

WORKSHOP UPGRADES: SPACE-SAVING ROUTER TABLE p.52 + **MOBILE BASES** p.72

ISSUE 291 OCTOBER 2023

10
TIPS FOR
MEASURING
SUCCESS
p.30

WOOD®

ALL ABOARD!

OUR LATEST TOY SERIES: THE TIMBER LINE EXPRESS
p.38

Cut with Confidence!
**SMALL-PARTS
CROSSCUT SLED**

p.34

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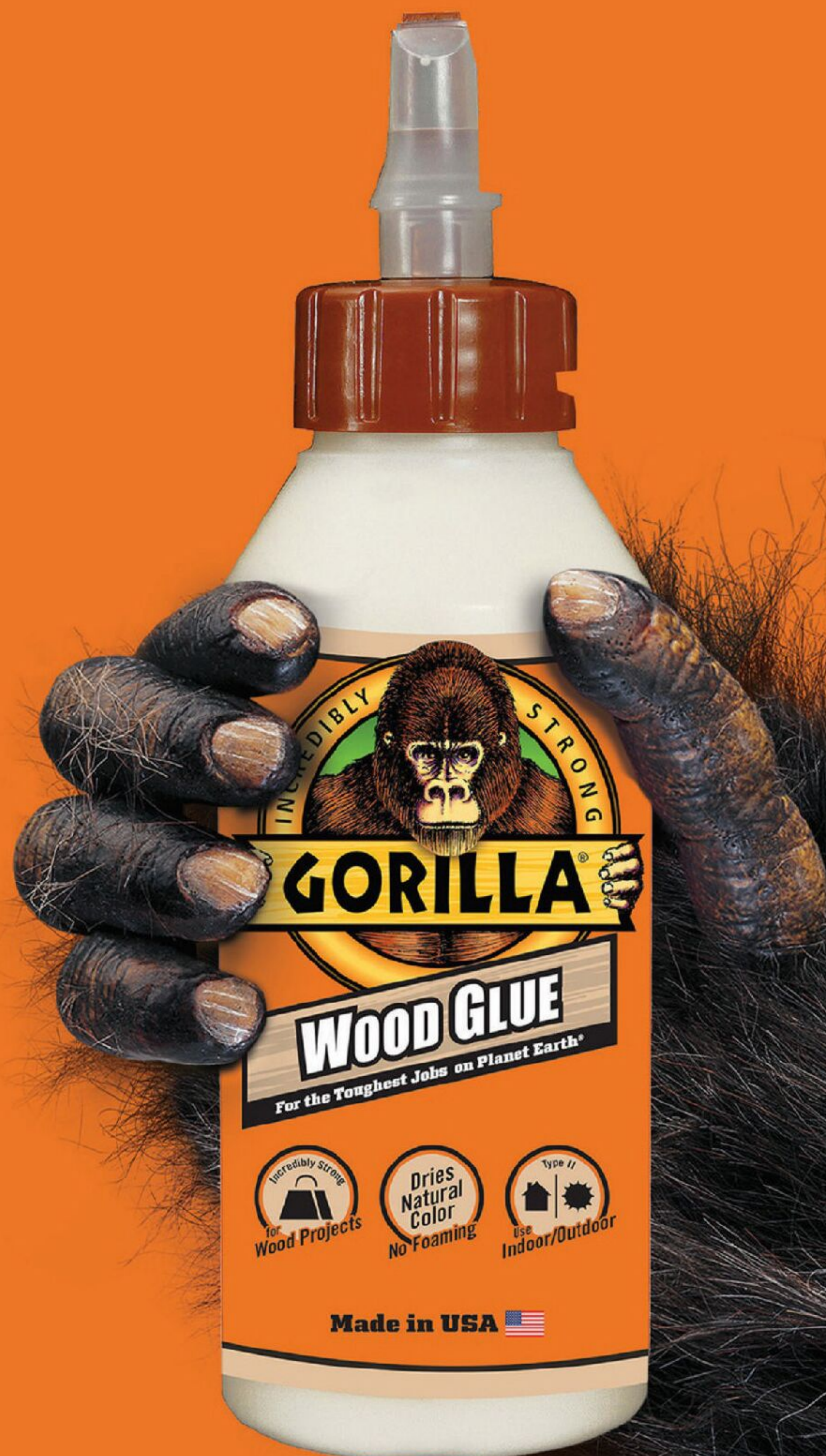
GREAT PLANS

- Arts & Crafts Cabinet p.22
- Portable Puzzle Tray p.58
- Chainsaw Carrying Case p.66





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KIDS AT HEART

WHETHER IT'S OVER TOOLS OR TOYS, WOODWORKERS CAN'T SUPPRESS THEIR CHILDLIKE ENTHUSIASM.

A recent office remodel has the WOOD® team cleaning and consolidating decades' worth of accretion in preparation for some updated digs. Aside from some interesting trips down memory lane, the thing that stood out to me most is how many toys our staff has on hand, both hand-made and store-bought.

Senior Designer Kevin Boyle is the proprietor of a miniature clown bike that has more surreptitious “double-dog-dare” mileage through the office hallways than we'd care for Human Resources to know about. Our latest version of a “team-building exercise” was to assemble a giant Lego set. And though she's tried to suppress it, somewhere there is video footage of Creative Director Jessica Eno doing an army crawl to retrieve foam darts in an all-out staff Nerf battle. In my office alone, I've gathered a skateboard that my son and I built, a wind-up dancing spider, a shop-made Spirograph, the aforementioned foam darts from every potted plant and file drawer, and the list goes on.

It stands out to visitors, too. Every horizontal surface in the office cube-ville we currently call home is covered in toys from our past issues, such as those from the *Construction-grade* and *Mil-spec* series. Woodworkers coming through our offices for tours will stand back and admire the gorgeous furniture projects on display in our gallery as if they are untouchable art, but they rush over and immediately start playing with the toys. It brings us much joy to see the instinctive childlike glee the toys bring out in fully grown men and women. Many of you have told us you build one for each of your children or grandchildren and an extra one to keep for yourselves.

That childlike glee seems to be especially concentrated in the woodworker community. It's what transforms our garages into Santa's workshops during the holiday season and makes us drop everything for a pinewood derby.

It's also what has us very excited for the “Classic Steam Engine” on page 38 which kicks off our *Timber Line Express* train series. Designer John Olson and the whole team have been working hard to bring you this first beautifully detailed locomotive and coal tender. But John has also made it easily expandable, so watch and wait for future cars, tracks, and accessories. Or better yet, don't. Harness that childlike glee and come up with your own.

We're just as excited to see your creations as we hope you are to see ours. Send pictures to woodmail@woodmagazine.com. 🌲

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WOOD®

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WOOD®

Issue No. 291 | October 2023

PLANS

- 22 DIVIDED-LIGHT CABINET**
Through-tenons and a gorgeous glass door adorn a classic Arts & Crafts cabinet.
- 34 SMALL-PARTS SLED**
A small-but-mighty tablesaw sled keeps your digits safely distant from the blade.
- 38 STEAM LOCOMOTIVE**
This classic steam engine is fueled by pure joy and your scrap bin. Build multiples.
- 48 TENDER & TRACK**
Stoke the imagination with a coal tender and complete the journey to playland with rails.
- 58 PUZZLE TRAY**
Make your puzzle portable and take back the table. Reversible drawers store or extend.
- 66 CHAINSAW CARRY-ALL**
You're the most organized lumberjack in the forest when you build this saw hauler.



ON THE COVER



38

Our new *Timber Line Express* train series pulls into the station with not one, but three, project plans: a Classic Steam Engine, a Coal Tender, and the Track to run it on.

TOOLS & TECHNIQUES

- 30 TOOLS THAT RULE**
Our shop relies on these simple, must-have tools for precision measuring.
- 52 ROUTER-TABLE INSERT**
Reclaim space by transforming your tablesaw wing into a full-featured router table.
- 56 EASY TEMPLATE ROUTING**
No-measure scrapwood templates make perfect-fit pattern routing a breeze.
- 62 PISTON-FIT DRAWERS**
A quiet, hydraulic hiss of air makes a loud noise about your ability to dial in a drawer's fit.
- 70 HINGE MORTISING**
Flush-mount fixed-pin utility hinges with a quick shop-made mortising jig.
- 72 TOOLS & MATERIALS**
These five mobile bases tackle a variety of tool-toting needs to put your shop on a roll.

52



16



DEPARTMENTS

1 TAKING MEASURE

The joy of toys

4 WOOD-WIDE WEB

We say the B-word.

6 YOUR VOICE

Next-level feedback

8 YOUR PROJECTS

A guitar table and more!

12 YOUR SHOP

Comforts of home in a small shop

16 ASK WOOD

Need a tpi tip for bandsaw blades?

18 SHOP TIPS

Easy keyhole jig and more!

76 WHAT'S AHEAD

A sneak peek at your next *WOOD*

62



58



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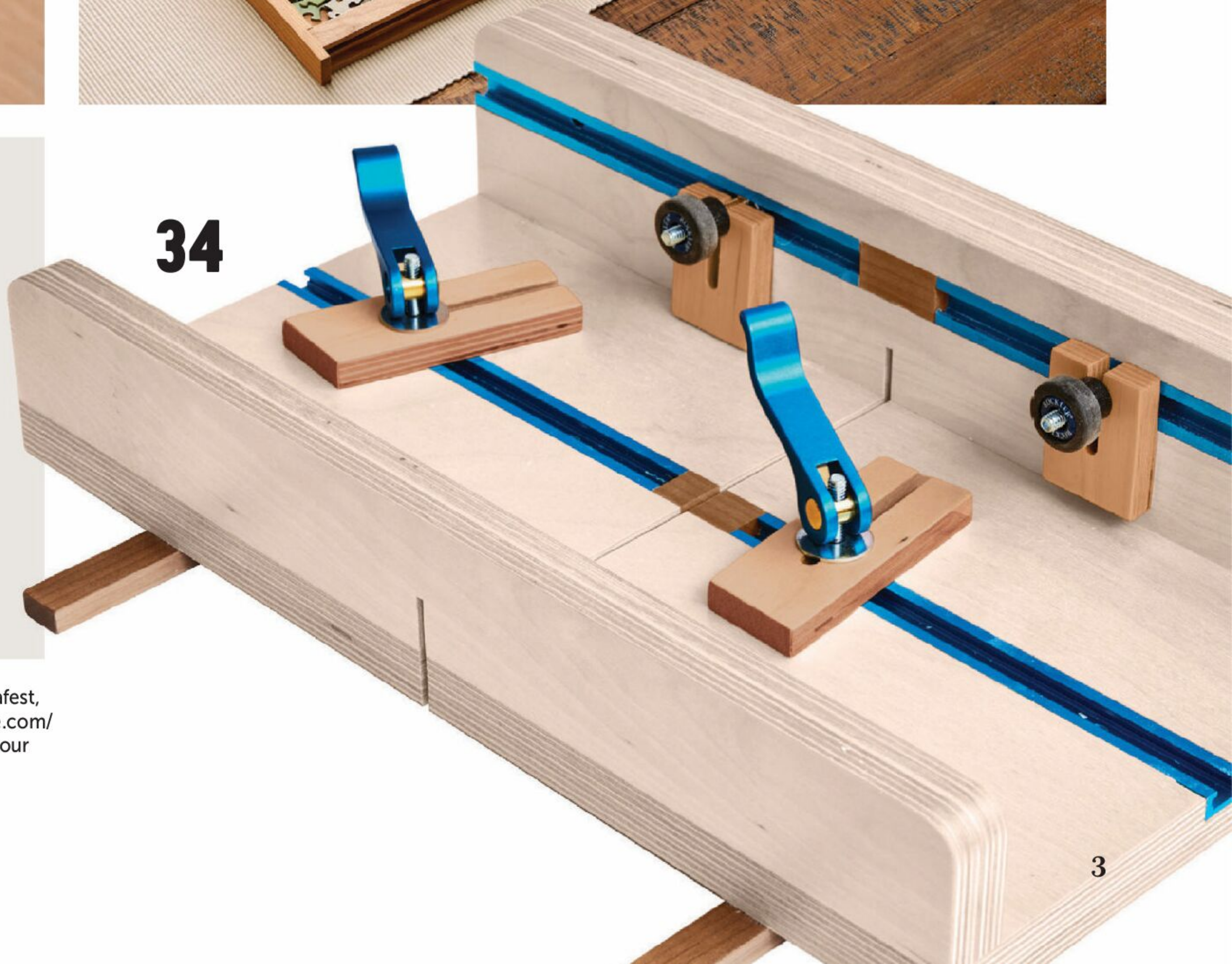
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34



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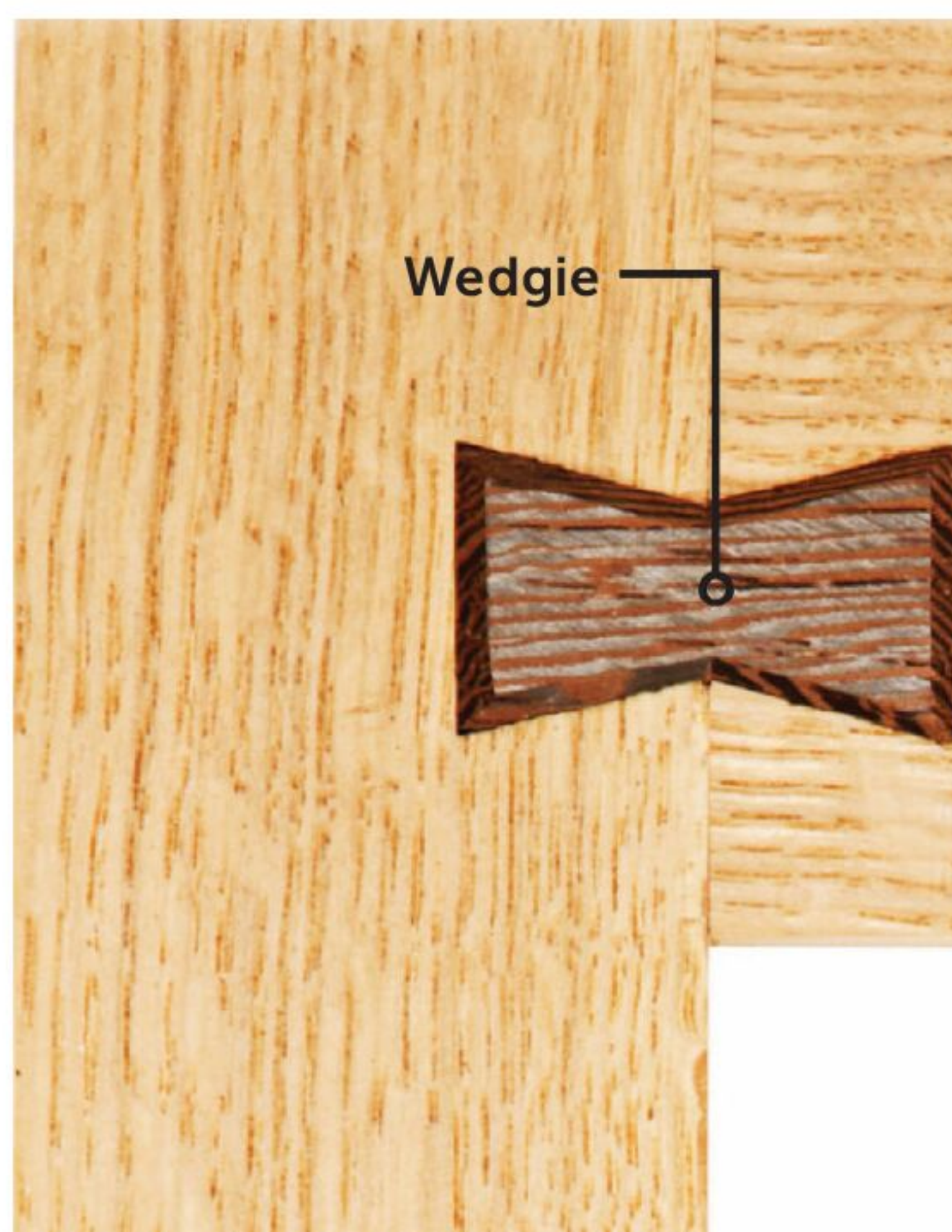
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BUTT ENHANCEMENTS THAT HOLD

With just a little nip and tuck, these eight end-to-end joints transform a butt joint from basic to brawny.

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PICK BUTT AND MAKE FRAMES

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ON THE LEVEL

I identified with your editor's letter "Leveling Up" in issue 289 (July 2023). For me, the bandsaw was my most transformational purchase.

The eight stitches I received in my thumb are my personal reminder of how dangerous my tablesaw can be.

Rather than let it stop me, I learned that I prefer to rip wood on my bandsaw and then run it across my jointer to achieve a smooth finish. For crosscuts, I almost always use my mitersaw.

I'm a great believer that there is no single way to correctly do woodworking—that's what makes it the fun, creative, inventive hobby (or business) that it is.

John Koski

Sturgeon Bay, Wisconsin

Ah, John, you've brought up a topic that has divided woodworkers for decades. What's the primary tool in your shop: a tablesaw or bandsaw?

I'm with you, though, on the merits of a bandsaw for ripping lumber to rough width. The downward cutting action of the blade inherently makes this a better option than a tablesaw, especially with the dangers of kickback.

But, as you stated, we all tackle woodworking tasks in different ways and still create excellent work.

Dave Stone

Managing Editor



Perhaps mastery of a new tool, rather than its purchase, should be used to consider when a woodworker has "leveled up."

A wealthy beginner who can purchase top-of-the-line equipment remains a beginner until he masters those tools and builds with an advanced degree of accuracy.

My neighbor bought a tablesaw that scared him to death so he sold everything before he even learned to use it. On the other end, many of us know an advanced woodworker who makes award-winning projects with a relatively small number of tools.

Brian Tandrow

Boise, Idaho

Of course you're correct, Brian. The purchase of a tool doesn't come with immediate mastery. But the recognition of the need is definitely an early step in the "leveling up" process. It's like finally turning the doorknob after banging your head on the door for so long. The new world of capability on the other side of that door is now yours if you're willing to take the step. Your neighbor might not have been, but plenty are.

Lucas Peters

Editor-In-Chief

How do you know when you've "leveled up?" The answer, in my mind, is when looking at a project how often do I think, "I could make that."

If, more than half of the time, I think that I don't have the knowledge, skills, or tools to do that project correctly, then I'm a beginner.

How do you know when you've "leveled up?"

If, more than half of the time, I think I could do that project, then I'm an intermediate. If I never even have to ask if I could make something, then I'm an advanced woodworker.

I consider myself to be a beginner, leaning toward intermediate.

Brian Smead

Wadsworth, Ohio

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YOUR PROJECTS



• His wife loves carousels, but **BILL PARKINSON** of Tabernash, Colorado, waited to build one for her until he was able to collect animals of the appropriate size. Having succeeded, he finally built this working carousel that makes the animals go up and down as it turns. Bill says, "This got me big 'husband points!'"



• **CRAIG ST. MARTIN** of McKinney, Texas, built this guitar end table for his musical friend Jim. It mimics a 1959 Les Paul guitar with sunburst finish. As in the original guitar, Craig used maple, mahogany, and rosewood. He finished it with transparent lacquers (red and amber), coated with clear lacquer, then wet-sanded to 2000-grit and polished it to a high gloss.



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To house his gun-cleaning supplies, **DENNIS SAATHOFF** of Hudson, Wisconsin, designed and built this box that also secures firearms for cleaning. His son-in-law became jealous, so Dennis had to make one for him too. One is made from cherry, the other, oak. Both feature deer-antler handles, dovetailed sliding support arms, and antique lock sets found in Dennis's great-grandfather's shop.



While he had been making inspiring art work for many years, **MARK DENSON** of Pottstown, Pennsylvania, had to slow down when he moved and downsized his shop. A friend reignited his passion by asking him to make two treble clefs with doves—one from walnut and the other from red cedar. He used a scrollsaw and router followed by lots of sanding. He finished the pieces with lacquer.



During the COVID pandemic, **JAMES ROBINSON** of Santa Maria, California, decided to try his hand at intarsia. This art form suits his 160 sq. ft. workshop housed within his two-car garage. Since then, James has completed over 50 pieces.



DAVID HARTLINE of Albuquerque, New Mexico, built this cradle for his granddaughter. Made from poplar, it features ball-bearing pivots. David finished it with amber water-based stain followed by a rosewood stain then three coats of wipe-on polyurethane.



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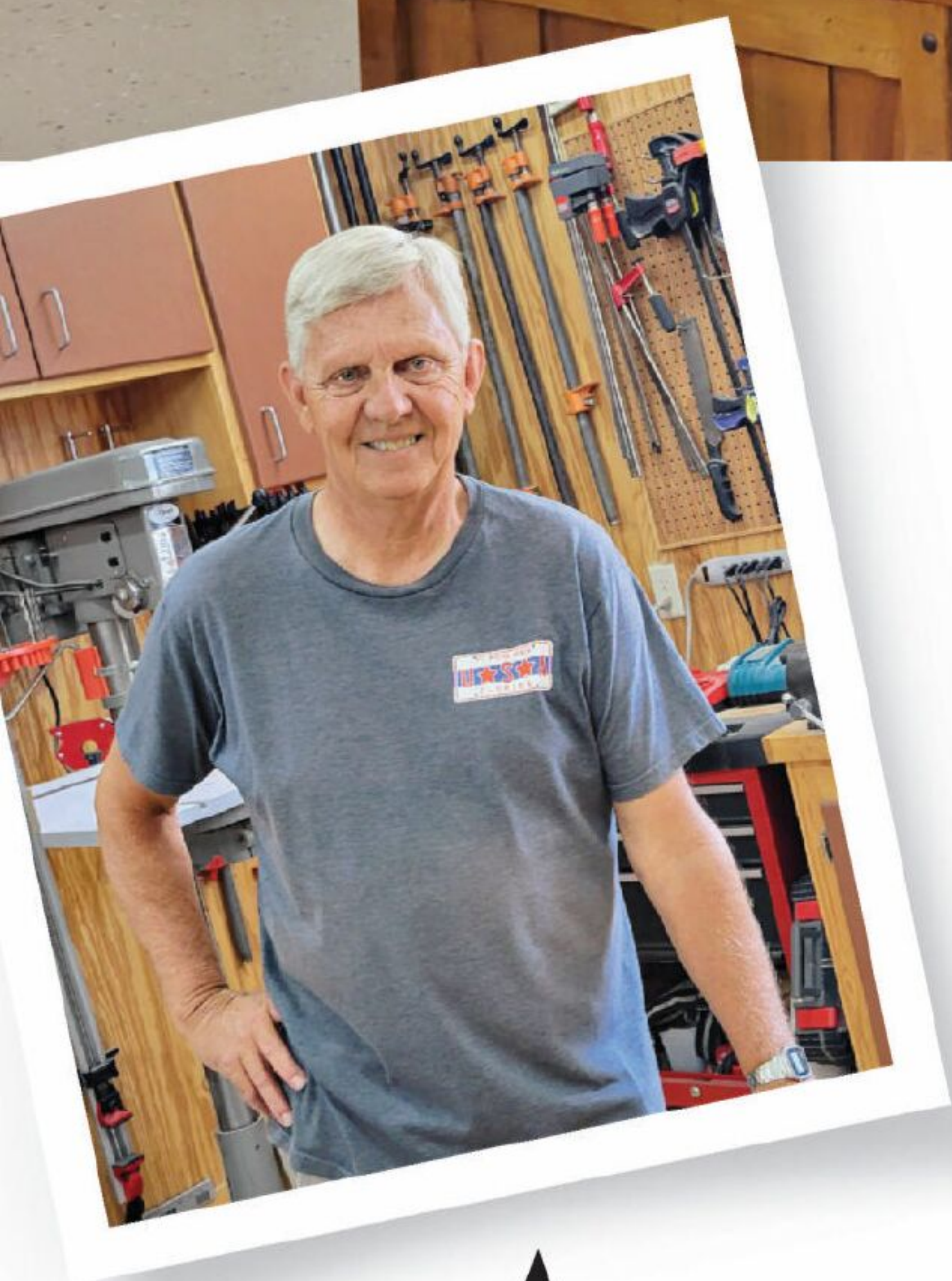


COMFORT & CONVENIENCE SHOP

Beadboard paneling provides a solid surface for mounting pegboard panels, magnetic tool bars, and wall cabinets. Custom base cabinets create additional storage below.

Don't let looks deceive you. There's more to this cozy shop than meets the eye.

WRITER: RANDY MAXEY



▲ As a charter subscriber to *WOOD*® magazine, Keith Bonnema never lacks inspiration for shop projects. With over 50 years as a woodworker, he puts his experience to use for family and charity projects.



SHOW US YOUR SHOP

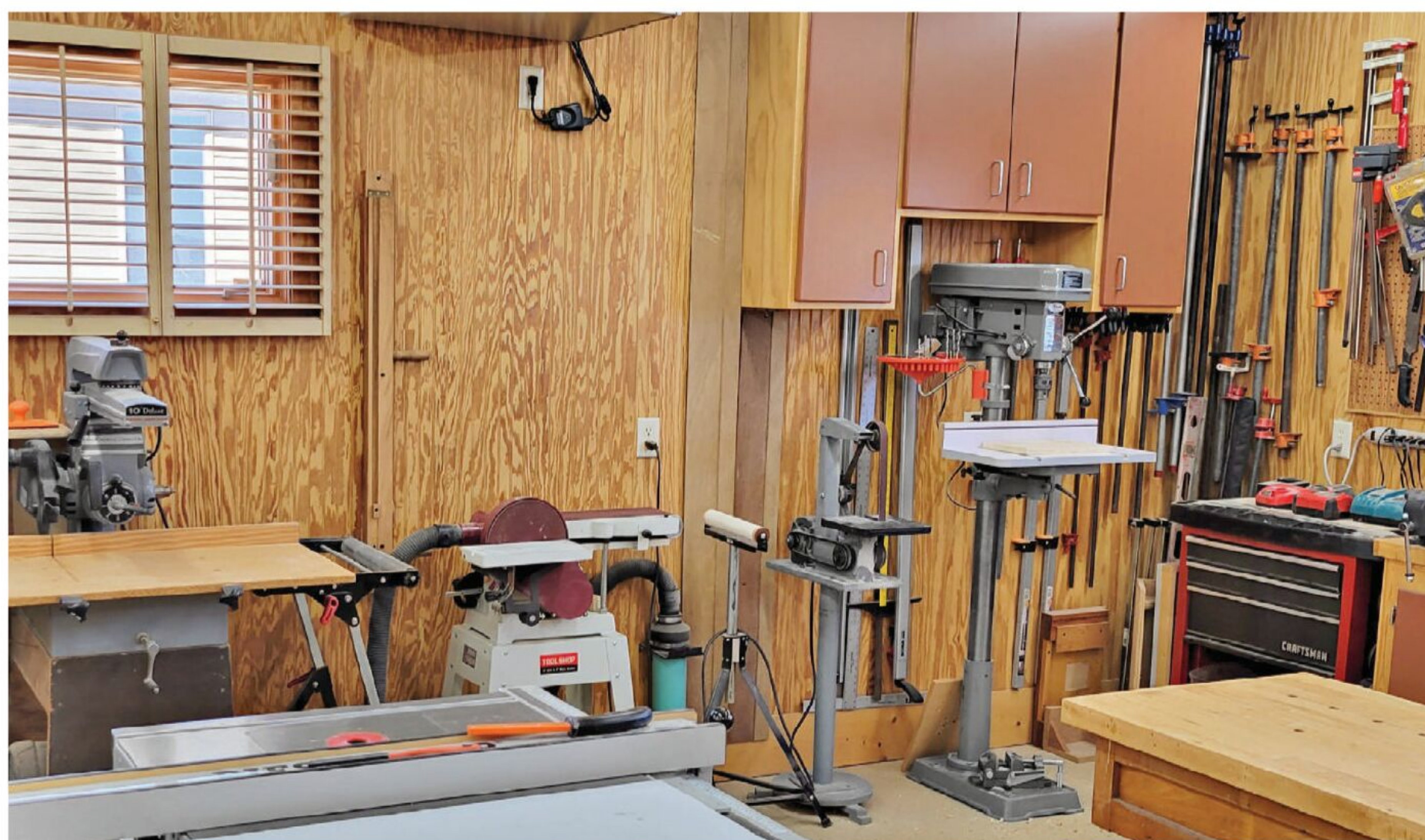
Send high-resolution digital photos of your shop to woodmail@woodmagazine.com and we may showcase it in the magazine!

During the 40-plus years Keith Bonnema operated his plumbing, heating, and air conditioning business in northwest Iowa, he would often retreat to his woodworking shop to relieve stress. He knew then that woodworking was going to occupy a large part of his time when he retired.

When that time came, Keith built his shop above a walkout basement with engineered I-joists supporting the wood

shop floor. That allowed him to tuck the mechanicals and lawn equipment out of the way. With access through his three-car garage, Keith can easily offload materials straight into the shop.

The stick-built, well-insulated structure features 8'-8" ceilings. Keith lined the interior walls with pine beadboard paneling finished with clear, water-based satin polyurethane. Beadboard allows him to be fairly



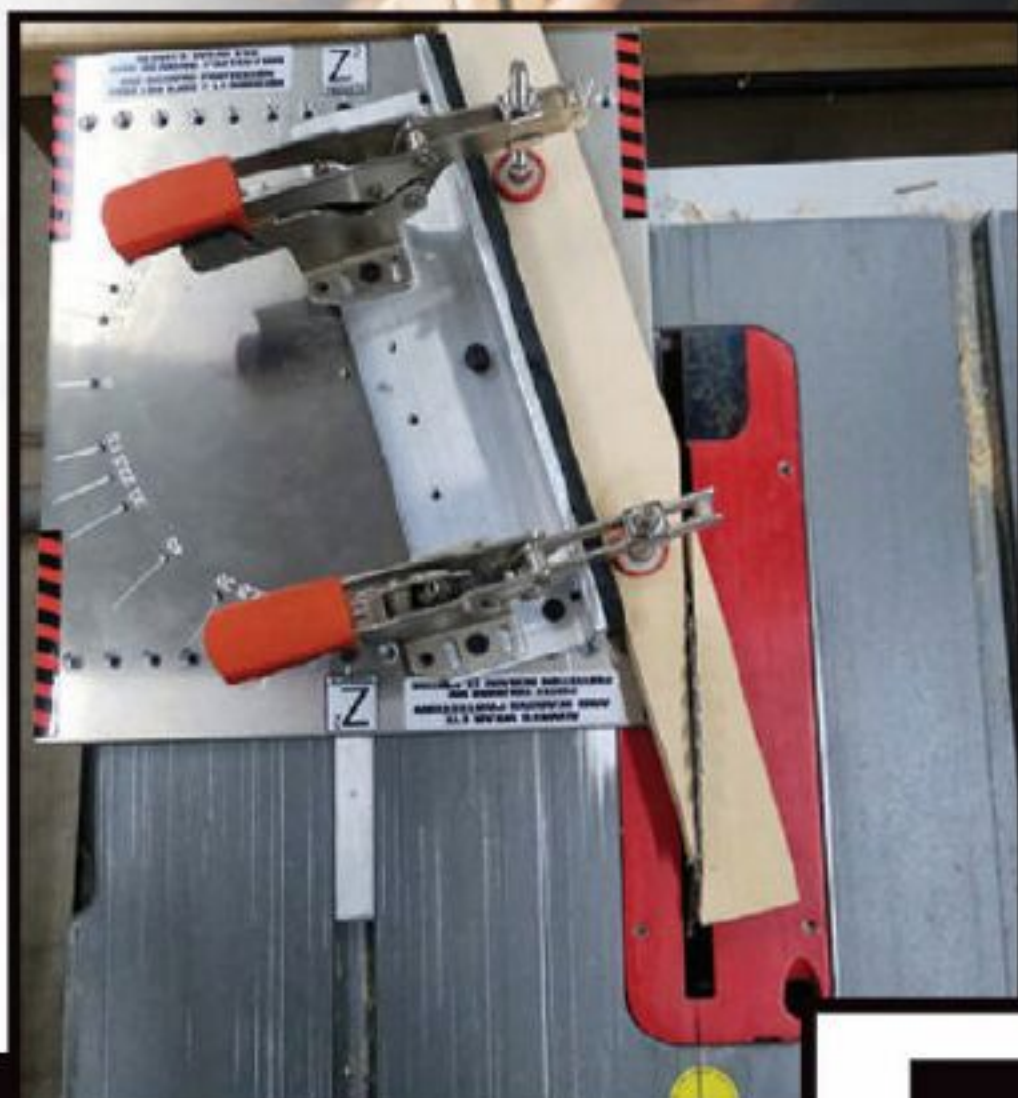
Wall cabinets surrounding the drill press keep bits and other accessories organized and within easy reach. Large windows let in natural light to complement the LED fixtures.

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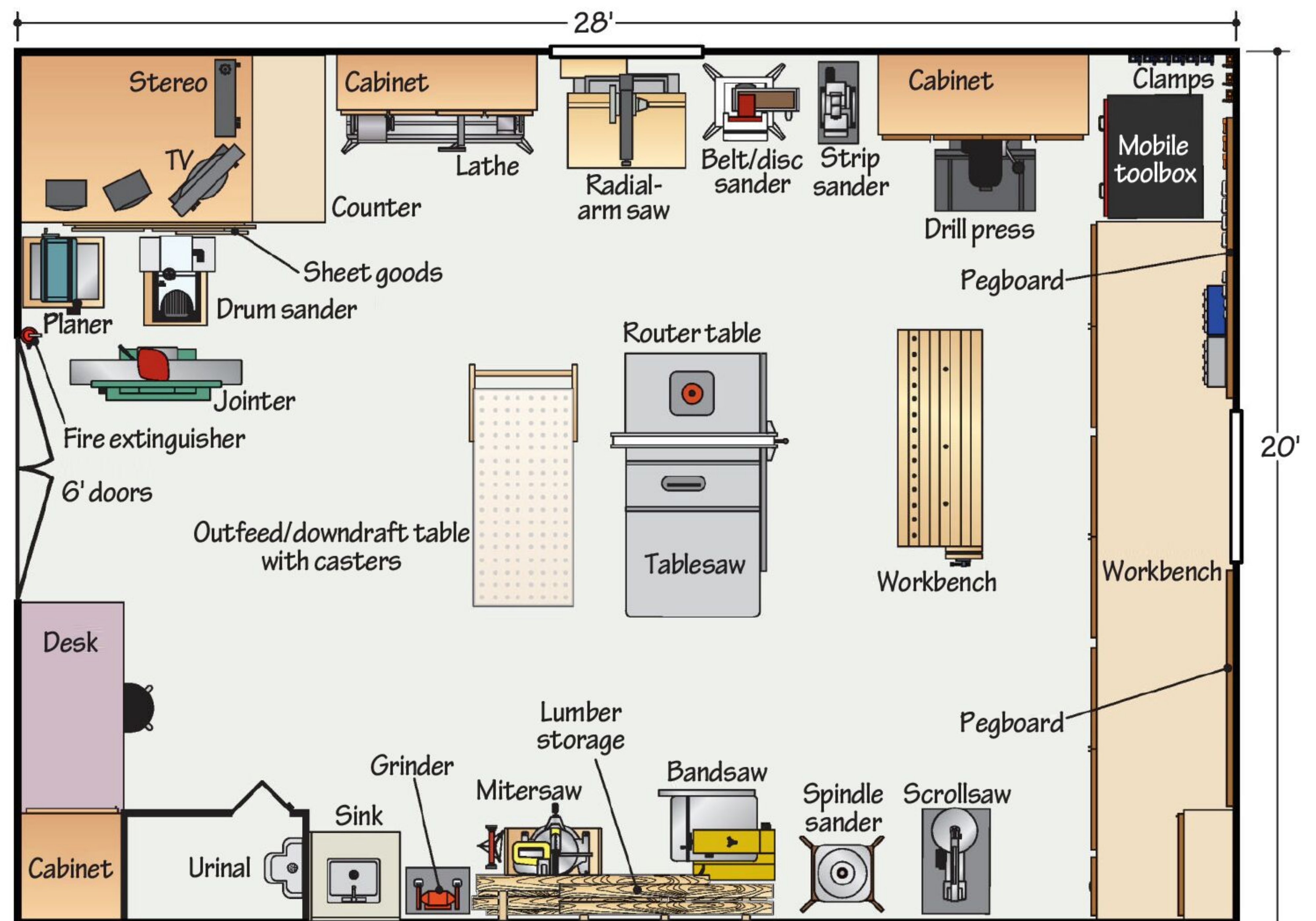
indiscriminate about where he hangs cabinets and tool racks, giving him a lot more flexibility for organization.

Keith routed ductwork for the 1½-hp dust collector up through the shop floor to blast gates, giving his basement-dwelling dust collection system a gravity assist. On the wall near each blast gate, he added J-hook pipe hangers to support the flex hoses when not in use.

A combination of ½" PEX tubing and soldered copper pipe supply compressed air to the shop. Repurposed plastic garden hose racks keep coiled air hoses tidy and easily accessible.

Custom-built cabinets with a hardwood countertop line one short wall of the shop. Above that, pegboard panels and magnetic bars keep Keith's tools organized and close at hand. Lathe tools also reside on wall-mounted magnetic bars behind the lathe.

To avoid trips back into the house in times of need, Keith enclosed one corner of the shop to hide a urinal. A nearby sink provides easy washing of hands and serves the shop with a



commercial roll-style towel dispenser and towel hooks. With a desk and shop stool, this corner also lets Keith retreat

to plan his projects or relax with a cup of coffee. A stereo and TV nearby make shop time more enjoyable.

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Keith packed a ton of convenience into one end of his shop, including a utility sink, J-hooks and a garden hose rack for storing hoses, an easily accessible lumber rack, and a wall-mounted reel for an air hose.

Several tools serve multiple roles, doubling their usefulness. The tablesaw in the center of the shop features a cast-iron wing that serves as his router table. The multipurpose downdraft sanding table (*below*) sports a 4" dust port and a removable sheet-metal auxiliary top. Built from two salvaged hospital cabinets, Keith made sure its final height matched that of his tablesaw to serve as an outfeed table. On one end, he mounted a paper roll to keep messes off the worksurface when gluing and applying finish to projects.

Laboratory bench cabinets purchased at a school auction create a rock-solid base for the traditional-style workbench. Maple tongue-and-groove flooring laminated to 3/4" plywood make up the benchtop.

For flexibility in shop layout, Keith mounted his benchtop planer, drum sander, bandsaw, and jointer on mobile bases. As part of his power-tool arsenal, he uses a radial-arm saw for crosscutting stock that is too wide for his 12" mitersaw. Keith says he also likes the radial-arm saw for cutting dados.

In addition to building baby cradles for his grandchildren, Keith helps a local non-profit organization by repairing overstocked or returned items they collect to resell. Many of these items are furniture pieces. And his

generosity doesn't stop there. "For over 16 years I've helped design and cut out over 100 pinewood derby cars for boys and girls, mostly through our church-affiliated Cadets and Gems." 🌲



◀ A sheet-metal top converts Keith's downdraft sanding table to an outfeed table for the table saw. A 4" hose provides plenty of suction when sanding.

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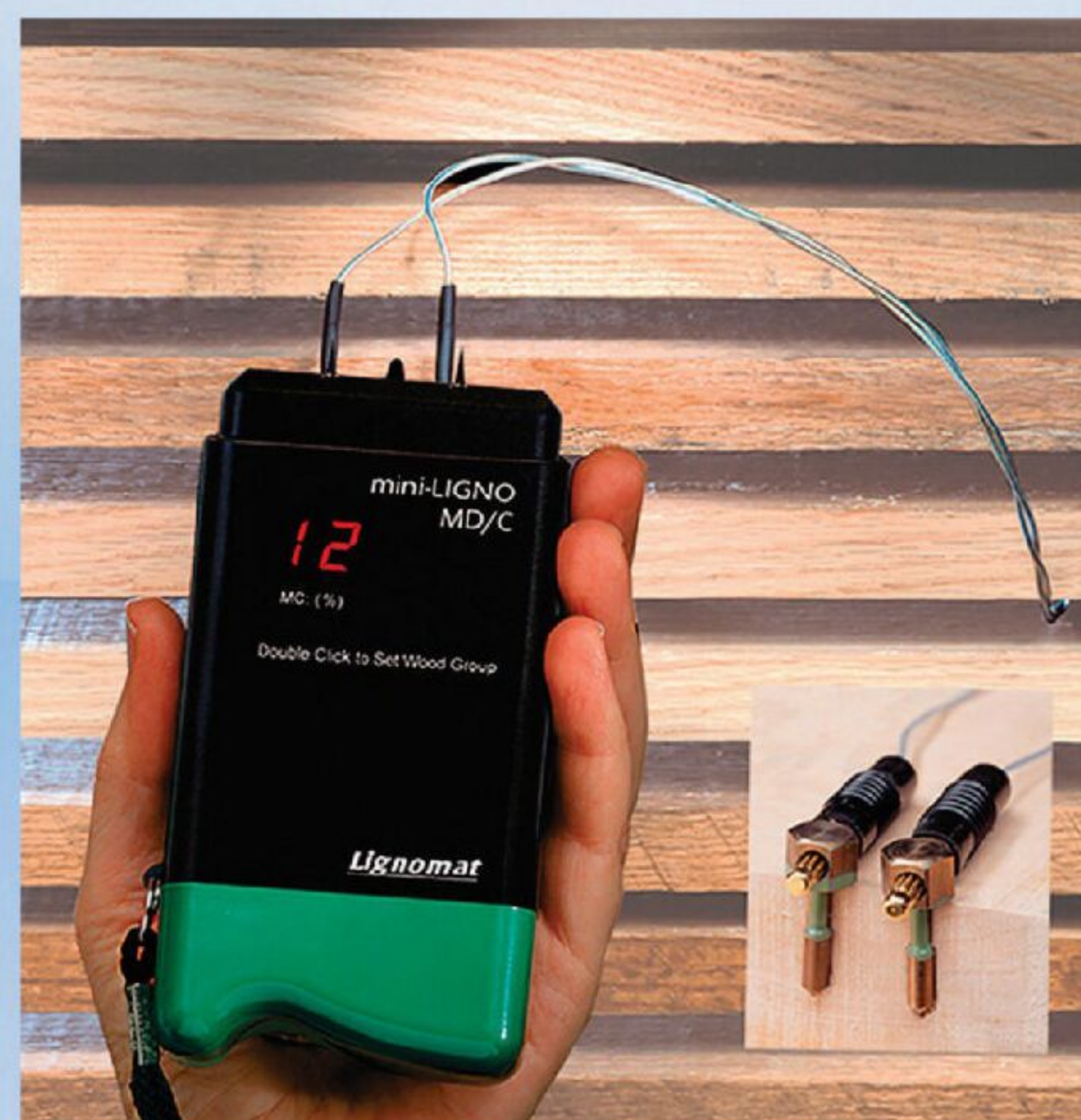


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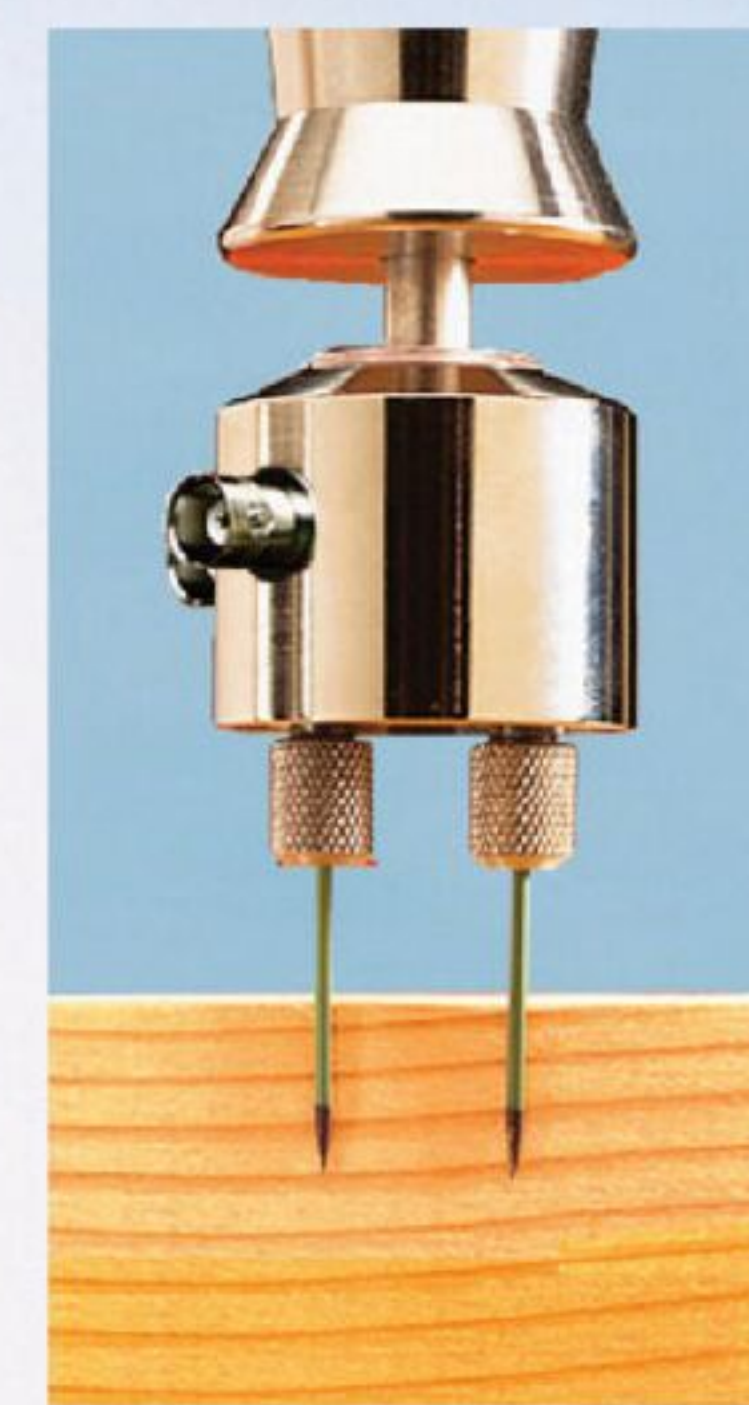
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TOOTHOSOME TIPS FOR BANDSAW BLADES

How do I determine how many teeth per inch my bandsaw blades should have? More is better, right?

James Chung
Manhattan, Kansas

A: When it comes to teeth and bandsaw blades, more isn't always better. The thickness of the material you're cutting, as well as the desired quality of cut, determine the optimum teeth per inch (tpi). One simple rule of thumb is to keep a minimum of three teeth engaged in the wood at all times. So for cutting $\frac{3}{4}$ "-thick stock, select a blade with at least 4 tpi. For $\frac{1}{2}$ "-thick material, choose a blade with at least 6 tpi, and so on.

Going beyond this three-tooth rule, a blade with fewer teeth allows you to cut faster because it has larger, deeper gullets (the spaces between the teeth) to carry away sawdust quickly and efficiently. A blade with a slightly higher tooth count leaves a smoother surface requiring less sanding, but is more prone to loading up with sawdust. You'll need to adjust your feed rate to prevent heat buildup and burning.

Keep in mind that tpi is only one factor that goes into selecting a blade. To match the job at hand, you'll also need to consider blade width and tooth geometry. For general cutting, a $\frac{3}{8}$ "- or $\frac{1}{2}$ "-wide skip- or hook-tooth blade with 4 to 6 tpi is a good balance between speed and cut quality. For resawing, choose the widest blade your saw can handle with the fewest number of teeth (usually 2 or 3 tpi) in either a hook or variable-pitch tooth style. For cutting curves, scrollwork, or intricate cuts, select a narrow ($\frac{1}{4}$ " or less) regular or hook-tooth blade with more teeth (6 to 12 tpi) to minimize the amount of finish-sanding needed.

If choosing the correct tpi still seems like a daunting proposition, know that most blade suppliers stock a limited range of tpi choices for each width of blade, so you'll most likely only have to choose between two or three options. But if you're still stuck, don't be afraid to contact your supplier [\[Sources\]](#) for advice. Most bandsaw blade sellers are knowledgeable about their products and happy to help you choose the best blade for your intended purpose. 🌲



SOURCES:

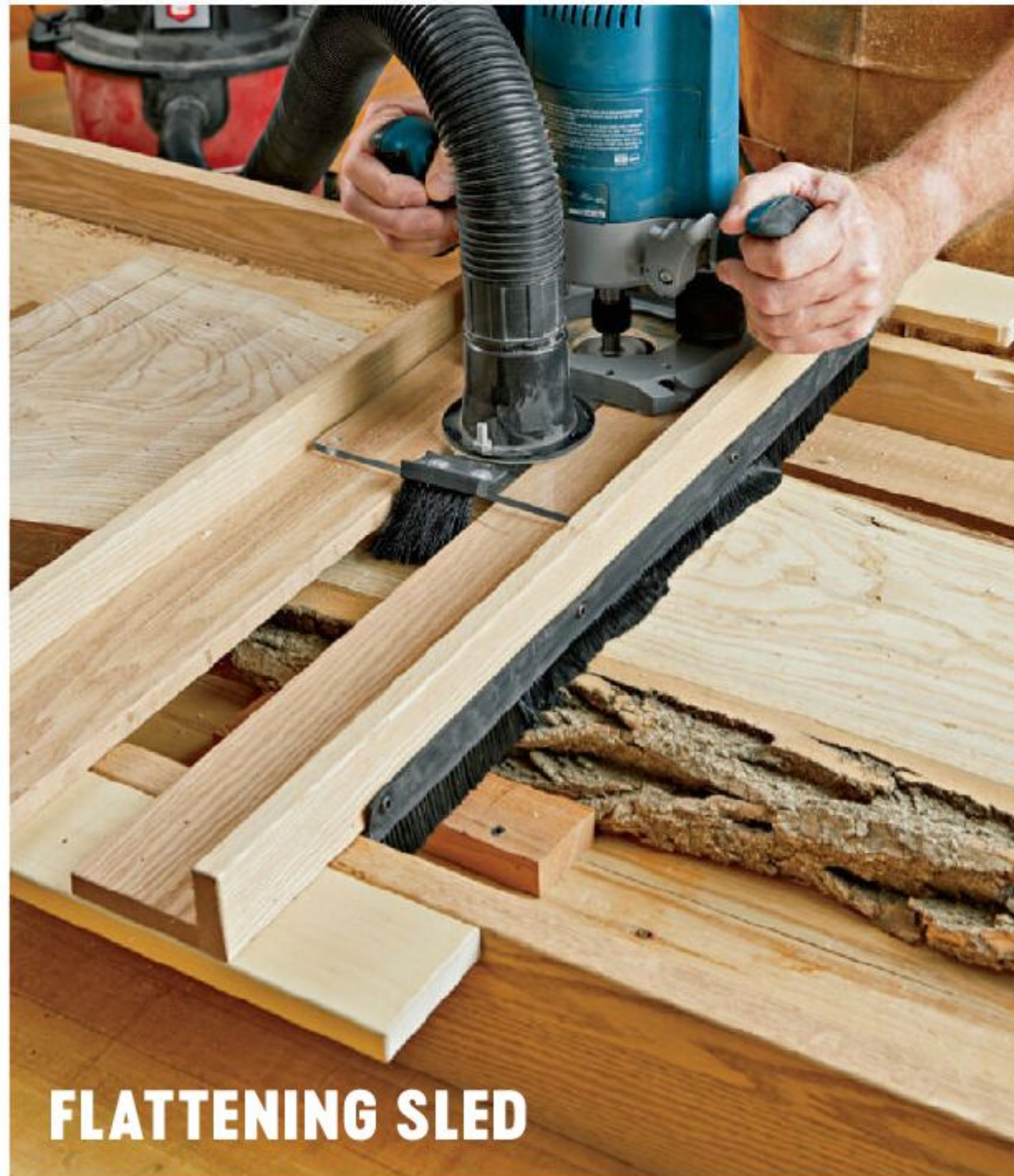
- Timber Wolf Bandsaw Blades, timberwolfblades.com, 800-234-7297.
- Carter Products, carterproducts.com, 888-622-7837.
- Olson Saw, olsonssaw.net, 800-272-2885.
- Band Saw Blades Direct, bandsawbladesdirect.com, 888-527-5548.



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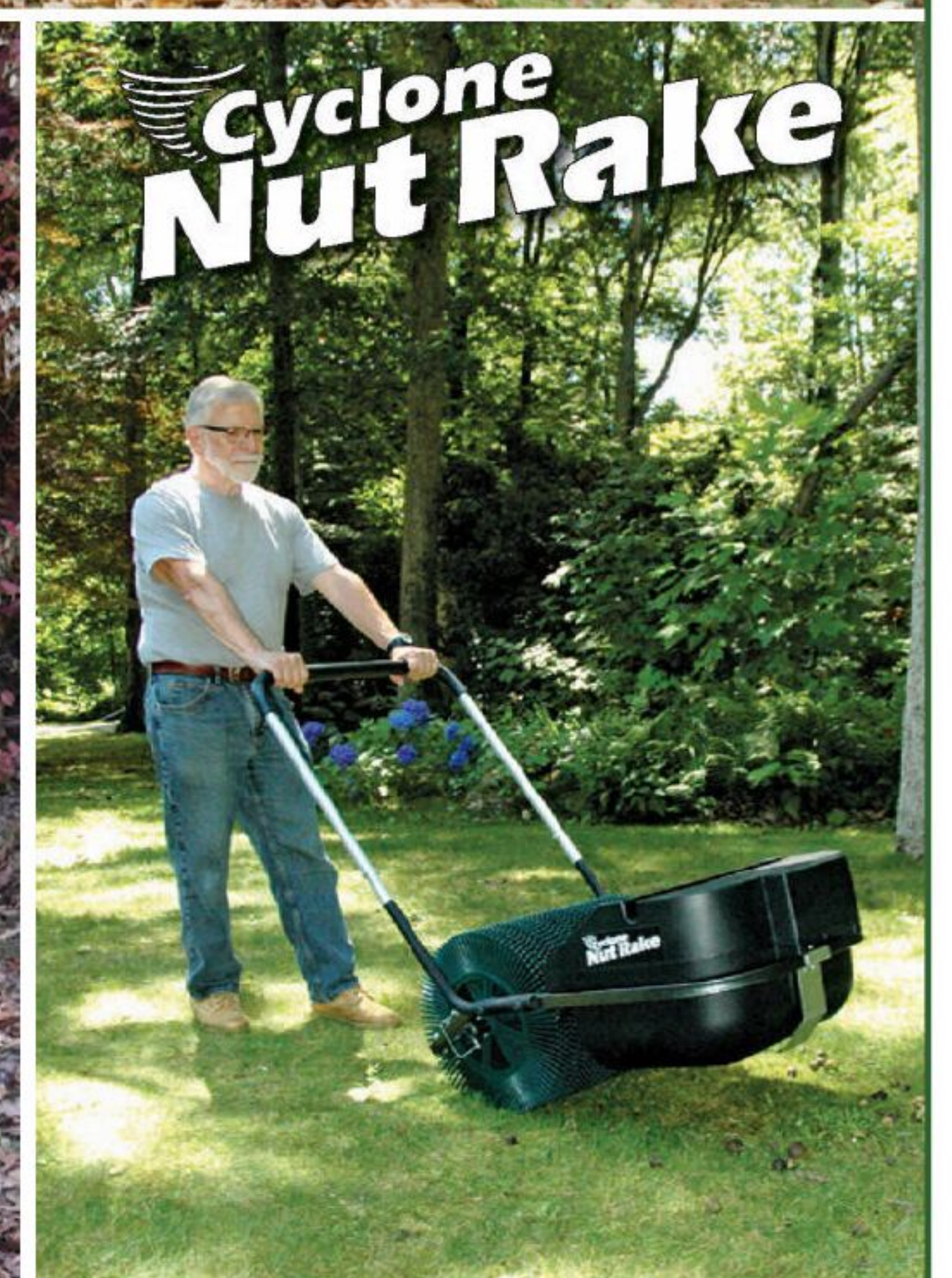
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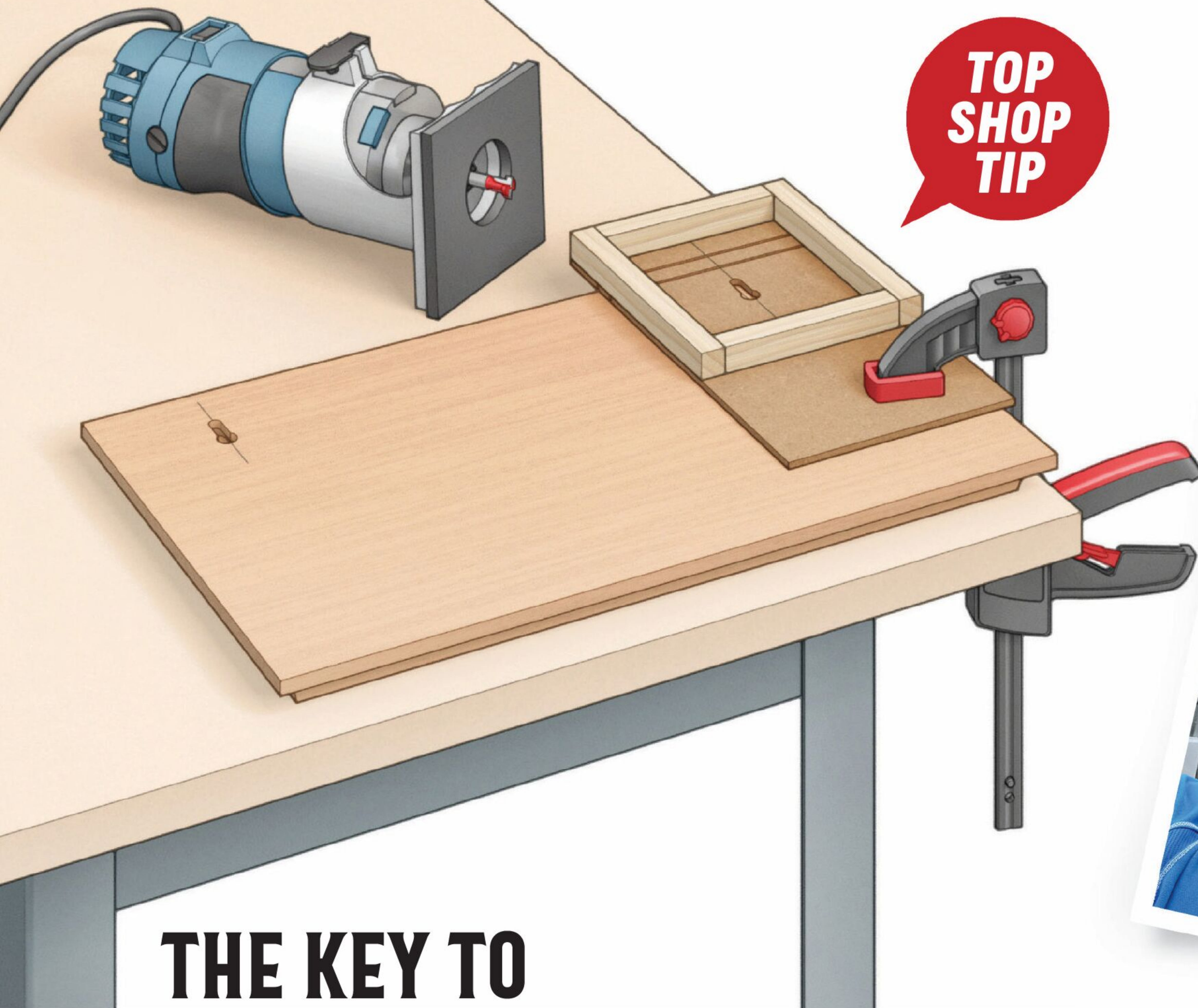


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THE KEY TO KEYHOLE SLOTS

I use keyhole slots often for hanging projects. This jig makes it easy to locate and cut the slots using my palm router.

The jig features a frame sized to fit the base of my router, constraining movement from side to side but allowing for 1" of travel forward and back. I glued the frame to an oversized base made from 1/4" hardboard. This allows clamping the jig to the workpiece.

I used a keyhole-slot bit to cut the slot in the jig base. I also cut a couple of kerfs in the base to align the jig to the edge of the workpiece. The kerfs give me two different spacing options for offsetting the keyhole from the edge. Finally, a vertical reference line centered on the slot aids in accurate placement.

Adam Munn

Bunnlevel, North Carolina

For his tip, Adam wins a Craftsman V20, 8-Tool, 20-volt MAX tool combo kit worth \$400.



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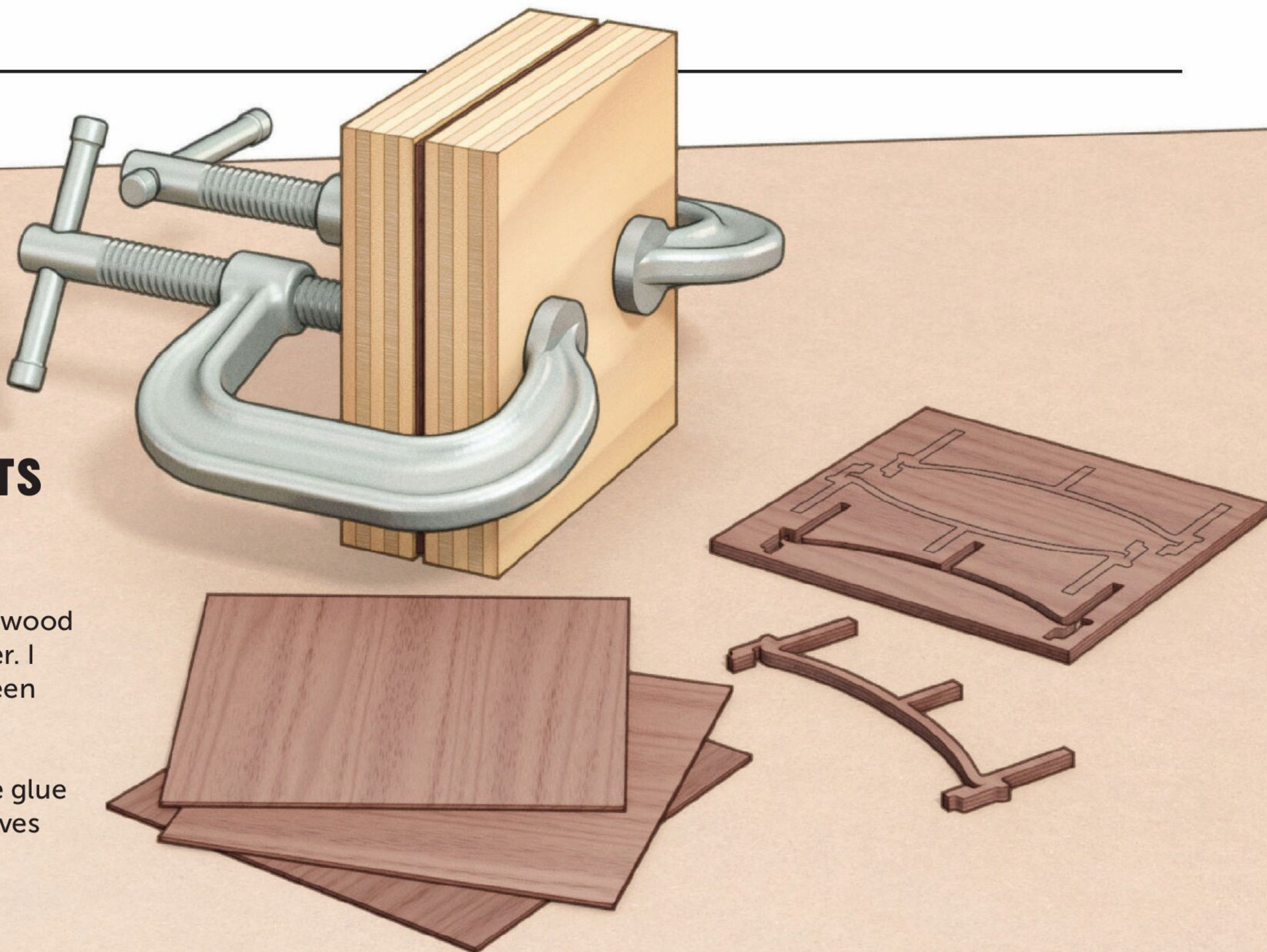
Because we try to publish original tips, please send yours only to **WOOD**® magazine.

ILLUSTRATOR: CHRISTOPHER MILLS

PETITE PLYWOOD PARTS

I love to build wood models but creating thin, delicate parts out of hardwood presents challenges. My solution is to make my own plywood using several layers of wood veneer. I alternate the grain direction between layers. After applying glue and assembling the stack, I clamp it between two flat surfaces until the glue dries. My homemade plywood proves super strong and has no voids.

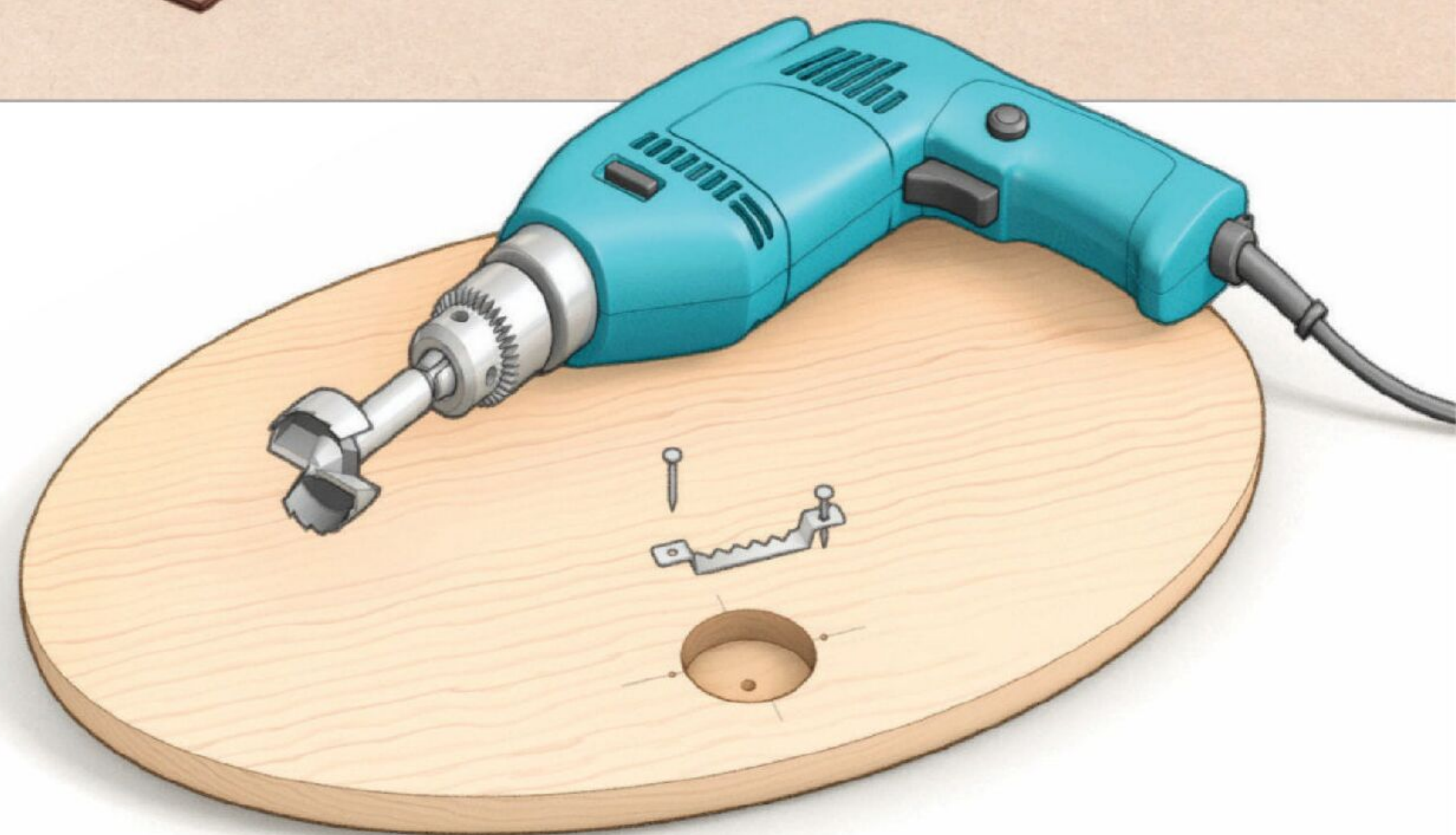
Roger Mickelson
Mesa, Arizona



A GREAT START TO FINISH

A paint pad creates a smooth, even film when applying polyurethane finishes to a project, especially on large, flat surfaces. An empty glue bottle holds and dispenses the finish without making a mess. Simply scribble beads of finish onto the workpiece and then spread it across the surface.

Marcus Hartley
Leetonia, Ohio



SAW-TOOTH HANGER HANGUPS

Sawtooth hangers provide a quick solution to hanging plaques and other pieces. But they don't sit flush, forcing the hanging object to tilt away from the wall.

I take a different tack to install sawtooth hangers. First, I drill a shallow hole in the back of the workpiece using a Forstner bit. The diameter matches the width of the hanger, minus the end tabs. The depth of the hole matches the height of the hanger plus allowance for the nail or screw head in the wall used to hang the item. I install the hanger reversed with the sawtooth portion recessed into the hole. Now I can mount items flush to the wall.

Dustin Davis
Cumberland, Maryland



CRAFTY TOOLS

While browsing the aisles at a hobby store, I ran across a set of inexpensive sculpting spatulas and I immediately thought of some handy uses in the workshop.

Originally designed for sculpting clay and wax, these double-ended, stainless-steel tools feature different shapes at each end of the shafts. I find them ideal for applying wood putty into small areas and cracks. They're great for scraping excess glue before it sets up. Apply self-adhesive sandpaper for sanding details. It didn't take long before these tools found a place within arm's reach of my workbench.

Tom Combs
Bend, Oregon

FLIPPIN' VACUUM BOX

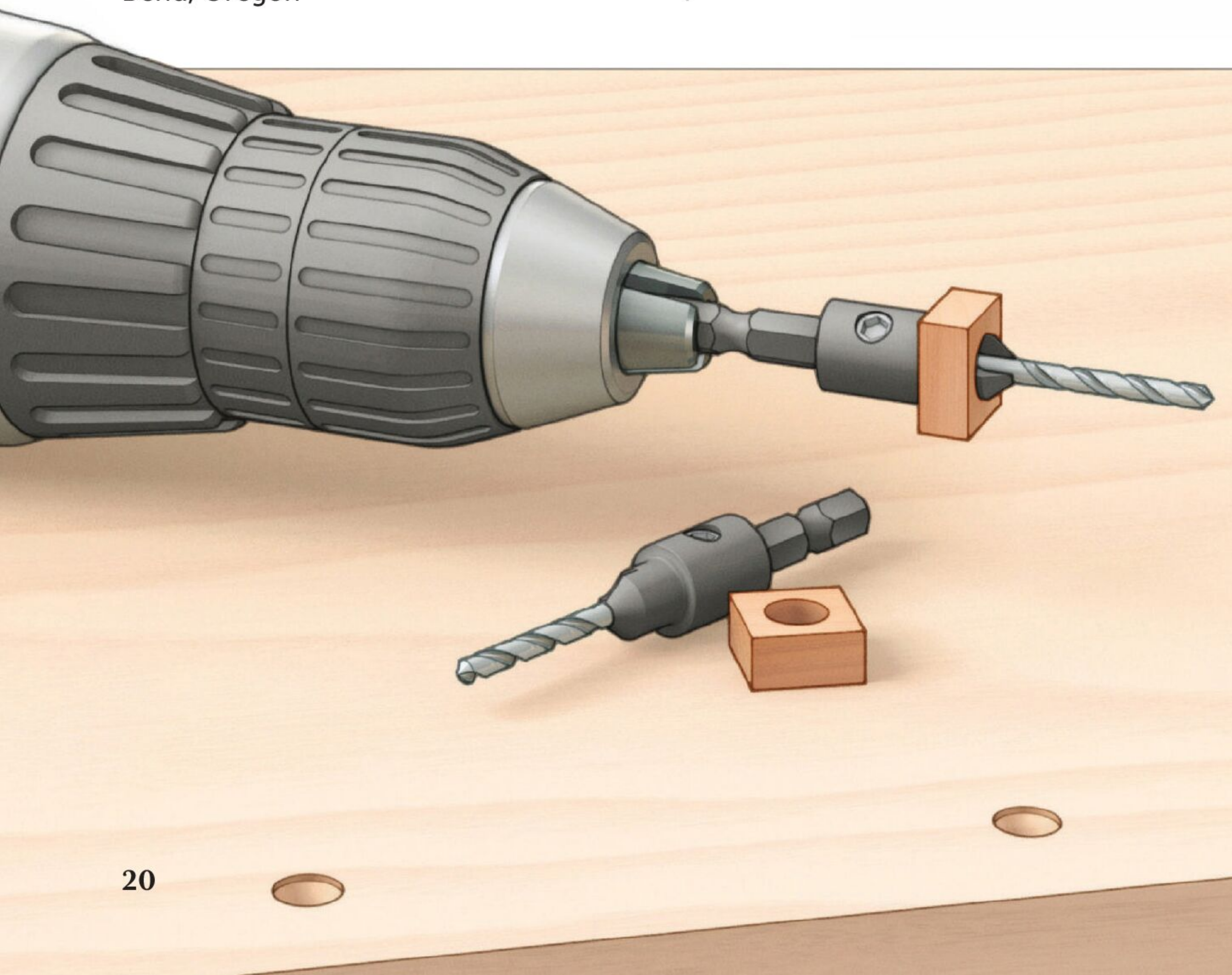
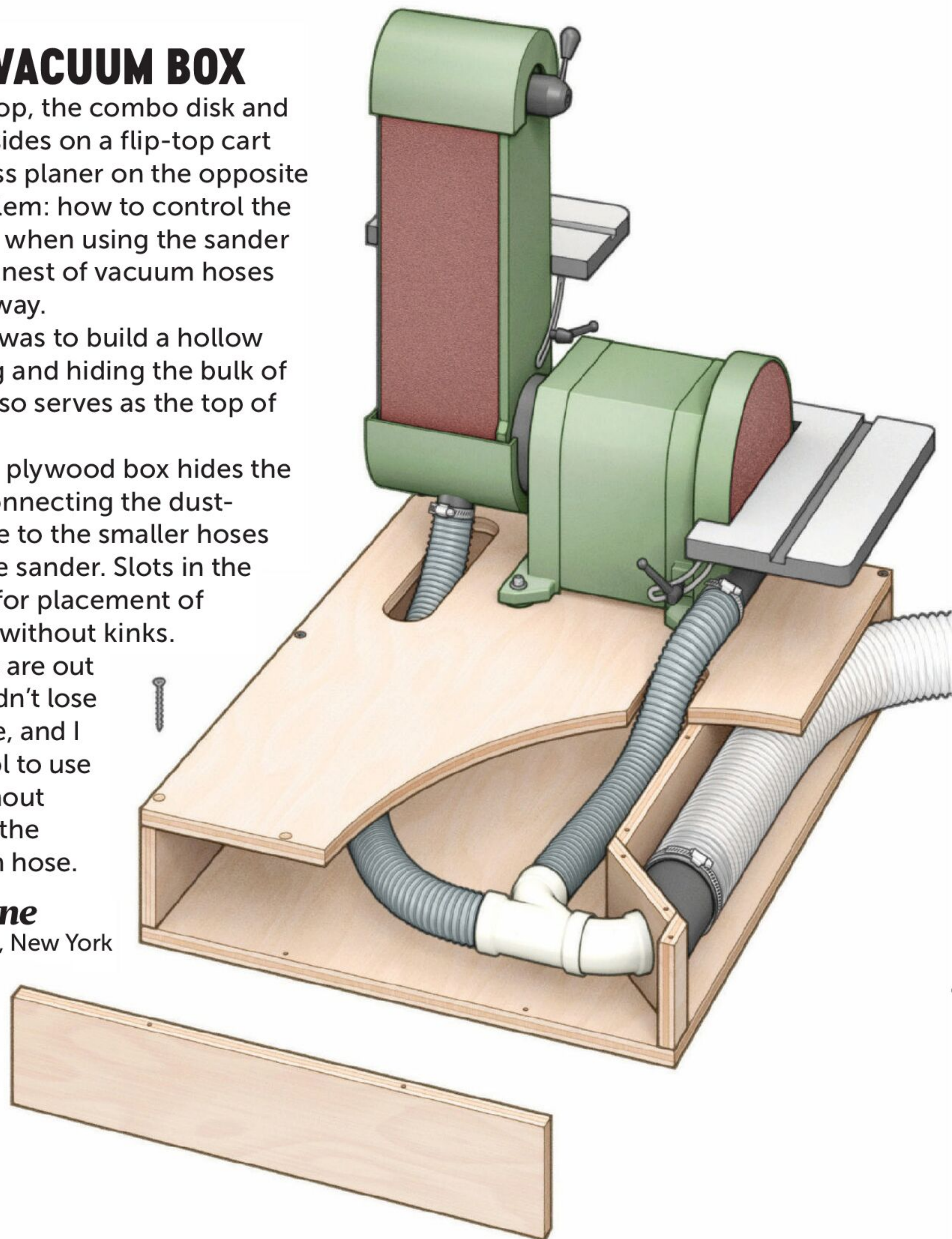
In my small shop, the combo disk and belt sander resides on a flip-top cart with a thickness planer on the opposite side. The problem: how to control the sawdust cloud when using the sander without a rat's nest of vacuum hoses getting in the way.

My solution was to build a hollow box for routing and hiding the bulk of the hoses. It also serves as the top of my tool stand.

The 3"-deep plywood box hides the PVC fittings connecting the dust-collection hose to the smaller hoses attached to the sander. Slots in the box top allow for placement of the hose ends without kinks.

All the hoses are out of the way, I didn't lose any work space, and I can flip the tool to use the planer without disconnecting the dust-collection hose.

Chris Simone
Port Washington, New York



CONSISTENT COUNTERSINK CALIBRATION

Call me obsessive-compulsive, but a project appears more professional when screws are set at a uniform depth. Eyeballing or guessing as you drill countersunk pilot holes simply doesn't yield consistent results.

My simple depth guide costs nothing and is easy to make. I drill a hole centered in a small wood block that fits snugly over the head diameter of the countersink bit. The thickness of the block dictates the depth of the countersink. It's a perfect treatment for my OCD (Oddball Countersink Depths).

Larry Schaller
Edgerton, Wisconsin

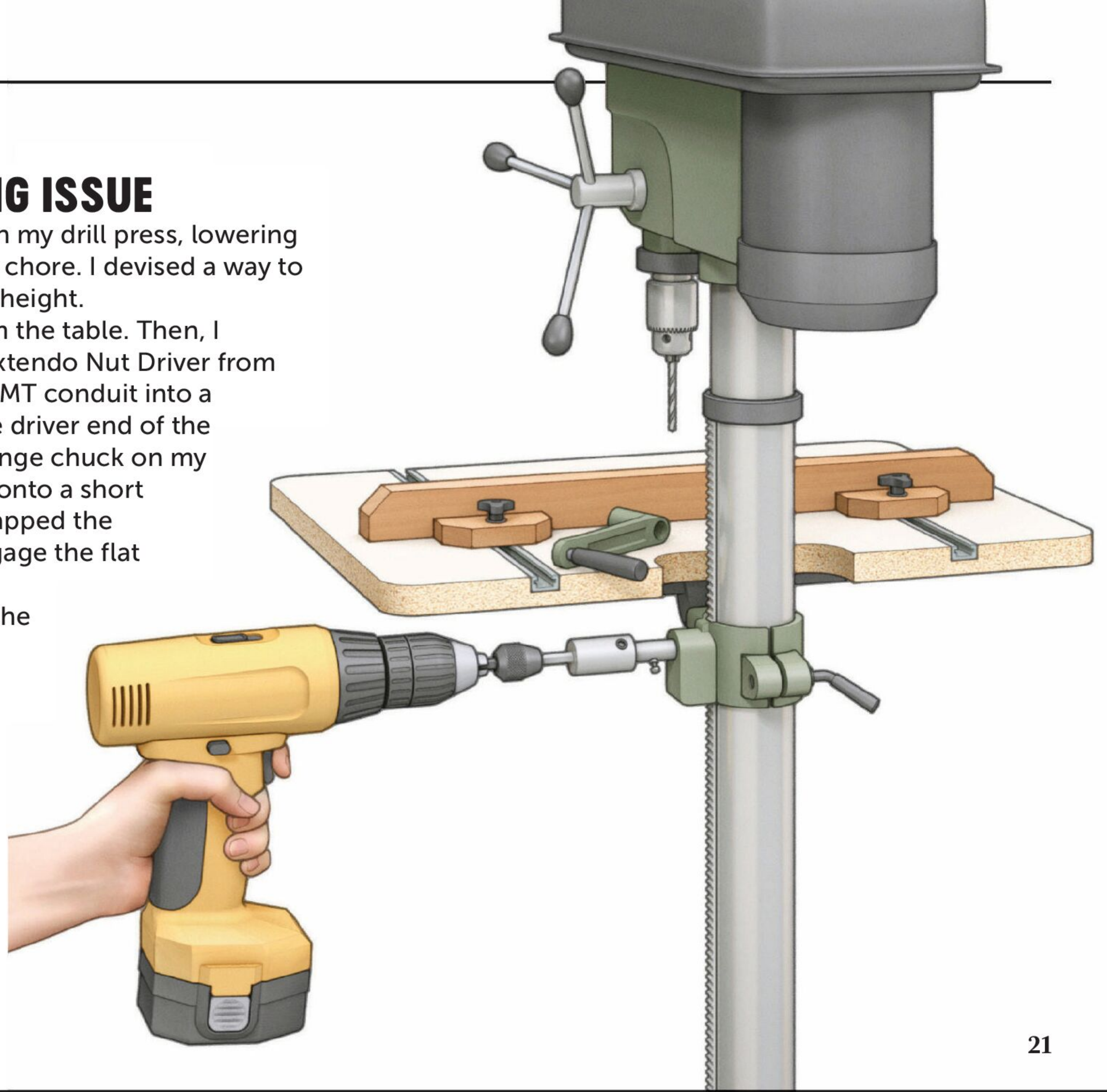
DRILLING INTO A PRESSING ISSUE

With the addition of an auxiliary table on my drill press, lowering and raising the table becomes quite the chore. I devised a way to use my portable drill to adjust the table height.

First, I removed the crank handle from the table. Then, I used an electrician's accessory called Extendo Nut Driver from rack-a-tiers.com. It turns common 1/2" EMT conduit into a custom-length, hollow-shaft driver. The driver end of the Extendo Nut Driver fits into a quick-change chuck on my drill. The opposite end of the driver fits onto a short piece of 1/2" EMT conduit. I drilled and tapped the conduit for a #10 machine screw to engage the flat on the drill press table shaft.

With this setup, raising and lowering the drill-press table is as quick and easy as pulling the trigger.

Rich D'Antoni
Tamarac, Florida



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21



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WRITER: ZACH BROWN with LUCAS PETERS

DESIGNER: KEVIN BOYLE

BUILDER: BRIAN BERGSTROM



OVERALL DIMENSIONS
24³/₄"W x 16¹/₄"D x 57¹/₂"H

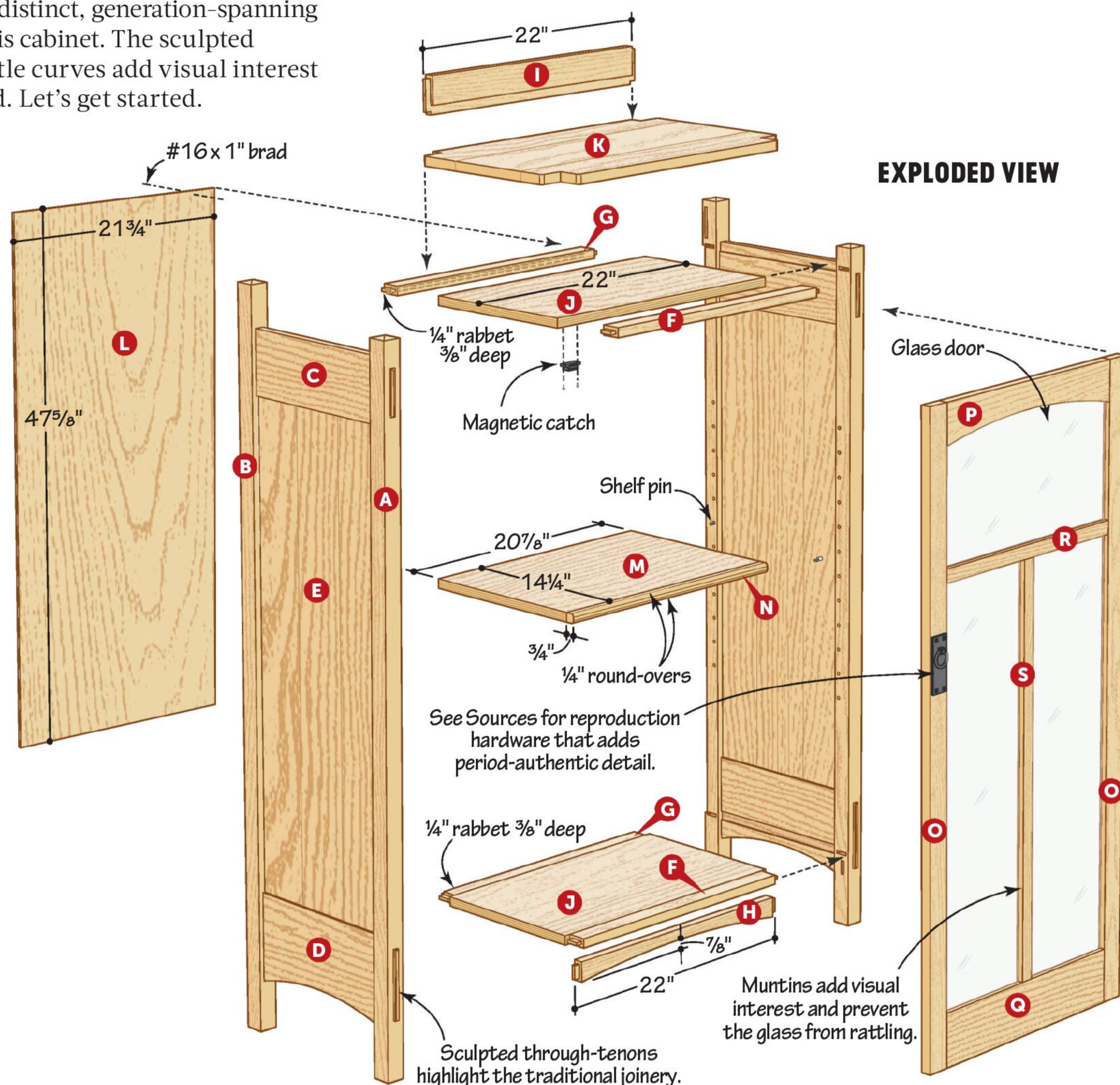
PHOTOGRAPHER: KELSEY HANSEN; ILLUSTRATORS: ROXANNE LEMOINE, LORNA JOHNSON

The Charles P. Limbert Furniture Company was one of the most influential furniture manufacturers in the United States, producing distinct, generation-spanning furniture that inspired this cabinet. The sculpted through-tenons and subtle curves add visual interest without being overstated. Let's get started.



Learn three ways to craft mortise-and-tenon joints.

woodmagazine.com/
3mortisemethods



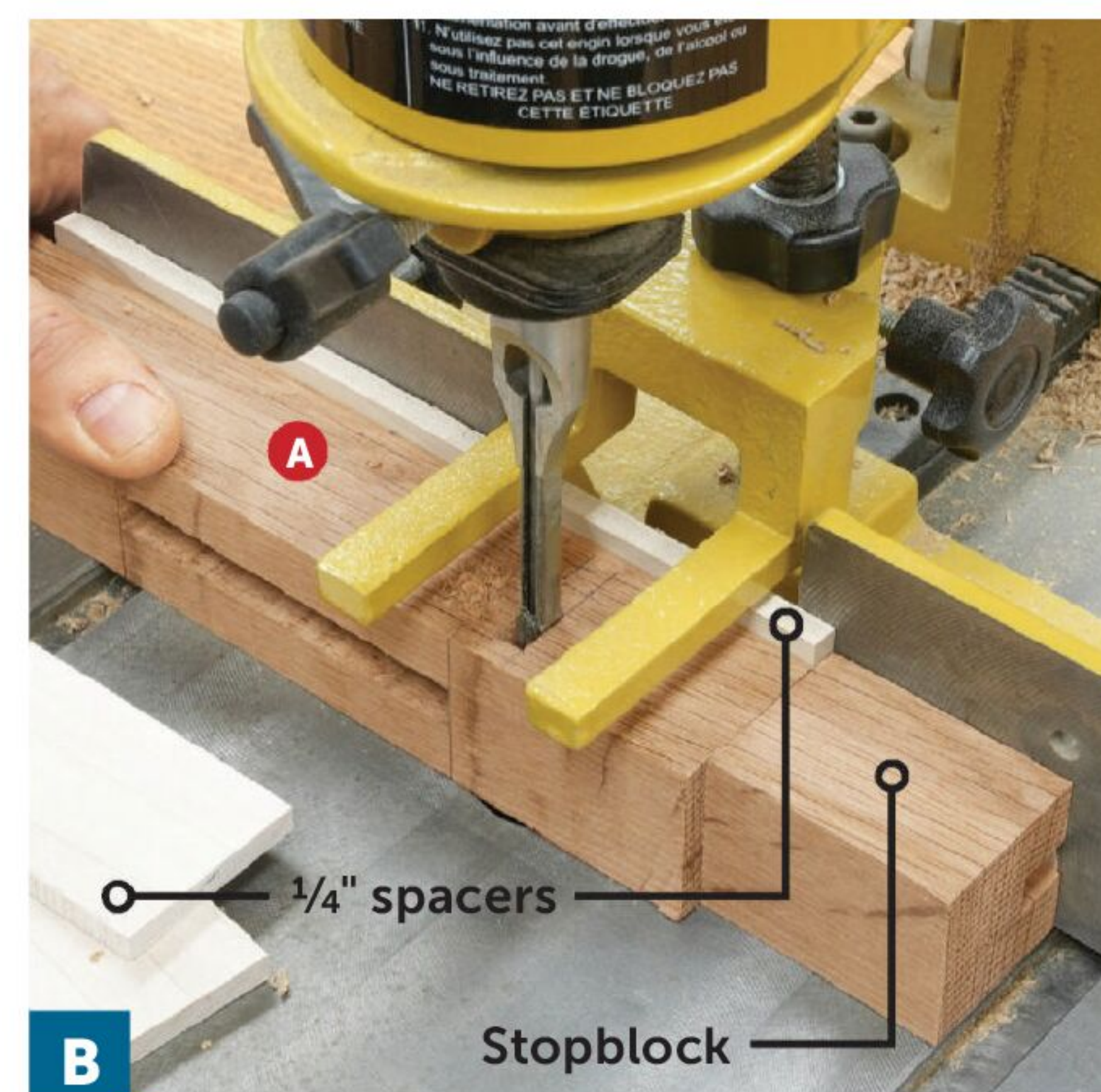
DO THE LEG WORK

1 Cut the legs (A,B) to size [Materials List, Drawing 1]. Lay out the $\frac{3}{8}$ " through-mortises, centered on the front faces of the front legs. Then, form the mortises [Photo A].

2 Install a $\frac{1}{4}$ " chisel in the mortiser and form the vertical $\frac{1}{4}$ " mortise in the inside face of each front and back leg [Drawing 1], making sure to create mirror-image legs. (Add a masking-tape label to the end of each leg to help you keep track of its position in the cabinet.) Form the horizontal mortises, also at the mortiser, but with a slightly different setup [Photo B].

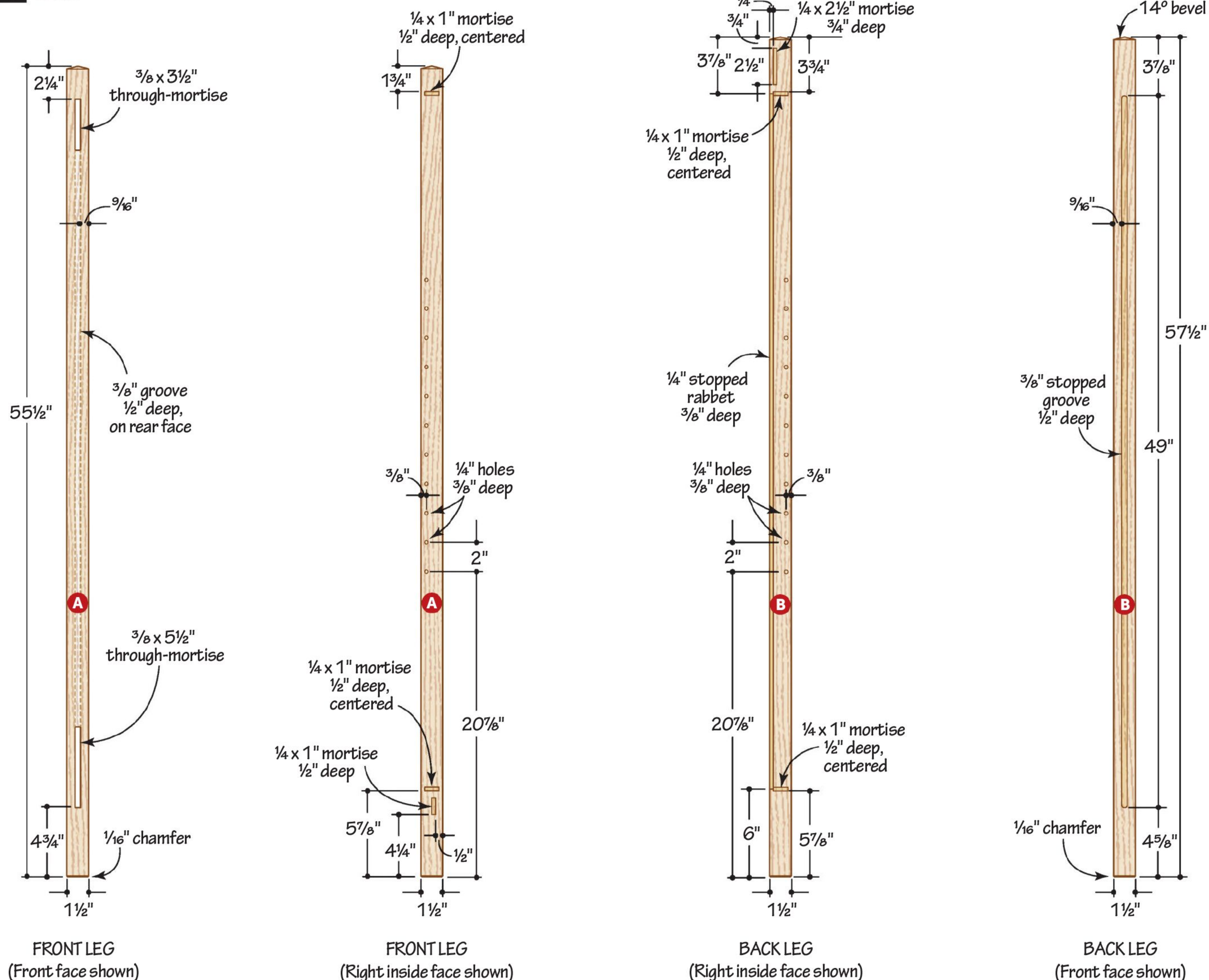


Install a $\frac{3}{8}$ " chisel in the mortiser, form the ends of the mortise, then remove the waste in between. Use a backer board below the workpiece to eliminate tear-out on the through-mortises.



Use double-faced tape to attach a stopblock to the fence, and adjust the fence to cut the front end of the mortise. Make the first cut, then add $\frac{1}{4}$ " spacers one at a time until you reach the back of the mortise.

1 LEGS



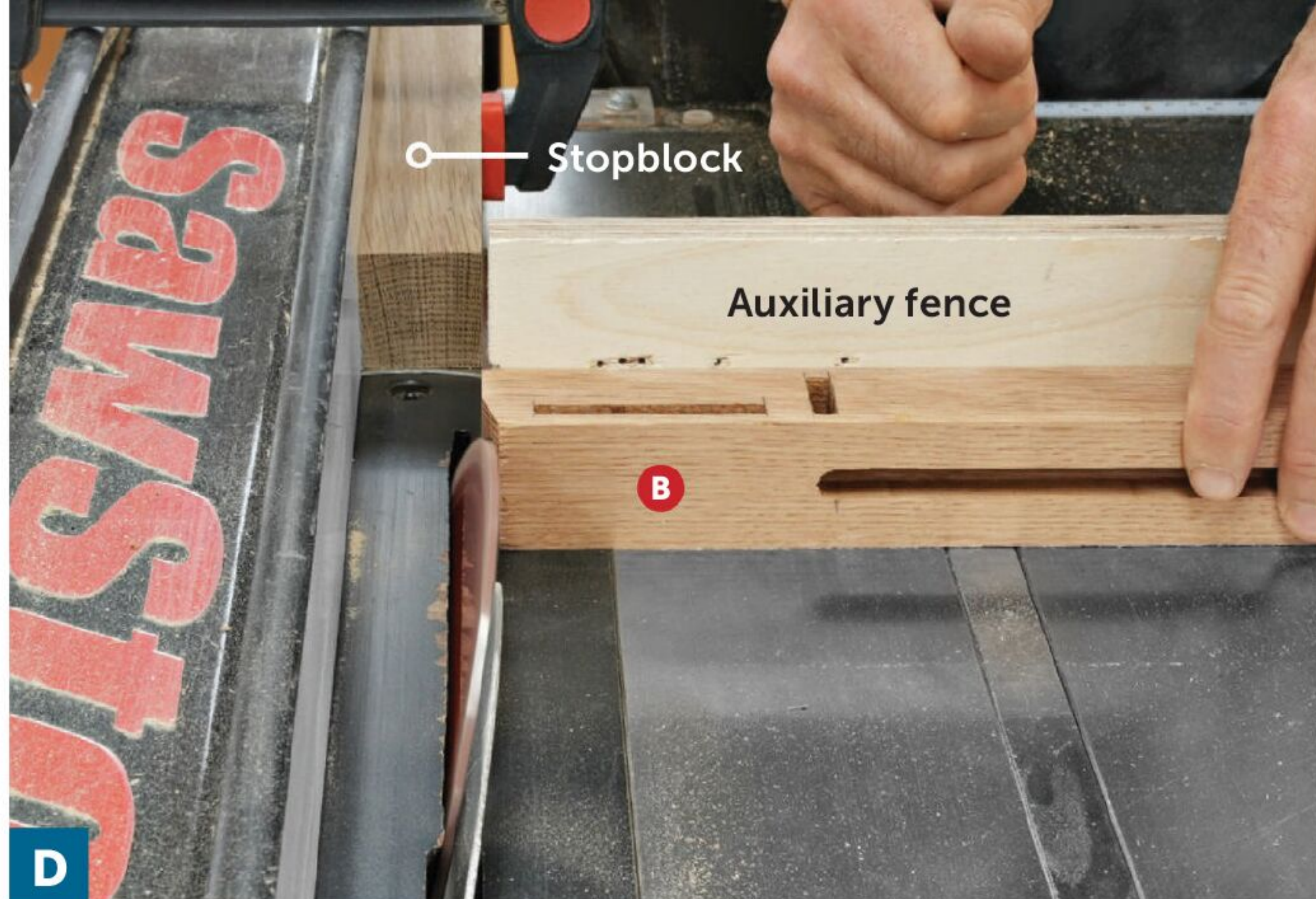
3 Install a 3/8" straight or spiral upcut bit in the router table and rout the groove in the rear face of each front leg [Photo C]. Reposition the stops on the router-table fence for the back leg groove and rout the grooves using the same method. The back leg's grooves are 1/2" longer than needed so you don't need to square up the ends.

4 Rout the stopped rabbet on the back legs [Drawing 1], squaring the ends with a chisel. Lay out and drill the shelf-pin holes on the inside faces of all four legs.

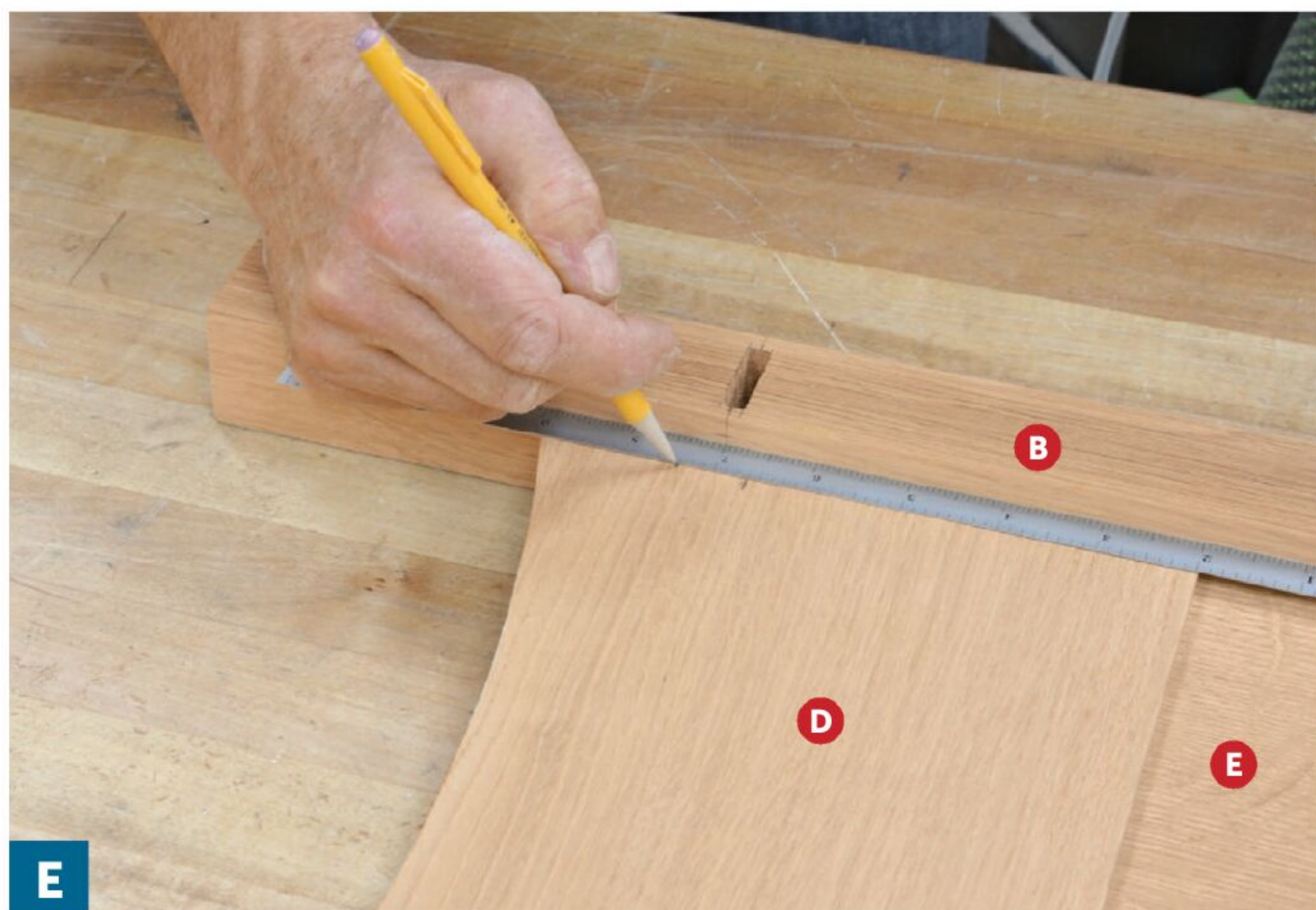
5 Cut the bevels on the top ends of the legs [Photo D], chamfer the bottom ends, then finish-sand the legs.



Position the fence to center the groove on the leg (A) and use masking tape to indicate start and stop points for the groove. Lower the leg onto the spinning bit, and rout the groove in one pass.



Tilt the tablesaw blade to 14° and clamp a stopblock to the fence behind the blade. Adjust the rip fence so the bevels meet in the center of the end, then cut them using the miter gauge with an auxiliary fence.



Lay out the lower rail (D) groove, centered on the horizontal mortises in the legs (A, B). Size the width of the groove to match the actual thickness of your 3/4" plywood.

ASSEMBLE THE SIDES

1 Cut the side rails (C, D) to size and form the groove along one edge [Drawing 2] using a 3/8" straight bit in your router table.

2 Install a dado set in the tablesaw and form the tenons on the side rails. Then, use a block plane to chamfer the ends of the front tenons.

3 Lay out the arc on the bottom of the lower side rails, then cut and sand them to shape.

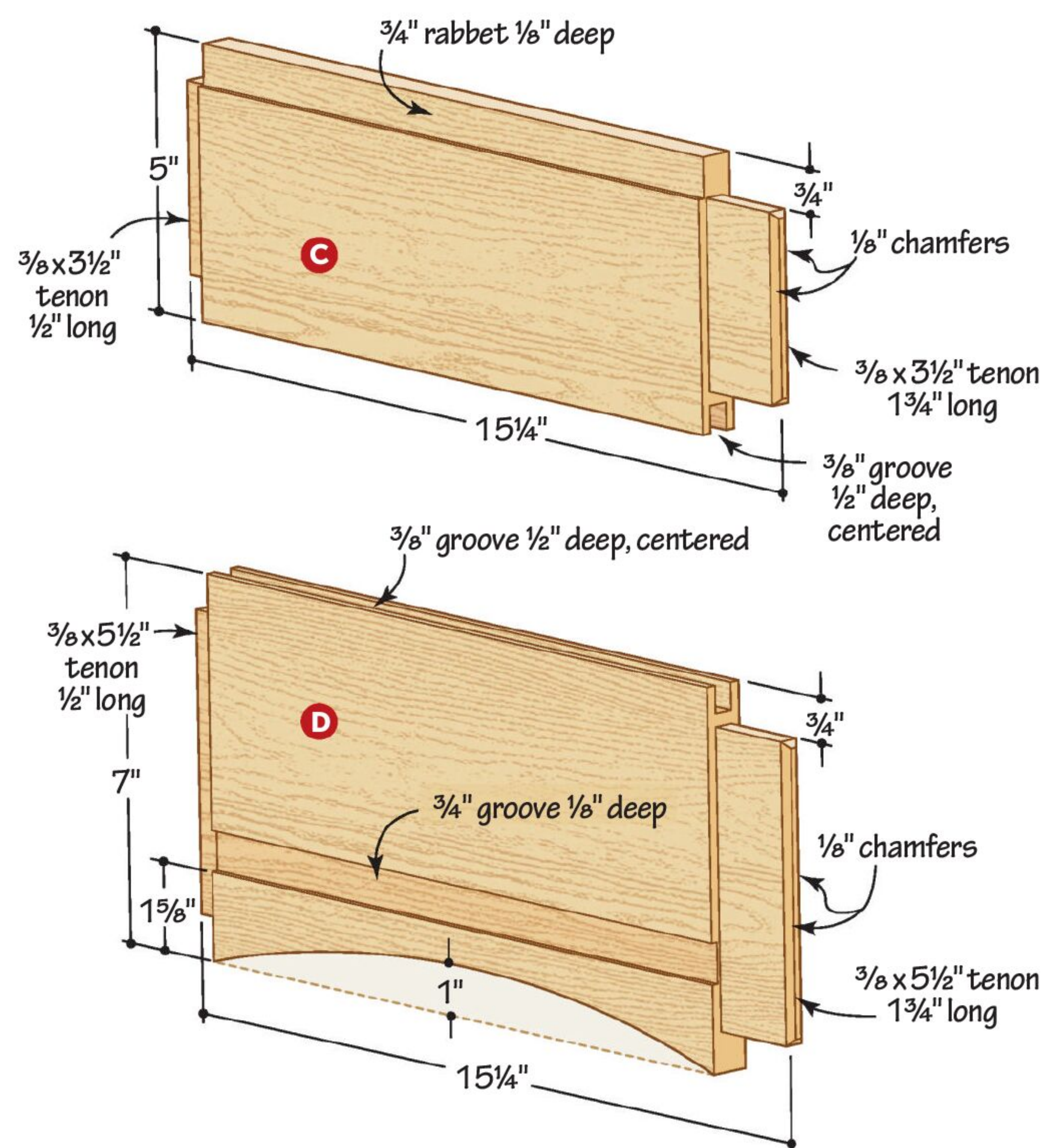
4 Edge-glue stock for the side panels (E), then cut them to size.

5 Dry-fit both side assemblies (A-E) [Drawing 3] and use the mortise location to lay out the grooves on the inside faces of the lower rails (D) [Photo E]. Disassemble the sides, cut the grooves in the lower rails, and rabbet the upper rails (C).

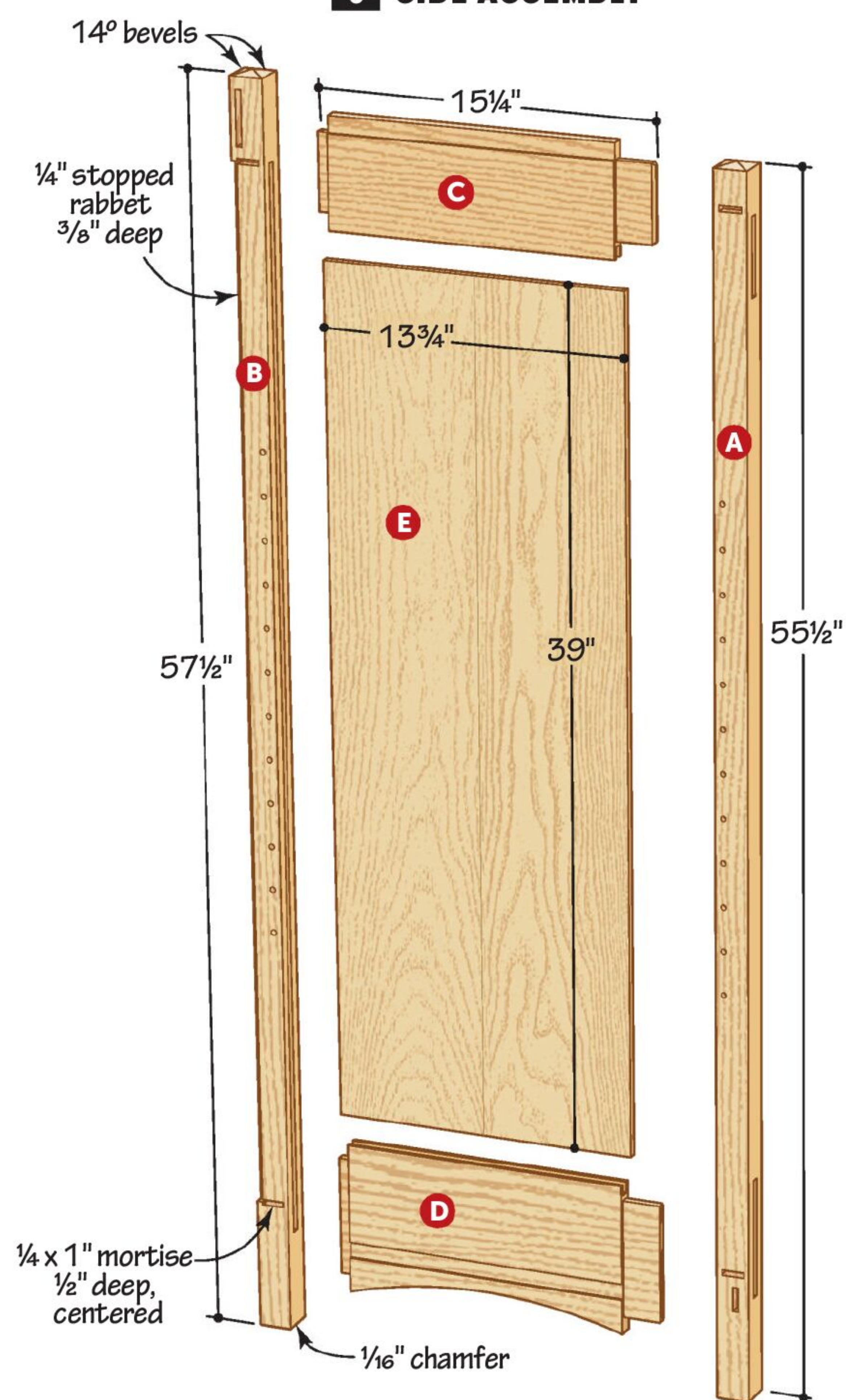
TIP!

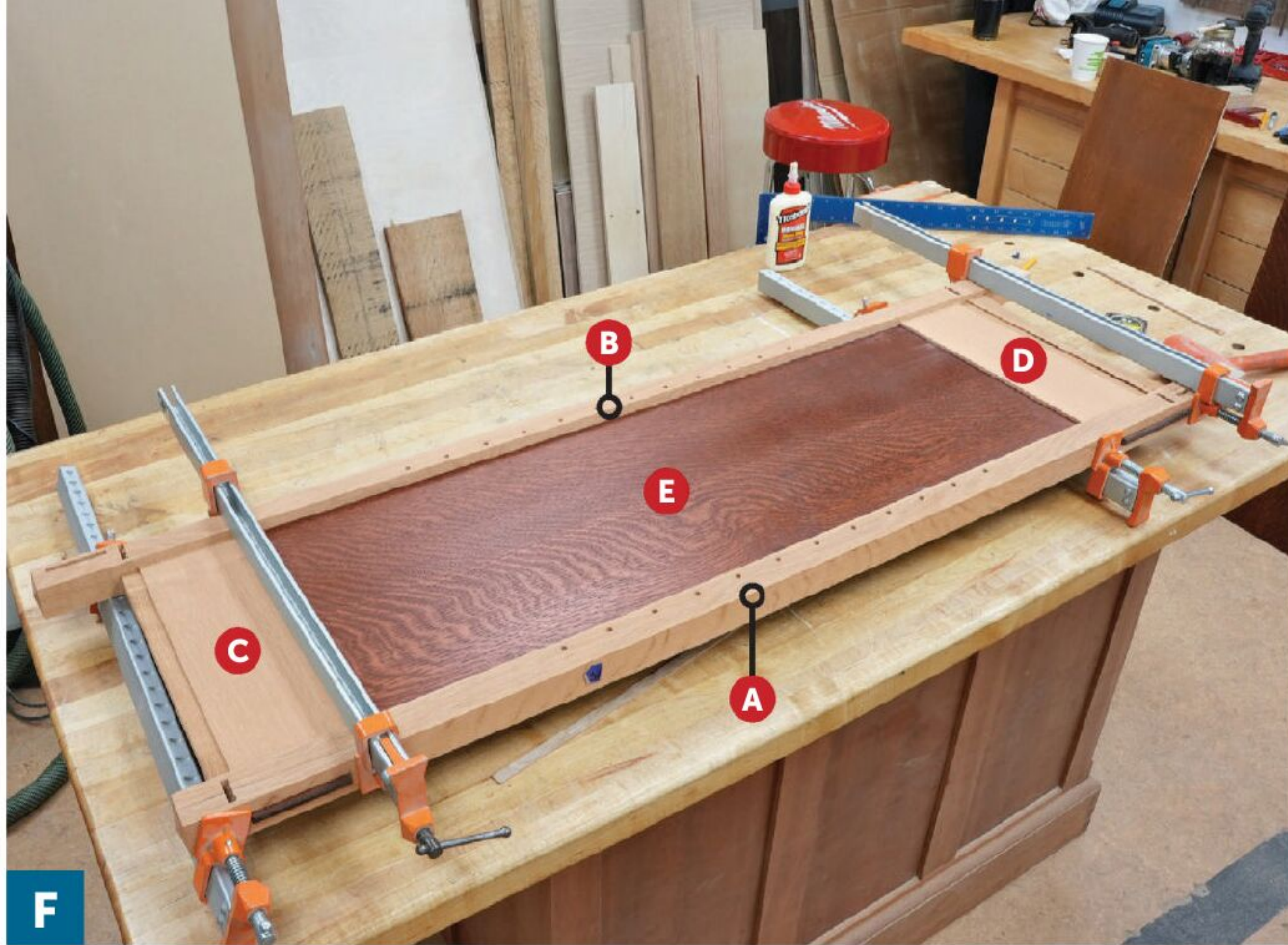
The side panels (E) present a great opportunity for a book-matched panel with a piece of quartersawn lumber at least 7" wide.

2 SIDE RAILS



3 SIDE ASSEMBLY





Apply glue to the rail (C, D) 1/2" tenons and to the through-tenons, just behind where you applied finish, then assemble the side and clamp.

6 Finish-sand the rails and panels. Add masking tape to the portions of the tenons that will be hidden in the mortise and apply a finish to the exposed ends of the rail front tenons and the panels. Applying finish now ensures that the panels don't reveal unstained edges with seasonal movement. We applied W. D. Lockwood dye #144, followed by a coat of Varathane Gunstock stain and a final coat of matte lacquer.

7 Once the finish dries, unmask the tenons then glue and clamp together the side assemblies [Photo F, Drawing 3].

Note: For the through-tenons, apply glue only to the base of the tenons—not the mortises—to keep the exposed ends of the tenons glue-free.

ASSEMBLE THE CASE

1 Cut the stretchers (F, G), front lower rail (H), and crest rail (I) to size [Exploded View]. Form the tenons on the ends of each part and rabbet the back stretchers (G) and crest rail (I) [Drawing 4]. Lay out and form the arc on the front lower rail (H).

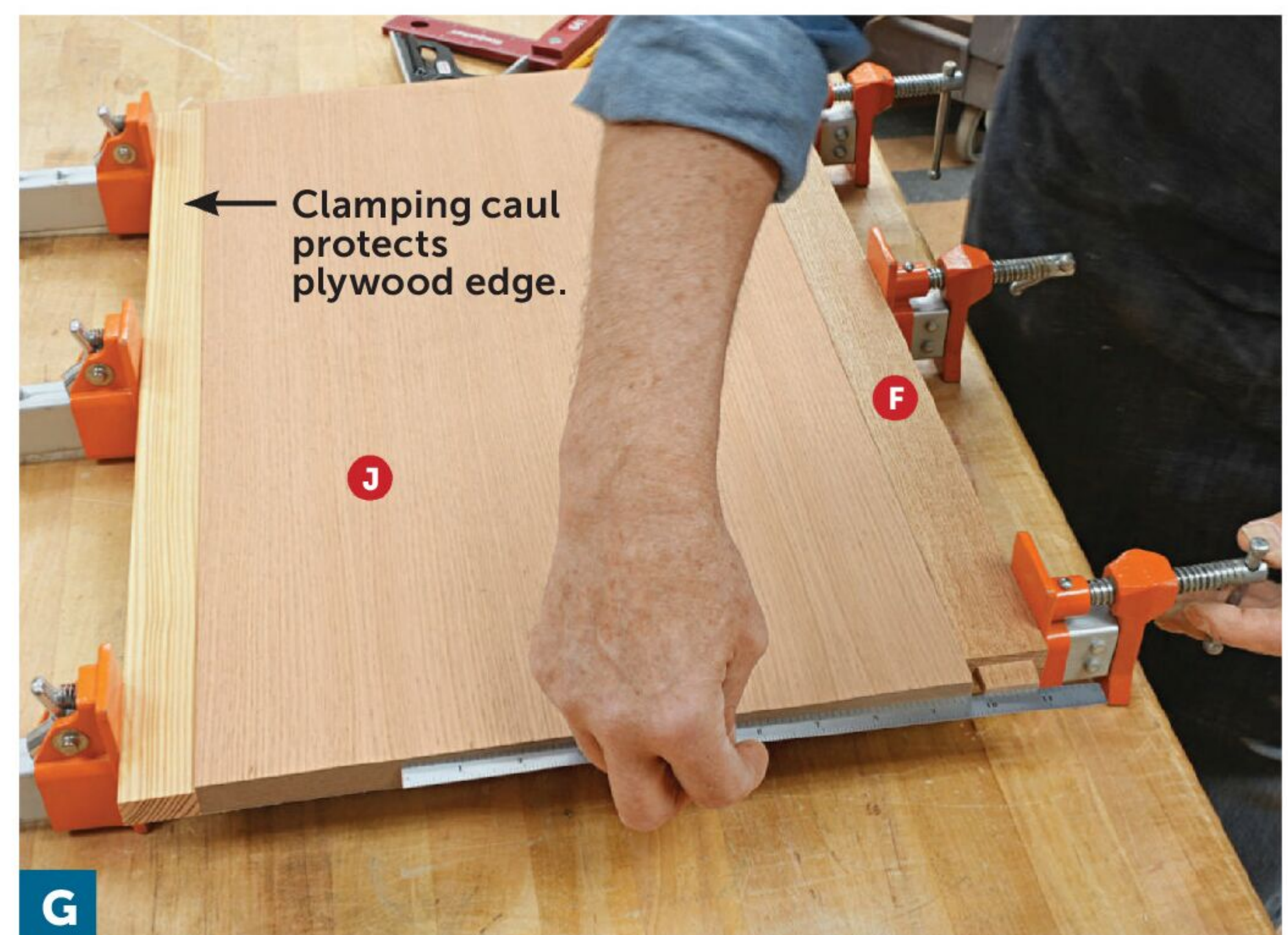
2 Dry-fit the cabinet assembly, clamping the stretchers and crest rail between the sides [Exploded View]. Then measure between the upper side rail (C) rabbets before cutting the subtop and bottom (J) to size.

3 Glue and clamp the stretchers (F, G) to the subtop and bottom [Photo G]. Once the glue dries, finish-sand these assemblies.

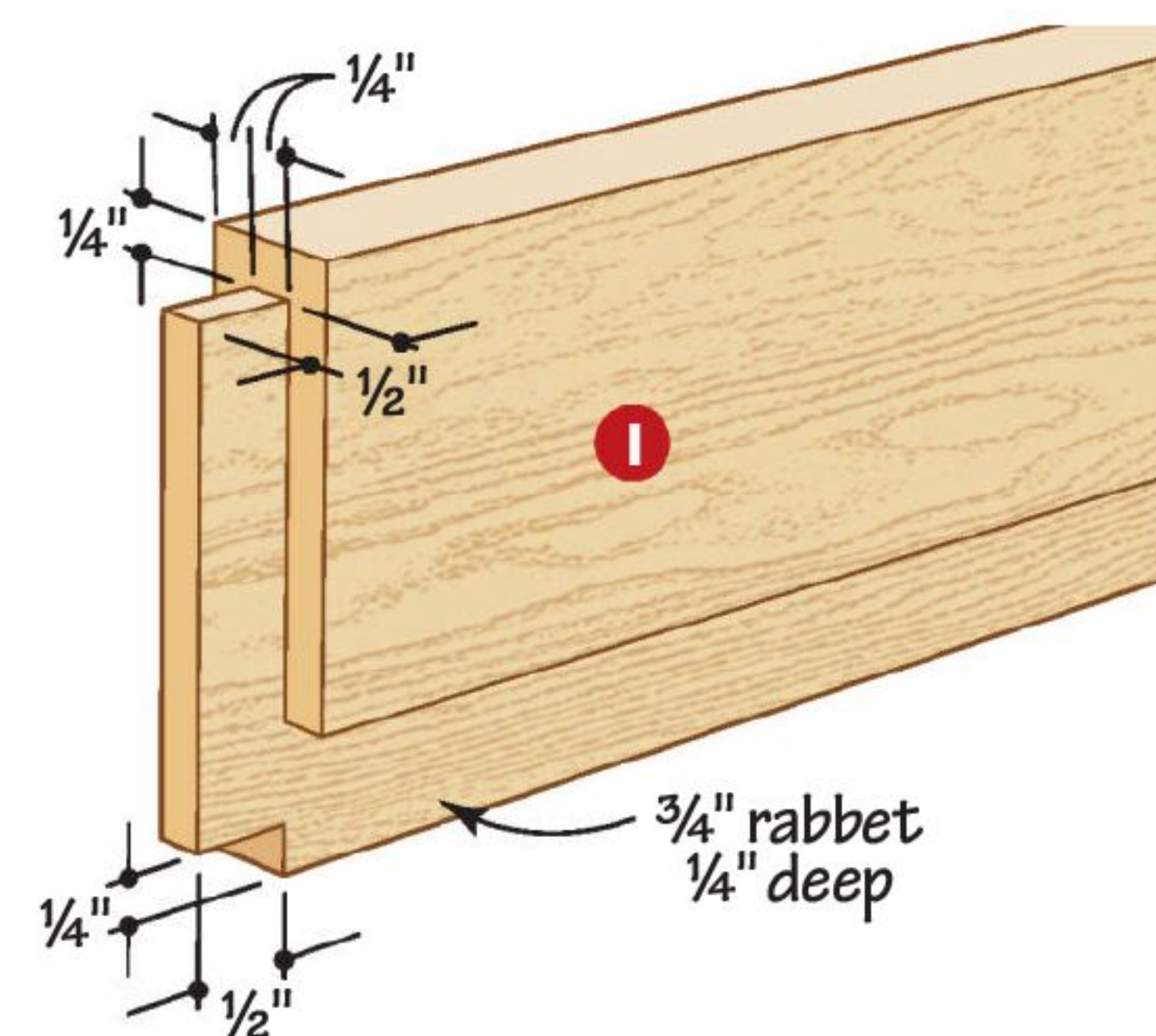
4 Glue and clamp the subtop and bottom assemblies to one side assembly, checking for square. Once the glue dries, glue the front lower rail (H) and crest rail (I) into place on the side assembly. Then, add the second side to the case, gluing and clamping it in place and checking the case for square.

5 Glue up a panel for the top (K), then cut it to size [Drawing 5]. Notch the corners to fit around the legs, radius the corners, and finish-sand the top.

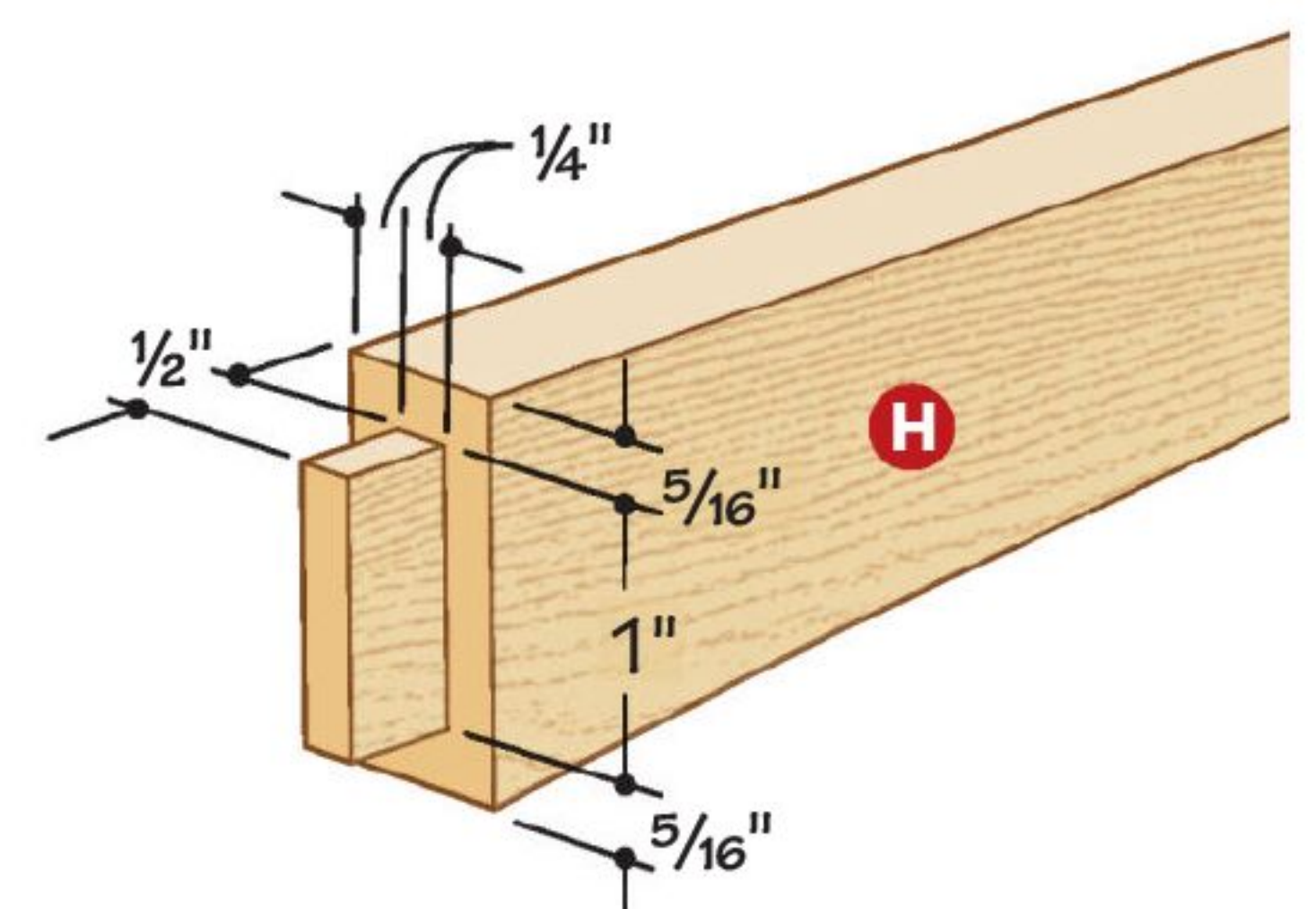
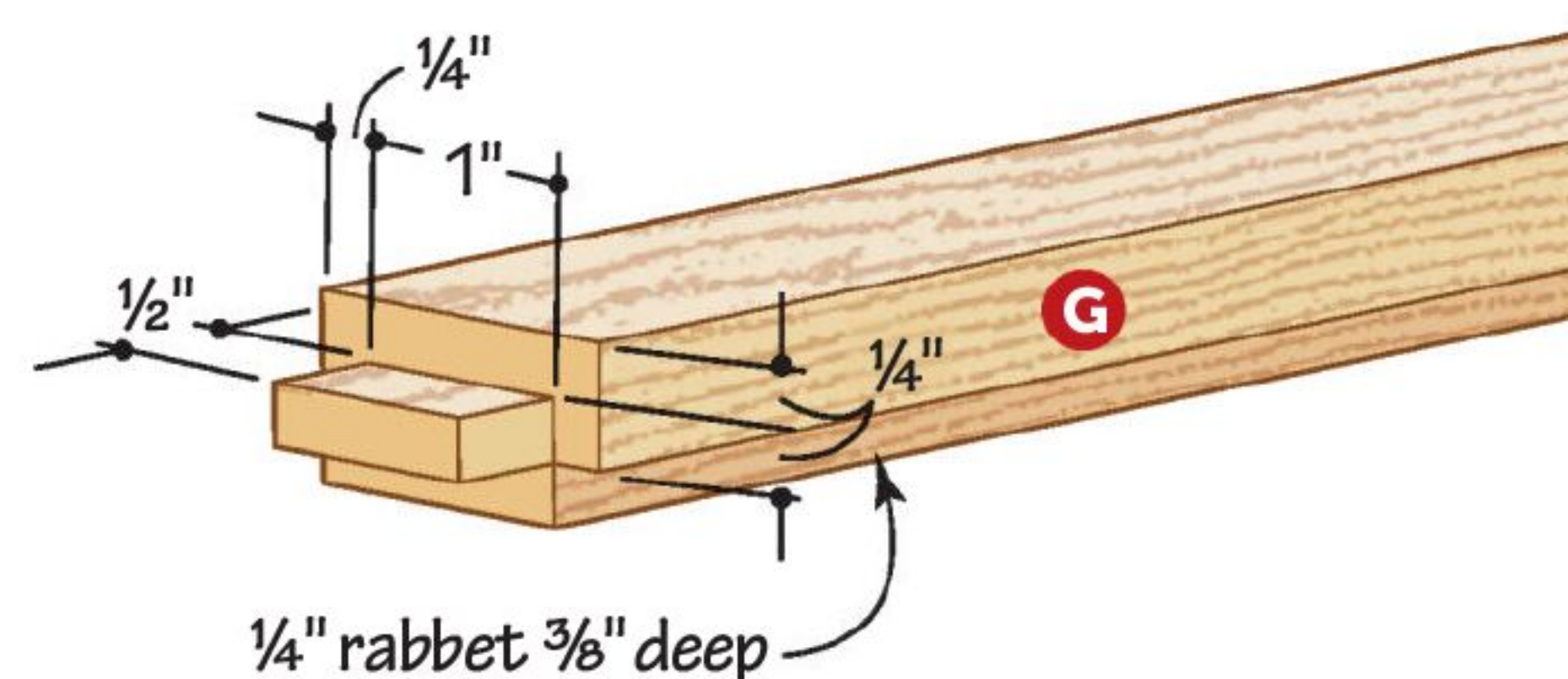
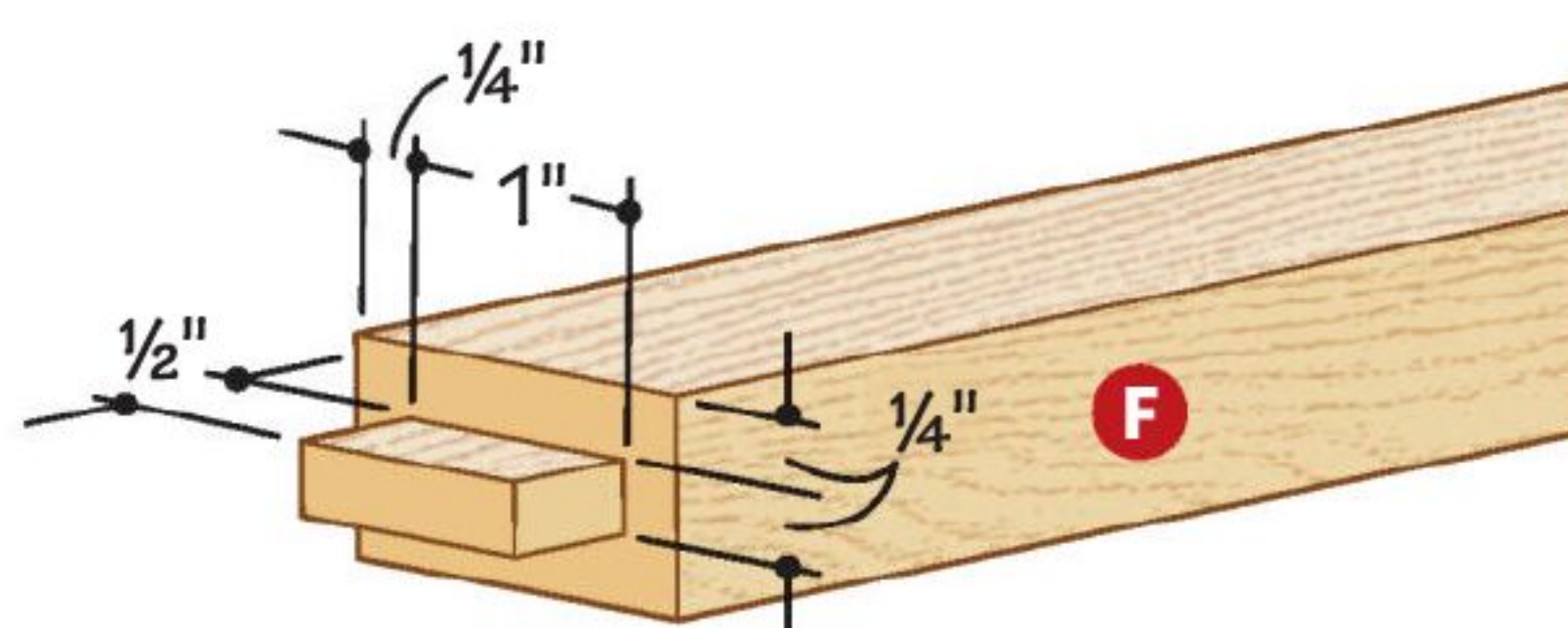
6 Cut the back (L) to fit the rabbeted opening in the case [Exploded View] and finish-sand the back. Cut the shelves and shelf edging (M, N) to size. Glue the edging to the front of the shelves, and once the glue dries, form the round-overs and finish-sand the shelves.

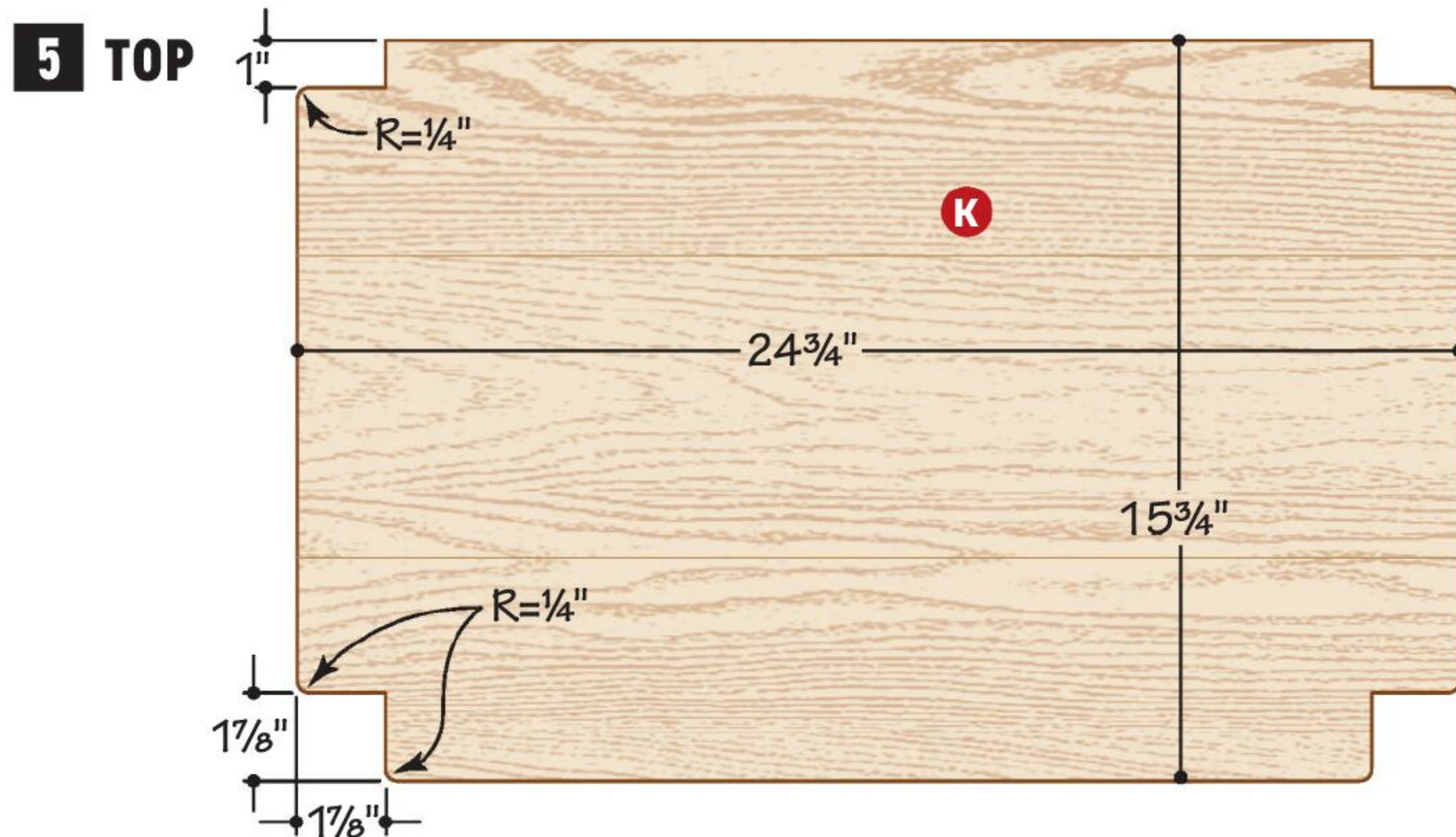


Glue and clamp the front stretchers (F) to the subtop/bottom panels (J). Use a straightedge to ensure that the ends of the tenons are flush to the ends of the panels. Repeat with the back stretchers (G).

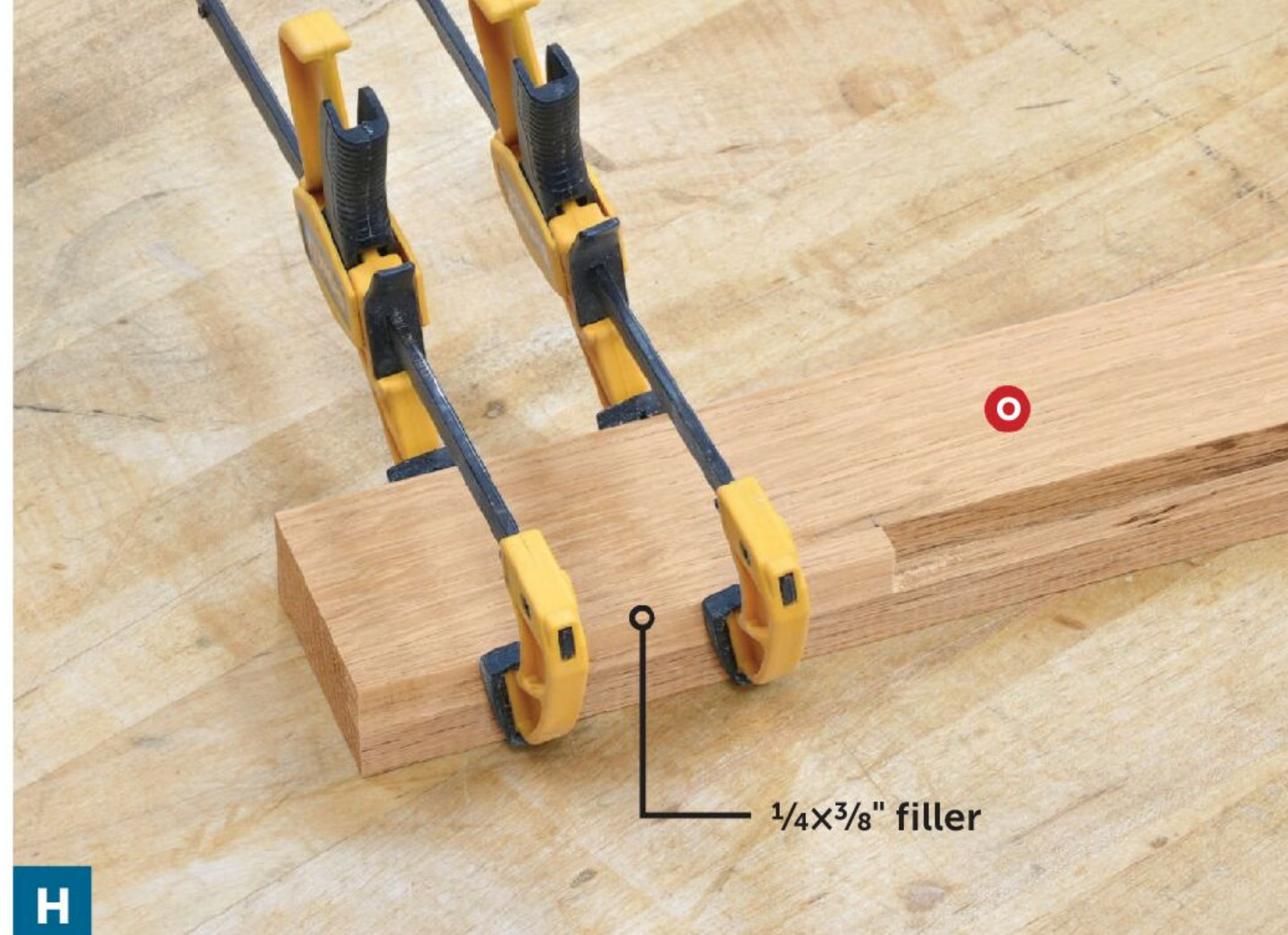
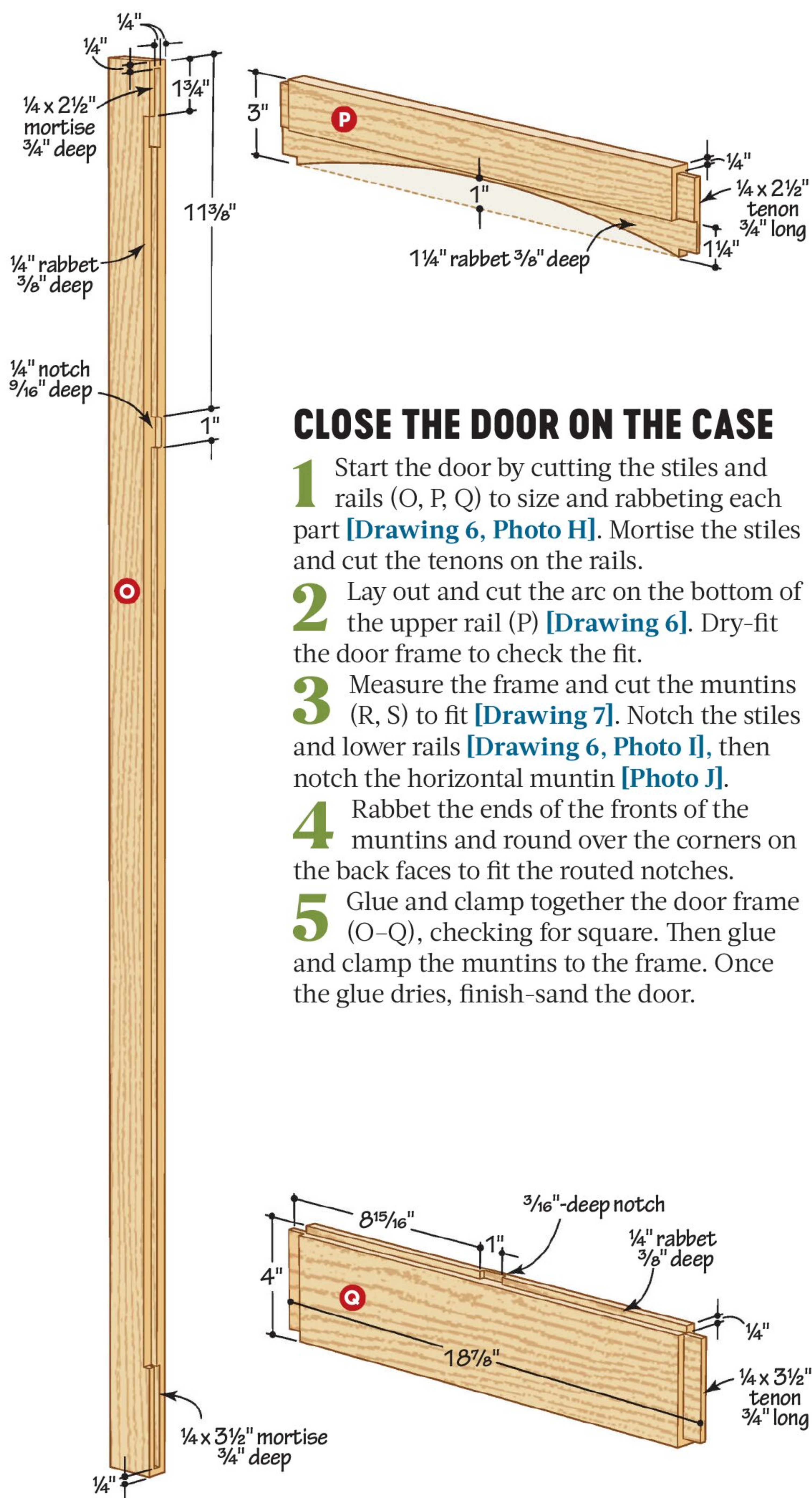


4 STRETCHERS AND RAILS

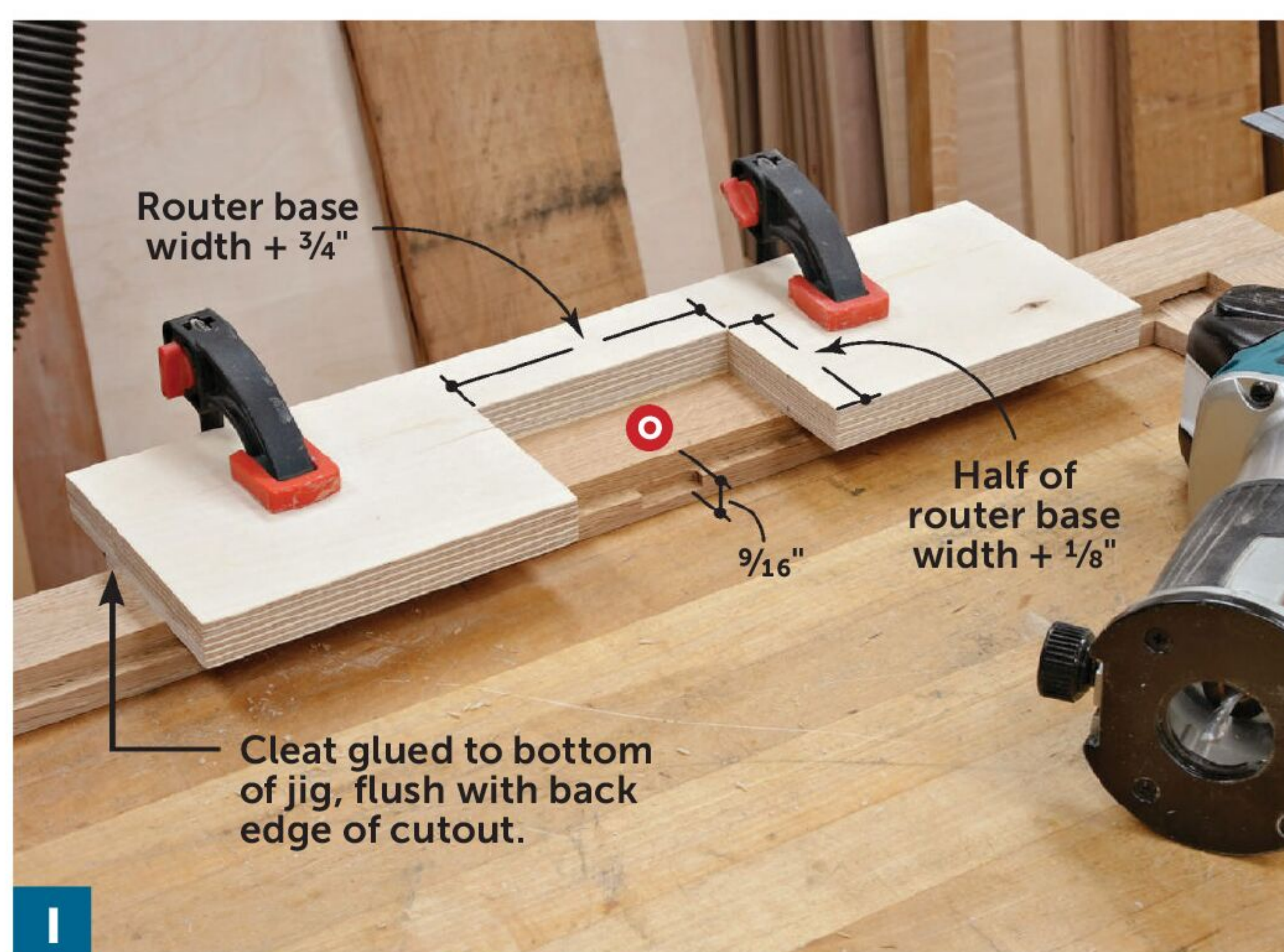




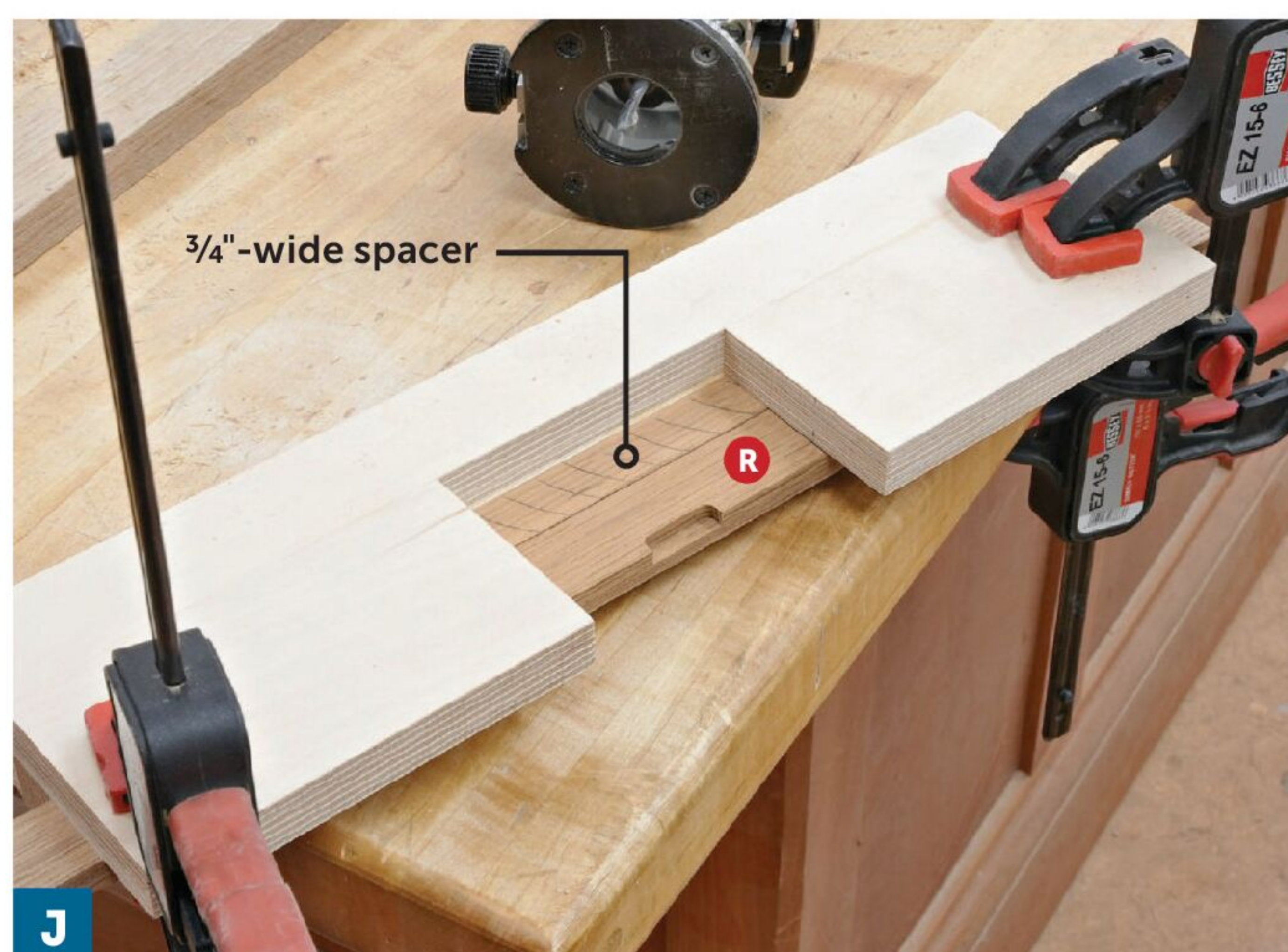
6 DOOR STILES AND RAILS



To form the stopped rabbets on the door stiles (O), cut a rabbet the entire length of the stile and glue in 1/4 x 3/8" fillers, 1 3/4" long at the top and 4" long at the bottom.



Install a 1/4" bit in the trim router and set it to rout a 9/16"-deep notch in the stiles and lower rail (O, Q), or 3/16" into the rabbet. Make the mortising jig, clamp it to the workpieces, and rout the notches.



Use the same jig, but with a 3/4"-wide spacer, to rout a 3/16"-deep notch centered on the length of the horizontal muntin (R).

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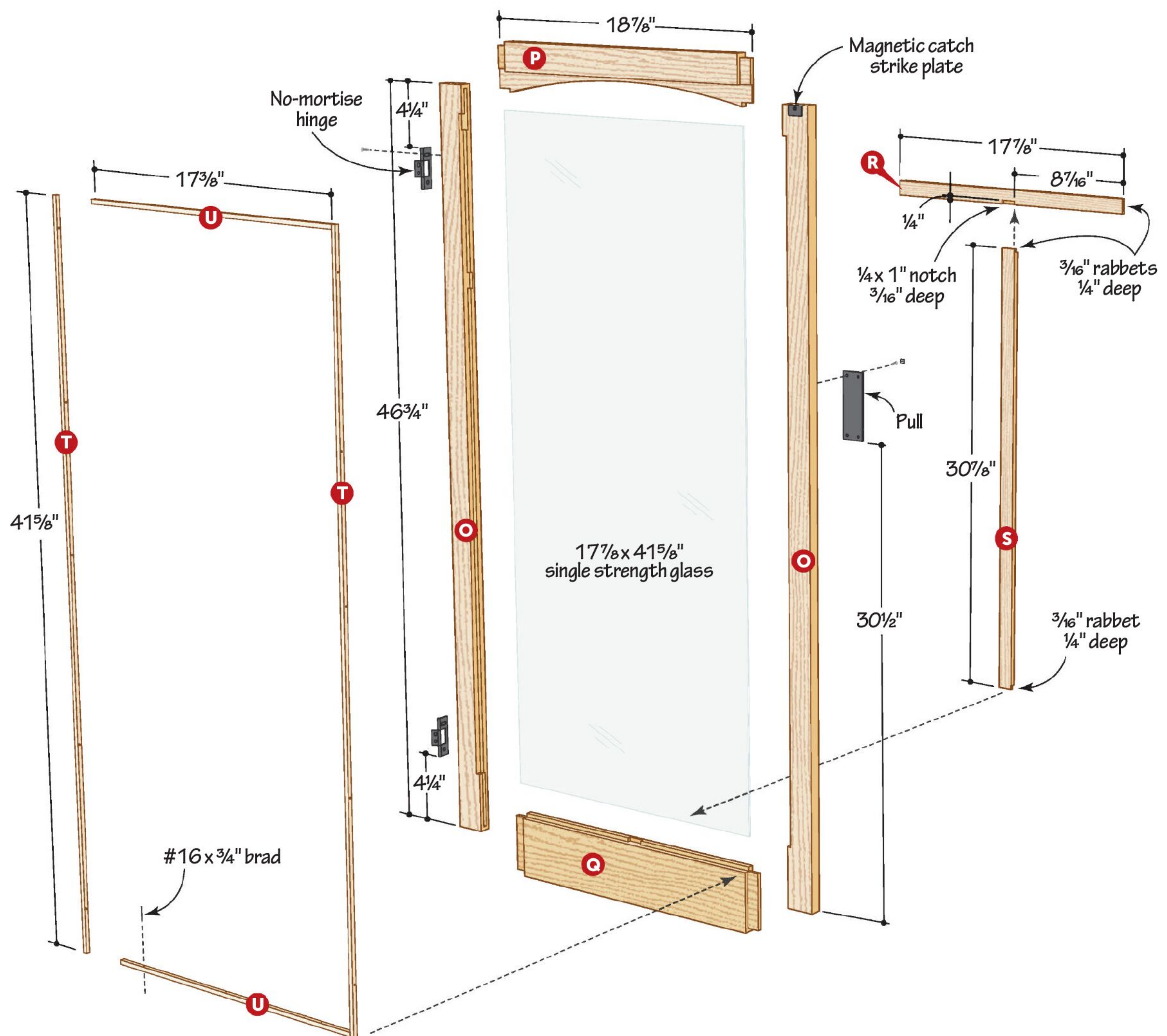


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7 DOOR (viewed from back)



MATERIALS LIST

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A	FRONT LEGS	1½"	1½"	55½"	QWO	2
B	BACK LEGS	1½"	1½"	57½"	QWO	2
C	UPPER SIDE RAILS	¾"	5"	15¼"	QWO	2
D	LOWER SIDE RAILS	¾"	7"	15¼"	QWO	2
E	SIDE PANELS	⅜"	13¾"	39"	EGQWO	2
F	FRONT STRETCHERS	¾"	1½"	22"	QWO	2
G	BACK STRETCHERS	¾"	1½"	22"	QWO	2
H	FRONT LOWER RAIL	¾"	1⅝"	22"	QWO	1
I	CREST RAIL	¾"	3"	22"	QWO	1
J	SUBTOP/BOTTOM	¾"	13"	22"	OP	2
K	TOP	¾"	15¾"	24¾"	EGQWO	1
L	BACK	¼"	21¾"	47⅝"	OP	1
M	SHELVES	¾"	14¼"	20⅞"	OP	3
N	SHELF EDGING	¾"	¾"	20⅞"	QWO	3

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
O	DOOR STILES	¾"	1¾"	46¾"	QWO	2
P	DOOR UPPER RAIL	¾"	3"	18⅞"	QWO	1
Q	DOOR LOWER RAIL	¾"	4"	18⅞"	QWO	1
R	HORIZONTAL MUNTIN	⅜"	1"	17⅞"	QWO	1
S	VERTICAL MUNTIN	⅜"	1"	30⅞"	QWO	1
T	VERTICAL GLASS STOPS	¼"	⅝"	41⅝"	QWO	2
U	HORIZONTAL GLASS STOPS	¼"	⅝"	17⅜"	QWO	2

MATERIALS KEY: QWO—quartersawn white oak, EGQWO—edge-glued quartersawn white oak, OP—oak plywood.
SUPPLIES: #16x3/4" brads, #16x1" brads, 1/8x17 7/8x41 5/8" single strength glass, 1/4" shelf pins.
BLADE AND BITS: Dado-blade set, 1/4" and 3/8" hollow-mortise chisels, 1/4" and 3/8" straight router bits, 1/4" round-over router bit.
SOURCES: Non-mortise hinges no. CH-1554AC (1 pair), \$5; antique copper vertical pull no. CH-1019ACS, \$14, craftsmanhardware.com, 509-766-4322. Copper magnetic catch, no. 233959, \$3, Lowes, 877-465-6937, lowes.com.
PROJECT COST: It cost us about \$365 to build this project. Your cost will vary by region and source.

6 Screw the hinges to the door, then to the inside face of the leg (A). Add one screw per hinge in the slotted holes, adjust the door as needed, then add the remaining screws. Secure the pull to the door. Screw the magnetic catch to the case and the catch plate to the door **[Exploded View]**.

7 Cut the glass stops (T, U) to size and finish-sand. Remove the hardware from the case and door, then touch up any remaining finish-sanding, and apply the dye,

stain, and lacquer to the unfinished portion of the cabinet.

8 Once the finish dries, attach the back (L) and top (K) **[Exploded View]**. Add a small dot of clear silicone adhesive to the center of each muntin and install the glass in the door. Add the glass stops, securing them with brads **[Drawing 7]**. Reinstall the hardware and the door. Set the shelves in the cabinet using shelf pins and put your most-prized treasures on display. 🌲

CUTTING DIAGRAM

This project requires 8 board feet of 8/4 quartersawn white oak, 13 board feet of 4/4 quartersawn white oak, and 12 square feet of 1/2" quartersawn white oak based on the example boards shown.



1 1/2 x 3 1/2 x 60" Quartersawn white oak (2 needed)



3/4 x 7 1/4 x 96" Quartersawn white oak



3/4 x 3 1/2 x 72" Quartersawn white oak



3/4 x 5 1/2 x 84" Quartersawn white oak



3/4 x 5 1/2 x 48" Quartersawn white oak



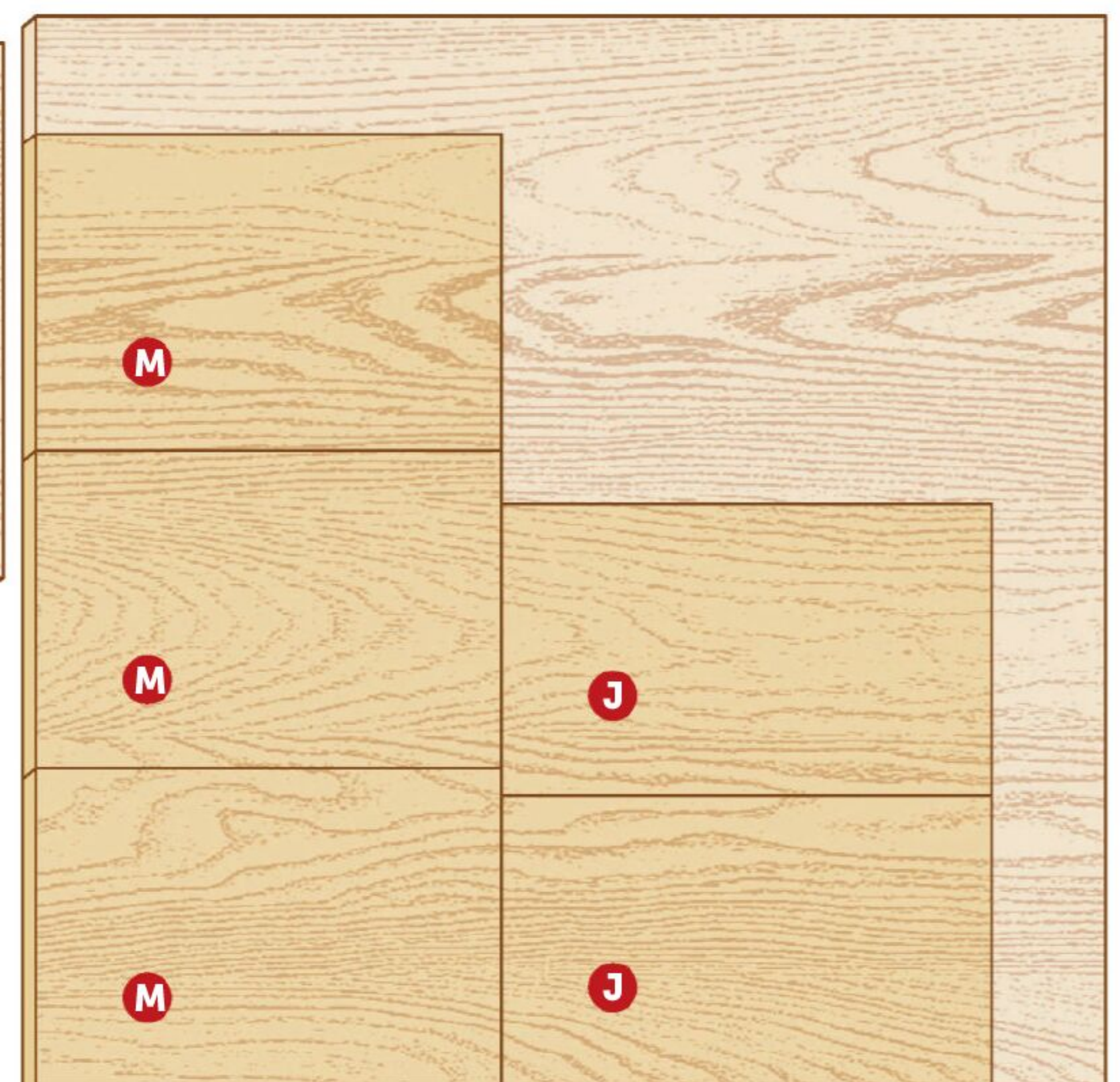
3/8 x 7 1/4 x 96" Quartersawn white oak (2 needed)



3/8 x 3 1/2 x 60" Quartersawn white oak *Plane or resaw to the thickness listed in the Materials List.



1/4 x 24 x 48" Oak plywood



3/4 x 48 x 48" Oak plywood

MUST-HAVE TOOLS FOR ACCURATE MEASURING

Achieving spot-on precision doesn't require a collection of expensive devices. In our shop, a simple few handle the majority of what we do.

WRITER: DAVE STONE

Project success often comes down to fractions of an inch. But you don't need a bunch of expensive or high-tech measuring tools to achieve that needed accuracy. In the WOOD® shop, we rely every day on just a few surprisingly simple measuring devices that give us dependable results.

Best of all, none of these tools is expensive, and all will last you through a lifetime of building. So, set down the tape measure and pick up these simple ways to master measuring.

PHOTOGRAPHERS: MARTY BALDWIN, KELSEY HANSEN, CARSON DOWNING

STEEL RULES

Tape measures are great for measuring in feet, but when it comes down to inches, and especially fractions of an inch, steel rules [Opening Photo] simply rule. That makes them the most-used measuring tools in our shop.

A 6" rule should reside full-time in your shop apron. You'll find thin, flexible versions and thicker, stiff rules. Both work well, so choose one to suit your personal preference.

Longer steel rules—12", 24", or even longer—are fantastic for long measurements, setting saw fences, and more.

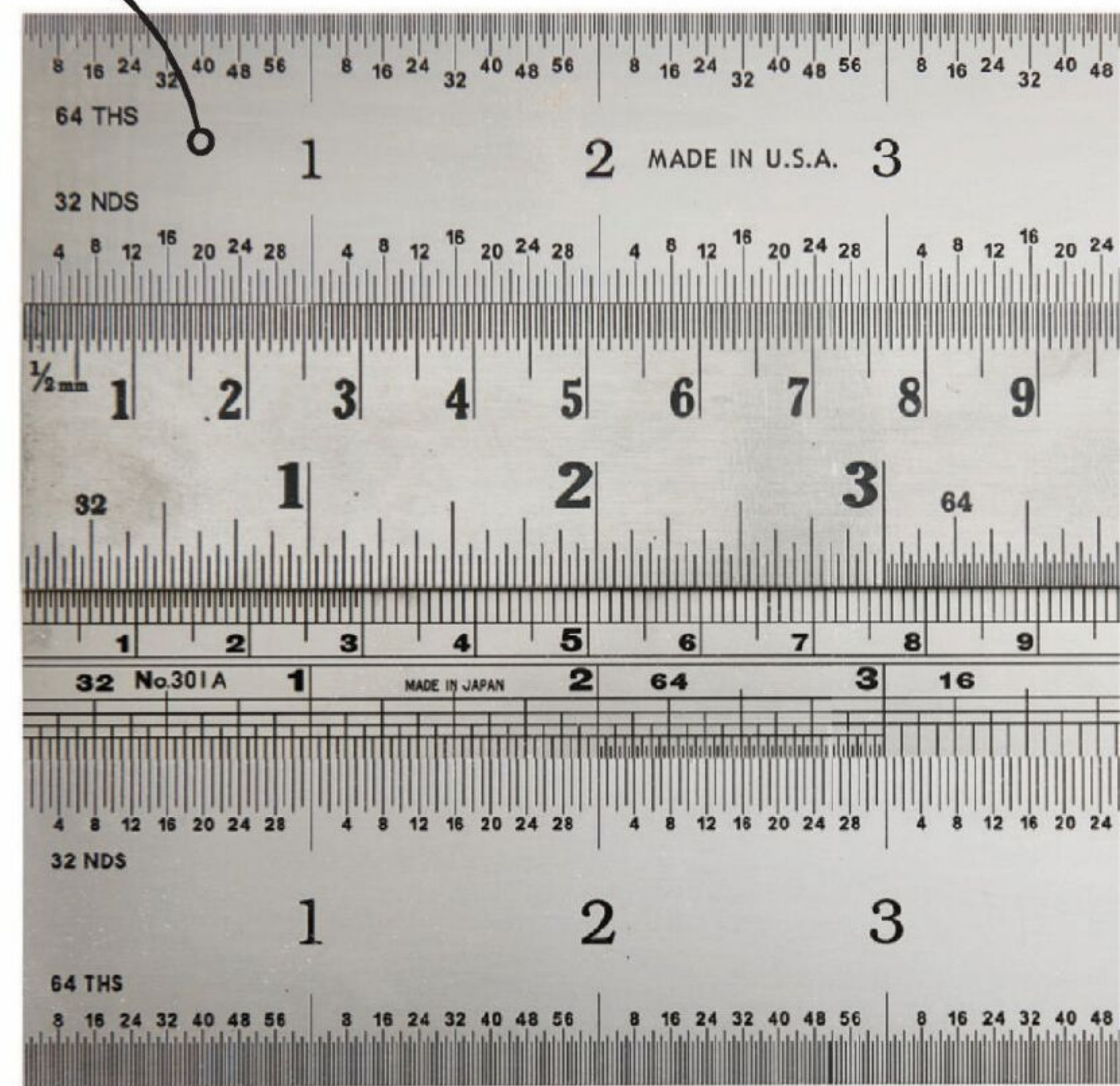
To ensure accuracy when you swap between rules of different lengths, make sure they all read the same. Align their "zero" ends and examine the marks to ensure they're consistent, *right*.

To make sure you won't encounter any measuring surprises, check your steel rules against one another to ensure that the readings all match. Check the entire length of each rule.

Flexible steel rules can conform to gentle curves, and be used to create a fairing stick, *below left*.

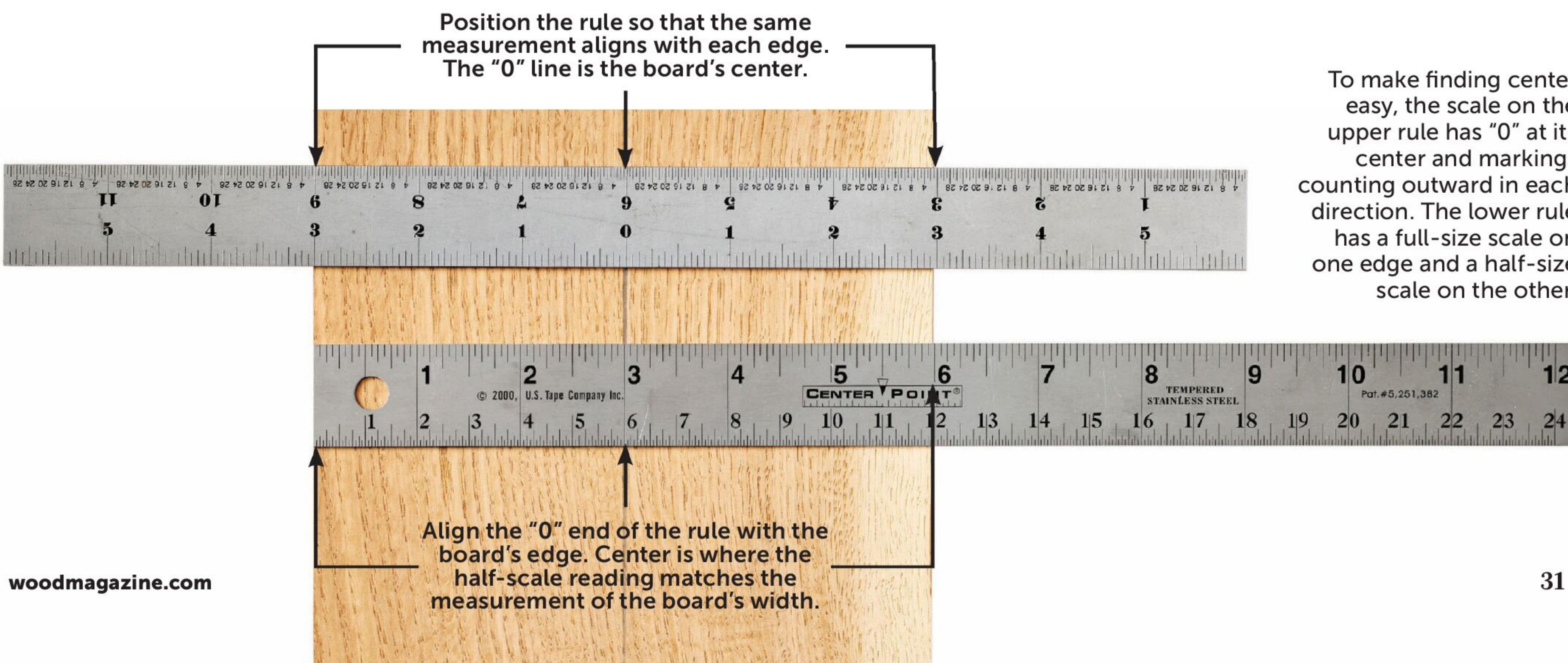
One variation on the common steel rule adds holes, sized to accept a mechanical pencil lead, for laying out accurate marks without the pencil's wandering, *below right*.

Center-finding rules are handy when you need to locate the exact middle of the face or edge of a board. You'll find them in a couple of styles, *bottom*.



For laying out repeatable curves, make a fairing stick by flexing a steel rule in a clamp. It holds a consistent arc from end to end and provides a reliable edge to mark against.

With a pencil-lead-sized hole at every measurement and a removable head on the end, this rule can be dragged along the face or edge of a board to mark accurate layout lines.



To make finding center easy, the scale on the upper rule has "0" at its center and markings counting outward in each direction. The lower rule has a full-size scale on one edge and a half-size scale on the other.

PROJECT PARTS

While we rely on measuring tools every day, we also size a lot of project parts and perform many tool setups without measuring at all. We do this by transferring dimensions directly from the project parts, *right*.

With this method, instead of having to hit an exact dimension, you concern yourself only with hitting a correct size. Even if you're working with a part that wasn't sized perfectly, you'll still ensure that your project fits together correctly.



Already cut parts make the most reliable measuring tools for any project. Setting according to the part you've made eliminates multiple opportunities for measuring errors and ensures a matched fit.



An angle gauge with a digital display makes it easy to lock in the exact setting you need, down to a tenth of a degree. Models with built-in measuring scales serve double duty.

ANGLE GAUGES

Not all measurements are straight and square. When setting angles, we have to admit that we let a bit of technology in.

Digital displays simplify setting angles thanks to easily legible readouts that measure in tenths of a degree, *above*. Most models allow resetting the display to zero at any angle, which comes in handy for laying out multiple points along an arc.

On the other hand, we still find a decidedly low-tech bevel gauge, *inset photo*, invaluable for transferring a known angle from one workpiece to another.

A bevel gauge has no digital display and not even an angle scale, so you won't use it to set an angle at an exact degree. But it's the perfect tool for duplicating an angle from one workpiece to another.

SQUARES

Framing squares and rafter squares are great for building homes but won't provide fine-furniture accuracy. Woodworking squares bring the higher level of precision necessary when measuring to fractions of an inch.

A combination square features a movable head with fixed faces at 90° and 45°. That means you always have a tool to measure the two most common angles you'll use. We find that combination squares really shine for laying out consistent marks across multiple, ganged workpieces, *right*.

Flat squares, which are close cousins to the steel rule, work great for transferring marks from the edge of the workpiece onto the field. Just be sure that you use the square correctly to ensure accuracy, *below left*.

Combination squares and flat squares will both work for tool setups, but for those tasks, we prefer setup squares. We keep a couple small ones around that are fantastic for accurately setting router-bit and tablesaw blade heights, *below right*. 🪵



When you need to accurately measure across multiple workpieces, line them up and grab a combination square to make identical marks on all the workpieces at one time.



When using a flat square, don't rely on aligning one leg with the edge, *above*. Instead, hang one leg over the edge, *below*, and pull it tight to ensure that the other leg sits perfectly square across the face.



Setup squares resemble miniature rafter squares with a foot on one side that allows them to stand on their own. A 3" version is perfect for setting bit and blade heights and easily fits in your shop apron.

SMALL-PARTS TABLESAW SLED

With customizable hold-downs, this small-parts tablesaw sled lets you safely trim even miniature workpieces with ease and accuracy.

WRITER: KERRY GIBSON
DESIGNER: JOHN OLSON
BUILDER: BRIAN BERGSTROM

OVERALL DIMENSIONS
17½"W x 12"D x 4"H



PHOTOGRAPHER: CARSON DOWNING; **ILLUSTRATORS:** ROXANNE LEMOINE, LORNA JOHNSON

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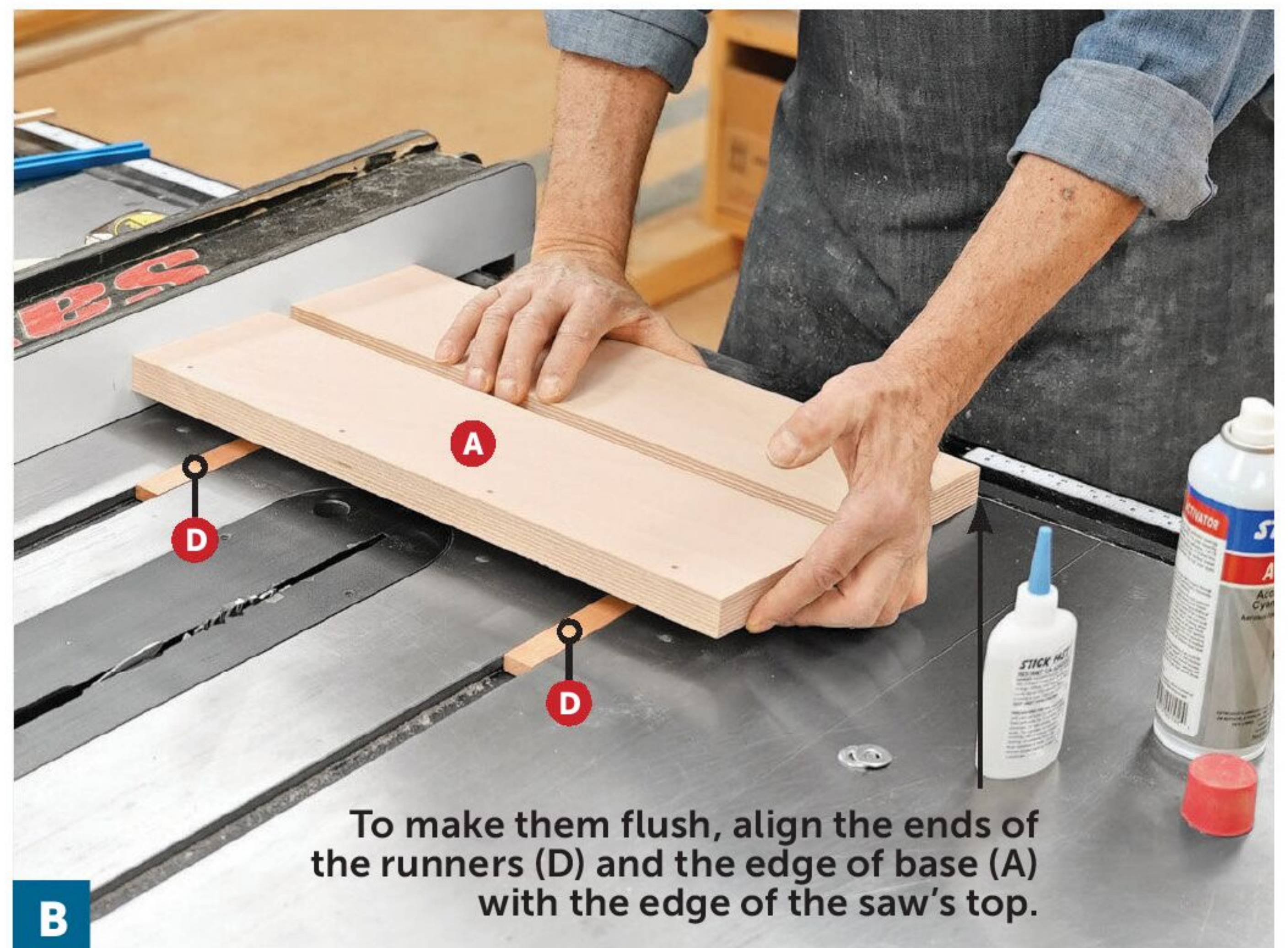
ADD THE RUNNERS

TIP!

Sliding the runners back and forth in the slots should mark any rub spots that you can then sand away.

1 Cut two 12"-long sled runners (D) to fit the slots for your saw [Materials List]. They should be snug, but not so tight they can't slide smoothly.

2 Place washers under the sled runners (D) to elevate them slightly above the surface of the tablesaw. Position the tablesaw rip fence to center the base (A) over the blade. Apply cyanoacrylate (CA) glue or double-faced tape to the top faces of the runners, then press the base onto the runners [Photo B]. Carefully remove this assembly from the saw, flip it over, and permanently attach the runners to the base using #8×1" wood screws.



Set the saw's rip fence to center the base (A) on the blade. Use the edge of the saw's top to align the runners with the sled base. Adhere the base to the runners, then flip it over and drive mounting screws.

SQUARE THE REAR FENCE

Since you'll cut against the rear fence, you need to make sure it's installed perpendicular to the blade.

1 Set the sled on the tablesaw and use a framing square against the rip fence to mark the location for the rear fence (B) [Photo C].

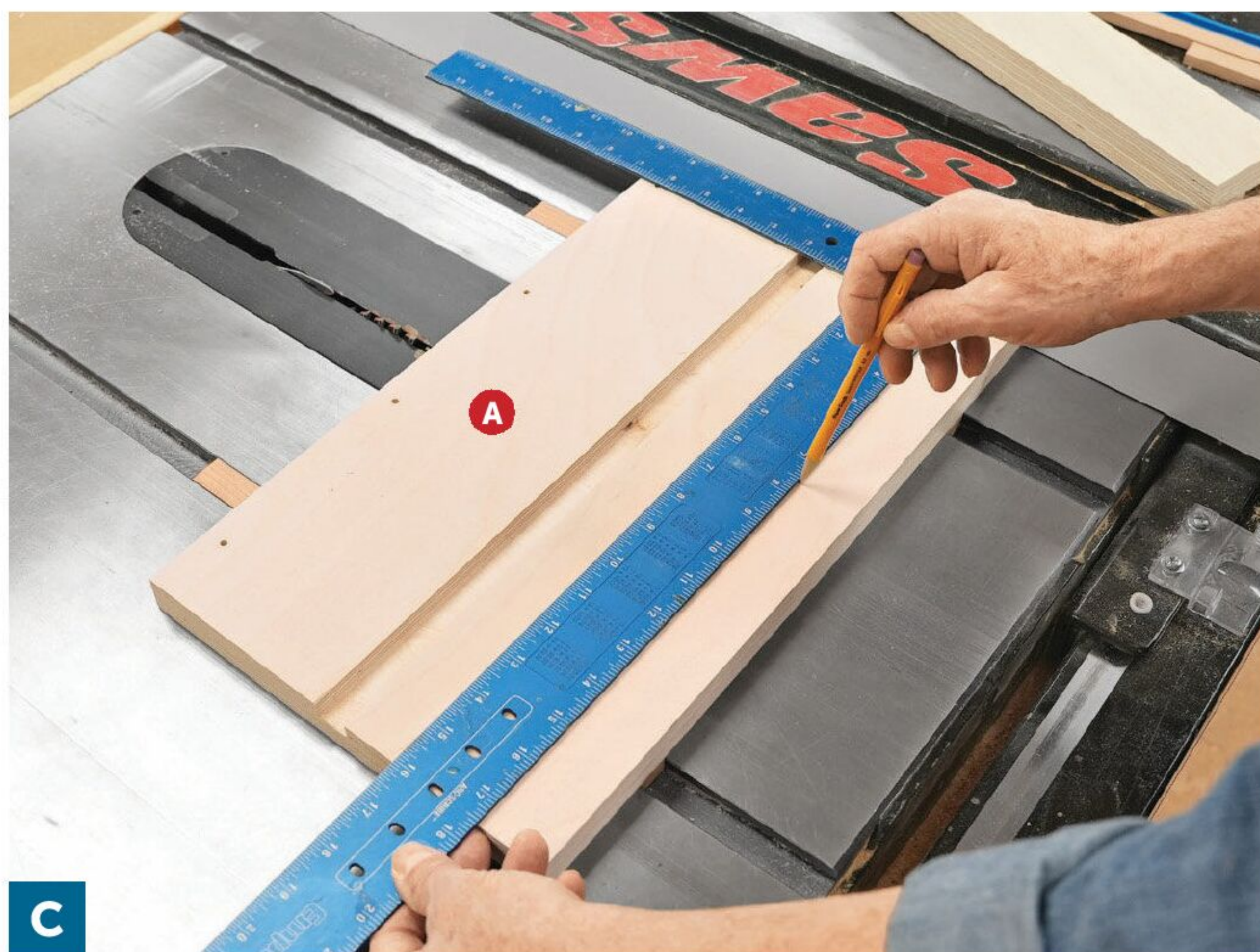
2 Clamp, then screw the rear fence to the assembly, aligning its front face with the scribe line. Next screw the front fence in place, flush with the leading edge of the base.

LAY TRACK, CUT HOLD-DOWNS

T-track gives this sled real versatility by allowing you to custom tune the position of the hold-downs to keep workpieces locked in place when making cuts.

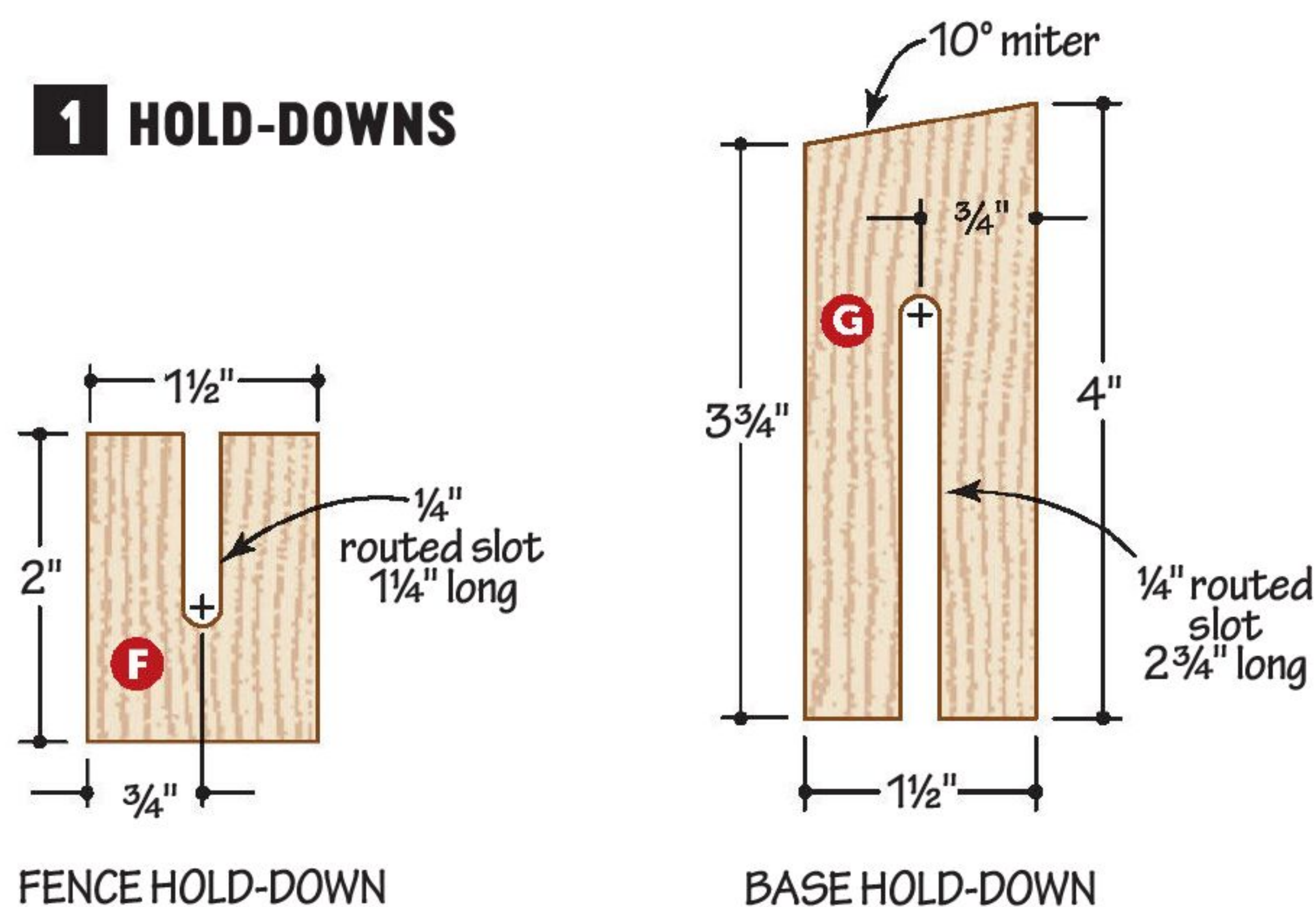
1 Cut four pieces of T-track to 8" long and place them in the grooves cut in the base (A) and rear fence (B), flush to the outside ends. This will leave a gap for the blade. Drill pilot holes for #6×5/8" screws using the factory holes in the T-track as a guide. Temporarily screw the track in place.

2 Cut two T-track spacers (E) [Materials List, Exploded View] to fit between the T-track sections in the base and rear fence. Glue and clamp these in place.



With the sled runners in the saw's miter slots and the rip fence locked, butt a framing square against the fence. Scribe a layout line 1½" from the rear edge of the base to locate the rear fence.

1 HOLD-DOWNS

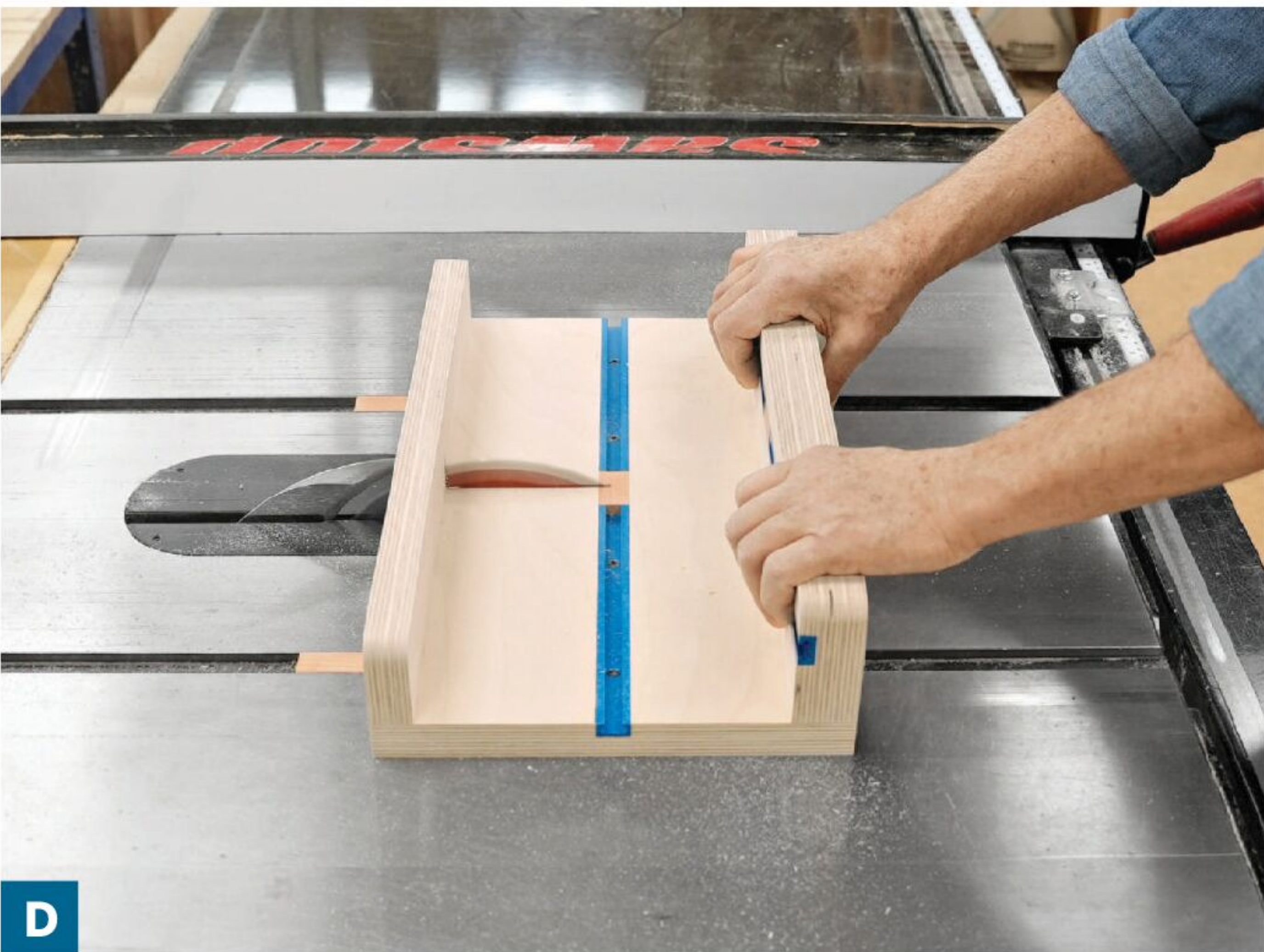


Note: We show four hold downs. Batch cut multiples now with precut slots that you can trim to custom size/shape later on.

- 3 From 1/2" plywood, cut two 1 1/2x8" blanks for the fence hold-downs (F) and base hold-downs (G). Install a 1/4" spiral upcut bit in the router table, then adjust the fence to cut a centered slot. Add a stopblock to the fence to cut a 2 3/4"-long slot in one end of each blank. Reposition the stopblock to cut a 1 3/4" slot in the other end of the hold-down blanks.
- 4 Cut the fence hold-downs (F) and base hold-downs (G) to size and shape [Drawing 1]. These are just a starting point to get you going; customize as needed for your small parts needs.

FINISHING TOUCHES

- 1 To make the blade kerf, first install the blade you intend to use with your small-parts sled. Next, cut through the base and fences [Photo D].
- 2 Remove the T-track from the project but label where each part came from for later reinstallation.
- 3 Apply a finish to the project. We sprayed on three coats of Deft satin lacquer, sanding between coats with a fine sanding sponge. Once the finish is dry, apply paste wax to the base and runners.



You may want to buy a crosscut blade and dedicate it to use with your sled. Install the blade you plan to use, raise it to 1 3/4", then make a cut through the base of the sled. Mark the blade for use with the sled.

- 4 Attach the T-tracks, making sure the screws don't poke through the bottom of the base when you tighten them. Mount the hold-downs with T-bolts and either knobs or levers [Sources] and you're ready to cut those little parts. 🌲



To use your small-parts sled, mark your workpiece on the back edge and align the mark with the kerf in the sled. Use the hold-downs to lock it into place, keeping your fingers clear while you make the cut.

MATERIALS LIST

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A	BASE	1"	10"	17½"	LPly	1
B	REAR FENCE	1½"	3"	17½"	LPly	1
C	FRONT FENCE	1"	2"	17½"	LPly	1
D	SLED RUNNERS	⅜"	¾"	12"	C	2
E	T-TRACK SPACERS	⅜"	¾"	1½"	C	2
F*	FENCE HOLD-DOWNS	½"	1½"	2"	Ply	2
G*	BASE HOLD-DOWNS	½"	1½"	4"	Ply	2

*Parts initially cut oversize. See the instructions.

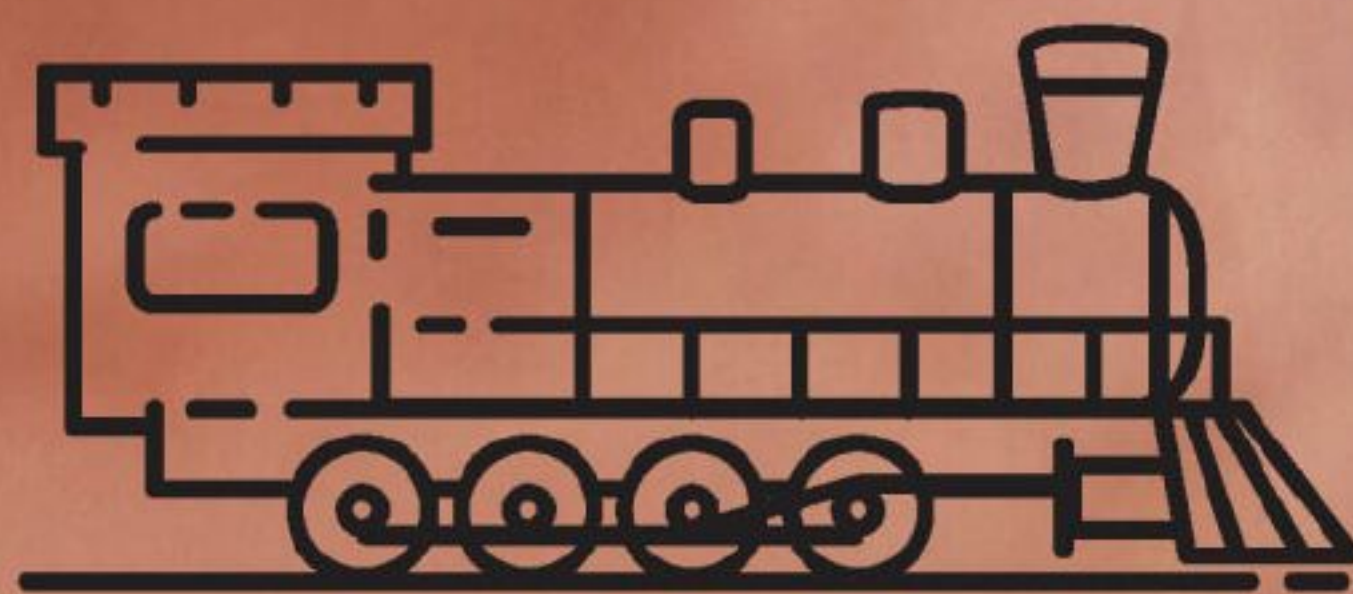
MATERIALS KEY: C—Cherry, LPly—laminated Baltic birch plywood, Ply—Baltic birch plywood.

SUPPLIES: #8x2" flathead screw, #8x1" flathead screws, #6x5/8" flathead screws.

BLADES AND BITS: Dado set, 1/4" spiral upcut router bit.

SOURCES: 3' T-track no. 26420 (1), \$17; 1" round knob 1/4"-20 female thread no. 58088 (2), \$5 each; pair 1/4"-20 cam clamps no. 58244 (2), \$10; 1 1/2" T-bolts 1/4"-20 no. 38002 (4) \$7 per 5-pack, Rockler, 800-279-4441, rockler.com.

PROJECT COST: It cost us about \$130 to build this project. Your cost will vary by region and source.



TIMBER LINE



EXPRESS



OVERALL DIMENSIONS

Steam engine: $3\frac{3}{8}$ "W $\times$ $12\frac{3}{4}$ "L $\times$ $4\frac{1}{8}$ "H

Coal tender: $3\frac{1}{16}$ "W $\times$ $8\frac{3}{4}$ "L $\times$ $3\frac{15}{16}$ "H

Track (14-segment loop): 29"W $\times$ $65\frac{3}{4}$ "L $\times$ 1"H



CLASSIC STEAM ENGINE

All aboard! This is your ticket for large-gauge fun as we kick off the **WOOD®** Timber Line Express train series.

WRITER: ZACH BROWN

DESIGNER/BUILDER: JOHN OLSON

PHOTOGRAPHERS: JASON DONNELLY, CARSON DOWNING

ILLUSTRATORS: ROXANNE LEMOINE, LORNA JOHNSON

Get your toymaker dreams on track with the first installment of our new train series: the Timber Line Express. We're leaving the station with this classic engine and tender, along with a big loop of track—the perfect setup to build a head of steam for more cars, tracks, and accessories to come in future issues.

We'll tackle this train starting where it meets the tracks: the wheels. Up front, a pivoting assembly called a truck holds the steering wheels. Next come the big driving wheels. Another pivoting truck at the back holds the trailing wheels. We call this a "standard" truck because you'll build two more for the coal tender. Then we'll take you through the engine frame and body, coal tender, and enough track segments to create a loop.

To get you chugging along with ease, we've put together a kit [\[Sources\]](#) that includes the specialty items like the wheels, pegs, smokestack, and dowels for the boiler, sand dome, and water dome.

This project is an exercise in crafting small parts, so consider first building the "Small-Parts Tablesaw Sled" on *page 34* to help you safely and accurately cut them to size. For other operations, avoid using your fingers to hold parts while machining. Instead, use clamps or double-faced tape to secure the parts to carrier boards and auxiliary miter fences, creating an extension or handle that keeps your fingers away from bits and blades. Now, climb aboard, and we'll get this train moving.

STEERING TRUCK

Note: To keep your fingers safely away from the bit when routing small parts, first secure the part, flat on the router table, in a wooden handscrew clamp that can be used as a handle.

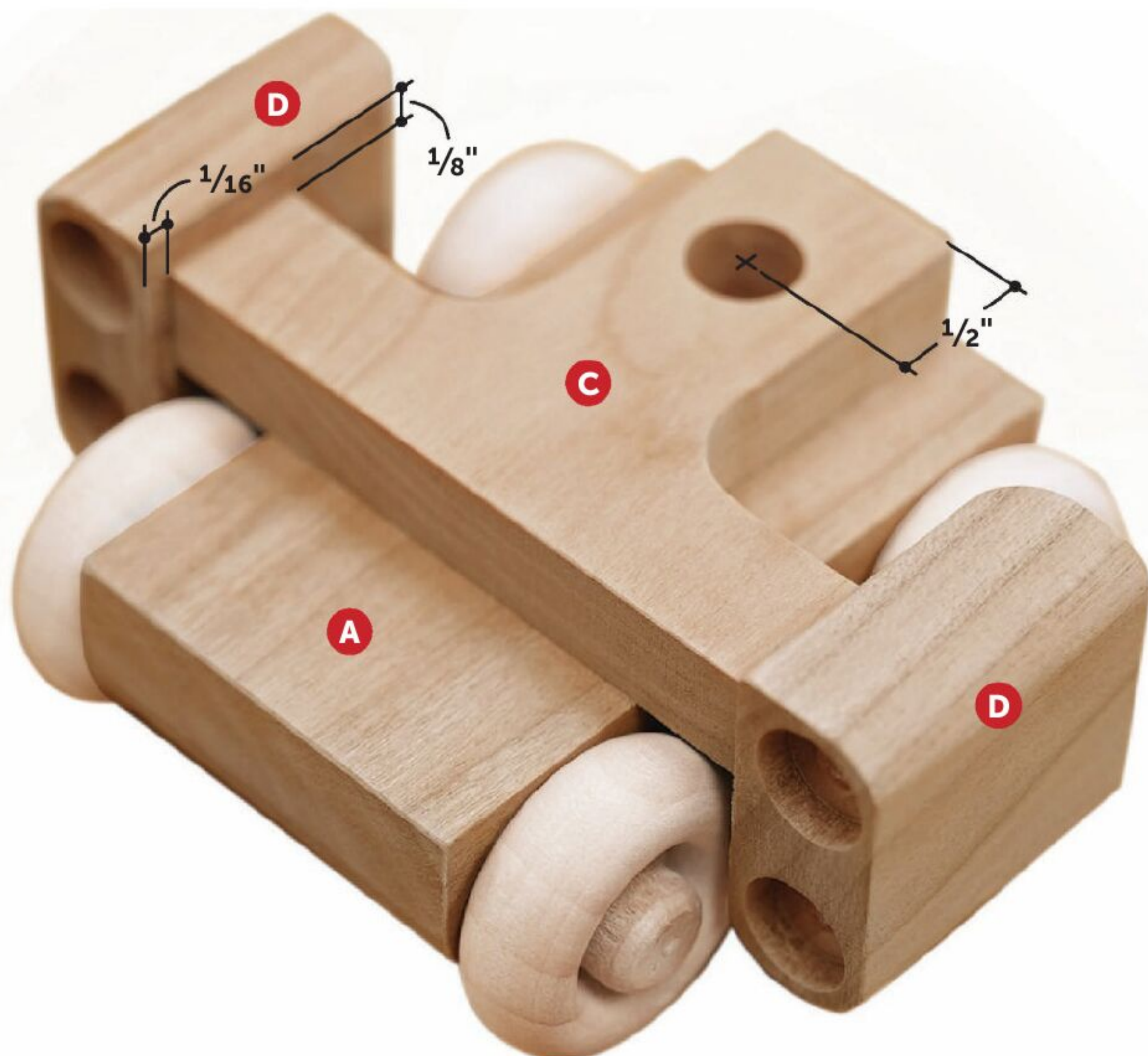
1 Cut the steering truck parts (A–D) to size [Materials List]. Drill the holes in the sides of the steering frame (A) for the axle pegs [Drawing 1, Photo A], then round over the lower front and back ends of the frame. Glue the steam spacers (B) to the sides of the frame [Drawing 2], flush at the top and centered front to back.

2 Cut the steering bridge (C) to shape [Drawing 1] and glue it to the top of the frame/spacer assembly, flush at the back [Drawing 2]. Cut four axle pegs to $\frac{7}{8}$ " long and use them to attach wheels to the frame (A) [Photo B].



To ensure straight holes for the wheel axles, clamp the steering frame (A) against a backer block, then drill the holes at the drill press using a sharp brad-point bit.

STEERING TRUCK



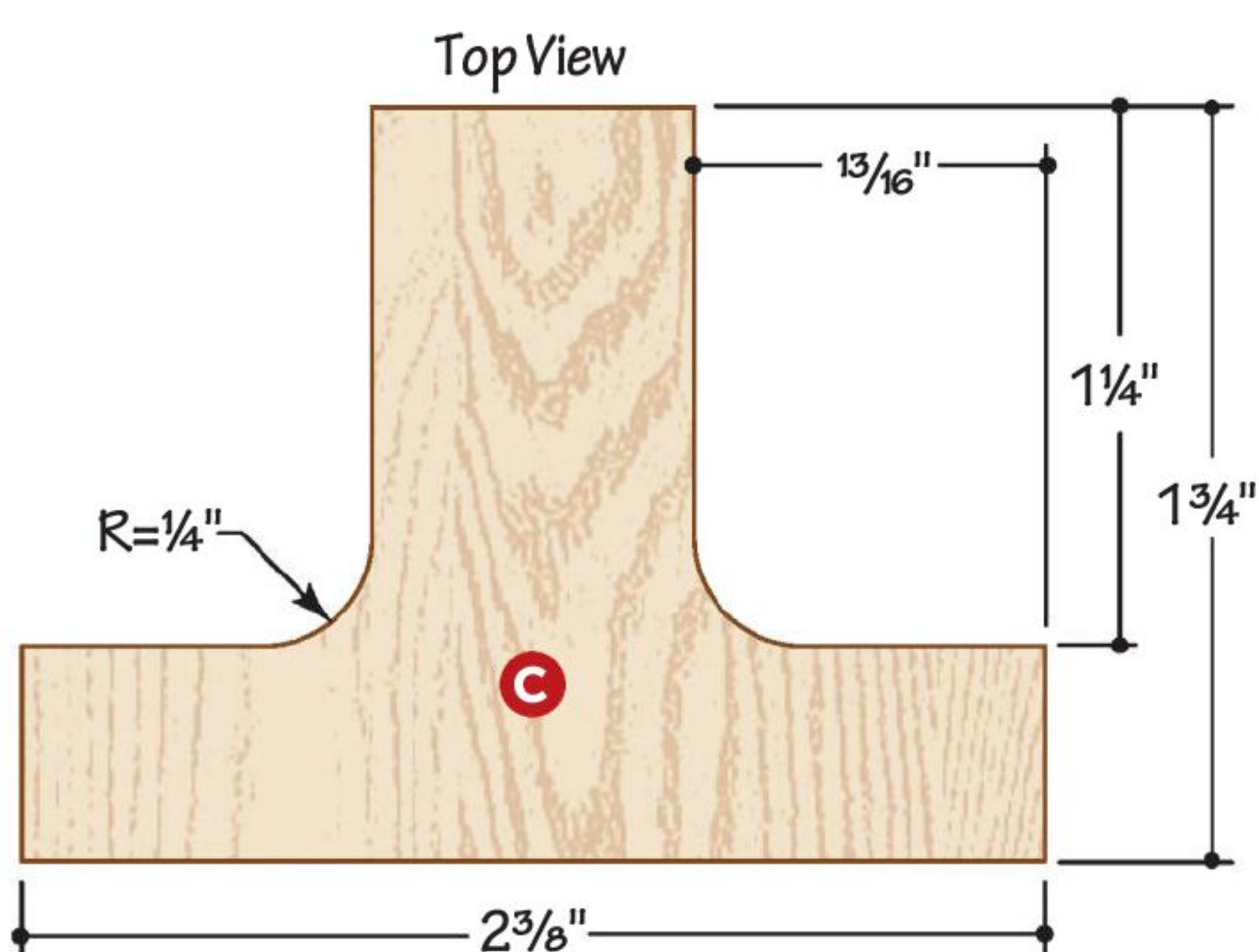
3 With the steering truck assembly (A–C) face down, drill a $\frac{1}{2}$ " counterbore, $\frac{1}{4}$ " deep on the bottom face of the steering frame (A), then a $\frac{3}{8}$ " hole through the steering frame and steering bridge (C) to accept a recessed peg that will connect the truck to the engine body [Drawing 2].

4 Round over three edges on each steam chest (D) [Drawing 1], leaving the upper inside edge square. Then, form the round-over on the rear inside corner of each. Lay out and drill the holes on the front end of each steam chest [Photo C]. Glue and clamp the steam chests to the steam spacers (B) and steering bridge [Drawing 2] so they sit $\frac{1}{8}$ " above the steering bridge and $\frac{1}{16}$ " beyond the front end, left.

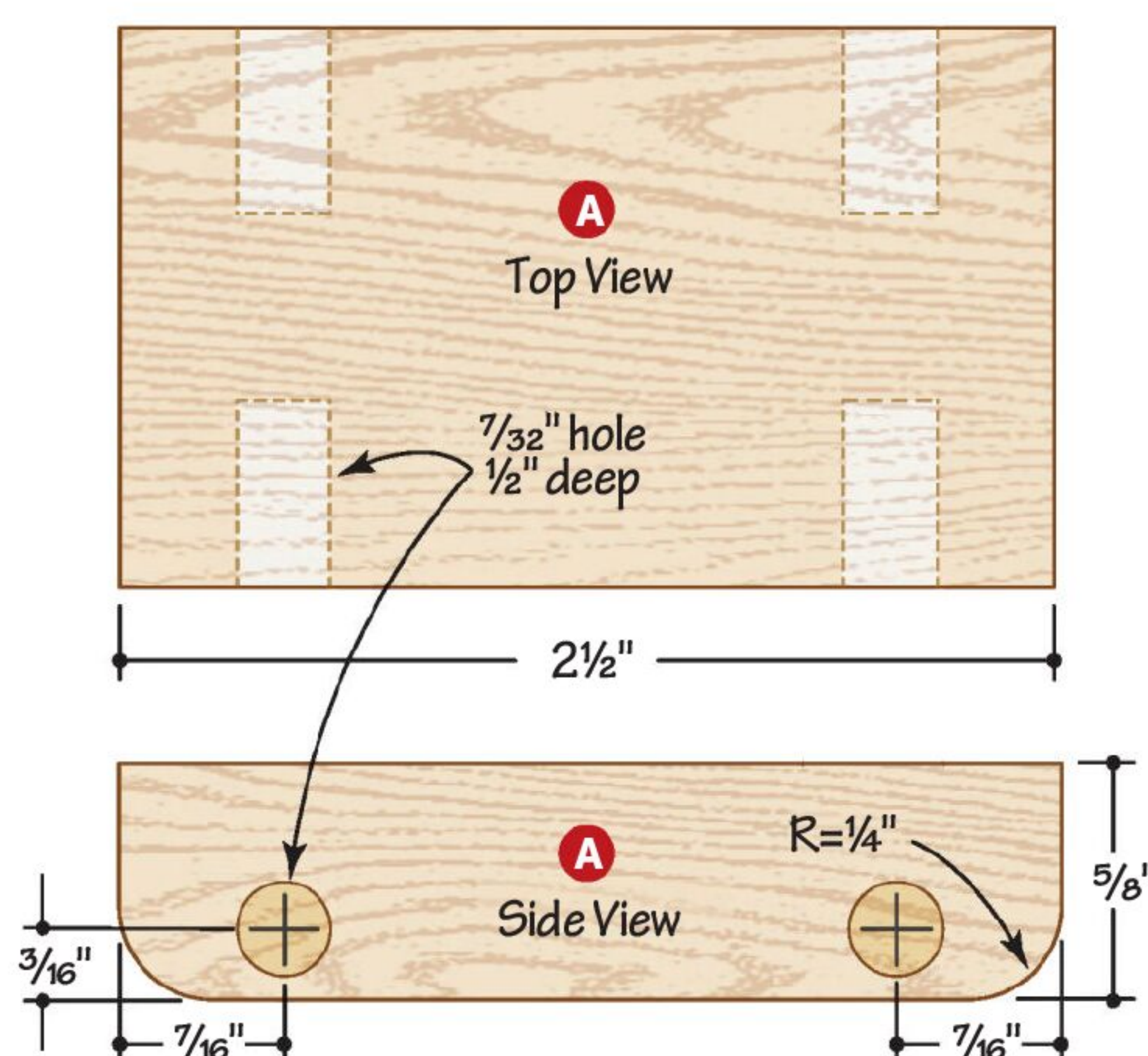


Learn how to safely handle small parts at the router table.
woodmagazine.com/smallandsafe

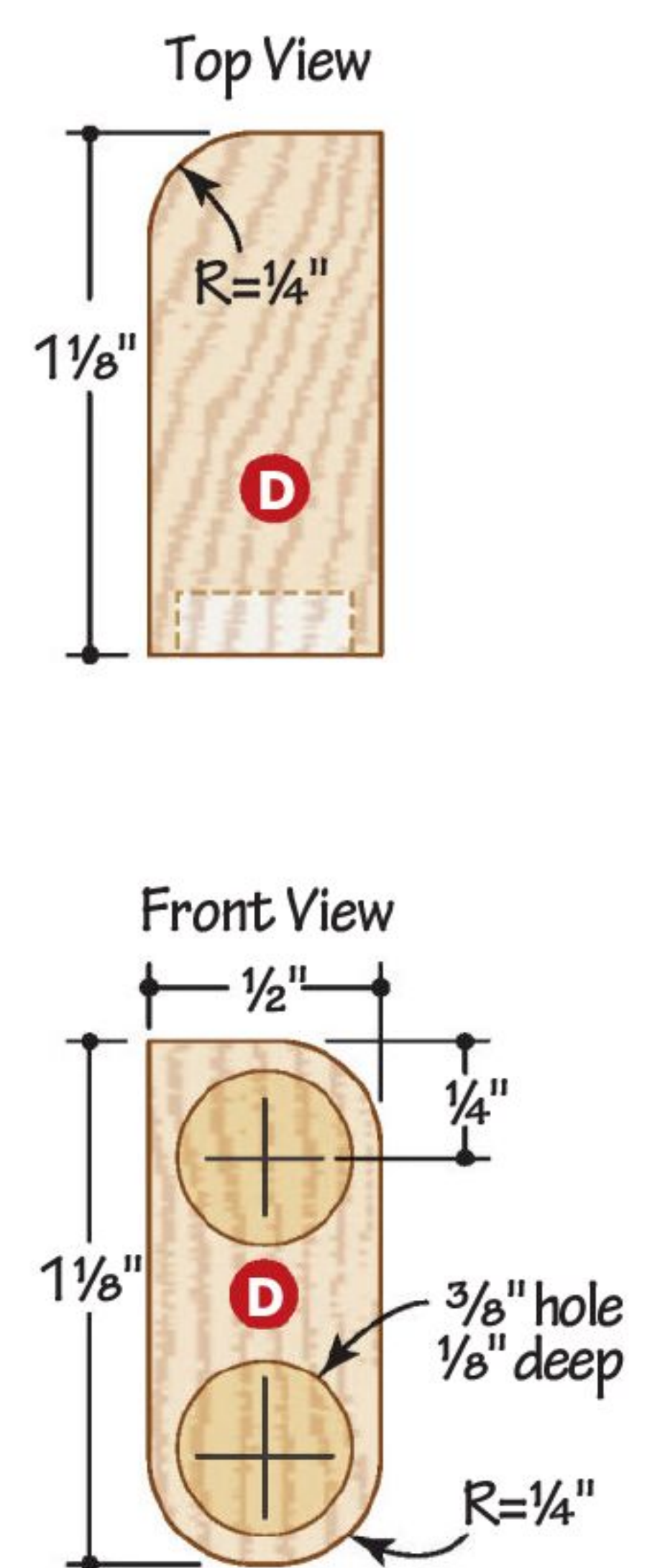
1 STEERING TRUCK PARTS



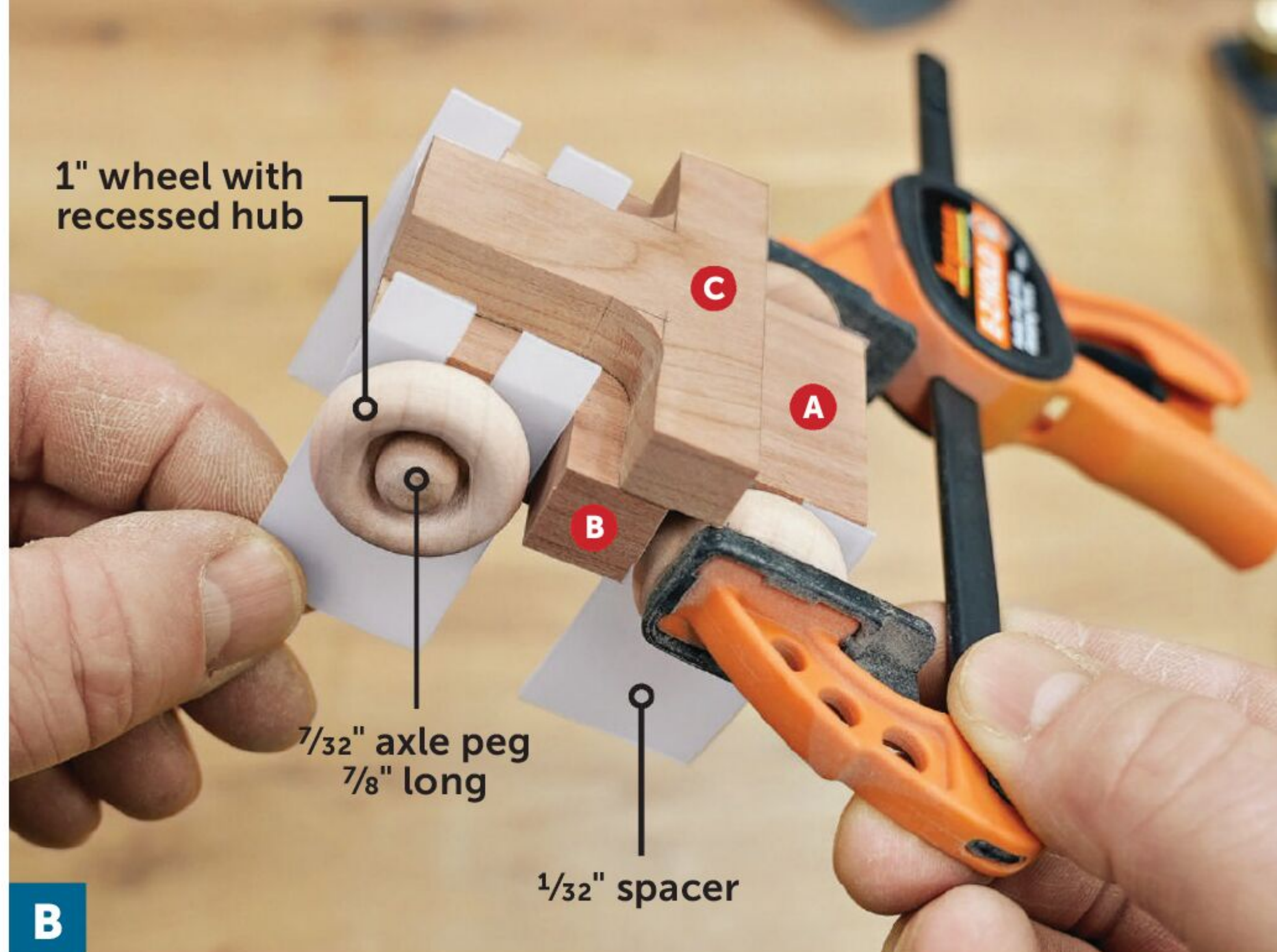
STEERING BRIDGE



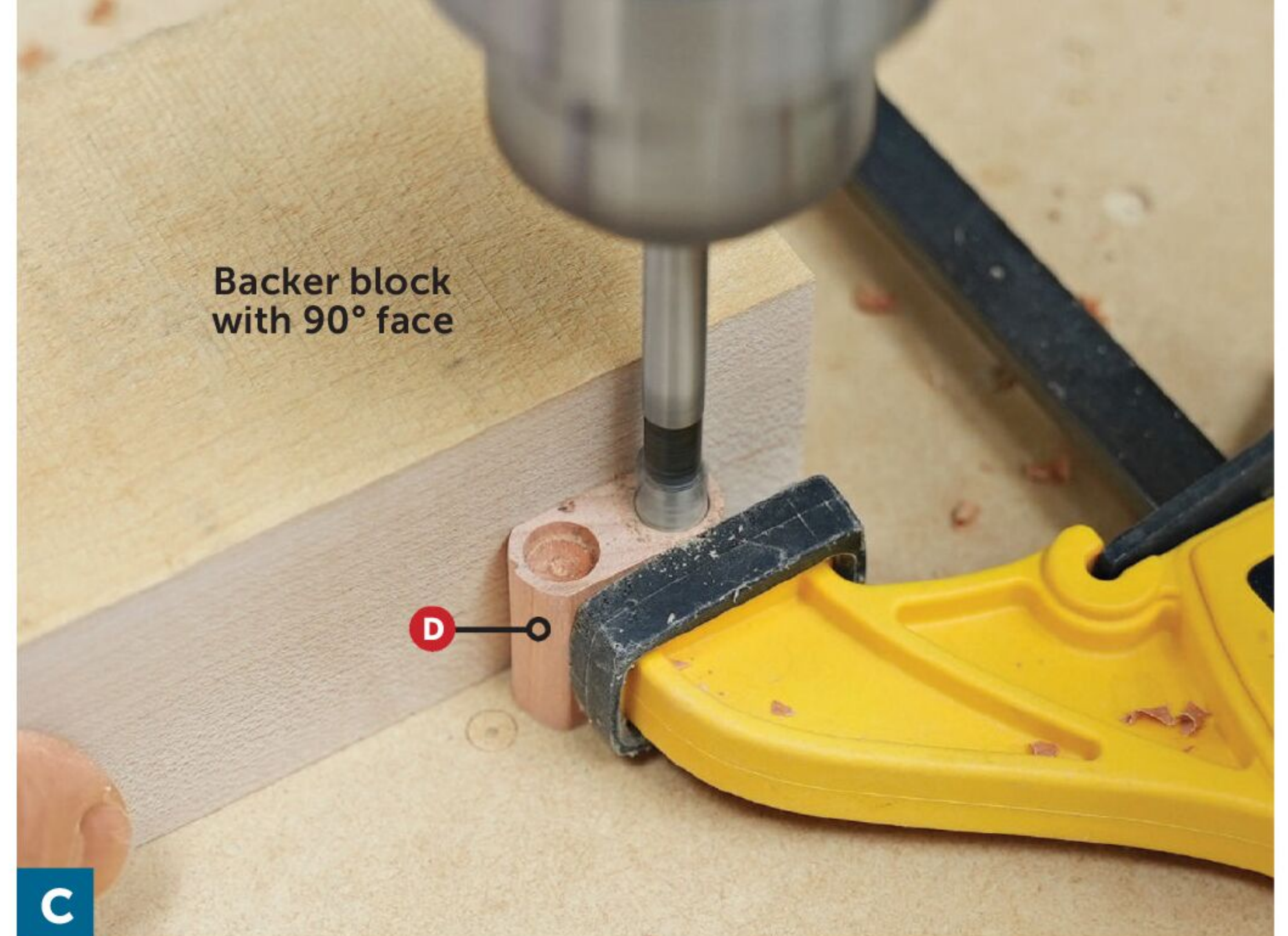
STEERING FRAME



STEAM CHEST
(Left steam chest shown.)

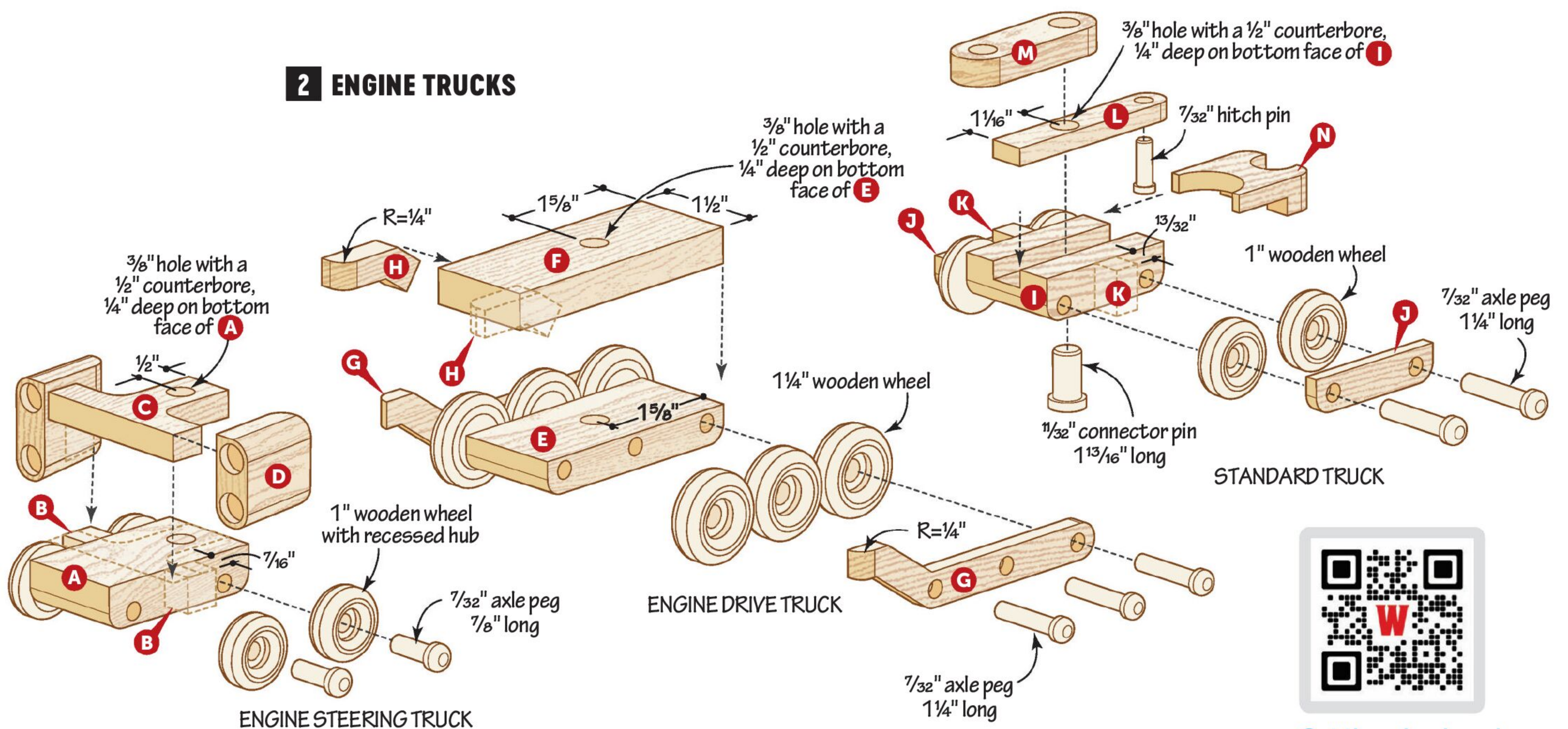


Slot the 1/32"-thick plastic spacers from the project kit around the axle pegs. With glue in only the bottom of the axle holes, clamp the pegs to the frame (A) through the wheels and spacers.



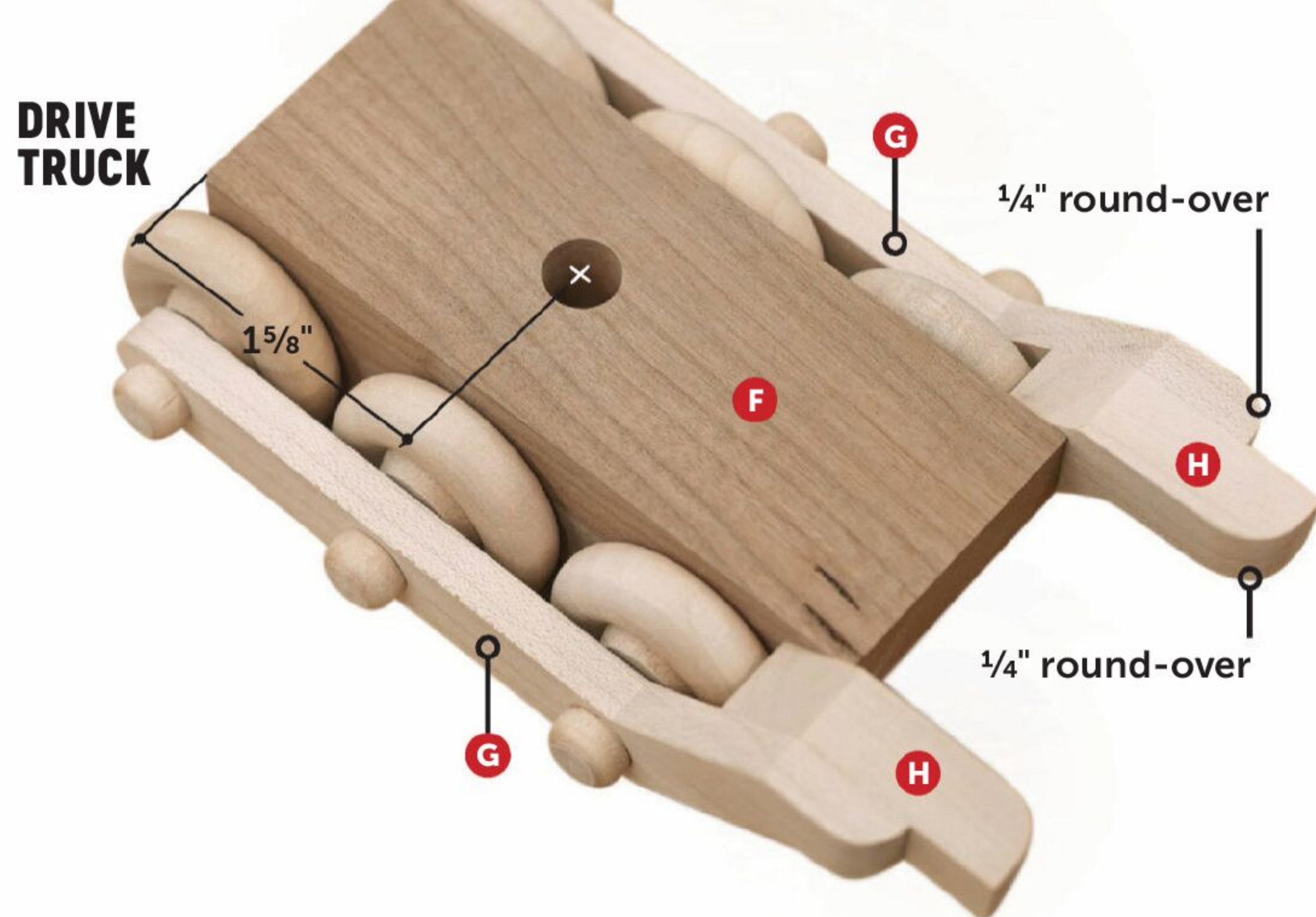
Install a 3/8" Forstner bit in the drill press and clamp a steam chest (D) to a backer block. Drill 1/8"-deep holes in the front edge only of the steam chest. Repeat for the other chest.

2 ENGINE TRUCKS



Get the wheels, axle pegs, and dowels you need in one handy project kit.
woodstore.net/engineandcoalkit





DRIVE TRUCK

1 Cut the drive frame and spacer (E, F) to size [Materials List]. Drill the holes in the sides of the frame and round over the lower front and back ends [Drawing 3]. Glue the spacer to the frame, flush at the back end [Drawing 2].

2 Use the full-size patterns to bandsaw the drive rods (G) to size and shape, then drill the holes through the sides [Drawing 3]. Round over the outside front corner of each drive rod [Drawing 2].

3 Use the full-size pattern and bandsaw the valve gears (H) to shape [Drawing 3, Photo D]. Glue the valve gears to the inside face of each drive rod (G), aligning the top and upper angle. Then round over the inside front corner of each valve gear to provide clearance for the steering bridge (C) [Drawing 2].

4 Glue the axle pegs into the holes in the drive rods (G) [Drawing 2], then add the wheels to the assembly [Photo E]. Once the glue dries, drill the counterbore and hole through the drive frame and spacer (E, F) for the connector pin.

Note: Use small beads of cyanoacrylate glue on the shaft near the pegs' heads to affix them into the drive-rod holes to prevent transferring glue through the holes.

STANDARD TRUCKS

A trailing truck brings up the rear of the train engine. Make three of these "standard" assemblies. Two will be used for the tender.

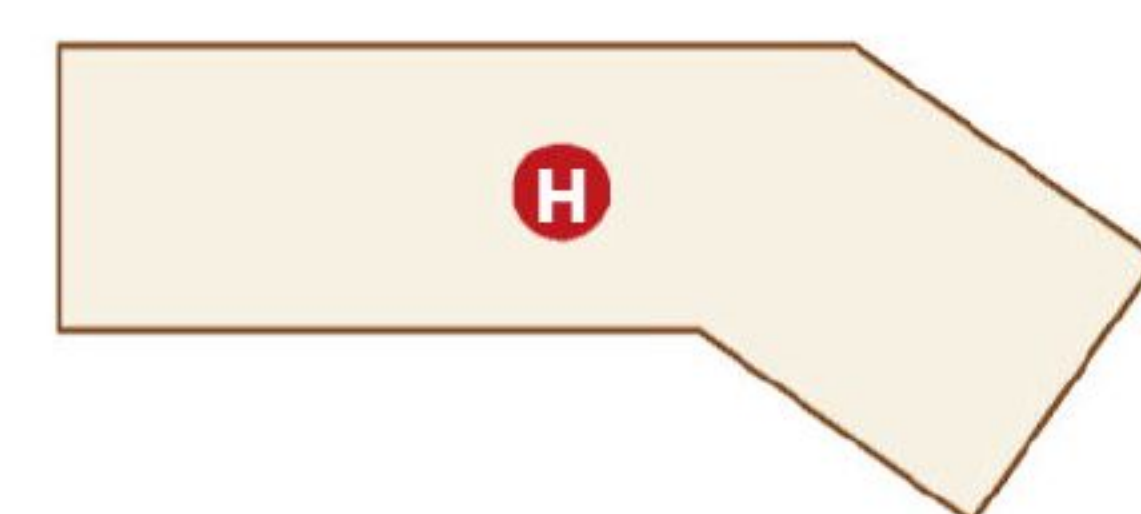
1 Cut the standard frames and side frames (I, J) to size. Drill holes in the sides of each part [Drawing 4] and round over the lower front and back ends. Form the centered groove in the top face of each standard frame (I).

2 Cut the spring groups (K) to size [Materials List]. Glue and clamp them to the sides of each standard frame (I), centered front-to-back [Drawing 2]. Glue the axle pegs into the side frames (J), then attach the wheels to the assembly.

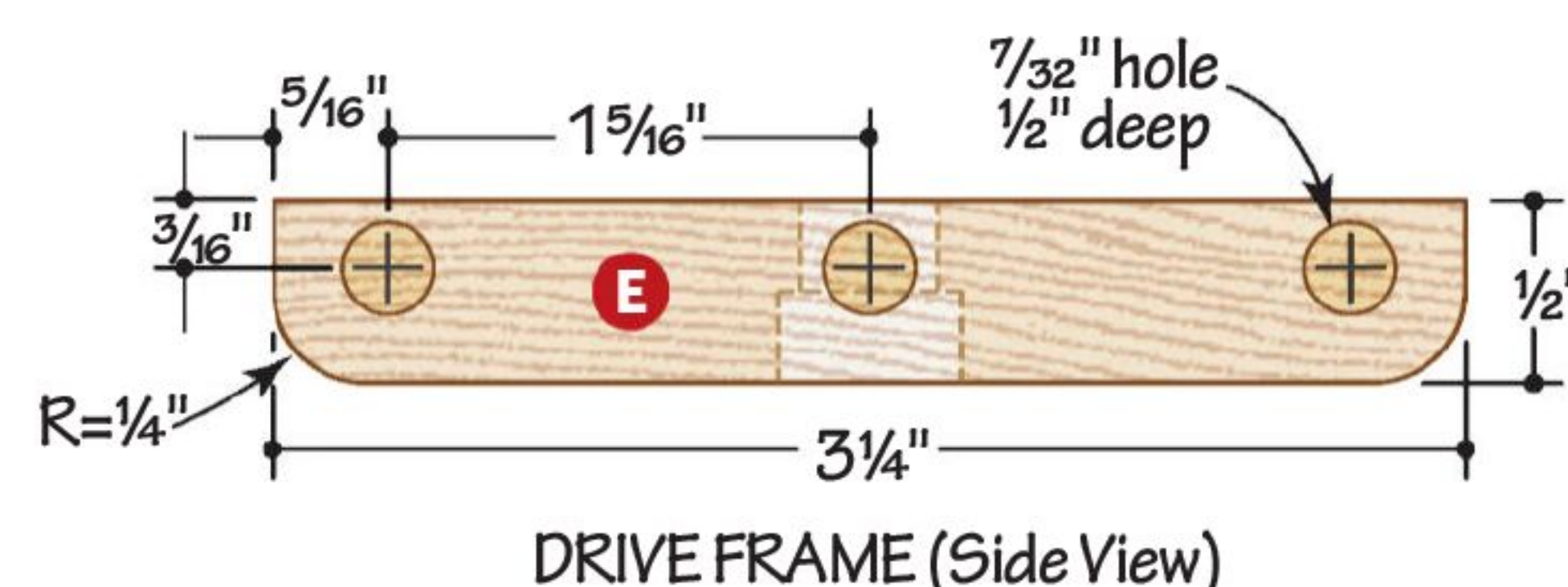


Spray-mount the full-size pattern to a $1\frac{3}{32}$ "-thick blank. Attach the blank to a carrier board with double-faced tape and bandsaw the valve gears (H) to shape.

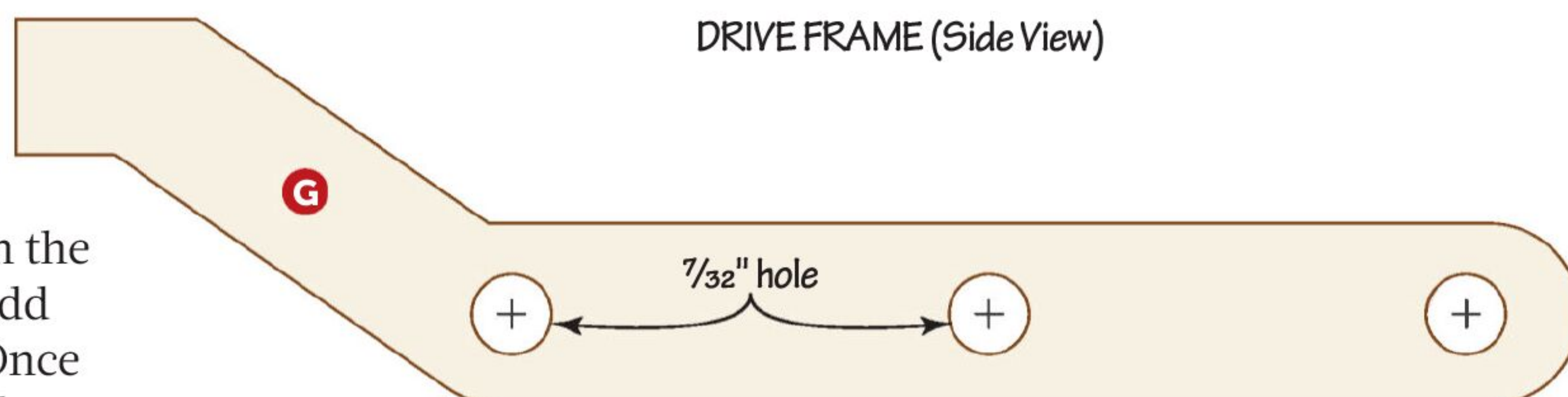
3 DRIVE TRUCK PARTS



VALVE GEAR FULL-SIZE PATTERN



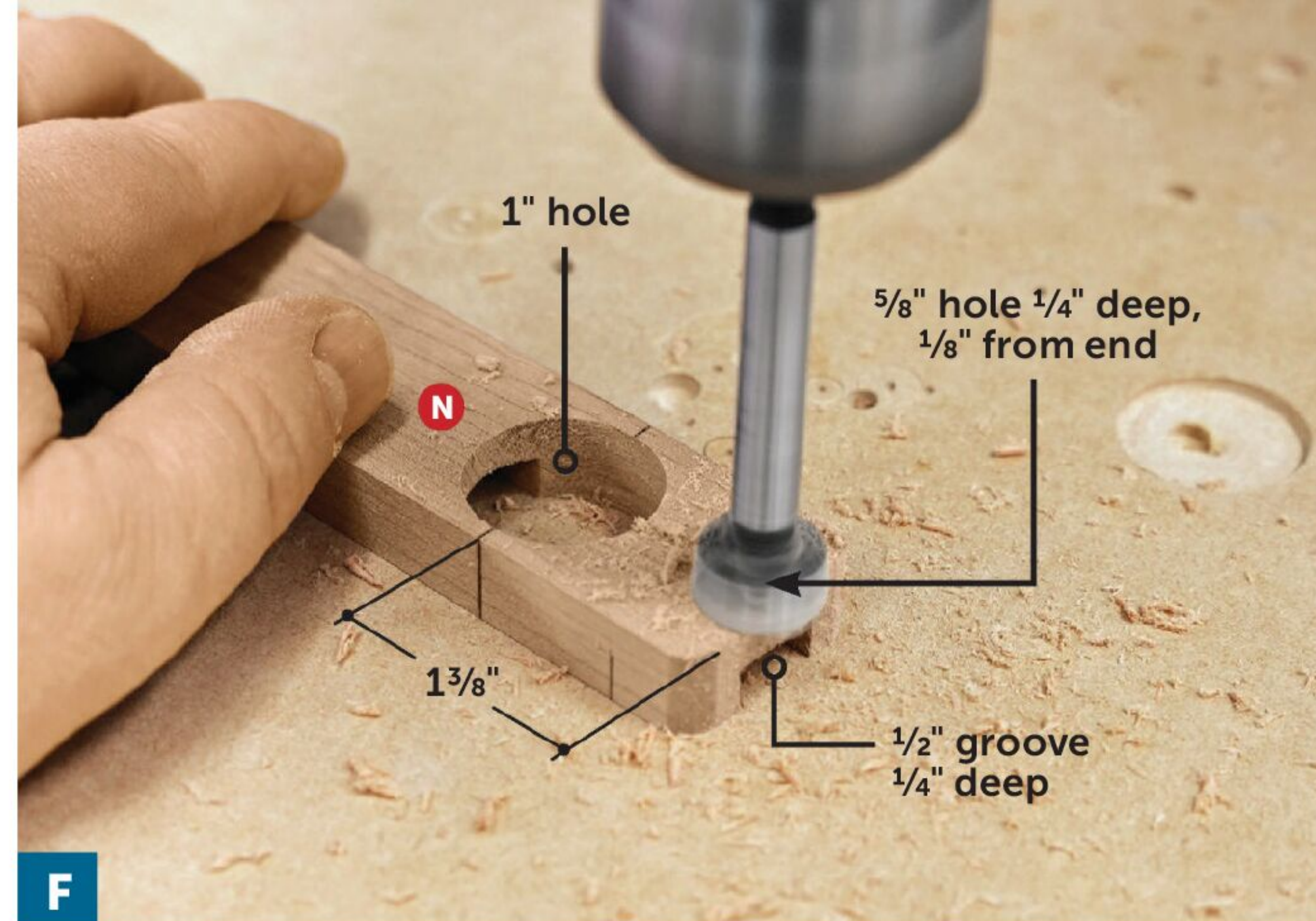
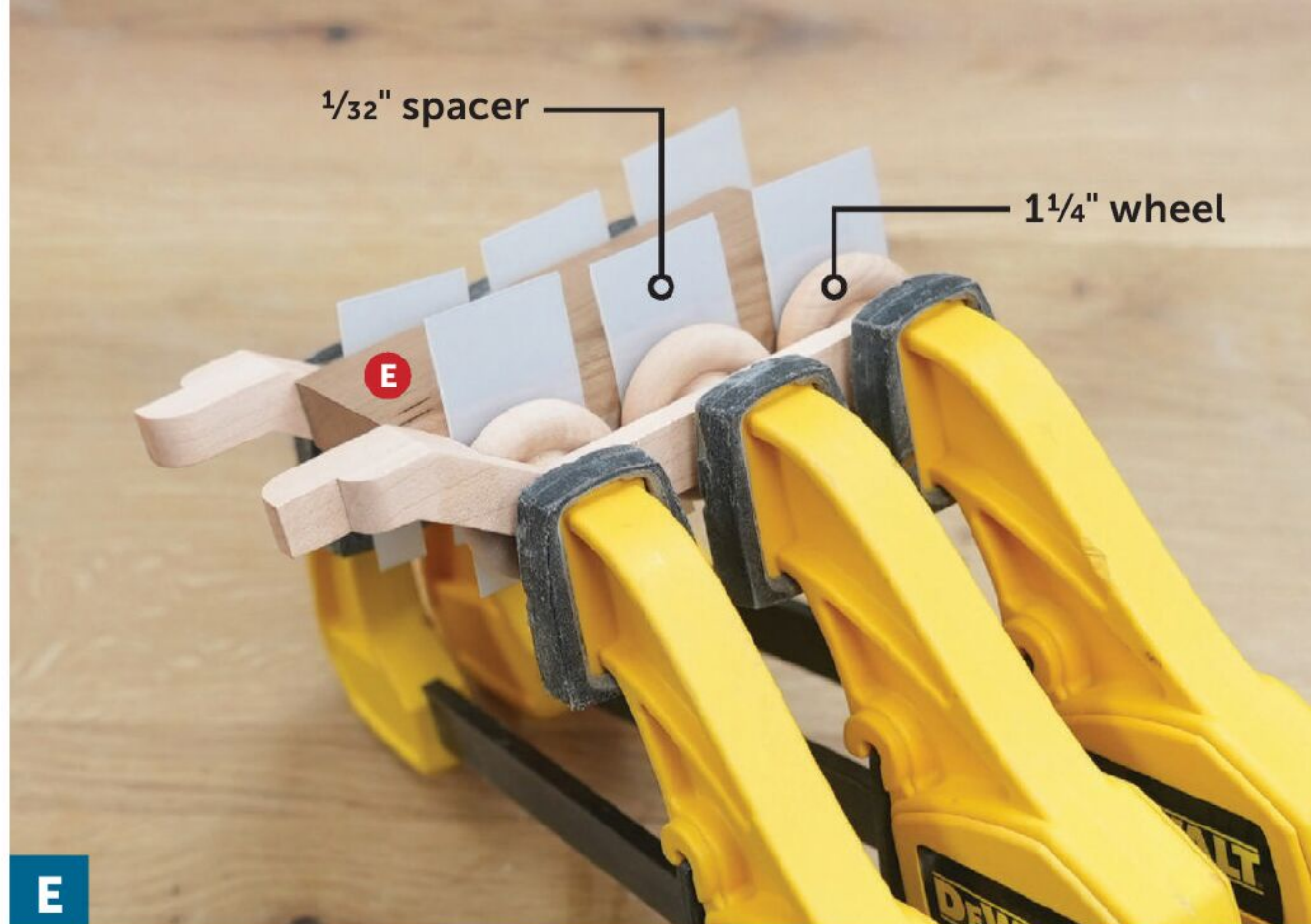
DRIVE FRAME (Side View)



DRIVE ROD FULL-SIZE PATTERN

3 Set aside two of these truck assemblies for the coal tender. Cut the engine tongue and link (L, M) to size, drill the holes, and form the round-overs [Drawing 4]. Glue the tongue (L) into the groove of the engine standard frame (I), flush at the front end [Drawing 2]. Once the glue dries, drill the counterbore and hole in the frame and tongue.

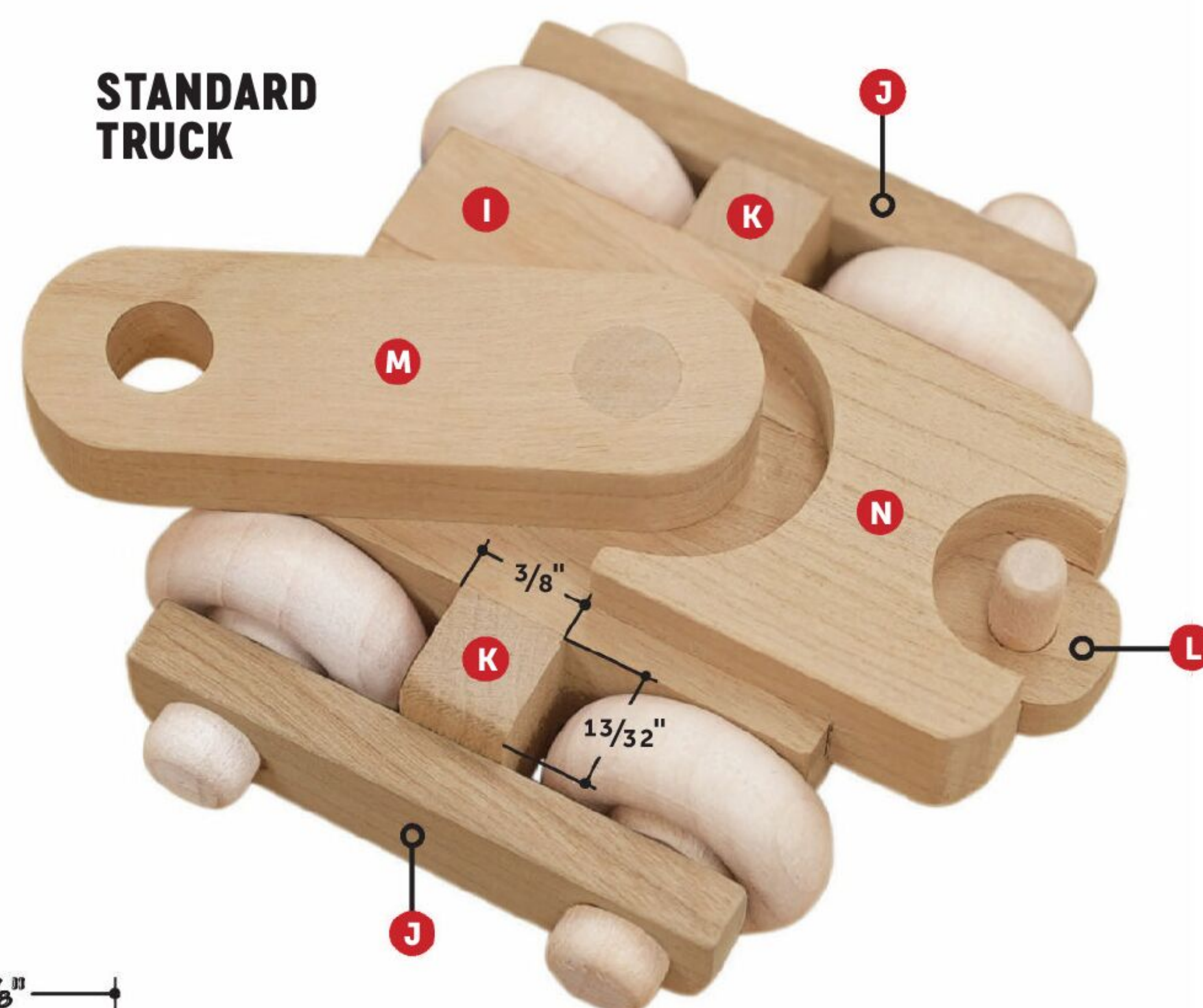
4 Cut a 6"-long workpiece to thickness and width for the engine hitch shroud (N) [Materials List]. Form the centered groove along the bottom face and the round-overs on one end [Drawing 4]. Mark the finished length and drill a 1" hole centered on that layout line, then a $\frac{5}{8}$ " recess on the top face [Photo F]. Cut a $\frac{7}{8}$ "-wide dado on the bottom face aligned with the length line. Crosscut the hitch shroud to length, leaving all of the dado to create a $\frac{7}{8}$ " rabbet.



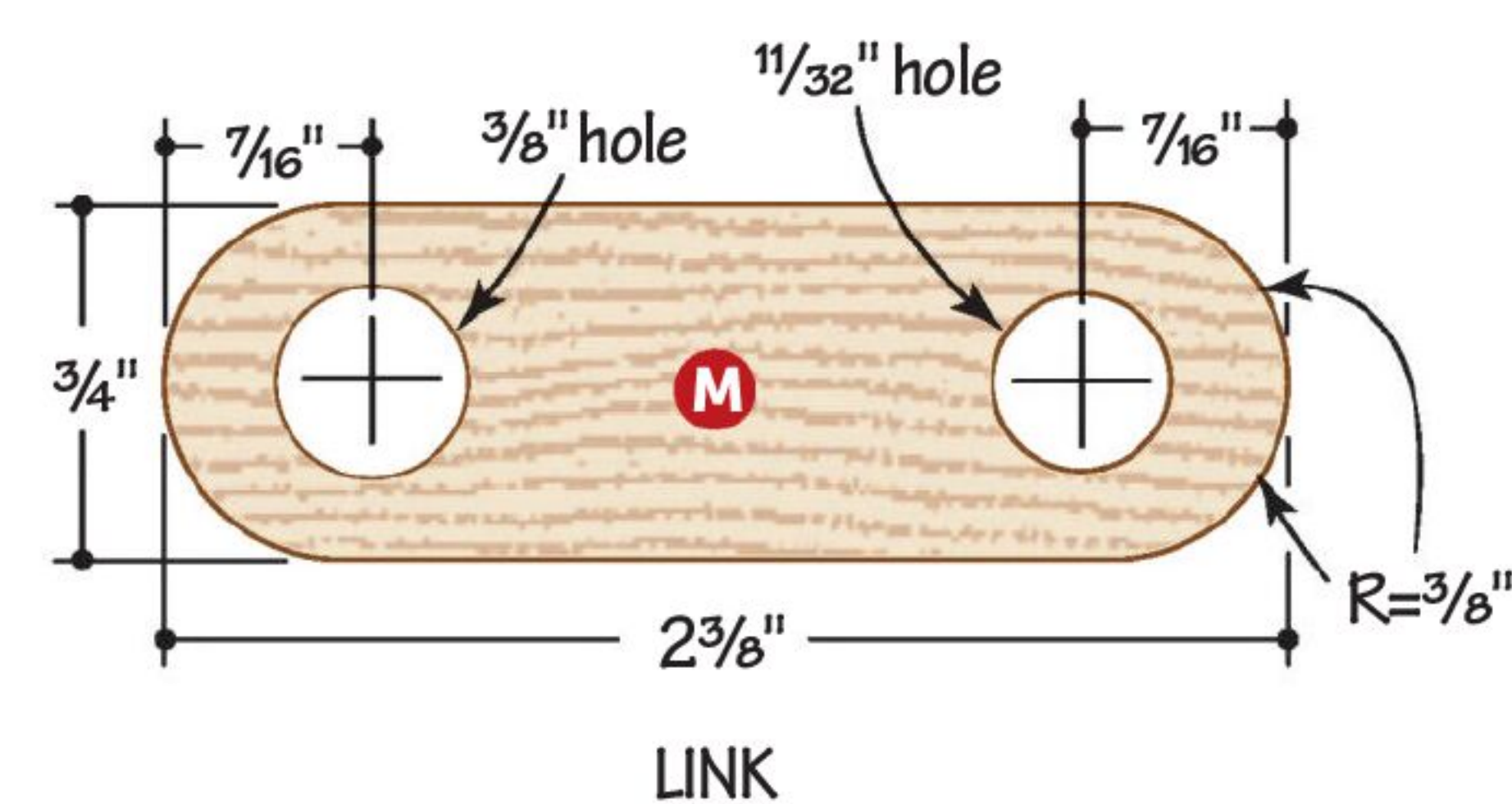
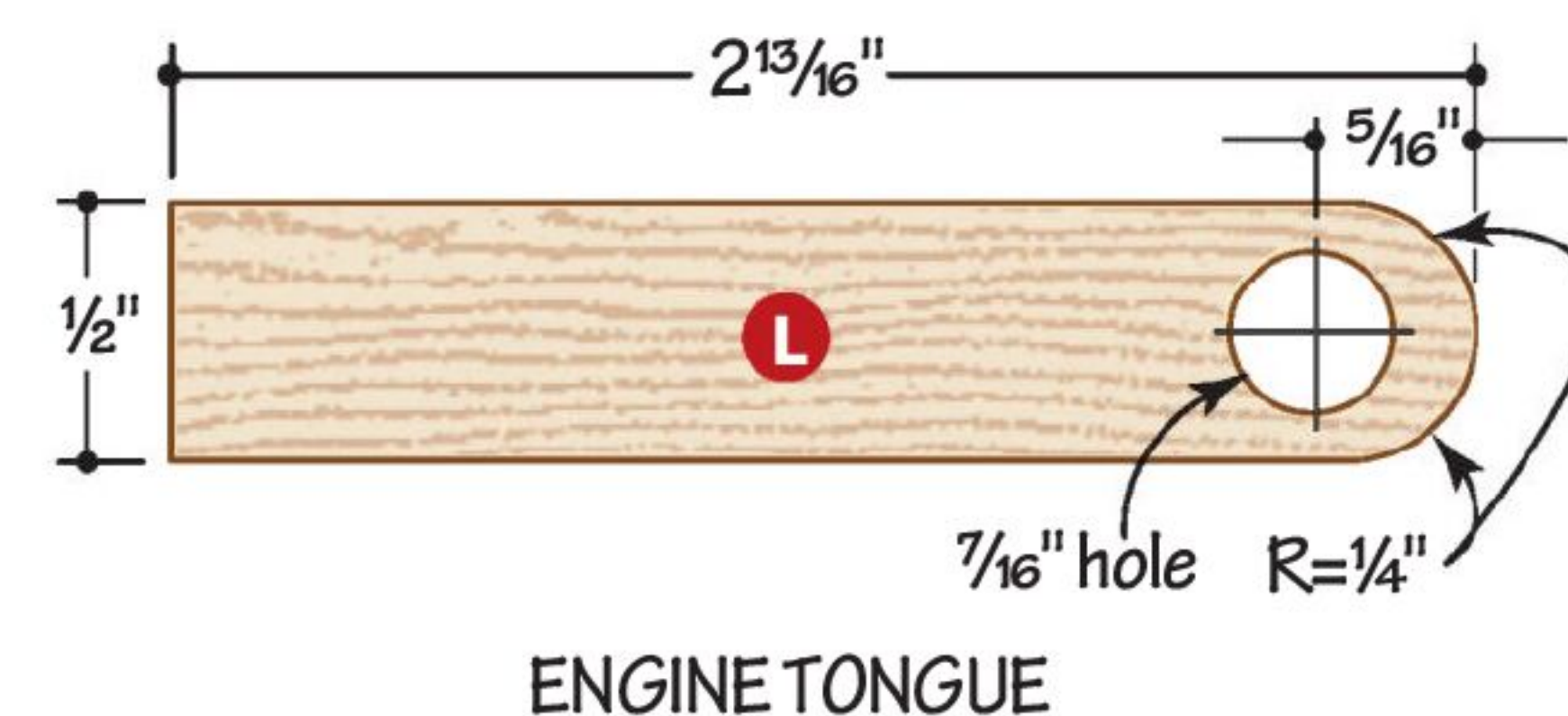
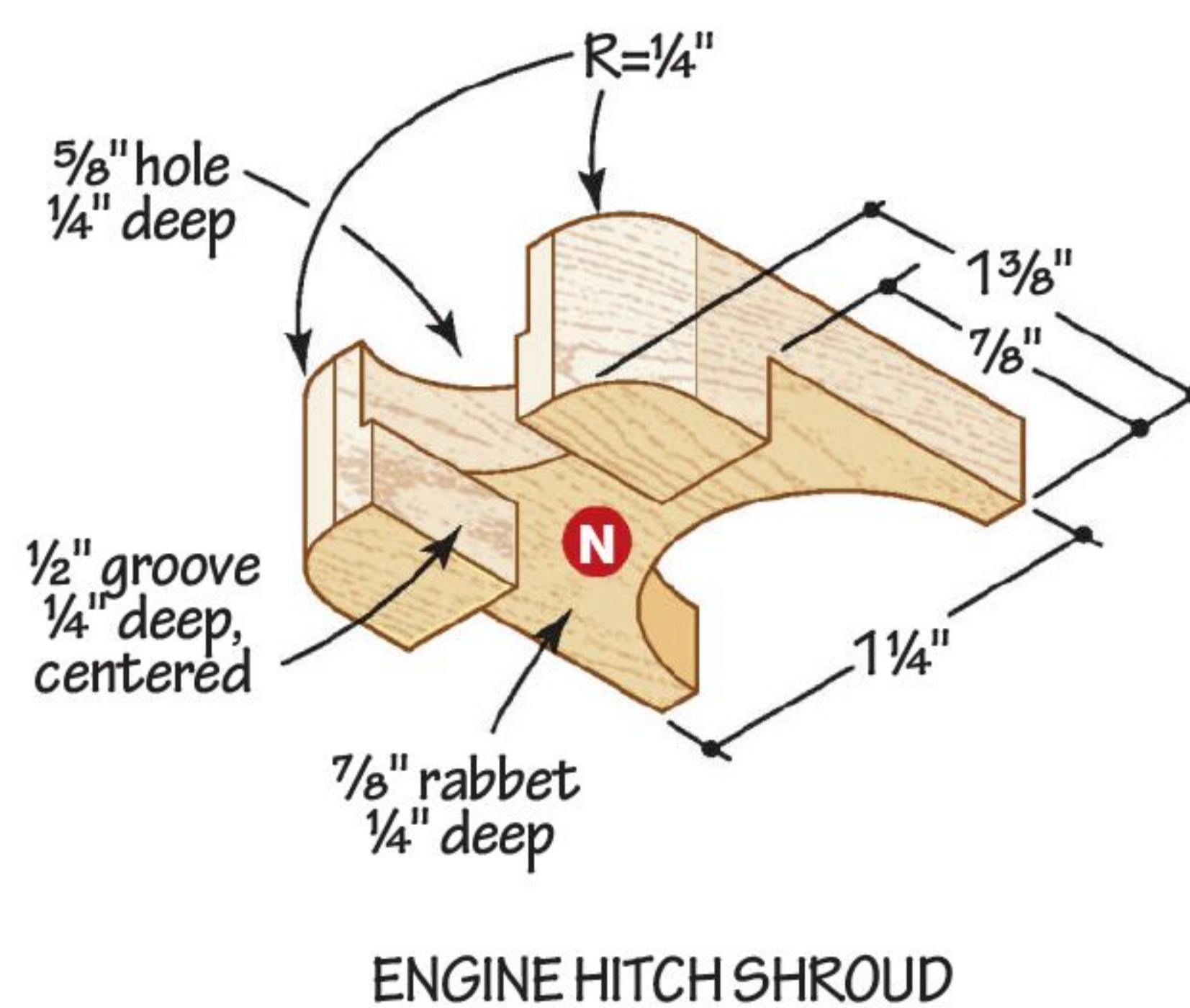
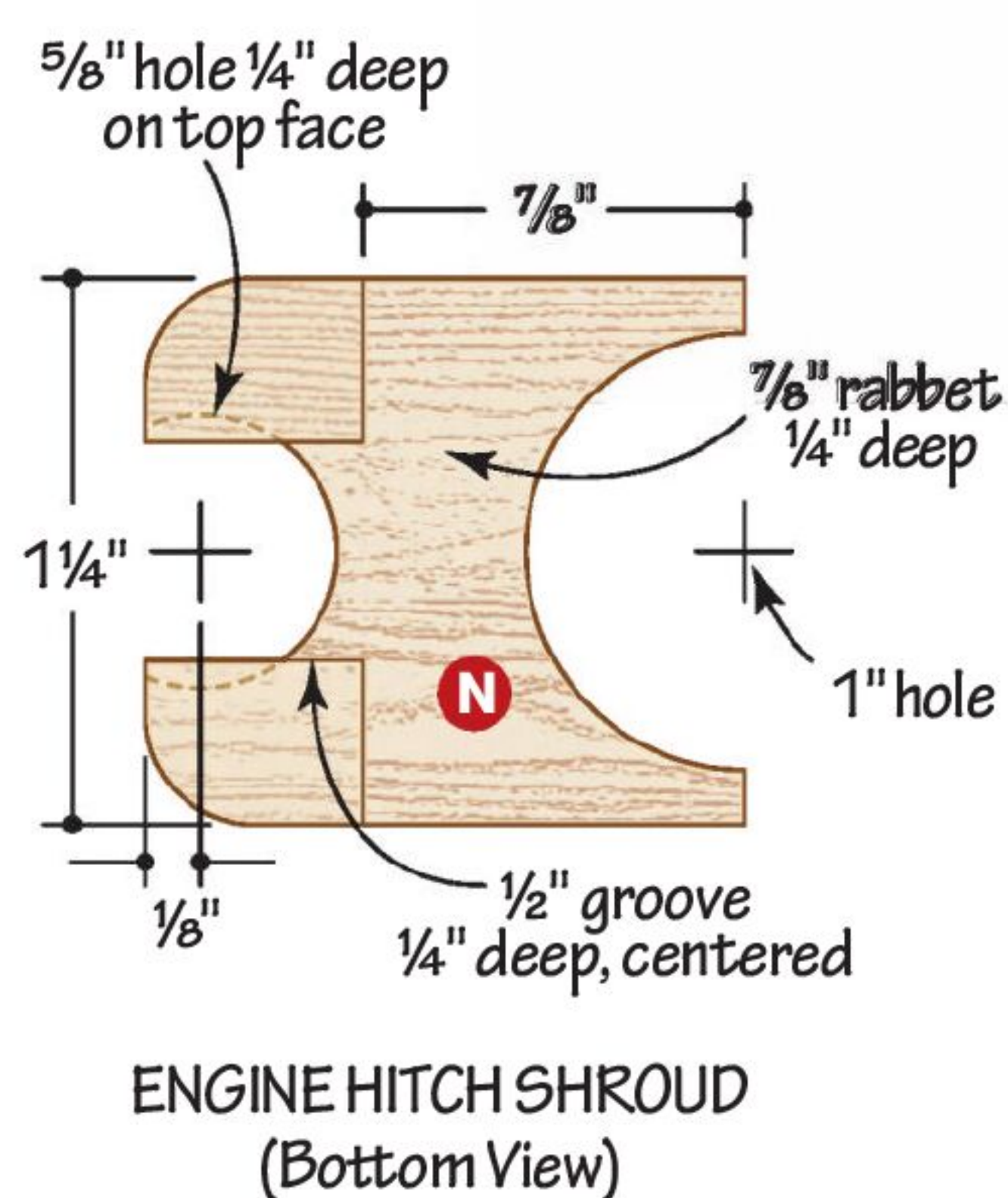
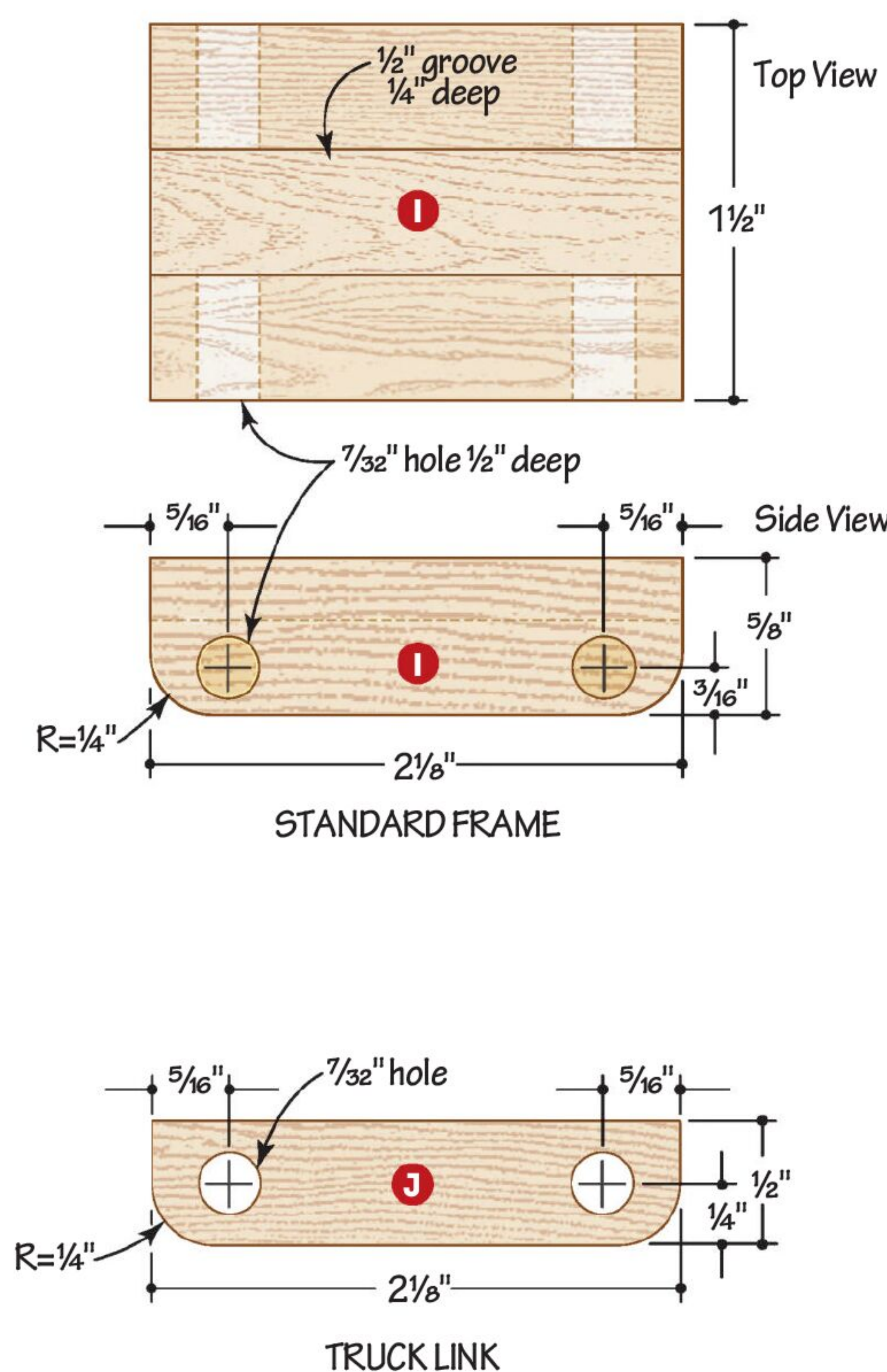
Using the $\frac{1}{32}$ " spacers from the project kit, and with glue in only the bottom of each hole, slip the wheels onto the axle pegs and glue the pegs into the holes in the drive frame (E).

Use a 1" Forstner bit to drill the through-hole, $1\frac{3}{8}$ " from the end. Then, install a $\frac{5}{8}$ " Forstner bit and drill a hole, $\frac{1}{4}$ " deep on the top face and $\frac{1}{8}$ " from the end.

5 Insert an $\frac{11}{32}$ " connector pin through the bottom of the standard truck assembly and glue it into the $\frac{11}{32}$ " hole in the link (M) [Drawing 2]. Cut the top of the connector pin flush with the top of the link, then glue and clamp the hitch shroud (N) to the top of the frame (I) and around the tongue (L). Glue a $\frac{7}{32}$ " hitch pin into the hole in the end of the tongue from below and, once the glue dries, cut the top of the pin flush with the top face of the hitch shroud.



4 STANDARD TRUCK PARTS



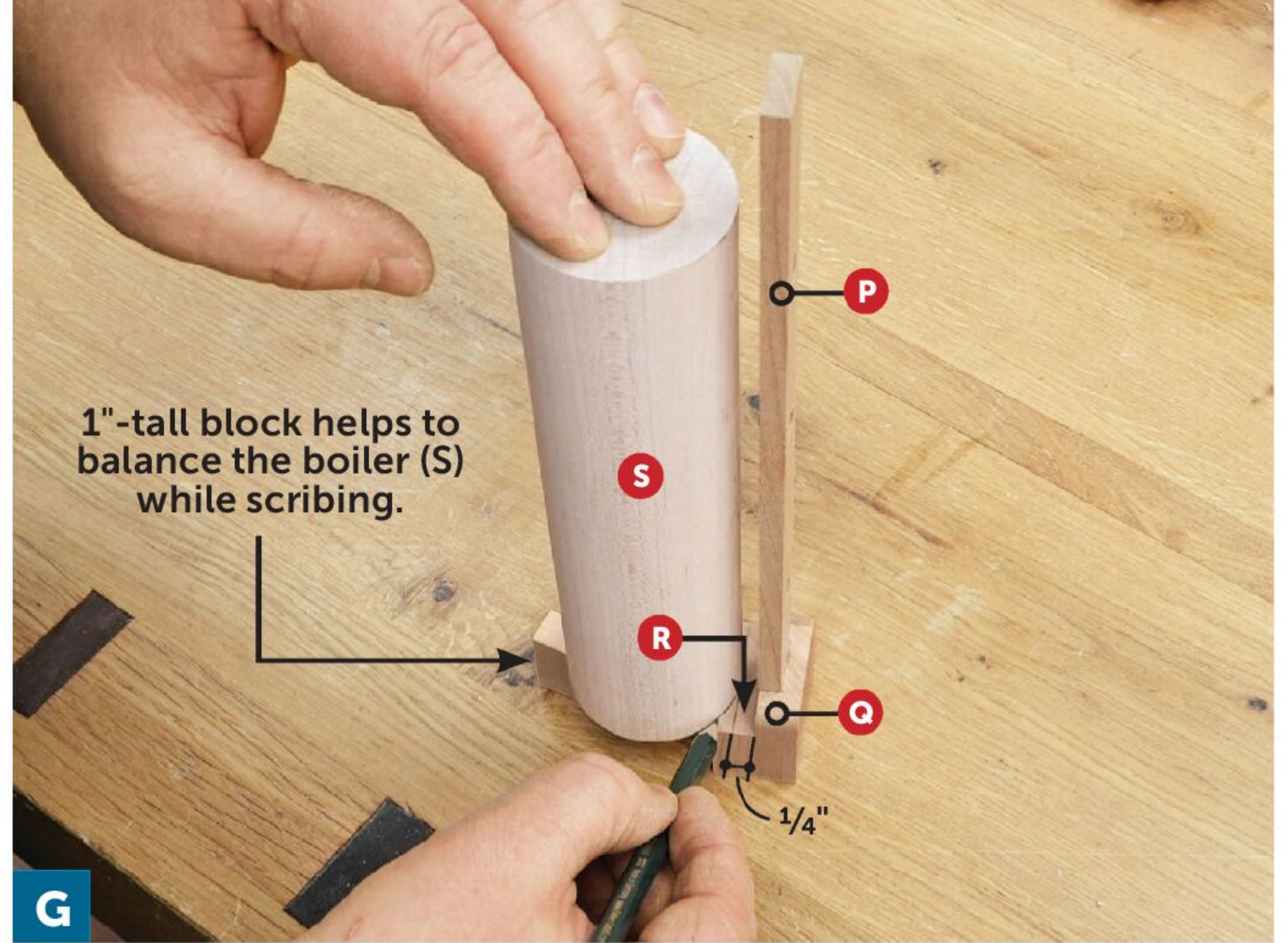
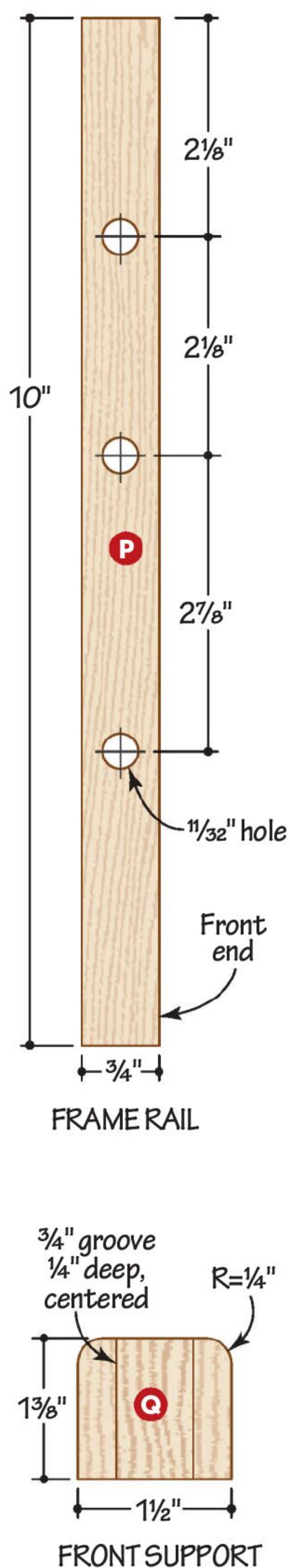
ENGINE FRAME

1 Cut the catwalk and frame rail (O, P) to size [Materials List]. Drill holes centered on the width of both parts and notch the front end of the catwalk [Drawing 5]. Cut a 6"-long workpiece to thickness and width for the front support (Q). Form a centered groove on the top face, round over the corners on one end, then cut it to length. Glue the frame rail (P) into the front support groove, flush at the front end [Drawing 6].

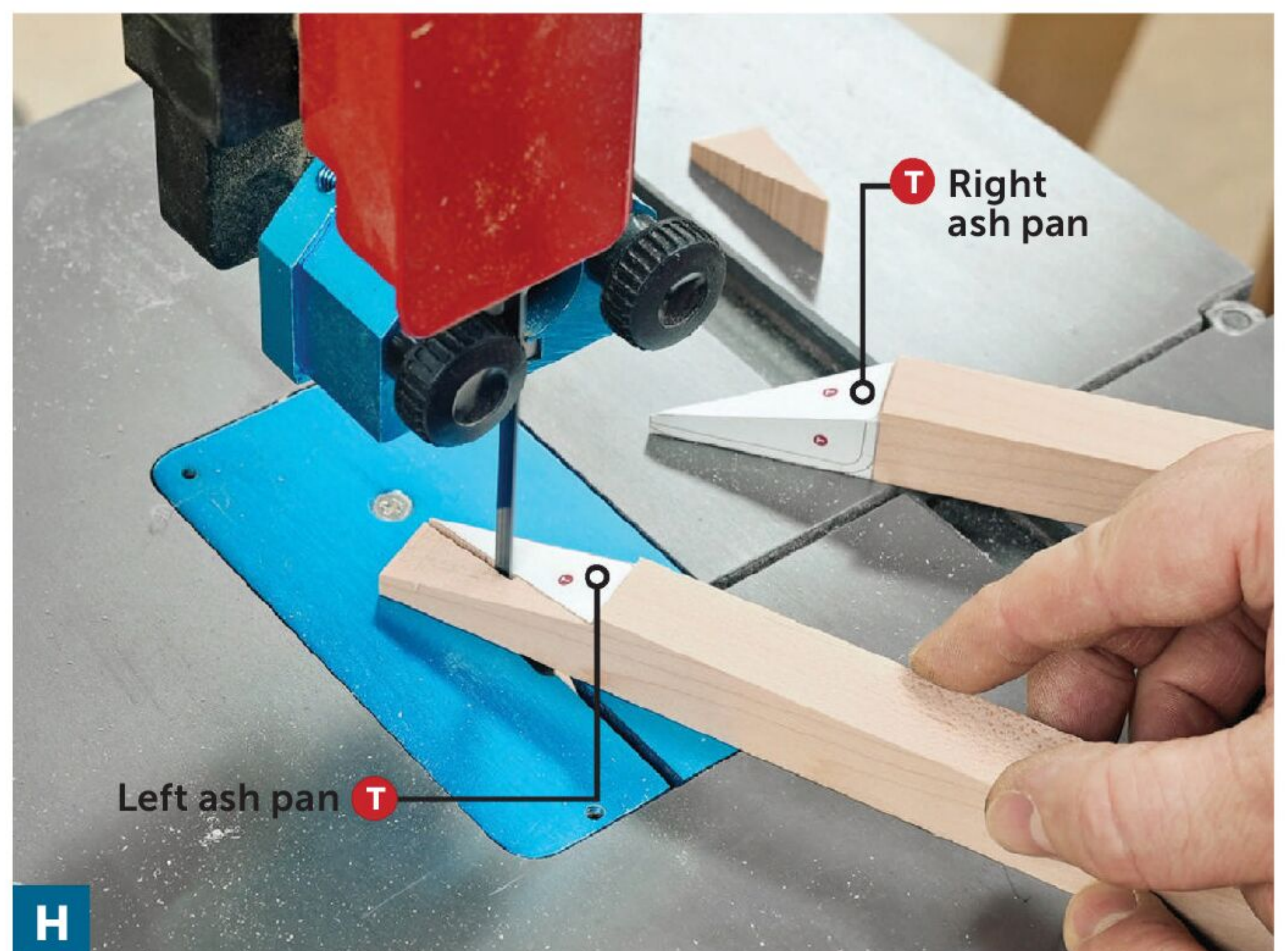
2 Cut the boiler cradle (R) to size [Materials List] and glue it to the top of the frame rail/support assembly (P, Q), flush at the front end [Drawing 6]. Cut the engine boiler (S) to length from a 2" dowel and scribe it to the back face of the boiler cradle [Photo G]. Cut and sand the curve on the boiler cradle, then bevel-cut the front end.

3 Cut two $\frac{3}{4} \times \frac{3}{4} \times 12$ " workpieces for the ash pans (T). Use the full-size patterns to lay out the side views of the left and right ash pans on each workpiece [Drawing 5] and cut them on the layout lines. Then lay out and cut the top views [Photo H]. Crosscut the ash pans to length, sand the cut surfaces smooth, and round over the outside and bottom corners [Drawing 6].

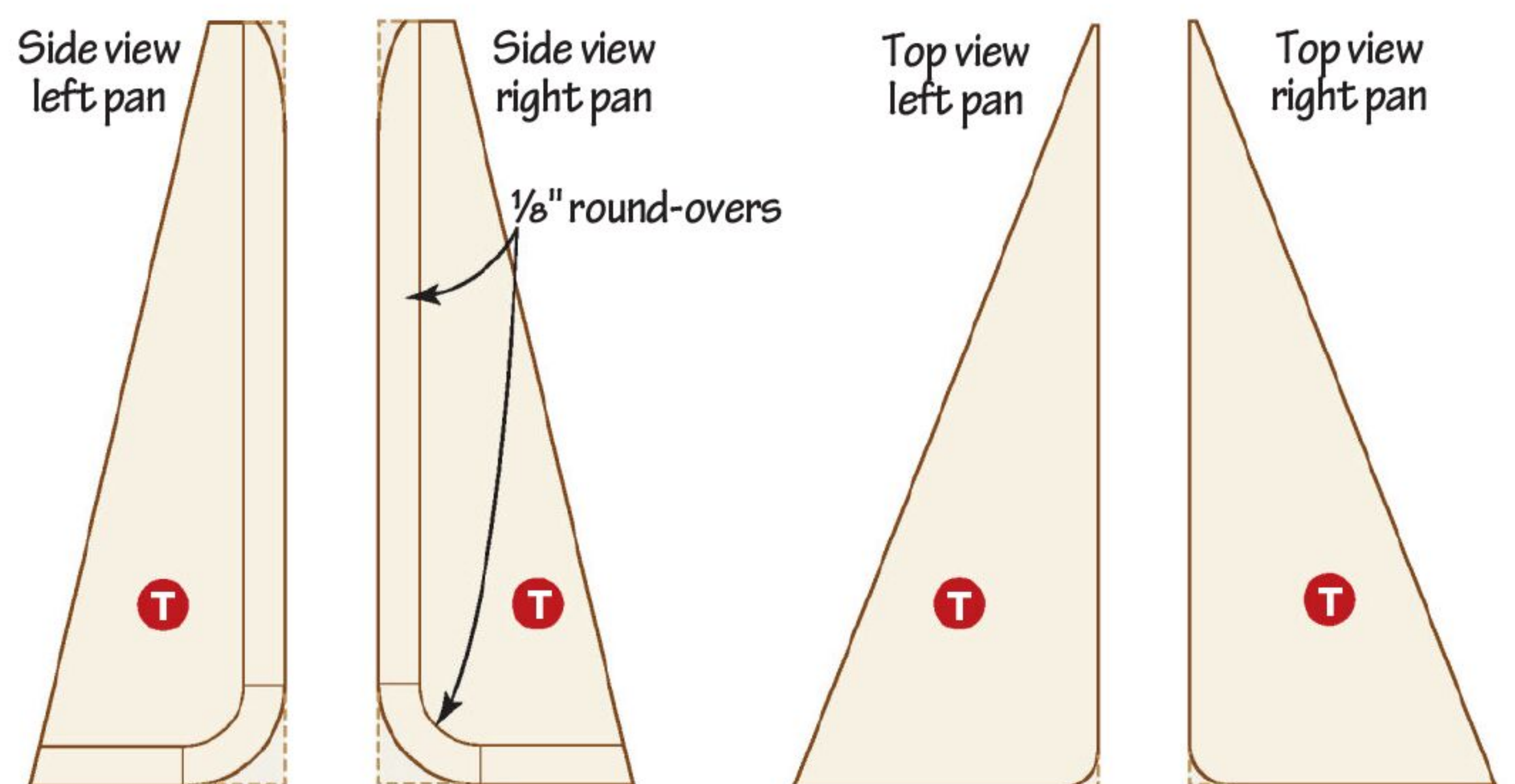
5 ENGINE FRAME PARTS



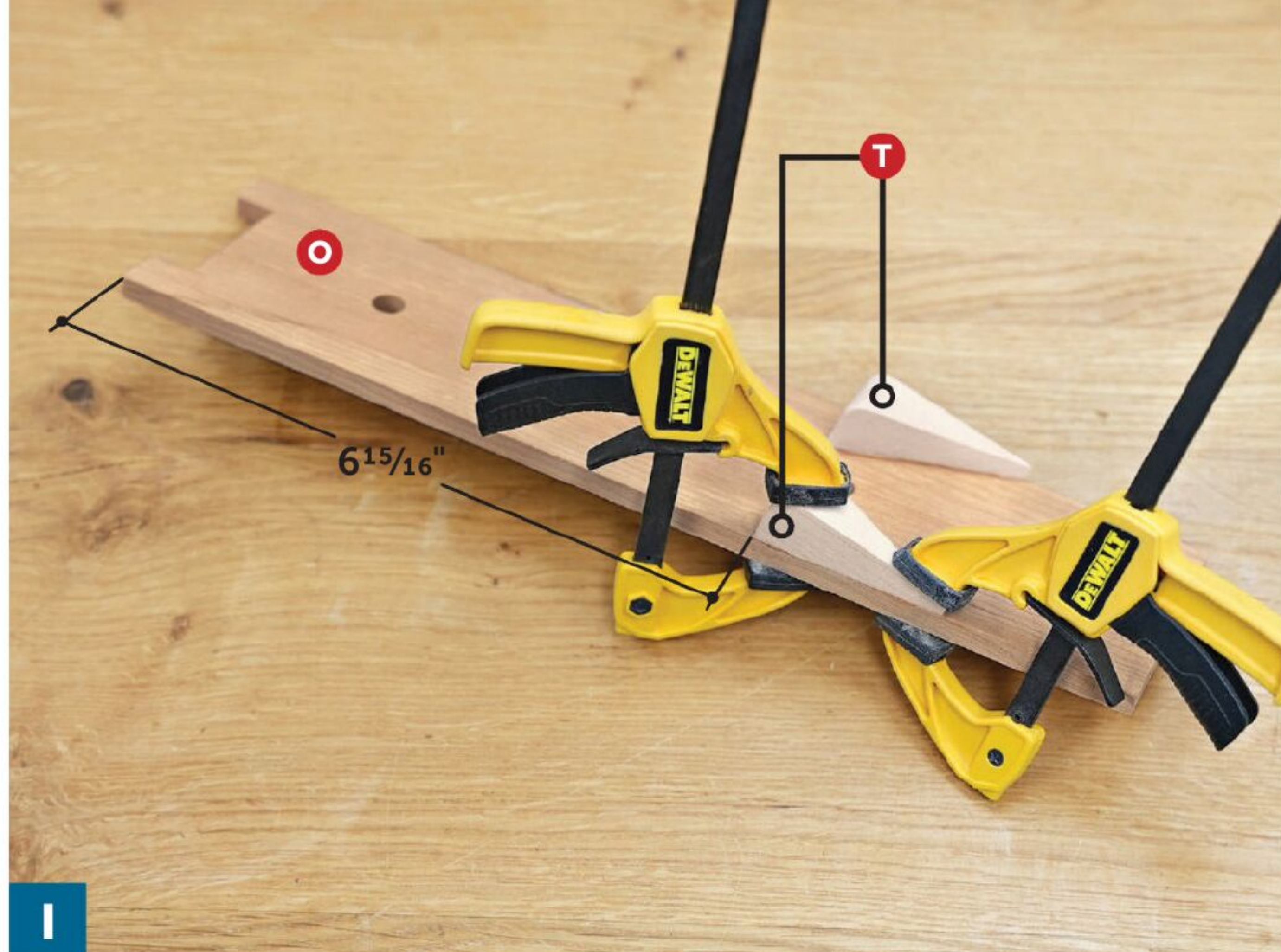
Mark a line on the back face of the boiler cradle (R) $\frac{1}{4}$ " from the frame rail (P) to account for the thickness of the catwalk (O). Center the boiler (S) on the boiler cradle, touching the line, and scribe the curve.



Attach the side-view patterns and cut the side of each ash pan (T). Then attach the top-view pattern to the cut edge and cut the top to give the pans their final shape.



ASH PAN FULL-SIZE PATTERNS



I Glue and clamp the ash pans (T) flush at the edges of the catwalk (O) and $6\frac{15}{16}$ " from the front end. Make sure the edge with the $\frac{1}{8}$ " round-over is oriented at the outside.



J Tilt your tablesaw blade to 35° , rotate the miter gauge to 20° , and crosscut the end of the workpiece. Then, rotate the miter gauge to the opposite 20° setting and make the second cut (above).

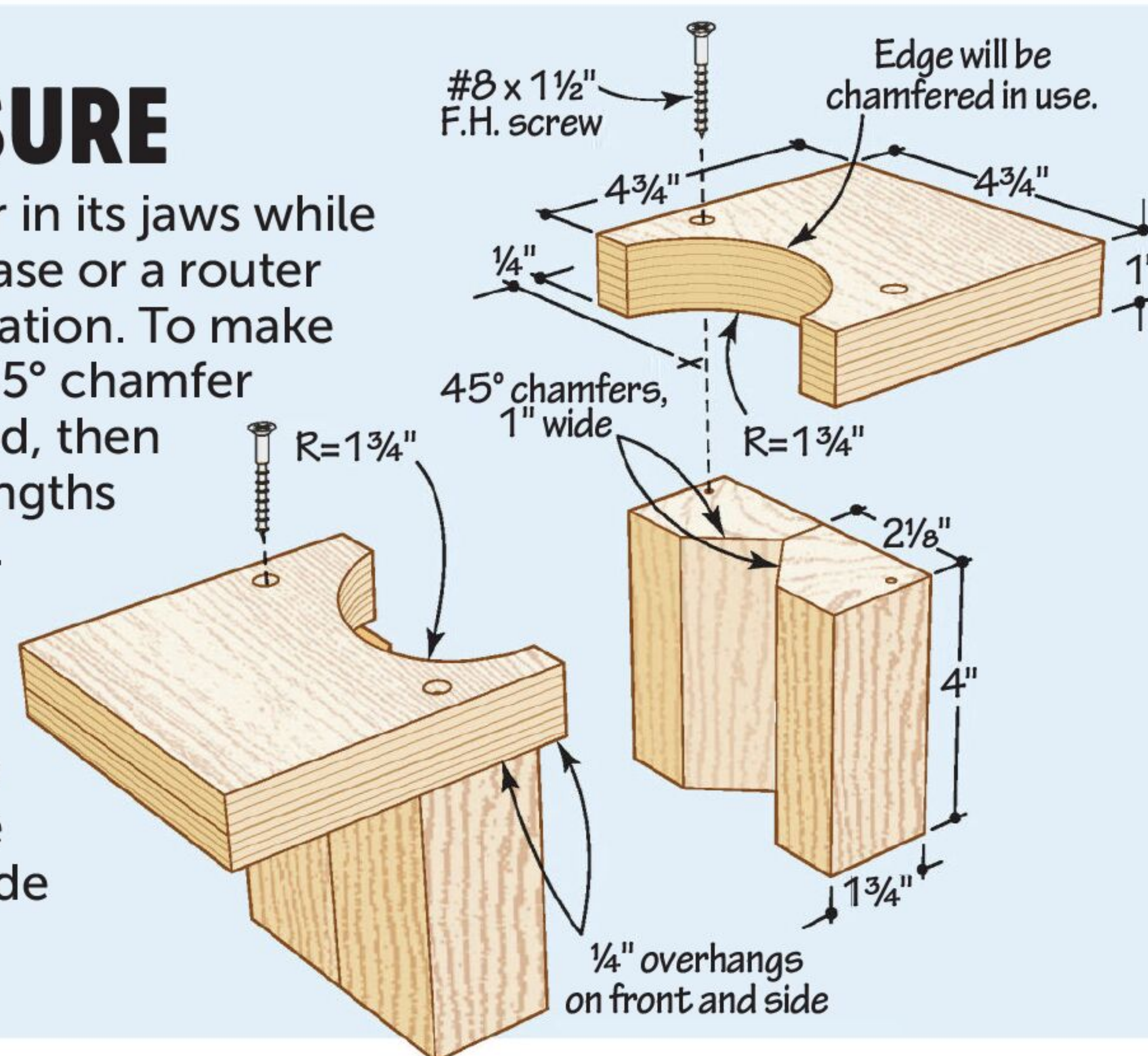
4 Glue and clamp the ash pans onto the bottom of the catwalk (O) [Photo I]. Lay out and cut the curve on the rear of the catwalk [Drawing 5], then glue and clamp the frame rail assembly (P, Q, R) to the bottom of the catwalk, making sure to align the holes [Drawing 6].

5 Cut the cross rail, stair base, and stairs (U, V, W) to size [Drawing 6]. Glue the cross rail (U) to the bottom of the catwalk (O) and back end of the frame rail (P). Glue the stair base (V) to the bottom of the front support (Q), centered and flush at the front end. Add the stairs (W).

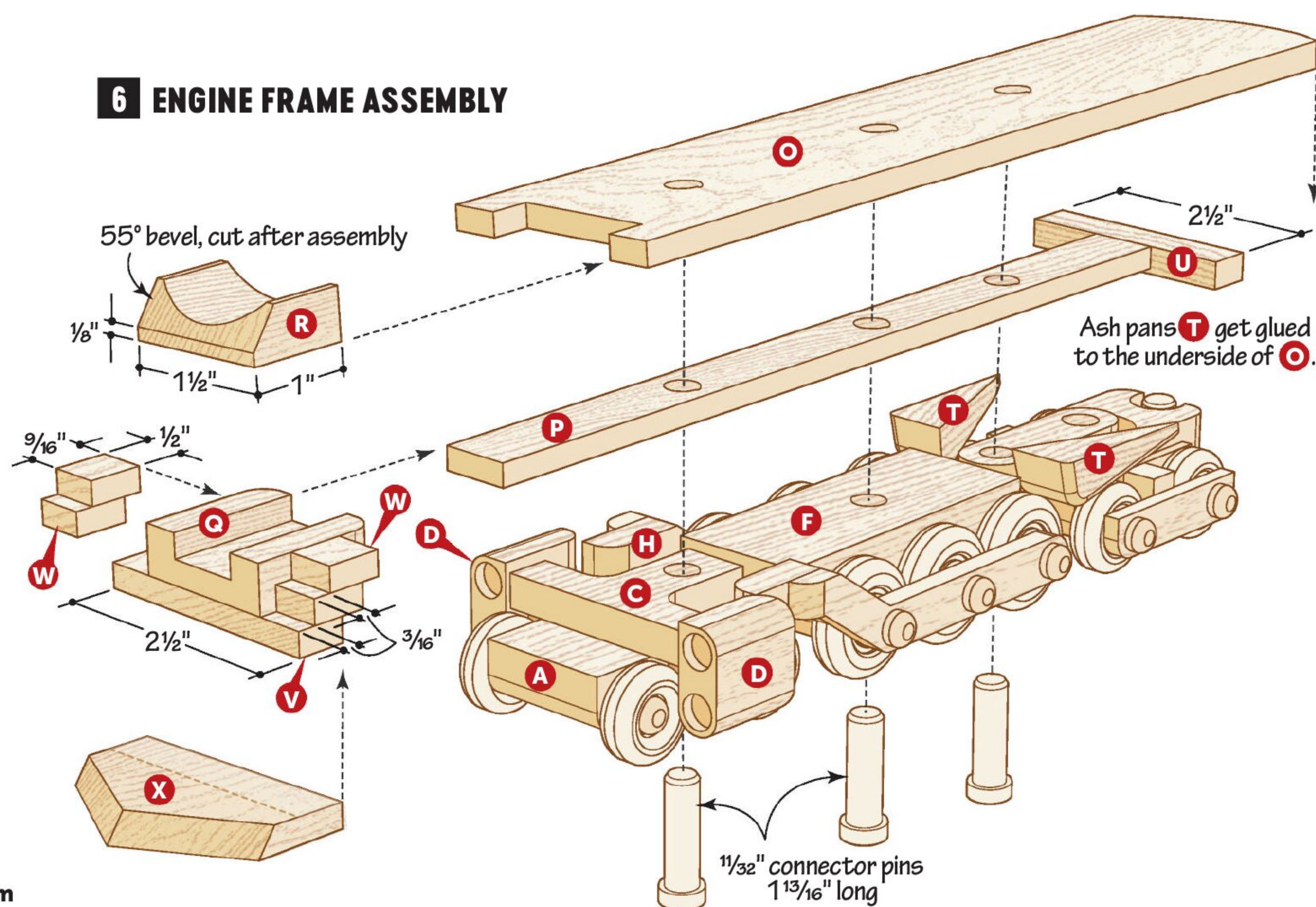
6 Cut a $\frac{1}{2} \times 2\frac{1}{2} \times 12$ " workpiece for the cowcatcher (X). Shape one end [Photo J], then crosscut it to length. Glue the cowcatcher to the bottom of the stair base (V), flush at the back edge [Drawing 6].

BOILER PRESSURE

This jig secures the boiler in its jaws while its platform serves as a base or a router rest depending on orientation. To make the jaws, rout a 1"-wide 45° chamfer on $1\frac{3}{4} \times 2\frac{1}{8} \times 18$ " hardwood, then crosscut it into four 4" lengths and glue up pairs of jaws. Laminate $\frac{1}{2}$ " plywood to form the platform. Lay out and cut the radii. Screw each platform to a jaw, centered side to side and overhanging the inside of the jaw by $\frac{1}{4}$ ".



6 ENGINE FRAME ASSEMBLY



ENGINE BODY

1 Drill the headlight hole in the front end of the boiler (S) [Photo K, Drawing 7]. A dowel vise simplifies this. See *Boiler Pressure* on the *previous* page. You can also use it to chamfer the front [Photo L]. Glue the headlight into the hole.

TIP!

To mark an accurate centerline, lay a 1"-thick block or a 1"-wide steel rule alongside the boiler and use that to guide the tip of your pencil.

2 Cut the firebox (Y) [Drawing 8] and scribe the back end of the boiler (S) onto the end of the firebox, flush at the top face. Cut and sand the curve, then glue the firebox to the boiler [Drawing 7]. Once the glue dries, mark a centerline along the top of the boiler and drill the holes for the smokestack, sand dome, and water dome.

3 Cut the cab front, sides, and backs (Z, AA, BB) to size. Drill a hole in the cab front (Z) and cut notches in the ends [Drawing 8]. Notch the upper edge of the cab sides (AA) and rabbet the lower outside face. Glue the cab backs (BB) to the sides [Drawing 7], then glue the side/back assemblies to the ends of the cab front.

4 Glue the cab assembly onto the top face of the catwalk (O), aligning the back of the cab with the back corners. Scribe the headliner (CC) shape onto a $\frac{3}{8}$ "-thick workpiece [Photo M], cut it to shape, and glue it to the top edge of the cab front (Z), flush at the front and centered [Drawing 7].

5 Cut a blank to overall size for the cab roof (DD) [Materials List], then scribe



K

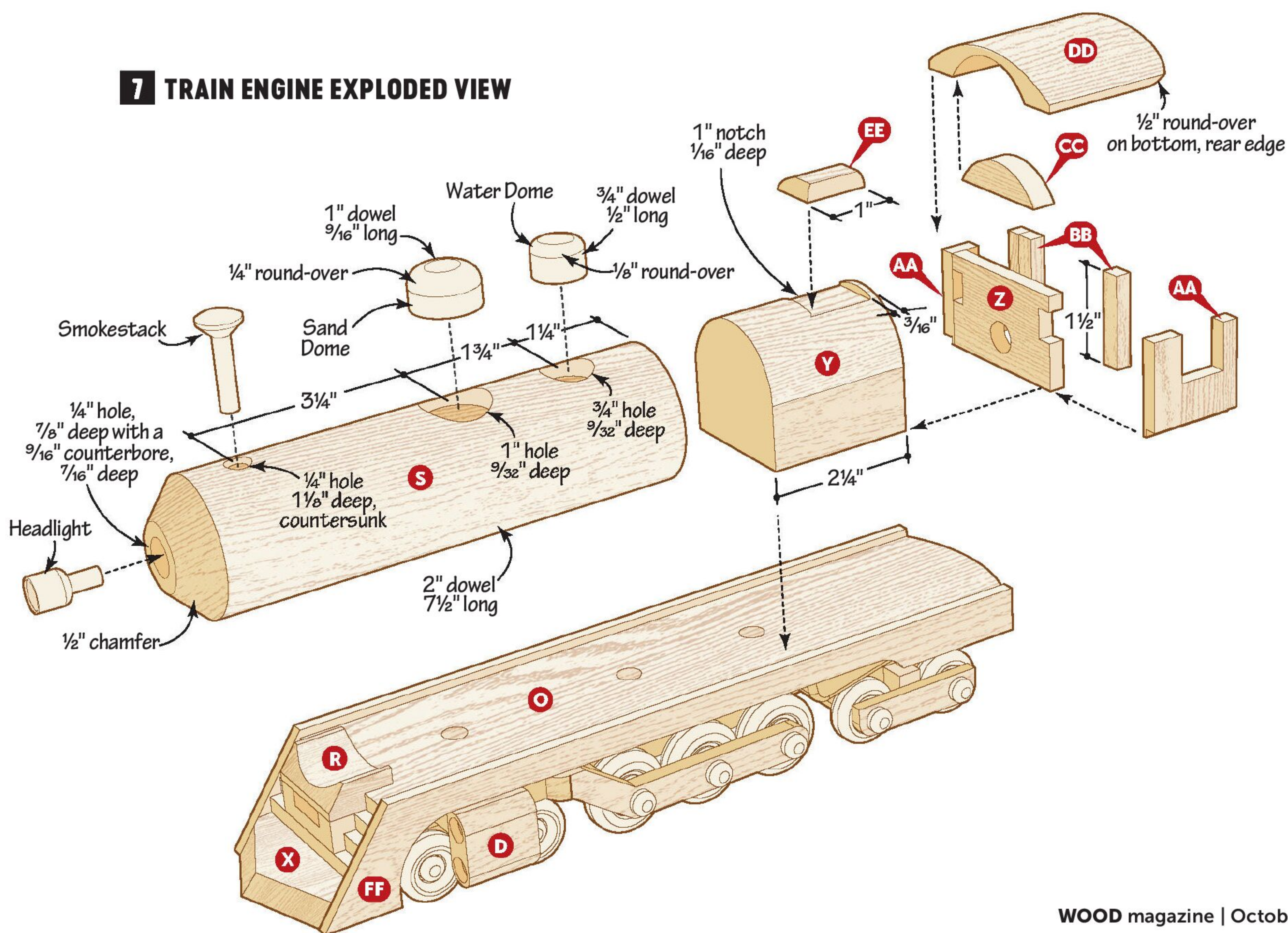
Clamp the jig around the boiler (S) to keep it vertical at the drill press. Drill the $\frac{9}{16}$ " counterbore, then the $\frac{1}{4}$ " hole centered in the counterbore to receive the headlight.

the inside curve of the headliner (CC) onto it [Photo N]. Bandsaw the curve to rough shape, then use a spindle sander to sand to your layout line. Use the full-size pattern to lay out the outside curve [Drawing 8]. Cut and sand it to shape, and round over the back corners. Set it aside.

6 Notch the firebox (Y) [Drawing 7] by setting your tablesaw blade $\frac{1}{16}$ " high, then making multiple passes using your miter gauge to nibble away the width of the notch. Cut the water valve (EE) to fit. Ease the upper front and side edges of the water valve and glue it into the notch.

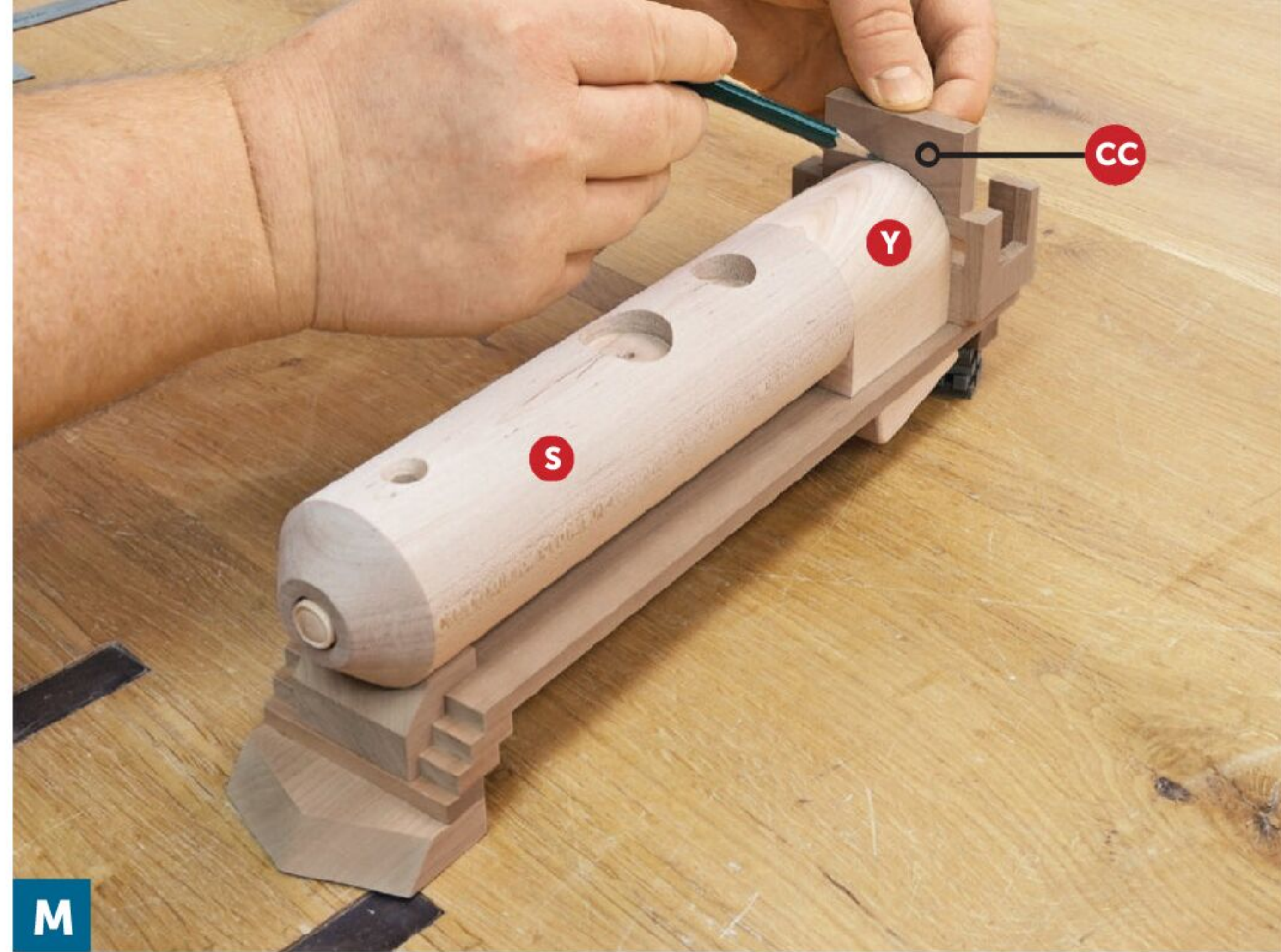
Note: Install an auxiliary fence on your miter gauge that extends 3" beyond the blade to support the boiler/firebox assembly as you cut the notch.

7 TRAIN ENGINE EXPLODED VIEW

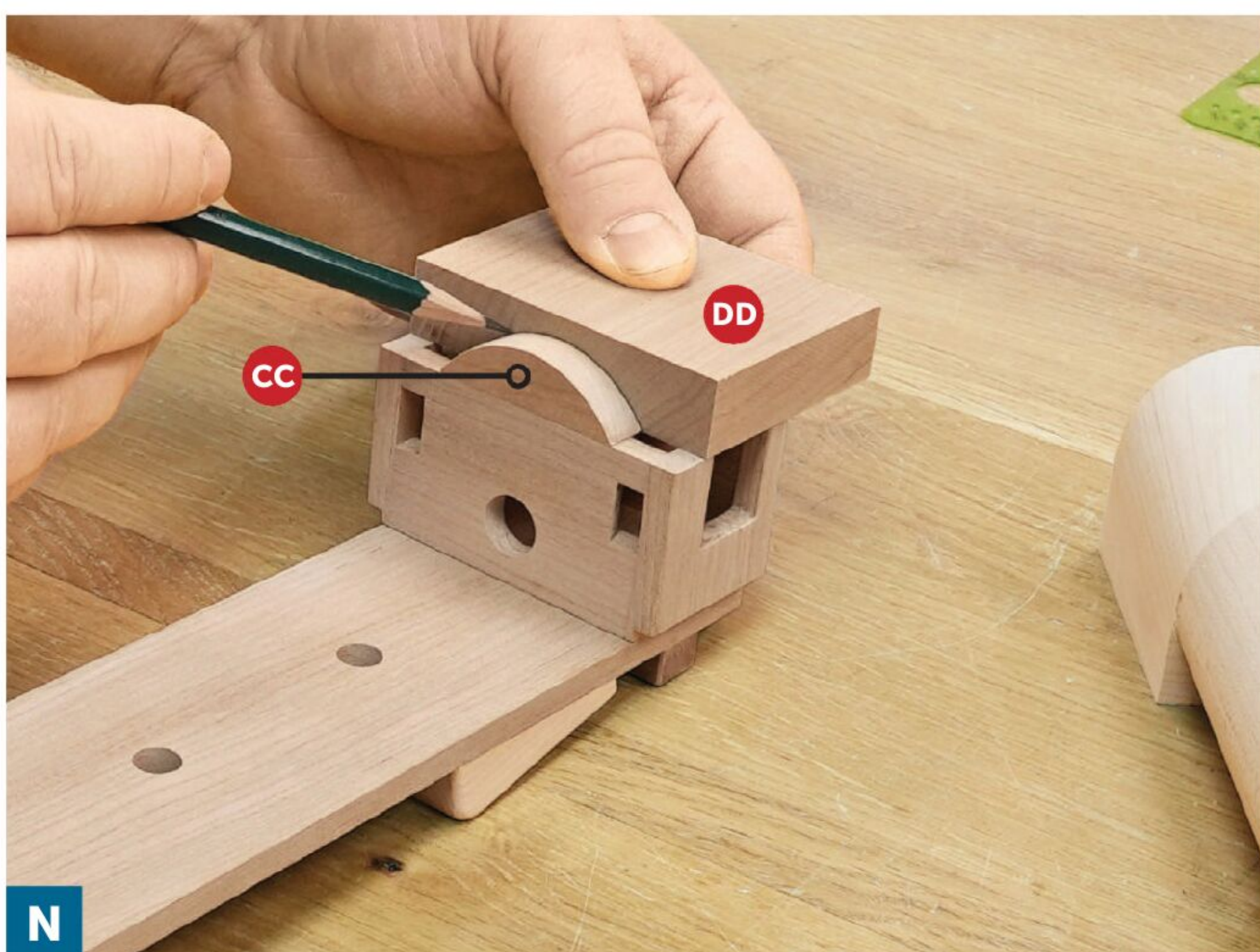




L Flip the jig and clamp it to the boiler (S) with the top of the platform flush at the front end of the boiler. Install a $\frac{1}{2}$ " chamfer bit in a plunge router and rout the chamfer in multiple passes until it's $\frac{1}{2}$ " wide.

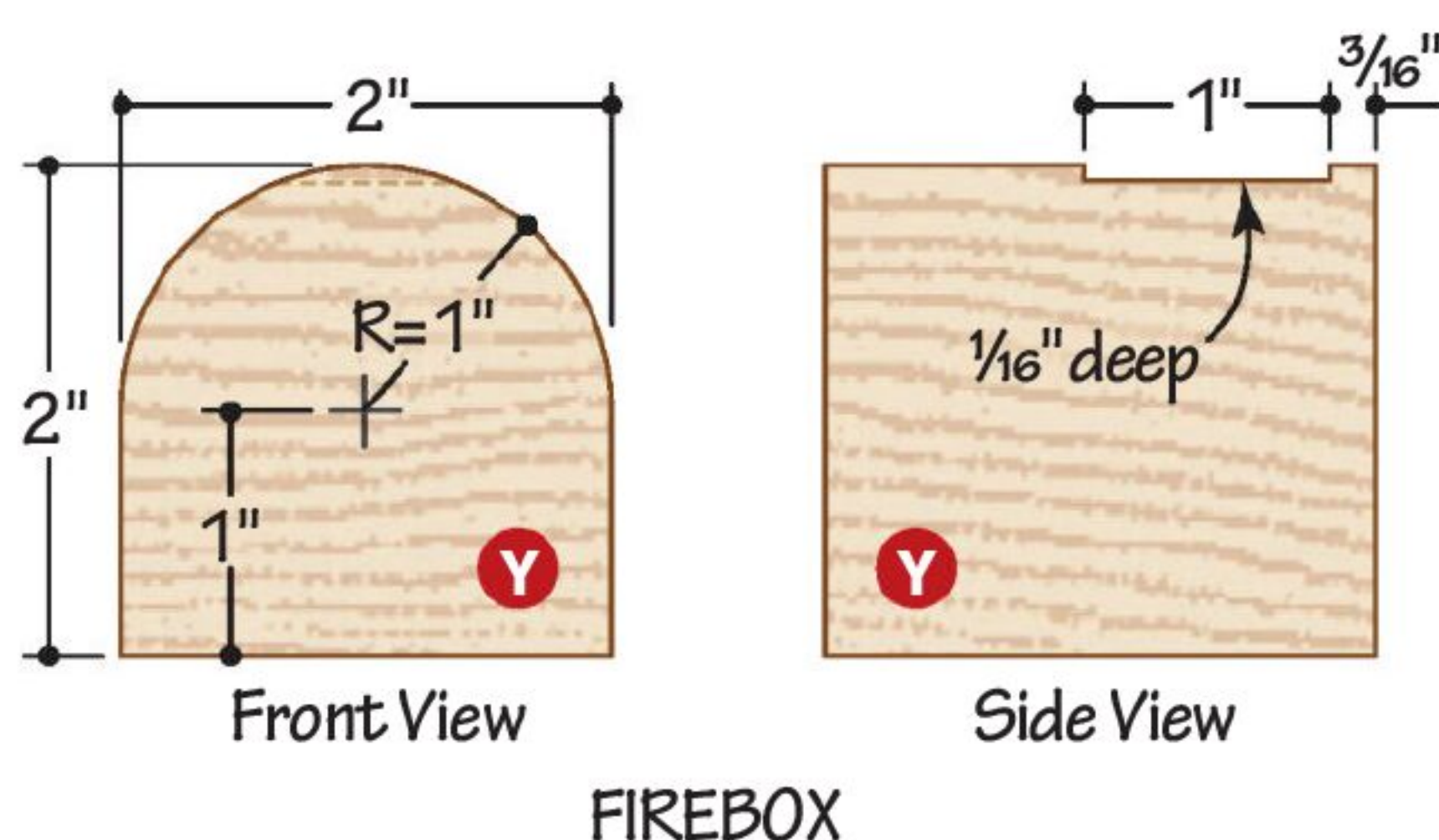


M Place the boiler/firebox assembly (S/Y) onto the engine frame and scribe the top of the firebox onto a workpiece to lay out the shape of the headliner (CC).

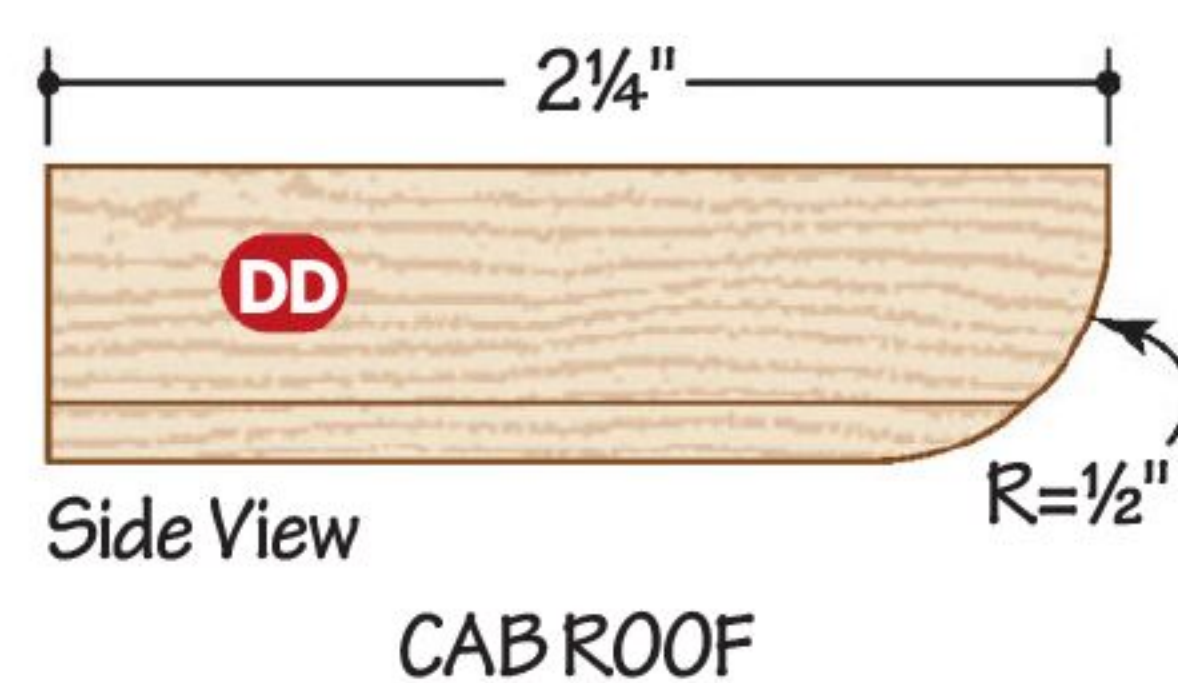


N Place the cab roof (DD) behind the headliner (CC), flush with the sides of the cab, and scribe the headliner curve onto the end of the roof.

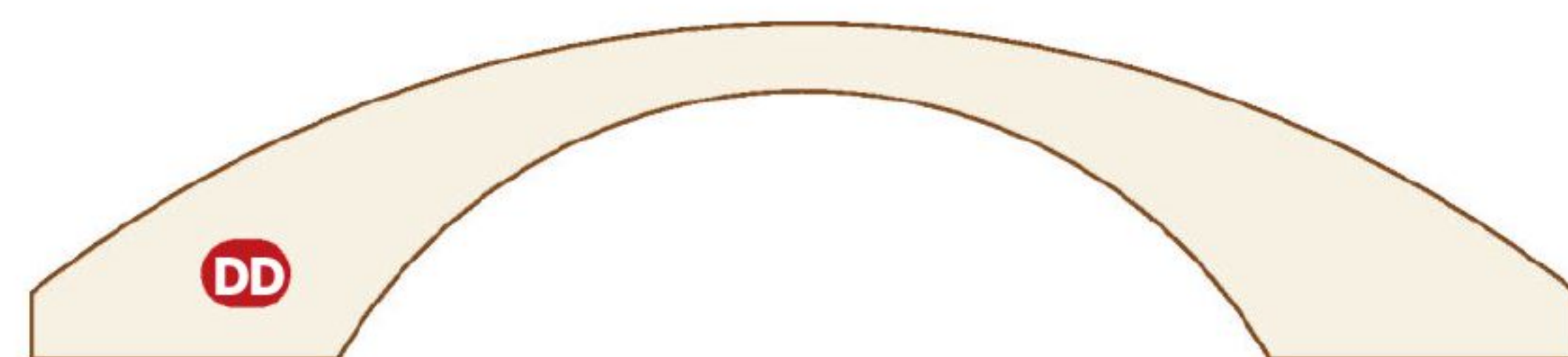
8 ENGINE BODY PARTS



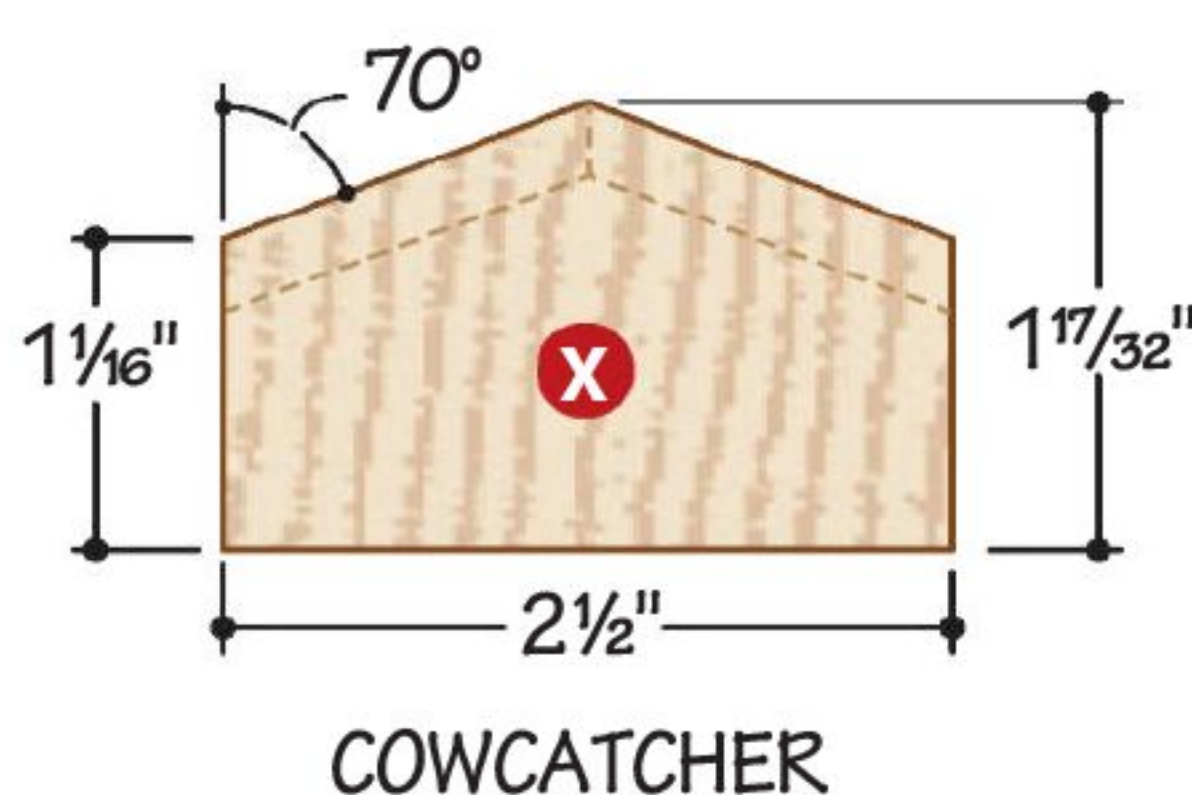
FIREBOX



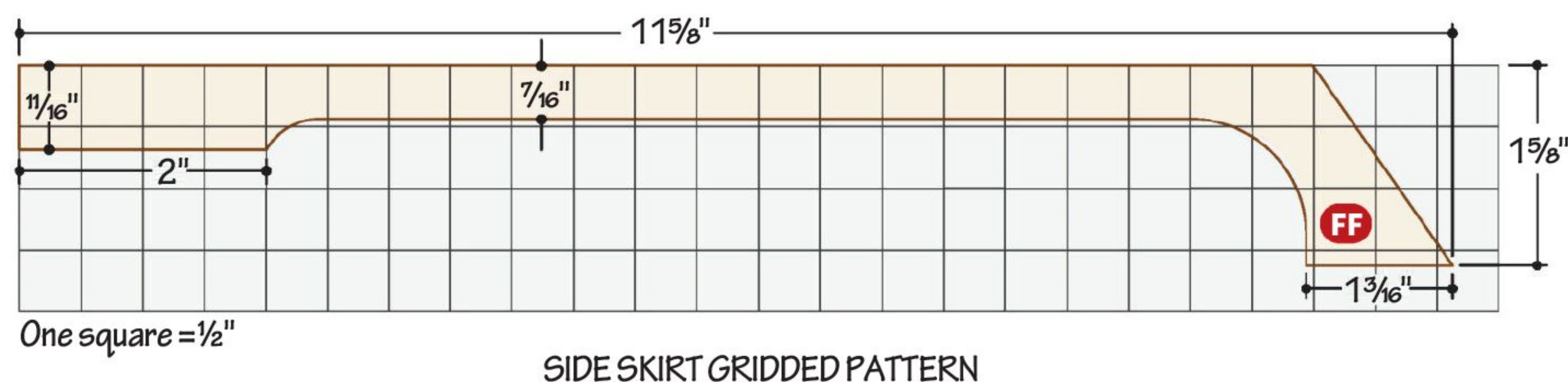
CAB ROOF



CAB ROOF FULL-SIZE PATTERN



COWCATCHER

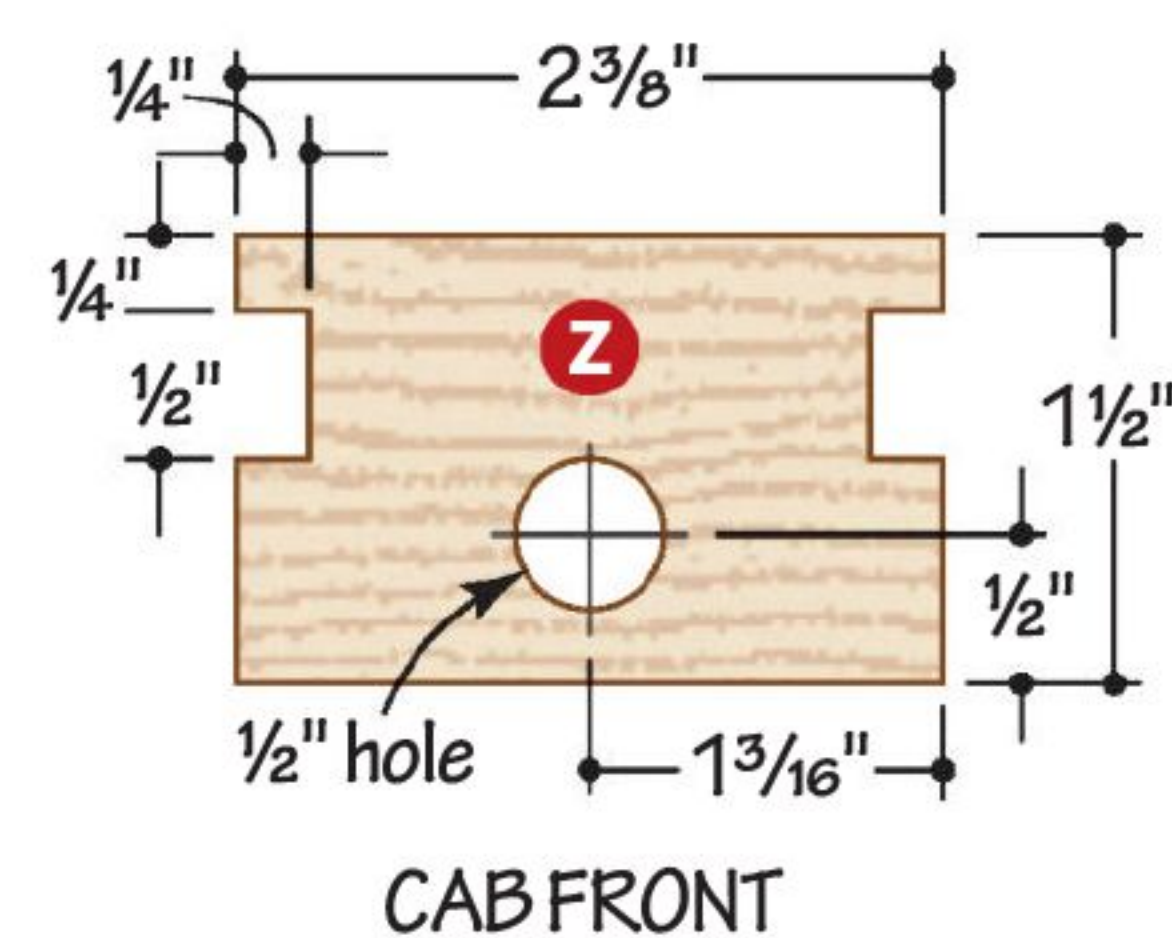


SIDE SKIRT GRIDDED PATTERN

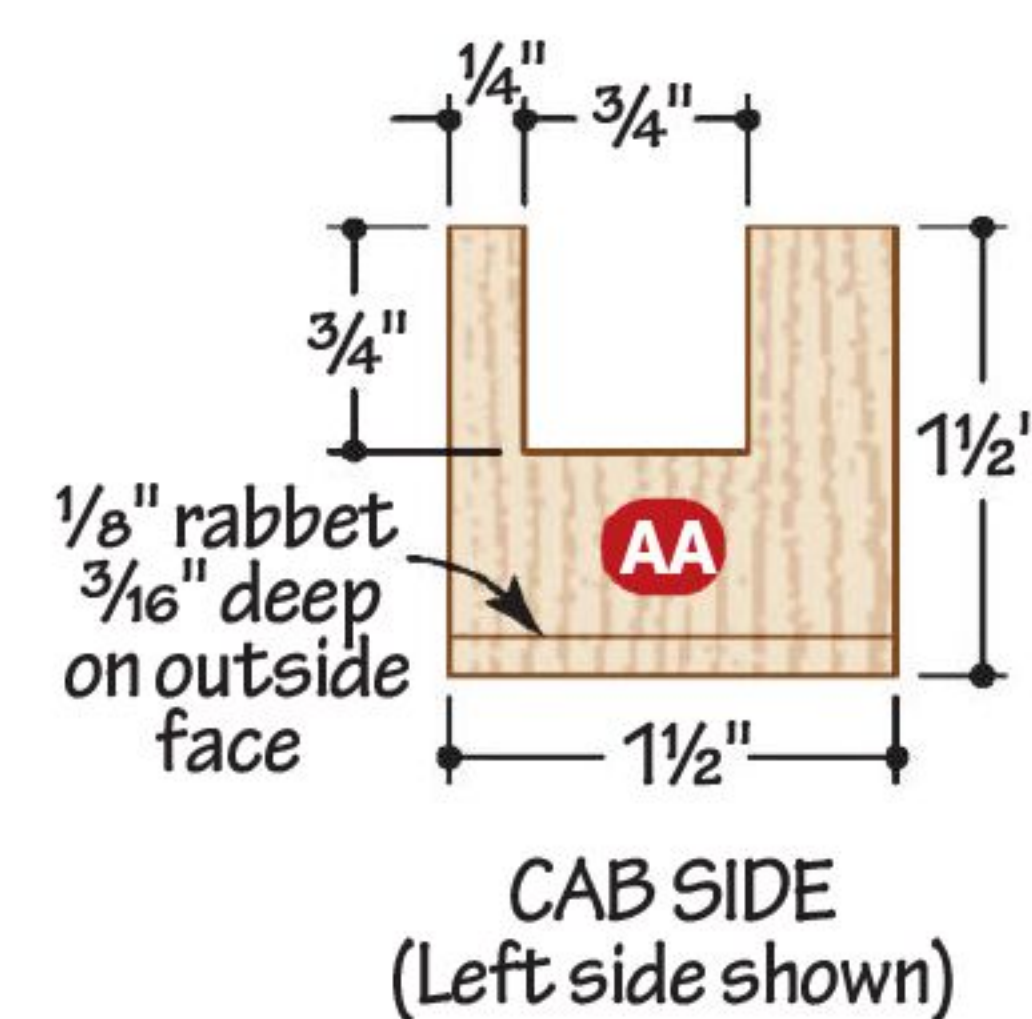
7 Round over one end of a $\frac{3}{4}$ " dowel and a 1" dowel, then cut each one to length to form the water and sand domes [Drawing 7]. Sand or cut away the top $\frac{1}{8}$ " of the smokestack, then glue it and the sand and water domes into their holes in the top of the boiler (S). Glue and clamp the boiler/firebox assembly to the boiler cradle (R), catwalk (O), and cab front (Z).

8 Use the gridded pattern to lay out the side skirts (FF) [Drawing 8] and cut them to shape. Glue the side skirts to the cab side (AA) rabbets, flush at the back ends, and to the sides of the engine frame assembly [Drawing 7]. Glue the cab roof (DD) to the top of the cab assembly and to the back end of the water valve (EE). Extend the $\frac{11}{32}$ " holes in the frame rail and catwalk into the boiler (S) and firebox (Y) by $\frac{3}{4}$ ".

9 Apply glue to the holes in the catwalk (O), then attach the trucks to the engine using $\frac{11}{32}$ " connector pins [Drawing 6]. Apply a finish. We sprayed four coats of matte lacquer, buffing between coats with extra-fine steel wool.



CAB FRONT



CAB SIDE
(Left side shown)

COAL TENDER

Your steam engine won't get far without fuel to fire the boiler. Build this coal tender to move it farther on down the line.

START WITH THE TRUCKS

1 Retrieve the two standard trucks started earlier. Cut the coal tongues and tongue extension (GG, HH) to size [Drawing 9]. Round over the back corners of the extension and glue it to one of the tongues, flush at the front end [Drawing 10]. Drill a pilot hole for a screw eye in the end of the extension, round over the front corners of the tongue/extension assembly, then glue it into the top groove of one of the standard truck assemblies, flush at the back end.

2 Drill a $\frac{7}{32}$ " hitch-pin hole in the other coal tongue (GG) [Drawing 10] and round over the rear corners [Drawing 9]. Glue the tongue into the groove of the remaining truck assembly, flush at the front end. Once the glue dries, drill the counterbores and holes in the frame and tongue of both wheel assemblies.

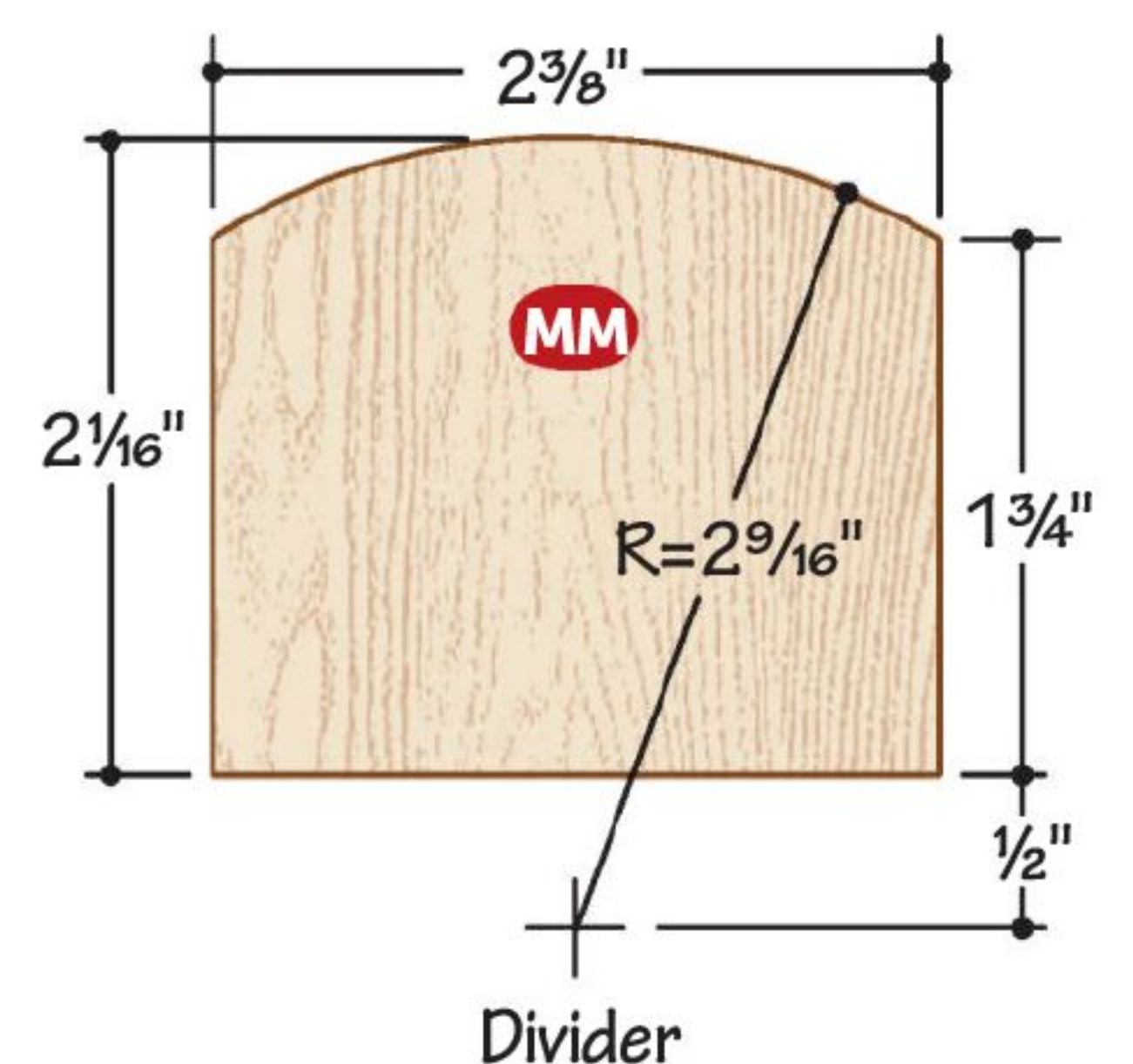
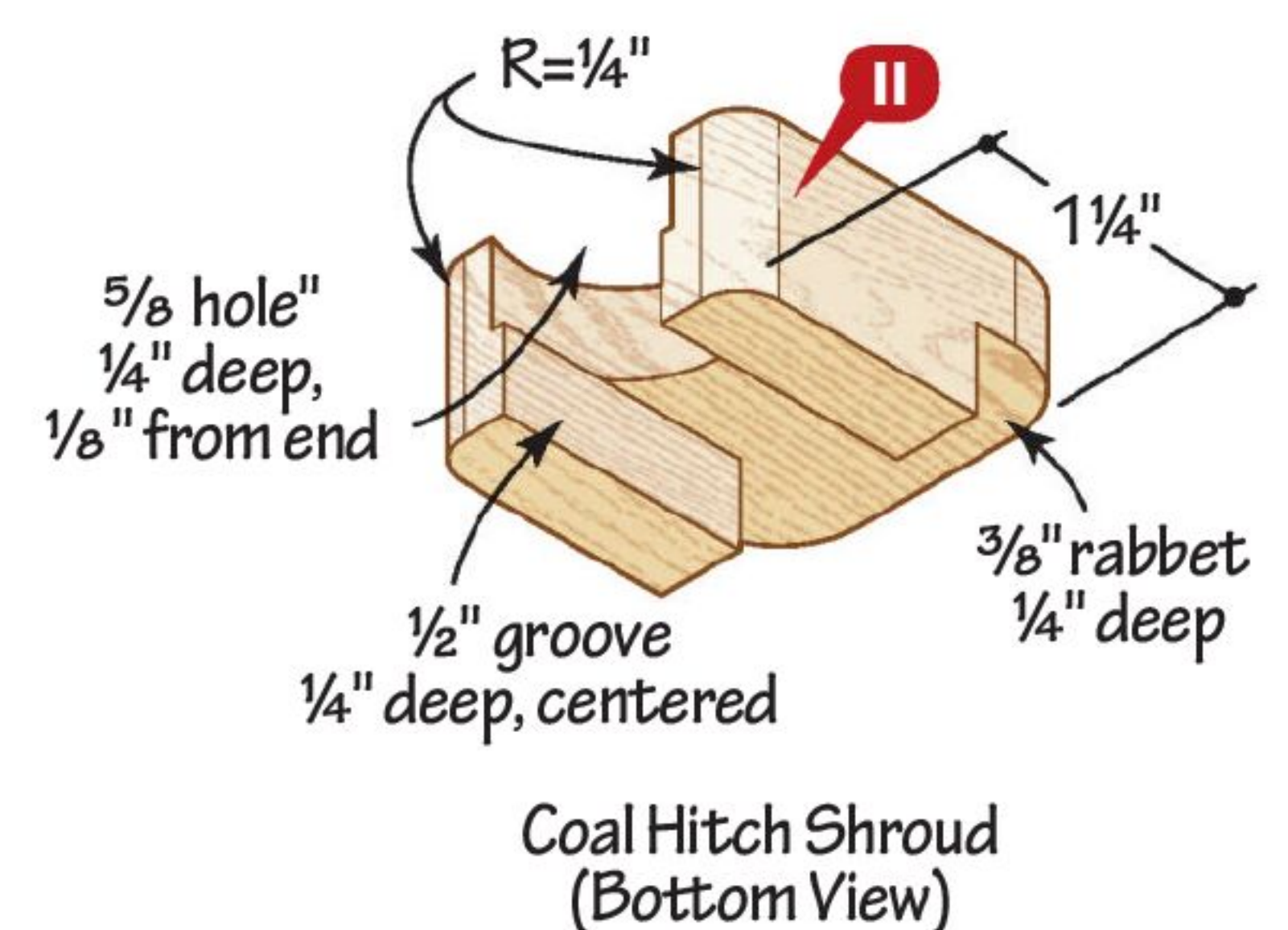
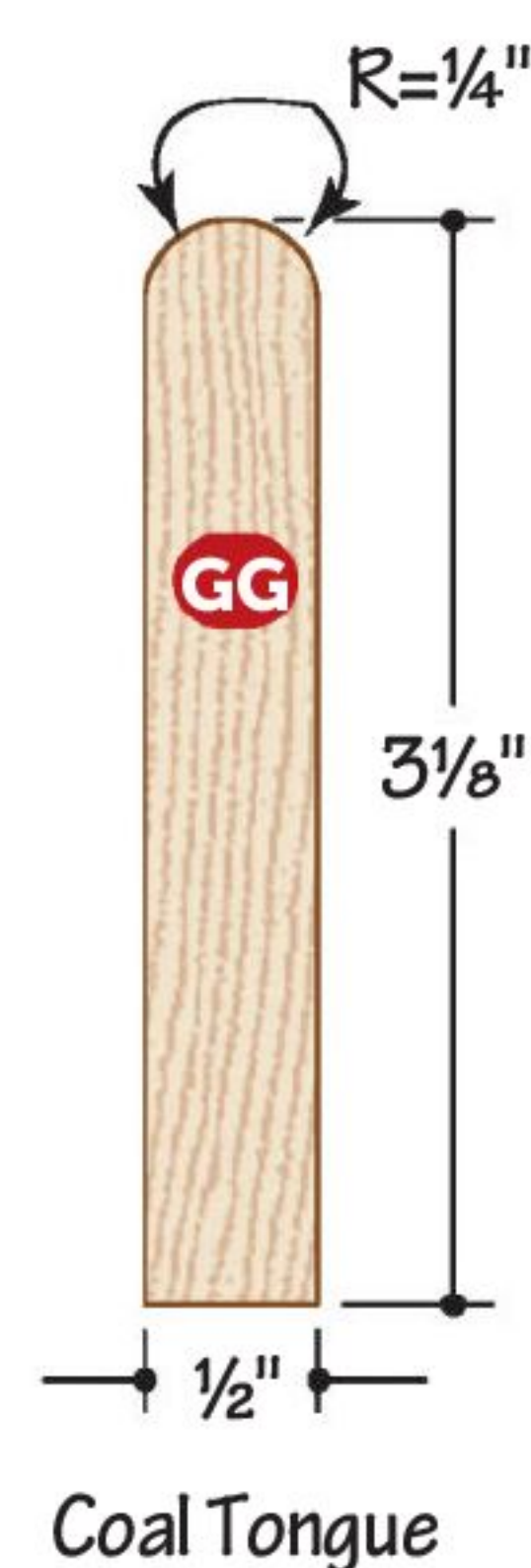
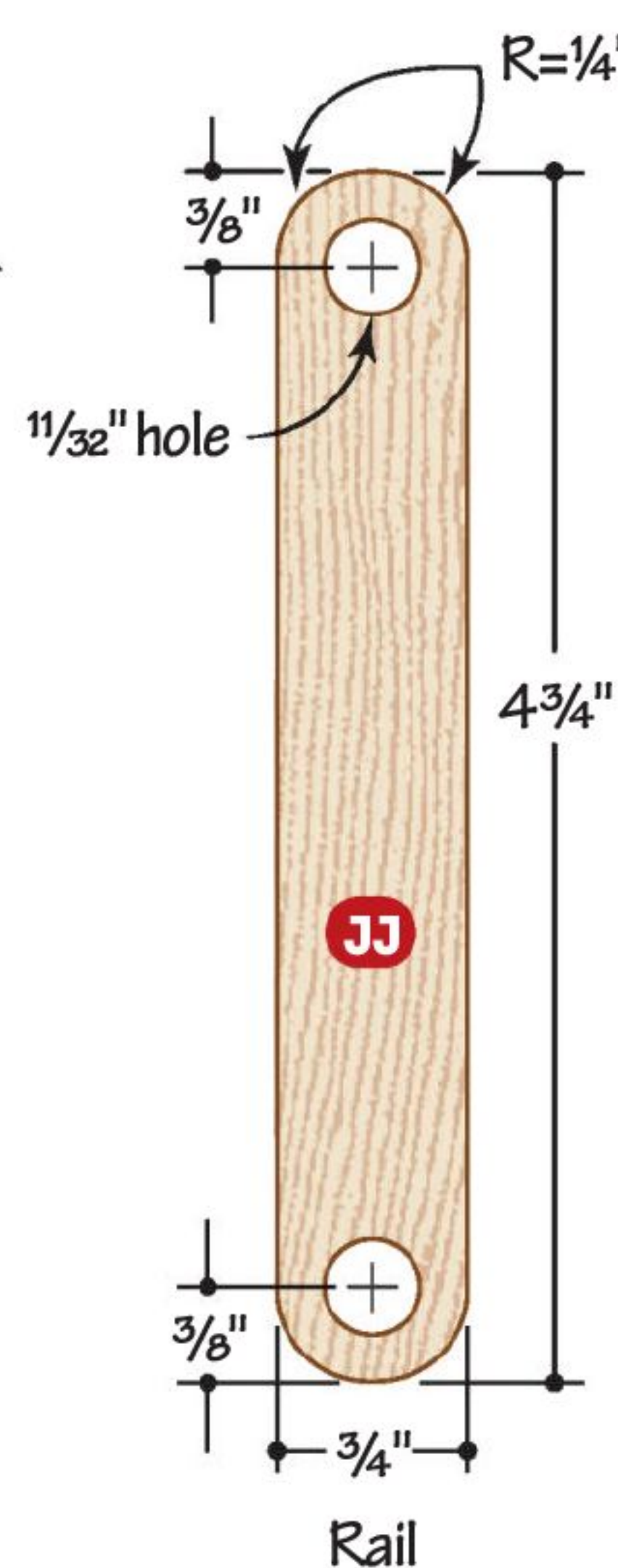
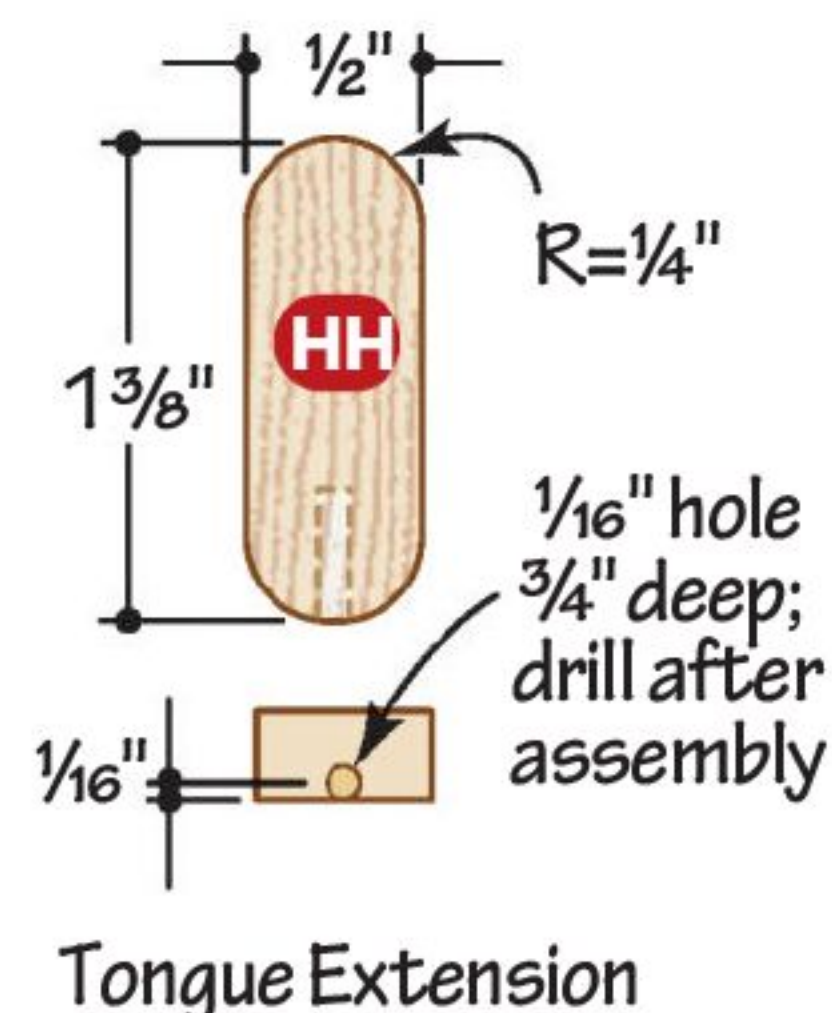
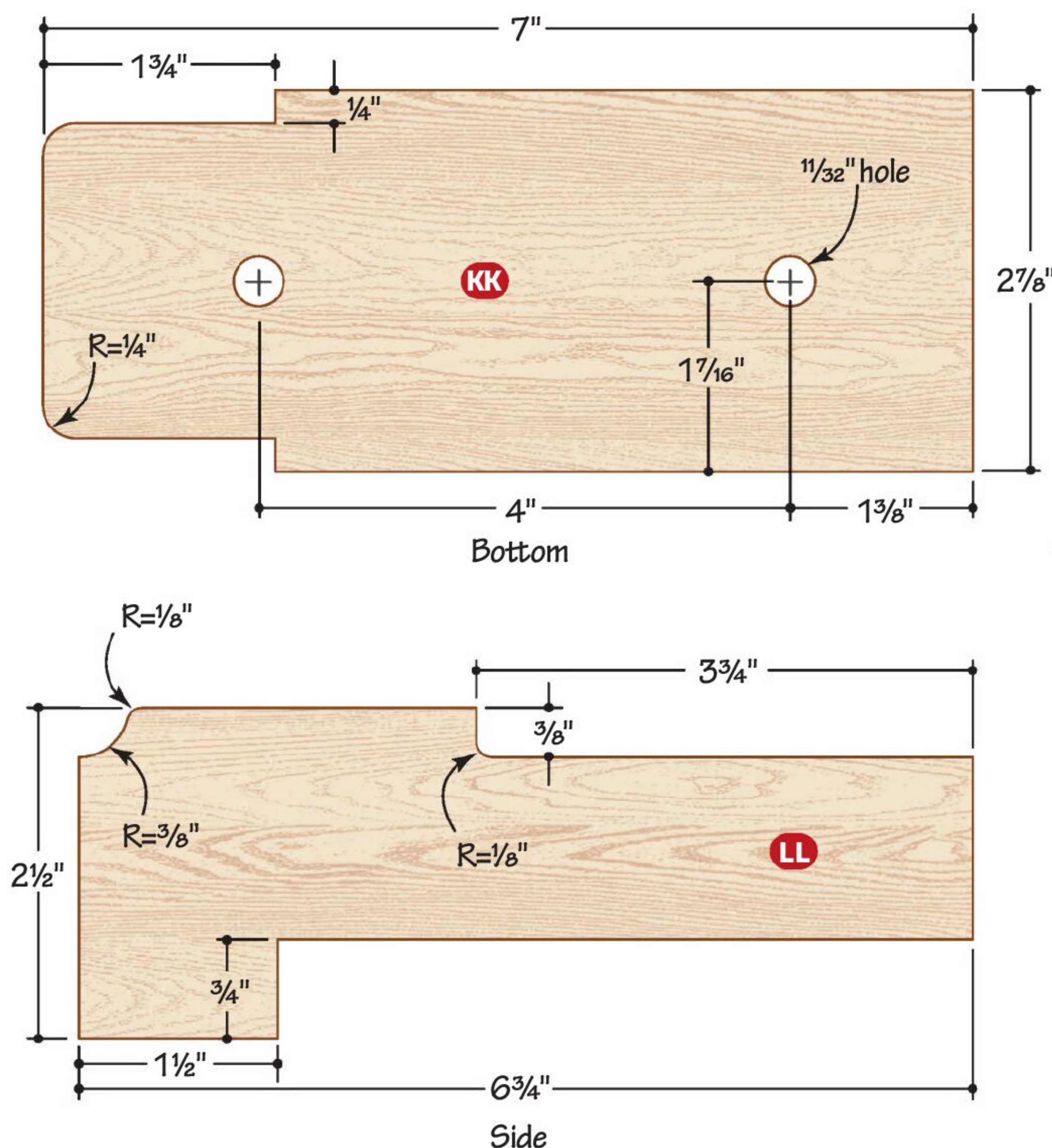
3 Cut a 6"-long workpiece to thickness and width for the coal hitch shroud (II). Form the centered groove along the bottom



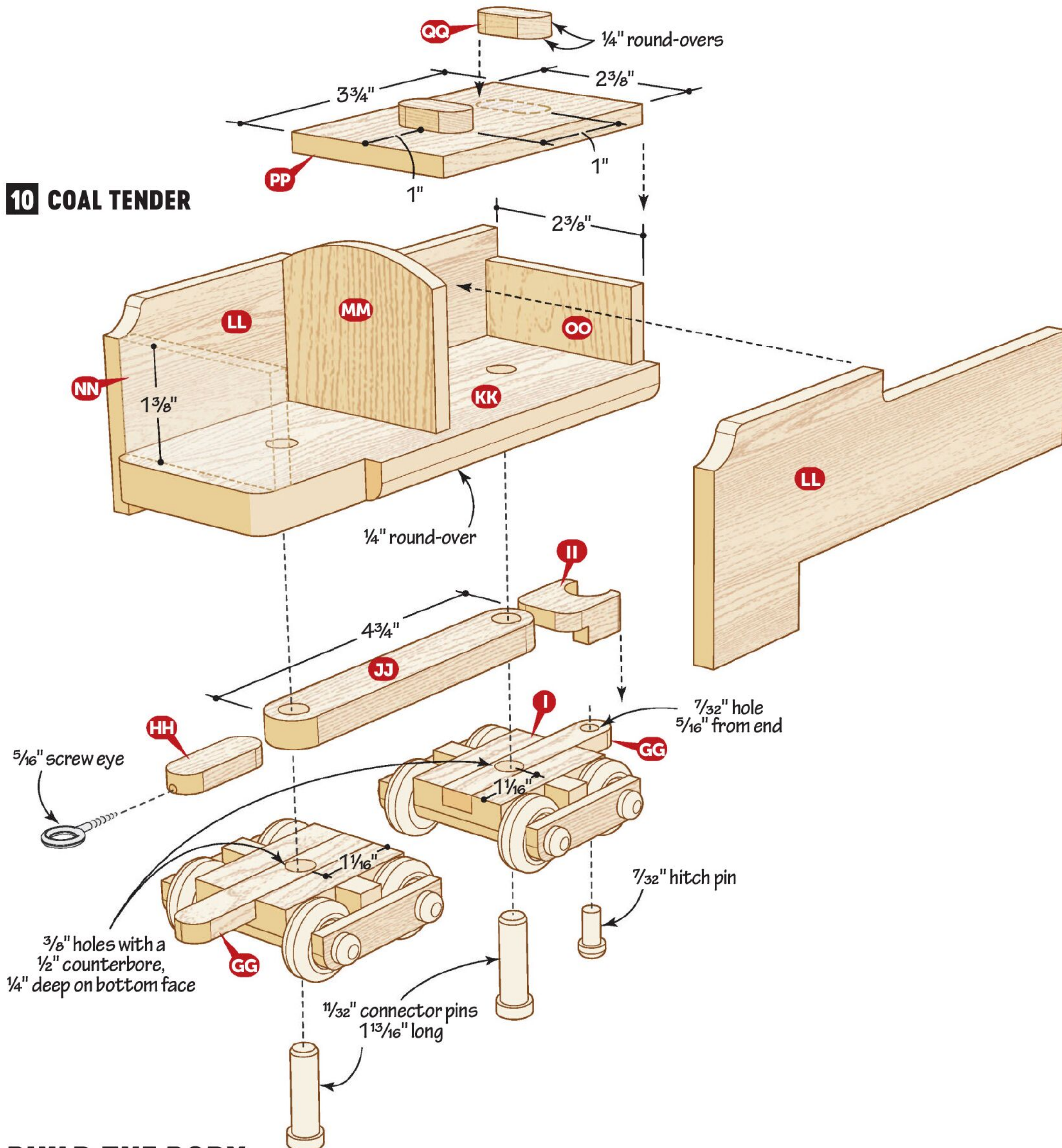
face [Drawing 9]. Mark the finished length and cut a dado across its width at that length line. Drill the hole in the top face, then crosscut the hitch shroud to length, leaving all of the dado to form the $\frac{3}{8}$ "-wide rabbet. Round over all four corners.

4 Glue the hitch shroud to the tongue and frame of the rear truck assembly [Drawing 10]. Then, glue a hitch pin into the hole in the end of the tongue and cut it flush with the top face of the shroud. Insert the screw eye into the hole in the front tongue.

9 COAL TENDER PARTS



10 COAL TENDER



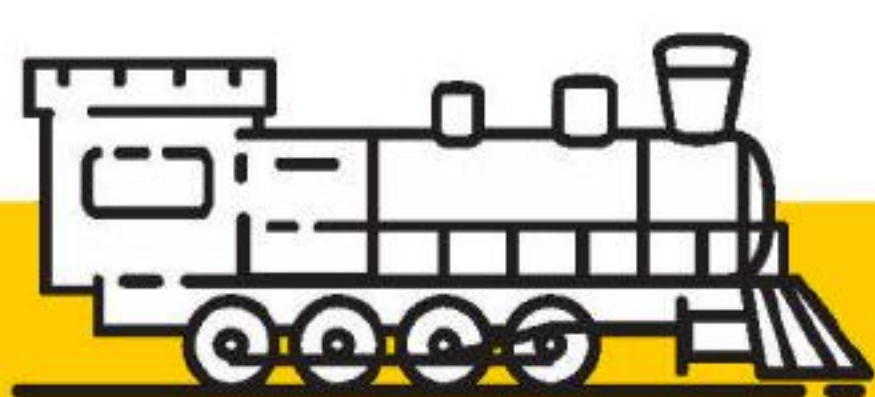
BUILD THE BODY

- 1 Cut the rail and bottom (JJ, KK) to size and drill the holes [Drawing 9]. Notch the front corners of the bottom and round over the lower edges of the un-notched portion [Drawing 10]. Round over the front corners of the bottom (KK) and all four corners of the rail (JJ).
- 2 Cut the sides (LL), forming the notches and round-overs [Drawing 9]. Clamp the sides to the bottom (KK) [Drawing 10] and measure to verify the width of the divider, front, back, and top (MM–PP). Cut them to size and lay out and cut the curve on the top of the divider (MM). Glue the back (OO) to the top (PP), flush at the back end, then glue the front (NN), divider (MM), and top/back assembly between the sides.

- 3 Cut the water tanks (QQ) to size and round over the corners [Drawing 10]. Glue them to the top (PP), spaced as shown and centered side-to-side.

- 4 Glue and clamp the upper body assembly (LL–QQ) to the bottom (KK) [Drawing 10]. Note that the bottom overhangs the front (NN) by 1/4". Glue the rail (JJ) to the underside of the bottom (KK) with the holes aligned.

- 5 Finish-sand any areas of the tender that need attention. Apply glue to the holes in the coal tender bottom (KK), and attach the wheel assemblies using 11/32" connector pins [Drawing 10], making sure the trucks can pivot. Apply finish to spruce the tender up to match the engine.



WHAT KIND OF TRAIN CAR CAN YOU DREAM UP?

Just build a set of standard trucks, lengthen part JJ to suit, and create what you want on top. Use our design-your-own-car kit, no. RS-01380E (\$10, woodstore.net/dreamcar), then send us photos at woodmail@woodmagazine.com

TRACK

The engine and tender are great for display, but that's not what we designed them for. This is a toy to be played with, so you'll need a sturdy, smooth-running track. Six sections of straight track and eight sections of curved track will form a simple oval shape. Adjust the quantity to customize the length and shape of your track.

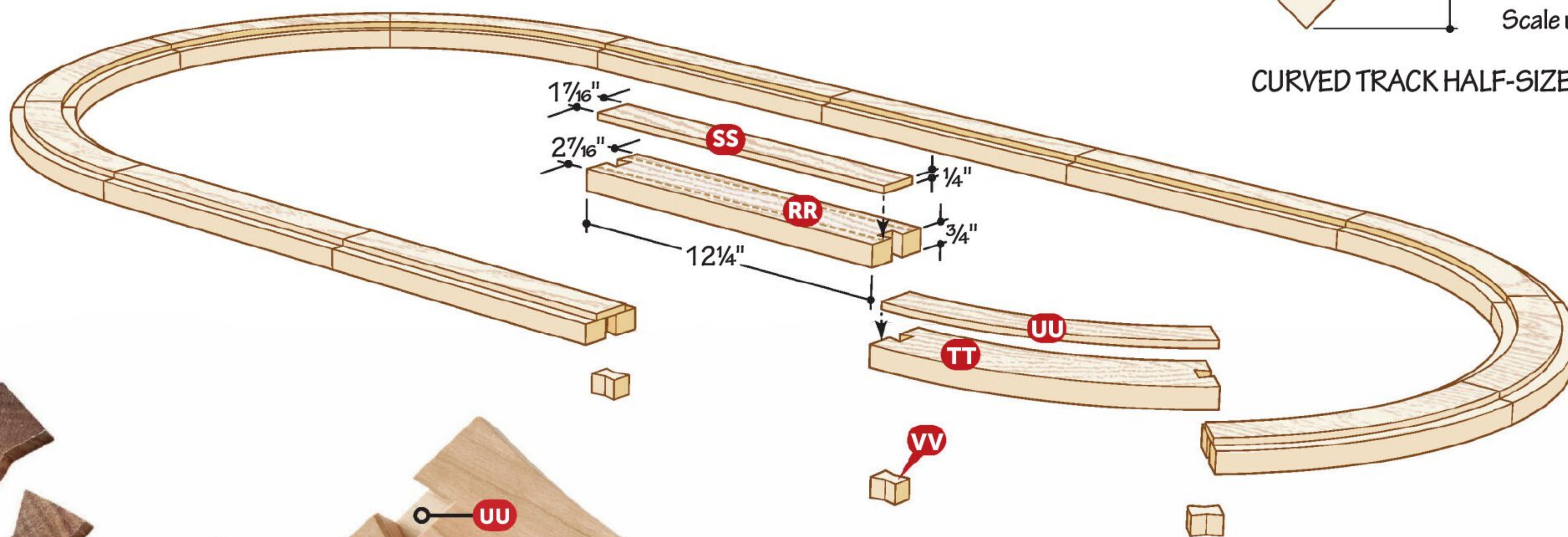
1 Cut the straight track bases (RR) and tops (SS) to size [Materials List, Drawing 11]. Photocopy and enlarge the half-size track pattern [Drawing 12] and use it to lay out the curved track bases (TT) and tops (UU), then cut them to shape.

2 Install a $14^{\circ} \times \frac{3}{4}$ " dovetail bit in the router table, raise it to $\frac{1}{2}$ ", and rout the notches in the ends of the bases (RR, TT) [Photo O]. Leave the bit at this height for the next step. Glue the track tops (SS, UU) to the bases, centered [Drawing 11].

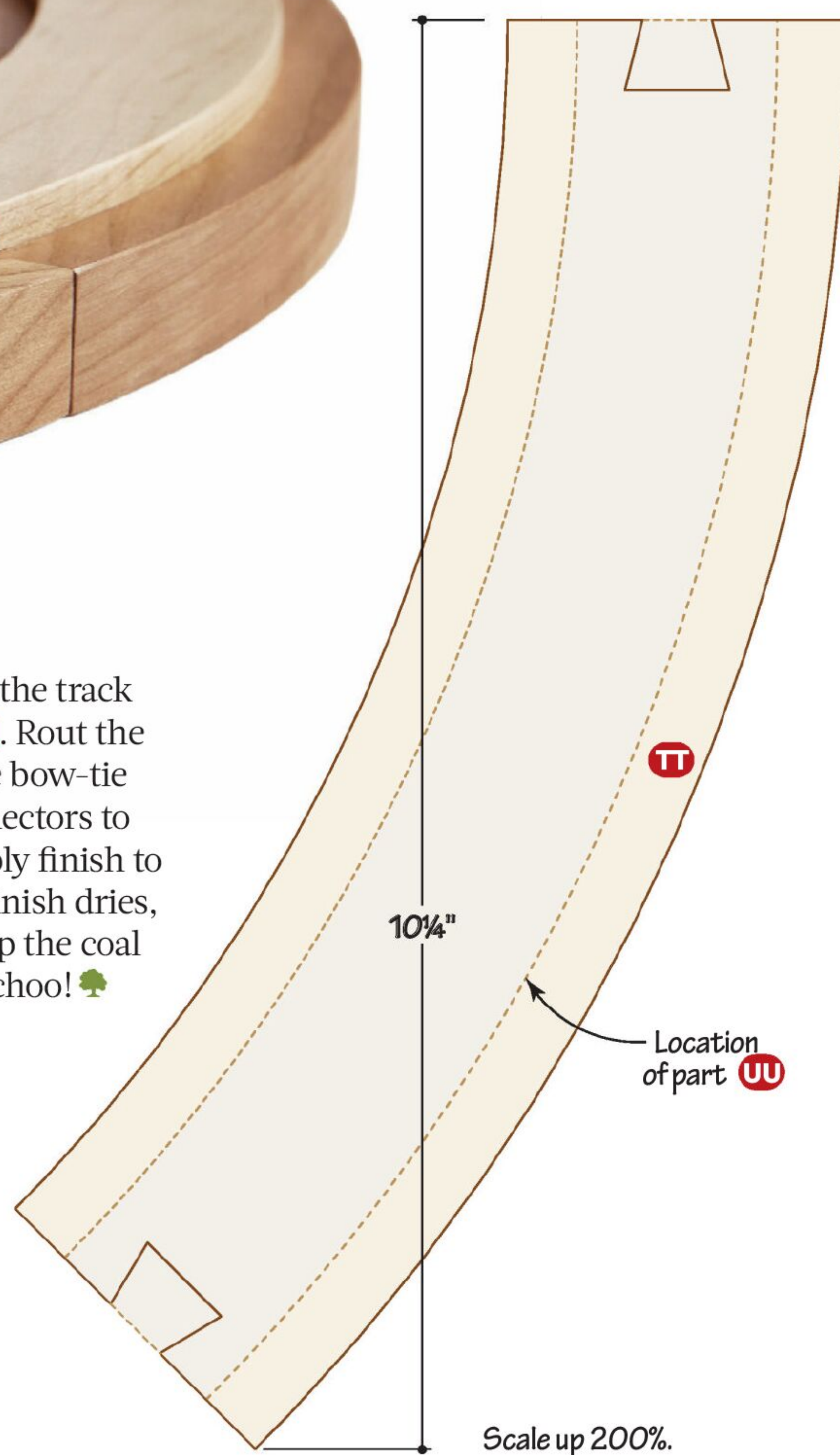
3 Cut a $\frac{3}{4} \times 1 \times 16$ "-long blank for the track connectors (VV) [Drawing 11]. Rout the faces of the workpiece to create the bow-tie shape [Photo P]. Crosscut the connectors to length [Materials List]. Finally, apply finish to all of the track sections. After the finish dries, form the tracks into a loop, hook up the coal tender, and chugga-chugga, choo-choo! 🌲

Note: If you're concerned about the connectors being choking hazards for any young ones, glue a connector into one end of each track section.

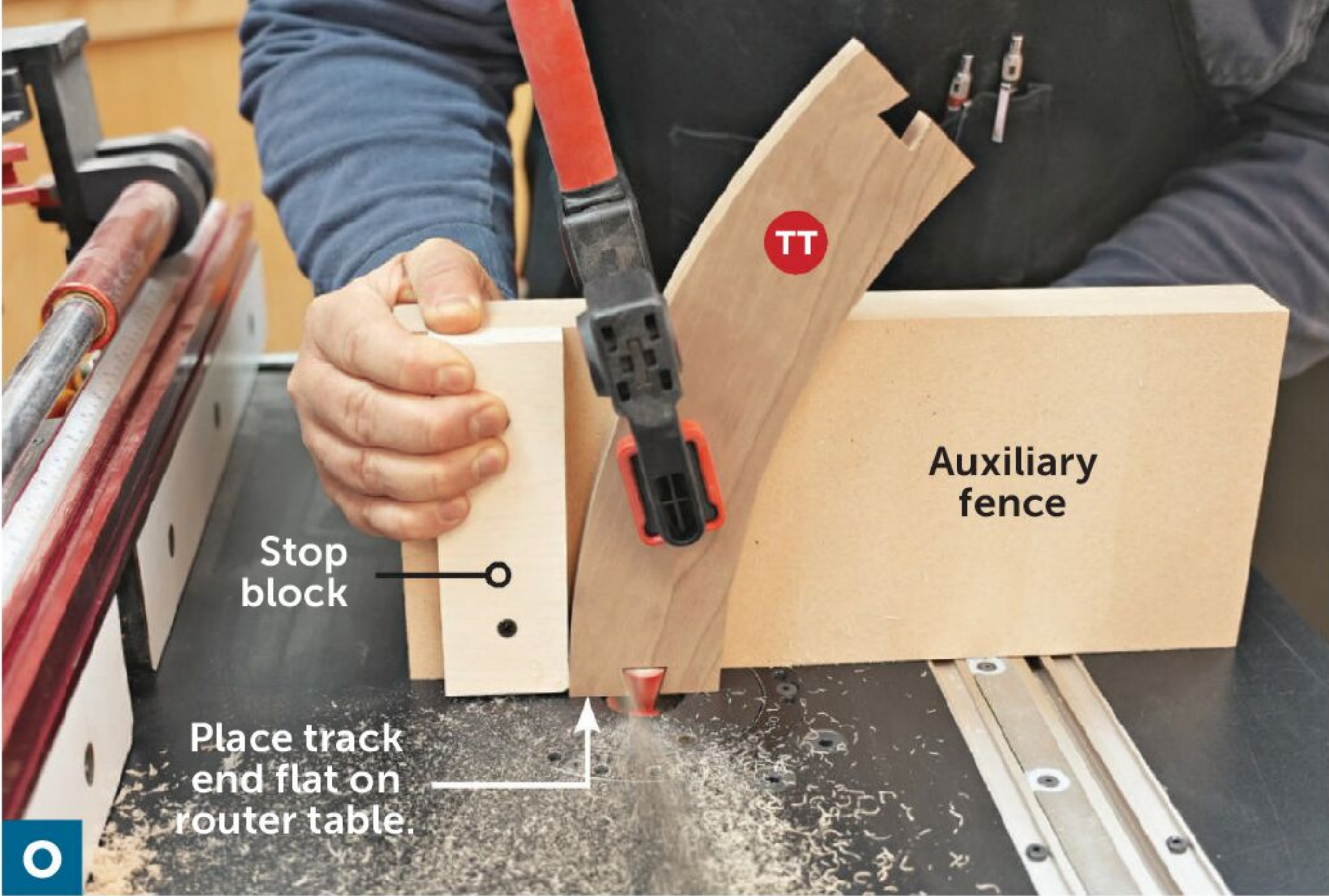
11 TRACK



12 CURVED TRACK



CURVED TRACK HALF-SIZE PATTERN



Install a tall auxiliary fence to your router-table miter gauge, and a stop block that centers the bit on the width of the track bases (RR, TT). Rout the notches on both ends of the straight and curved bases.



Position the fence so the bit cuts into the edge of the workpiece without removing the corners. Rout both faces on one edge and test the fit in the track. Adjust the fence if needed, then rout the other edge.

MATERIALS LIST

PART	FINISHED SIZE			Matl.	Qty.	
	T	W	L			
STEERING TRUCK						
A	STEERING FRAME	5/8"	1½"	2½"	C	1
B	STEAM SPACERS	½"	7/16"	½"	C	2
C	STEERING BRIDGE	¾"	2¾"	1¾"	C	1
D	STEAM CHESTS	½"	1⅛"	1⅛"	C	2
DRIVE TRUCK						
E	DRIVE FRAME	½"	1½"	3¼"	C	1
F	DRIVE SPACER	½"	1½"	3¾"	C	1
G	DRIVE RODS	¼"	1⅛"	4⅝"	M	2
H	VALVE GEARS	13/32"	5/8"	17/16"	M	2
STANDARD TRUCKS						
I	STANDARD FRAMES	5/8"	1½"	2⅛"	C	3
J	SIDE FRAMES	¼"	½"	2⅛"	C	6
K	SPRING GROUPS	¾"	13/32"	5/8"	C	6
L	ENGINE TONGUE	¼"	½"	213/16"	C	1
M	LINK	¾"	¾"	2¾"	C	1
N*	HITCH SHROUD	½"	1¼"	1⅜"	C	1

ENGINE (continued)	PART		FINISHED SIZE			Matl.	Qty.
			T	W	L		
	FRAME						
	O	CATWALK	1/4"	2 1/2"	10 7/8"	C	1
	P	FRAME RAIL	1/4"	3/4"	10"	C	1
	Q*	FRONT SUPPORT	1/2"	1 1/2"	1 3/8"	C	1
	R	BOILER CRADLE	1/2"	1 1/2"	1"	C	1
	S	BOILER	2"	2"	7 1/2"	M	1
	T*	ASH PANS	5/8"	3/4"	17/8"	M	2
	U	CROSS RAIL	5/16"	1/2"	2 1/2"	C	1
	V	STAIR BASE	1/4"	1/2"	2 1/2"	C	1
	W	STAIRS	1/4"	1/2"	9/16"	C	4
	X*	COWCATCHER	1/2"	2 1/2"	1 17/32"	C	1
	BODY						
	Y	FIREBOX	2"	2"	2 1/4"	M	1
	Z	CAB FRONT	1/4"	1 1/2"	2 3/8"	C	1
	AA	CAB SIDES	1/4"	1 1/2"	1 1/2"	C	2
	BB	CAB BACKS	1/4"	3/8"	1 1/2"	C	2
	CC	HEADLINER	3/8"	1/2"	1 3/4"	C	1
	DD*	CAB ROOF	5/8"	2 7/8"	2 1/4"	C	1
EE	WATER VALVE	3/16"	3/4"	1"	C	1	
FF	SIDE SKIRTS	3/16"	1 5/8"	11 5/8"	C	2	

COAL TENDER	PART		FINISHED SIZE			Matl.	Qty.
			T	W	L		
	GG	COAL TONGUES	1¼"	1½"	3⅞"	C	2
	HH	TONGUE EXTENSION	1¼"	1½"	1⅜"	C	1
	II*	COAL HITCH SHROUD	1½"	1"	1¼"	C	1
	JJ	RAIL	⅜"	¾"	4¾"	C	1
	KK	BOTTOM	1½"	2⅞"	7"	C	1
	LL	SIDES	1¼"	2½"	6¾"	C	2
	MM	DIVIDER	1¼"	2⅜"	2⅛"	C	1
	NN	FRONT	1¼"	2⅜"	1⅜"	C	1
	OO	BACK	1¼"	2⅜"	1"	C	1
	PP	TOP	1¼"	2⅜"	3¾"	C	1
QQ	WATER TANKS	1¼"	1½"	1"	M	2	

TRACK	PART		FINISHED SIZE			Matl.	Qty.
			T	W	L		
	RR	STRAIGHT TRACK BASES	3/4"	27/16"	121/4"	C	6
	SS	STRAIGHT TRACK TOPS	1/4"	17/16"	121/4"	M	6
	TT	CURVED TRACK BASES	3/4"	6"	101/4"	C	8
	UU	CURVED TRACK TOPS	1/4"	51/8"	929/32"	M	8
	VV*	CONNECTORS	3/4"	1"	11/16"	W	14

*Parts initially cut oversize. See the instructions.
MATERIALS KEY: C—cherry, M—maple, W—walnut.
BLADE AND BITS: Dado set, 3/8", 5/8", and 1" Forstner bits, 1/2" chamfer router bit, 14°x3/4" dovetail router bit.
SOURCES: Train Engine and Coal Tender Kit no. RS-01380 \$25, woodstore.net/engineandcoalkit
PROJECT COST: It cost us about \$130 to build this project. Your cost will vary by region and source.

UPGRADE YOUR TABLESAW — WITH A — ROUTER TABLE

Maximize your shop space by turning your tablesaw into a dual-purpose cutting and shaping center.

WRITER: DAVE STONE
BUILDER: BRIAN BERGSTROM
PHOTOGRAPHER: JACOB FOX

The tablesaw and router table often occupy the most floor space of any power tools in a shop. Combining both in the space of one is easy to do. We'll show you how to create a solution that looks great and works well.

In addition to space savings, combining these two tools can yield significant cost savings over buying a separate router table. We built a new extension wing from a half sheet of MDF and some 4/4 oak scraps we had in the shop. The plastic laminate that tops it only set us back \$45.

We chose a fence that's full featured but only costs \$110 [\[Sources\]](#). With the insert plate and levelers, the table setup cost less than \$400, which is considerably less than an equivalent stand-alone router table.

We expanded the size of the extension wing slightly, but barely increased the saw's footprint. It's a project you can complete in a day and use for a lifetime.



START WITH THE TABLETOP

On most tablesaws, the extension wing doesn't go past the ends of the rip-fence rails, so the rails prohibit moving the miter gauge bar past the table edge. Remedy this by making a new extension wing that protrudes 7–8" beyond the rails **[Photo A]**.

TIP!

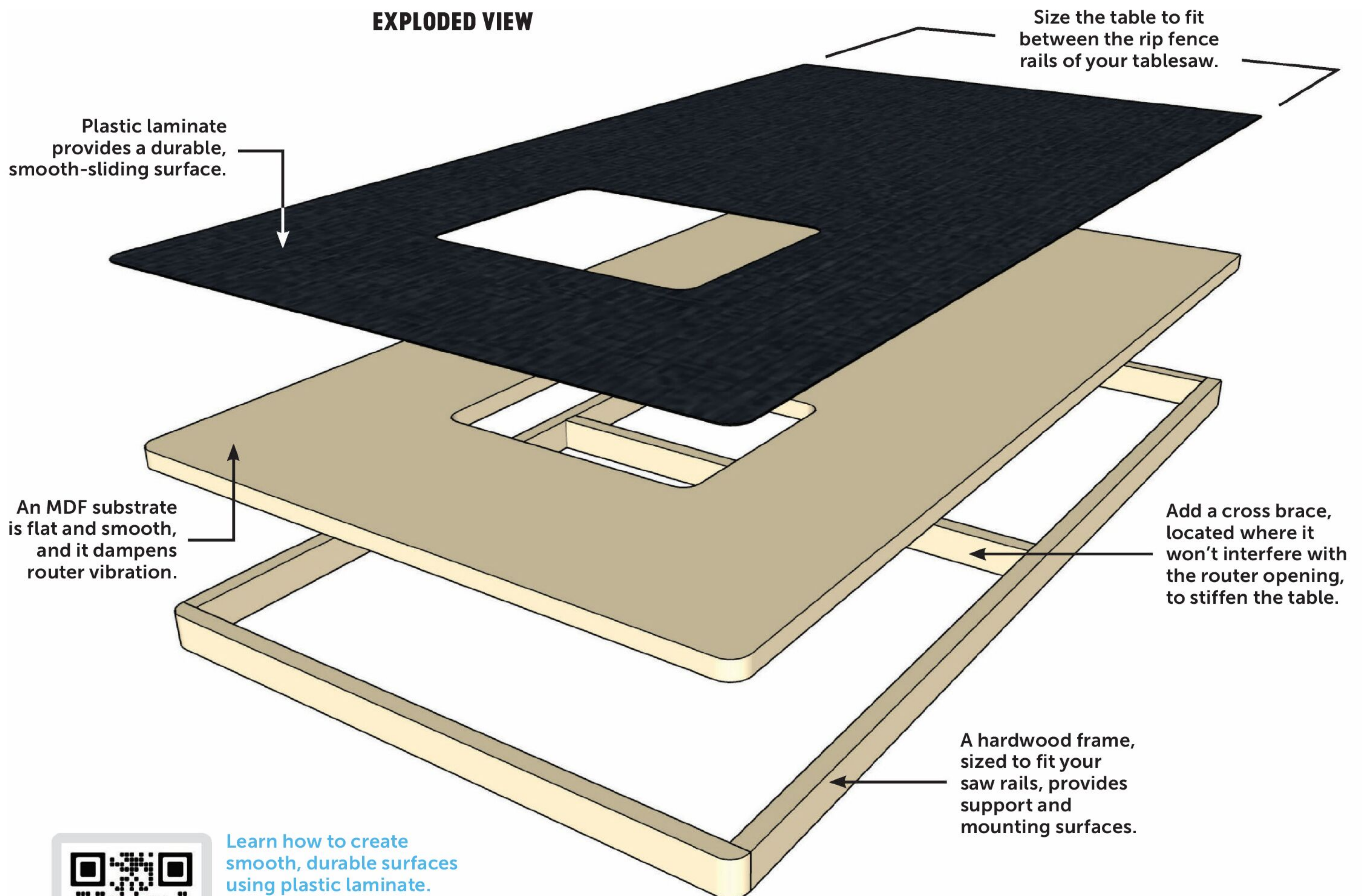
Drill oversize holes in your table frame to allow adjusting the top flush and level with your saw table.

Make your extension wing from 1×2 boards, MDF, and plastic laminate **[Exploded View]**. Drill mounting holes that align with the holes in your fence rails, and bolt the new wing in place. Use a long straightedge to ensure the table sits flush and level with the tablesaw table.



A Make your tabletop long enough to protrude beyond the ends of the fence rails so the miter-gauge bar can travel past the table edge without interference.

EXPLODED VIEW



Learn how to create smooth, durable surfaces using plastic laminate.
woodmagazine.com/laminate

Next, install a miter-gauge track. A miter saw easily cuts aluminum track to length. The track we used [\[Sources\]](#) pairs a miter-gauge slot with a T-track for mounting accessories such as featherboards.

Start by positioning the track. We placed ours 5½" from the end of the table. Make sure the track sits parallel to the end of the table and beyond the ends of the tablesaw's fence rails [\[Photo B\]](#).

Cut a pair of guide boards slightly longer than your table's width. You can

use scraps, but make sure they're both the same thickness and have one straight edge. Apply double-faced tape [\[Sources\]](#) to the underside of each guide and stick them to the table tight against each side of the miter-gauge track.

Remove the miter track without disturbing the guides and use them to rout a groove [\[Photo C\]](#). Before you pull up the guides, ensure that the track sits flush with or slightly below the table surface. Then attach it using short screws [\[Photo D\]](#).



B Determine the distance from the table end to the miter-gauge track, then use a combination square to accurately position the track. Hold the track in place with a couple small pieces of double-faced tape.



C Rout using a ½" dado-cleanout bit [\[Sources\]](#). Make a pass along one guide, then work your way across to follow the other guide. Cut the groove in a couple passes to the final depth required for your track.

“
THE TABLESAW AND ROUTER TABLE OFTEN OCCUPY THE MOST FLOOR SPACE OF ANY POWER TOOLS IN A SHOP. COMBINING BOTH IN THE SPACE OF ONE IS EASY TO DO.
”



D Use a file to slightly ease the cut edges of the laminate, then screw the track in place. With MDF, you won't need pilot holes, but take care not to over-drive the screws and strip out the MDF.



E Position the T-track guides on the table so they'll align with mounting slots in your router-table fence, securing them with double-faced tape. Rout the slots using a dado-cleanout bit.



F Center the T-tracks in the length of the slots. This allows space for the bolts that hold the fence to drop in and engage the track. Secure the tracks using short screws.

ADD A DEDICATED FENCE

Machining operations in many projects go back and forth between the tablesaw and router table. That's why we recommend a separate fence rather than trying to tie your router table fence to the saw's rip fence.

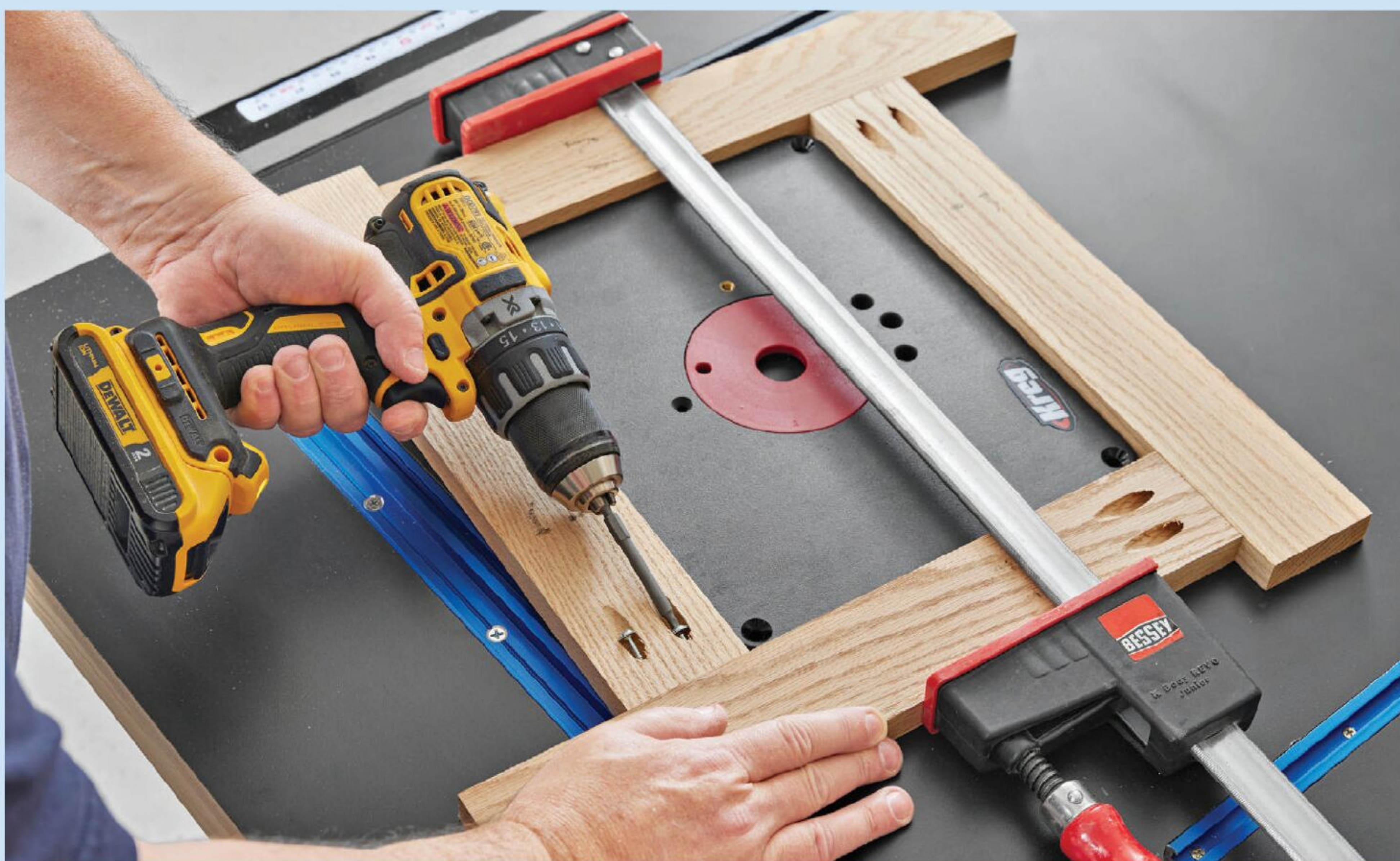
The fence we used is inexpensive yet fully featured [\[Sources\]](#). It rides in two pieces of T-track that fit into routed slots, just like the miter-gauge track.

The position of the bit center determines where the fence tracks will be placed. We located our bit center 13" from the end of the table. You'll position the tracks so the

fence can pull forward slightly ahead of the bit opening, and push back far enough to allow full access to the router insert plate without having to remove the fence.

Cut your T-tracks to length, then make a set of guides. We used two straight scrap pieces, and joined them by gluing in spacers cut to match the T-track width. When you glue in the blocks, make the opening about $\frac{3}{4}$ " longer than your T-track length.

Position the guides on the table, and rout the T-track slots [\[Photo E\]](#). Then screw the tracks in place [\[Photo F\]](#).



MAKE A SIMPLE, SURE-FIT ROUTING TEMPLATE

A properly sized routing template ensures the insert plate will fit tightly in its opening without play. You can measure the plate and cut guides to fit, but there's an easier way.

Simply cut four scrap boards about 15" long, then drill pocket holes on one end of each board. Wrap the boards tightly around the insert plate in a pinwheel pattern, clamp them in place, and drive in the screws. You'll get a precision-fit template without measuring.



G Check the corner radius of your router insert plate, then use a Forstner bit to drill a hole at each corner of the opening. The template serves as a guide for the bit as you drill.



H Cut the rough opening using a jigsaw and a fine-tooth blade staying about $\frac{1}{16}$ " inside the line. If your jigsaw has orbital cutting, make sure it's disengaged to prevent chipping out the laminate.



I Secure the template, then rout the opening using a pattern bit. Stop routing before you reach each corner so you don't cut into the larger radius of the drilled holes.



J Setscrews on the plate levelers adjust to set the plate surface flush with the tabletop. The threaded insert accepts a machine screw to hold the plate in place.

PLACE YOUR ROUTER PLATE

Installing an insert plate doesn't need to be intimidating. Corner-mounted plate levelers [\[Sources\]](#) eliminate the need for a stepped insert opening, while a template makes fussy measuring unnecessary.

Start by making the template from $\frac{3}{4}$ " stock sized to fit the perimeter of the plate. See *Make a Simple, Sure-Fit Routing Template*, [previous page](#).

Position the template where you want the plate, making sure it's square to the miter-gauge slot, and secure it with double-faced tape. Drill holes at each corner [\[Photo G\]](#).

Draw pencil lines on the table surface connecting each corner, then remove the template. Cut between the holes with a jigsaw to remove most of the waste [\[Photo H\]](#).

Reattach the template by aligning the corners and the layout lines and then rout the opening [\[Photo I\]](#).

After that, all you have to do is install the insert-plate levelers [\[Photo J\]](#) following the manufacturer's instructions, mount your router and slide on the fence. Optionally, mount a paddle switch [\[Sources\]](#) to the edge of the table to remotely power up your router, and your dual-purpose cutting and shaping center is ready to use. 🌲

SOURCES:

- Combo track—48", no. KMS7448, \$57; Mini Trak—48", no. KMS7509, \$28; Precision Router Table Insert Plate, no. PRS4038, \$80; Router Table Insert Plate Levelers, no. PRS3040, \$25; Kreg Tool Co., kregtool.com, 800-447-8638.
- 32" Deluxe Router Table Fence Kit #3319, \$110, Peachtree Woodworking Supply, ptreeusa.com, 888-512-9069.
- Ortis 110-volt Router Table Switch (ASIN B08PY8B8CZ), \$33; XFasten double-sided woodworking tape, no. DSWT136P3, \$22; Amana $\frac{1}{2}$ " dado cleanout bit, no. 45489-S, \$26, Amazon, amazon.com.

PORTABLE PUZZLE TRAY

This expandable assembly station provides dedicated space for your jigsaw masterpieces, plus it stores the puzzle and its pieces between sessions.

WRITER: KERRY GIBSON
DESIGNER: JOHN EIDEM
BUILDER: KEVIN BOYLE

OVERALL DIMENSIONS

22"W x 32"D x 1¼"H closed

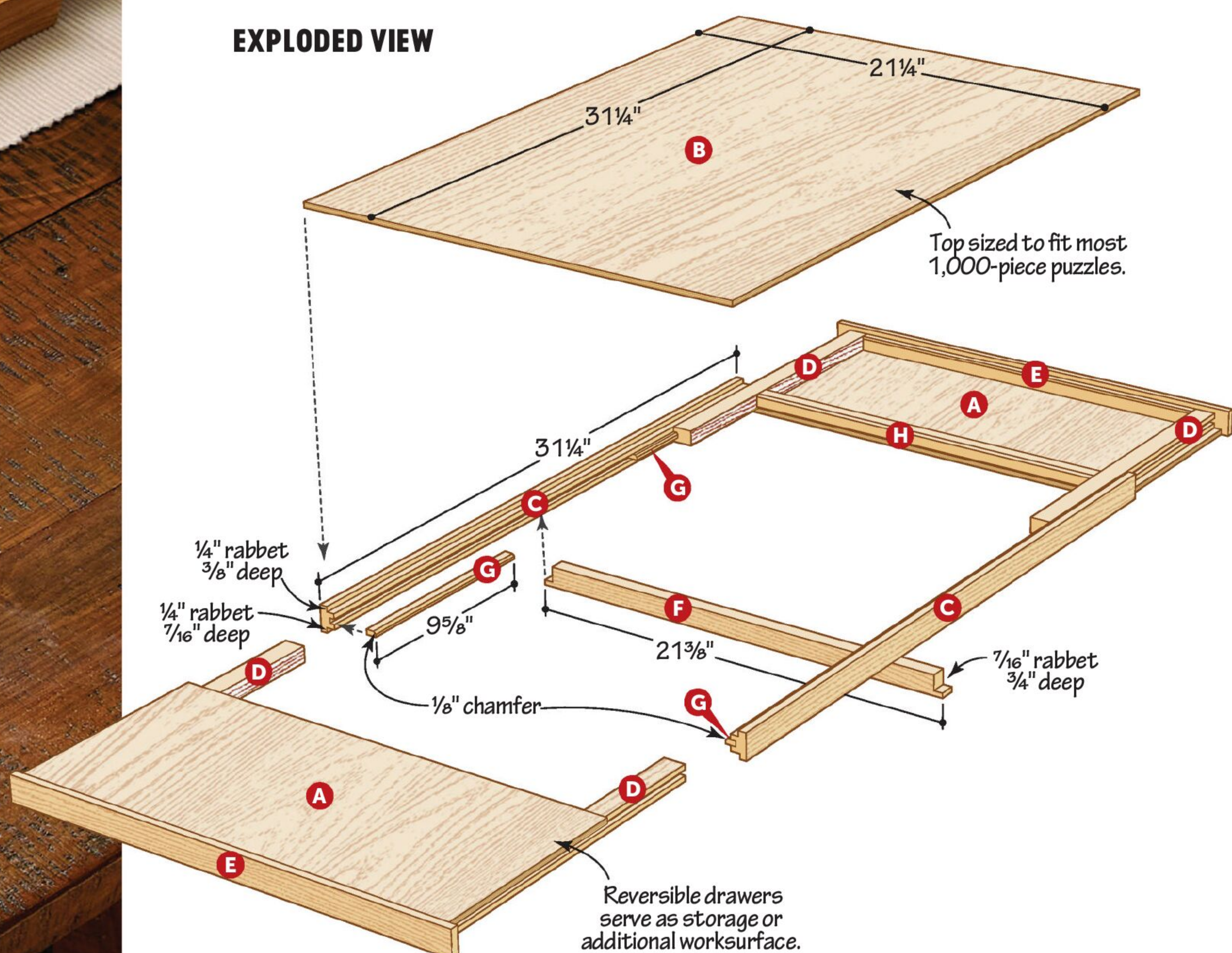
22"W x 51¼"D x 1¼"H open



Assembling a jigsaw puzzle tests your eye for detail, but finding a dedicated workspace for a span of days presents its own set of challenges. This puzzle tray provides a portable space so you can set your work aside. A double-duty drawer on each end stores unplaced pieces or flips over to expand the worktop.

Simple dado setups on your tablesaw create the drawer slides, and a full-sized sheet of $\frac{1}{4}$ " plywood makes it economical to build two—one as a gift and one to keep and use yourself!

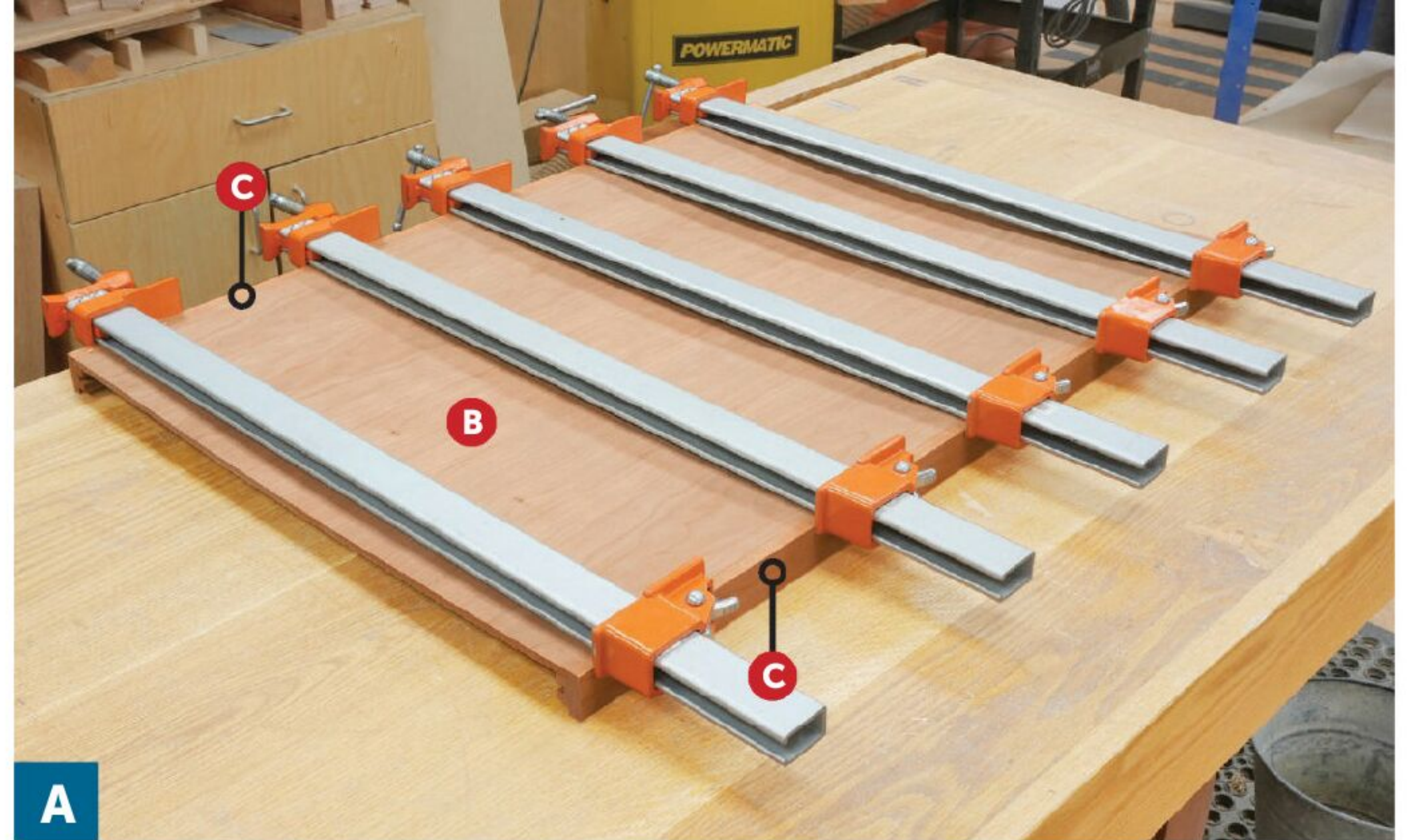
EXPLODED VIEW



BUILD THE BASE

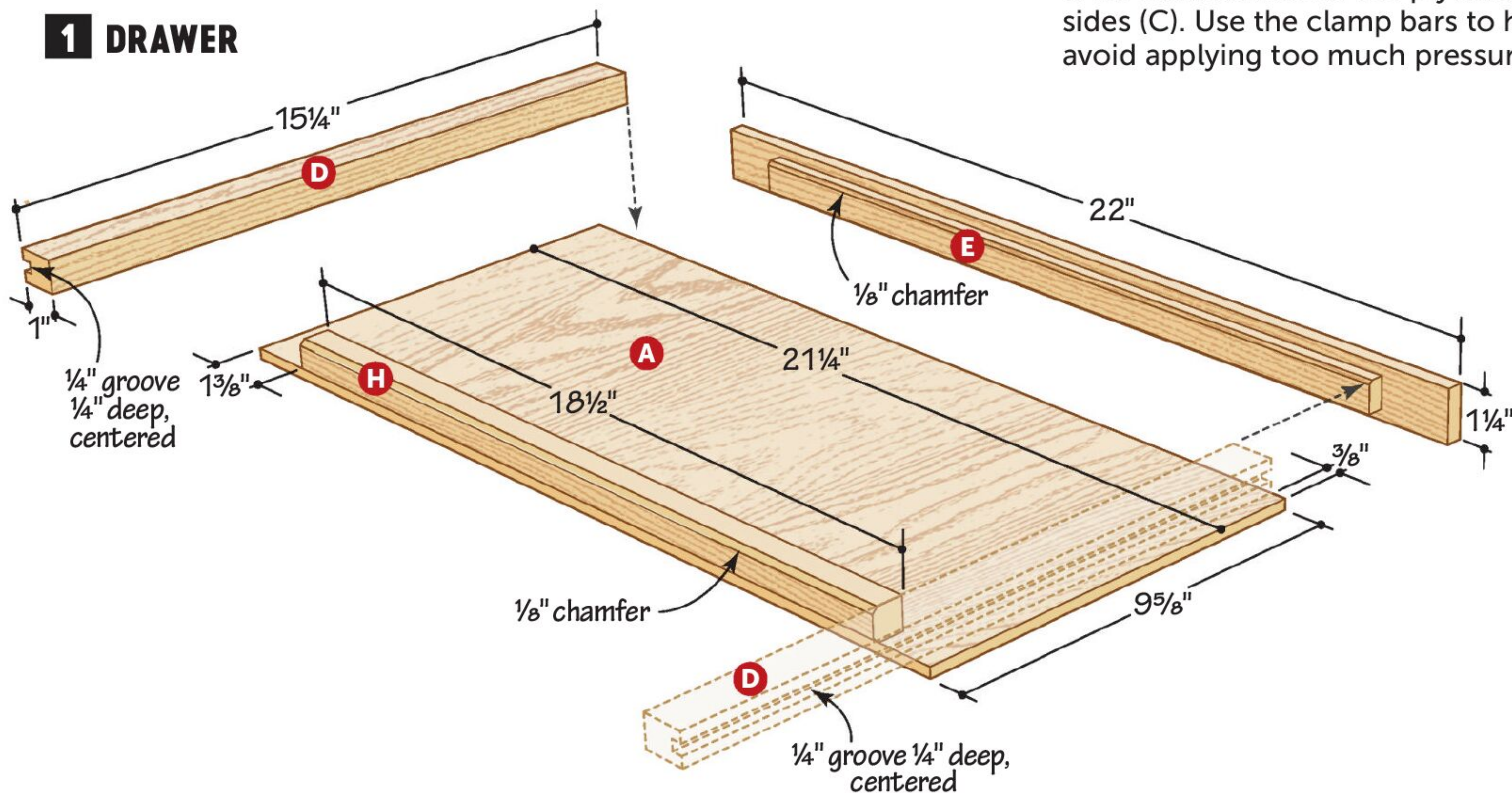
We cut the tray top and drawer bottoms from one piece of $\frac{1}{4}$ " plywood. You'll put the good face down as you assemble some of this project, so double-check grain orientation as you work.

- From $\frac{1}{4}$ " plywood, cut a $21\frac{1}{4} \times 51$ " blank. From this, first crosscut one drawer bottom (A) to length, then the top (B) and then the other drawer bottom (A) [Exploded View, Drawing 1]. Set the drawer bottoms aside.

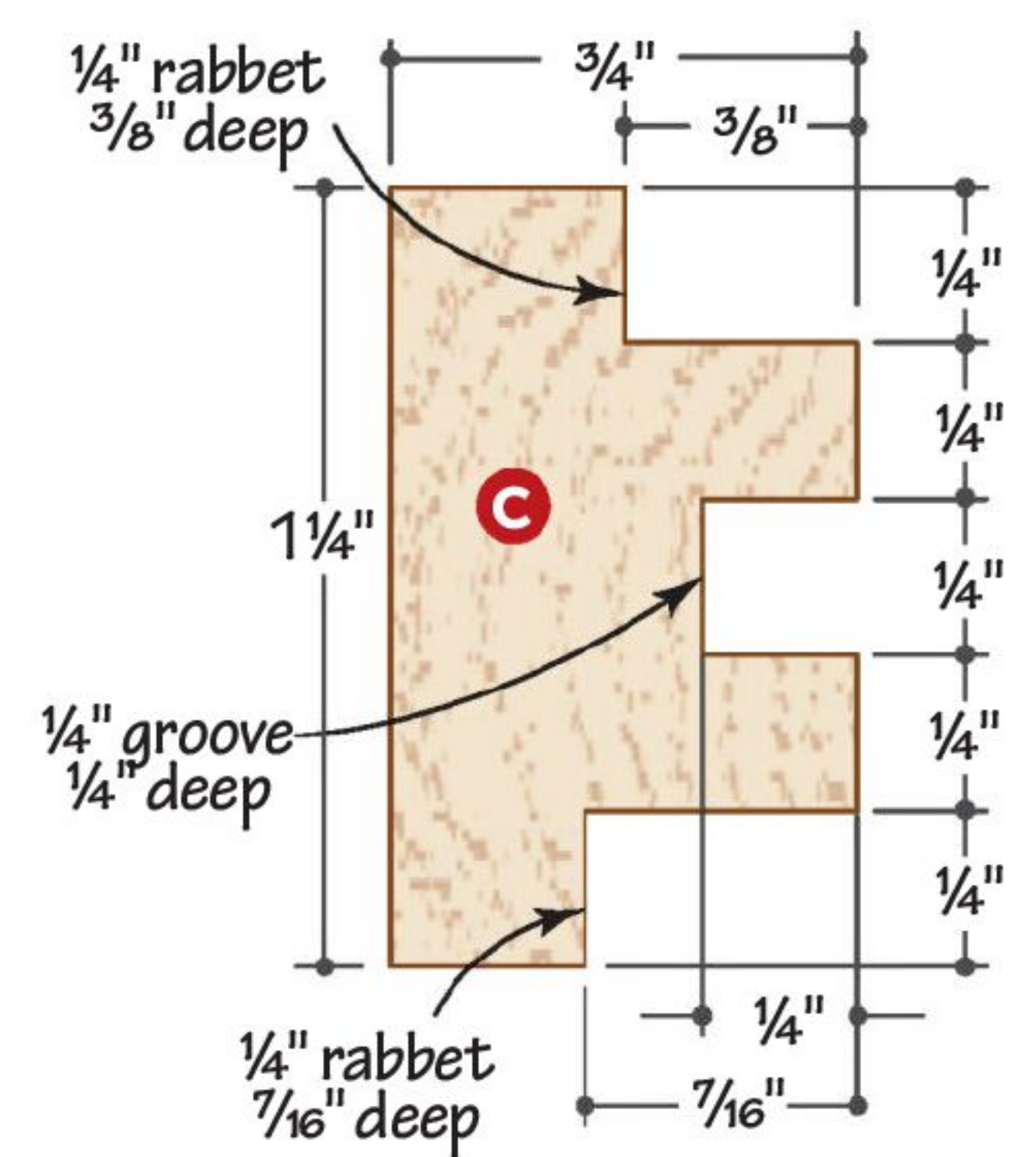


With the best face of the plywood up, glue the tray top (B) to the tray sides (C). Use the clamp bars to help hold the top in the rabbets, and avoid applying too much pressure, which could bow the plywood.

1 DRAWER



2 TRAY SIDE END VIEW



- Cut the tray sides, drawer sides, drawer fronts, and center support (C-F) to size [Materials List, Drawing 1].

- Install a $\frac{1}{4}$ " dado set in the tablesaw and raise it to a height of $\frac{1}{4}$ ". Set the rip fence to cut a centered groove in the tray sides (C) [Drawing 2].

- Adjust the fence and cut a centered groove in the drawer sides (D) [Drawing 1].

- Install an auxiliary fence on the tablesaw fence and move it so it just touches the dado stack. Raise the blade to $\frac{7}{16}$ " and cut the rabbet on the bottom edge of each tray side (C) [Drawing 2]. Then lower the blade to $\frac{3}{8}$ " and cut the rabbet in the top edge of each tray side.

- Without changing the saw setup, rabbet the edges of the drawer fronts (E) [Drawing 3]. Then remove the auxiliary fence

and set the rip fence $1\frac{3}{4}$ " from the far side of the blade to cut the rabbets in the ends of the drawer fronts. Use your miter gauge to guide each piece, and then nibble away the waste to complete the rabbet. Finish-sand the tray sides, drawer sides, and drawer fronts.

- Raise the blade to $\frac{3}{4}$ ", reinstall the auxiliary rip fence, and butt the fence against the dado blade. Then cut the rabbets on the ends of the center support (F) [Exploded View]. Finish-sand.

- Apply glue to the $\frac{3}{8}$ "-deep rabbet along the upper edge of each tray side and clamp the top in between [Photo A].

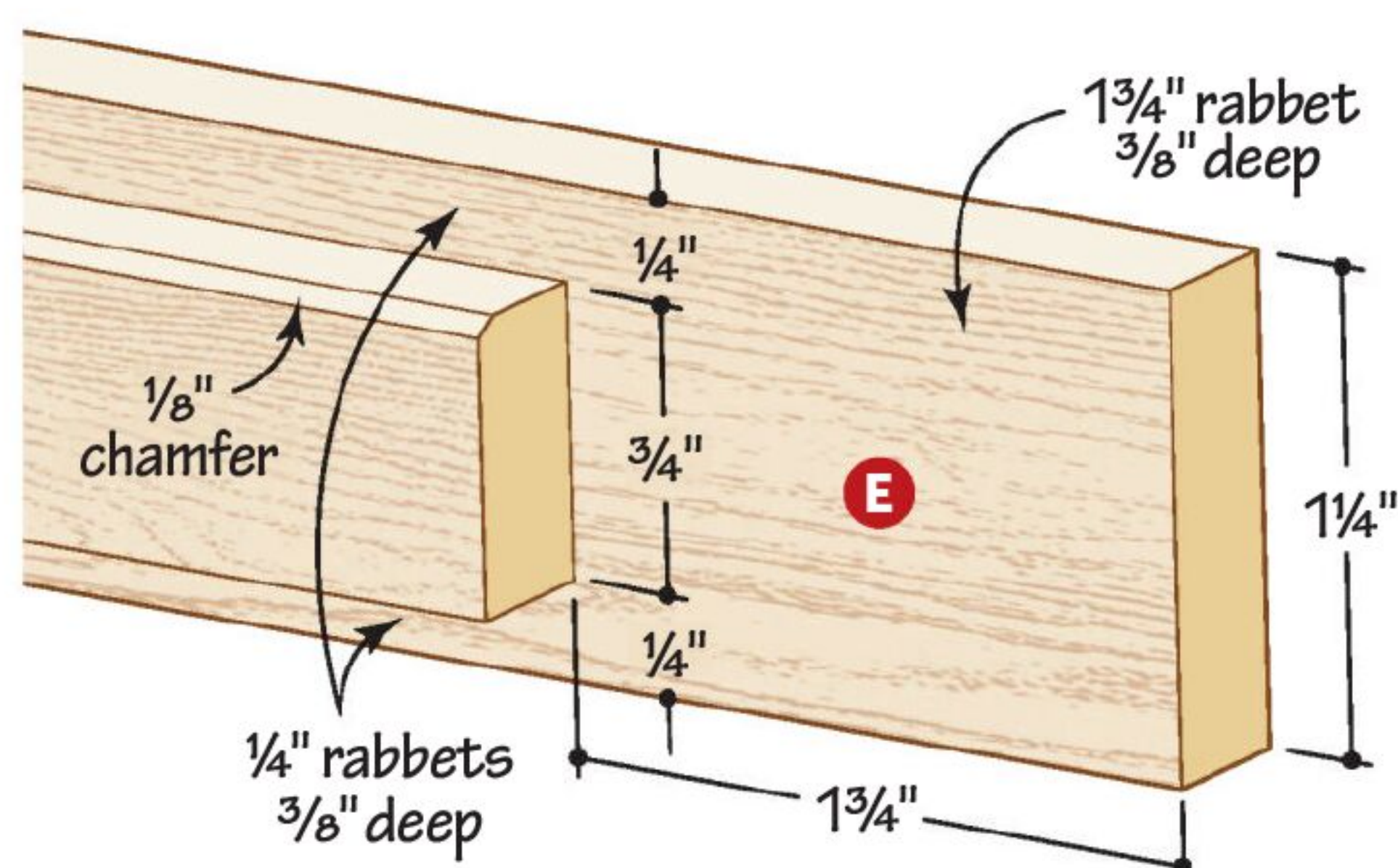
- Next, spread glue on the top edge of the center support (F), as well as in the rabbeted ends. Then glue the support to the underside of the tray assembly (B/C), centered on the tray's length. After the glue dries, finish-sand the tray assembly, taking care to not sand through the plywood veneer.

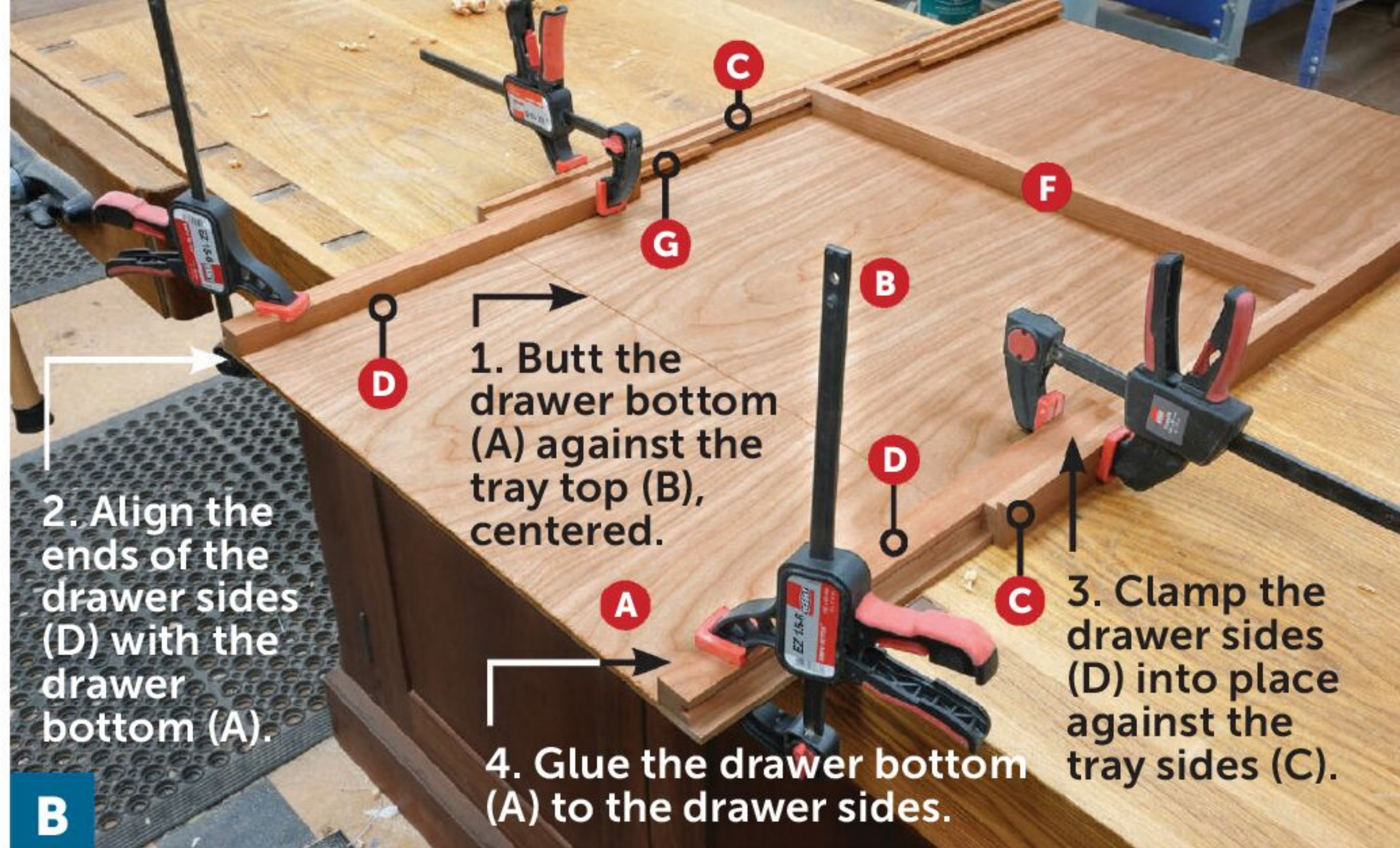
- Cut the drawer guides (G) to size [Materials List]. Glue the guides into the center slots of the tray sides so one end of each guide is flush with each end of the tray sides [Exploded View]. After the glue dries, sand a slight chamfer on the end of each guide.

TIP!

Label the upper edge of each tray side (C) to prevent mixing up the rabbets during assembly.

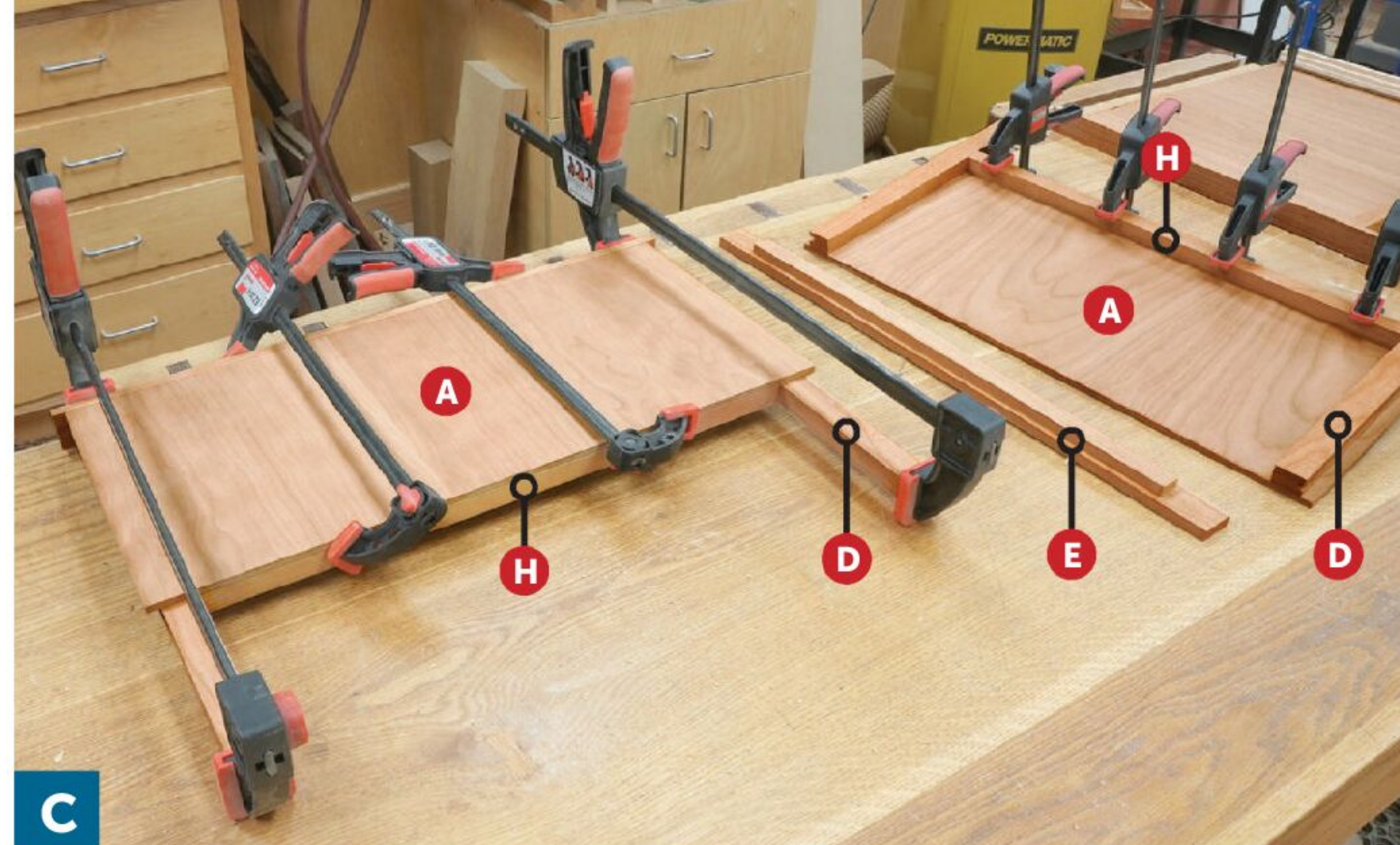
3 DRAWER FRONT DETAIL





1. Butt the drawer bottom (A) against the tray top (B), centered.
2. Align the ends of the drawer sides (D) with the drawer bottom (A).
3. Clamp the drawer sides (D) into place against the tray sides (C).
4. Glue the drawer bottom (A) to the drawer sides.

Use the tray assembly to help align the drawer sides (D) and bottom (A) for glue-up following the steps above. Take care to orient A and B for continuous grain across the show face.



First, glue and clamp the drawer backs (H) into place. Once the glue dries, glue the drawer fronts (E) into place. Use longer clamps near the ends to span the drawer sides, and shorter clamps in the middle.

ADD THE DRAWERS

TIP!

To get a smooth fit with no binding, wrap 100-grit sandpaper around a scrap of your 1/4" plywood and sand the grooves until they slide smoothly over the guides.

- 1 Retrieve the drawer sides (D) and test their fit on the drawer guides. A little friction is good to help hold the drawers in place, but you want them to slide easily.
- 2 Place the drawer bottoms (A) face down on the workbench next to the tray assembly (B/C/F/G) with the plywood edges lined up, then glue one set of drawer sides to a drawer bottom [Photo B]. Repeat this to assemble the other drawer.
- 3 Cut the drawer backs (H) to fit between the drawer sides [Materials List, Exploded View]. Install a 45° chamfer bit in your router table and chamfer one edge of the drawer backs [Drawing 1].

- 4 Retrieve the drawer fronts (E) and chamfer one edge [Drawing 3]. Then glue each drawer back and drawer front into place [Photo C]. Finish-sand each drawer assembly.
- 5 Double-check the fit of the drawers and sand the grooves again if necessary. Do any final touch-up sanding and apply a finish. We wiped on two coats of water-based polyurethane, sanding in between with a 220-grit sanding sponge. When the finish dries, rub wax into the grooves in the drawer sides. With your project complete, pick out your first puzzle to challenge yourself. But don't worry about completing it in one sitting—you can now move and store it easily. 🌲

CUTTING DIAGRAM

This project requires 3 board feet of 4/4 cherry based on the example board shown.



1/4 x 24 x 60" Cherry plywood



3/4 x 5 1/2 x 96" Cherry *Plane or resaw to the thickness listed in the Materials List.

MATERIALS LIST

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A*	DRAWER BOTTOMS	1/4"	21 1/4"	9 5/8"	CP	2
B*	TRAY TOP	1/4"	21 1/4"	31 1/4"	CP	1
C	TRAY SIDES	3/4"	1 1/4"	31 1/4"	C	2
D	DRAWER SIDES	3/4"	1"	15 1/4"	C	4
E	DRAWER FRONTS	3/4"	1 1/4"	22"	C	2
F	CENTER SUPPORT	3/4"	1"	21 3/8"	C	1
G	DRAWER GUIDES	1/4"	1/2"	9 5/8"	C	4
H	DRAWER BACKS	3/4"	3/4"	18 1/2"	C	2

* Parts initially cut oversize. See the Instructions.

MATERIALS KEY: CP—cherry plywood, C—cherry.

BLADES AND BITS: Dado set, 45° chamfer bit.

PROJECT COST: It cost us about \$70 to build this project. Your cost will vary by region and source.

PISTON-FIT DRAWERS

Create snug-fitting, smooth-sliding drawers for your fine project builds.

WRITERS: HUY HUYNH with RANDY MAXEY



A perfectly fit drawer that slides smoothly with little effort shows off your craftsmanship and attention to detail.

Drawers provide practical storage space, but for woodworkers they do much more. A well-built, well-fitting drawer brings satisfaction every time it's opened and closed.

The term “piston-fit” often describes an inset drawer that's perfectly sized for a case opening, much like a piston in its bore. This means silky-smooth action with minimum side-to-side and vertical clearance and just a puff of air resistance to show off your skill. Building such a drawer requires careful sizing and a bit of finessing with a few hand tools, a household iron, and paraffin wax.

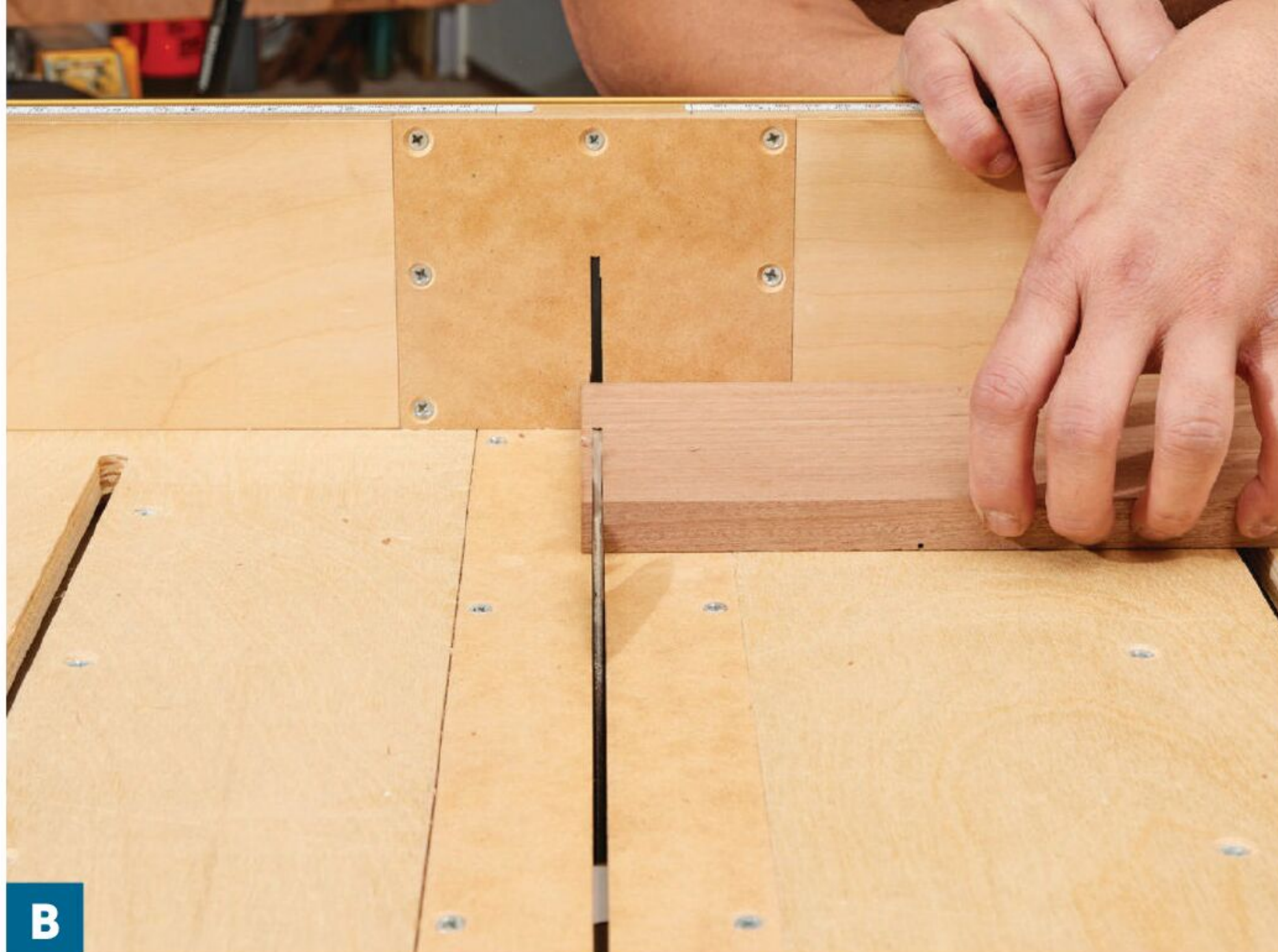
SIZING THE DRAWER PARTS

Fitting a drawer starts with milling stock for the drawer front, sides, and back to width. Measure the drawer opening height, and rip the drawer parts $\frac{1}{32}$ " narrower. Leave all the pieces extra long.

The length of the drawer front is the most important dimension and requires a near exact fit. To mark this dimension, lay the drawer front down on the case opening and run a marking knife along the inside wall of the case [\[Photo A\]](#).



A Put away the rulers and tape measures. Use the drawer opening to mark the length of the drawer front.



B Use a tablesaw sled to accurately cut the drawer parts to length and to ensure perfectly square ends.



C Finesse the fit of the drawer front in the opening using a plane and shooting board on the end grain while checking the fit often.

Crosscut the drawer front on the tablesaw, being sure to leave the scribe line. A tablesaw sled makes this an easy task **[Photo B]**.

To size the drawer exactly to the scribe line, use a low-angle plane and shooting board **[Photo C]**. Test-fit the drawer front within the case opening after every couple of strokes to make sure it isn't undersized. At this point, slightly snug is better than the drawer front being too loose.

After sizing the drawer front, cut the back to match. Then cut the sides to length to fit the depth of the opening, taking into account the joinery.

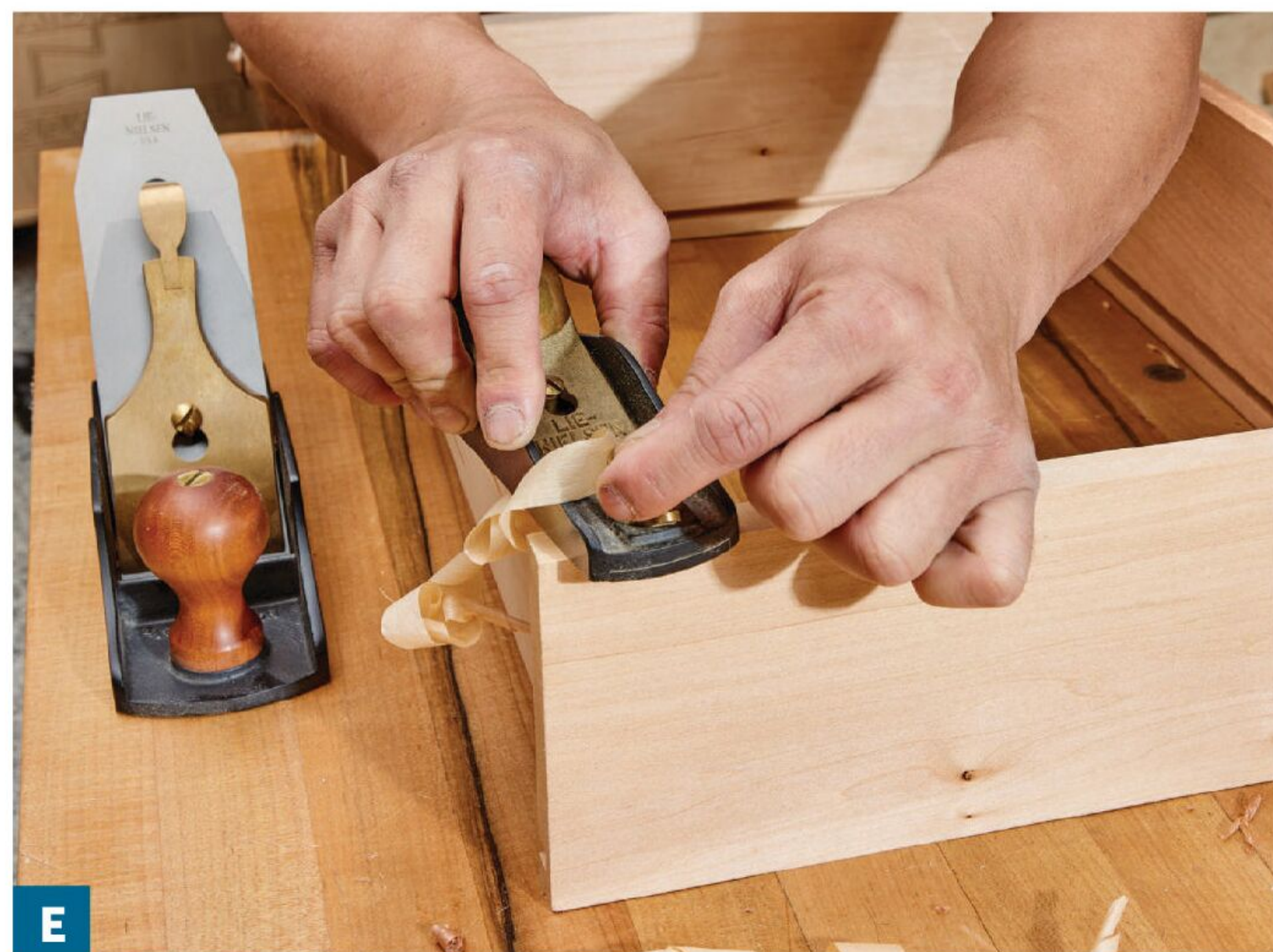
JOINERY & ASSEMBLY

With drawer parts sized appropriately, start laying out the joinery. I prefer to use dovetails. Whether you hand-cut dovetails or use machines, the process for getting an accurately sized drawer is the same **[Photo D]**. For this project, I hand-cut through-dovetails and attached a $\frac{1}{8}$ "-thick veneer to conceal the dovetails on the front of the drawer.

After assembling the drawer, make sure the top and bottom edges of the drawer sides, front, and back are in the same plane, flush with one another. A few swipes with a sharp block plane along the top and bottom of the drawer removes any ridges between adjacent pieces **[Photo E]**. Test-fit the drawer ensuring there are no "hang-ups" along the top and bottom of the opening.



D Dry-assemble the drawer to ensure the joints are tight and the sides are square.



E Fine-tune the height of the drawer sides, front, and back using a block plane, paying particular attention to making the corners flush.

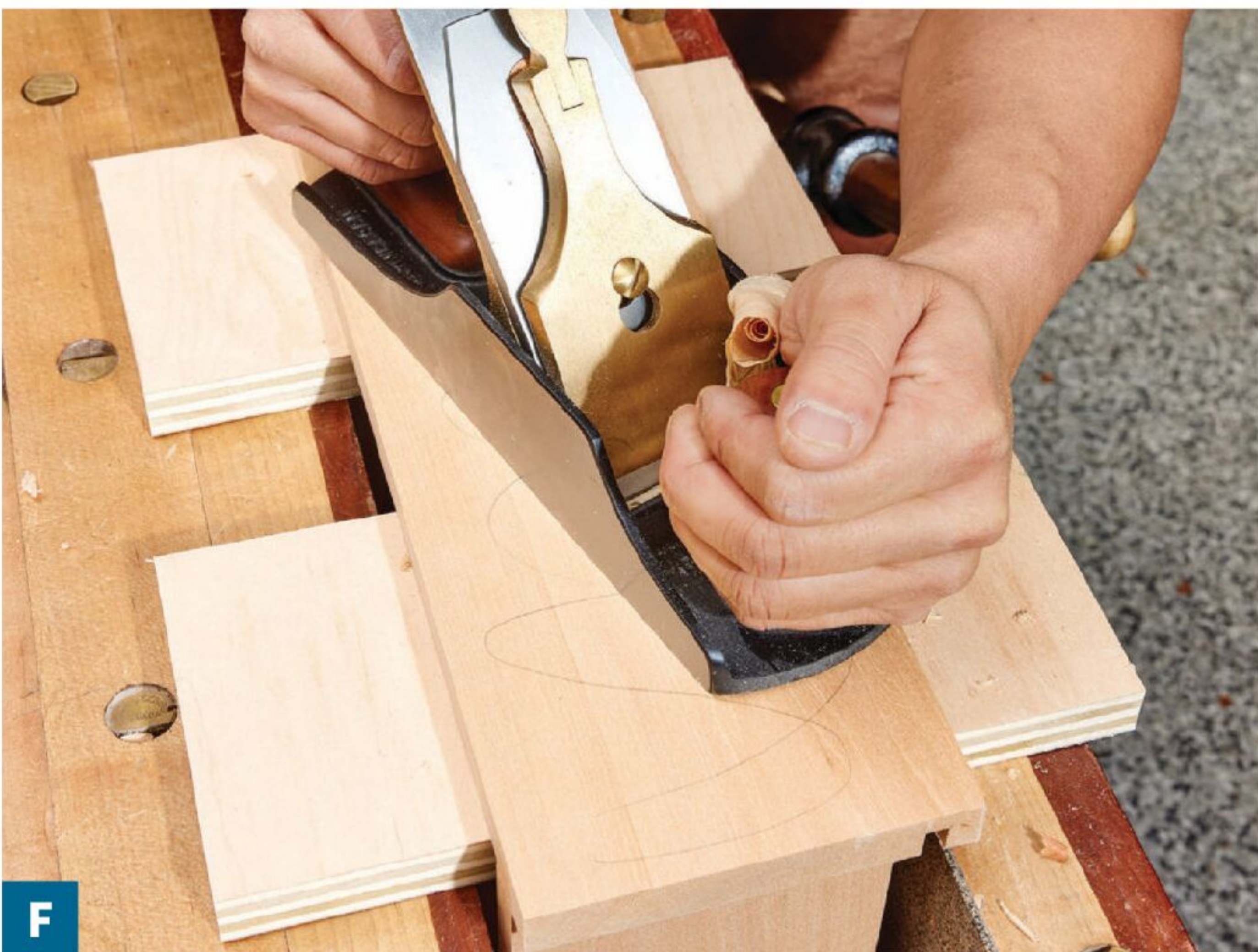
FINAL FITTING

The drawer likely fits too tightly within the opening, but that's exactly what you want going into the next step. With the drawer clamped in a bench vise, scribble the sides with a pencil. Remove just enough material with a smoothing plane to make those pencil marks disappear [Photo F]. Check the fit while keeping track of which side you just planed.

Alternate sides when planing to ensure you remove an equal amount from each side in between fittings. This may take several light passes on each drawer side, but helps you to sneak up on a perfect,

sliding fit in the opening. The drawer should operate smoothly without binding anywhere along the length of the drawer.

To make the drawer glide smoothly, apply paraffin wax along the drawer sides [Photo G]. Melt the wax into the wood using a household iron with a shop rag placed over the drawer side [Photo H]. Repeat this wax application two or three times. Finally, burnish the sides with an abrasive pad or 0000 steel wool for a silky, smooth finish and feel [Photo I]. Paraffin wax seals the wood grain and ensures a lifetime of friction-free operation. 🌲



F Set your hand plane for a very light cut to remove material on the drawer sides until the drawer goes into the opening with a sliding fit.



G Rub paraffin wax on the drawer sides to create a non-stick surface that slides easily in the drawer opening.



H With a cloth placed over the drawer side, use an iron on high heat to melt the paraffin wax.



I Buff the wax on the drawer sides using an ultrafine abrasive pad. The resulting silky smooth surface ensures the drawer glides smoothly.

CHAINSAW BOX

Channel your inner Paul Bunyan by carrying everything you need to tame the forest with your own "Babe the Blue Ox" sidekick.

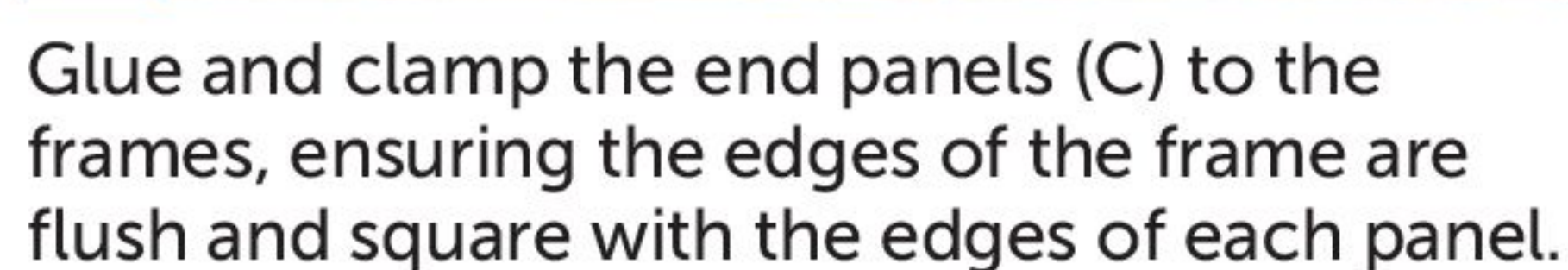
WRITER: BRYAN NELSON

DESIGNER: JOHN OLSON

BUILDER: BRIAN BERGSTROM



This chainsaw box will house gas- or battery-powered models up to 32" in overall length. Adjust the size to suit your chainsaw by tracing its outline on cardboard and using the template to make dimension adjustments.

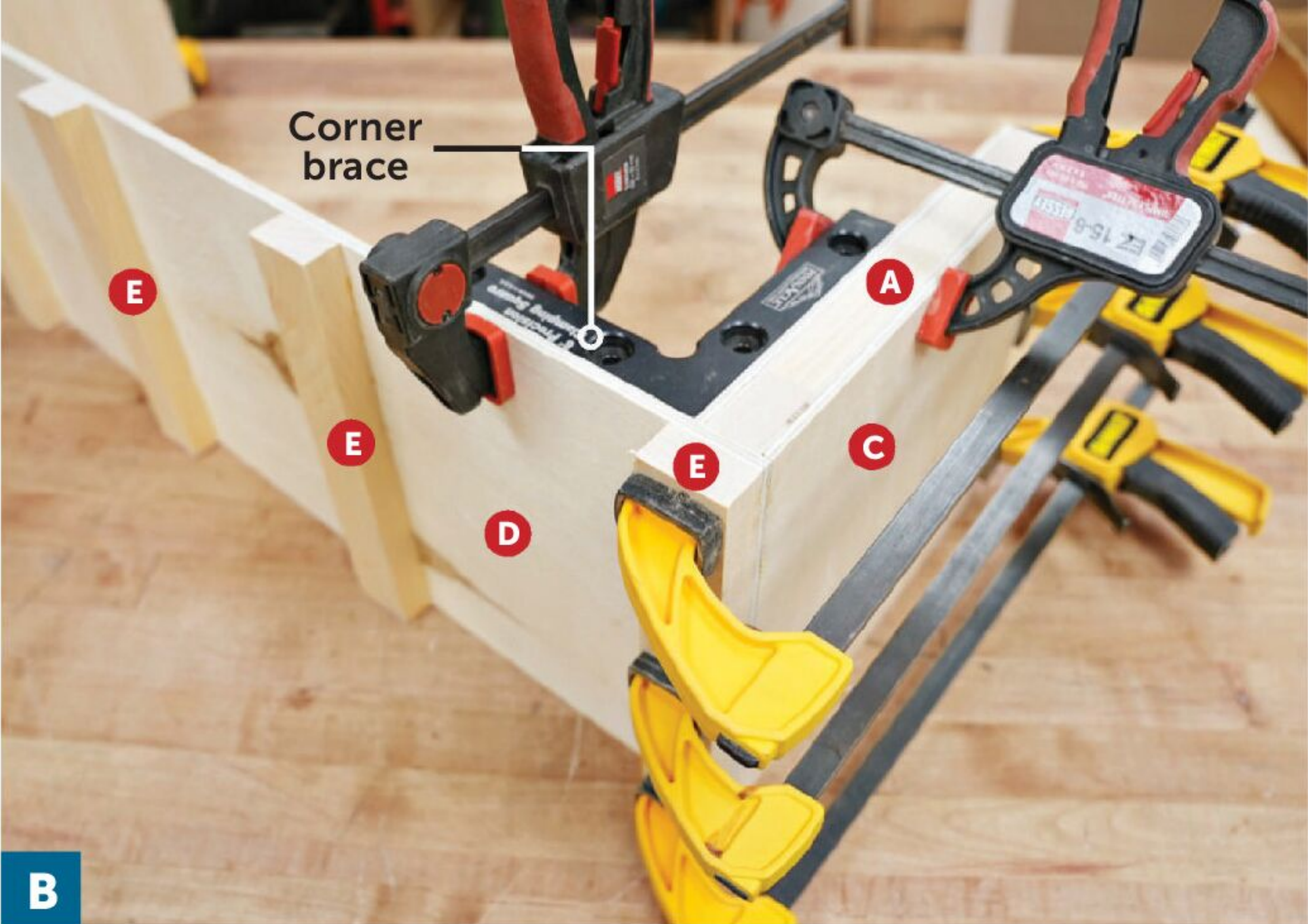


OVERALL DIMENSIONS
37½"W x 13⅜"D (handle down) x 19"H (handle up)

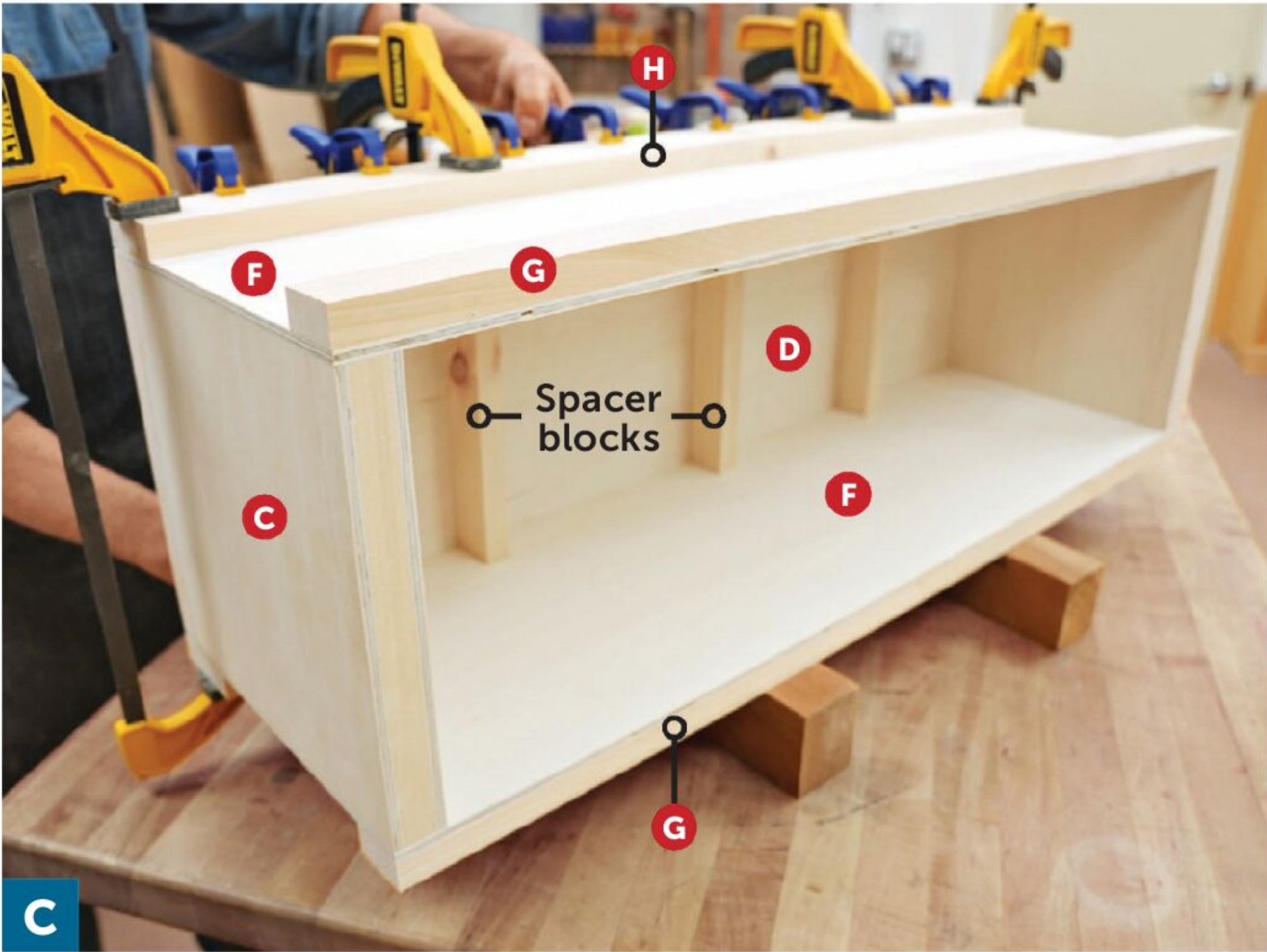
Glue and clamp the end assemblies (A–C) to the bottom assembly (D/E) **[Photo B]**.

Note: Because 1/4" plywood often measures less than its nominal thickness, use the Materials List as a guide only and cut the front/back and subsequent parts to fit from this point forward.

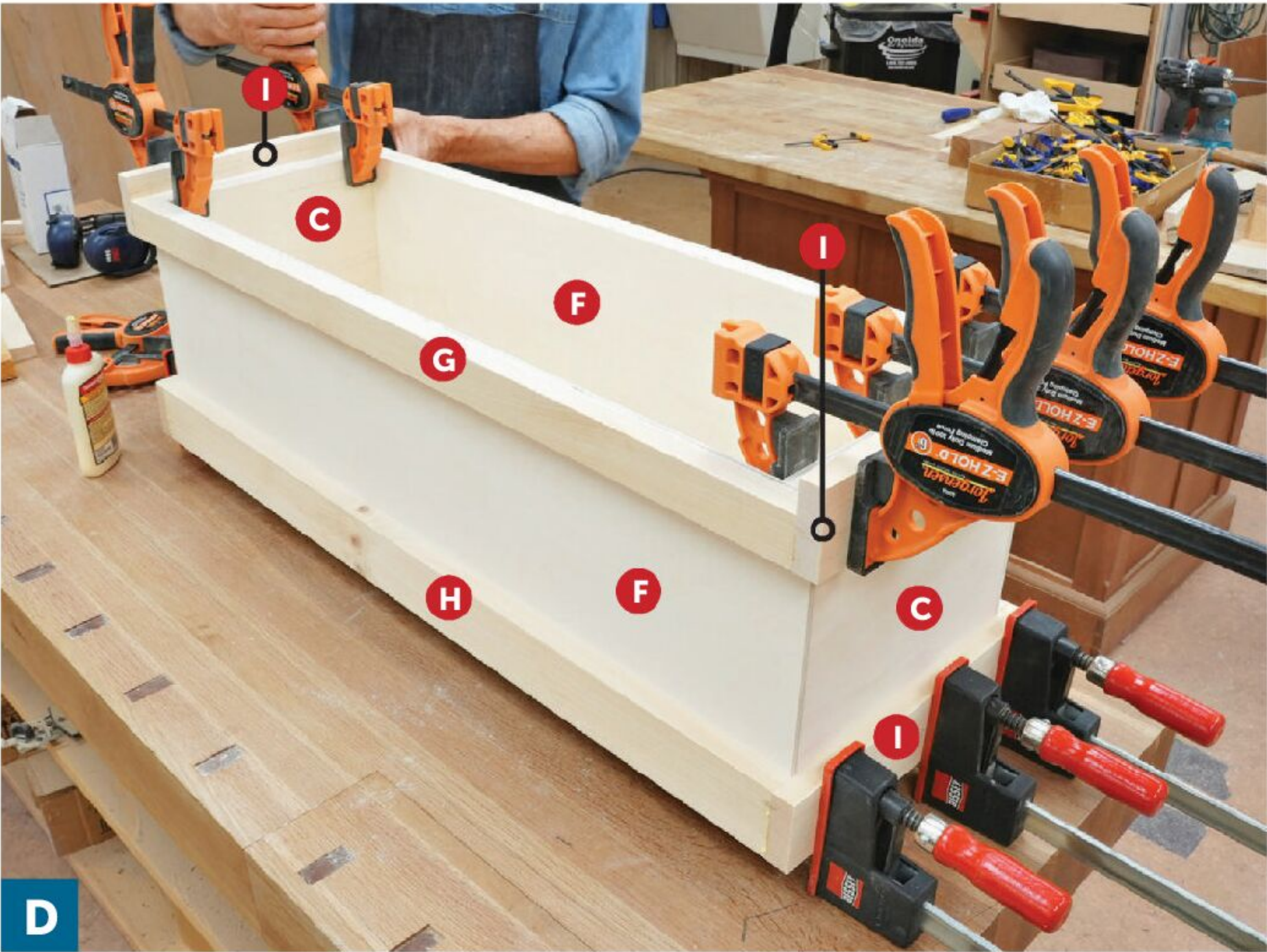
- 4** Cut the front/back (F) to size and glue and screw them to the end assemblies (A-C) and bottom rails (E) [Exploded View].
- 5** Cut the upper (G) and lower (H) trim to size [Exploded View] and then glue it to the case [Photo C]. Cut the end trim (I) to size, then glue it to the end panels (C) [Photo D].



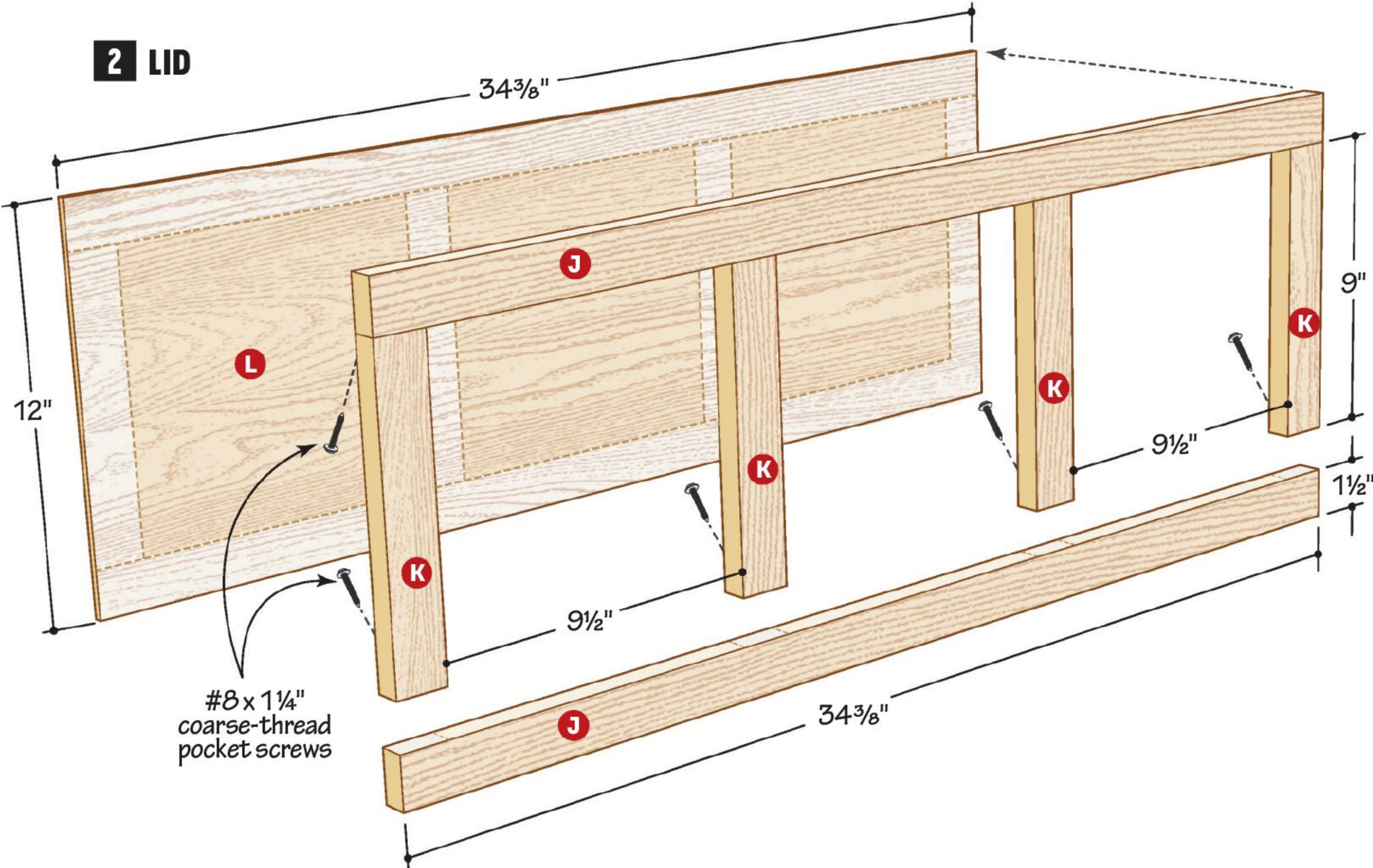
Use corner braces as you clamp to ensure the end assemblies remain square and flush to the outside edge of the bottom assembly.

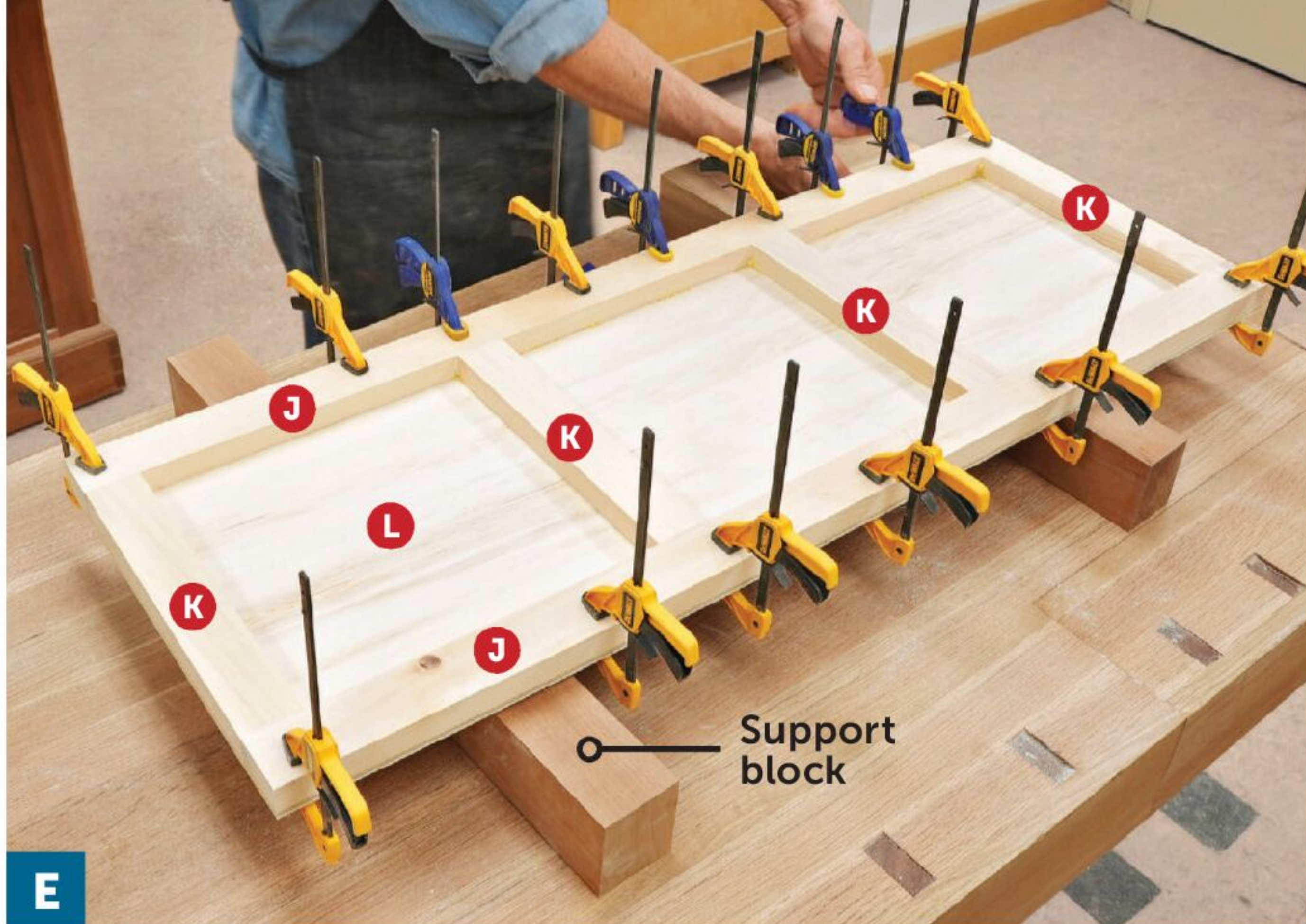


Glue and clamp the upper (G) and lower (H) trim pieces into place. Temporary scrap spacer blocks inside the case support the lower trim.



Long clamps across the base and short clamps up top secure the end trim (I) in place while the glue dries.





Glue the lid panel (L) to the lid frame (J/K) with a series of clamps to ensure a good bond. Support blocks provide clearance for the clamps.

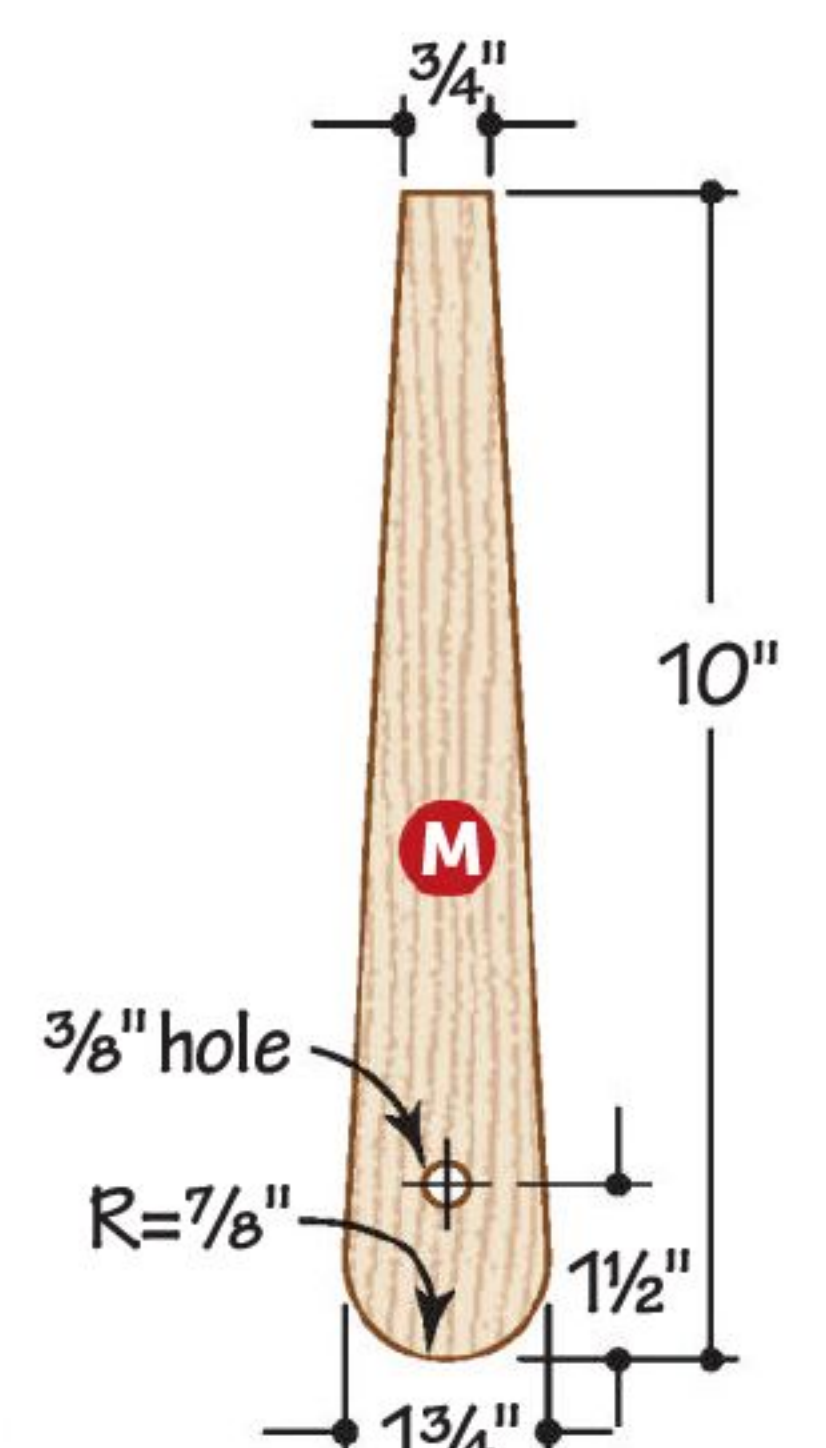
Use a jigsaw to make the long cuts for the sides of the handle ends (M). Then cut the handle ends free from the oversized blank.

ADD A LID AND HANDLE

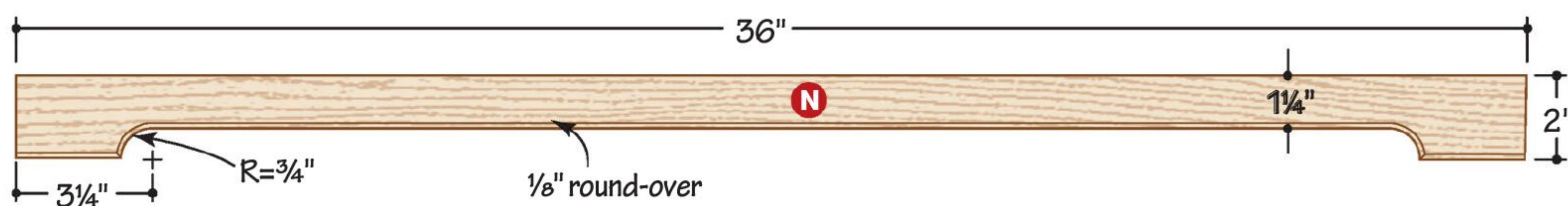
- 1 Cut the lid rails (J) and stiles (K) to size [Drawing 2] and glue and pocket-screw the lid frame while checking for square.
- 2 Cut the lid panel (L) to size and glue it to the lid frame (J/K) [Photo E].
- 3 See *Handy Hinge Mortising* on the next page to rout mortises in the lid and case [Exploded View]. Using a self-centering bit [Sources], predrill holes for the hinge screws and mount the hinges to the lid and case.

- 4 From $\frac{3}{4}$ "-thick stock, cut a 4×20" blank, then lay out the handle ends (M) on one end of the blank [Drawing 3a]. Shape the handle ends [Photo F], drill the mounting holes at the wide end, and finish-sand.
- 5 Cut the handle (N) to size and shape [Drawing 3]. Sand the edges smooth and rout a round-over on the inside edges.
- 6 Glue and screw the handle ends to the handle [Exploded View]. Drill mounting holes in the end trim (I) and then bolt the handle assembly into place.

3a HANDLE END



3 HANDLE

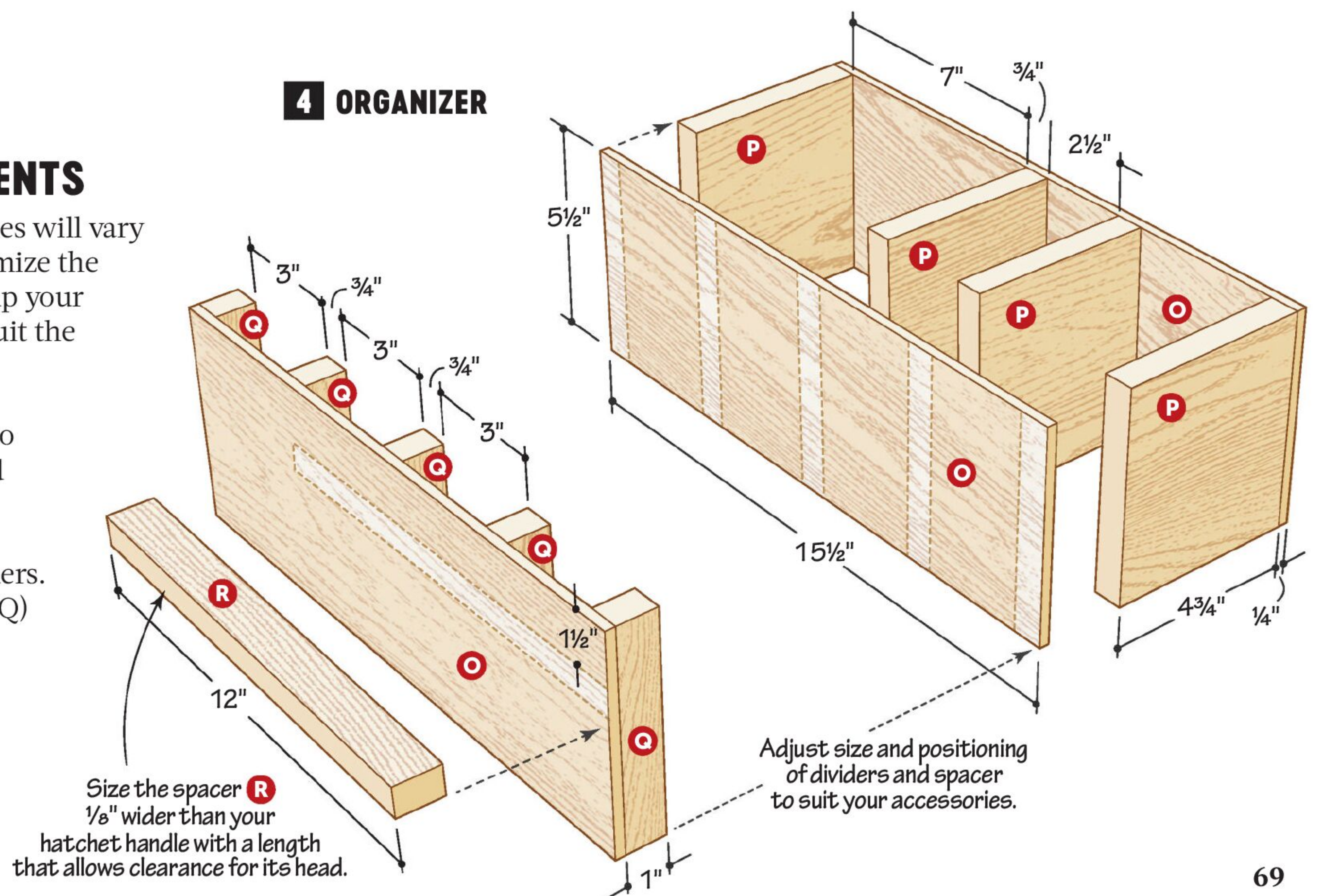


4 ORGANIZER

CUSTOMIZE FOR CONTENTS

Chainsaw accessories and supplies will vary by brand and your needs. Customize the interior organizer by gathering up your collection and size the parts to suit the accessories in your arsenal.

- 1 Cut the organizer panels (O) to size [Drawing 4]. Finish-sand the panels and set them aside.
- 2 From $\frac{3}{4}$ "-thick stock, cut a 5 1/2 × 27" blank for the dividers. Crosscut the long (P) and short (Q) dividers to size.



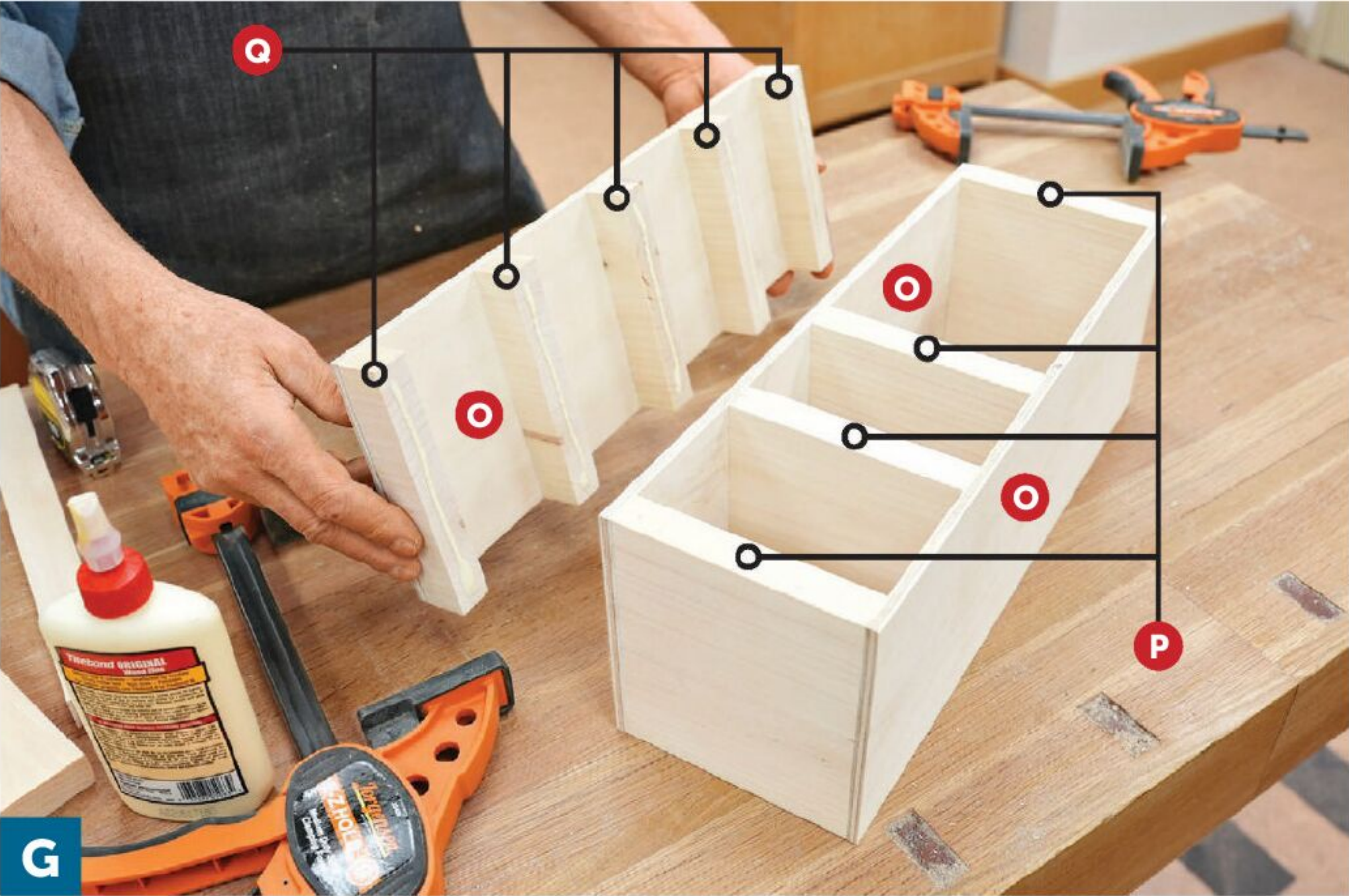
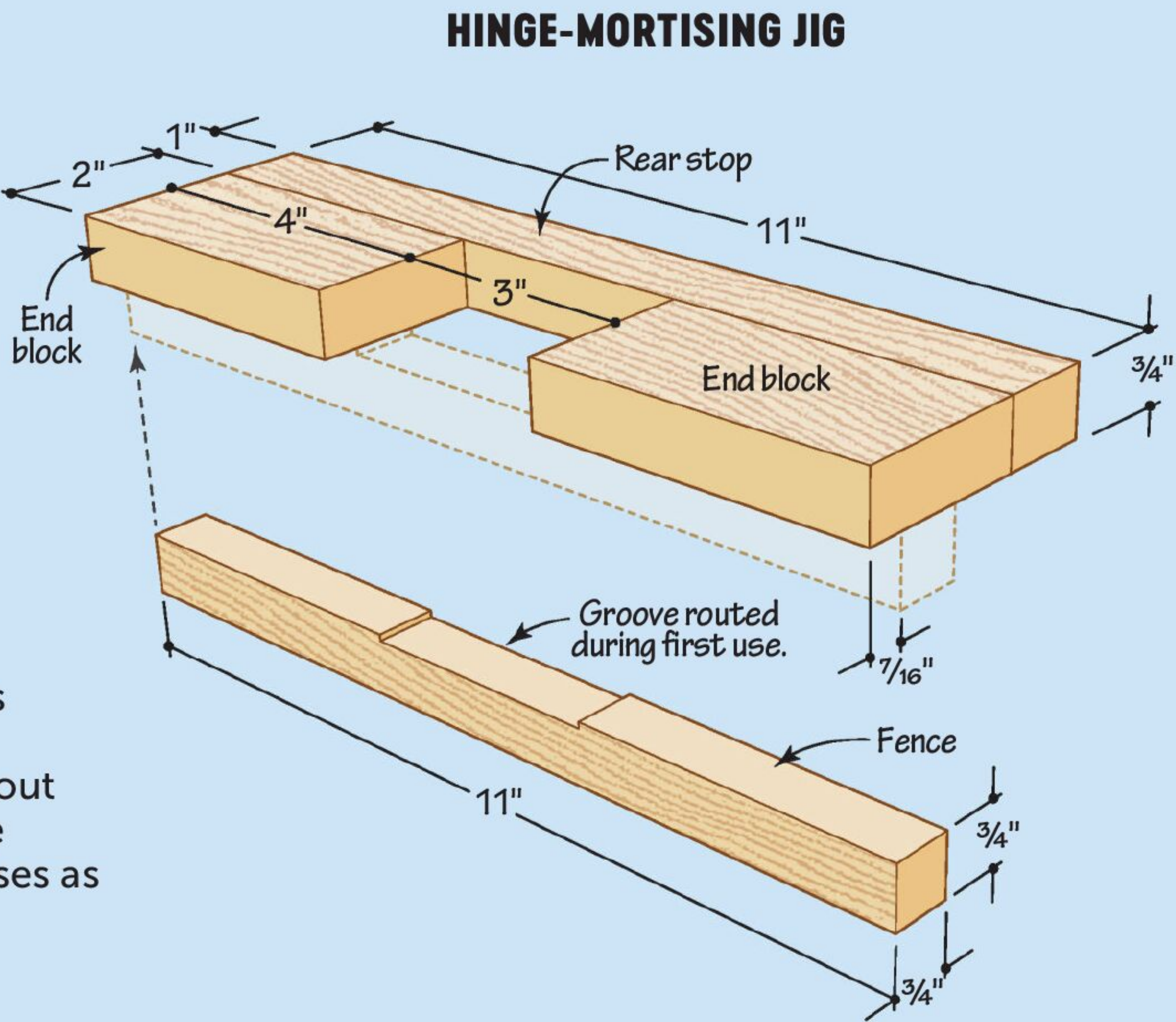
HANDY HINGE MORTISING

Basic utility hinges with fixed pins connect the lid to the chainsaw box. They're strong, inexpensive, and easy to find at most hardware stores. But for the lid to sit flush with the top edges of the case, the hinges need to fit into mortises in both the lid and box.

While you could cut the mortises by hand, a shop-made hinge-mortising jig and 1/2" bearing-guided mortising bit make the work go faster with more accurate results.

The jig consists of a few parts made from 3/4"-thick hardwood scraps **[Drawing]**. A pair of end blocks glued to a rear stop are spaced to match the length of the hinge. (Ours was 3".) A fence glued to the bottom of the assembly positions the opening in the jig to accurately rout the mortises for both the lid and the chainsaw box.

Once you have the jig built, clamp it in place on the lid and rout away the waste for both mortises (*next page, left*). Transfer the hinge locations to the case and use the jig to rout those mortises as well. Complete the mortises with a chisel (*next page, right*).



After cutting the panels (O), long dividers (P), and short dividers (Q), assemble the organizer by gluing the long dividers between a pair of panels, then glue the short dividers and final panel to the assembly.

3 Glue and clamp the long dividers between two panels and the short dividers to the third panel. Once dry, glue the two assemblies together **[Photo G]**.

4 Cut the spacer (R) to size to fit your ax or hatchet. The width should be 1/8" wider than the handle thickness and the length should provide clearance at the end for the head **[Drawing 4]**. Glue the spacer to the organizer assembly, then glue the entire assembly to the bottom and back of the case.

MATERIALS LIST

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A	END-PANEL STILES	3/4"	1 1/2"	7"	P	4
B	END-PANEL RAILS	3/4"	1 1/2"	10"	P	4
C	END PANELS	1/4"	10"	10"	Ply	4
D	BOTTOM	1/4"	10"	34 1/2"	Ply	1
E	BOTTOM RAILS	3/4"	1 1/2"	10"	P	5
F	FRONT/BACK	1/4"	11"	34 1/2"	Ply	2
G	UPPER TRIM	3/4"	1 1/2"	34 1/2"	P	2
H	LOWER TRIM	3/4"	2 1/2"	34 1/2"	P	2
I	END TRIM	3/4"	2 1/2"	12"	P	4
J	LID RAILS	3/4"	1 1/2"	34 3/8"	P	2
K	LID STILES	3/4"	1 1/2"	9"	P	4
L	LID PANEL	1/4"	12"	34 3/8"	Ply	1

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
M*	HANDLE ENDS	3/4"	1 3/4"	10"	P	2
N	HANDLE	3/4"	2"	36"	P	1
O	ORGANIZER PANELS	1/4"	5 1/2"	15 1/2"	Ply	3
P	LONG DIVIDERS	3/4"	5 1/2"	4 3/4"	P	4
Q	SHORT DIVIDERS	3/4"	5 1/2"	1"	P	5
R	SPACER	3/4"	1 1/8"	12"	P	1

*Parts initially cut oversize. See the instructions.

MATERIALS KEY: P—pine, Ply—plywood.

SUPPLIES: #8x1 1/4" flathead screws, #8x2 1/2" flathead screws, 1 1/4" pocket-hole screws, 3/8x2 1/2" carriage bolts, 3/8" lock nuts, 3/8" washers, 3" utility hinges (fixed pin).

BITS: 1/2" mortising bit, 1/8" round-over bit, self-centering drill bits.

PROJECT COST: It cost us about \$115 to build this project. Your cost may vary by region and source.



Clamp the hinge-mortising jig on the lid layout lines. Remove the waste using a 1/2" hinge-mortising bit set to cut the thickness of the hinge leaf. Transfer the hinge locations to the case and repeat.

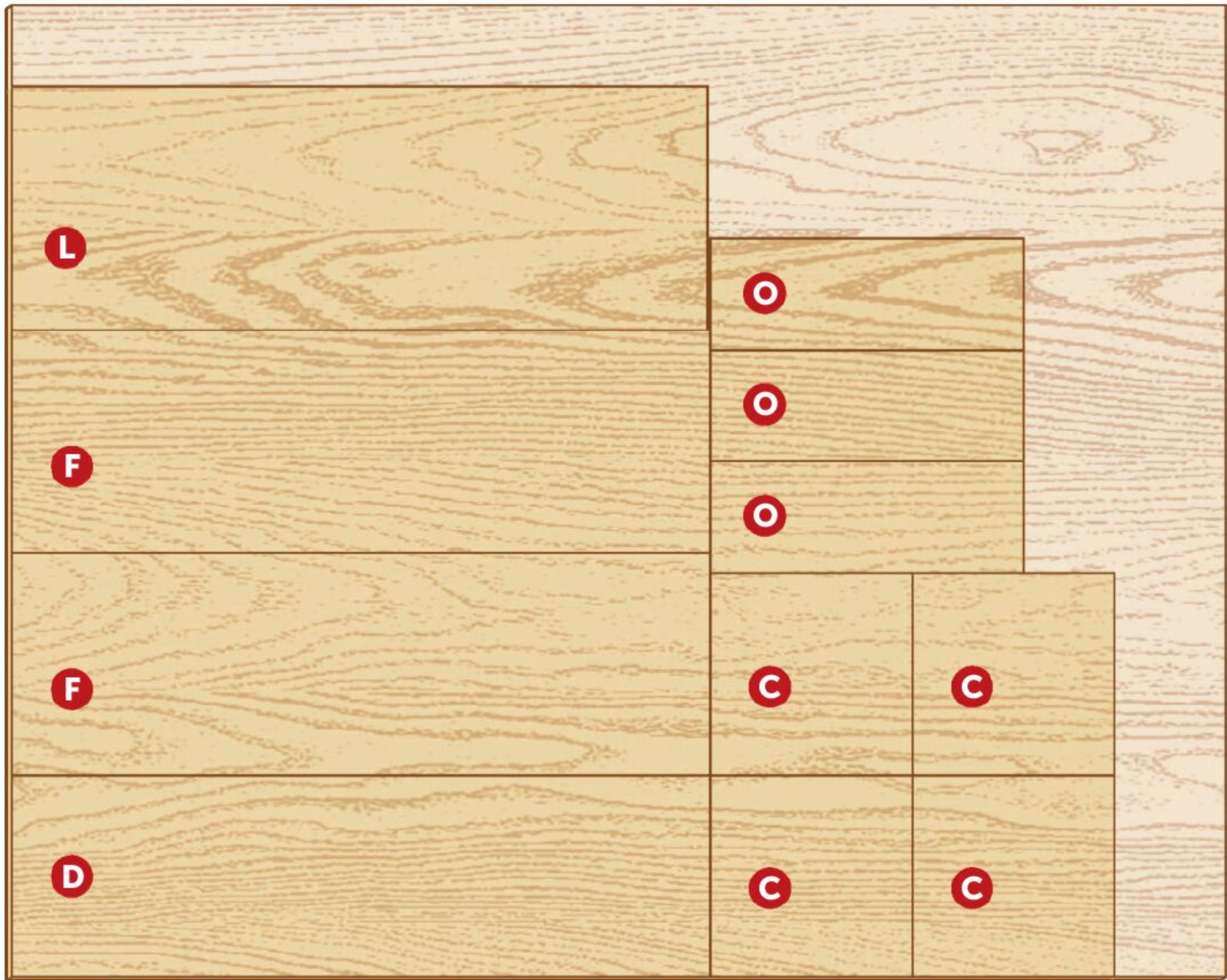


After routing the hinge mortises in both the lid and case, square up the corners of the mortises with a chisel, using the edges of each mortise as a guide.

- 5 Remove the handle assembly and lid and finish-sand the entire project as needed, then apply a finish. A few coats of spray lacquer will do fine if the chainsaw box is kept out of the rain. For a more weather-resistant option, choose a spar varnish.
- 6 Once the finish dries, reinstall the lid and handle assembly. Gather up your chainsaw and accessories, toss them into the box (or organize things first), then throw on some flannel and head to the hills for some tree-cutting exercise. 🌲

CUTTING DIAGRAM

This project requires three pieces of 1x6 pine dimensional lumber based on example boards shown.



1/4 x 48 x 60" Plywood



3/4 x 5 1/2 x 72" Pine



3/4 x 5 1/2 x 96" Pine



3/4 x 5 1/2 x 96" Pine

GOING MOBILE

Whether your tools reside in a dedicated shop or in a shared space, making them mobile provides the ability to transform your floor plan to suit your usage and storage needs. These five bases all take slightly different approaches to accomplish the goal of getting you on a roll.

All-Terrain Mobile Base

If your shop floor isn't dance-hall smooth, you'll appreciate the 5" heavy-duty casters on Rockler's all-terrain mobile base. They roll easily over cracks, debris, and rough surfaces while raising the tool height by only 1". All four casters lock for firm footing while in use (especially handy for tools that bear lateral forces, such as a jointer or router table). The base holds up to 800 lbs and adjusts from 18x18" to 28x28" (or larger with optional longer rails).

Rockler, [rockler.com](https://www.rockler.com)

All-terrain mobile base, no. 22672, \$280

Throw Yourself a Bone

Full tang stainless steel blade with natural bone handle —now **ONLY \$79!**

The very best hunting knives possess a perfect balance of form and function. They're carefully constructed from fine materials, but also have that little something extra to connect the owner with nature.

If you're on the hunt for a knife that combines impeccable craftsmanship with a sense of wonder, the **\$79 Huntsman Blade** is the trophy you're looking for.

The blade is full tang, meaning it doesn't stop at the handle but extends to the length of the grip for the ultimate in strength. The blade is made from 420 surgical steel, famed for its sharpness and its resistance to corrosion.

The handle is made from genuine natural bone, and features decorative wood spacers and a hand-carved motif of two overlapping feathers—a reminder for you to respect and connect with the natural world.

This fusion of substance and style can garner a high price tag out in the marketplace. In fact, we found full tang, stainless steel blades with bone handles in excess of \$2,000. Well, that won't cut it around here. We have mastered the hunt for the best deal, and in turn pass the spoils on to our customers.

But we don't stop there. While supplies last, we'll include a pair of \$99 8x21 power compact binoculars *and* a genuine leather sheath **FREE** when you purchase the **Huntsman Blade**.

Your satisfaction is 100% guaranteed. Feel the knife in your hands, wear it on your hip, inspect the impeccable craftsmanship. If you don't feel like we cut you a fair deal, send it back within 30 days for a complete refund of the item price.

Limited Reserves. A deal like this won't last long. We have only 1120 **Huntsman Blades** for this ad only. Don't let this beauty slip through your fingers. Call today!

Huntsman Blade ~~\$249*~~

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Rating of A+

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Burnsville, Minnesota 55337 www.stauer.com

*Discount is only for customers who use the offer code versus the listed original Stauer.com price.

California residents please call 1-800-333-2045 regarding Proposition 65 regulations before purchasing this product.

- 12" overall length; 6 1/2" stainless steel full tang blade • Genuine bone handle with brass hand guard & bolsters • Includes genuine leather sheath

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Stauer® 8x21
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Binoculars
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Huntsman Blade



BONUS! Call today and you'll also receive this genuine leather sheath!

What Stauer Clients Are Saying About Our Knives



"This knife is beautiful!"

— J., La Crescent, MN



"The feel of this knife is unbelievable...this is an incredibly fine instrument."

— H., Arvada, CO





Bargain-Priced Base

Wen dubs its universal mobile base "heavy duty" though it lands mid-pack with a 500-lb capacity. At only \$55, though, this base offers a lot of mobile bang for the buck. Depending on how you bolt it together, it adjusts from 11x11" to 35x35". You can set it up as a rectangle, too, though it flexes a bit as the side length increases.

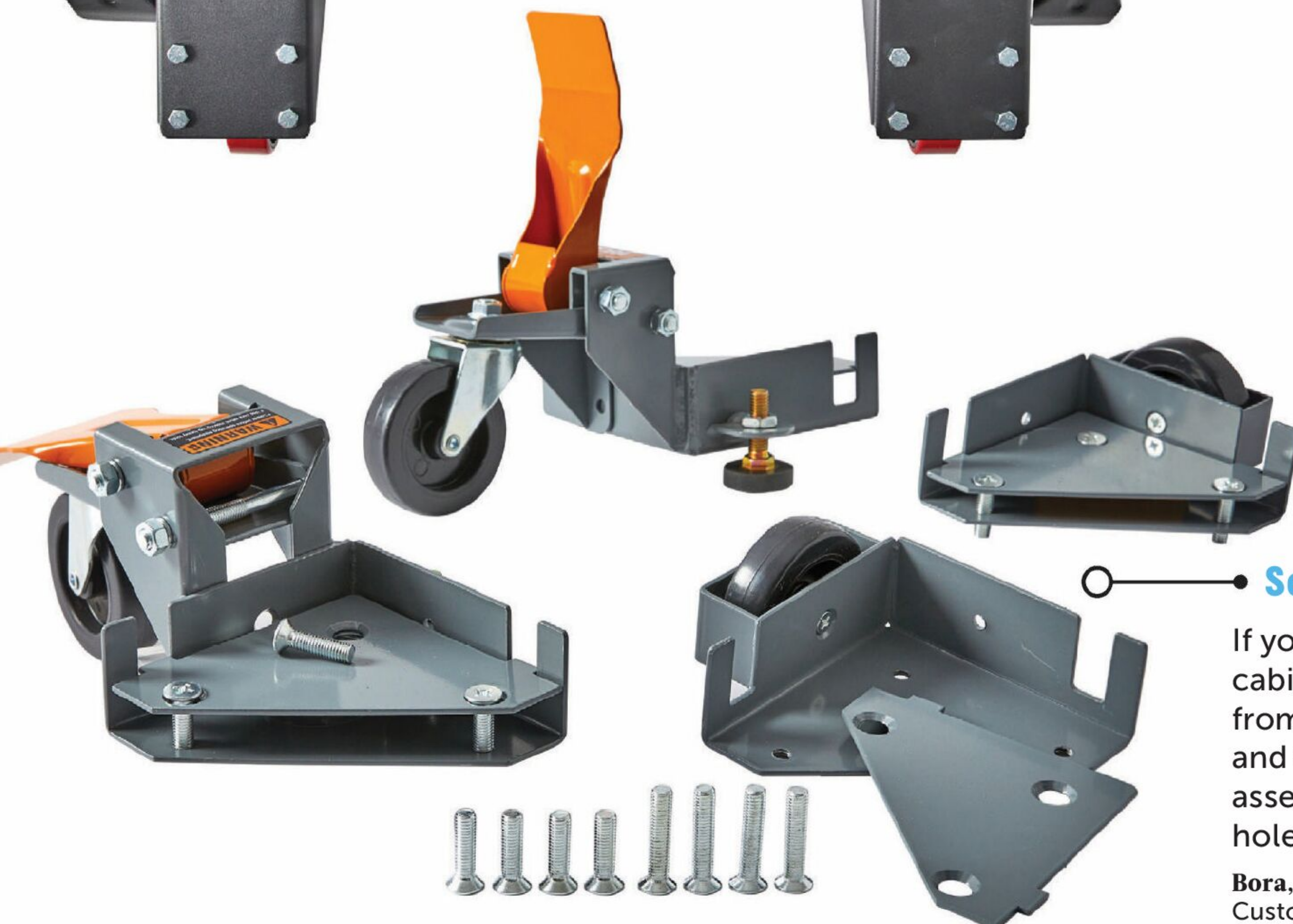
Wen, wenproducts.com
Universal mobile base, no. MB500, \$55



A Bear of a Base

The Grizzly Bear Crawl Cub adjusts from 14x14" to 22½x22½" by simply sliding the aluminum bars in the corner assemblies then tightening the locking bolts. Urethane-coated steel wheels always stay in contact with the floor to support an impressive load of 1,200 lbs, while adjustable pads at the front corners press down to hold the base stationary.

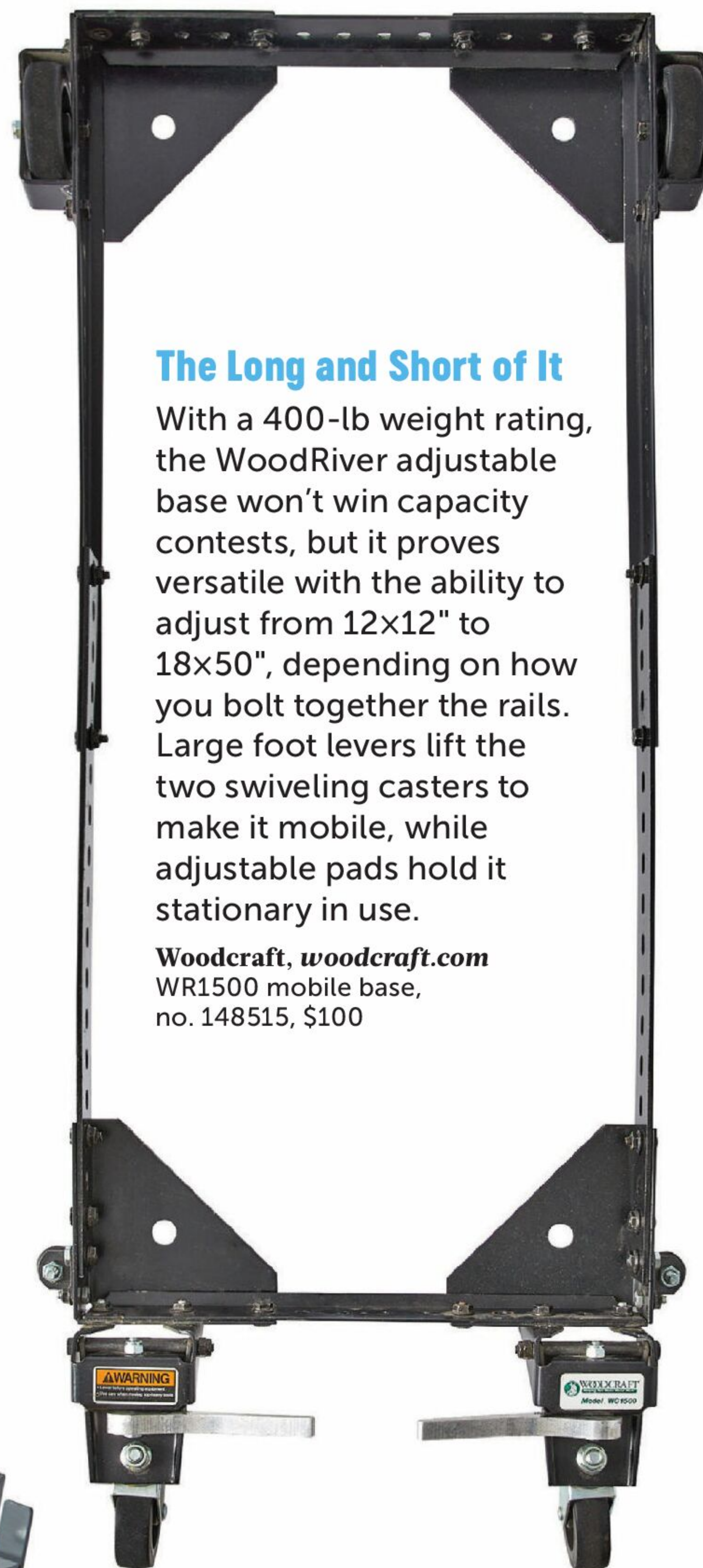
Grizzly, grizzly.com
Bear Crawl Cub mobile base, no. T28922, \$90



Select a Size

If you want to mobilize an oddly shaped machine, tool cabinet, or workbench, consider the universal base kit from Bora. Simply cut a piece of ¾" plywood to the size and shape you need, sandwich it between the caster assemblies using the included screws and threaded holes, and you're set to support up to 400 lbs.

Bora, boratool.com
Customizable mobile base, no. PM-1100, \$60



The Long and Short of It

With a 400-lb weight rating, the WoodRiver adjustable base won't win capacity contests, but it proves versatile with the ability to adjust from 12x12" to 18x50", depending on how you bolt together the rails. Large foot levers lift the two swiveling casters to make it mobile, while adjustable pads hold it stationary in use.

Woodcraft, woodcraft.com
WR1500 mobile base, no. 148515, \$100



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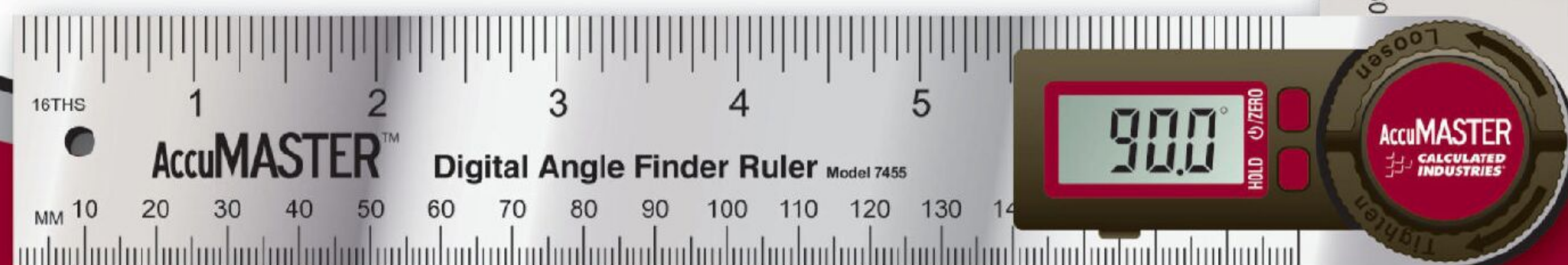
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WHAT'S AHEAD

A GLIMPSE INSIDE THE NOVEMBER ISSUE (ON SALE OCTOBER 6)

TEALIGHT TRIO
These elegant, octagonal candle holders make the perfect gift. Crank out multiples; they're easy on the eye and cleansing on the scrap bin.



MUDROOM MARVEL
Park your posterior while you ready yourself for the elements at this impressive entry organizer that corrals coats and stashes shoes. It's surprisingly easy to build. We'll show you.

THE RIGHT TRACK
We put 16 tracksaws, both corded and cordless, through a course of tests—including cutting nearly a mile of wood. Discover which ones beat the pack.



WOOD FOR VINYL
Attention wax chasers: Craft this classy console, top it with your turntable, and fill it with your 45s. Spin up an LP while you display its sleeve in the sliding door.

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