

ISSUE 299 NOVEMBER 2024

14
TIPS TO NIX
ROUTING
ERRORS
p.44

WOOD®

COZY-TO-ACCOMMODATING DINING TABLE

p.50

Create
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**INSET
DOORS**
p.32



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GREAT PLANS

- Shop-Built Jointer Plane p.28
- Wall-Mounted Shop Storage p.38
- Railway Passenger Car p.60
- Crumb-Busting Bread Tray p.68

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ON TRACK

WE'VE GOT TRAIN ON THE BRAIN, AND SOMETIMES IT MAKES OUR PROJECTS GO A LITTLE BIT OFF THE RAILS.

If you've been following along with our Timber Line Express train series, I suspect you're just as excited as we are to see the incredible detail that designer John Olson packs into each new rail car—the Passenger Car on *page 60* being no exception. Try as we might, staying faithful to that detail has meant that we don't have enough room in our pages to pack in the fantastic accessories that John seems compelled to design. There's no "off" to the genius switch in his head, but there *was* a railroad switch in there. Adding this Y-shape diverter to your collection makes the original straight and curved track pieces detailed in issue 291 (October 2023) remarkably reconfigurable, sending your Timber Line train on nearly infinite adventures. We opted to not wait to get it into your hands.

You can find the plans at the link *below right*. We'll update that link with more of John's brainstorm. In the meantime, get out to the shop and make something. We'll help.

Lucas
LUCAS PETERS

✉ lucas.peters@woodmagazine.com
📷 @peters.lucas

Lay down 16 curved track pieces to create this nested switchyard.



Find track switch plans and additional track layout ideas at woodmagazine.com/trackdesign

WOOD

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Vol. 41, No. 6

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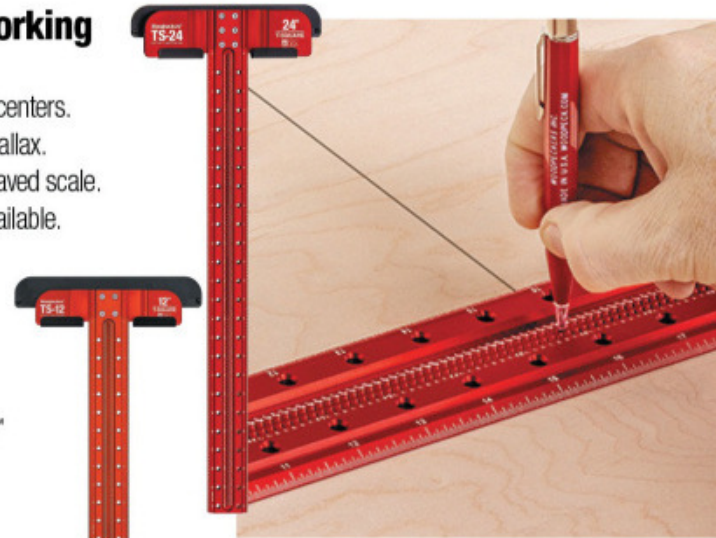
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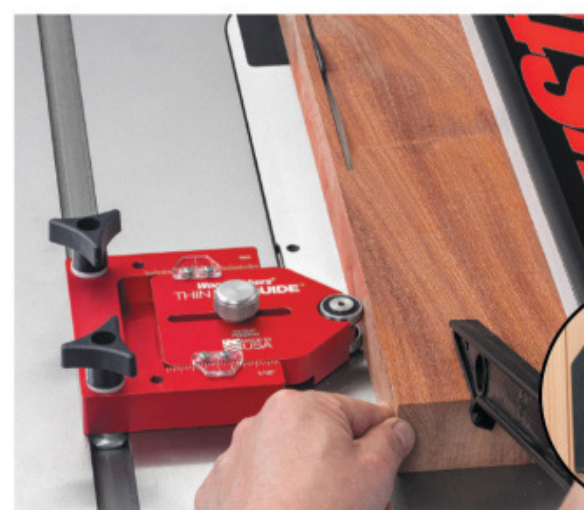
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WOOD

Issue No. 299 | November 2024

PLANS

- 28

HAND-MADE HAND PLANE
This gorgeous long-bed jointer plane build starts with a hardware kit and ends with a hard-working heirloom.
- 38

ALL-ON-A-WALL STORAGE
A complement to last issue's workbench, this reconfigurable unit shifts to suit your shop.
- 50

DANISH MODERN DINING
We show you how to build a dining table that is as comfortable for a family of four as it is for a party of ten.
- 60

PASSENGER RAILROAD CAR
Have your ticket ready for the latest addition to the Timber Line Express: a highly detailed open-coach passenger car.
- 68

CRUMB-FREE CUTTING
Tidy up your holiday list when you give this crumb-catching bread cutting board.



ON THE COVER



This Danish Modern delight belies its simple lines with an ingenious mechanism that expands its capacity, raising and cantilevering the extension wings to add four rock-solid place settings.

TOOLS & TECHNIQUES

- 17

WORKSHOP AUTOMATION
A checklist of voice-command options for your workshop.
- 32

INSET AND PERFECT FIT
Make inset doors with an even reveal all the way around.
- 34

STRAIGHT-LINE SAW GUIDE
Out-of-parallel cuts call for a circular saw and this DIY rail.
- 44

AVOID ROUTER BLUNDERS
We supply the solutions to preventable router problems.
- 54

TRIM EDGE BANDING FLUSH
A straight bit and this simple base even out edge banding.
- 72

TOOLS & MATERIALS
High-tech, music-friendly hearing protectors, and more

68



DEPARTMENTS

2 TAKING MEASURE

Choo-choo-check the web for bonus train track content.

8 YOUR VOICE

Change is good—especially reader-modified projects.

12 YOUR PROJECTS

A detailed toy tractor with peanut picker, and more

16 YOUR SHOP

A modern shop in a scenic setting

20 ASK WOOD

Starting grit and when to quit

22 SHOP TIPS

Tablesaw angle jig and more

76 WHAT'S AHEAD

A sneak peek at your next *WOOD*

72



38



44



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PINING FOR PINE?

Does your personal pickiness make you prone to prohibit pine from your projects? Or do you perceive this popular species as the perfect path for personality-packed pieces? Perhaps we can push your preferences toward the positive.



PUZZLING PINE PROBLEMS

Learn how to avoid potential problems when working with pine.

- [Are you finished with sap?](https://woodmagazine.com/sappy)
woodmagazine.com/sappy
- [How to wrangle warping in pine](https://woodmagazine.com/pinewarp)
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- [Get a perfect finish on pine](https://woodmagazine.com/pinefinish)
woodmagazine.com/pinefinish

PINE PROJECT PLANS

Pine lends a classic, heirloom look to projects. Here are some affordable plans to get you started.

- [Simple & Stylish Bookcase](https://woodstore.net/bookingpine)
woodstore.net/bookingpine
- [Heirloom Pine Blanket Chest](https://woodstore.net/chestofpine)
woodstore.net/chestofpine
- [Heirloom Pine Hutch](https://woodstore.net/starsky)
woodstore.net/starsky
- [Country Pine Cabinet](https://woodstore.net/pinecountry)
woodstore.net/pinecountry



SIMPLE SCIENCE

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- [What is western white pine?](https://woodmagazine.com/westpine)
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- [The lowdown on long leaf pine](https://woodmagazine.com/longpine)
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MOD SQUAD

Issue 286 (December 2022/January 2023) featured plans for a sliding-tray jewelry box. I built one for my grandson for his high school graduation, renaming it a “valet box.”

Leftover maple from a replacement staircase in my house forms the box. I deviated from the plan slightly by building inserts rather than purchasing liners, and omitting splines on the miter joints.

The book-matched top panel utilizes old barnwood, while lauan plywood serves for the inner panels and bottom. Danish oil and spray shellac finish it off.

John Gebhart

Bellevue, Iowa

Thanks to designer John Olson, writer Zach Brown, and builder Brian Bergstrom for the “Handy Hall Tree” in issue 294 (March 2024). I like the Stickley/Limbert style and found this project’s design the perfect inspiration for a special project.

My wife’s niece is attending college to become a registered nurse and has to read large, heavy books. She asked if I could make a book stand with a couple of special requests: adjustable in height so she could use it while standing or sitting, and casters to make it mobile.

The hall tree base and post proved the perfect starting elements to hold the book stand. My niece uses the stand often for her studies.

Jeff Sims

Moreno Valley, California

Thank you for sharing your projects John, Jeff, and Rich. We always enjoy seeing how readers modify our designs to personalize and customize them. And we love to see when our designs become the jumping-off point for something completely new. The imagination and ingenuity shown by our readers consistently blow us away.

Dave Stone
Managing Editor



I thought you might be interested in my version of Kevin Boyle’s cell phone stand featured in issue 293 (December 2023/January 2024). I built several as gifts, so I wanted to keep them compact for shipping.

The solution: Instead of gluing on the back supports, I attached them using sliding dovetails as described in issue 148 (May 2003) to create a two-piece version. The sliding dovetail makes for a nice, tight fit and comes apart for travel. I used oak for the support with walnut and cherry for the backs.

Rich Cain

Upton, Massachusetts



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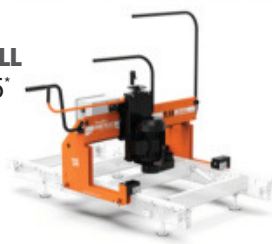
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WHAT WOOD?

You have listed great resources for identifying wood species in issue 293. Another is the International Wood Collectors Society (IWCS). Society members collect and identify wood samples from all over the world and publish resources regarding wood identification.

Whether collecting samples, learning to identify local woods, or improving their craftsmanship on wood projects, IWCS is for anyone seriously interested in various wood species. You can find them online at woodcollectors.org.

James Dominick
via email

SMALL SHOP SPACE SAVIORS

I have two Bora Universal Base Kits in my shop like those you mentioned in "Going Mobile" in issue 291 (October 2023). You mentioned their customizable size, but another advantage I've found is that the plywood base can serve as additional storage space when they carry open-legged tools. The shop vacuum resides under my bandsaw, for example. My shop is the bottom story of a 12x16' storage shed. These bases help overcome the space problem.

Paul Kricensky
via email



OUTDOOR EXPOSURE

A few years ago I built an outdoor bench out of western red cedar then applied three coats of exterior polyurethane. The bench sits on a covered patio and has held up pretty well. I would like to relocate it to my pool deck where it will be exposed to the harsh sun and water. Unfortunately, some pine chairs I made three years ago and painted are rotting in this location. The chairs don't make for very inviting spots to relax around my pool. Am I just asking for trouble?

Clyde Patterson
via email

LEARNING JOURNEY

I read the *Taking Measure* column in issue 289 (July 2023) regarding woodworking experience, from beginner to advanced.

During lockdown, I became restless so I started playing with wood. I read articles and watched videos to gain knowledge, then spent time practicing what I learned. My first project was an art piece made from 729 square poplar dowels, all stained individually by hand. From there, I started building clocks, furniture, spoons, and more. I "turned the corner" to more advanced woodworking with my walnut slab trestle table. It's built with traditional woodworking joinery; no nails or screws.

I just keep going while adding to my arsenal of tools. Woodworking is a lot of fun and very rewarding. Thanks for the tips and advice!

Joel Hill
Carrollton, Texas



Thanks for sharing your story and your gorgeous projects, Joel. We couldn't be happier to be part of your new woodworking journey. Keep leveling up, and enjoy the ride!

Lucas Peters
Editor-In-Chief

Clear film finishes are vulnerable to two enemies. Ultraviolet (UV) rays degrade the finish, causing it to crack. This gives access to the second enemy, moisture, which causes wood to swell.

Pigments combat UV rays, which then slows moisture's infiltration. That's why paint finishes last so long. But they obscure the grain.

A middle ground is a penetrating oil or stain designed for exterior use. These penetrate the fibers while introducing UV-blocking pigments. Reapply every couple of years to maintain appearance and extend protection.

Randy Maxey
Contributing Editor

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OCT. 14



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OCT. 15



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OCT. 16



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OCT. 17



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OCT. 18



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OCT. 19



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OCT. 20



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OCT. 21



Penn State Industries
Barracuda2 Lathe
Chuck Bundle
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OCT. 22



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OCT. 23



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Moisture
Meter
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OCT. 24



Oliver Machinery
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OCT. 25



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OCT. 26



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OCT. 27



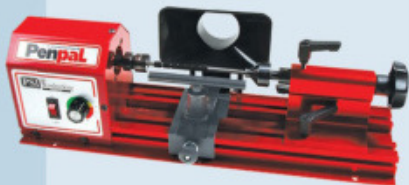
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Tracksaw Guide
with Guide Rail
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OCT. 28



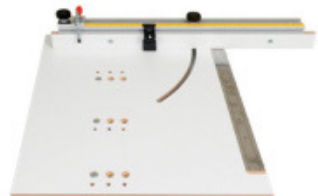
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Instant Bond
Assortment Pack
\$100 Value

OCT. 29



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\$299 Value

OCT. 30



Peachtree
Dubby Jr. Cutoff Sled
\$140 Value

OCT. 31



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NOV. 1



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NOV. 2



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● **TOM MEYER**, of Bettendorf, Iowa, built three live-edge tables for his basement recreation room from local walnut trees that were milled into slabs and kiln-dried. He used a shop-made router sled to flatten the slabs then finished them with epoxy. A local welding shop fabricated the legs to Tom's specifications. He custom-fit this sofa table to match the profile of his sectional sofa.



● **STEVE CLARK** of Grayson, Georgia, completed this cherry tea chest for his wife just in time for Mother's Day. To stretch his skills, he turned to a bombé-style chest for inspiration. He relied heavily on his router to create custom moldings, finishing them with sanders and hand planes. A handle with a leaf design hints at the chest's contents. Steve was proud that he created something that exceeded his expectations and proved worthy of its recipient.



● For a church fundraiser, **MELVIN WOODARD** of Pendleton, North Carolina, built this tractor and peanut picker from oak, walnut, and ash. The handcrafted pair was a hit at the auction, selling for over \$2,000.



● **KEVIN GOOSMAN** of Dorridge, England, used American white oak to build this desk. The drawers were constructed with dovetail joints. He turned the handles and made the storage compartments inside. The desk includes mechanisms to automatically extend salvaged lopers (runners) to support the drop-down writing surface. He built the frame using mortise-and-tenon joints.



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YOUR PROJECTS

• **JAY MORRIS** of Lawrence, Kansas, built this intricate dollhouse for a friend's granddaughter based only on a photo. It incorporates 52 small mortise-and-tenon joints. A retractable slide from the second floor allows Barbie a rapid egress in case of fire, while a movable wall opens up the space for hosting bigger parties. Jay also runs a nonprofit group that produces dozens of old-fashioned wooden toys for local Toys for Tots Christmas toy drives.



• **JON KOUNOVSKY** of Buffalo, New York, designed and built this hexagonal box using curly varieties of maple and walnut. 🌲



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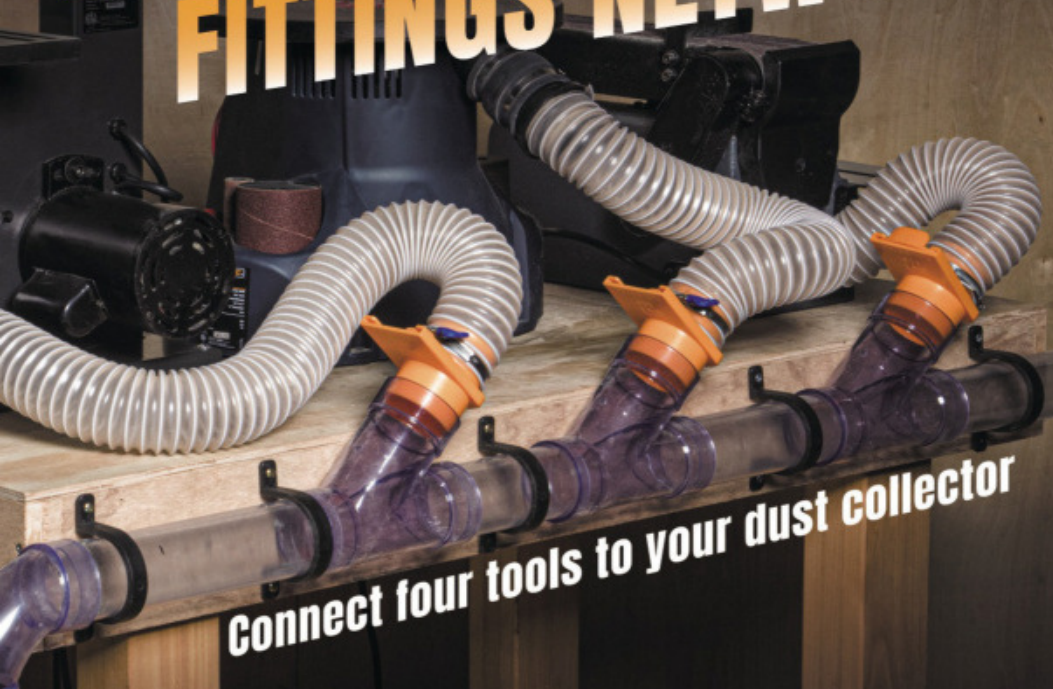
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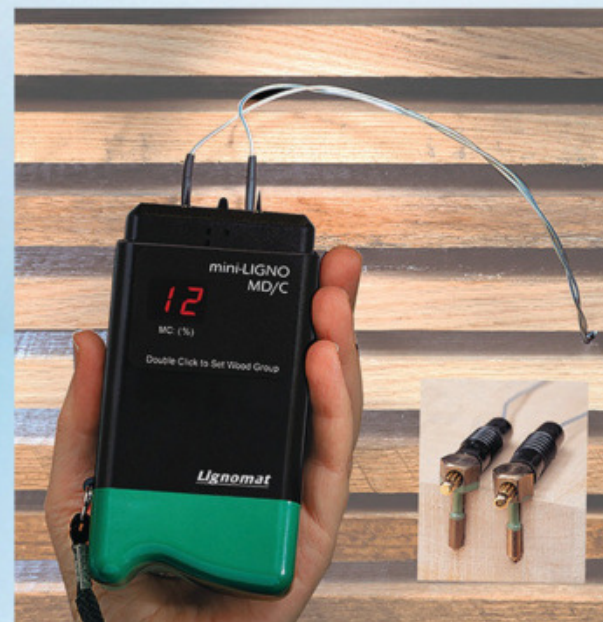
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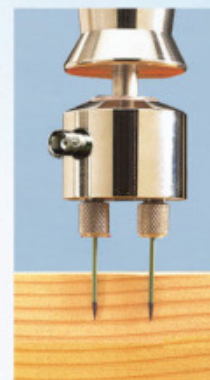


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HILLSIDE HAVEN

Nestled into a southern California hillside, this shop is surrounded by natural beauty visible through large windows from inside the well-organized workspace.

WRITER: RANDY MAXEY



▲ Set among the hills and dales surrounding Henry's home, his workshop invites you in to sit around the workbench with a cup of coffee and to chat about all things woodworking.



After a 30-year career in law enforcement, Henry serves as a local fire commissioner. He attended woodworking classes at Palomar College in San Marcos, California.

A hillside lot with no level grades drove creative solutions for fitting in Henry Sawicki's new 24×24' shop. Because it couldn't sit on grade, he supported the structure on posts secured to large boulders. Floor joists set 16" on center and topped with glued and screwed tongue-and-groove plywood form a rigid base for 9'-tall 2×6 walls. "We live in fire country," Henry says. So he clad the exterior in plywood sheathing that supports fiber-cement siding for fire resistance. Inside, painted drywall caps the well-insulated walls to keep the interior bright, while commercial-grade vinyl tile makes the floor durable and easy to clean.

Because of the terrain, Henry faced a problem: He couldn't easily move machines in using trucks and trailers. So, before the roof was added, he hired a crane to place the heavy, stationary tools inside the shop space. Henry located machinery to maximize flow and accommodate larger projects. All of the machines sit on mobile bases. After all of his stationary tools were in place, he would occasionally bump into them as he walked around the shop. That's when he got the idea to apply safety tape to the floor around them. It provides a visual reminder of where to step, plus it satisfies his deep-seated desire for order.



SHOW US YOUR SHOP

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

PHOTOGRAPHER: HENRY SAWICKI; ILLUSTRATORS: ROXANNE LEMOINE, LORNA JOHNSON

Ductwork from the dust collector runs under the floor to a connection at the tablesaw. Safety tape around the equipment serves as a visual marker to prevent tripping.



A pair of ceiling fans, French doors, and large operable windows allow for fresh air circulation. A mini-split system cools or heats the air as needed to keep the shop comfortable.

AN ALLIANCE WITH ALEXA

With an Amazon Echo Dot and his phone, Henry controls several devices in his shop for convenience.

ECHO DOT

Henry plays music through the Echo Dot. It also serves as the controller for voice commands. Henry's wife uses the Echo Dot to drop in from the house and chat with Henry when needed.

AIR COMPRESSOR

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Voice- and phone-controlled from anywhere in the shop to turn on or off as required.

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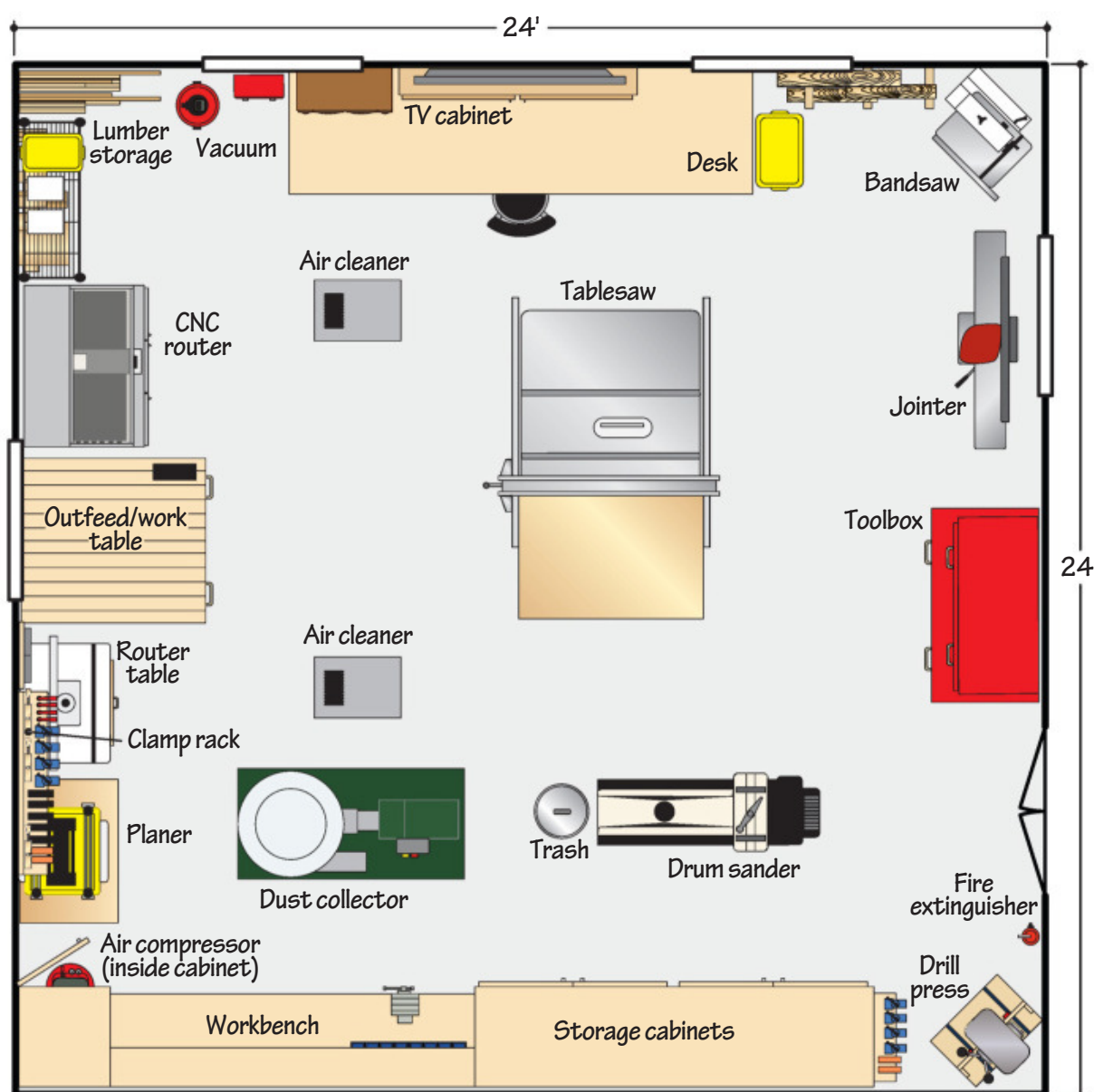
WiFi-enabled to set temperature and switch on or off using a smartphone. Henry turns the unit on and sets the temperature about 30 minutes before he's ready to work in the shop.

TV & MUSIC

An Amazon Fire TV stick enables Henry to stay up to date with his favorite sports teams.

AIR FILTERS

The Wen air filtration systems ship with stock remotes to switch the units on or off, set timers, and choose fan speeds.



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“
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MACHINERY TO
MAXIMIZE FLOW AND
ENSURE ENOUGH SPACE
TO ACCOMMODATE
LARGER PROJECTS.

-HENRY SAWICKI, SHOP OWNER

”



Henry's well-lit, spacious shop creates a woodworking haven, complete with a television. Conveniences like hose reels and floor receptacles keep the shop tidy and free of trip hazards.

He installed and routed PVC piping below the floor for the dust collection system. Ports extend through the floor in four places for easy connection to big sawdust producers like the tablesaw without running a hose across the floor. He painted the overhead ductwork red “for a splash of color,” he says, adding that all his cars are red, too. A pair of air filters take care of removing fine dust from the air.

French doors with their large glass panels, in combination with large windows, provide natural lighting and ventilation. Henry plans to convert the eight fluorescent, ceiling-mounted light fixtures to LEDs.

Seeking a fast, inexpensive way to add storage, Henry shopped a local store selling used office furniture. He purchased several lateral file cabinets to use as bases for mobile and stationary benches. One of the drawers keeps Henry's back issues of *WOOD*® magazine at hand. The remaining file drawers hold tools and supplies.

Henry is a geek at heart. A mesh WiFi system with a dedicated modem provides plenty of signal strength from his house to connect to the internet. He uses the Amazon Alexa app with voice and phone commands to control some of his shop equipment using smart plugs, switches, and thermostat. Alexa also



Henry built a cabinet to house his Shark CNC machine. The hinged top with 4" dust port makes it easy to access and tames the noise when closed. The base holds accessories like bits and tools.

provides music and entertainment through a 50" flat-screen TV mounted in its own wall cabinet.

The traffic signal mounted on the wall? Henry swears it's not stolen from the traffic department. He claims, “The traffic signal is a replica I received as a Father's Day present. It really works!” 🌳



Tall wall cabinets provide plenty of storage space. One hides the miter saw on a pull-out shelf. Cubbies in another cabinet keep short cut-offs organized and accessible.

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Q:

SANDING BY THE NUMBERS

When it's time for sanding, I always feel a little uncertain about which grit to start with, the progression of grits I should use, and where to stop. Are there any guidelines on sanding grits?

Elmer Hopkins
Modesto, California

A: In general, Elmer, choose your range of grits based on two details: the starting condition of the wood and the finish you plan on applying.

As a rule of thumb, start with 120-grit to quickly create a smooth surface without introducing deep sanding scratches. However, if your wood has scratches or ripples from a planer or jointer, or a lot of surface imperfections to remove, start with a coarser grit such as 100 or even 80. Keep sanding until you've removed all major scratches and surface defects before moving to the next grit.

On the opposite end of the range, choose your finest grit based on the finishing regimen you plan to use. According to General Finishes, when using a stain or dye which could highlight the swirl or scratch marks from coarser grits, sand up to 180-grit (or 220-grit for closed-pore woods such as maple or cherry). For clear topcoats, sand to 220-grit with water-based finishes or 150-grit with oil-based finishes. Sanding beyond these grits tends to burnish the surface of the wood, making it too smooth to accept the stain or finish.



See General Finishes' sanding recommendations at woodmagazine.com/whichgrit

Sand thoroughly with each grit in your selected range, first to remove surface defects, then to remove scuff marks from the previous grit. For example, follow up 120-grit with 150, before moving to 180. Resist the temptation to skip grits, which could increase sanding time for finer grits or leave behind scuff marks from coarser grits.

Like all rules of thumb, there are some exceptions to the 120-150-180 sequence. Hardwood plywood, for example, is sanded at the factory, so it should only need a touch-up sanding with 150-grit (or higher) to smooth the surface without risking sanding through the thin veneer layer.

End grain also calls for sanding with finer grits—not as you start, but as a final step. End grain's open pores absorb stain and finish more readily than face grain, making it appear darker. To counteract this, sand the end grain through the same grit progression as you use on the face grain, then go one level finer to prevent over-absorption and make the end grain's appearance better match the face grain.

Finally, make sure to replace your sandpaper often. Many woodworkers tend to use sandpaper until it practically disintegrates. As the grit on the sandpaper wears, it stops cutting as aggressively. So what started as 120-grit paper starts to work less and less effectively until it just burnishes the wood. This slows down the whole sanding process, making the task take that much longer. And nobody likes that. 🌱



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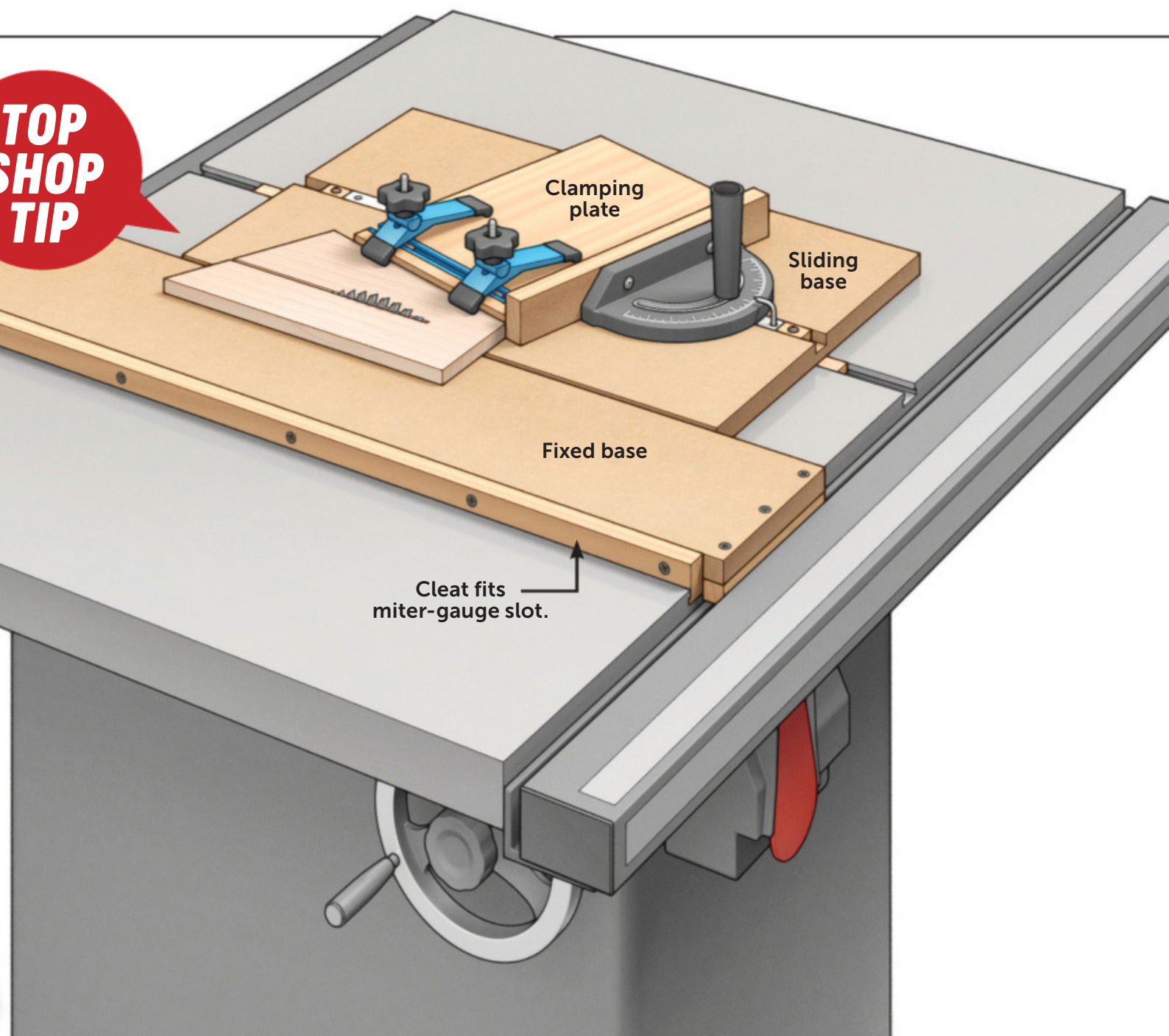
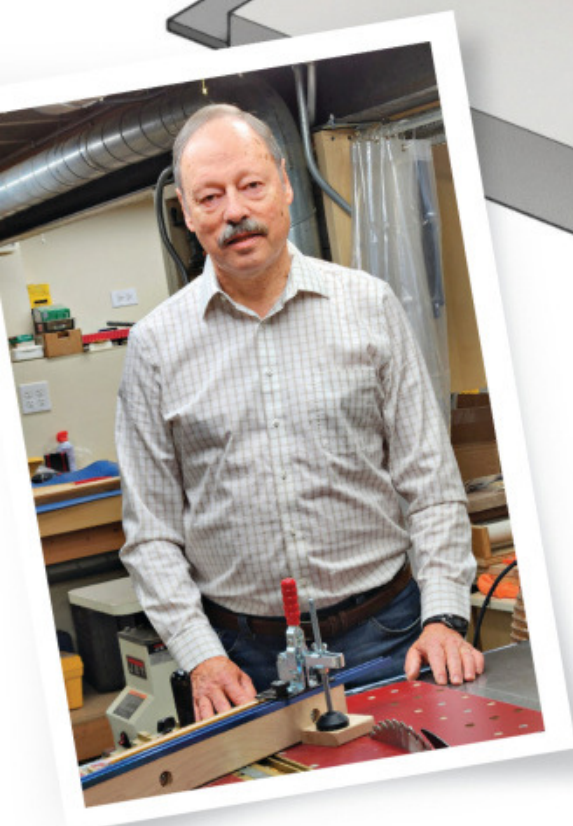
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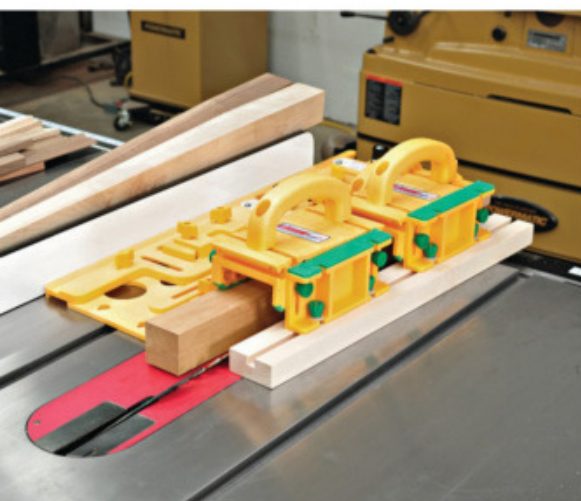
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**TOP
SHOP
TIP**



For his tip, Adriaan wins two GR-200 GRR-RIPPERS, a TJ-5000 MicroDial Tapering Jig, and a Gravity Heel Kit from Microjig worth \$300.



ANGLING FOR SMALL PARTS

I build a lot of toys that require small parts cut at odd angles. To cut them safely and consistently, I made a sled for my tablesaw.

The heart of the sled is the two-part base. The sliding base has a bar that rides in the saw's miter slot. Cleats on the fixed base keep it locked in place to support the offcut during and after the cut. A groove atop the sliding base holds a conventional miter gauge with two small hardwood blocks that lock the miter gauge in place.

A fence screws to the miter gauge for angle adjustment while a plate attached to that fence uses T-track with hold-downs to secure the workpiece. This allows moving the entire sliding base using the handle on the miter gauge when making angled cuts.

Adriaan Sachtleer
Des Plaines, Illinois



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ILLUSTRATOR: CHRISTOPHER MILLS



RECLAMATION RESTORE

With the price of lumber getting higher, I've gone to using more reclaimed wood, like barn or pallet wood, in my projects. The problem is, the fresh-cut edges of the used lumber stick out like a neon light compared to the surrounding weathered wood.

I've discovered a little secret to disguising the cut edges. I dilute blackboard paint with water to create a weathered gray I paint on edges. With some experimentation I can get the ratio of water to paint correct to match the surrounding wood.

Ron Vander Ark

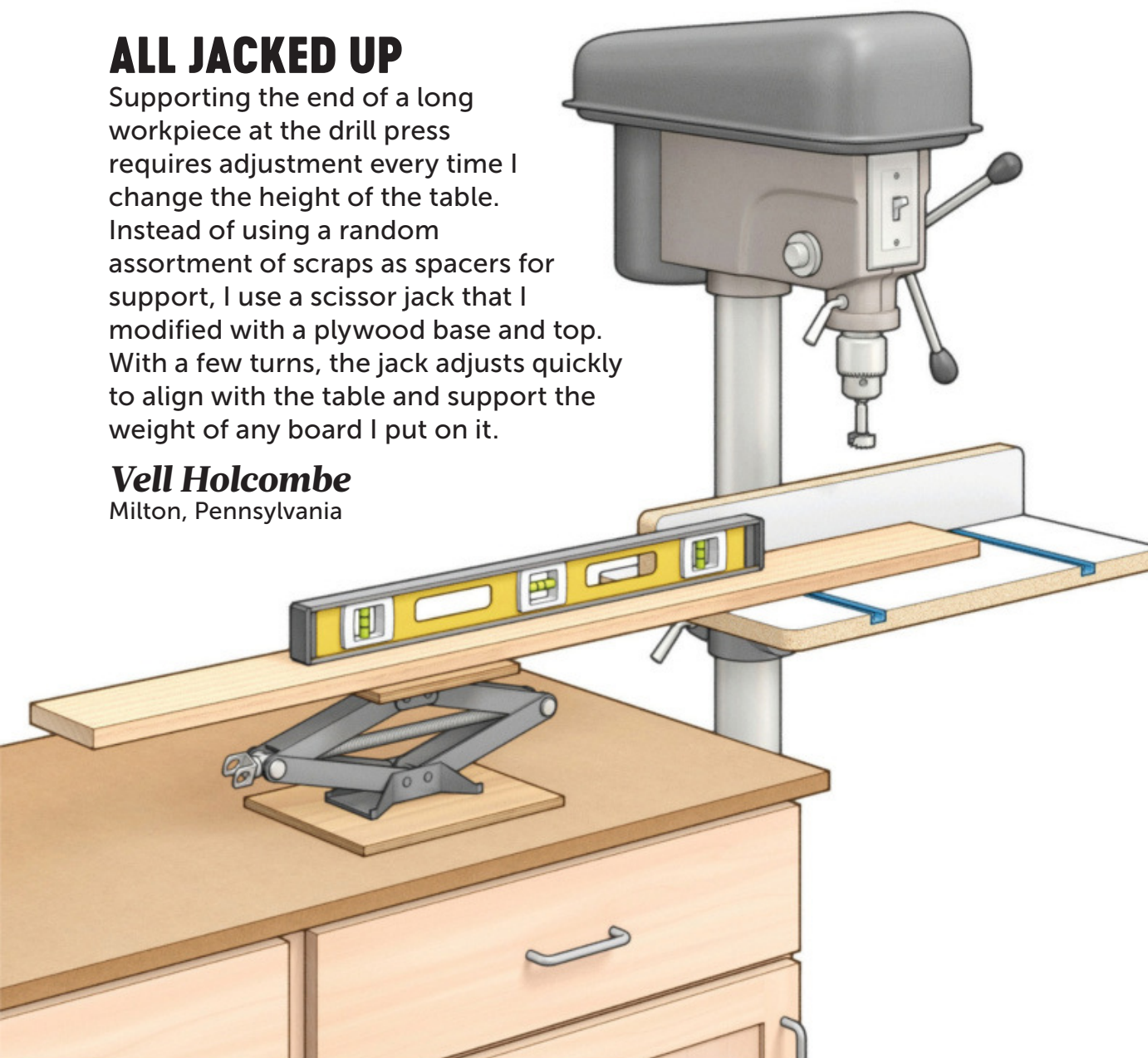
Phoenix, Arizona

ALL JACKED UP

Supporting the end of a long workpiece at the drill press requires adjustment every time I change the height of the table. Instead of using a random assortment of scraps as spacers for support, I use a scissor jack that I modified with a plywood base and top. With a few turns, the jack adjusts quickly to align with the table and support the weight of any board I put on it.

Vell Holcombe

Milton, Pennsylvania



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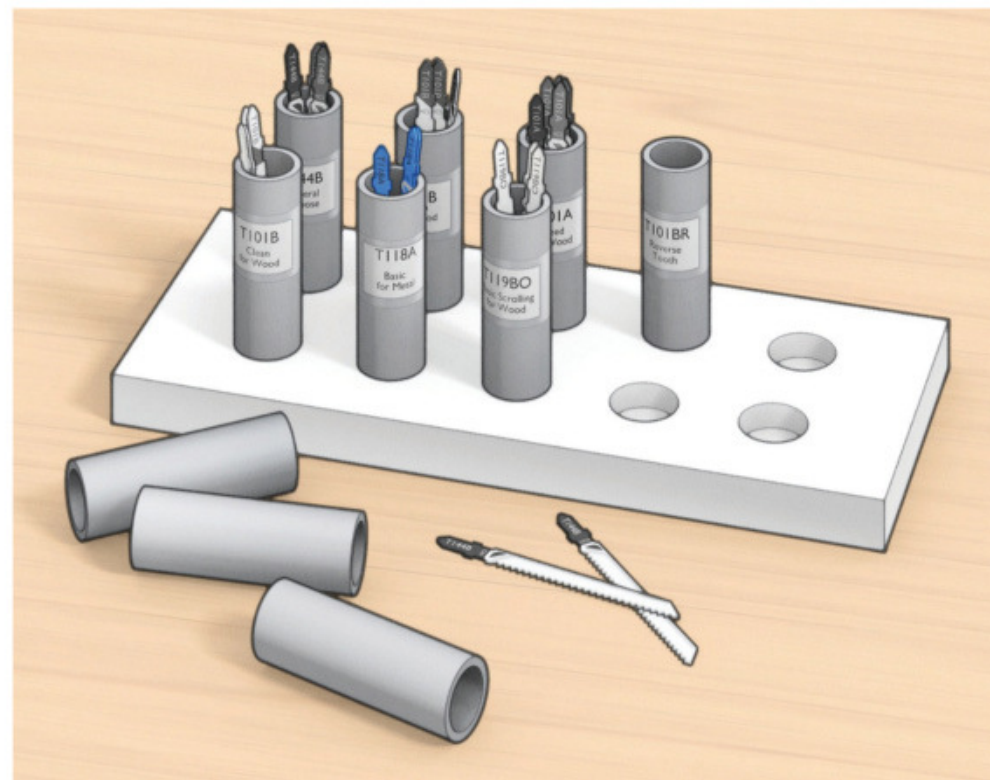
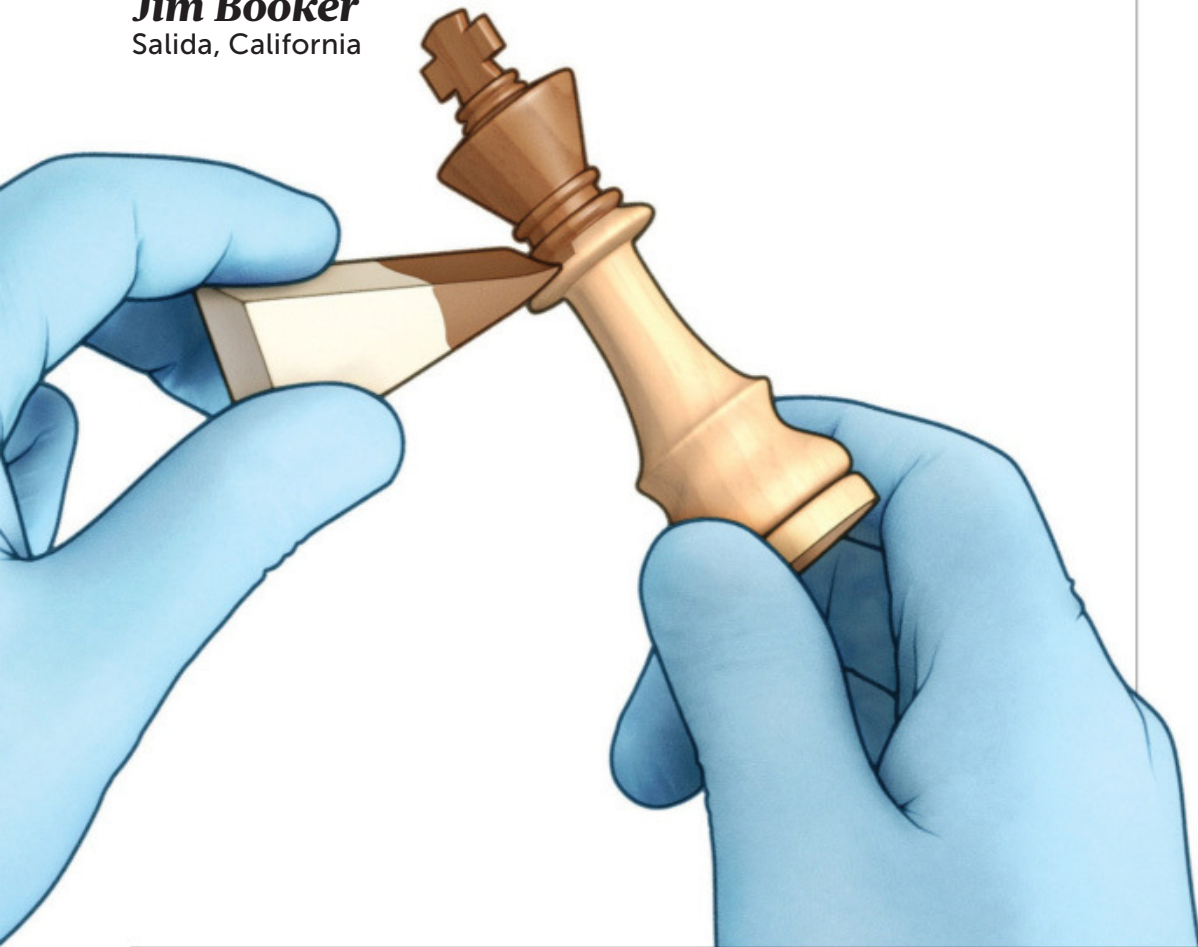


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WONDER WEDGES

When staining small pieces or projects, I like to use foam cosmetic wedges to apply stain. They absorb just the right amount of stain and the small end of the wedge works great to get into tight areas. They also work great for touch-ups. When used with water-based finishes, I simply toss them in the trash. To avoid a potential fire with oil-based finishes, I lay the used wedges out on concrete until the finish cures or toss them into a covered, water-filled container.

Jim Booker
Salida, California



DOWN THE TUBES

I own a wide variety of jigsaw blades, each designed for a specific purpose or material. To better organize the blades, I made a storage rack from plastic pipe and a piece of PVC trim. I printed labels and attached them to the pipes using clear tape, making it easy to select the correct blade for the task at hand. This worked so well I made another rack for scrollsaw blades.

Walt Henry
Centerville, Massachusetts

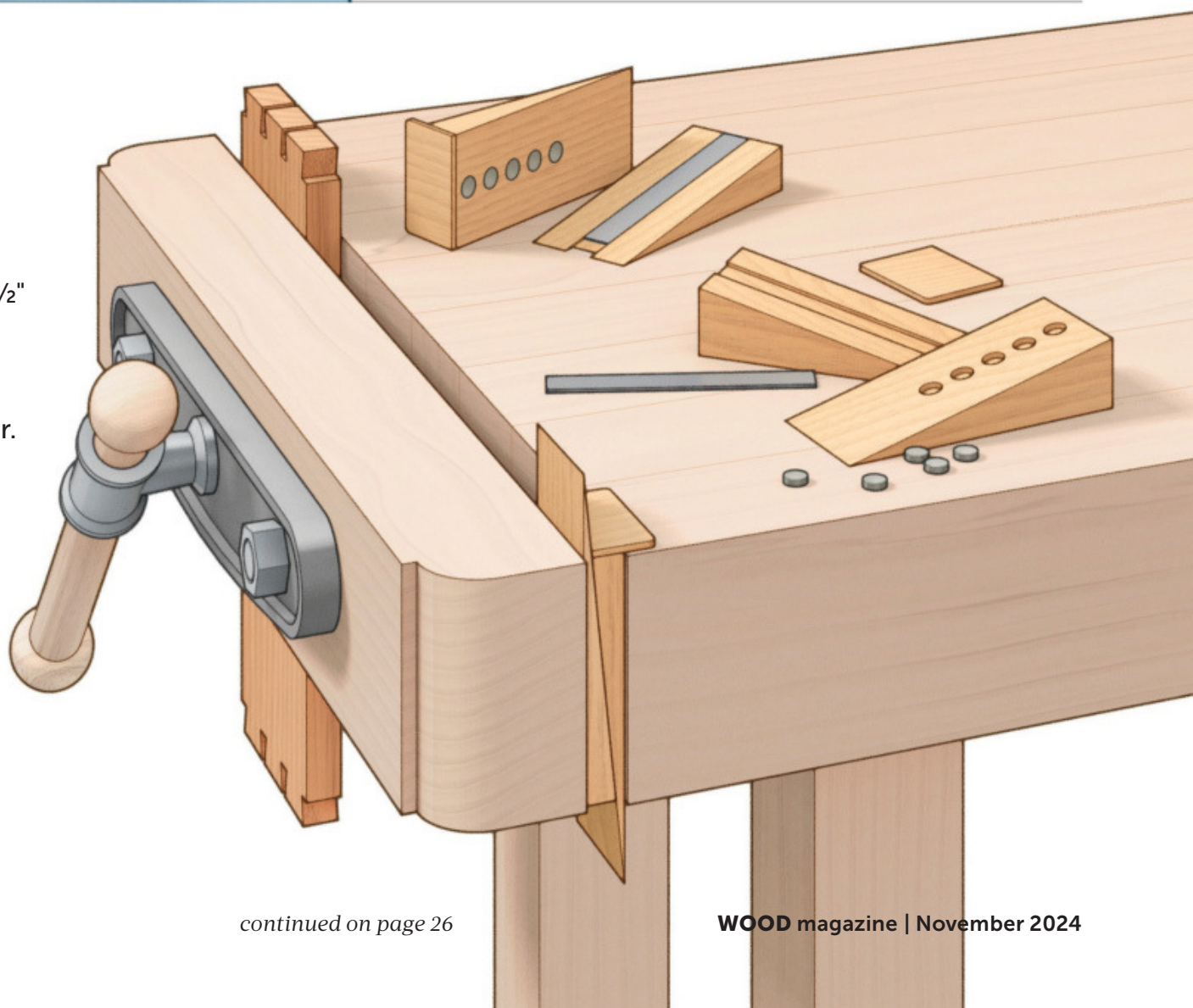
WISE VISE ADVICE

Conventional workbench face vises have a tendency to rack when a workpiece is clamped at one end. To combat this, I cut two pairs of wedges from 4/4 scrap and another pair from 8/4 scrap. All measure 2½" wide by 6" long.

In half of the wedges, I cut a shallow groove down the center of one face into which I installed a length of ½" steel flat bar. In the rest, I drilled five counterbores and set in rare-earth magnets using epoxy.

Sliding the wedge halves adjusts the thickness, while the magnets hold them where set. A ¼" cleat glued to one end of each magnetic wedge keeps it from dropping through the vise, leaving my hands free to clamp the workpiece without the vise racking.

Carl Stefaniak
Hinckley, Ohio



1920s Style for a 1920s Price

It was a warm summer afternoon and my wife and I were mingling with the best of them. The occasion was a 1920s-themed party, and everyone was dressed to the nines. Parked on the manse's circular driveway was a beautiful classic convertible. It was here that I got the idea for our new 1920s Retrograde Watch.

Never ones to miss an opportunity, we carefully steadied our glasses of bubbly and climbed into the car's long front seat. Among the many opulent features on display was a series of dashboard dials that accentuated the car's lavish aura. One of those dials inspired our 1920s Retrograde Watch, a genuinely unique timepiece that marries timeless style with modern technology.

With its remarkable retrograde hour and minute indicators, sunburst guilloché face and precision movement, this design is truly one of a kind. What does retrograde mean? Instead of displaying the hands rotating on an axis like most watches, the hands sweep in a semicircle, then return to their starting point and begin all over again.

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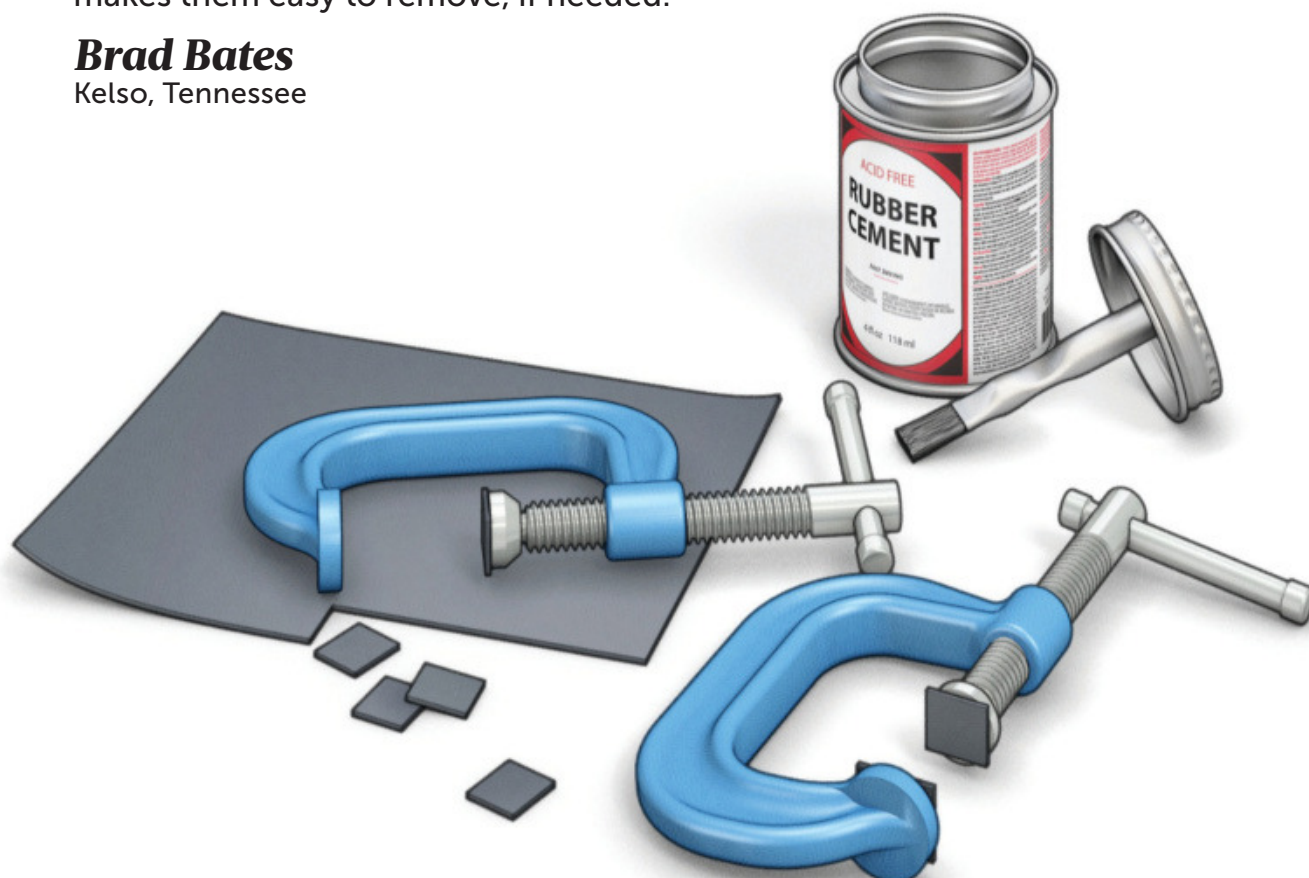
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SHOP TIPS

DON'T BLOW A GASKET!

I use C-clamps for small assemblies, but often end up with indentations. Clamping pads help, but require a third hand I don't have to hold them in place. So, I made stick-on pads using inexpensive rubber gasket material (available in auto parts stores). Rubber cement holds the pads securely yet makes them easy to remove, if needed.

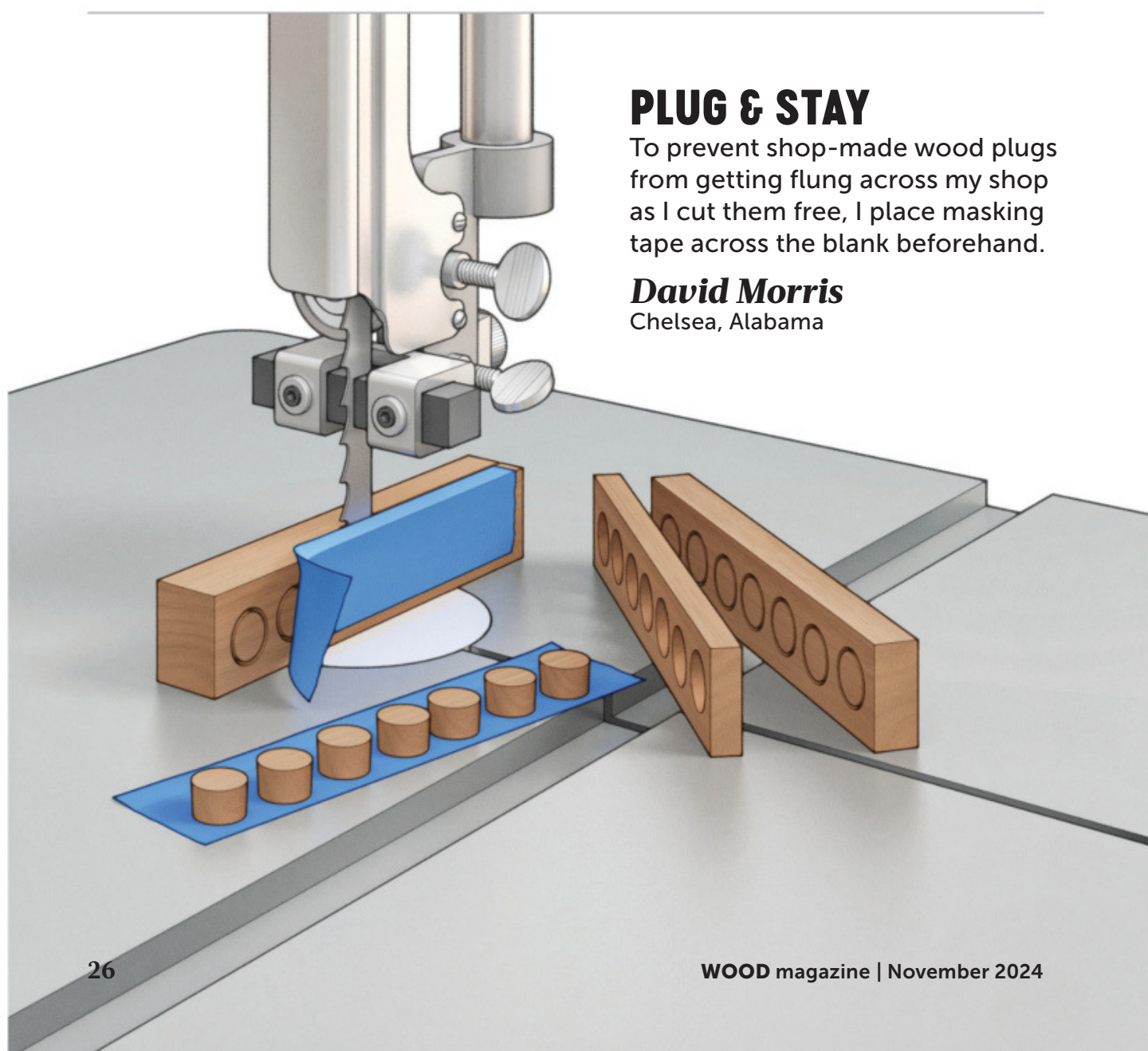
Brad Bates
Kelso, Tennessee



PLUG & STAY

To prevent shop-made wood plugs from getting flung across my shop as I cut them free, I place masking tape across the blank beforehand.

David Morris
Chelsea, Alabama



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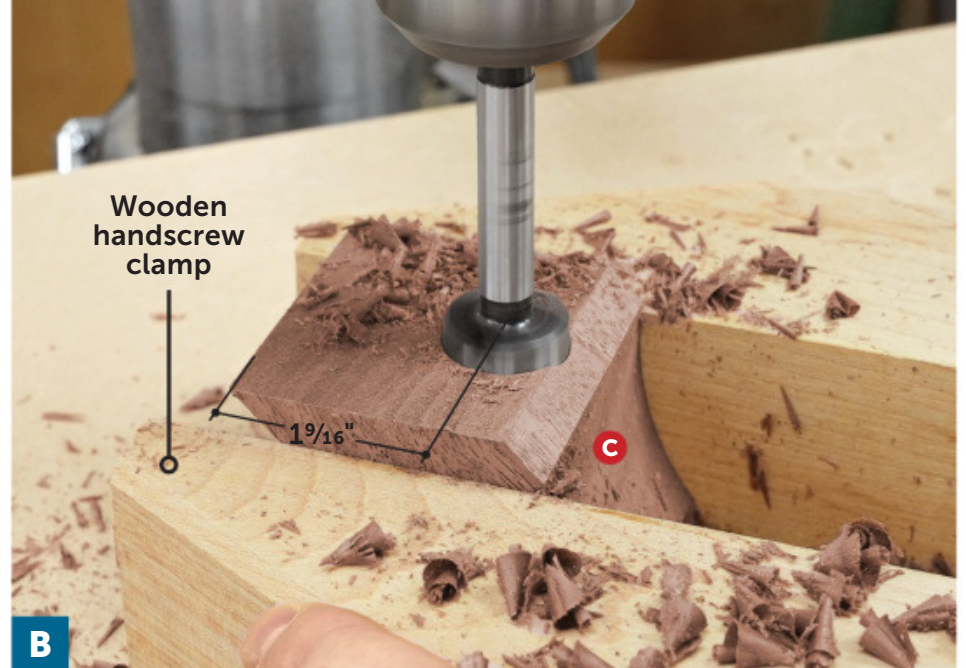
OVERALL DIMENSIONS
21³/₁₆"W × 22¹/₂"L × 6¹/₄"H

Working wood by hand brings heightened satisfaction, especially when you use a tool you've built with your own hands. With its long bed, this jointer plane trues up workpiece edges for perfect glue-ups. The kit provides a high-quality iron and adjustment hardware necessary to produce ribbon-like shavings. You choose and machine the contrasting wooden body parts, sculpt the tote, and turn the knob.

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



A Raise the dado blade to $\frac{1}{2}$ " above the table and set the rip fence as a stop. Using an auxiliary fence on the miter gauge, rabbet one end of the rear infill (B) in multiple passes.



B Support the bed extension (C) with its 45° offcut and clamp it with the mitered end square to the $\frac{7}{8}$ " Forstner bit. Drill the adjuster cup hole $\frac{5}{8}$ " deep centered on the extension's width.

MACHINE THE INFILLS

Sandwiched between the sides, the front and rear infills get machined to hold the adjustment hardware and form the angled bed that supports the plane iron [Exploded View].

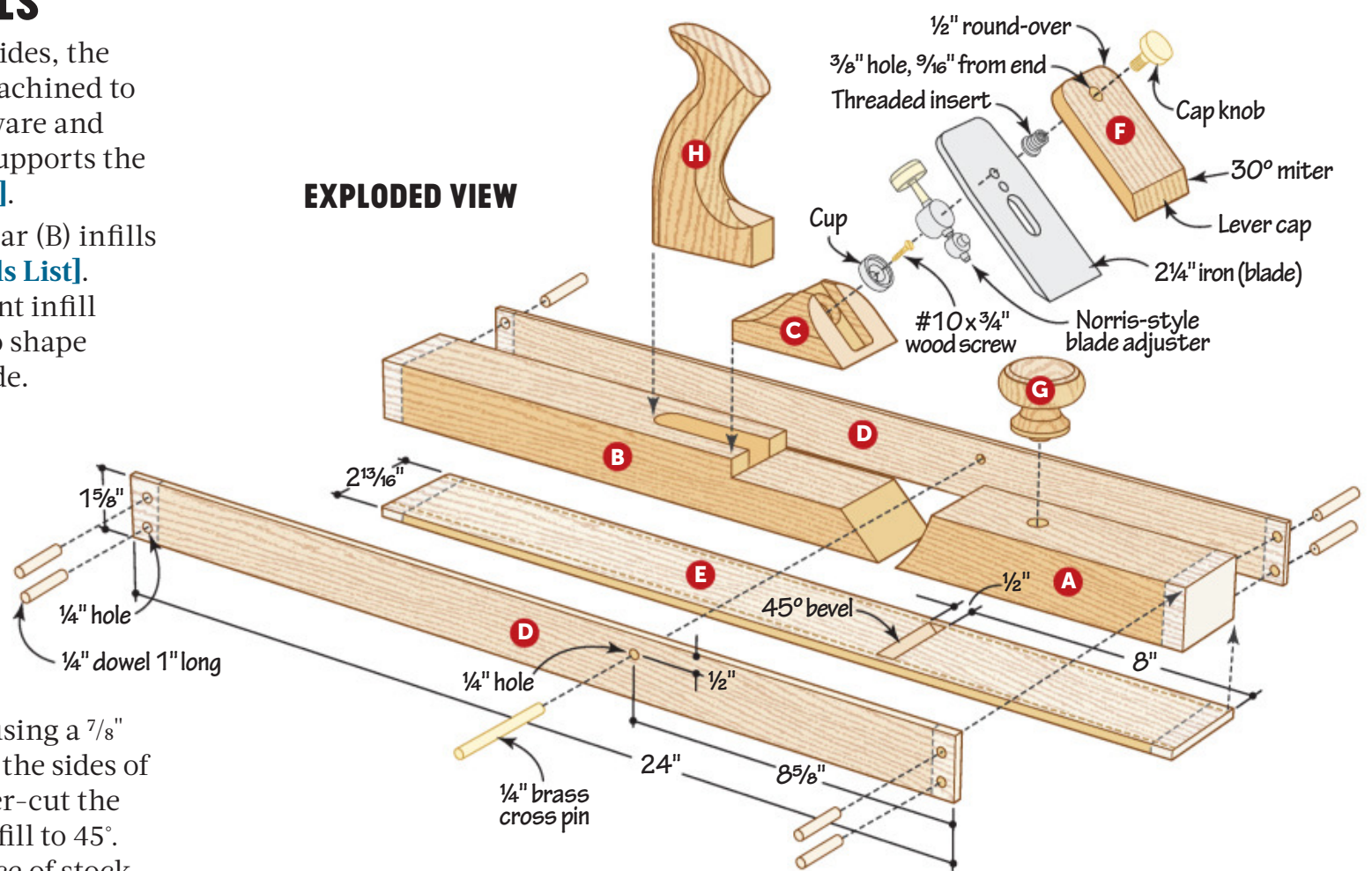
1 Cut the front (A) and rear (B) infills to overall size [Materials List]. Mark a 4" radius on the front infill (A), bandsaw and sand it to shape [Drawing 1], then set it aside.

2 Install a dado blade in your tablesaw and rabbet one end of the rear infill (B) [Photo A], then mark out a $3\frac{1}{8}$ " slot for the tote along the upper face of the rear infill [Drawing 1]. Form the slot by drilling overlapping holes 1" deep using a $\frac{7}{8}$ " Forstner bit, then clean up the sides of the slot using a chisel. Miter-cut the rabbeted end of the rear infill to 45°.

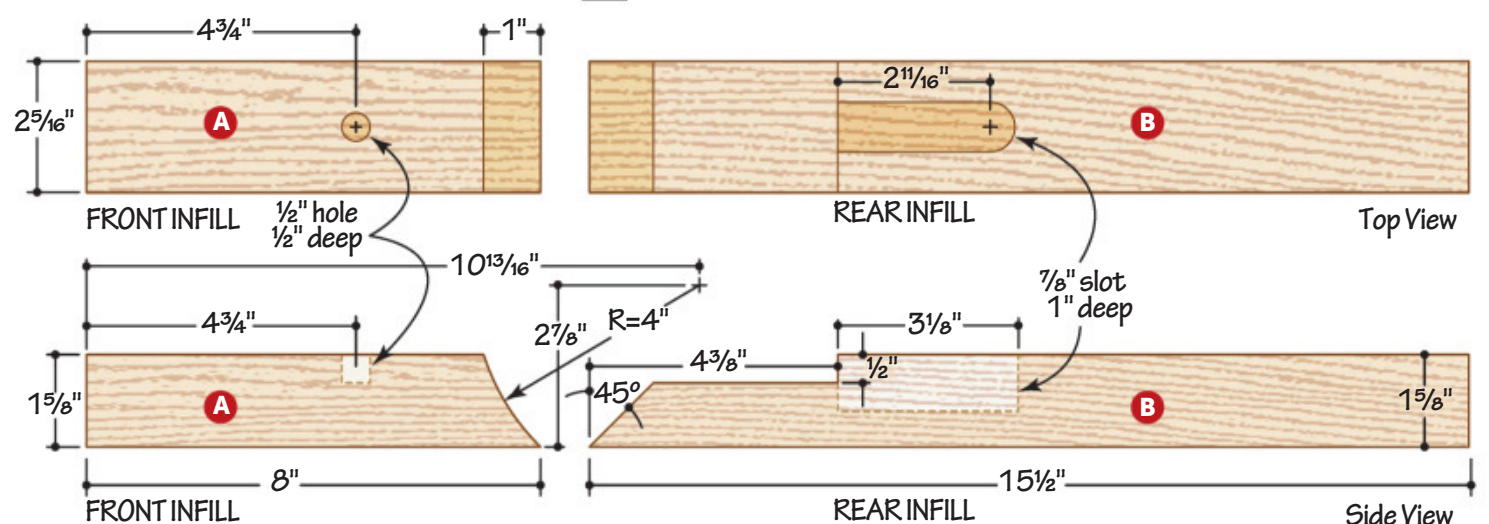
3 Cut an overlength piece of stock for the bed extension (C) and plane it to $1\frac{3}{8}$ " thick. Miter-cut one end to 45° [Drawing 2]. Cut the extension to final length, matching the rabbeted portion of the rear infill, then bandsaw and sand the radius on the non-mitered end. Drill the adjuster cup hole [Photo B].

4 Glue and clamp the bed extension (C) to the rear infill (B) [Exploded View]. When the glue dries, clamp the rear infill assembly (B/C) in a vise and rout the slot for the adjuster in the mitered end [Photo C].

EXPLODED VIEW



1 INFILL VIEWS



TIP!

To avoid breaking the soft brass screw, drive a steel screw first to cut threads in the wood.

5 Sand round-overs on the upper corners of the bed extension (C). Glue the adjuster cup in position with a couple drops of cyanoacrylate (CA) glue, drill a pilot hole and drive the brass screw to secure the cup in place.

ADD SIDES AND SOME SOLE

To help keep the sides and infill pieces aligned during glue-up, you'll drill and install dowels. These get trimmed off later before applying finish.

1 From $\frac{1}{4}$ " stock, cut the sides (D) to size [\[Exploded View and Materials List\]](#). Clamp a side to the front infill (A), making sure the ends and edges are aligned, and drill the alignment-pin holes [\[Photo D\]](#). Align the rear infill assembly (B/C) with the opposite end of the side (D), and drill pin holes at that end. Repeat this process to drill pin holes for the other side.

2 Glue the infills between the sides, glue and drive dowels in the alignment holes, then clamp the assembly together. Use plenty of clamps to ensure even clamping pressure. Note that you should have a $\frac{1}{2}$ " gap between the infills on the bottom face.

3 Measure the plane body (A-D) and cut the sole (E) to size from $\frac{1}{4}$ " stock. Glue and clamp the sole to the bottom face of the plane body.

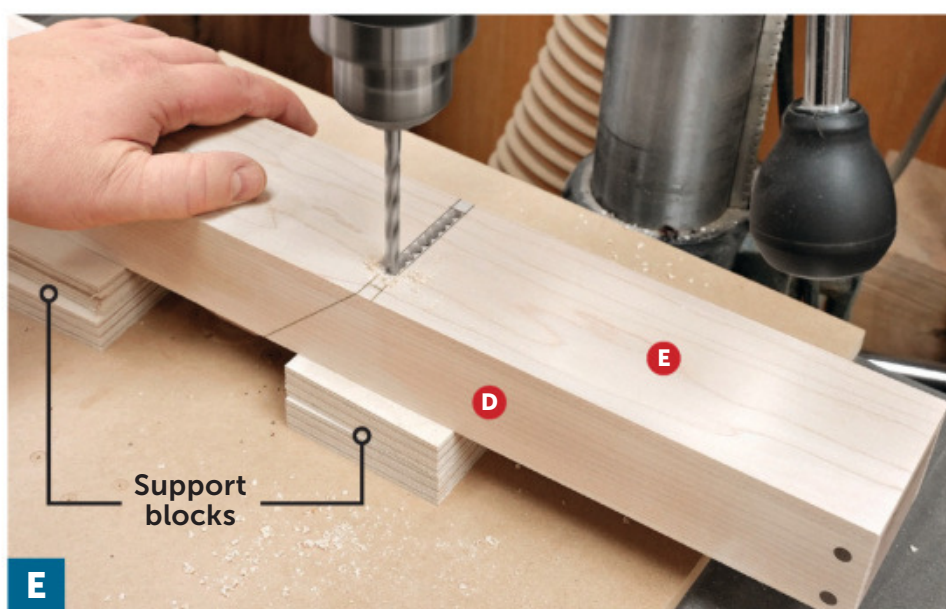
4 Lay out the mouth of the plane by first transferring the intersection of the bed extension to the outer sides, extending the line at 45° to the bottom, then connecting the marks across the sole. Use a $\frac{1}{4}$ " brad-point bit to form the mouth [\[Photo E\]](#). Complete the mouth by



Using a router equipped with a fence and $\frac{1}{4}$ " spiral upcut bit, rout the $\frac{5}{16}$ "-deep slot for the adjuster. Rout one edge, then the other, and then remove the waste in the center of the slot.



Clamp a side (D) to the front infill (A) and drill $\frac{1}{4}$ " holes 1" deep for the $\frac{1}{4}$ " dowel alignment pins. Repeat this step for the rear infill assembly (B/C), then repeat the same steps for the other side.



Mark the mouth location on the bottom of the sole (E), then drill overlapping holes using a $\frac{1}{4}$ " brad-point bit. Support the plane body on blocks to provide clearance for the bed extension (C).

laying a chisel flat against the bed on the rear infill and paring away the waste at a matching angle. Then square up the toe end of the mouth and sand the opening smooth.

5 Mark the location of the brass cross pin on both sides of the plane body [\[Exploded View\]](#) and drill $\frac{1}{4}$ " holes. Drive and glue the pin in place with CA glue, wiping away any excess before it cures, then file and sand the cross pin flush with the sides.

6 Cut the lever cap (F) to size [\[Materials List\]](#), and cut a 30° bevel on one end, then round over the corners on the opposite end [\[Exploded View\]](#). Drill a $\frac{3}{8}$ " hole and install the threaded insert with a couple of drops of CA glue. Check the fit of the lever cap with the plane iron in place.

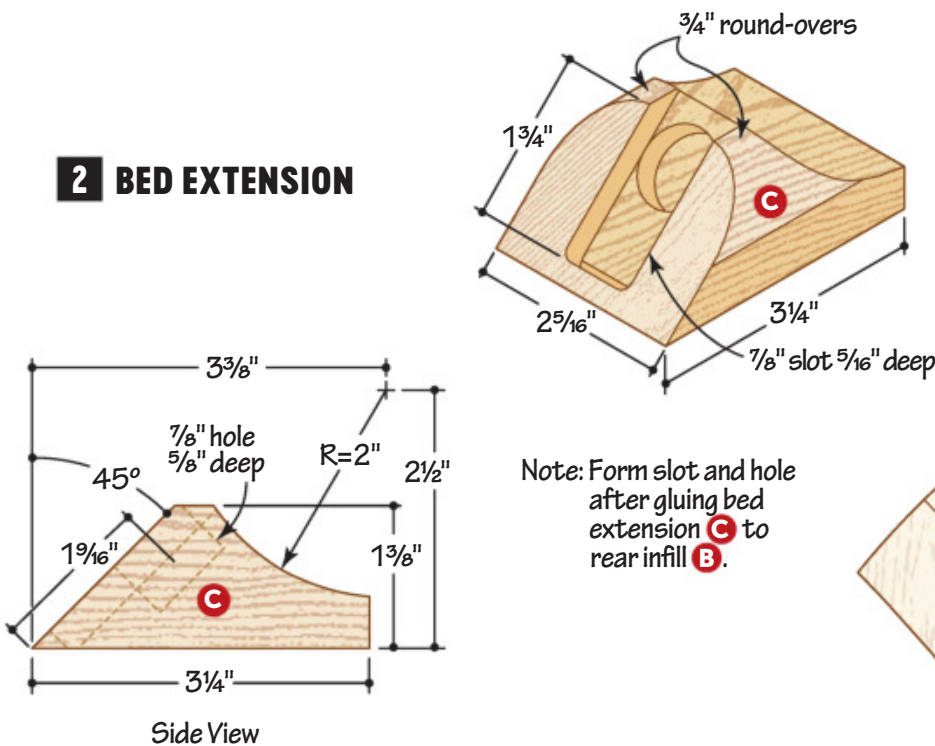
ADD THE KNOB AND TOTE

- 1 From 8/4 stock, cut a 2"-square blank for the knob (G). Mark and drill a 1/2" hole 1/2" deep in the center of one end. Trim the four corners off the square blank and glue a 1"-long dowel in the blank. Mount the dowel in a lathe chuck and turn the knob using the full-size knob pattern.
- 2 Drill a 1/2" hole for the knob dowel in the front infill [Drawing 1]. Glue the knob in place.
- 3 Using the full-sized tote pattern, cut the tote (H) to shape from 7/8" stock. Use a router with a 1/2" round-over bit to remove much of the waste from the front and rear edges and finish shaping it by hand. Glue the tote in place on the rear infill (B).

TRY IT OUT AND FINISH UP

- 1 Sharpen the plane iron if necessary. Install the iron and lever cap and adjust the iron's position. If the mouth is too tight, use a file to widen it until you have proper clearance. When you're satisfied with the way it cuts, remove the iron and adjuster.
- 2 Cut 3/4" off each end of the plane, eliminating the alignment pins and bringing the plane to finished length. Finish-sand the body and lever cap to 220 grit, then sand the ends of the body to 320 grit.
- 3 Plane or sand 1/16" chamfers on the top edges of the plane body and on the four corners. Apply finish to the plane body and lever cap. We used three coats of Watco natural Danish oil, rubbing out between coats with 0000 steel wool. Once the finish dries, apply a coat of paste wax for added protection. Waxing the sole occasionally will keep the plane gliding along as you roll up paper-thin shavings! 🌲

2 BED EXTENSION



MATERIALS LIST

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A	FRONT INFILL	1 5/8"	2 5/16"	8"	W	1
B	REAR INFILL	1 5/8"	2 5/16"	15 1/2"	W	1
C*	BED EXTENSION	1 3/8"	2 5/16"	3 1/4"	W	1
D	SIDES	1/4"	1 5/8"	24"	M	2
E	SOLE	1/4"	2 13/16"	24"	M	1
F	LEVER CAP	3/8"	2 1/4"	3 1/2"	W	1
G*	KNOB	2"	2"	1 5/8"	W	1
H*	TOTE	7/8"	5 3/8"	3 1/8"	W	1

*Parts initially cut oversize. See the instructions.

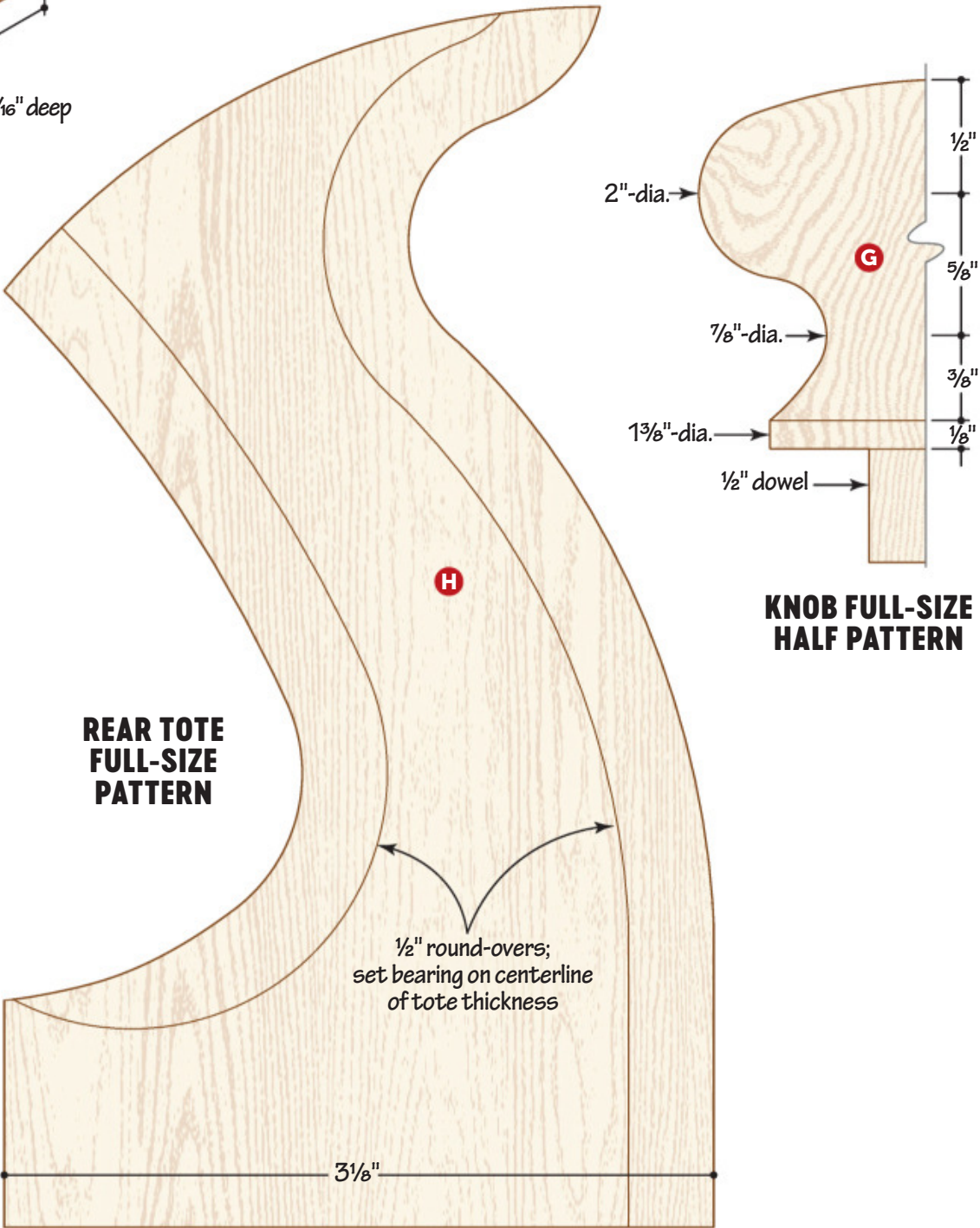
MATERIALS KEY: M—maple, W—walnut.

SUPPLIES: 1/4" dowel, 1/2" dowel.

BLADES AND BITS: Dado blade, 7/8" Forstner bit, 1/4" brad-point drill bit, 1/2" brad-point drill bit, 1/4" spiral upcut and 45° chamfer router bits.

SOURCES: Veritas 2 1/4" wooden bench plane hardware kit, no. 05P4061, \$85, www.leevalley.com.

PROJECT COST: It cost us about \$150 to build this project. Your cost will vary by region and source.



FLAWLESS-FIT INSET DOORS

A systematic approach and attention to detail yield perfect results.

WRITER: VINCE ANCONA with KEVIN BOYLE



Download a free article on tips for building square assemblies.
woodmagazine.com/
startsquare

Nothing says fine craftsmanship like a well-fitted inset cabinet door—one that not only opens and closes smoothly, but also has a consistent gap around all four edges. The human eye easily detects small differences in spacing, making this detail matter.

Your first inclination might be to dive in and build a door smaller than your opening to account for the gaps. But an opening that is even slightly out of square will quickly frustrate by creating gaps that are uneven or vary in width from one end to the other.

You'll have better luck by making the door just slightly oversize, then trimming it to fit the opening. Focusing on one edge at a time, in a specific order,

will allow you to sneak up on a custom fit with consistent gaps on all four sides. Here's how.

OPEN WITH THE CASE

Make your door-fitting job easier by taking care to build a case that is square in every direction. Once you've done that, place the cabinet on a flat surface to eliminate twist and racking, then check the opening for square [Photo A].

Next, measure the opening's width at the top and bottom, as well as its height at the left and right sides [Photo B]. If your opening is square, increase the width of your rails and stiles to shoot for a door that is a tight fit [Photo C].

TIP!

For hopelessly out-of-square openings, or if you don't want to deal with custom-fitting each door, consider overlay doors.



A Before checking the door opening for square, place the cabinet on a stable, flat surface and install the back of the cabinet (if you haven't already).



B Measure the width and height of the opening at several points. Use the largest measurement in each direction when sizing your door.



C If the opening is relatively square, size the door for a tight fit. This makes it easier to fit the door, while still providing enough extra material for trimming.

PHOTOGRAPHER: CARSON DOWNING



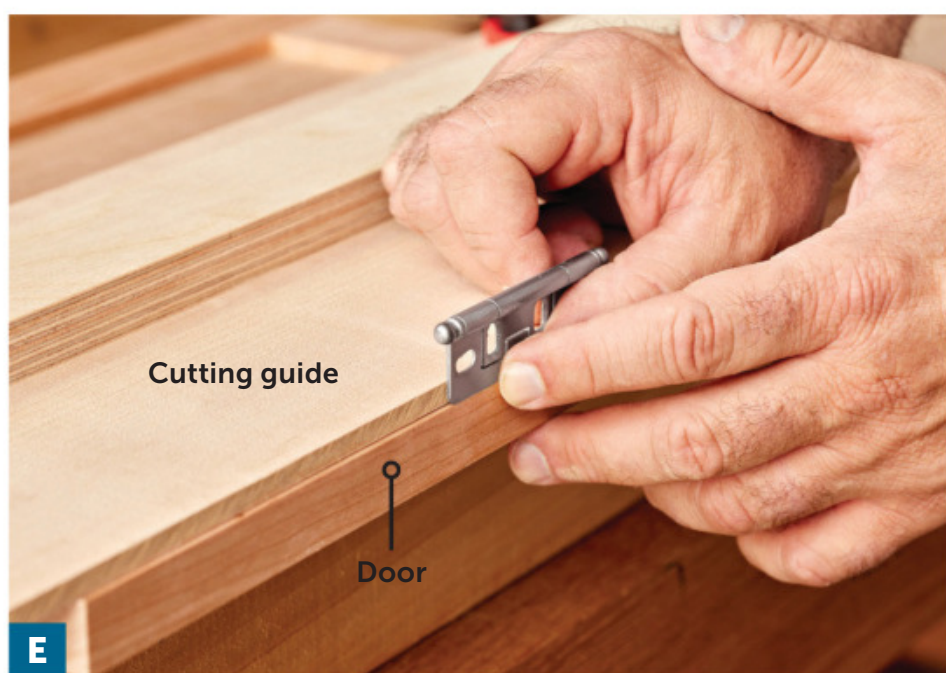
Note: Non-mortise hinges are easier to install and align than traditional hinges.

MIND THE GAP

Before you start trimming away at the door, you'll need to determine the amount of gap, or reveal, that you want. You'll find various opinions on what constitutes an ideal gap, but in reality the hinges you're using will often dictate this decision. For non-mortise hinges (which we choose most of the time), use calipers to measure the thickness [Photo D]. For traditional mortised hinges, measure the gap between the hinge leaves with the hinge closed and the leaves parallel.



To determine the ideal gap around the door, measure the thickness of the hinge using a digital caliper. The non-mortise hinges we used measure $\frac{1}{16}$ " thick.



Clamp the cutting guide in place to trim an amount equal to the desired gap from the hinge stile. We used one of the hinges as a gauge to determine where to position the guide.

START ON THE HINGE STILE

You'll start trimming the door at the hinge stile. A tablesaw sled will work for small doors, but we prefer a tracksaw or a circular saw with a guide (see *Make Precise Cuts With a Shop-Made Guide*, below). Clamp the saw guide parallel with the hinge stile to trim off an amount just equal to your desired gap [Photo E]. Using a fine-tooth blade, trim the stile [Photo F].

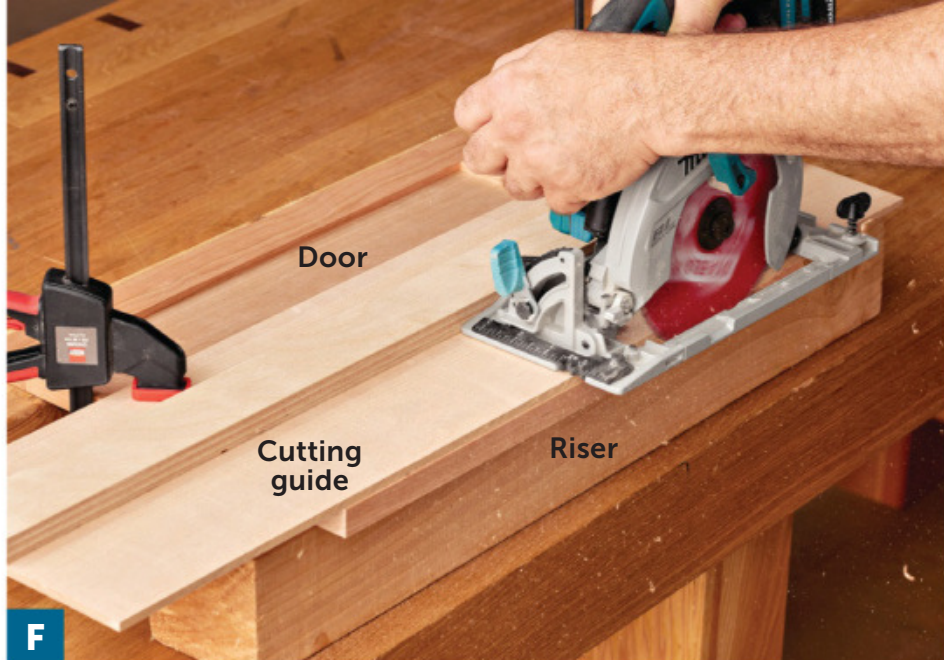
Set the door in the case, holding the hinge stile tight against the side of the opening to check for any gaps. (If your door is too large to fit in the opening, hold it ajar to fit the edge of the hinge stile against the case.)

If you observe any gaps between the stile and the case frame, use a hand plane to remove the high spots on the door stile, as well as any saw marks [Photo G]. Continue checking the fit against the case and trimming with the hand plane until you have a seamless fit between the hinge stile and the case.

MAKE PRECISE CUTS WITH A SHOP-MADE GUIDE

Make a zero-clearance cutting guide for your circular saw with just a couple of scraps of plywood or hardboard. Start with a wide piece of $\frac{1}{4}$ " plywood or hardboard for the base of the guide, then rip and glue a narrow, straight strip of wood to the base to serve as a fence. After the glue dries, place the saw's shoe against the fence and run the saw along the base to trim it flush with the blade. With your new saw guide, you can cut straight, reduce tear-out, and easily set up accurate cuts by simply aligning the base of the guide with your cutline.





With the door and cutting guide resting on risers (or overhanging your workbench), trim the hinge stile using a circular saw. A fine-tooth blade will leave a smooth edge.

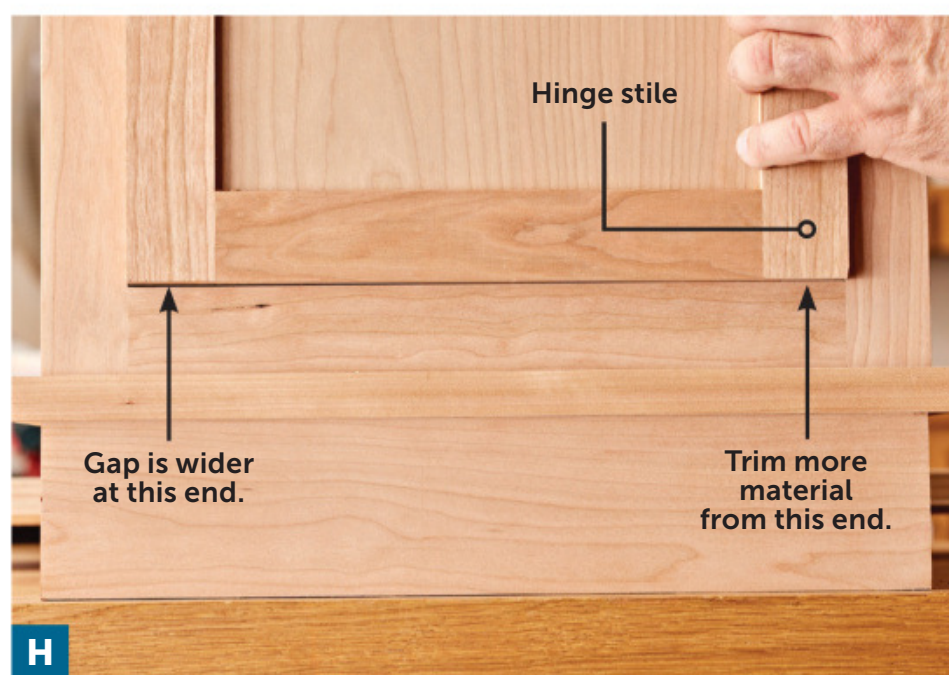


After checking the cut edge against the case opening, use a hand plane to remove the saw marks and to adjust the fit of the hinge stile to the case.

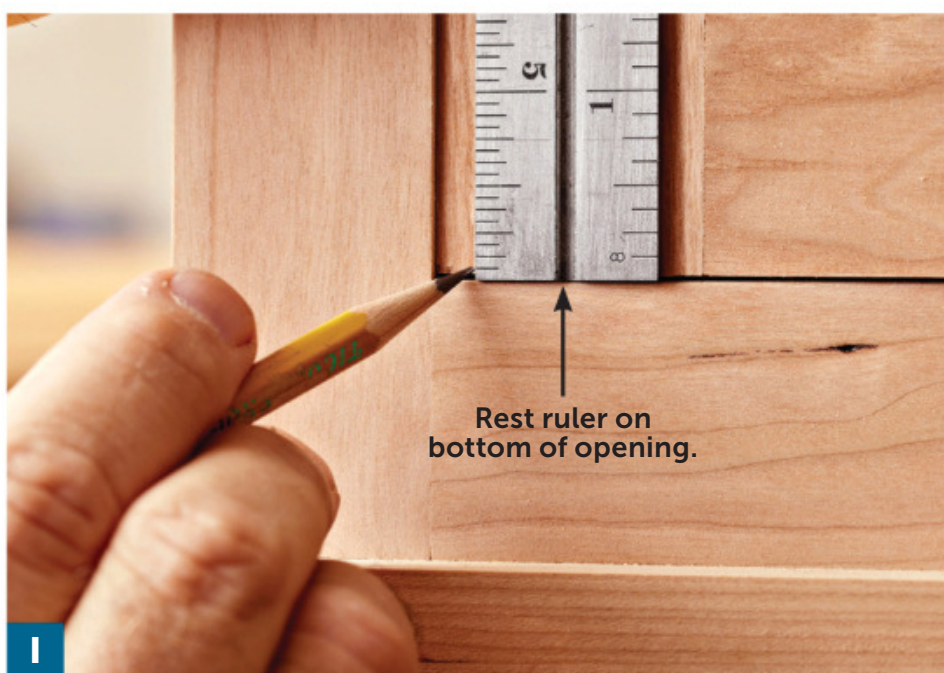
TRIM THE BOTTOM RAIL

Next, move to the bottom rail. Rest the door on the bottom of the opening, with the hinge stile butted tightly against the side of the opening [Photo H]. Measuring from the bottom of the opening, mark the width of the gap at each end of the door [Photo I]. This ensures that you'll be trimming the door parallel with the bottom of the opening. Clamp your saw guide along these marks [Photo J] and trim the bottom edge of the door.

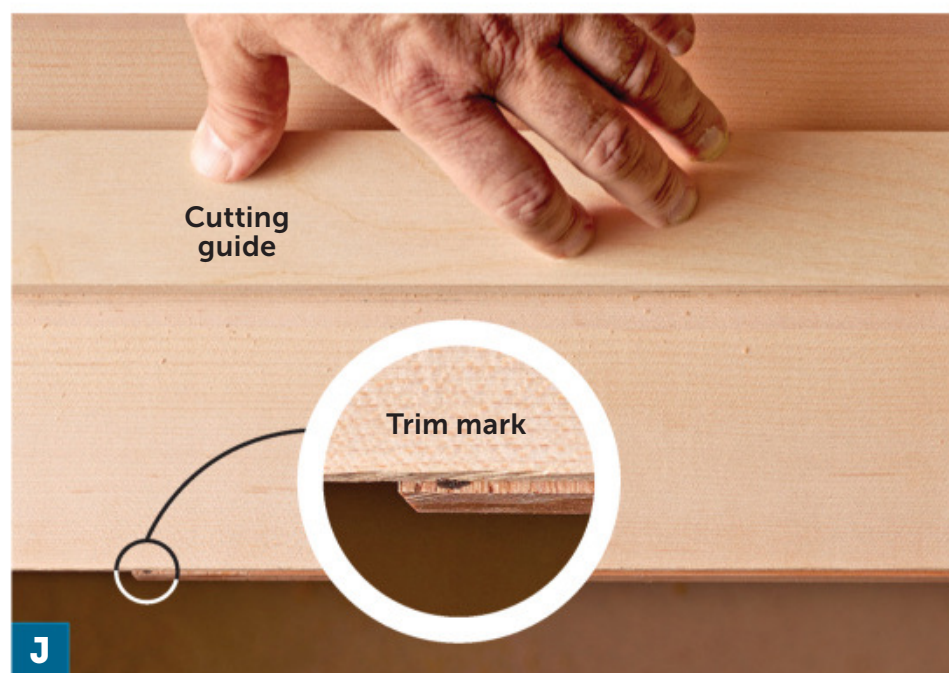
Check the fit of the door against the bottom of the opening and make any necessary adjustments using the plane. Work from the outer edge to the center in both directions when planing the bottom (and top) of the door to prevent tearing out the end grain on the stiles.



Rest the door in the opening with the hinge stile tight against the case to reveal any issues with squareness. The gap on the left side indicates more material will have to be removed from the right side.



With the hinge stile butted against the opening, measure from the bottom of the opening and mark the door (at $\frac{1}{16}$ " in our case) at each end to indicate where to position the cutting guide to make the cut.



Align the cutting guide with the marks you made at each end of the door and clamp it in place to trim the bottom rail just to the waste side of your marks. Clean up the cut edge with your hand plane.



K If you're using no-mortise hinges, use them as spacers to position the door at the proper height in the opening before marking the top rail for trimming. Or you can make spacers by ripping thin strips.

L Set the door back in the opening, resting on the spacers, to measure the top gap. Fine-tune the fit with your hand plane to make the gaps at the top and bottom of the door equal.

TAKE IT TO THE TOP

With the bottom edge fit, move on to the top. Set the door in the case, resting on spacers that are the same thickness as your door gap [\[Photo K\]](#). Mark the top rail of the door for trimming, measuring from the top of the case opening, and then trim the top rail. Here, you can set your saw guide to trim a hair shy of your marks to allow a little more material for planing.

Set the door back into the opening, again on spacers, to check the gap along the top rail [\[Photo L\]](#), then fine-tune the fit with your hand plane. Remove enough material so the gap at the top is equal to the gap at the bottom.

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A CIRCULAR SAW WILL QUICKLY GET YOU INTO THE BALLPARK. BUT FOR FINAL FITTING, NOTHING BEATS A HAND PLANE.

-VINCE ANCONA, CONTRIBUTING EDITOR

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M After mounting the hinges to the door, place the door in the opening and mark the knob stile at the top and bottom for trimming.

FINISH FITTING IN STILE

Before fitting the remaining edge (the knob stile), install the hinges on the door. Place the door in the opening and mark the knob stile for trimming [\[Photo M\]](#). After trimming the edge with the saw, check the fit. At this point, the door should fit in the opening with an even gap on all four edges. If it doesn't, use your hand plane to take a few very thin shavings from any offending edges.

HANG IT ON THE HINGES

With the door fitted to the opening, install the hinges to the case (see *It's All in the Hardware*, below). Center the door in the opening from top to bottom and carefully transfer the hinge locations from the door to the case. Then drill pilot holes in the case [Photo N] and drive the screws.

You may find that the knob stile rubs against the case as you open and close the door. To correct this, plane a slight (2° or 3°) back bevel on the edge of the knob stile (being careful to not take off the front of the

edge) until the door opens and closes freely [Photo O]. With smaller doors, you may be able to do this without removing the door from the case.

Depending on how tightly the doors fit, you may have to make minor adjustments after moving the cabinet to its permanent location. Uneven floors or differences in humidity can affect the fit. But armed with the knowledge you gained from the initial fitting, using a hand plane to make tweaks is a piece of cake. 🌲

IT'S ALL IN THE HARDWARE

To make installing the door easier, choose hinges with slotted holes. This allows you to adjust the hinge slightly up and down or from front to back to dial in a perfect alignment.



Hinges with fixed holes (left) give you one shot at positioning and installation. Hinges with slotted holes (right) allow you to make slight adjustments to the position of the door after installation.



Center the door in the opening, then use a self-centering bit to drill pilot holes for the hinge screws. Mount the door to the cabinet and use the slotted screwholes to adjust the fit.



A back bevel allows the door to clear the case when you open and close it. Create the back bevel with a hand plane, either by skewing the blade slightly or by concentrating your cut along the back edge.

WORKSHOP WALL UNIT

Build the most easily configured—and reconfigured—tool storage you’ve ever seen with just a sheet of plywood and some 1-by boards. Attach custom tool holders wherever you want using only a few screws.

WRITER: CRAIG RUEGSEGGER

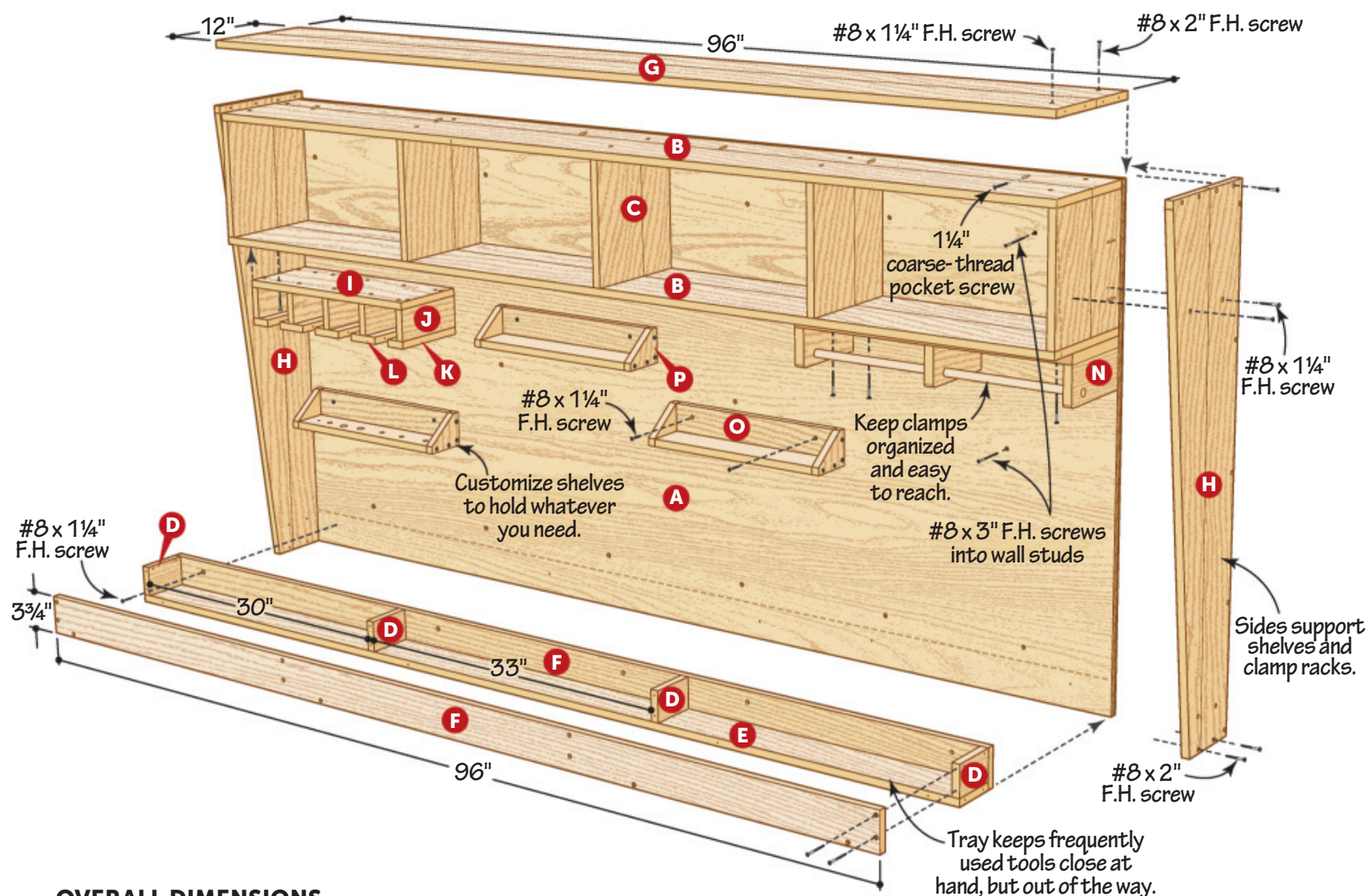
DESIGNER: JOHN OLSON

BUILDER: BRIAN BERGSTROM

The design of this wall storage unit maximizes the 32 square feet of a sheet of plywood. Build and customize tool holders to organize your tool collection. You won’t need to look for studs when hanging them—just screw into the plywood backer.

This unit is shown mounted above the “Bombproof Basic Bench” from issue 298 (October 2024) but can be easily up- or downsized and placed wherever you need tools within easy reach.

EXPLODED VIEW



OVERALL DIMENSIONS

97 1/2" W x 12" D x 48 3/4" H



PHOTOGRAPHER: JACOB FOX
ILLUSTRATORS: ROXANNE LEMOINE,
LORNA JOHNSON





A Temporarily screw the 2-by supports to the wall. Mark the stud locations below a line between the tops of the supports. Stand the backer (A) on the supports and screw it to the studs.



B Position the cleats to place the top of the shelf assembly flush with the top of the backer (A). A helper may be needed to steady the shelf as you drive the pocket screws.

START WITH THE BACKER

The backer is simply a sheet of plywood attached to the wall. Add a shelf unit at the top and a tray at the bottom to provide storage and also serve as anchor points for the sides and top, which further support the structure.

TIP!

36" places the wall unit above the top of the workbench. Adjust the length of the supports to your desired height, if needed.

1 Identify a length of wall where you want to mount the backer (A) and mark a level line 36" above the floor. Cut two lengths of 2-by lumber to temporarily support the backer along this line [Photo A]. Secure the backer to at least three studs using 3" screws [Exploded View].

2 Edge-glue stock for the upper shelf top and bottom (B) and ends/dividers (C). After the glue dries, cut the parts to size [Materials List].

3 Dry-fit and clamp the ends and dividers between the top and bottom [Drawing 1]. Drill $\frac{3}{32}$ " countersunk pilot holes into the ends and dividers. Disassemble, apply glue, and screw the ends and dividers between the top and bottom.

4 Drill pocket holes on the top face of the top shelf, the bottom face of the bottom shelf, and the outside faces of the shelf ends (C) [Drawing 1].

5 Temporarily screw a cleat at each end of the backer (A) to support the shelf assembly as you pocket-screw it in place [Photo B]. Remove the cleats after securing the shelf.

6 Cut the parts for the tray (D-F) to size. Glue the ends and dividers (D) to the bottom (E) [Exploded View]. After the glue dries, add the front and back (F) in the same manner as you did with the upper shelf.

7 Drive screws through the tray back (F) to attach the tray to the backer (A), flush at the bottom [Exploded View].

SUPPORT YOUR BACKER

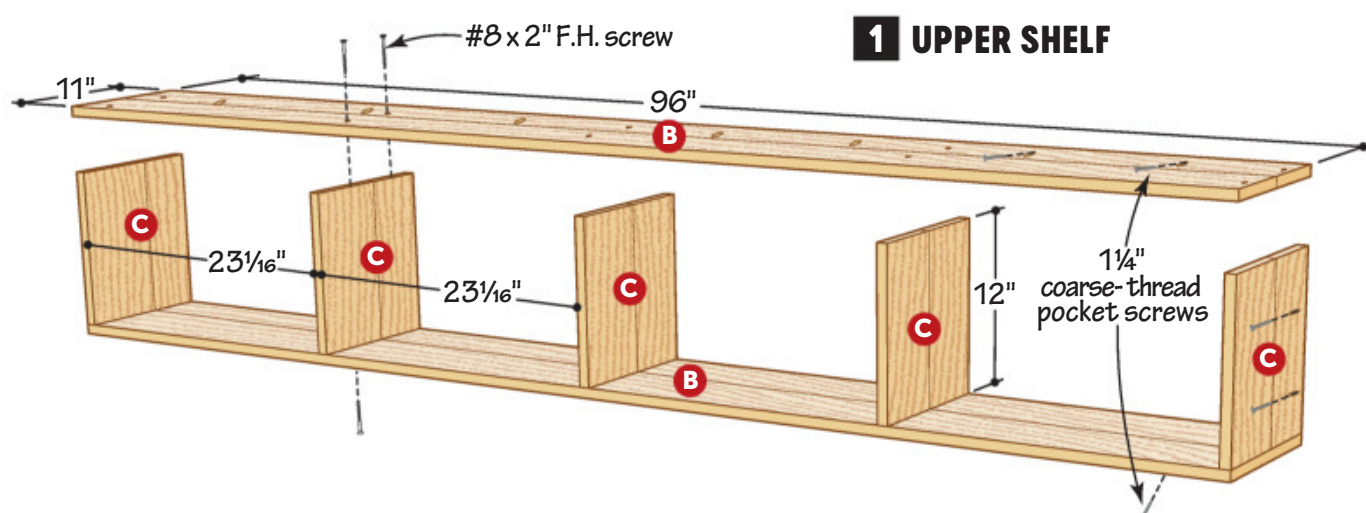
The top (G) and sides (H) brace the upper shelf and tray, as well as other tool holders added later.

1 Edge-glue material for the top (G) and sides (H) [Exploded View, Drawing 2], then cut them to size [Photo C].

2 Screw the top (G) to the upper shelf top (B) [Exploded View]. Use 2" screws into the edge of the backer (A) and $1\frac{1}{4}$ " screws into the shelf top.

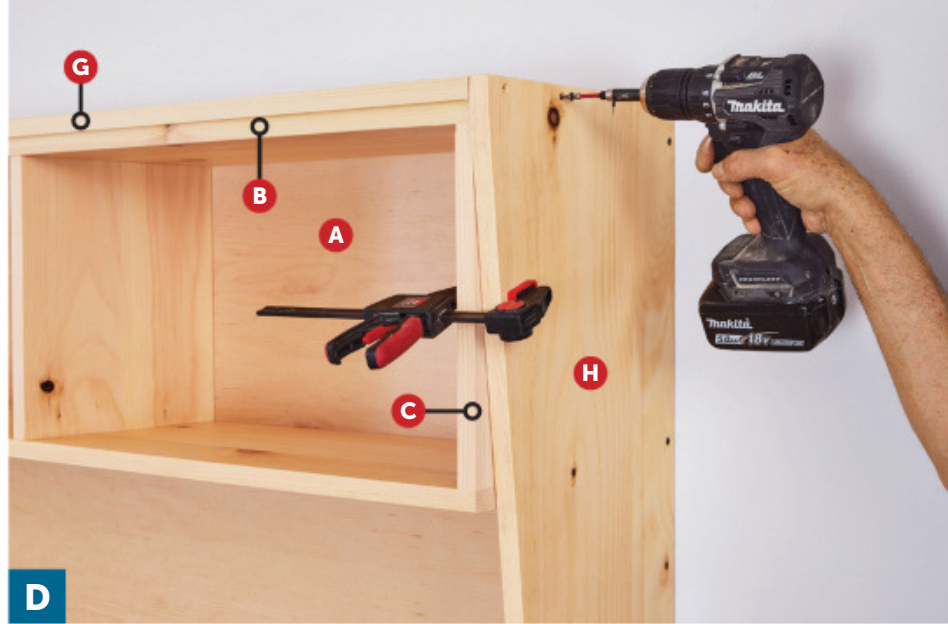


Turn your circular saw into a tracksaw.
woodmagazine.com/circotrack





We tapered the sides (H) using a tracksaw, but you can just as easily use a circular saw. Protect the benchtop with a sheet of polystyrene, then set the depth of cut $\frac{1}{8}$ " more than the stock thickness.



Align the end of the side (H) with the top face of the top (G) and clamp the side in place. Drive screws into the top, shelf end (C), tray end (D), and backer (A).

3 Clamp the sides (H) to the upper shelf ends (C) and tray ends (D). Screw the sides in place [Exploded View, Photo D].

4 Apply a finish to the backer assembly. We brushed on two coats of General Finishes Arm-R-Seal satin urethane.

ADD CUSTOM TOOL HOLDERS

Use these three designs as starting points for making cubbies and holders for your tools. Make as many of each as you need, changing lengths to accept bigger or smaller items.

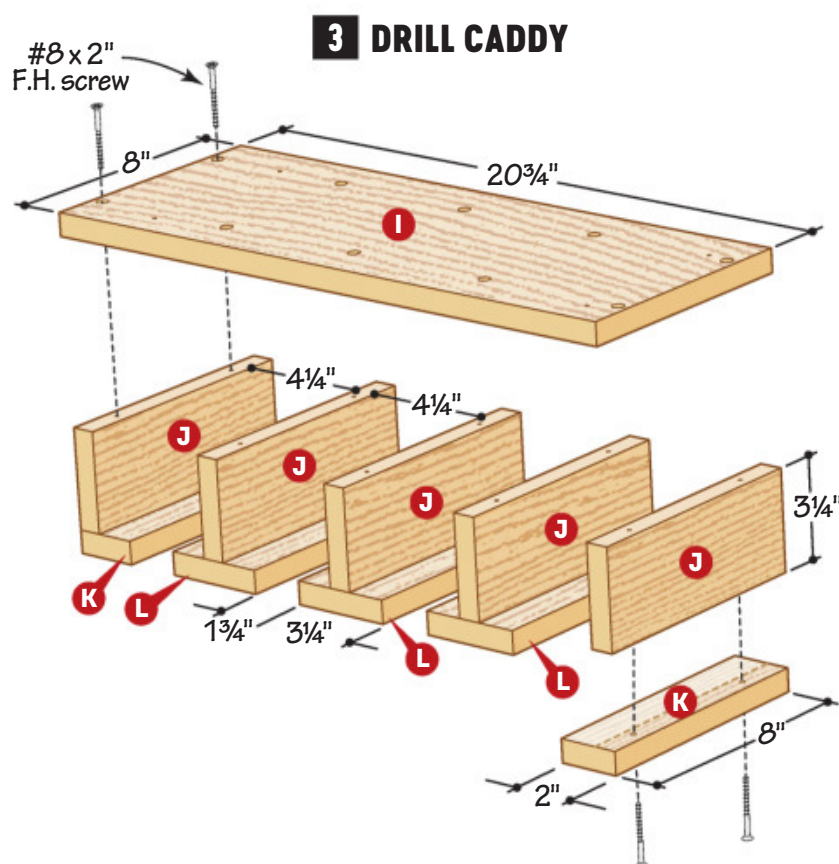
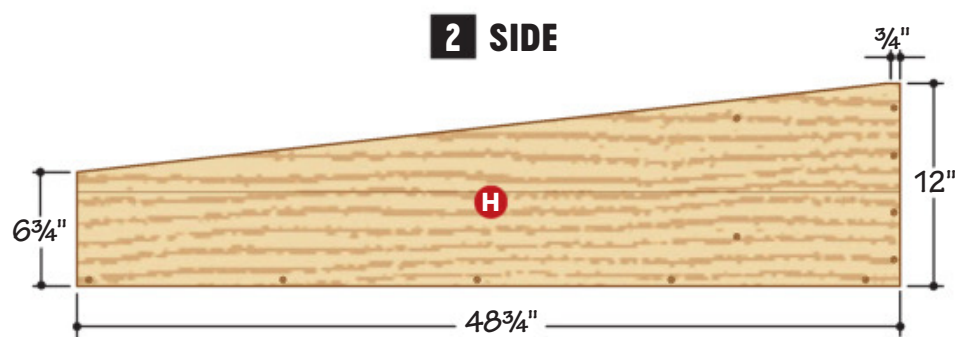
TEE UP A DRILL CADDY

1 Cut to size the drill-caddy top (I), dividers (J), and cleats (K, L) [Drawing 3]. Glue and screw each cleat to a divider, with the narrow cleats (K) flush with the face of the divider, and the wide cleats (L) centered.

2 Glue and screw each cleat/divider assembly to the caddy top (I), spacing them as shown in Drawing 3.

3 Apply finish to the drill caddy, then screw it to the upper shelf bottom (B) [Photo E].

Note: The spacing shown accommodates most drills, drivers, and nail guns. Adjust as needed if your tools are wider or narrower.

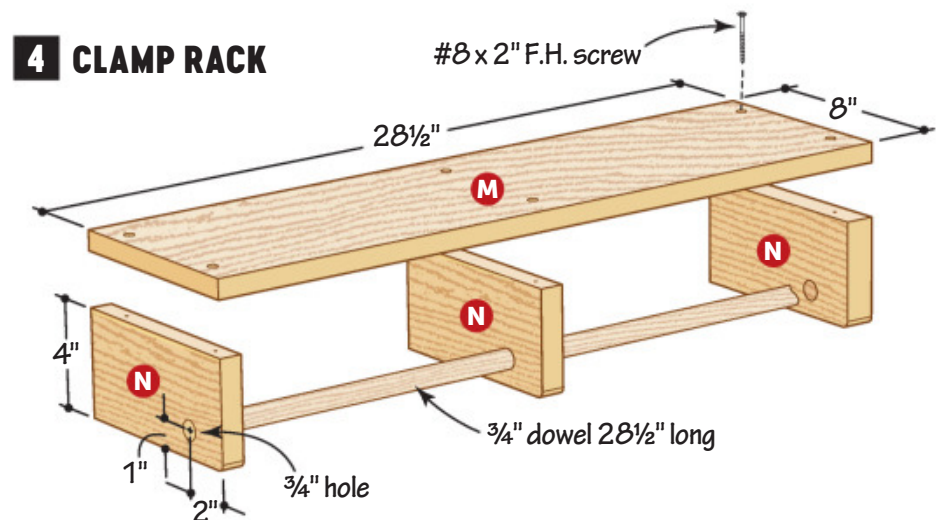


Secure the drill caddy with screws, no glue, so you can reposition it if your needs change.



HANG A CLAMP RACK

- 1** Cut the clamp rack top (M) and brackets (N) to size. Drill a $\frac{3}{4}$ " hole through each bracket [Drawing 4].
- 2** Cut a $\frac{3}{4}$ " dowel to match the length of the rack top (M). Glue it into the holes in the brackets (N), centering the middle bracket on the dowel's length. Glue and screw this assembly to the clamp rack top.
- 3** Apply finish to the clamp rack, then screw it to the upper shelf bottom.

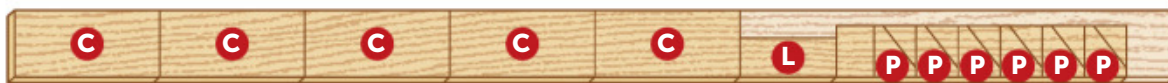


CUTTING DIAGRAM

This project requires the dimensional (1-by) boards shown along with a sheet of $\frac{3}{4}$ " plywood.



$\frac{3}{4}$ x $5\frac{1}{2}$ x 96" Pine (4 needed)



$\frac{3}{4}$ x $5\frac{1}{2}$ x 96" Pine (2 needed)



$\frac{3}{4}$ x $5\frac{1}{2}$ x 96" Pine



$\frac{3}{4}$ x $5\frac{1}{2}$ x 96" Pine (2 needed)



$\frac{3}{4}$ x $5\frac{1}{2}$ x 96" Pine



$\frac{3}{4}$ x $7\frac{1}{4}$ x 96" Pine



$\frac{3}{4}$ x $5\frac{1}{2}$ x 72" Pine (2 needed)



$\frac{3}{4}$ x $7\frac{1}{4}$ x 72" Pine (2 needed)



$\frac{3}{4}$ x $9\frac{1}{4}$ x 96" Pine

“
**RECONFIGURABLE
 STORAGE MEANS THAT
 YOUR SHOP GROWS
 AND CHANGES ALONG
 WITH YOUR SKILLS
 AND TOOL COLLECTION
 INSTEAD OF HOLDING
 THEM BACK.**

-JOHN OLSON, DESIGN EDITOR

”



F Cut slots to accept squares, hammers, and chisels. Drill stopped holes $\frac{3}{8}$ " deep to fit the shanks of router and drill bits, or through holes for screwdrivers. Or leave the shelf whole for odds and ends.

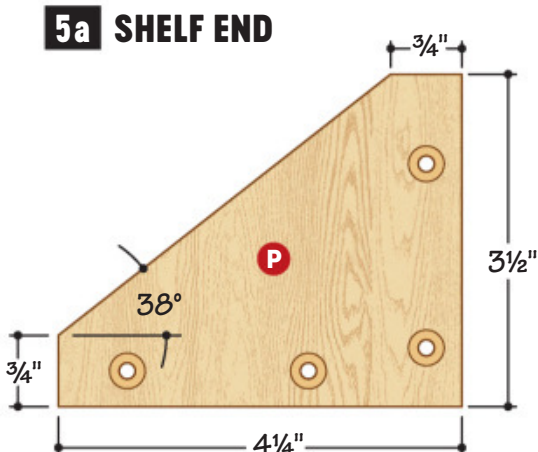
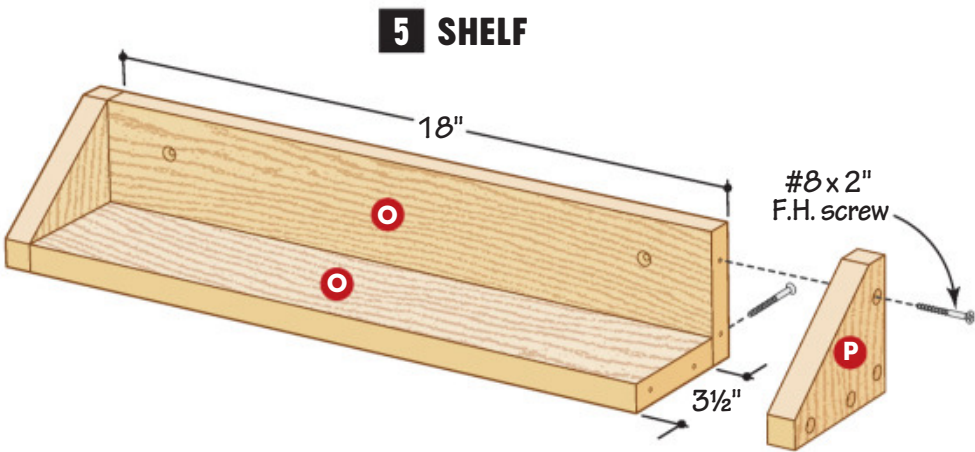


G After miter-cutting the end of the blank, crosscut a shelf end (P) from the blank. Reset the saw to 38°, miter-cut again, leaving the squared tip, and repeat the process to make each shelf end.

CUSTOMIZE TOOL SHELVES

- 1 Cut the shelf backs and bottoms (O) to size [Drawing 5]. If you need to cut slots or drill holes for tools or accessories [Photo F], do that now.
- 2 For the ends (P), cut a $\frac{3}{4} \times 4\frac{1}{4} \times 24$ " board. Miter-cut one end at 38°, leaving a $\frac{3}{4}$ " square at each edge of the blank [Drawing 5a]. Set the saw back to 90° and cut away a shelf end (P) [Photo G].

- 3 Glue a shelf back and bottom (O) together [Drawing 5]. Glue and screw an end (P) to each end.
- 4 Apply finish to the shelves, then screw them to the backer (A) where you like. Organize your tools, bits, and accessories in their new homes, knowing you can easily reconfigure your storage as your collection grows. 🌱



MATERIALS LIST

PART	FINISHED SIZE			Matl.	Qty.
	T	W	L		
A BACKER	$\frac{3}{4}$ "	48"	96"	Ply	1
B UPPER SHELF TOP/BOTTOM	$\frac{3}{4}$ "	11"	96"	EP	2
C UPPER SHELF ENDS/DIVIDERS	$\frac{3}{4}$ "	11"	12"	EP	5
D TRAY ENDS/DIVIDERS	$\frac{3}{4}$ "	3"	4 $\frac{1}{2}$ "	P	4
E TRAY BOTTOM	$\frac{3}{4}$ "	4 $\frac{1}{2}$ "	96"	P	1
F TRAY FRONT/BACK	$\frac{3}{4}$ "	3 $\frac{3}{4}$ "	96"	P	2
G TOP	$\frac{3}{4}$ "	12"	96"	EP	1
H SIDES	$\frac{3}{4}$ "	12"	48 $\frac{3}{4}$ "	EP	2
I DRILL-CADDY TOP	$\frac{3}{4}$ "	8"	20 $\frac{3}{4}$ "	P	1
J DRILL-CADDY DIVIDERS	$\frac{3}{4}$ "	3 $\frac{1}{4}$ "	8"	P	5
K DRILL-CADDY NARROW CLEATS	$\frac{3}{4}$ "	2"	8"	P	2

PART	FINISHED SIZE			Matl.	Qty.
	T	W	L		
L DRILL-CADDY WIDE CLEATS	$\frac{3}{4}$ "	3 $\frac{1}{4}$ "	8"	P	3
M CLAMP-RACK TOP	$\frac{3}{4}$ "	8"	28 $\frac{1}{2}$ "	P	1
N CLAMP-RACK BRACKETS	$\frac{3}{4}$ "	4"	8"	P	3
O SHELF BACKS/BOTTOMS	$\frac{3}{4}$ "	3 $\frac{1}{2}$ "	18"	P	6
P* SHELF ENDS	$\frac{3}{4}$ "	4 $\frac{1}{4}$ "	3 $\frac{1}{2}$ "	P	6

*Parts initially cut oversize. See the instructions.

MATERIALS KEY: Ply—plywood, EP—edge-glued pine, P—pine.
SUPPLIES: #8×1 $\frac{1}{4}$ ", #8×2", #8×3" flathead screws, 1 $\frac{1}{4}$ " coarse-thread pocket screws, $\frac{3}{4}$ ×36" dowel.
PROJECT COST: It cost us about \$200 to build this project. Your cost will vary by region and source.



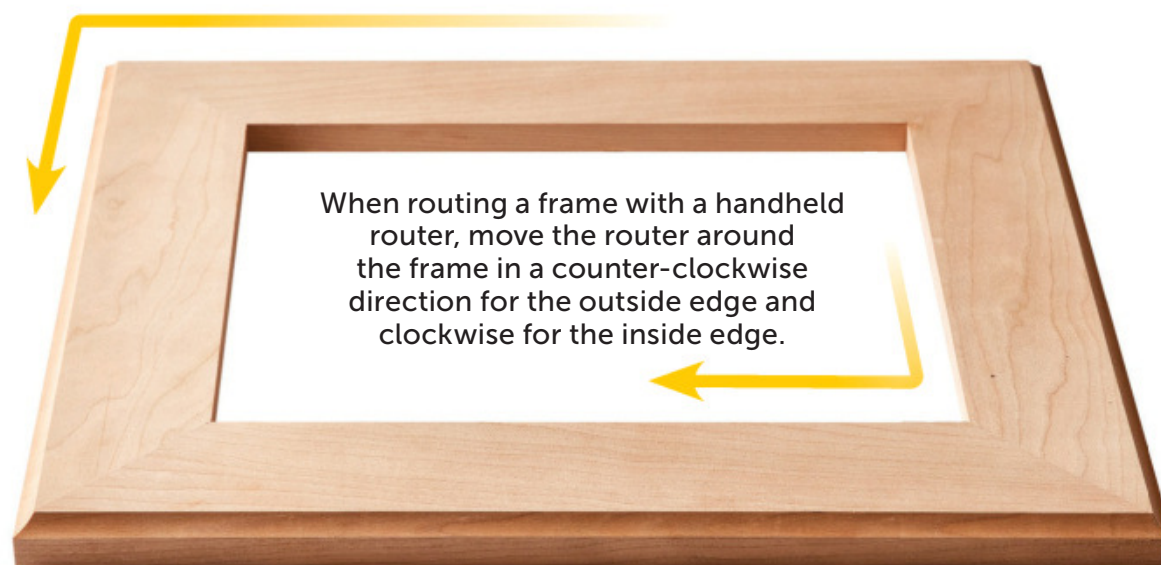
TAKE THE RIGHT ROUTE TO AVOID COMMON ROUTING ERRORS

Ensure crisp, clean profiles and a safe routing experience by avoiding these easy-to-make mistakes.

WRITER: VINCE ANCONA

Router owner's manuals are chock full of safety warnings in bold letters and cover basic information like where to find the power switch. But when it comes to actually using the router, you're pretty much on your own. So let's go beyond the manual basics with easy ways to prevent making all-too-common mistakes.

PHOTOGRAPHER: KELSEY HANSEN



ASK FOR DIRECTIONS

Routing in the wrong direction—a classic rookie mistake—makes the router difficult to control and potentially unsafe. Like the wheels of a muscle car, the bit wants to use its rotation to take the router along for a fast ride. With rare exception, you guide the router (or the workpiece) to do the opposite, moving it so the bit's cutting edges feed into the wood head-on, which draws the router against the edge of the workpiece and makes it easier to control.

When using a handheld router, the bit spins clockwise when viewed from above. This means moving the router from left to right when routing the near edge of a workpiece. Mounted in a table, the router spins the bit counterclockwise and you generally rout on the far edge of a workpiece, moving it from right to left against the bit's rotation.

Confusion often sets in when routing around a frame. The direction depends on whether you're routing the inside or outside edge of the frame, as well as whether you're using a handheld router (*above*) or a router table (*right*).



With a router table, you move the workpiece instead of the router. But you still feed against the direction of the bit rotation, regardless of whether you're routing the inside or outside of the frame.

FIRST PASS

SECOND PASS

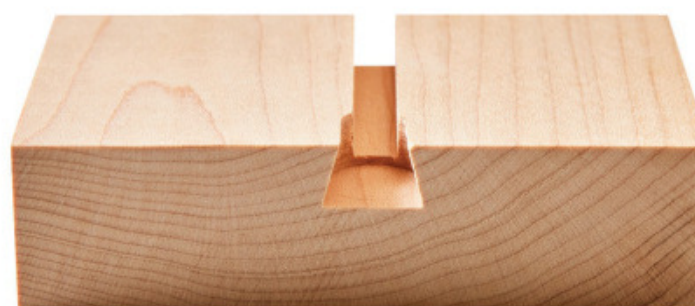
THIRD PASS

BITE WHAT YOU CAN CHEW

Routing small chamfers and round-overs in a single pass doesn't usually pose a problem. But routing a large or complex profile in one pass is hard on both the router and the bit, and often results in tear-out. Instead, rout large profiles in multiple passes, lowering the bit or adjusting the fence position after each pass until you reach your final depth (*left*).

◀ Rout complex profiles in stages, lowering the bit no more than $\frac{1}{8}$ " to $\frac{3}{16}$ " after each pass. For a smooth result, take a light cut (approximately $\frac{1}{32}$ ") on the final pass.

If the profile you're routing doesn't allow you to make progressively deeper passes (as with a sliding dovetail) remove a portion of the waste with a straight bit or tablesaw cuts before routing the profile, (*below*).



◀ To rout a sliding dovetail, use a straight bit first to remove the bulk of the waste in the middle of the socket. Then complete the cut using a dovetail bit.

TIP!

Slip a rubber O-ring onto the shank of the bit to quickly set the insertion depth.

GET A GRIP

Avoid dropping the bit all the way into the collet, which could prevent the collet from gripping properly, *below left*. Likewise, don't allow the bit to extend too far out of the collet, *below center*. A rule of thumb for the just-right Goldilocks zone is to insert

the bit into the collet as far as it will go, then pull it out approximately $\frac{1}{8}$ " before you tighten the collet, *below right*.

Tighten the collet securely, but there's no need to tighten it with all your might (see *Put the Squeeze on Router Collets*, next page).



Bottoming out the bit can limit the collet's ability to tighten around the bit. Some bits have a rounded fillet on the underside of the cutter that may prevent the collet from engaging with the shaft.



A collet compresses around the bit and holds it in place with a friction fit. Extend the bit too far upon installation and you rob it of the friction needed to hold under load.



Some bits include a scribed line on the shank to indicate the minimum insertion depth. For those that don't, insert at least 1" into the collet. Dropping the bit all the way in before pulling it out about $\frac{1}{8}$ " works as a rule of thumb.



For more on choosing the right router speed, check out woodmagazine.com/routerspeeds

SET YOUR SPEED

If you own a variable-speed router, make sure you're using the correct speed for the task at hand. Using the top speed is fine for bits up to 1" in diameter. But as the diameter of the bit increases, so does the rim speed of the cutting edge, and you should dial down the RPM accordingly, *right*. (Router bit manufacturers usually specify the maximum RPM for each bit.)

Choosing a lower speed can also help prevent burning when making trapped cuts such as dados or mortises, or when routing woods like cherry and hard maple that are especially prone to burning.

Variable-speed routers allow you to dial the RPM speed up or down as needed. Run small bits at full speed; use lower speeds for larger diameter bits.



PACE YOURSELF

When first learning how to use a router, most of us have a tendency to move it along the workpiece too slowly, which can lead to burning. Conversely, a feed rate that is too fast can cause chatter. Knowing the proper feed rate comes with experience and depends

to some degree on the size of the bit and type of wood you're routing. In general, keep the bit moving over the wood at a steady pace, listening to the motor as you rout. If you hear the motor start to strain or wood chipping as you rout, back off the feed rate.

HANG ON FOR THE RIDE

Router bits spin at a high rate of speed. And when that spinning bit slams into the wood, the inertia can kick the workpiece away if it's not clamped or held securely, ruining the cut and possibly creating a safety hazard. When using a handheld router, clamp workpieces to your bench before routing. For smaller pieces, use a router mat or secure the pieces with double-faced tape. When working with small pieces at the router table, use a sled or some sort of holding device to provide a firm grip and keep your fingers a safe distance from the bit, *right*.



A handscrew clamp is ideal for gripping small workpieces for routing. For larger workpieces, use featherboards and push pads at the router table, or clamps when using a handheld router.

PUT THE SQUEEZE ON ROUTER COLLETS

Tighten your router collet effectively by first snugging it down by hand. Place the wrenches on the collet and shaft with the handles offset by about 30°, then squeeze the wrenches together with one hand, *below*, until the handles align. To loosen the collet, offset the wrenches in the opposite direction and squeeze again.



“

RATHER THAN BEATING YOURSELF UP OVER A ROUTING MISTAKE, TREAT IT AS A REMINDER NOT TO BECOME TOO COMPLACENT ABOUT SETUP AND SAFETY.

-VINCE ANCONA, CONTRIBUTING EDITOR

”

KEEP IT CLEAN

A new, sharp router bit cuts cleanly and smoothly. Over time, pitch and sawdust can build up on the bit and the edges can dull (*below*), leading to burned or ragged-looking cuts. To get the most out of your bits, keep them clean and sharp. Router bits are consumable items, so plan to replace bits that become damaged or chipped.



Over time, router bits dull and develop pitch buildup through use, which negatively affects cut quality. Remove buildup with an approved cleaner and replace dull or damaged bits. ▶

HAVE A BACKUP PLAN

Routing end grain without properly backing up the cut is a sure-fire recipe for grain tear-out. As the bit exits the cut, the force of the spinning bit can easily push the edge-grain fibers away, *below left*. Deal with this problem in one of two ways. If

you're routing all edges of a workpiece, rout the ends first. This way, you'll remove any tear-out when routing the edges. Alternatively, clamp a scrap to your workpiece to back up the wood fibers as the bit exits the cut, *below right*.



Routing end grain tends to tear out the wood along the adjoining edge as the router bit exits the cut, particularly in woods that are prone to splintering, such as this Douglas fir.



Prevent tear-out by clamping a backer board to the edge of the workpiece and routing into it as you make the cut. The backer board supports the wood fibers of the workpiece.

“

KEEP GUIDE BEARINGS IN TOP SHAPE BY OCCASIONALLY REMOVING THEM FOR CLEANING AND LUBRICATION.

-KEVIN BOYLE, SENIOR DESIGN EDITOR

”

SET YOUR BEARING

Many profile and flush-trim bits have a small ball bearing on the end to guide the bit. As you rout, the bearing rides along the front face or edge of the work, maintaining a consistent depth (or width) of cut. But if you hold the bearing against the wood too tightly, particularly in softwoods like pine, it can leave an indentation on the surface that has to be sanded out. To avoid this, place a strip of painter's tape along the path of the bearing before you rout, *left*. The tape acts as a thin cushion to prevent the bearing from marring the wood and it's easily removed after you're done routing.



A strip of painter's tape takes only seconds to apply and prevents the bearing of the router bit from leaving marks or indentations on the surface of the wood.



Attempting to balance the router on the narrow edge of a workpiece often leads to tipping the router forward or backward, which can cause the bit to cut into the edging or the panel.

STRIVE FOR BALANCE

Accurate routing depends upon having adequate support for the base of the router. Attempting to balance a router on the edge of a workpiece or on the face of a very narrow workpiece often leads to the router tipping and spoiling the cut, *above*. When routing moldings or narrow workpieces, start with a wide blank. After routing the profile along the edge, rip the piece to final width at the tablesaw.

To trim plywood edging flush, clamp two workpieces together with a spacer in between, *right*. Then trim the edging with the router straddling the edge of both workpieces (or use a scrap piece if you only have one panel to trim). Make sure to rout in the proper direction to maintain control.

USE A PRE-FLIGHT CHECKLIST

Trying to remember all these tips can be a bit overwhelming. The best way to incorporate them into your routing is to make a mental checklist before flipping the switch. Check that the bit is securely mounted in the router and the depth of cut is set accurately. Plan out your routing path and do a dry run with the motor off. If you're still a bit unsure, make a test cut in a piece of scrap. Test cuts will also help you dial in your setup for perfect results. After you become more comfortable with your router and bits, these precautions and setup procedures will become second nature. 🌳



Clamp two workpieces together with a spacer sandwiched in between. The additional workpiece acts as an outrigger support while routing the first piece.

DANISH MODERN DINING TABLE

Expand your skills building a table that sits a family of four or a party of ten. Beneath the clean lines, self-storing wings pull out to add seating.

WRITER: CRAIG RUEGSEGGER
DESIGNER/BUILDER: KEVIN BOYLE



PHOTOGRAPHER: JACOB FOX; ILLUSTRATORS: ROXANNE LEMOINE, LORNA JOHNSON

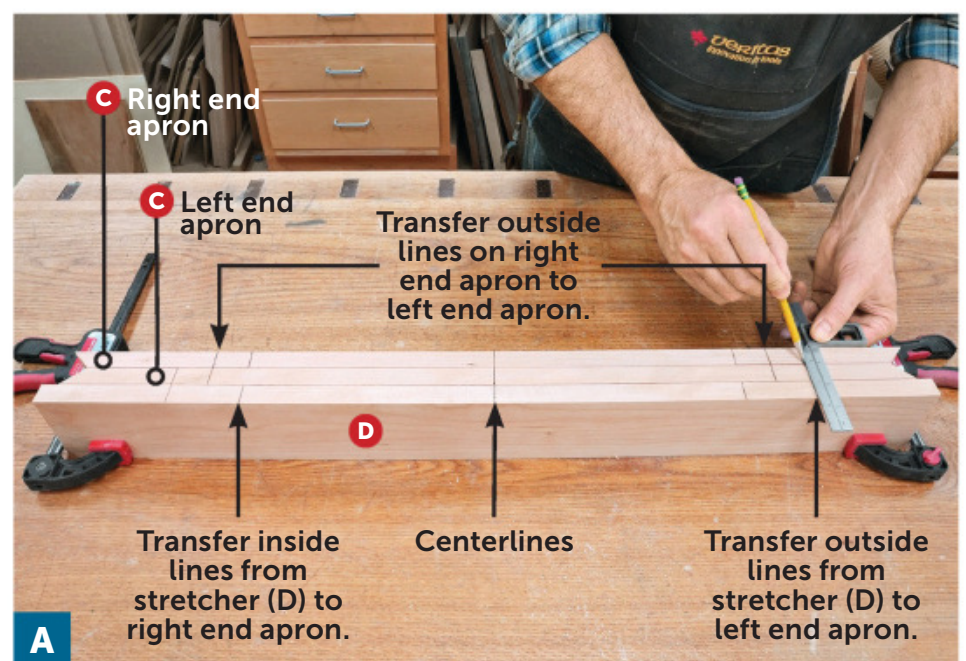
The clean, simple lines of this table are accented by tapered legs set at 45° to the aprons. The one-piece top hides two wings stored underneath. Lift each end of the top to pull out a cantilevered wing and increase seating around the table from six guests to ten.

Cherry plywood edged with solid wood makes quick work of building the panels for the top and the wings—while eliminating concerns about wood movement with seasonal humidity changes.

LEGS AND APRONS FIRST

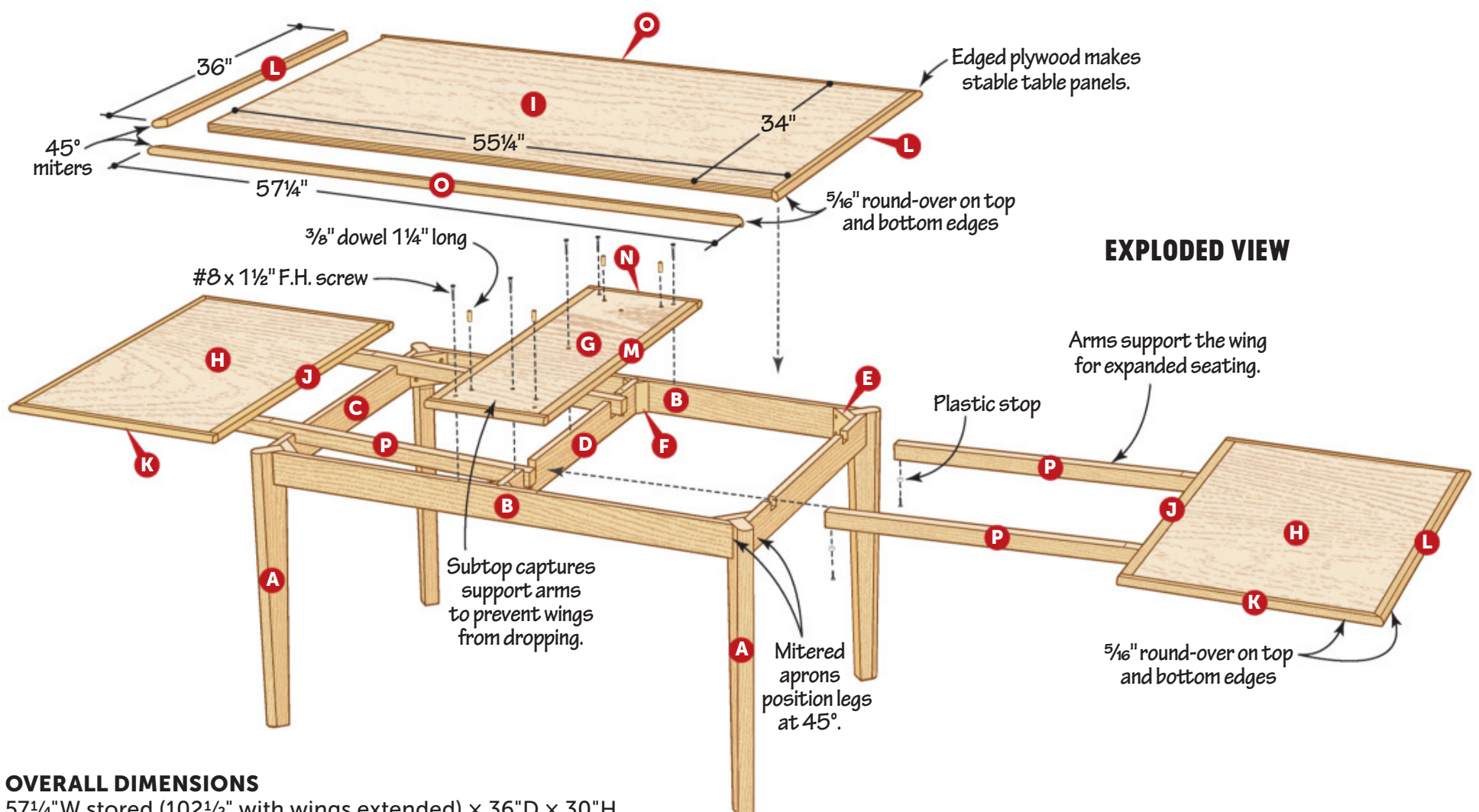
Four aprons tie the legs together, and a stretcher between the side aprons provides additional bracing. Notches in the end aprons and the stretcher guide the arms that support the wings.

- 1 Prepare 1½"-thick stock for the legs (A) and cut them to size [Materials List]. Save a 1"-wide cutoff from this stock to use later as a spacer.
- 2 Lay out the tapers on the legs [Drawing 1a], bandsaw them to rough shape, and plane to the lines.
- 3 Install a ¾" round-over bit in your router table and round the outside edges of each leg [Drawing 1a]. Rout a ⅛" round-over around the bottom of the legs and finish-sand the legs.



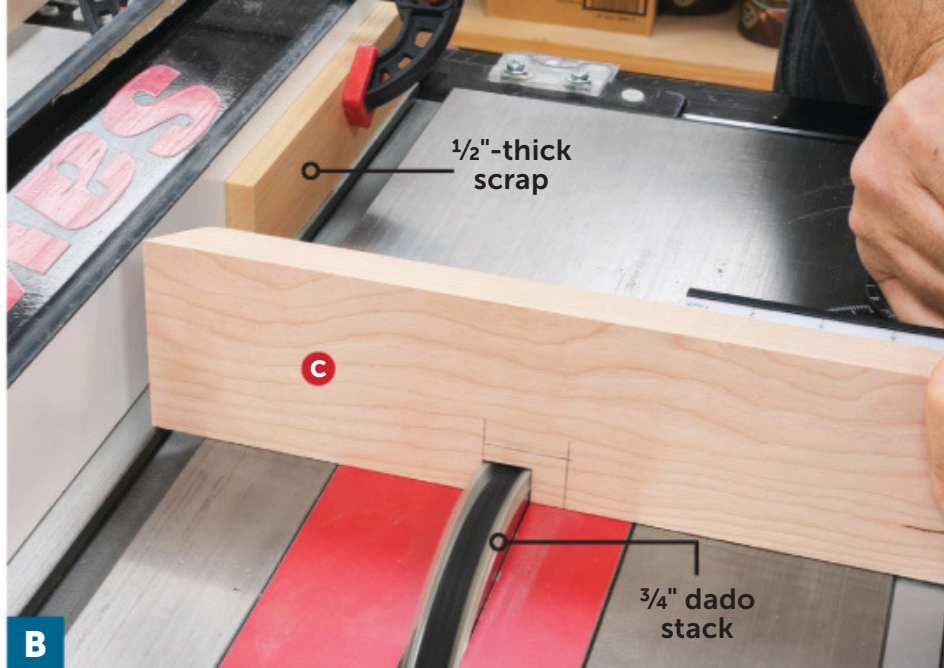
With the centerlines of the three pieces aligned, lay out the notches, first for the stretcher (D), then extending these for the aprons (C). Note that the notches in the aprons are offset [Drawing 1b].

- 4 Prepare stock for the aprons (B, C) and stretcher (D), and miter-cut the four aprons to length [Drawings 1, 1b].
- 5 Mark a centerline on the lengths of the end aprons (C) and stretcher (D). Clamp these pieces together with the centerlines aligned and mark the notches in each [Photo A]. Set up a ¾" dado blade in your tablesaw for a ⅞"-deep cut, and notch the end aprons [Photo B]. Then raise the blade height and notch the stretcher [Drawing 1c].



OVERALL DIMENSIONS

57¼"W stored (102½" with wings extended) x 36"D x 30"H



B Clamp a 1/2"-thick scrap to the rip fence to establish the outer shoulder of each notch. Butt the apron against the rip fence to complete the notch. Readjust the rip fence for the other apron.

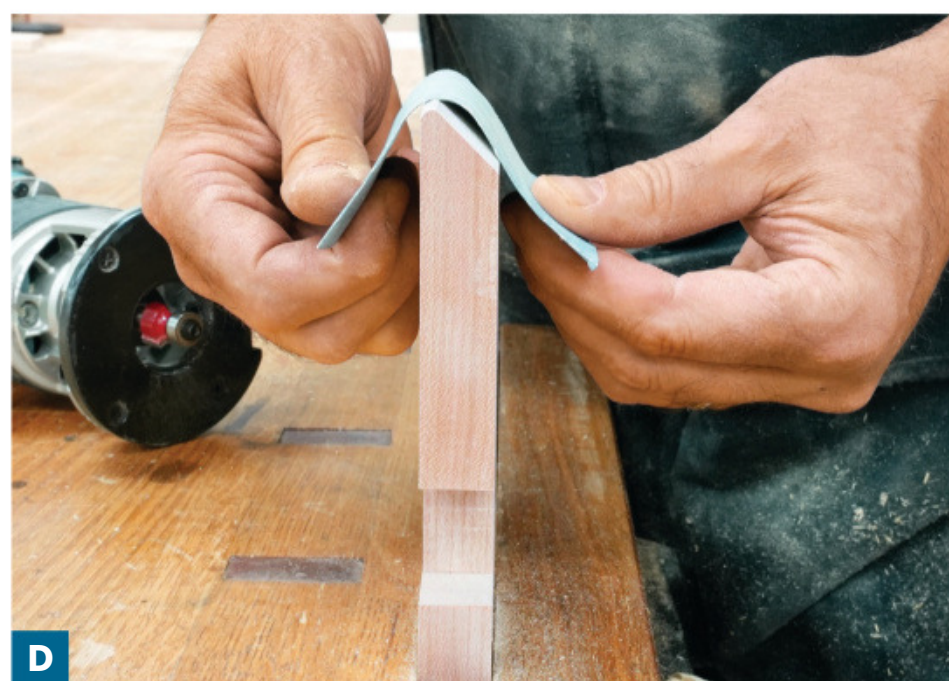


C Start with the blade slightly lower than needed and sneak up on the finished thickness of the tenons, testing the fit in the dados in the side aprons (B).

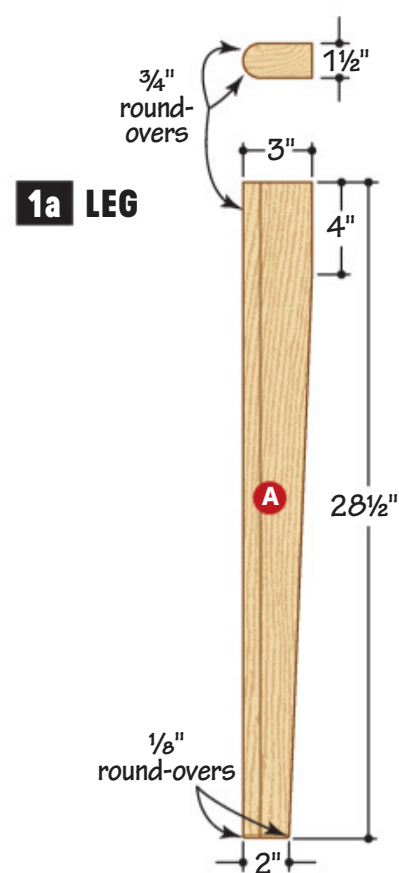
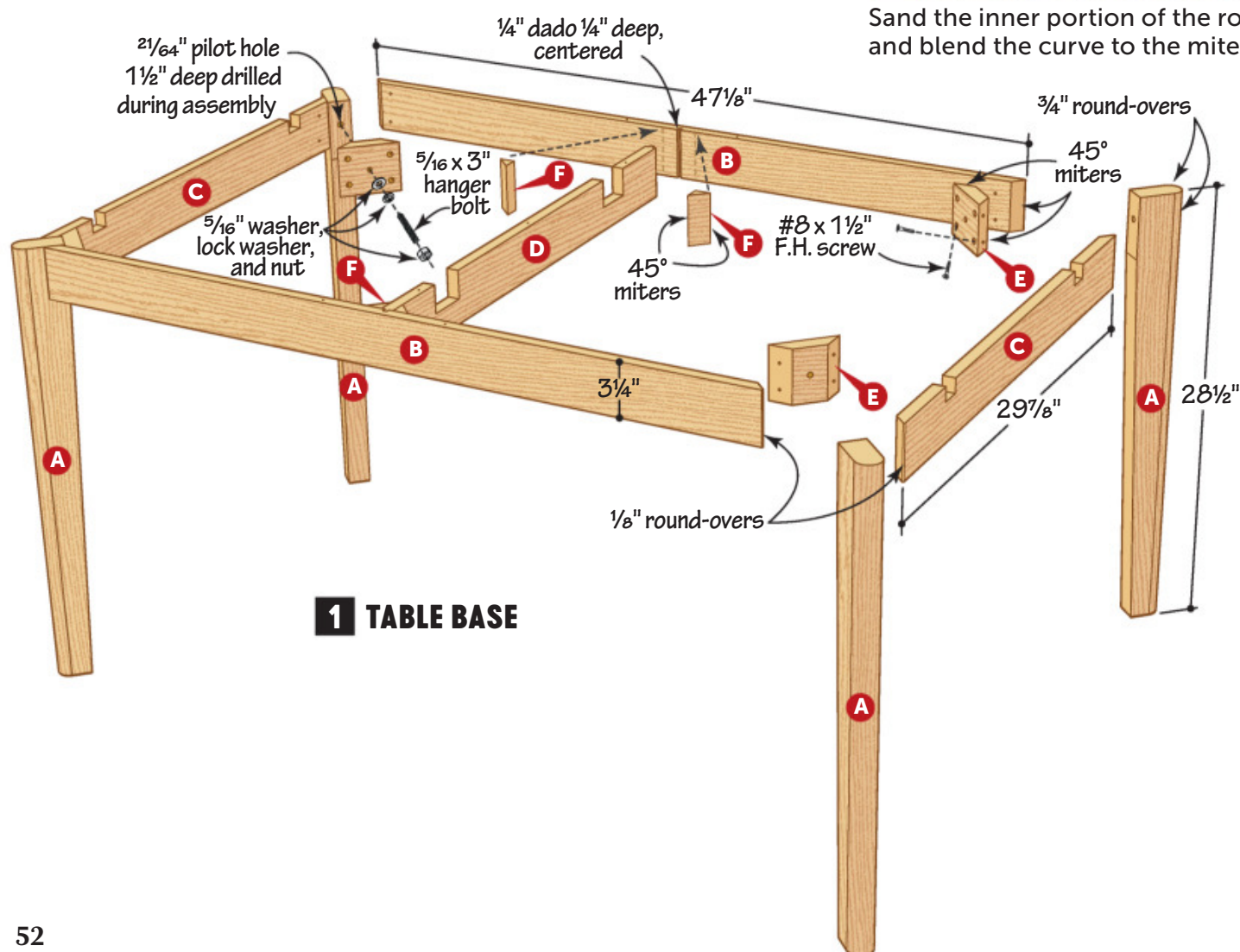
6 Adjust the dado blade width to 1/4" and cut a 1/4"-deep dado centered on the side aprons (B) [Drawing 1].

7 To form the tenons on the ends of the stretcher (D), attach an auxiliary rip face to your tablesaw rip fence and raise the dado blade into it. Adjust the fence to cut 1/4" rabbets on each face of the stretcher [Photo C].

8 Rout 1/8" round-overs on the ends of all four aprons (B, C). Blend in the round-overs with sandpaper [Photo D]. Finish-sand the aprons.

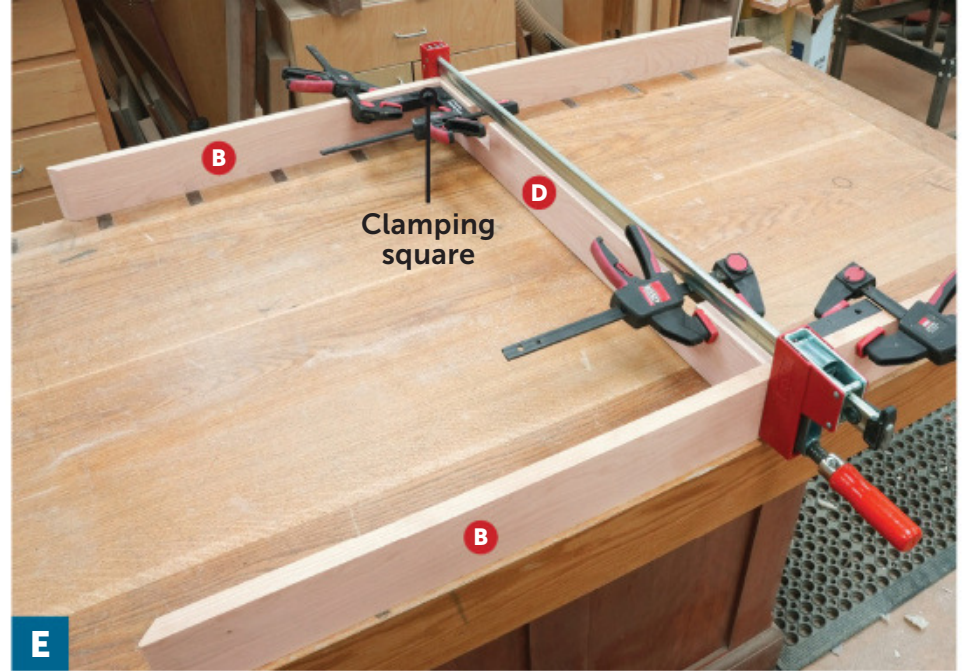


D Sand the inner portion of the round-overs to remove the shoulder and blend the curve to the miter cut.



ASSEMBLE THE BASE

- 1** Glue the stretcher (D) between the side aprons (B) [Photo E].
- 2** To make the corner blocks (E, F), prepare a $1 \times 3\frac{1}{4} \times 30$ " blank. Bevel-cut four apron corner blocks (E) and six stretcher corner blocks (F) [Materials List, Drawing 1]. (Two of the stretcher corner blocks serve as clamping aids later.)
- 3** Lay out and drill the countersunk shank holes near the corners of each apron corner block (E), but don't drill the center hole [Drawing 1d, Photos F, G].



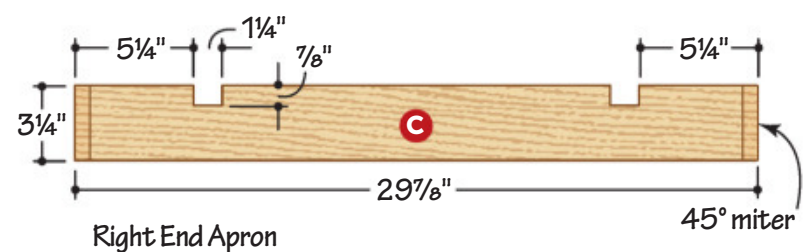
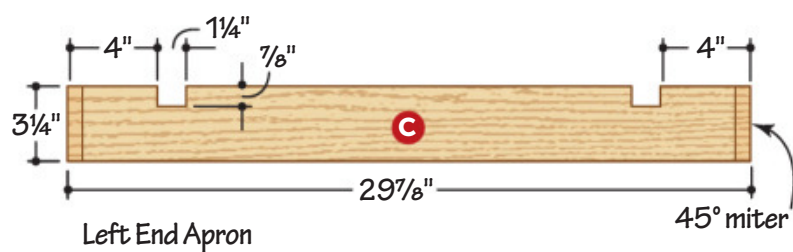
Use clamping squares to properly align the stretcher (D) with the side aprons (B) while you glue and clamp these three pieces together.



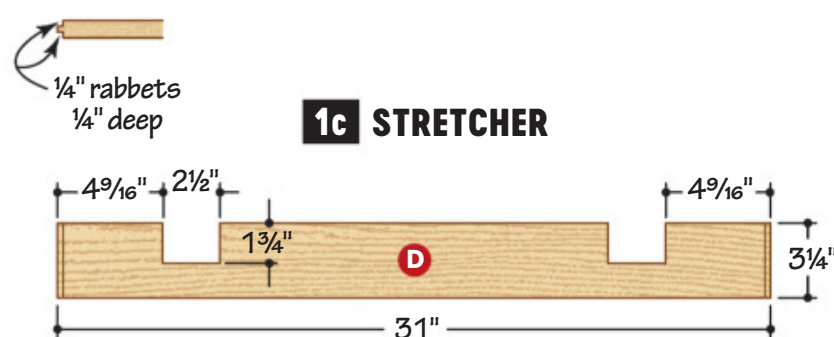
Rest the corner block (E) on a scrap backer block. Start drilling at the marked locations with the bit perpendicular to the face of the corner block. Drill no more than $\frac{1}{8}$ " deep.

After the bit bites into the wood, raise the corner block to rest on its beveled end. Keeping the bit perpendicular to the bench, drill through the block.

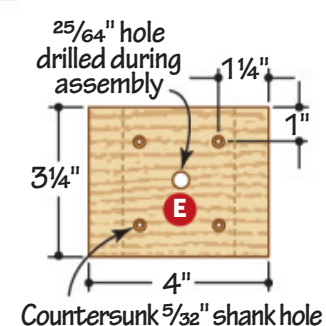
1b END APRONS



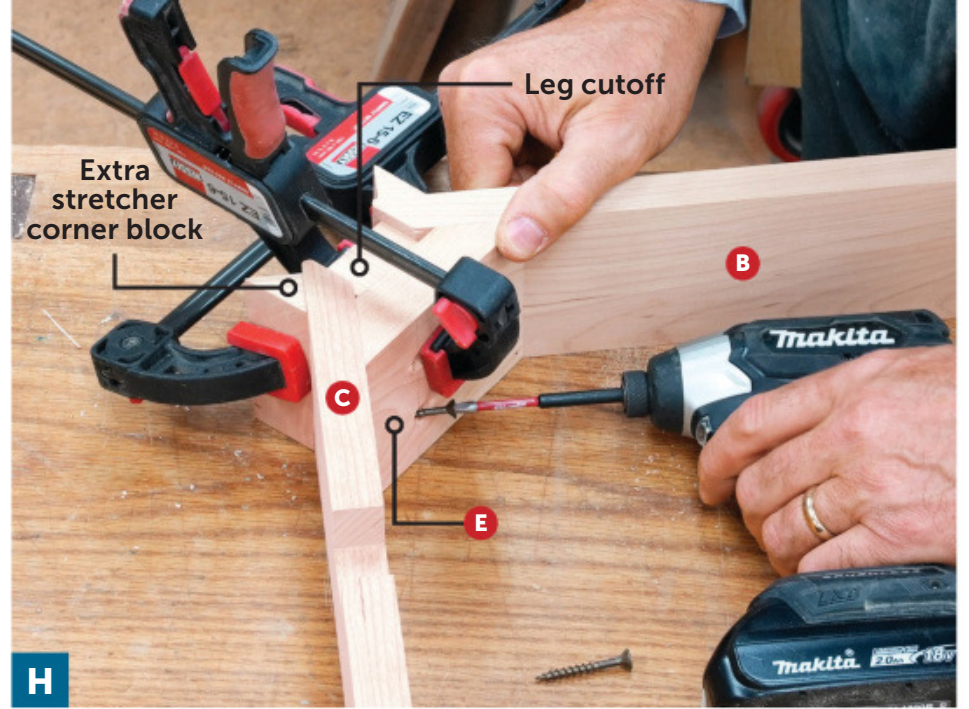
1c STRETCHER



1d APRON CORNER BLOCK



4 Retrieve the cutoff from the leg stock, as well as the two extra stretcher corner blocks. Apply double-faced tape to the extra corner blocks and press them firmly to an end apron (C) and a side apron (B) near their ends [Photo H]. Butt the aprons against the cutoff and clamp an apron corner block (E) in place. Extend one pilot hole into each apron. Remove the clamps and extra corner blocks, add glue to the apron corner block, and drive screws into the pilot holes. Drill the remaining pilot holes and drive the screws. Repeat for the other three corners.



Establish an equal overhang for each apron (B, C) on the corner block (E), then clamp everything together. Extend the pilot holes into the aprons before driving one screw into each apron.

5 Working on one corner at a time, place a leg (A) in position and drill a $\frac{21}{64}$ " hole through the center of the corner block (E) and $1\frac{1}{2}$ " into the leg. Remove the leg and enlarge only the hole in the corner block to $\frac{25}{64}$ ".

6 Install a hanger bolt in each leg, then secure the legs to the corner blocks with a flat washer against the corner block followed by a lock washer and nut.

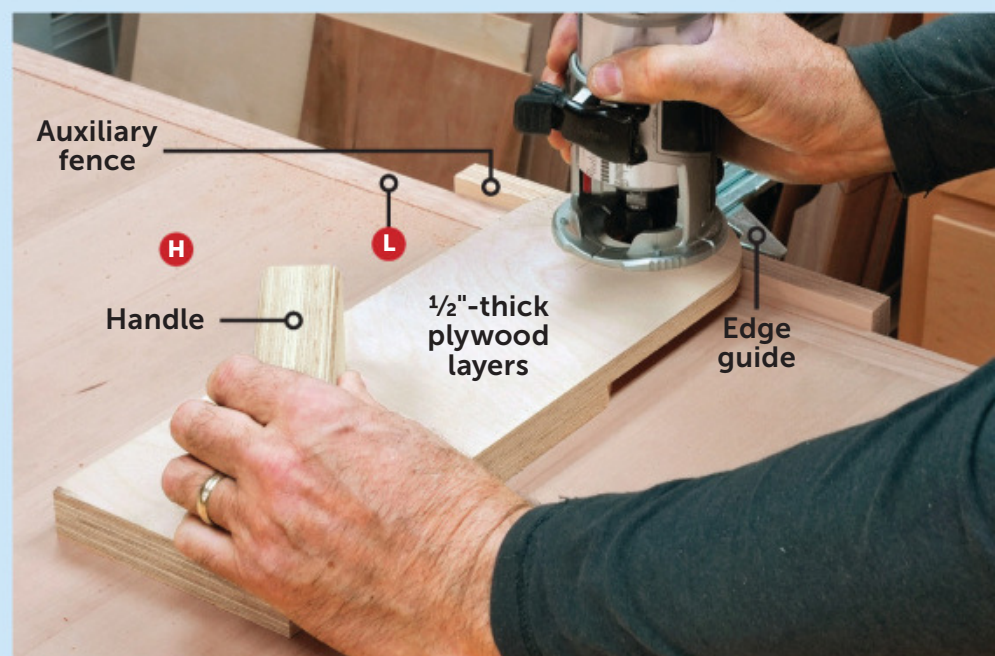
7 Apply glue to a stretcher corner block (F) and rub it against the stretcher (D) and side apron (B) [Drawing 1] until you feel the glue begin to grab. Repeat for the three remaining corner blocks.



FEELING FLUSH

This jig works in concert with your router's edge guide and a straight bit to trim the edging nearly flush with the plywood panel, leaving just a hair's thickness to sand away. Mount your router to one end of a plywood base and add a handle at the opposite end. Glue a shorter layer of plywood below the handle to provide clearance for the edging as the bit trims it. An auxiliary fence attached to the router edge guide stabilizes the jig and allows for fine-tuning the cutting position of the bit.

To set the bit's depth, gently lower it to touch a sheet of paper beneath it. We used a $\frac{3}{4}$ " mortising bit [Sources]. Adjust the edge guide so the bit's inner edge trims along the joint between the edging and panel. Test your setup on a scrap with edging glued to it, then trim the edging in two passes, *right*.



The first pass trims the edging next to the plywood. Move the jig outward enough on the second pass to remove the remaining waste.

MAKE TABLETOP PANELS

Plywood panels trimmed with strips of solid-wood edging make up the tabletop, wings, and subtop.

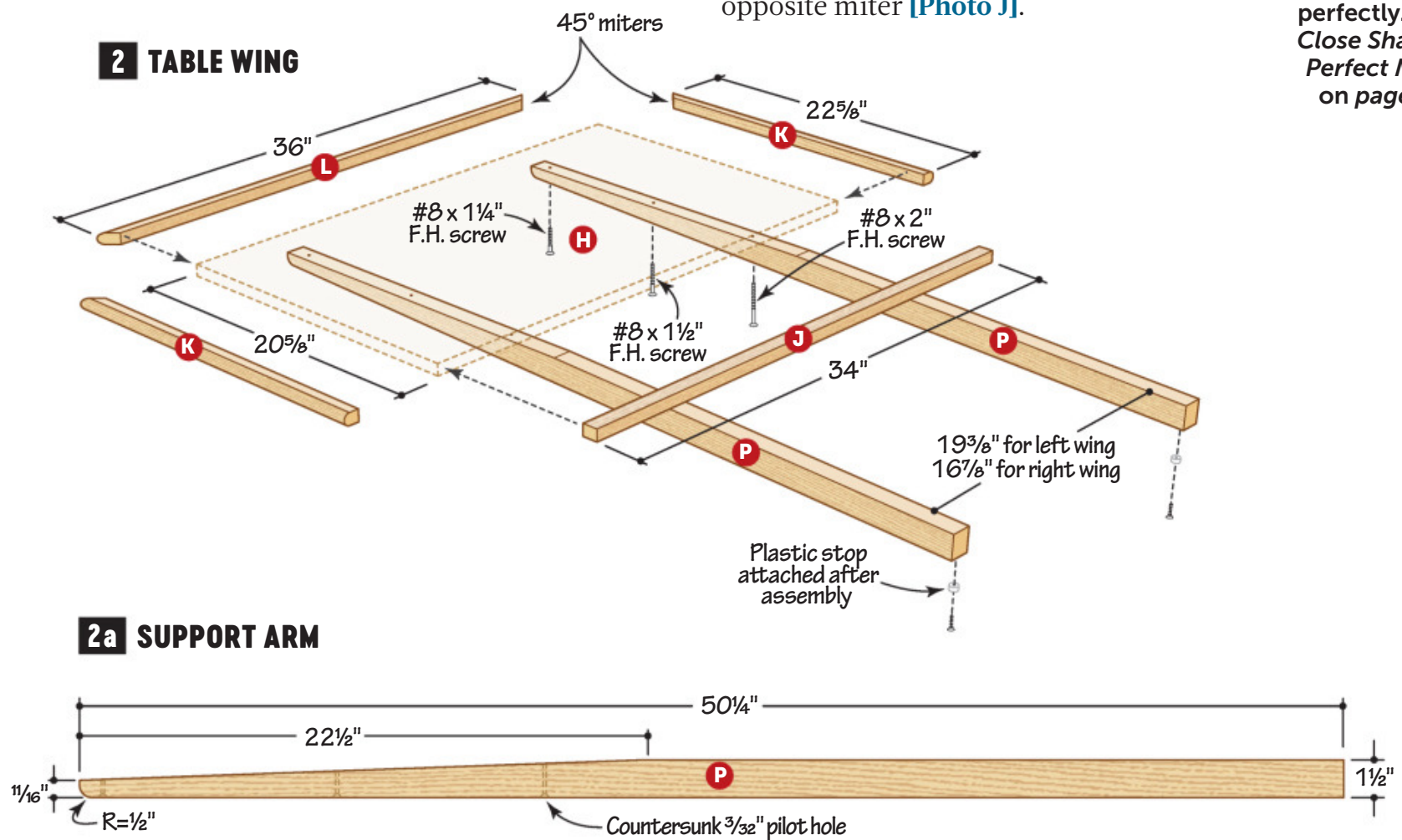
1 From $\frac{3}{4}$ " plywood, cut the subtop (G), wings (H), and top (I) to size [Materials List]. From solid stock slightly thicker than the plywood, cut the edging pieces (J-O) 2" longer than listed.

2 Glue the wing inside edging (J) to the inner long edge of each wing (H), flush on the bottom face [Drawing 2]. Build the flush-trim jig shown in *Feeling Flush*, previous page, and trim the edging. Then cut the edging flush with the edges of the wing [Photo I].

3 Miter-cut one end of each wing side edging (K) and the wing end edging (L). Clamp one side edging and the end edging to the wing (H) and mark the opposite miter [Photo J].

TIP!

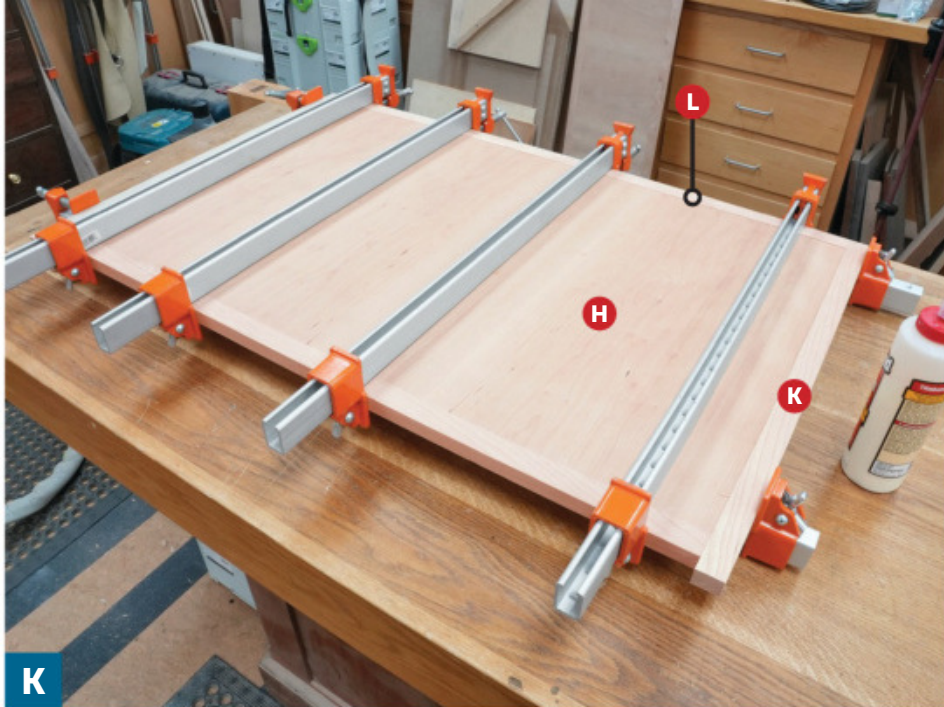
A shooting board helps you fine-tune miters perfectly. See *A Close Shave for Perfect Miters* on page 58.



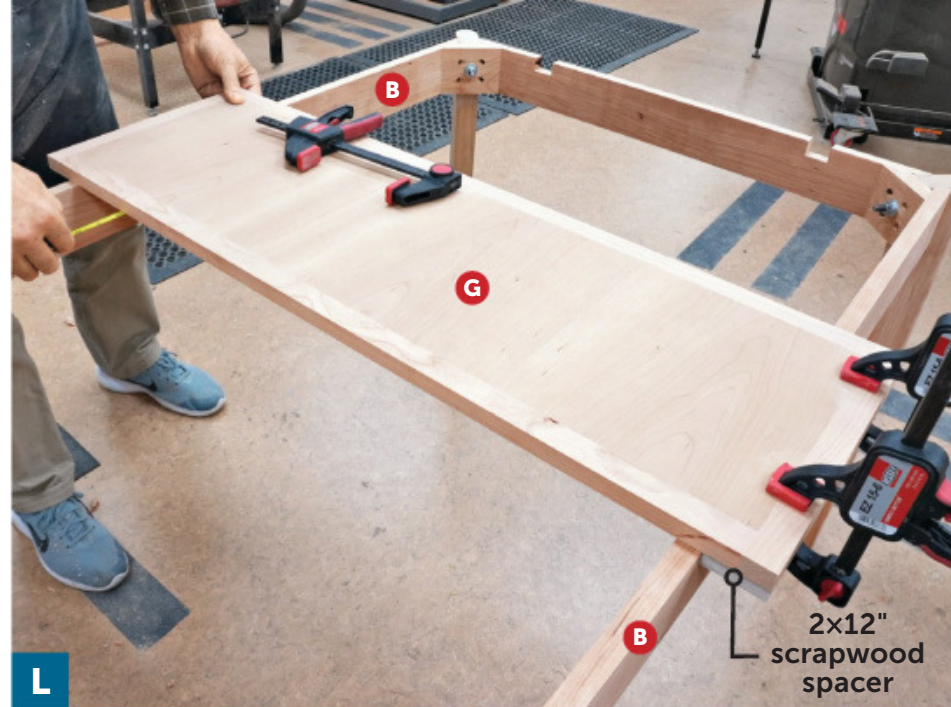
Set the outside edge of the tablesaw blade flush with the outside edge of a plywood spacer. Place the spacer behind the edging (J) and stop the cut after trimming the edging flush.



Align the miters of one end of the edging (K, L) for a tight fit, then mark the location of the miter on the opposite end of the end edging (L). Miter-cut the end edging to length.



Dry-fit the end edging (L) to check the fit of the miters at each end, shaving down the miters as needed. Glue the end edging in place, then remove the side edging (K).



Center the subtop assembly on the base, squaring it to the aprons (B). Drill countersunk screw holes through the subtop and into the aprons and stretcher (D).

4 Dry-fit and clamp both pieces of wing side edging (K) to the wing (H) to help position the end edging (L) as you glue the end edging in place [Photo K]. After the glue dries, rout the end edging flush, and add a piece of side edging. Repeat this process of gluing on one piece of edging and trimming it flush to complete the wings (H/J/K/L), the subtop (G/M/N), and the top (I/L/O) [Drawings 2, 3, Exploded View]. Finish-sand each edged panel.

5 To position the subtop on the base, clamp a 2×12" scrap spacer flush with one edge of the subtop assembly (G/M/N). Center this assembly on the base and clamp it in place [Photo L] to locate and drill the screw holes [Exploded View]. Remove the subtop, round over the side edging (N) [Drawing 3], then screw the subtop in place.

6 Rout $\frac{5}{16}$ " round-overs around the top and bottom edges of the top assembly (I/L/O) and the side and end edging (K, L) of the wings [Exploded View]. Do not round over the wing inside edging (J).

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WHILE I MADE SEVERAL CHANGES TO OUR VERSION, THIS TABLE IS BASED ON THE DANISH DESIGNER IB KOFOD-LARSEN'S DESIGN.

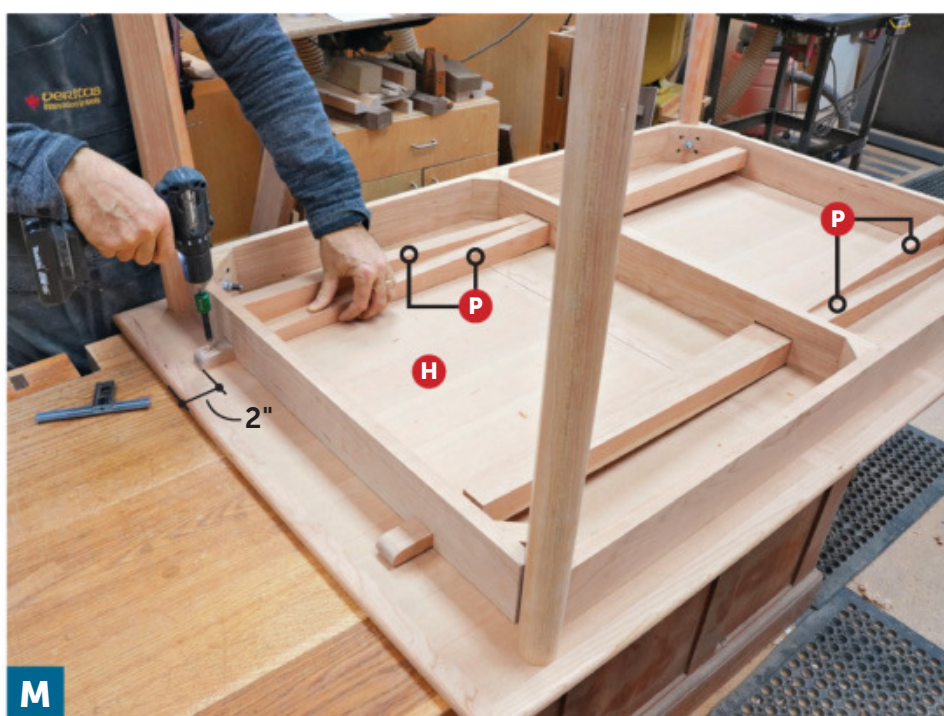
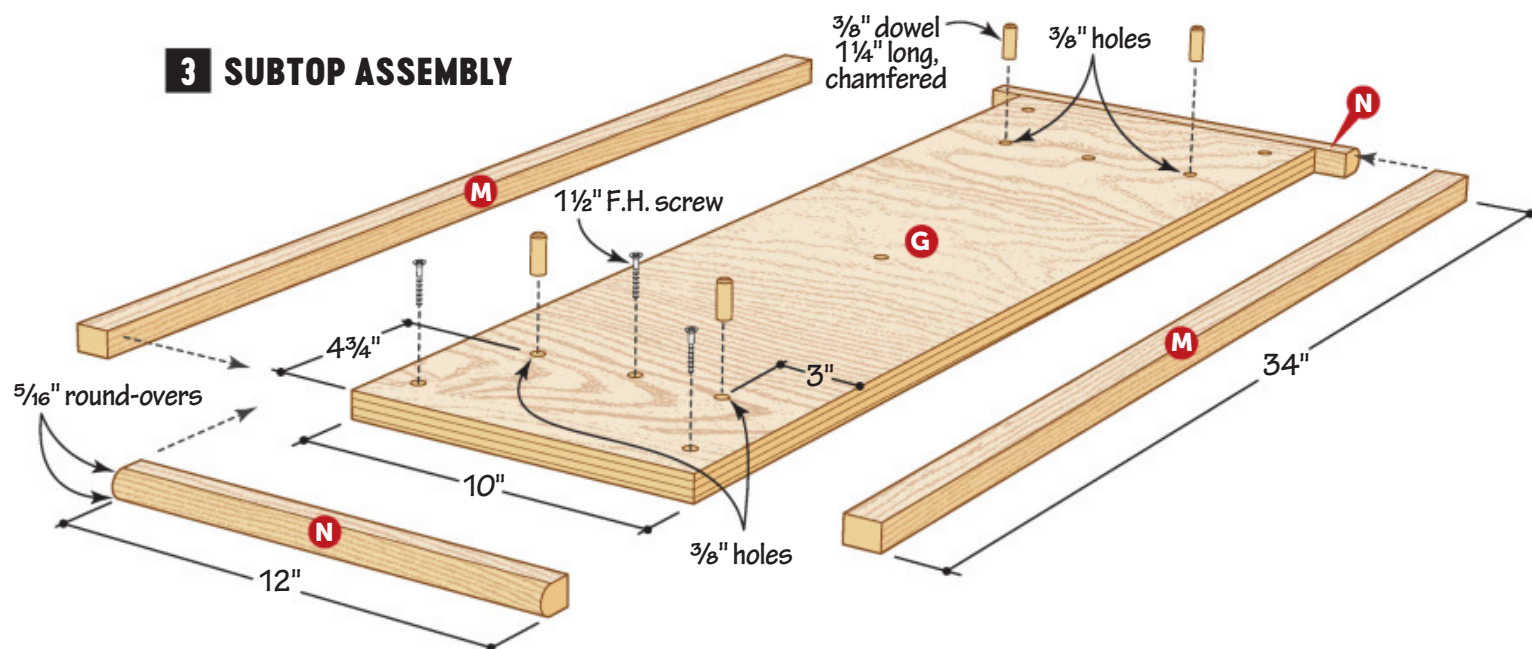
-KEVIN BOYLE, DESIGN EDITOR

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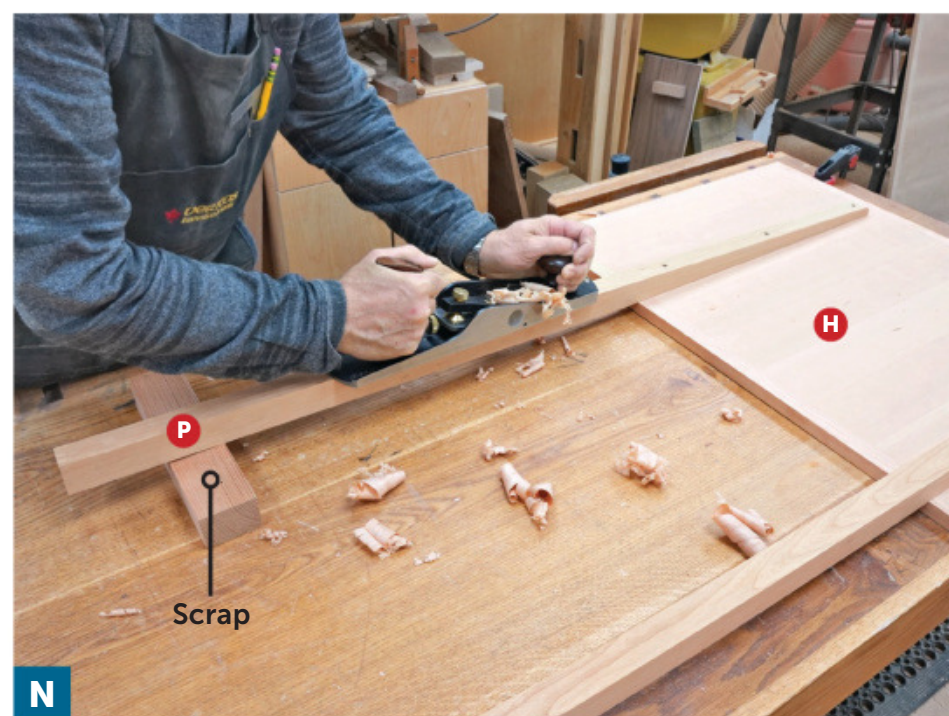


To expand the table for company, raise one end of the tabletop slightly and slide the wing out. The clever, angled arms raise the wing to the level of the tabletop, stop when the bumpers contact the center stretcher, and cantilever against the underside of the subtop to support the wings. Lower the top, which is now supported on the arms and locked in place by the positioning dowels.

3 SUBTOP ASSEMBLY



Drill one countersunk pilot hole near the end of each arm (P). Be careful to not drill through the wing (H). Drive a screw into the wing to secure it as you check the movement of the wings.



With the wing (H) flat on your bench, support the end of the arm (P) with a scrap. Make sure the screwheads are sufficiently countersunk to avoid damaging your plane blade.

SUPPORT THE WINGS

Two arms guide and support each wing as it slides out from the end of the table to expand the tabletop surface. Fit the arms to slide easily in the notches in the end aprons and stretcher.

1 Cut the arms (P) to size. Bandsaw the tapers to rough shape, then plane them smooth. Add a 1/2" round-over on the small ends [Drawing 2a].

2 Flip the base upside down on your bench. Place the wings (H/J/K/L) under the aprons, against the subtop (G/M/N) and flush with its edges. Slide the arms (P) into place 2" from the ends of the wings. If the arms fit too tightly in

the notches in the aprons and stretcher, plane the arms to fit.

3 Drill a countersunk pilot hole 1" from the end of each arm [Photo M]. Drive a screw through each arm. Flip the table over and check the movement of the wings in and out. There should be no binding. If there is, mark the problem areas with a pencil and plane them [Photo N].

Note: Three different screw lengths attach the tapered arms (F) to the tabletop assembly (I/L/O).

4 Once all four arms slide smoothly in and out, drill two additional holes in each arm [Drawing 2a]. Remove the arms, apply glue, and screw the arms in place.

5 Place the top (I/L/O) facedown on your bench and place the base/wing assembly on it. Seat the wings tight to the subtop (G/M/N), and align the edges of the wings and top. Drill $\frac{3}{8}$ " holes through the subtop and $\frac{1}{2}$ " deep into the top [Photo O].

6 Flip the base over and glue $\frac{3}{8}$ " dowels into the holes in the subtop, flush on the bottom face [Drawing 3]. Sand chamfers on the top ends of the dowels. Drill or sand slight countersinks on the holes in the top (I/L/O).



At the drill press, drill a $\frac{3}{8}$ " through-hole in a notched block. Use this to guide your drill bit as you drill the holes for the dowels in the subtop (G/M/N). Chuck the bit in your drill to limit the hole depth to $1\frac{1}{4}$ ".

A CLOSE SHAVE FOR PERFECT MITERS

A shooting board lets you remove fine shavings from miters, allowing you to adjust the mitered piece's length for a precise fit. Build this shooting board from MDF and use it with a sharp hand plane.



Find plans for shooting boards at woodstore.net/shootingboards



To stop the wings at the proper position and prevent pulling the wings out of the base, attach plastic bumpers to each arm (P) and against the stretcher (D).

7 Finish-sand all parts. Remove the top and wing/arm assemblies from the base and apply a finish to all parts. We used two coats of Danish oil.

8 After the finish dries thoroughly, flip the table upside down and with the wings extended and tight to the top, attach plastic bumpers [Sources] to each arm [Photo P].

9 Stand your table upright, lift the top slightly, and slide the wings under it. Then sit and enjoy a meal with friends and family until you need to slide the wings out to expand seating capacity for more guests. 🌲

MATERIALS LIST

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A	LEGS	1½"	3"	28½"	C	4
B	SIDE APRONS	¾"	3¼"	47½"	C	2
C	END APRONS	¾"	3¼"	29⅞"	C	2
D	STRETCHER	¾"	3¼"	31"	C	1
E	APRON CORNER BLOCKS	1"	3¼"	4"	C	4
F	STRETCHER CORNER BLOCKS	¾"	3¼"	1⅓⅓₂"	C	6
G	SUBTOP	¾"	34"	10"	CP	1
H	WINGS	¾"	34"	20⅝"	CP	2
I	TOP	¾"	34"	55¼"	CP	1
J*	WING INSIDE EDGING	¾"	1"	34"	C	2
K*	WING SIDE EDGING	¾"	1"	22⅝"	C	4

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
L*	WING/TOP END EDGING	¾"	1"	36"	C	4
M*	SUBTOP END EDGING	¾"	1"	34"	C	2
N*	SUBTOP SIDE EDGING	¾"	1"	12"	C	2
O*	TOP SIDE EDGING	¾"	1"	57¼"	C	2
P	ARMS	1¼"	1½"	50¼"	C	4

*Parts initially cut oversize. See the instructions.

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

SUPPLIES: #8×1¼", #8×1½", #8×2" flathead screws, ⅜×12" dowel, ⅝×3" hanger bolts (4), ⅝ flat washers (4), ⅝ lock washers (4), ⅝ nuts (4).

BLADE AND BITS: Dado blade; ⅛", ⅝", ¾" round-over bits.

SOURCES: Freud ¾" mortising bit no. 16-510, \$33, rockler.com. Plastic stops no. EURO DOOR 10 SCR WH, \$2.50 (10 pack), fastcap.com.

PROJECT COST: It cost us about \$425 to build this project. Your cost will vary by region and source.

CUTTING DIAGRAM

This project requires 12 board feet of 4/4 cherry, 7 board feet of 6/4 cherry and 7 board feet of 8/4 cherry based on example boards shown.



1½ x 7¼ x 60" Cherry



¾ x 7¼ x 84" Cherry



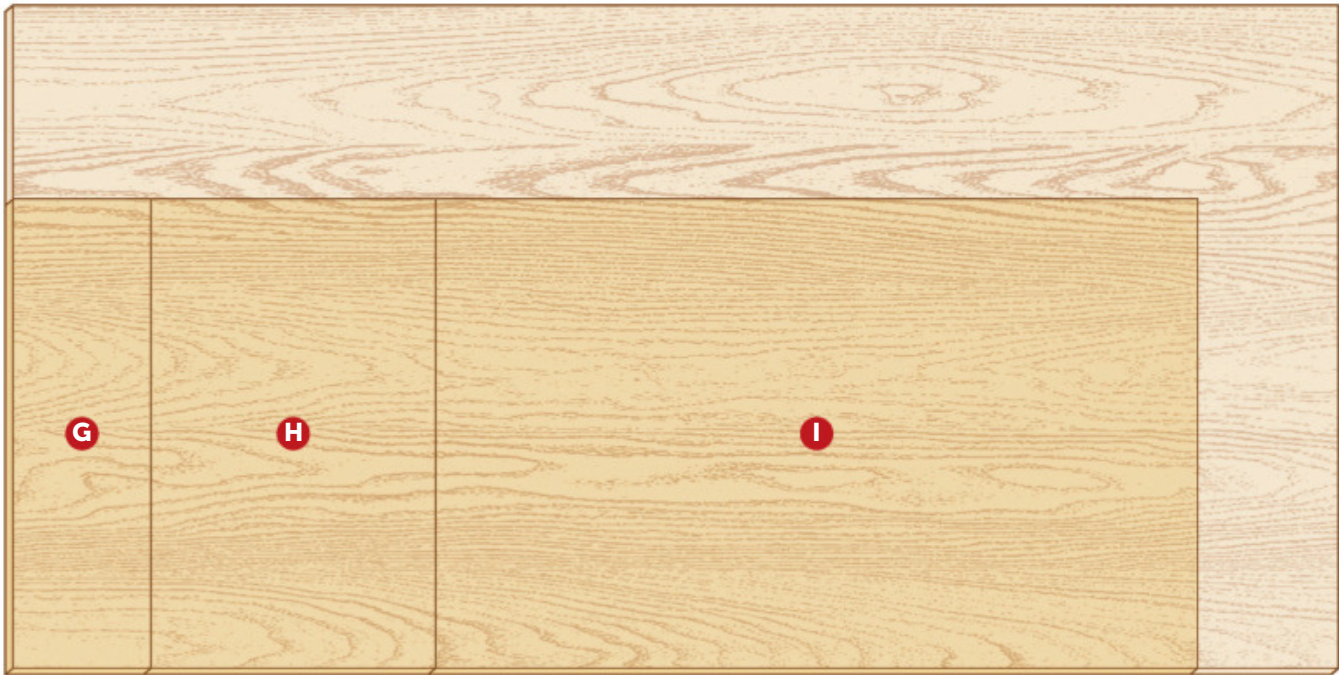
¾ x 5½ x 96" Cherry



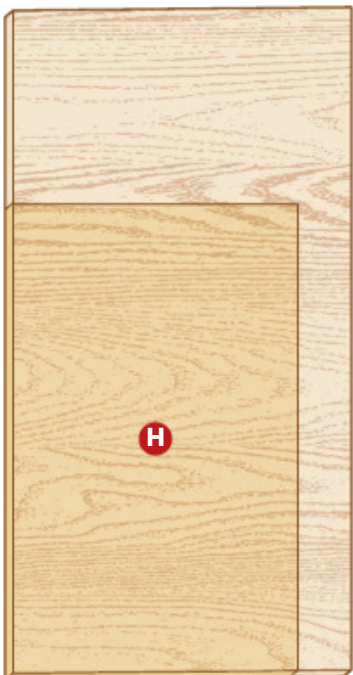
¾ x 3½ x 96" Cherry



1¼ x 7¼ x 84" Cherry †Plane or resaw to the thickness listed in the Materials List.



¾ x 48 x 96" Cherry plywood



¾ x 48 x 24" Cherry plywood



For chair plans that complement this table, visit woodstore.net/cherrychair





SCENIC VIEW PASSENGER CAR

Create a carriage to transport passengers to far-off places on the Timber Line Express.

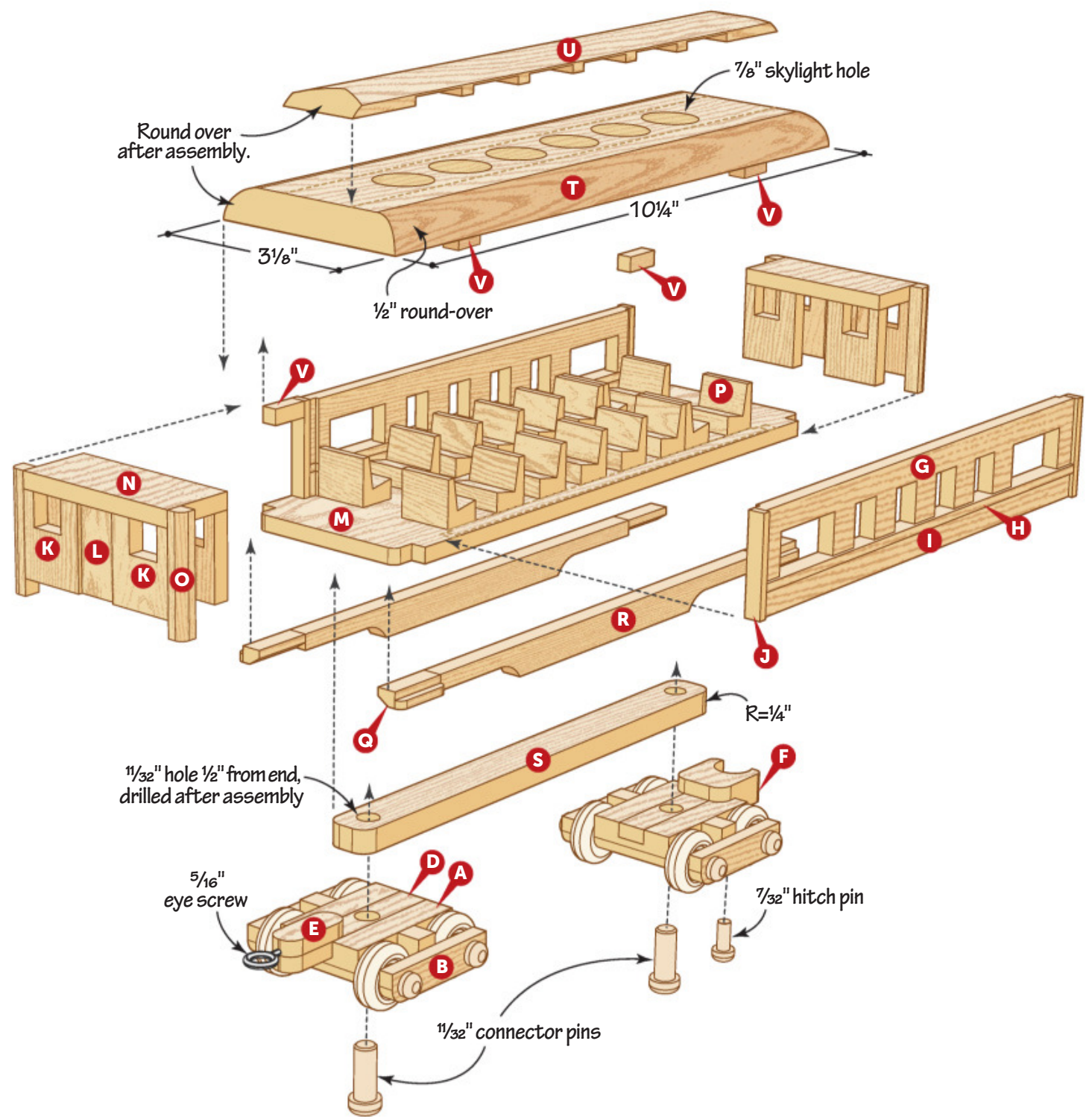
WRITER: ZACH BROWN
DESIGNER/BUILDER: JOHN OLSON



Next out of the yard in the Timber Line Express, it's a passenger car with a removable roof. We had fun imagining the scenic vistas (and woodshops) soon to be visited by passengers aboard the Timber Line. Imagine seeing the coastline of basement beach, icy garage glacier, or the wide-open spaces of the living room.

As with the other cars in the Timber Line, we have assembled a kit [\[Sources\]](#) with specialty components to help you get started. The rest you can build from small pieces of scrapwood. All aboard!

EXPLODED VIEW



WHEEL TRUCKS

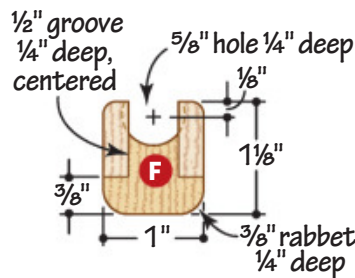
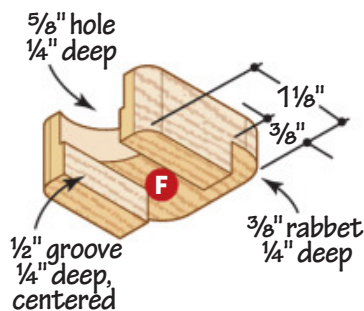
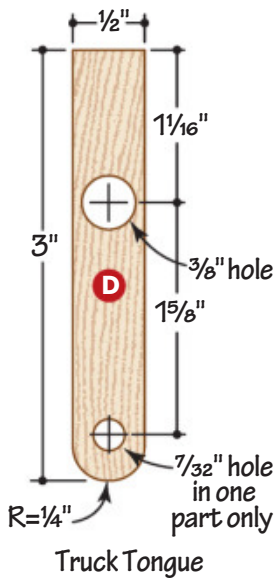
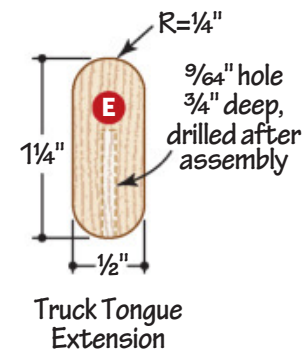
Pivoting front and rear truck assemblies keep the car on track. These are the same truck assemblies used on the previous cars in the Timber Line Express series.

1 Cut the truck frames and side frames (A, B) to size [Materials List, Drawing 1]. Form the centered groove on the top of each truck frame (A). Drill the stopped holes in the edges of the truck frames [Photo A] and the through-holes in the side frames (B) for the axle pegs. Round over the lower ends of the frames [Photo B].

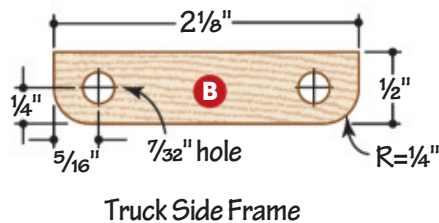
2 Cut the spring groups (C) to size and glue the 3/8"-wide face to the sides of each truck frame (A), centered and flush to the top and bottom [Drawing 2].

3 Cut the truck tongues and tongue extension (D, E) to size [Drawing 1]. Round over the corners on one end of the tongue extension (E) and glue it to the top of the front truck tongue (D), square end of the extension flush with the end of the tongue. Once the glue dries, drill the 9/64" hole in the front end of the tongue assembly [Drawing 2, Photo C], then round over the drilled end.

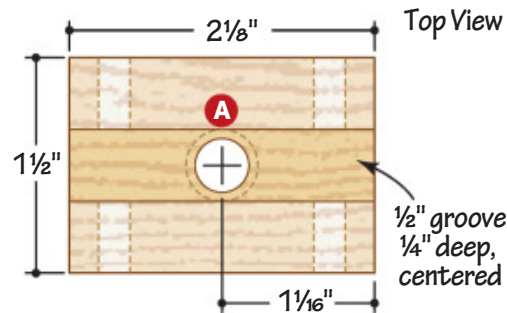
1 TRUCK PARTS



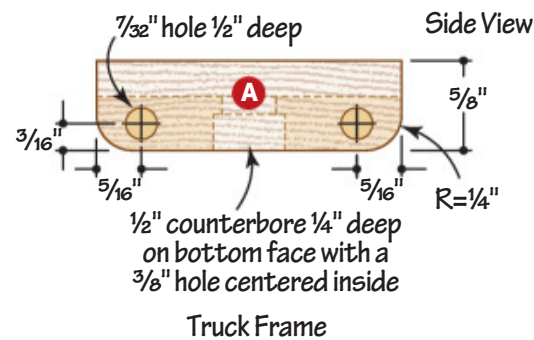
Tongue Hitch Shroud



Truck Side Frame

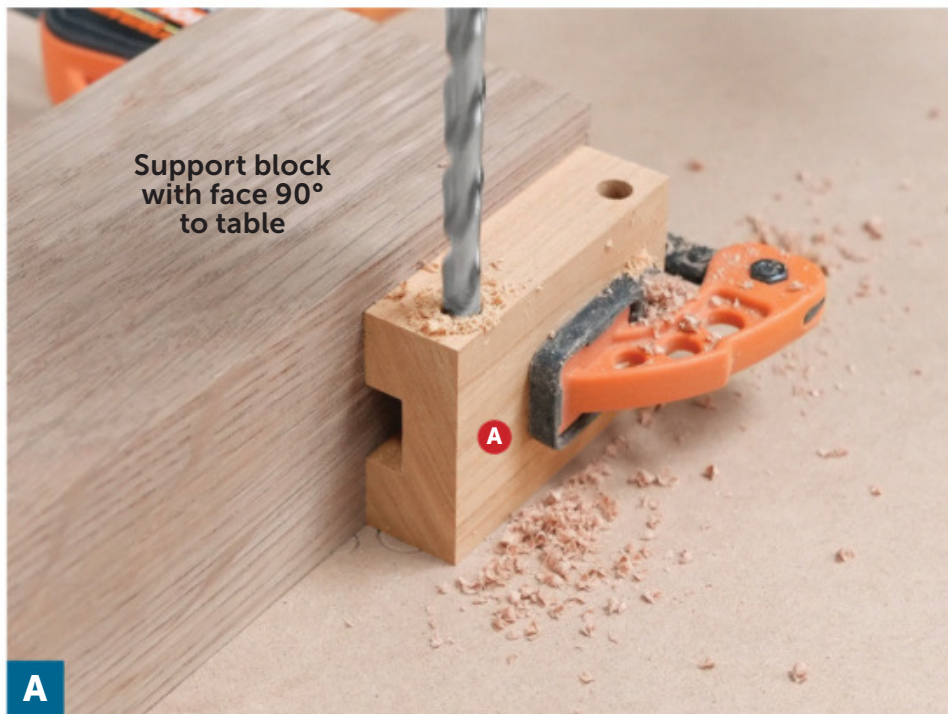


Top View



Side View

Truck Frame



Support block with face 90° to table

A

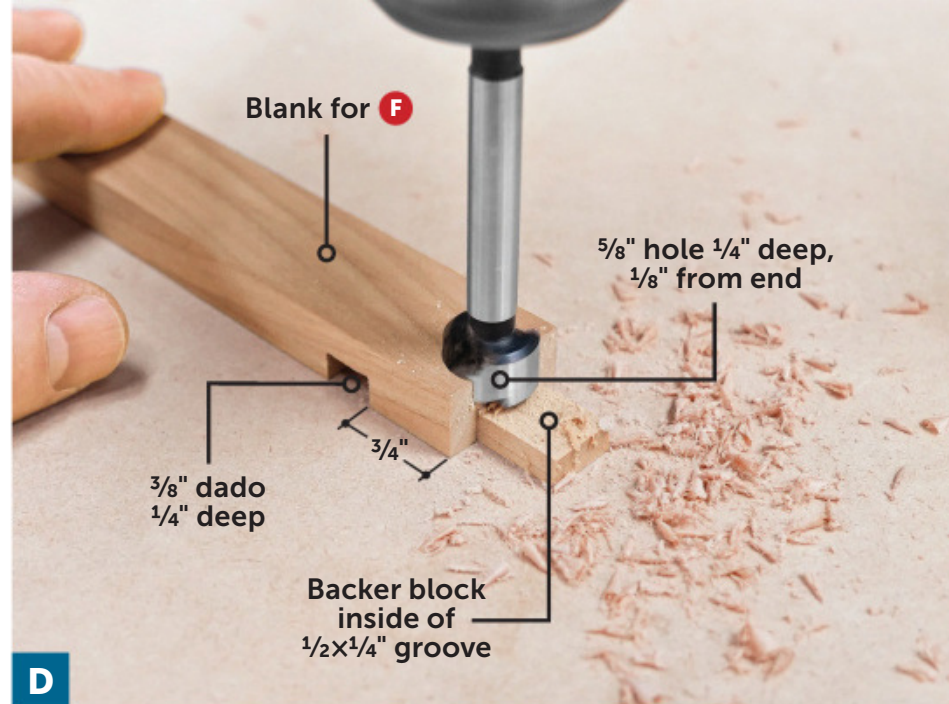
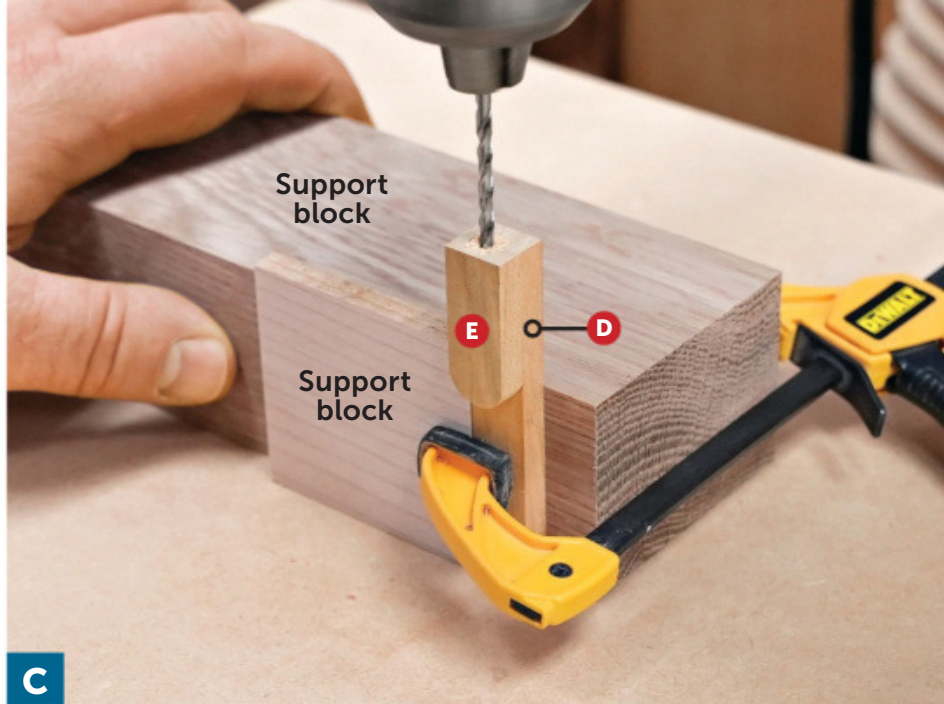
To ensure straight holes for the axle pegs, clamp the truck frames (A) against a support block on your drill-press table, then drill 1/2"-deep holes using a 7/32" brad-point bit.



Backer block

B

Install a 1/4" round-over bit in the router table and clamp a truck frame to a backer block to keep your fingers away from the bit and to prevent tear-out as you rout across the grain.



C Use a pair of support blocks to hold the tongue in a plumb and square vertical position at the drill press. A $\frac{9}{64}$ " brad-point bit makes a clean hole in the end grain.

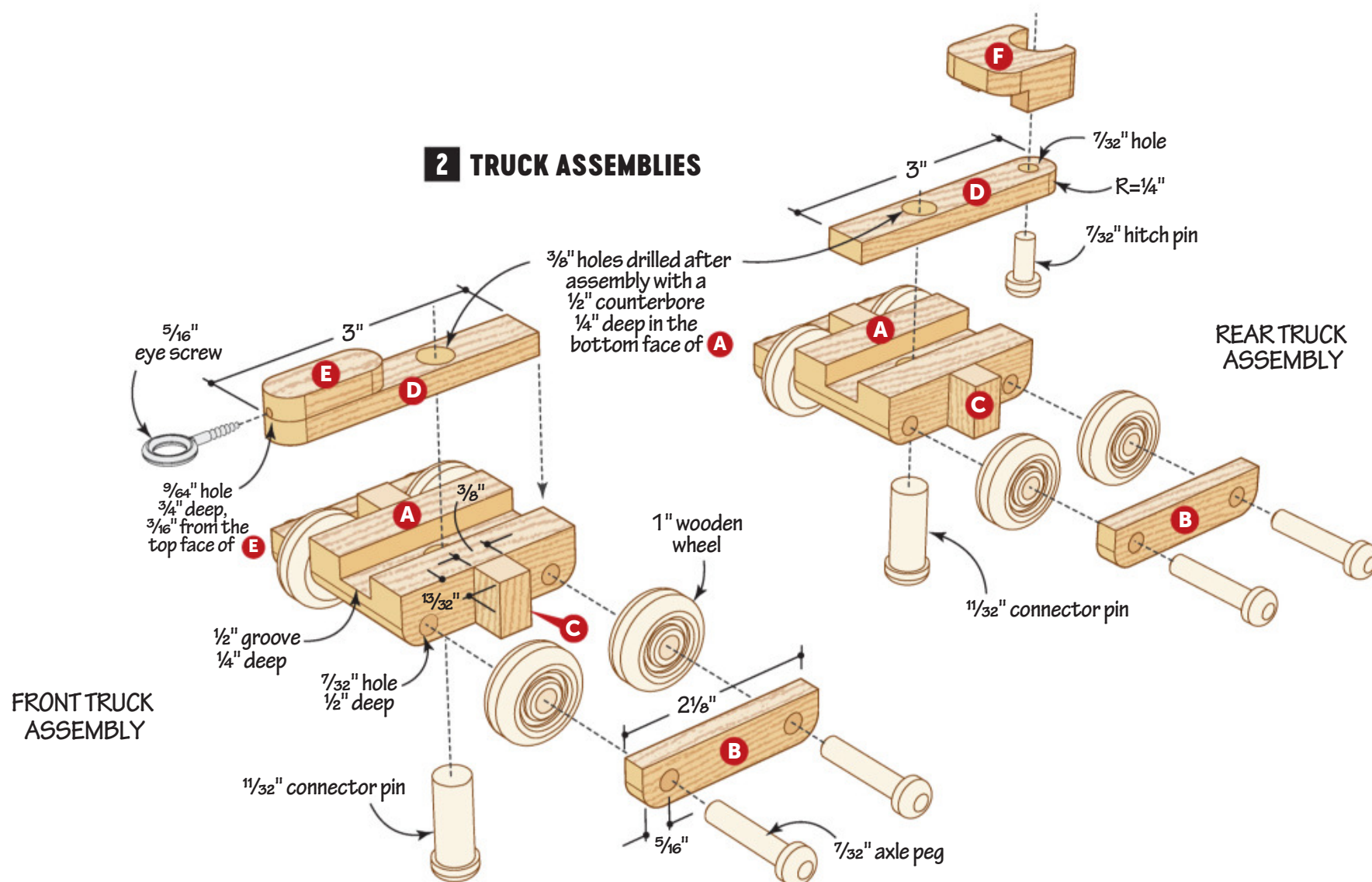
D Install a $\frac{5}{8}$ " Forstner bit in the drill press and drill a $\frac{1}{4}$ "-deep hole, centered $\frac{1}{8}$ " from the end of the workpiece. A backer block prevents tear-out as the bit passes into the groove.

4 Glue the front tongue assembly into the groove on the front truck frame (A), flush at the back end [Drawing 2]. Drill the $\frac{7}{32}$ " hole in the rear tongue (D), round over the back corners, and glue it into the groove on the rear truck frame, flush at the front end.

5 Cut a 6"-long blank to thickness and width for the tongue hitch shroud (F) [Materials List]. Form a centered

groove along one face to fit the rear truck tongue (D) [Drawing 1], then cut a $\frac{3}{8}$ " dado $\frac{3}{4}$ " from one end. This will become a rabbet after cutting the hitch shroud to length. Drill the hole in the top face [Photo D] and round over the corners on the same end. Crosscut the hitch shroud to length at the edge of the dado, round over the front corners, and glue it to the rear truck tongue [Drawing 2].

2 TRUCK ASSEMBLIES



6 Continue the truck assembly by gluing an axle peg into each hole in the truck side frames (B) using a few drops of cyanoacrylate glue on the underside of the peg heads [Drawing 2]. Once the glue cures, slip the wheels and spacers (included in the kit) onto the axle pegs. Then use wood glue to secure the ends of the pegs into the holes in the truck frames (A), and the side frame (B) to the spring group (C) [Photo E].

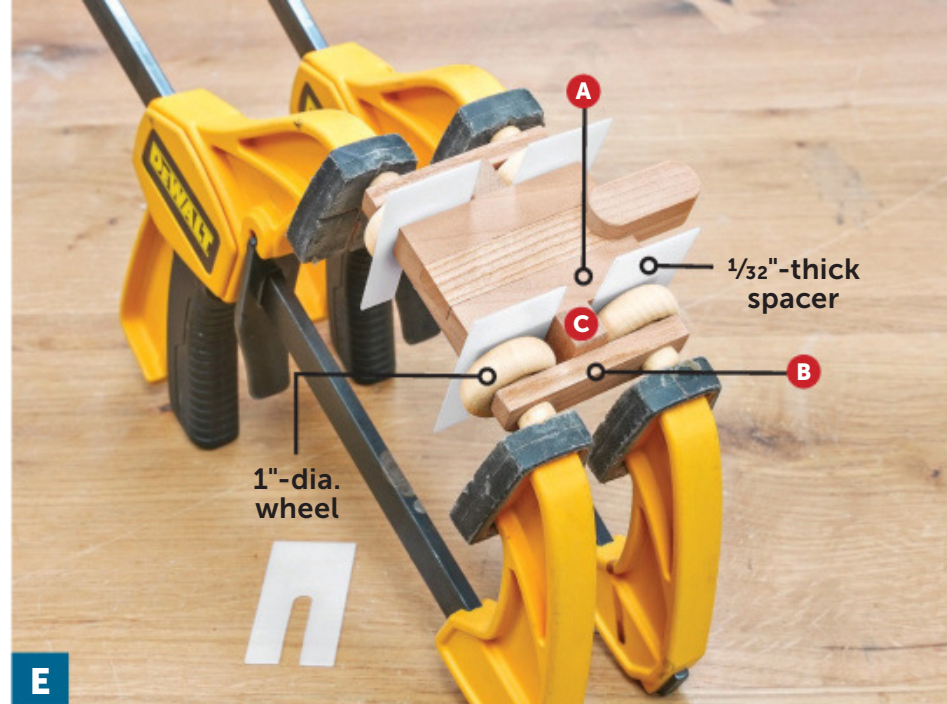
7 Form a recess for the truck connector pins by drilling a $\frac{1}{2}$ " counterbore $\frac{1}{4}$ " deep, centered on the bottom face of each truck frame (A) [Drawing 1]. Then drill a $\frac{3}{8}$ " hole through each truck assembly, centered in the counterbore. Add the eye screw to the front truck and glue the hitch pin into the hole in the rear truck tongue (D), trimming it flush with the top of the hitch shroud (F).

CRAFT A COZY INTERIOR

1 Cut the upper sides, window sills, lower sides, and door frames to size (G–J). Lay out and notch the window openings in the upper sides (G) [Drawing 3, Photo F]. Glue the window sills (H) between the upper and lower sides, flush with the inner faces, and the door frames (J) to the ends of each assembly. Once the glue dries, rabbet the ends of the side assemblies [Photo G].

2 Cut four 3"-long blanks to thickness and width for the breezeway end walls (K) [Materials List, Drawing 4]. Notch the ends [Photo H], then cut the end walls to length from each end of the blanks. Cut the doors (L) to size and glue each one between a pair of end walls, centered front-to-back. Glue the remaining four end walls into the rabbets on the ends of the side assemblies, flush to the bottom edges.

3 Cut the platform (M) to size and notch the corners [Drawing 5]. Glue the side (G–K) and end wall (K/L) assemblies to the top of the platform. Cut the breezeway ceilings and corner posts (N, O) to size and glue them to the car assembly [Exploded View].



Slot the $\frac{1}{32}$ " spacers from the project kit to fit around the axle pegs between the wheels and the truck frame (A) before clamping the wheel assemblies into place. Once the glue dries, remove the spacers.



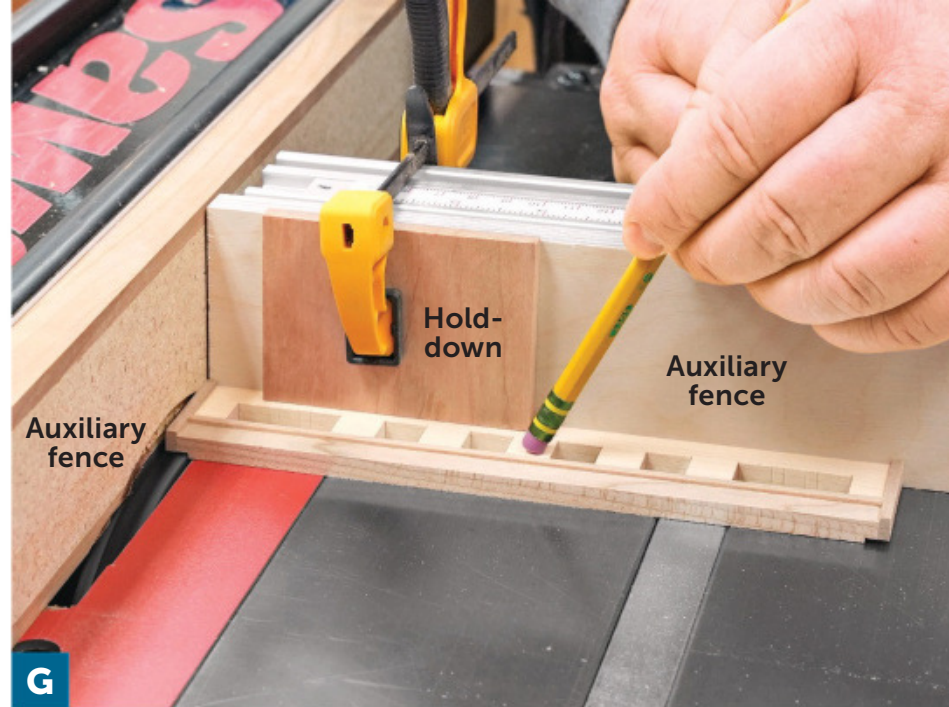
“
WE DESIGNED THE TIMBER LINE EXPRESS AROUND WHEELS AND AXLES THAT ARE CLOSE IN SIZE TO “L” OR LEGO SCALE. THIS MAKES THE PASSENGER CAR THE PERFECT SIZE TO TRANSPORT YOUR LEGO MINIFIGS.

—JOHN OLSON, DESIGN EDITOR

”

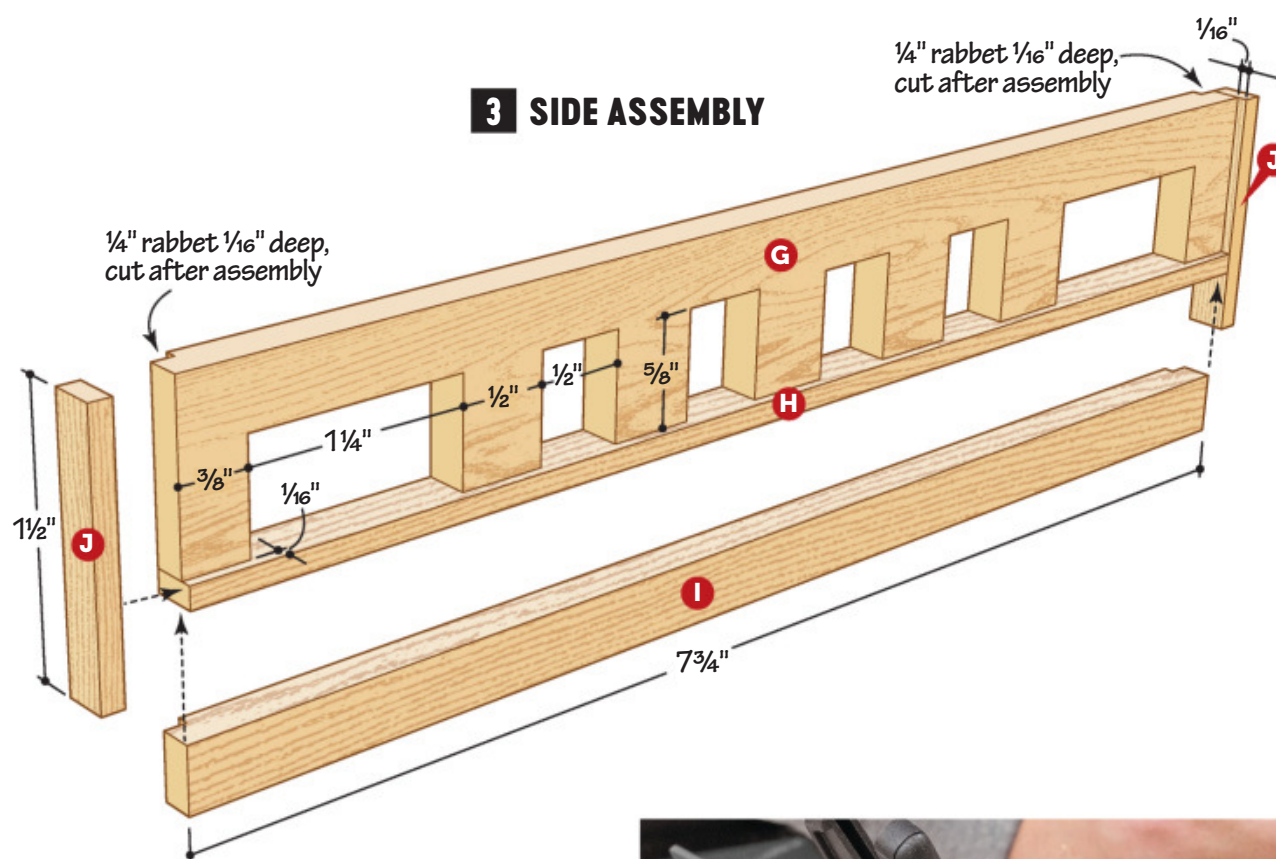


F Install a $\frac{1}{2}$ " dado stack raised to $\frac{5}{8}$ ". Use a stopblock and clamp for each cut, flipping the workpiece end-for-end each time you position the stopblock for symmetrical notches.

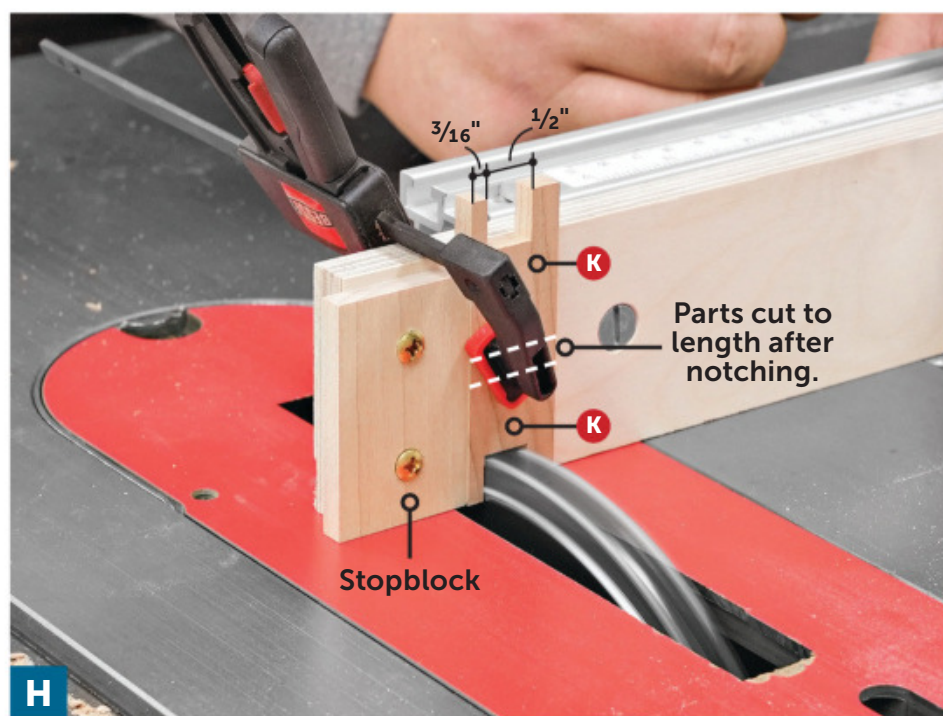
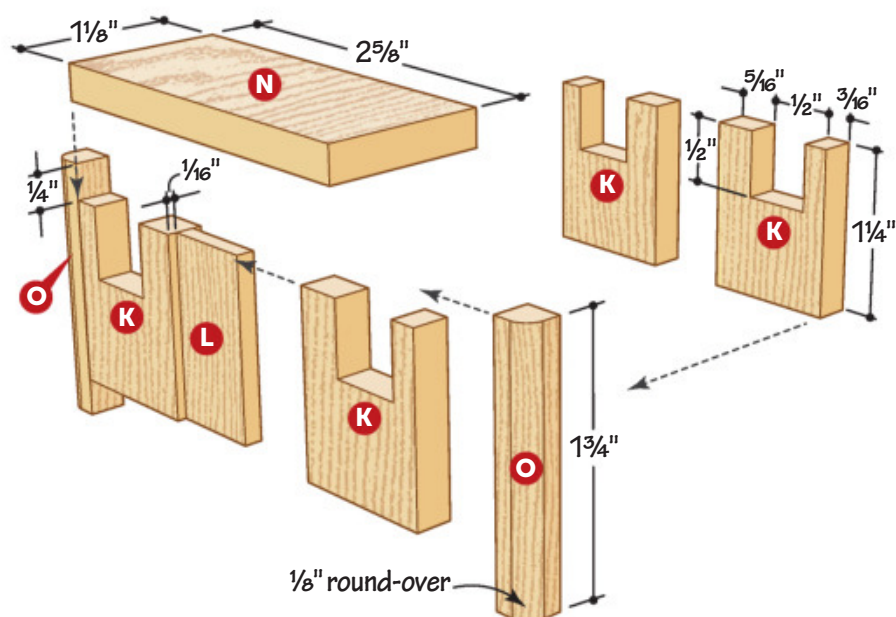


G Install an auxiliary fence on the tablesaw fence and adjust the height of the dado stack to $\frac{1}{16}$ ". Bury the dado stack in the fence, leaving $\frac{1}{4}$ " exposed, and rabbet both ends of each side assembly.

3 SIDE ASSEMBLY



4 BREEZEWAY



H Adjust the dado stack height to $\frac{1}{2}$ ". Attach a stopblock to the miter-gauge auxiliary fence to both support the workpiece and position the offset notch $\frac{3}{16}$ " from one edge.

4 Prepare a $\frac{3}{4} \times 3 \times 20$ " maple workpiece and use the full-size pattern to lay out the seat profile on one end, flush with an edge [Drawing 6]. Adjust the tablesaw blade to 10° and cut the angled rabbet on the edge of the workpiece to match the seat shape; then cut the seat strip from the workpiece [Photo I]. Crosscut the seats (P) to length and glue them to the platform [Exploded View, Drawing 5].

5 On a 6"-long workpiece, cut a $\frac{3}{16}$ " chamfer and $\frac{1}{8} \times \frac{1}{8}$ " rabbet for the stairs (Q) [Drawing 7]. Crosscut four 1"-long stairs and glue them to the bottom of the platform (M), flush with the corner posts (O) and the edge of the platform [Exploded View]. Once the glue dries, sand a slight round-over on both corners of the stairs, the outside corner of the posts, and the corners of the platform (M).

6 Measure between the stairs to verify the length of the skirts (R), then cut them to size and shape [Exploded View, Drawing 8]. Glue the skirts to the bottom of the platform, $\frac{1}{8}$ " from each edge. Cut the frame rail (S) to size, round over the corners, and glue it to the bottom of the platform (M), centered. Once the glue dries, drill the $\frac{11}{32}$ " holes through the frame rail and just into the underside of the platform.

RAISE THE ROOF

1 Cut the lower and upper roof (T, U) to size. Lay out and drill the $\frac{7}{8}$ " skylight holes in the lower roof (T) [Drawing 9]. Adjust the dado stack for a $\frac{1}{8}$ "-deep cut and form the dados across the bottom face of the upper roof (U).

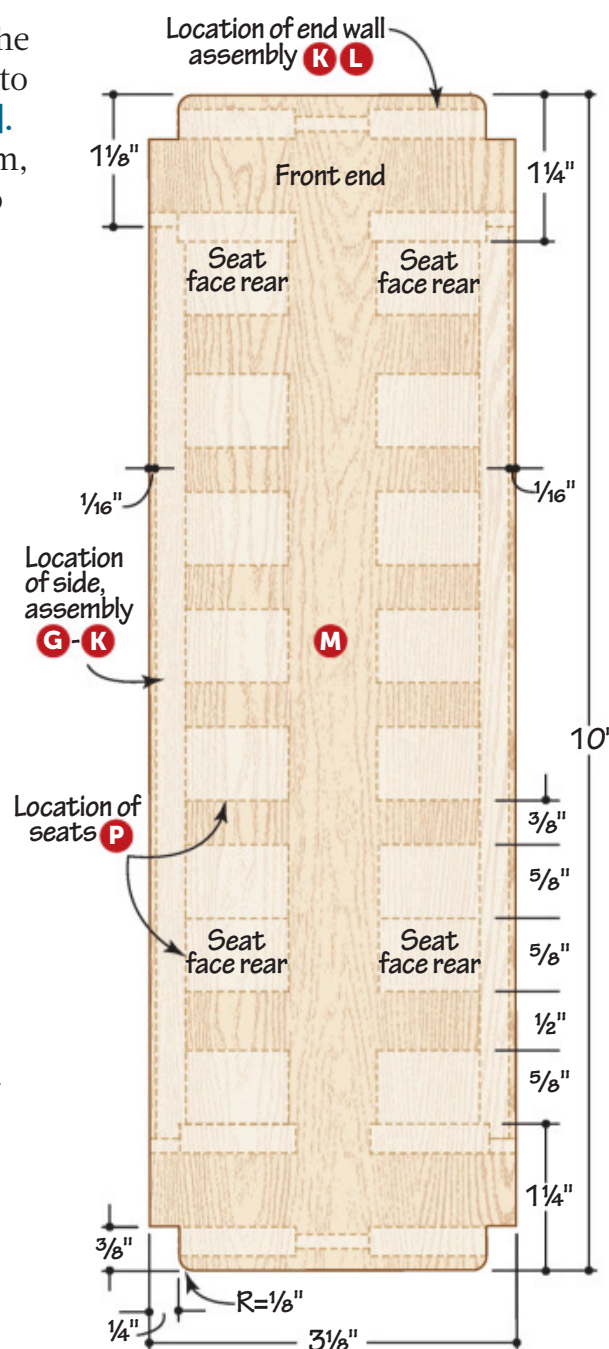
2 Glue the upper roof to the lower roof, flush to the ends and centered side-to-side [Exploded View]. Use a block plane or sanding block to round over the long upper edges of the lower and upper roof.

3 Measure between the door frames (J) and corner posts (O) and cut the door headers (V) to fit [Exploded View]. Center the roof assembly on the car assembly, mark the locations of the door headers on the underside of the lower roof (T), then glue the headers to the lower roof. Round off the ends of the roof assembly [Photo J].

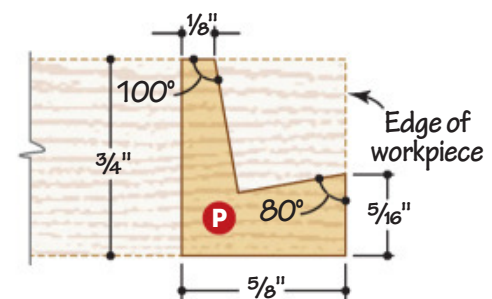


Adjust the tablesaw fence to leave a $\frac{5}{8}$ "-wide strip on the left side of the blade, then ripcut the seat strip to width.

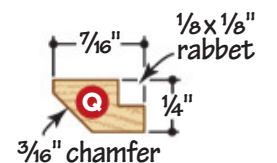
5 PLATFORM TOP VIEW



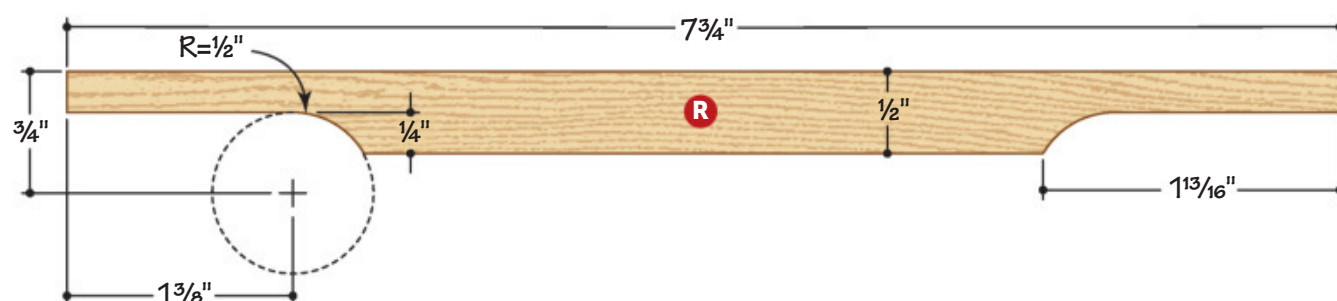
6 SEAT FULL-SIZE END PATTERN



7 STAIRS

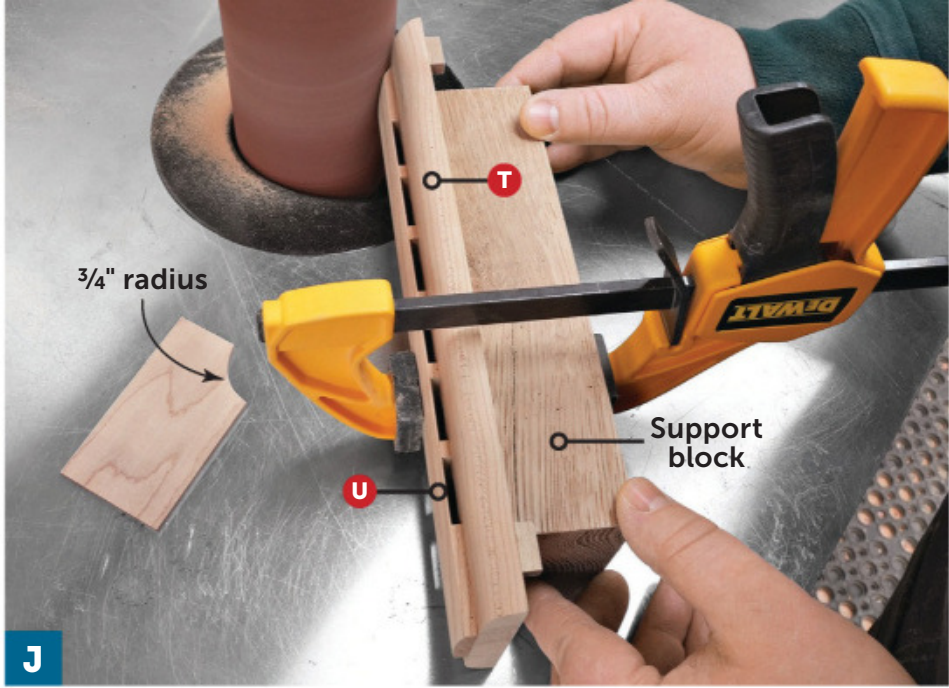


8 SKIRT

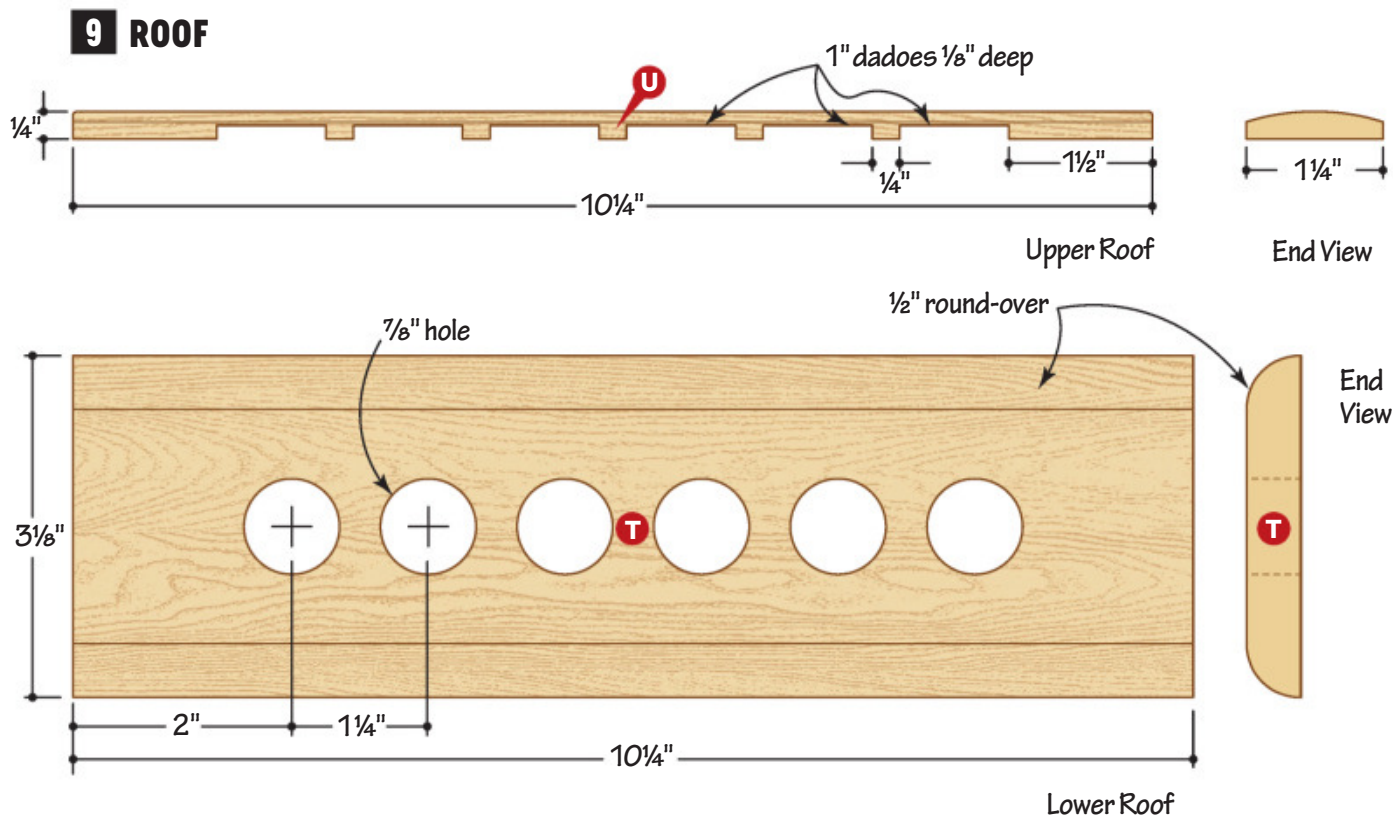


FINISH AND FINAL ASSEMBLY

- 1 Finish-sand and apply a finish to the wheel trucks, car assembly, and roof assembly. We sprayed on three coats of matte lacquer, buffing between each coat with 0000 steel wool.
- 2 Cut the truck connector pins to length, add a small amount of glue to the holes in the frame rail (S), and use the pins to connect the wheel trucks to the car [Exploded View]. Don't apply glue to the pins or the holes in the trucks, to ensure the trucks rotate freely.
- 3 Drop the roof onto the car and hitch it to your train. Pick up some passengers for a journey on the Timber Line Express. 🌲



Clamp the roof assembly to a support block and use a spindle sander (or a belt or disc sander) to round off the ends. A 3/4" radius cut into the corner of a piece of scrap helps to gauge your progress.



MATERIALS LIST

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A	TRUCK FRAMES	5/8"	1½"	2⅛"	C	2
B	TRUCK SIDE FRAMES	¼"	½"	2⅛"	C	4
C	SPRING GROUPS	⅜"	1⅜"	5/8"	C	4
D	TRUCK TONGUES	¼"	½"	3"	C	2
E	TONGUE EXTENSION	¼"	½"	1¼"	C	1
F*	HITCH SHROUD	½"	1"	1⅛"	C	1
G	UPPER SIDES	¼"	1"	7¾"	M	2
H	WINDOW SILLS	⅛"	5/16"	7¾"	C	2
I	LOWER SIDES	¼"	⅜"	7¾"	C	2
J	DOOR FRAMES	⅛"	5/16"	1½"	C	4
K*	END WALLS	¼"	1"	1¼"	C	8
L	DOORS	⅛"	5/8"	1¼"	M	2
M	PLATFORM	¼"	3⅛"	10"	C	1
N	CEILINGS	¼"	2⅝"	1⅛"	C	2
O	CORNER POSTS	¼"	¼"	1¾"	C	4

PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
P*	SEATS	3/4"	5/8"	7/8"	M	16
Q*	STAIRS	1/4"	7/16"	1"	M	4
R	SKIRTS	1/2"	5/16"	7 3/4"	M	2
S	FRAME RAIL	3/8"	3/4"	8 1/2"	C	1
T	LOWER ROOF	1/2"	3 1/8"	10 1/4"	C	1
U	UPPER ROOF	1/4"	1 1/4"	10 1/4"	C	1
V	DOOR HEADERS	1/4"	1/4"	5/8"	M	4

*Parts initially cut oversize. See the instructions.

MATERIALS KEY: C—cherry, M—maple.

BLADE AND BITS: Dado stack, 9/64", 7/32", 11/32", and 3/8" brad-point bits, 1/2", 5/8", and 7/8" Forstner bits, 1/4" round-over router bit.

SOURCES: Train Passenger Car Kit no. RS-01380E \$10 each (\$40 5-pack), woodstore.net/passengercarkit.

PROJECT COST: It cost us about \$30 to build this project. Your cost will vary by region and source.

BREAD SLICING TRAY

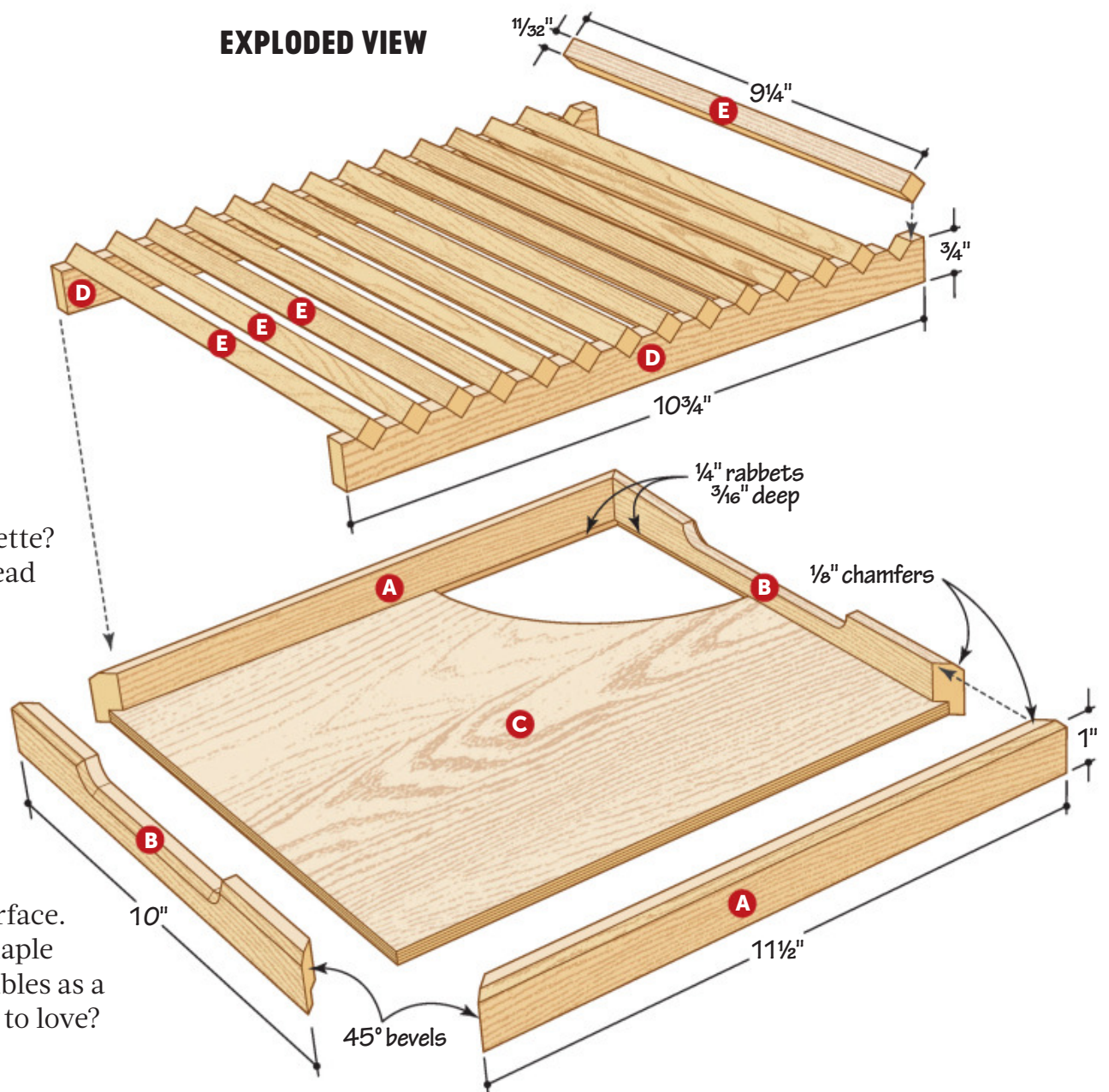


With its evenly spaced slats and crumb-catching tray, this cutting-edge bread board actually ranks right up there as the best thing since sliced bread!

WRITER: KERRY GIBSON
DESIGNER: KEVIN BOYLE
BUILDER: BRIAN BERGSTROM

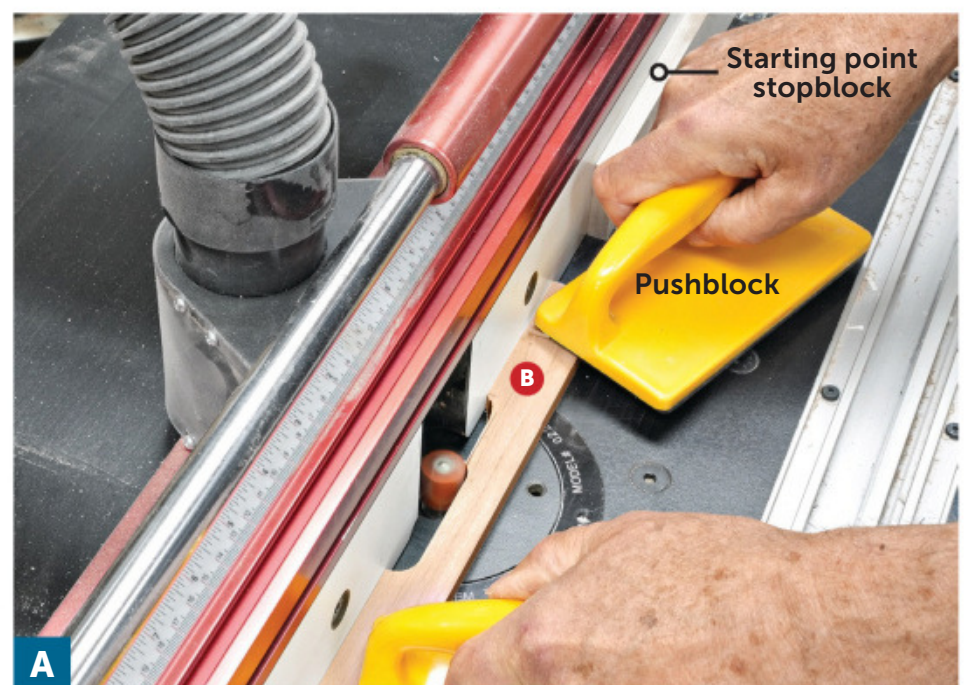
OVERALL DIMENSIONS
11½"W x 10"D x 1⅞"H

Ever try slicing a hard-crusted, French baguette? You can wind up with bread crumbs everywhere. This bread tray solves that problem, letting crumbs drop through the slatted cutting surface where they're captured in the tray. The slots also save your knife blade from dulling contact with a cutting surface. And the beautiful hard maple means the tray easily doubles as a serving piece. What's not to love?



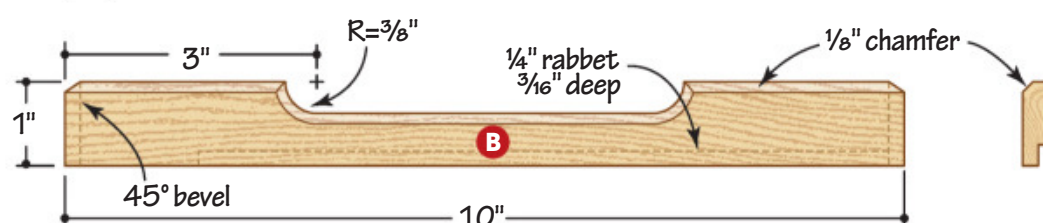
TRICK OUT THE TRAY

- 1 From 3/8" stock, cut the tray sides (A) and tray ends (B) to width and slightly overlength [Exploded View, Materials List] and bevel-cut them to final length at the tablesaw.
- 2 Lay out the cutouts in the tray ends (B) [Drawing 1], bandsaw them to rough shape, then rout to final shape [Photo A].
- 3 Reset the router fence and bit to rout the rabbets on the inside lower edge of the tray sides and ends. Switch to a chamfer bit and rout chamfers on the upper outside edges of the tray ends and sides.
- 4 Dry-assemble the tray ends and sides and cut the bottom (C) to fit from 1/4" plywood. Finish-sand the inside faces of the sides, ends, and bottom, then glue and clamp the tray.



Set your router fence to expose 3/8" of a 3/4" straight bit. Stopblocks set the starting and stopping points and pushblocks guide the workpiece while you rout it to final shape.

1 TRAY END DETAIL



CREATE THE SLICING SLATS

- 1 Cut three slat rails (D) to width and 1" overlength [Drawing 2] from 3/8" stock. You'll use one of these rails as a test piece to fine-tune the spacing for the slats (E).
- 2 Install a 90° V-bit in your router table at 1/4" height, mount an auxiliary fence to your miter gauge, and make a cutting pass over the bit. Cut a triangular key to fit the notch in the auxiliary fence, then glue the key in place on the fence.
- 3 Shift the auxiliary fence so the key is 1/4" from the edge of the bit. Cut several notches [Photo B], adjusting the position of the auxiliary fence if necessary to create 1/4" spacing between the V-notches [Drawing 2]. When you're satisfied with the test cuts, cut notches in the actual slat rails. Then cut the rails to final length, leaving equal-length flats at each end.
- 4 Starting with 3/8x3/8x12" stock, plane the slats (E) in thickness and width until the corners of the slats meet flush with the edges of the flats in the rails (D). Then cut the slats to final length.

Note: Form the triangular key by bevel-cutting the corner from the edge of a wider board at the tablesaw, then crosscutting it to length.

- 5 Glue and clamp the outer slats in place at each end of the rails, checking the assembly for square. Once the glue dries, glue the remaining slats to the rails.
- 6 Finish-sand the slat-rail assembly and the outer faces of the tray, then apply a food-safe finish, such as General Finishes butcher block oil. Now buy or bake a loaf of bread and cut slices for your favorite piled-high sandwich! 🥪



MATERIALS LIST

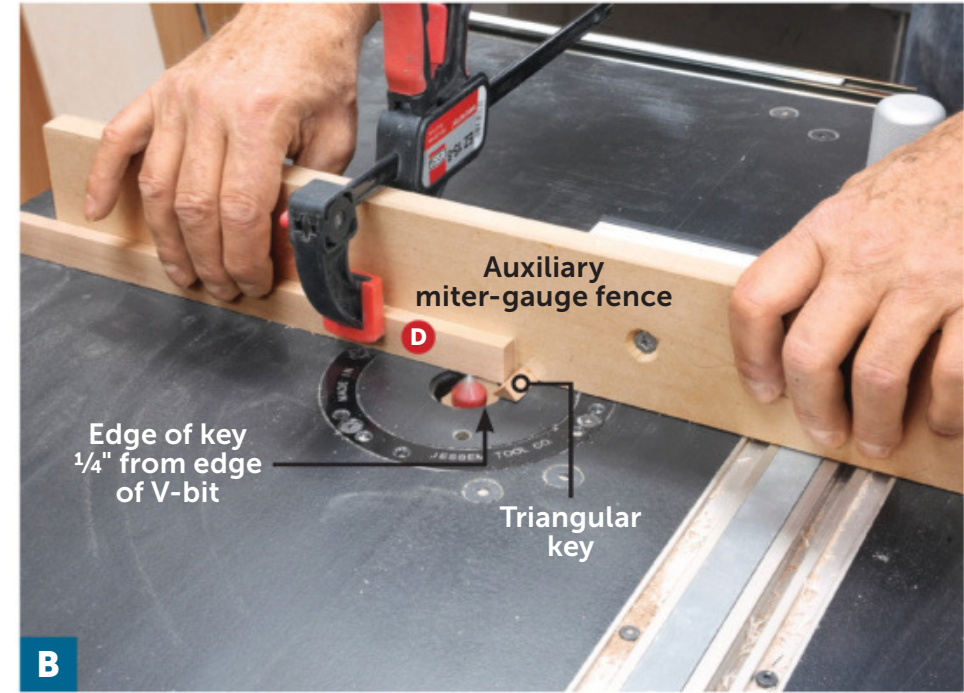
PART		FINISHED SIZE			Matl.	Qty.
		T	W	L		
A*	TRAY SIDES	3/8"	1"	11 1/2"	M	2
B*	TRAY ENDS	3/8"	1"	10"	M	2
C	TRAY BOTTOM	1/4"	9 5/8"	11 1/8"	Ply	1
D*	SLAT RAILS	3/8"	3/4"	10 3/4"	M	3
E*	SLATS	3/8"	3/8"	9 1/4"	M	14

*Parts initially cut oversize. See the instructions.

MATERIALS KEY: M—maple, Ply—maple plywood.

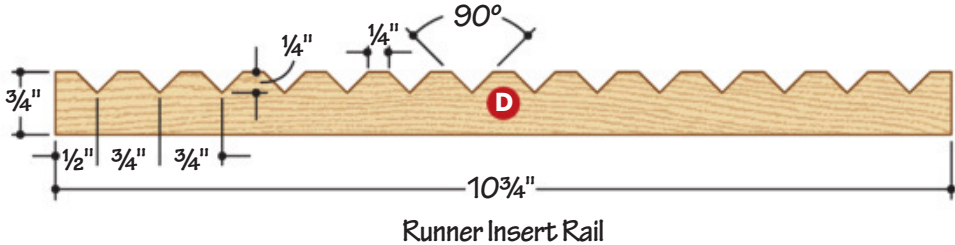
BLADES AND BITS: 3/4" straight and 90° V-groove router bits.

PROJECT COST: We built this project using scrapwood. You can build it for about \$25, depending on region and source.



Butt the slat rail (D) against the triangular key in the auxiliary fence, then make a pass over the V-bit. Shift the rail so the notch you just cut sits on top of the key and make another pass, then repeat.

2 SLAT RAIL DETAIL





Survive Just About Anything for Under \$20

On any outdoor adventure, Mother Nature's job is to present you with challenges. Some days she's more demanding than others. And on those days, you'd better come prepared. **The Stauer Survival Box is a near-guarantee you'll be up to the challenge.** The stainless steel multitool offers wire cutters, knife, bottle opener, file, a set of screwdrivers, a pair of pliers and much more. The powerful flashlight has three different settings, and the tactical loop watch is a reliable, water-resistant timepiece that clips to your hip and never leaves your side. All told, opening the Survival Box gives you instant access to nine different tools for **JUST \$19.50**.

Regularly sold for \$99, we're offering this collection of survival essentials to you for **A FIFTH OF THE NORMAL PRICE!** Why? Because we've had an incredible year and we feel like giving back to our valued customers. As this kit has proven to be one of our all-time best sellers, we can only extend this offer while supplies last. Of our initial run of 1,737, **more than half have already sold.** Your move, Mother Nature.

Survival Box Specifications:

- Multitool: 3 1/4" x 1" folded
- Flashlight: 3 1/2" x 1", 260 lumens, takes AA batteries (not included), three LED light modes: strong, medium and caution flashing
- Watch: 2 3/4" x 1", battery type SR626SW (included)

Survival Box ~~\$99~~ \$19.50* + S+P **Save \$79.50**

***You must use Insider Offer Code: SVB282-01 to get this price.**

California residents please call regarding Proposition 65 regulations before purchasing this product.

1-800-333-2045

Your Insider Offer Code: SVB282-01

Regularly priced at \$99, take advantage of this special offer while supplies last!



Praise for Stauer's Survival Box



"[It] has everything!"
— Carol T.,
Anaheim, CA

Box includes flashlight, watch and multitool with wire cutters, knife, bottle opener, file, screwdrivers, pliers and more!

Stauer, 14091 Southcross Drive W., Dept. SVB282-01, Burnsville, MN 55337 www.stauer.com

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HIGH-TECH HEARING PROTECTION

Bluetooth-connected hearing-protection devices quiet the din of loud workshop machines while still allowing you to comfortably listen to music, a podcast, or your favorite book. Here are a few options for eliminating unwanted sounds without putting yourself in sensory isolation.

Choose your own audio adventure

DeWalt's neckband delivers sound when you want it and protection when needed. Speakers built into a wraparound collar direct music toward your ears during quiet tasks. Pop in the attached earbuds and press a button to continue listening during loud operations. DeWalt doesn't test the noise reduction rating (NRR) of its earbuds, but they do muffle sounds effectively and prove comfortable to wear with included interchangeable tips. You can also make and receive calls when connected to your phone. Magnets hold the earbuds together to prevent dangling when not in use.

DeWalt, dewalt.com

Jobsite pro max neckband with speakers, no. DXMA1902093, \$79



Battery-powered Bluetooth

Pro-Protect muffs from 3M take a no-nonsense approach with AA battery power, meaning you can just pop in a new pair when power wanes. A 26-decibel (dB) NRR muffles loud sounds effectively whether or not you're playing connected audio. Double-gasket earpieces provide extra seal and fit well over most ear sizes. Two buttons handle all the audio controls, but require memorizing multiple button-press sequences, which makes control easier using your phone.

3M, 3m.com

Pro-Protect electronic hearing protector, no. 70009127427, \$80



Stay in touch while staying protected

Link Aware headphones from Isotunes take a different approach to hearing protection by blocking only loud noises. A built-in microphone transmits ambient sounds through at a volume of your choosing, allowing you to stay aware of your environment as you listen to connected audio. When ambient volume rises above 85 dB, the microphone shuts down almost instantaneously, protecting your hearing at a 25-dB NRR while still allowing your connected audio to play. We like this unique approach, and we appreciate these headphones' comfort over long periods.

Isotunes, isotunes.com

Link aware, no. IT-34B, \$160



Over-the-ear muffs allow safe listening

Prohear headphones look and feel like traditional over-the-ear hearing muffs, and they carry a 25 dB NRR, making them suitable for sound reduction any time. Connect them to your phone, and they deliver audio that you don't have to crank up to enjoy. Built-in volume and playback buttons let you easily control your audio without having to dig out your phone, and these muffs stay on well without squeezing too tight.

Prohear, theprohear.com

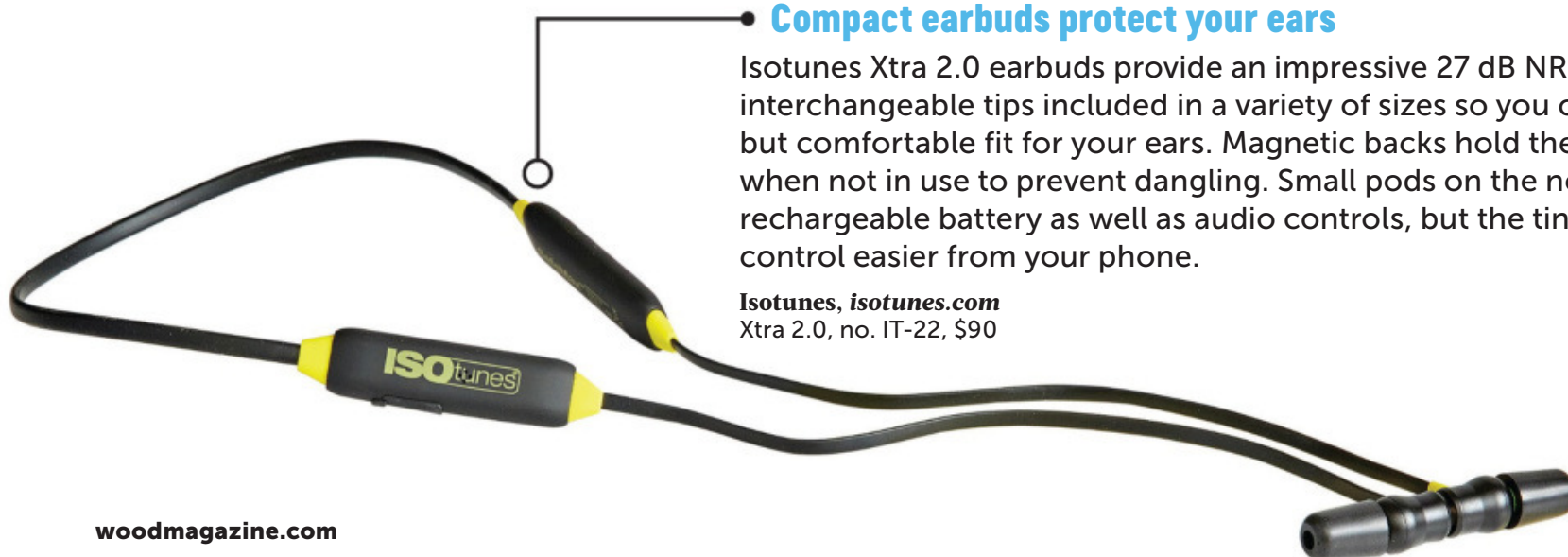
BT hearing protector, no. 037, \$46

Compact earbuds protect your ears

Isotunes Xtra 2.0 earbuds provide an impressive 27 dB NRR thanks to interchangeable tips included in a variety of sizes so you can find a snug but comfortable fit for your ears. Magnetic backs hold the earbuds together when not in use to prevent dangling. Small pods on the neckband hold a rechargeable battery as well as audio controls, but the tiny buttons make control easier from your phone.

Isotunes, isotunes.com

Xtra 2.0, no. IT-22, \$90





SHOP-TESTED ROCKLER ADAPTER FITS CLICK-CONNECT ACCESSORIES TO STANDARD VAC HOSES

Tester: Dave Stone

I'm a fan of Rockler Click-Connect fittings that mount to various tools and allow quick swapping of a vacuum hose from one tool to another. Until now, using those fittings also required purchasing a Rockler vacuum hose. The new Click-Connect hose adapter fits any vacuum hose from 1" to 2½", as well as Festool hoses, allowing me to easily connect any hose to my tools that I've outfitted with Click-Connect fittings.

Rockler, rockler.com

FlexiPort Click-Connect adapter for shop vacuum hoses, no. 69290, \$10



SHOP-TESTED RIDGID PUTS GUIDED CIRC-SAW CUTTING ON THE RIGHT TRACK

Tester: Craig Ruegsegger

Ridgid's 6½" cordless tracksaw impressed me not with any one or two standout features, but with a solid collection of attributes that make this saw a pleasure to use. The brushless motor had no trouble cutting through even 2"-thick ash. Connect the swiveling dust port to a vacuum hose and almost all dust disappears. Stops at 0° and 45° were spot-on out of the box. The bevel mechanism provides a detent at 22½° and overrides to allow bevel angles from -1° to 47°. The saw provides dual depth gauges for setting blade depth for cuts with or without a track, but on both scales cuts were about 1/16" deeper than indicated. For precise stopped cuts, a window on the side of the guard shows exactly where the blade exits the top of the workpiece. The retractable riving knife works well, as I found out when I got the saw slightly twisted during a freehand cut. The included 40-tooth blade made clean cuts in plywood.

The bare tool, which works with any 18-volt Ridgid battery, includes two 27½" lengths of track that lock together solidly and align well. Add the optional 60" track (\$100) for full-length ripcuts in sheet goods. When clean, the anti-skid strips on the bottom kept the track in place, even unclamped while ripping a wavy, 1½"-thick, rough-cut slab. For a belt-and-suspenders approach, anchor one end of the track with the included clamp. Additional track clamps sell in pairs for \$45.

Ridgid, ridgid.com

18-volt 6½" tracksaw, no. R48630B, \$400 (bare tool, includes two 27½" track sections)

SHOP-TESTED MOVING HEADS ADD CLAMPING VERSATILITY

Tester: Kerry Gibson

Several features on Kreg's new VersaGrip clamps pleasantly surprised me. First, the "fixed" head isn't fixed at all. With the push of a button, the head slides to any location on the bar, then holds in place. You can also remove the head and install it on the other side of the handle to quickly create a spreader. The clamps don't feel as robustly made as similar rapid-action clamps, but they've held up to my use, and they produce plenty of clamping force. The large, nonmarring clamping pads have a slight texture on their surface that seems to help grip the workpiece. Dried glue peels easily off the pads. You'll find VersaGrip clamps in 6", 12", 24", and 36" lengths.

Kreg, kregtool.com

VersaGrip clamp, 6"-36", \$21-\$38



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WHAT'S AHEAD

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

CATURDAY NIGHT LIVE Make cat videos more bingeable when you watch them live on this retro telly bed for your favorite little couch purr-tato.



COMPRESSED AIR, ANYWHERE
It's never been easier to plumb your entire shop for air. We take a look at a DIY kit with plenty of expansion options to suit.



MULTI-AXIS TURNING
Are your turnings starting to feel one-dimensional? Give multi-axis turning a spin. Learn how while crafting a cabriole leg.



FESTIVE FRAMES Celebrate the holidays with mementos of Christmas past when you deck the tree with these easy-to-build ornament frames. We show you five profiles to pick from.

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