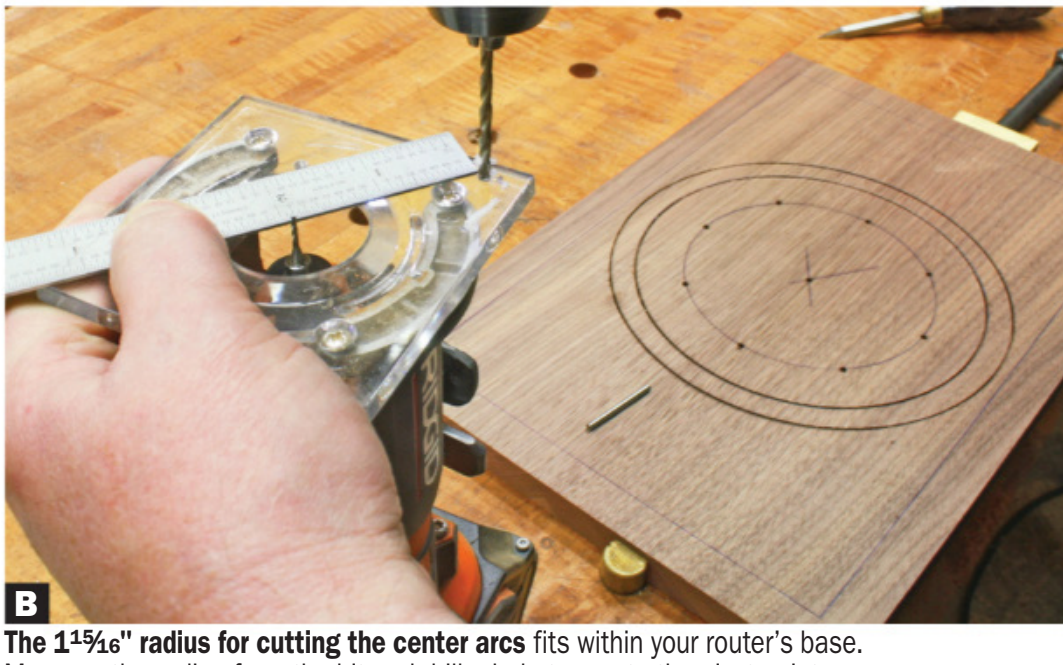
The overlapping interior arcs take a bit more work. The small radius makes a trammel cumbersome. Instead, drill through your router baseplate a hole sized to fit your pivot pin [**Photo B**]. Now, using the same drill

▶Learn to divide any size circle into eight equal segments. woodmagazine.com/circle8ths

▶Build a trammel for your router. woodmagazine.com/routercircles



For a visually pleasing layout, begin at the 12 o'clock position of the circle. Make a mark on the circumference, move the compass point to that mark, and repeat.



The 1 15/16" radius for cutting the center arcs fits within your router's base. Measure the radius from the bit and drill a hole to create the pivot point.

SKILL BUILDER

Making stringing

Make your own stringing using a tablesaw and spindle sander. First, rip strips just over 1/16" wide on the waste side of the tablesaw blade. Remove blade marks at the spindle sander while bringing the strip to final width.

Position a fence next to a 150-grit sanding drum so the stringing blank just fits between them. Check the fit of the stringing in a channel after a pass, and adjust the fence to further reduce the width if needed. Bandsaw 3/16"-thick stringing from the blank.

bit chucked into your drill press, drill a shallow hole centered on each of the points marked around the innermost ring.

Insert the pivot pin into one of the holes along the inner circle, and fit your router base over the pin with the bit resting in an adjacent hole. Start the router and slowly pivot the tool from hole to hole.

Cut a piece of stringing to fit the arc [**Skill Builder**]. Glue the stringing into the just-cut arc and plane or sand it flush to the panel surface. Move your pivot to the next hole and rout a second arc that cuts through the first piece of stringing. Fill that slot with stringing and repeat these steps until you complete the routing and inlay work of the center design [**Photo C**].

Install stringing into the two full circles. On wider inlay, using a scarf joint helps to hide the joint. However, with this narrow stringing, a simple butt joint disappears.

Now rout the grooves around the edge of your tray [**Photo D**], taking care not to overcut the corners. For best appearance, miter the ends of the stringing with a chisel, then glue it in place.

Give it the berries

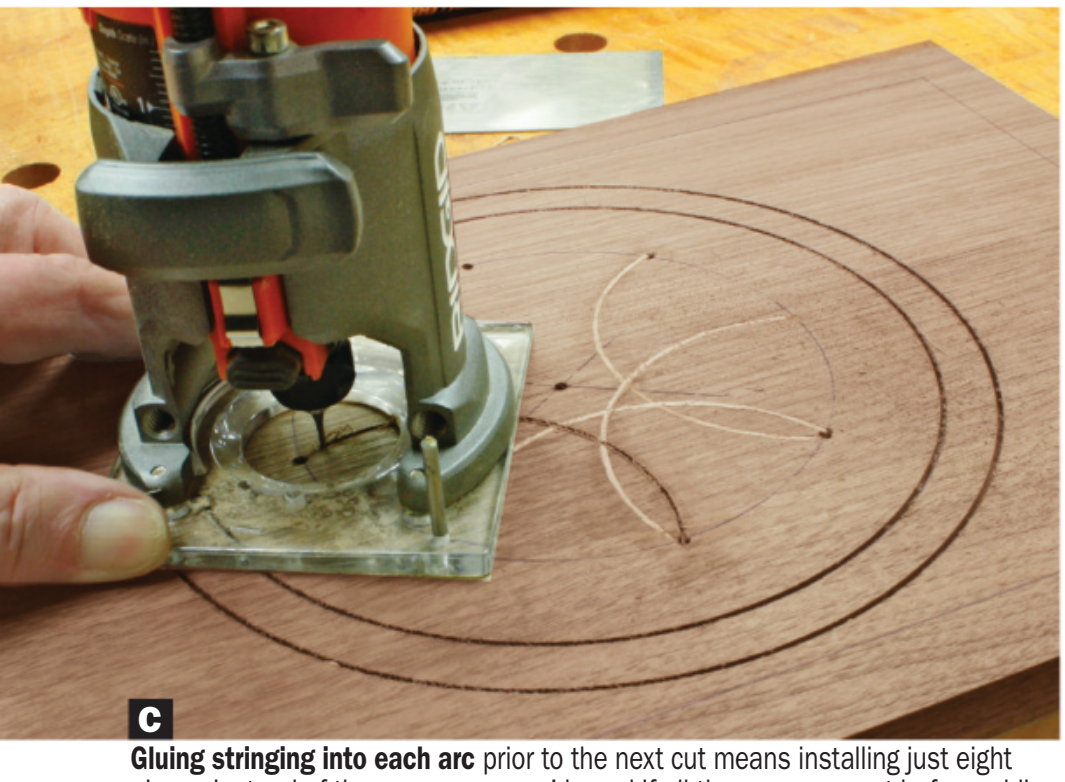
Traditionally, berries were red cedar, holly, and locust. I used cherry and maple, which can also be found in period work, to contrast with the walnut tray. Cluster three berries at the center of the design (to cover the pivot for the outer circles) and at each of the arc ends. Drill 1/8" deep for one berry at each location using a 3/8" Forstner bit, then install a berry cut with a 3/8" plug cutter.

After the glue dries, level the berries with the surface. Repeat the process for a second round of berries [**Photo E**], slightly overlapping the previous berries. Repeat again for the third berry at each location.

▶Traditional stringing would be holly, but I'm using maple, which is also found in period work.

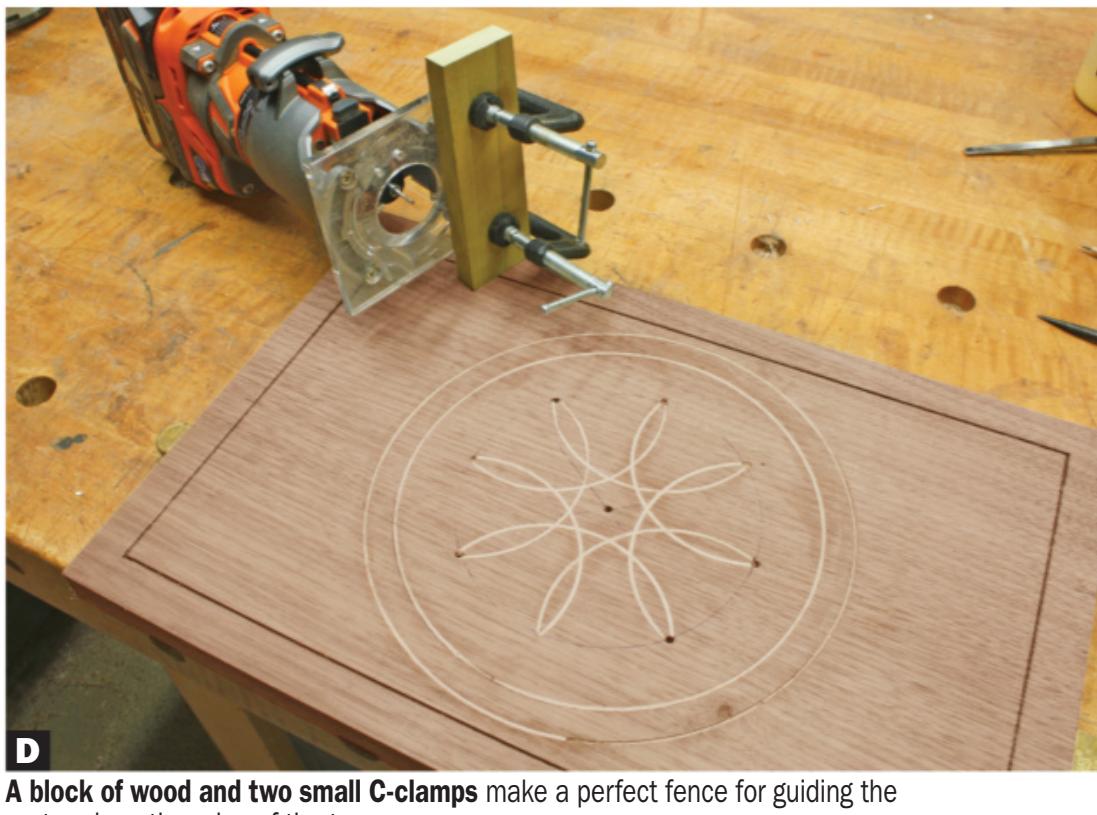
▶Install the berries combining the various species any way you find pleasing.

Tip! *If you level your berries too soon, a slight concavity could appear—drying glue sucks the material into the hole.*



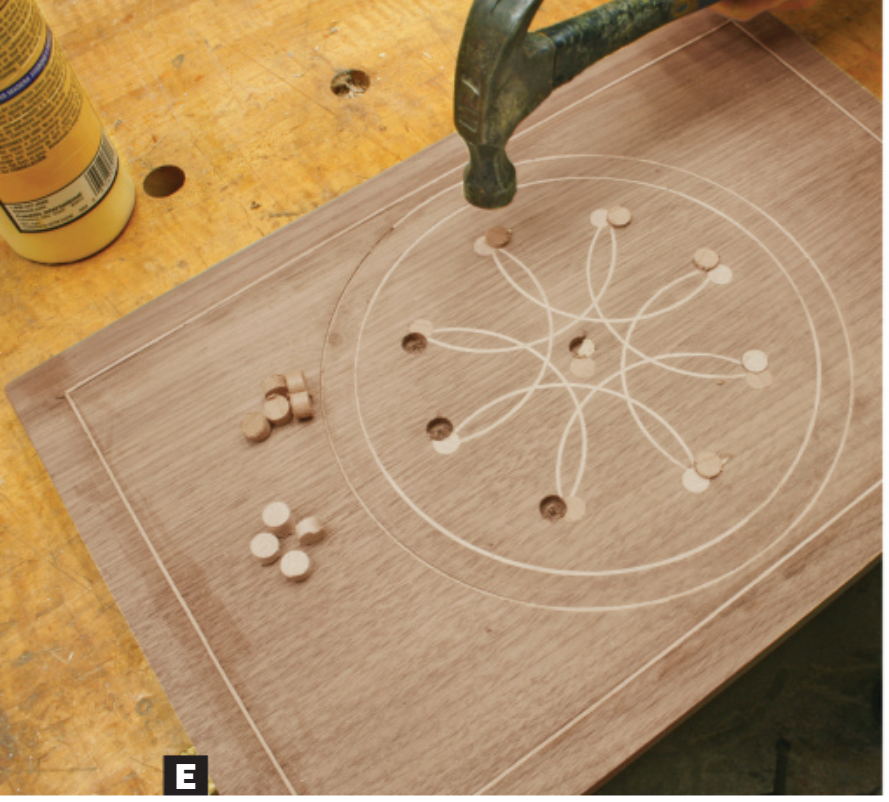
C

Gluing stringing into each arc prior to the next cut means installing just eight pieces instead of the many more you'd need if all the arcs were cut before adding stringing. It also creates tight joints.



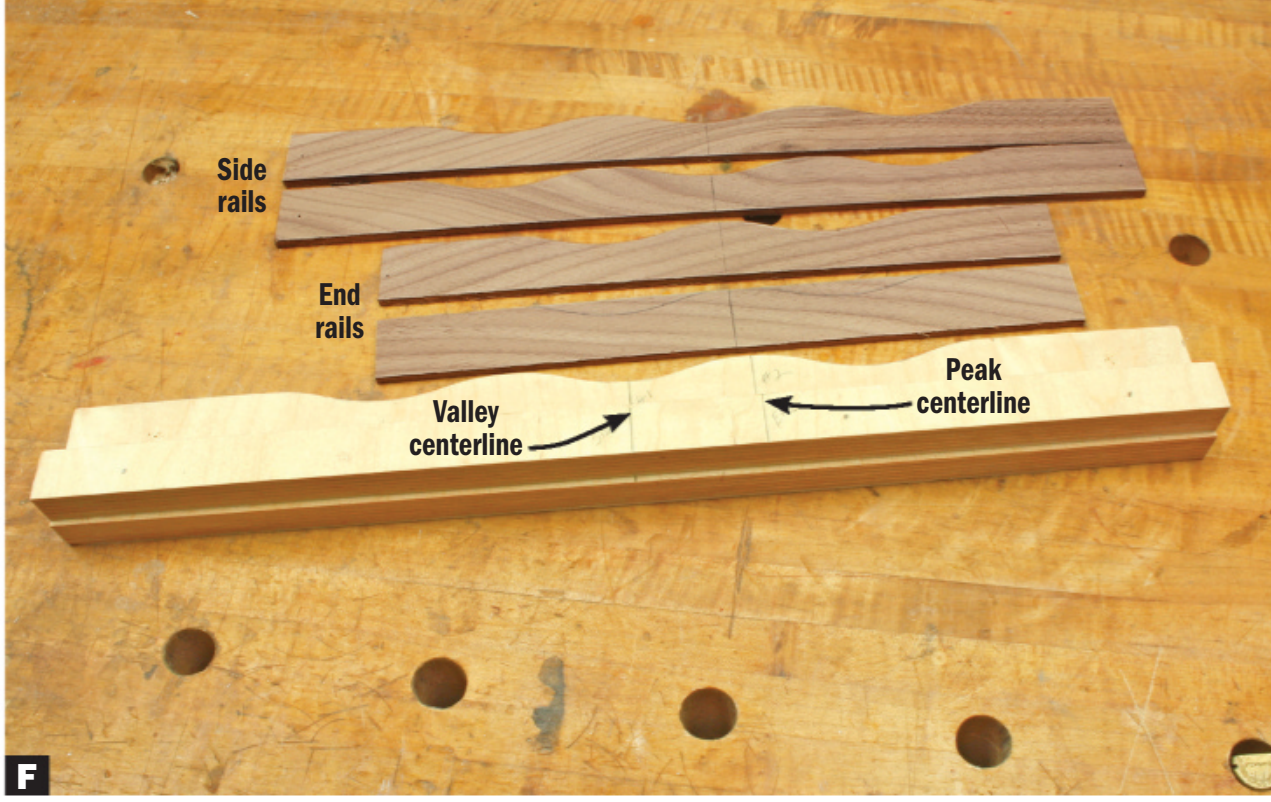
D

A block of wood and two small C-clamps make a perfect fence for guiding the router along the edge of the tray.



E

Place only a drop of glue in the hole, then tap the inlay lightly to seat it fully.



F

To mark the side rails align the rail centerline with the valley centerline and mark the full length of the template. For the end rails, align the rail's centerline with the peak centerline on the template. Mark to the peak of the next curve in both directions.

Wavy rails

Now let's give that beautiful panel some side rails to keep your tea service in place. Using a template makes this task quick and the pieces uniform.

First, prep 3/16" stock for the rails: two pieces 16½" long and two 11½" long. Mark the centerline of each rail's length.

On a scrap of ¾" plywood, lay out the **Rail Pattern**, adding 1" at each end. Bandsaw and smooth your template and mark the centerline of a peak and a valley, as shown on the pattern.

Trace the curves from the template onto the rails [**Photo F**]. Bandsaw close to the line.

Attach a rail to the template using double-faced tape, aligning the centerlines and keeping the bottom edges flush. Flush-trim the rails, working from the peak of each curve into the valley—some of the routing is done as a climb-cut. Miter-cut each of the rails to fit around the tray base, then sand the tray and rails to 180 grit. As you smooth the rails, round the sharp corners on the wavy edges.

Glue and pin the rails to the base, gluing the miters to reinforce them.

Finish

After the glue dries, apply a coat of boiled linseed oil to highlight the figured grain.

G

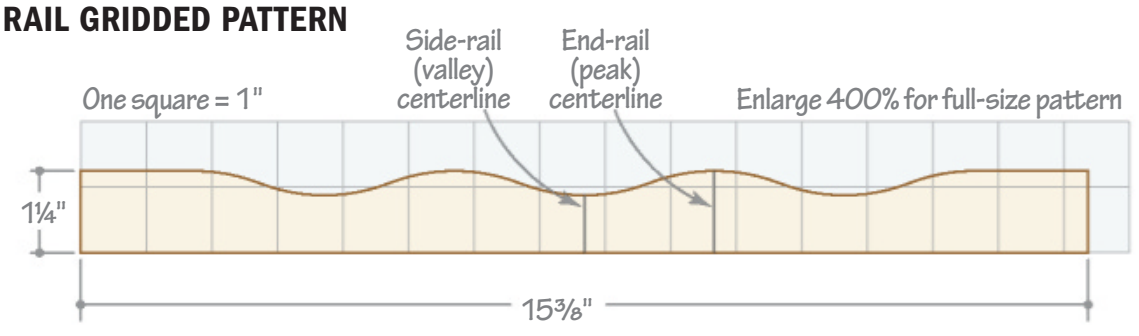
Check for a fully dried oil finish by rubbing the surface with the palm of your hand. If you see no shininess, the oil is dry.

Allow the oil to dry fully [**Photo G**], then apply a few coats of finish for protection. I prefer at least five coats of shellac, alternating clear and amber, to add warmth.

Your beautifully decorated tray will provide service for generations to come, and the inlay technique you learned can push your woodworking projects to new levels.

After running his own homebuilding business through cold winters and mud-laden springs, Glen began a new career building reproduction period furniture in the comfort of a heated shop. His passion for woodworking led him to teaching and writing about it, including four books.

RAIL GRIDDED PATTERN



Finishing with Oil/Varnish Blends

by Jim Heavey

Choosing a finish for your completed project is surely one of the most agonizing decisions you make. After all, a trip to the store reveals a dizzying display of oil- and water-based polyurethanes, as well as lacquers, shellacs, and acrylic finishes. But don't overlook the oil/varnish blends with names such as Danish oil, tung oil, antique oil, and others. These easy-to-apply blended finishes penetrate the wood, form a light film on the surface, and provide the feel and look of a "hand-rubbed" finish in a satin sheen.

What it is

An oil/varnish blended finish is generally a mix of boiled linseed oil (BLO), mineral spirits, and varnish or poly resins. Manufacturers adjust the proportions to affect sheen and hardness. BLO enhances the grain and color of woods such as walnut, cherry, and mahogany. But its tendency to darken over time may give lighter woods, such as maple or holly, a yellow cast, so choose a tung oil instead for light-colored woods [**Photo A**]. Check the tung-oil product label for phrases such as "contains mineral spirits" or "petroleum distillates." This indicates a blended finish rather than the far-slower drying pure tung oil.

The addition of polymerizing agents and chemical dryers causes BLO to harden when exposed to oxygen (a fact demonstrated when trying to unscrew the cap on the can the next time the finish is used). Adding mineral spirts or naphtha thins the

A

Unlike Danish oil, which yellows significantly over time, a penetrating finish with tung oil will preserve the lighter look of this tiger-striped maple.

B

Apply finish with a foam brush, chip brush, or rags. Spot-apply finish as areas lose their sheen. After 30 minutes, wipe the surface to remove excess finish, leaving a uniform dull sheen.

C

Open up rags used for finishing and place them on the floor or drape them over a bucket or worksurface. Allow 24 hours for them to dry.

▶Mix up your own oil/varnish blend. woodmagazine.com/homebrew

BLO, allowing it to penetrate deeper into the wood; this solvent evaporates as the finish cures. Because the oil soaks into the wood, added poly or varnish resins improve durability and provide a bit of sheen.

Super-simple application

Applying these finishes is pretty straightforward. Begin by sanding the project to 220 grit and removing any dust. Shake the finish well, then flood the wood surface with finish and maintain a wet surface for about 30 minutes to allow the mixture to penetrate deeply [**Photo B**]. Then, wipe all remaining wet areas with a clean rag.

Note that the finish's chemical driers generate heat as the finish cures, and the rag used to apply it may catch fire if left wadded up. Allow rags to dry out before discarding them [**Photo C**].

On open- or large-pore woods, such as oak, mahogany, and others, small rings or pools of finish may reappear after wiping [**Photo D**]. As the finish flows into the pores, air moves out, bringing a bit of finish to the surface after the initial wiping. Remove it with a rag. If you notice it after the finish cures, sand lightly with 400-grit sandpaper.

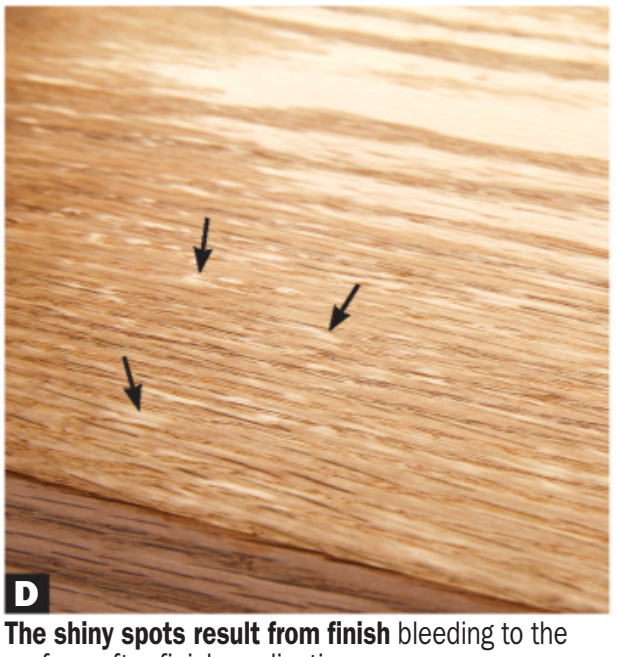
Give the first coat 24 hours to cure, then apply a second coat in the same way. On very porous woods, a third coat may be necessary.

Drying times are based on a 70-degree temperature and 50–70 percent humidity. A blended finish applied in warmer and drier conditions may become thick or gummy prior to the recommended reapplication time, making it difficult to wipe cleanly. Adding a bit of fresh finish (which contains mineral spirits) will soften the finish and make removal easier.

Because an oil/varnish blend doesn't provide much durability, consider a topcoat of a film-forming finish such as polyurethane, lacquer, or shellac [**Photo E**].

Tip! *During cool temperatures, warming the finish can in a pan of warm, not boiling, water reduces the finish's viscosity, allowing it to better penetrate into the wood.*

Get the convenience of an oil/varnish blend while adding some color to a workpiece with tinted mixes. Danish oil comes in a number of pigmented colors. As with all tinted finishes, test on a sample board prior to use on the project itself.



D

The shiny spots result from finish bleeding to the surface after finish application.

E

Apply a topcoat after the oil/varnish blend cures fully. If in doubt about a topcoat's compatibility, apply a coat of shellac, then your preferred topcoat.

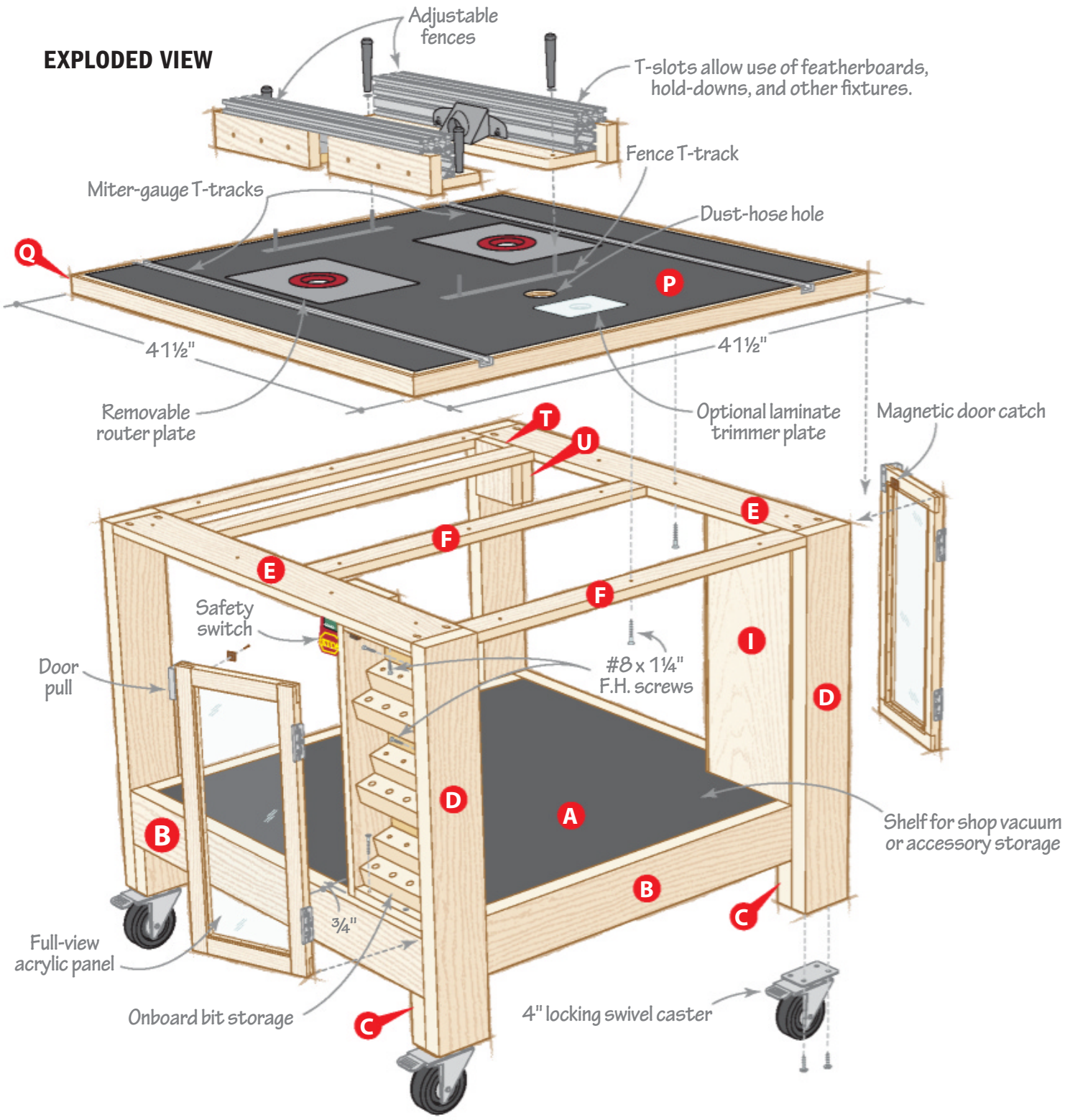
Table for Two

A single table for two (or even three) routers conserves shop space, saves time, and improves efficiency.

DIMENSIONS:
41½" W × 41½" D × 36¼" H

Approximate materials cost:
$900
routers not included

Cabinets keep bits handy and a shelf holds accessories.



Matching joinery-bit sets such as those for tongue-and-groove joints work best in a table-mounted router. But having to change a setup in the course of work takes time and may introduce errors when resetting. This table lets you run two setups without making changes. And, it fits in about the same space as a single router table.

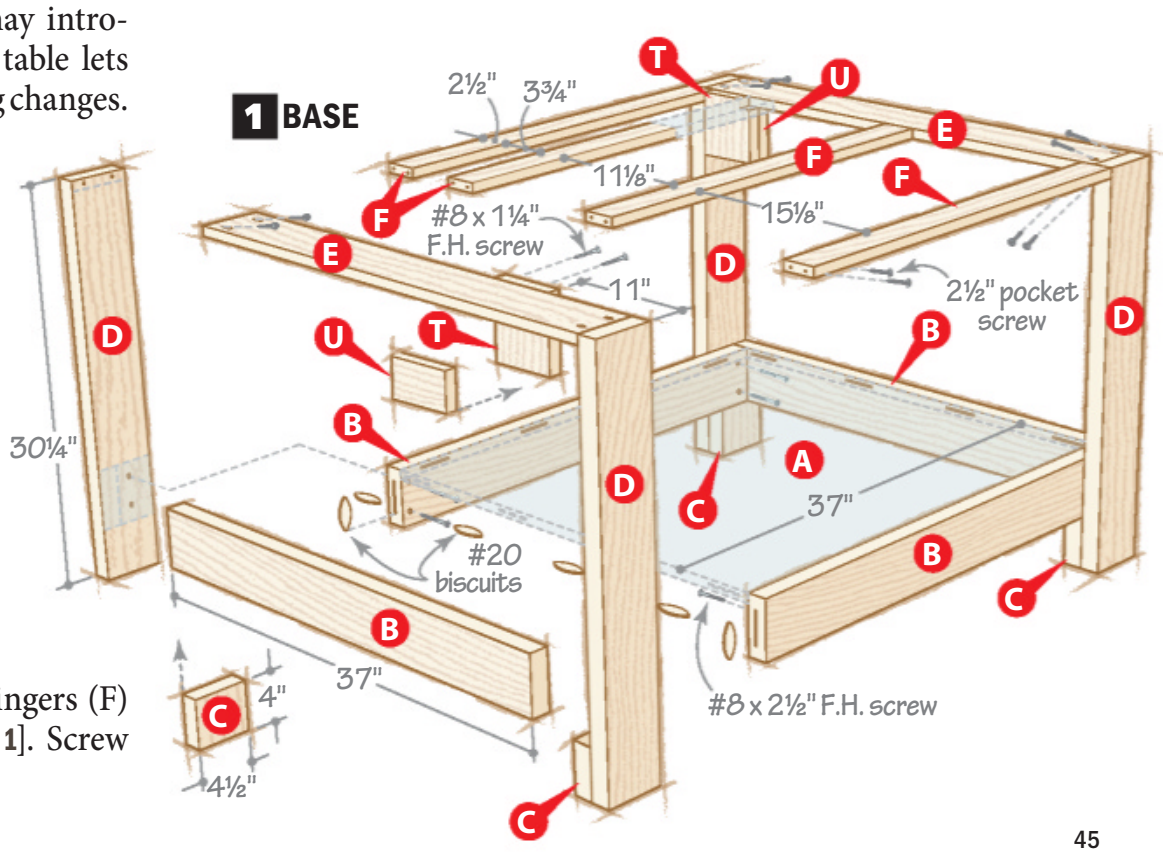
A sturdy base comes first

1 Cut to size parts A–D [**Materials List, Drawing 1**]. Apply plastic laminate to the top face of the shelf (A) and trim the edges flush.

2 Glue and biscuit the rails (B) to the shelf (A) [**Drawing 1**]. Glue the leg blocking (C) to the legs (D). Glue and screw the shelf assembly A/B to the legs C/D.

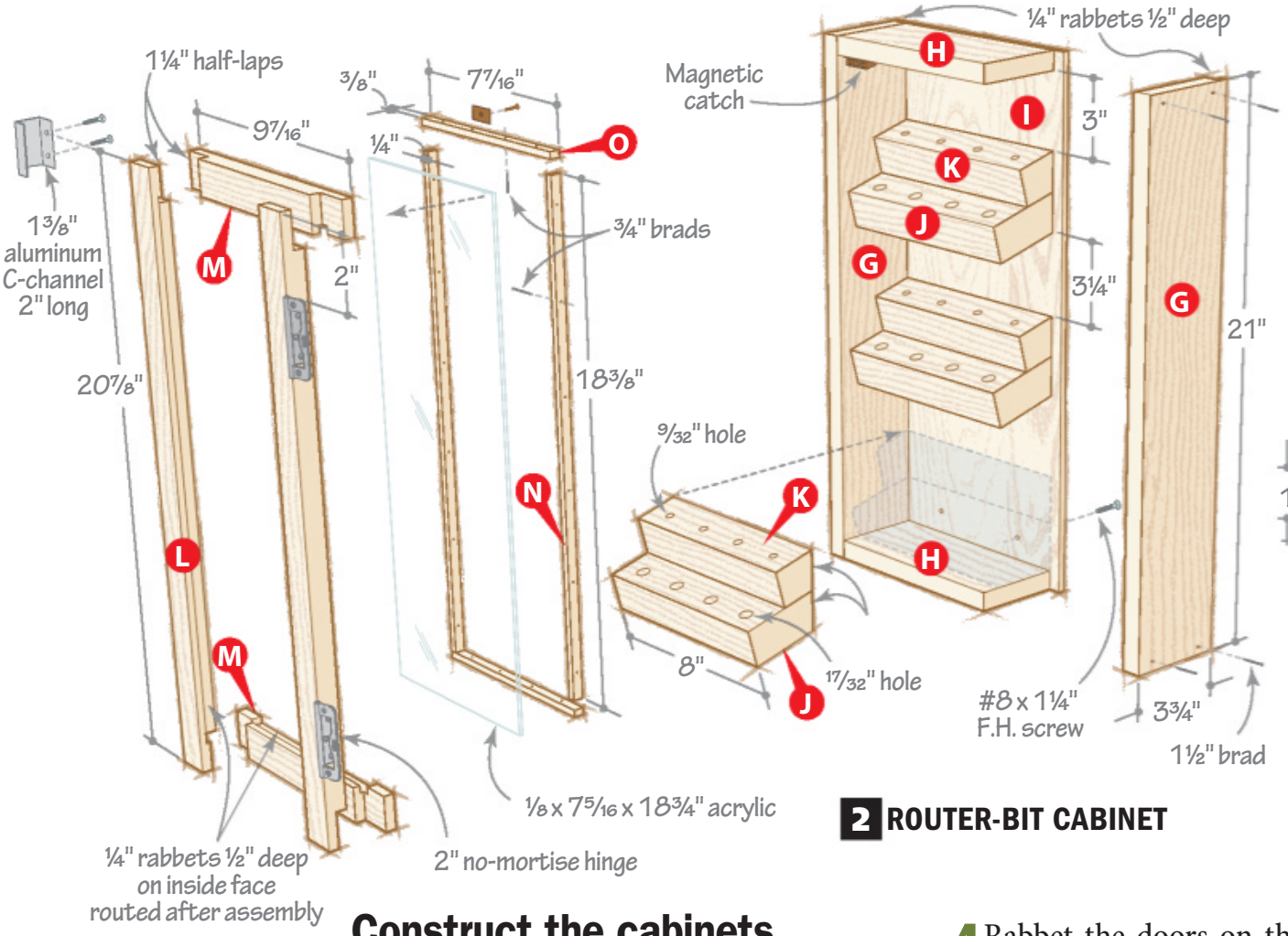
3 Cut the upper rails (E) and stringers (F) and drill pocket holes [**Drawing 1**]. Screw the upper rails to the legs, then install the stringers. Finish-sand to 220 grit.

4 Install a 4" locking swivel caster on the bottom of each leg [**Exploded View**].

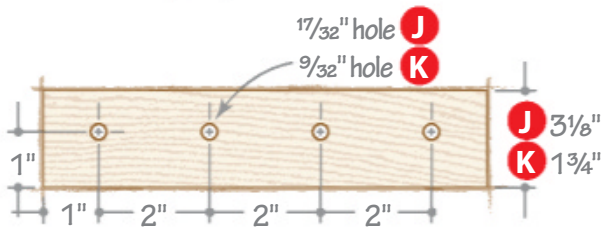


Note: *For structural parts B, C, and D, plane 8/4 maple to 1½" or rip from 2×6 construction lumber.*

▶Learn about working with plastic laminate. woodmagazine.com/laminate



2 ROUTER-BIT CABINET



Construct the cabinets

1 Cut to size parts G, H, and I. Rabbet the sides and assemble the cabinets with brads and glue [**Drawing 2**]. Finish-sand the cabinets.

2 Bevel-rip stock for the bit holders (J, K) and cut the parts to length. Drill shank holes [**Drawing 2a**] and glue together six holders [**Photo A**]. Finish-sand the holders, and glue them into the cabinets.

3 Cut the door stiles and rails (L, M) to size and cut mating half-laps on the ends [**Photo B**]. Glue the parts together to make two doors.

4 Rabbet the doors on the back [**Photo C**]. Cut stops N and O to fit the openings. Finish-sand the doors and stops, but wait until after applying finish to install the acrylic panels and stops.

5 Drill screw pilot holes for 2" no-mortise hinges on the right-side stile of one door [**Drawing 2**] and the left-side stile of the other [**Exploded View**].

Tip! *Measure the height between the shelf (A/B) and upper rails (E) before cutting the cabinet sides (G) and backs (I) to ensure the cabinets fit.*

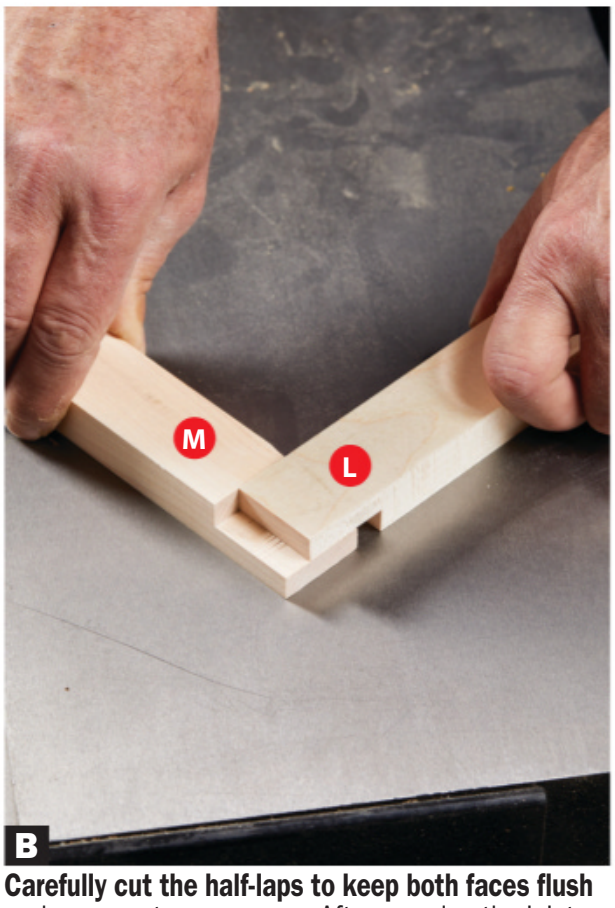
Note: *The holders shown store four ¼" and four ½" standard-profile bits. You can modify them to meet your requirements.*

Go to the top

1 Cut the top (P) to size. Apply laminate to the top face, and trim the edges flush.

▶Make your own custom router plates. woodmagazine.com/routerplates

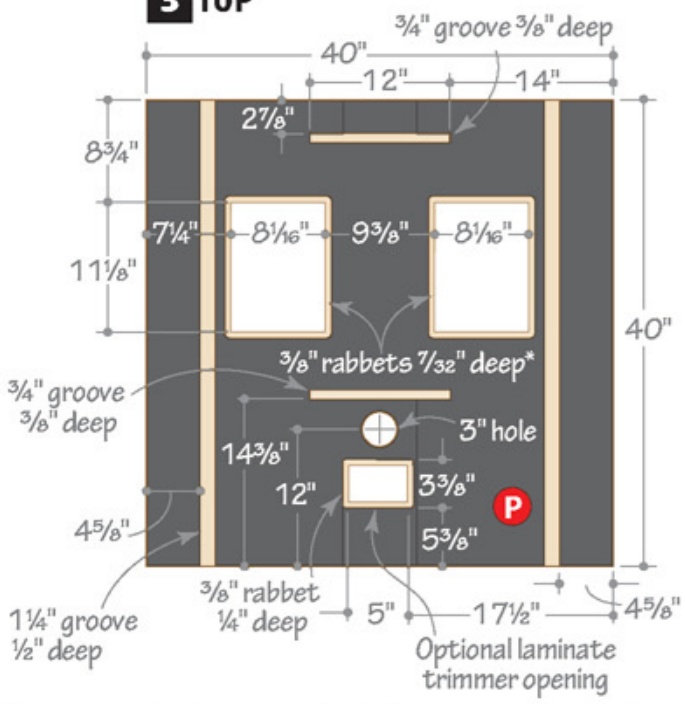
Glue each bit holder (J/K) together with the ends and beveled edges flush.



Carefully cut the half-laps to keep both faces flush and ensure strong corners. After you glue the joints, double-check the doors for square.

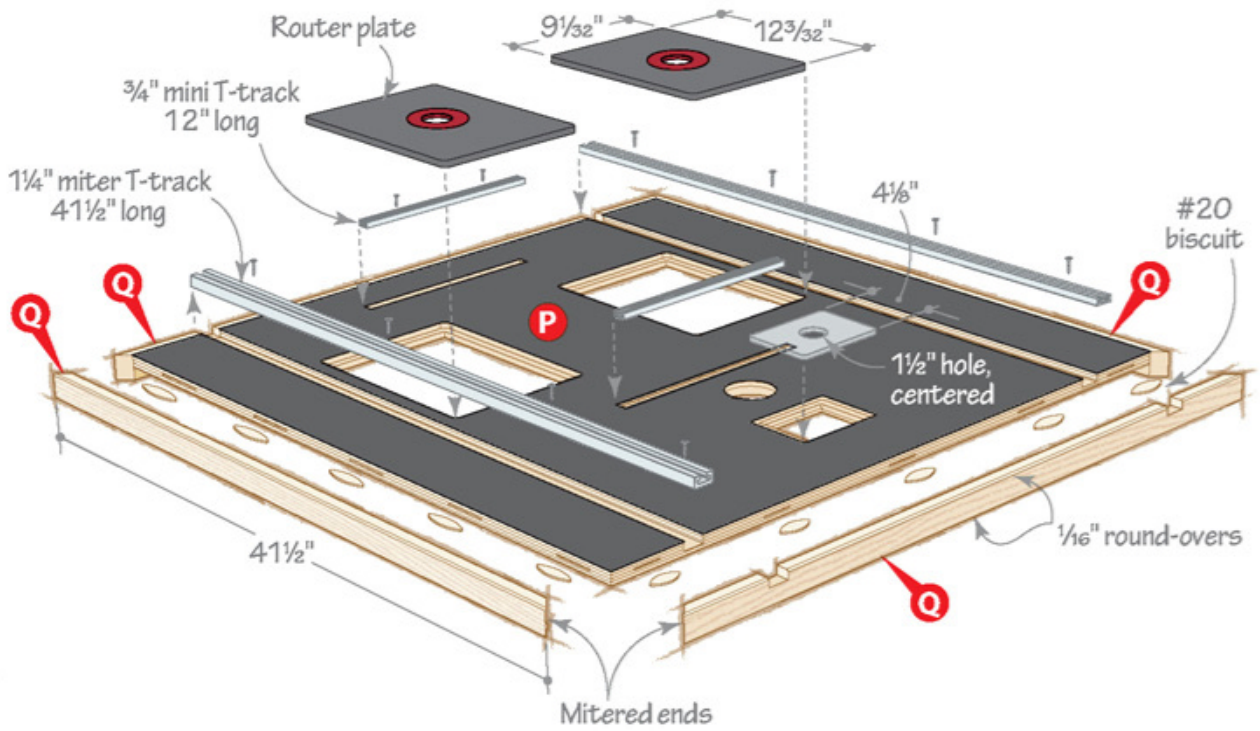
Rout the deep rabbets by making shallow passes. Square the corners with a chisel, measure the inside of the rabbet, and cut acrylic sheet to fit.

3 TOP



*Rout rabbet depths to match thickness of your insert plates.

4 TOP ASSEMBLY



Tip! *If you make your own plates, cut the rabbeted openings in the table first. Then, fit the plates to the openings.*

Note: *We attached a ¼×4⅛×5¼" acrylic subbase to our cordless trim router and made an opening to fit it.*

2 We built the table using commercial router-table plates and an installation kit [**Sources**]. Make the rabbeted router-plate openings, following the instructions with the template kit [**Photos D** and **E**]. The template remains in place for both cutting out and rabbeting each opening.

Even with two full-size routers in place, space remains to install a laminate trimmer (set up for quick round-overs, for example) to enhance versatility [**Drawing 3**]. If you do, make the router plate and rabbeted opening when you rout the two main openings.

3 Cut the top trim (Q) and miter-cut it to fit around the top [**Drawing 4**]. Glue and biscuit the trim in place, flush at the top.

4 Rout grooves for the miter-gauge slots and fence T-tracks [**Drawings 3** and **4, Sources**]. Cut the tracks to length, drill and countersink mounting holes in them if necessary due to cutting, and drill screw pilot holes in the top (P). Set the tracks aside. Cut the 3" hole with a holesaw.

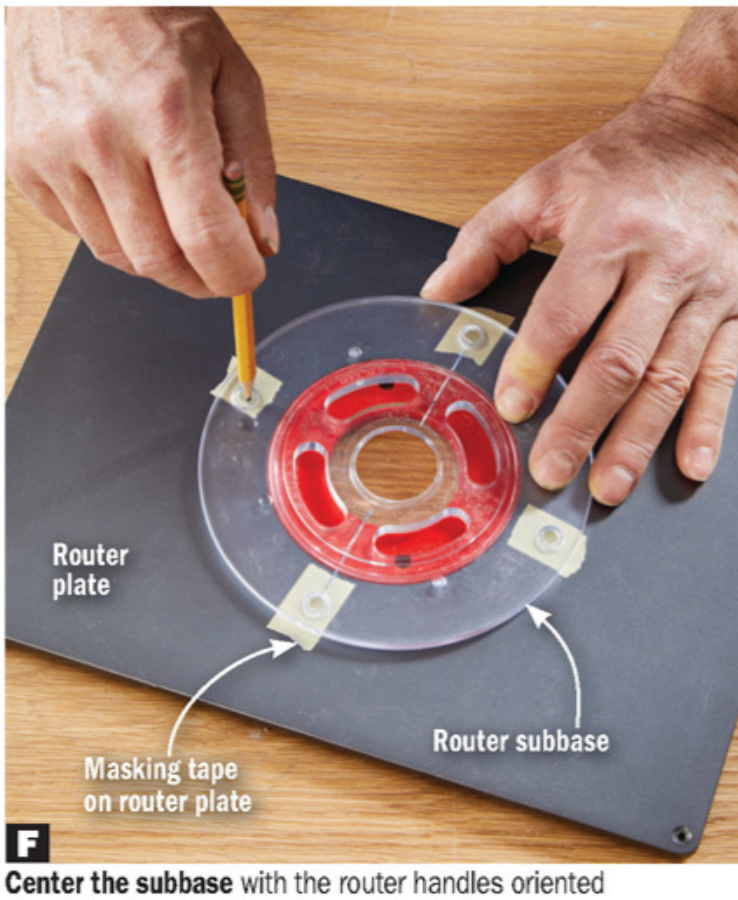
5 Remove the subbases from the routers to be installed and mark the mounting screw holes, following the router plate instructions [**Photo F**].

6 Drill 5⁄16" holes into the table under the plate leveling screw locations and epoxy the magnets provided into them. Attach the routers to the plates and set them aside.

Tip! *Rout the three grooves near the edges using an edge guide; clamp a straightedge to the top as a guide for the remaining groove. Chisel the ends of the stopped grooves square.*

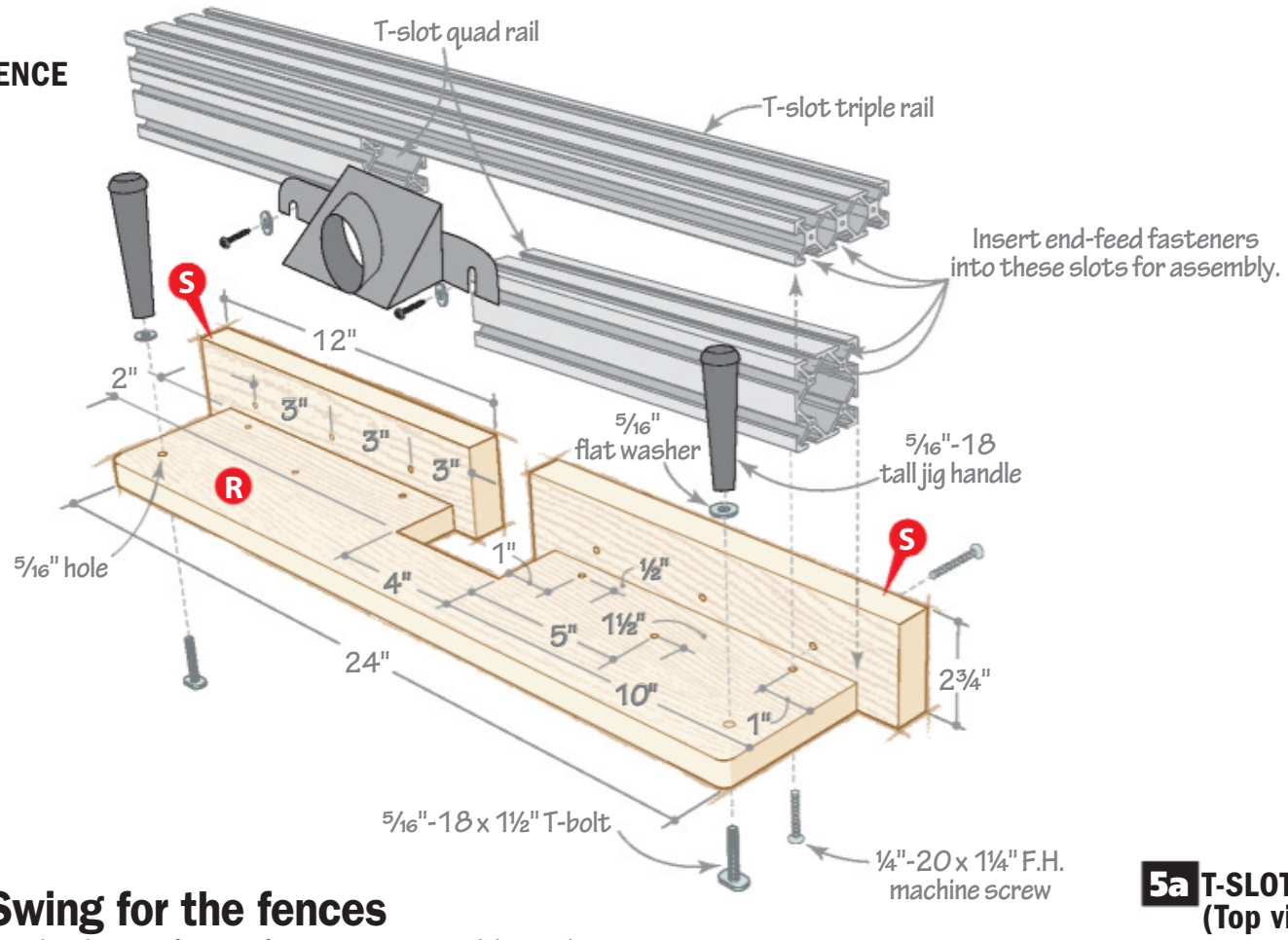
Install the large bushing on the router template guide to form the table opening. A ½" spiral upcut bit makes clean work of the heavy cut.

Remove the large bushing and set the cutting depth to about ¼" to rabbet the edge. Incrementally deepen the rabbet until the plate rests flush.



Center the subbase with the router handles oriented along the plate length. Drill mounting holes and countersink them on top of the router plate.

5 FENCE



Swing for the fences

We built two fences for our router table and have listed parts quantities accordingly in **Materials List** and **Sources**.

Tip! *See pencil marks on dark surfaces by applying masking tape where the marks will be made.*

1 Cut the fence bases (R) and faces (S) to size [**Drawing 5**]. Bandsaw or jigsaw the notches and drill holes in the bases.

2 Drill holes in the T-slot triple-rail extrusions [**Drawing 5a, Photo G**].

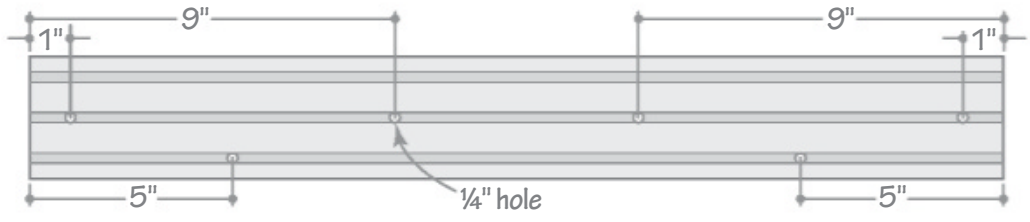
3 Attach two quad-rail sections to each fence base (R) with flathead machine screws through the bottom of the base into end-feed fasteners plates in the rails [**Drawing 5**]. Leave the fasteners loose so you can adjust the rails.

4 Attach a triple-rail extrusion across the tops of the two quad-rail sections on each fence, making them flush at the ends [**Drawing 5, Photo H**].

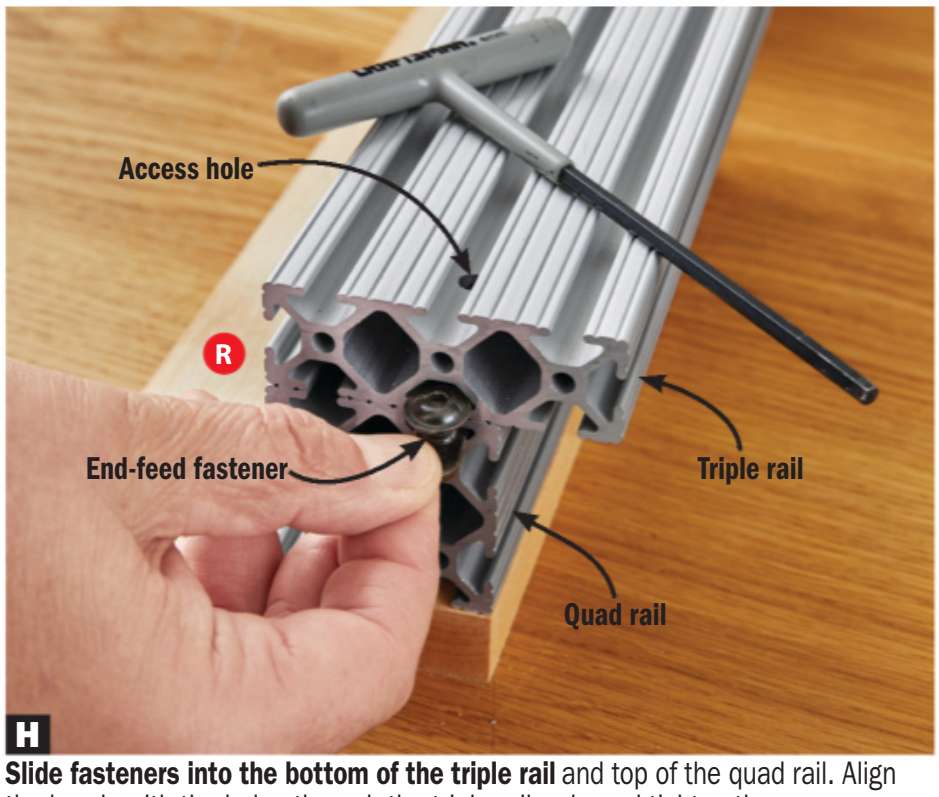
5 Hold the fence faces (S) against the front of the base/extrusion assemblies, and mark the centers of the quad rail's lower T-channels on them. Mark hole locations [**Drawing 5**] and drill the holes.

6 Remove the extrusion assemblies from the bases, and finish-sand the bases (R) and faces (S).

5a T-SLOT TRIPLE RAIL (Top view)



Center the bit between the rail edges as you drill through the triple-rail web. The holes provide access to tighten socket cap screws in the bottom rail.



Slide fasteners into the bottom of the triple rail and top of the quad rail. Align the heads with the holes through the triple-rail web, and tighten the screws.

Put it all together

1 Glue a switch-bracket back (T) to each front (U), with one end and the edges flush [**Drawing 1, Exploded View**].

2 Apply a clear finish to all wood surfaces. We used satin water-based polyurethane.

3 Place the top upside down on the floor and invert the base assembly on it. Center the base, and attach it with countersunk screws through the upper rails (E) and stringers (F) [**Exploded View**].

4 Stand the table upright. Screw the cabinets into place. Install acrylic panels in the doors, securing them with the stops. Attach the doors to the legs (D) and install pulls and catches [**Drawing 2**].

5 Screw the switch brackets (T/U) to the base and install the switches [**Exploded View**]. Screw a robe hook to the back of each switch bracket to hold the coiled-up router cord.

6 Place the routers and plates in the table and route the cords to the switches, securing them as necessary.

7 Install the miter-gauge tracks. File the heads and first few threads under the head on four 5/16" T-bolts bolts to fit into the fence T-tracks [**Drawing 5, Exploded View**]. Slide two bolts into each track, and screw the tracks into their slots.

8 Reassemble the fences, set them over the T-bolts in the T-tracks, and secure them with tall jig handles and washers [**Sources, Exploded View**]. Attach a dust port to each fence [**Drawing 5**], and run a hose through the hole in the top. Roll the table into your shop and rout everything in sight. Twice.

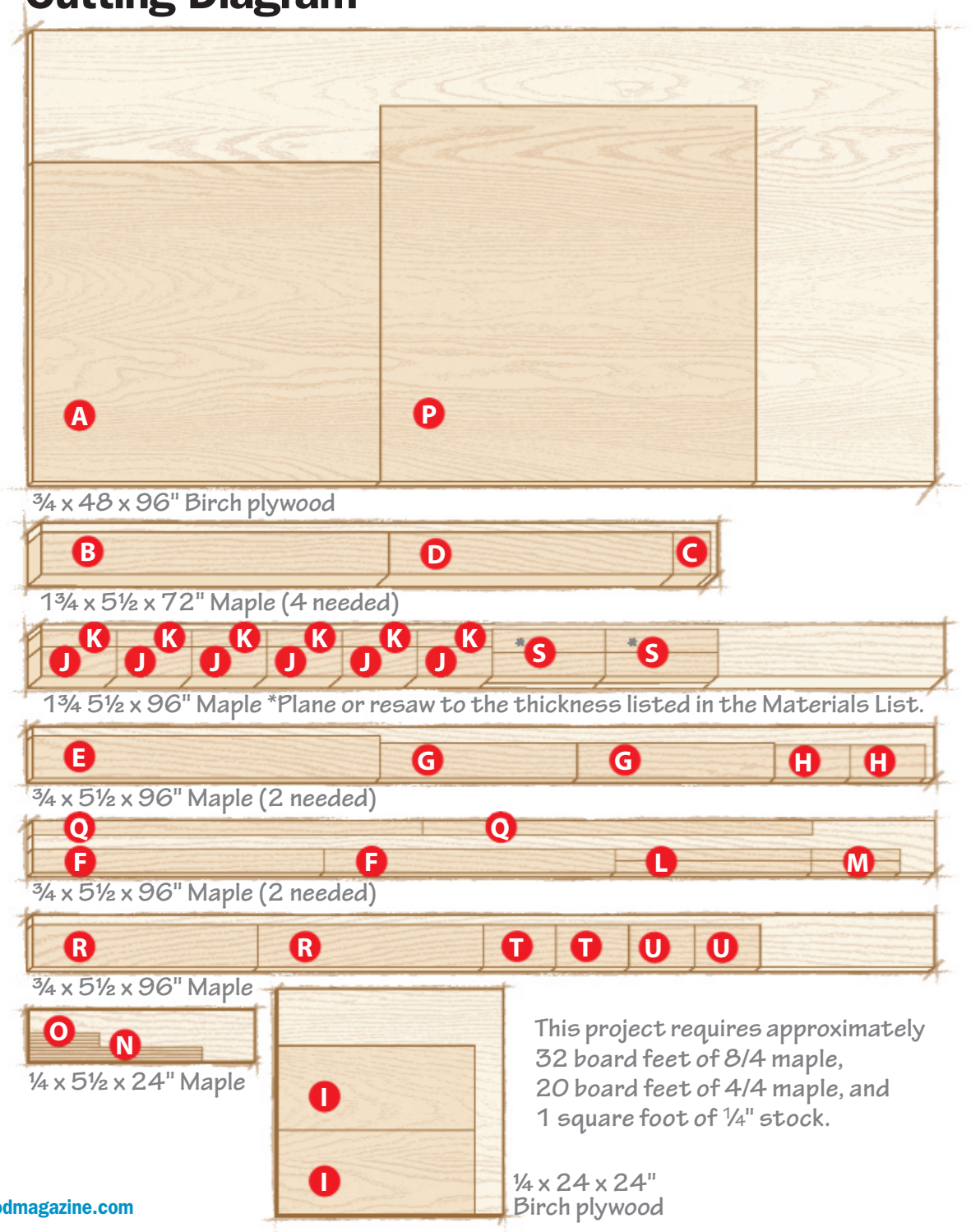
Note: *You'll need to notch the top back corner of one switch bracket to fit between the top stringers so it will fit tightly against the leg.*

Note: *Southpaw users can install the switch brackets on the left side of each bay.*

Tip! *For a self-contained routing center, set a shop vacuum on the bottom shelf and connect the dust hose to it. Otherwise, run the hose to your shop dust-collection system.*

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

Cutting Diagram



Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
Base						
A	shelf	¾"	34"	37"	BP	1
B	base rails	1½"	4½"	37"	M	4
C	leg blocking	1½"	4½"	4"	M	4
D	legs	1½"	4½"	30¼"	M	4
E	upper rails	¾"	4½"	37"	M	2
F	stringers	¾"	2½"	31"	M	4
Router-bit cabinets						
G	sides	¾"	3¾"	21"	M	4
H	tops/bottoms	¾"	3½"	8"	M	4
I	backs	¼"	9"	21"	BP	2
J	wide bit holders	1½"	3⅛"	8"	M	6
K	narrow bit holders	1½"	1¾"	8"	M	6
L	door stiles	¾"	1¼"	20⅞"	M	4
M	door rails	¾"	1¼"	9⅞"	M	4
N*	vertical stops	¼"	⅜"	18⅜"	M	4
O*	horizontal stops	¼"	⅜"	7⅞"	M	4
Top and fences						
P	top	¾"	40"	40"	BP	1
Q	top trim	¾"	1½"	41½"	M	4
R	fence bases	¾"	4½"	24"	M	2
S	fence faces	1"	2¾"	12"	M	4
T	switch-bracket backs	¾"	4½"	7¾"	M	2
U	switch-bracket fronts	¾"	4½"	7"	M	2

Materials key: BP-Baltic birch plywood, M-maple.
Supplies: Plastic laminate, #8×1¼", and #8×2½" flathead wood screws, #20 biscuits, 2½" pocket screws, 1½" brads, no-mortise hinges (4), magnetic door catches (2), 1⅜" aluminum C-channel for door pulls, ⅛×7⅝16×18¾" acrylic panel (2), 4" locking swivel casters (4), ¼"-20×1¼" flathead machine screws (24), 5/16" flat washers (4), robe hooks (2).
Blade and bits: Dado set; 3" holesaw; ½" straight router bit.
Sources: All-in-one black phenolic router plate (2), no. 9338, $35; installation template and bushing kit, no. 9331, $25; 48" miter T-track (2), no. 1702, $20; 24" mini T-track, no. 9470, $13; router-table power switch (2), no. 9078, $30, MLCS Woodworking, 800-533-9298, mlcswoodworking.com.
2×2×10" T-slot quad-rail framing (4), no. 47065T805, $9; 3×1×24" T-slot triple-rail framing (2), no. 47065T511, $21; end-feed fasteners (10), no. 47065T142 [package of 4], $2.30; ¼"-20×1½" flathead socket cap screws, no. 91253A546 [package of 25], $6, McMaster-Carr Supply Co., 630-833-0300, mcmaster.com.
Tall jig handle, 5/16"-18 female thread (4), no. 52360, $5; 5/16"-18×1½" T-bolts, no. 36677 [package of 5], $5.50; router-table dust port (2), no. 21528, $10; 2½" flexible dust hose, no. 22784, $28, Rockler Woodworking and Hardware, 800-279-4441, rockler.com.

Drawers 101

Design and build strong, smooth-sliding, and properly fitted drawers.

If the thought of building drawers for your projects makes you break out in a cold sweat, fear no more. Simply start with an easily achievable drawer design, practice a few time-proven techniques, and you'll soon be churning out just-right drawers. Here's how.

Start with good design

Before making a single cut, consider the function and style of the drawers. They will help you determine the final design and hardware choice.

Function. Knowing what the drawers will hold helps dictate their design and construction. A drawer for holding tools, for example, requires beefier materials, joinery, and slides than one for table linens. Drawers that will house heavyweight contents should be built with ⅝"- or ¾"-thick sides and a ½"-thick bottom. Smaller drawers that will store lightweight items can use ⅜" or ½" drawer sides and ¼" or ⅜" bottoms.

Style. Drawers in a furniture project, such as a dresser, sideboard, or desk, often incorporate elements of the piece's overall design, and should be proportional to the project's overall dimensions. For projects with multiple stacked drawers, especially dressers and lingerie cabinets, graduated drawers [**Photo A**] look best. On kitchen cabinets with a single drawer and door, those components are typically of uniform height and style [**Photo B**]. Kitchen cabinets with all drawers can have drawers of varying heights, though not necessarily graduated from top to bottom. Shop or utility cabinets can be built with lower-cost materials and less concern about style, with function taking priority over appearance.

▶Learn more about building and installing doors and drawers. woodmagazine.com/doors&drawers

Dressers look best with graduated drawers, with a deep bottom drawer and progressively shallower drawers above.

For a uniform appearance, the top drawers of kitchen base cabinets are usually the same height across a bank of cabinets.

The front of an inset drawer rests flush with the face frame of the cabinet or furniture piece. These drawers incorporate an integral front.

A full overlay drawer false front covers the drawer-box front and, when closed, conceals the gap around the drawer box.

A rabbeted overlay false front allows for half of the false front's thickness to set back into the cabinet, making it appear less bulky.

Drawer fronts fit their cases in one of two typical styles: inset and overlay. Inset drawers [**Photo C**] slide completely into the cabinet or furniture piece. The front of an inset drawer can be integral (joined directly to the drawer-box sides), or attached to the front of a drawer box as a "false front."

An overlay drawer front, usually applied as a false front, is wider and taller than the drawer box. When closed, the front of an overlay drawer rests against the cabinet or face frame. Overlay fronts can be full overlay [**Photo D**] or rabbeted [**Photo E**].

Pleasing proportions make a project stand out

Learning how to design projects with eye-pleasing proportions will make you a better woodworker and create more appreciation for your work. One way is using the Golden Mean, a ratio of 1:1.618 when calculating dimensions for adjacent components on a project. (Rounding to an easy fraction or whole number won't greatly affect appearances.) You should also trust your eyes, because most people can lay out project parts in good proportion using only what looks pleasing. But never let a project's design compromise its function. For example, when designing a dresser with multiple banks of drawers [**Photo A**], start with a known number. If you plan to stack three pairs of jeans in the bottom drawer, measure a stack of jeans and then design a drawer tall enough for that purpose. Then, make each drawer shorter as you go up, using either your trusty eyes or the Golden Mean.

▶Build your own proportioning gauge. woodmagazine.com/fibonacci

Hardware. Before building your drawers, plan and purchase any store-bought items, such as mechanical drawer slides (which we'll discuss in a moment) and handles, knobs, or pulls. Mechanical slides will affect the size of the drawer boxes: You'll need to incorporate space for them in the design. Choose handles, knobs, and pulls that not only function usefully, but also complement the overall project design.

Now decide on your slides

Any hardware or shop-made device that helps the drawer slide in and out of its opening in a straight path can be considered a drawer slide. You can buy multiple styles of mechanical slides or buy or make your own wood slides. Fine-furniture makers seldom use mechanical slides in their projects, opting instead for custom-fit drawers and support frames.

Metal slides. Buy slides to match the function and expected weight capacity of the drawer. Epoxy-coated roller slides [**Photo F**] cost the least and work well, but support lower weight capacities and don't extend fully, limiting access to contents at the back of the drawer. You'll often see these slides in inexpensive kitchen cabinets and ready-to-assemble furniture pieces.

Ball-bearing slides [**Photo G**] cost a little more than roller slides but provide a more solid feel, with three-quarter- and full-extension models available. Drawers that will house heavy contents, such as cast-iron skillets, small appliances, or tools, should use heavyweight-rated full-extension slides [**Photo H**]. For kitchen-cabinet drawers that house silverware (or any type of loose contents), choose soft-close slides [**Photo I**]. Those cost the most and may require special store-bought jigs to install.

All of those types of metal slides come in side-mount (most visible), corner-wrap (less visible), and bottom-mount (hidden) styles. Generally, the higher the quality—and cost—of slides, the more adjustments they provide for getting a just-right fit.

▶To watch a video about installing metal drawer slides, point your smartphone's camera at the code above, or visit woodmagazine.com/drawerslides

Epoxy-coated roller slides provide a good, basic, economical option for projects such as these shop cabinets.

Ball-bearing slides provide higher weight ratings (rated per pair) and a smoother sliding action than epoxy roller slides.

Heavy-duty, full-extension ball-bearing slides support drawers loaded with heavy objects, even when pulled out fully.

Soft-close slides close by hand, but the self-closing mechanism engages the last couple of inches to gently close the drawer and keep contents from scooting.

▶Learn more about installing drawers without metal slides. woodmagazine.com/noslides

Tip! *Apply a light coat of paste wax to wood drawer slides to ensure smooth movement.*

Wood slides. Whether square-cornered or dovetailed, wood slides [**Photo J**] serve the same purpose as metal slides, and are sometimes incorporated into the construction of the drawers. Besides saving money (if you make your own), wood slides also look great on furniture pieces where metal slides might look out of place. Plastic glide tape, used by itself or in conjunction with wood slides, reduces friction [**Photo K**].

Drawer construction

You can build drawers from solid wood or sheet goods. We prefer solid wood for drawer boxes, especially small drawers, because you can easily match the grain and color, and scale parts to thicknesses appropriate for your project. Choice of wood species doesn't matter, but furnituremakers often choose lower-cost "secondary" woods, such as pine or poplar, for these seldom-seen parts.

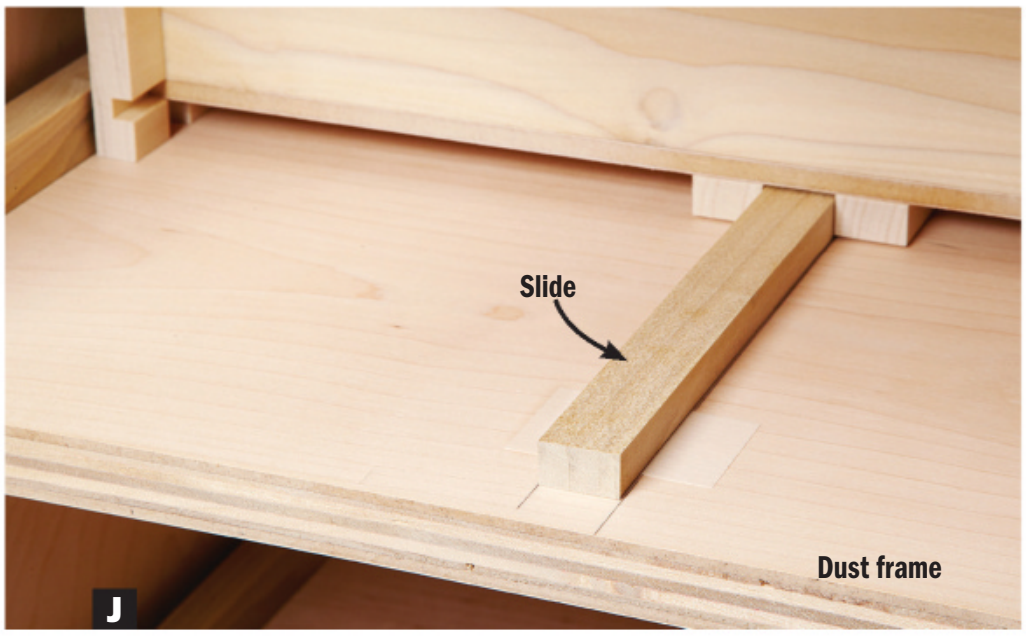
Although strong, stable, and uniform in size and color, plywood is perceived as lesser quality in the eyes of many people. If you use plywood [**Photo L**], choose a high-quality product, such as true Baltic birch plywood because of its stability and lack of flaws and gaps in the plies. Remember that some types of joinery, such as dovetails, can result in chipping and tear-out in the plies.

When it comes to joinery for drawer boxes, never compromise a drawer joint's strength just to get a particular look. Fortunately, some of the most attractive joints also provide all the strength you'll likely need. Box joints [**Photo M**], half-blind dovetails [**Photo N**], and through dovetails [**Photo O**] provide strong, attractive joints that show an attention to detail. Lock rabbets [**Photo C**] deliver adequate strength, but lack pizzazz.

Make drawer bottoms from plywood, hardboard, or MDF, all of which move little

▶Learn to create box joints, dovetails, and lock rabbets for drawers. woodmagazine.com/boxjoints woodmagazine.com/dovetails woodmagazine.com/lockrabbetdrawers

Note: *Router dovetail jigs with fixed-spacing templates will dictate the size of your drawers if you set up for joints with a half-pin on each end. A jig with variable spacing eliminates this restriction.*



A wood slide, such as this center-mounted version, keeps a drawer moving in a straight line front to back, and at a bargain price.

Apply self-adhesive glide strips to the dust frame inside a cabinet or case so the drawer slides easily on their slippery-smooth surfaces.

This plywood drawer box with a painted false front functions well as a drawer, but lacks the perceived quality of a well-made solid-wood drawer.

Box joints provide the most glue surface of any drawer joint, and can be cut with a tablesaw or router. Dry-clamp the drawer box to rout a groove for a fully captured bottom panel.

with seasonal humidity changes. For most drawers, ¼" or ⅜" plywood makes the best bottom panels. For large drawers, use ½" plywood. A bottom that fits into a rabbeted groove on the bottom edge of a drawer box—even if it's tacked with brad nails—can fall out, especially when the drawer gets loaded. So capture the bottom panel in grooves cut into the sides and ends of the drawer box [**Photo M**].

To prevent a drawer from sliding in or out too far, drawers without metal slides should, ideally, have built-in stops. With overlay drawers, the fronts act as a stop when they contact the face frame or cabinet front. In other cases, you should build a stop into the back of the cabinet [**Photo P**] to prevent the drawer from simply hitting the back panel. A front stop [**Photo Q**] helps prevent a drawer from accidentally being pulled out completely, potentially spilling the contents.

Produced by **Bob Hunter** with **Kevin Boyle**

N

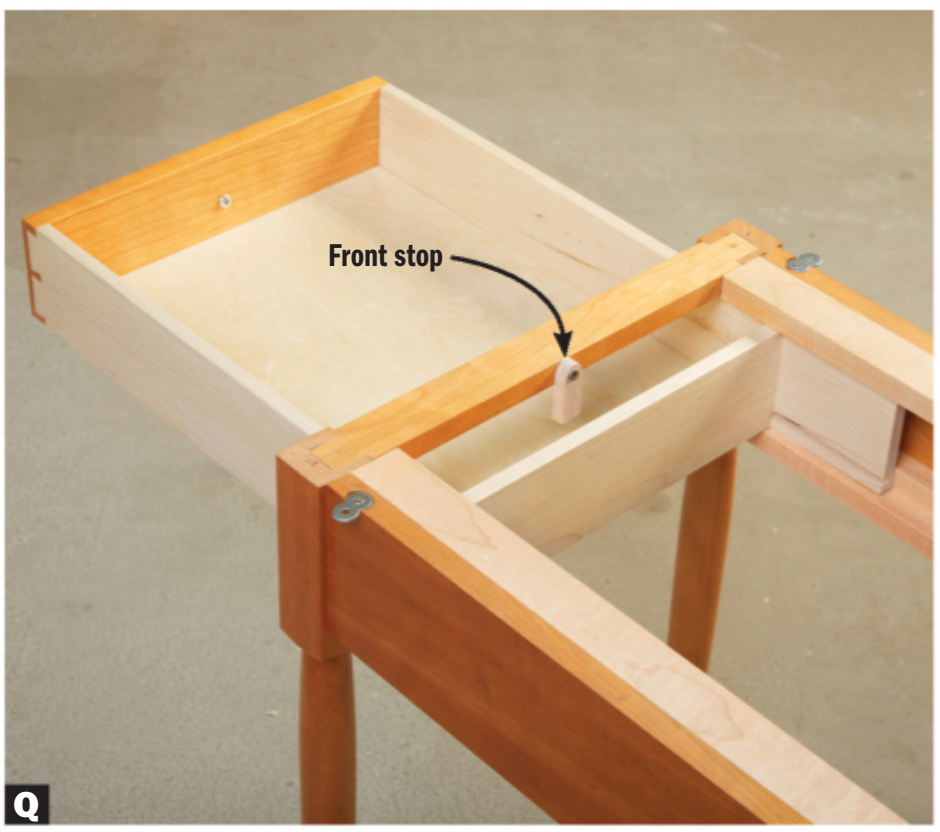
A half-blind dovetail joint mechanically locks the sides into the front securely without revealing the joint when the drawer is closed.

O

A through-dovetail joint provides plenty of strength as well as eye appeal. Generally, you'll position the pin boards at the front and back to maximize the mechanical strength of the joint.

P

A rear stop aligns the drawer front precisely flush with the cabinet's or project's front or face frame.



Q

A front stop limits forward movement of the drawer, yet pivots up to allow removal of the drawer when needed.

DIMENSIONS:
19½" W × 22" D × 36½" H

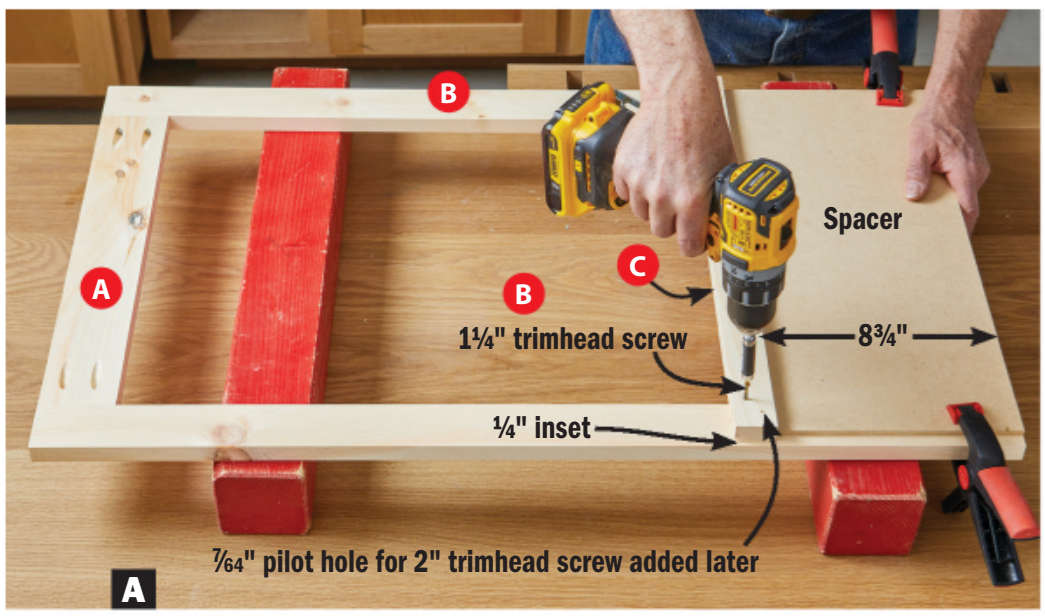
Approximate materials cost:

$145

Made from economical pine lumber

Kitchen Vegetable Bin

Preserve apples and vegetables safe from pests on the sturdy shelves of this ventilated cabinet.



Mount the bottom drawer runners using a spacer set flush with the bottom edge of the frame. Drill two off-center pilot holes at the end of each runner. Drive a screw into one hole of each pair.

Assemble the inner frames

1 Cut parts A–E to size [**Materials List**]. Drill pocket holes in the rails (A), then glue and screw them to the stiles (B) [**Drawing 1**]. Repeat for the second inner frame.

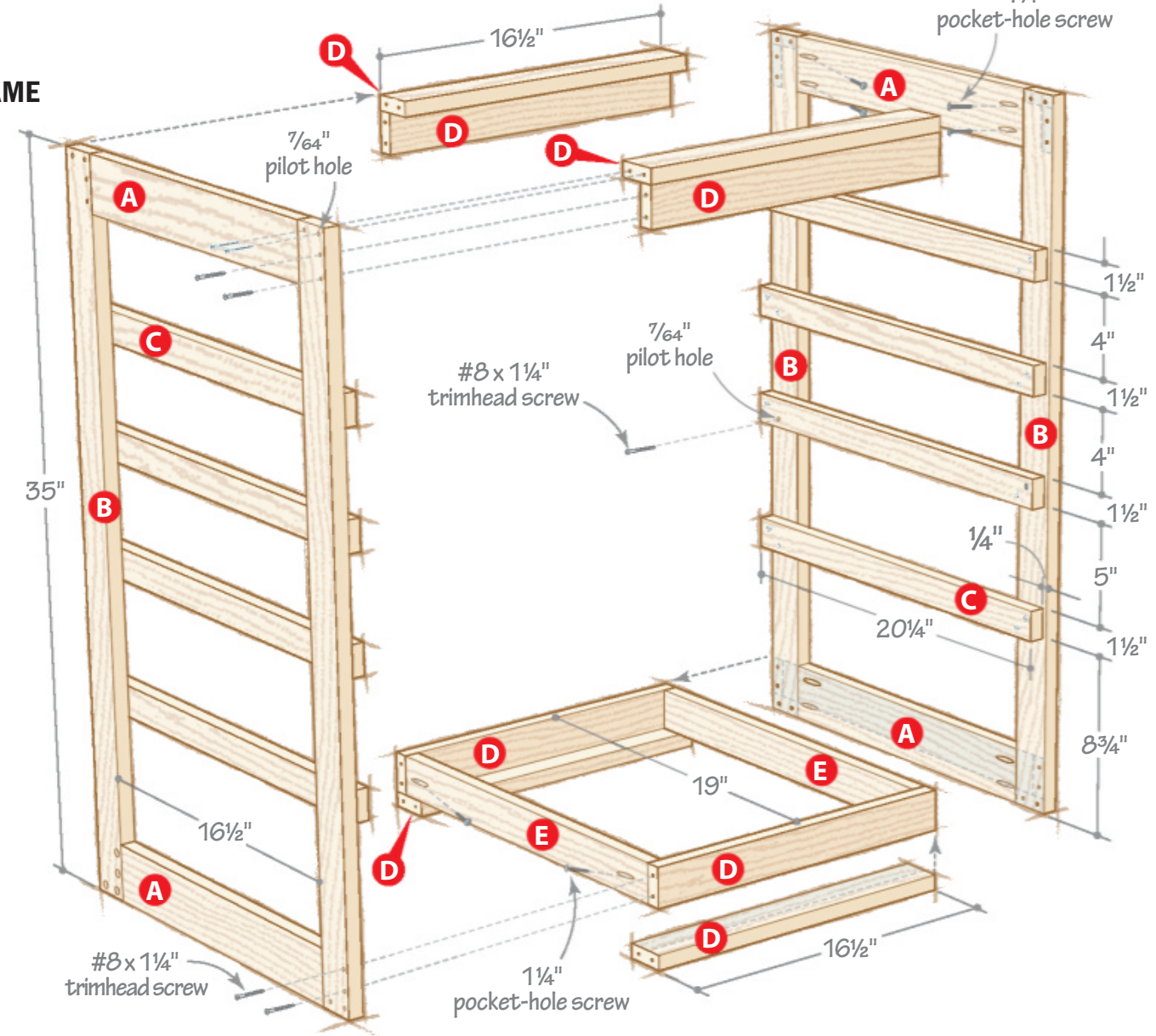
2 Use an 8¾"-wide spacer to attach a bottom drawer runner (C) on each frame [**Photo A, Drawing 1**].

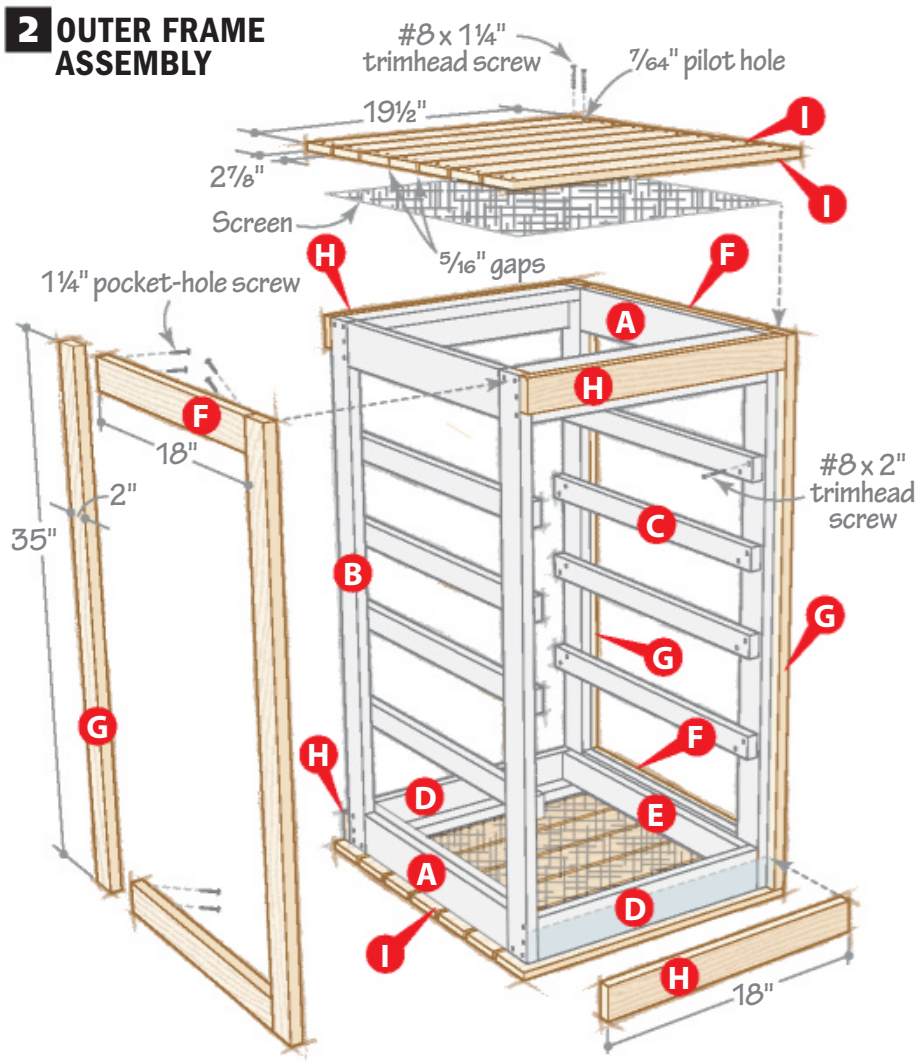
3 Rip the spacer to 5" wide to add the second pair of runners, and to 4" wide to screw on the top two pairs of runners.

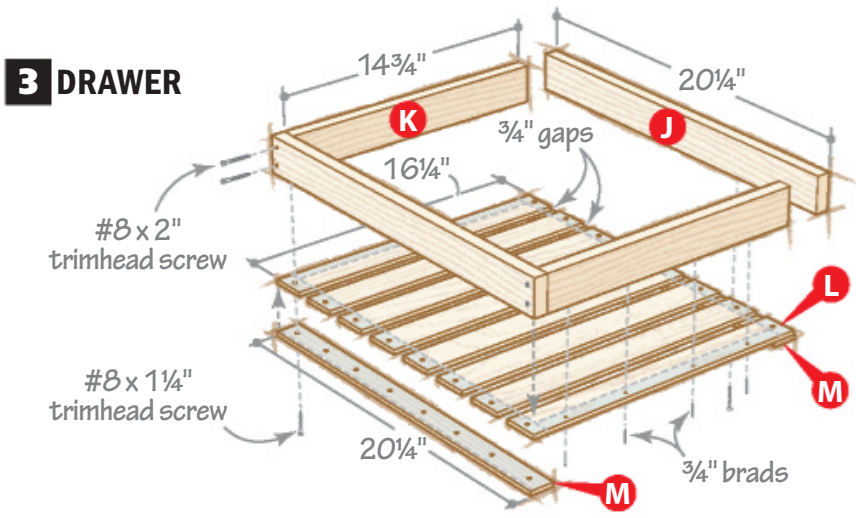
4 Glue four pairs of front/back rails (D) [**Drawing 1**]. Glue and pocket-screw short drawer runners (E) to two rail assemblies (D/D). Then glue and screw these rail assemblies (D/D, D/E) to the frames (A–C).

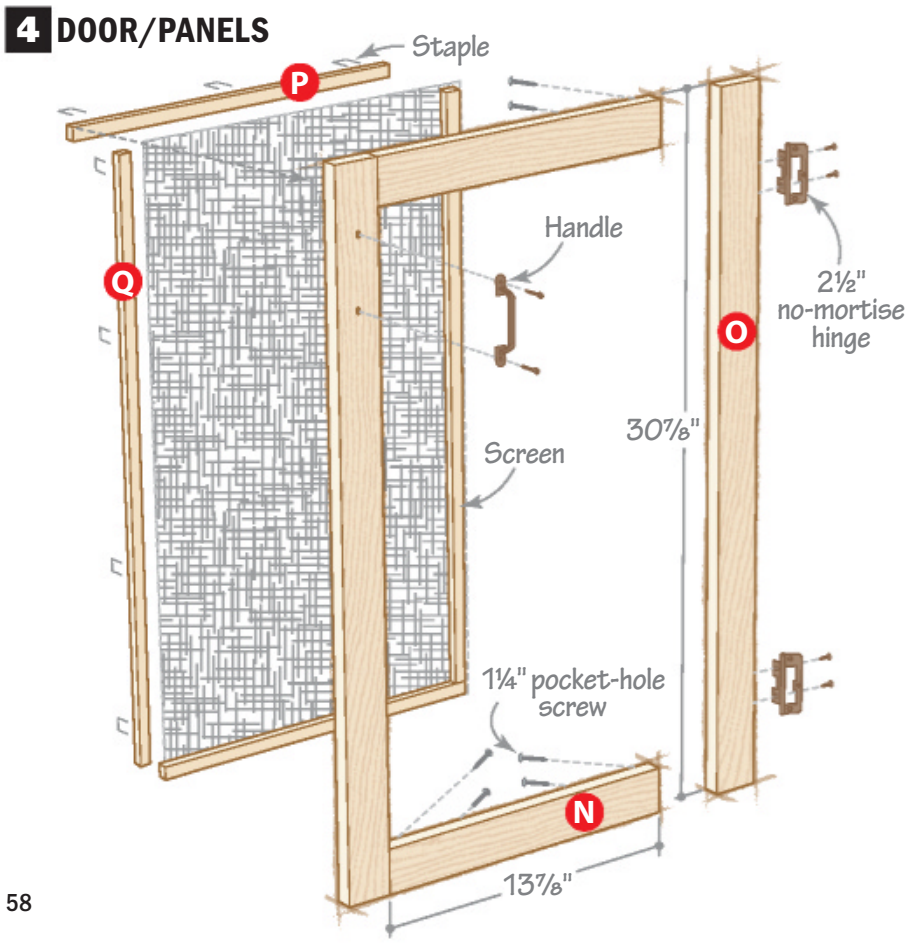
Note: *Drawer runners are ¼" shorter than the frame width and mount flush with the back stile. Build frames as a mirrored set.*

1 INNER FRAME ASSEMBLY









Use a utility knife with a fresh blade to slice cleanly through the heavy-duty fiberglass screen fabric.

Outer frames come next

1 Cut parts F–I and drill pocket holes in the side rails (F) [**Drawing 2**]. Glue and pocket-screw the rails to the stiles (G).

2 Glue the outer frames to the inner frame assembly (A–E) with a ¾" overhang front and back. After the glue dries, drive screws through the open pilot holes in each drawer runner (C) and into the outer stiles (G).

3 Glue and clamp the front and back rails (H) to the assembly.

4 Evenly space the top and bottom slats (I) on the assembly and drill pilot holes, but don't drive the screws yet. Label the slats in order and set them aside.

Build the drawers and a door

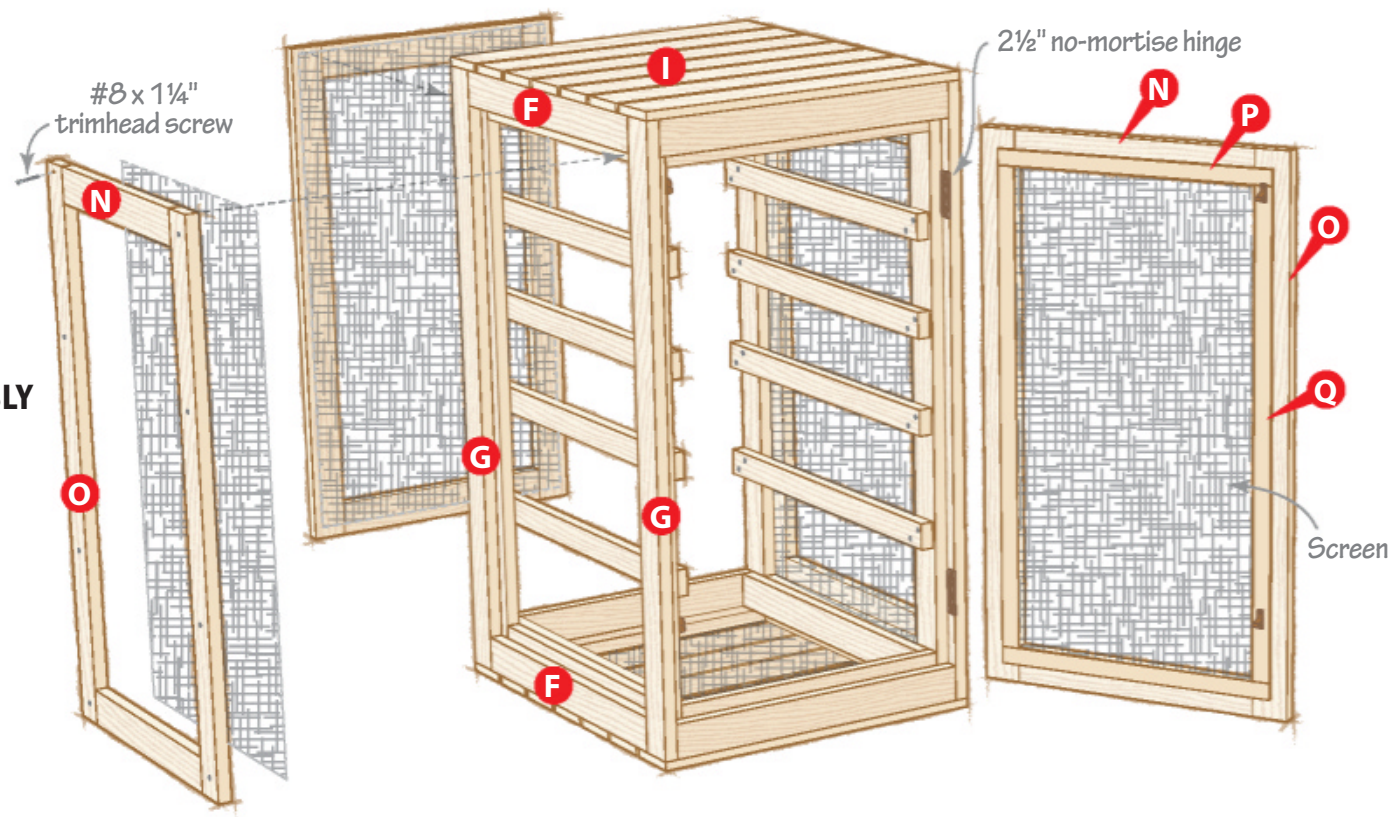
1 Cut drawer parts J–M. Screw the fronts and backs (K) to the sides (J) [**Drawing 3**].

2 Glue and nail the slats (L) to the frames (J/K). Then glue and screw the drawer slips (M).

3 Cut door/panel rails (N) and stiles (O) [**Drawing 4**]. Glue and pocket-screw the rails and stiles. Check that the door and panels fit the case assembly with a 1/16" reveal all around.

Staple screen to the inner frame (A, D) while stretching the fabric tight.

5 FINAL ASSEMBLY



4 Sand the drawers, door, panels, case, and slats, then finish them with three coats of polyurethane.

Bugproof the case

1 Staple screen [**Sources**] to the inside faces of each door/panel (N/O). Cut and staple the screen molding (P, Q) ½" from the inside edges of the door [**Drawing 5**]. Then trim the screen on the panels ¼" from the outside edges [**Photo B**], and trim the door screen along the outside edges of the molding.

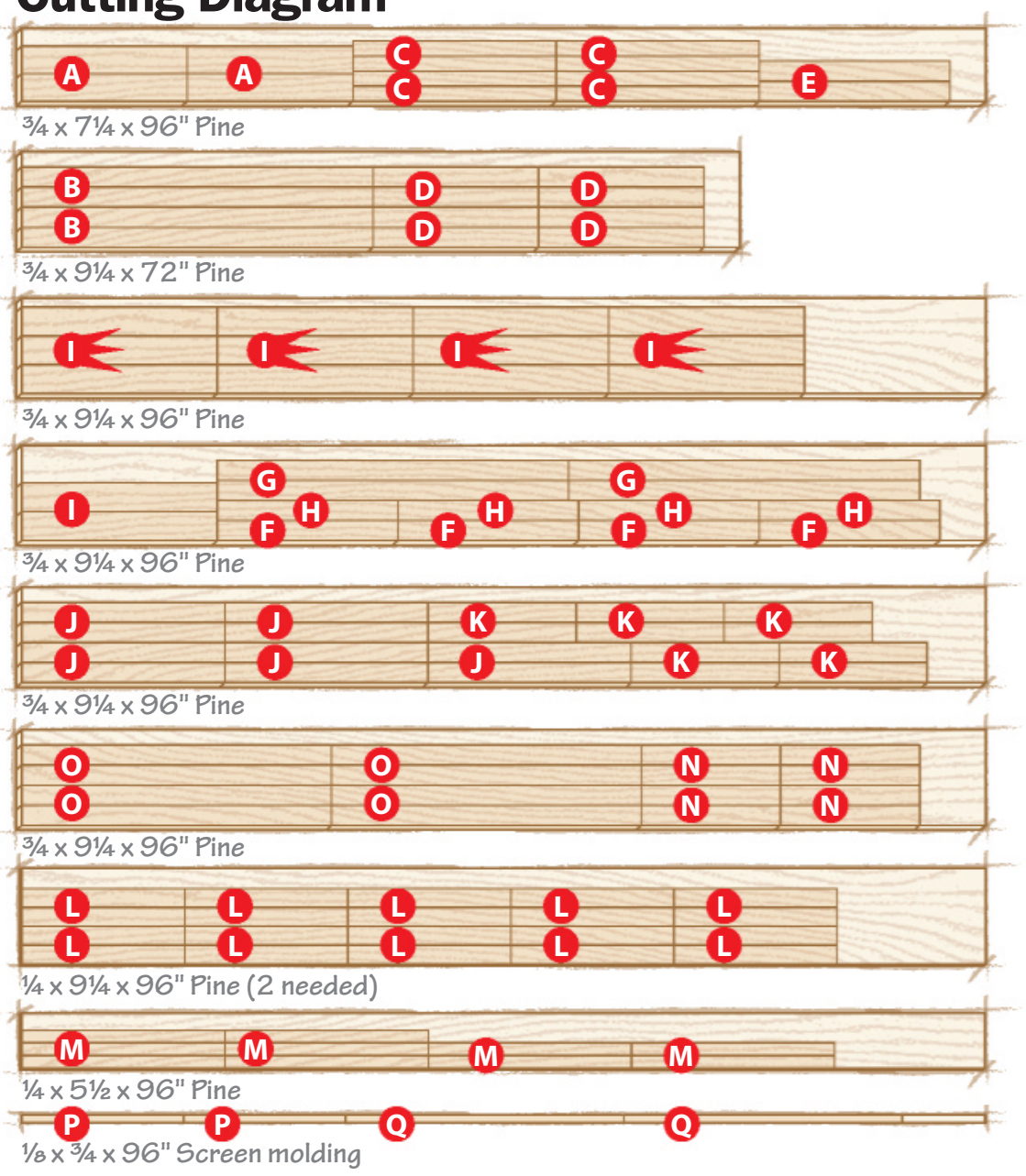
2 Screw three panels to the case sides and back [**Drawing 5**]. Screw hinges, catches, and a handle [**Sources**] to the door.

3 Staple screen to the top and bottom of the case and trim to fit [**Photo C**].

4 Screw the top and bottom slats to the outer frame (F, H) [**Drawing 2**].

5 With the door centered, screw the hinges to an outer frame stile (G). Then screw the roller half of the catches to the opposite inner frame stile (B). Add the drawers and you're ready to go grocery shopping.

Cutting Diagram



Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
Inner frames						
A	side rails	¾"	2¾"	16½"	P	4
B	inner stiles	¾"	2"	35"	P	4
C	drawer runners	¾"	1½"	20¼"	P	8
D	front/back rails	¾"	2"	16½"	P	8
E	short drawer runners	¾"	2"	19"	P	2
Outer frames						
F	side rails	¾"	2"	18"	P	4
G	outer stiles	¾"	2"	35"	P	4
H	front/back rails	¾"	2"	18"	P	4
I	top/bottom slats	¾"	2⅞"	19½"	P	14
Drawers, door/panels						
J	drawer sides	¾"	2"	20¼"	P	10
K	drawer fronts/backs	¾"	2"	14¾"	P	10
L	drawer bottom slats	¼"	1⅞"	16¼"	P	40
M	drawer slips	¼"	1¼"	20¼"	P	10
N	door/panel rails	¾"	2"	13⅞"	P	8
O	door/panel stiles	¾"	2"	30⅞"	P	8
P	short screen molding	⅛"	¾"	16⅜"	P	2
Q	long screen molding	⅛"	¾"	27⅞"	P	2

Materials key: P-pine.
Supplies: #8×1¼" trimhead screws, #8×2" trimhead screws, 1¼" coarse-thread pocket-hole screws, ¾" brads, ¼" staples.
Sources: 36×84" charcoal pet-resistant window screen, no. 697360, $15 (2), The Home Depot, local stores and homedepot.com. Large spring catches, no. 00W11.02, $1.70 ea. (2); 2½" no-mortise hinges, no. 00H51.23, $2.45 ea. (2); 4⅝" bronze handle, no. 02W27.92, $9.10, Lee Valley, 800-871-8158, leevalley.com.

Produced by **Robert Wilson** with **John Olson**
Project design: **John Olson**
Illustrations: **Roxanne LeMoine, Lorna Johnson**

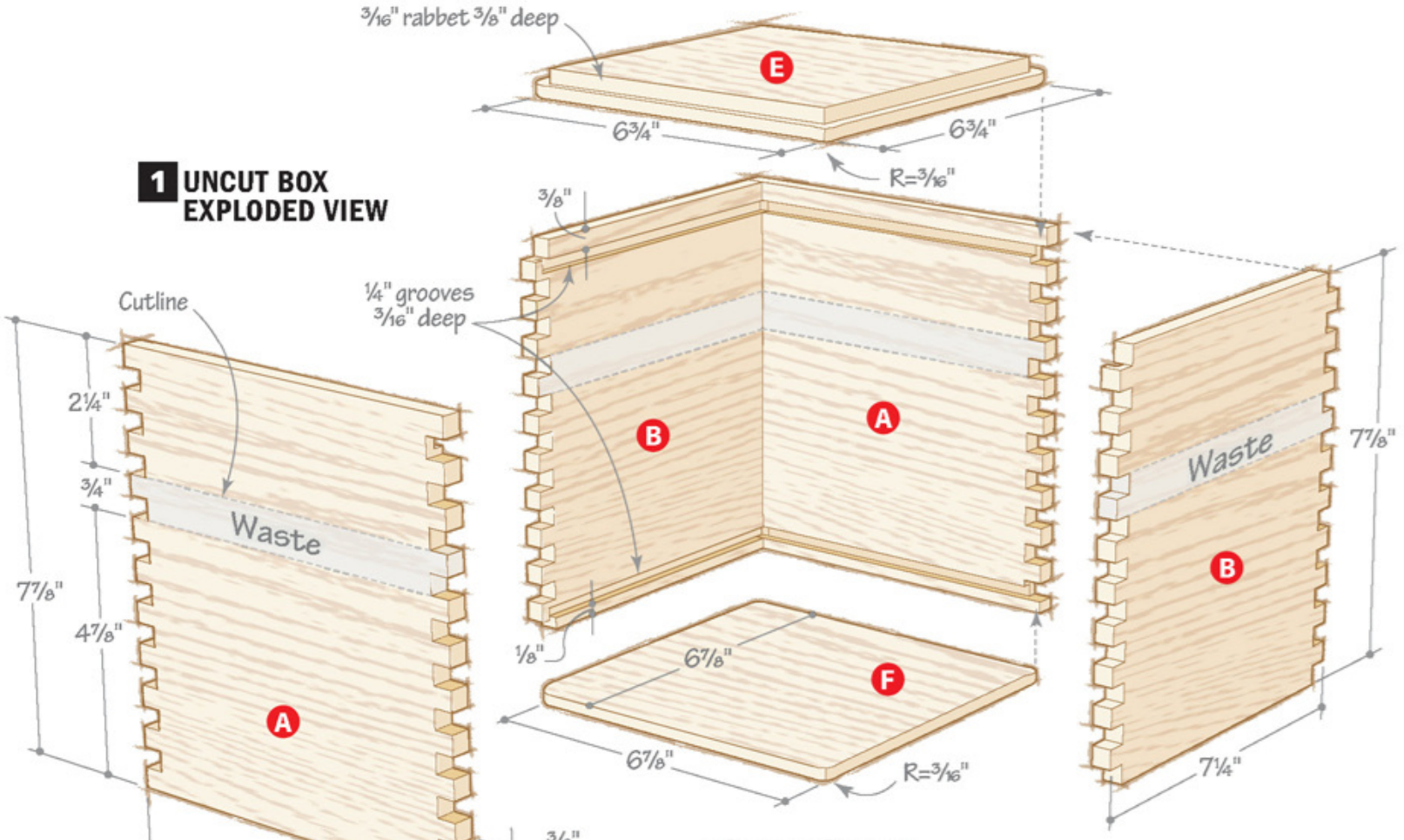
Wood-hinge Box

Be ready for any occasion by keeping an easily accessible supply of greeting cards on hand, all stored in a perfectly sized box showcasing your woodworking chops. Wood hinges and box joints add simple elegance; for ease of construction you cut both elements using the same super-simple jig!

DIMENSIONS:
7¼" W × 7¼" D × 7⅛" H

Approximate materials cost:
$24

Fits cards
4½ × 6⅛"



1 UNCUT BOX EXPLODED VIEW

Finger it out

1 Cut the front/back (A) and sides (B) to size, but 7⅞" wide [**Drawing 1, Materials List**]. From the same stock cut two 1×12" blanks for the hinges (C, D), and a ⅜×1½" piece for the box-joint-jig key. Save a couple of cutoffs to help set up the box-joint jig [**Skill Builder**].

SKILL BUILDER

The simplest-ever box-joint jig

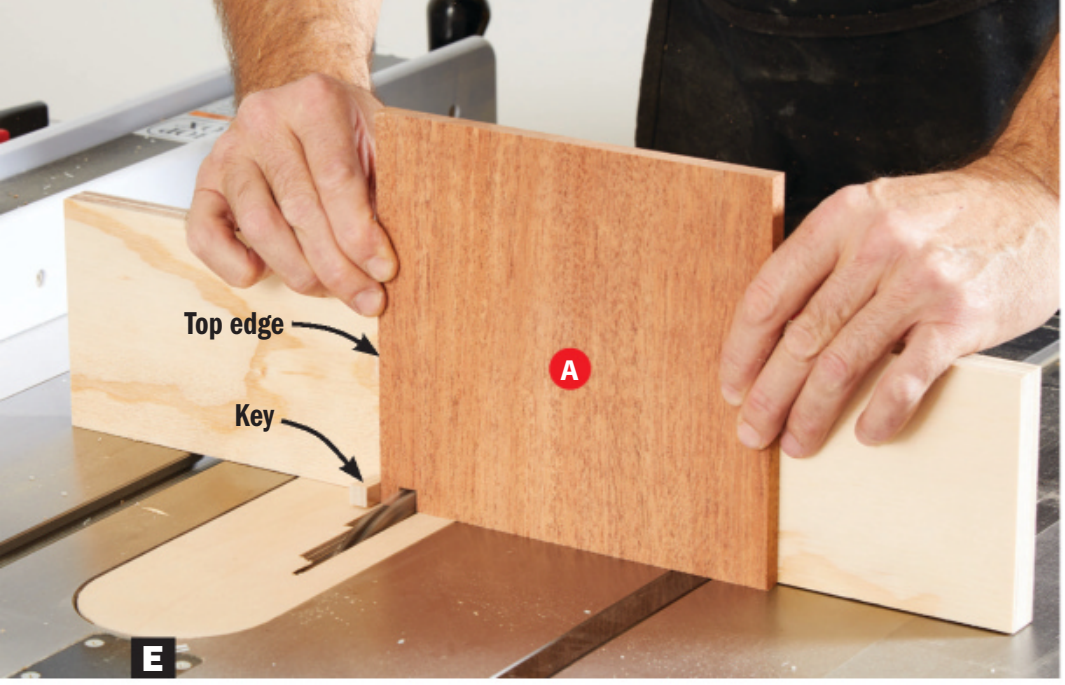
Use scraps of the material in which you'll be cutting the box joints to help set up this jig and make it spot-on with the first cut.

Set your rip fence 10" from the blade, clamp two of the cutoffs against it, and butt a 4×14" piece of ¾" plywood against the cutoffs. Screw the plywood to your miter gauge.

With a ⅜" dado stack in your saw set just a hair more than ⅜" above the table, make a cut through the jig.

Remove the spacers, unscrew the jig, and reposition it against the rip fence. Screw the jig to the miter gauge again.

Make a second cut through the jig. Then, glue the key into the first notch you cut. Allow the glue to dry before using the jig.



Touch the edge of a front/back (A) against the key, hold the workpiece against the jig, and make the cut. Remove the workpiece before drawing the jig back.

The initial cut on each side (B) should remove the full width of the dado stack without leaving any waste.

Tip! *When cutting the joint on the opposite end, start with the top edge against the key again.*

Tip! *To prevent the hinges from binding in use, press the jig against one side of the miter slot during the cut, hold the blank in place, and press the jig against the opposite side of the slot as you pull it back through the blade.*

2 Make the first cut in the front and back (A) with the top edge of the workpiece against the key [**Photo E**]. Fit the notch over the key, and repeat the process, stepping along the width of the workpiece. Cut joints on both ends of the front and back.

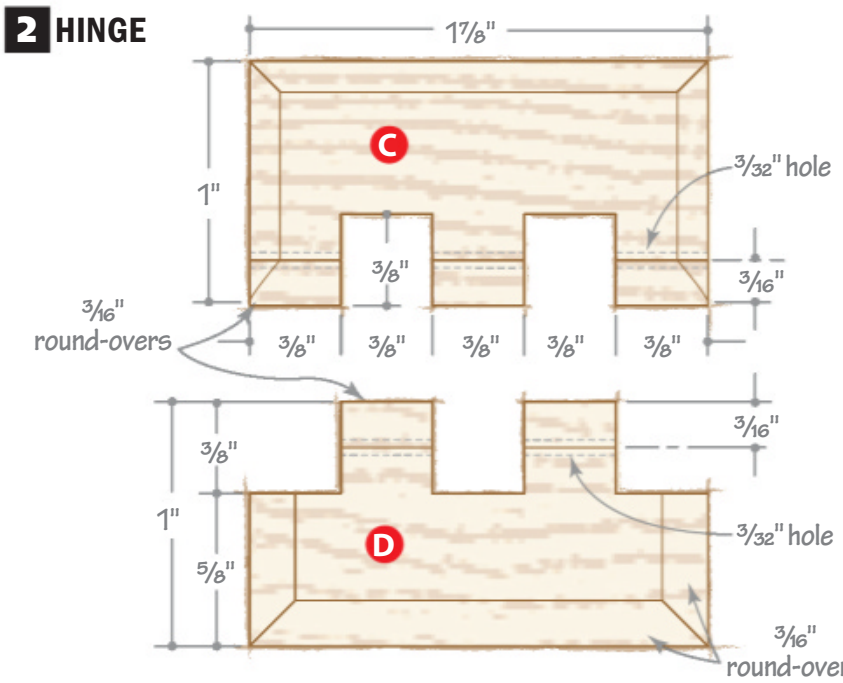
3 For the sides (B), align the top edge with the edge of the notch nearest the key. Make a cut [**Photo F**], press the notch against the key, and repeat across both ends of both sides.

4 Retrieve the hinge (C, D) blanks and round over both faces on one edge of each [**Drawing 2**]. Cut box joints on the rounded edges. Set the blanks aside.

5 Dry-fit the box, securing it with painter's tape. Using a box-slotting bit [**Source**] in the router table, rout the grooves for the top (E) and bottom (F) [**Drawing 1**].

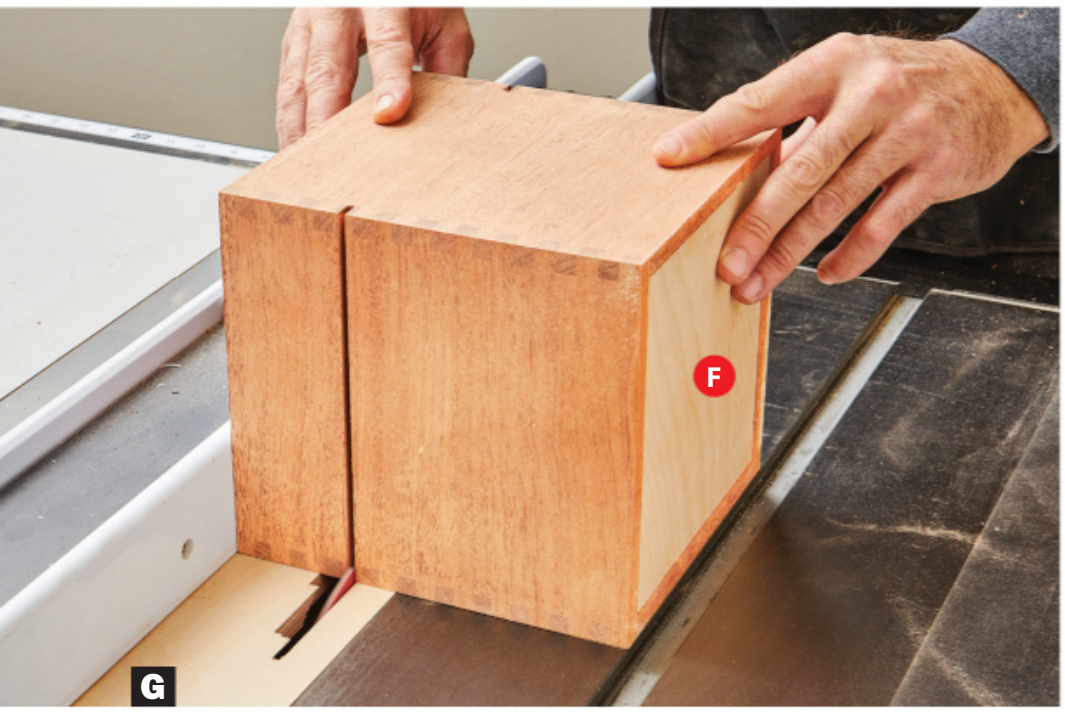
6 Cut the top (E) and bottom (F) to size. Rabbet the top and radius the corners of the bottom [**Drawing 1**]. Glue up the box with the top and bottom, applying glue to only the middle 1" along each end of the top. After the glue dries, sand the faces smooth.

2 HINGE



Flip the lid

1 Set your tablesaw blade a hair more than ⅜" above the table. Separate the lid from the box [**Photos G, H**], then finish-sand the pieces.

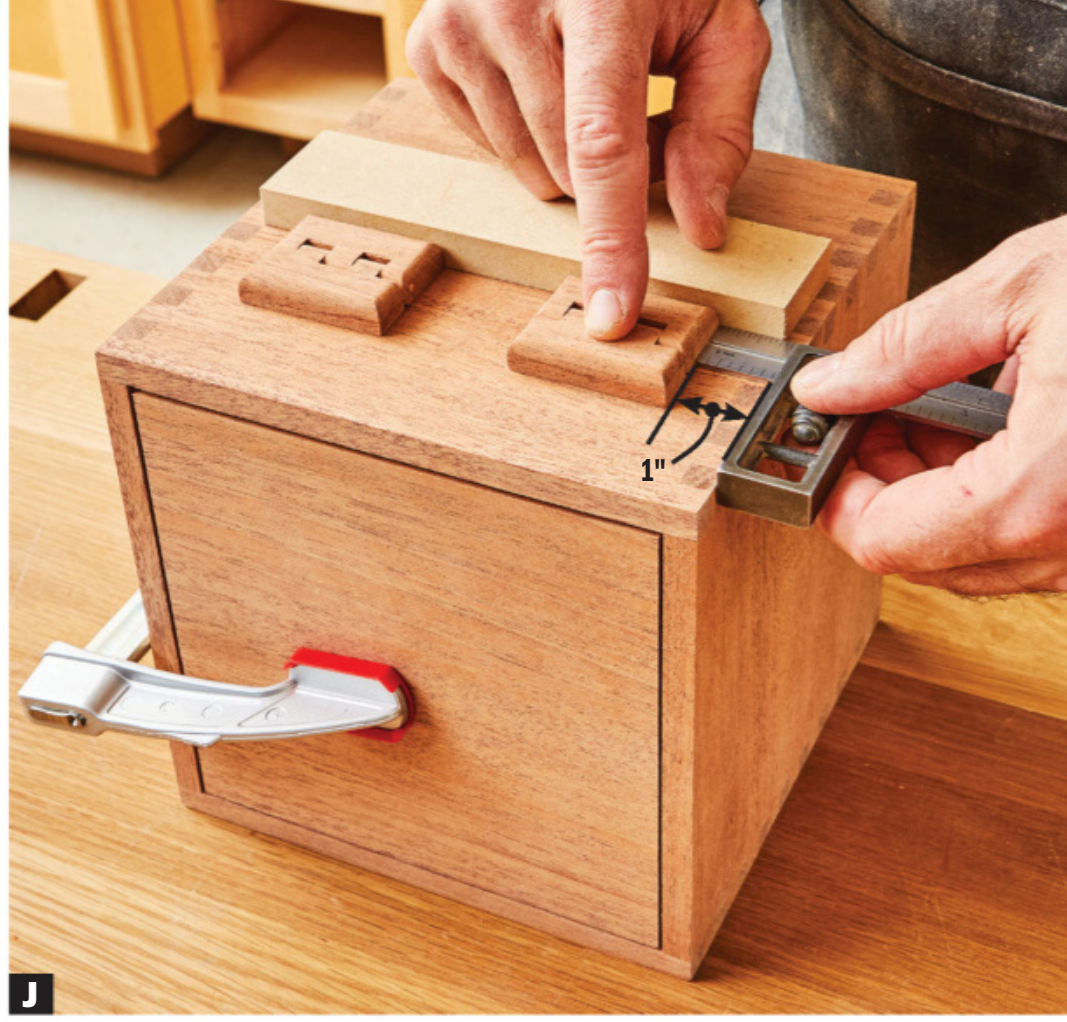


Position the fence to leave just more than six fingers between the blade and fence. Make a pass on each face, placing shims in the kerfs on the third and fourth cuts to prevent them from pinching shut.

Trim away the partially cut finger on the lid and the next finger on the box to maintain the joint pattern with the lid in place.

I

Clamp a hinge top and bottom (C, D) in a handscrew, mark the pin location with a punch, and slowly drill through the assembly. This hole must be pefectly perpendicular to the ends of the hinge.



J

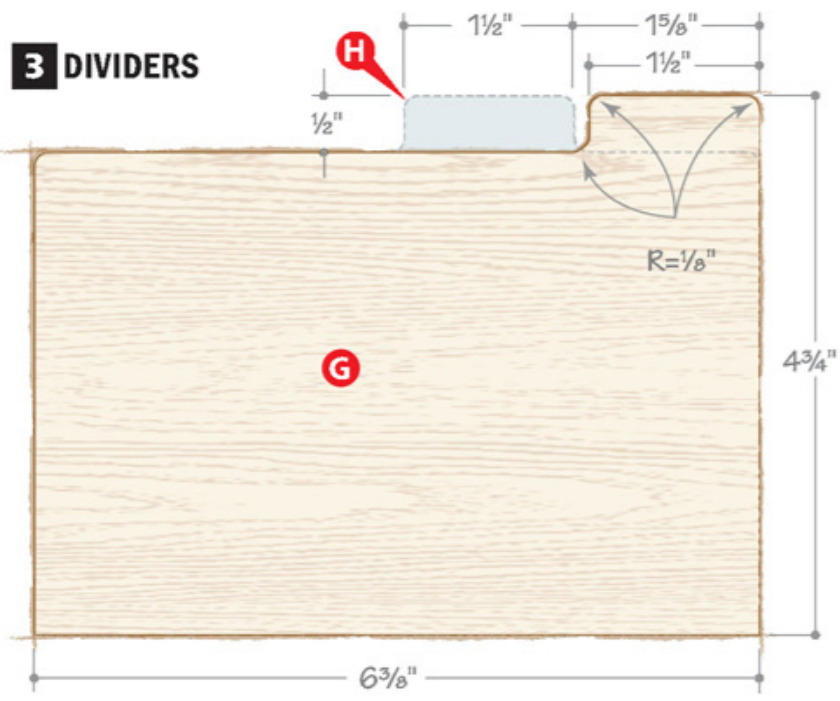
Center the hinge pins on the lid joint, and secure a spacer below the hinges with double-faced tape. Attach the hinges with double-faced tape and check the lid swing. Remove the tape and glue the hinges in place.

Tip! *To prevent the drill bit from wandering, lift it frequently to clear the waste.*

Tip! *Set up your drill press for peak performance.* *woodmagazine.com/drillpresstips*

2 Crosscut two hinges (C, D) to length [**Drawing 2**]. Drill the hinge-pin holes [**Photo I**]. Press in a 2¼" length of brass rod, and check the hinge operation. When satisfied, trim the rod and sand it flush. Round over the outside ends and edges of the hinges. Clamp the box together and mount the hinges [**Photo J**].

3 Cut the dividers (G, H) [**Drawing 3**] and finish-sand them. Apply a finish to all pieces (we sprayed on aerosol semigloss lacquer). Apply labels to the dividers, and start organizing your greetings.



Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A*	front/back	⅜"	7⅛"	7¼"	M	2
B*	sides	⅜"	7⅛"	7¼"	M	2
C*	hinge tops	⅜"	1"	1⅞"	M	2
D*	hinge bottoms	⅜"	1"	1⅞"	M	2
E	top	⅝"	6¾"	6¾"	M	1
F	bottom	¼"	6⅞"	6⅞"	P	1
G	outside dividers	⅛"	4¾"	6⅜"	P	2
H	middle dividers	⅛"	4¾"	6⅜"	P	2

*Parts initially cut oversize. See the instructions.

Materials key: M–mahogany, P–plywood.
Supplies: 3/32 × 6" brass rod.
Blade and bit: Dado blade; 3/16" round-over router bit.
Source: ¼" shallow-slot box-slotting bit, no. 16J83.04, $32.40, Lee Valley, 800-871-8158, leevalley.com.

Produced by **Craig Ruegsegger** with **Kevin Boyle**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine, Lorna Johnson**

Lunar Lumber

In this 56×53" intarsia artwork from Judy Gale Roberts, moon wood serves as the flagpole, the plaque (lower center), and as the planet Mars in the last "O" of "Apollo." All wood pieces are their natural colors, except the flags' blue fields, which are dyed.

by Jim Heavey

As the Apollo 14 lander rested on the surface of the moon in 1971 and Alan Shepard hit a couple of golf balls to test the effect of the moon's reduced gravity on his driving distance, about 500 tree seeds took 34 revolutions around the moon with astronaut Stuart Roosa in the command module. The seeds were part of an experiment by NASA and the U.S. Forest Service (USFS) to see if seeds subjected to zero gravity and harsh radiation would germinate back on earth. Though there were a few seed casualties, most of them did become saplings, and some matured into "moon wood."

One of those saplings was transplanted at Cape Canaveral at the Kennedy Space Center in June of 1976 to celebrate the nation's bicentennial. That sycamore tree grew well for about 40 years until Hurricane Irma destroyed it in September of 2017. Most of the tree was cut up to be mulched and would have been forever lost were it not for Scott G. Phillips, a member of the Huntsville (Alabama) Space Shuttle team. He felt that the tree might be a way to preserve the legacy of the Apollo program and NASA. With the permission of NASA and the USFS, Phillips took possession of a 30" section of the tree.

▶This is a portion of an online article detailing more of the projects made from the moon wood. Read the full article and see more photos at woodmagazine.com/moonwood.

Alex Snodgrass, left, resaws a log of the sycamore moon wood. The slabs found use in various commemorative projects, including a guitar, plaques, pens, and more.

The patch for the Apollo 14 mission rests on a slab of the sycamore moon wood.

This plaque stood beside the tree and will be reused in a memorial to honor the late astronaut Stuart Roosa, who carried the seeds into orbit.

Sycamore moon wood rings the sound hole on this Martin guitar. Another piece inside the body is etched with a replica of the plaque attached to the lunar lander during the first moon landing in 1969.

In April 2019, Phillips brought that log to the shop of bandsaw expert Alex Snodgrass who cut the log into 5/4 slabs, *top*. I was present to gather information for this story in *WOOD*® magazine. Every piece of this log was saved, even the sawdust!

Scott took possession of the bulk of the material, and he has already put some to great use. Pieces were sent to intarsia expert and artist Judy Gale Roberts to be part of her intarsia piece *For All Mankind*, *previous page*. More than 150 design hours, 1,000 shop hours, and 1,300 pieces of wood went into its construction. The stunning results capture the spirit of this moment in history. This artwork will greet visitors to the Kennedy Space Center for many years to come.

▶See in-progress photos and video of Judy Gale Roberts' intarsia. woodmagazine.com/moonintarsia

Projects from other craftsmen are in the works, *above*. Alex has taken small pieces of his stock to make commemorative pens. And he and I have discussed the possibility of collaborating to create projects befitting this very special stock.

As for me, I have to admit being a bit intimidated by the enormous pressure to create something worthy of this exceptional, unique piece of "found wood." Some will surely be donated to *WOOD* magazine, where this "moon wood" will be used in a manner befitting its otherworldly heritage.

Successfully Finish Curves,

The woodworking world isn't flat, so explore these sanding and finishing tips to keep bumps from becoming hurdles.

If every project consisted of only smooth, flat surfaces, the hardest thing about finishing would be prying the lid off the can. But in the real world, potential finishing flaws lurk in every raised-panel door corner, routed profile, and turned table leg.

Don't assume that manufactured products, such as turned legs or crown molding, arrive from the factory ready to stain and finish. They may have machine marks that stain will reveal [**Photo A**]. Use the following techniques to sand, stain, and finish these parts with the same care you'd give flat surfaces or routed profiles created in your shop.

Sanding-success shortcuts

For consistent stain color, smooth the surfaces on all parts and part sections equally. Ensure equal smoothness by developing a regular sanding routine, then disciplining yourself to complete each step. First, separate curved and profiled parts to be sanded and finished prior to assembly—especially turned legs and door panels. Then work all of the flat surfaces at the same time, and all of the curved or contoured sections together.

Use a random-orbit sander to smooth each flat surface it can reach, starting with the highest grit that still removes machine marks. After the final grit—180 or 220 for most jobs—hand-sand flat surfaces in the direction of the grain, using that final grit to eliminate any swirl marks.

Next, hand-sand corners and contours missed by the random-orbit sander, switching up sandpaper backing pads to suit the surface being sanded. The most versatile profile sanding tools are right at your fingertips. Your hands can conform to many different shapes, but be careful to press evenly on the sandpaper [**Photo B**]. Gaps between your fingertips can create ridges.

For fine details narrower than your fingertips, or in tight spaces, use sanding and specialty tools, like the ones shown on the *next page*; scrapwood, dowels, or other objects around your shop to back up sheets of sandpaper. Some curved profiles require no sandpaper backing at all. For example, to avoid cross-grain scratches on the face, sand an end-grain round-over with a loose piece of sandpaper [**Photo C**].

Here's a trick to bypass the 80- or 100-grit sanding stage in tough-to-reach areas: Scrape the wood instead. In addition to card scrapers or paint scrapers, make your own

The sanded molding section on the left takes stain evenly and shows no ridges, unlike the unsanded area on the right.

Overlapping fingertips and a piece of folded sandpaper smooth the bevel on this manufactured door panel.

Corners, and Crevices

C

Sanding this end-grain round-over using a shoeshine motion eliminates the likelihood of leaving facets on the curve.

D

Foam pads have two abrasive faces. They distribute pressure from your fingers for an evenly sanded surface.

miniature scrapers for working tight areas by grinding squared ends on pieces of discarded hacksaw or bandsaw blades.

Regardless of which tools you choose, hand-sand all areas to the same grit used to machine-sand the flat surfaces. We hand-sand nearly every *WOOD*® magazine project with abrasive sponges [**Photo D**].

While checking off your personal sanding routine steps, measure sanding progress using your sense of touch. If the skin of your fingertips catches on the wood, keep sanding through the grits until it's smooth. Pay special attention to transition areas where the random-orbit sander stops and hand-sanding begins.

Once you've sanded to your final grit, use compressed air to blow trapped dust out of corners and profiles. Then wipe all surfaces clean with a soft cloth.

Match the right specialty tool to the job

RUBBER SANDING GRIPS

Profile sanding blocks reach into and around narrow coves, grooves, and round-overs. (See **Sources,** *page* 69.)

GOOSE-NECK SCRAPERS

Work a goose-neck scraper at a slight skew angle to remove machine marks from coves prior to finish-sanding.

PAINT SCRAPERS

This scraper offers replaceable round-, teardrop-, and triangle-shape blades that clean a profile without distorting it.

RADIAL-BRISTLE DISCS

Powered by a rotary tool, these discs (inset) conform to the radius of an inside curve without changing it.

This remote holder was stained prior to assembly to avoid reaching into the recesses with a stain cloth. Joint areas were taped off.

Prestaining door panels eliminates the chance that wood movement will expose an unstained strip as the panel shrinks.

Apply a consistent color

Before assembling any loose parts, decide whether it's easier to apply stain and finish to separate parts and assemblies, or the finished project. For example, deep recesses in the remote control holder shown in **Photo E** mandate staining before assembly. When staining unassembled parts, first, tape off glue-joint areas to ensure solid glue bonds.

Stain door panels before assembling the door [**Photo F**]. Otherwise, seasonal wood movement can reveal unstained or blotchy strips at the panel edges around the frame.

Woods such as maple and pine can blotch because even their flat surfaces absorb stain unequally. Others, such as oak, have open pores that trap stain pigment particles, especially on turned or routed areas. But both types can be stained uniformly using the same precautions needed to match solid-wood edging to plywood panels: Stain over sealer, wood conditioner, or gel stain. For example, contours sanded with 320-grit abrasive and sealed with a thin coat of shellac take stain evenly [**Photo G**].

Don't worry about minor color variations on contoured pieces, such as the cherry table leg shown in **Photo H**. Different surfaces reflect light—or block it—in different ways, so you'll never notice minor differences.

A shellac sealer applied before staining on the left side of this oak spindle prevents blotching in areas showing end grain.

Despite an even color on this cherry table leg, shadows in recesses and glare on curves still give the illusion of color variations.

I

Foam brushes apply uneven pressure, but a bristle brush reaches into the tiniest details with fewer drips and skipped spaces. Avoid using a bristle brush to touch up runs or skips left by a disposable brush.

J

Brushing contours with the grain causes runs and drips. Instead, brush with the profile, using thin coats from a lightly loaded brush.

Brush on a no-drip finish

Set up an angled light that reflects the surface as you work, and then assemble the right tools. Foam brushes work on flat areas, but contours require quality bristle brushes [**Photo I**]. Use a synthetic-bristle brush for water-based finishes, and a natural-bristle brush for oil-based finishes. Select the narrowest brush that still allows you to apply a finish quickly on the area to be covered.

On turned parts, such as table legs, load the brush only about a third as much as you would for a flat surface. Then brush around the profile, not with the grain. Brushing with the grain releases too much finish as the brush passes over raised areas and too little inside the crevices [**Photo J**].

To apply a film finish in the corners of a door panel, again load the brush less than usual. Begin brushing near a corner but not in it. Brush away from the corner to unload some of its finish; then reverse direction to spread finish into the corner. That avoids creating a pool of finish. You also can help avoid corner pooling on raised-panel doors by using an angled sash brush [**Photo K**].

In both cases, lay the finish on and keep moving. Repeatedly brushing over a freshly finished area increases the likelihood of leaving brushstrokes. If finish collects in a crevice or corner, empty the brush on a towel and lightly lift off the extra finish with just the bristle tips. If you notice a skipped area after the finish skins over—especially with fast-drying water-based finishes—resist the temptation to touch it up. Just catch it with the next coat.

K

The pointed tip of a sash brush reaches into corners while laying down an even finish on adjacent flat surfaces.

If brushing still seems too intimidating, or you're finishing intricate surfaces, such as a carving, use a wipe-on finish. You can buy wipe-on finishes, or make your own by mixing two parts polyurethane to one part mineral spirits.

As the name suggests, wipe these on with a cloth; then immediately wipe away the surplus with a clean cloth before it forms a surface skin. Each application of a wipe-on finish forms a thinner coat than a full-strength film finish, so you'll need roughly twice as many coats. But you can work it into nooks and crannies without worrying about drips. On intricate carvings or fine details, apply thinned finish with just the tips of a nearly dry bristle brush and lightly wipe away the excess.

Sources

Profile sanding blocks. Concave sanding pad set of four, no. 145958, $7; round sanding pad set of 8, no. 145957, $11; angle sanding pad set of 4, no. 145960, $6.79. Woodcraft, 800-225-1153 or woodcraft.com

Card scrapers. Concave, convex, and gooseneck scraper set, no. 05K20.20, $16. Lee Valley Tools, 800-871-8158, leevalley.com

Paint scraper. Bahco carbide scraper no. 625, $17.52 woodmagazine.com/bahco625

3M Scotch-Brite radial bristle discs. In 120, 220, and 400 grit, in 9/16–3" diameter, $10–28, plus mandrel, $1.50. The Sanding Glove, 800-995-9328 or thesandingglove.com

Produced by **Robert Wilson**

Signmaking Simplified

An inexpensive kit makes the job nearly goof proof.

With a signmaking kit and your router, you can create handsome wooden signs fast and with no special skills. A kit typically comes with letter and number templates that fit into a fixture, which in turn clamps to your workpiece. You then rout each character by plunging the bit and tracking the guide bushing along the template cutouts. We like Milescraft's SignPro kit (no. 1212, 847-683-9200, milescraft.com). It's easy to set up and use, comes with 1½"- and 2½"-tall templates, matching bits and guide bushings, and a universal subbase that fits almost any router. Best of all, it costs only $80. Here's how to make the most of this kit.

A ½" round-nose bit adds greater depth and width to the characters than the ⅜" round-nose bit included with the kit.

A V-groove bit creates beveled side walls, but slight play between the bushing and templates leaves a thin ridge in the bottoms.

A straight bit tears out the wood slightly more than other bits, but the perpendicular side walls add shadows for more contrast.

There's no substitute for making test cuts

Before you begin routing a prized piece of wood, familiarize yourself with the router and the kit, and how they work together. Begin by mounting the included subbase onto your plunge router. We recommend a midsize model (1½ to 2¼ hp) because it's more nimble than a bulky 3-hp unit. Make plenty of test cuts in scrap stock to get the feel of guiding the router through the various templates.

Although the kit includes two round-nose router bits, you can use any bit that fits within the guide bushings. As shown in the photos *above*, you'll get different looks from round-nose, V-groove, and straight bits. Sharp bits reduce tear-out and burn marks.

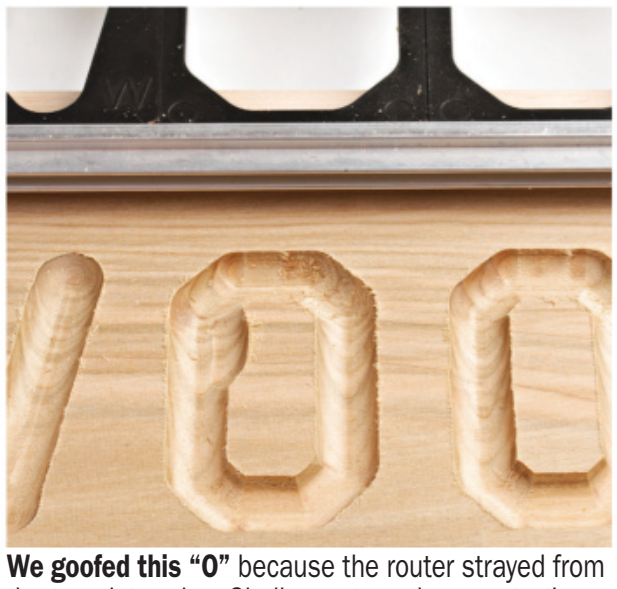
Rout each character in ⅛"-deep increments for best results; the final depth depends on your workpiece thickness and your preferred look. When routing letters and numbers with inner fields (A, B, D, O, P, Q, R, 6, 8, 9, and zero), hold the guide bushing tightly against the outer perimeter of the template as you rout. Even a slight wandering off the template wall results in a botched character, *below left*.

Choose wood that showcases your sign

If you're going to paint your sign, almost any wood species will do. For clear-finished signs, laminate two contrasting species, such as the padauk-on-maple sign *below center*. This sign, however, works best for indoor uses; it will fade and lose its lustrous color quicker if displayed outdoors.

If you're making a sign for outdoor use, choose cedar, redwood, or white oak because those species resist rot better than others. After routing the characters on your sign, use spray paint for a quick way to add contrast (rather than painting each one with a brush). After the paint dries, plane or sand away enough stock to clean up the face, as shown *below right*. Don't apply a clear-film finish to outdoor signs; the sun's ultraviolet rays will cause it to peel. Instead, apply a penetrating, pigmented deck finish, or leave the wood bare and allow it to weather naturally.

Produced by **Bob Hunter**



We goofed this "0" because the router strayed from the template edge. Shallow cuts and concentration will help avoid this.

Laminate ¼"-thick padauk or another dark species onto ½" or thicker maple, and then rout at least ⅜" deep to get contrast.

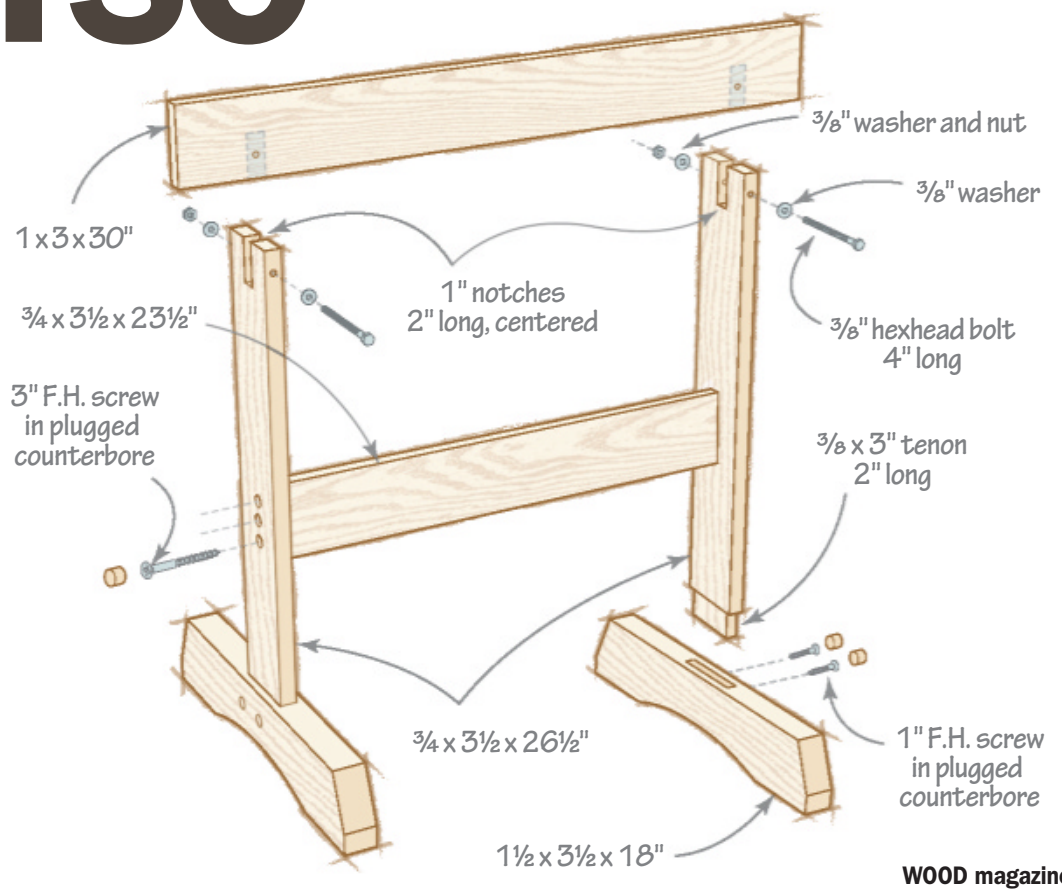
When planing a sign to remove overspray, skim off no more than 1/64" per pass to avoid tearing out the wood around the characters.

Replaceable-beam Sawhorse

The top beam on a sawhorse can get really chewed up with saw kerfs. Eventually, that beam needs replacement for cosmetic and functional reasons. This simple design makes swapping the beam a straightforward affair. Reader John Kutyba of Hayward, Wisconsin, built this one from scraps of cherry, oak, and walnut for strength and appearance, but you could use a softwood to save on cost and weight.

Though John, a cabinetmaker by trade, incorporated mortise-and-tenon joinery connecting the feet to the legs, a simpler half-lap joint would perform well, too. In that case, make the feet and legs from 1½" (2-by) stock.

John sized these sawhorses for his 5'8" height. If you're taller or shorter than him, change the length of the legs accordingly.



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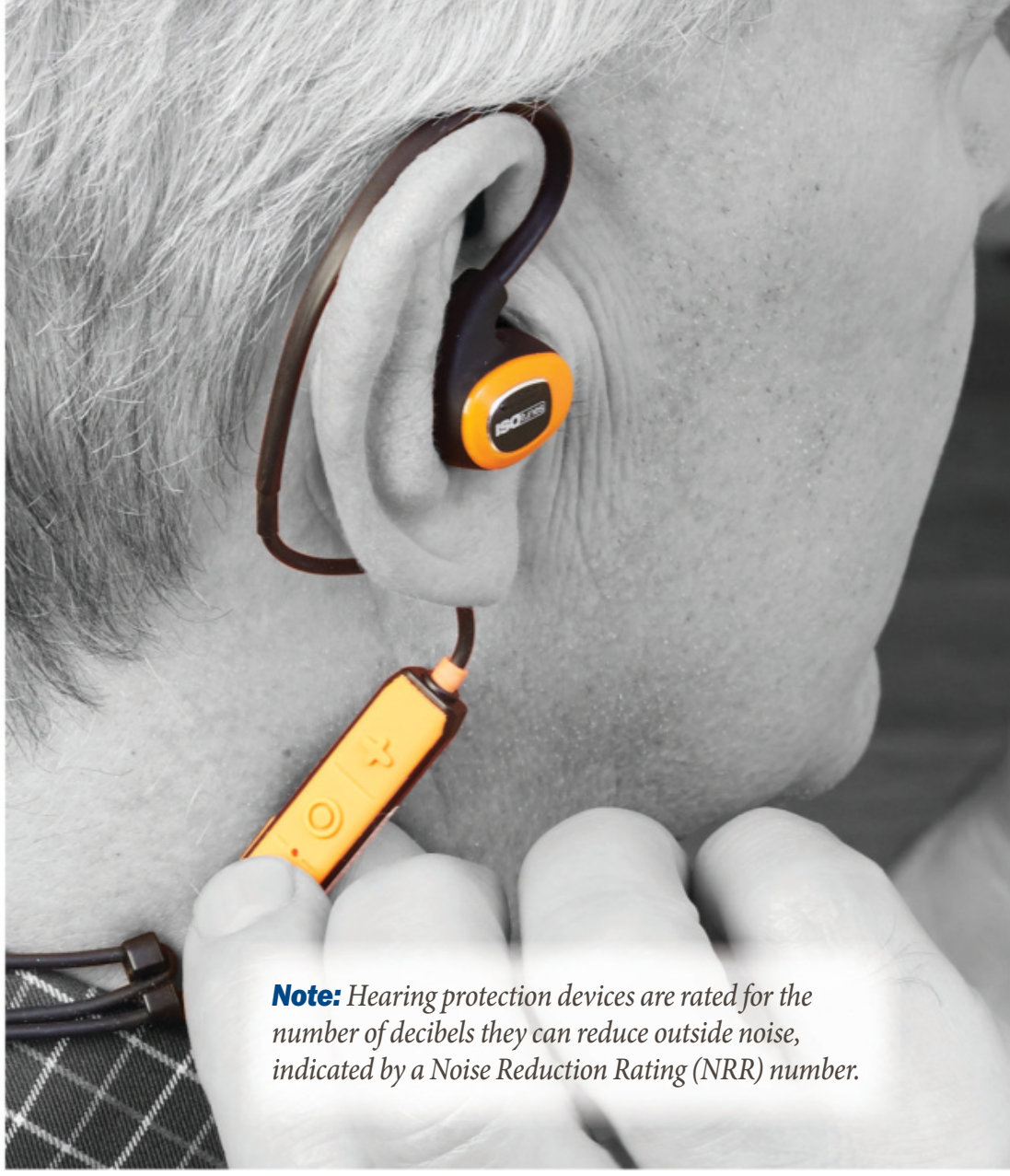
Music To Your Ears

Power-tool noise can, over time, lead to hearing loss. So it makes sense to wear hearing protection as much as possible in the shop. The devices shown here make that protection more tolerable by synching wirelessly to your smartphone or tablet via Bluetooth signal, letting you listen to your favorite entertainment. Wear them in the shop, while mowing the lawn, or even when traveling on an airplane. We especially like these five products; they all have rechargeable lithium-ion batteries for all-day bliss, and you can even answer phone calls with them.



Note: *Hearing protection devices are rated for the number of decibels they can reduce outside noise, indicated by a Noise Reduction Rating (NRR) number.*

ISOtunes Pro, $90 ▶

This unit comes with five pairs of different-shaped foam tips, so you can choose the ones that best fit your ears. They hook over your ears to stay put. To get maximum protection (27NRR) from outside noise, you'll have to insert the tips well into your ear canal for a good seal. Reception and sound quality are outstanding, and a built-in limiter prevents audio from blasting above 85 decibels (dB). The controller's three raised buttons prove easy to use without having to take the unit off and look.

ISOtunes Xtra, $80 ▼

Similar to the Pro earbuds, the Xtra has a 27 NRR and 85-dB limiter, but lacks the ear wrap. You get four pairs of foam tips and three pairs of rubber tips to ensure a comfortable fit. Built-in magnets on the back of each earbud snap together to hold the unit around your neck after removing the tips from your ears.

317-740-0419, isotunes.com

PlugFones Liberate 2.0, $100 ▼

You get four sets of tips: two foam and two silicone. The foam plugs can achieve 29 NRR, and the silicone 26 NRR. Pair that with easy-to-use controls and this makes for a great hearing-protection/entertainment system.

801-349-2545, plugfones.com

3M Safety WorkTunes Connect, no. 90543-4DC, $50 ▼

If you prefer earmuff-style hearing protectors to earbuds, these provide good sound quality at a value price. With a 24-dB NRR, they effectively dampen workshop and lawnmower noise to comfortable levels. The spring-tension level squeezes an average-size head at first, but loosens up after a few weeks of use.

888-364-3577, 3msafety.com

Bose QuietComfort 35 wireless headphones II, $350 ▼

Okay, you might not think of this unit for shop hearing protection, and it's quite an investment, but that price buys some advanced features. Active noise-canceling technology produces three levels of "counternoise" to block out ambient noise, making it like stepping into a soundproof booth. But, you can still hear a router or tablesaw well enough to get feedback from the tool. These incredibly comfortable muffs have intuitive controls, and come equipped with options for Apple's Siri, Amazon's Alexa, and Google Assistant (provided you have those apps on your phone).

800-379-2073, bose.com

continued on page 79

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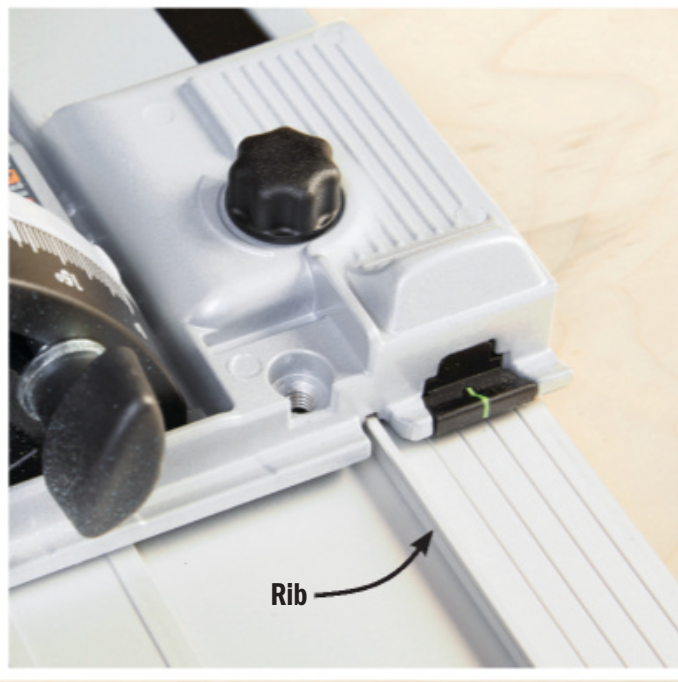
Another great tracksaw enters the market

6½" tracksaw kit, no. GKT13-225L, $600



Bosch's new plunge-cutting corded tracksaw, launched earlier this year, delivers what you need most: power, precision, and convenience. Its 13-amp motor powers through cuts, including 8/4 hard maple, without bogging down or overheating.

Using any of the four lengths of track, I accurately cut sheet goods to a precise layout line. The saw demonstrated no wiggle on the track, ensuring straight cuts. (Bosch tracks use a thin raised rib, *inset photo, right*, to register the saw in a straight line—a big difference from other tracksaw brands—so you won't be able to use this saw on a competitor's tracks.) The zero-clearance rubber edging on the track and an antisplinter guard on the saw deliver chip-out-free cuts in tear-out-prone veneered plywood. The saw tilts from -1° to 47° for making bevel cuts.

Sawdust proved no problem, as almost all of it was sucked away by a shop vacuum connected to the swiveling dust port.

The saw comes in a roomy plastic storage case. Tracks sell separately in four sizes: 31" (no. FSN800, $79); 43" (no. FSN1100, $99); 63" (no. FSN1600, $129); and 83" (no. FSN2100, $199). Connectors and clamps also sell separately.

—Tested by Bob Hunter, Tools Editor

Bosch
877-267-2499, boschtools.com

Grab your workbench and go

Workbench caster kit, no. PM-900, $90

Bora's foot-pedal casters screw to any workbench, and provide a quick and simple way to elevate and move a heavy bench, large stand, or tool chest around the shop. The set of four carries a load of up to 620 pounds, and the 3" swiveling casters make for easy maneuvering. I was able to smoothly roll a heavy workbench around a rough concrete floor with ease, even bumping over a ½" raised portion. The foot plates operate easily enough, but when released, stand vertically against the bench legs, requiring you to reach down and pull them away enough to get a foot on them.

—Tested by John Olson, Design Editor

Bora Tool
866-588-0395, boratool.com

continued on page 84

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44908530

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

BRAUN — SUPER COUPON

5000 LUMEN LED HANGING SHOP LIGHT

NOW $19.99

~~$29.99~~

SAVE 57%

Customer Rating ★★★★★

COMPARE TO INOLED $47 MODEL: SNT28B-12

ITEM 64410

44487688

LIMIT 3 - Coupon valid through 2/1/20*

BANKS — SUPER COUPON

23 GAUGE PIN NAILER

Customer Rating ★★★★★

NOW $24.99

~~$29.99~~

COMPARE TO PORTER-CABLE $119 MODEL: PIN138

SAVE $94

ITEM 64143

44501277

LIMIT 3 - Coupon valid through 2/1/20*

PREDATOR — SUPER COUPON

Customer Rating ★★★★★

2000 WATT SUPER QUIET INVERTER GENERATOR

- 12 hour run time

NOW $449.99

~~$499.99~~

SAVE $559

COMPARE TO HONDA $1,009 MODEL: EU2000i

ITEM 62523

44507110

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

Bauer — SUPER COUPON

15 AMP, 12-1/2" PORTABLE THICKNESS PLANER

Customer Rating ★★★★★

NOW $269.99

~~$329.99~~

SAVE $179

COMPARE TO DEWALT $449 MODEL: DW734

ITEM 63445

44510045

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

CHICAGO ELECTRIC POWER TOOLS — SUPER COUPON

Customer Rating ★★★★½

10", 15 AMP BENCHTOP TABLE SAW

Stand sold separately.

COMPARE TO RYOBI $229 MODEL: RTS22

NOW $114.99

~~$144.99~~

SAVE $114

ITEM 45804/68827/63117/64459/63118 shown

44517804

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

CENTRAL MACHINERY — SUPER COUPON

2 HP, 5 MICRON INDUSTRIAL DUST COLLECTOR

NOW $179.99

~~$209.99~~

- 70 gallon capacity

Customer Rating ★★★★½

COMPARE TO SHOP FOX $405.99 MODEL: W1685

SAVE $226

ITEM 61790/97869 shown

44518191

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

HaulMaster — SUPER COUPON

18" WORKING PLATFORM STEP STOOL

Customer Rating ★★★★★

- 350 lb. capacity

NOW $19.99

~~$29.99~~

COMPARE TO GPL $51.45 MODEL: H-21

SAVE 61%

ITEM 62515/66911 shown

44521071

LIMIT 4 - Coupon valid through 2/1/20*

SUPER COUPON

7 FT. 4" x 9 FT. 6" ALL PURPOSE/WEATHER RESISTANT TARP

Customer Rating ★★★★½

NOW $2.99

~~$4.99~~

COMPARE TO BLUE HAWK $8.78 MODEL: BGBX10-Y

SAVE 65%

ITEM 69115/69121/69129/69137/69249/877 shown

44523171

LIMIT 4 - Coupon valid through 2/1/20*

HARDY — SUPER COUPON

POWDER-FREE NITRILE GLOVES PACK OF 100

- 5 mil thickness

12¢ PER PAIR

SAVE 59%

NOW $5.99

~~$7.99~~

COMPARE TO VENOM $14.97 MODEL: VEN4145

Customer Rating ★★★★★

ITEM 97581, 37050, 64417, 64418, 61363, 68497, 61360, 61359, 68498, 68496 shown

44533166

LIMIT 5 - Coupon valid through 2/1/20*

PITTSBURGH — SUPER COUPON

50" CLAMP AND CUT EDGE GUIDE

LIFETIME WARRANTY

Customer Rating ★★★★½

NOW $14.99

~~$22.99~~

Tools sold separately.

COMPARE TO BORA $39.98 MODEL: 543050

ITEM 56363 66581 shown

SAVE 62%

44533463

LIMIT 4 - Coupon valid through 2/1/20*

Lynxx — SUPER COUPON

40 VOLT LITHIUM CORDLESS 14" BRUSHLESS CHAIN SAW

Customer Rating ★★★★★

~~$179.99~~

NOW $154.99

COMPARE TO KOBALT $199 MODEL: KCS120-07

SAVE $44

ITEM 64715/64478/63287 shown

44534674

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

CENTRALPNEUMATIC — SUPER COUPON

3" HIGH SPEED AIR CUT-OFF TOOL

Customer Rating ★★★★½

NOW $6.99

~~$9.99~~

COMPARE TO SPEEDWAY $16.38 MODEL: 7625

SAVE 57%

ITEM 60243/47077/69473/60374 shown

44540991

LIMIT 4 - Coupon valid through 2/1/20*

HaulMaster — SUPER COUPON

18" x 12" MOVER'S DOLLY

Customer Rating ★★★★★

- 1000 lb. capacity

NOW $7.99

~~$10.99~~

COMPARE TO BUFFALO TOOLS $22.99 MODEL: HDFDOLLY

SAVE 65%

ITEM 60497/61899/63095/63096/63097/63098 shown

44543758

LIMIT 5 - Coupon valid through 2/1/20*

SUPER COUPON

200 LUMEN LED SUPER BRIGHT FLIP LIGHT

- Wireless, tool-free and easy installation

Customer Rating ★★★★★

NOW $2.99

~~$4.49~~

COMPARE TO PROMIER $4.99 MODEL: SW-SWITCH-12/24

SAVE 40%

ITEM 64189/64723/63922 shown

44548827

LIMIT 5 - Coupon valid through 2/1/20*

SUPER COUPON

DUST AND PARTICLE MASKS PACK OF 5

Customer Rating ★★★★½

NOW $1.69

~~$2.19~~

SAVE 81%

COMPARE TO ACME UNITED $9.27 MODEL: ACM13259

ITEM 63723 62606/50027 shown

44550410

LIMIT 4 - Coupon valid through 2/1/20*

1,000+ Stores Nationwide • HarborFreight.com

*Original coupon only. No use on prior purchases after 30 days from original purchase or without original receipt. Valid through 2/1/20.

HARBOR FREIGHT
QUALITY TOOLS AT RIDICULOUSLY LOW PRICES

1,000+ Stores Nationwide • HarborFreight.com

PITTSBURGH — SUPER COUPON
9 PIECE FULLY POLISHED COMBINATION WRENCH SETS
Customer Rating ★★★★★ LIFETIME WARRANTY

Item 42305 shown

YOUR CHOICE $5.99

~~$7.99~~ SAVE 66%

TYPE	ITEM
SAE	69043/63282/42304
METRIC	69044/63171/42305

COMPARE TO HUSKY $17.97 MODEL: HCW10PCSAE

44555201

LIMIT 4 - Coupon valid through 2/1/20*

CHICAGO ELECTRIC WELDING — GOOD Great Value
125 AMP FLUX-CORE WELDER
• Best in Class Duty Cycle: 20% @ 90 Amps

Customer Rating ★★★★★ EVERYTHING YOU NEED TO WELD

NOW $99.99 ~~$119.99~~

ITEM 63583/63582 shown SAVE $80

COMPARE TO IRONTON $179.99 MODEL: 45433

44564070

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

TITANIUM — BETTER Professional Features
NEW EASY FLUX 125 AMP WELDER
• Duty Cycle: 90A @ 30%

NOW $179.99 ~~$199.99~~

Customer Rating ★★★★★ ITEM 56359/56355 shown SAVE $259

COMPARE TO LINCOLN ELECTRIC $439 MODEL: K2513-1

44675373

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

VULCAN — BEST Industrial Performance
OMNIPRO™ 220 INDUSTRIAL MULTIPROCESS WELDER
• Duty Cycle: 200A @ 20% – 240V

NOW $879.99 ~~$949.99~~

Customer Rating ★★★★★ ITEM 63621 SAVE $552

COMPARE TO LINCOLN ELECTRIC $1,432 MODEL: K3963-1

44576639

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

FORTRESS — SUPER COUPON — Customer Rating ★★★★★
2 GALLON, 1.2 HP, 135 PSI ULTRA-QUIET, OIL-FREE PROFESSIONAL AIR COMPRESSOR
• Air delivery: 2.2 SCFM @ 90 PSI

NOW $169.99 ~~$199.99~~

SAVE $30 ITEM 64596/64688 shown

44911729

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

luminar OUTDOOR — SUPER COUPON
24 FT., 18 BULB, 12 SOCKET OUTDOOR STRING LIGHTS

~~$27.99~~ YOUR CHOICE OF COLOR $19.99

Customer Rating ★★★★★ NEW SAVE 50%

BLACK ITEM 64486 WHITE ITEM 64739 63483 shown

COMPARE TO PORTFOLIO $39.98 MODEL: SLC12BK

44584207

LIMIT 4 - Coupon valid through 2/1/20*

VOYAGER — SUPER COUPON
15" TOOL BAG WITH 14 POCKETS

NOW $6.99 SAVE 46% ~~$10.99~~

Tools sold separately.

COMPARE TO HUSKY $12.97 MODEL: 823035N12

Customer Rating ★★★★★

ITEM 62348/62341/61469 shown

44588668

LIMIT 4 - Coupon valid through 2/1/20*

CENTRAL PNEUMATIC — SUPER COUPON
18 GAUGE, 2-IN-1 NAILER/STAPLER
Customer Rating ★★★★★

WE CARRY A FULL LINE OF NAILS

~~$24.99~~ NOW $19.99

COMPARE TO PORTER-CABLE $49.97 MODEL: BN200C SAVE 59%

ITEM 63156 64269 68019 shown

44597000

LIMIT 4 - Coupon valid through 2/1/20*

drill master — SUPER COUPON
1/4" SHEET ORBITAL PALM SANDER

~~$14.99~~ NOW $9.99

Customer Rating ★★★★½ SAVE 66%

ITEM 40070 61509/61311 shown

COMPARE TO BLACK+DECKER $29.98 MODEL: BDEQS300

44602141

LIMIT 5 - Coupon valid through 2/1/20*

HYDROSTAR — SUPER COUPON
50 FT. ELECTRIC DRAIN CLEANER
Customer Rating ★★★★½

NOW $199.99 ~~$249.99~~

OSHA COMPLIANT GFCI

COMPARE TO COBRA PRO $429 MODEL: 3020 SAVE $229

ITEM 61856 68285 shown

44607868

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

SUPER COUPON
SOLAR ROPE LIGHT
• 16 ft. of warm white LEDs

NOW $8.99 ~~$12.99~~ SAVE 72%

COMPARE TO HAMPTON BAY $32.97 MODEL: 84130

Customer Rating ★★★★½

ITEM 62533/63941/64625/68353 shown

44609023

LIMIT 5 - Coupon valid through 2/1/20*

PITTSBURGH — SUPER COUPON
60" ALUMINUM F-STYLE BAR CLAMP
Customer Rating ★★★★½ LIFETIME WARRANTY

NOW $10.99 ~~$16.99~~

COMPARE TO SHOP FOX $35.95 MODEL: D2468 SAVE 69%

ITEM 60673

44610052

LIMIT 4 - Coupon valid through 2/1/20*

PREDATOR — SUPER COUPON
4000 WATT MAX. STARTING GAS POWERED GENERATOR
SUPER QUIET

• 10 hour run time Customer Rating ★★★★★

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

NOW $299.99 ~~$359.99~~

SAVE $1,639

COMPARE TO HONDA $1,939 MODEL: EB4000

ITEM 63080/69729/56172/56174/63079 shown

ITEM 63089/56173/56175/63090, CALIFORNIA ONLY

44614952

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

CHICAGO ELECTRIC WELDING — SUPER COUPON
STANDARD AUTO-DARKENING WELDING HELMET

NOW $34.99 ~~$44.99~~ SAVE 56%

Customer Rating ★★★★½

COMPARE TO KOBALT $79.99 MODEL: SGY-A13

ITEM 67618 61611/56358/46092 shown

44627545

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

SUPER COUPON
SAFETY GLASSES
Customer Rating ★★★★★

YOUR CHOICE $1.29 ~~$1.99~~

CLEAR LENS ITEM 63851/99762 shown

YELLOW LENS ITEM 66823

SMOKE LENS ITEM 66822

COMPARE TO 3M $5.96 MODEL: 90552-00000B SAVE 78%

44633608

LIMIT 5 - Coupon valid through 2/1/20*

CHICAGO ELECTRIC POWER TOOLS — SUPER COUPON
2.5 HP, 10" TILE/BRICK SAW
Customer Rating ★★★★½

NOW $239.99 ~~$299.99~~

Blade sold separately.

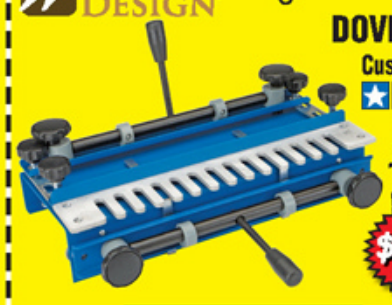
COMPARE TO KOBALT $499 MODEL: KWS $10-06 SAVE $259

ITEM 62391 69275 shown

44634822

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

WINDSOR DESIGN — SUPER COUPON
DOVETAIL JIG
Customer Rating ★★★★½



~~$37.99~~ NOW $27.99

COMPARE TO GENERAL TOOLS $47.16 MODEL: 861 SAVE 40%

ITEM 34102

44644324

LIMIT 3 - Coupon valid through 2/1/20*

CHICAGO ELECTRIC POWER TOOLS — SUPER COUPON
RECIPROCATING SAW WITH ROTATING HANDLE

Blade sold separately.

Customer Rating ★★★★½

~~$29.99~~ NOW $19.99

COMPARE TO PORTER-CABLE $59.98 MODEL: PCE360 SAVE 66%

ITEM 65570/61884/62370 shown

44665440

LIMIT 4 - Coupon valid through 2/1/20*

Lynxx — SUPER COUPON
40 VOLT LITHIUM CORDLESS BRUSHLESS BLOWER
Customer Rating ★★★★★

~~$149.99~~ NOW $129.99

COMPARE TO DEWALT $199 MODEL: DCBL790B SAVE $69

ITEM 64716/64481/63284 shown

44670780

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

SUPER COUPON
7" BENCH BRUSH

• Perfect for workshop, home or car

~~$1.99~~ NOW $1.49

COMPARE TO QUICKIE $11.99 MODEL: 412RM

Customer Rating ★★★★★ SAVE 87%

ITEM 62617/1072 shown

44671494

LIMIT 5 - Coupon valid through 2/1/20*

PITTSBURGH SERIES 2 — SUPER COUPON

*1 SELLING JACKS IN AMERICA

RAPID PUMP® 3 TON STEEL HEAVY DUTY LOW PROFILE FLOOR JACK

- Weighs 78 lbs.

SAVE $90

COMPARE TO TEQ CORRECT $189.99 MODEL: T83001SZ

NOW $99.99

$109.99

ITEM 56618/56619/56620/56617 shown

44677780

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

WINDSOR DESIGN — SUPER COUPON

60" HARDWOOD WORKBENCH WITH 4 DRAWERS

Customer Rating ★★★★★

NOW $119.99

$149.99

COMPARE TO GRIZZLY $399.95 MODEL: H7723

SAVE $279

ITEM 63395/93454/69054/62603 shown

44682059

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

PORTLAND — SUPER COUPON

7 AMP ELECTRIC POLE SAW 9.5" BAR

Customer Rating ★★★★★

NOW $59.99

$79.99

COMPARE TO WORX $99.98 MODEL: WG309

SAVE $39

ITEM 68862/63190/56808/62896 shown

44684180

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

KRAUSE & BECKER — SUPER COUPON

AIRLESS PAINT SPRAYER KIT

Customer Rating ★★★★★

NOW $164.99

$214.99

SAVE $134

COMPARE TO GRACO $299 MODEL: 262800

ITEM 62915/60600 shown

44687088

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

FRANKLIN — SUPER COUPON — Customer Rating ★★★★★

HEAVY DUTY PORTABLE SCAFFOLD

- 900 lb. capacity
- 30 height adjustments

NOW $169.99

$209.99

COMPARE TO BAKER $260.40 MODEL: I-CISCNB

SAVE $90

ITEM 69055 63051 63050 shown

44699620

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

HaulMaster — SUPER COUPON

72" x 80" MOVING BLANKET

Customer Rating ★★★★★

NOW $5.99

$8.99

COMPARE TO BLUE HAWK $19.99 MODEL: 77280

SAVE 70%

ITEM 69505/62418/66537 shown

44710671

LIMIT 4 - Coupon valid through 2/1/20*

CENTRAL MACHINERY — SUPER COUPON

8", 5 SPEED BENCHTOP DRILL PRESS

Customer Rating ★★★★☆

NOW $54.99

$67.99

COMPARE TO BUFFALO TOOLS $113.35 MODEL: DP5UL

SAVE $58

ITEM 38119/62520/60238 shown

44719926

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

ADMIRAL — SUPER COUPON

12", 80 TOOTH FINISHING SAW BLADE

Customer Rating ★★★★★

NOW $22.99

$27.99

COMPARE TO DEWALT $59.98 MODEL: DW3232PT X

SAVE 61%

ITEM 64911/62725 shown

44720603

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

CHICAGO ELECTRIC WELDING — SUPER COUPON

MIG/FLUX WELDING CART

Customer Rating ★★★★★

NOW $29.99

$39.99

Welders, tools & supplies sold separately.

SAVE $70

COMPARE TO FORNEY $99.99 MODEL: 117535099

ITEM 61316/90305/131/60790/69340 shown

44721181

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

SUPER COUPON

HEARING PROTECTOR

Customer Rating ★★★★★

NOW $8.99

$12.99

COMPARE TO DEWALT $23.91 MODEL: DPG62-C

ITEM 64675 SAVE 62%

50725793

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

BADLAND — SUPER COUPON — Customer Rating ★★★★☆

2500 LB. ELECTRIC WINCH WITH WIRELESS REMOTE CONTROL

NOW $49.99

$69.99

- Weighs 14.3 lbs.
- 11-1/8" L x 4-1/2" H

COMPARE TO SUPERWINCH $189.99 MODEL: 1125220

SAVE $140

ITEM 61258/61297/63476/61840 shown

44725347

LIMIT 3 - Coupon valid through 2/1/20*

Haul Master — SUPER COUPON

1000 LB. CAPACITY SWING-BACK TRAILER JACK

- Lift range: 12-1/2" to 20-1/2"

Customer Rating ★★★★★

NOW $18.99

$25.99

COMPARE TO REESE TOWPOWER $49.99 MODEL: 74410

SAVE 62%

ITEM 69780/41005 shown

44728444

LIMIT 3 - Coupon valid through 2/1/20*

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drill master — SUPER COUPON — Customer Rating ★★★★☆

2 HP FIXED BASE ROUTER

NOW $44.99

$57.99

COMPARE TO HITACHI $179 MODEL: KM12VC

SAVE $134

ITEM 68341

44734460

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

Grant's — SUPER COUPON — Customer Rating ★★★★★

12" x 12" MICROFIBER CLEANING CLOTHS PACK OF 4

NOW $1.19

$2.99

SAVE 80%

COMPARE TO PROELITE $5.99 MODEL: 887400

ITEM 63358/63925/63363 shown

44736104

LIMIT 5 - Coupon valid through 2/1/20*

CEN-TECH — SUPER COUPON

2/10/50 AMP, 12 VOLT BATTERY CHARGER AND ENGINE STARTER

Customer Rating ★★★★☆

NOW $29.99

$54.99

SAVE 49%

COMPARE TO SCHUMACHER ELECTRIC $59.77 MODEL: SE-1250

ITEM 60581 3418/66783 60653 shown

44742178

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

BRAUN — SUPER COUPON

450 LUMEN LED TROUBLE LIGHT

- Impact-resistant lens and housing
- Super-bright 20 LED light source

Customer Rating ★★★★☆

NOW $16.99

$19.99

COMPARE TO BAYCO $26.48 MODEL: FLR-2134PDQ

SAVE 35%

ITEM 63920

44742491

LIMIT 3 - Coupon valid through 2/1/20*

CENTRAL MACHINERY — SUPER COUPON

FOLDABLE SAWHORSE

Customer Rating ★★★★☆

- 350 lb. capacity

NOW $8.99

$12.99

COMPARE TO STANLEY $17.99 MODEL: STST11200

SAVE 50%

ITEM 61979/60710/69446 shown

44752543

LIMIT 4 - Coupon valid through 2/1/20*

CENTRAL MACHINERY — SUPER COUPON

4" x 36" BELT/ 6" DISC SANDER

NOW $64.79

$77.99

Customer Rating ★★★★☆

SAVE $84

COMPARE TO RYOBI $149 MODEL: BD4601G

ITEM 5154/64778/97181 shown

44752599

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

PITTSBURGH AUTOMOTIVE — SUPER COUPON

PNEUMATIC ADJUSTABLE ROLLER SEAT

Customer Rating ★★★★★ • 300 lb. capacity

NOW $19.99

$26.99

SAVE 71%

COMPARE TO DURALAST $69.99 MODEL: TR6201C

ITEM 61160/63456/46319 shown

44763066

LIMIT 3 - Coupon valid through 2/1/20*

CHICAGO ELECTRIC POWER TOOLS — SUPER COUPON

ELECTRIC CHAIN SAW SHARPENER

Customer Rating ★★★★★

NOW $24.99

$29.99

SAVE 50%

COMPARE TO TIMBER TUFF $49.99 MODEL: 399020499

ITEM 93213/40208/61613/63804/63803/68221 shown

44781072

LIMIT 3 - Coupon valid through 2/1/20*

1,000+ Stores Nationwide • HarborFreight.com

*Original coupon only. No use on prior purchases after 30 days from original purchase or without original receipt. Valid through 2/1/20.

At Harbor Freight Tools, the "Compare to" price means that the specified comparison, which is an item with the same or similar function, was advertised for sale at or above the "Compare to" price by another national retailer in the U.S. within the past 90 days. Prices advertised by others may vary by location. No other meaning of "Compare to" should be implied. For more information, go to HarborFreight.com or see store associate

DeWalt launches line of subcompact cordless tools

12-volt Max hammer drill, no. DCD706, $149; 12-volt Max drill/driver, no. DCD701, $139; 12-volt Max impact driver, no. DCF801, $139; 12-volt Max ⅜" impact wrench, no. DCF902, $149; 12-volt Max screwdriver, no. DCF601, $119

All sporting brushless motors, DeWalt's new Xtreme Subcompact series of tools runs on 12-volt 2.0-Ah battery packs and features smaller bodies than the previous generation of tools in this line. The hammer drill has a three-jaw chuck and two speed ranges. The drill/driver also offers a three-jaw chuck and two speed ranges. The impact driver has a ¼" hex chuck and three speed ranges. The impact wrench has a ⅜" drive and three speed ranges. The screwdriver has a ¼" hex chuck and 15-setting clutch. Each can be purchased without a battery.

DeWalt
800-433-9258, dewalt.com

Milwaukee debuts cordless 12" slider

18-volt 12" dual-bevel sliding compound mitersaw
no. 2739-21HD (w/12.0 Ah battery), $850;
no. 2739-20 (bare tool), $700

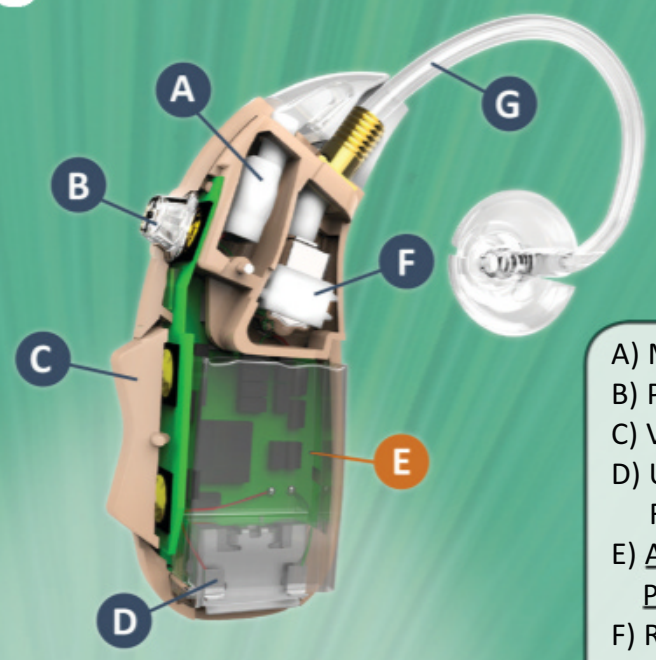
Milwaukee's newest M18 Fuel battery-powered mitersaw runs on a single 18-volt battery pack, and the company says the saw can make as many as 330 crosscuts in 3¼" baseboard per charge. The saw miters up to 60° left and 52° right with nine stops. For bevel cuts, the saw tilts up to 48° left and right, and has seven stops. It can crosscut up to 13 miter, 90° bevel.

Milwaukee
800-729-3878, milwaukeetool.com

Advanced Rechargeable Digital Hearing Aid Technology Only $229!*

(*Each when you buy a pair)

The new Advanced HearClear™ **HCR3 rechargeable** hearing aid combines advanced technology with a low price to provide you with outstanding value.



NEW ADVANCED R3 Digital Processor™

A) Microphone
B) Program Button
C) Volume Control
D) USB Charging Port & Rechargeable Battery
E) Advanced Digital Processor
F) Receiver (Speaker)
G) Sound Tube

5 Star Reviews! ★★★★★

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

HCR3 Features!

- New Advanced Third Generation **American Technology**
- Digital sound processing chip provides **clear sound and makes speech easier to understand** with less feedback than old analog technology
- Don't worry about replacing batteries! **Full Charge Gives 16 Hours of Use! (Charger Included)**
- Easy **On / Off Button**
- Automatic Noise Reduction and Feedback Cancellation
- **100% Money Back Guarantee**
- **4 Programs** for different listening situations

Even Better In Pairs!

Your brain is designed to use both ears working together. In fact, studies show that you may be able to **hear up to 3 times better** in noisy situations when using two hearing aids. Buy a pair for the best results and maximum savings!

Simple. Affordable. Rechargeable Digital Hearing Aid - For Only $229!*

The new HearClear™ HCR3 Rechargeable Digital Hearing Aids features **advanced third generation digital technology** at an unbelievably affordable Price! The HCR3 is packed with the same key technologies that all high end digital hearing aids share while leaving out the extra bells and whistles that increase cost and require expensive adjustments. This **helps you hear better, while saving you a lot of money.**

NOW ON SALE!
~~List Price: $849~~
Sale Price: $229*

Your new HearClear HCR3 hearing aids work at a fraction of the cost of name-brand hearing aids, and you won't have to keep changing the batteries! You will love the discreet, comfortable, lightweight Open-fit design. The HCR3 is pre-programmed for most moderate to significant hearing losses, so you won't need professional appointments to make costly adjustments. **It is shipped directly to you and will help you hear better right out of the box!**

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What's Ahead

A GLIMPSE INSIDE THE DECEMBER/JANUARY ISSUE (ON SALE NOVEMBER 15)

Ultimate quilting station
Like woodworkers, quilters need good outfeed support, a versatile workbench, and copious storage. This pair has all that and more.

Woven Shaker-style bench
Simple style makes this an instant classic. Only basic turning skills and tools are required; or round the parts with a router.

Smart shop layout
Whether you choose high-tech 3D computer models or pencil on napkin, good shop layout still depends on the functional fundamentals of organization and workflow.

Shop test: Supervacs
These dust extractors fire up automagically when you turn on a connected tool. And they capture the finest dust efficiently.

Dovetail tail light
Create this graceful giftable in an evening, thanks to our simple steps and full-size patterns.

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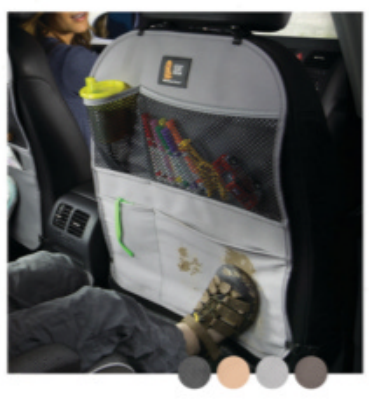

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