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ISSUE 229 NOVEMBER 2014

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Beautiful, Simple, Affordable p.27

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Construction-Grade
Toy Crane p.52

Cope & Stick
Doors
Yes, it's really
that easy!
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Timeless Design
Wall Clock p.60



**Gorgeous Hutch
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**Why you need a
Trim Router
and which one**





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- Maximum depth of cut @ 45°: 2 1/2"
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- Maximum depth of cut @ 45°: 2 1/2"
- Maximum rip capacity: 50"
- Distance from front of table to center of blade: 17 1/4"
- Overall dimensions: 40" H x 41" W x 82" L
- Approximate shipping weight: 557 lbs.

Reviews & Awards

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Reviews & Awards



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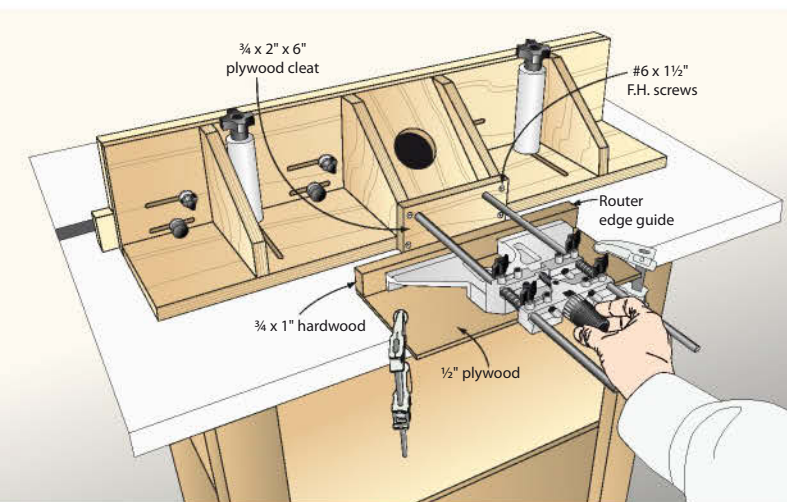


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Editor's Angle

But is it woodworking?

At the 2014 International Woodworking Fair last month, *WOOD*® Tools Editor Bob Hunter and I were again treated to a cornucopia of woodworking delights, from house-size machines that pull pallets of MDF in one end and spit out cabinet parts from the other, to a home-shop router lift that dials in the perfect bit height all by itself. Computer-controlled (CNC) tools, machines, and accessories were *everywhere*.

The computer part of a CNC router can turn a drawing into multiple identical project parts (to grossly oversimplify the process), complete with edge treatments and screw holes, with no human assistance. And you can now do the same thing—or rout signs, or add intricate carvings—in your own shop for about the cost of a decent cabinet saw.

But is it woodworking? Do computers delete the “craft” from craftsmanship?

I suspect the same conversation occurred in the mid-1800s, when the treadle-style tablesaw was introduced. And again when motorized routers began to replace router planes for fashioning an ogee along a tabletop. Did those technological advances quell our passion for woodworking? No, they simply made the craft more accessible and allowed more of us to do more of it.

Is there still a place for router planes in a 21st-century shop? You bet. And computerized router lifts, too. Because woodworking is in your heart, not your tools.



So long, fella.

Speaking of hearts, ours are hurting after longtime *WOOD* contributor Erv Roberts passed away recently. I trust he's crafting his beautiful boxes in the ultimate shop right now. 🌳

See you in the shop!

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Classmate finishes project for friend's widow

Three years after Pat, a friend and high school classmate of mine, passed away, his wife began cleaning out his shop and came across a partially finished project. I thought it would be nice to complete it for his wife and young boys. The problem was, Pat had only begun work on the project, and had no plans in his shop to indicate what the parts were meant to become.

Most of the pieces were cut to rough dimension—bundled with plastic wrap and labeled—but the assembled end pieces consisted of a poplar frame with oak beadboard panels, so I decided he must have planned to paint them. Given the size of the end pieces, I determined that the project was meant to be a medium-size cabinet, such as a pie safe or linen closet. I consulted with my wife and a few friends and came up with a rough drawing of the project. From there, a little basic cabinetry, assembly, and finish, and it was returned to Pat's family. Front to back, this was a labor of love in honor of a wonderful friend.

—Dennis Wiggins,
Des Moines, Iowa



BEFORE



AFTER

Swing out, fold-flat tool stand extra feature

In simplifying my design for a fold-flat tool stand in *WOOD*® issue 224 (March 2014), you eliminated a feature that some readers might find useful. In my design, the caster mounts on a vertical, free-moving post encased in the end of the stand. Inside, a heavy-duty spring counterbalances the tool weight and compensates for an uneven shop floor.

—Dan Christen, Boise, Idaho



What about the water?

As much as I enjoyed your review of shop vacuums under \$150 in issue 224 (March 2014), I felt you overlooked an important feature many shop vacuums have: the ability to pump out water. I've had to use my vacuum to pump water from my cellar following heavy rains, and would have been interested to see how each vac stacked up in that regard.

—Robert Weber, Hancock, N.Y.

None of the models we tested come equipped with a built-in water pump, although Craftsman and Ridgid offer optional accessory pumps that connect to the vacuums we tested.

—WOOD Editors

Overhead rack could be a headache

I would urge caution when building and using the overhead clamp rack on page 18 in issue 226 (July 2014). Aside from the fact that it wouldn't easily accommodate different clamp lengths, the ceiling is not a good place to store anything that can do damage on the way down. 🌳

—Ron Niendorf, Madison, Wis.

The facts are hard to ignore.

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Shorter Open Time	✓	✓
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Develop Your Shop Skills

As with many other woodworking tasks, routing hinge mortises requires precision and consistency for flawless results. The smallest error will affect how the hinge or door operates and looks. So build this made-to-size jig specific to the hinges you're using, and you'll get repeatable, accurate results with little effort. Here's how to make it using just a few scraps of ½" medium-density fiberboard (MDF) or Baltic birch plywood.

First, select the right bit

This jig works with a pattern bit which has the bearing mounted above the cutters. As the bearing rides against the edges of the jig opening, the cutters rout the mortise to the same size as the opening. Choose a bit with a cutter length of ⅜" or less (sometimes called a mortising or dado-cleanout bit) for best results. Longer bits require thicker jig material to work in the same way.

Now, build a jig

Begin by measuring the short edge of a hinge leaf, excluding the barrel. Double that measurement to determine the width of the jig's center strips [**Drawing, next page**]. Rip a 12"-long piece of MDF to that width, as well as a 2½×20" piece of MDF. Crosscut both in half. With those four pieces cut, assemble the jig's face [**Photo A**].

Next, clamp the jig's face to the door [**Photo B**]. Use a pencil to mark the jig along the door's ends; then, cut along those lines to bring the jig to final length. Mark the center of the hinge's



barrel on the jig face [**Photo C**]. Then, cut a piece of plywood to 4½" wide and the exact length of the jig face to make the support arm.

Glue and screw this piece perpendicular to the underside of the jig, edge abutting the marked line, covering the hinge-barrel-side of the bit opening.

BUILD THE JIG TO FIT THE HINGE



A Capture the hinge leaf with the jig's center strips and side pieces, apply glue to their edges, and clamp them together to make the jig's face.

LOCATE THE HINGES, MARK THE JIG



B Line up the bit opening with the hinge location on the edge of the door. Mark the jig along the door's end. Repeat for the other end of the door and jig.

MARK FOR THE JIG'S SUPPORT ARM



C Hold the closed hinge inside the bit opening, leaf-side tight to an edge. Mark the jig at the center of the hinge barrel—the location of the support arm.

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DIAL IN THE PERFECT DEPTH



D Place the jig face-down on your router's subbase. Set cutting depth equal to the thickness of the hinge's leaf plus the jig face.

MORTISE THE FACE FRAME



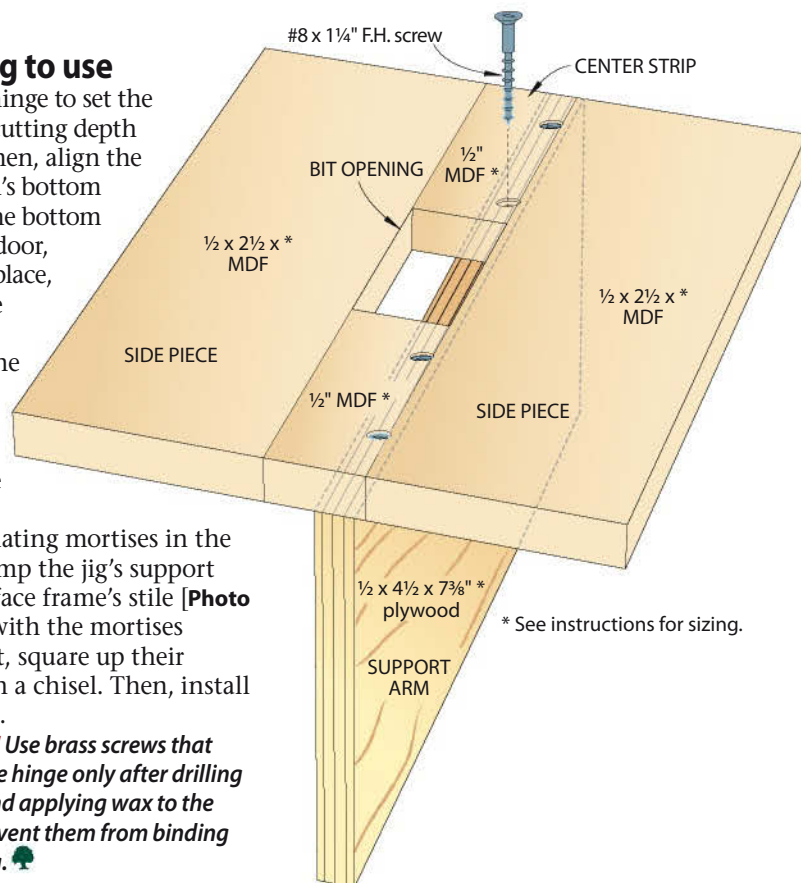
E Before you mount the jig to the cabinet, slide a penny between the jig and the face frame to give the door a proper reveal.

Put the jig to use

First, use a hinge to set the router bit's cutting depth [Photo D]. Then, align the support arm's bottom edge with the bottom edge of the door, clamp it in place, and rout the mortise (as shown on the previous page). Repeat at the top edge of the door.

To rout mating mortises in the cabinet, clamp the jig's support arm to the face frame's stile [Photo E]. Finally, with the mortises roughed out, square up their corners with a chisel. Then, install your hinges.

Quick Tip! Use brass screws that come with the hinge only after drilling pilot holes and applying wax to the screws to prevent them from binding and breaking. 🌲



* See instructions for sizing.

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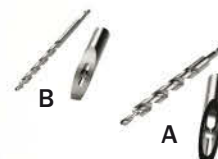


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| 148991 | Rep. 3/8" Drill Bit |
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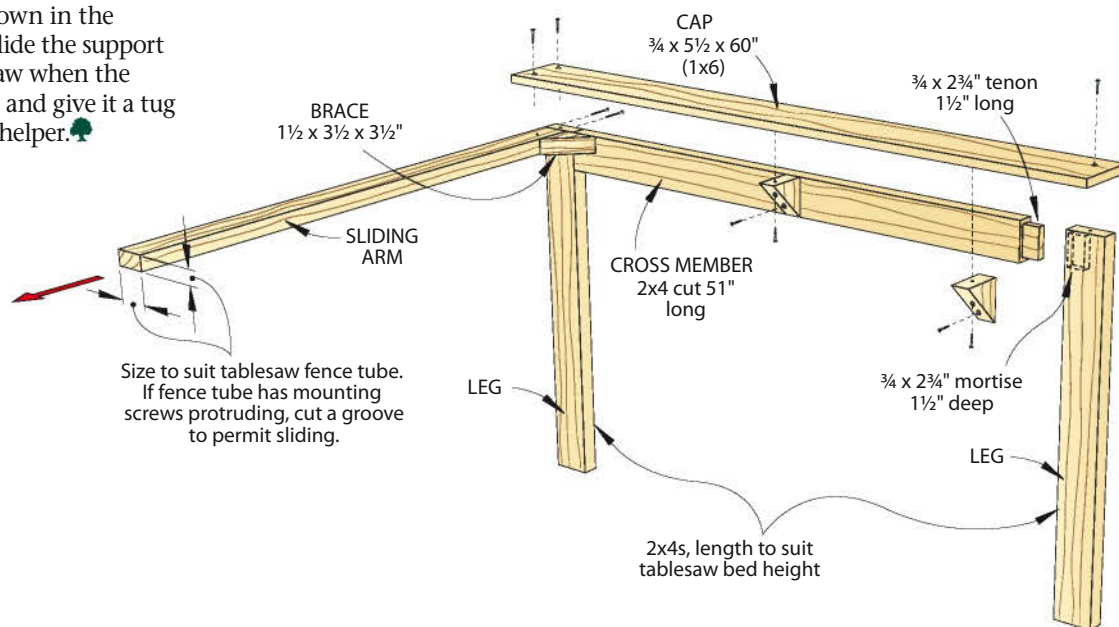
Great Ideas For Your Shop

Easy-extending Tablesaw Stock Support

Breaking down unwieldy sheet goods or crosscutting an especially long piece without sufficient support can be awkward and dangerous. Add this simple, easily adjustable extension support built from dimensional lumber, and you'll find those cuts a breeze to make.

Cut the legs to match the height of your tablesaw less $\frac{3}{4}$ " (to account for the cap's thickness) and connect them with the cross member. Although we used mortises and tenons to join the pieces, you could instead use pocket screws.

Next, machine the sliding arm to slide inside your tablesaw's fence tube and complete assembly as shown in the **Drawing**. Now, you can slide the support flush against your tablesaw when the extra width isn't needed, and give it a tug when you need a sturdy helper. 🌲



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Avoiding Workshop Goofs

Secrets to Keep Your Finish Fresh

Preserving stains and varnishes just makes sense. You'll save money, be able to match new projects to existing ones, and make hard-to-detect repairs to dings and nicks.

Keeping finish fresh requires limiting the liquid's contact with oxygen and storing it at a finish-friendly temperature. Oxygen causes finish to cure; temperature extremes break it down.

Reducing or eliminating oxygen in the container starts when you open the can. To pry up the lid, use a paint-can opener, not a screwdriver or, heaven forbid, a chisel. Using the right tool prevents damaging the lip on the lid or the groove in the can, preserving an airtight fit.

Pour a small amount of finish into another container and reseal the original can while you apply stain from the smaller container. When reinstalling the lid, tap it in place with a rubber mallet to prevent deforming the lid or the can. Such damage makes a tight seal impossible.

After applying the last coat of stain or finish, use one or more of the following tips to minimize the amount of oxygen in the container before storing it:

► If you haven't used much of the finish, add a few marbles to displace air in the can [**Photo A**]. But don't add more than you can easily fish out, as you'll need to stir the finish before using it again. Using larger marbles means fewer to retrieve later.

► For cans with 1½" or more of air space, transfer the finish to smaller containers [**Photo B**]. Oxygen can permeate plastic, so stick with glass jars or metal cans with tight-fitting lids. Narrow containers expose less finish-surface area, further reducing the amount of finish in contact with air. Clear jars allow you to inspect the



finish to see if it's good without removing the lid. Regardless of the container, wipe the rim clean before adding the lid for a tight seal, and attach a label with the finish information and date you stored it.

► Bloxygen [**photo above; Source**], a can of compressed argon gas (which is heavier than oxygen), provides another solution. Direct a 2-second burst of Bloxygen into the can and the argon settles on top of the finish, displacing

the air and preventing it from contacting the finish.

After sealing the container, find a suitable spot to store it, ideally from 50°F to 70°F. For water-base finishes, avoid any location that drops below freezing. And keep both oil- and water-base finishes away from any area that reaches 100°F or higher. 🌳

Source: Bloxygen, \$10.95, 888-810-8311, bloxygen.com.

MARBLES FORCE OUT THE AIR



A Carefully drop in a few marbles to raise the level of the finish. Glass marbles won't react with the finish, and wipe off easily for reuse.

REDUCE THE FINISH'S SURFACE AREA

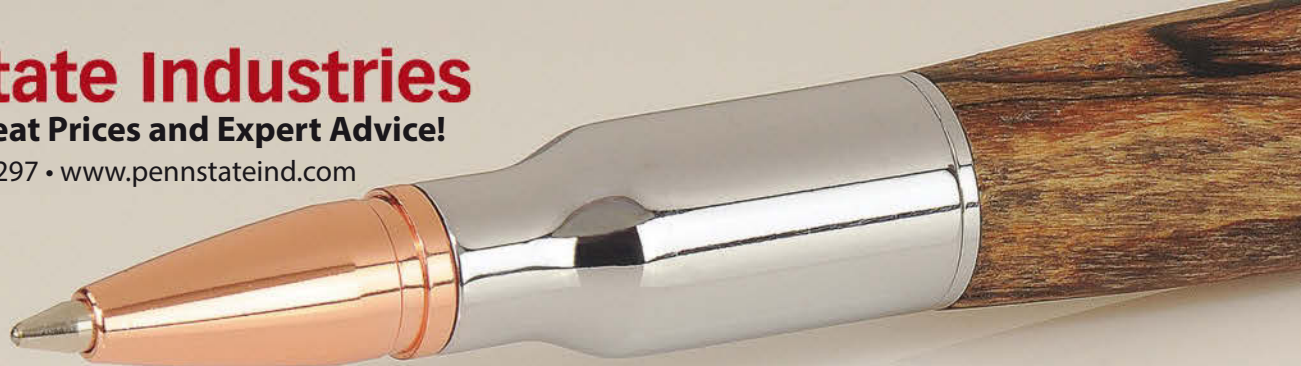


B Use the smallest container possible for storage. The wide jar, left, exposes more than twice the surface area of the finish compared with the small jar.

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24kt Gold shown with refill retracted

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Stress Management

Shop smartly to steer clear of wood under tension.

You've been there. You pick out the perfect lumber from the hardwood dealer for your weekend project—right size, right color, right figure. But when the weekend rolls around and you cut into that lumber, the board that rolls off is anything but straight and square. To minimize your stress in the shop learn to recognize, avoid, and counter the three main causes of stress in wood.



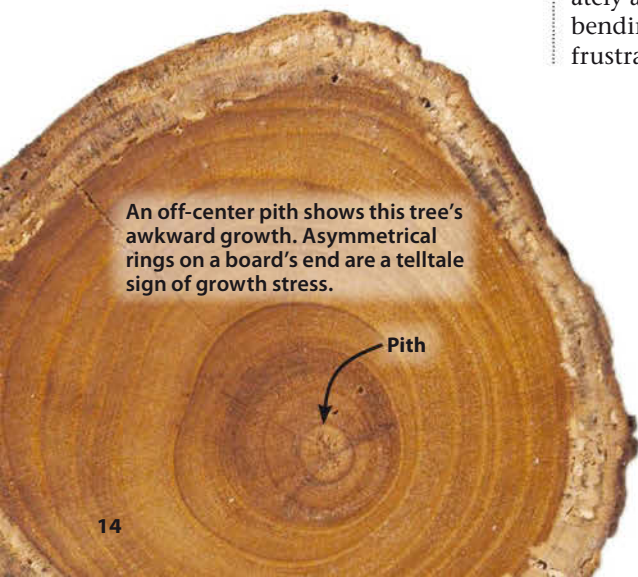
Powerful internal stresses in this walnut board closed the kerf tightly as the board came off the blade. Fortunately, the riving knife prevented binding, burning, motor strain, and kickback.

1. Growth stress

Fence-row trees lean toward the sunlight on their exposed side. Hillside trees struggle to grow in line with gravity. Windblown trees fight to stay upright.

Though these awkwardly growing trees may look normal from the outside, they strain internally to do so. In your shop, boards milled from trees like these release their pent-up stresses immediately as you machine them, *above*, bending in often unpredictable and frustrating ways.

Most lumber from high-volume hardwood dealers comes from managed forests containing few growth-stressed trees. If you do encounter stress, save the wood for small parts. The less wood in the part, the less pent-up stress and warp potential. Cut oversize; then joint, plane, and sand to final shape.



An off-center pith shows this tree's awkward growth. Asymmetrical rings on a board's end are a telltale sign of growth stress.

Pith



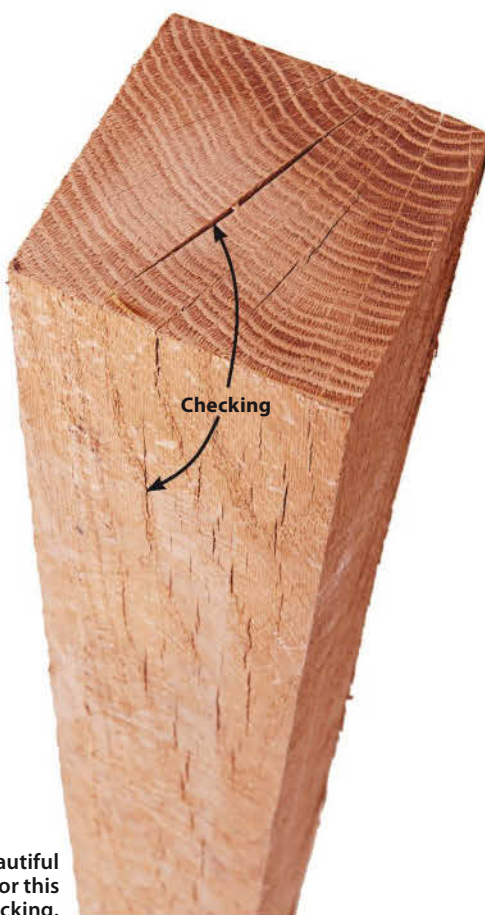
Splits appear in board ends where growth stress overcomes the interwoven wood fibers. The wood near the split will likely warp further.

2. Drying stress

Drying nearly always introduces some amount of stress in wood. In the kiln, the fast-drying outside of the board tries to shrink, but the slower-drying core prevents it, creating tension in the wood called *case hardening*. Most professional kiln operators introduce moisture (usually in the form of steam) toward the end of the drying process to relieve the stress on the outer portion of the wood. Unrelieved case-hardening acts much like growth stress in your shop, warping immediately after cutting, and should be handled the same.

Severe case-hardening results in the fibers of the wood pulling apart, creating gaps called *checking*, as shown at *right*. Report any checking you encounter to your hardwood dealer. They'll want to know about improper drying, and will likely allow you to return or exchange the affected wood.

The kiln drying schedule produced beautiful 4/4 oak, but proved too intense for this 16/4 beam. The result: severe checking.



3. Moisture-related instability

Even the most stress-free, perfectly dried wood suffers from movement caused by changes in moisture. As moisture is absorbed or expelled from wood, the cells grow or shrink. Improperly stored wood and poorly designed projects suffer from warping or even breakage due to moisture-induced changes.

These changes happen over time, so give your newly purchased wood a fighting chance. Cut and machine it to rough size as soon as you bring it into the shop, milling both faces evenly to prevent an uneven moisture gradient—where wood is wetter on one side of the board than the other. Then sticker and stack the wood on raised runners for a few days before you use it.

Also, build your project with movement in mind. Avoid gluing or screwing project parts cross-grained in a manner that restricts movement. Leave space in door stiles for raised panels to expand in higher humidity. And finish all sides of a project part evenly so changes in moisture happen at a consistent rate. 🌳

“Wow! You made Those Too?”

Southwest Twist Pen Kit

The pen kit features geometric shapes inspired by weaving patterns of the Southwestern American Indians, a stylized arrowhead clip, turquoise stones and a Desert Mesa flower on the top.

2 Southwest Pen Kit Starter Package

You get one Southwest Pen Kit in Antique Pewter and one in Antique Brass plus the drill bit and 3-piece Bushing Set.

Item #PKSWPSS **SAVE \$5 Only \$44.75**

Victorian Twist Pen Kit

This extravagant, elaborately designed and absolutely striking pen kit incorporates a profusion of intricately cast decorative motifs including scrolling foliage, garlands and flowers as decoration.

4 Victorian Pen Kit Starter Package You get one of each Victorian Pen Kit in 24kt Gold, Gun Metal, Antique Brass and Antique Pewter. Plus you get the drill bit and 2-piece Bushing Set.

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Proclaim your national pride with this most patriotic pen. Rich design details abound; The pen clip features an American flag and handsomely cast Bald Eagle emblem. The pen end features a laurel leaf, a symbol of victory. And God Bless America is intricately etched into the pen band.

3 American Patriot Pen Kit Starter Package You get one of each American Patriot Pen Kit in Pewter, Antique Brass and Chrome plus you get the bushings and drill bit you need to make these pen kits.

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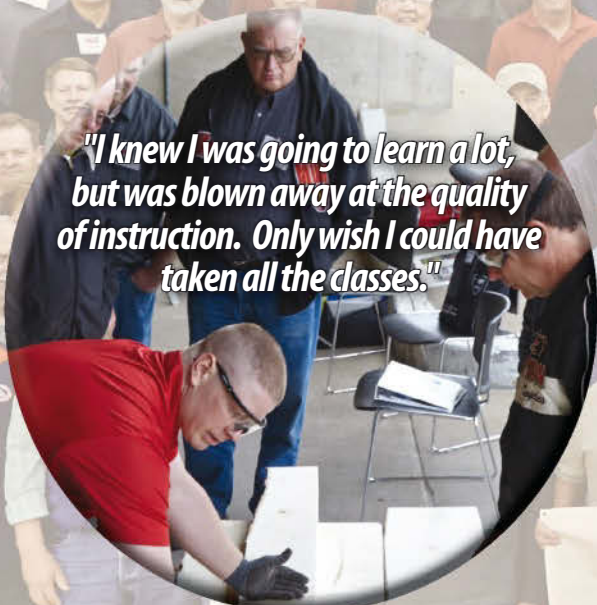
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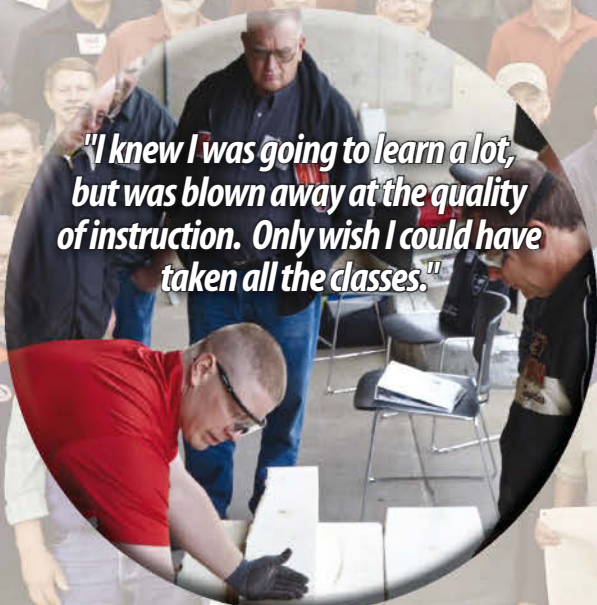
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Cross-training: Extracurricular Exercises that Strengthen Your Woodworking

thing about woodworking. And I've found that my view of my hobby often benefits in interesting ways. Here are some ways to freshen your perspective on woodworking by venturing outside of the shop.

Get a new hobby. Other disciplines can benefit you in the shop. Want to improve your design sketches or learn more about proportion and composition? Try a beginner's drawing class at an art supply store or community center. You might also find that learning to use software, such as SketchUp (sketchup.com) or Illustrator

(adobe.com), helps you get ideas out of your head and onto paper faster.

Or seek out a seemingly unrelated skill, such as glassmaking or sculpting, that can be incorporated into your woodworking to create unique pieces. Active learners practice thinking outside the box—a skill that can definitely be applied in the shop. **Take up a life of crime.** Specifically, steal ideas from other disciplines. Pick up inspirational books in the fields of architecture, art, and graphic design. Many great craftsmen borrow ideas from other industries, and it's the crossover that makes their work unique.

Make your crime pay by containing your spree to your local library. Many libraries are interconnected, so if your branch doesn't have the book you're looking for, another branch might be able to ship it to your library for free. **Shop 'til you drop.** In fact, as soon as you're done reading this article, go out and buy a new tool. Although it won't automatically make you a better woodworker, it will get you excited to get back in the shop and try out a new technique or hone an old one. A new tool often transforms immobilizing roadblocks into easy, fun tasks.

Pop some popcorn. Everybody who's anybody is making woodworking videos these days, and there's a never-ending supply on YouTube. Want to learn how to cut a dovetail? It's on YouTube. What's the best finish for a tabletop? It's on YouTube. Sometimes the overwhelming amount of online video can be paralyzing, so expand

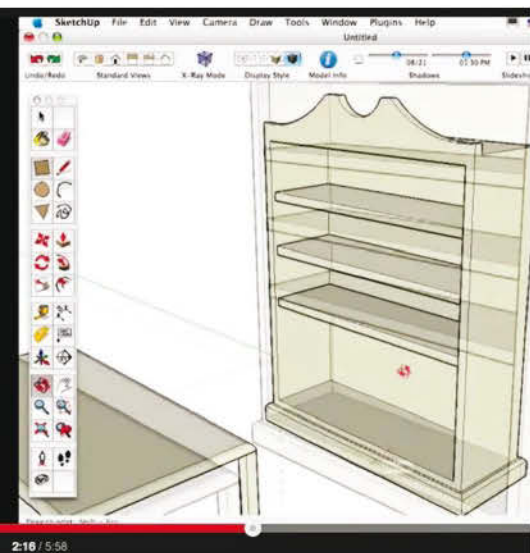
For me, woodworking is more than just something to do in my spare time: It's my passion. So, even when I'm not in the shop making sawdust, I find ways to make every-



So maybe the author's craft-beer hobby doesn't mix well with woodworking, but it can inform the projects he chooses, such as this custom mug.



What projects have you avoided tackling because you couldn't create custom curves? Maybe it's time to pick up a spokeshave.



If you can think of it, you can find it on YouTube. But instead of what you're thinking right now, how about searching for SketchUp training instead?

your DVD library with some premium content, as well. I get a great deal of inspiration from watching documentaries about artists and makers. Seeing the creative process of a successful artist is a great motivator and can spark an interesting idea that I cannot wait to try in my shop.

Drink a beer. Maybe not in the shop, but grab a woodworking buddy or two and find a place to hang out and talk about the craft. Sharing stories and experiences is a great way to pick up new tips and techniques. Woodworkers just love to talk about woodworking and share their knowledge. Don't have a woodworking buddy? Attend an adult ed class, or find a guild and meet some new friends.

No matter how long you've been woodworking, there's always something new to learn. Stay passionate and make something! 🌲



David Picciuto's two passions, woodworking and craft beer, never mix in his Toledo, Ohio, shop. But his site, drunkenwoodworker.com, brings you the best of both in his weekly woodworking wrapups and project videos.

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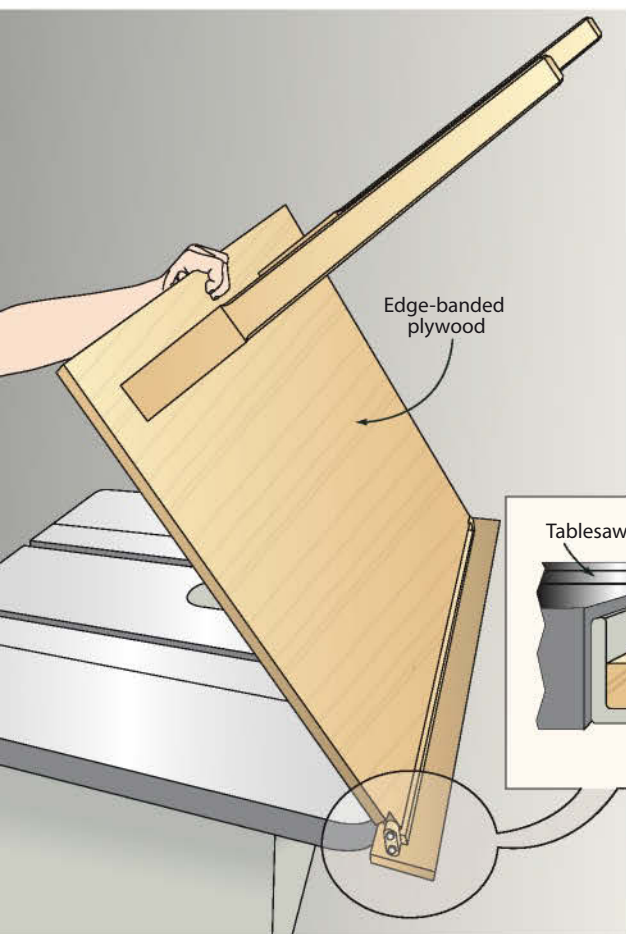
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Tablesaw cover protects and serves—as support

I enjoy having guests visit my shop, but after discovering rust rings on my tablesaw's cast-iron top left behind by sweaty soda cans, I decided a protective cover was in order. And it needed to do more than simply cover the top.

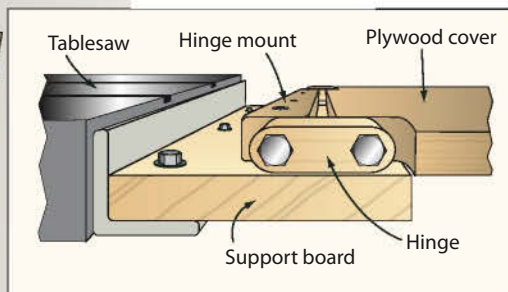
By adding a pair of legs to the cover and mounting it to the tablesaw's outfeed rail with simple wooden hinges, I can flip it down to serve as an outfeed table.

—Dave Melton, Wichita, Kan.



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continued on page 22



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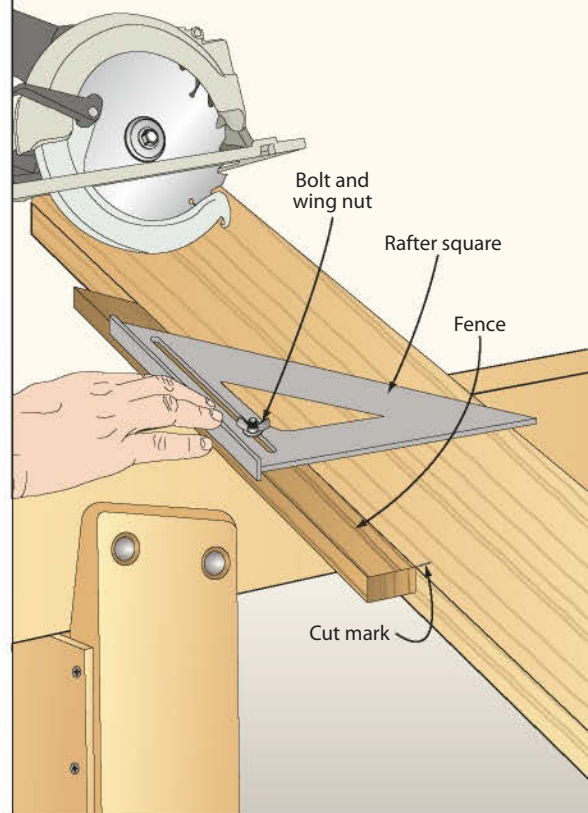
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Shop Tips

A rafter square saw guide will have you raising the roof

Make square crosscuts and flawless 45° miters effortlessly with a circular saw by building this adjustable guide. With the circular saw tight to the square, loosen the wing nut to slide the scrapwood fence over until it overhangs the saw's blade. Tighten the wing nut and trim the fence to exact length. You can then align the fence's edge with the workpiece's cut mark for a precise starting point.

—John Stahr, Chicago



More Terrific Shop Tips



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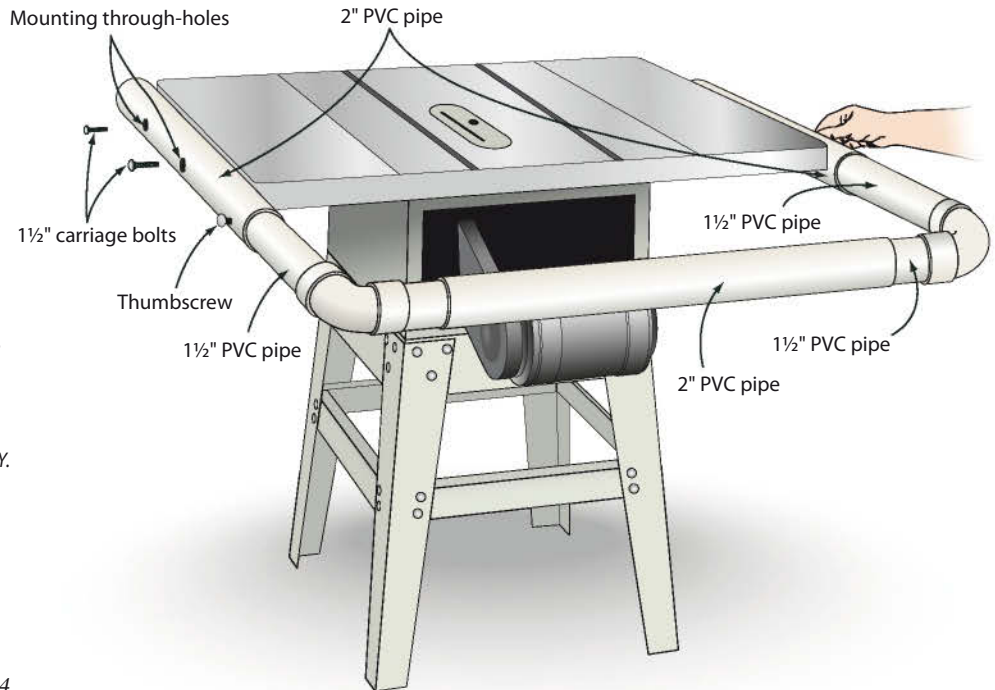
or go to

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This PVC outfeed support is no pipe dream

To build an inexpensive, retractable outfeed support for my tablesaw, I turned to the plumbing section of my local home center. Using a combination of 1½" and 2" PVC pipe, I built this U-shaped support and mounted it to the tablesaw's wings using carriage bolts. Loosening a pair of thumbscrews allows the outfeed support arm to slide in and out according to what size piece I'm cutting.

—George Travis, Elizaville, N.Y.



continued on page 24

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See official rules on page 72.



Shop Tips

Permanently pliable putty as easy as a drop in the bucket

No matter how firmly I twist the lid onto an open jar of wood putty, it eventually begins to harden up and becomes useless. To cut down on waste, I figured out this way to keep air out of the jar.

Simply fill a paint can or similar container with water and drop your jars of putty inside. Be sure to label the jars' lids with a permanent marker since the paper label will peel off after being submerged. Even if a little water gets into a putty jar, oil and water don't mix—simply pour off the water before using the putty.

—Warren Valente, Plymouth, Mass.



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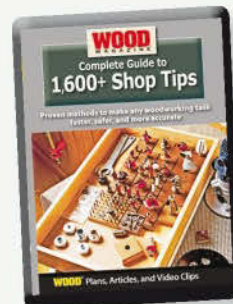


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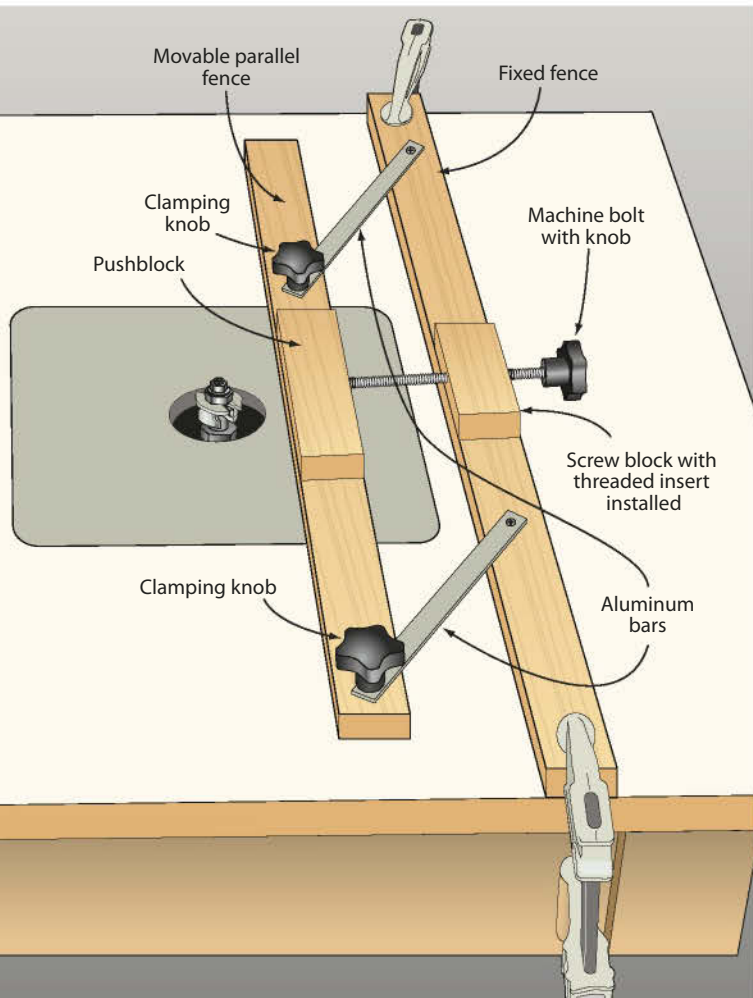
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No-nudge fence dials in accuracy

Adjusting my old router-table fence was a clumsy operation: After loosening the adjustment knobs, the two halves of the fence wobbled and wouldn't easily align. So, I replaced that fence with one that dials in superb accuracy with just a twist of the wrist.

Aluminum bar stock connects the two fences and ensures they stay parallel during adjustments. Once the fixed fence is clamped in place, the microadjuster dials in the precise fence location. This is especially handy for making multiple passes at increasing depths, something you may need to do if you have a small-motored router or need to hog away large amounts of material. 🌲

—Bill Wells, Olympia, Wash.



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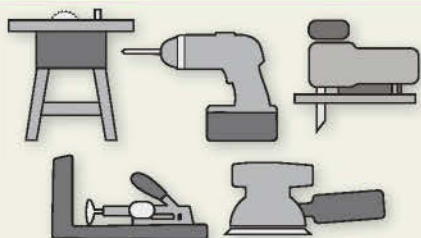
Chairside Chest

Build this six-drawer pine pleaser in a couple of weekends using just your tablesaw and a few basic tools.

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Start with the cabinet

1 Cut a $\frac{3}{4}$ ×26×18" plywood blank for the interior sides (A). Cut and glue a $\frac{3}{4}$ × $\frac{3}{4}$ ×18" interior side trim (B) to each edge of the plywood [**Drawing 1**] and allow to dry. (This panel will be cut to length and ripped into two parts later.)

Quick Tip! Working with an oversize panel allows you to cut dados across just one panel. Later, after you rip the sides to final width, the dados will align perfectly between the two sides. And ripping the trim edge to final thickness removes any tear-out or clamping compression marks.

2 Edge-glue [**More Resources**, page 31] two $\frac{3}{4}$ ×15×19 $\frac{1}{4}$ " pine blanks for the exterior sides (C) [**Drawing 1**]. Set them aside for now.

3 From $\frac{3}{4}$ " pine, cut the frame fronts and backs (D) and sides (E) to size [**Drawing 1**, **Materials List**]. Using a pocket-hole jig and drill [**More Resources**], bore the pocket holes in each end of the sides. Glue and screw the frames together with 1 $\frac{1}{4}$ "-long coarse-thread pocket-hole screws [**Photo A**].



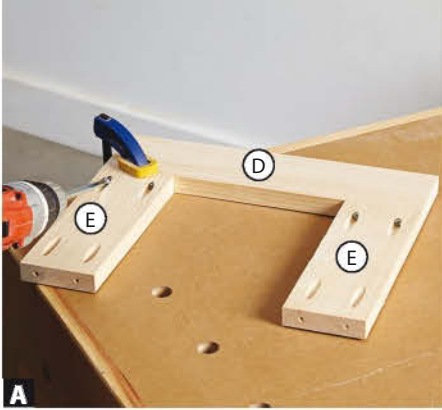
Overall dimensions: 16"W × 16"D × 23 $\frac{3}{4}$ "H
Materials and supplies cost: approx. \$100

4 Trim an end of the interior-side assembly (A/B) square to an edge (see **More Resources** for plans to make a cross-cut sled), and crosscut it to 17 $\frac{1}{16}$ " long. Mark the locations of the dados onto the interior-side trim [**Drawing 2**]. (See the **Shop Tip** on the next page for help in

making accurate layout marks.) Install a $\frac{1}{4}$ "-wide dado blade in your tablesaw and cut the dados in the panel [**Photo B**].

5 Rip the interior-side (A/B) blank into two 13 $\frac{1}{2}$ "-wide parts, measuring from the edge of the trim (B). Reposition the rip fence for a 13"-wide cut, place

POCKET-SCREW THE FRAMES



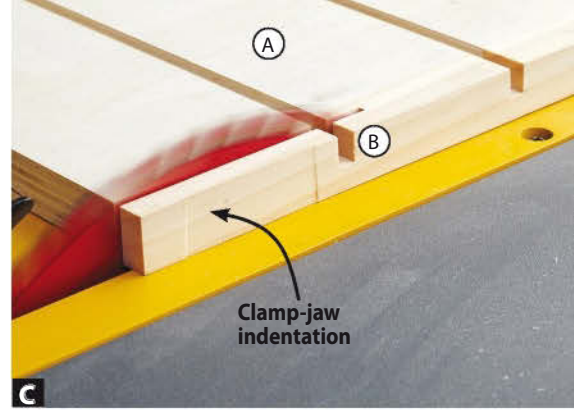
Clamp across the joint with the ends of the front/back (D) flush with the outer edge of a side (E), then screw them together.

CUT THE DRAWER-GUIDE DADOES



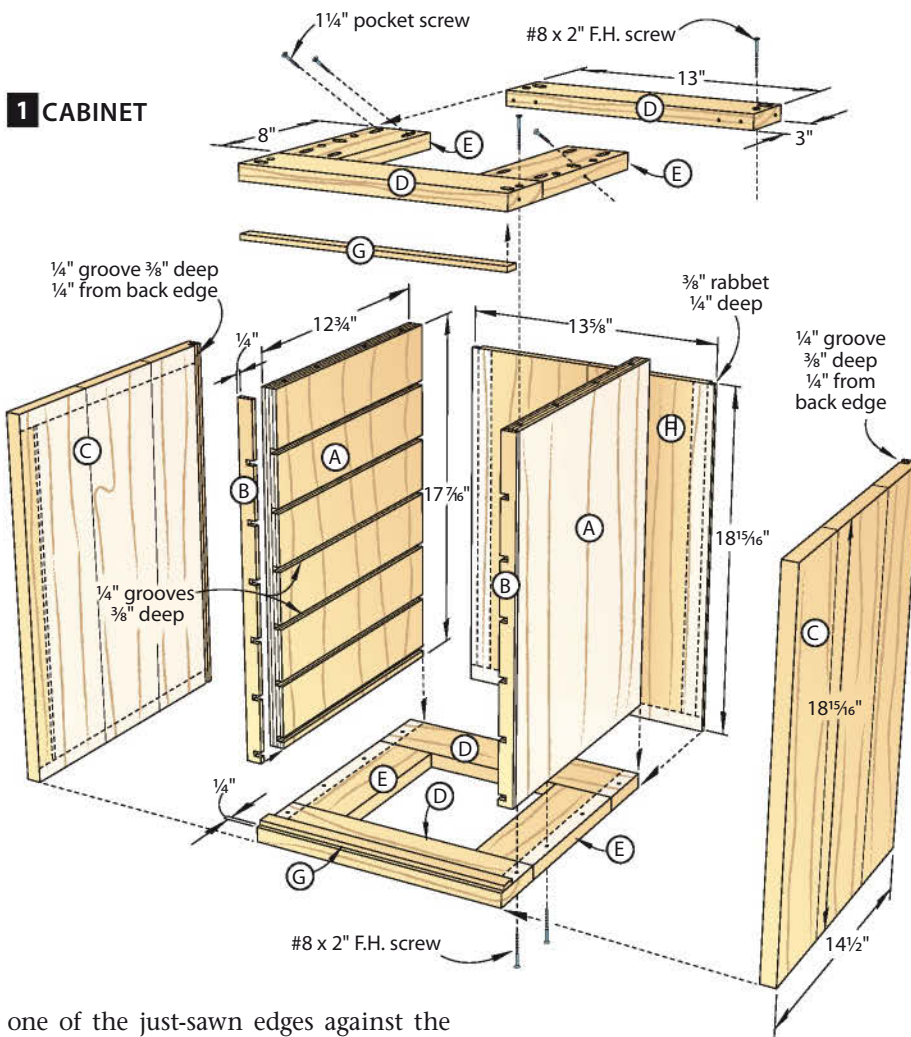
After positioning the rip fence to align the dado blade with a layout mark, make the cut, maintaining pressure against the fence.

RIP AWAY THE "SAFETY NET"



After cutting the interior-side assemblies (A/B) to rough width, cut away all but $\frac{1}{4}$ " of the trim for a clean, damage-free edge.

1 CABINET



one of the just-sawn edges against the fence, and rip the assembly to final width [Drawing 2, Photo C]. Repeat for the remaining blank.

6 From $\frac{3}{4}$ " pine, rip fourteen $\frac{1}{4}$ "-wide strips 13" long. Set two strips aside to use in the next step as the drawer-face trim (G). Glue and clamp 12 strips into the dadoes in the interior-side assem-

blies (A/B) to serve as drawer guides (F) [Drawing 4].

7 Dry-fit and clamp the interior-side assemblies (A/B/F) between the top and bottom frames (D/E), flush at the back of the cabinet. Next, drill $\frac{3}{32}$ " pilot holes for the screws that will join these

SHOP TIP

Does your pencil need to go on a diet?

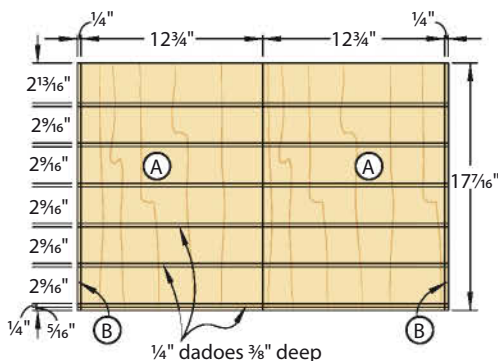
Cutting to the wrong side of a fat, imprecise pencil line can throw off accuracy by as much as $\frac{1}{16}$ ". Improve your results by marking thinner-than-a-whisker layout lines with a marking knife, which makes a line far finer than a carpenter pencil. Even a 4H pencil (sold in art and office supply stores) makes a line about half the width of a typical no. 2 pencil.



Dado location marked with a marking knife



2 INTERIOR-SIDE ASSEMBLY



assemblies [Drawing 1]. Then, glue and clamp the drawer-face trim (G) on the front of the frames, butting them against the interior-side trim (B). When the glue has dried, remove the clamps and drill six pocket holes in each frame for the screws that will connect the frames to the exterior sides (C).

8 Assemble the carcass [Drawing 1, Photo D]. Then, retrieve the exterior sides (C), crosscut one end of each square to an edge; then, cut them to final size. Rip a 1/4" groove in each exterior side for the back panel where shown. Secure the exterior sides to the cabinet assembly with pocket screws [Photo E]. **Note:** Do not use glue. This will prevent wood splits later as the solid-wood panels shrink and swell with seasonal humidity changes.

9 Glue up a blank for the back (H) from 1/2" pine [Drawing 1]. Glue up a blank for the top (I) from 3/4" pine [Drawing 4]. After the glue has dried, cut these parts to size, sand them smooth, and set them aside for later. **Note:** Leaving the back and top off the cabinet allows easy access to the drawers as you custom-fit them to the cabinet.

Quick Tip! If you can find 1/2" pine plywood with a face made up of grain and coloration similar to your pine lumber, you can substitute that for the solid-wood back. This project might be visible from all sides, so make sure the back is visually appealing too.

Now make the drawers

1 From 1/2" pine, cut to size the drawer fronts and backs (J) and sides (K) for all six drawers [Drawing 3]. Rip grooves for the drawer bottoms in two passes, with the second removing just enough material to create a snug fit of the plywood from which you'll cut the bottoms (L); make test cuts in scrap, adjusting the rip fence position as needed.

CONNECT THE FRAMES AND SIDES...



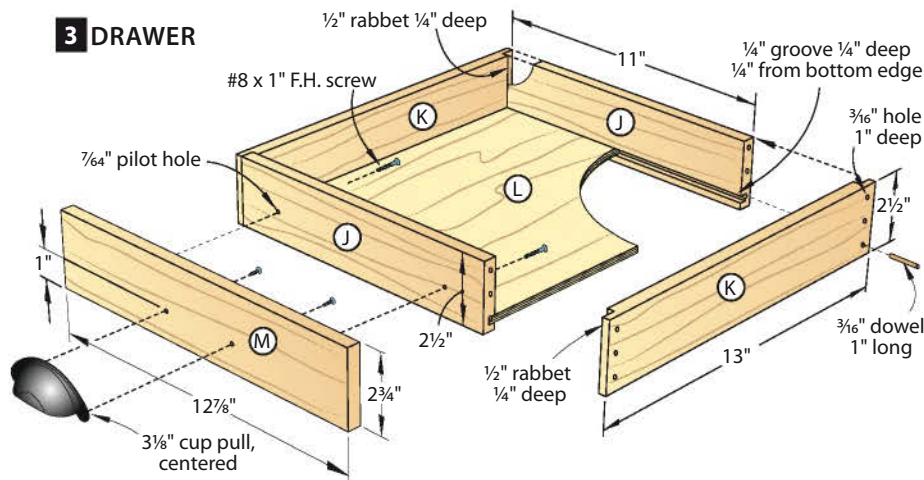
D Glue and screw the frame assemblies (D/E/G) to the interior-side assemblies (A/B/F) with the back edges flush.

...AND THEN THE EXTERIOR SIDES



E Clamp the cabinet assembly (A/B/D-G) to an exterior side (C) flush at the front edges, and then pocket-screw them together.

3 DRAWER



2 Install a 3/8" dado set in the tablesaw, and position the rip fence 1/8" away from it to cut rabbets in the drawer sides (K) [Drawing 3]. Then, hold a side against your miter gauge with the end touching the fence, and make a dado cut. Slide the workpiece away from the blade and complete the rabbet by cutting off the remaining bit at the end.

3 Retrieve the cabinet back (H), and position the rip fence 13 5/8" from the far side of the dado blade. Cut the 3/8" rabbets along both edges [Drawing 1]. Check the fit of the back in the cabinet; enlarge the rabbets if needed. Set the back aside again.

3 Dry-fit a drawer box and measure for the drawer bottoms (L)—the distance between opposing sides plus the depths of the grooves, minus 1/16". Cut six bottoms to size from 1/4" plywood [Draw-

ing 3]. Insert one of the bottoms into a drawer box to test the fit. When satisfied, sand all drawer parts; then glue and clamp each drawer.

4 After the glue has dried, drill three 3/16" holes 1" deep into each corner [Drawing 3, Photo F]. Glue a dowel into each hole, allow them to dry, and then trim and sand them flush.

5 From 3/4" pine, cut the drawer false fronts (M) to size [Drawing 3] and temporarily mount them to the drawer boxes [Photo G]. Drill 7/64" pilot holes through each drawer-box front and 1/2" into the back face of each false front. Mark the drawers and false fronts so you can pair them up again later, and then remove the false fronts. Lay out and drill screw-mounting holes for the cup pulls on the false fronts. Sand the false fronts smooth, but don't reattach them yet.

the miters. Glue them in place [Drawing 4, Photo I].

5 At the tablesaw, cut a 45° bevel along the top edges of the base assembly (N/O/P) [Drawing 4, Photo J] so that the top of the bevel aligns with the outer edges of the cabinet (A–G).

6 Retrieve the top (I) and cut the top and bottom bevels [Drawing 4a] at the tablesaw.

Add the finishing touches

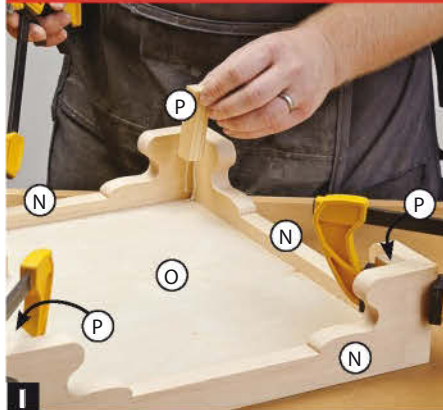
1 Sand all parts and assemblies smooth, progressing from 120 to 150 to 220 grit.

2 Apply a finish to all parts except the drawer boxes (J/K/L). We sprayed on three coats of Zinsser Bull's-Eye aerosol shellac [More Resources].

Quick Tip! For best results when finishing, leave the back (H), top (I), drawer false fronts (M), and base (N/O/P) separate from the cabinet (A–G). When possible, position these parts so you're applying finish to horizontal surfaces to avoid runs and drips.

3 When the finish has dried, slide the back (H) into the cabinet (A–G) but do not glue it in place. Position the cabinet onto the base assembly (N/O/P) [Drawing 4], drill $\frac{3}{32}$ " pilot holes, and secure with #8x1 $\frac{1}{4}$ " flathead screws. Lay the top (I) onto a flat surface with the good face down. Next, flip the cabinet assembly upside down and center it on the top. Then, drill pilot holes into the top through the frame;

REINFORCE WITH GLUE BLOCKS



I Apply glue to the back side of the apron miter joints and rub the glue blocks (P) up and down until snug, then clamp as shown.

elongate the holes in the frame only to allow the solid-wood top to expand across its width without splitting. Screw the top in place.

4 Attach the drawer pulls to the false fronts (M), and then screw these to the drawer boxes (J/K/L) [Drawing 4]. Insert the drawers into the cabinet and check the gap between each drawer front and the cabinet. To adjust a gap, loosen the screws that secure the false front to the drawer box, reposition it as needed, then retighten. If you need more adjustment, drill out the holes in the drawer-box front (J) slightly.

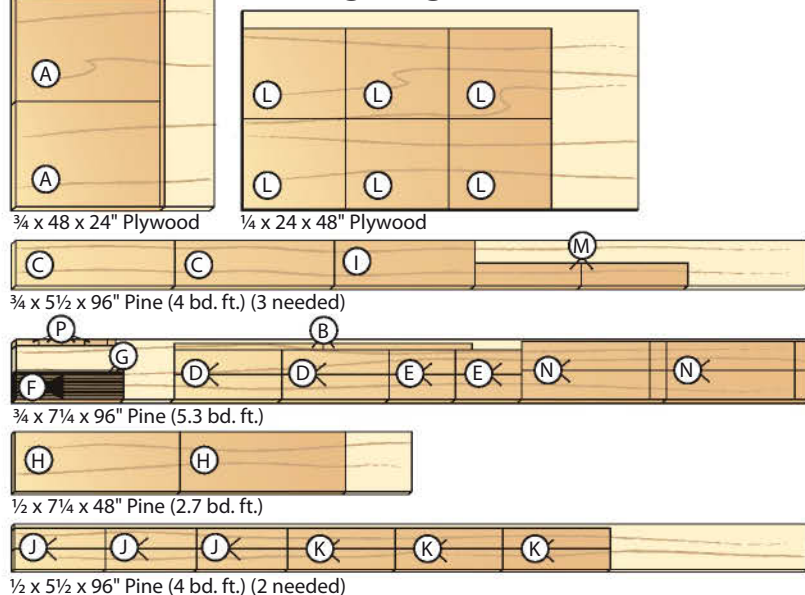
When finished, place the chest alongside your favorite chair, top it off with a good book or the TV remote control, then kick back and enjoy! 🌲

Produced by **Bob Hunter** with **John Olson** and **Bill Damman**

Project design: **Kevin Boyle**

Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

Cutting Diagram



BEVEL-CUT THE BASE



J When bevel-ripping the assembled base (N–P) at the tablesaw, push on the plywood panel rather than the aprons.

Materials List

		FINISHED SIZE			Matl.	Qty.
Part		T	W	L		
Cabinet						
*A	interior sides	¾"	12¾"	17½"	PL	2
*B	interior-side trim	¼"	¾"	17½"	P	2
*C	exterior sides	¾"	14½"	18⅟16"	EP	2
D	frame fronts/ backs	¾"	3"	13"	P	4
E	frame sides	¾"	3"	8"	P	4
F	drawer guides	¾"	¼"	13"	P	12
G	drawer-face trim	¾"	¼"	13"	P	2
*H	back	½"	13⅞"	18⅟16"	EP	1
*I	top	¾"	16"	16"	EP	1
Drawers						
J	fronts/back	½"	2½"	11"	P	12
K	sides	½"	2½"	13"	P	12
L	bottoms	¼"	10⅟16"	12⅟16"	PL	6
M	false fronts	¾"	2¾"	12⅞"	P	6
Base						
*N	aprons	¾"	3½"	15½"	P	4
O	bottom panel	¾"	14"	14"	PL	1
P	glue blocks	¾"	¾"	2¾"	P	4

*Parts initially cut oversize. See the instructions.

Materials key: PL—plywood, P—pine, EP—edge-glued pine.

Supplies: $\frac{3}{16}$ "x3' dowel (3), $\frac{1}{4}$ " pocket-hole screws (32), #8x1" flathead screws (12), #8x1 $\frac{1}{4}$ " flathead screws (8), #8x2" flathead screws (16).

Drawer pulls: Dark bronze cast round cup pulls (6), no. 01A56.62, \$3.10 each, Lee Valley, 800-871-8158, leevalley.com.

Blade and bits: Stacked dado set; $\frac{3}{32}$ ", $\frac{7}{64}$ ", and $\frac{3}{16}$ " drill bits; $\frac{7}{8}$ " Forstner bit.

More Resources

- ▶ Want easy edge-glued panels? Watch this video: woodmagazine.com/flatpanels.
- ▶ Build a crosscut sled for a benchtop/job-site table saw from plans at woodmagazine.com/jobsitesled.
- ▶ Read more about pocket-hole drilling techniques and tips at woodmagazine.com/phpointers.
- ▶ Discover how to finish projects with shellac at woodmagazine.com/shellac.

Cope-and-stick doors

Add easy elegance to your furniture projects.

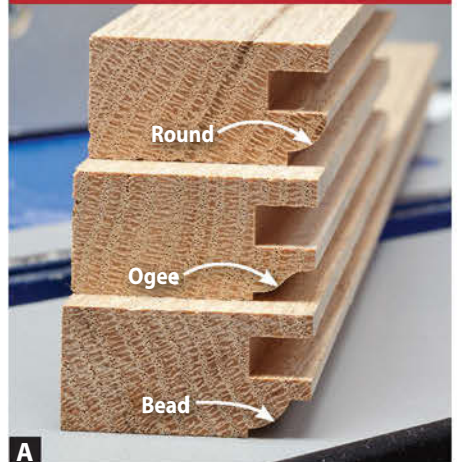
Nothing dresses up a cabinet like a raised-panel door. A decorative edge on the door's rails and stiles frames the panel to set it off, and tenon-and-groove joinery gives it long-lasting durability. You can easily create the "sticking" profile on the inside edge of the door frame and the mating "coping" cuts on the ends of the rails using a set of matching router bits.

Know your door anatomy

Before cutting material, let's define some basic door-construction terms. The *panel* fits into a grooved *frame* consisting of horizontal *rails* that fit between vertical *stiles*. The sticking router bit cuts a groove in the edge of the stiles and rails and shapes a profile on one edge of the frame pieces [Photo A].

The coping bit cuts a *stub tenon* that fits in the groove and creates a profile that mates with the sticking cut. The increase in face-grain gluing surface strengthens the resulting joint.

PICK A STICKING PROFILE



A

Sticking bits give you a choice of edge profiles from traditional round, suitable for Shaker-style projects, to the more elaborate ogee.

Start by sizing things up

Overlay doors typically overlap the cabinet opening by $\frac{3}{8}$ " all around, so if you choose this door style, make the finished door $\frac{3}{4}$ " taller and $\frac{3}{4}$ " wider than the opening. Inset doors fit within the cabinet opening and flush with the front of the cabinet, and require a uniform $\frac{1}{16}$ " gap around all sides; so for this style, make the door height and width $\frac{1}{8}$ " less than the opening.

Stile length always equals the door height. But rail length depends on the width of the stiles and the bit set used. (See **Determining Rail Length Drawing**, above right.) If the bit cuts a $\frac{3}{8}$ "-deep groove, you'll need to add twice that— $\frac{3}{4}$ "—to allow for the tenon on each end of the rail.

Prepare the frame stock

To make tight, flush-fitting joints, all rail and stile pieces must be of uniform thickness. After planing the stock, rip the stiles and rails to width and cut them to length. Save some cutoffs for making test cuts later. Then select and mark the outside faces [Photo B].

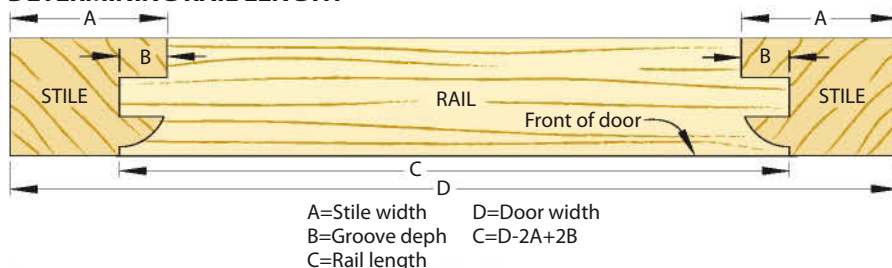
Quick Tip! For rails 6" or shorter, rout the sticking cut first in a long piece of rail stock, then cut individual rails to finished length.

Make the sticking cuts

Install the sticking bit in your table-mounted router and use a piece of frame stock as a gauge to adjust the bit height. Position the bit so the full sticking profile appears on the face side (against the table) while leaving sufficient stock behind the groove [Photo C].

With the bit height set, use a straight-edge to bring the router-table fence flush with the bit's top bearing [Photo D]. Install featherboards on the table and

DETERMINING RAIL LENGTH



PUT YOUR BEST FACES FORWARD



To help you keep the proper orientation when routing the stick and cope cuts, mark the outside faces of the rails and stiles.

SET THE FENCE



A metal rule sliding on both fence faces should just skim the bit bearing. Spin the bit by hand to ensure the fence clears the bit.

ADJUST THE STICKING BIT HEIGHT



Butt a piece of frame stock against the sticking bit and adjust the bit height so the full sticking profile shows with $\frac{3}{16}$ " to $\frac{1}{4}$ " of stock left above the groove cutter.

STEADY GO THE STICKING CUTS



Keeping the marked faces down against the table, rout the inside edges of each rail and stile. Feed the stock steadily past the bit for smooth cuts.

fence to hold the stock firmly in place and provide uniform cuts [Photo E]. Make the sticking cuts in all the rail and

stile pieces and an extra piece of scrap stock to use later as a test-cutting piece for setting up the coping bit.

Rout a raised panel

Flat panels of plywood or solid wood work well in cope-and-stick doors, but a solid-wood raised panel, such as the one shown in the photos in this article, adds visual interest. If you own a 3-hp variable-speed router, create a raised panel with a horizontal bit. Its mass helps it power through cuts with the carbide cutters leaving a clean, smooth surface. (See **More Resources** on page 35 for other methods of raising panels.)

Available in several profiles, these cutters perform best at low speed (10,000 rpm or less). Success also requires making the cuts in multiple passes, as shown in the photos, right. Rout the panel ends first, then the sides.

START SHALLOW



Adjust both bit height and fence depth to make a shallow first pass. Start with the two cross-grain cuts first to minimize tear-out, and rout all four edges before adjusting the fence back for the next passes.

SNEAK UP IN MULTIPLE PASSES



Once the bit's bearing sits flush with the fence, raise the bit in stages to make multiple passes until you reach the proper panel thickness.

SET THE COPING BIT HEIGHT



F Align the bottom edge of the upper cutter with the top edge of the groove to cut the stub tenon in perfect alignment with the sticking groove.

Learn how to cope

Set the stiles aside, remove the sticking bit, and install the coping bit. Using the test piece you made earlier as a gauge, adjust the bit's height [Photo F]. Then, align the fence and bit bearing as you did with the sticking bit.

Because the coping cut goes across the end grain of the rails, use a backer board to support the test piece and keep it square to the fence [Photo G]. Make a cut and fine-tune the bit's height accordingly [Photo H].

Once you have the face of the test piece fitting flush with the face of a stile, make the coping cuts in both ends of each rail, placing the marked face down against the router-table top.

Size the panel

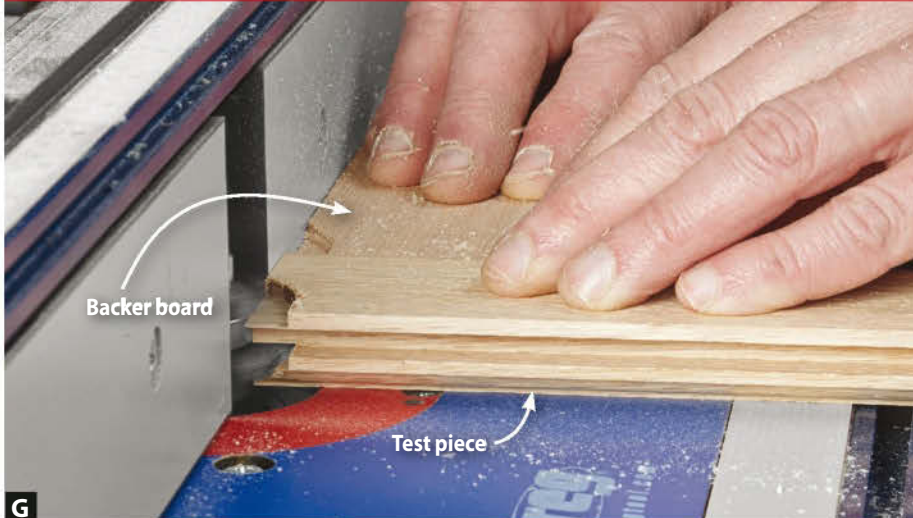
Whether you make the panel from plywood or a solid wood, size it $\frac{1}{16}$ " smaller than the space within the panel grooves of the door frame. This allows the frame joints to close tightly and provides room for a solid-wood panel to expand. Figure panel width by subtracting $\frac{1}{16}$ " from the rail length. To find the panel length, dry-assemble the panel frame and measure the distance between the rails, including the grooves, then subtract $\frac{1}{16}$ ".

Assemble the door

Dry-fit the door frame and panel to check for fit. Disassemble it, apply glue to one end of the rails, and position them on a stile. Slide the panel into place (no glue); then glue the other stile to the rails. Clamp the frame together [Photo I].

Produced by **Kerry Gibson**
Illustrations: **Roxanne LeMoine, Lorna Johnson**

BACKER SERVES MULTIPLE PURPOSES



G To make the coping cut in the end of a rail, butt the rail test piece against the fence and a square backer board. The backer also helps prevent tear-out.

CHECK THE BIT HEIGHT



H If the test cut leaves excess stock on the top edge of the tenon, as shown in the photo, lower the bit. If the excess is on the bottom edge, raise the bit.

EASY DOES IT



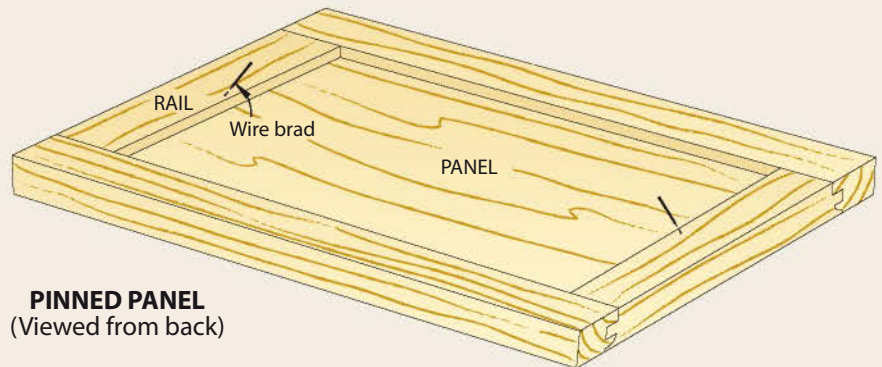
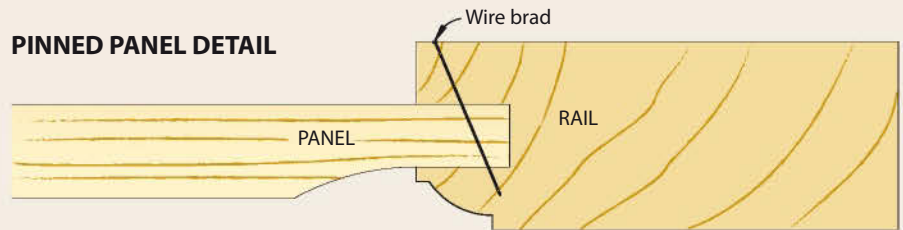
I Properly routed cope-and-stick joints fit tightly so light clamping pressure snugs them up while helping keep the door assembly flat and square.

Taming a rattler

Panels cut too small or thinner than the groove in the rails and stiles of a door will likely rattle. If you hear a rattle during a dry-fit assembly, insert a spacer to fill the gap. You can use commercially available spacers, such as Space Balls or the rubber panel barrels shown *below* [Sources]. Or, for a homemade solution, substitute a ¼" length of vinyl window-screen spline.



But what about a door that develops a rattle down the road, after the door has been glued together? In that case, drive a small wire brad at an angle through the rail and into the panel on the back side of the door. (See **Pinned Panel**, *below*.) A pin nailer makes quick, easy work of this task and provides a nearly invisible fix. 🌲



Sources

Space balls: \$6.49 (100), no. 12386, Rockler, 800-279-4441, rockler.com.
¼" panel barrels: \$4.90 (100), no. 00S08.14, Lee Valley Tools, 800-267-8767, leevalley.com.

More Resources

► Learn more about raised-panel bits and tips for setting up your router:
woodmagazine.com/raised-bits



► To find out about vertical panel-raising router bits, check out this free article:
woodmagazine.com/vertbit



► Read about using your tablesaw to cut raised panels in issue 164 (Sept. 2005) or download the article for a small fee at:
woodmagazine.com/2raised



Interlocking Snowflake Ornaments

With three eye-catching patterns to choose from, you'll scrollsaw these quick and easy snowflakes by the driftful!

1 For each ornament you plan to make, cut three $3\frac{7}{8} \times 3\frac{7}{8}$ " squares of $\frac{1}{8}$ " Baltic birch plywood (see **Source**). Spray-adhere the pieces together into a stack. (We used 3M Spray Mount Artist's Adhesive for a temporary bond.) Then, photocopy and cut out your preferred full-size **Snowflake Pattern** from the three options in the *WOOD Patterns*[®] insert and spray-adhere it to the stack.

2 Drill $\frac{1}{8}$ " blade start holes in all the interior waste areas. Using a #2 scrollsaw blade, cut the pattern to shape, leaving the shaded notch sections intact [**Photo A**]. Separate the three layers, but leave the paper pattern in place on the first layer to use as a reference.

3 Cut a $\frac{1}{8}$ " notch $\frac{3}{16}$ " deep in a scrap of the $\frac{1}{8}$ " plywood. (Refer to **Photo C**.) Using the scrap as a marking gauge, mark the notches on the second layer in the locations indicated by the dark gray shading of the pattern [**Photo B**]. Then, cut the notches away at the scrollsaw [**Photo C**].

4 On the third layer, cut away the center section indicated by the light gray shading on the pattern, separating the layer into halves. Then use the notched gauge to mark each half where indicated by the light gray shading on the pattern, and scrollsaw the notches [**Photo D**].

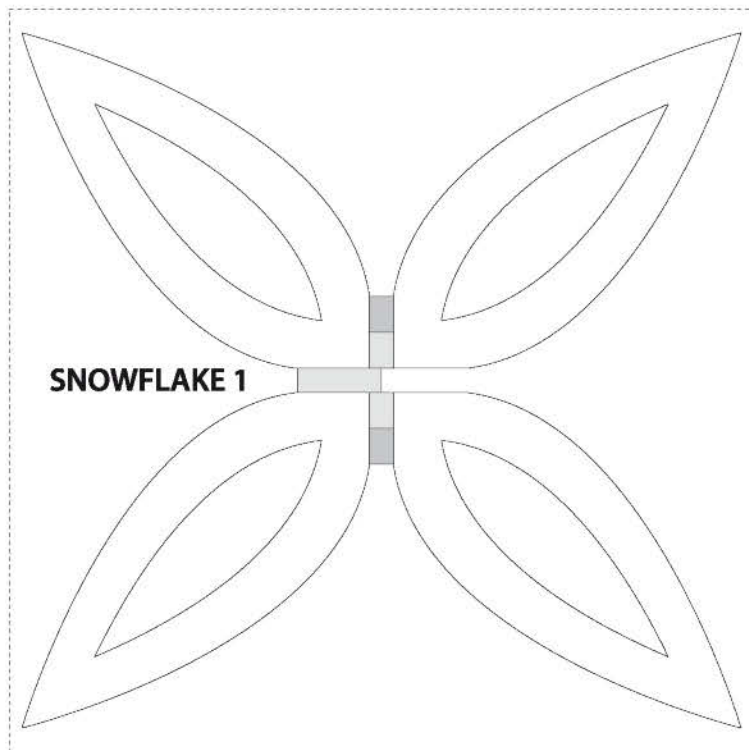
MISS THE LINE TO FIT THE NOTCH



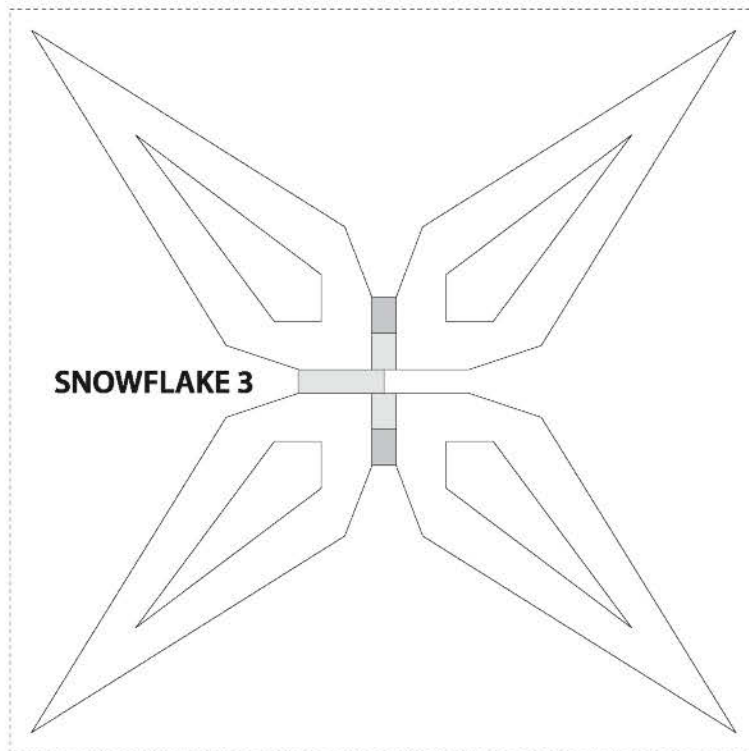
A

For the deep, unshaded notch, cut just inside the line for a snug fit. If it's too tight, it can be filed wider prior to assembly.

Download this full-size
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Interlocking Snowflake Ornaments
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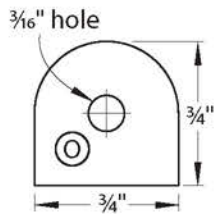
November 2014

Issue 229

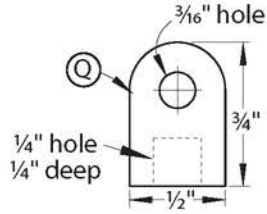
Dear Reader: As a service to you, we've included full-size patterns on this insert for irregular-shaped and intricate project parts. You can machine all other project parts using the Materials List and the drawings accompanying the project you're building.

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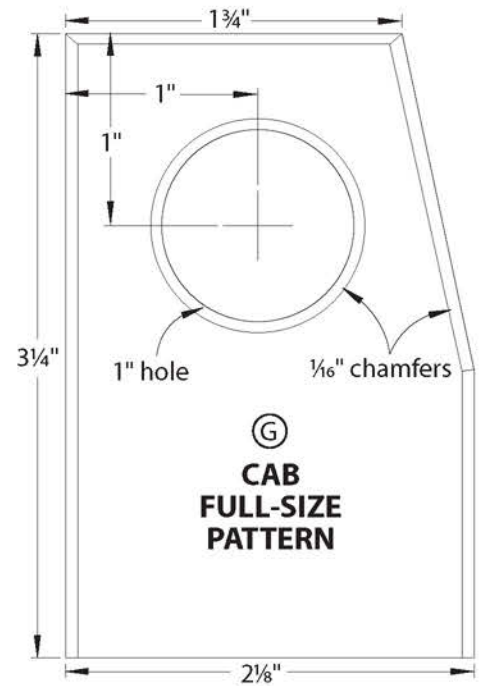




**COLLAR
FULL-SIZE
PATTERN**
(8 needed)

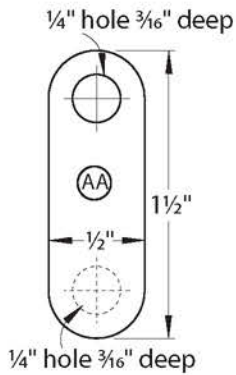


**PISTON END
FULL-SIZE
PATTERN**
(2 needed)

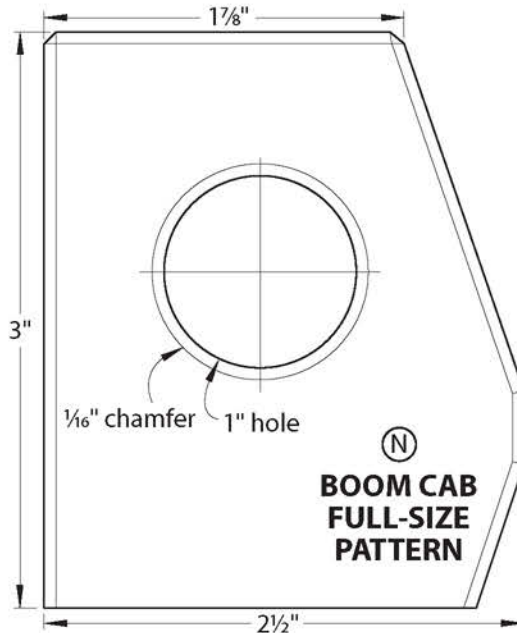


**CAB
FULL-SIZE
PATTERN**

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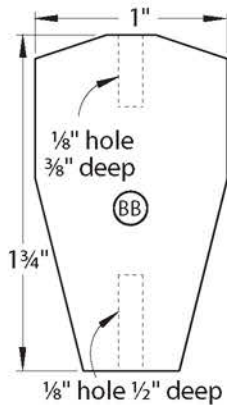
**CRANK
FULL-SIZE
PATTERN**



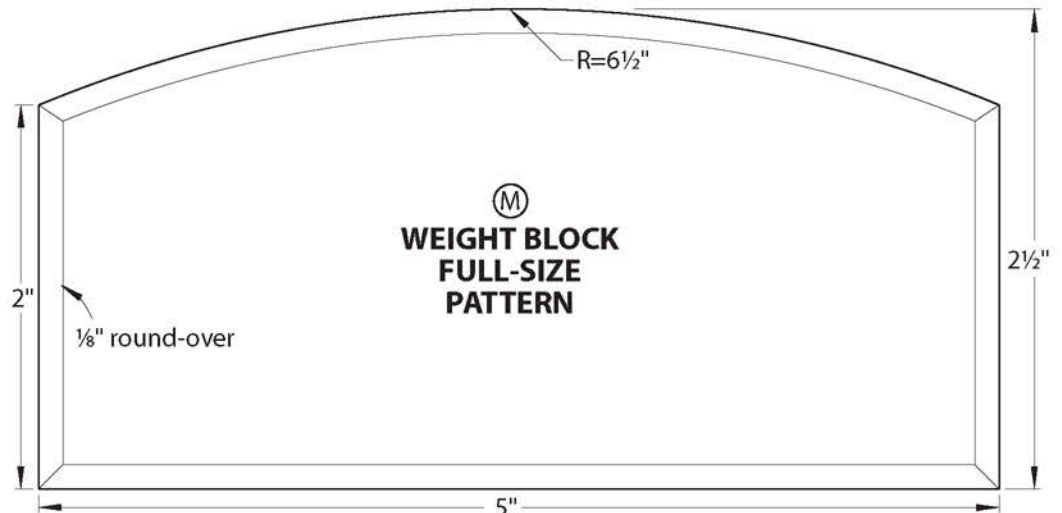
**BOOM CAB
FULL-SIZE
PATTERN**



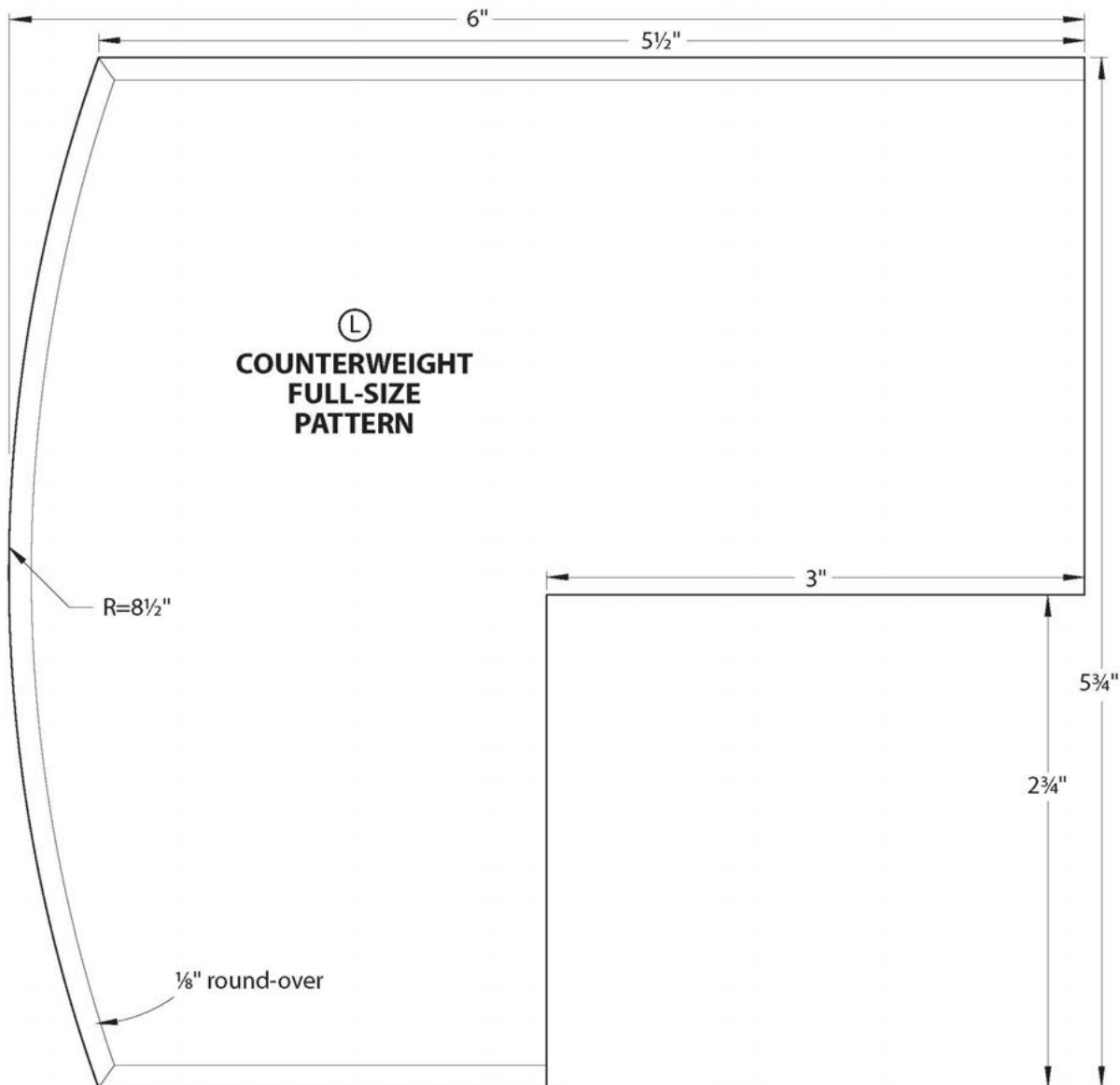
**Construction-grade
Mobile Crane**
Page 52



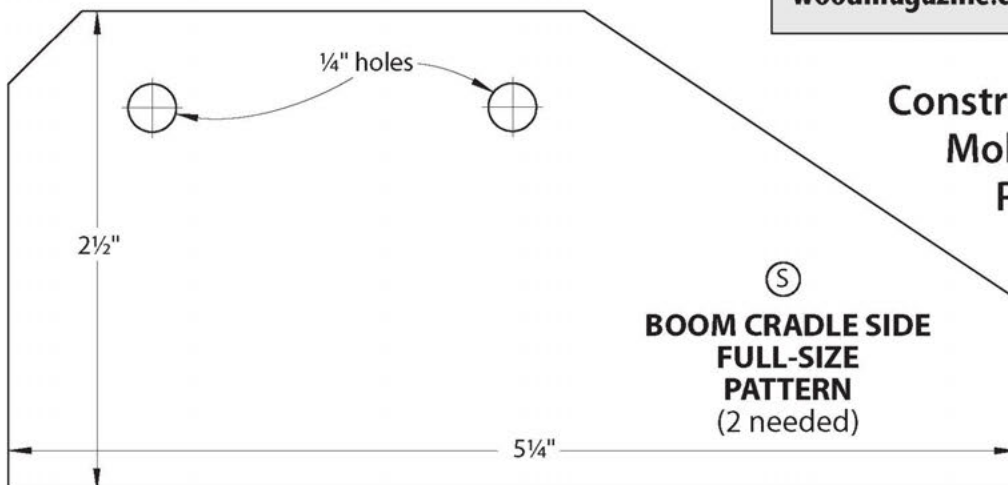
**BLOCK
FULL-SIZE
PATTERN**



**WEIGHT BLOCK
FULL-SIZE
PATTERN**



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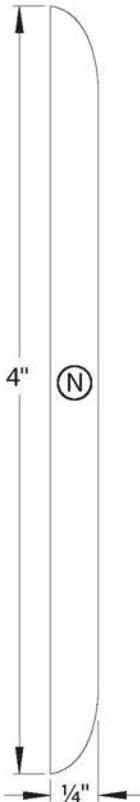
**Construction-grade
Mobile Crane
Page 52**



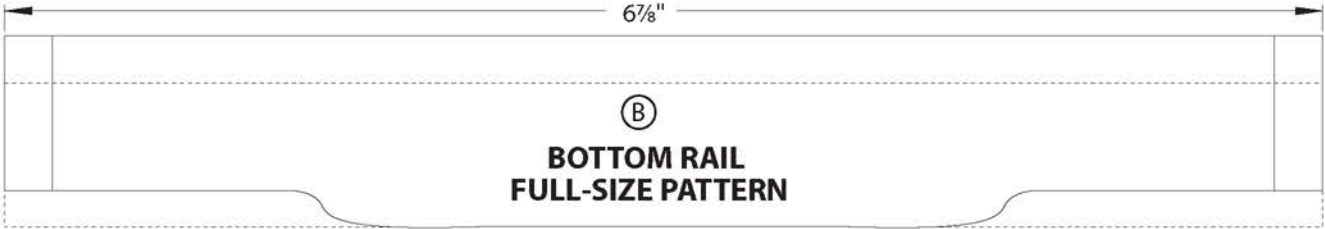
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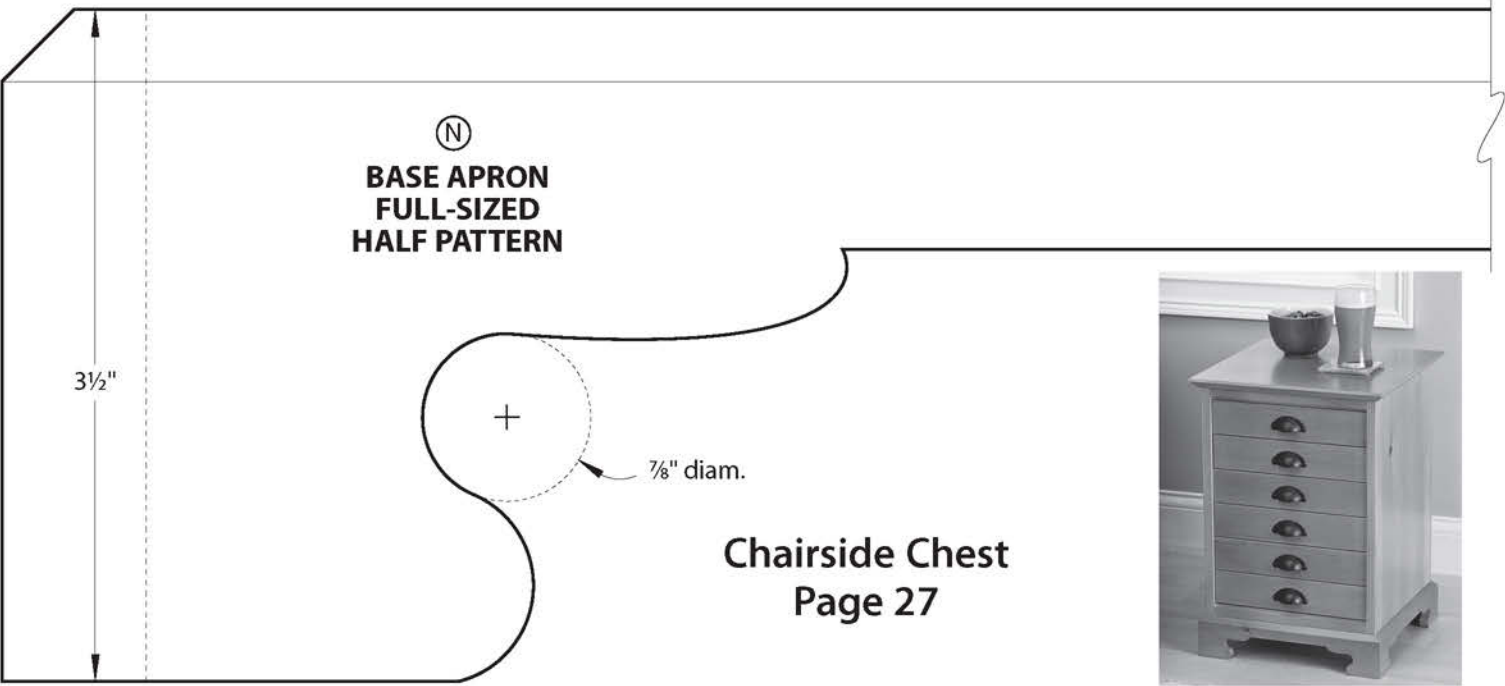
Greene & Greene
Wall Clock
Page 60



SIDE ACCENT
FULL-SIZE
PATTERN



BOTTOM RAIL
FULL-SIZE PATTERN



BASE APRON
FULL-SIZED
HALF PATTERN

Chairside Chest
Page 27



5 Remove the paper pattern from the first layer and sand all four pieces with 220-grit sandpaper to remove any spray adhesive or fuzzy edges. Dry-fit the snowflake, first joining the two larger pieces by the deep notches, then adding the half pieces, joining them by the shallow notches. Use a file to widen any notches if necessary. When the fit is snug, disassemble, and apply small dabs of cyanoacrylate (CA) glue to the notches before reassembly.

6 After the glue dries, apply a clear coat. We sprayed three coats of satin aerosol lacquer. (See the photo *right* for an alternate finish.) Drill a hole for the

hanger [Photo E]. Screw in a size 214 screw eye. Then, tie ribbon to the screw eye, and deck the boughs. 🌲

Source

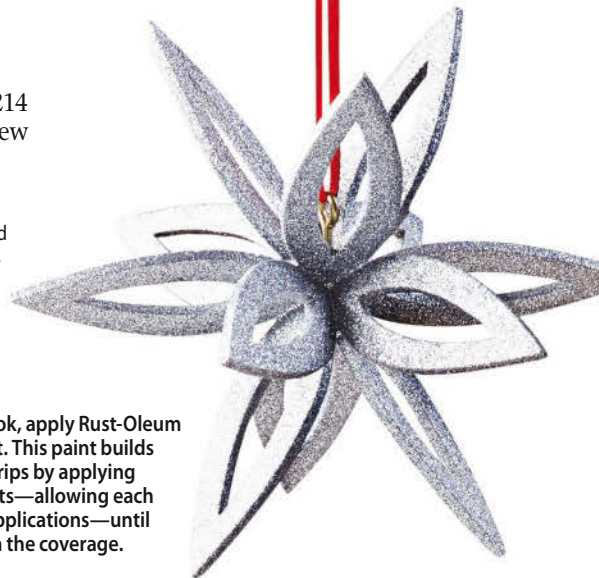
Supplies on Demand: $\frac{1}{8}$ ×12×12" Baltic birch plywood (enough for three ornaments), 3M Spray Mount Artist's Adhesive, size 214 screw eyes, $\frac{1}{8}$ "-wide red ribbon, and Rust-Oleum glitter spray paint, silver: woodmagazine.com/229ornament.

Produced by **Lucas Peters** and **John Olson**

Project design: **Thomas Luc**

Illustrations: **Lorna Johnson**

For a sparkling look, apply Rust-Oleum Glitter spray paint. This paint builds slowly, so avoid drips by applying multiple light coats—allowing each to dry between applications—until you're happy with the coverage.



MAKE A GAUGE TO MARK AND NOTCH THE SECOND LAYER



B Marking around a gauge made from scrap stock instead of cutting to a pattern line ensures a snug fit in case the plywood is undersized.



C Leave the marked line when scrollsawing the notches of the second layer. If necessary, they can be widened later.

THE HALVES, AND THEY HAVE NOTCHES



D After separating the two halves of the third layer, mark and cut notches in the straight edges, leaving the marked line for a snug fit.

ADD A HANGER HOLE



E Use a $\frac{1}{16}$ " bit to drill $\frac{1}{4}$ " deep into the crevice where the three layers meet. Don't worry if the bit punches through the bottom. No one will see.

High-Style Hutch



Curved legs and lithe lines combine to give this hutch a refreshing contemporary look. Build it with glass (*above*) or wood-panel doors and sides (*page 1*), or a combination of both. Though the hutch could grace almost any room on its own, a matching dining table and chairs (coming up in the next issue) create a striking dining room suite.

Dimensions:
41½"W×20½"D×48¾"H
Materials cost: \$480

Make the cabinet components

1 Cut $\frac{3}{4}$ " cherry plywood to size for the top/bottom panels (A) and the back panel (B) [Materials List, Drawing 1]. From solid stock, cut the back top rail (C), back bottom rail (D), back stiles (E), end trim (F), and front/back trim (G) to size.

2 Cut a $\frac{1}{4}$ " rabbet $\frac{1}{2}$ " deep along one back edge of each back stile (E), making mirror-image parts [Drawing 1]. Glue the top rail (C), bottom rail (D), and stiles to the back panel (B). Glue the end trim (F) and front/back trim (G) to the top/bottom panels (A).

3 Cut the side top rails (H), side bottom rails (I), side stiles (J), front stiles (K), door top rails (L), door bottom rails (M), and door stiles (N) to size [Materials List, Drawings 1, 2, and 3].

4 Plane or resaw enough $\frac{5}{16}$ " solid stock to yield eight 36"-long pieces $\frac{3}{8}$ " wide for the vertical and horizontal side and door stops (O, P, Q, R). (To install $\frac{1}{4}$ " plywood panels in the frames instead of glass, make the stops $\frac{3}{16}$ " thick.)

5 Cut and edge-glue stock for the cabinet top (S) [Materials List]. Cut the glued-up top to size, and bevel both ends and edges [Drawings 5 and 5a, Photo A]. Finish-sand the cabinet top and set it aside for final assembly.

Build the side and door frames

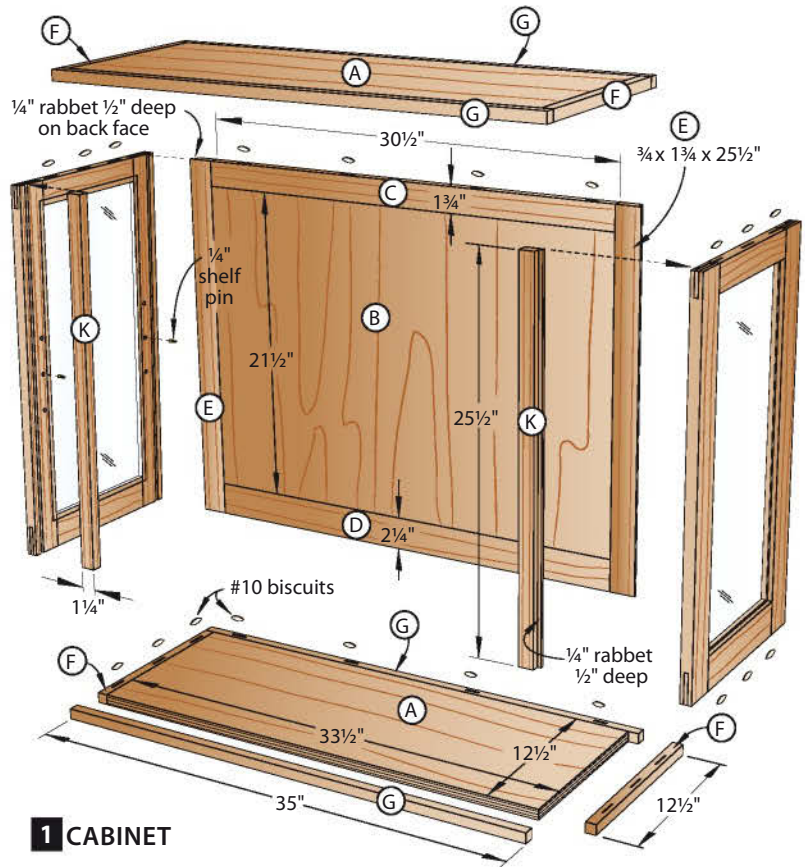
1 Cut a centered $\frac{1}{4}$ " slot 2" deep at the bottom of each side stile (J) and door stile (N) to create a bridle mortise [Photo B, Drawings 2 and 3]. Cut a similar slot $1\frac{1}{2}$ " deep at the top of each stile.

2 Cut mating tenons on the ends of the side top rails (H), side bottom rails (I), door top rails (L), and door bottom rails (M) [Drawing 4]. **Note:** These corner bridle joints will be visible on the door edges of the completed hutch, so take your time fitting the tenons to the slots to ensure tight, good-looking joints.

3 Glue and clamp the side frames (H/I/J) and door frames (L/M/N) [Drawings 2 and 3]. Measure both diagonals on each assembly to ensure they're equal and the assembly is square.

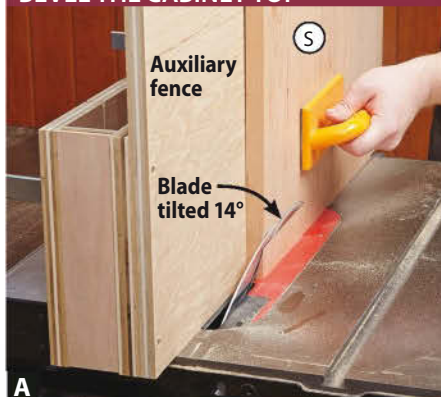
4 Saw or rout $\frac{1}{4}$ " grooves $\frac{1}{4}$ " deep $\frac{1}{2}$ " from the front and back edges on the inside face of each side frame assembly (H/I/J) [Drawing 2]. Next, drill three shelf-pin holes in each side stile (J) where shown in Drawing 2.

5 Rout $\frac{3}{8}$ " rabbets $\frac{1}{16}$ " deep around the opening on the inside face of both



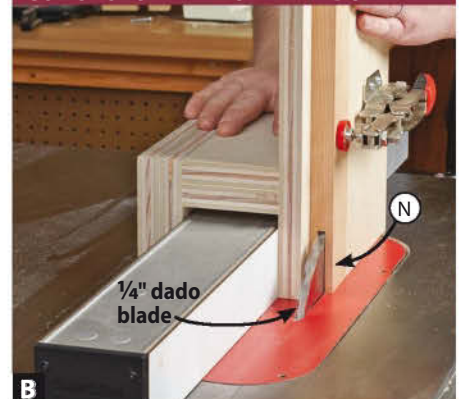
1 CABINET

BEVEL THE CABINET TOP



Attach a tall auxiliary fence—at least as tall as half the length of the cabinet top (S)—to your table saw to cut the 14° bevels on the ends and edges.

CUT SLOTS IN THE STILE ENDS

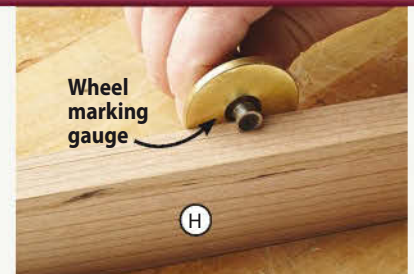


A tenoning jig that slides over the saw fence holds the stiles (J, N) securely as you cut the top and bottom slots with a $\frac{1}{4}$ " dado blade.

SHOP TIP

Scribe before rabbeting for cleaner cut

To minimize tear-out or splintering on the visible edge when rabbeting the side and door openings, scribe the edges of the rabbet before routing. A wheel marking gauge, right, cuts wood fibers cleanly.



side frames (H/I/J) and both door frames (L/M/N) [Drawings 2, 3, Photo C; Shop Tip, previous page]. Measure the openings in the side and door frames, and note the dimensions so you can buy $\frac{1}{8}$ " glass or cut $\frac{1}{4}$ " plywood panels to fit. Set the door frames aside until later.

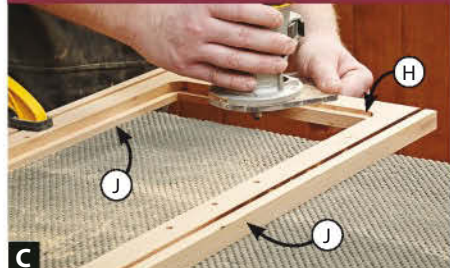
6 Cut a $\frac{1}{4} \times \frac{1}{2}$ " rabbet along the front outside edge of each front stile (K) [Drawing 1], creating a tongue to fit the groove in a side stile (J).

Assemble the cabinet

1 Finish-sand the inside surfaces of the top and bottom (A/F/G), back (B–E), sides (H/I/J), and front stiles (K) using progressively finer abrasives to 220 grit.

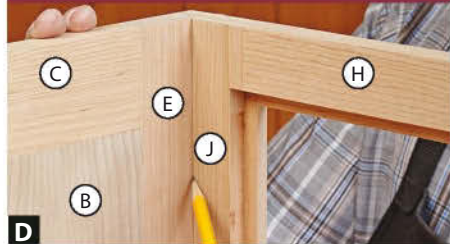
2 Dry-assemble the top and bottom (A/F/G), back (B–E), sides (H/I/J), and front stiles (K) [Drawing 1]. Mark the component intersections on the inside so you can mask the joints for finishing the interior [Photos D and E].

CUT PANEL-HOLDING RABBETS



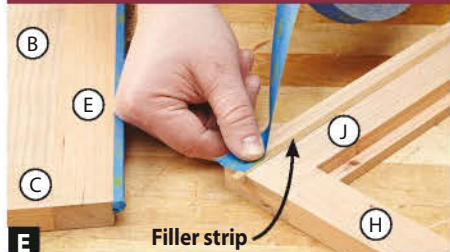
Rout the openings on the inside faces of the doors and sides with a piloted rabbet bit, making several shallow cuts. Square the corners with a chisel.

MARK GLUING AREAS AT JOINTS



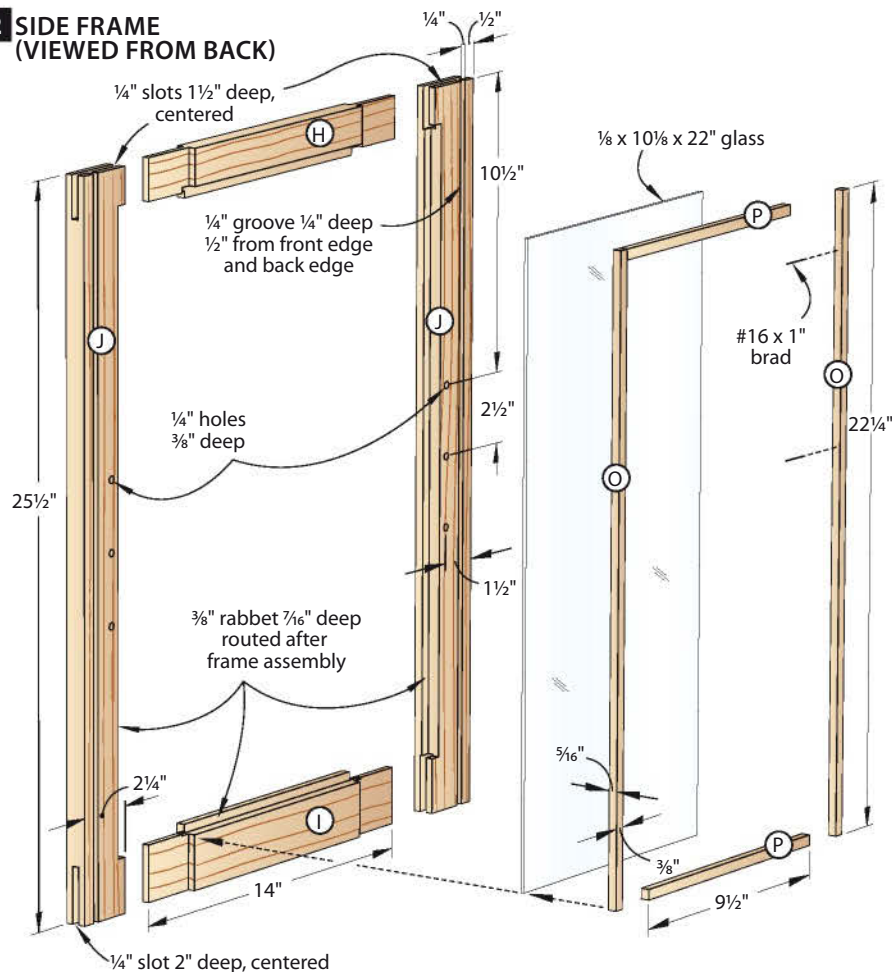
Mark the back (B–E) and the front stiles (K) where they meet the sides (H/I/J). (The top has been removed here for clarity.)

PROTECT GLUE AREAS FROM FINISH

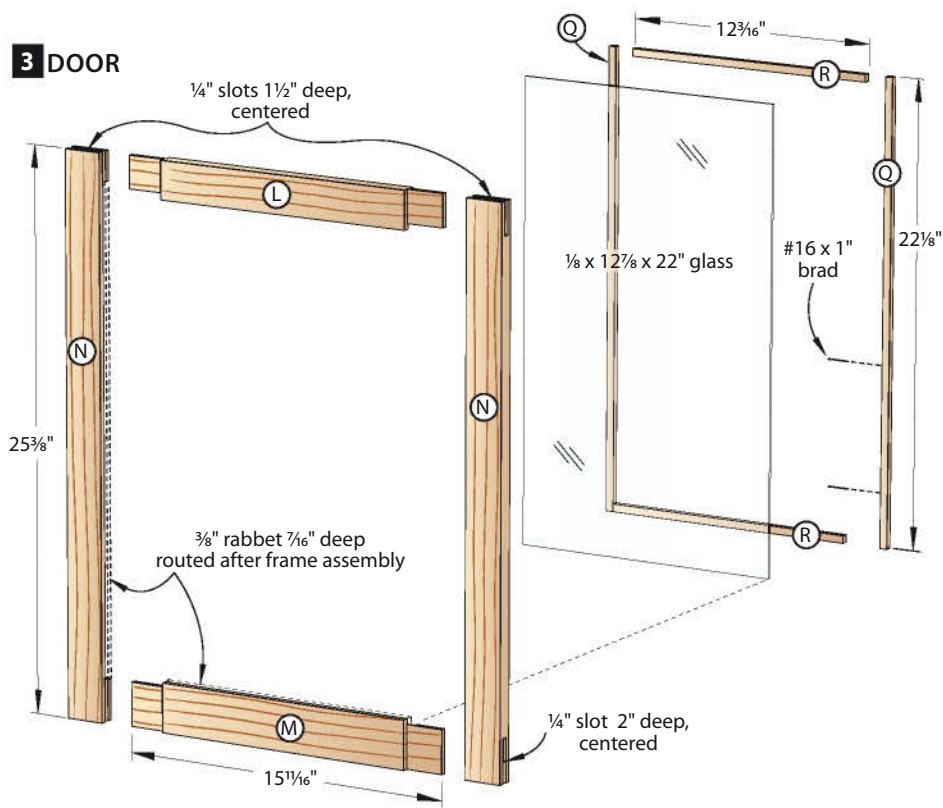


Insert filler strips to keep finish out of the grooves in the side stiles (J). Tape gluing surfaces adjacent to the grooves as well as the mating tongues.

2 SIDE FRAME (VIEWED FROM BACK)



3 DOOR

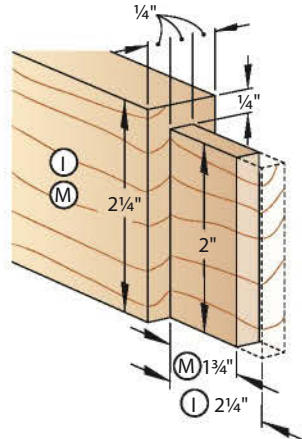
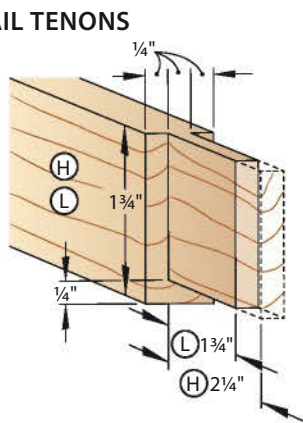


The back and sides will glue to the end and back trim (F, G) on the top and bottom, and the front stiles (K) will glue to the front trim (G); mark and mask the areas on the top and bottom that should not be finished for gluing [Drawing 1].

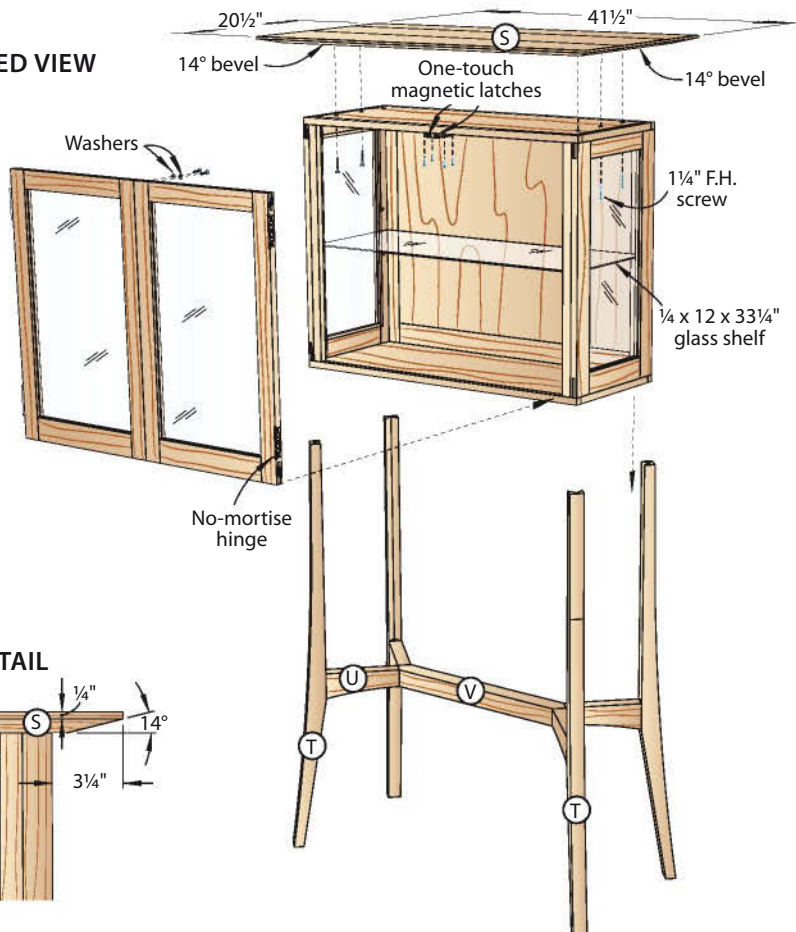
3 Apply finish to the interior surfaces of the top/bottom (A/F/G), back (B-E), sides (H/I/J), and front stiles (K). We finished our hutch with a coat of boiled linseed oil followed by three sprayed coats of clear lacquer.

4 Assemble the back (B-E), sides (H/I/J), and front stiles (K) [Drawing 1].

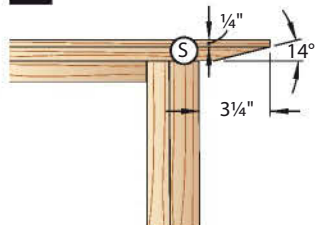
4 RAIL TENONS



5 EXPLODED VIEW



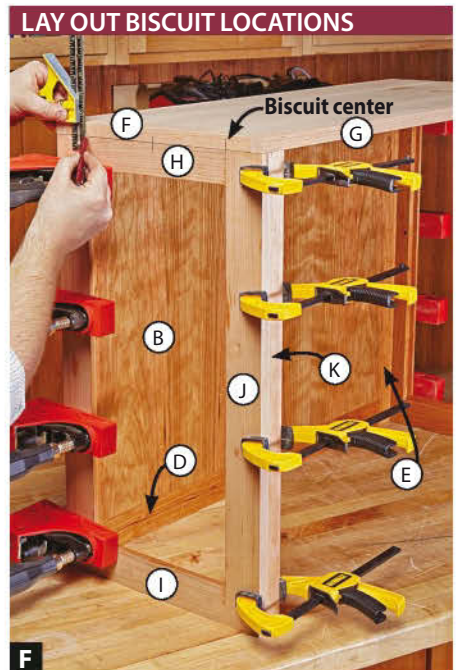
5a TOP DETAIL



Quick Tip! Square the assembly with clamping braces at the back corners; see **More Resources**.

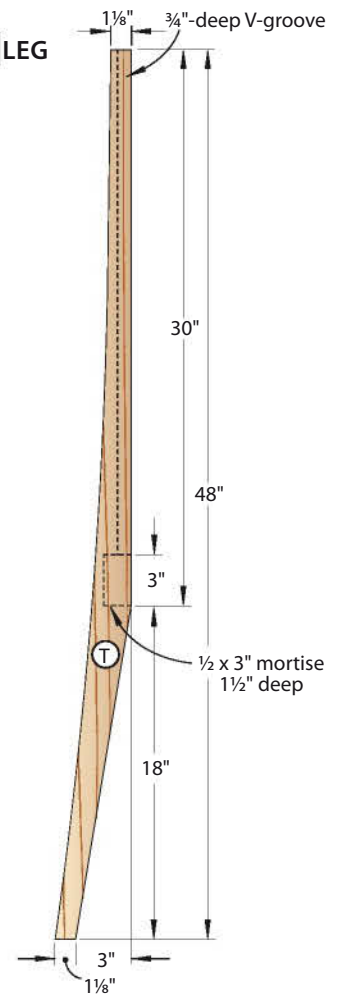
Temporarily position the top (A/F/G) and mark centers for biscuits (Photo F). Then, temporarily place the assembled back, sides, and front stiles on the bottom, and mark those biscuit centers.

5 Cut #10 biscuit slots centered on the locations marked. Apply glue, insert biscuits, and assemble the back/side/front stile assembly (B-E/H-K) to the top and bottom. Clamp the carcass, check it for square, and set it aside.



F Using a square, mark centerlines for biscuits on the back edge and both ends of the top and bottom and the outside face of the back and sides.

6 LEG



Build the base

1 Lay out the legs (T) [Drawings 6 and 7, Photo G] and leg supports (U) [Drawing 7a] on 1½" stock.

2 Cut mortises in the legs (T) and form mating tenons on the leg supports (U) [Drawings 6, 7, 7a].

3 Rout a 90° V-groove in each leg, starting at the top and extending to the mortise [Drawings 6 and 7, Photo H]. Finish the area where the V-groove meets the mortise with a chisel.

4 Saw the legs (T) and leg supports (U) to shape [Drawings 6 and 7a]. Sand the edges smooth, and finish-sand the parts. Glue a support to each leg [Drawing 7].

5 Glue a leg/support (T/U) assembly to each corner of the cabinet (A–K) [Photo I].

6 Cut the center support (V) from 2" stock, making it slightly longer than shown in Drawing 7b. Leave the ends square for now.

7 Invert the cabinet assembly (A–K/T/U). Scribe the center support (V) to fit between the ends of the leg supports (U) [Photo J, Drawing 7]. Finish-sand the part, and glue it in place.

LAY OUT THE LEGS

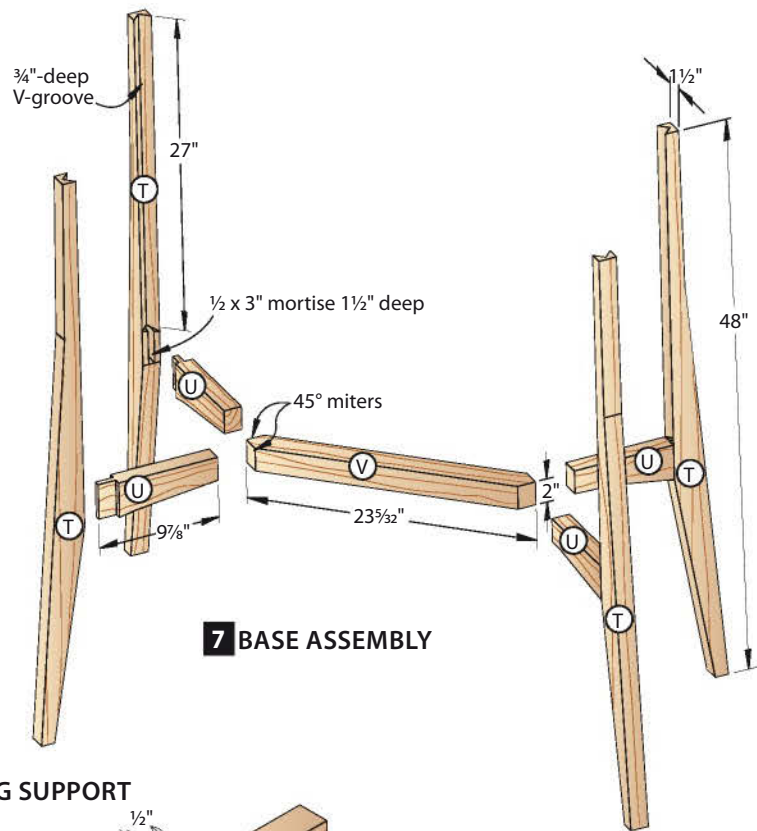


Establish the continuous curve from the top of the leg to the bottom along the outside edge using a fairing stick [More Resources].

ROUT V-GROOVES IN THE LEGS

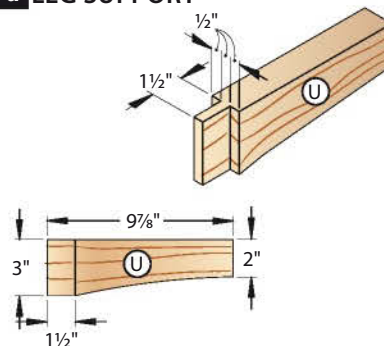


Form the leg grooves accurately with a V-groove bit 1½" in diameter [Sources] in a table-mounted router. Cut to full depth in several shallow cuts.

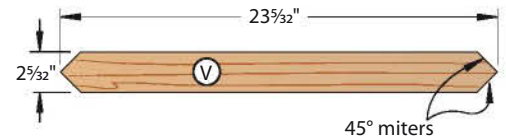


7 BASE ASSEMBLY

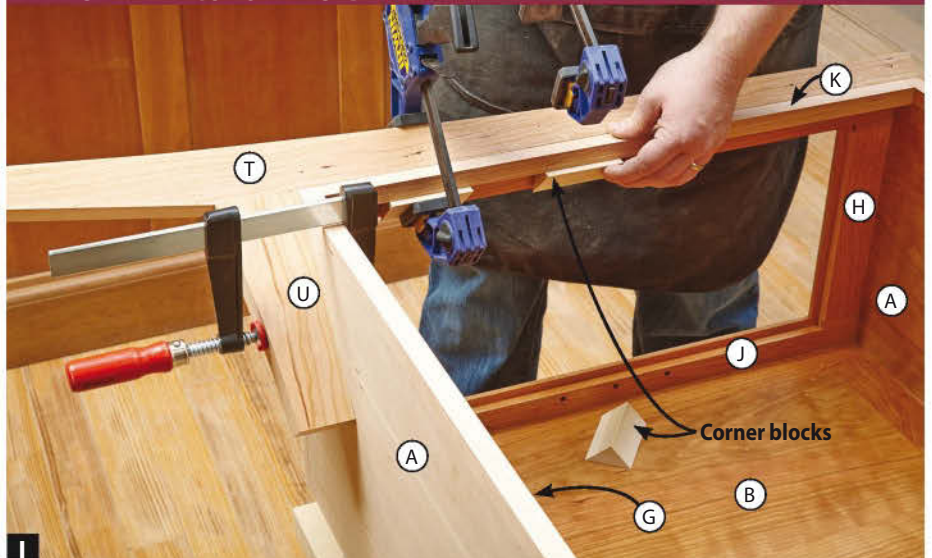
7a LEG SUPPORT



7b CENTER SUPPORT

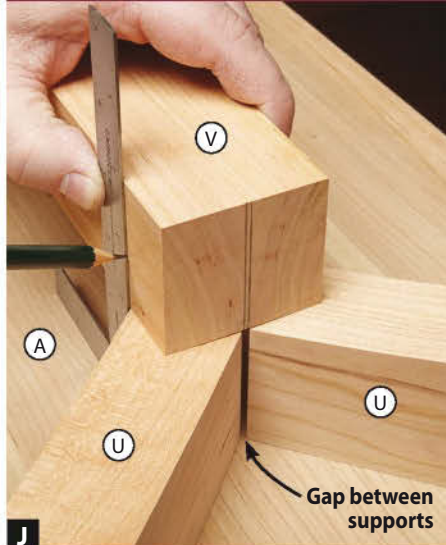


ATTACH THE LEGS TO THE CABINET



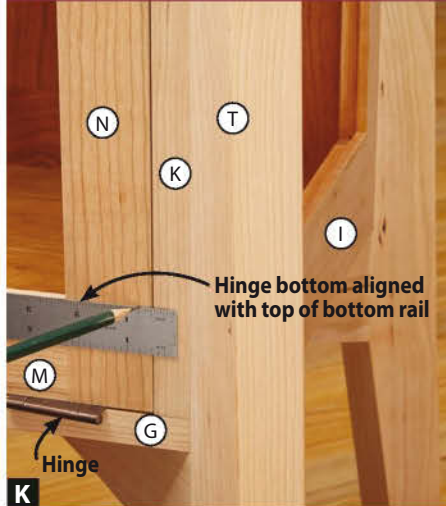
Corner blocks inside the cabinet ease clamping the legs (T) and leg supports (U) to the cabinet. The ends of the leg supports do not touch each other. Clamp the leg supports first, then clamp the legs.

FIT THE CENTER SUPPORT



J Hold the center support (V) in position while you mark the miter cuts at both ends. When you cut the part, sneak up on the marks to make a tight fit.

MARK THE HINGE LOCATIONS



To ensure an equal gap, stand the door on the hinges you'll use to hang it; then mark the hinge locations on the door stile (N) and front stile (K).

ATTACH THE HINGES TO THE DOORS



L Press the hinge barrel against the front of the door stile (N) and mark the screw holes. Drill the holes; then, flip over the hinges for installation.

Add the final touches

1 Stand the hutch on its legs. Place the door frames (L–N) in the front opening to mark the hinge locations. Align the top of the upper hinge with the bottom of the door top rail (L), the bottom of the lower hinge with the top of the door bottom rail (M) [**Photo K**].

2 Position a hinge on the edge of one door stile (N) at a mark, bringing the hinge barrel against the front face of the stile. Mark the screw-hole locations [**Photo L**] and drill the holes. Repeat for the remaining hinges.

3 To mark the screw holes on the cabinet front stiles (K), hold a hinge in position at a mark with the barrel resting against the stile. (This will be the installed orientation.) Drill pilot holes.

4 Cut and fit the stops (O–R) into the rabbets in the doors and sides. You can cut one horizontal and one vertical stop from each 36" length of stock.

5 Finish-sand all parts not already sanded. Apply finish to all bare surfaces and allow to dry thoroughly.

6 Position the cabinet top (S) on the hutch, centered side-to-side and front to back [**Drawing 5**]. Drill pilot holes for the attaching screws, making oversize holes or slots in the carcass top (A/F/G) to allow for wood movement. Attach the cabinet top.

7 Place glass or solid panels into the openings and fasten the stops in place with brads [**Drawings 2 and 3**].

8 Reattach the hinges to the doors, and install the doors. Add one-touch latches [**Drawing 5**]. Put in shelf pins and lay the glass shelf in place. Clean all the glass, and put your treasured items into the hutch. 🌿

Produced by **Larry Johnston** with **John Olson**

Project design: **John Olson**

Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
Cabinet and doors					
A top/bottom	¾"	12½"	33½"	CP	2
B back	¾"	30½"	21½"	CP	1
C back top rail	¾"	1¾"	30½"	C	1
D back bottom rail	¾"	2¼"	30½"	C	1
E back stiles	¾"	1¾"	25½"	C	2
F end trim	¾"	¾"	12½"	C	4
G front/back trim	¾"	¾"	35"	C	4
H side top rails	¾"	1¾"	14"	C	2
I side bottom rails	¾"	2¼"	14"	C	2
J side stiles	¾"	2¼"	25½"	C	4
K front stiles	¾"	1¾"	25½"	C	2
L door top rails	¾"	1¾"	15½"	C	2
M door bottom rails	¾"	2¼"	15½"	C	2
N door stiles	¾"	1¾"	25¾"	C	4
O* side vertical stops	⅝"	⅜"	22¼"	C	4
P* side horiz. stops	⅝"	⅜"	9½"	C	4
Q* door vertical stops	⅝"	⅜"	22½"	C	4
R* door horiz. stops	⅝"	⅜"	12¾"	C	4
S cabinet top	¾"	20½"	41½"	EC	1
Base					
T* legs	1½"	4⅞"	48"	C	4
U* leg supports	1½"	3"	9⅞"	C	4
V* center support	2"	2⅜"	23⅜"	C	1

*Parts initially cut oversize. See the instructions.

Materials key: CP—cherry plywood, C—cherry, EC—edge-glued cherry.

Supplies: ⅝×10⅞×22" glass (2), ⅝×12⅞×22" glass (2), ¼×12×33¼" glass with polished edges (1), #8×1¼" F.H. screws (6); #16×1" brads, ¼" shelf pins (4), #10 biscuits (20).

Blade and bits: Stacked dado set, ⅜", ¼" drill bits; ⅜" piloted rabbet router bit, 1½" 90° V-groove router bit [Sources].

Sources

V-groove router bit: Freud 20-116, \$57.97, Woodcraft, 800-225-1153, woodcraft.com.

Hardware: 2" no-mortise hinges, 00H51.22, \$1.90 per pair plus shipping (2 pairs needed); one-touch latches, 00S33.11, \$3.40 each plus shipping (2 needed), Lee Valley, 800-871-8158, leevalley.com.

More Resources

► For a free plan to make a right-angle clamping brace, see woodmagazine.com/clampingbrace.



► For a free plan to make a fairing stick and instructions to use it, go to woodmagazine.com/fairing.



Trim Routers

You'll love these nimble, one-handed tools for light-duty trimming, edge-forming, and hinge-mortising tasks.

Some tools you gotta have because they do a job or two like no other tool can. Then there are others—such as trim routers—that just make life simpler and more enjoyable. Also known as laminate trimmers, these mighty mites got their start in the carpentry trade as an effective way to trim plastic-laminate countertops. But their usefulness goes way beyond that. Need to round over or chamfer a workpiece or flush-trim edging on plywood? Do the job quickly and controllably with a trimmer. In fact, many woodworkers dedicate a trim router to a commonly used bit, such as $\frac{1}{8}$ " or $\frac{1}{4}$ " round-over, 45° chamfer, or a bearing-

guided flush-trimmer, so it's always ready to go. To help you find a trim router that best suits your needs, we tested 11 in these and other applications.

First, a bit about bits

With motors rated at 1 hp or less, these routers lack the power to spin large bits. So they all have $\frac{1}{4}$ " collets, limiting you to bits with $\frac{1}{4}$ " shanks. The bit opening on the subbase also limits the size of bit you can use—the routers we tested have

openings from $1\frac{3}{16}$ " to just over $1\frac{1}{16}$ ". Two of the routers have self-releasing collets similar to those found on larger routers: The Bosch Colt PR20EVSK and Craftsman 28212 use one-piece collet-and-nut assemblies (*next page, top*) that pop the bit free as you untighten it. We prefer this style over the two-piece systems found on the other trim routers. Two-piece collets occasionally wouldn't release the bit shank, requiring added muscle to free the bit.

To change bits with all the routers, it's easiest to remove the base first. You do that by loosening a lever lock or wing nut and then sliding the base off the motor housing. The Bosch and Ryobi P600 routers require you to twist the base slightly as you slide it off, a quirk you'll get used to after several uses. The base on Ridgid's R2401 has a catch just before the base comes off, requiring a sharp tug to free it.

You use two wrenches to tighten or loosen the collet nut on the Drill Master 44914, Grizzly H7790 and H7791, and Makita 3709. The other routers have a collet lock you depress with one hand while you wrench the nut with the other hand. Both styles work well, so choose a router that suits your preference. (About two-thirds of the *WOOD*® staff prefer one-wrench bit changes.) The Bosch Colt comes with two wrenches and a collet lock, letting you use either method.

Setting bit depth can be tricky

Most of the trimmers have both coarse and fine adjustments for setting bit depth, *right*. The Grizzly H7790 and Ryobi have only coarse adjustments (difficult to dial in precise bit depth), and the DeWalt DWE6000 and Porter-Cable PCE6430 have only fine-adjust dials (tedious for large depth changes). Our favorite adjusters are on the Bosch Colt and Ridgid; we could dial in both with reliable precision. All but the Grizzly H7790 have depth-of-cut scales, but we found them all more finicky to use than simply eyeballing and test-cutting.

ONE-PIECE COLLETS WORK BEST



A one-piece, self-releasing collet (left) releases bits easier than does either a two-piece split-cone collet (center) or a slotted-sleeve collet (right).

THREE WAYS OF SETTING BIT DEPTH



GOOD With the Porter-Cable and DeWalt routers, you release a cam lever and slide the base until the side locks latch into the fine-adjustment ring.



BETTER Half of the routers, including the MLCS Rocky 30, use a rack-and-pinion adjuster to move the base up and down on the motor housing.



BEST Bosch's Colt uses a thumbwheel fine adjuster. To make coarse movements, rotate the base slightly to bypass the fine-adjuster bolt inside the base.

The DeWalt and Porter-Cable routers have the greatest amount of vertical collet travel (2½") within their bases, nearly an

inch more than the Craftsman. That's crucial if you use bits with long shanks or long cutters.

Bosch Colt PR20EVSK, \$120

877-267-2499, boschtools.com

Craftsman 28212, \$90

800-549-4505, craftsman.com

DeWalt DWE6000, \$100

800-433-9258, dewalt.com

Drill Master 44914, \$30

800-423-2567, harborfreight.com



Details make the difference

Using new, identical CMT bits, we routed countless round-overs, chamfers, coves, dadoes, grooves, rabbets, and shallow mortises. We also flush-trimmed solid-wood edging on $\frac{3}{4}$ " plywood. The good news: Once the bit was set, all the routers performed about equally in terms of power and cut quality. But a few aspects give some routers an edge over the others.

► **Variable speed.** The Bosch, Craftsman, MLCS, and Ridgid models have variable-speed motors, so you can dial in the speed to match the application or bit. We appreciate this flexibility, especially when working with burn-prone wood species, such as cherry and maple. Of those four, all but the MLCS have soft-start motors that don't jerk when powered up. The other models run at single speeds of at least 26,000 rpm. Porter-Cable launched a variable-speed model (PCE6435, \$130) too late for us to include in this review.

► **Bit visibility.** The older we get, the more we appreciate the assist of LEDs to brighten the area around the bit. You'll find these on the Craftsman, DeWalt, Porter-Cable, and Ridgid routers. Of these four, only the DeWalt has a clear plastic base, which allows in ambient light as well. Other clear-base models: Drill Master, both Grizzly's, and Makita.

► **Balance.** All the routers weigh between 3 and 4 lbs, and most handle about the same in terms of balance and tippiness. The Craftsman, tallest in the group, felt more tippy than the others when extended in its base, but was fine otherwise. And the battery-powered Ryobi felt awkward and top-heavy, especially

ROUT WITH MORE CONFIDENCE WHEN YOU CAN SEE THE BIT



The combination of an LED light and a clear plastic subbase enhanced the Ridgid's bit visibility, even with larger-diameter bits.



A metal base that wraps halfway around the base and the lack of an LED light make the MLCS Rocky 30 more difficult to use when you need to see the bit.

CORD-FREE, YES, BUT AWKWARD



Although we were pleased with the run-time of Ryobi's 18-volt lithium-ion battery pack, it makes the router top-heavy and unwieldy.

ADD A HELPING HAND



Craftsman's auxiliary subbase gives you the ability to better control the router with two hands when needed, such as for hinge-mortising.

when used with a 3-amp-hour or larger battery pack.

► **Extra bases and guides.** All but the Ryobi come with edge guides that attach to the base and let you rout parallel to a workpiece edge. The Drill Master, both Grizzly's, Makita, and MLCS also include bearing-guided attachments for flush-trimming edges with a straight or spiral bit. The Craftsman comes with a two-

handed auxiliary subbase, shown *above*. Bosch sells auxiliary plunge, tilting, and offset bases for the Colt as optional accessories.

The DeWalt and Porter-Cable models have subbases with molded openings compatible with common two-piece guide bushings. The Drill Master, Grizzly, and Makita routers come with one proprietary $\frac{3}{8}$ " guide bushing apiece.

Grizzly H7790, \$47

800-523-4777, grizzly.com



Grizzly H7791, \$45

800-523-4777, grizzly.com



Makita 3709, \$110

800-462-5482, makitatools.com



MLCS Rocky 30, \$70

800-533-9298, mlcswoodworking.com



Trim Routers Deliver a Fistful of Furious Finesse

MANUFACTURER	MODEL	PERFORMANCE RATINGS (1)				MOTOR		COLLET			BASE										
		EASE OF SETTING BIT DEPTH	EASE OF CHANGING BITS	BIT VISIBILITY	BALANCE AND CONTROL	SPEED x 1,000 rpm	SOFT START ? (YES/NO)	STYLE (2)	TIGHTENING METHOD (3)	MAXIMUM TRAVEL, INCHES	MATERIAL (4)	BIT OPENING, INCHES	GUIDE-BUSHING READY? (YES/NO) (5)								
BOSCH	COLT PR20EVSK	A	A-	A-	A	16–35	Y	R	1, 2	1 ²⁵ / ₃₂	M	1 ³⁷ / ₆₄	N	C, F	89	3–6	10	1	M	\$120	
CRAFTSMAN	28212	B+	A	A	A-	18–28	Y	R	1	1 ³ / ₁₆	M	1 ¹³ / ₃₂	N	C, F	87	3–14	10	1	C	\$90	
DEWALT	DWE6000	B	A-	A	A	31	N	C	1	2 ¹ / ₈	P	1 ¹³ / ₆₄	Y	F	86	3–4	8	3	C	\$100	
DRILL MASTER	44914	B	A-	B+	B	26	N	C	2	1 ³¹ / ₃₂	P	1 ²⁷ / ₆₄	Y*	C, F	85	3–3	7	90 days	C	\$30	
GRIZZLY	H7790	B-	A-	B+	B	30	N	C	2	1 ⁶¹ / ₆₄	P	1 ³ / ₈	Y*	C	93	3–8	8	1	C	\$47	
	H7791	B	A-	B+	B	30	N	C	2	1 ³¹ / ₃₂	P	1 ³ / ₈	Y*	C, F	90	3–9	8	1	C	\$45	
MAKITA	3709	B	A-	B+	B	30	Y	C	2	2	P	1 ³ / ₈	Y*	C, F	82	3–7	8	1	J	\$110	
MLCS	ROCKY 30	B	A-	B	A	10–30	N	C	1	1 ²³ / ₃₂	M	1 ³ / ₈	N	C, F	89	4	6	1	C	\$70	
PORTER-CABLE	PCE6430	B	A-	A	A	31	N	C	1	2 ¹ / ₈	M	1 ¹³ / ₆₄	Y	F	86	3–4	8	1	C	\$100	
RIDGID	R2401	A	B	A	A	20–30	Y	C	1	1 ⁹ / ₁₆	M	1 ³ / ₁₆	N	C, F	86	3–2	8	3	C	\$100	
RYOBI	P600	B-	B+	B	C	26	N	S	1	1 ⁹ / ₁₆	P	1 ¹³ / ₃₂	N	C	88	3–14*	NA	2	C	\$50*	

1. **A** Excellent
B Good
C Fair

2. (C) Split cone
(R) Self-releasing slotted cone
(S) Slotted sleeve
3. (1) Spindle lock & one wrench
(2) Two wrenches

4. (M) Metal
(P) Plastic
5. (*) Made for proprietary guide bushings (one included)

6. (C) Coarse
(F) Fine
7. (*) Including optional 3-amp-hour battery

8. (C) China
(J) Japan
(M) Malaysia

9. Prices current at time of article production and do not include shipping, where applicable. (*) Does not include battery and charger

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

Although just 1 hp, this Colt gets after it

If you simply have to have the best, get the Bosch Colt PR20EVSK—our Top Tool. At \$120, it's at the top of the price range, but it topped nearly every test we conducted. (You can get this router in a single-speed 35,000-rpm version for \$20 less.)

On the other hand, you can buy four Drill Master 44914 trimmers for the same money you'd spend for the Colt. You could dedicate three to commonly used bits and still keep one available for other uses. That's economical now and saves time in the shop, making it our Top Value. 🌳

Porter-Cable PCE6430, \$100

888-848-5175, portercable.com



Ridgid R2401, \$100

866-539-1710, ridgid.com



Ryobi P600, \$50*

800-525-2579, ryobitools.com
*Not including battery pack and charger



WOOD MAGAZINE'S
REVIEW-A-TOOL

Read more in-depth analysis of each of these trim routers at woodmagazine.com/trimmers.

Construction-grade Mobile Crane

Our biggest one yet!



With 13 toys in this popular series, I knew I had to pull out all the stops to design a crane that would make you go "Wow!" To do that, this one includes a boom that extends more than 4', a 360°-rotating turntable, and fully functioning outriggers. For ease of building, a hardware kit with all of the specialty parts is available [Source, page 58].

Kevin

Kevin Boyle
Senior Design Editor



Background photo courtesy of Ben Six, Champion Crane Service, Inc.

You'll find patterns for several of the crane parts in the *WOOD Patterns*® insert, *pages 38-39*. To use them, photocopy the pattern, spray-adhere the copy to your workpiece, cut and sand along the lines, and drill any holes where indicated. Remove the pattern with a rag soaked in mineral spirits, then finish-sand the part to 220 grit.

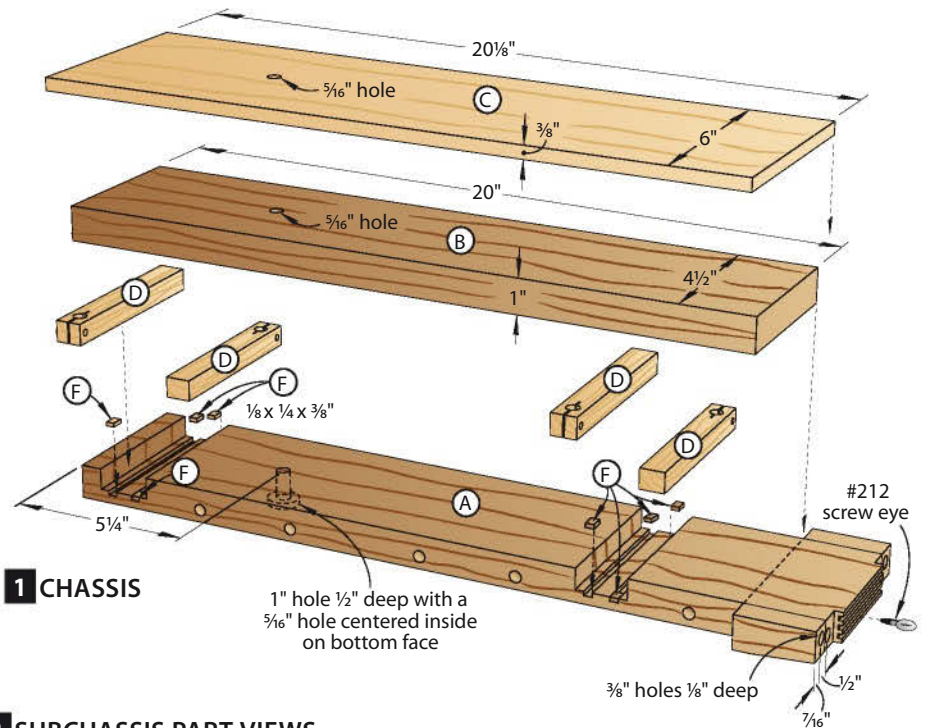
Start with a solid chassis

1 Cut a $1 \times 6 \frac{1}{4} \times 22 \frac{3}{8}$ " walnut blank for the subchassis (A). Rip a $\frac{3}{4}$ "-wide strip from each edge of the blank, label them so you can reorient them later, and set them aside. Following the **Materials List** on *page 58* cut the chassis (B), deck (C), outrigger arms (D), and outrigger feet (E) to size [**Drawings 1 and 3**]. Set parts B–E aside for the moment.

2 Install a $\frac{1}{4}$ " dado set in your table saw to cut $\frac{5}{8}$ " deep. Make several passes over the blades to cut the $1 \frac{1}{2}$ "-wide dados across the subchassis (A) [**Drawing 2**]. Raise the dado set to $\frac{3}{4}$ " and cut the two $\frac{1}{4}$ " dados inside each wider dado [**Photo A**].

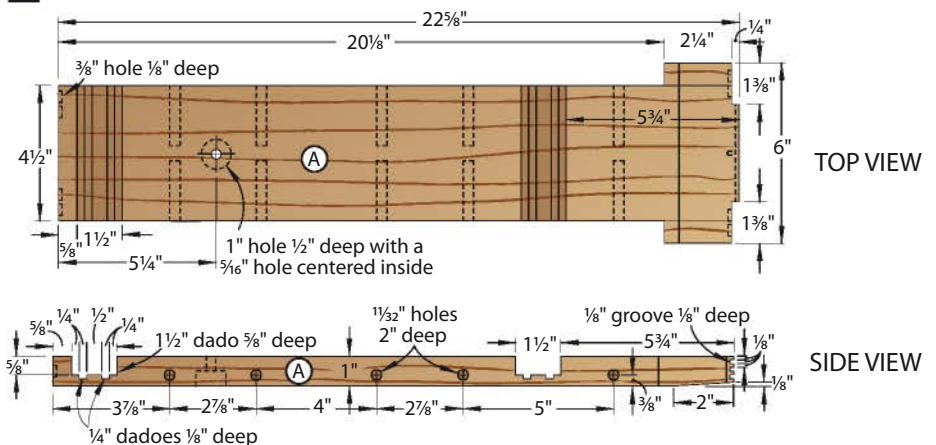
3 Cut a $\frac{1}{8} \times \frac{1}{4} \times 12$ " blank for the outrigger stops (F). Cut the outrigger stops to length [**Photo B**], then glue one into each end of the $\frac{1}{4}$ " dados in the subchassis (A) [**Photo C**].

4 Drill a 1" hole $\frac{1}{2}$ " deep in the bottom face of the subchassis (A), the $\frac{5}{16}$ " hole centered within it, and the five $\frac{1}{32}$ " axle holes in each edge of the subchassis [**Drawing 2**]. Note that the axle holes are not centered on the thickness of the subchassis.



1 CHASSIS

2 SUBCHASSIS PART VIEWS

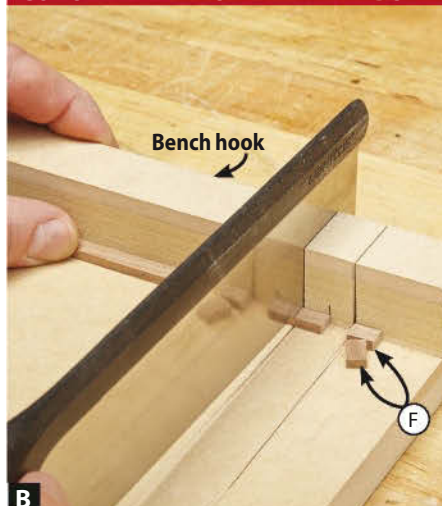


CUT DADOES IN DADOES



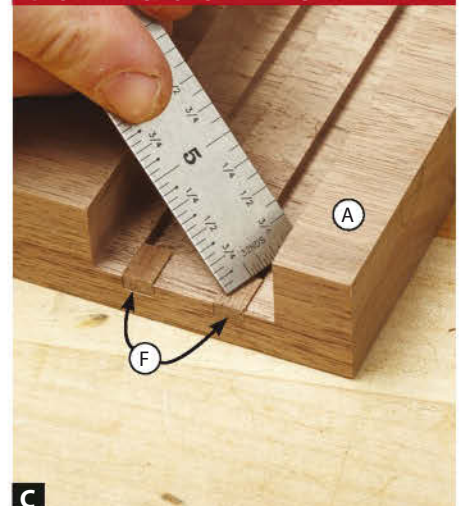
Use the rip fence as a stop to precisely position the narrow dadoes in the subchassis (A). These dadoes will guide the outriggers as they slide in and out.

CUT SMALL PARTS WITH A HANDSAW



Keep your fingers safe and get better results by using a fine-tooth handsaw and a bench hook to cut the outrigger stops (F) from a long blank.

GLUE THE STOPS IN PLACE



Use a steel rule or piece of scrap to press the outrigger stops (F) into place. Sand them flush with the outside edge of the subchassis (A).

5 Retrieve the subchassis cutoffs and cut a $2\frac{1}{2}$ " length from the front end of each. Glue these back onto the subchassis (A) in their original positions, flush with the front end. After the glue dries, create the grille by cutting grooves in the front end of the subchassis [Drawing 2]. Notch the front end of the subchassis [Photo D].

6 Lay out and sand the $\frac{1}{8}$ " bevel on the bottom front face of the subchassis (A) [Drawing 2]. With a $\frac{3}{8}$ " brad-point or Forstner bit, drill the headlights and taillights [Drawings 1 and 2]. (They are spaced identically on each end.)

7 Retrieve the outrigger arms (D). Drill the holes where shown and bandsaw the kerf centered on the thickness [Drawing 3]. Glue a $\frac{3}{8}$ " length of $\frac{1}{4}$ " dowel into the stopped hole. **Note:** Make sure no more than $\frac{1}{8}$ " of the dowel protrudes.

8 Place the outrigger arms (D) in the dadoes in the subchassis (A), with the dowels in the $\frac{1}{4}$ " dadoes. Trap the outrigger arms by clamping the chassis (B) to the subchassis. Check that the outrigger arms slide in and out smoothly, and adjust their fit if needed. **Note:** You want a loose sliding fit, not a friction fit. Otherwise the arms may bind as parts expand with changes in humidity. Once you are happy with the fit, glue the chassis and subchassis together [Photo E]. After the glue dries, finish-sand the chassis assembly to 220 grit.

9 Retrieve the outrigger feet (E) and rout $\frac{1}{8}$ " chamfers around their top edges [Drawing 3]. Drill a centered $\frac{3}{8}$ " hole and glue in a $2\frac{1}{4}$ " length of maple dowel. Set these assemblies aside to dry.

On to the cab and engine

1 Laminate stock for the cab (G) and cut it to size [Materials List]. Adhere a photocopy of the **Cab Pattern** to one

edge, and cut the cab to shape. Working from both edges, drill the hole where shown. **Note:** It isn't necessary to drill all the way through the cab. Chamfer all of the edges except the bottom [Drawing 4].

2 [Drawing 4], centered side-to-side. Retrieve the deck (C) and glue it to the chassis (B) [Photo F]. After the glue dries, flip the assembly (A–D/F/G) upside down and, using the hole in the subchassis as a guide, drill a $\frac{5}{16}$ " hole through the chassis and deck [Drawing 1].

3 Cut the engine cover (H) to size. Bandsaw and sand the bevel [Drawing 4a], rout the chamfers, and cut the grooves on the end for the grille. Finish-sand the engine cover, then glue it in place on the deck (C) against the cab (G).

4 For the steps (I), prepare a $\frac{5}{8} \times 2\frac{1}{8} \times 12$ " maple blank. Cut $\frac{1}{4}$ " grooves $\frac{3}{16}$ " deep spaced $\frac{1}{4}$ " apart [Drawing 4b]. Crosscut two 1"-long steps from the blank. Temporarily attach the wheels to the chassis using axle pegs. Glue the steps to the subchassis (A) and chassis (B), tight to the deck (C) and centered between the two rear sets of wheels.

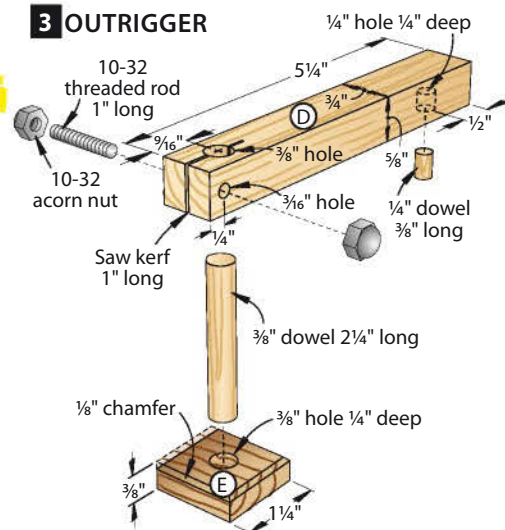
5 To make the boom cradle (J) [Drawing 4c], cut a $\frac{1}{2} \times 4 \times 2\frac{1}{16}$ " blank. Then, cut a $2\frac{1}{16}$ "-wide dado $\frac{1}{4}$ " from one end. Rip the boom cradle to size [Materials List] from the blank and glue it to the engine cover (H) [Drawing 4].

Take a turn at the turntable

1 Cut the turntable (K) to size [Drawing 4d] and bandsaw and sand the radius on the rear end. Drill the holes where shown. Insert a $\frac{5}{16} \times 3$ " bolt and washer through the hole and epoxy them in place.

2 Following their respective patterns, cut the counterweight (L), weight block (M), and boom cab (N) to shape.

3 OUTRIGGER



3 Glue the boom cab (N) to the front corner of the turntable (K) [Drawing 4]. Glue and clamp the counterweight (L) to the turntable [Photo G]. After the glue grabs, glue the weight block (M) to the counterweight, centered side-to-side and flush with the notch in the counterweight.

Round up the boom cylinder

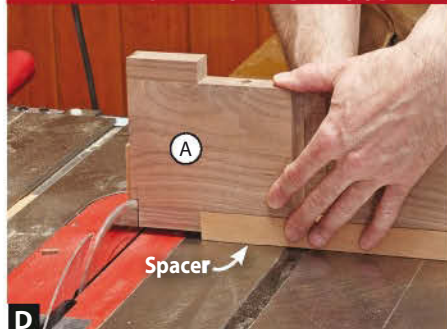
1 From a $\frac{3}{8} \times \frac{3}{4} \times 12$ " maple blank, cut and shape eight collars (O) following the **Collar Pattern**. Drill the $\frac{3}{16}$ " hole in each where shown. Set the collars aside.

2 To make the piston cylinder (P), start with a $\frac{5}{8} \times \frac{3}{4} \times 8$ " maple blank.

Quick Tip! Make a few additional blanks of the same size to help check your router-table and tablesaw setups before working on the piston-cylinder blank.

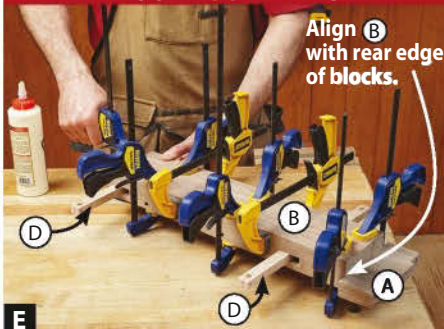
Set up a $\frac{1}{8}$ " core-box bit in your router table, raised $\frac{1}{8}$ " above the table. Position the fence to center the bit on the $\frac{5}{8}$ " thickness of the blank and rout a groove in opposite edges of the blank [Photo H]. Rip the blank in half and reglue it with the grooves facing each other to create a cylindrical opening [Photo I].

MAKE THE GRILLE STAND PROUD



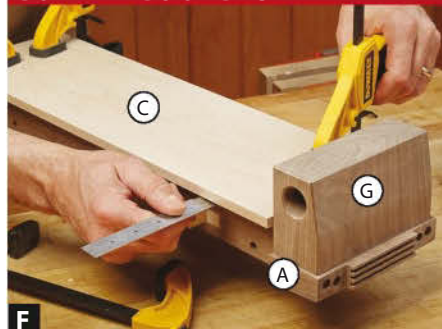
Rest the subchassis (A) on a 1"-thick spacer and cut a $\frac{1}{4} \times 1\frac{3}{8}$ " notch along each edge of the subchassis' front end.

TRAP THE OUTRIGGER ARMS



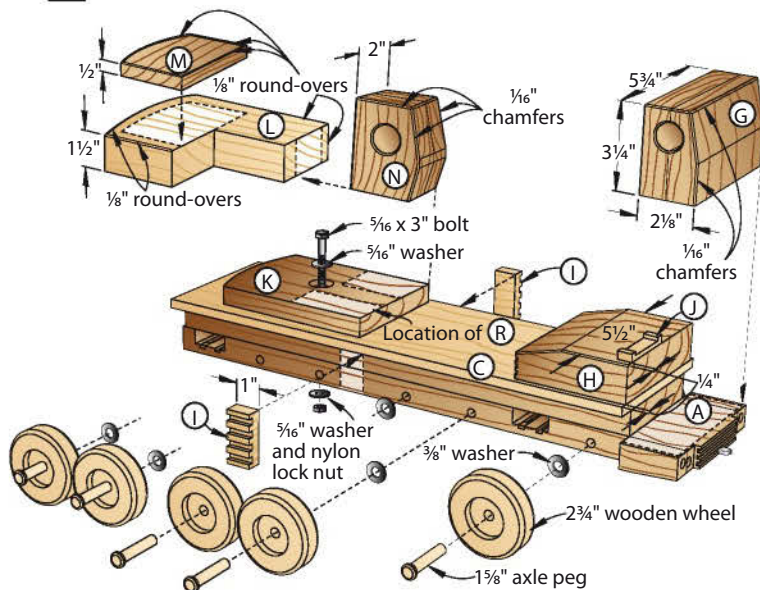
Go easy on the glue near the dadoes to avoid squeeze-out that would adhere in place the outrigger arms (D). Align the chassis as shown.

BOTH HANDS ON DECK

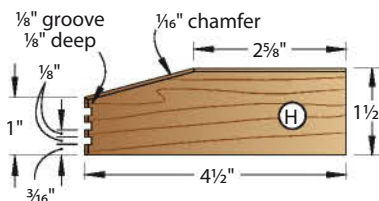


Check for equal measurements on both sides to center the deck (C) on the chassis (B). Register the deck against the back face of the cab (G) as well.

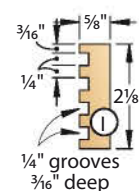
4 CHASSIS EXPLODED VIEW



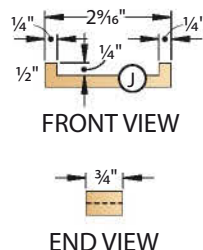
4a ENGINE COVER



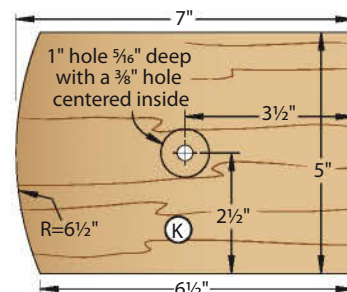
4b STEPS



4c BOOM CRADLE



4d TURNTABLE



3 After the glue dries, round over all four edges of the piston-cylinder blank [Photo J]. Cut off the square ends of the blank to bring the piston cylinder (P) to final length of 8".

4 As you did with the collars (O), follow the **Piston-End Pattern** to shape two piston ends (Q). Drill the 3/16" hole where shown and the 1/4" hole centered on an end. Glue a 1/2" length of dowel into one piston end and a 6" length into the other [Drawing 5].

5 Cut the boom cradle base (R) to size and finish-sand it. Cut two 1 5/8" lengths of 10-32 threaded rod, sandwich each piston end (Q) between two collars (O), and secure the threaded rods with acorn nuts [Drawing 5]. Glue the O/Q assembly with the 1/2" length of dowel to the boom cradle base.

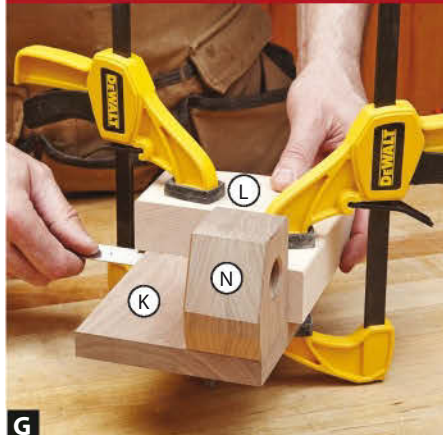
6 Following the **Boom Cradle Side Pattern**, cut the boom cradle sides (S) to shape and drill the holes where shown. Glue them to the edges of the boom cradle base (R), making sure they are perpendicular to the base [Drawing 7].

7 After the glue dries, glue the boom cradle (O/Q/R/S) to the turntable (K), nestled in the notch of the counterweight (L).

Make a big ol' boom

1 Cut the boom sides (T, V, X) and tops/bottoms (U, W, Y) to size [Materials List]. Drill and chamfer the 1" and 3/4" holes in the lower and middle boom sides [Drawing 6], and drill the 3/8" holes in the upper boom sides. Drill a 3/8" hole 1/8" deep on the inside face of only one

ASSEMBLE THE TURNTABLE



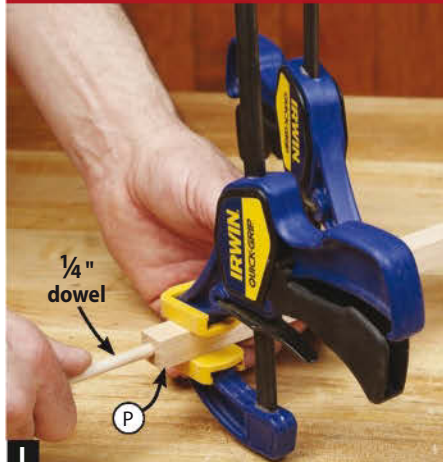
Center the counterweight (L) on the turntable (K) and against the rear of the boom cab (N). Double-check its positioning after tightening the clamps.

ROUT A CYLINDER'S INTERIOR



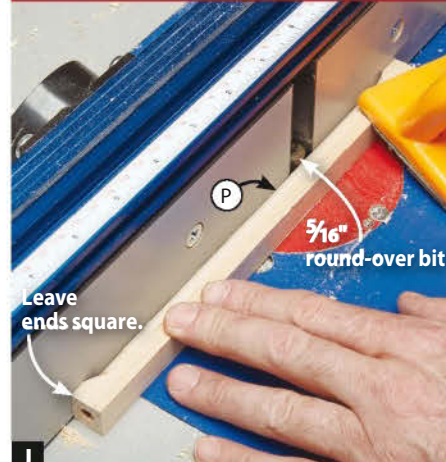
After routing one edge, flip the piston-cylinder blank end for end and keep the same face against the fence when routing the second edge.

CLEAN AND ALIGN THE INTERIOR



After clamping together the piston-cylinder (P) halves, check the alignment and clear any squeeze-out by running a waxed 1/4" dowel through the hole.

ROUT THE CYLINDER ROUND



Leave 1/2" on each end of the piston-cylinder (P) blank unrouted to provide stable flat surfaces while routing the edges to create a cylinder.

lower and one middle boom side [Drawing 6], then drill a $\frac{3}{16}$ " hole centered in each $\frac{3}{8}$ " hole. Epoxy a 10-32 nut into these $\frac{3}{8}$ " holes.

Quick Tip! Use a toothpick or finish nail to dab the epoxy around the perimeter of the $\frac{3}{8}$ " hole. Make sure no epoxy gets into the threads of the nut or the $\frac{3}{16}$ " hole.

2 Cut the boom filler (Z) to size leaving both ends square, and a spacer the same size as the filler. Assemble the

lower boom [Photos K, L]. Cut spacers to help assemble the middle and upper booms, but don't glue them in place. Drill the $\frac{1}{4}$ " hole in the lower boom (T/U/Z) [Drawing 6].

3 After the glue dries, check the fit of the three booms: X/Y within V/W, and V/W within T/U/Z. Each should slide freely without friction. Sand or plane surfaces as needed; then, finish-sand the booms.

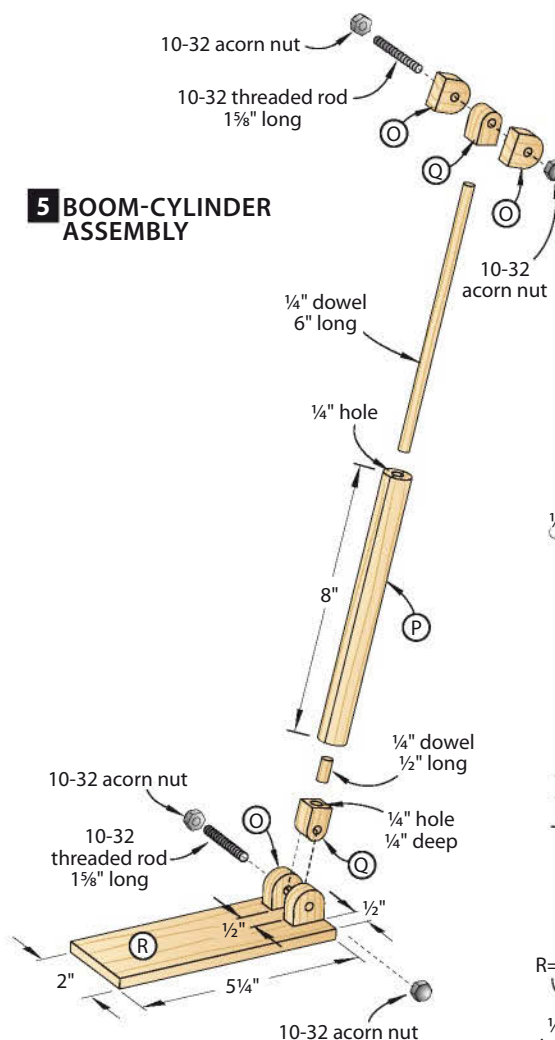
4 Retrieve the piston assembly with the 6" length of dowel and glue it to the lower boom (T/U/Z) [Photo M]. Bandsaw the radii on the lower end of the lower boom and upper end of the upper boom (X/Y) [Drawing 6]. At the tablesaw, cut a $\frac{1}{4}$ "-deep kerf centered on the top end of the upper boom to guide the cable [Drawing 7]. Glue the four

remaining collars (O) in place centered on the width of each boom.

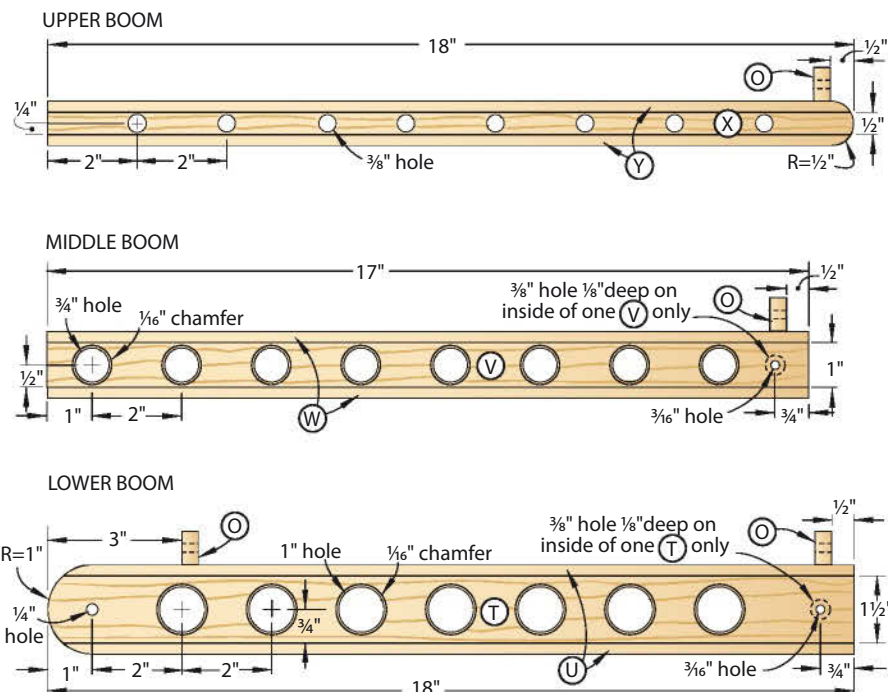
5 Position the closed end of the lower boom (O/T/U/Z) between the boom cradle sides (S) and slide the piston into the piston cylinder (P). Secure the lower boom with a $\frac{1}{4} \times 3$ " hexhead bolt and nylon lock nut [Drawing 7].

6 Cut three $\frac{3}{8}$ " lengths of $\frac{5}{8}$ " dowel. In one, drill a $\frac{1}{4}$ " hole $\frac{3}{16}$ " deep and glue in a $3\frac{3}{8}$ "-long dowel. Save this for the crank assembly later. Make knobs from the two remaining $\frac{5}{8}$ " dowels by drilling a $\frac{3}{16}$ " centered hole $\frac{1}{4}$ " deep in each one and securing a $\frac{5}{8}$ " length of 10-32 threaded rod in each hole with epoxy [Drawing 7a]. After the epoxy cures, thread these knobs into the nuts epoxied into the lower and middle booms. After the crane is completed, snug the knobs to lock the middle and upper booms (O/V/W, O/X/Y) in position.

5 BOOM-CYLINDER ASSEMBLY



6 BOOM ARMS (Side views)



Build the whole crew!

Purchase plans and kits for these companion projects at woodmagazine.com/cgtoys.

Pour it on with the concrete truck (issue 224, March 2014).

Giv (iss Sep 2008) a spin on its rais low buc a cr



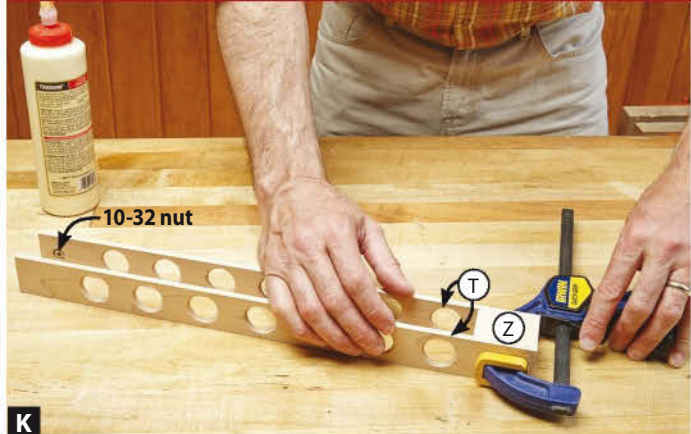
Load and spin with the skid loader (issue 211, May 2012).



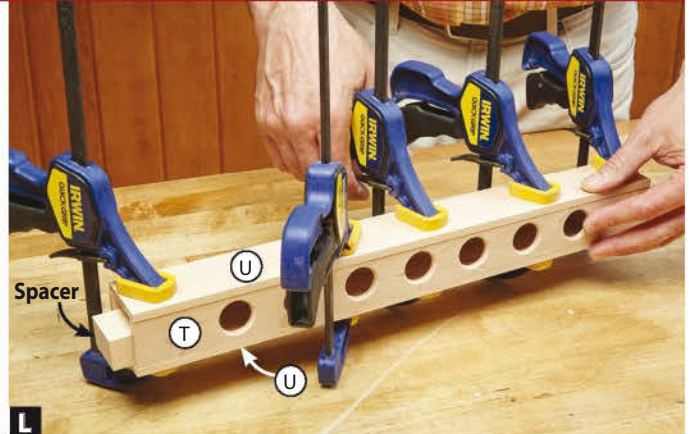
Reach out and scoop with the excavator (issue 194, November 2009).

For heavy hauling, fill the dump truck (issue 215, November 2012).

ASSEMBLE THE LOWER BOOM



K Glue and clamp the boom filler (Z) between the lower boom sides (T), flush at the edges and one end. Make sure the 10-32 nut in the lower boom side is at the opposite end. After the glue grabs, glue the lower boom top and bottom (U) to the sides, using the spacer to help maintain the spacing between the sides.



Crank it up

1 Following the **Crank Pattern**, cut and sand the crank (AA) to shape. Drill stopped holes on opposite faces of the crank. Glue a $1\frac{3}{8}$ " length of dowel into one of the holes [Drawing 7].

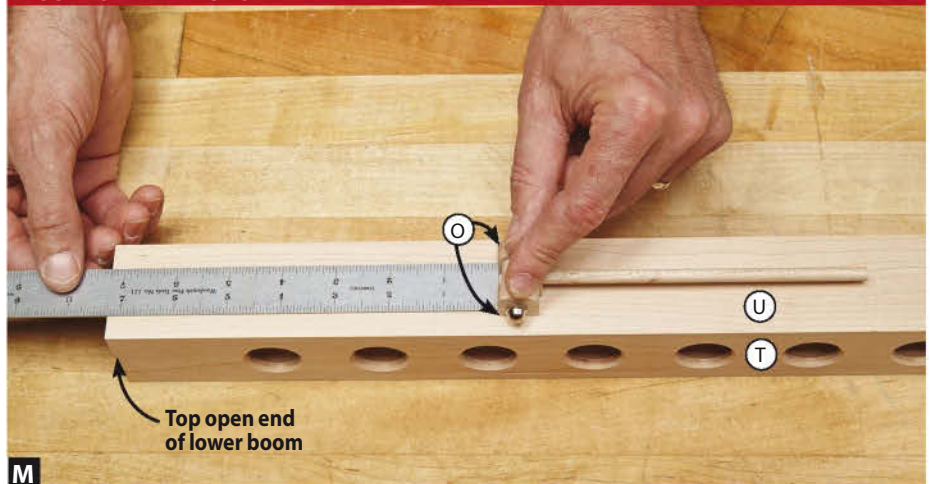
2 To assemble the crank mechanism, retrieve the knob made in **Step 6** above and insert it through a boom cradle side (S) [Drawing 7]. Slide on a $\frac{3}{8} \times .78$ " compression spring, a $1\frac{1}{8} \times \frac{7}{8}$ " wood spool, and a second spring before passing the dowel through the opposite boom cradle side. Glue the crank (AA) to the end of the dowel.

Quick Tip! If the spool spins on the dowel, secure it with a small screw or brad.

3 Spray-adhere the **Block Pattern** to a $\frac{1}{2}$ "-thick walnut blank, cut it to shape, and drill holes centered in the ends where shown. Screw a #212 screw eye in the top [Drawing 7]. Grind off the point from an 8d finish nail and bend the nail into a J to create the hook. Epoxy it in the bottom of the block (BB).

4 Remove all of the hardware except that which is epoxied in place, remove the booms from within each other, finish-sand any areas needing it, and apply a finish to all wood parts,

POSITION THE PISTON



M Apply glue to the collars (O) and adhere them to the bottom (U) of the lower boom, $7\frac{1}{4}$ " from the upper end, centered from side to side.

including the wheels. (We sprayed on three coats of aerosol satin lacquer.)

Note: Tape the ends of the axle pegs to preserve a clean glue surface. Extend and retract the outrigger arms (D) and the piston after each coat so the parts don't get stuck.

5 Reassemble the crane, using a dab of blue thread locker on each acorn nut. Secure the dowels of the outrigger

feet (E) assemblies in the outrigger arms (D) with threaded rod and acorn nuts [Drawing 3]. Place a $1\frac{1}{2}$ " nylon washer between the turntable (K) and deck (C) and secure the turntable assembly with a washer and lock nut [Drawing 4]. Twist the lock nut just enough to steady the turntable, yet allow it to rotate freely.

6 Tie the end of a 12'-long string around the spool, and feed the free



Move earth with the bulldozer (issue 199, September 2010).

Put the scraper to work (issue 219, July 2013).



Rev up the motor grader (issue 208, November 2011).



The backhoe serves as the Swiss Army knife of the job site (issue 226, July 2014).



Scoop and dump with the end loader (issue 222, November 2013).



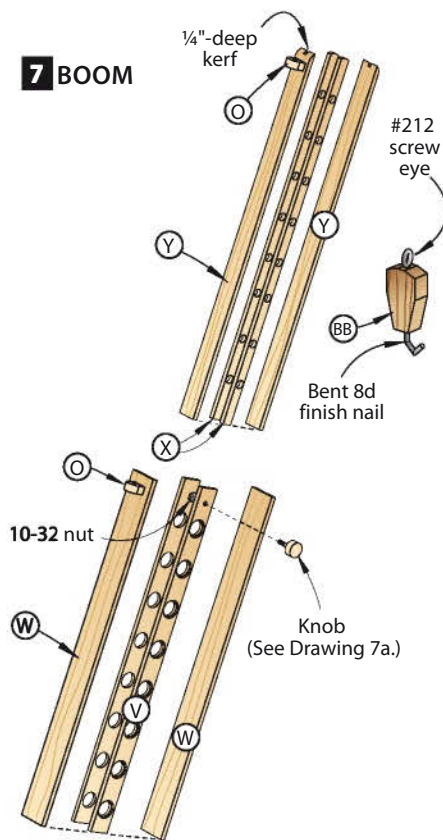
end through each of the collars (O) and the kerf in the end of the upper boom (O/X/Y). Tie the string to the screw eye in the block (BB) and wind the slack onto the spool. Drive a #212 screw eye into the lowest groove of the grille at the front of the subchassis (A), centered on its width. Secure the boom hook here when it's not hoisting mate-

rials. Insert each axle peg through a wheel and $\frac{3}{8}$ " washer, then apply a dab of glue before pressing them into the holes in the subchassis.

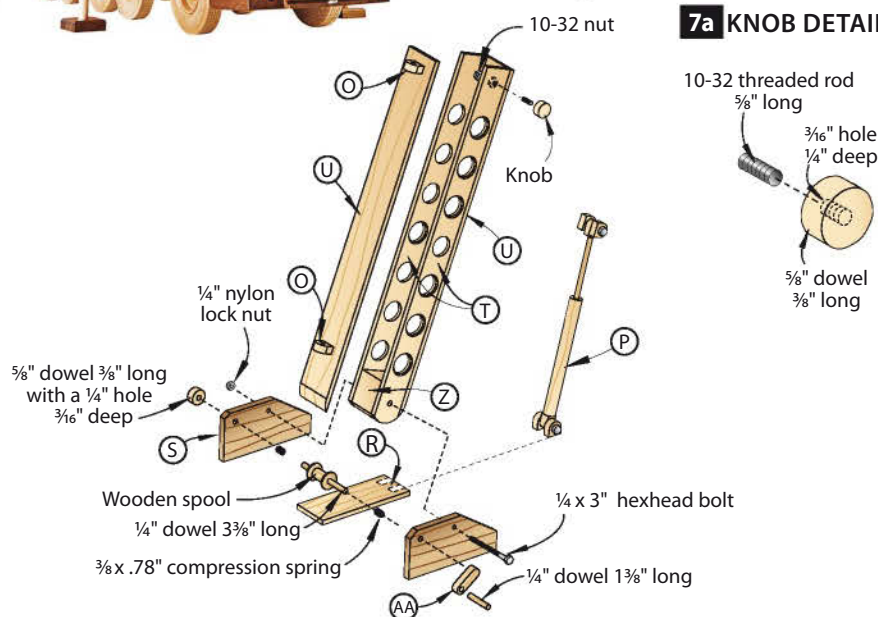
7 After the glue dries, grab your hard hat, plant those outriggers, and extend the boom. There's heavy lifting ahead. 🌲



7 BOOM



7a KNOB DETAIL



Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
Truck					
A* subchassis	1"	6"	22 $\frac{5}{8}$ "	W	1
B chassis	1"	4 $\frac{1}{2}$ "	20"	W	1
C deck	$\frac{3}{8}$ "	6"	20 $\frac{1}{8}$ "	M	1
D outrigger arms	$\frac{3}{4}$ "	$\frac{5}{8}$ "	5 $\frac{1}{4}$ "	M	4
E outrigger feet	$\frac{3}{8}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	W	4
F* outrigger stops	$\frac{1}{8}$ "	$\frac{1}{4}$ "	$\frac{3}{8}$ "	W	8
G cab	2 $\frac{1}{8}$ "	5 $\frac{3}{4}$ "	3 $\frac{1}{4}$ "	LW	1
H engine cover	1 $\frac{1}{2}$ "	5 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "	W	1
I* steps	$\frac{5}{8}$ "	2 $\frac{1}{8}$ "	1"	M	2
J* boom cradle	$\frac{1}{2}$ "	$\frac{3}{4}$ "	2 $\frac{9}{16}$ "	M	1
Crane turntable					
K turntable	$\frac{3}{4}$ "	5"	7"	W	1
L counterweight	1 $\frac{1}{2}$ "	5 $\frac{3}{4}$ "	6"	M	1
M weight block	$\frac{1}{2}$ "	2 $\frac{1}{2}$ "	5"	W	1
N boom cab	2"	2 $\frac{1}{2}$ "	3"	LW	1
Boom					
O* collars	$\frac{3}{8}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	M	8
P* piston cylinder	$\frac{5}{8}$ "	diam.	8"	M	1
Q piston ends	$\frac{1}{2}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	M	2
R boom cradle base	$\frac{1}{4}$ "	2"	5 $\frac{1}{4}$ "	M	1
S boom cradle sides	$\frac{3}{8}$ "	2 $\frac{1}{2}$ "	5 $\frac{1}{4}$ "	W	2
T lower boom sides	$\frac{1}{4}$ "	1 $\frac{1}{2}$ "	18"	M	2
U lower boom top/ bottom	$\frac{1}{4}$ "	2"	18"	M	2
V middle boom sides	$\frac{1}{4}$ "	1"	17"	M	2
W middle boom top/ bottom	$\frac{1}{4}$ "	1 $\frac{1}{2}$ "	17"	M	2
X upper boom sides	$\frac{1}{4}$ "	$\frac{1}{2}$ "	18"	M	2
Y upper boom top/ bottom	$\frac{1}{4}$ "	1"	18"	M	2
Z boom filler	1 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "	2"	M	1
AA crank	$\frac{3}{8}$ "	$\frac{1}{2}$ "	1 $\frac{1}{2}$ "	M	1
BB block	$\frac{1}{2}$ "	1"	1 $\frac{3}{4}$ "	W	1

*Parts initially cut oversize. See the instructions.

Materials key: M=maple, W=walnut, LW=laminate walnut.

Supplies: Spray adhesive, epoxy, $\frac{1}{4}$ " dowel 16" long, $\frac{3}{8}$ " maple dowel 12" long, $\frac{3}{8}$ " maple dowel 6" long, blue thread locker.

Blade and bits: Dado blade; $\frac{1}{8}$ ", $\frac{3}{16}$ " round-over, 45° chamfer, $\frac{1}{8}$ " core-box router bits; $\frac{1}{8}$ ", $\frac{3}{16}$ ", $\frac{1}{4}$ ", $\frac{5}{16}$ ", $\frac{1}{32}$ ", $\frac{3}{8}$ ", $\frac{3}{4}$ ", 1" drill bits.

Source

Kit: The kit contains the wheels, axle pegs, string, spool, hardware, and dowels (no lumber) needed to build one crane. \$29.95+shipping. Kit no. RS-01045, 888-636-4478, woodmagazine.com/truckcrane.

More Resources

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Greene & Greene Wall Clock

Start with the sides

1 Cut the sides (A) to size [Materials List]. Using a $\frac{1}{4}$ " dado blade in your tablesaw, cut two grooves on the inside face [Drawing 1]. Without adjusting the blade, reposition the tablesaw's fence to cut the centered $1\frac{1}{4}$ " groove on the opposite face [Photo A]. After making the two outside grooves, clear the waste between them by incrementally moving the fence over. Then, clean up the groove [Photo B].

2 Rout $\frac{1}{8}$ " round-overs on the sides (A) where shown [Drawing 1]. For the inside edges of the centered groove, use sandpaper to make the round-overs, as the groove is too shallow to accommodate most router bits.

3 To cut the square holes for the plugs (O) [Drawing 1], use a $\frac{1}{4}$ " square hole punch [Sources] or a mortiser. If you're using the punch, first drill a $1\frac{3}{4}$ " hole $\frac{1}{4}$ " deep using a brad-point bit. Remove the bit from the drill and return it to the hole. Then, slide the punch over the bit, aligning the edges with the sides (A). Remove the bit and drive the punch $\frac{1}{4}$ " deep with a mallet [Photo C].

Quick Tip! To prevent cutting too deeply, mark the exact depth on the punch using a permanent marker.

A PERFECTLY CENTERED GROOVE

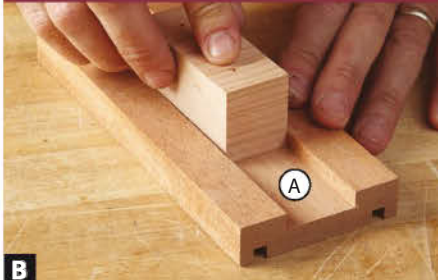


When cutting the wide groove in the sides (A), set the fence $\frac{7}{8}$ " from the blade, make a cut, flip the piece around, and make the second cut.

Constructed of gorgeous mahogany and featuring tasteful faux ebony accents, this clock will look right at home on any wall.

Overall dimensions: $12\frac{1}{4}$ " W x 5" D x $13\frac{3}{4}$ " H

SMOOTH THE GROOVE

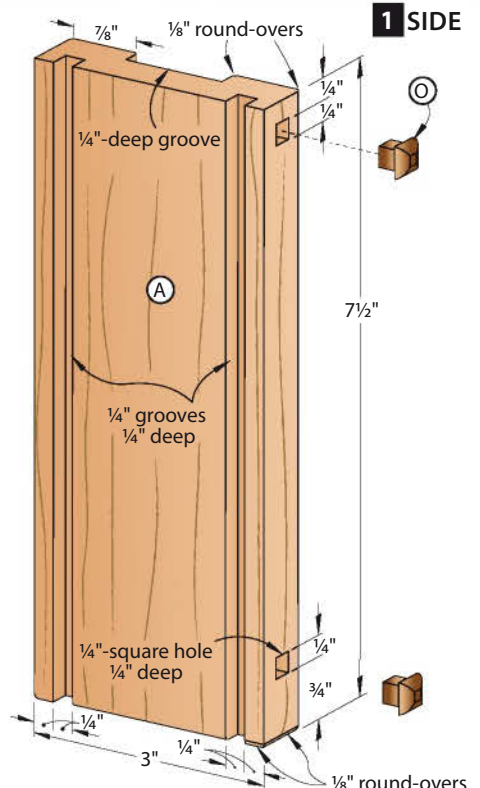


To clean up any saw marks in the wide grooves, apply self-adhesive sandpaper to a sanding block and make a few passes.

BACK UP YOUR PUNCH



To avoid damaging the sides (A) when using the square punch, insert scrap into and under the grooves for added support.

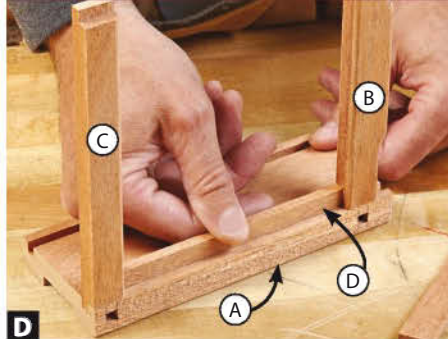


Now, fashion the frame

1 From $\frac{1}{2}$ " stock, cut the bottom rails (B) and top rails (C) to size. Cut the $\frac{1}{4}$ " rabbets in the ends [Drawing 2]. Spray-adhere a copy of the **Bottom Rail Pattern** from the *WOOD Patterns*® insert to each bottom rail. Cut and sand them to shape, and then remove the pattern. Cut a $\frac{1}{8}$ " groove $\frac{1}{4}$ " deep in one of the bottom rails and a $\frac{3}{8}$ "-deep groove in one of the top rails [Drawing 2]. Mark these two pieces for the back frame. Rout $\frac{1}{8}$ " round-overs on the lower edge of the back bottom rail [Drawing 2] and where shown on the front top and bottom rails [Drawing 3].

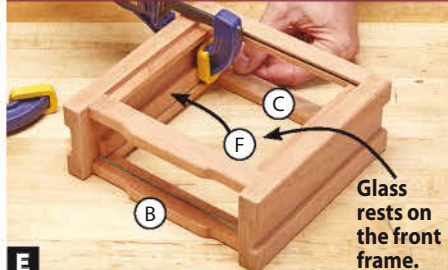
2 From $\frac{1}{4}$ " stock, cut the stiles (D) to size, and the fillers (E) $\frac{1}{2}$ " overlong. Place a top rail (C) into a side's (A) $\frac{1}{4}$ " groove, flush with the top, followed by a stile below the top rail, a bottom rail (B), and a filler [Photo D]. Trim the filler flush with the side's end. Repeat for the other side and the remaining frame. When you're satisfied with the fit of the parts, glue one end of each rail, the stiles, and the fillers in place on one side's grooves. After the glue dries, apply glue to the rabbets on the exposed ends of the rails, the remaining stiles, and the fillers, and insert them into the grooves on the opposite side.

DO A DRY FIT, FIRST



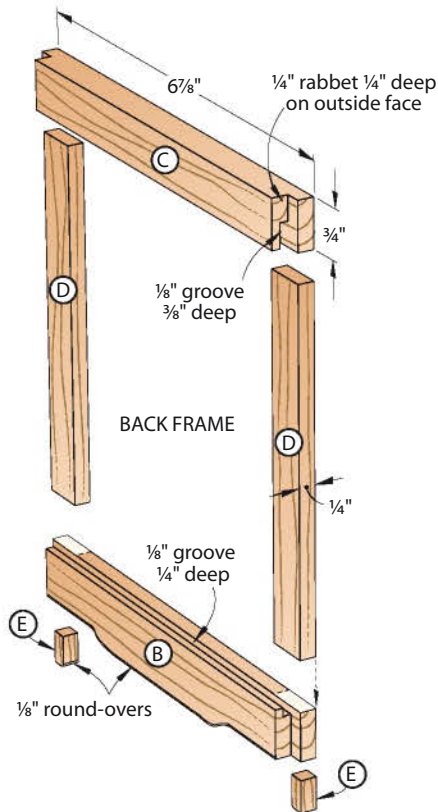
D Ensure a perfect assembly by checking, without glue, the fit of the bottom rail (B), top rail (C), stile (D), and filler (E) in the side (A).

LOCK IN THE GLASS



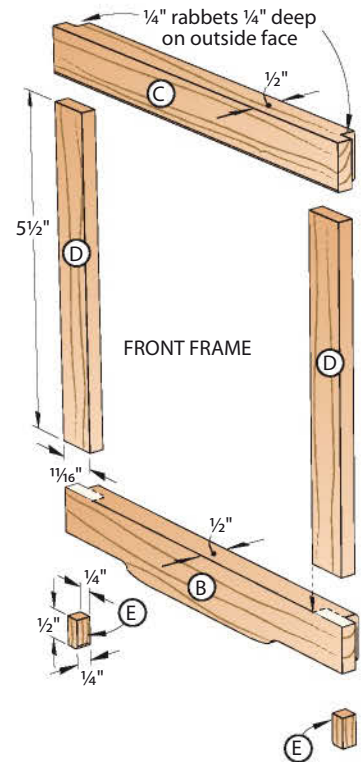
E Use a pair of one-handed bar clamps to secure each glass stop (F) snugly atop the glass, flush with the case's top edge.

3 Cut the glass stops (F) to size. With the case facedown on your bench, place the glass on the back face of the front frame assembly (B-D). Glue the glass stops in place [Photo E] and remove the glass.

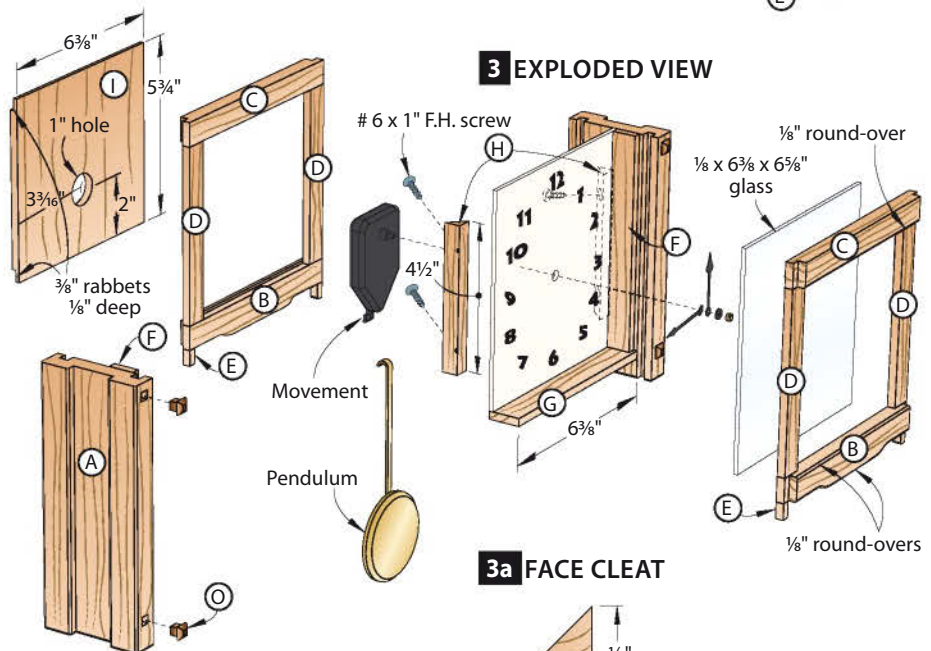


4 Cut the bottom (G) and face cleats (H) to size [Drawings 3 and 3a]. Set them aside for later. Then, cut the back (I) to size. Cut $\frac{3}{8}$ " rabbets $\frac{1}{8}$ " deep in the ends of the back, and drill a 1" access hole where shown. Sand the back using 220-grit sandpaper.

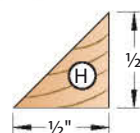
2 FRAME ASSEMBLIES (VIEWED FROM BACK)

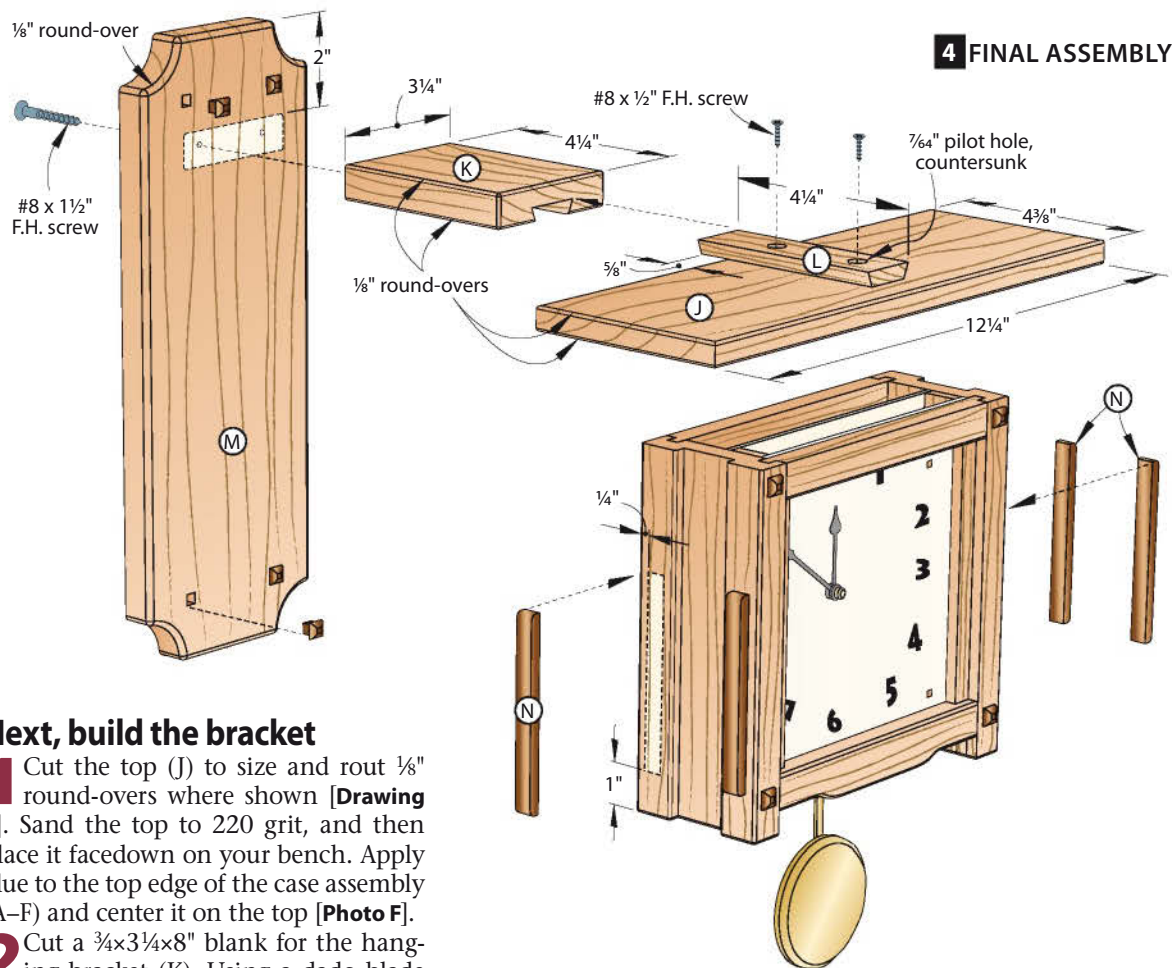


3 EXPLODED VIEW



3a FACE CLEAT





Next, build the bracket

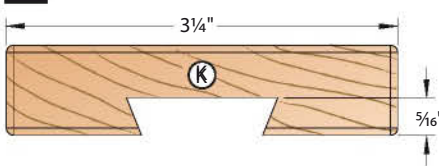
1 Cut the top (J) to size and rout $\frac{1}{8}$ " round-overs where shown [Drawing 4]. Sand the top to 220 grit, and then place it facedown on your bench. Apply glue to the top edge of the case assembly (A–F) and center it on the top [Photo F].

2 Cut a $\frac{3}{4} \times 3\frac{1}{4} \times 8$ " blank for the hanging bracket (K). Using a dado blade raised to $\frac{5}{16}$ ", cut a $\frac{3}{4}$ "-wide, centered straight groove the length of the blank. Then, mount a 14° dovetail bit in your router table and raise it to $\frac{5}{16}$ ". Use it to turn the straight groove into a dovetail [Photo G]. Leave the bit at the same height for the next operation. Cut the blank to final length and rout $\frac{1}{8}$ " round-overs where shown [Drawing 4].

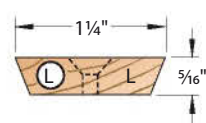
3 From $\frac{5}{16}$ " stock, cut a $1\frac{1}{4} \times 8$ " blank for the dovetail key (L). At the router table, bevel the key's edges until it fits inside the hanging bracket's (K) dovetail groove [Photo H]. Cut the key to final length; then, center and screw the key to the top face of the top (J), with $\frac{5}{8}$ " of the dovetail key overhanging the back edge [Drawing 4].

4 Cut the wall mount (M) to size. Lay out, bandsaw, and sand the arcs in the four corners [Drawing 5]. Rout $\frac{1}{8}$ " round-overs where indicated. Using the same technique as before, cut the four square holes where shown. Mount a keyhole slot bit in your router table, position its fence $2\frac{1}{2}$ " from the center of the bit, and rout a $1\frac{1}{4}$ "-long slot in the wall mount's back face, starting 3" from the mount's top edge.

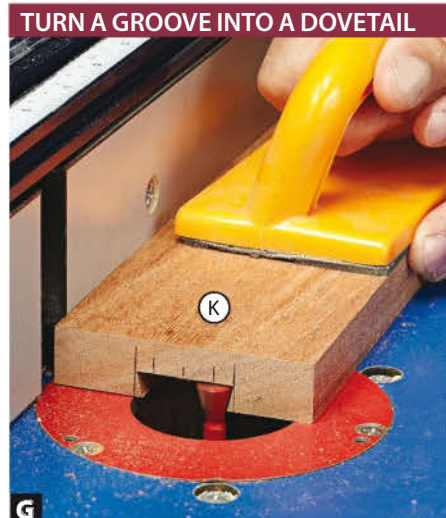
4a HANGING BRACKET



4b DOVETAIL KEY



F Capture glue squeeze-out for easy cleanup by outlining the location of the clock's case assembly (A–F) with painter's tape.



G Take light cuts in each side of the hanging bracket's (K) groove. Move the fence back between passes, sneaking up on the final width.

ROUT THE DOVETAIL KEY



H Adjust the router-table fence so just enough of the bit is revealed to angle the dovetail key's (L) edges. Check its fit in the hanging bracket (K) groove.

CREATE A CROWN



I Slightly round the end of the plug (O) blank on 120-grit sandpaper. Sand all four faces to create an even crown.

CUT THE PLUG CHEEKS



J Attach a stopblock to a miter-gauge extension $\frac{1}{8}$ " from the blade. Cut cheeks on each face of the plug (O) blank.

Add the final touches

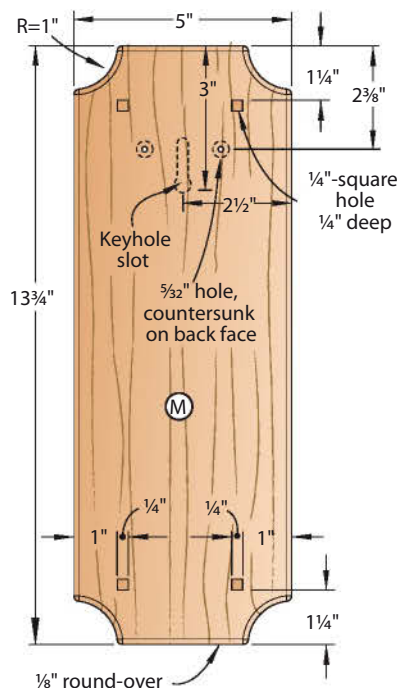
1 Sand all the parts to 220 grit. Cut two $\frac{1}{4} \times \frac{3}{8} \times 12$ " blanks for the side accents (N). Apply the **Side Accent Patterns** to the edge of each blank; then, cut and sand the accents to shape. Ease the edges with sandpaper.

Quick Tip! Use a black permanent marker to darken the accents' exposed faces. It's easier to apply than a dark stain and gives an ebony-like appearance without obscuring the wood's grain.

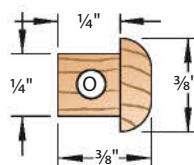
Glue the side accents to the sides (A) [Drawing 4].

2 Cut a $\frac{3}{8} \times \frac{3}{8} \times 12$ " blank for the plugs (O). With a $\frac{1}{4}$ " dado blade in your tablesaw set to a depth of $\frac{1}{16}$ ", cut a $\frac{1}{4}$ "-long test tenon on one end by making a pass on each face. Check the fit of the tenon in one of the plug holes. If it fits, cut the test tenon off, then round the end of the blank on sandpaper [Photo I, Drawing 6]. Cut the cheeks of the tenon [Photo J], then handsaw the plug from the blank. Repeat to make eight plugs. Color the top of each plug with a permanent marker before gluing them in place.

5 WALL MOUNT



6 PLUG DETAIL



3 Tape off the back face of the front bottom rail (B) where the bottom (G) will be glued. Apply a finish. We applied three coats of clear matte-finish spray shellac, sanding between coats with 320-grit sandpaper. Slide the glass in front of the glass stops (F). Install the clock movement and hands on the clock face, and then place this assembly into the clock's case. Secure the clock face with the face cleats (H), mounted using #6x1" screws (without glue, so you can access the movement and glass if necessary). Glue the bottom into place. Mount the clock on the wall, sit back, and enjoy your craftsmanship! 🌳

Produced by **Nate Granzow** with **Kevin Boyle**
Project design: **John and Mark Schlabaugh**
Illustrations: **Roxanne LeMoine** and **Lorna Johnson**

Materials List

Part	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A sides	$\frac{3}{4}$ "	3"	7 $\frac{1}{2}$ "	M	2
B bottom rails	$\frac{1}{2}$ "	1"	6 $\frac{7}{8}$ "	M	2
C top rails	$\frac{1}{2}$ "	$\frac{3}{4}$ "	6 $\frac{7}{8}$ "	M	2
D stiles	$\frac{1}{4}$ "	1 $\frac{1}{16}$ "	5 $\frac{1}{2}$ "	M	4
E* fillers	$\frac{1}{4}$ "	$\frac{1}{4}$ "	$\frac{1}{2}$ "	M	4
F glass stops	$\frac{1}{4}$ "	$\frac{3}{4}$ "	6 $\frac{7}{8}$ "	M	2
G bottom	$\frac{1}{4}$ "	1"	6 $\frac{7}{8}$ "	M	1
H face cleats	$\frac{1}{2}$ "	$\frac{1}{2}$ "	4 $\frac{1}{2}$ "	M	2
I back	$\frac{1}{4}$ "	6 $\frac{3}{8}$ "	5 $\frac{3}{4}$ "	M	1
J top	$\frac{1}{2}$ "	4 $\frac{3}{8}$ "	12 $\frac{1}{4}$ "	M	1
K* hanging bracket	$\frac{3}{4}$ "	3 $\frac{1}{4}$ "	4 $\frac{1}{4}$ "	M	1
L* dovetail key	$\frac{5}{16}$ "	1 $\frac{1}{4}$ "	4 $\frac{1}{4}$ "	M	1
M wall mount	$\frac{3}{4}$ "	5"	13 $\frac{3}{4}$ "	M	1
N* side accents	$\frac{1}{4}$ "	$\frac{3}{8}$ "	4"	M	4
O* plugs	$\frac{3}{8}$ "	$\frac{3}{8}$ "	$\frac{3}{8}$ "	M	8

*Parts initially cut oversize. See the instructions.

Material key: M—mahogany.

Supplies: #6x1" flathead screws (4), #8x $\frac{1}{2}$ " flathead screws (2), #8x1 $\frac{1}{2}$ " flathead screws (2), $\frac{1}{8} \times 6 \frac{3}{8} \times 6 \frac{3}{8}$ " glass. **Blade and bits:** Dado set; $\frac{1}{32}$ " brad-point bit, 1" Forstner bit; $\frac{1}{8}$ " round-over, 14° dovetail, keyhole slot router bits.

Sources:

$\frac{1}{4}$ " square hole punch, \$29.50, 50K59.04, Lee Valley, 800-871-8158, leevalley.com.

Clock movement and face, RS-01044

woodmagazine.com/greenclockkit.

More Resources

► Designers John and Mark Schlabaugh maintain a family tradition of fine woodworking with pieces selling in prestigious galleries nationwide. Learn more at woodmagazine.com/schlabaugh.

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Get the glue out—sometimes

No matter how careful I am, wood glue sometimes gets on my clothes when working in the shop, and it doesn't always come out in the wash. How can I get it out?

—Tim Kirkpatrick, Mason, Tenn.

Wood glues that aren't water-resistant, such as hide glue or Titebond original yellow glue (red label), will wash out, even after they dry. Tim. If residual

staining lingers, try soaking the fabric in a 50-50 mix of vinegar and water, then launder as usual.

On the other hand, water-resistant and waterproof glues, such as Titebond II, Titebond III, and polyurethane glues, will likely not wash out once dry, so rinse these glues out of fabric or carpet *before* the adhesive dries. If it dries before you get to it, attack it with a hot steam iron and stiff-bristle brush.



We smeared eight commonly used woodworking glues onto cotton-duck work pants and let them dry before laundering.



Four of the eight glues—all water-resistant or waterproof varieties—did not come out during a normal washing-machine cycle.

Situate, then activate, your random-orbit sander

When using a random-orbit sander, should I power it up and then place it on the workpiece, or switch it on after it's on the surface to be sanded? I've seen people do it both ways.

—Robert Mobley, Van Nuys, Calif.

For best results, Robert, start with the sander in hand and flat on the workpiece; then turn it on. When done, lift it off before powering down. An easy way to remember the rule: "Start on, stop off."

Here's why: A random-orbit sander's pad begins spinning when you engage the motor, but it doesn't oscillate in small orbits until you apply downforce. (The weight of the sander and your hand resting on it provide sufficient force—don't push down.) But if the disc is already spinning at full speed when the abrasive contacts the wood and begins its oscillating action, the sander can abruptly grab, skip, or jump, especially with 120-grit or coarser sanding discs, scratching or gouging the workpiece. That then requires more extensive sanding or scraping to remove. Starting the sander on the workpiece keeps the spin under control.

Stopping the sander while it's in contact with the wood would be like slamming on a car's brakes on pavement, except in this case the skid marks would be pigtail sanding swirls on your workpiece.



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Ask WOOD

You can turn MDF, but better options exist

Before I turn a few vases from some prized—and pricey—wood, I'd like to experiment with designs on prototypes. Can I turn these prototypes from less-expensive, glued-up MDF?

—Paul Bianchina, Bend, Ore.

WOOD® turning expert Brian Simmons says there's nothing wrong with turning medium-density fiberboard, Paul, but you should be aware of two caveats. First, MDF is manufactured from fine wood pulp and lots of glue, so turning it creates loads of fine dust, as shown below, especially as you take lighter cuts during final shaping. Wear a respirator to avoid breathing the dust. Second, all that glue in MDF dulls high-speed-steel turning tools much quicker than does regular wood. So if you go this route, use carbide-insert tools to avoid sharpening so often.

For a less-dusty and -dulling test material, make your prototype blanks from a low-cost solid-wood species, such as pine or poplar. Your costs should be about the same, and your shop air much cleaner.



So you'll never say "This tool was a steal!"

I received a router as a gift, and it has a 3"-long black plastic "pod" near the end of the power cord. What is it? If it's not important, can I remove it without damaging the router?

—Allan Hawley, Wappapello, Mo.

We checked with several power-tool manufacturers, Allan, and it turns out that pod is simply an anti-theft device that deactivates when scanned at a store's checkout register. It serves no other purpose, and you can safely remove it if you wish. But be warned: It won't come off easily even after removing the screws because it has internal snap connectors. One manufacturer suggested busting it with a hammer; just be sure to avoid damaging the cord.



Anti-theft device



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Automate your dust-collector network with a “green” thumb

Because I make my living through woodworking, I appreciate the time- and effort savings the automated dust-collection system from GrnGate brings to my shop. It automatically turns my dust collector on and off whenever I operate the machines hooked into the system. Although it has high-tech innards, you don't have to be a tech geek to install or operate it. Here's how it works:

First, connect the central control unit between the dust-collector plug and its electrical outlet, *below*. Next, add one of the provided automated 4" blast gates to

each duct leading to a machine, and connect each gate to the control unit with the included cables. Clip a sensor around each machine's power cord, *below right*—no splicing or electrical work needed—and connect its cable to the corresponding blast gate. That's it.

When you turn on a woodworking machine, the sensor detects the electrical current passing through the cord, opens the gear-driven blast gate, and activates the dust collector. I hooked this system up to my tablesaw, planer, and jointer, and it's worked perfectly from the get-go.

You can buy a GrnGate system for 110- or 220-volt (up to 3 hp) dust collectors. The starter kit outfits three machines; you can buy two extra blast gates, sensors, and required cables for \$195.

—Tested by Matt Seiler



Automated dust-collection system (GG1002A)

Performance	★★★★★
Price	Starter system with 3 gates \$599

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Tool-free blade changes make this a top utility knife

I use a utility knife frequently for everything from opening boxes of new tools to test, to marking dovetails and mortises, to various DIY wiring, plumbing, and other repair jobs around the house. And Milwaukee's 48-22-1910 side-slide knife is my favorite. The blade extends and retracts easily with a quick flick of the thumb, and you're less likely to accidentally retract it during use the way you can with top-slide knives.

The knife uses standard utility-knife blades, and has tool-free blade changes: Simply extend the blade, hold in the release button, and either flip the blade end for end or replace with a new one. You can also store up to five blades in the handle. Another nice feature: You can strip electrical wire up to 10-gauge in the slot near the front.

—Tested by Bob Hunter, Tools Editor



Utility knife (48-22-1910)

Performance ★★★★★

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continued on page 72

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Craftsman revamps sanders

With 10 new models over three categories, Craftsman has overhauled its portable power-sander lineup. Two new 5" random-orbit sanders (single speed and variable), two ¼-sheet sanders (single and variable speeds), one ½-sheet sander, and a detail sander with triangular-shaped pad give you lots of options for finish sanding. Four new belt sanders in three sizes help with rapid removal. Find them all at craftsman.com. 🌳



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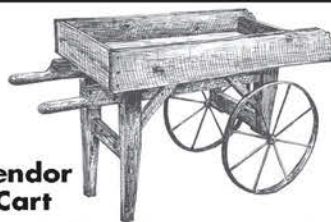


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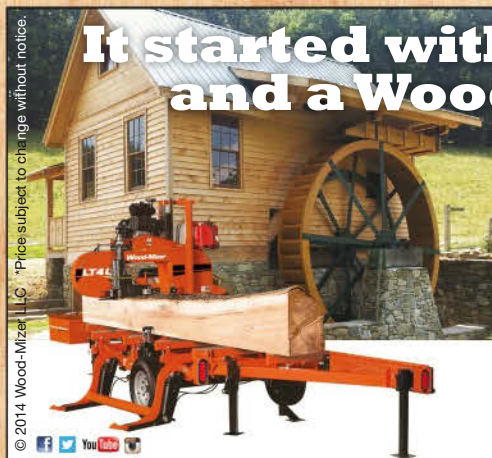
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What's Ahead

A glimpse inside the
December/January issue
(on sale November 25)



Finishing reclaimed wood

Aged lumber's patina is part of its charm.
We'll show you how to easily blend fresh-cut edges to
match what it took Mother Nature years to achieve.

Beer caddy

Cart some cold ones to
the patio...or use it as
a handy hardware or
tool tote.



Cherry dining table

Contemporary looks meet rugged
mortise-and-tenon construction
in this eye-catching piece that
matches the High-style Hutch on
page 42 of this issue.

Midi-lathes

We compare six 12"
variable-speed wood
spinners head-to-head.



Cribbage board

An elegant gift that requires only a few scraps to
build and some quality time spent at the drill press.



Doll-changing table

Little ones will love tending to their dolls'
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