

# IN 1958, VARATHANE® SET OUT TO INSPIRE WOODWORKERS EVERYWHERE.

Since 1958, Varathane has been used by fine woodworkers and master DIYers like you. Every stain is formulated with a passionate respect for the wood, allowing you to create enduring pieces for generations to come.

We've earned the trust of woodworkers who want durable, time-saving, easy-to-use stains and coatings they can count on. And when it comes to innovation, we remain a category leader.

Trusted for over 60 years, Varathane stains and finishes are renowned for their stunning beauty and exceptional performance.

DON'T JUST FINISH IT. VARATHANE IT.

*Varathane*  
— SINCE 1958 —



Available at





# WOOD

The World's Leading Woodworking Resource

## Find Quality Lumber

 p.30

## Great Plans

▶ **Arts & Crafts Display Cabinet** p.24

▶ **Mil-spec Apache Helicopter** p.44

▶ **Gardener's Seed Starter** p.34

## The Secrets of Sandpaper

 p.54





# Grizzly Industrial

**PURVEYORS OF FINE MACHINERY®, SINCE 1983!**

- ALMOST A MILLION SQUARE FEET PACKED TO THE RAFTERS WITH MACHINERY & TOOLS
- 2 OVERSEAS QUALITY CONTROL OFFICES STAFFED WITH QUALIFIED GRIZZLY ENGINEERS
- HUGE PARTS FACILITY WITH OVER 1 MILLION PARTS IN STOCK AT ALL TIMES
- TRAINED SERVICE TECHNICIANS AT BOTH LOCATIONS • MOST ORDERS SHIP THE SAME DAY
- **BUY DIRECT & SAVE!**

## 14" DELUXE BANDSAW 35<sup>TH</sup> ANNIVERSARY EDITION

- Motor: 1 HP, 110V/220V, single-phase
- Amps: 11A at 110V, 5.5A at 220V
- Precision-ground cast-iron table size: 14" x 14"
- Table tilt: 10° left, 45° right
- Floor-to-table height: 43"
- Cutting capacity/throat: 13½"
- Max. cutting height: 6"
- Blade size: 93½" (½" to ¾" wide)
- Blade speeds: 1800 and 3100 FPM
- Overall size: 27" W x 67½" H x 30" D
- Footprint: 23½" L x 16½" W
- Approx. shipping weight: 247 lbs.



**G0555LA35 ONLY \$655<sup>00</sup>**



## 17" HEAVY-DUTY BANDSAW 35<sup>TH</sup> ANNIVERSARY EDITION

- Motor: 2 HP, 110V/220V, prewired 220V, single-phase, TEFC capacitor start induction, 60 Hz, 1725 RPM
- Amps: 20A at 110V, 10A at 220V • Power transfer: belt drive
- Precision-ground cast-iron table size: 17" x 17" x 1½"
- Table tilt: 10° left, 45° right • Floor-to-table height: 37½"
- Cutting capacity/throat: 16¼" L of blade
- Max. cutting height: 12½" • Blade size: 131½" long
- Blade width range: ½"–1" wide • Footprint: 27" W x 17¼" D
- Blade speeds: 1700 and 3500 FPM
- Fully-balanced cast aluminum wheels
- Overall size: 32" W x 73" H x 32" D
- Approx. shipping weight: 342 lbs.

**MADE IN AN ISO 9001 FACTORY**



**G0513ANV ONLY \$925<sup>00</sup>**



## 10" HYBRID TABLE SAW WITH RIVING KNIFE

**MADE IN AN ISO 9001 FACTORY**

- Motor: 2 HP, 110V/220V<sup>†</sup> (prewired 220V), single-phase
- Amps: 16A at 110V, 8A at 220V
- Precision-ground cast-iron table with wings measures 40" W x 27" D
- Table height: 34"
- Arbor: 5/8" • Arbor speed: 3850 RPM
- Capacity @ 90°: 3½"
- Capacity @ 45°: 2¾"
- Cutting capacity: 30" right, 12" left
- Overall size: 62" W x 39" D x 48" H
- Footprint: 20½" L x 19½" W
- Approx. shipping weight: 416 lbs.



**FREE 10" X 40T CARBIDE-TIPPED BLADE**

**G0833P ONLY \$1145<sup>00</sup>**

<sup>†</sup>115V operation requires part T23999 circuit breaker and wiring procedures that must be completed by an electrician or other qualified service personnel.

## 10" LEFT-TILTING TABLE SAW WITH RIVING KNIVES & CAST-IRON ROUTER TABLE



- Motor: 3 HP, 240V, single-phase
- Precision-ground cast-iron table size with wings: 48" W x 27" D
- Arbor: 5/8"
- Cutting capacity: 26" R, 8" L
- Max. depth of cut: 3" @ 90°, 2½" @ 45°
- Approx. shipping weight: 550 lbs.



**G1023RLW ONLY \$1550<sup>00</sup>**



## 8" x 76" PARALLELOGRAM JOINTERS

**MADE IN AN ISO 9001 FACTORY!**

- Motor: 3 HP, 230V, single-phase
- Max. depth of cut: 1½"
- Rabbeting capacity: 1½"
- Cutterhead speed: 5500 RPM
- Cutterhead diameter: 3½"
- Table: precision-ground cast-iron
- Table size: 76" x 8"
- Fence size: 38" x 4½"
- Dust port: 4"
- Fence system: positive stops @ ±45° & 90°
- Approx. shipping weight: 365 lbs.



**WITH MOBILE BASE  
G0857 ONLY \$1295<sup>00</sup>**

**WITH SPIRAL CUTTERHEAD & MOBILE BASE  
G0858 ONLY \$1725<sup>00</sup>**

## 15" PLANERS

- Motor: 3 HP, 220 V, single-phase
- Max. cutting width: 14½"
- Max. cutting height: 6½"
- Max. cutting depth: 1/8"
- Rate of feed: 16 FPM & 20 FPM
- Cutterhead speed: 5000 RPM
- Approx. shipping weight: 540 lbs. (G1021Z), 581 lbs. (G1021X2)

**MADE IN AN ISO 9001 FACTORY!**



**WITH CABINET STAND  
G1021Z ONLY \$1395<sup>00</sup>**

**WITH SPIRAL CUTTERHEAD  
G1021X2 ONLY \$1995<sup>00</sup>**



## 1½ HP PORTABLE CYCLONE DUST COLLECTOR

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



**G0860 ONLY \$699<sup>00</sup>**

## 2 HP PORTABLE CYCLONE DUST COLLECTOR

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

**LIFT HANDLE & ROLL DRUM EASILY FOR SAWDUST DISPOSAL!**



**G0861 ONLY \$975<sup>00</sup>**



Due to rapidly changing market conditions and tariffs our advertised prices may be increased at any time without prior notice.

**1-800-523-4777 grizzly.com**

TECHNICAL SERVICE: 570-546-9663 • FAX: 800-438-5901

2 GREAT SHOWROOMS!  
BELLINGHAM, WA • SPRINGFIELD, MO





# Story sticks

**W**henever I build a project for someone else, I try to include something that gives the completed piece a story; some interesting tidbit the recipient can share with those who might ask about it.

For example, when building a new conference table for my church, I went searching for some solid-wood banding to hide the plywood edges. My hardwood dealer had a whole rack of old-growth oak harvested from sunken ships at the bottom of Lake Michigan. Bingo! A merely functional table now had a story. Last Christmas, I made “pegs and jokers” games for both kids from a Philippine mahogany shelf I’d salvaged while remodeling our first house.

So, when my son, Colby, married his fiancée, Jenny, last November, I wanted to build them a gift that would have a special story.

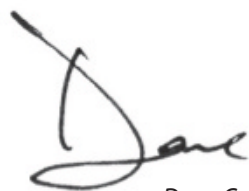
Earlier, *WOOD*® magazine’s Tools Editor, Bob Hunter, had shown me a unity cross he had made for a family wedding. One cross nests inside the other, and, during the wedding ceremony, the bride and groom tap in dowels to permanently bind them together. The symbolism—that the only way to separate the two is to destroy each of the individuals—was too powerful to pass up.

To give it a story, I made the inset cross out of offcuts from the beautiful ash altar furniture made for our family’s church. (I’d been saving them for 15 years, waiting for *just the right project*.) Because Jenny was born in Illinois, I used quartersawn white oak—Illinois’ state tree—for the frame cross. On the back I laser-engraved “What God has joined, let no one put asunder” to really hammer the message home.

It was tremendously rewarding to contribute to the most important day of Colby and Jenny’s life together.

Bob shared the unity cross idea with me, so I’ll go a step further and share with you my plans for building the cross at [woodmagazine.com/unitycross](http://woodmagazine.com/unitycross). That’s in the new “Member Plans” section of our website. When you check it out, I hope you’ll share the story of one of your own projects by posting photos and some simple how-to.

See you in the shop!



Dave Campbell  
dave.campbell@meredith.com  
Facebook and Twitter: @WOODeditor  
Instagram: @wood\_editor



EDITORIAL CONTENT CHIEF **DAVE CAMPBELL**

DEPUTY EDITOR **CRAIG RUEGSEGG**

ART DIRECTOR **KARL EHLERS**

SENIOR DESIGN EDITOR **KEVIN BOYLE**

DESIGN EDITOR **JOHN OLSON**

TOOLS EDITOR **BOB HUNTER**

DIGITAL PRODUCT MANAGER **LUCAS PETERS**

ADMINISTRATIVE ASSISTANT **SHERYL MUNYON**

CONTRIBUTING DESIGNER **ANNA GLEASON**

CONTRIBUTING CRAFTSMEN **JIM HEAVEY, BRIAN SIMMONS,**

**BOB BAKER, BRIAN BERGSTROM**

PHOTOGRAPHERS **JASON DONNELLY, SCOTT MORGAN, BRIE PASSANO**

CONTRIBUTING EDITORS **LARRY JOHNSTON, BILL KRIER,**

**RANDY MAXEY, ROBERT WILSON**

CONTRIBUTING ILLUSTRATORS **LORNA JOHNSON,**

**ROXANNE LEMOINE, KURT SCHULTZ**

PROOFREADERS **SAM CADY, BABS KLEIN, IRA LACHER, THOMAS MORIARTY**

## ADVERTISING AND MARKETING

VICE PRESIDENT & GROUP PUBLISHER **SCOTT MORTIMER**

ADVERTISING ACCOUNT EXECUTIVE **DANIEL WELLS**

ONLINE MEDIA KIT **WOODMAGAZINE.COM/MEDIAKIT**

BUSINESS MANAGER **DARREN TOLLEFSON** CONSUMER MARKETING MANAGER **ED LICHINSKY**  
PRODUCTION MANAGER **SANDY WILLIAMS** PREPRESS DESKTOP SPECIALIST **RANDY J. MANNING**  
COLOR QUALITY ANALYST **TONY HUNT**

## MEREDITH NATIONAL MEDIA GROUP

**JON WERTHER** PRESIDENT

MEREDITH MAGAZINES PRESIDENT **DOUG OLSON**

PRESIDENT, MEREDITH DIGITAL **STAN PAVLOVSKY**

PRESIDENT, CONSUMER PRODUCTS **TOM WITSCHI**

CHIEF REVENUE OFFICER **MICHAEL BROWNSTEIN**

CHIEF MARKETING & DATA OFFICER **ALYSIA BORSA**

MARKETING & INTEGRATED COMMUNICATIONS **NANCY WEBER**

## SENIOR VICE PRESIDENTS

CONSUMER REVENUE **ANDY WILSON** DIGITAL SALES **MARLA NEWMAN** RESEARCH SOLUTIONS **BRITTA CLEVELAND**

PRODUCT AND TECHNOLOGY **JUSTIN LAW** CHIEF DIGITAL OFFICER **MATT MINOFF**

CORPORATE SALES **BRIAN KIGHTLINGER**

## VICE PRESIDENTS

FINANCIAL **CHRIS SUSIL** BUSINESS PLANNING & ANALYSIS **ROB SILVERSTONE**

DIRECT MEDIA **PATTI FOLLO** STRATEGIC SOURCING, NEWSSTAND, PRODUCTION **CHUCK HOWELL**

CONSUMER MARKETING **STEVE CROWE**

VICE PRESIDENT, GROUP EDITORIAL DIRECTOR **LIZ VACCARIELLO OR STEPHEN ORR**

DIRECTOR, EDITORIAL OPERATIONS & FINANCE **ALEX BREZ OR GREG KAYKO**



## MEREDITH CORPORATION

PRESIDENT & CHIEF EXECUTIVE OFFICER **TOM HARTY**

CHIEF FINANCIAL OFFICER **JOSEPH CERYANEC**

CHIEF DEVELOPMENT OFFICER **JOHN ZIESER**

PRESIDENT, MEREDITH LOCAL MEDIA GROUP **PATRICK MCCREERY**

SENIOR VICE PRESIDENT, HUMAN RESOURCES **DINA NATHANSON**

EXECUTIVE CHAIRMAN **STEPHEN M. LACY**

VICE CHAIRMAN **MELL MEREDITH FRAZIER**

## ► For subscription help:

Online: [woodmagazine.com/myaccount](http://woodmagazine.com/myaccount)  
E-mail: [wdmcustserv@cdsfulfillment.com](mailto:wdmcustserv@cdsfulfillment.com)  
Phone: 800-374-9663, select option 1.

► **To find past articles:** Search for previous articles, plan corrections, and article updates online at [woodmagazine.com/index](http://woodmagazine.com/index).

► **To order past articles and issues:** For articles, search [woodstore.net](http://woodstore.net). For issues, visit [woodmagazine.com/backissues](http://woodmagazine.com/backissues).

To download patterns from this issue,  
visit [woodmagazine.com/259patterns](http://woodmagazine.com/259patterns)

Our subscriber list is occasionally made available to carefully selected firms whose products may be of interest to you. If you prefer not to receive information from these companies by mail or by phone, please let us know. Send your request along with your mailing label to Magazine Customer Service, PO Box 37508, Boone, IA 50037-0508.

© Copyright Meredith Corporation 2019. All rights reserved. Printed in the U.S.A.

Meredith Corporation allows the purchaser of this magazine to photocopy the included patterns solely for personal use. Any other reproduction of these patterns is strictly prohibited.





# IN THIS ISSUE OF **WOOD**<sup>®</sup>

MARCH 2019 · ISSUE 259

## PLANS

### 24 Arts & Crafts Display Case

You'll love the heirloom look of this curio afforded by the seeded glass panels.

### 34 Stacking Seed Starter

Kick off the growing season early (and learn a new interlocking joinery method).

### 44 Mil-spec Apache Helicopter

Full-size patterns make building this iconic aircraft a downdra... er, breeze.

### 58 Pie and Cupcake Carrier

Transport sweet treats in style with this box-jointed beauty.

### 64 No-lathe Salt and Pepper Shakers

"Turn" these tapered cylinders using only common power tools.

## TOOLS & TECHNIQUES

### 30 On the Cover: Get Quality Lumber

It's easy to find affordable hardwoods—if you know where to look. We'll show you.

### 38 Simple CNC Tricks

George Vondriska teaches how to robo-rout different patterns and materials.

### 50 How to Get a High-gloss Finish

Know how to polish your lost shaker of salt (and other small projects)? Buff it!

### 54 The ABCs of Abrasives

Stop guessing at grits and staring at stearates. Here's all you need to know.

### 62 Preserve Your Plunge Router

Ensure your router plunges when it should, and doesn't when it shouldn't.

### 68 Power Sander Primer

Learn how to choose and use the right motorized sander for the job.

### 72 The Slat-wall Storage Solution

Get groovy and embrace your hang-ups with this simple system.

### 76 Tools & Materials

The best portable workstations, a bigger compact router, and more.

## DEPARTMENTS

### 1 Taking Measure

Story sticks.

### 4 Wood-Wide Web

Post your project plans.

### 6 Sounding Board

Your voice, your projects, your shop.

### 16 Ask WOOD

Build a better birdhouse.

### 18 Shop Tips

Light tight spaces and more.

### 88 What's Ahead

A sneak peek at your next WOOD.

24



34









# Share your build with the woodworking community!

It's easy! Log in or register at [woodmagazine.com](http://woodmagazine.com), hop over to [woodmagazine.com/memberplans](http://woodmagazine.com/memberplans), and click "Create Your Own Member Plan." Then, follow the directions to teach other woodworkers how to build your amazing project. While you're there, browse through the projects from other woodworkers for inspiration.



Album

## Turn these...



## Happy Hammock Stand

Lucas Peters, posted on Oct 22, 2018



## ...into this!

### Materials or Supplies

Two 8' pine 2x2s  
One 4x8' sheet of particle board  
Fourteen 8' cedar 2x4s  
West System epoxy and hardener  
Lag screws  
Screw hooks  
Clear, outdoor finish  
Nuts, bolts, washers

### Tools

Drill/Drivers  
Jigsaws/Saber Saws  
Miter saws  
Finish Nailers  
Bandsaws  
Drum Sanders  
Clamps  
handsaw  
Wood Chisels

### STEP 1

#### Trammel

First I created a large curved mold from particle board. To start, I marked a centerline on the particle board. Then I built a makeshift trammel from 2x2s. I attached the trammel's lower 2x2 to the underside of the board in line with the centerline. And I supported the opposite end sort of tenuously on a piece of plywood scrap. The pivot of the trammel is just a screw. There is a particle-board spacer between the 2x2s. Then I drilled a hole for a pencil 89" from the pivot screw. (The distance of the arc from the bottom of the particle board isn't critical. Just make sure the apex of the arc doesn't go beyond 2' so you can get two from the same piece of particle board. You can see my post-it-note plan in the foreground.



### STEP 2

#### Mold Parts

After removing the trammel (Don't throw it away!), I cut out the arc with a jigsaw, staying about 1/16" away from the line. Then, I traced a second arc on the other half of the particle board and cut it out. I clamped the two halves together and used a belt sander to sand the radius smooth to the line. Then, I drilled some large clamp access holes.



### STEP 3

#### Sacrifice the trammel to complete the mold

I then cut up the trammel into 3" blocks and used a trim nailer to tack them between the bottom and radius of the arc as shown to form the mold. I added plastic book-binding tape to





# SHARPEN EVERY KNIFE YOU OWN.

*AND YOUR TOOLS TOO.*



If it has an edge we can sharpen it. The original Knife & Tool Sharpener was designed to maximize performance and precision for any edge in your shop or home. Flexible belts and angle guides deliver a precise edge every time, and prevent steel from overheating. Work Sharp brings new life to your knives and tools, helping you work faster and safer on every project.

---

## SHARPENS:

---

- Knives
- Wood Splitting Tools
- Scissors & Shears
- Shovels
- Mower Blades





## Digging out the Splinter

*Just curious: Did the all-wood Splinter supercar you featured on the cover 10 years ago (issue 186, October 2008) ever make it to the street?*

—Wendell Barrick  
via e-mail

Yes, but technically no, Wendell. Its progenitor, Joe Harmon, took a few years off from the

project after earning his master's degree in industrial design (for which the car was created) and married Caroline, one of the build-team members.

After being asked in 2016 to show the mid-engine supercar—90 percent of which is made from wood—at the Essen Motor Show, Joe initially declined because the car wasn't done.

But, inspired by the invitation, he made it street-legal in time to display at the show.

Although he says the car has lived up to his expectations, Joe confesses he's never licensed the Splinter nor driven it at speeds anywhere near its 200 m.p.h. capability. The birth last year of his daughter, Jemma, has made that less of a priority. See more photos at [splintersupercar.com](http://splintersupercar.com).



## Wait—they did what?

Your article on sharpening handsaws in issue 257 (November 2018) brought back memories. When Camp Phillips at Salina, Kan., was being dismantled after World War II, they used handsaws to cut the barracks in half for moving. My dad was the saw sharpener on that job, and he taught me to sharpen them. I remember he always cut off the teeth within 2" of the handle, saying they never cut wood and would snag your pant legs.

—Lowell Johannes  
Hays, Kan.

As a woodworker who uses and appreciates old handsaws, I read with interest your article in issue 257. I cringed when I saw an angle grinder and wire brush being used to clean a rusty saw. Any etching (which can help identify the make, model, and age of the plate) remaining under the rusty surface can be damaged by your method. A more prudent approach is a synthetic abrasive pad, a spray bottle of household cleaner, and a little elbow grease. The process is also made easier by removing the handle from the saw plate.

—Bob Norcott  
Sebec, Maine

## One good turn deserves a non-turned brother

After seeing the Woven Bowl project in issue 253 (May 2018), I was inspired to make a "woven" container for a small extinguisher I keep near the fireplace. But without access to either a band-saw or a lathe, I needed a different technique to make the vessel round. Here's the method I came up with.

First, I used an adjustable circle cutter in my drill press to create a ring-shaped MDF template with the inside and outside diameters of the vessel. Then, after building the first layer of the weave, I used the template and a bearing-guided flush-trim bit to rout the inside and outside shape of the layer. As I built each additional layer of the weave, the previous layer served as that layer's routing template, limiting construction to one layer per day.

—Dave Pettitt  
Santa Barbara, Cal.





# EVERYDAY PROTECTION *for your vehicle!*

## *Laser Measured* **FLOORLINER™**

**Ultimate protection** against spilled coffee, wet shoes and muddy messes. Our custom-fit FloorLiners™ keep messes away from your vehicle's floor and saves you time when cleaning. Easy to install, a vehicle lifesaver in minutes!



Available in Black, Tan and Grey  
(Cocoa Available for Select Applications)



*Rear FloorLiner™*



*Front FloorLiner™*



*Cargo/Trunk Liner*



*TechLiner®*



*TechShade®*



*Seat Protector*

*See these products and much more at*  
**WeatherTech®.com**

**Order Now: 800-441-6287**



American Customers  
**WeatherTech.com**



Canadian Customers  
**WeatherTech.ca**



European Customers  
**WeatherTech.eu**

Acura • Alfa Romeo • Aston Martin • Audi • BMW • Buick • Cadillac • Chevrolet • Chrysler • Dodge • Ferrari • Fiat • Ford • Genesis • GMC • Honda • Hummer • Hyundai  
Infiniti • Isuzu • Jaguar • Jeep • Kia • Land Rover • Lexus • Lincoln • Maserati • Mazda • Mercedes-Benz • Mercury • Mini • Mitsubishi • Nissan • Oldsmobile  
Plymouth • Pontiac • Porsche • RAM • Saab • Saturn • Scion • Smart • Subaru • Suzuki • Tesla • Toyota • Volkswagen • Volvo and more!



MADE IN USA

© 2019 by MacNeil IP LLC





## Dust separator no longer a pipe dream

*I was doing research to build my own dust separator when I picked up issue 255 (September 2018). There, on page 18, was my solution. My build went quickly because I used PVC pipe for the legs instead of 2x4s, as shown here. Thanks to Ed Piche for the great tip!*

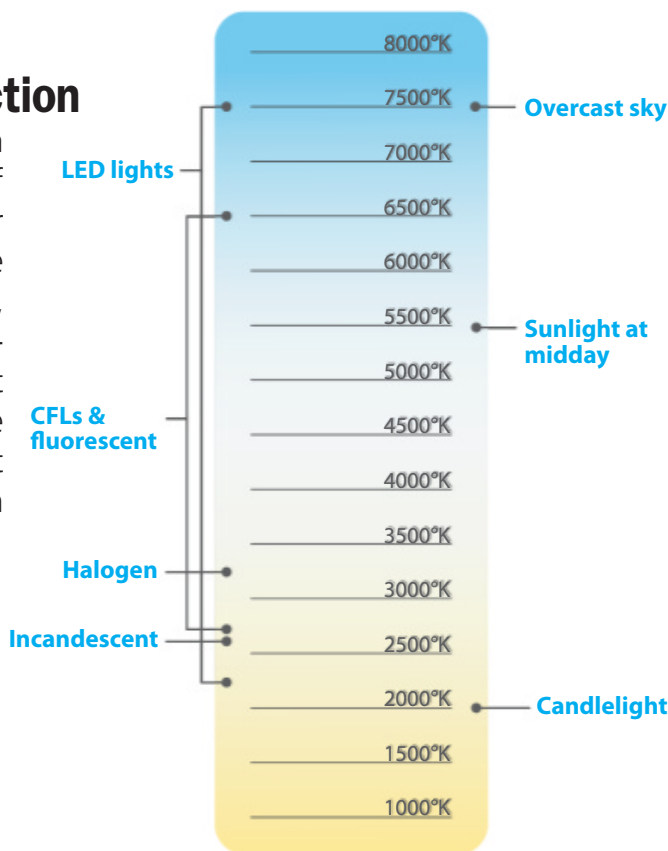
—Rick Munroe  
Visalia, Calif.

# SOUNDING BOARD

YOUR VOICE

## Color correction

In the color-spectrum chart on page 64 of issue 256 (October 2018, "Let There Be [Better] Light"), the color temperature of sunlight at midday should have been listed at about 5500°K, as shown here.



## Speed infraction

In the chart on page 16 of issue 258 (December/January 2018/2019, "Ask WOOD"), the maximum speed of 2<sup>5</sup>/<sub>8</sub>–3" bits should be listed as 12,000–14,000. The corrected chart is shown below.

### Router Bit Speed Chart

| Bit diameter                                                   | Max. speed x 1,000 rpm | My router |
|----------------------------------------------------------------|------------------------|-----------|
| Up to 1"                                                       | 24                     |           |
| 1 <sup>1</sup> / <sub>8</sub> –2 <sup>1</sup> / <sub>2</sub> " | 16–18                  |           |
| 2 <sup>5</sup> / <sub>8</sub> –3"                              | 12–14                  |           |
| 3 <sup>1</sup> / <sub>8</sub> " or larger                      | 10–12                  |           |

## What's your hurry?

*As I read through your router-accessories article in issue 255 and the \$600 worth of "gotta have" accessories, my mind turned to golf and bowling—two pastimes in which the better you are at it, the less time you spend doing it. WOOD® magazine's editorial seems to have taken the same attitude toward woodworking: Get the latest and greatest gizmos and get things done QUICKLY so that you spend less time in the shop. Huh?*

—Bob Wey  
via e-mail

Bob, we cherish our shop time as much as any woodworker. Being accurate and efficient in the shop doesn't necessarily mean getting out quicker. (But for those time-strapped by a job and other activities, that's a bonus.) It means getting more done in the same amount of time. It means extra time to tidy up the shop at the end of one project, so you can hit the ground running for the next one. It means making 25 toy cars for the children's hospital instead of 20. And finishing up a project sooner gives you time to learn a new woodworking technique that you can enjoy on a future project.

## A potentially hot shop topic

*I enjoy reading WOOD magazine, especially the neat readers' shops you feature. But in many cases, the location of the fire extinguisher is not very well thought out, as if the owners just placed them where they had a blank spot on the wall. In one shop, the extinguisher was hidden behind the bathroom door.*

*A fire extinguisher should always be hung next to the entry door, in plain sight, and with the handle at about hip level.*

—Dennis Murphy  
Bismarck, N.D.



## Connect with us



E-mail [woodmail@woodmagazine.com](mailto:woodmail@woodmagazine.com); or write to WOOD magazine, 1716 Locust St., LS-253, Des Moines, IA 50309; or call 800-374-9663, option 2.

**WOOD® magazine** never uses outside parties to solicit subscription renewals. The safest, easiest way to renew your subscription is with a credit card online at [woodmagazine.com/myaccount](http://woodmagazine.com/myaccount). If you have questions about a renewal offer you've received, please call our customer service line at 800-374-9663, and select option 1. We're happy to help.



**FOR THOSE WHO**



**Clamps without compromise.**

For woodworkers seeking clamps crafted with the highest-quality materials, tested relentlessly since 1903, there's only one choice – original Pony Jorgensen clamps.

**Find your next clamp at [ponyjorgensen.com](http://ponyjorgensen.com).**

**PONY | JORGENSEN®**



# SOUNDING BOARD

## YOUR PROJECTS



When **Neil King**, of Black Mountain, N.C., designed and built these stools for his kitchen island, the goal was to create a simple, comfortable design featuring clean lines and through-tenon joinery. The frames are leopardwood, accented by zebrawood seats and backs.



**John Wright**, of Sacramento, Calif., built this walnut-and-maple reading stand for his daughter. The sturdy ledge supports a book, laptop or tablet.



**Thomas Martin**, of Webberville, Mich., salvaged some discarded limbs from a tree that was being milled and then waited for just the right project to come along. It finally arrived on the cover of issue 225 (May 2014) with the Garden Bench, where he incorporated the crooked limbs into one end.



Oklahoma-born **Floyd Beeson**, now of San Diego, loves to build wood projects for his backyard, including this from-scratch replica cannon. The only purchased components are the 3" PVC barrel and the wood cannonballs.



**Colin Smith**, of Hurricane, Utah, built this elaborate cabinet to display mementos collected during a trip to Russia with his wife. Colin did all of the carving, marquetry, and gilding by hand.

### Send us a photo of your work

Want to see your work showcased in WOOD® magazine? Send a high-resolution digital photo of your completed project to [woodmail@woodmagazine.com](mailto:woodmail@woodmagazine.com).





# ZERO DAMAGE, HIGHEST ACCURACY

## NEW ORION® WOOD MOISTURE METER

- 3X Faster Than Any Pin Meter
- Independently Confirmed Accuracy
- 7-Year Warranty
- Non-Damaging Pinless Meter
- Dual Depth Measurement






 @WagnerMeters

[wagnermeters.com](http://wagnermeters.com)  
 Call (800) 795-9916



## Precision lap joints are easy with this jig!



Make torsion boxes, lattice, wine racks and so much more with this easy-to-set up and use Rockler Cross Lap Jig. The jig's indexing key is infinitely width-adjustable for stock ranging from 1/8" to 3/4" thick. Once set, push your cut onto the key and you'll get perfectly-spaced cuts. Just think of all of the projects that could incorporate this sturdy joint and *create with confidence*.

Rockler Cross Lap Jig  
(56372) \$34.99



EMAIL SUBSCRIBERS

**FREE  
SHIPPING  
EVERY DAY**  
ON \$35+ ORDERS

**Sign up for our emails  
and get every day FREE SHIPPING!**  
 For details go to [rcklr.co/779](http://rcklr.co/779)  
 or call 1-800-279-4441 and mention  
 code 779 at checkout.



For a store near you or free catalog:

Rockler.com

1-877-ROCKLER

Materials code 779



# Two-Car (no-car) Shop



**W**hen Ed Kassof converted his two-car garage to a woodworking shop, he exiled the family cars to the driveway, a decision he hasn't regretted.

The shop features many creative solutions for storage, mobility, and multipurpose use. For example, the hideaway tablesaw (*page 14*) and mitersaw workstation with flip-up wings both store small, but work big.

Ed designed his shop with lots of open floor space. Putting casters under benches, a lumber bin, tool cabinet, and clamp rack means that "no tool in the shop is ever in the way of any production," Ed says.

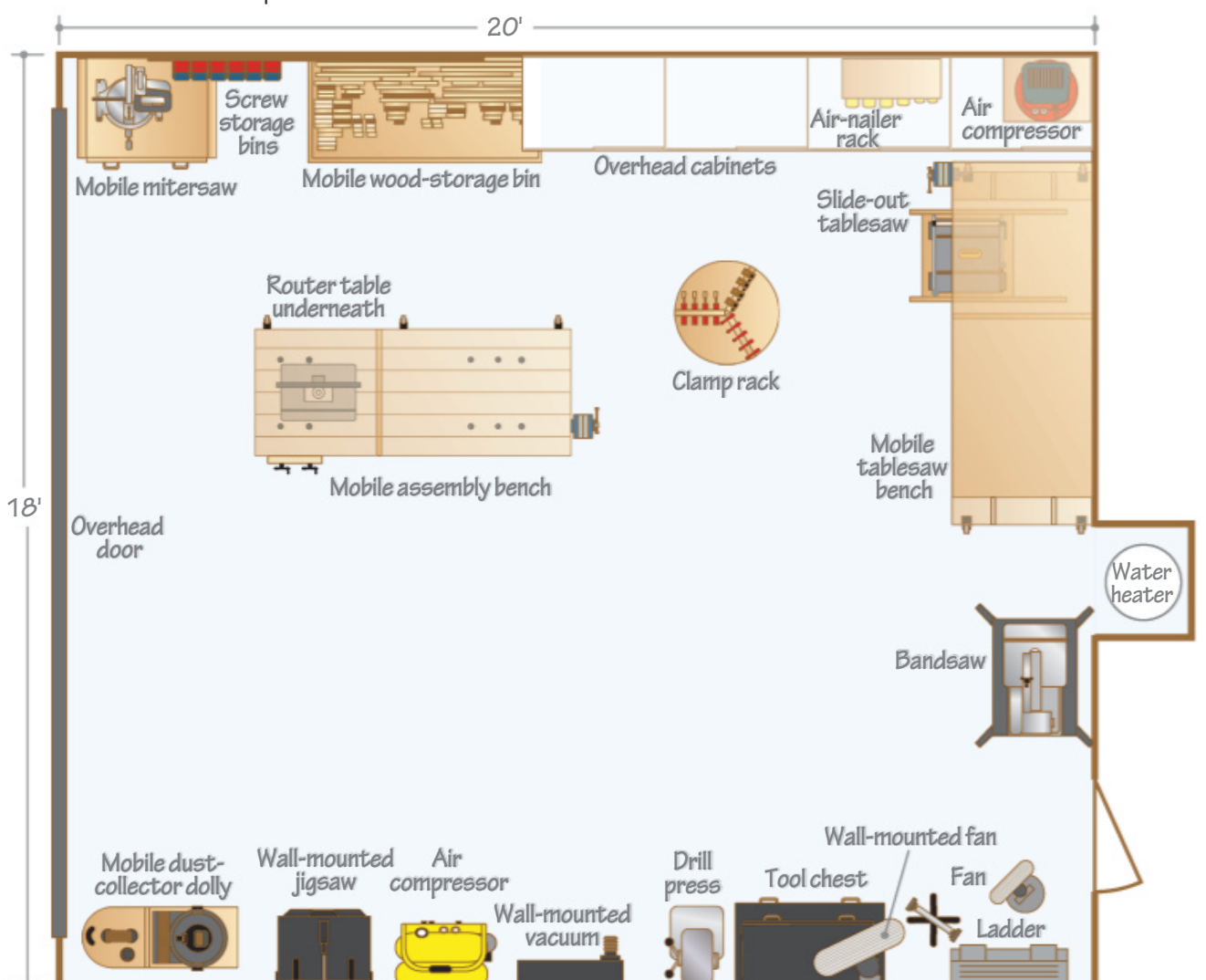
Two custom-made workbenches fill specific needs. The top of the tablesaw workstation consists of a hollow-core door sandwiched between two layers of plywood. At the front of the bench, an outlet strip nestles between the plywood layers. Large drawers hold tablesaw blades and accessories.

The main workbench provides a rock-solid project-assembly worksurface. Its sturdy 2×4 frame supports the 2¼"-thick solid-wood top; a pair of vises and rows of dogholes add secure work-holding options.

Ed framed in a series of wall cabinets before the drywall was hung. Securing the cabinets directly to the wall studs and ceil-

**Ed's main workbench incorporates a large face vise made with pipe clamps, and a conventional wood tail vise. A roll of paper at one end protects the benchtop during glue-ups. His benchtop router table and sander tuck underneath to maximize space.**

**A wall-mounted shelf keeps Ed's pancake compressor accessible and frees up floor space. The drop-down door reveals accessory storage.**







888.437.4564  
[sales@epiloglaser.com](mailto:sales@epiloglaser.com)  
[www.epiloglaser.com/bhg-wood](http://www.epiloglaser.com/bhg-wood)

# FUSION M2 40

- 40" x 28" engraving area
- Flame-polished edge cuts
- Dual source (fiber and CO<sub>2</sub>)
- eView™ Camera options
- Laser tube wattages up to 120 watts
- Our highest CO<sub>2</sub> engraving and cutting speeds
- Engrave items up to 13.25" in height
- Maximum substrate compatibility



Begin your wood table, cabinets, shelving, live-edge furniture, and more by sawing your own logs with a Wood-Mizer portable sawmill.

14 sawmill models starting with the LT10 at \$3,995\*. Financing Available!



**Wood-Mizer**  
 from forest to final form®



© 2019 Wood-Mizer LLC \*Price subject to change without notice.

800.553.0182 | [woodmizer.com](http://woodmizer.com)

**LiVE** *the wood life*



## SOUNDING BOARD

YOUR SHOP



ing joists increased their weight-holding capacity. Sliding  $\frac{1}{4}$ "-plywood doors hide the contents and create a clean look.

You won't see much sawdust in Ed's shop. He keeps things tidy using a shop vacuum attached to a Dust Deputy miniature cyclone system. This assembly rolls where it's needed on a cart Ed made.



Ed's benchtop tablesaw stores on a platform below this workbench (top left), then glides out on full-extension drawer slides. The platform lifts up to bring the tablesaw surface flush with the benchtop. The end of the workbench stores the rip fence, miter gauge, and blade guard.

# WoodRiver®

**Harness Hand Tool Power Where You Need It**

WoodRiver® Hand Tools are made from the best modern materials and are designed for easy use, consistently great results, and long life. The V3 Bench Plane Series, Adjustable Mouth Block Planes, specialty planes, screwdrivers, chisels and other WoodRiver® Hand Tools are sure to become favorites in your shop.

**WOODCRAFT®** HELPING YOU MAKE WOOD WORK®

For A Free Catalog Or To Find Your Local Woodcraft Store,  
Visit [woodcraft.com](http://woodcraft.com) Or Call 800-225-1153. Follow Us: [f](#) [t](#) [p](#) [@](#) 19W103H





A compact rolling rack corrals lots of clamps and accessories in very little floor space.



The folding wings on Ed's mitersaw station support long workpieces, then fold down for compact storage. Two casters on the back, and handles up front, make easy work of moving the workstation.

A 24" wall-mounted Air King fan helps circulate air when the garage door is up. "But it's still warm when the temperature hits 100 degrees outside!" Ed quips, as he reaches for his glass of sweet iced tea. 🌿



Ed Kassof, a disabled veteran with 35 years of combined military service, retired from the New York Police Department. During 40 years of woodworking, he has built projects for his home, family, and workshop.

### Show us your shop

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



*The Industry Leader in Dust Collection*

# V-SYSTEM™

## HEPA CYCLONE DUST COLLECTORS

Shown with Stacking Sound Filter



U.S. Patent #  
8,377,160 B2  
8,496,719 B2



- Industrial U.S. made motor
- Easy assembly (<3 hrs.)
- HEPA filtration
- Quiet and compact aerodynamic design
- Wireless remote
- Bin level sensor
- 110V available

The Oneida Air Systems V-System™ patented design has a compact shape and sound dampening features which make it the perfect solution for garage and basement shops where size and noise play a significant factor. Optional Stacking Sound Filter available to make it even quieter.



Stacking Sound Filter reduces sound by an additional 6 - 8 dB.

1-833-429-8326 • [oneida-air.com](http://oneida-air.com)

MADE IN THE USA SINCE 1993 🇺🇸



## Q Build feather-friendly birdhouses and feeders

I use all sorts of wood scraps and recycled materials to make houses and feeders for songbirds. Some of those projects attract flocks of feathered visitors, but others don't. What can I do to improve results?

—Dan Polson, Durango, Colo.

A The material you use and how you treat it can have a big impact on whether a birdhouse or feeder will appeal to its target audience, Dan. For better visitation, try these pointers:

- Like us, birds prefer to stay out of the heat in the summer and the cold during winter. So don't use plastic decking that gets hot in the sun. Tin and other metals also heat up in a hurry and provide little insulation.

- If possible, don't place a birdhouse in direct sunlight. Of course, some species, such as bluebirds, require houses out in the open. For those, make walls and roofs from two wood layers, with a ventilating space of 1" or so between the layers. At the least, provide ventilation holes near the tops and bottoms.

- Thick, solid wood insulates well. Woods that stand up best to Mother Nature include cypress, cedar, redwood, and white oak.

- Avoid treated wood, which could prove hazardous to birds. For the same reason, stay away from pallet wood, which may have been chemically treated.

- Resist the temptation to gussy up your birdhouse or feeder with paint, stain, or other finishes. Birds don't like the residual vapors, and dark colors will amplify the sun's heat. Birds also prefer structures that blend into surroundings rather than attract attention from predators. If you can incorporate bark, branches, or other natural wood features into the project, all the better. On feeders, bark and branches help birds feed on the seeds.

- Staying with the natural theme, avoid sanding the wood. Rough surfaces help adult birds cling to the side of a box when bringing in nesting material or feeding young. And the fledglings will find it easier to scramble out for their first flights.

- Birds enjoy a tidy house, so include drainage holes in the floor. And allow a means to clean out the house after the nesting season. Scrub down the interior with a solution of one part bleach to nine parts water.

- Finally, always remember to build and position a birdhouse to minimize the amount of rain that can get through the entrance hole. An overhang helps, as does making the hole no larger than necessary. Online, you can find many charts showing best hole size (as well as interior dimensions) for many bird species. 🌳

► Shop birdhouse and birdfeeder plans. [woodmagazine.com/birds](http://woodmagazine.com/birds)



Have a question?  
Drop us an e-mail.  
[askwood@woodmagazine.com](mailto:askwood@woodmagazine.com)



# GO DIRECT CUT OUT THE MIDDLEMAN



## Great pricing on custom-welded saw blades

**Q101® – Extremely Hard Cutting,  
Spring-tempered Edge**

**Q101® Band Saw Blades –  
72"x1/2" (6'0"x1/2")**  
72" length for Shopsmith or similar  
models, hard edge, Flex-back Carbon  
**only \$13.77ea**

**Q101® Band Saw Blades –  
93 1/2"x1/2" (7'9 1/2"x1/2")**  
Flex-back Carbon, fits most 14"  
Delta Jet, etc.  
**only \$16.71ea**

**Q201® – Precision Ground Tooth,  
Computer Controlled Hardening**

**Q201® Premium Band Saw Blades –  
72"x1/2" (6'0"x1/2")**  
72" length for Shopsmith or similar  
models, hard edge, Hard Back Carbon  
**only \$12.57ea**

**Q201® Band Saw Blades –  
93 1/2"x1/2" (7'9 1/2"x1/2")**  
Hard Back Carbon, fits most 14"  
Delta Jet, etc.  
**only \$15.11ea**

**Q201® Band Saw Blades –  
105"x1/2" (8'9"x1/2")**  
Hard Back Carbon, fits most  
14" band saws with risers  
**only \$16.38ea**

Ideal for the woodworking  
industry, our custom-welded  
blades feature spring-tempered  
backs and precisely hardened  
teeth allowing for very  
accurate cuts.



- Manufactured with precision ground tooth
- Computer controlled hardening
- Custom welded to any length
- Shipped in 24 hours

## Blade Guide Upgrade Kits

A drastic improvement over factory blade guides which translates into cleaner cuts, quieter operation and less wasted wood.



Delta 14" Blade Guide  
Conversion Upgrade Kit

**only \$166.47**



Jet 14" Blade Guide  
Conversion Upgrade Kit

**only \$166.47**

## Circular Saw Blades



Q-Saw Wood Blade  
7-1/4" x 5/8" x 24T

**\$9.30 ea.**



Q-Saw Wood Blade  
10" x 5/8" x 40T

**\$20.35 ea.**

800.754.6920

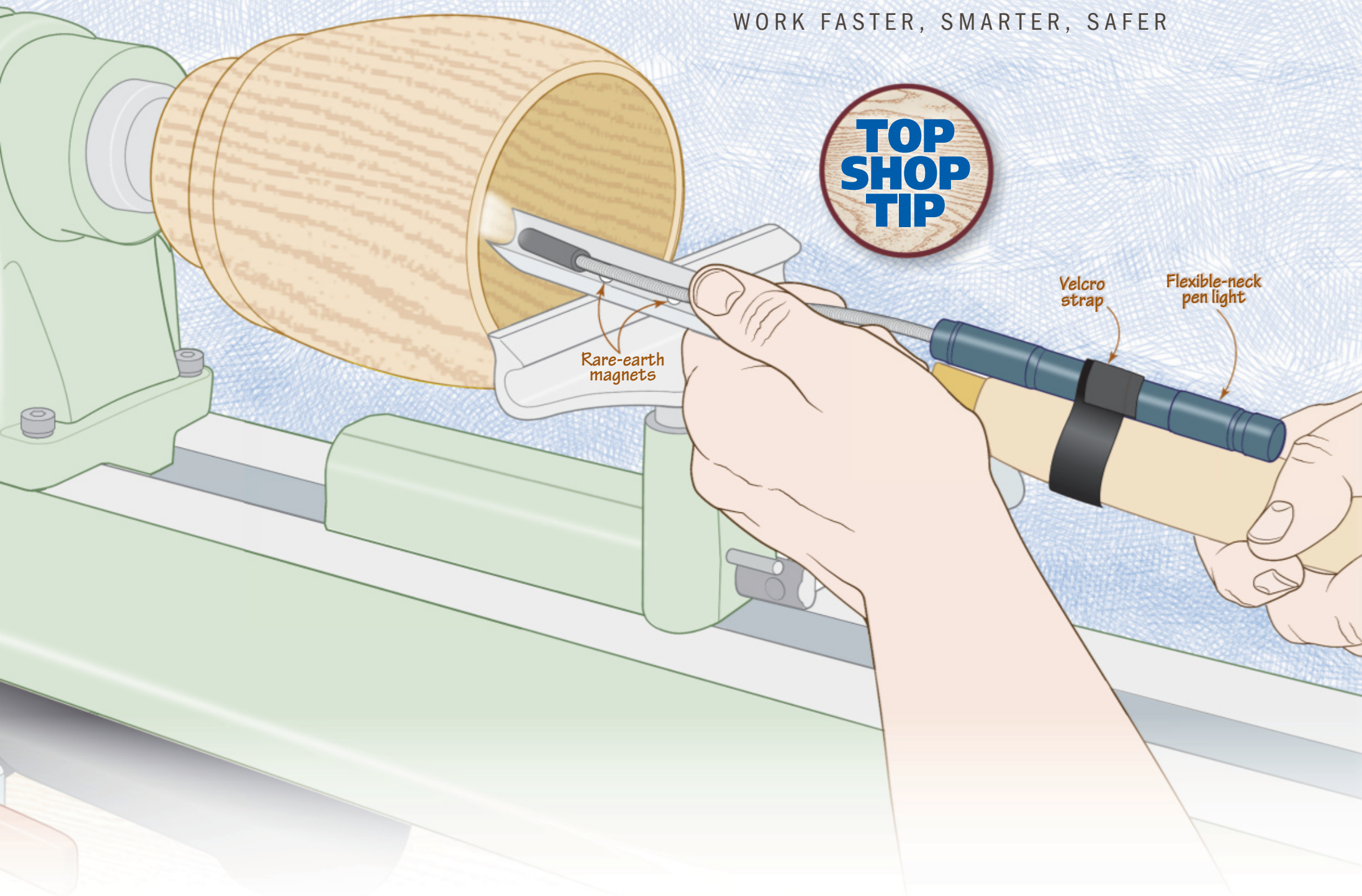
**SAWBLADE.COM®**  
GO DIRECT



# SHOP TIPS

WORK FASTER, SMARTER, SAFER

**TOP  
SHOP  
TIP**



## Light tight spaces when turning vessels

While turning the inside of deep vessels, I struggled to see the tool's cutting action, even while using a flashlight to peer inside. Then, it occurred to me to mount a flexible-neck penlight ([woodmagazine.com/streamlight](http://woodmagazine.com/streamlight)) directly to the tool. Mounted as shown, the light can be repositioned on the tool, as dictated by the shape of the vessel.

—Peter Messinger, East Amherst, N.Y.

### Tips earn up to \$150.

If your tip is the best of the issue, it wins **Top Shop Tip** honors, and you receive a **tool prize** worth at least **\$300**.

Send your tip, photos or drawings, and contact info to [shoptips@woodmagazine.com](mailto:shoptips@woodmagazine.com)

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



For sending this issue's **Top Shop Tip**, Peter receives an assortment of bandsaw accessories from Carter Products worth \$330.





# Come for the weekend. Learn for a lifetime.

## Weekend With **WOOD**<sup>®</sup>

North America's Premier Woodworking Educational Event

### May 16–19, 2019

at the **WOOD**<sup>®</sup> magazine shops in Des Moines, Iowa



Get more details and register at [weekendwithwood.com](http://weekendwithwood.com) or call 888-636-4478.

Weekend with **WOOD**<sup>™</sup> is supported by:





# SHOP TIPS

## Easy-build cart solves several shop issues

I organize and store hardware in shallow fishing-tackle boxes, with clear lids that enable me to quickly see what's inside. Those boxes began to take up a lot of room on my workbench, so I came up with this cart to hold all of them.

Build the cart from  $\frac{3}{4}$ " MDO (medium-density overlay) plywood for the top, bottom, sides, and middle divider. The divider adds structural integrity and creates more storage on the other side of the cart. Determine the cart's dimensions, using your tackle boxes as a starting point. Dado the sides to hold  $\frac{1}{4}$ " hardboard panels supporting each tackle box. Attach trim strips to the front and back edges to keep the panels from sliding out.

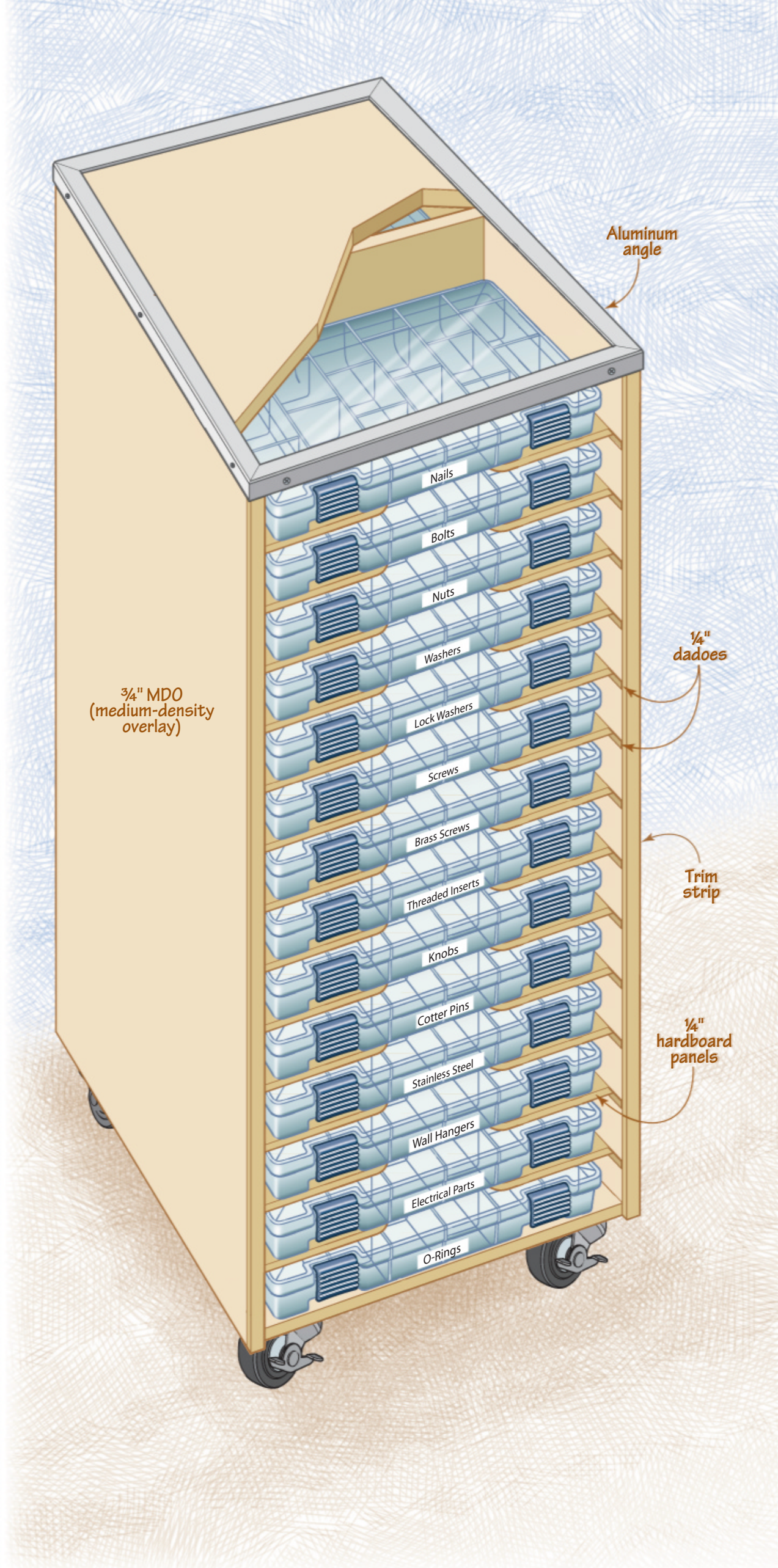
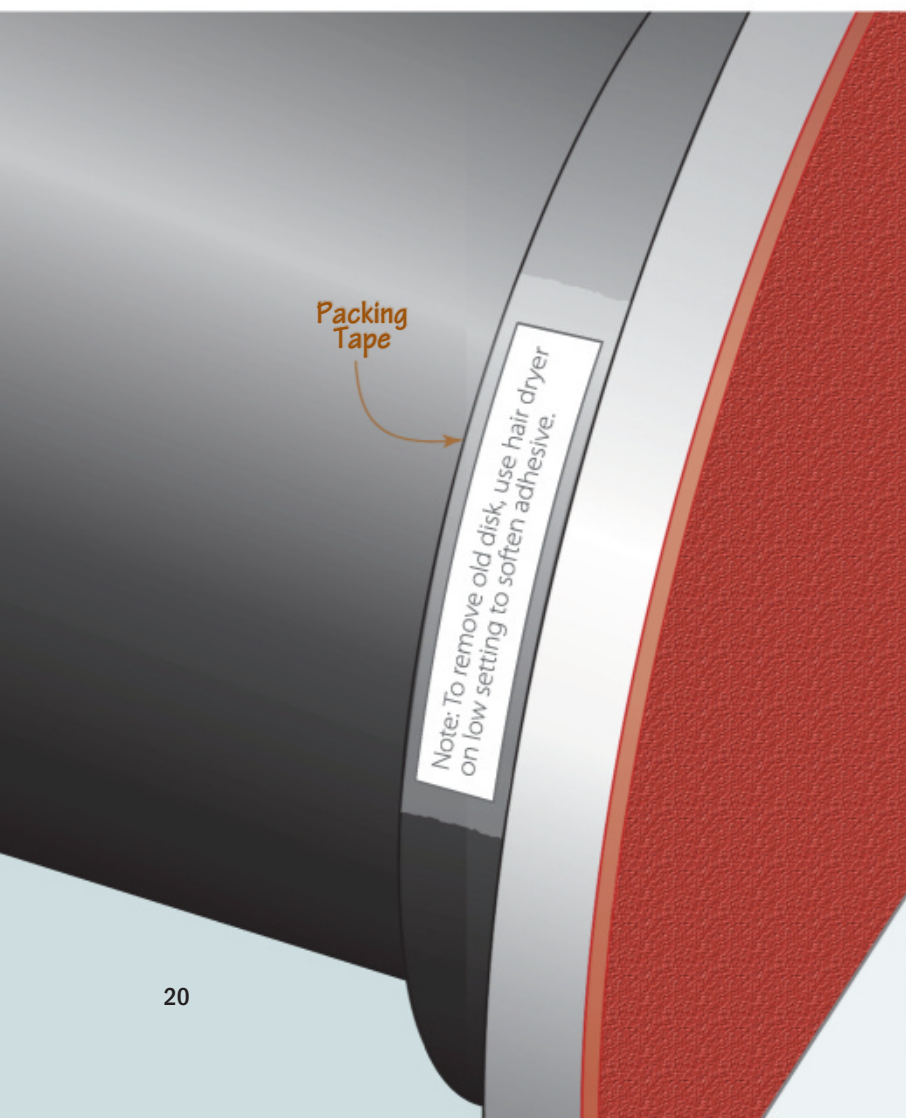
I added aluminum angle around the top for appearance's sake, durability, and to keep small items from rolling off. The top also makes a good spot for bench-top tools. I built a slightly larger top that fits over the cart top for jobs that require a bigger worksurface. The loaded cart will weigh a lot, so use good casters, two of them the locking type.

—Kevin Schendel, Saint Cloud, Fla.

## Never forget a great tip

I love a good shop tip but often forget it when an opportunity comes to apply it. To jog your memory, print out tips you're likely to use on a sheet of paper and clip them to the size of labels. Then, use clear packing tape to laminate and stick the tips where you're likely to see them when opportunity knocks.

—Scott Hunter, Chicago





I think  
I need a  
moisture  
meter.



# Moisture Meters from Lignomat

The Woodworker's Choice:

*Nobody can beat our quality, price and proven measuring technology.*



Mini-Lignos are accurate, reliable and versatile: Used when drying lumber, buying lumber, selecting lumber for a project, installing floors ...

The best tools and excellence in craftsmanship cannot guarantee lasting beauty in woodwork, if the wood for the project was too wet.

The solution is simple: Use a moisture meter and check the wood moisture before you start.

**Best Lignomat Price**  
[www.mini-Ligno.com](http://www.mini-Ligno.com)

**For a Recommendation call:**  
**800-227-2105**  
[www.Lignomat.com](http://www.Lignomat.com)

**Buy a pin or pinless meter from Lignomat:**

- ✓ Better Quality
- ✓ Better Accuracy
- ✓ Better Warranty
- ✓ Better Customer Service



# RIKON

**NEW**

## Introducing the NEW 10" Deluxe Bandsaw

**Improved User-Friendly Features Include:**

- ✓ Spring Loaded Tool-less Blade Guides
- ✓ Quick-Release Blade Tension Lever
- ✓ 2 Blade Speeds 1,515 or 3,250 ft. / min
- ✓ Improved Rip Fence System
- ✓ More Powerful 1/2 HP Motor
- ✓ Increased Cutting Height of 5" with 9-5/8" Width
- ✓ Re-Engineered Blade Guard System
- ✓ Windows Added for Viewing Blade Tracking
- ✓ And More!

**Deluxe Model #10-306**

\* Patent Pending



Call today for more information **877-884-5167**  
or visit [www.rikontools.com](http://www.rikontools.com) for a dealer near you!

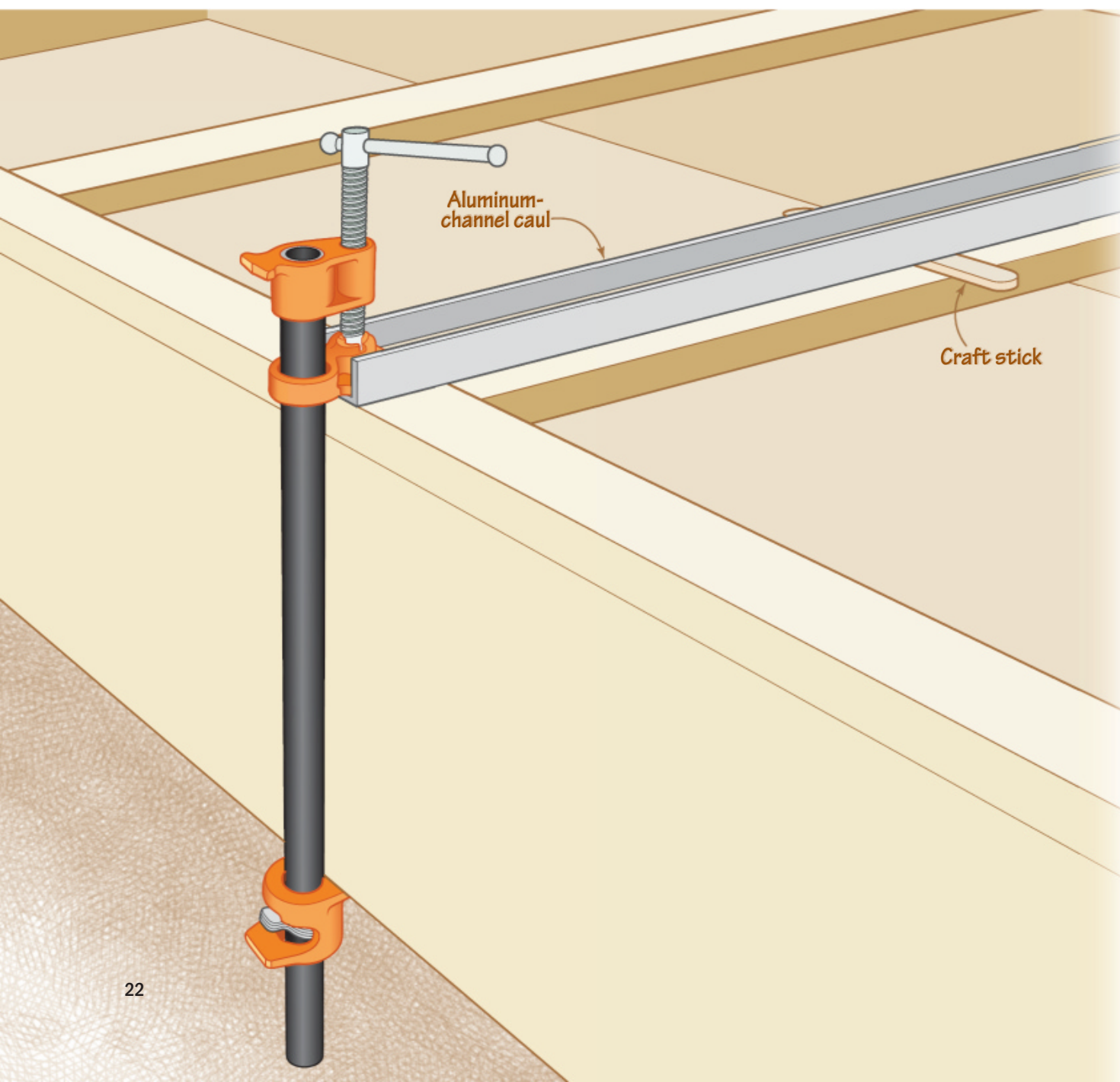
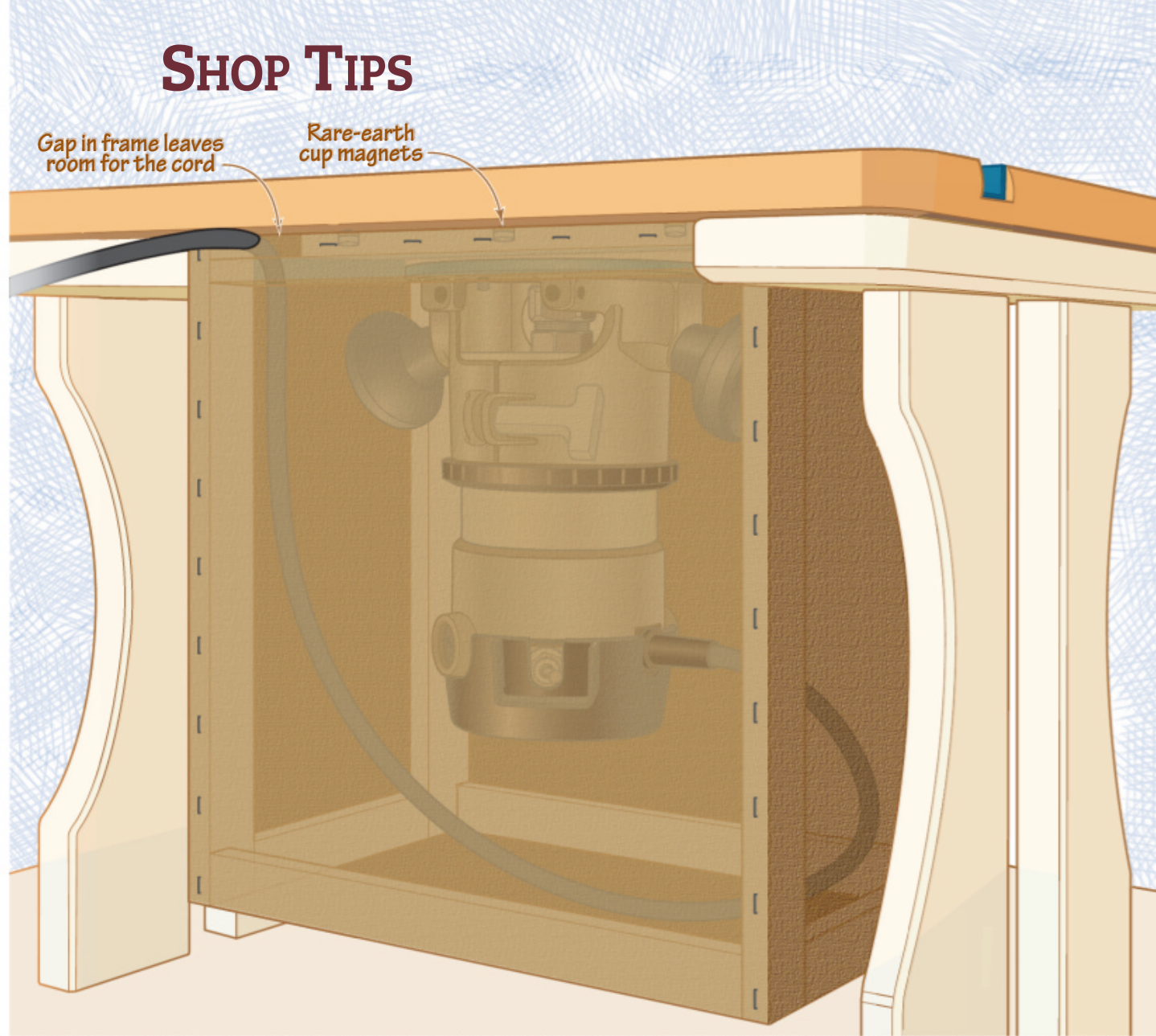




## In-the-bag solution to elusive router-table sawdust

The dust port on a router-table fence collects most of the dust above the table, but some still escapes below. To keep that debris off the floor, I built a lightweight poplar frame, large enough to fit around the router, with ample room for cooling air. I tacked fabric around the sides and bottom of the frame. Rare-earth magnets mounted to the top of the frame attach to metal washers on the underside of the router table. The collector catches all falling debris and detaches easily for emptying. Note that I left room for the cord to exit the collector by leaving a gap in the frame at each corner. That way, no matter how you replace the collector, there's a notch positioned for the cord.

—Tom Moss, Bradenton, Fla.



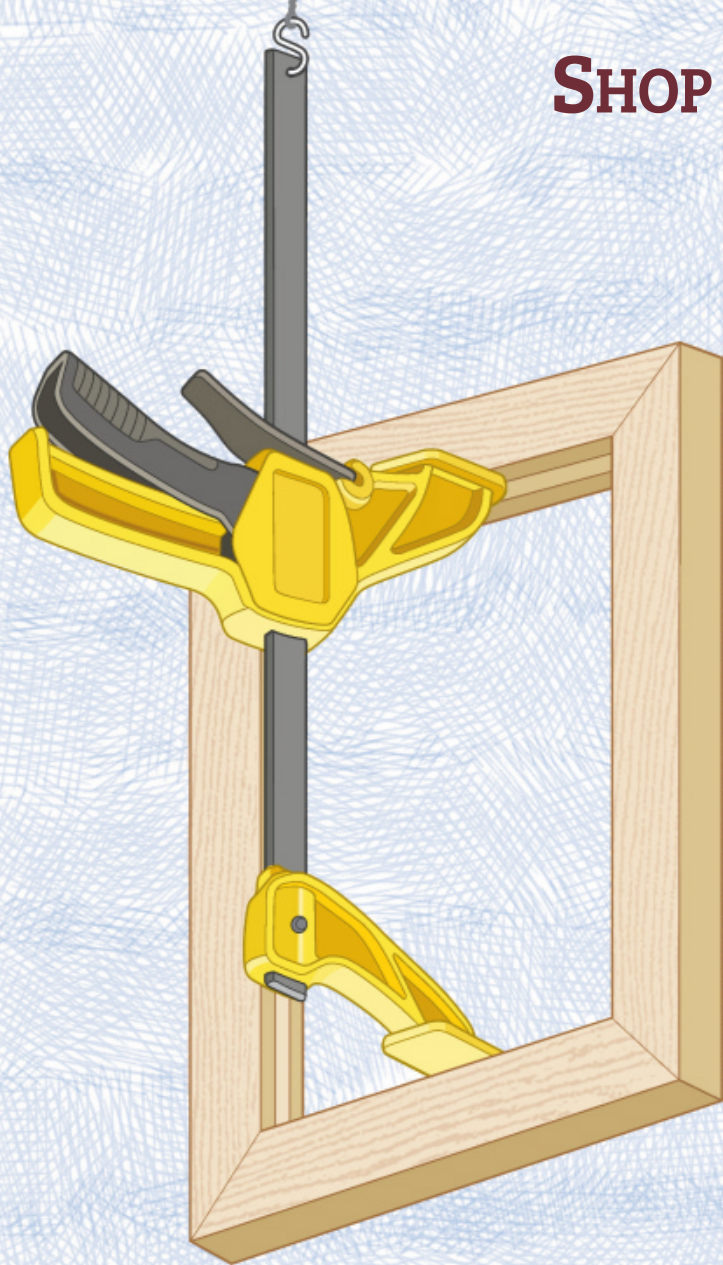
## Curved caul-like clamping with this crafts-stick cure

A wood caul, with its slightly bowed face down, helps distribute clamping pressure to the middle of a long workpiece such as a face-frame rail. To get the same effect without having to make bowed cauls, use a straight piece of hardwood or aluminum channel for the caul. Then, insert crafts sticks under the caul where you need a little extra downward pressure.

—Fraser MacLean, Langley, B.C.



## SHOP TIPS



### Put it in reverse for simple frame finishing

By reversing the jaws of a one-handed clamp (making it a spreader), you can use the clamp to hold a trivet or picture frame while you apply a finish with your other hand. Expand the jaws into the frame's rabbet, where missing finish won't show. Then, insert a hook through the hole in the end of the clamp bar and hang the hook from a wire loop for drying. I leave off the clamp pads for better jaw bite on the thin rabbet edges.

—Dave Whiting, Townsend, Mass.

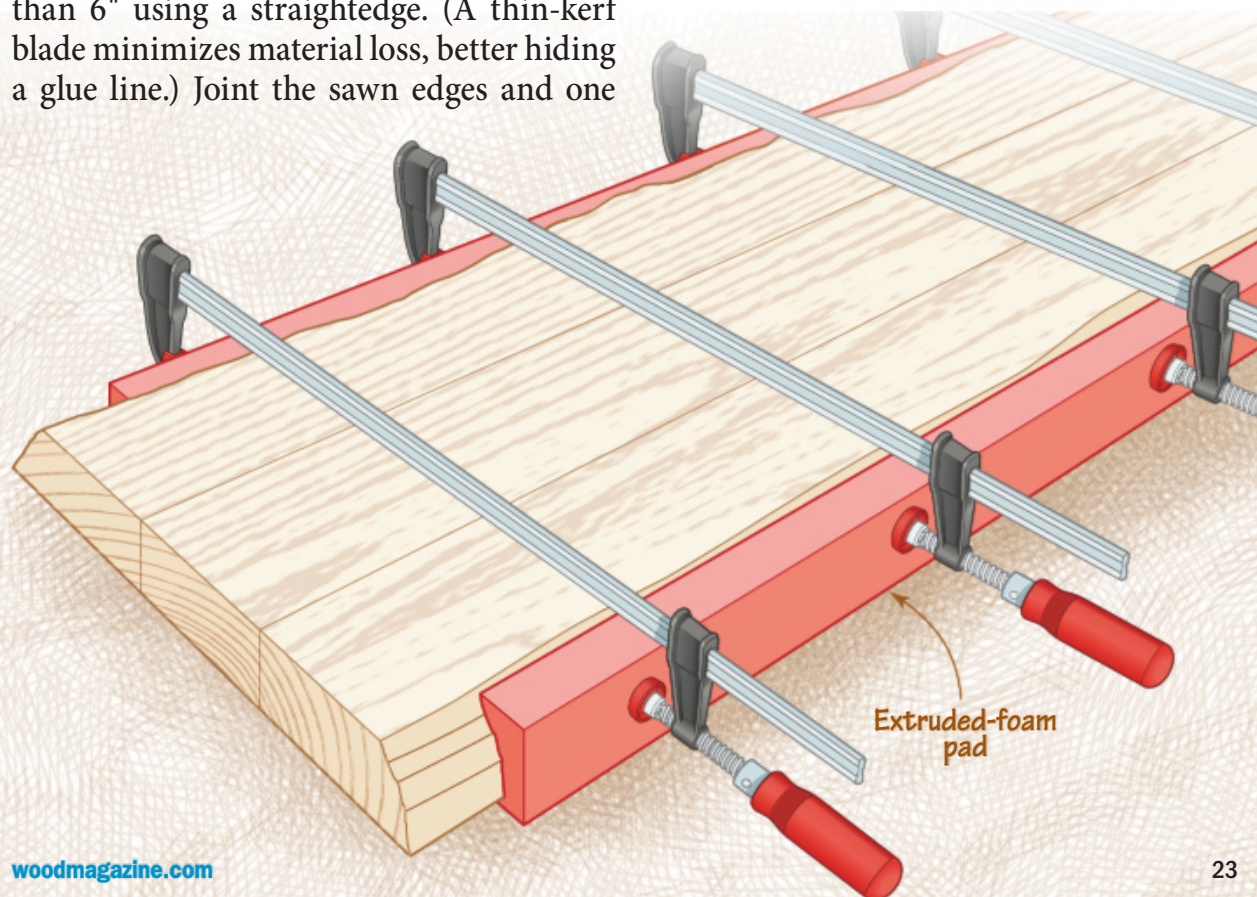
### Flatten natural-edge tabletops...without a router sled

Want to make a tabletop from a wide slab with natural wavy edges, but don't want to go to the hassle of making a router sled and railed platform for flattening the slab? Here's a simple way to get the job done with a portable circular saw, jointer, and thickness planer.

First, rip the slab into boards no wider than 6" using a straightedge. (A thin-kerf blade minimizes material loss, better hiding a glue line.) Joint the sawn edges and one

face. Then thickness-plane the boards. Arrange the boards in natural order, and glue them back together, using strips of extruded foam as clamp pads. The foam conforms to the irregular edge to protect it, and gives the clamp jaws a somewhat-square surface to press against. 🌲

—Bob Hunter, WOOD® magazine



# WIN A FREE WEEKEND WITH WOOD!

Attend North America's  
Premier Woodworking  
Educational Event

**May 16–19, 2019**

at the WOOD® magazine shops  
in Des Moines, Iowa

Prize includes  
tuition, hotel, and more.  
And **YOU** could win it all!

Learn more and  
enter **TODAY** at  
[weekendwithwood.com/  
freeweekend](http://weekendwithwood.com/freeweekend).

## Weekend With WOOD®

NO PURCHASE NECESSARY TO ENTER OR WIN. Subject to Official Rules at [www.woodmagazine.com/www19rules](http://www.woodmagazine.com/www19rules). Begins at 9:00 a.m. CT on 01/01/19 and ends at 11:59 p.m. CT on 03/31/19. Open to legal residents of the 50 United States, and the District of Columbia, 21 years or older. Limit one (1) entry per person using only one (1) email address. Void where prohibited. Sponsor: Meredith Corporation.



# Clear-view Display Case

*Straightforward joinery makes for a simple, sturdy build.*



D I M E N S I O N S :  
42 1/2" W x 17 3/4" D x 35 1/4" H

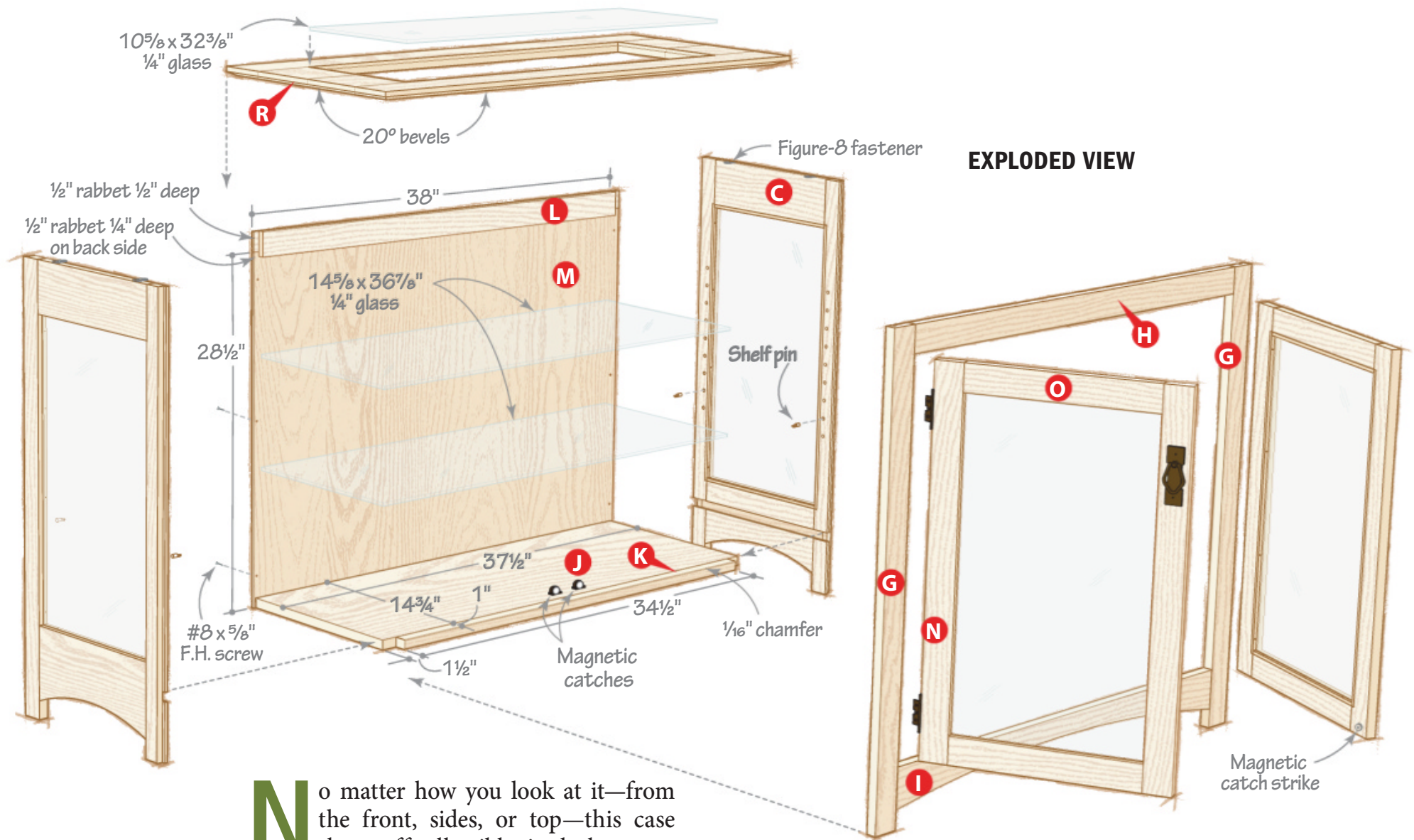
Approximate materials cost:

**\$375**

**4**  
sided view

**11**  
sq. ft. display area





**N**o matter how you look at it—from the front, sides, or top—this case shows off collectibles in the best possible light, thanks to lots of seeded (wavy with tiny bubbles) glass. Have the glass cut to size, or cut it yourself following our step-by-step instructions.

**Note:** Although the front stiles (A) and rear stiles (B) have different initial widths, they will appear symmetrical in the final assembly.

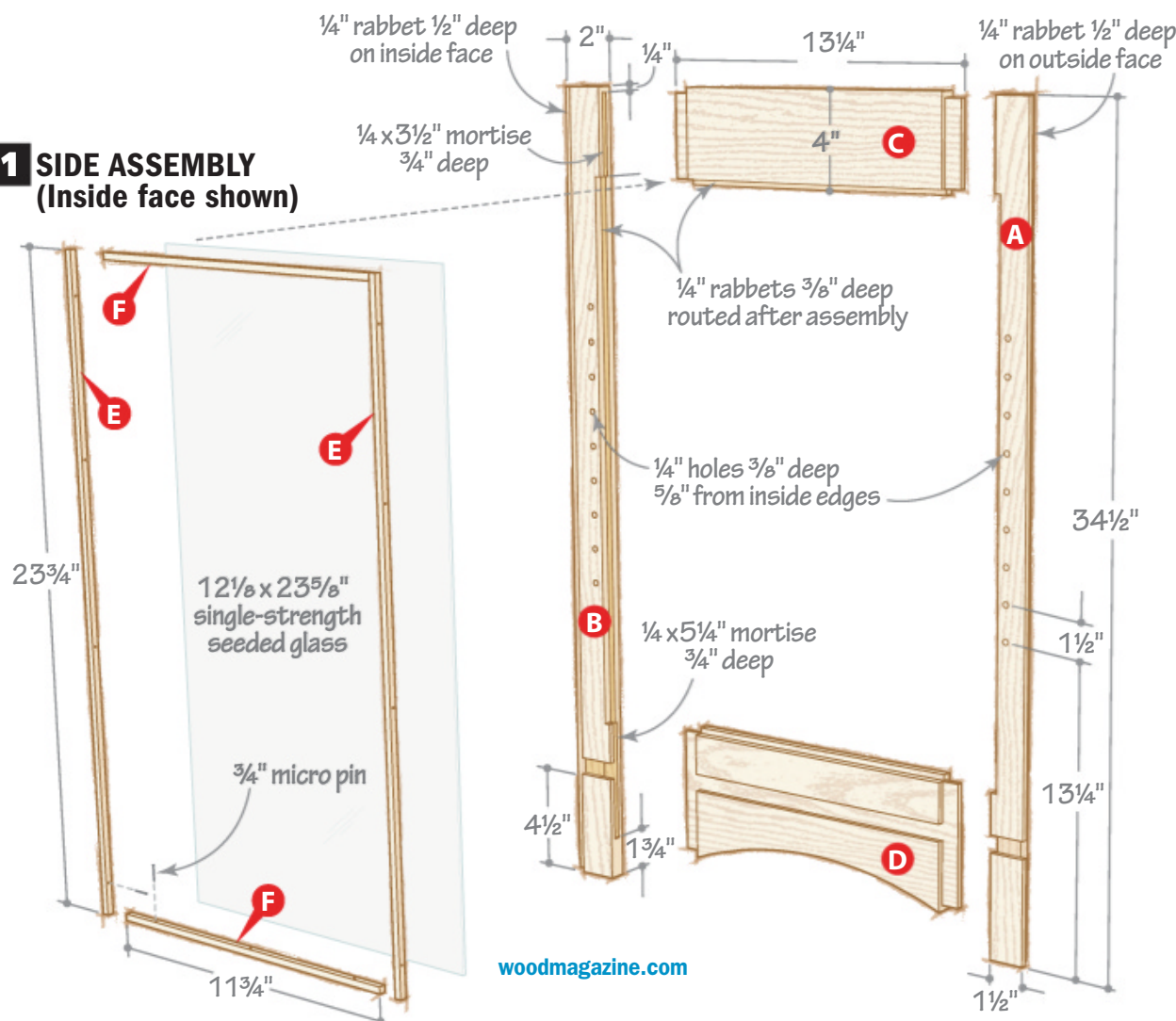
## Make the case

**1** Cut side frame parts A–D to size [Materials List, Drawing 1], and arrange them as mir-

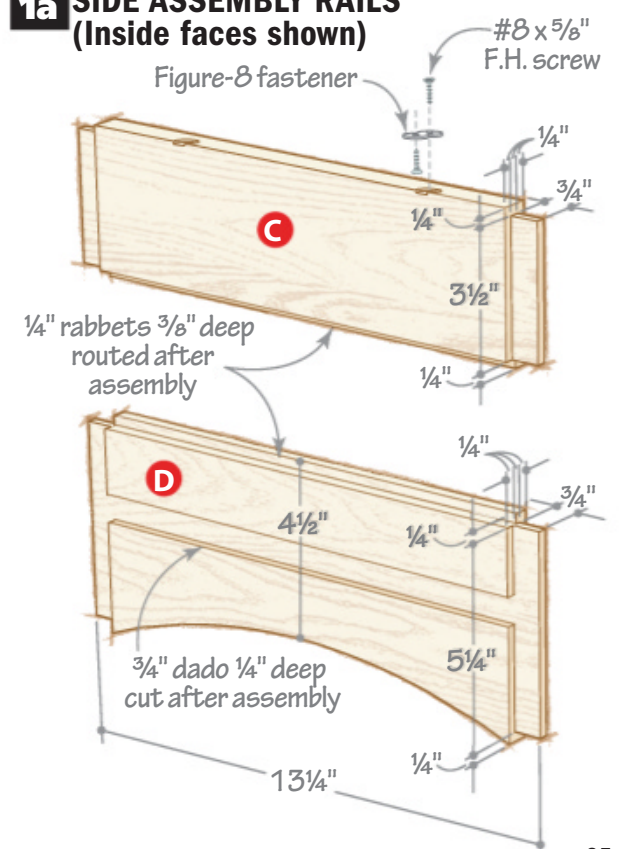
ror images. Mark part letters and orientation (right, left) on the outside faces with chalk. Form the stile (A, B) mortises and then cut the rail (C, D) tenons [Drawing 1a] to fit the mortises. Use a fairing stick to draw the arc on the lower rails (D) and bandsaw and sand them to shape.

► Learn methods to make mortise-and-tenon joints. [woodmagazine.com/mt4ways](http://woodmagazine.com/mt4ways)

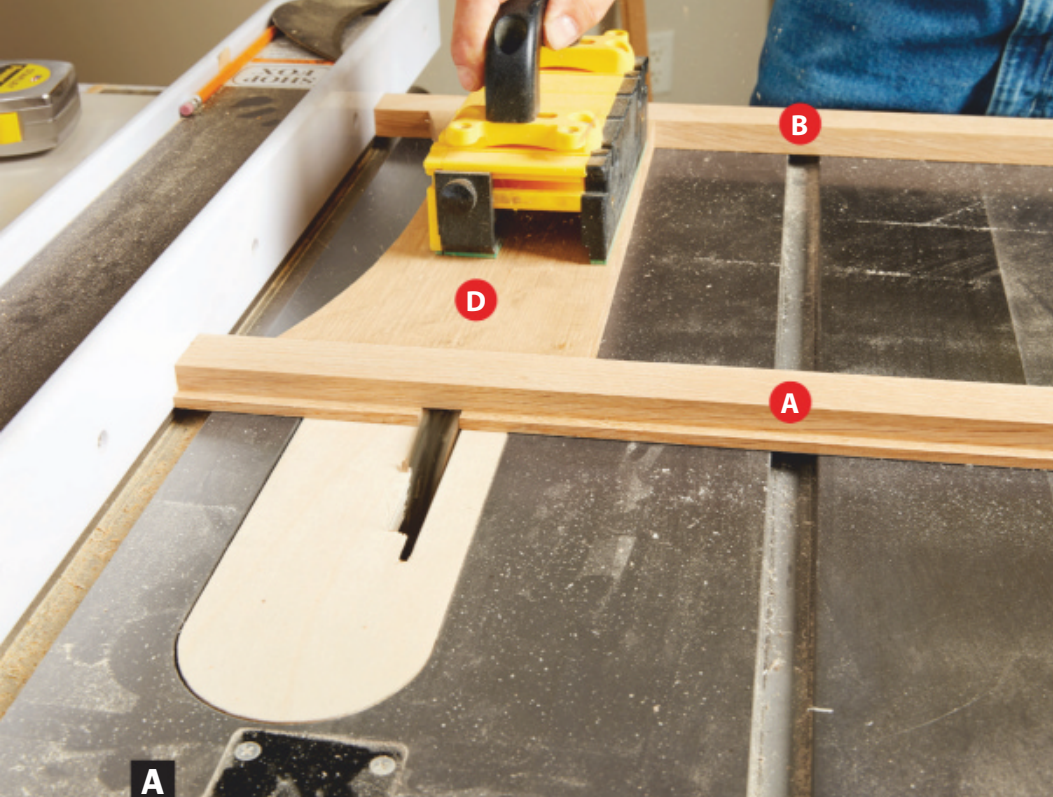
### 1 SIDE ASSEMBLY (Inside face shown)



### 1a SIDE ASSEMBLY RAILS (Inside faces shown)



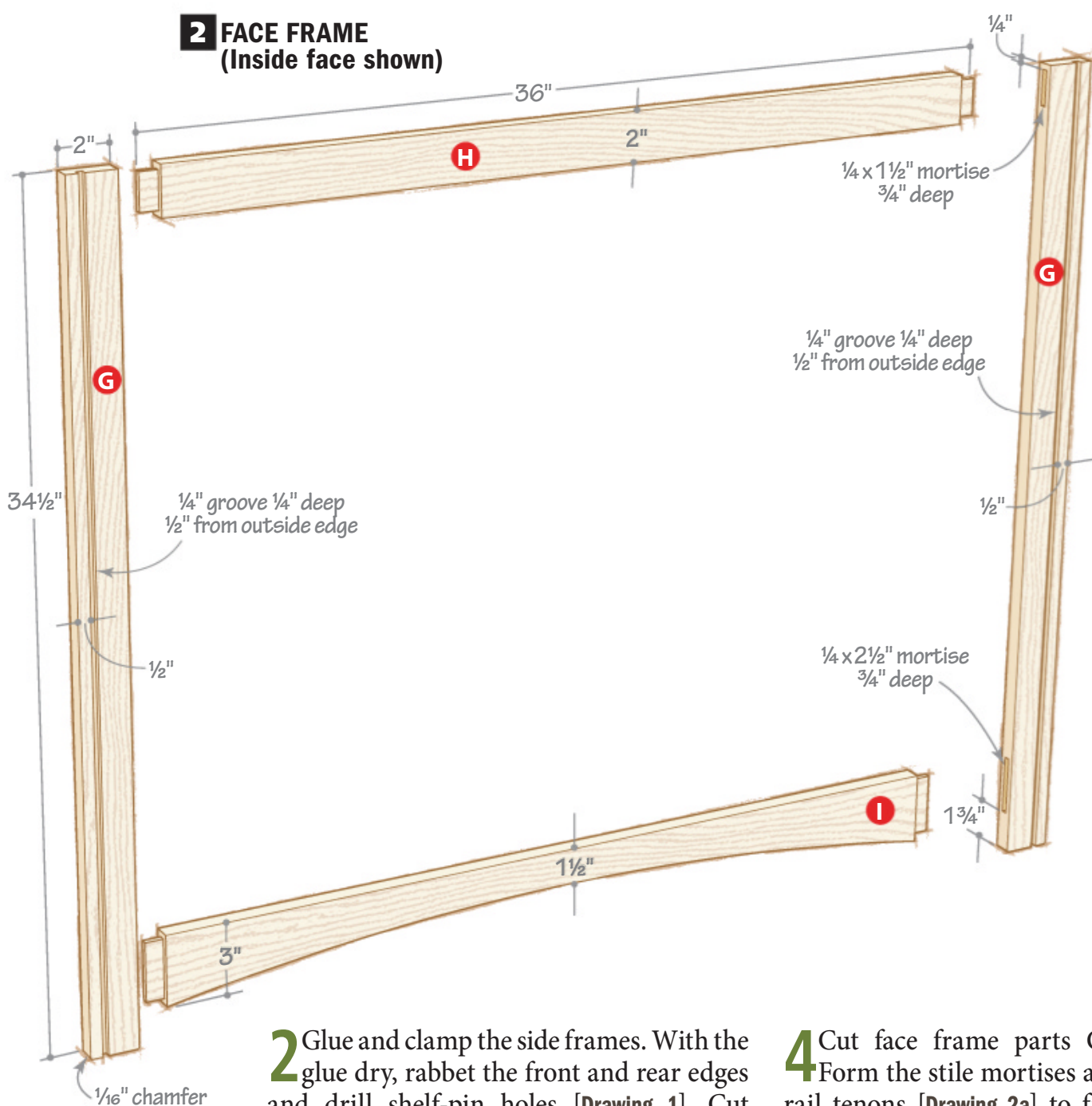




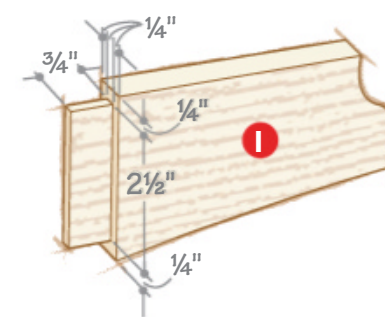
**A** Dado the inside faces of the sides to match the thickness of the bottom (J).



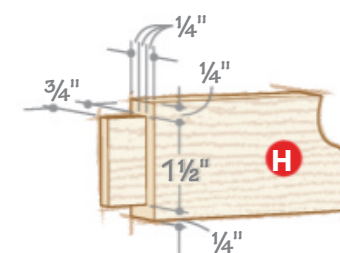
**B** Squaring braces orient the side and face-frame assemblies while riser blocks make room for bar-clamp heads.



## 2 FACE FRAME (Inside face shown)



## 2a FACE FRAME RAILS



**2** Glue and clamp the side frames. With the glue dry, rabbet the front and rear edges and drill shelf-pin holes [Drawing 1]. Cut dados for the bottom [Photo A]. Rabbet the inside edges of the frame openings and square the corners with a chisel to receive the glass. Finish-sand the sides.

**3** Cut the glass stops (E, F) 1/2" longer than listed [Materials List]. Finish-sand the stops and set them aside.

**4** Cut face frame parts G–I [Drawing 2]. Form the stile mortises and then cut the rail tenons [Drawing 2a] to fit the mortises. Groove the stiles (G) to fit the tongues formed on the side stiles (A). Bandsaw and sand the arc on the lower rail (I).

**5** Glue and clamp the face frame. With the glue dry, finish-sand it.

**6** Cut the bottom (J) and trim (K) [Exploded View]. Glue the trim to the bottom, flush

**Tip!** Dry-assemble the sides, face frame, and bottom assembly to check the fit of the parts before gluing.



[illegible]

Technical drawing of a wooden box. The front panel is labeled with a red circle containing the letter 'O'. Dimensions are indicated: 1 1/2" for the height, 3/4" for the width, and 1/4" for the thickness of the side panel.

**7** Assemble one side (A–D) to the face frame [Photo B]. Glue the bottom assembly (J/K) into the side dado and to the top edge of the face-frame lower rail (I). Glue and clamp the remaining side to the bottom assembly and face frame.

## Build the doors

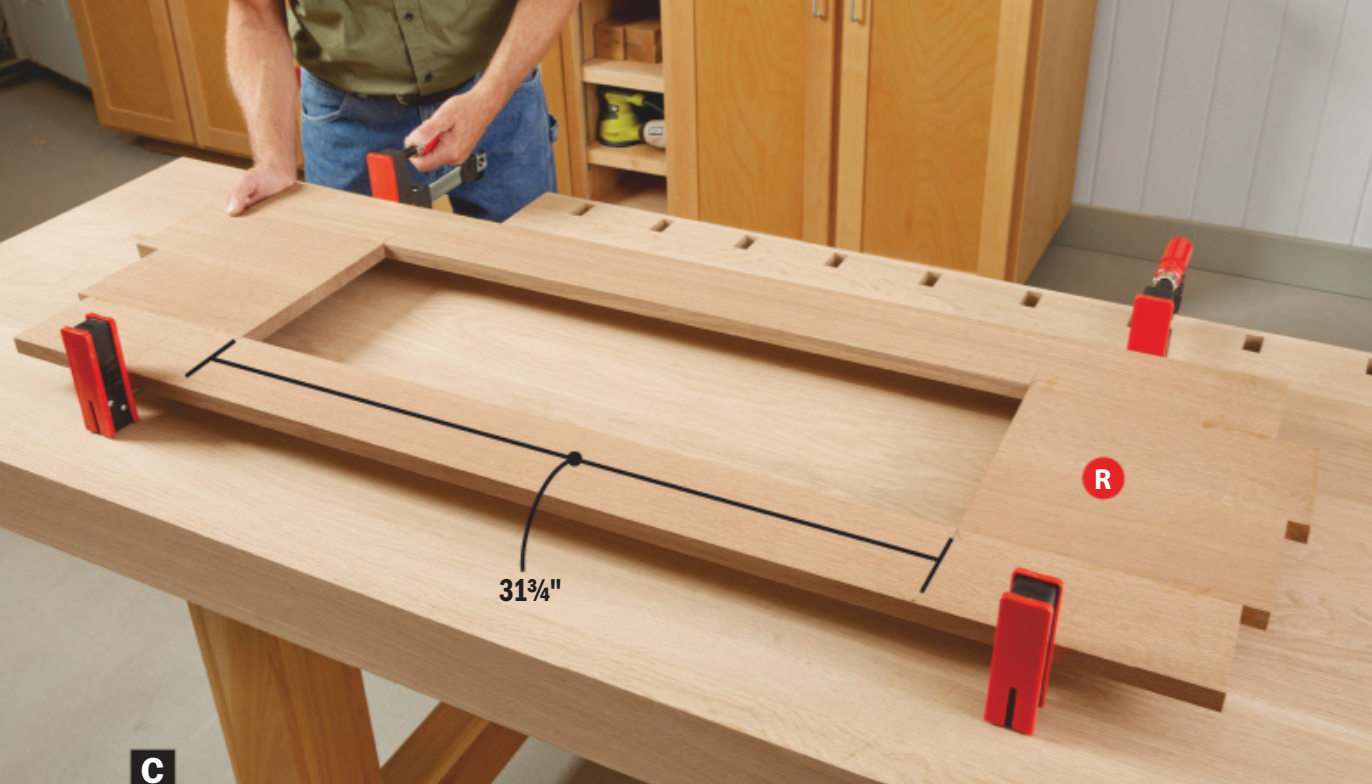
**1** Cut door parts N and O and form the mortises and tenons [Drawings 3 and 3a]. Glue and clamp the doors. With the glue dry, rabbet the rear edges of the door openings and square the corners with a chisel. Drill holes for pulls [Sources]. Finish-sand the doors.

**2** Cut the door glass stops (P, Q)  $\frac{1}{2}$ " longer than listed. Finish-sand the stops and set them aside.

► Hang perfectly spaced inset doors.  
[woodmagazine.com/fittingdoors](http://woodmagazine.com/fittingdoors)

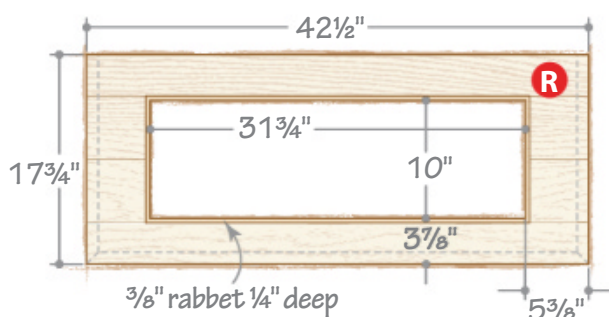
27





**C** Glue and clamp the panel halves between the rails, creating an opening for the top glass.

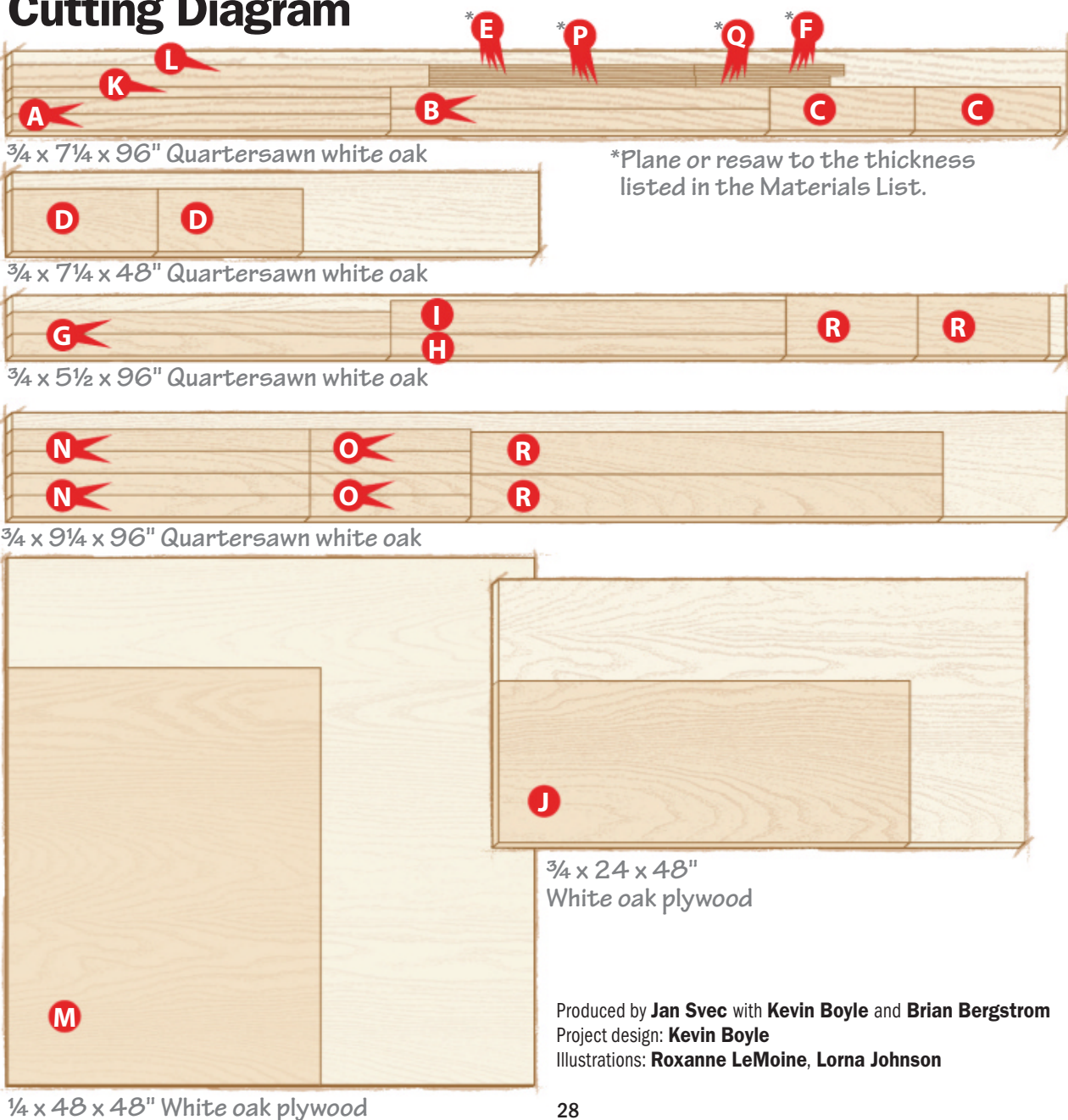
#### 4 TOP (Top face shown)



#### 4a BEVEL



## Cutting Diagram



## Top it off

**1** For the top (R), cut two 3/4 x 3 7/8 x 43" rails and edge-join a 3/4 x 10 x 12" panel. With the glue dry, crosscut the panel in half. Assemble the top [Drawing 4, Photo C].

**2** With the glue dry, trim the top to length, and rabbet the upper inside edges of the opening [Drawing 4]. Bevel the ends and front edge [Exploded View, Drawing 4a] on the tablesaw. Finish-sand the top.

## Finish up

**1** Remove all hardware. Inspect all parts and assemblies and finish-sand where necessary. Apply a finish. (We used water-based satin polyurethane.)

## Materials List

| Part          |                       | FINISHED SIZE |      |      | Matl. | Qty. |
|---------------|-----------------------|---------------|------|------|-------|------|
|               |                       | T             | W    | L    |       |      |
| Case          |                       |               |      |      |       |      |
| A             | side front stiles     | ¾"            | 1½"  | 34½" | QO    | 2    |
| B             | side rear stiles      | ¾"            | 2"   | 34½" | QO    | 2    |
| C             | side upper rails      | ¾"            | 4"   | 13¼" | QO    | 2    |
| D             | side lower rails      | ¾"            | 5¾"  | 13¼" | QO    | 2    |
| E*            | side vertical stops   | ¼"            | ¼"   | 23¾" | QO    | 4    |
| F*            | side horizontal stops | ¼"            | ¼"   | 11¾" | QO    | 4    |
| G             | face-frame stiles     | ¾"            | 2"   | 34½" | QO    | 2    |
| H             | face-frame upper rail | ¾"            | 2"   | 36"  | QO    | 1    |
| I             | face-frame lower rail | ¾"            | 3"   | 36"  | QO    | 1    |
| J             | bottom                | ¾"            | 14¾" | 37½" | OP    | 1    |
| K             | trim                  | ¾"            | 1"   | 34½" | QO    | 1    |
| L             | stretcher             | ¾"            | 2"   | 38"  | QO    | 1    |
| M             | back                  | ¼"            | 38"  | 28½" | OP    | 1    |
| Doors and top |                       |               |      |      |       |      |
| N             | door stiles           | ¾"            | 2"   | 27⅞" | QO    | 4    |
| O             | door rails            | ¾"            | 2"   | 14⅞" | QO    | 4    |
| P*            | door vertical stops   | ¼"            | ¼"   | 23⅝" | QO    | 4    |
| Q*            | door horizontal stops | ¼"            | ¼"   | 13⅜" | QO    | 4    |
| R*            | top                   | ¾"            | 17¾" | 42½" | EQO   | 1    |

\*Parts initially cut oversize. See the instructions.

**Materials key:** QO-quartersawn white oak, OP-white oak plywood, EQO-edge-joined quartersawn white oak.

**Supplies:** #8 x 5/8" flathead screws; 3/4" micro pins; 1/4" shelf pins (8); 12 1/8 x 23 5/8" single-strength seeded glass (2); 13 3/16 x 23 1/2" single-strength seeded glass (2); 1/4 x 10 5/8 x 32 3/8" glass, edges ground and polished; 1/4 x 14 5/8 x 36 7/8" glass, edges ground and polished (2).

**Blade and bits:** Dado set; 1/4" and 3/8" rabbet router bits.

**Sources:** Figure-8 fasteners, 20-pack no. 13K01.50, \$3.30 pk. (1 pack); ball-tip full-wrap inset hinges, dark antique English finish no. 01H30.32, \$4.70 ea. (4); 3/8" rare-earth magnets no. 99K32.03, \$0.75 ea. (2); 3/8" panel magnet cups no. 99K32.72, \$2.90 ea. (2); 1/2" steel washers no. 99K32.62, \$0.60 ea. (2), Lee Valley, 800-871-8158, leevalley.com.

Vertical pulls with cast drops and antique finish no. MS-28, \$23.25 ea. (2), Horton Brasses, 800-754-9127, horton-brasses.com.

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



**Note:** Seeded glass in the sides and doors provides an antique look. Use standard glass for the top and shelves.

**2** Have single-strength glass cut to fit the sides and doors ( $\frac{1}{8}$ " less in length and width than the rabbeted openings) or cut it yourself from glass you already may have on hand [Skill Builder]. Have  $\frac{1}{4}$ " glass cut and the edges ground and polished for the shelves and top panel. Trim the glass stops (E, F, P, Q) to fit and install the glass. (We used a micro-pinner to secure the stops.)

**3** Install the doors and hardware. Secure the top with figure-8 fasteners. Move the case to its ultimate location and install the top panel and rest the shelves on shelf pins [Sources]. Arrange your collection on the shelves, step back, and see it sparkle! 🌟

**Tip!** To get the best fit for the top glass panel, take the finished top (R) to a glass shop and have them cut and finish the glass to leave a  $\frac{1}{16}$ " gap all around.

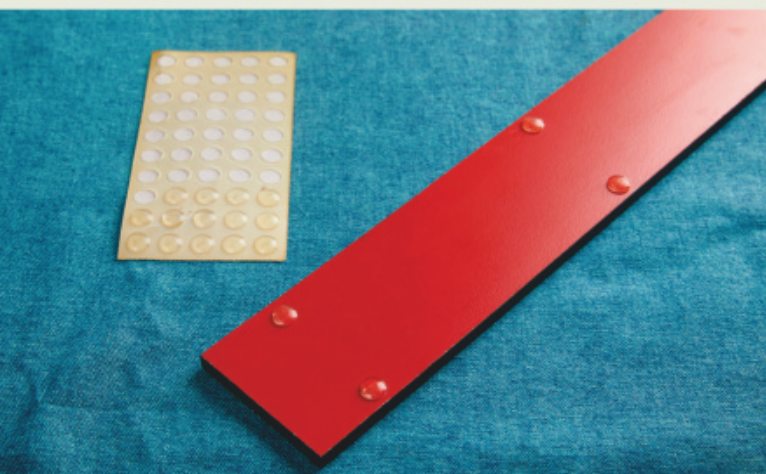
## SKILL BUILDER

### Cut glass, save cash

That assortment of perfectly good single- and double-strength window glass in the corner of your shop is worth around \$3 per square foot. Here's how to safely and effectively cut that glass to size for anything from cabinet doors to picture frames.



Cover a flat, sturdy worksurface with a heavy dropcloth to prevent scratching the glass and gather your supplies.



**Make a straightedge** using any sturdy  $\frac{1}{4}$ "-thick material from tempered hardboard to aluminum bar stock. Apply self-adhesive bumpers to prevent slipping.



**Wipe the area of the cut** with a clean damp cloth to remove dirt and grit.



**Position the straightedge** and drip or brush paint thinner along the cut path. The thinner lubricates the cut, ensuring a cleaner score line, and prolongs the life of the cutter.



**Grip the glass cutter** between index and middle fingers. Apply firm, even pressure with your index finger as you draw the cutter over the glass along the straightedge in a single stroke.



**The score line** should be even and continuous with no gaps. Do not rescore the line, as doing so usually leads to a bad break.



**Position the score line** just off the edge of the worksurface, firmly grip the waste piece, and snap the glass along the score line with a quick, firm downward motion.



# Beyond Home-Center Lumber

*Knowing how and where to find good wood can save you loads of money.*







**Most hardwood retailers offer short boards** and sample lots at reduced prices. Take advantage of those to try working new wood species without much risk.



**Find exotic wood species at retailers** that specialize in hardwoods, such as Woodworker's Source, shown here. These imported woods offer distinctive looks not common with domestic species, but at a premium price due to their origins and greater shipping costs.

**A**fter tools, the wood itself typically takes the biggest bite out of a woodworker's wallet. Home-center lumber proves a hard-to-resist temptation because of the convenience. But that premilled lumber, especially hardwood, sells at a premium price, compared with buying it roughsawn or partially milled. Starting from the log, every handling and machining step that's done before you buy it adds to your cost. So the closer you get to the log, in most cases, the more you save. You'll also have to do more of those machining steps, but you can, over a few projects, save enough money to pay for a jointer and planer, two machines crucial to dimensioning rough lumber. You can also find a greater selection of sizes and species by shopping at businesses dedicated to selling wood. Let's look at the options.

## Woodworking retailers

These businesses specialize in all things woodworking: tools, machinery, bits, blades, hardware, glues, finishes, and, yes, some kiln-dried wood. For example, Woodcraft and Rockler sell selections of S4S hardwood boards, veneer, and natural-edge slabs. If you live near one of these stores, you'll save money by not paying for shipping, and gain the ability to sort through the boards to find what you want. Some stores will cut boards to shorter lengths.

## Hardwood retailer/wholesaler

Companies that specialize in selling kiln-dried wood, such as Jewell Hardwoods,

Woodworker's Source, Hearne Hardwoods, and Talarico Hardwoods, buy (or mill the wood themselves) in great enough quantities to offer competitive pricing. The wood from these sellers usually comes skip-planed just under its designated thickness. For example, 4/4 lumber (starting at 1") might be  $\frac{7}{8}$ " thick. You can plane away any slight warping that might occur after the wood stabilizes, and still get  $\frac{3}{4}$ "-thick boards.

Unless you can visit the business, most times you have to trust their selections without seeing the boards. Shipping costs can quickly eat up the savings of lower-cost lumber though, so shop around and compare; a retailer located closer to you will likely have lower shipping costs. Check with trade groups, such as the Hardwood Distributor's Association ([hardwooddistributors.org](http://hardwooddistributors.org)), to find nearby retailers.

When shopping for lumber online, you might be able to view specific boards, but more often will be "buying blind" and simply getting what the retailer sends. Also, unless stated, you won't know the moisture content of the wood and how it will react to your environment. Be sure to check the company's return policy for wood. You might get a break on shipping costs by buying in greater quantity or price. Some retailers offer online shopping, where you can see and select specific slabs or lumber lots, complete with photos. And many of these businesses also sell high-quality sheet goods in a wide variety of hardwood veneers.

► **Hardwood:** Any tree that sheds its leaves annually (deciduous).

► **Softwood:** Any tree that has needles rather than leaves and stays green all year (coniferous).

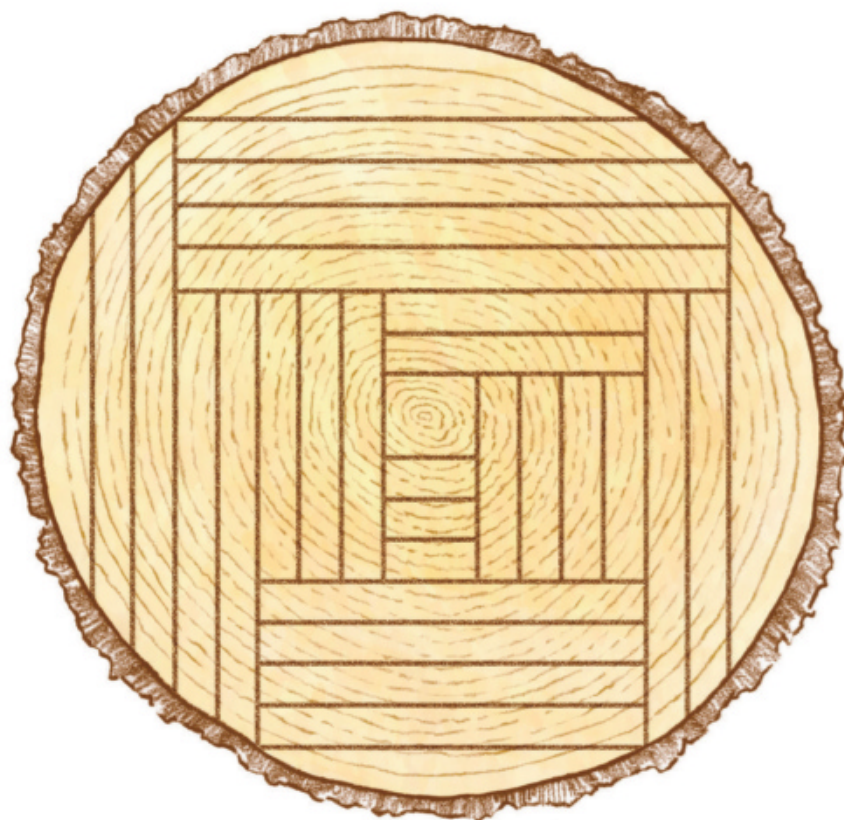
► **Skip-planed:** Wood planed on both faces just enough to reveal the grain, but retaining some milling marks.

► **Roughsawn:** Wood that still has its just-off-the-sawmill surfaces.

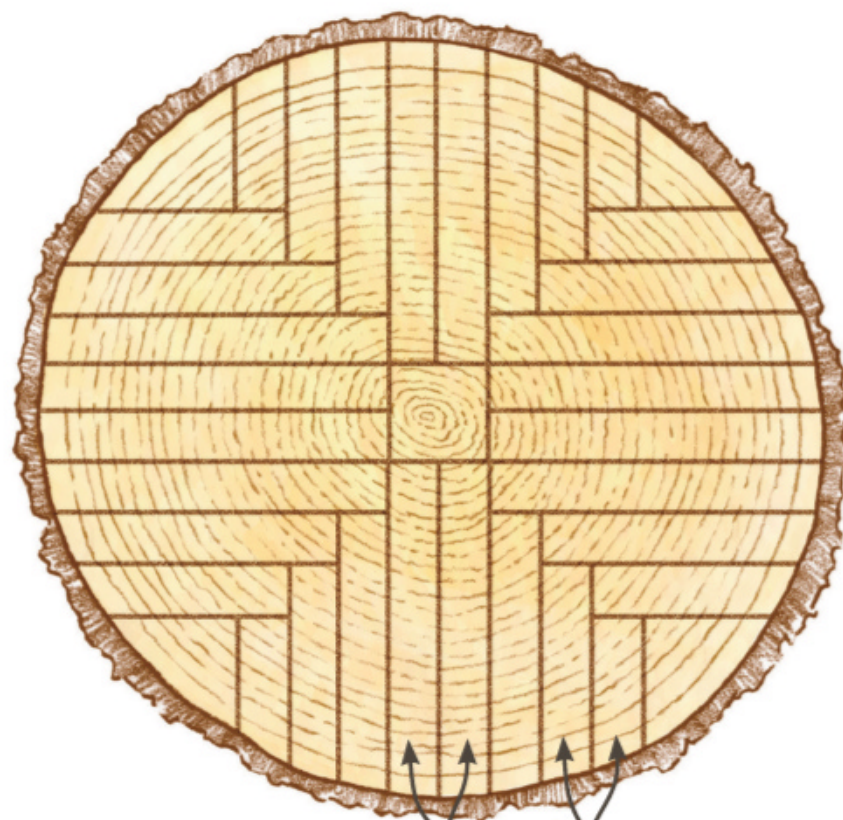
► **S4S:** Wood that has been surfaced on all four faces and edges.

► Learn more about hardwood terminology and grading specifications.  
[woodmagazine.com/bdft](http://woodmagazine.com/bdft)





Plainsawn (all boards)



Quartersawn Riftsawn

## Sawmill/custom sawyer

► Learn more about wood moisture content and how it affects lumber. [woodmagazine.com/woodmoisture](http://woodmagazine.com/woodmoisture)

► To locate a sawyer near you, search the websites of bandsaw-mill manufacturers. Most have locator services for customers who use their mills professionally.

Purchasing from a local sawmill or sawyer often proves one of the best values in lumber buying. These mills typically buy logs from within a few hundred miles of their locations. So your choice of wood species will be limited, compared with national retailers. If the mill has its own kiln for drying lumber, expect to pay more than for air-dried boards. Air-dried lumber will likely measure about 12–15 percent moisture. (Ideal working moisture is 6–10 percent; that figure varies by climate.) This wood will typically be roughsawn; to work this lumber you'll definitely need a jointer and planer.

If you have your own logs, a sawyer with a bandsaw or chainsaw mill can often bring the mill to the logs, or you can take the logs to the mill. Either way, you pay for the sawyer's services, but keep all the wood. Some sawyers discount their fees if you help cut

and stack the lumber. Also, you can direct how the sawyer cuts the log. An experienced, skilled sawyer will typically cut logs for maximum yield with the least amount of time and effort. This results in more plain-sawn lumber (*above*). To get more quartersawn or riftsawn lumber, you'll get less yield and pay more for the extra labor. As soon as you've cut the wood, stack it to dry (shown *below left*) in a barn, shed, or anywhere out of direct weather.

If you prefer, you can buy your own bandsaw mill (*below center*) or chainsaw mill (*below right*) and saw your own logs into lumber. Entry-level bandsaw mills start at around \$4,000. Many chainsaw mills sell for less than \$1,000, but you'll need a hefty chainsaw (another \$800 to \$1,300 plus ripping chain) to power it. Most chainsaw mills require a great deal more physical labor in milling logs, compared with a bandsaw mill.

► Watch a video of a bandsaw milling a log, as well as tips for stacking the lumber. [woodmagazine.com/bandsawmill](http://woodmagazine.com/bandsawmill)



**Stack fresh-cut boards to air-dry** with narrow spacers (called stickers) between each row. Let the wood dry for at least one year per inch of thickness.



**A bandsaw-mill operator will custom-cut** logs to your specifications. These mills cut the thinnest kerf, wasting less wood.



**A chainsaw mill has the added benefit** of being the most portable, letting you cut a log where it fell, eliminating the need to drag or move the log.



## Other cost-saving options

■ **Auctions.** Many farm and estate auctions include stacks of lumber, sometimes including gems, such as walnut, cherry, or white oak. Auctioneers typically sell this lumber by the stack, and often at bargain prices. When assessing a stack of lumber, determine the species, quality, and approximate board footage. If possible, scrape a few boards to get a peek at the grain. And beware of potential pitfalls: The lumber could contain nails, nail holes, splits, cracks, or worm and insect damage. Armed with this information, bid accordingly. Also, be sure you have a way to transport the lumber—most auctions require you to take your prizes home that same day—as well as a dry place to store it.

■ **Craigslist.org.** This online buy/sell site can be both a gold mine and a junkyard, so browse and shop with a discerning eye. To make it easier to see and get the wood, search only the area within driving distance. Ask for details, such as board sizes, condition, and moisture content. Always look over the wood in person before handing over money! Inspect and measure the boards to make sure you're getting the correct species and amount advertised.

► **Board foot:** The measure by which hardwoods sell. A board foot equals 144 cubic inches, such as a 1×12×12" or 2×6×12" board.

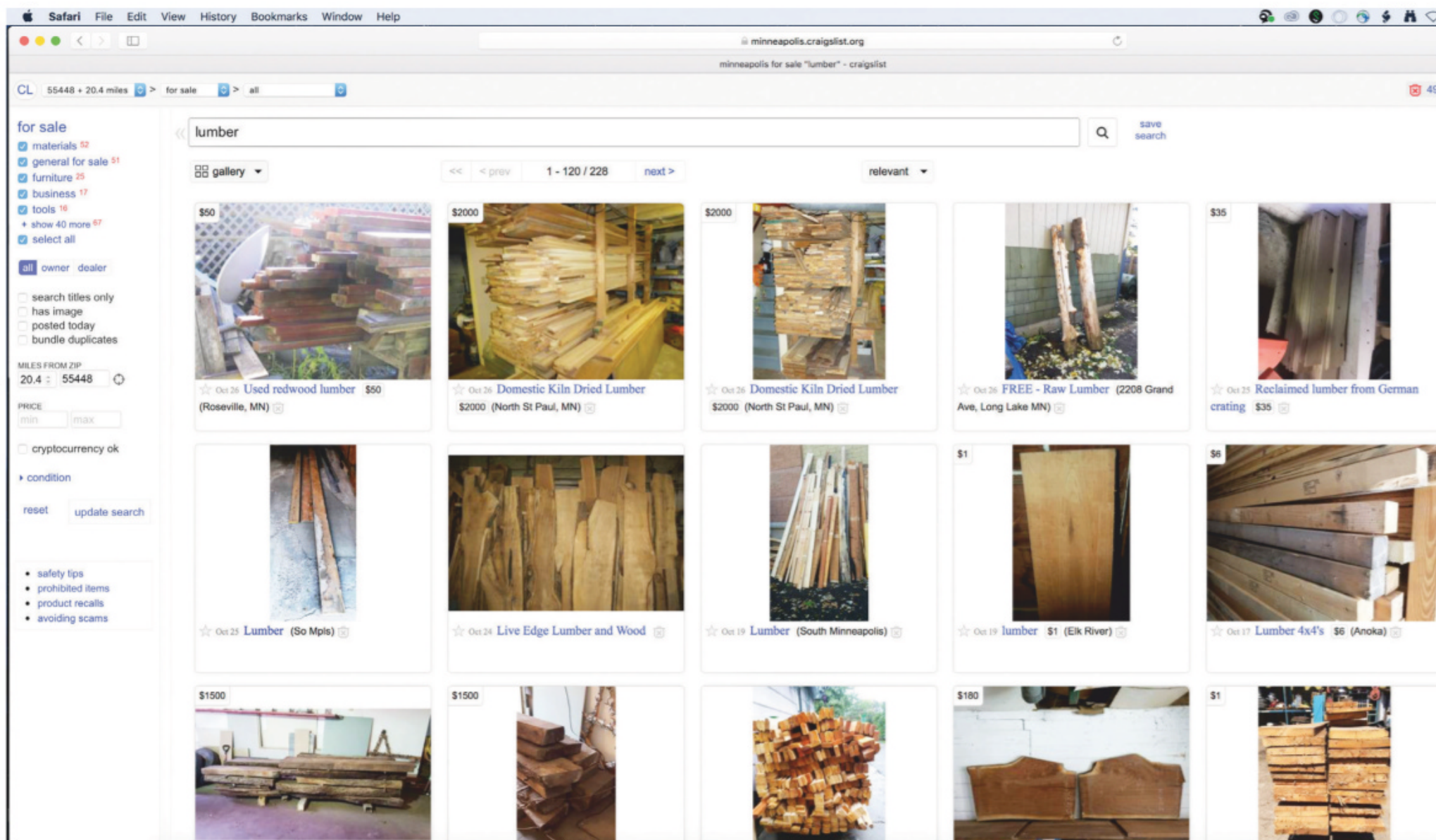
► A few tools to carry with you when looking at lumber: moisture meter, tape measure, pocketknife, block plane, calculator.

■ **eBay.** Like craigslist, this online buy/sell site reaches nationwide, but you can limit your search to postings that originate within a certain radius of home, using the "advanced" search option. When buying boards from a seller too far away to drive, expect to pay shipping costs. Wood on this website tends to involve specific boards or slabs, or unusual pieces, such as burls. Always check the seller's rating: 100-percent positive feedback helps ease worries about buying something sight-unseen. And you can, in most cases, readily return items purchased on eBay—something not possible with craigslist or auction sales.

■ **Club links and discounts.** Woodworking clubs or guilds might provide members with discounts at local retailers. Many clubs also provide links and contact information for trusted retailers along with sources for wood and other supplies. So that club membership might pay for itself in savings available only to members. And, club members tend to share information about sources, and even sell their own lumber at times. 🌳

► If you do buy your lumber from a home center, read more about how to shop for the best quality. [woodmagazine.com/homecenterlumber](http://woodmagazine.com/homecenterlumber)

Produced by **Bob Hunter**



**Searching for lumber online can lead to** occasional gems, but be diligent in determining what the seller has before going to take a look. Some sellers overestimate or don't know exactly the type and amount of wood they have.



# Seed Starter

*Build this simple rugged garden helper and get a head start on spring planting.*



D I M E N S I O N S :  
48" W x 24" D x 16 1/4" H

Approximate  
materials cost:

**\$75**

plus your  
choice of  
finish

Build and  
stack extra  
frames to  
hold tall pots  
or plants.

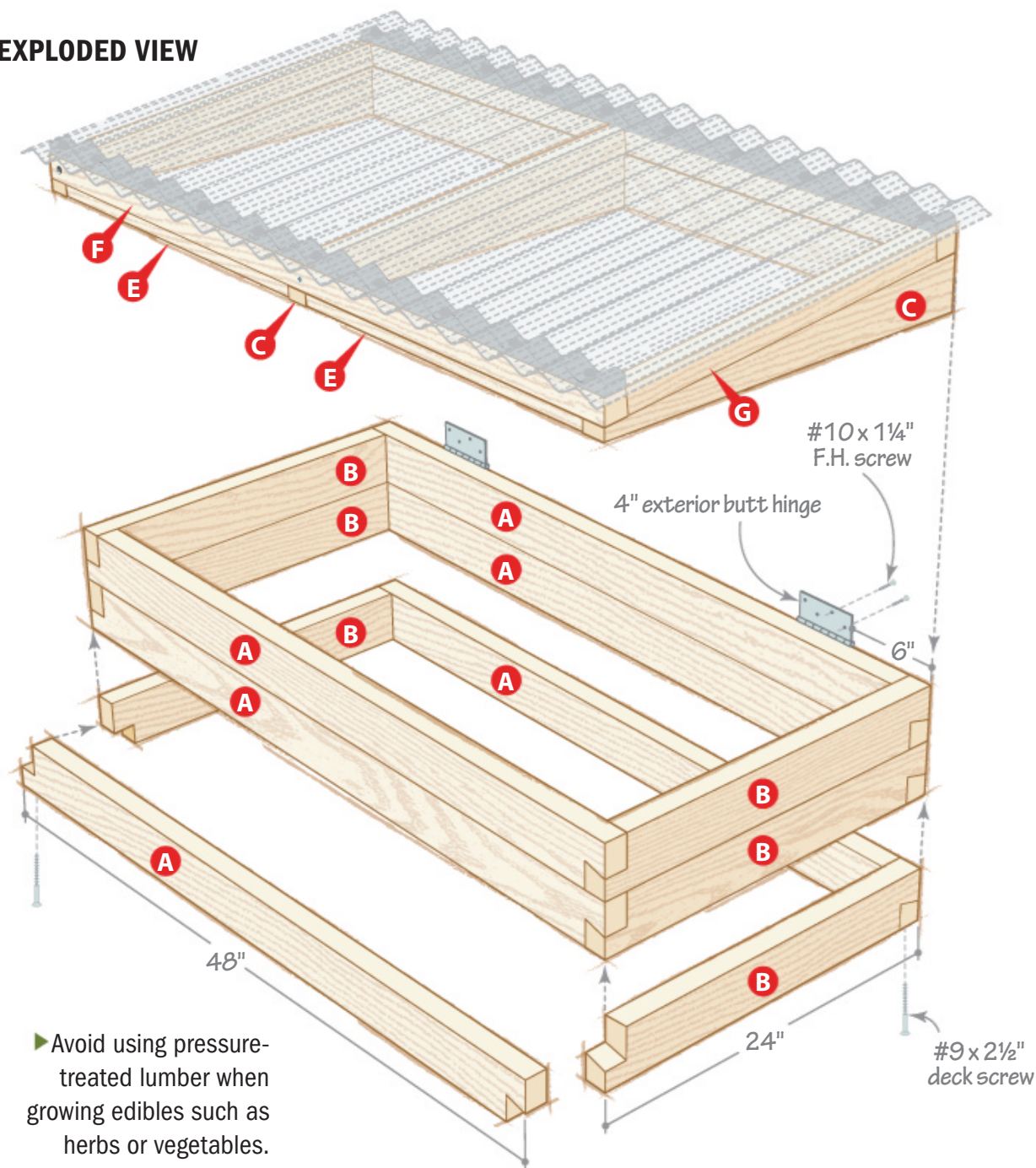
## Seed Starter Tips

Seed starters protect seedlings from temperature extremes until they're ready to plant in a garden. Here's how to use your new project:

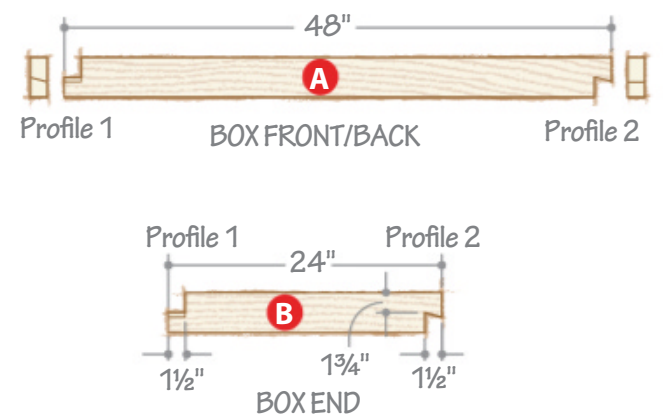
- To check the temperature in the seed starter without going outside, install a remote-sensor outdoor thermometer [Sources] inside the frame. Some models even record high and low temperatures.
- Before starting plants, practice controlling the temperature within the box. Monitor the heat buildup on sunny days and prop the lid open as needed to release excess heat.
- For better temperature control, line the inside walls with 1"-thick foam insulation board. Leave a 1" gap between the top of the foam and the top edge of the wooden box.
- To seal in warmth at night, lay a foam board on the top edges of the foam liner. An old blanket draped over the whole seed starter also helps.
- Place jugs of water inside the frame. The heat they store up during the day releases gradually at night.
- If you position the seed starter on a deck or patio to grow seeds in pots, rest it on at least one layer of foam board.



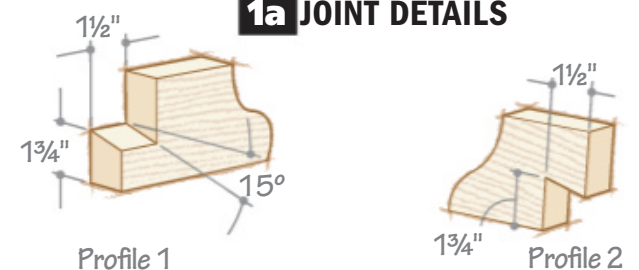
## EXPLODED VIEW



## 1 CORNER JOINTS



## 1a JOINT DETAILS



## Build the box

For each layer (A/B), you'll cut different but mating profiles at opposite ends for a chasing assembly. Three layers stack to 10 1/2" high, but you can add more to boost the height of the sides. Repeat **Steps 1-6** for each layer.

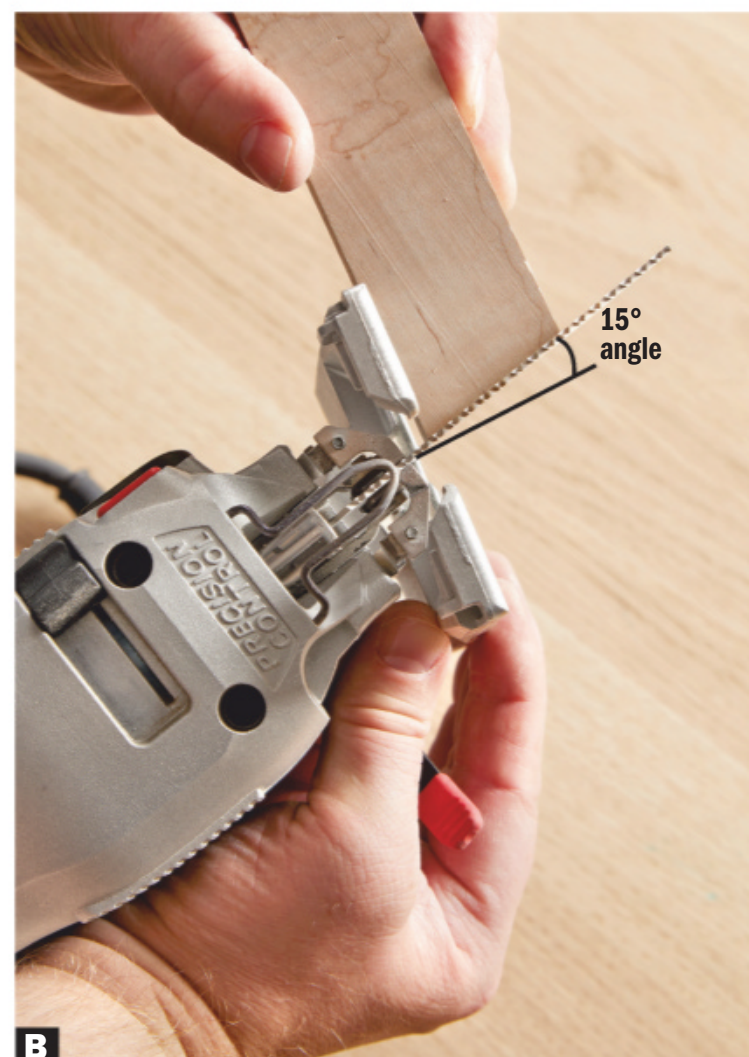
**1** Cut the box fronts, backs, and ends (A, B) to length [Materials List]. Label the outside face of each piece. With the outside face toward you, mark the left end "Profile 1" and the right end "Profile 2" [Drawings 1 and 1a].

**2** Clamp two box fronts/backs (A) and two ends (B) on edge with the outside faces away from you and the ends flush. To establish the shoulder of each joint, cut a 1 3/4"-deep kerf 1 1/2" from the flush ends [Drawing 1, Photo A]. Flip the pieces onto their opposite edges, make the unsawn ends flush, and clamp and saw as before.

**3** To cut the Profile 1 ends, tilt the base of a jigsaw to 15° [Photo B]. Mark a centered line

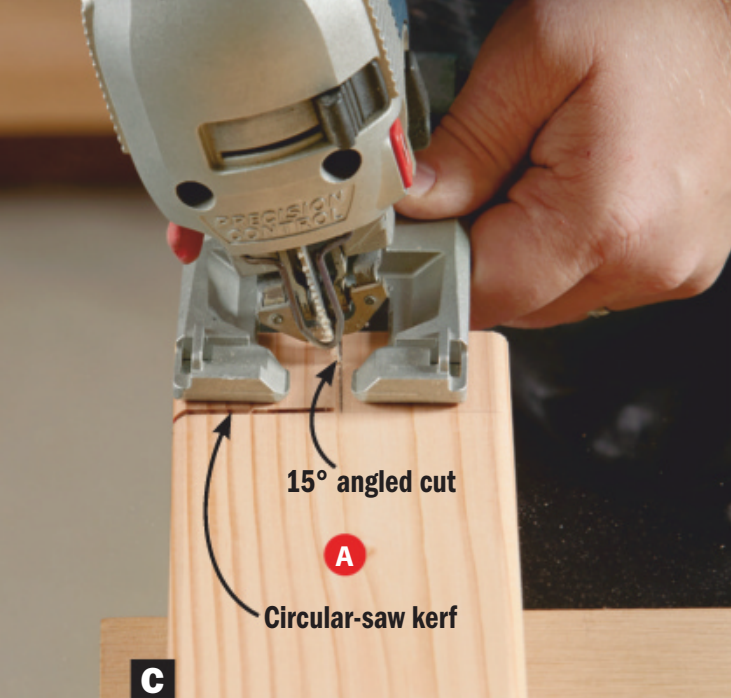


**A** Align the ends of the box pieces (A, B) for consistently positioned kerfs and a wide, stable surface for the saw base to ride on.



**B** With your circular-saw, crosscut a scrapwood block at 15°. Use the block to set the jigsaw blade angle.





**C** Make the angled cut slowly on the waste side to ensure a straight cut that, if necessary, can be fine-tuned with a chisel.



**D** Press a handsaw blade against the "keeper" side of the kerf and cut at an angle to remove the waste.



**E** Transfer the angle from the cut end to the inside face of the mating piece. A square helps ensure the edges stay flush as you mark.

on the inside face of a front/back (A). Jigsaw along the line to the circular-saw kerf [Photo C].

**4** Complete the cut using a handsaw [Photo D]. Repeat for the other Profile 1 ends.

**5** Scribe a Profile 1 end onto the inside face of its mating piece [Photo E]. Set the jigsaw base back to 90° and cut along the scribed line [Drawing 1, Photo F]. Repeat for the remaining Profile 2 ends.

**6** Test-fit each joint [Photo G]. Screw the frame pieces together [Exploded View].

**Tip!** For smooth cuts from your circular saw, use a 40- or 60-tooth blade.

## Top it with a lid

**1** Lay out the lid wedges (C) [Drawing 2] on a 2×4. Rip them to shape [Photo H] before cutting them to length.

**2** Cut the lid backs and fronts (D, E) to length, but wait to cut the bevels. Glue and screw two lid wedges (C) to a lid back and front. Add the second lid back and front and a third wedge.

**3** Sand or plane bevels [Drawing 2] on parts D and E to match the lid wedges (C).

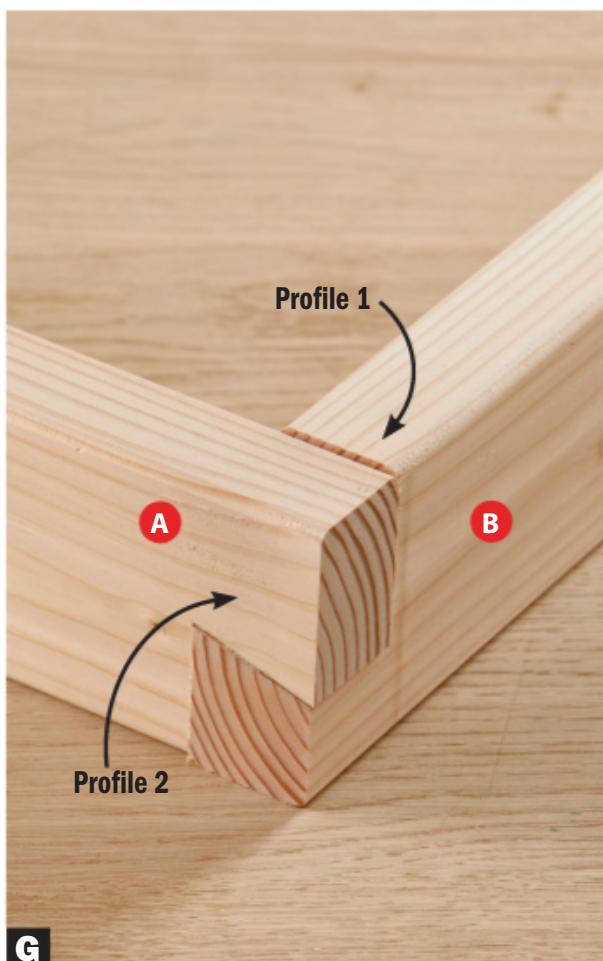
**4** Cut the lid rails (F) and stiles (G) to size, and glue and screw them together. Glue this assembly to the lower assembly (C-E).

**5** Plane or sand bevels on the lid rails (F) [Drawing 2]. Then sand the lid assembly (C-G).

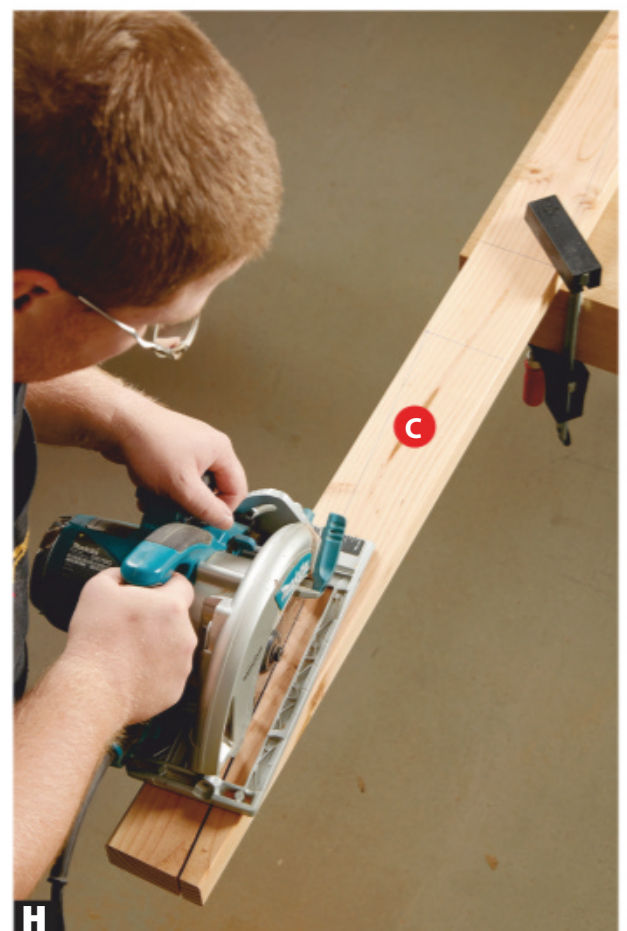
► Use a wood glue rated for exterior use.



**F** Cut on the waste side of the scribed line connecting the end of the board to the circular-saw kerf.



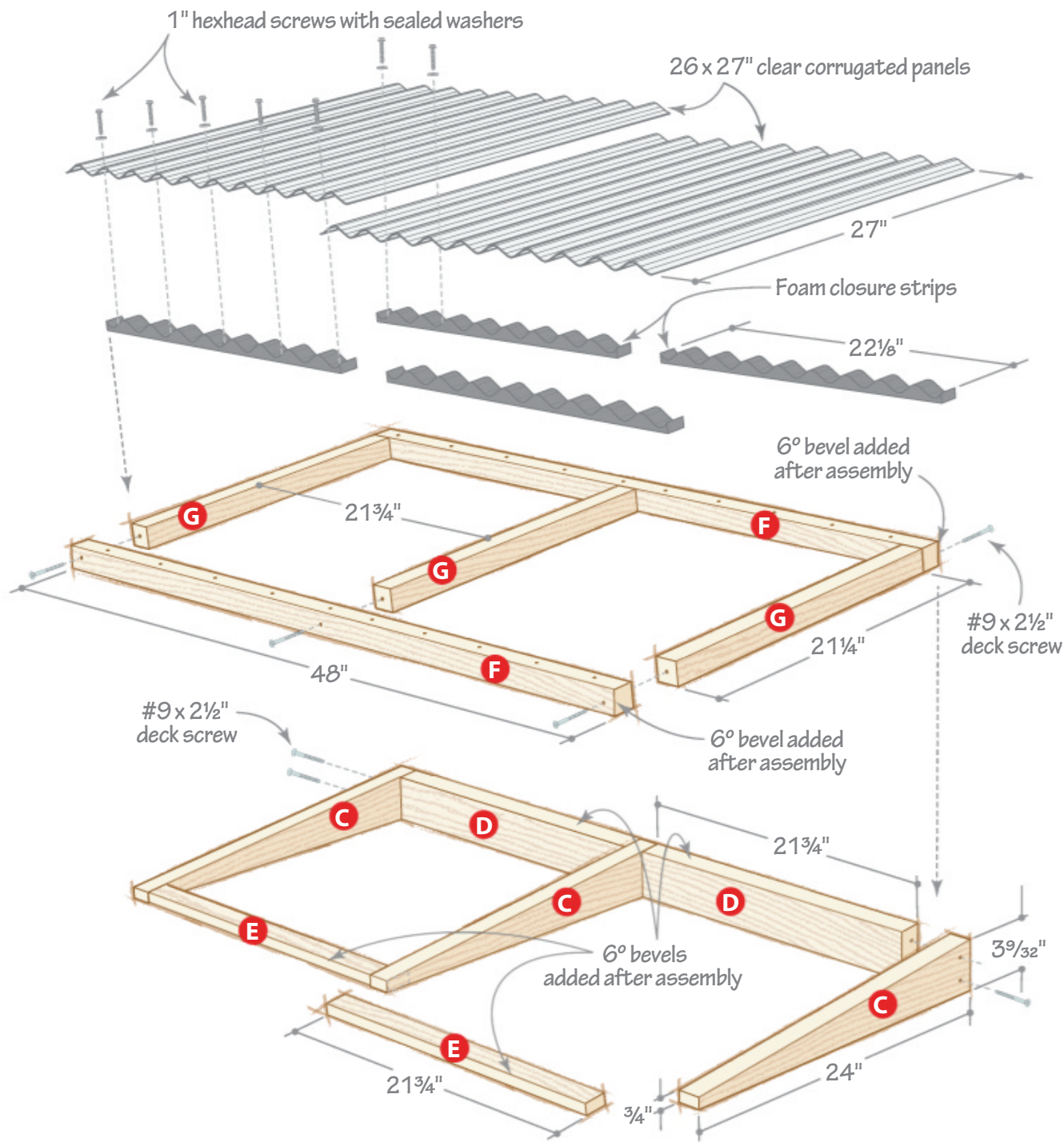
**G** Adjust the fit of the joints for flush frame edges with no gaps between the pieces.



**H** Ripping the lid wedge (C) angle from an oversize piece of stock makes it easier and safer to cut with a circular saw.



## 2 LID ASSEMBLY



## Add the finishing touches

**1** Apply exterior-oil finish or paint to the lid and frame assemblies. (We used natural-tone Thompson's Waterseal timber oil.)

**2** Cut two 26"-wide clear panels 27" long [Sources] using a 40- or 60-tooth blade. Drill ¼" holes in the valleys of the corrugation [Drawing 2]. Cut foam closure strips to follow the corrugations.

**3** Center the panels on the lid (they overhang on all sides), and screw the panels and foam to the lid rails (F). Install the hinges [Exploded View].

**4** To install the cold frame, prepare a flat location on bare soil. (Add soil amendments or nutrients as needed.) Rest the bottom frame on the soil and drive 2×2 stakes at the inside corners, leaving enough of each stake exposed to hold the remaining stacked frames and lid assembly in place. 🌳

**Note:** Drilling 1/4" holes in the plastic allows the panel to expand without buckling. Avoid overdriving washer screws—the gasket should not squeeze out around the washer.

## Materials List

| Part |                 | FINISHED SIZE |     |      | Matl. | Qty. |
|------|-----------------|---------------|-----|------|-------|------|
|      |                 | T             | W   | L    |       |      |
| A    | box fronts/back | 1½"           | 3½" | 48"  | DF    | 6*   |
| B    | box ends        | 1½"           | 3½" | 24"  | DF    | 6*   |
| C    | lid wedges      | 1½"           | 3¾" | 24"  | DF    | 3    |
| D    | lid backs       | 1½"           | 3¾" | 21¾" | DF    | 2    |
| E    | lid fronts      | ¾"            | 1½" | 21¾" | DF    | 2    |
| F    | lid rails       | 1½"           | 1½" | 48"  | DF    | 2    |
| G    | lid stiles      | 1½"           | 1½" | 21¼" | DF    | 3    |

\*Cut additional parts to build a taller frame.

**Materials key:** DF-Douglas fir.

**Supplies:** 26"x6' clear corrugated roof panel, foam closure strips (8' total), 4" exterior butt hinges (2), 1" hexhead screws with sealed washers, #9x2½" deck screws, #10x1¼" flathead screws.

**Blade:** 40- or 60-tooth circular-saw blade.

**Sources:** 26"×6' clear corrugated roof panel and foam closure strips available at most home centers.

ThermoPro PT-60S digital indoor/outdoor thermometer, \$17.99,

[woodmagazine.com/outdoortemp](http://woodmagazine.com/outdoortemp)

Produced by **Robert Wilson** with **John Olson**

Project design: **John Olson**

Illustrations: **Roxanne LeMoine, Lorna Johnson**



# CNC Routers Can Do All THAT?

by George Vondriska

**W**hether you currently use a CNC router or are just curious to see what the hype is all about, get ready to see some of the amazing capabilities a CNC can bring to your shop. This article provides recipes for success in making cuts in polycarbonate, brass, foam, cardboard and yes, wood. The “ingredients” for each operation include the material being machined, the cutters used, feed speed, depth of cut (DOC), and other variables.



## You gotta obey the speed limits

For best results running a CNC, you must control the feed rate and rpm of the router. You do this all the time with handheld routers, probably without thinking about it. Handheld routers constantly provide tactile feedback and you respond by changing feed rate, reducing the depth of cut, changing the rpm, or all of the above. A CNC router can't respond like a human, so you need to tell the machine what to do. Otherwise, it will quickly dull or break bits, and produce poor-quality cuts. Check the machine's owner's manual to learn how to set rpm and feed rate.

This article serves as a starting point rather than a comprehensive feed and speed guide. If you use different router bits or materials (such as aluminum instead of brass) you'll need to experiment, and possibly change the listed parameters. Some CNC routers yield good cut quality at faster feeds, others require slower feed rates. Good cut quality and router bit longevity depend on chip load—the size of the chip the router bit makes. If you see dust, not chips, the setup needs tweaking. Find chip-load calculators on the web; router bit manufacturers also can help.

► Try a free trial of a speed and feed calculator.  
[woodmagazine.com/cncfeedspeed](http://woodmagazine.com/cncfeedspeed)

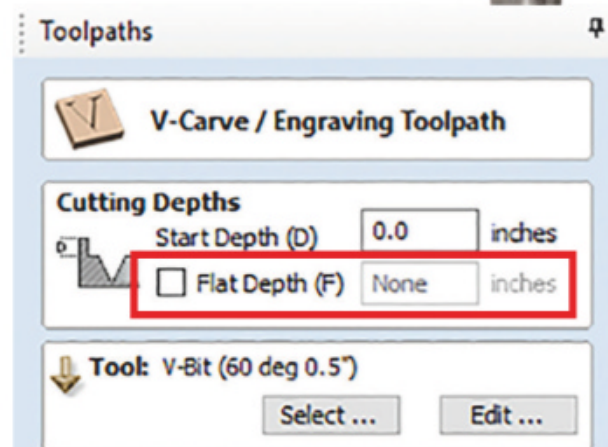


► Watch a free video demonstrating each of the projects shown.  
[woodmagazine.com/cnccuts](http://woodmagazine.com/cnccuts)

## Wood sign: Incised letters

When people first consider what they'll make with a CNC router, making wood signs tops the list. Master this simple process and earn back some of the money you invested in the machine, or just knock out some cool gifts.

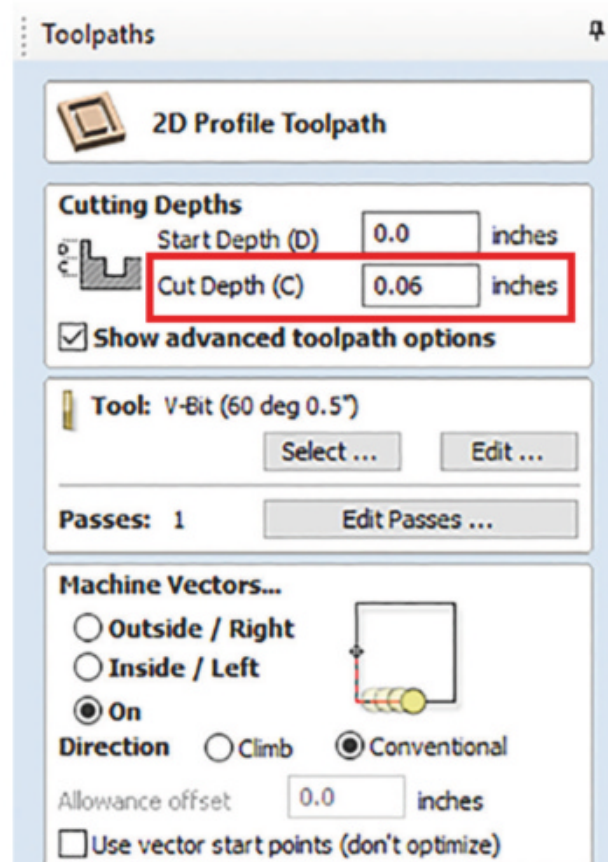
For the letters and cup:  
 ■ **Router bit:** 60° ½" V-bit  
 ■ **RPM:** 12,000  
 ■ **Feed speed:** 100"/min



**Notes:** To create an incised sign, select only the letters and the coffee cup when you create the V-Carve/Engraving Toolpath. Cut most hardwoods with the feed and speed shown here.

**An engraving toolpath requires no depth of cut.** The software automatically "fills" each letter based on the angle and diameter of the V-bit.

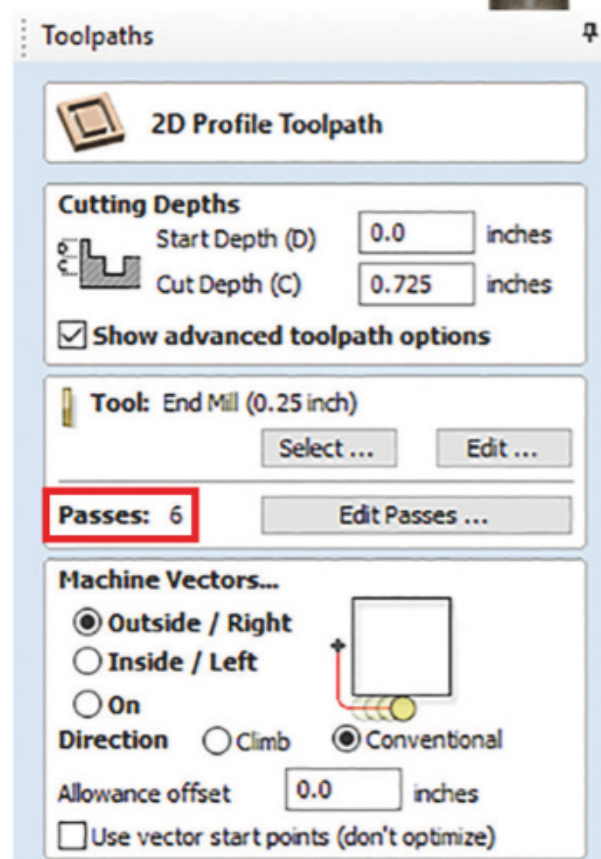
For the rectangle border:  
 ■ **Router bit:** 60° ½" V-bit  
 ■ **RPM:** 12,000  
 ■ **Feed speed:** 100"/min



**This toolpath requires Cut Depth** as it "traces" a single line, not a letter with boundaries. The .06" (about 1/16") creates a visible detail. Don't worry about the image under *Cutting Depths* that shows a square profile rather than a V. This is a standard image for this toolpath, regardless of the bit being used.



For cutting the exterior:  
 ■ **Router bit:** ¼" upcut spiral  
 ■ **RPM:** 12,000  
 ■ **Feed speed:** 100"/min



**VCarve Pro automatically chooses** the number of passes based on bit diameter and material thickness. You can modify this as needed, with harder material requiring more passes.

► The designs and toolpaths used in this article were created in VCarve Pro, software commonly used with benchtop CNC machines. Find it at [vectric.com](http://vectric.com).



## Wood sign: Raised letters

These first two projects show how using different toolpaths on the same design can dramatically affect the final look. This shows the versatility of CNC router work.

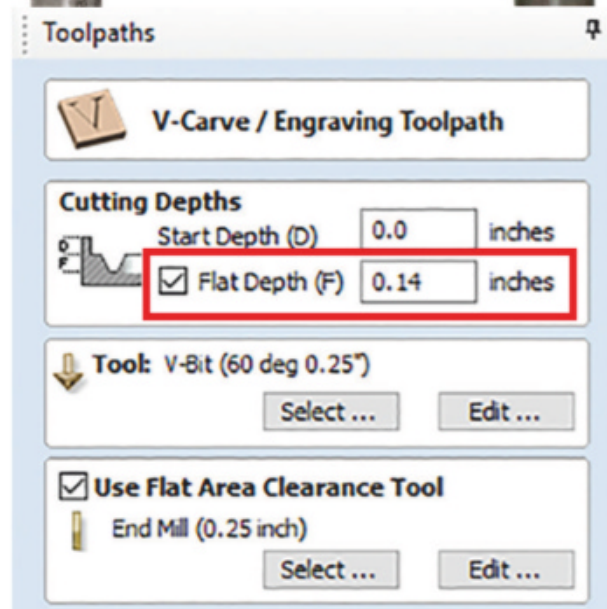
For the letters, coffee cup, and border:

- **Router bit:** 1/4" upcut spiral
- **RPM:** 12,000
- **Feed speed:** 100"/min

**Note:** To get raised letters and graphics, select the border, letters, and coffee cup when you create the toolpath.



- **Router bit:** 60° 1/2" V-bit
- **RPM:** 12,000
- **Feed speed:** 100"/min

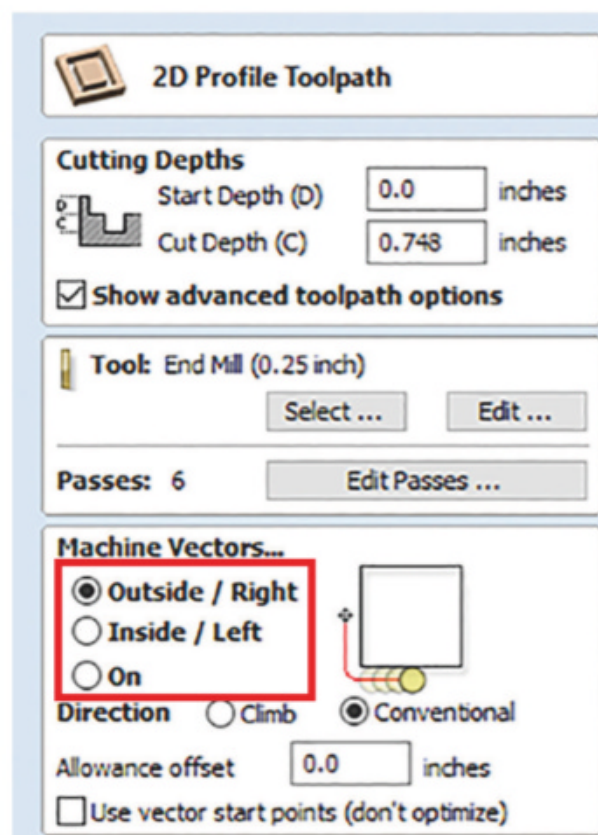


**Flat Depth** tells you how much the letters and cup will project beyond the background. The 1/4" bit serves as a *Flat Area Clearance Tool*, removing waste faster than a V-bit, which routes the finish details. This one toolpath shows both bits but they will, of course, be used separately.



For cutting the exterior:

- **Router bit:** upcut spiral
- **RPM:** 12,000
- **Feed speed:** 100"/min



You can cut **Outside, Inside, or On** the line you've created. This controls where the router bit cuts relative to the design.



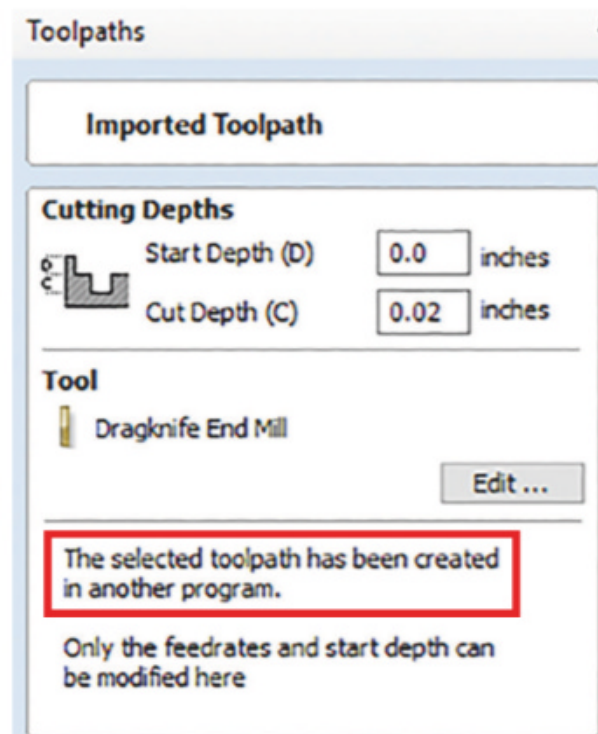
## Cardboard templates

Create shapes in drawing software, such as SketchUp, then turn them into templates you can trace onto your project parts. Instead of a router bit, cut with a utility-knife blade.

- **Tool:** Donek D4 drag knife
- **RPM:** 0
- **Feed speed:** 100"/min



**Notes:** This tool comes with great setup instructions. To create the toolpath within VCarve Pro, use the Dragknife Toolpath Gadget. The knife cuts materials up to 1/4" thick, such as cardboard, styrene, and vinyl-letter material.



Although VCarve Pro has an on-board dragknife gadget built into the software, it shows up here as an imported toolpath.



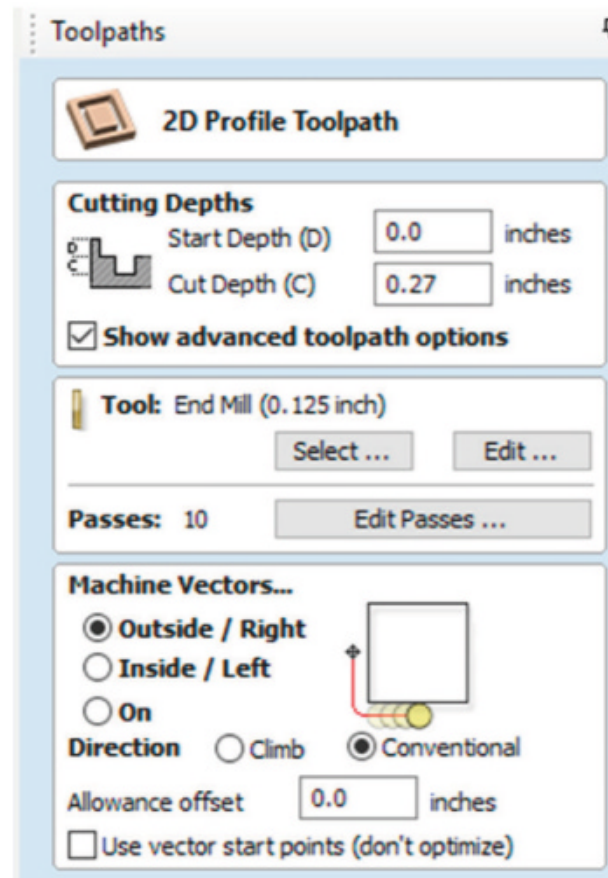


## 360-brass bowtie

► 360 brass is a specific type of readily available brass [Sources].

Yes, a CNC router can cut non-ferrous metals. Add aluminum, copper, or brass inlays and other decorative items to your projects.

- **Router bit:** 1/8" spiral "O" single flute
- **RPM:** 18,000
- **Feed speed:** 40"/min



Cutting non-ferrous metal requires light cuts, so the machine makes many passes.

**Notes:** In addition to controlling feed rate and rpm, be careful about DOC when machining non-ferrous metals. Dividing the .27 Cut Depth by the 10 passes results in a light .027" DOC with each pass. You can use a similar setup to cut aluminum or copper, but different materials dictate slight changes in these settings.

## Engraving granite

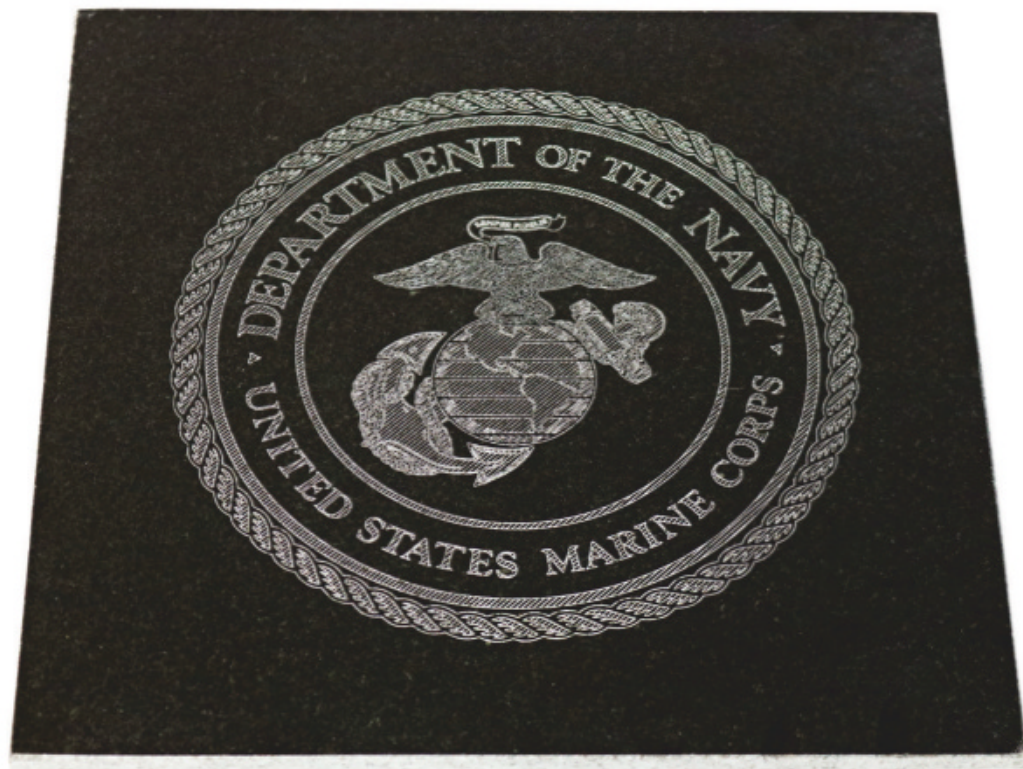
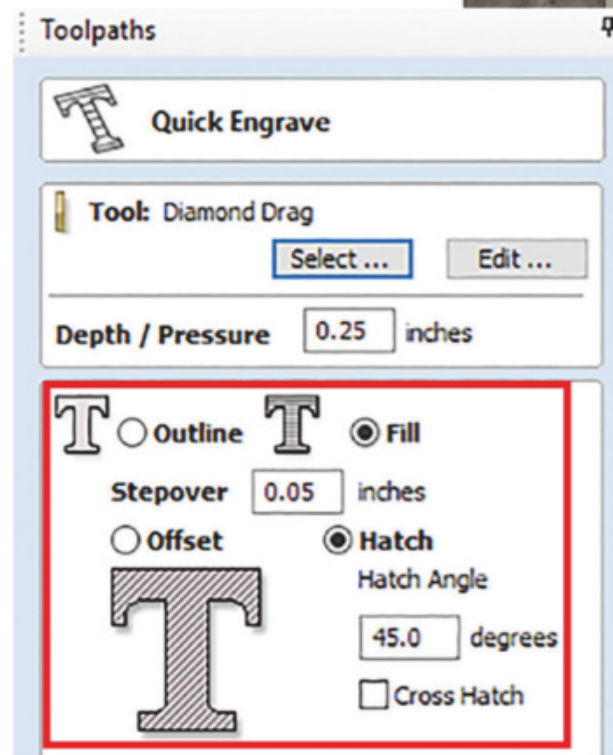
Diamonds are a CNC's best friend, especially for engraving glass, granite, or steel. A diamond-tipped stylus etches amazing detail on these materials, and others.

- **Tool:** Diamond drag engraving bit
- **RPM:** 0
- **Feed speed:** 30"/min



**Notes:** The diamond drag comes with excellent setup instructions. Increasing DOC on the spring-loaded tip applies the additional pressure required for harder material. It may take some experimentation to get the best cut, depending on the material. Use this tool on plastic, glass, aluminum, brass, and steel. Choose a 120° tip for engraving, and a 90° tip for scoring glass so you can snap it on the score line.

Find lots of options to experiment with in the *Quick Engrave* toolpath. Stepover controls line spacing within the engraving. A small number places the lines close together making the final result appear more opaque. Hatch Angle is the angle at which the lines are engraved. I commonly use 45°—experiment to see what you like.





## Polycarbonate

Etch polycarbonate to create a translucent sign to hang in a window. Or back- or edge-light it with LEDs for a cool glow.

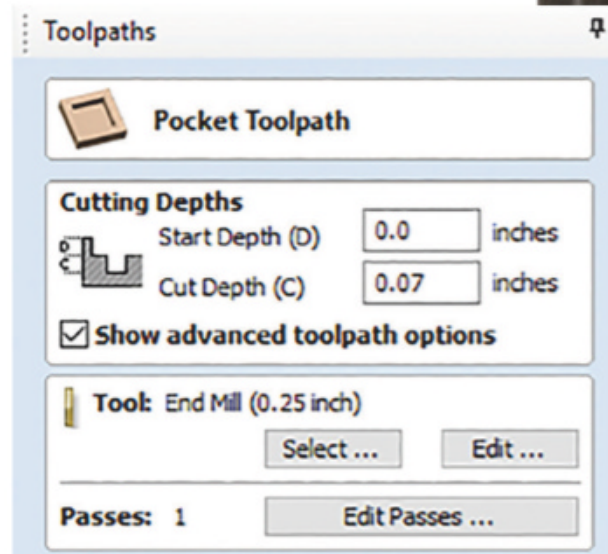
For etching the letters:

■ **Tool:** 1/4" spiral "O" single-flute, plastic cutting used for all operations

■ **RPM:** 16,000

■ **Feed speed:** 70"/min

**Note:** When making signs in polycarbonate, reverse the image and cut from the back, leaving the front smooth.

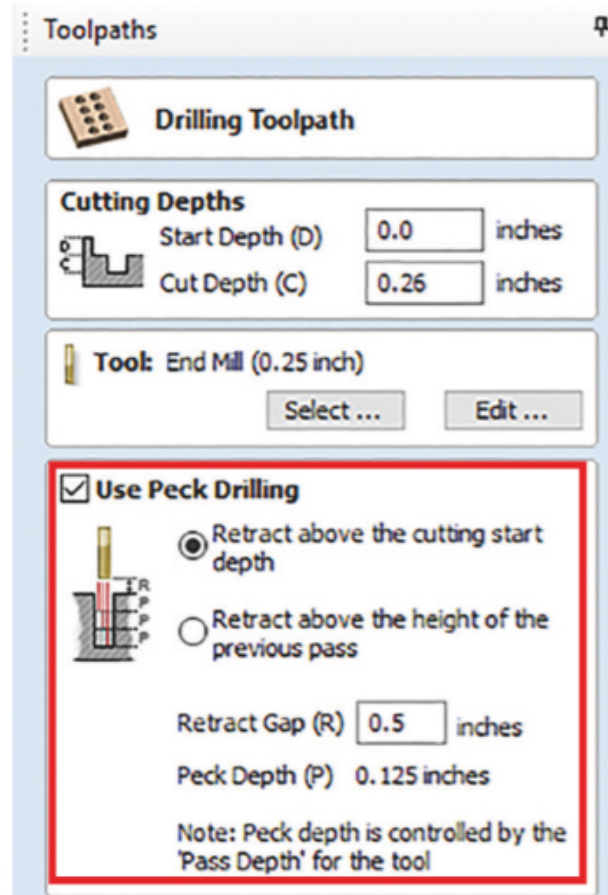


A light *Cut Depth* suffices for etching letters or artwork in polycarbonate and typically can be done in one pass.

For boring the hanger hole:

■ **RPM:** 16,000

■ **Feed speed:** N/A



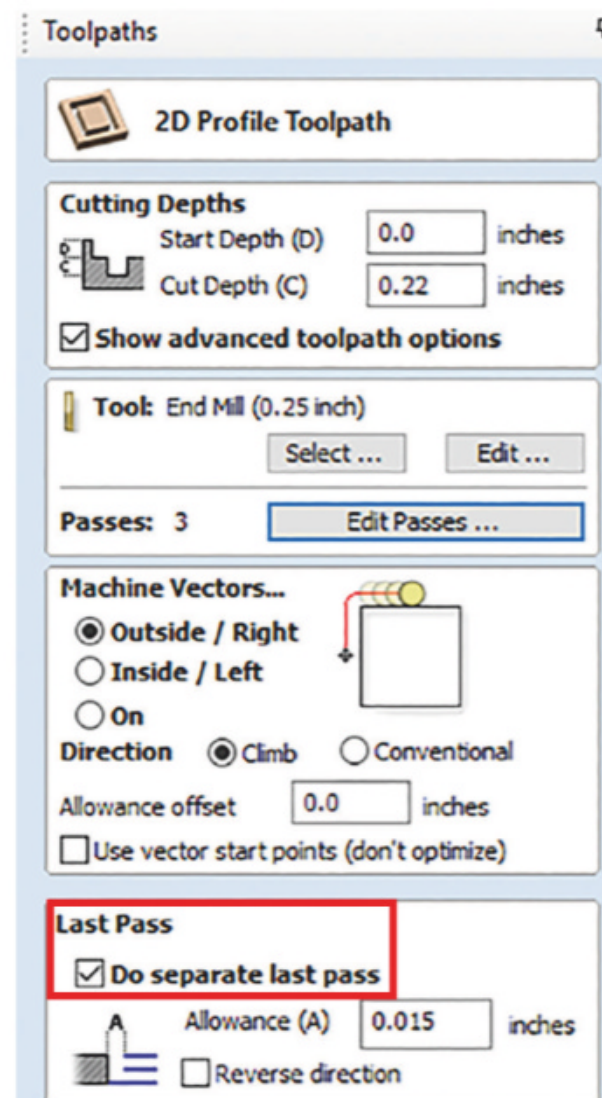
When you *Retract above the cutting start depth*, the bit repeatedly drills, then raises. That clears the flutes of material prone to sticking to the bit.



For cutting the exterior:

■ **RPM:** 16,000

■ **Feed speed:** 70"/min



Choosing *Do separate last pass* optimizes the surface finish of the cut. In this case, the part gets cut .015" oversize. The last pass skims off that small amount of material, providing a smooth edge.

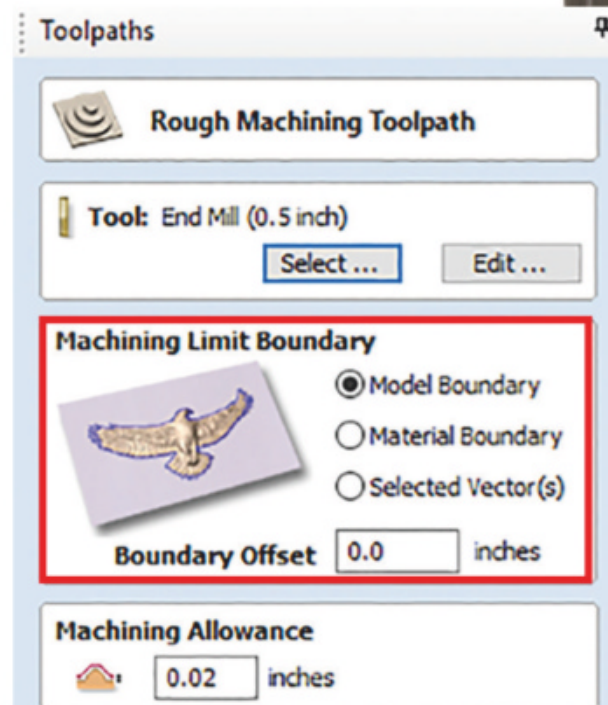


## Foam insulation

Prototype a project before cutting into expensive wood by cutting and carving foam insulation. Thick foam serves well for paintable letters, decorations, and more.

For initial 3D roughing:

- **Tool:** ½" spiral upcut
- **RPM:** 12,000
- **Feed speed:** 100"/min

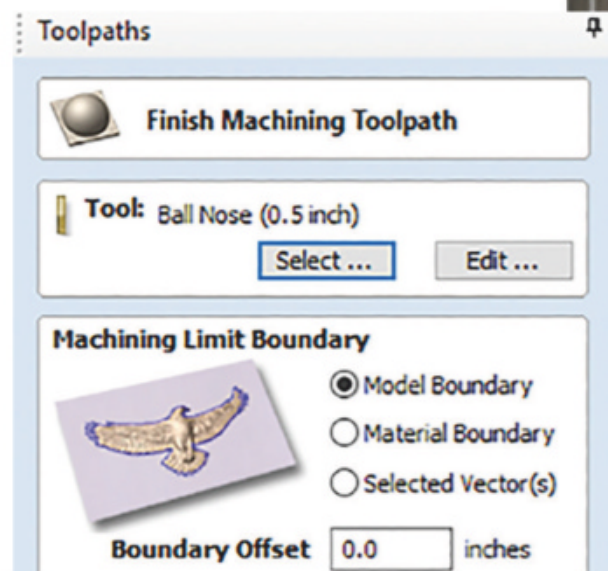


**Notes:** Standard router bits will easily cut pink or blue foam insulation sold by home centers. Painting the final result? Use latex paint to prevent melting the foam.

In most cases you machine 3D artwork to the Model Boundary; literally the edges of the artwork. You can choose to cut all the way to the edge of material (Material Boundary), or to a shape that you created (Selected Vectors).

For 3D finishing:

- **Tool:** ½" roundnose router bit
- **RPM:** 12,000
- **Feed speed:** 100"/min

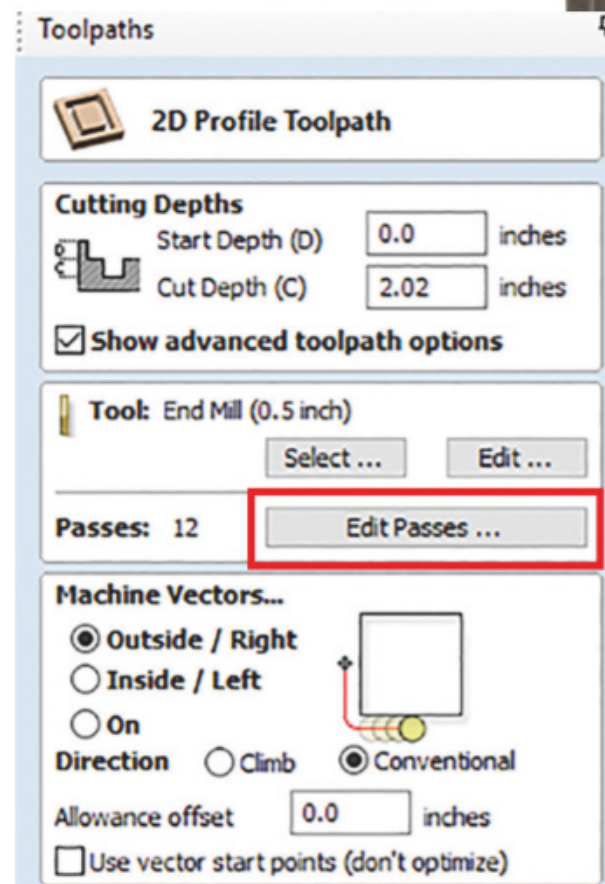


True ball nose bits are CNC specific and a must-have for small-scale 3D work. For this large 3D artwork, a ½" roundnose router bit works fine.



For cutting out the exterior:

- **Tool:** ½" spiral upcut
- **RPM:** 12,000
- **Feed speed:** 100"/min



Use the **Edit Passes** function if you want to increase or decrease the number of passes.

**Sources:** Freud 60° ½" V-bit, no. 20-152; Freud ¼" upcut spiral, no. 75-102; Amana ⅛" spiral "O" flute aluminum cutting, no. 51454; Amana ¼" spiral "O" flute plastic cutting, no. 51404; Donek D4 drag knife; WidgetWorks Unlimited diamond drag engraving tool; Whiteside ½" upcut spiral bit, no. RU5200 (for 1" foam you can use a shorter bit); Whiteside ½" ballnose bit, no. 1408. The link below places all of the above bits in an Amazon cart; you can remove any you don't need.  
[woodmagazine.com/cncbits](http://woodmagazine.com/cncbits)  
 ¼×2×12" C360 brass plate, Stoner Metals, stonermetals.com, 719-629-9525  
 12×12" granite tile, Home Depot  
 Polycarbonate sheets, home centers



In addition to classes at Vondriska Woodworks in Hammond, Wisconsin, George teaches at woodworking shows, guilds across the country, and *Weekend With WOOD*. Get more CNC instruction in George's book, "CNC Router Essentials: The Basics for Mastering the Most Innovative Tool in Your Workshop." [woodmagazine.com/cncessentials](http://woodmagazine.com/cncessentials)



# Mil-spec Apache

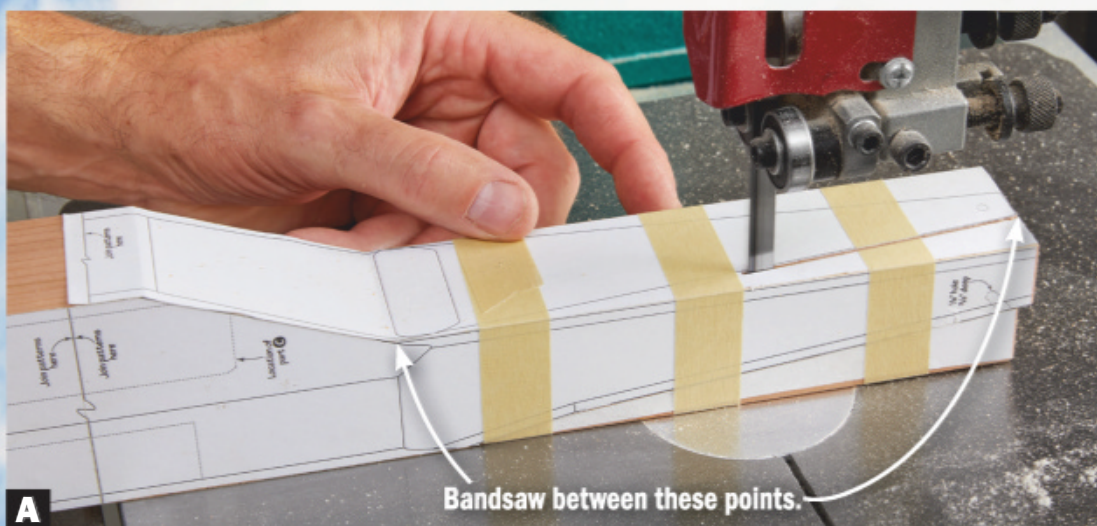


**D I M E N S I O N S :**  
15" W (7<sup>3</sup>/<sub>8</sub>" rotors folded) × 17<sup>3</sup>/<sub>4</sub>" D × 47<sup>1</sup>/<sub>8</sub>" H

**2**  
turboshaft  
engines  
enable a  
**152**  
knots top cruise  
speed. (Yours  
may vary.)

**F**irst seeing service in 1986, the AH-64 “Apache” attack helicopter takes out tanks, bunkers, and other targets. This toy displays much of that firepower, disguised as maple dowels. Easily shape the Apache’s iconic angled fuselage profile by following our full-size patterns. And we’ve gathered all of the hardware and specialty parts in a kit so you can get started quickly [Source].

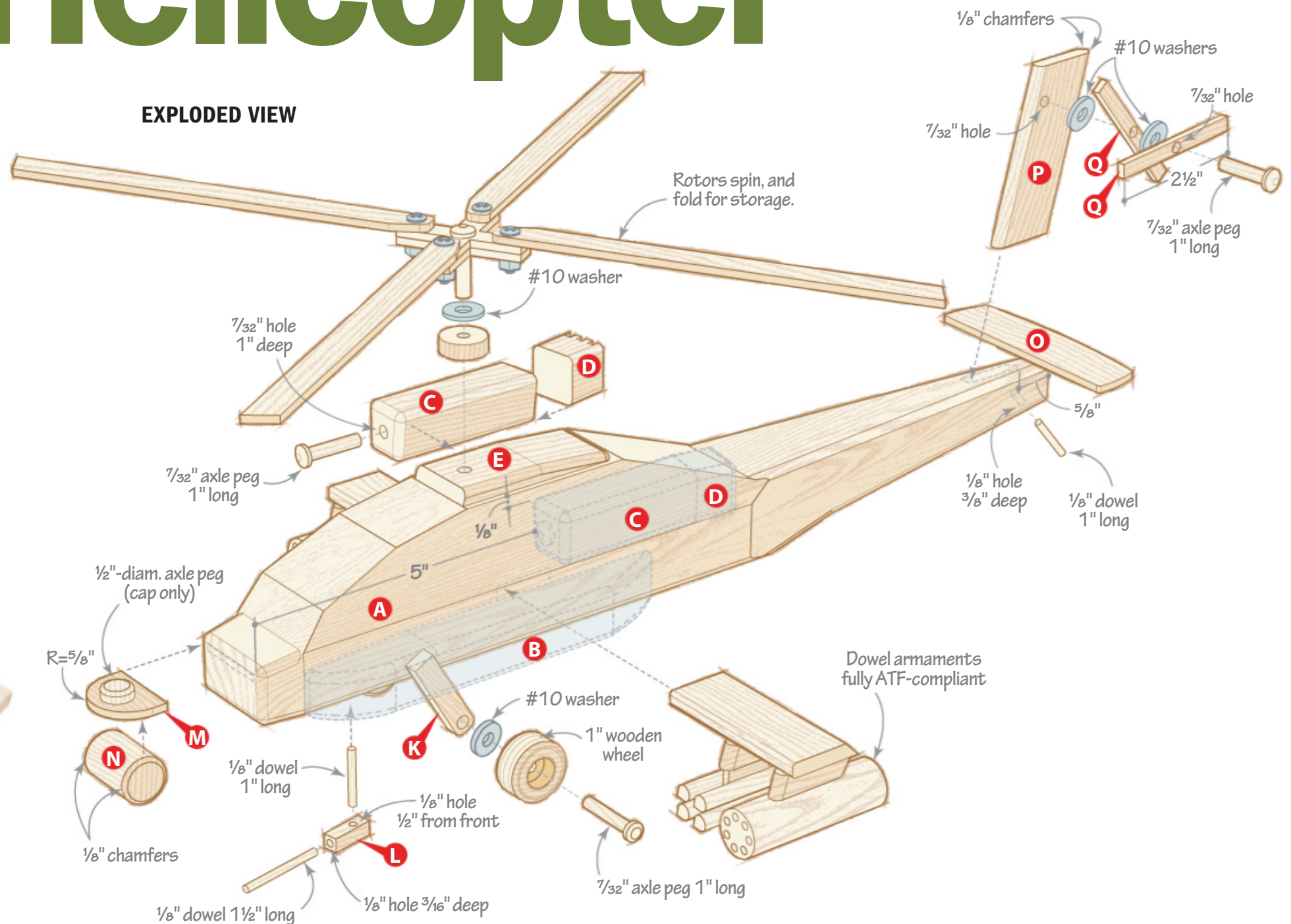
**Tip!** Learn how to easily apply and remove patterns.  
[woodmagazine.com/applypatterns](http://woodmagazine.com/applypatterns)



**A** Bandsaw the tail profile between the indicated points on both faces.



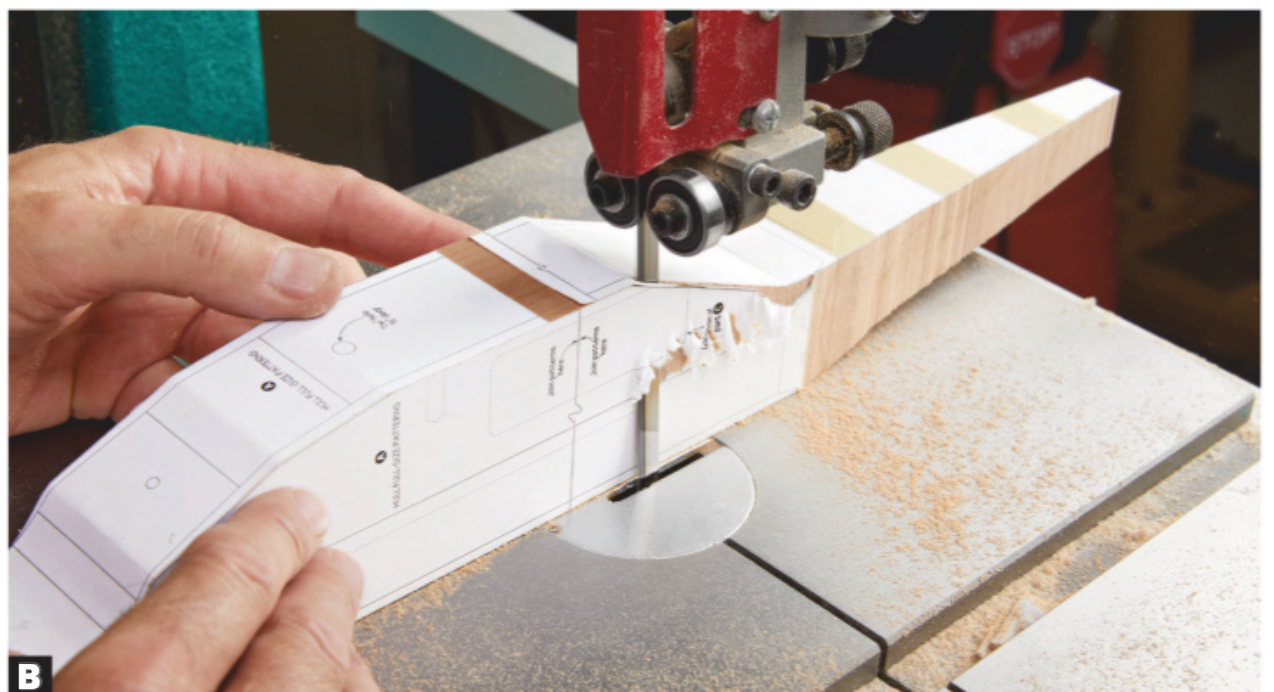
# Helicopter



## Build the fuselage assembly

**1** Cut the fuselage (A) to size [Materials List, page 47]. Apply a copy of the **Fuselage Side-view Full-size Pattern**, pages 48 and 49, to it. Cut the fuselage profile and save the cutoff from under the tail. Drill the 1/8" hole centered on the width of the tail.

**2** Apply the **Top-view Patterns** to the fuselage (there will be a gap between them), and tape the saved cutoff back in place. Cut the nose and tail profiles [Photo A] and the fuselage front [Photo B]. Remove the pattern remnants, and finish-sand the fuselage.



**Tilt the bandsaw table 6° and cut the front portion of the fuselage. The blade should exit along the middle line of the Side-view Pattern.**





**C**

Remove the bulk of the waste with a  $\frac{3}{8}$ " Forstner bit, drilling  $\frac{1}{4}$ " deep. Then, square up the pocket.

► Much of the Apache's avionics reside in the sponsons.

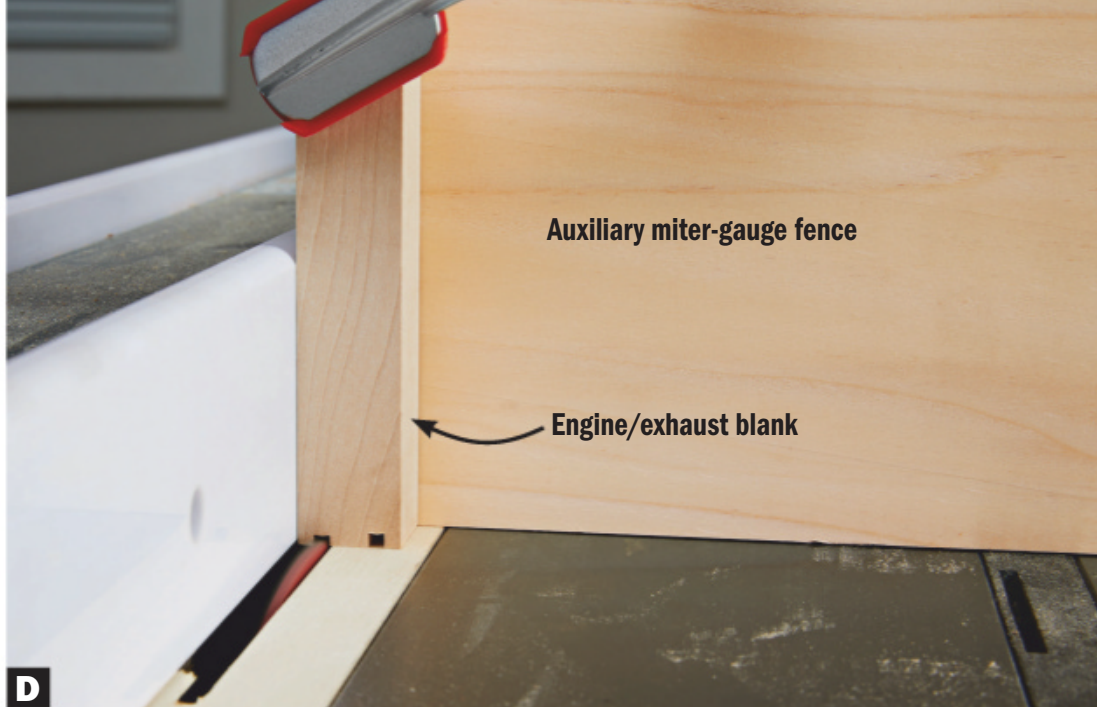
**Tip!** Use cyanoacrylate glue and a spray-on accelerator to join small, difficult-to-clamp parts.

► Learn to cut and shape small parts safely.

[woodmagazine.com/smallparts](http://woodmagazine.com/smallparts)

**3** Cut the sponsons (B) to size. Apply copies of the **Sponson Patterns** to each. Drill out most of the waste for the landing-gear pocket, then clean up the pocket with a chisel [Photo C]. Cut the sponsons to shape, finish-sand them, and glue them in place [Exploded View].

**4** Cut two  $\frac{7}{8} \times \frac{7}{8} \times 12$ " blanks for the engines (C) and exhausts (D). Kerf one end of each [Photo D, Drawing 1]. Round over the edges, then miter-cut an exhaust from each blank. Bevel-rip the long edge of each engine at  $6^\circ$  [Drawing 1a], then crosscut the engines to length. Glue an exhaust to each engine, angled outward. After the glue dries, drill the hole in the engine and glue in an axle peg [Source]. Glue the engines to the fuselage [Exploded View].



**D**

Attach a tall auxiliary face to your miter gauge to steady the engine/exhaust blank as you cut the kerfs.

**5** Cut the rotor base (E) to size and shape [Drawing 2]. Round the edges, drill the hole, and glue it to the fuselage [Exploded View]. Drill through the hole  $\frac{3}{4}$ " into the fuselage.

## Give it wings...and arms

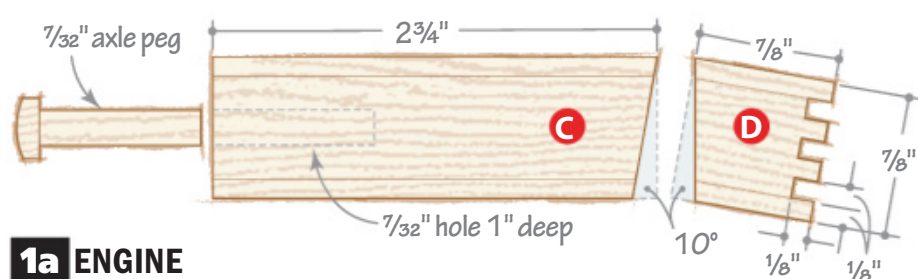
**1** Cut the stub wings (F) to size [Materials List, Drawing 3]. Round the leading edges and chamfer the trailing edges. Bevel one end of each at  $6^\circ$  to match the fuselage. Glue the stub wings to the fuselage and sponsons with the chamfer facing up.

**2** Cut the pylons (G) to shape [Drawing 3a]. Cut the missile hangers (H), missiles (I), and rocket launchers (J) to size. Sand a point on one end of each missile, and drill the holes in the rocket launchers [Pattern]. Glue the missiles to the hangers [Drawing 3]. After

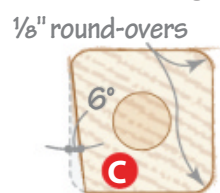
► The scanning systems on the nose allow the Apache to operate day or night and in bad weather.

► The Apache's helmet-mounted display allows either the pilot or gunner to aim the 30mm cannon where they look.

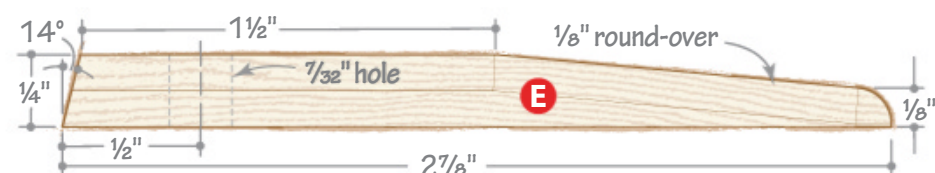
## 1 ENGINE AND EXHAUST (Top view, port engine)



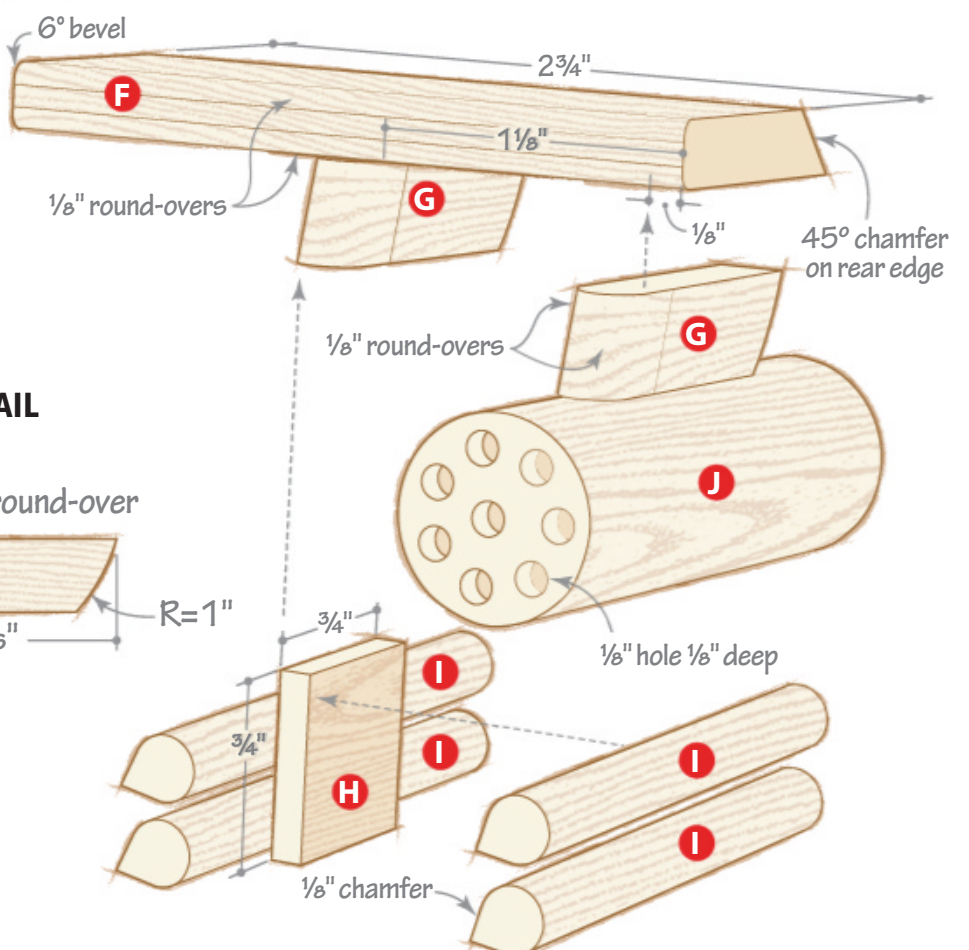
### 1a ENGINE (Front view, port engine. Starboard engine is mirror image.)



## 2 ROTOR BASE (Side view)

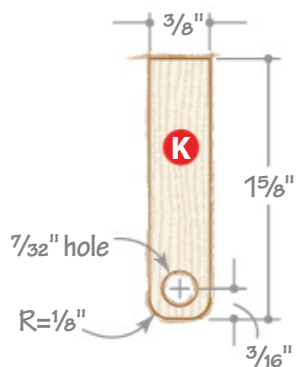


## 3 MISSILE ARRAY/ROCKET LAUNCHER

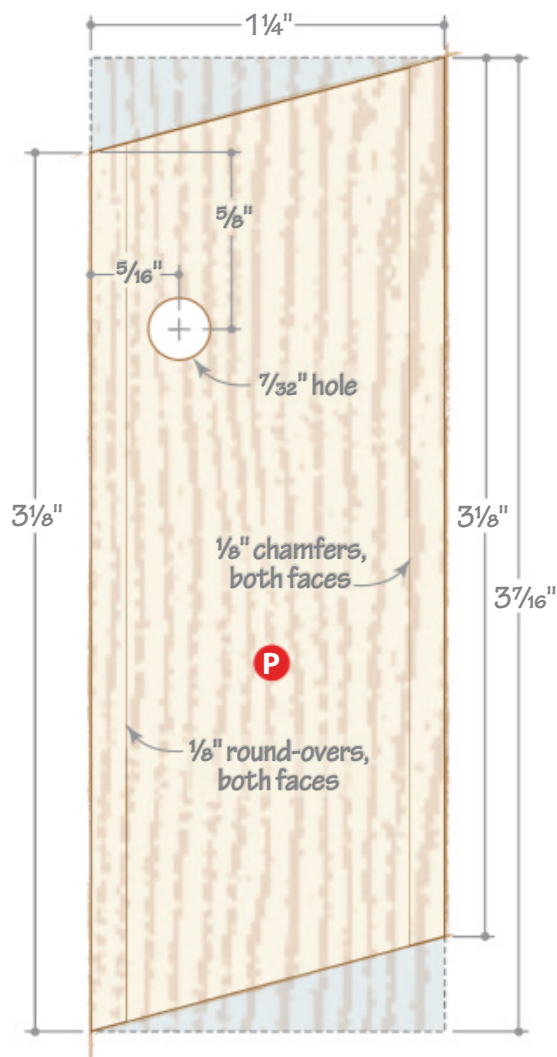




#### 4 FRONT-GEAR STRUT (Side view)



#### 5 TAIL



the glue dries, adhere the missile assemblies (H/I) and the rocket launchers to the pylons. Glue these assemblies under each wing.

3 Cut and shape the front-gear struts (K) [Drawing 4]. Glue them into the recesses in the sponsons (B).

4 Cut the cannon (L) to size and drill the holes [Exploded View]. Glue the dowels in the holes and set the assembly aside.

5 Cut the scanner mount (M) and scanner (N) to size [Exploded View]. Chamfer the ends of the scanner, then glue the mount to the nose. After the glue dries, glue the scanner below the mount. Cut an axle-peg head to serve as the night-vision turret and glue it to the top of the mount.

#### Rear tail and rotors

1 Following the Full-size Pattern and Drawing 5, cut the rear wing (O) and tail (P) to shape. Drill the hole in the tail, round over its leading edge, and chamfer the trailing edge. Glue the wing and tail to the fuselage [Exploded View].

2 Cut the tail rotors (Q) to size [Exploded View]. Drill the holes, and secure the rotors to the tail (P) with an axle peg and washers. Trim and sand the axle peg flush with the opposite face of the tail.

3 To form a blank for the rotor hub (R), laminate two pieces of 1/8"-thick stock with their grain perpendicular to each other. Cut the hub to shape [Drawing 6], and drill the holes.

4 Cut and shape the main rotor blades (S) and spacer (T), and drill the holes [Drawings 6 and 6a].

5 Apply a finish to all pieces. (We sprayed on satin-finish aerosol lacquer.) Use CA glue to secure the cannon in place [Exploded

View]. Assemble the rotor assembly with machine screws, a washer, and lock nuts [Drawing 6], then secure the rotor assembly by gluing an axle peg through it and into the rotor base (E), leaving enough space to allow the rotor hub to spin. Likewise, secure the wheels to the struts [Exploded View], and glue a length of dowel in the tail of the fuselage. 🌲

### Materials List

| Part                | FINISHED SIZE |         |         | Matl. | Qty. |
|---------------------|---------------|---------|---------|-------|------|
|                     | T             | W       | L       |       |      |
| A fuselage          | 1 3/4"        | 2 1/2"  | 16 1/2" | C     | 1    |
| B sponsons          | 3/4"          | 7/8"    | 6 1/2"  | M     | 2    |
| C* engines          | 7/8"          | 7/8"    | 2 3/4"  | M     | 2    |
| D* exhausts         | 7/8"          | 7/8"    | 7/8"    | M     | 2    |
| E rotor base        | 1/4"          | 1 1/4"  | 2 7/8"  | M     | 1    |
| F stub wings        | 1/4"          | 1 1/4"  | 2 3/4"  | C     | 2    |
| G pylons            | 1/4"          | 3/8"    | 1 7/16" | C     | 4    |
| H missile hangers   | 1/4"          | 3/4"    | 3/4"    | M     | 2    |
| I missiles          | 1/4" diam.    | 2 1/2"  |         | MD    | 8    |
| J rocket launchers  | 3/4" diam.    | 2 1/2"  |         | MD    | 2    |
| K front-gear struts | 1/4"          | 3/8"    | 1 5/8"  | M     | 2    |
| L cannon            | 1/4"          | 1/4"    | 3/4"    | M     | 1    |
| M scanner mount     | 1/8"          | 7/8"    | 1 1/4"  | C     | 1    |
| N scanner           | 3/4" diam.    | 1 1/8"  |         | MD    | 1    |
| O rear wing         | 1/8"          | 1 1/16" | 3 7/8"  | C     | 1    |
| P tail              | 1/4"          | 1 1/4"  | 3 7/16" | C     | 1    |
| Q tail rotor blades | 1/8"          | 3/8"    | 2 1/2"  | M     | 2    |
| R rotor hub         | 1/4"          | 2"      | 2"      | LM    | 1    |
| S main rotor blades | 1/8"          | 1/2"    | 7"      | M     | 4    |
| T spacer            | 3/4" diam.    | 1/4"    |         | CD    | 1    |

\*Parts initially cut oversize. See the instructions.

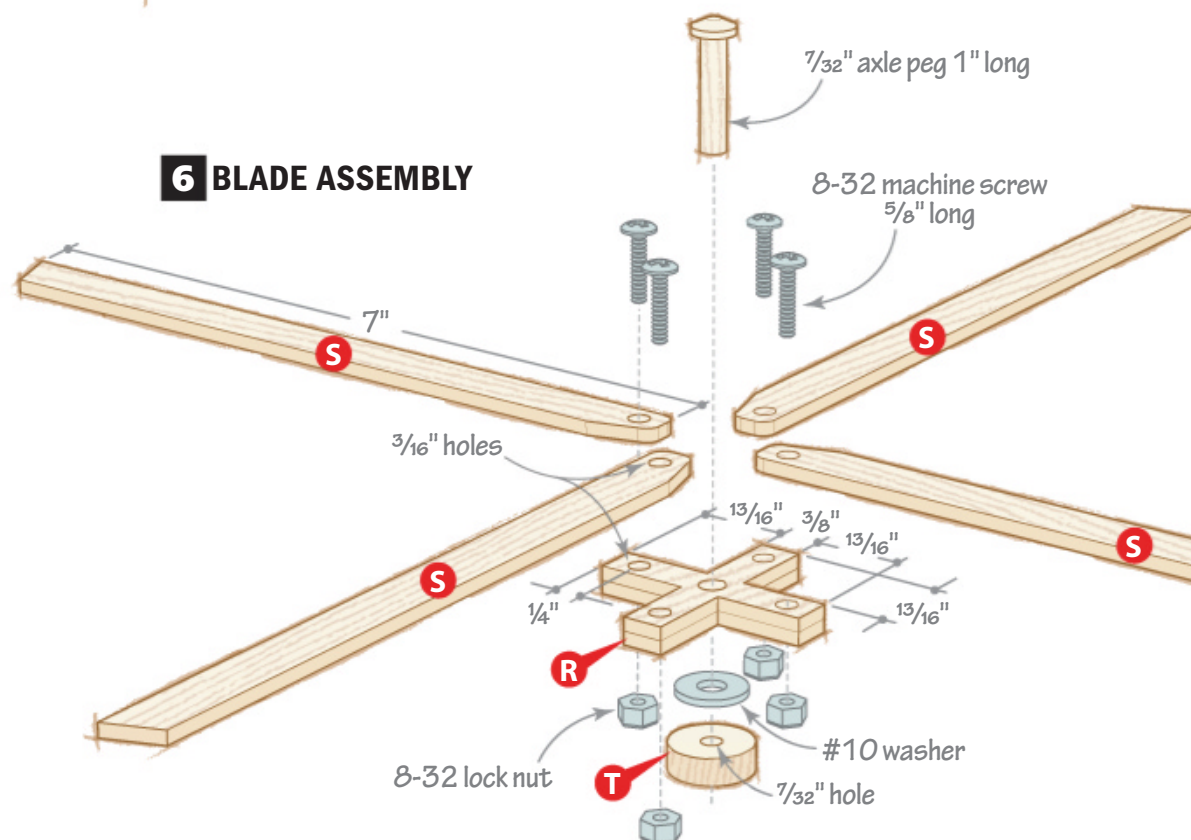
**Materials key:** C-cherry, M-maple, MD-maple dowel, LM-laminated maple, CD-cherry dowel.

**Supplies:** 7/32 x 1" axle pegs (6), 1/2" axle peg (1), 1"-diam. wood wheels (2), 8-32 x 5/8" machine screws (4), 8-32 lock nuts (4), #10 washers (5), 3/4 x 12" maple dowel, 1/4 x 24" maple dowel, 1/8 x 12" maple dowel.

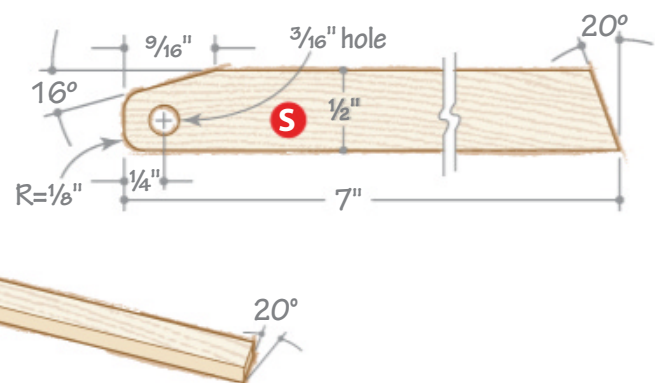
**Bits:** 1/8" round-over, 45° chamfer router bits, 3/8" Forstner bit.

**Source:** Order a kit with the hardware, axle pegs, wheels, and dowels required for this project (no lumber). No. RS-01209, \$5.95, 888-636-4478, [woodmagazine.com/apache](http://woodmagazine.com/apache).

#### 6 BLADE ASSEMBLY

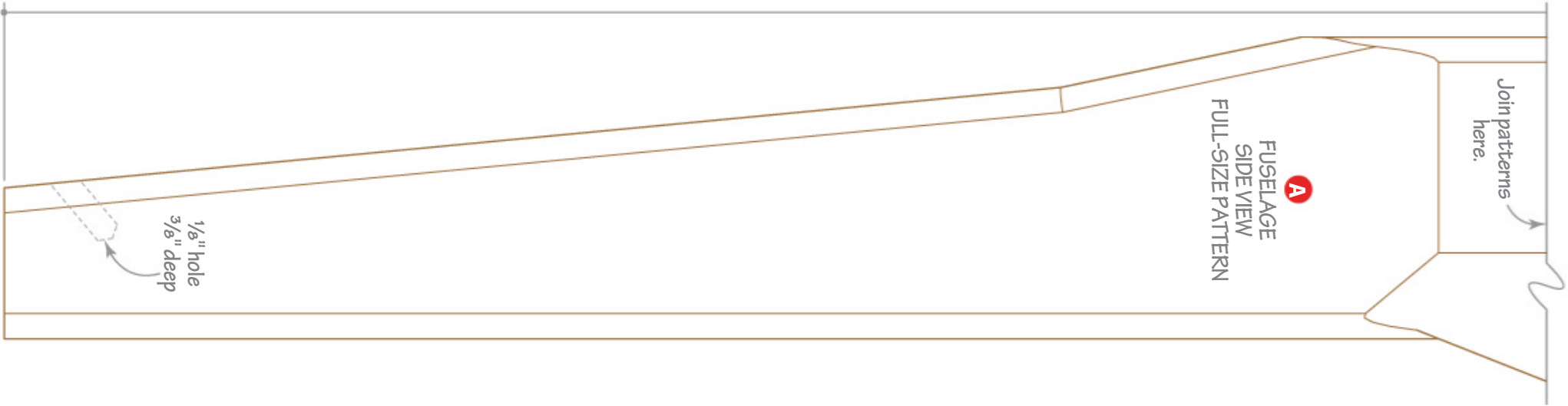


#### 6a MAIN ROTOR BLADE DETAIL

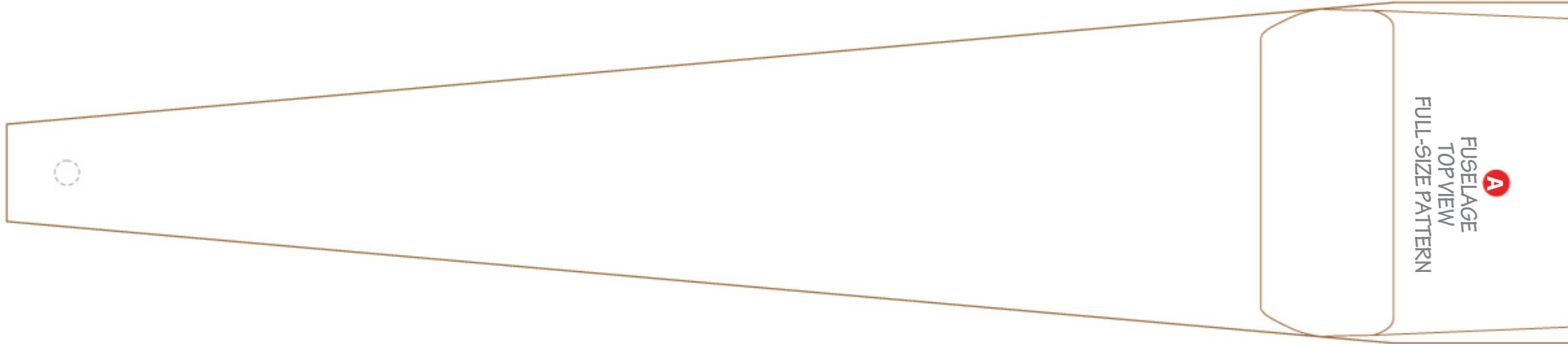


Produced by **Craig Ruegsegger** with **Kevin Boyle**  
Project design: **Kevin Boyle**  
Illustrations: **Roxanne LeMoine, Lorna Johnson**

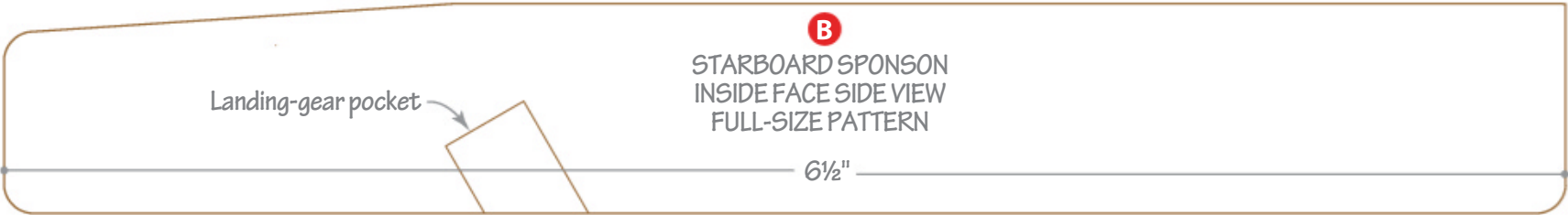
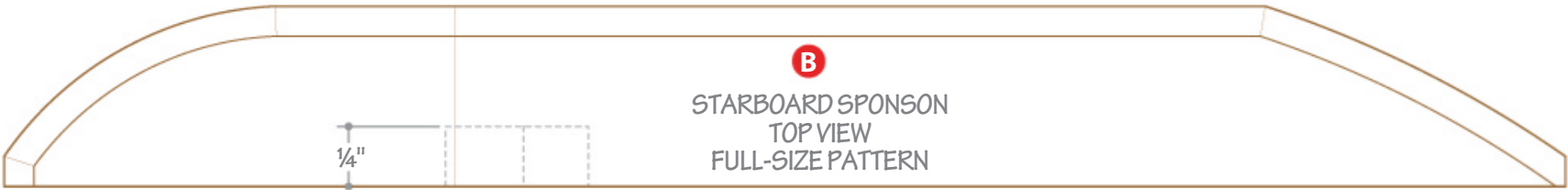
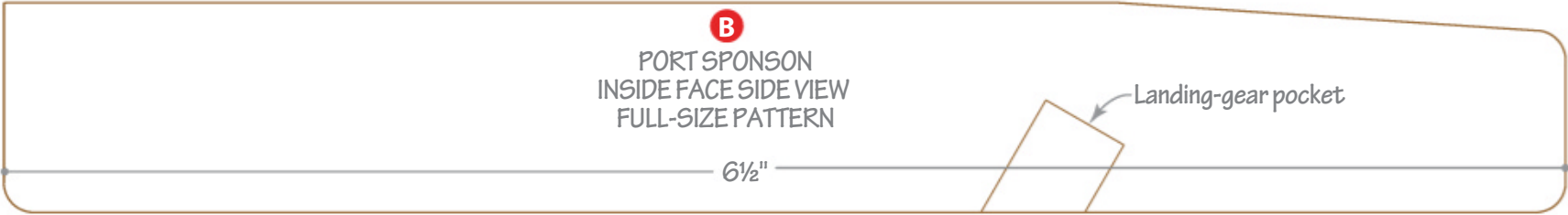
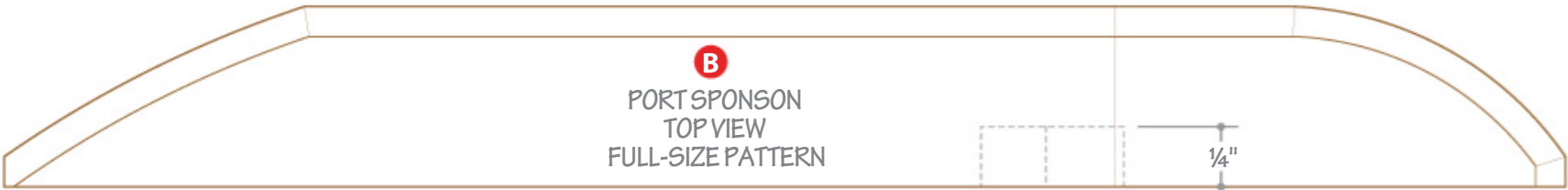




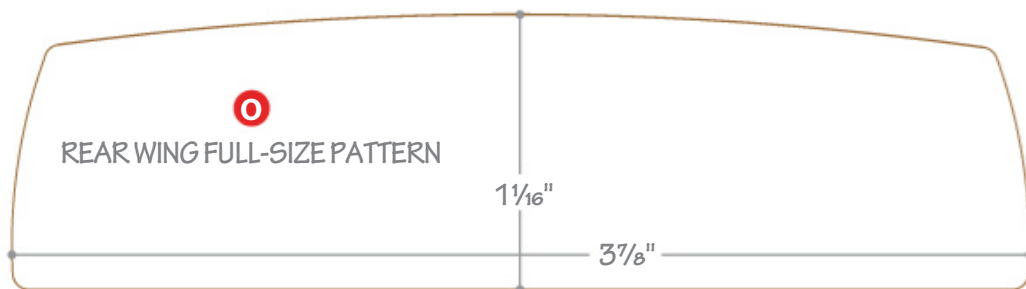
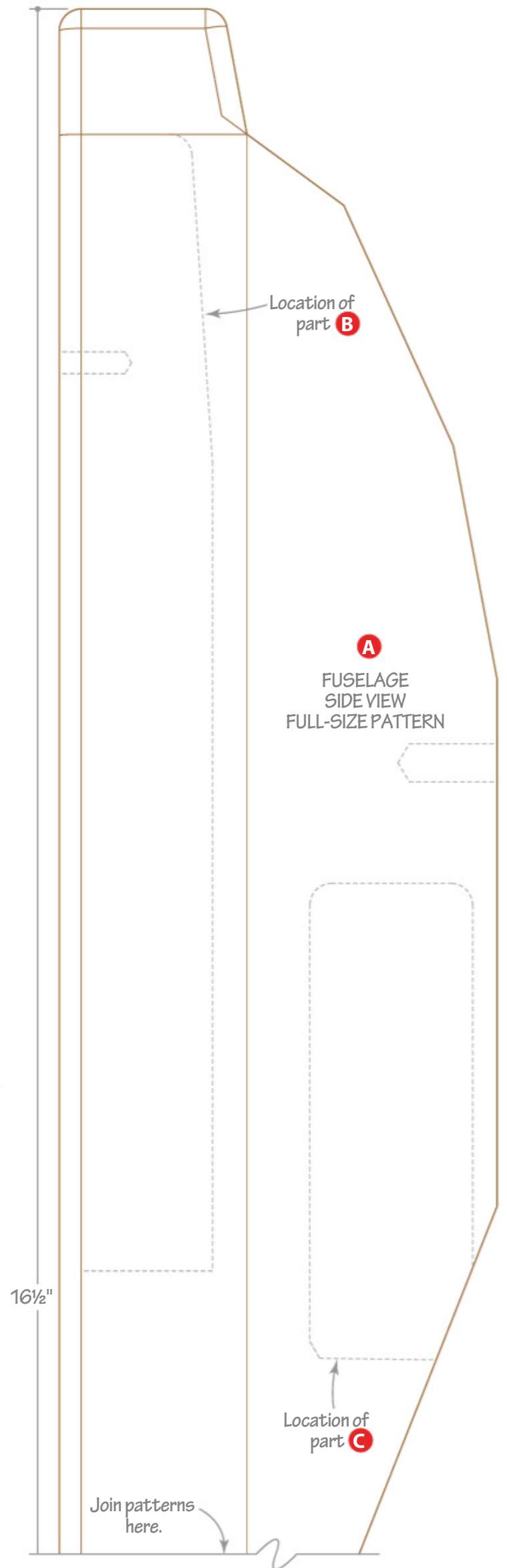
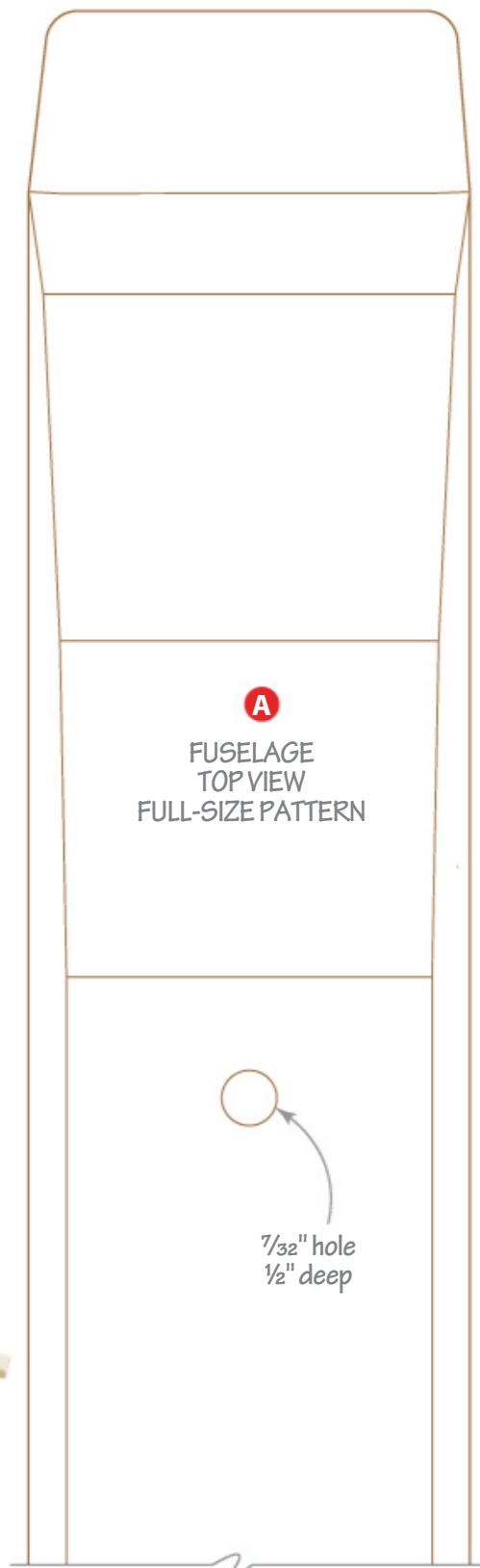
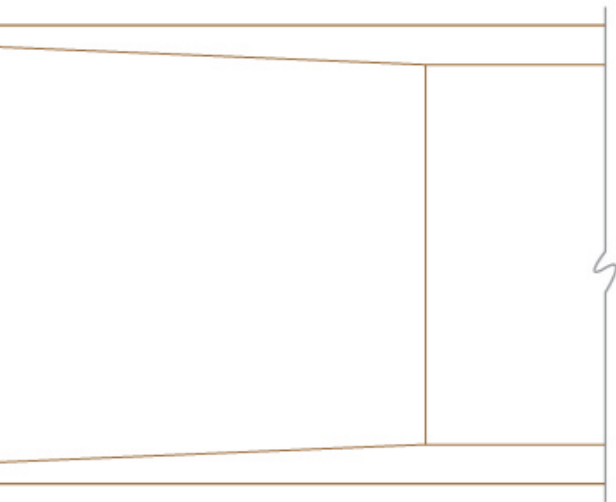
**FULL-SIZE PATTERNS**



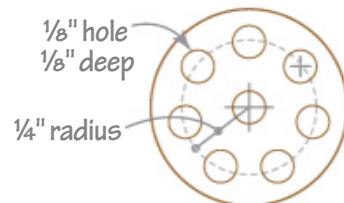
► Download full-size patterns for this project. [woodmagazine.com/apache](http://woodmagazine.com/apache)







**J**  
ROCKET LAUNCHER  
FULL-SIZE PATTERN





# Buff On a High-Gloss Finish

*A lathe-mounted buffing system shines turnings and much more.*





**A**

An oil-varnish mix brings out the color of the wood and seals the pores while creating a foundation you can polish and wax.



**B**

Sandpaper removes lint that might otherwise find its way onto your project. Paper protects the lathe from loose polish.

**F**or an eye-catching shine on turned projects, use the same tool that made them—your lathe. Then, stretch your equipment investment by using the same setup to finish other projects small enough to hold. You'll need a set of three buffing wheels, an adaptor for mounting the wheels, tripoli and white-diamond buffing compounds, and a bar of carnauba wax [Sources].

### Begin with a good finish

A glossy finish starts with smooth wood, so sand projects up to 320 grit before you begin polishing and waxing. On turned projects, follow up sanding on the lathe by hand-sanding with a 320-grit sanding sponge. If you're working with a hard exotic wood, such as cocobolo, continue sanding up to 1000 grit.

You can polish and wax bare wood, but a film finish provides better protection. We prefer one with a penetrating oil to make the grain "pop," so the bowl shown received four wipe-on coats of Waterlox Original

[Photo A, Sources]. You can also use Danish oil, but avoid water-based finishes that can soften from the heat of the buffing wheel. Let the finish dry until you no longer smell solvent on the surface.

While you're waiting for the finish to dry, begin preparing your wheels. Attach a strip of adhesive-backed 100-grit sandpaper to a piece of flat scrap. Then, mount one of the buffing wheels on your lathe and set the motor speed to about 1,800 rpm. *Note: For wheel preparation and buffing, wear eye protection and a respirator to guard against airborne lint and abrasives.*

Turn on the lathe and press the abrasive against the fabric hard enough to slightly flare out the sides of the wheel [Photo B]. You can reduce the mess by having a helper hold the nozzle of a shop vacuum near the spinning wheel while you press the sandpaper against it. Then, turn off the lathe and vacuum lint and loose sandpaper grit from the layers of fabric. Repeat this process for the remaining two wheels.

### Sources

Wood Buff Kit (three buffing wheels, buffing compounds, wax, and a wheel adaptor), \$73, The Beall Tool Co., 800-331-4718, bealltool.com.  
Waterlox Original Sealer/Finish, \$31.50 per quart, Woodcraft, 800-225-1153, woodcraft.com.





**C** A linen wheel loaded with tripoli polish evens out scratches left by the 320-grit sandpaper. A low gloss already has started to emerge.



**D** Hold the white abrasive stick against the linen/cotton wheel for only about 2 seconds to load it for extremely fine polishing.

### 3 steps to a glossy finish

**1** Begin the polishing process by mounting the all-linen wheel and turn on the lathe, again at 1,800 rpm. Press the stick of red tripoli polish—a dustlike silica—against the wheel edge until it turns red. Unlike the finer polish and wax you’ll use later, you can load the wheel with this polish. The tripoli abrasive breaks down into smaller particles as you work, so reload the wheel when it no longer removes the sanding scratches.

To prevent buffing wheels from flipping the workpiece back toward you, hold it low against the wheel [Photo C] and apply light to moderate pressure. Keep the project moving and avoid polishing any one place for more than a couple seconds to prevent heating and softening the film finish.

Frequently check your progress in an angled light. You should see an even sheen that contrasts with the duller less-polished areas. Once you achieve an even sheen, stop. Then, wipe the surface with a soft cloth.

**2** Replace the linen wheel with a softer linen/cotton wheel. Turn on the lathe and touch the white abrasive stick against the cloth [Photo D]. You only need a small amount of this extremely fine abrasive.

Polish your project as you did with the tripoli wheel, but use a lighter touch and keep exposing new surfaces to the wheel. For flat surfaces, polish end to end, with the grain, in overlapping passes.

**3** After you buff to the desired sheen, replace the linen/cotton wheel with a flannel wheel. Turn on the lathe and lightly press the carnauba wax stick against the



**E** Buffed and waxed to a high shine, this turned bowl reflects light evenly around its entire surface. Should you need to renew the finish, simply buff on another coat of carnauba wax.

fabric. You’ll need even less of this than the white abrasive.

The wax doesn’t polish the finish; it fills the fine scratches left by the white abrasive for a glossy surface. Work the surface until the wax leaves an even shine. If you notice smudges as you handle the project, you’re using too much wax. Wear off excess wax on the wheel by holding a piece of clean scrap against the edge. Then, buff again until the wax hardens without smudging. 🌲



## DISCOVER CNC SHARK HD4<sup>®</sup>

INDUSTRIAL PERFORMANCE —  
SMALL SHOP FOOTPRINT



### The CNC Shark HD4<sup>®</sup> features:

- Commercial grade, industrial construction
- Use a 2-1/4HP router or our variable speed, water-cooled spindle
- Perfect for heavy cutting, carving and machining on wood, soft metals or plastics
- Upgraded software is included with Virtual Zero, Auto Piece Alignment, X/Y Homing Switches, Auto Rotation, Edge Detection and more!
- Also available with an extended, 50" base
- User-friendly interface with touch screen, color pendant display



[www.NextWaveAutomation.com](http://www.NextWaveAutomation.com)

Next Wave  
Automation



# LUMBER YOU'LL LOVE

No Minimum Order • Friendly Service

Massive Selection of  
Domestics & Exotics

Walnut  
Cherry  
Maple  
Oak

Mahogany  
Purple Heart  
Zebrawood  
**+ more**

**100%**  
Satisfaction  
Guarantee  
Every Order



# [www.101Woods.com](http://www.101Woods.com)

Toll Free 800-423-2450



PayPal



# The Nitty-Gritty



by Jim Heavey

**S**andpaper seems to be simple enough stuff: sand bound to paper, right? But if you read the packages on store shelves, or shop online, your choices in abrasives can be overwhelming and confusing.

Hundreds of products, many aimed at auto-body shops, industrial cabinet shops, metalworkers, painters, plumbers, and drywallers, leave many woodworkers in a quandry. Industry terms and marketing-speak further muddy the waters.

Fortunately, what you really need to know boils down to five items: the *size* of the abrasive; how *densely* the abrasive is packed; the *type* of abrasive; the *backing* material; and whether the sandpaper has *stearate* or not. So let's sort out these choices.

## The truth about grit

► Learn more about the two different, but similar, scales for grading grit.

[woodmagazine.com/sandinggrits](http://woodmagazine.com/sandinggrits)

► Following an orderly sanding process saves time and yields excellent results.

[woodmagazine.com/sandingbasics](http://woodmagazine.com/sandingbasics)

First, consider grit size when choosing sandpaper. Large, coarse abrasives of 40, 60, and 80 grit easily strip paint and perform the initial smoothing of rough surfaces. Use 100, 120, and 150 grit to remove minor surface imperfections created by cutting and milling. Grits of 180, 220, and 320 serve for final sanding before finishing, and smoothing between finish coats. Grits 320 and above buff finishes to final smoothness.

## The open and closed case

Abrasives labeled “open coat” [Photo A] have about 30 percent less grit, providing space for the dust, or “swarf,” to go as you work. Choose open-coat paper when sanding soft or resinous woods such as pine and fir.

Closed-coat papers have nearly 100 percent grit coverage and offer quicker sanding on hardwoods because the swarf on these species isn't sticky.

► A swarf buildup clogs the sanding medium, reducing effectiveness.

## Types of abrasives

Many, but not all, sandpapers list their abrasive media on the packaging or back of the sheet. Although any sandpaper abrasive will smooth wood, three types work best for woodworking, with a fourth that we'll also discuss.

Find *garnet* [Photo B], a natural mineral, on inexpensive sandpapers best used for hand-sanding. The granules, initially sharp, wear quickly, especially when used with power sanders, which explains why garnet has fallen out of favor with many woodworkers.



**A**

**Open-coat papers may be labeled as such.** Closed-coat papers typically have no designation on the label or backing.



**B**

**Garnet has been used on sandpaper for decades.** It's inexpensive, but it doesn't last long in use, so you end up using more to get the same results achieved with other abrasives.



# of Sandpaper

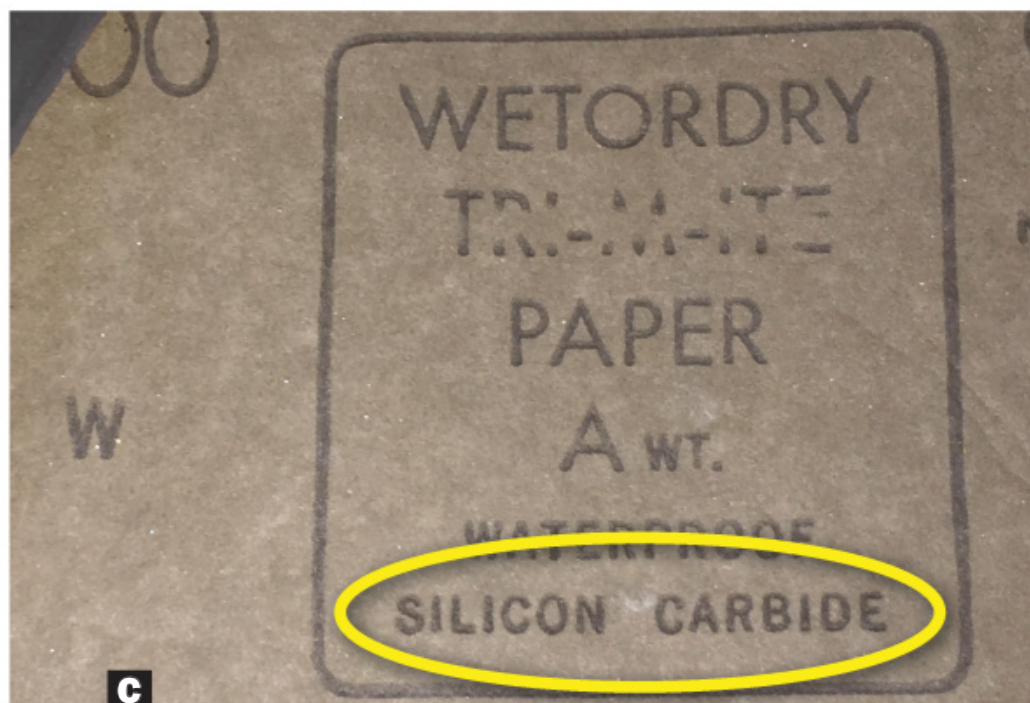
Hard but brittle *silicon carbide* [Photo C] fractures easily, creating fresh cutting edges as you work. The brittleness makes it less suitable for coarse grits but a good choice for finish-sanding by hand, as well as for rubbing out finishes.

*Aluminum oxide* has become the go-to abrasive for woodworking [Photo D]. This low-cost compound excels in nearly every aspect of surface preparation, from paint removal to final finishing. The very hard granules wear slowly and can be used in both hand- and power-sanding operations.

Though better suited for metalworking, you may see *ceramic* in retail stores, touted for woodworking. Ceramic grains break consistently, constantly exposing fresh cutting edges, but some woods may not be hard

enough to break them. Manufacturers may blend ceramic with other abrasives, such as aluminum oxide or silicon carbide, to create a longer-lasting sandpaper [Photo E].

► Find each of these abrasives in a full range of grits from 60 to 220, with silicon carbide and aluminum oxide offering even finer grits.



In addition to smoothing wood, silicon carbide excels at buffing the edges of cut glass and plastics, or producing a bright sheen on aluminum or copper surfaces.



Aluminum oxide wears down during use instead of fracturing. As a result, it sands finer as it wears.



Ceramic typically costs more, so if you find a ceramic-mix sandpaper at the same price as other abrasives, its durability makes it a good value.





**F** **A-weight paper** conforms easily to the tight curves of a detail sanding block.



**G** **Film backings look shiny.** When folding film-backed sheets, the film grips itself, so the paper holds its bent shape without slipping.

## Backing determines flexibility and durability

Several types of materials serve as backing for abrasives. Manufacturers use an alphabetical scale, with A as the lightest weight, and heavier, more durable backings designated with subsequent letters. Choose papers weighted A, B, or C for hand-sanding, with C and D holding up better to the demands of the coarsest (36–80) grits. Lighter-weight paper flexes more, so choose it when sanding profiles or small interior spaces [Photo F].

Although you can use A–C weight paper on a quarter-sheet sander, they will wear fast and may tear. Instead, look for papers with D, E, or F weights.

Some manufacturers offer film backing that provides great flexibility and resists tearing [Photo G]. The film won't slide around on rubber sanding blocks or pads, improving results. Film withstands moisture and provides a flatter surface, making it a good choice for wet-sanding with water or oil to bring a finish to a mirrorlike sheen.

Discs for random-orbit sanders come with paper, film, or fabric backings in weights that withstand the demands of the tool, so you don't get to choose the weight. Papers and fabric backings labeled as water-resistant or suitable for wet applications have been treated to withstand moisture.

## When to choose stearate

Stearated or self-lubricating sandpaper adds a dry metallic soap between the grains of grit [Photo H]. Swarf doesn't stick to the stearate, as it would to the resin binder that holds the granules, so debris falls away from the paper as you sand. That reduces clogging



**H** **Stearate might be listed on the package**, but look for other words, such as non-loading, no-fill, zinc stearate, or anti-clog.

when sanding resinous woods or painted surfaces. Usually applied to aluminum-oxide or silicon-carbide papers, this dry lubricant causes no finishing problems, such as fish-eye or orange peeling. Although hardware stores and home centers carry some stearate-coated abrasives, you'll find them well-stocked at auto-parts stores.

Regardless of the grit, material, or backing, it's important to discard any abrasive when its cutting action falls off. How do you know? Rub your fingers over the piece you're using, then over a fresh piece of the same grit. If the old one feels significantly smoother, discard it. 🌱



# Jig Plan Super Bundle



## 25 Downloadable Jig Plans for \$25

**This is it:** The greatest collection of woodworking jig plans ever assembled.

Increase your efficiency, amp up your accuracy, and crank up your confidence with must-have jigs for the tablesaw, bandsaw, router, and more.

Download today at [woodstore.net/jigbundle](http://woodstore.net/jigbundle)



✓Yes



✓Yes



xNo



✓Yes



✓Yes



✓Yes

- ✓ Reliably Low Prices
  - ✓ Easy To Use Website
  - ✓ Huge Selection
  - ✓ Fast Shipping
- [www.rockauto.com](http://www.rockauto.com)





# Sweet Treats Carrier

*Get your desserts to the party intact and looking oh-so-delectable in this combo carrier and display case.*



**D I M E N S I O N S :**  
13" W x 13" D x 13½" H

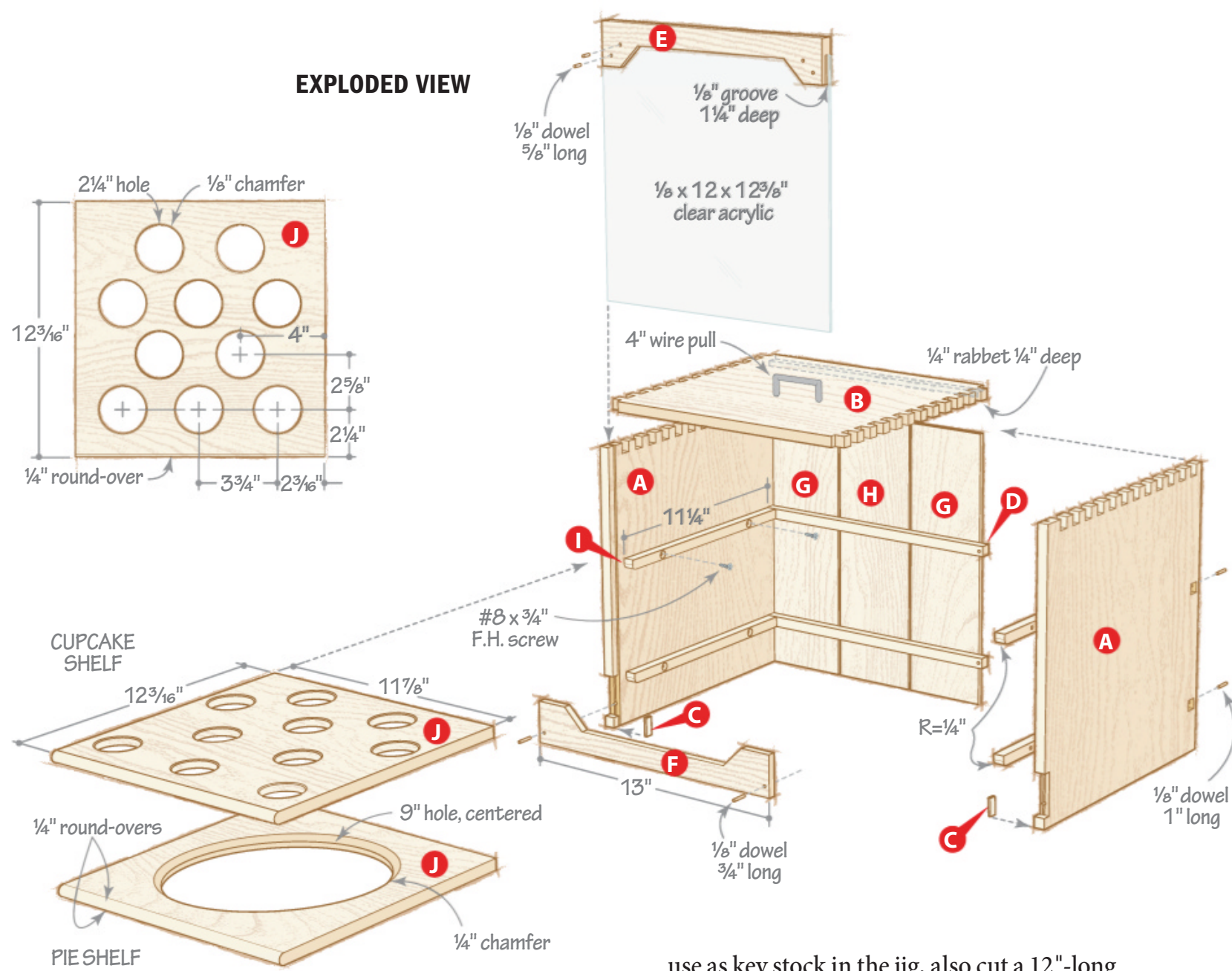
Approximate materials cost:

**\$50**

including a handle and acrylic door

Build multiple shelf types for maximum versatility.





## First, make the sides and top

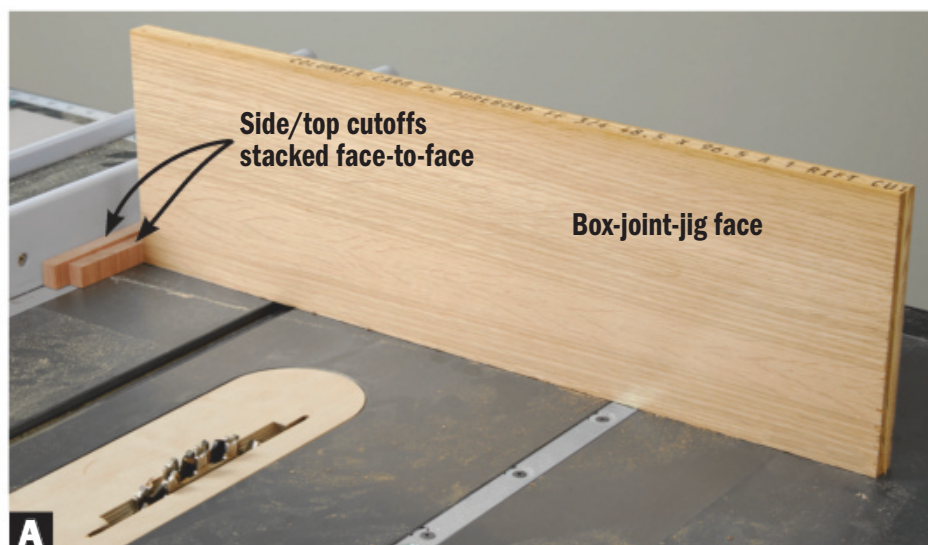
Box joints lend loads of strength *and* good looks where the carrier sides and top meet. A lower rail and back stretchers further tie the case together, with their ends exposed in the sides to complement the box joints. For wood we chose relatively light, but strong, lyptus.

**1** Glue up panels for the sides (A) and top (B), making the top as wide as the sides for now [Materials List]. When trimming the panels to length, save the cutoffs to use as spacers in the upcoming box-joint jig. For

use as key stock in the jig, also cut a 12"-long scrap to a thickness and width matching the thickness of the sides and top.

**2** Install in your tablesaw a 1/2"-wide dado set, and adjust its height to match the thickness of the sides and top. Attach a 3/4 x 6 x 24" plywood box-joint-jig face to your miter gauge, positioned so the dado set will cut through the face's approximate center. Stack two of the cutoffs face-to-face and place them against the rip fence. Slide over the rip fence until the cutoffs contact the end of the jig [Photo A]. Lock the rip fence.

**3** Make a dado cut through the jig's face [Photo B]. Unscrew the face from the miter



**Precisely space the box-joint-jig face** from the rip fence using two thicknesses of cutoffs from the sides or top.



**Cut through the face** and check the fit of the key stock in the notch. If the fit's not snug, adjust the dado set width and/or height.





**C** Butt the jig's end against the rip fence and rescrew it to the miter gauge. Then slide the fence out of the way.



**D** Raise the blade just a hair before cutting the second notch. Doing that ensures the box-joint's fingers stand slightly proud for flush-sanding later.



**E** Hold the workpiece securely against the jig as you make the first box-joint cut.



**F** Work your way across the width of the panel, positioning the most recent cut over the key in preparation for cutting the next notch.

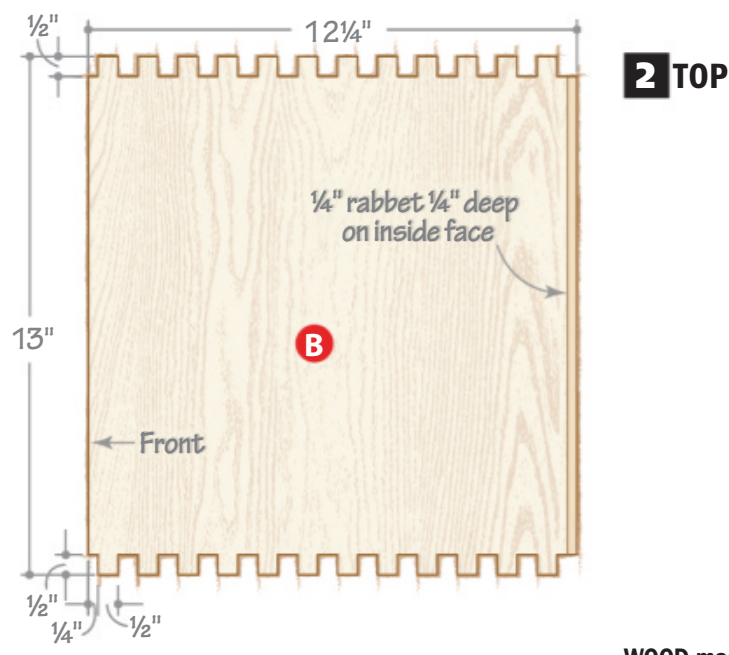
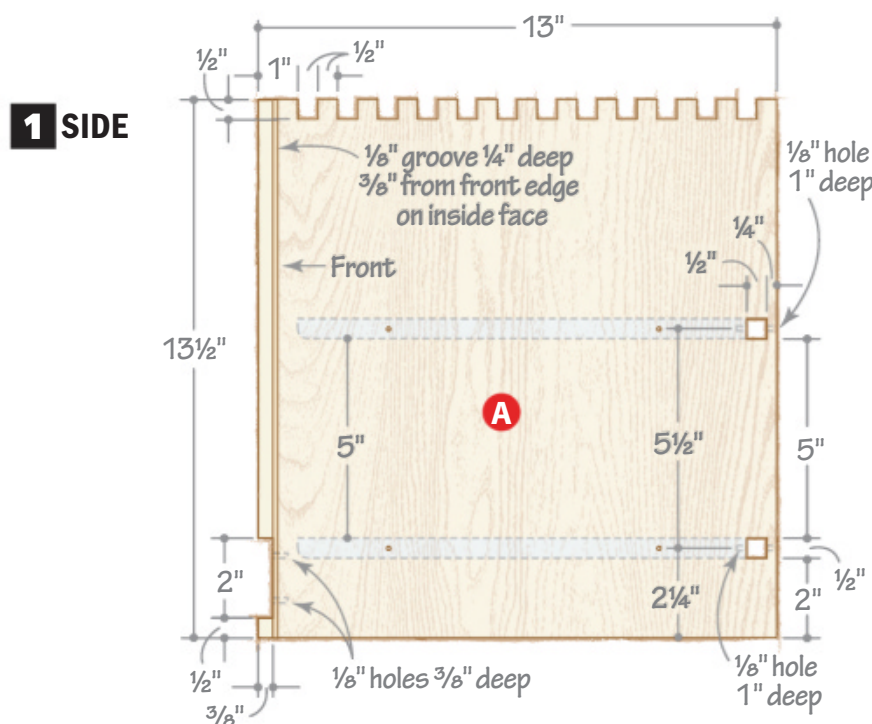
gauge and glue a 2"-long piece of key stock into the notch. Reposition the jig's face as shown in **Photo C**.

**4** Cut another notch [**Photo D**]. Position one of the sides (A) tight against the key and make the first box-joint cut [**Photo E**]. Place that notch over the key and repeat the cuts [**Photo F**],

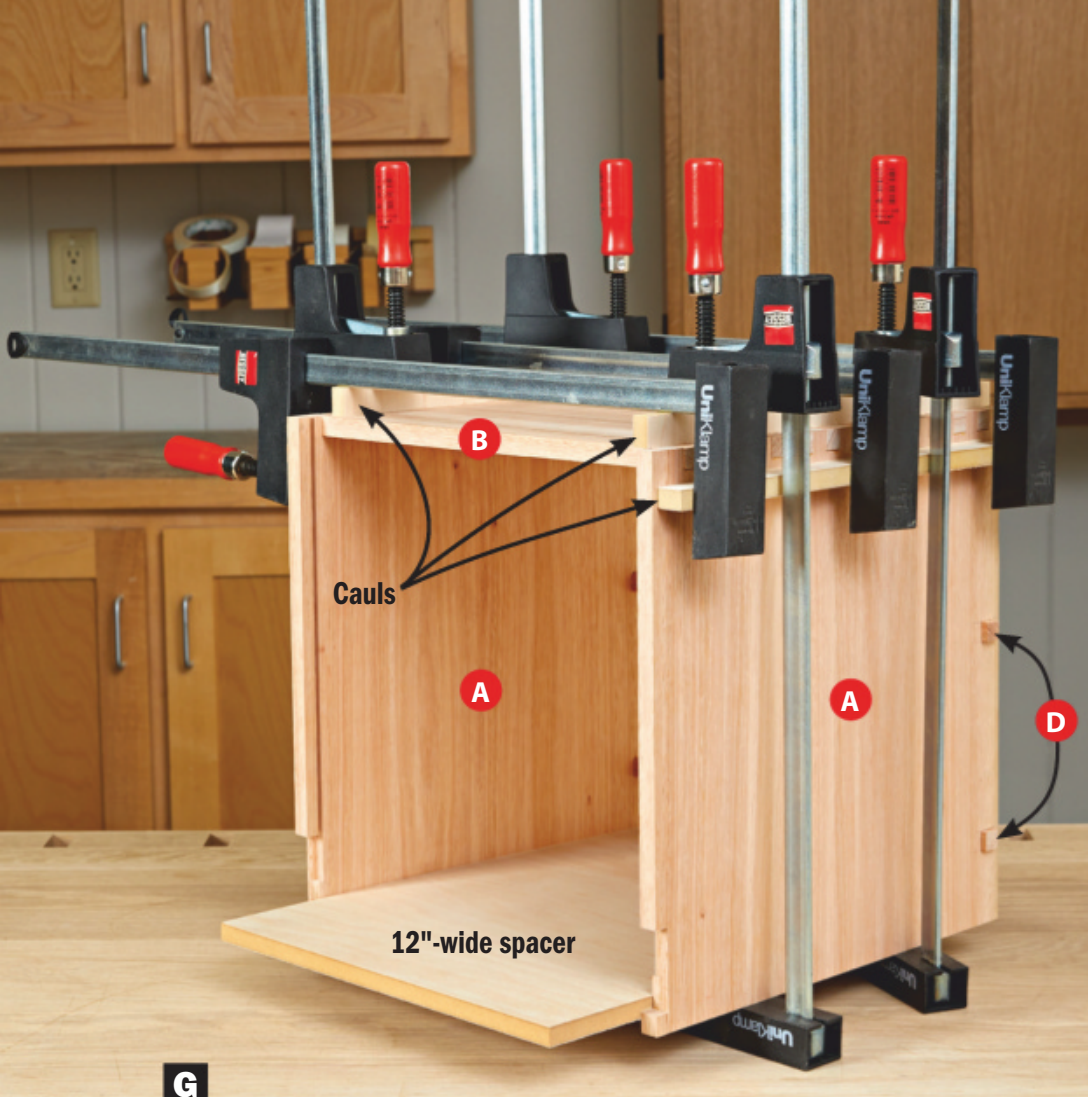
stopping 1" from the edge of the panel [**Drawing 1**]. Repeat on the other side panel.

**5** Cut box joints across the full width on both ends of the top (B). Then rip  $\frac{1}{2}$ " of material from the back edge of the top and  $\frac{1}{4}$ " from the front. Cut the rabbet on the underside of the back edge [**Drawing 2**].

**6** On the sides cut the groove near the front, two square mortises near the back,







**G**

Keep the assembly square using a spacer and clamping cauls. The stretchers (D) stand a little proud, but will be trimmed later.

and the notch on the front edge [Drawing 1]. Glue a filler (C) into the bottom of each groove [Exploded View].

## Just a few more parts to go

**1** Cut the stretchers (D) about  $\frac{1}{4}$ " longer than listed. Dry-fit the sides, top, and stretchers. Check that the top sits back  $\frac{1}{4}$ " from the  $\frac{1}{8}$ " groove (for door clearance). Once satisfied with the fit, glue and clamp the assembly [Photo G].

**2** Drill holes in the back edges of the sides into the stretchers (D) [Drawings 1 and 3]. Glue  $\frac{1}{8}$ " dowels just a bit longer than 1" into those holes and trim flush. Trim the stretchers flush.

**3** Cut the door rail (E) and case rail (F) to size. In the door rail cut a groove to fit your acrylic [Drawing 4]. Lay out and cut both parts to shape. Set the door rail aside for now. Glue the case rail in place and reinforce the joint with dowels [Drawing 4, Exploded View].

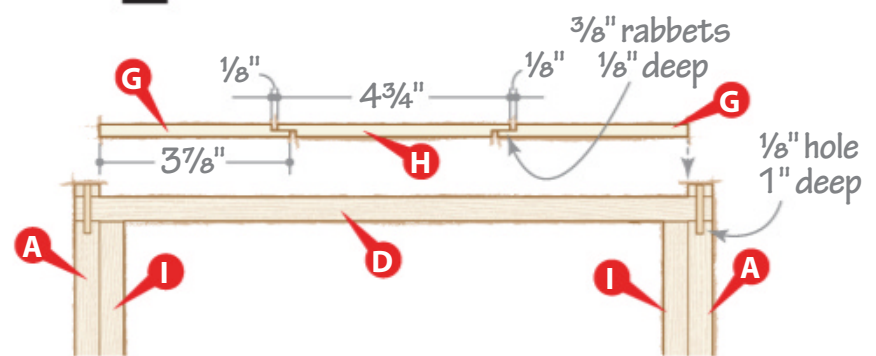
**4** Cut to size the slats (G, H), then rabbet four of their edges [Drawing 3]. Glue only the center third of each slat to allow seasonal expansion/contraction.

**5** Cut the cleats (I) to size and round over their bottom front ends [Exploded View]. Screw them to the sides.

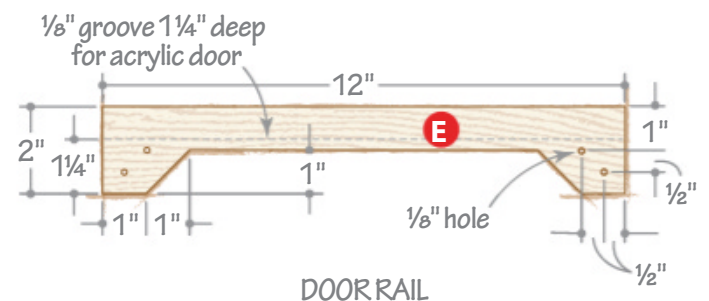
**6** Glue up and cut to size the shelves (J). Round over their front edges [Exploded View]. Cut holes and rout their top edges to customize the shelves for holding a pie or cupcakes.

**Tip!** Use a pin nailer to hold light, unclamped pieces, such as the slats, in place while glue dries.

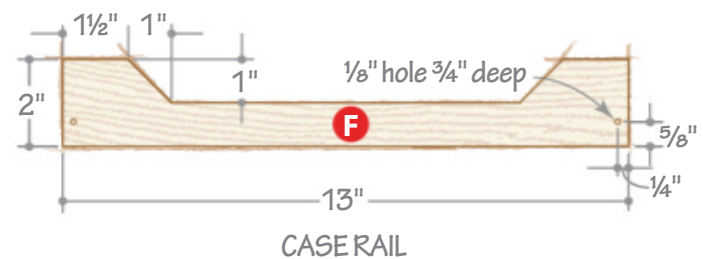
## 3 TOP SECTION VIEW



## 4 RAILS



DOOR RAIL



CASE RAIL

**7** Finish-sand all parts. For the door cut a piece of  $\frac{1}{8}$ " acrylic to fit [Exploded View]. Slide the acrylic into the door rail (E), center it side-to-side, and pin it in place with dowels.

**8** Apply your preferred finish (we sprayed three coats of lacquer). Add a handle centered on the top. Now let's get baking! 🌿

**Tip!** If your acrylic sheet comes with a protective film covering, leave it in place until after you apply finish to the project. If it doesn't have a covering, mask the acrylic prior to applying finish.

## Materials List

| Part           | FINISHED SIZE   |                     |                    | Matl. | Qty. |
|----------------|-----------------|---------------------|--------------------|-------|------|
|                | T               | W                   | L                  |       |      |
| A sides        | $\frac{1}{2}$ " | 13"                 | 13 $\frac{1}{2}$ " | L     | 2    |
| B* top         | $\frac{1}{2}$ " | 12 $\frac{1}{4}$ "  | 13"                | L     | 1    |
| C fillers      | $\frac{1}{8}$ " | $\frac{1}{4}$ "     | $\frac{3}{4}$ "    | L     | 2    |
| D* stretchers  | $\frac{1}{2}$ " | $\frac{1}{2}$ "     | 13"                | L     | 2    |
| E door rail    | $\frac{5}{8}$ " | 2"                  | 12"                | L     | 1    |
| F case rail    | $\frac{3}{8}$ " | 2"                  | 13"                | L     | 1    |
| G narrow slats | $\frac{1}{4}$ " | 3 $\frac{7}{8}$ "   | 13 $\frac{1}{4}$ " | L     | 2    |
| H wide slat    | $\frac{1}{4}$ " | 4 $\frac{3}{4}$ "   | 13 $\frac{1}{4}$ " | L     | 1    |
| I cleats       | $\frac{1}{2}$ " | $\frac{1}{2}$ "     | 11 $\frac{1}{4}$ " | L     | 4    |
| J shelves      | $\frac{1}{2}$ " | 12 $\frac{3}{16}$ " | 11 $\frac{7}{8}$ " | L     | 2    |

\*Parts initially cut oversize. See the instructions.

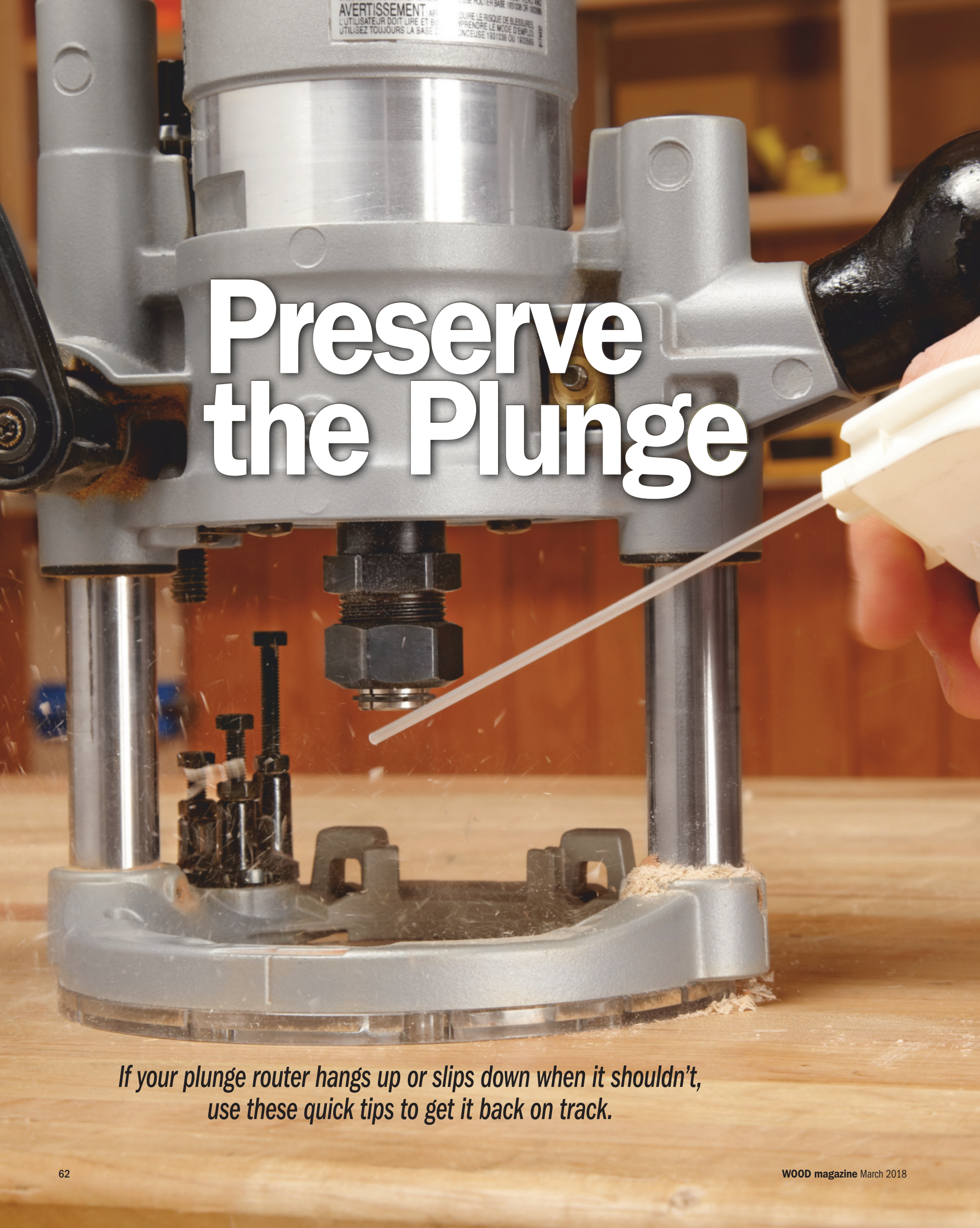
**Materials key:** L-lyptus.

**Supplies:** #8 $\times$  $\frac{3}{4}$ " flathead screws,  $\frac{1}{8}$ " dowel 36" long,  $\frac{1}{8}$  $\times$ 13 $\times$ 13" acrylic,  $\frac{3}{4}$ " pin nails, 4" wire pull.

**Blade and bits:** Dado set; 45° chamfer and  $\frac{1}{4}$ " round-over router bits; countersink; 2 $\frac{1}{4}$ " Forstner bit.

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





# Preserve the Plunge

*If your plunge router hangs up or slips down when it shouldn't,  
use these quick tips to get it back on track.*





If the plunge action catches or drags, the guide rods may be dirty. Use compressed air, as shown on *previous page*, to blast off loose dust; then, wipe the rods with a rag dipped in mineral spirits to remove



rust or stubborn particles, *above left*. Finally, lubricate and protect the guide rods by applying a nonstick tool spray, such as Bostik GlideCote (no. 124627, \$21, 800-225-1153, woodcraft.com), *above*.



**If the base doesn't grip the motor tightly**, it may cause the bit's cutting depth to suddenly deepen as the motor slips. Snug the clamp tension screw to get a better bite on the router motor.



**Plunge lock not providing enough purchase?** Tighten the locking stud on the plunge-lock lever. Be careful to not overtighten it, or you may not be able to plunge at all! 🌲

- ▶ For tips on getting the most from your plunge router, visit [woodmagazine.com/plungeroutertips](http://woodmagazine.com/plungeroutertips).
- ▶ See top editor-rated plunge routers at [woodmagazine.com/review](http://woodmagazine.com/review).
- ▶ Learn more about using routers: [woodmagazine.com/routeruse](http://woodmagazine.com/routeruse).



# No turning required! Salt & Pepper Shakers

*Make these dispensers using  
a drill press, tablesaw, router table,  
and two crazy-simple jigs.*



D I M E N S I O N S :  
4 1/2" T x 1 7/8" Diameter

Approximate  
materials cost:

**\$20**

including the  
metal  
components

Add salt  
and pepper  
as desired



In just a few hours, shape two small pieces of wood into custom shakers, each with affordable metal components [Source].

## Prep the blanks

**1** Create two  $1\frac{7}{8} \times 1\frac{7}{8} \times 4\frac{1}{2}$ " blanks (A, B) [Materials List]. We used maple and walnut for a no-brainer color connection.

**2** Draw diagonals to mark the center on each end, and mark the endpoints of each of the 12 facets on the bottom of each blank.

**3** Drill holes for the tube, cap, and plug [Exploded View, Photos A and B].

► Learn to lay out 12 equidistant points around a circle.  
[woodmagazine.com/12points](http://woodmagazine.com/12points)



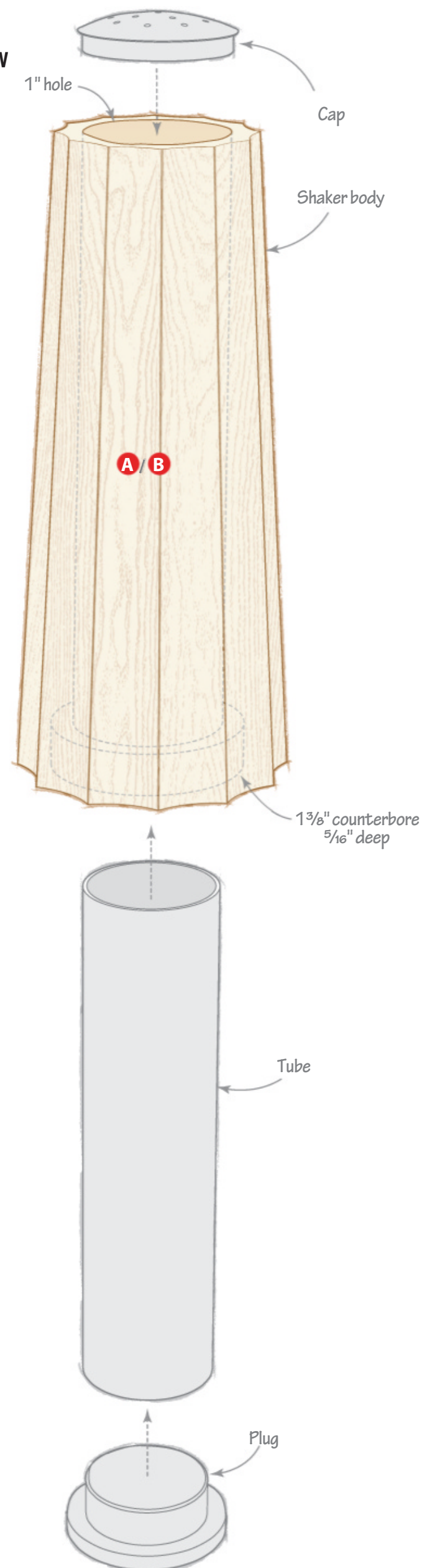
**A** Drill the counterbore at the bottom of each blank. Secure the blank in a clamp, with the blank aligned precisely with the bit.



**B** Switch to a 1" bit and bore each blank fully through. If your bit or drill press won't reach the full depth, simply turn the blank over and drill from that end.

## EXPLODED VIEW

**Tip!** Add character to your shakers with exotic-wood turning blanks from Penn State Industries, our source for the hardware components.



**Tip!** If you drill the through-holes from each end and they don't connect perfectly, simply wrap sandpaper around a  $\frac{3}{4}$ "-diameter or smaller dowel and sand the transition until the tube fits.



## Bevel-rip to shape

**1** Build the beveling jig [Drawing 1, Materials List]. Install a short dowel in the divider (D) to provide better purchase for the screw that holds down the top (E).

**2** Secure both shaker blanks (A, B) in the beveling jig with the blank bottoms against the stops. Tilt your tablesaw blade to 30°, and rip 12 facets on each blank [Photo C]. Save the first two cutoffs—they become part K in the next step.

► Watch the correct sequence for cutting the 12 facets. [woodmagazine.com/shakerbevels](http://woodmagazine.com/shakerbevels)

## Rout the tapered flutes

**1** Build the fluting jig [Drawings 2 and 2a]. Retrieve the two cutoffs (K), and glue them to the base and riser, spaced to cradle a shaker blank.

**2** Install a 1¼"-diameter (⅝" radius) round-nose bit in your router table. Set the bit ¼" above the table and center the bit on the width of the jig. Rout the length of the jig. Raise the bit to ½", clamp in a blank, and rout the first pass on all facets [Photos D-F]. Raise the bit and make shallow passes until the flutes extend the full length of the shaker blanks.

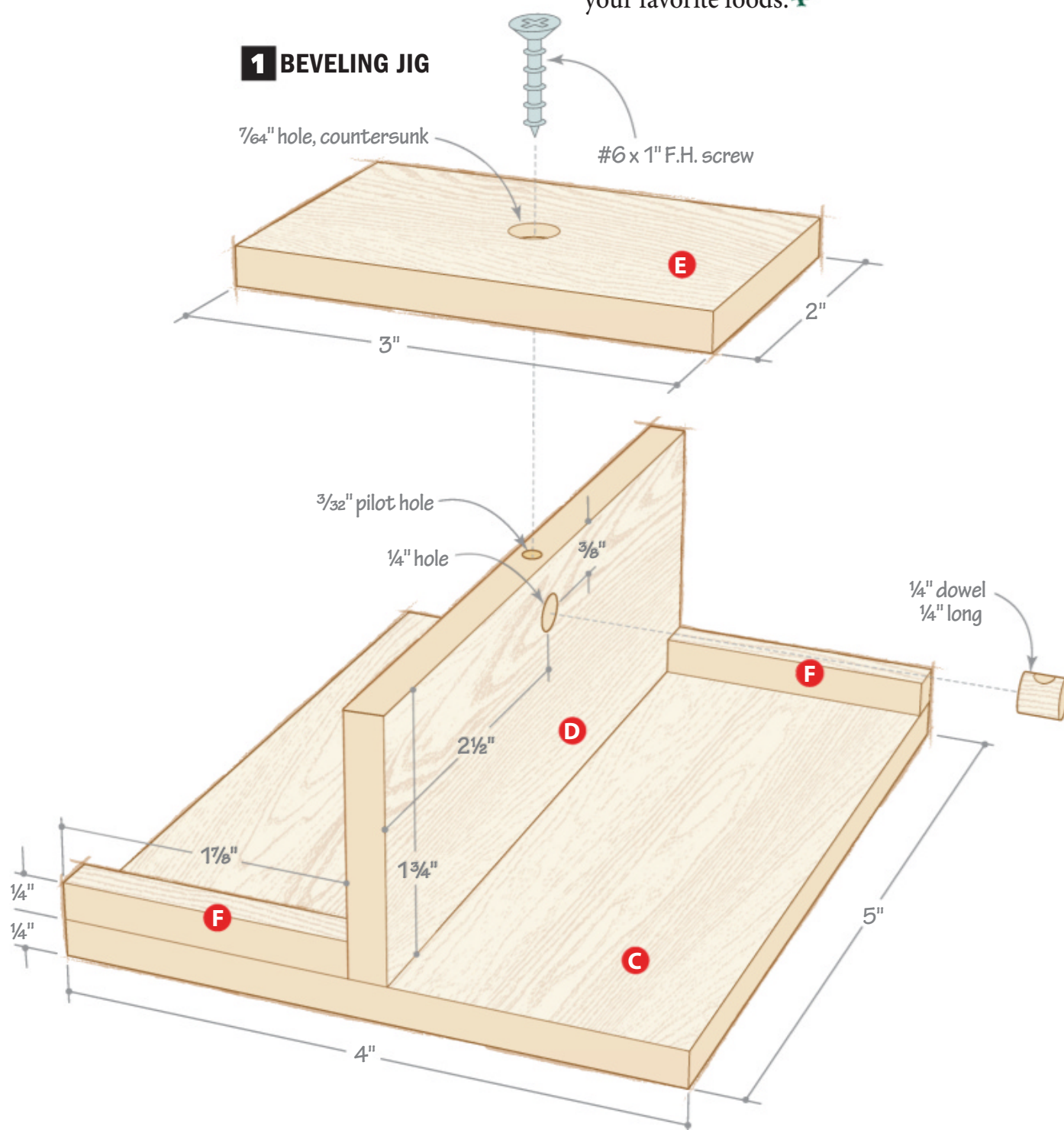


**C** Bevel-rip each shaker blank by keeping one of the original flat surfaces resting on the jig, and cutting to the lower layout mark on the edge over the blade. Flip the jig end for end and rip the other blank. Reposition the blanks and repeat until finished.

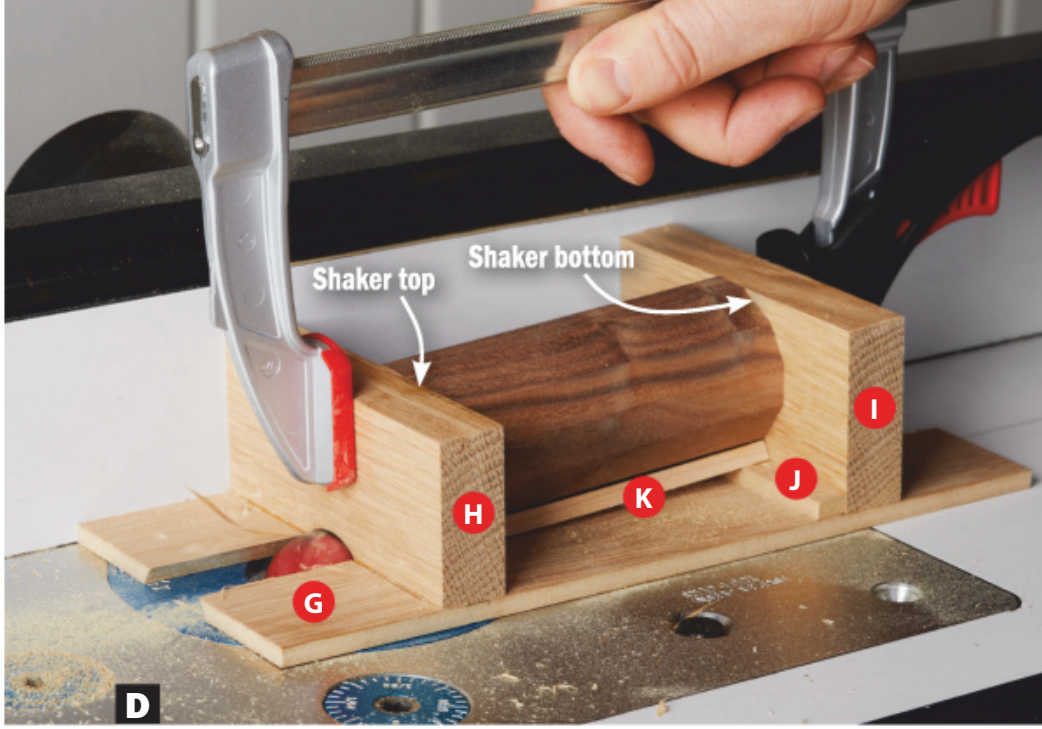
**3** Sand the shakers smooth and apply a finish. We applied three coats of Varathane aerosol satin lacquer.

**4** Adhere the tubes and caps to each blank with two-part epoxy. When cured, fill each shaker, insert the plug, and add zest to your favorite foods. 🌿

**Note:** To safely rout flutes in the shakers without them working loose from the jig, make the cuts in three or four passes.



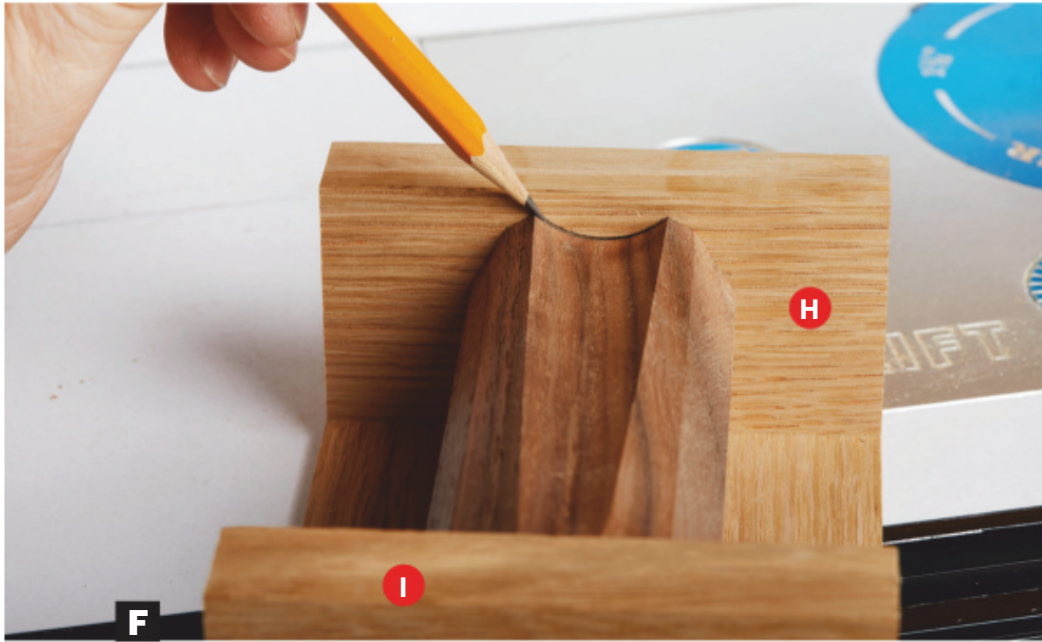




**D** Clamp a shaker blank in the fluting jig with one facet directly over the bit, and rout the full length of the jig. Rotate the blank and repeat for all 12 facets.



**E** Raise the bit until it cuts a flute the full length of the shaker blank. The flute should connect two of the 12 points at the shaker bottom.



**F** Rotate the blank a half-turn, resting on the wedges, and mark the flute's "smile" on the jig's front. This mark will help you register the blank for routing the last four flutes, which can be difficult to register without a flat surface.

## Materials List

| Part         |         | FINISHED SIZE |     |     | Matl. | Qty. |
|--------------|---------|---------------|-----|-----|-------|------|
|              |         | T             | W   | L   |       |      |
| Shakers      |         |               |     |     |       |      |
| A            | salt    | 1⅞"           | 1⅞" | 4½" | M     | 1    |
| B            | pepper  | 1⅞"           | 1⅞" | 4½" | W     | 1    |
| Beveling jig |         |               |     |     |       |      |
| C            | base    | ¼"            | 4"  | 5"  | MDF   | 1    |
| D            | divider | ¼"            | 1¾" | 5"  | MDF   | 1    |
| E            | top     | ¼"            | 2"  | 3"  | MDF   | 1    |
| F            | stops   | ¼"            | ¼"  | 1⅞" | MDF   | 2    |
| Fluting jig  |         |               |     |     |       |      |
| G            | base    | ¼"            | 4"  | 10" | MDF   | 1    |
| H            | front   | ¾"            | 1⅞" | 4"  | H     | 1    |
| I            | back    | ¾"            | 2⅜" | 4"  | H     | 1    |
| J            | riser   | ¼"            | ⅜"  | 4"  | MDF   | 1    |
| K            | wedges  | †             | †   | 4½" | M/W   | 2    |

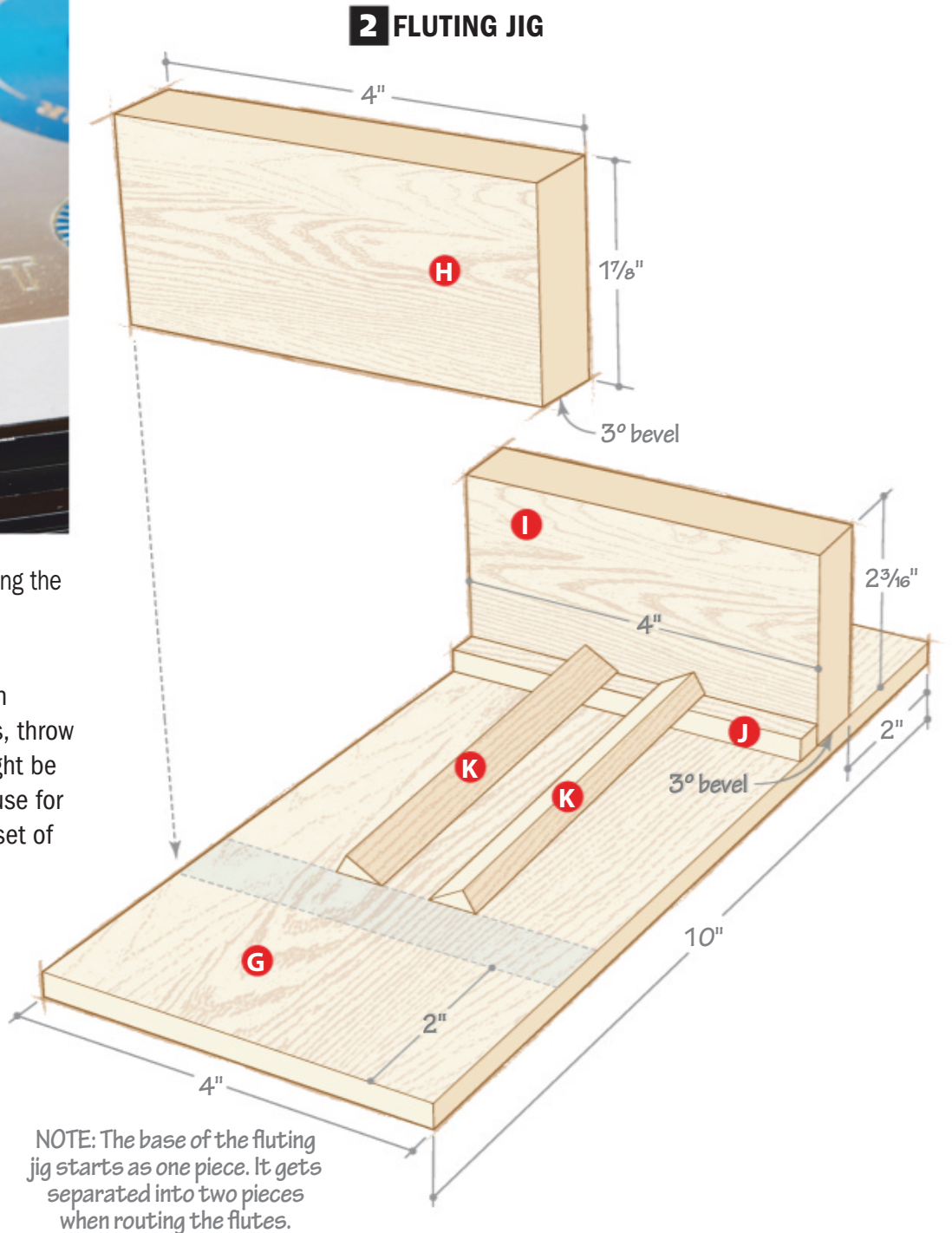
† Cutoffs from shaker blanks. See the instructions.

**Materials key:** M-maple, W-walnut, H-hardwood, MDF-medium-density fiberboard core (or plywood).

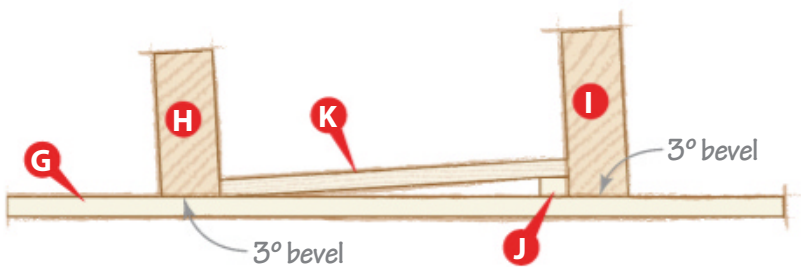
**Bits:** 1 1/4"-diameter roundnose router bit; 1" and 1 3/8" Forstner bits.

**Source:** Salt and pepper shaker kit, no. PKSANDP, \$9.95, Penn State Industries, 800-377-7297, pennstateind.com.

► When you finish routing the flutes, throw out the jig. It might be too unstable to use for making another set of shakers.



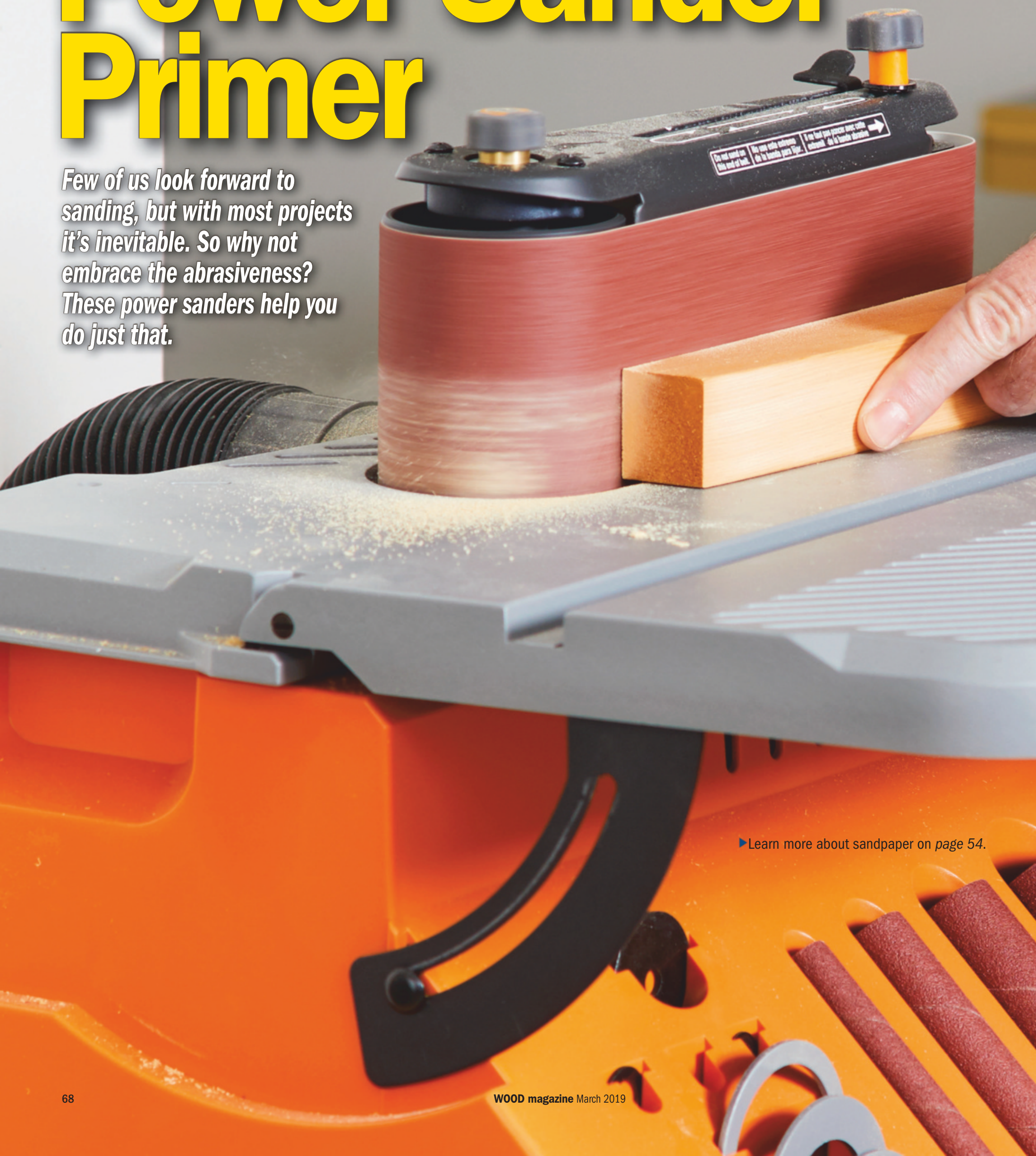
### 2a FLUTING JIG SIDE VIEW





# Power Sander Primer

*Few of us look forward to sanding, but with most projects it's inevitable. So why not embrace the abrasiveness? These power sanders help you do just that.*



► Learn more about sandpaper on page 54.



# Portable Sanders



Belt sander

Orbital sander

Random-orbit sander

Dual-mode random-orbit sander

Typically held with one hand, some portable sanders require two hands for better control. All types (belt, orbital, random-orbit, detail) come in corded versions, with many also available battery powered. If you already own tools in a particular battery platform, it might make more sense—cord freedom!—to buy sanders that use the same batteries.

■ **Belt.** This handheld sander transports an abrasive belt around drums at each end of the tool. The aggressiveness of a belt sander works best for rapid material removal rather than fine finishing. Most use one of three common belt sizes: 3×18", 3×21", or 4×24". Belt sanders come with a dust-collection bag, but most struggle to capture the large volume of fine dust created. Overcome this by setting up a dust collector or shop vacuum with a large hood to capture dust that escapes the tool.

■ **Orbital.** Primarily used for finishing, these sanders have a square or rectangular pad that vibrates in tiny circles, or orbits, to abrade the wood. Sandpaper sheets attach with either built-in clamps or hook-and-loop pads. Newer models feature holes in the pads for improved dust collection, with included punch pads to create matching holes in your abrasives. Orbital sanders produce smooth surfaces, but often leave swirly scratch marks that show up when you stain or dye the wood.

■ **Random-orbit.** If you don't own a power sander, get this one first. A random-orbit sander's 5"- or 6"-diameter pad spins while simultaneously orbiting in tiny circles of 1/8" or less. These combined actions help blend the scratch patterns, so that by the time you sand through 180 or 220 grit, the scratches become almost invisible.

The pads of most sanders in this class have eight dust-collection holes, and the abrasive discs on the market match them perfectly. The included bag or canister filter provides good dust collection, but for even better performance, attach a fine filtering shop vacuum. If possible, choose a random-orbit sander with variable speed so you can choose the best speed to match the workpiece and abrasive grit. A few models offer dual modes, letting you choose between a fine-finishing, smaller orbit and a larger, more aggressive orbit for rapid removal.

■ **Detail.** A cousin of orbital sanders, these tools use smaller triangular or rectangular pads for sanding into corners and tight spaces. They remove material well, but it can be difficult to blend their scratch marks with those made by another sander. We view detail sanders as a tool of last resort, when no other will do the job. (Sanding project parts prior to assembly helps avoid the need to sand into tight corners.)

► Read reviews of random-orbit sanding discs. [woodmagazine.com/sandingdiscs](http://woodmagazine.com/sandingdiscs)

**Tip!** Avoid using coarse abrasives, which can accidentally scratch adjacent surfaces that might already be ready for finish.

**Tip!** Stick with coarse grits (60–120) and use these tools only for rough-sanding. When done, switch to a finish sander.

**Tip!** Sand one grit finer (usually 320) with this tool than you would with a random-orbit sander to remove unseen swirls that would reveal themselves under stain or finish.

**Tip!** Replace the 5-hole pad on an older sander with an 8-hole pad from the same manufacturer; 8-hole abrasive discs are easier to find.



Detail sander





■ **Oscillating spindle.** If you don't own a benchtop or floor-standing model, this handheld version works well for sanding curved edges. You'll find only a couple of models on the market (Grizzly and MLCS Woodworking). They come with four drums and abrasive sleeves ( $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1", and  $1\frac{1}{2}$ " diameters), providing a good solution for most curves.

**Tip!** Clamp one of these tools to a workbench for a small, but effective, spindle sander with a tiny table surface.



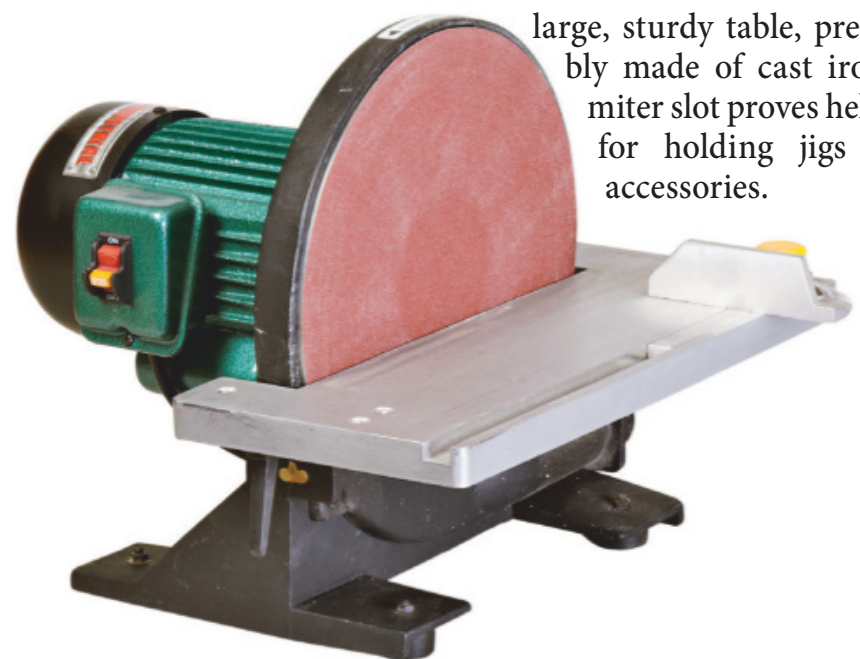
■ **Drum sander.** This tool's drum holds an abrasive sleeve that can dish out wood quickly if you don't keep it moving. We know of two models (Makita and Porter-Cable Restorer); both have accessory heads available with wire or nylon brushes for (purposely) scratching the wood to add texture or simulated age, or for cleaning up actual barn siding or similar wood. You can also buy paint-removal drums. As you'd expect, these generate a lot of coarse dust, so connect to a vacuum to minimize the mess.

**Tip!** For best control, use this tool in a pulling motion to resist the rotation of the drum.

## Stationary Sanders

Most of these machines come in both robust floor-standing models and benchtop versions that cost less and typically have smaller work-surfaces and motors.

■ **Disc.** Many disc sanders for home shops have 12"-diameter discs, but a few smaller and larger models exist. A self-adhesive abrasive disc sticks directly to the tool's metal platen, which excels at creating square, flat edges. Because you can work only on the downward-spinning portion of the disc, it provides a limited working surface, and you can sand only flat or convex surfaces. Look for a disc sander with a large, sturdy table, preferably made of cast iron; a miter slot proves helpful for holding jigs and accessories.



■ **Belt/disc combo.** These machines have a single motor that powers the belt and disc at the same time. The belts come in 1–6" widths, and the discs from 6" to 12" in diameter. Like a dedicated disc sander, these machines primarily sand flat and convex surfaces. But some models allow you to use one of the belt drums for sanding concave surfaces. The belts excel at sanding long straight edges, such as tapered table legs or box sides.

**Tip!** Use a coarse grit on one platen of your combo sander for shaping, and a finer grit on the other for detail work and smoothing.





**Tip!** When sanding to thickness, use 80–120 grit. For finish sanding, choose 150–220 grit.

► Read reviews of various power-sanding tools and machines. [woodmagazine.com/review](http://woodmagazine.com/review)

■ **Drum.** A drum sander's wide abrasive-wrapped drum spins parallel to the machine's power-driven feed belt. Because the abrasive wraps spirally around the drum, it requires special-shaped and -sized abrasive rolls. You can sand the faces of a workpiece or assembly (raised-panel door, picture frame, etc.) to a specific thickness, flatten a glued-up panel, or simply remove milling marks. The drums measure 7–18" wide in open-ended models, but you can double the capacity by rotating the workpiece end for end and sanding the other half to the same thickness. Closed-end drum sanders, such as the one shown, limit workpiece width, but virtually eliminate drum deflection or sagging.



■ **Oscillating spindle.** Nothing beats one of these machines—with a sanding drum that raises and lowers while spinning—for sanding inside curves. Bench-top models usually include at least four drums of different diameters; floor models often provide 6–8 drums. They usually come with 80- or 100-grit abrasive sleeves for the drums, with finer grits available as accessories. Taller spindles (8–10") provide more working surface for thick or wide workpieces. Heavy-duty spindle sanders have an oil-bath gearbox for a quieter, longer life.

**Tip!** Coating the rubber drum with baby powder or talcum allows the sleeve to slide on and off easier. Tighten the drum's lock nut to secure the sleeve.



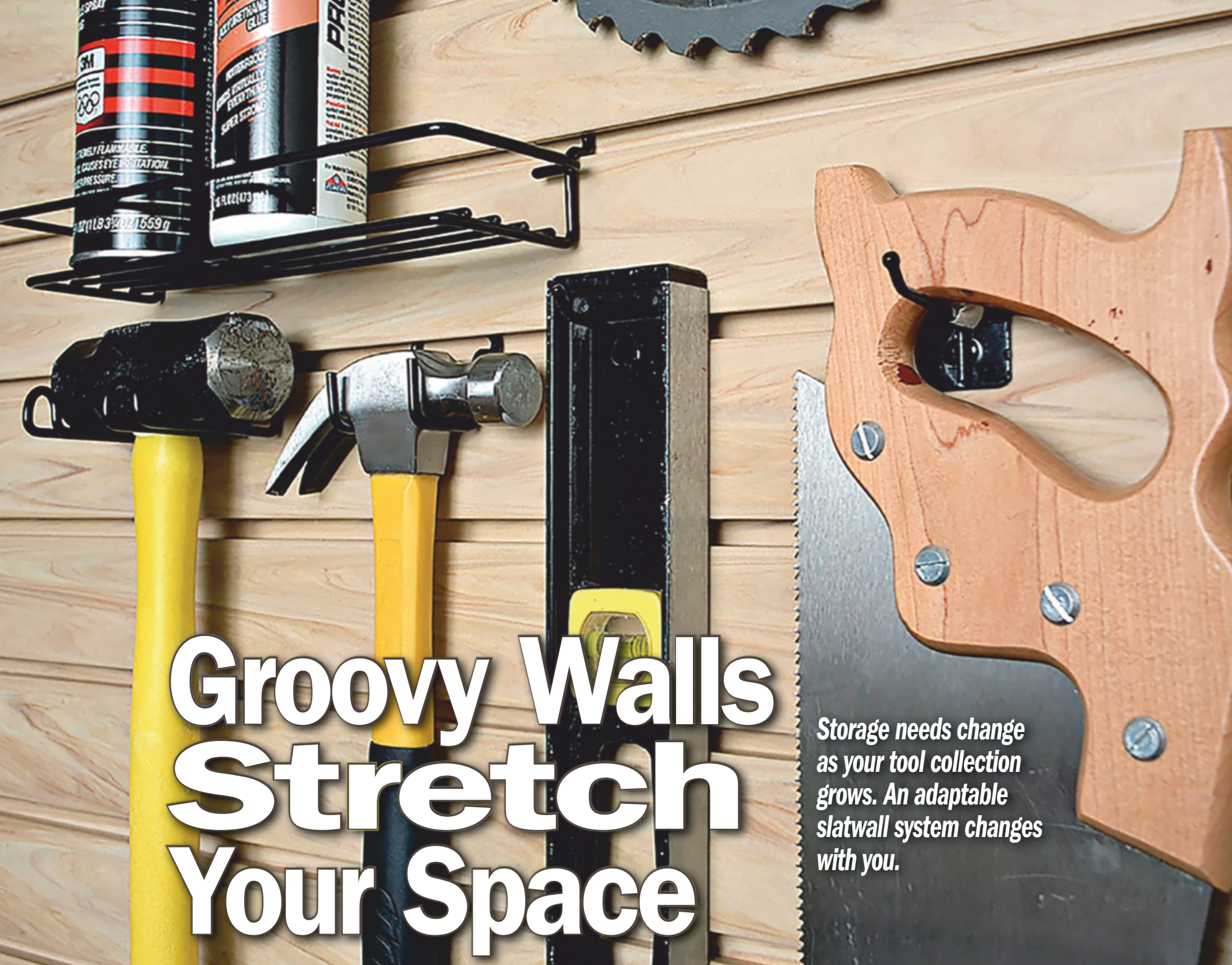
■ **Oscillating edge.** Think of this as an oversize horizontal belt sander with the up-and-down action of an oscillating spindle sander. This action extends the life of the abrasive belt, while also blending the scratch pattern. An edge sander works great for smoothing long straight edges, such as table legs and spindles. You can also shape concave edges at the end on one of the drums, usually requiring the removal of a guard. 🌲

**Tip!** Use 150- or finer-grit belts here. This machine typically works best at smoothing and refining workpieces rather than rough-shaping.

Produced by **Bob Hunter**







# Groovy Walls Stretch Your Space

*Storage needs change as your tool collection grows. An adaptable slatwall system changes with you.*

**B**esides holding weighty tools that would uncurl a wire peg hook, slatwall storage systems brighten a shop with a more finished look than pegboard, or nails in a wall.

Slatwall consists of strips or panels with horizontal T-shaped or L-shaped slots. Many commercial systems use plastic panels, such as StoreWall's 15"-wide sections that come 4' or 8' long. MDF panels made for retail applications commonly measure 4×8'. You can also make your own panels using  $\frac{3}{4}$ " birch plywood.

Hooks, shelves, and other hardware hang in the slots, as shown *above* and on the *next page*. To supplement these with your own custom storage, attach Z-shaped tabs to anything from router-bit holders, as shown on the *next page*, to cabinets. Unlike pegboard hardware, a single hook on some slatwall systems can handle more than 100 pounds.

► Learn how to rout slatwall grooves in  $\frac{3}{4}$ " plywood.  
[woodmagazine.com/slatwall](http://woodmagazine.com/slatwall)



**Slatwall hangers distribute their load** over a wider area than peg hooks. These L-shaped slots hold industry-standard hardware.

Load-bearing area



Convenience costs, though. For example, 4×8' sheets of perforated hardboard cost about \$15, but plastic slatwall that covers the same 32 square feet may cost ten times as much. Slatwall hardware comes in a greater variety, but it also costs more than peg hooks. Prices range from about \$2 per slatwall hook to \$25 for a 2'-wide basket or \$80 for a 3'-long shelf.

But you're really paying for flexibility: panels and hardware that, unlike pegboard, can hold a 50-lb cabinet in tomorrow's shop as easily as an 8-oz hand tool today.

## Plan a basic system

To create a slatwall system on a budget, ask commercial remodelers about salvaging slatwall panels and hardware from closed or remodeled stores. If you're hanging cabinets and shelves heavier than about 50 pounds, install plastic slatwall panels. For example, a heavy-duty StoreWall panel holds up to 148 lbs versus 68 lbs on an MDF panel.

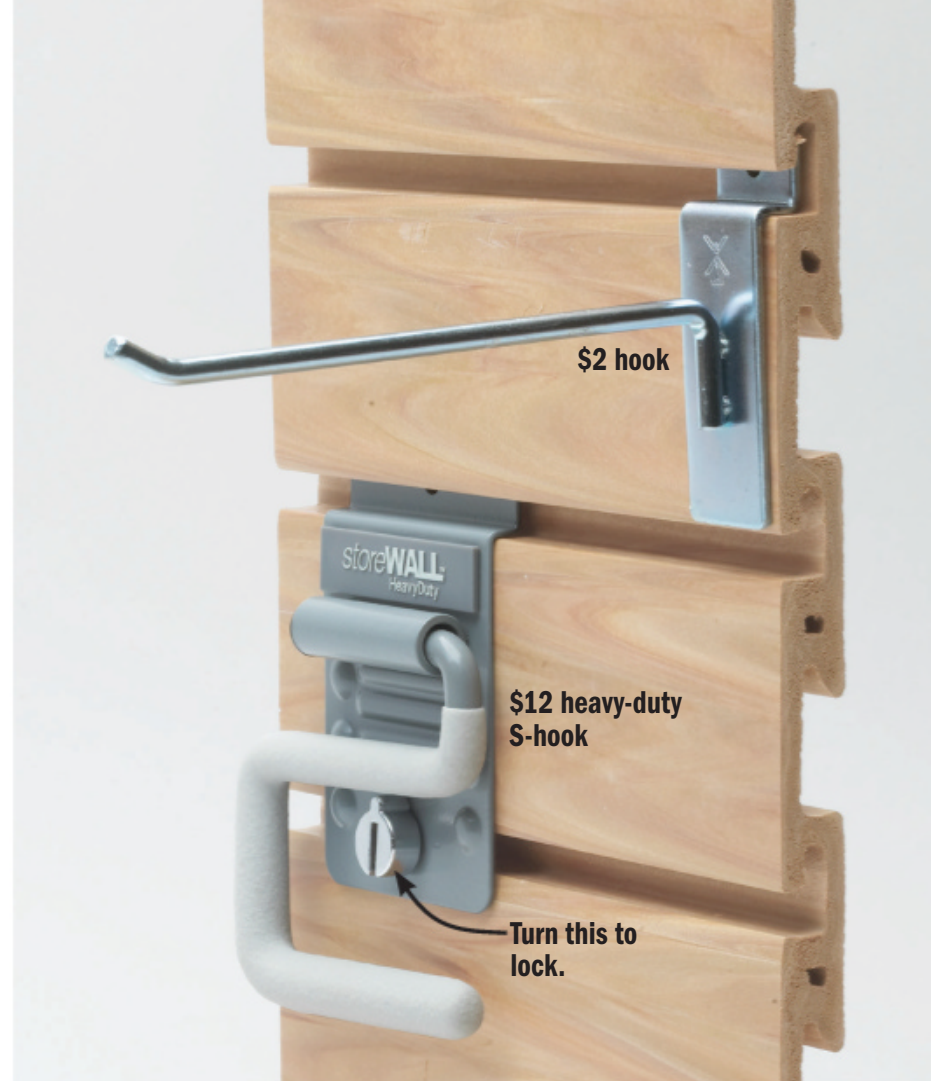
With the wall system decided, it's time to shop specialty stores, home centers, and the web (see **Sources**) for hardware to suit your needs. You can mix inexpensive hardware for light- or medium-duty jobs, as shown *above right*, with more expensive hardware for the heavy stuff because slatwall slots are typically spaced 3" apart to accept all types of hardware.

On a tight budget? Start small by mounting just one row of 15"-wide plastic slatwall strips around your workshop. Position it between chest and eye level—high if you'll use more hanging hooks, and low for baskets. Later, add more strips above the first one to store jigs or lumber, and below to hang more hooks, baskets, and shelves as needed.

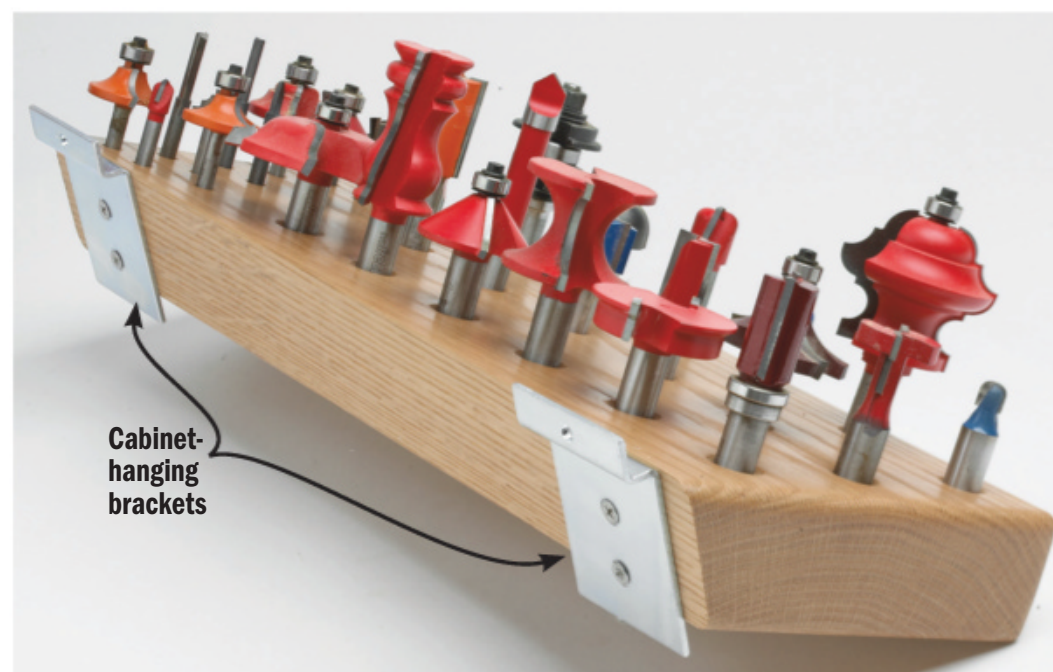
## Install panels for flexibility

A future shop reorganization may have you move a rack of hefty pipe clamps to where a few ounces of bandsaw blades now hang, so install all panels for maximum weight capacity from the start. Installation instructions vary, but these tips will help strengthen any system:

- ▶ When stacking interlocking panels, install the lowest panel first. Level each strip or course of panels.
- ▶ Use #8×1½" flathead wood screws on bare studs and #8×2" screws over drywall.
- ▶ Drive a screw into every stud at each slot. Screw heads can be painted or covered with color-matching caps available from some suppliers.
- ▶ Cut panels as you would veneered plywood: with the good (slot) face up on a tablesaw with at least a 40-tooth blade.



Hardware from StoreWall comes with a lock to keep it from pulling loose. Inexpensive hooks can handle lightweight items.



GarageEscape brackets made for hanging cabinets on slatwall also can be used to hang shop-made accessory holders.

When using a portable circular saw, cut with the slot face down using a carbide blade with 32 teeth or more.

- ▶ Check with the manufacturer to see if screws can be supplemented with adhesive. Allow any adhesive to dry overnight before using the panels. 🌳

## Sources

Several companies offer slatwall panels and hardware either by mail or through dealers, including:

**Garage Escape**  
800-548-7528, garageescape.com

**Gladiator Garageworks**  
866-342-4089, gladiatorgw.com. Note: Gladiator uses proprietary hardware that's incompatible with industry-standard slatwall.

**StoreWall**  
Heavy-duty panels and accessories, 866-889-2502, storewall.com



**NEW**

# Porter-Cable Dovetail Jig Owners NO DUST – NO MESS!



Without VRS1200



With VRS1200

Leigh's Vacuum & Router Support, model VRS1200, works with your 4200 series **Porter-Cable** dovetail jig. See videos at leighjigs.com.



Made by  
**LEIGH**

Porter-Cable is a registered trademark  
of Stanley Black & Decker USA.

See Videos  
Online



Scan QR code



Home of the  
Low Angle Pocket



*"The Castle 100 has  
become my favorite  
'go to' fastening tool"*

~Brian Gamberg  
Executive Vice President  
DCX-CHOL, Engineered Products

**See It In Action!  
Get yours @**

**castleusa.com**

**1.800.282.8338**



/ castlepockets



/ castlepockets

# IT'S WHAT THE REAL PRO'S USE

**THE REAL PROS  
KNOW THEIR  
REPUTATION IS  
ON THE LINE WITH  
EVERY PROJECT.**



Famowood® Wood Filler spreads smoothly, takes stains & paints evenly and resists cracking.

Glaze Coat® is a pour-on epoxy coating where just one coat equals 70 coats of varnish!

E6000® is the ultimate adhesive for a high performance bond you can trust.

**ACCEPT. NO. SUBSTITUTES.**

USA



Eclectic Products

**QUALITY  
MATTERS**



# Forrest Sharpening

Helps Prevent Bad Cuts Like These

**NEW  
Website!  
More  
Blades!**



Abrasion, pitch buildup, micro chipping and poor sharpening jeopardize the life and performance of even the finest carbide-tipped blades and dado sets. Our *expert factory sharpening* will help protect your investment. We handle *all types and makes of blades*. Typical turnaround is just 4 to 5 days.

We've been the leader for over 60 years, so contact us today.

**FORREST**

The First Choice of Serious Woodworkers Since 1946

[www.ForrestBlades.com](http://www.ForrestBlades.com)

1-800-733-7111

(In NJ, call 973-473-5236)

© 2018 Forrest Manufacturing Code WOOD

# Make perfect raised panel doors and drawers.

**FREE  
SHIPPING**  
Contiguous  
USA

## Cabinet Maker Raised Panel Router Bit Set

**Set Savings!**

- Ogee Raised Panel Undercutter
- Ogee Rail and Stile
- Glue Joint
- Door Lip
- Drawer Lock

**Item #8389**



## "Rocky 30" Trim Router Two Base Set

**With Plunge Base!** Router accepts Porter-Cable® type template guides. High performance 1-HP variable speed motor. With Plunge and Fixed Bases.

**Item #9060**



## Oscillating Handheld Spindle Sander

**Sand anywhere!**

- Hand Hold in tight spaces
- Use in the Vertical or Horizontal positions
- Large flat bottom base keeps spindle square to work

**Item #9557**



**FUJISPRAY®**

VERSATILE • INNOVATIVE • TRUSTED



4.5 OUT OF 5\*

**Leaders in HVLP**



[www.fujispray.com](http://www.fujispray.com)

\*Average of 4.5/5 stars by customers featured on amazon.com

**MLCS**  
[mlcswoodworking.com](http://mlcswoodworking.com)

Ordering & Technical: 800-533-9298



## Woodworker Support Group

We like these three portable workstations for temporarily adding workspace and stock support to the shop.

### Pegasus folding worktable and sawhorse

no. WX051, \$100

The 25×31" worksurface provides lots of space, and the sturdy legs make it rock solid. It comes with two quick-action clamps that recess into the aluminum channels, and four bench dogs provide stops for clamping workpieces. The Pegasus folds up nicely and weighs just 30 lbs., making it easy to store.

Worx  
855-279-0505, worx.com



### Express Folding Workbench

no. DWST11556, \$80

This workstation folds up quickly for storage and carries easily, but shines best when set up. Made of heavy-duty plastic with metal legs, it supports up to 1,000 lbs., according to DeWalt. We never piled on that much weight, but it handled everything we stacked on without buckling. Slots and holes accommodate quick-action clamps (not included) to secure workpieces.

DeWalt  
800-433-9258, dewalt.com



### Track Horse

no. KWS500, \$120

True to sawhorse tradition, Kreg built this stand to handle heavy loads (1,100-lb. rating per Track Horse). The steel-leg base with an aluminum top rail supports boards and sheet goods with ease. The top rail has a T-slot and included cam clamp to hold stock securely, and T-bolts for mounting a sacrificial 2×4 for sawing. Mount the clamp in one of the end brackets to secure a board on edge for routing or planing. The adjustable legs let you set the top beam 24–35" high.

Kreg Tool  
800-447-8638, kregtool.com



# DOWELMAX

PRECISION ENGINEERED JOINING SYSTEM

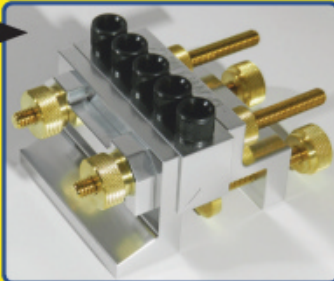
JOINT STRENGTH IS DIRECTLY PROPORTIONAL TO ACCURACY



Mitered Drawer Corner with Exposed Dowels on Chess Table  
Built In House by Dowelmax with 100% Dowel Construction

Full System Not Shown-Main Unit Only

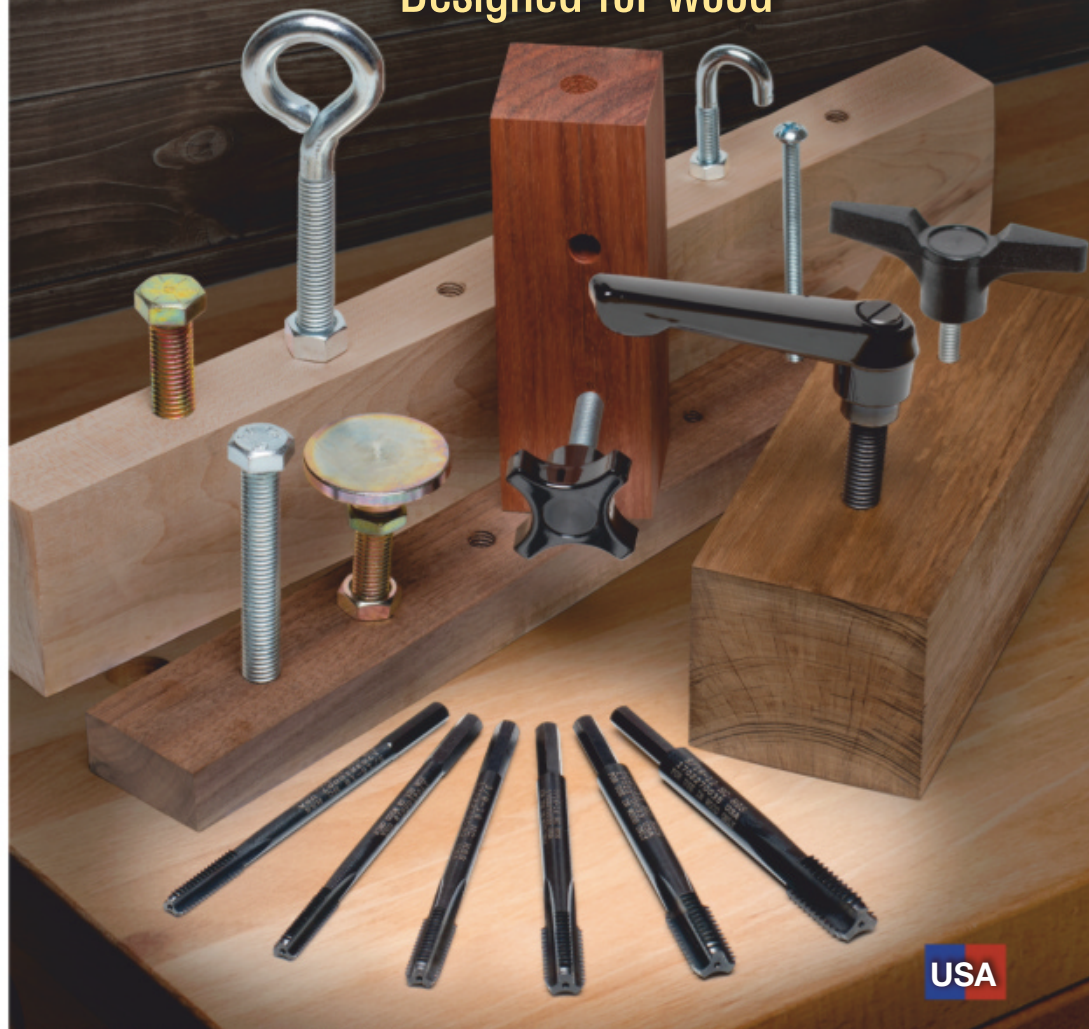
OUR GUARANTEE: Joints Made with Dowelmax are Test Proven Stronger and More Accurate than Comparable M&T or Domino Joints.



Call 1.877.986.9400 or visit [dowelmax.com](http://dowelmax.com)

# Eagle Thread Taps

Designed for wood



USA

# Rabbit MasterPro Router Bit Sets

USA

Ten different depths of cut  
Set 100-5075



Prepare Your Garden the **EASY WAY...**

## ...with Dual Rotating Tines!

OUR PRO XL ROTOTILLER lets you choose between forward rotation for cultivating or counter-rotation for deep soil tilling or sod busting.

ONE-HAND OPERATION! Self-propulsion lets you walk to one side while you easily steer with one hand, leaving no footprints in the freshly tilled bed!

8 TILLER MODELS! No matter how big or small the job, we've got one for you!

HUGE TILLER SALE!  
Starting at just \$199<sup>99</sup>



FREE SHIPPING 6 MONTH TRIAL

SOME LIMITATIONS APPLY

Go Online or Call for FREE DVD & Catalog!

 [DRrototiller.com](http://DRrototiller.com)

TOLL FREE 888-340-8923



1982AX © 2019

# Magnetic Tool Covers

Protect cast-iron and steel tables!

USA



# Eagle America

#1 Router Bit Made In The USA! • (800) 872-2511



ULTRA  
**SAFE**  
SUPER  
**EFFICIENT**  
TOTALLY  
**SILENT**  
**HEATING**  
FOR PEACE OF MIND!



**envi**<sup>TM</sup>  
WALL-MOUNTED ROOM HEATER

**ENERGY SAVING**  
runs for as little as 4 cts/hr

**SILENT**  
fanless design

**ULTRA-SAFE**  
cool to the touch

**EASY INSTALL**  
installs in minutes

**HEALTHY**  
doesn't blow dust around

**STYLISH AND SLEEK**  
slim design, only 2in thin!

WWW.EHEAT.COM

1-800-807-0107

10% off code 2 or More Envi Heaters: WD1910

Free Shipping to the USA + Canada



## Equipment that works as hard as you do.

### Powerful DR® Chippers

*Larger Capacity, Lower Prices!*



- Chip big branches up to 5.75" thick!
- Self-feeding models available. No more force-feeding!
- Powerful engines spin big fly-wheels (up to 62 lbs.), generating massive chipping force!
- Models that shred yard and garden waste as well as CHIP branches.

Starting  
at just  
**\$749<sup>99</sup>**

**DRchipper.com**

1982BB © 2019

### Grind Away ANY Size Stump FAST!



The **DR® STUMP GRINDER** uses carbide-tipped cutting teeth (taking 360 "bites" per second) to reduce any stump to a pile of woodchips. Grinds stumps below ground level so they are gone forever!

- Faster, safer and easier than digging, burning, or using chemicals.
- New, more powerful and lower-priced models.
- Now towable with your riding mower or ATV.



NEW Self-Propelled Model Available!

**DRstumpgrinder.com**

1982BC © 2019

### The DR® Powerwagon hauls up to 800 lbs!



- Self-propelled! More powerful engines make transporting big loads EASY—even going uphill! Electric-start models available.
- Converts to a flatbed quickly for carrying long loads.



Powered dumping available!

**DRpowerwagon.com**

1982BA © 2019

**FREE  
SHIPPING**

**6 MONTH  
TRIAL**

**EASY  
FINANCING**

SOME LIMITATIONS APPLY. GO ONLINE OR CALL FOR DETAILS.

Call for a **FREE DVD and Catalog!**

Includes product specifications and factory-direct offers.

TOLL FREE **888-340-8923**





# TOOLS & MATERIALS

SHOP-TESTED

## When you add a quarter horse, you get a grown-up Colt

1¼-hp fixed-base router, no. GKF125CEN, \$130

As a fan of Bosch's 1-hp Colt trim router for more than a decade, I've been eager to get my hands on this amped-up model. The new 1¼-hp Colt has more muscle: I could not bog it down without making ridiculous cuts. With that power comes a larger body, but it's still compact enough to operate one-handed, and it's nimble despite the added size. I like the variable-speed, soft-start motor, and twin LEDs that illuminate around the bit nicely. My favorite feature, though, is the bit-depth adjuster: Three modes on the base lock (locked, unlocked, and microadjust) make it incredibly easy to fine-tune a bit's cutting depth.

This Colt comes with an adjustable edge guide—a nice touch. Bosch's Steve Wilcox says they plan to launch a plunge base—a hotly anticipated accessory—in 2019.

—Tested by Bob Hunter, Tools Editor

Bosch  
877-267-2499, boschtools.com



## DeWalt vacs provide lots of suction

14 gallon, no. DXV14P, \$149; 10 gallon, no. DXV10P, \$139;  
4 gallon, no. DXV04T, \$119

DeWalt's new wet/dry vacuums range in size from 4-gallon capacity to 16. We tested three to see how they fared. The good news: They demonstrated better suction than most comparably priced vacs, and did about as well as other models at trapping the dust. If you use these vacs with the included filters and bags, you should consider wearing a respirator or dust mask to prevent breathing the fine dust that escapes. Or, buy a finer-rated filter (\$25–\$45) to improve the performance of each vac. The bigger models come nicely equipped in terms of accessory nozzles and extensions. The 4-gallon model works best as a detail vac for cleaning up small areas.

—Tested by Tom Brumback

DeWalt  
800-433-9258, dewalt.com





## SCISSOR SUPER COUPON

# FREE

**PITTSBURGH** WITH ANY PURCHASE

**1" x 25 FT. TAPE MEASURE**

**LIFETIME WARRANTY**

COMPARE TO KOMETON \$6.98  
MODEL: L4825W

- Thumb Lock
- Rubber Wrapped Case

ITEM 69030/47737/69031 shown

48252166

Cannot be used with other discounts or prior purchases. Original coupon must be presented. Valid through 5/4/19 while supplies last. Limit 1 FREE GIFT per customer per day.

## WARRIOR

### 18 VOLT LITHIUM CORDLESS 3/8" DRILL/DRIVER KIT

Customer Rating ★★★★★

**NOW \$29.99**

**NEW**

COMPARE TO RYOBI \$69  
MODEL: P1810

**SAVE 56%**

ITEM 64118

48257152

LIMIT 3 - Coupon valid through 5/4/19\*

## FRANKLIN

### HEAVY DUTY PORTABLE SCAFFOLD

Customer Rating ★★★★★

**NOW \$169.99**

**NEW**

COMPARE TO BAKER \$260.40  
MODEL: I-CSC8B

**SAVE \$90**

ITEM 69055/63051/63050 shown

48264257

LIMIT 3 - Coupon valid through 5/4/19\*

## BADLAND

### 2500 LB. ELECTRIC WINCH WITH WIRELESS REMOTE CONTROL

Customer Rating ★★★★★

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

**SAVE \$140**

COMPARE TO SUPERWINCH \$189.99  
MODEL: 1128220

**Voted Best Winches**

**NOW \$49.99**

ITEM 61840/61297/63476/61258 shown

48272083

LIMIT 3 - Coupon valid through 5/4/19\*

## HaulMaster

### 1000 lb. capacity 18" x 12" MOVER'S DOLLY

Customer Rating ★★★★★

**NOW \$7.99**

COMPARE TO BUFFALO TOOLS \$17.65  
MODEL: HD6DOLLY

**SAVE 54%**

ITEM 63098/60497/61899/63095/63096/63097/93888 shown

48277995

LIMIT 7 - Coupon valid through 5/4/19\*

## SCISSOR SUPER COUPON

# 20% OFF

ANY SINGLE ITEM\*

48248433

Limit 1 coupon per customer per day. Save 20% on any 1 item purchased. \*Cannot be used with other discount, coupon or any of the following items or brands: Inside Track Club membership, Extended Service Plan, gift card, open box item, 3 day Parking Lot Sale item, compressors, floor jacks, sales, saw mills, storage cabinets, chests or carts, trailers, trencher/backhoe, welders, Admiral, Ames, Bauer, Cobra, CoverPro, Daytona, Diamondback, Earthquake, Fischer, Hercules, Icon, Jupiter, Lynx, Poulton, Predator, Tailgator, Viking, Vulcan, Zurich. Not valid on prior purchases. Non-transferable. Original coupon must be presented. Valid through 5/4/19.

## BANKS

### 23 GAUGE PIN NAILER

Customer Rating ★★★★★

**NOW \$24.99**

COMPARE TO PORTER-CABLE \$119  
MODEL: PW138

**SAVE \$94**

ITEM 64143

48271167

LIMIT 3 - Coupon valid through 5/4/19\*

## drillmaster

### 1/4" TRIM ROUTER

Customer Rating ★★★★★

**NOW \$19.99**

COMPARE TO MAKITA \$99  
MODEL: RT0701C

**SAVE \$79**

ITEM 62659  
61626/44914 shown

48272297

LIMIT 6 - Coupon valid through 5/4/19\*

## CENTRAL MACHINERY

### UNIVERSAL STAND

Customer Rating ★★★★★

**NOW \$29.99**

COMPARE TO CRAFTSMAN \$41.99  
MODEL: 22305

**SAVE 28%**

ITEM 69805

48278696

LIMIT 6 - Coupon valid through 5/4/19\*

## U.S. GENERAL BEATS Snap-on\*

### 13 DRAWER DOUBLE BANK ROLLER CABINET

Customer Rating ★★★★★

**YOUR CHOICE \$449.99**

**RED**  
ITEM 64281  
64134/64133 shown

**BLUE**  
ITEM 64444  
64445/64446

**BLACK**  
ITEM 64441  
64442/64443

|                |                  |                |
|----------------|------------------|----------------|
| 41.9"          | WIDTH**          | 40"            |
| 14,000 CU. IN. | STORAGE CAPACITY | 14,529 CU. IN. |
| 2,600 LBS.     | WEIGHT CAPACITY  | 2,400 LBS.     |
| 291 LBS.       | CABINET WEIGHT   | 327 LBS.       |

**PRICE \$2,605**

**SAVE \$2,155**

48256186

LIMIT 4 - Coupon valid through 5/4/19\*

\*SNAP-ON KRA4813FPB0 stated specs  
\*\*Without including handles

## WARRIOR

### 29 PIECE TITANIUM DRILL BIT SET

Customer Rating ★★★★★

**NOW \$9.99**

COMPARE TO DEWALT \$64.99  
MODEL: DW1369

**SAVE 84%**

ITEM 5889/62281/61637 shown

48271461

LIMIT 9 - Coupon valid through 5/4/19\*

## CENTRAL MACHINERY

### 16" VARIABLE SPEED SCROLL SAW

Customer Rating ★★★★★

**NOW \$69.99**

COMPARE TO PORTER-CABLE \$199  
MODEL: PCB375SS

**SAVE \$129**

ITEM 62519/63283/93012 shown

48273269

LIMIT 3 - Coupon valid through 5/4/19\*

## CHICAGO ELECTRIC POWER TOOLS

### HEAVY DUTY MOBILE MITER SAW STAND

Customer Rating ★★★★★

- Rail system works with all makes of miter saw
- Heavy duty rollers support lumber to 16 ft. in length and loads to 400 lbs.
- Rugged tubular steel legs for extra-stable support
- Quick-release leg adjustment with levelers for uneven ground

**Supports 16 ft.**

**SAVE \$39**

COMPARE TO HITACHI \$139  
MODEL: UJ240F

**NOW \$99.99**

ITEM 63409/62750 shown

48272040

LIMIT 3 - Coupon valid through 5/4/19\*

## Grant's GARAGE

### SHOP TOWELS PACK OF 50

Customer Rating ★★★★★

**NOW \$9.99**

COMPARE TO VIKING \$17.98  
MODEL: 874900

**SAVE \$12.99**

ITEM 63365/64730/56119/63360 shown

48275490

LIMIT 6 - Coupon valid through 5/4/19\*

## PITTSBURGH

### 6" DIGITAL CALIPER

Includes two 1.5V SR44 button cell batteries.

Customer Rating ★★★★★

**NOW \$9.99**

COMPARE TO HUSKY \$29.97  
MODEL: 1467H

**SAVE 66%**

ITEM 63711/61585/62387/47257 shown

48281041

LIMIT 3 - Coupon valid through 5/4/19\*

## CHICAGO ELECTRIC POWER TOOLS

### 10", 15 AMP BENCHTOP TABLE SAW

Customer Rating ★★★★★

**NOW \$109.99**

COMPARE TO RYOBI \$229  
MODEL: RT322

**SAVE \$119**

ITEM 68827/63117/63118 shown

48281429

LIMIT 3 - Coupon valid through 5/4/19\*

Stand sold separately.



# SUPER COUPON

Customer Rating



**NOW \$299**

**SAVE \$300**

ITEM 63978



48281804

LIMIT 3 - Coupon valid through 5/4/19\*

## HERCULES BEATS DEWALT

## PROFESSIONAL 12" DOUBLE-BEVEL SLIDING COMPOUND MITER SAW

|                             |                                                             |                             |
|-----------------------------|-------------------------------------------------------------|-----------------------------|
| 15                          | AMPS                                                        | 15                          |
| 4100                        | RPM                                                         | 3800                        |
| 2 x 14                      | 90° CROSS-CUT CAPACITY (AGAINST FENCE)                      | 2 x 14**                    |
| 7-1/2"                      | VERTICAL CAPACITY: CROWN MOLDING VERTICALLY NESTED          | 7-1/2"                      |
| 6-3/4"                      | VERTICAL CAPACITY: BASEBOARD AGAINST FENCE                  | 6-3/4"                      |
| L:50° R:60°                 | MAX MITER CAPACITY (LEFT/RIGHT)                             | L:50° R:60°                 |
| YES                         | ADJUSTABLE STAINLESS STEEL DETENT PLATE W/10 POSITIVE STOPS | YES                         |
| YES                         | 12" x 60T CARBIDE TIP BLADE                                 | YES                         |
| 56 LBS.                     | WEIGHT                                                      | 56 LBS.                     |
| 1-YEAR MONEY BACK GUARANTEE | RETURN POLICY                                               | 90-DAY MONEY BACK GUARANTEE |

**\$399**

PRICE

**\$599**



DEWALT DWS780

\* DEWALT DWS780 stated specs  
\*\* 2x16 with back-fence design

# SUPER COUPON

**FREE**

WITH ANY PURCHASE  
**7 FUNCTION DIGITAL MULTIMETER**

- 3.5" LCD Display
- Battery Included

COMPARE TO PROSKIT \$1672  
ITEM 98025/30756/63604  
63758/63759/69096/90899 shown  
MODEL: MT-1210

48253011

Cannot be used with other discounts or prior purchases. Original coupon must be presented. Valid through 5/4/19 while supplies last. Limit 1 FREE GIFT per customer per day.

## CENTRAL PNEUMATIC

## 3 GALLON, 100 PSI OIL-FREE AIR COMPRESSORS

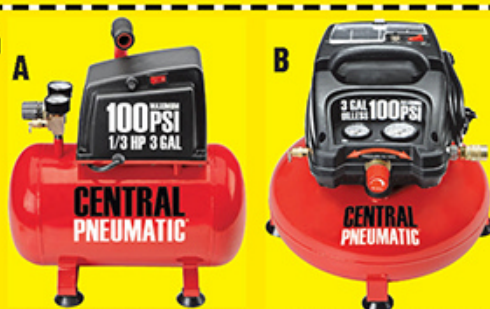
- A. HOT DOG  
ITEM 69269/97080 shown
- B. PANCAKE  
ITEM 61615/60637  
95275 shown



48283329

LIMIT 3 - Coupon valid through 5/4/19\*

SUPER COUPON



- Air delivery: 0.6 CFM @ 90 PSI, 1 CFM @ 40 PSI
- Low maintenance oil-free pump
- Built-in accessory storage
- Easy-to-read gauges
- Fully enclosed motor housing with easy carry handle
- Includes quick connect coupler
- Thermal overload protection

Customer Rating



**SAVE 59%**

**YOUR CHOICE \$39.99**

COMPARE TO PORTER-CABLE \$98.62  
MODEL: PCFP2063

## CENTRAL PNEUMATIC

Customer Rating



3/8" x 50 FT. RETRACTABLE AIR HOSE REEL



**SAVE \$39**

COMPARE TO KOBALT \$99  
MODEL: SBY-AIR184

ITEM 46320/69265/62344/64685/93897 shown



48285195

LIMIT 4 - Coupon valid through 5/4/19\*

## CENTRAL MACHINERY

## 14" OSCILLATING SPINDLE SANDER

Customer Rating



**NOW \$109.99**

**SAVE \$55**

COMPARE TO TRITON TOOLS \$165.71  
MODEL: TSP3450

ITEM 62146/69257 shown



48286048

LIMIT 4 - Coupon valid through 5/4/19\*



## HARDY

## MECHANIC'S GLOVES

Customer Rating

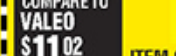


**NOW \$4.99**

**SAVE 54%**

COMPARE TO VALEO \$11.02  
MODEL: 25521

ITEM 62434, 62426, 62433, 62432, 62429, 64178, 64179, 62428 shown



48286604

LIMIT 9 - Coupon valid through 5/4/19\*



## FRANKLIN

## 17 FT. TYPE IA MULTI-TASK LADDER

- Versatile - 24 configurations
- Safe + Secure + Stable
- Super Strong - Holds 300 lbs.
- Weighs 34 lbs.

**NOW \$109.99**

**SAVE \$189**

COMPARE TO LITTLE GIANT \$298.99  
MODEL: XE M17

ITEM 67646/63418/63419/63417 shown



48288543

LIMIT 5 - Coupon valid through 5/4/19\*



OSHA/ANSI COMPLIANT

## PITTSBURGH

## 4 PIECE WOOD CHISEL SET WITH CLEAR PVC HANDLE



Customer Rating



**NOW \$4.99**

**SAVE 83%**

COMPARE TO DEWALT \$29.97  
MODEL: DWHT16063

ITEM 42429/69471 shown



48294372

LIMIT 9 - Coupon valid through 5/4/19\*

## VOYAGER

## 15" WIDE MOUTH TOOL BAG

Customer Rating



**NOW \$6.99**

**SAVE 58%**

COMPARE TO HUSKY \$16.97  
MODEL: B23035N12

ITEM 62348/62341/61469 shown



48297983

LIMIT 8 - Coupon valid through 5/4/19\*



Tools sold separately.

## CHICAGO ELECTRIC WELDING

## MIG/FLUX WELDING CART

Customer Rating



**NOW \$299**

**SAVE \$74**

COMPARE TO FORNEY \$104.19  
MODEL: 117535099

ITEM 61316/60790/69340 shown



48300704

LIMIT 5 - Coupon valid through 5/4/19\*



## CHICAGO ELECTRIC POWER TOOLS

## RECIPROCATING SAW WITH ROTATING HANDLE

Customer Rating



**NOW \$19.99**

**SAVE 66%**

COMPARE TO PORTER-CABLE \$59.98  
MODEL: PC360

ITEM 65570/61884/62370 shown



48308441

LIMIT 7 - Coupon valid through 5/4/19\*



Blade sold separately.

## PITTSBURGH

## 50" CLAMP AND CUT EDGE GUIDE



Customer Rating



**NOW \$14.99**

**SAVE 62%**

COMPARE TO BORA \$39.98  
MODEL: 543050

ITEM 66581



48308742

LIMIT 7 - Coupon valid through 5/4/19\*

## WARRIOR

## 18 PIECE, 3/4" - 5" CARBON STEEL HOLE SAW SET

Customer Rating



**NOW \$9.99**

**SAVE 89%**

COMPARE TO KOBALT \$96.90  
MODEL: 9224

ITEM 69073/68115 shown



48315756

LIMIT 8 - Coupon valid through 5/4/19\*



## SUPER COUPON

## 4 PIECE ANTI-FATIGUE FOAM MAT SET

Customer Rating



**NOW \$6.99**

**SAVE 65%**

COMPARE TO NORSK \$19.99  
MODEL: 001113246

ITEM 40187/61607/62389/94635 shown



48315792

LIMIT 8 - Coupon valid through 5/4/19\*



## HERCULES

## 12", 80 TOOTH ULTRA FINISH CARBIDE TIP SAW BLADE

Customer Rating



**NOW \$49.99**

**SAVE 16%**

COMPARE TO DEWALT \$59.98  
MODEL: DW2222PTX

ITEM 63802



48317602

LIMIT 5 - Coupon valid through 5/4/19\*



\*Original coupon only. No use on prior purchases after 30 days from original purchase or without original receipt. Valid through 5/4/19.

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



## SUPER COUPON

### FREE

WITH ANY PURCHASE

**PITTSBURGH**

**6 PIECE SCREWDRIVER SET**

- Magnetic Tips
- Ergonomic Handles

COMPARE TO **\$7.97**  
HUSKY MODEL: 20210003

ITEM 47770/62583/62728/62570 shown

48249170

Cannot be used with other discounts or prior purchases. Original coupon must be presented. Valid through 5/4/19 while supplies last. Limit 1 FREE GIFT per customer per day.

## PITTSBURGH

### SUPER COUPON

**9 PIECE FULLY POLISHED COMBINATION WRENCH SETS**

Customer Rating **★★★★★**

**YOUR CHOICE**

**\$5.99**

Item 42305 shown

**SAVE 86%**

COMPARE TO **\$17.97**  
HUSKY MODEL: HCW10PCSAE

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

48323112

LIMIT 4 - Coupon valid through 5/4/19

## Pierce BEATS HITACHI

### SUPER COUPON

Customer Rating **★★★★★**

**2", 18-GAUGE BRAD NAILER**

|            |                                       |           |
|------------|---------------------------------------|-----------|
| YES        | ACCEPTS 5/8" TO 2" 18-GAUGE FASTENERS | YES       |
| YES        | DEPTH OF DRIVE DIAL                   | YES       |
| YES        | TOOL-LESS EASY TO CLEAR NOSE          | YES       |
| YES        | LIGHTWEIGHT ALUMINUM BODY             | YES       |
| YES        | CARRYING CASE INCLUDED                | YES       |
| SEQUENTIAL | TOOL ACTUATION MODES                  | SELECTIVE |

**\$59.99** **PRICE** **\$69.98**

ITEM 64255

48333556

LIMIT 5 - Coupon valid through 5/4/19

HITACHI NT50AE2

\*HITACHI NT50AE2 stated specs.

## CENTRAL PNEUMATIC

### SUPER COUPON

**21 GALLON, 2.5 HP, 125 PSI VERTICAL OIL-LUBE AIR COMPRESSOR**

- Air delivery: 5.8 CFM @ 40 PSI, 4.7 CFM @ 90 PSI

Customer Rating **★★★★★**

**NOW \$149.99**

COMPARE TO **\$229**  
HUSKY MODEL: C201H

SAVE **\$79**

ITEM 61454/69091/62803/63635/67847 shown

48335937

LIMIT 3 - Coupon valid through 5/4/19

## SUPER COUPON

**TILTING FLAT PANEL TV MOUNT**

Customer Rating **★★★★★**

**HOLDS FLAT SCREEN TV, UP TO 70 INCHES**

**NOW \$14.99**

COMPARE TO **\$99.99**  
ROCKETFISH MODEL: RF-TVMLPT03

SAVE **\$85**

ITEM 62289/61807 shown

48340033

LIMIT 6 - Coupon valid through 5/4/19

## PREDATOR

### SUPER COUPON

**4000 MAX. STARTING/3200 RUNNING WATTS 6.5 HP (212 CC) GAS GENERATOR**

Customer Rating **★★★★★**

**10 hour run time**

**NOW \$289.99**

COMPARE TO **\$339.99**

Wheel kit sold separately. **SAVE \$1,609**

COMPARE TO **\$1,899**  
HONDA MODEL: EB4000

ITEM 63080/69729/63079 shown

ITEM 63089/63090, CALIFORNIA ONLY

48352668

LIMIT 4 - Coupon valid through 5/4/19

## PITTSBURGH

### SUPER COUPON

**60 ALUMINUM F-STYLE BAR CLAMP**

Customer Rating **★★★★★**

**NOW \$10.99**

COMPARE TO **\$47.95**  
SHOP FOX MODEL: D2468

SAVE **77%**

ITEM 60673

48352689

LIMIT 6 - Coupon valid through 5/4/19

## drillmaster

### SUPER COUPON

**80 PIECE ROTARY TOOL KIT**

Customer Rating **★★★★★**

**NOW \$6.99**

COMPARE TO **\$26.35**  
PROFESSIONAL WOODWORKER MODEL: 51832

SAVE **73%**

ITEM 68986/63235/63292/97626 shown

48361548

LIMIT 9 - Coupon valid through 5/4/19

## KRAUSE & BECKER

### SUPER COUPON

**AIRLESS PAINT SPRAYER KIT**

Customer Rating **★★★★★**

**NOW \$169.99**

COMPARE TO **\$214.99**

COMPARE TO **\$299**  
GRACO MODEL: 262800

SAVE **\$129**

ITEM 62915/60600 shown

48369160

LIMIT 4 - Coupon valid through 5/4/19

## SUPER COUPON

**200 LUMENS LED SUPER BRIGHT FLIP LIGHT**

- Wireless, tool-free and easy installation

Customer Rating **★★★★★**

**NOW \$2.99**

COMPARE TO **\$4.99**

COMPARE TO **\$6**  
PROMIER MODEL: SW-SWITCH-12/24

SAVE **50%**

ITEM 64189/64723/63922 shown

48376408

LIMIT 4 - Coupon valid through 5/4/19

## CHICAGO ELECTRIC WELDING

### SUPER COUPON

**125 AMP FLUX-CORE WELDER**

Customer Rating **★★★★★**

**NOW \$99.99**

COMPARE TO **\$114.99**

COMPARE TO **\$149.99**  
IRON TON MODEL: 45433

SAVE **\$50**

ITEM 63583/63582 shown

48376474

LIMIT 3 - Coupon valid through 5/4/19

## HaulMaster

### SUPER COUPON

**18" WORKING PLATFORM STEP STOOL**

Customer Rating **★★★★★**

- 350 lb. capacity

**NOW \$19.99**

COMPARE TO **\$51.45**  
GPL MODEL: H-21

SAVE **61%**

ITEM 62515/66911 shown

12306706

LIMIT 4 - Coupon valid through 5/4/19

## SUPER COUPON

**EAR MUFFS**

Customer Rating **★★★★★**

**NOW \$3.99**

COMPARE TO **\$16.06**  
MORRIS PRODUCTS MODEL: 53216

SAVE **75%**

ITEM 94334

48378048

LIMIT 6 - Coupon valid through 5/4/19

## ADMIRAL

### SUPER COUPON

**12", 80 TOOTH FINISHING SAW BLADE**

Customer Rating **★★★★★**

**NOW \$24.99**

COMPARE TO **\$59.98**  
DEWALT MODEL: DW3232PTX

SAVE **58%**

ITEM 62725

48382737

LIMIT 4 - Coupon valid through 5/4/19

## drillmaster

### SUPER COUPON

**1500 WATT DUAL TEMPERATURE HEAT GUN (572°/1112°)**

Customer Rating **★★★★★**

**NOW \$8.99**

COMPARE TO **\$28.06**  
BLACK & DECKER MODEL: HG1300

SAVE **67%**

ITEM 62340/62546/63104/96289 shown

48382915

LIMIT 9 - Coupon valid through 5/4/19

## CENTRAL PNEUMATIC

### SUPER COUPON

**20 OZ. GRAVITY FEED AIR SPRAY GUN**

Customer Rating **★★★★★**

- 1.4mm tip included

**NOW \$9.99**

COMPARE TO **\$49.98**  
KOBALT MODEL: SGY-AIR88TZ

SAVE **80%**

ITEM 67181/62300/47016 shown

48390192

LIMIT 8 - Coupon valid through 5/4/19

## BUNKER HILL SECURITY

### SUPER COUPON

**60 LED SOLAR SECURITY LIGHT**

Customer Rating **★★★★★**

**NOW \$29.99**

Includes 6V, 900 mAh NiCd battery pack.

COMPARE TO **\$59.99**  
SUNFORCE MODEL: 82123

SAVE **50%**

ITEM 62534/56213/69643 shown

48392863

LIMIT 5 - Coupon valid through 5/4/19

## CENTRAL PNEUMATIC

### SUPER COUPON

**3" HIGH SPEED AIR CUT-OFF TOOL**

Customer Rating **★★★★★**

**NOW \$5.99**

COMPARE TO **\$18.35**  
SPEEDWAY MODEL: 7625

SAVE **67%**

ITEM 60243/47077/69473/60374 shown

48394273

LIMIT 5 - Coupon valid through 5/4/19

## WINDSOR DESIGN

### SUPER COUPON

**DOVETAIL JIG**

Customer Rating **★★★★★**

**NOW \$27.99**

COMPARE TO **\$46.99**  
GENERAL TOOLS MODEL: 861

SAVE **40%**

ITEM 34102

48398400

LIMIT 4 - Coupon valid through 5/4/19



**SCISSOR SUPER COUPON**

# FREE

WITH ANY PURCHASE

## HEAVY DUTY BATTERIES

PACK OF 24

- Long Lasting, Reliable Power

**THUNDERBOLT MAGNUM**

YOUR CHOICE

AA  
ITEM 61323/68382  
61675 shown

AAA  
ITEM 61677  
61273/68377

**\$778**  
VALUE

48254687

Cannot be used with other discounts or prior purchases. Original coupon must be presented. Valid through 5/4/19 while supplies last. Limit 1 FREE GIFT per customer per day.

**SCISSOR SUPER COUPON**

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

Customer Rating ★★★★★

**NOW \$299**

COMPARE TO **\$998** **SAVE 70%**

BLUE HAWK MODEL: 88X10-Y

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

48398608

LIMIT 9 - Coupon valid through 5/4/19\*

**SCISSOR SUPER COUPON**

WINDSOR DESIGN **BEATS GRIZZLY\***

## 60" WOOD WORKBENCH

Customer Rating ★★★★★

**NOW \$129.99**

SAVE \$295

ITEM 63395  
93454/69054/62603 shown

|     |                    |     |
|-----|--------------------|-----|
| 60" | TABLE WIDTH        | 60" |
| 4   | DRAWER COUNT       | 2   |
| YES | HARDWOOD           | YES |
| YES | WOOD BLOCK VISE    | YES |
| YES | FELT LINED DRAWERS | YES |

**\$159.99** PRICE **\$425**

GRIZZLY H7723

\* GRIZZLY H7723 stated specs.

48401152

LIMIT 5 - Coupon valid through 5/4/19\*

**CENTRAL MACHINERY**

**SCISSOR SUPER COUPON**

## 8", 5 SPEED BENCHTOP DRILL PRESS

Customer Rating ★★★★★

**NOW \$54.99**

SAVE \$55

COMPARE TO **\$110.95**

BUFFALO BLACK MODEL: DP5UL

ITEM 62520/60238 shown

48401628

LIMIT 4 - Coupon valid through 5/4/19\*

**WINDSOR DESIGN**

**SCISSOR SUPER COUPON**

## 11 PIECE WOOD CARVING SET

Customer Rating ★★★★★

**NOW \$5.99**

SAVE 33%

ITEM 60655/56186/62673 shown

48405561

LIMIT 9 - Coupon valid through 5/4/19\*

**SCISSOR SUPER COUPON**

## 16" x 30" TWO SHELF STEEL SERVICE CART

Customer Rating ★★★★★

**NOW \$29.99**

SAVE 61%

COMPARE TO **\$78.43**

EDSAL MODEL: SC2016

ITEM 60390/5107 shown

48406136

LIMIT 4 - Coupon valid through 5/4/19\*

**PITTSBURGH**

**SCISSOR SUPER COUPON**

## CLICK-TYPE TORQUE WRENCHES

Customer Rating ★★★★★

**LIFETIME WARRANTY**

- Reversible

DRIVE ITEM

|      |                  |
|------|------------------|
| 1/4" | 61277/63881/2696 |
| 3/8" | 61276/63880/807  |
| 1/2" | 62431/63882/239  |

Item 239 shown

COMPARE TO **\$84.97** **SAVE 88%**

HUSKY MODEL: H20TWA

**\$19.99**

YOUR CHOICE **\$9.99**

48415619

LIMIT 4 - Coupon valid through 5/4/19\*

**BRAUN**

**SCISSOR SUPER COUPON**

## 5000 LUMENS LED HANGING SHOP LIGHT

Customer Rating ★★★★★

**NOW \$19.99**

NEW

46-3/8"

**SAVE 33%**

ITEM 64410

48416591

LIMIT 6 - Coupon valid through 5/4/19\*

**luminar OUTDOOR**

**SCISSOR SUPER COUPON**

## 24 FT., 18 BULB, 12 SOCKET OUTDOOR STRING LIGHTS

Customer Rating ★★★★★

**NOW \$19.99**

COMPARE TO **\$54.98** **SAVE 63%**

PORTFOLIO MODEL: SLC12BK

ITEM 64486  
63483 shown

48419184

LIMIT 6 - Coupon valid through 5/4/19\*

**drillmaster**

**SCISSOR SUPER COUPON**

## 1/4" SHEET ORBITAL PALM SANDER

Customer Rating ★★★★★

**NOW \$9.99**

SAVE 66%

COMPARE TO **\$29.98**

BLACK & DECKER MODEL: BDEQS300

ITEM 61509  
61311 shown

48420884

LIMIT 5 - Coupon valid through 5/4/19\*

**HYDROSTAR**

**SCISSOR SUPER COUPON**

## 50 FT. COMPACT ELECTRIC DRAIN CLEANER

Customer Rating ★★★★★

**NOW \$199.99**

COMPARE TO **\$398.95** **SAVE \$198**

COBRA MODEL: 90041

ITEM 61856  
68285 shown

48422162

LIMIT 4 - Coupon valid through 5/4/19\*

**HaulMaster**

**SCISSOR SUPER COUPON**

## 9" x 72" STEEL LOADING RAMPS SET OF TWO

Customer Rating ★★★★★

**NOW \$39.99**

COMPARE TO **\$80.53** **SAVE 50%**

MAXXTOW MODEL: MT70120

ITEM 69591  
69646/44649 shown

48425873

LIMIT 4 - Coupon valid through 5/4/19\*

**CENTECH**

**SCISSOR SUPER COUPON**

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

Customer Rating ★★★★★

**NOW \$29.99**

SAVE 50%

COMPARE TO **\$59.99**

SCHUMACHER ELECTRIC MODEL: SE-1250

ITEM 60581  
3418/60653 shown

48429068

LIMIT 5 - Coupon valid through 5/4/19\*

**Apache**

**SCISSOR SUPER COUPON**

## ULTRA-LIGHT, CRUSH PROOF WEATHER-RESISTANT LOCKABLE CASE

Customer Rating ★★★★★

**NOW \$22.99**

13-3/4" L  
11-1/2" W  
5-7/8" H

COMPARE TO **\$73.18** **SAVE 68%**

PELICAN MODEL: 1400

ITEM 64551  
63926 shown

48429605

LIMIT 5 - Coupon valid through 5/4/19\*

**SCISSOR SUPER COUPON**

## TWO-TIER COLLAPSIBLE EASY-STORE STEP LADDER

Customer Rating ★★★★★

**NOW \$19.99**

225 lb. capacity

COMPARE TO **\$33.88** **SAVE 40%**

WERNER MODEL: S322A-1

ITEM 67514

48430747

LIMIT 4 - Coupon valid through 5/4/19\*

**SCISSOR SUPER COUPON**

## DUST AND PARTICLE MASKS PACK OF 5

Customer Rating ★★★★★

**NOW 99¢**

SAVE 87%

COMPARE TO **\$7.81**

ACME UNITED MODEL: ACM13259

ITEM 62606  
63723/50027 shown

48435370

LIMIT 9 - Coupon valid through 5/4/19\*

**CHICAGO ELECTRIC POWER TOOLS**

**SCISSOR SUPER COUPON**

## 4" BISCUIT PLATE JOINER

Customer Rating ★★★★★

**NOW \$44.99**

COMPARE TO **\$179** **SAVE \$134**

MAKITA MODEL: PJ7000

ITEM 68987

48435979

LIMIT 5 - Coupon valid through 5/4/19\*

**HaulMaster**

**SCISSOR SUPER COUPON**

## 1000 LB. CAPACITY SWING-BACK TRAILER JACK

Customer Rating ★★★★★

**NOW \$17.99**

Height range: 12-1/2" to 24"

COMPARE TO **\$45.99** **SAVE 60%**

REESE MODEL: 74410

ITEM 69780/41005 shown

48436521

LIMIT 4 - Coupon valid through 5/4/19\*

**PITTSBURGH**

**SCISSOR SUPER COUPON**

## 12" RATCHET BAR CLAMP/SPREADER

Customer Rating ★★★★★

**LIFETIME WARRANTY**

**NOW \$2.99**

COMPARE TO **\$19.98** **SAVE 85%**

IRWIN MODEL: 1964718

ITEM 62123/63017/69222 shown

48439831

LIMIT 4 - Coupon valid through 5/4/19\*

\*Original coupon only. No use on prior purchases after 30 days from original purchase or without original receipt. Valid through 5/4/19.

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



# TOOLS & MATERIALS

NEW AND NEXT

## Bandsaw offers fully variable speed

Smart DVR controller with 1¾-hp motor, no. 13-926, \$630

Rikon Power Tools has added a direct-variable-resistance (DVR) motor, with electronic controller, as an accessory for its 14" bandsaws. This new package retrofits to six Rikon bandsaw models and provides the ability to adjust the blade speed anywhere from 100 rpm (45 surface feet per minute) to 2,375 rpm (4,400 sfpm). Rikon says cutting at faster speeds produces a cleaner cut with continuous torque. And this system, they say, provides faster electronic braking at shutdown.

Rikon Power Tools  
877-884-5167, rikontools.com



## Skilsaw launches worm-drive slider

12" sliding compound mitersaw, no. SPT88-01, \$579

The pioneer of the circular saw, Skilsaw has adapted its worm-drive technology to a corded 12" sliding dual-bevel mitersaw. This saw features a 15-amp motor with electric brake, 60° right-side miter capacity and 50° left with 11 detents, 48° bevel capacity left and right with nine stops, and table extensions to support workpieces. LEDs shine down both faces of the blade, creating an alignment shadow that indicates where the saw kerf will be cut.

Skilsaw  
877-754-5729, skilsaw.com





# NEW Rechargeable Digital Hearing Aid Technology Only \$229!\*

(\*Each when you buy a pair)

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

## 5 Star Reviews! ★★★★★

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

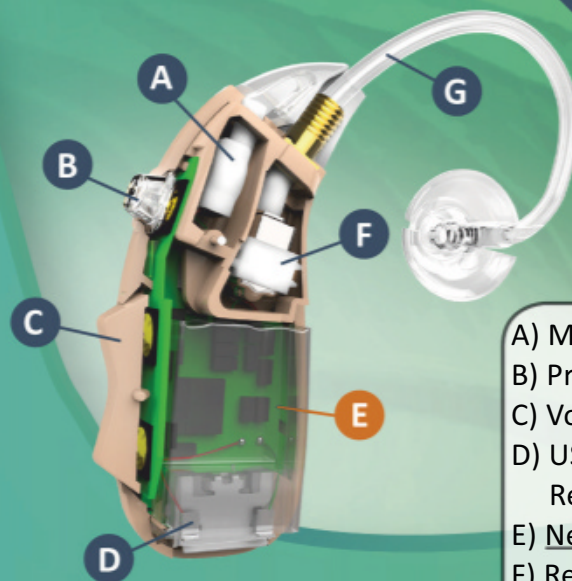


## HCR3 Features!

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

## Even Better In Pairs!

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



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

New Improved  
R3 Digital Processor™!

**Simple.  
Affordable.**

## Rechargeable Digital Hearing Aid - For Only \$229!\*

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

Your new HearClear HCR3 hearing aids work at a fraction of the cost of name-brand hearing aids, and you don't have to keep changing the batteries! You will love the discreet, comfortable, lightweight Open-fit design.

The HCR3 is **shipped directly to you and pre-programmed for most hearing losses.** It will help you hear better right out of the box and does not require professional appointments to make costly adjustments.

You can spend thousands for an expensive hearing aid, or you can spend just \$249 for a hearing aid that is great for most hearing losses (**only \$229 each when you buy a pair – hear up to 3 times better than wearing just one**). We are so sure you will love your hearing aids that we offer a **100% Money Back Guarantee - Risk Free** if you are not satisfied for any reason.

**NOW ON SALE!**

~~List Price: \$849~~  
**Sale Price: \$229\***

**MONEY SAVING OFFER!**

Use Coupon Code: **WD93**

**1-888-531-0672**

**\*Only \$229 Each When You Buy A Pair!**  
(Coupon Code & Price Valid For A Limited Time Only)



**The HCR3**



Visit and Save: [www.AdvancedHearing.com/WD93](http://www.AdvancedHearing.com/WD93)



# It's Enough to Make You Blue in the Face

Time to take a stand against overpriced watches with the Stauer Urban Blue, **now only \$29.**

You need a new watch...the one you are wearing was made when Nixon was in office, but extravagantly-priced watches that add zeros just because of a high falootin' name are an insult to your logic. It's time to put an end to such madness. It's absolutely possible to have the highest quality, precision classic timepiece without the high and mighty price tag. Case in point: The Stauer Urban Blue.

**Packed with high-end watch performance and style, minus the high-end price tag.** It's everything a high-end watch should be: Sturdy stainless steel and genuine leather construction. Precision timing that's accurate to four seconds a day—that's more precise than a 27-jewel automatic watch priced at over \$6,000. And, good looking—with simple, clean lines and a striking metallic blue face.

*"Blue watches are one of the growing style trends seen in the watch world in the past few years"*—WATCHTIME®

Precision movement • Stainless steel caseback and crown • Cotswold® mineral crystal • Date window  
• Water resistant to 3 ATM • Genuine leather band fits wrists 6 ¾"–8 ¾"

So, while we're busy revolutionizing the watch industry to bring you more real value, you can take your own stand against overpriced watches with the *Urban Blue*.

**Your satisfaction is 100% guaranteed.** Wear the *Urban Blue* for 30 days. If you're not convinced that you achieved excellence for less, send it back for a refund of the item price.

The *Urban Blue* is one of our fastest sellers. It takes six months to engineer this watch so don't wait. Take a stand against overpriced watches in impeccable style. **Limited to the first 1900 responders to this ad only.** Don't miss out...call today!

**Stauer Urban Blue Watch** ~~\$199~~  
Offer Code Price **\$29** + S&P **Save \$170**

**1-800-333-2045**

**Your Insider Offer Code: UBW423-02**

You must use this insider offer code to get our special price.



*"Are you kidding? What a great watch at a ridiculous price. Thank you Stauer!"*  
— Gitto, Hicksville NY

**Stauer®**



Rating of A+



14101 Southcross Drive W., Ste 155, Dept. UBW423-02  
Burnsville, Minnesota 55337 [www.stauer.com](http://www.stauer.com)

† Special price only for customers using the offer code versus the price on Stauer.com without your offer code.

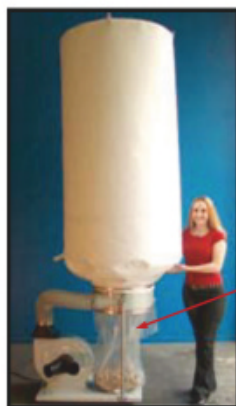
Woodworker's Marketplace

**Can Your Old Dust Collector  
Work Better Than A New One?**



*Cyclones,  
Stand-Alones,  
Baghouses & more*

**Yes, With Optimized Filters From...**



- Optimum Performance
- Low Maintenance
- Custom Designs
- Cleaner Air
- Longer Life
- Economical
- Best Size & Fit
- Proudly Made in USA

6 Mil Poly Bags  
In Stock!

*We Design & Fabricate Custom Filter  
Bags That REALLY WORK!*

**American Fabric Filter Co.**  
(800) 367-3591 [americanfabricfilter.com](http://americanfabricfilter.com)

**The Woodturner's Source**

1-800-683-8876  
[packardwoodworks.com](http://packardwoodworks.com)



**PERFECT FOR SLAB MAKING!**

**MEGA DADO**

EXCLUSIVE PLANER ROUTER BIT

*"This bit was fantastic. It cut with almost no tearout, even around the knots and irregularities. After the two slabs were flattened, the bit was still sharp."*

Nick Offerman, Fine Woodworking, No. 222

Shop 1000's of  
Innovative Tools!

**INFINITY**  
CUTTING TOOLS

- 2+2 Shear Angle Geometry
- 2" Cutter Diameter
- 1" Cutter Height



WATCH  
VIDEO  
ONLINE!



Item: 52-506

[INFINITYTOOLS.COM](http://INFINITYTOOLS.COM) • 877-USA-BITS



# Baltic Birch Plywood

Easy Shipping & Great Pricing

- ✓ 1/8" to 3/4" thick always in stock
- ✓ Choose your width & lengths
- ✓ No minimum order!
- ✓ Fast & friendly service



Secure Online Ordering

[www.BalticBirchPly.com](http://www.BalticBirchPly.com)

Woodworkers Source 800-423-2450

VISA MasterCard American Express PayPal



## MAKE MONEY WITH YOUR WOODSHOP

### THIS MONTH'S SPECIAL

2 Territories for the Price of 1

- Perfect for both beginning woodworkers and experts alike
- Recover your investment with ease
- Ranked A+ by the BBB

ACT TODAY to see if your territory is available

MAKE \$500 A DAY

[1800bunkbed.com](http://1800bunkbed.com)

**1800BunkBed**

It's Your Business!



# 25 OUTDOOR PLANS FOR \$25!



We've packed our top downloadable outdoor plans into one yard-transforming bundle. Save more than \$230 on plans for shade-casting arbors, eye-catching planters, feet-easing seating, and more.

Reclaim your outdoors, for a limited time, at

[woodmagazine.com/25for25outdoor](http://woodmagazine.com/25for25outdoor).

Instructional DVD & Supplies



## Learn Metal Inlay

[www.metal-inlay.com](http://www.metal-inlay.com)

570-937-9400



**ROCKLER**  
WOODWORKING AND HARDWARE

Create with Confidence™



Get your **FREE** catalog today at [rcklr.co/780](http://rcklr.co/780) or call **1-800-279-4441** (Code 780).

## RENEW Your Driveway...



...with the amazing **DR® POWER GRADER!**

**SAVES YOU MONEY**—loosens and redistributes existing material, saving you from purchasing new gravel or stone.

**EASY TO USE**—tows behind your ATV or riding mower, filling in potholes and ruts.

**PRECISE CONTROL** of grading depth is adjustable from your driver's seat.

**AMAZINGLY DURABLE** carbide teeth last 10X longer than steel on ordinary box scrapers.

**FREE SHIPPING 6 MONTH TRIAL**

SOME LIMITATIONS APPLY

Go Online or Call for **FREE Catalog!**

[DRpowergrader.com](http://DRpowergrader.com)

TOLL FREE **888-340-8923**



19829X © 2018



## CUTTING BOARD OIL

Try for only

**\$8.99** + FREE SHIPPING  
**amazon**

[walrusoil.com](http://walrusoil.com)

417-848-8598



Photo Demo by  
BOH Small Batch Woodshop



# WHAT'S AHEAD

A GLIMPSE INSIDE THE  
MAY ISSUE (ON SALE MARCH 1)



## One-wall workshop: Phase One

This workbench and mitersaw station pack maximum functionality into a minimal footprint. They're the start of a comprehensive, compact shop system we'll roll out over the next few issues.



**The best finish you've never tried**  
Shellac imparts deep luster, builds and dries quickly, and seals practically anything. Learn how to use this do-it-all finish.



## Tool test: Tracksaws

These hyperaccurate saw-and-guide systems may turn your tablesaw into a dust collector.



## Floating desk clock

The exotic-wood veneered face seems to levitate within its frame!



## Entry door

Why buy when you can build your own warm, welcoming entryway? One of our most-requested projects!

Better Homes & Gardens® WOOD® magazine (ISSN-0743-894X); March 2019, Volume 36, No. 1, is published 7 times a year in March, May, July, Sept, Oct, Nov, Dec/Jan by Meredith Corporation, 1716 Locust Street, Des Moines, IA 50309-3023. Periodicals postage paid at Des Moines, IA, and at additional mailing offices. Subscription prices: \$29.99 per year in the U.S.; \$44.99 (U.S. dollars) in Canada; \$49.99 (U.S. dollars) overseas. POSTMASTER: Send all UAA to CFS. (See DMM 507.1.5.2); NON-POSTAL AND MILITARY FACILITIES: Send address corrections to Better Homes & Gardens WOOD, PO Box 37508, Boone, IA 50037-0508. In Canada: mailed under Publications Mail Sales Product Agreement No. 40069223; Canadian BN 12348 2887 RT. Your bank may provide updates to the card information we have on file. You may opt out of this service at any time. All rights reserved. Printed in the U.S.A.





Dog Pen Kit



Firefighter Pen Kit



Bolt Action Pen Kit



Crochet Hook Kit



Measuring Spoon Kits

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



## “Wow! You Made Those”

**Dog Click Pen Kit** Always be reminded of your best friend - everywhere you go. Inspired everything doggie including a classic dog bowl with biscuit detail as the pen top, a bone treat clip, engraved paw prints around the tip and backend and “I LOVE MY DOG” is engraved below the paw prints on the tip.

### **3 Dog Pen Kit Starter Set**

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

**#PKDOGS SAVE \$12 Only \$47.75**

**Bolt Action Pen Kit** Our best-selling pen kits enjoy a huge following in the pen making community. It's beloved for its realistic bolt-action handle that smoothly advanced and retracts to securely lock the refill in place. Includes a bolt-action rifle clip and replica 30 caliber cartridge and rose gold tip for added authenticity.

### **3 Bolt Action Pen Kit Starter Set**

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

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

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

**#PKMSPN Only \$19.95**

**Firefighter “Push and Lock” Pen Kit** Create a gift to show your support for any firefighter. The clip represents a Firefighter's ladder and Maltese Cross, the pen end depicts the silhouette of a firefighter holding a hose with the words, “Honor” “Bravery” “Duty” and “Dedication”. And the cool “push and lock” mechanism even emulates an American fire hose.

### **3 Firefighter Pen Kit Starter Set**

You get one of each pen kit in Chrome and Red (shown above), Antique Brass and Polished Brass and Red. Plus you get the bushings and drill bit you need to make the pens.

**#PKFIRES SAVE \$20 Only \$77.75**

**Crochet Hook Kit Set** Here is the perfect gift for any of the 38 million crocheters and knitters in the USA! With this tool your recipient can make loops in thread or yarn and to interlock them into crochet stitches. The interchangeable handle will let you quickly swap out hooks we've included and you can flip the hooks to easily store into its handle. The set includes hardware to make 1 handle and 6 interchangeable metal crochet hooks. Sizes; C/2 - 2.75mm; D3 - 3.25mm; E4 - 3.5mm; F5 - 3.75mm; G/6 - 4mm and H/8 - 5mm.

**#PKCROCHET Only \$24.95**

**Penn State Industries**  
Top Quality, Great Prices and Expert Advice!

1-800-377-7297 • [www.pennstateind.com](http://www.pennstateind.com)