10th ANNIVERSARY

$10,000 BLOCKBUSTER SWEEPSTAKES *Details p.28*

WOODCRAFT® magazine

Projects, Techniques, and Products

Hand Plane Showcase *p.41*

MORE PROJECTS

- *Holiday Carousel*
- *Toy Bulldozer*
- *Votive Candle Stands*

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- ***10** Essential Sharpening Tips*
- ***10** Best-Ever Tips & Tricks*

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- Cutting capacity/throat: 16¼"
- Max. cutting height: 12⅛"
- Blade size: 131½" L (⅛"–1" W)
- Blade speeds: 1700 & 3500 FPM
- Quick-release blade tension lever
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- Precision-ground cast iron table size: 26¾" x 19"
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- Cutting capacity/throat: 18¼"
- Max. cutting height: 12"
- Blade size: 143" L (⅛"–1¼" W)
- Blade speeds: 1700 & 3500 FPM
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- Capacity: 3⅛" @ 90°, 2³⁄₁₆" @ 45°
- Rip capacity: 30" R, 12" L
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- Cutting capacity: 25⅝" R, 8" L
- Max. depth of cut: 3" @ 90°, 2⅛" @ 45°
- Approx. shipping weight: 550 lbs.

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- Max. dado width: 13/16"
- Approx. shipping weight: 557 lbs.

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3 HP LEESON® MOTOR!

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- Motor: 1 HP, 110V, single-phase, 6.9A
- 1725 RPM spindle speed (no load)
- 19 11/16" diameter cast iron table
- Spindle oscillation: 52 OPM
- 3 Rubber sanding drums: ¾" x 4½", 2" x 9", and 3" x 9"
- 3 Sanding sleeves: ¾" x 4½", 2" x 9", and 3" x 9"
- Table inserts: 6
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- Dust port: 2"
- Toggle ON/OFF safety switch with locking tab
- Includes two wrenches for easy spindle changes
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12" JOINTER/PLANER COMBINATION MACHINES

- Motor: 5 HP, 220V, single-phase
- Jointer table size: 14" x 59½"
- Cutterhead dia.: 3⅛"
- Cutterhead speed: 5034 RPM
- Max. jointer depth of cut: ⅛"
- Max. width of cut: 12"
- Planer feed rate: 22 FPM
- Max. planer depth of cut: ⅛"
- Max. planer cutting height: 8"
- Planer table size: 12¼" x 23⅛"
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- Surface speed of drum: 2300 FPM
- Handles stock up to 23½" wide and 4¼" thick
- ¼ HP Conveyor motor provides 11 FPM feed rate
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- Sanding drum size: 6"
- All steel and ball bearing construction
- Two 4" dust ports for easy hook-up to a collection system
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- Approximate shipping weight: 442 lbs.

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- Motor: 1½ HP, 110V/220V, single-phase, TEFC, 1725 RPM, prewired 110V
- Amps: 14A at 110V, 7A at 220V
- Table size: 19" x 12½" • Vertical spindle travel: 9"
- Head vertical travel: 3" • Table longitudinal travel: 14½"
- Table cross travel: 3" • Column tilt: ±30°
- Fence angle: 0–30° • Chisel capacity: ¼"–1½"
- Maximum chisel stroke: 6¼"
- Maximum workpiece width: 9"
- Chuck capacity: ½"
- Collar size: ⅝" and ¾"
- Spindle speed: 1725 RPM
- Overall size: 36" wide x 71" high x 24" deep
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- Maximum planing height: 7½"
- Maximum planing depth: ⅛"
- Maximum moulding depth: ¾"
- Feed rate: Variable • Cutterhead type: Square
- Knife size: 7⅛" x 1½" x ¼" HSS
- Cutterhead speed: 7000 RPM • 4" dust port
- Rubberized steel feed rollers • Powder-coated finish
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CYCLONE DUST COLLECTOR

- Motor: 1½ HP, 110V/220V, single-phase, TEFC, 3450 RPM
- Air suction capacity: 775 CFM
- Static pressure at rated CFM: 1.80"
- Intake port: 6" with included 5" optional port
- Impeller: 13½"
- Height: 65½"
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- Bag size (dia. x depth): 19½" x 33"
- Powder-coated finish
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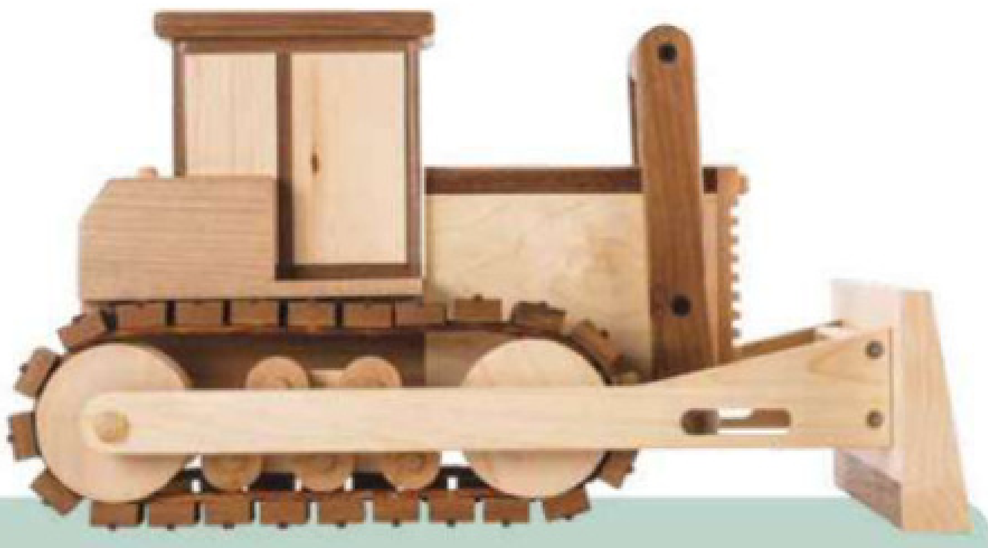
Contents: Projects

10th ANNIVERSARY
WOODCRAFT magazine
Dec/Jan 2015

30 Arts & Crafts Votive Candle Stands
Use simple frame-and-panel construction to build one or more of these tabletop accents. Made from quartersawn and riftsawn white oak, their heights are 7¼", 8 ½", and 9¾".

41 Windowed Hand Plane Cabinet
Protect your planes in this custom showcase. A deep shelf provides at-the-ready storage for smoothers, while the divided ramps organize longer tools. Stash related supplies in the drawers.



51 Tough-Enough Bulldozer
Make this hardworking earthmover for the busy road builder in the family. It features a lifting blade for easy maneuvering and treads that lay down tracks in sand or on carpet.

60 Holiday Carousel
Add a warm glow to the holiday season with this eye-catching decoration. The heat from four lit candles spins the propeller, causing the winter scene to rotate. Find the needed patterns inside.

Cover photo: Larry Hamel-Lambert

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Contents: Tools & Techniques

14 10 All-Time Best Tips & Tricks
Feast on this choice roundup of clever reader submissions, and find several ideas you can use right now.

24 10 Game-Changing Innovations
See the tools and technologies that have made the most significant impacts on the woodworking world in the last decade.

35 10 Essential Sharpening Tricks
Discover craftsman Andy Rae's shop-proven sharpening tips for grinding, honing, and polishing the cutting edges of chisels and plane blades.

69 Specialty Chisels
Check out these hand tool specialists that can help you to make quicker work of a variety of chiseling challenges.

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12 Mailbox

74 Woodsense
Red Oak

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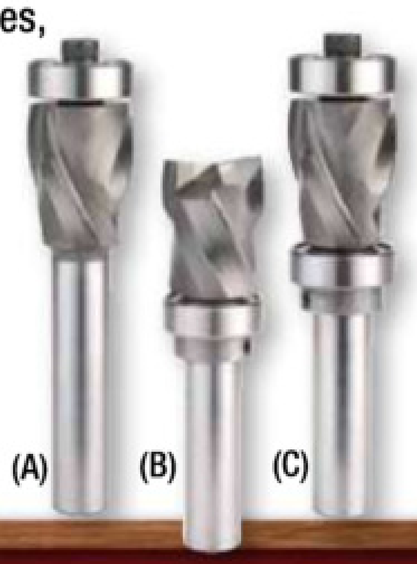

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Cutting In

Enter for a chance to WIN as we celebrate our 10th Anniversary Issue!

The dedicated staff at *Woodcraft Magazine* is proud to present to you our Dec/Jan 2014/15 issue of the magazine, a milestone event that marks 10 successful years of serving your woodworking needs. And whether you found us at the newsstand, at a Woodcraft store, or through a direct-mail subscription drive, we'd like to thank you for your support.

When we planned this issue, we wanted to pursue stories that tied in with the best of what *Woodcraft Magazine* has to offer in terms of engaging and useful content. We kick it off with a classic hand plane cabinet (page 41), a signature project that lets those visiting your shop know that they've entered the sanctuary of a quality woodworker.

We also got playful with the "10" concept behind our anniversary issue. You may enjoy reading the 10 best tips and tricks to ever run in the magazine (page 14) or reviewing the 10 most game-changing innovations in the woodworking product world over the last 10 years (page 24).

Finally, while 10th anniversaries are often marked by gifts in tin and aluminum, we've changed it somewhat by offering outstanding prizes in wood and steel. All you need to do is enter our **$10,000 Blockbuster Sweepstakes** for a chance to win one. Included is our Grand Prize–a leather-cushioned Morris Chair (a former cover project) and matching Ottoman. This is followed by a Jet lathe and set of Easy Wood turning tools; a Rikon bandsaw; and 15 other worthy prizes. (See the details in our advertisement on page 28.) We'll announce our winners on February 16, 2015, and name names in the April/May issue. Best of luck to each of you.

Jim Harrold

WOODCRAFT magazine

Dec/Jan 2015
Volume 11, Issue 62

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Circulation
Circulation Specialists, Inc.

Subscriptions
U.S. and Canada, $19.97 for one year
Single copy, $6.99
customer_service@woodcraftmagazine.com
(800) 542-9125

Contact Us
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4420 Emerson Avenue, Suite A
P.O. Box 7020
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Email: *editor@woodcraftmagazine.com*
Online: *woodcraftmagazine.com*

Woodcraft Magazine (ISSN:1553.2461, USPS 024-953) is published in January, March, May, July, September and November and printed in the United States by Woodcraft Supply, LLC, 4420 Emerson Ave., Suite A, Parkersburg, WV 26104. Tel: (304) 485-2647. Periodical Postage paid at Parkersburg, WV, and at additional mailing offices.

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POSTMASTER: Send address changes to *Woodcraft Magazine*, P.O. Box 7020, Parkersburg, WV 26102-7020. Canada Post: Publications Mail Agreement #40612608
Canada Returns to be sent to Pitney Bowes, P.O. Box 25542, London, ON N6C 6B2

Printed in the USA

Safety First! Working wood can be dangerous. Always make shop safety your first priority by reading and following the recommendations of your machine owner's manuals, using appropriate guards and safety devices, and maintaining all your tools properly. Use adequate sight and hearing protection. Please note that for purposes of illustrative clarity, guards and other safety devices may be removed from tools shown in photographs and illustrations in this publication.

King Arthur's Tools Congratulates Another Visionary – Woodcraft Magazine On Their 10th Anniversary!

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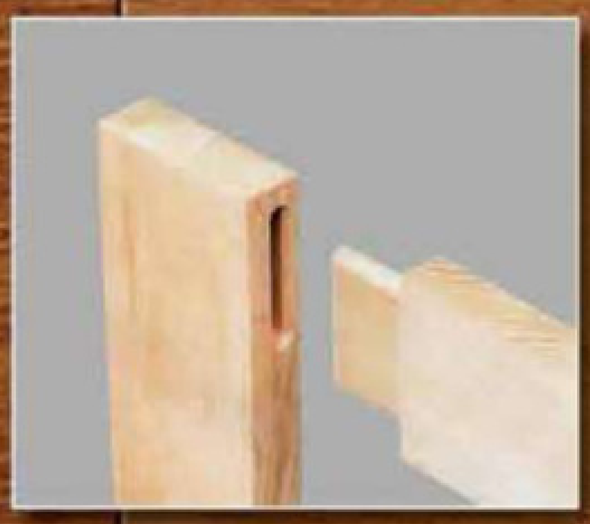

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lets you make perfectly matched mortise & tenon joints with one jig.

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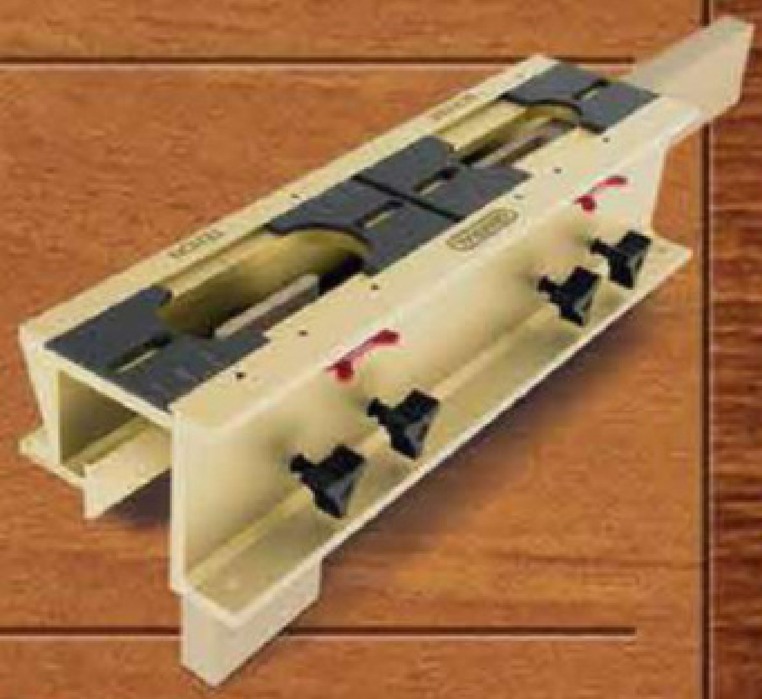

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lets you make dovetail and box joints – through or half-blind.

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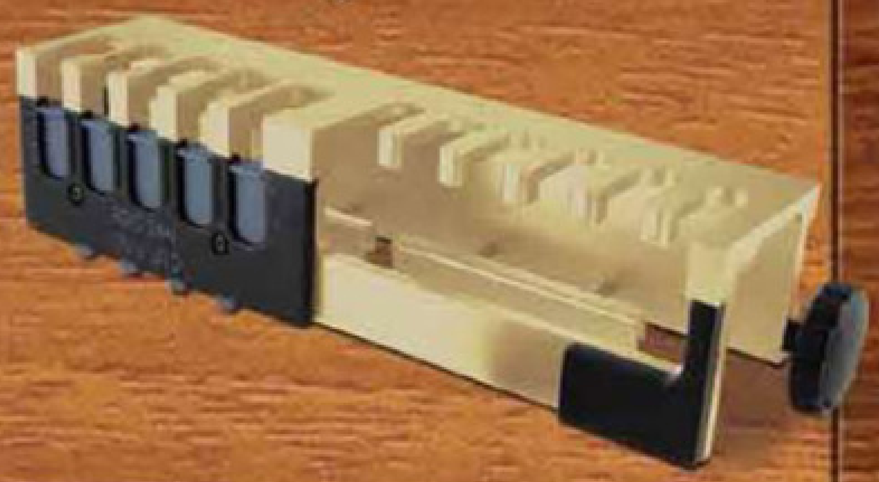

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Readers reflect

In my editor's column in the previous issue, I asked readers to tell me how the magazine has made a positive difference in their lives, now that we've completed 10 successful years of publishing. Here is a sampling of their responses.
–Jim Harrold, editor in chief

I am a hobbyist woodworker and was instantly attracted to your bagel slicer in the Feb/March 2014 issue. A professional violinist friend had her career destroyed by nerve and tendon damage when slicing a bagel she had held in her hand. Your design provides a much safer approach. I have made and given away a dozen to family, friends, and neighbors.
–Hank Burchard, Amherst, Virginia

I look forward to each new issue of *Woodcraft Magazine*, but especially the ones closest to Christmas. There are always great projects, many that will become presents for family and friends.
–Lewis Kauffman, Chambersburg, Pennsylvania

Whenever I receive my new issue of *Woodcraft Magazine*, it always inspires me to re-start my interest in lathe turning and finish up other projects I started from the last issue. The magazine has been a big part of my retirement and enjoyment.
–Dan Baxendale, Livonia, Michigan

Errata

As careful as we are, errors occasionally find their way into articles. If you spy an apparent mistake, particularly in a project article, please visit *woodcraftmagazine.com* and click on "corrections."

Picnic table pointers

I have completed the octagon picnic table from the April/May 2014 issue and plan to build another. Already it has generated some interest–a neighbor and another family member are hinting about getting the plans and/or my help too. As you can see above, I used pressure-treated lumber. The table is heavy and strong. You can walk in and sit down rather than climb in. Two adjacent sections of seat boards can be easily changed/cut shorter to allow for wheelchair access! All in all, I liked building it!
—Doug Farquhar, Sauble Beach, Ontario

Doug, some worthy ideas. Thanks.
—Jim Harrold, editor in chief

A mighty fundraiser, the pen

As a teacher of pen turning classes at the Cleveland Woodcraft store, I recently was involved in a church fundraiser that proved quite successful and worth adopting. It so happened that the church's organ (over 50 years old) fell into disrepair and was declared beyond restoring. Its wood was destined for the landfill. I spoke with the pastor and requested that the wood be set aside. Then, this past August, I did a pen turning demo for the men's group at my church. Here, I let them in on the surprise: the resulting pen, which I passed around, had been made from the old organ's salvaged wood. That sparked a fundraiser idea where we would make pens and sell

them for $30 each. Woodcraft store owner Mike Novak gave us a discount on the pen kits. In short order, we presented the pastor with a check for over $1,300.00.
—*Dave Sanborn, Cleveland, Ohio*

Chime in

Have comments about the magazine, questions about an article, or something to share with your fellow *Woodcraft Magazine* readers? Send an email to *editor@woodcraftmagazine.com* or a letter to ***Woodcraft Magazine*, PO Box 7020, Parkersburg, WV 26102**.

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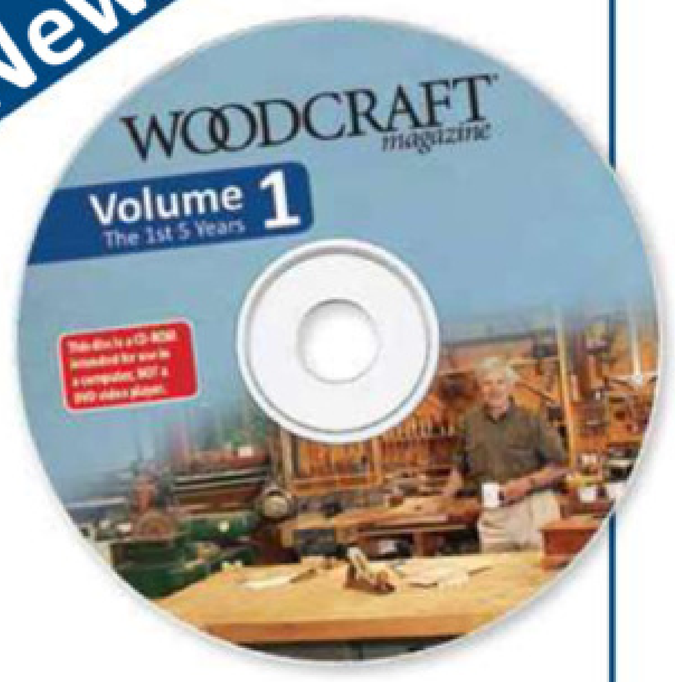

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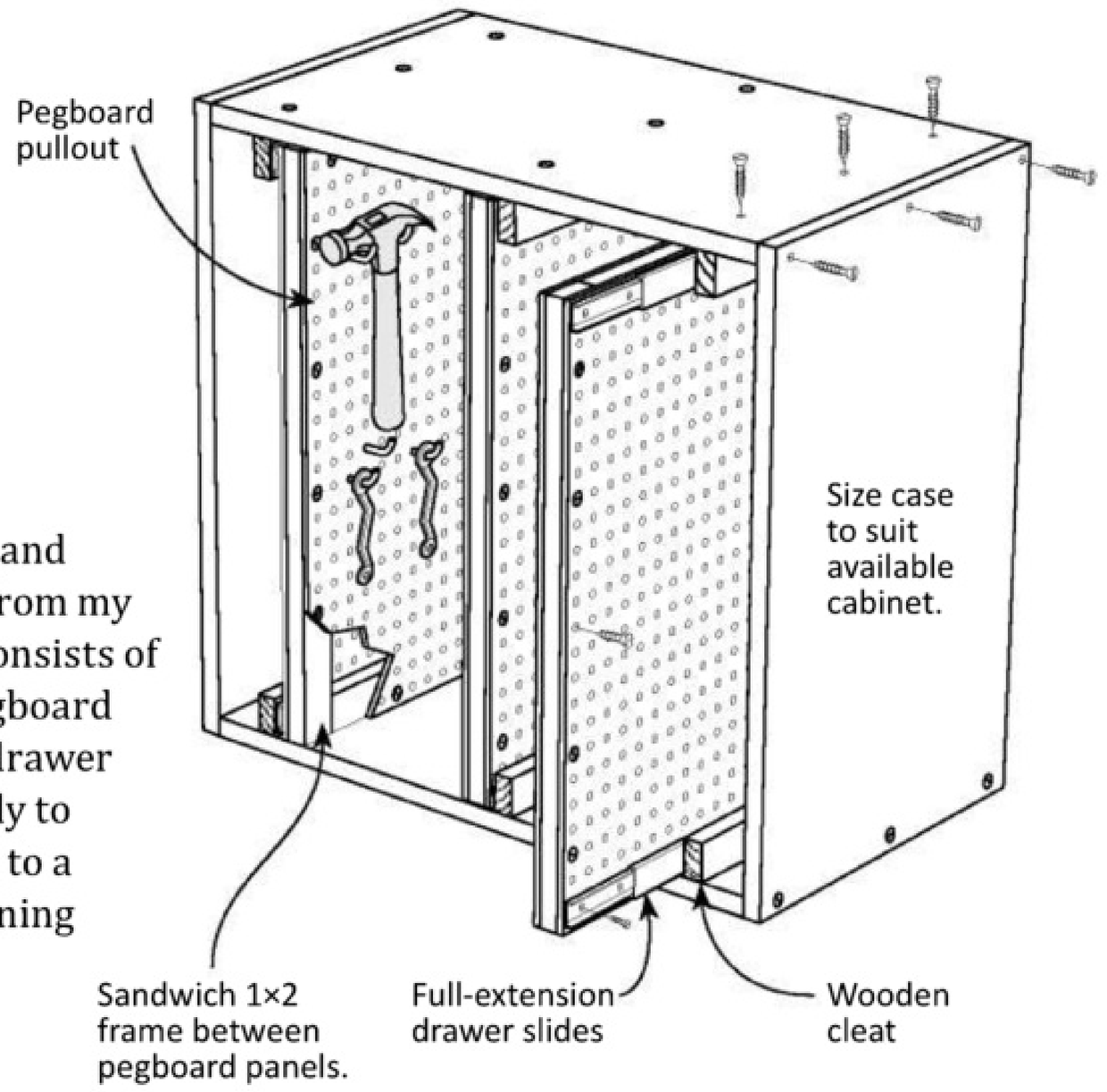
Best of Tips and Tricks

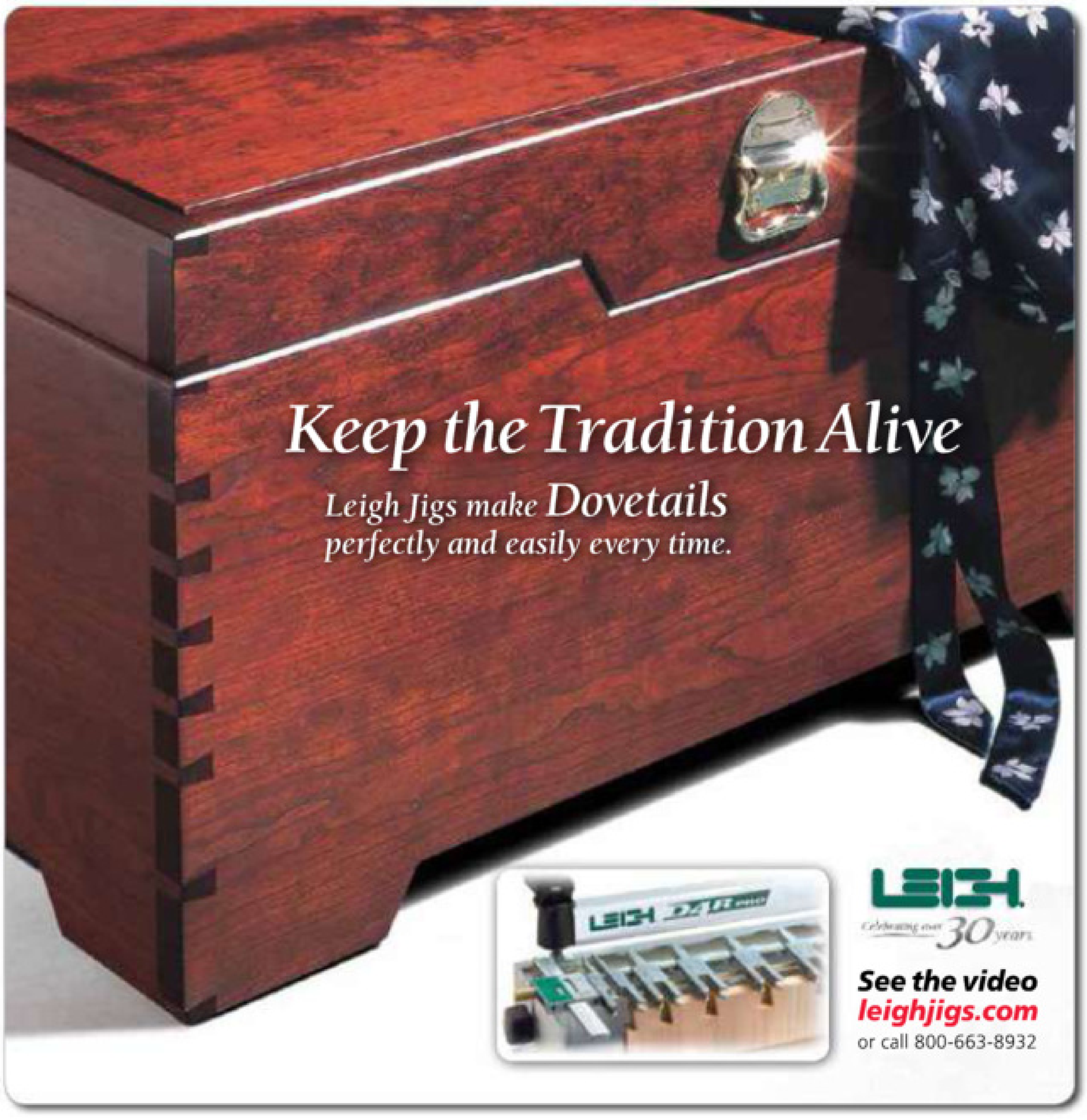
Over the past 10 years, readers have shared some great techniques, jigs, and shop accessories in our "Tips and Tricks" column. Every issue, we award "Top Tip" status (including a special prize) to the most useful or clever tip of the bunch. For your pleasure, we have compiled here what we consider to be the best of the best from the past decade. Enjoy!

Pegboard panel pullouts

When outfitting my new shop, I needed a way to store and organize my hand tools, so I stole this storage design from my friend Bob Della-Rovere in Mesa, Arizona. The setup consists of simple ¾"-thick frames covered on both faces with pegboard and mounted vertically in a cabinet on full-extension drawer slides screwed to cleats. You could fix the cleats directly to a cabinet top and bottom, but I decided to mount them to a "case insert," which I then slipped into the cabinet opening after assembling the entire unit. This system works great for storing lots of tools in a compact area.

—Bob Kellenberger, Fairview, Texas





Share a Slick Tip. Win Cash or a Prize!

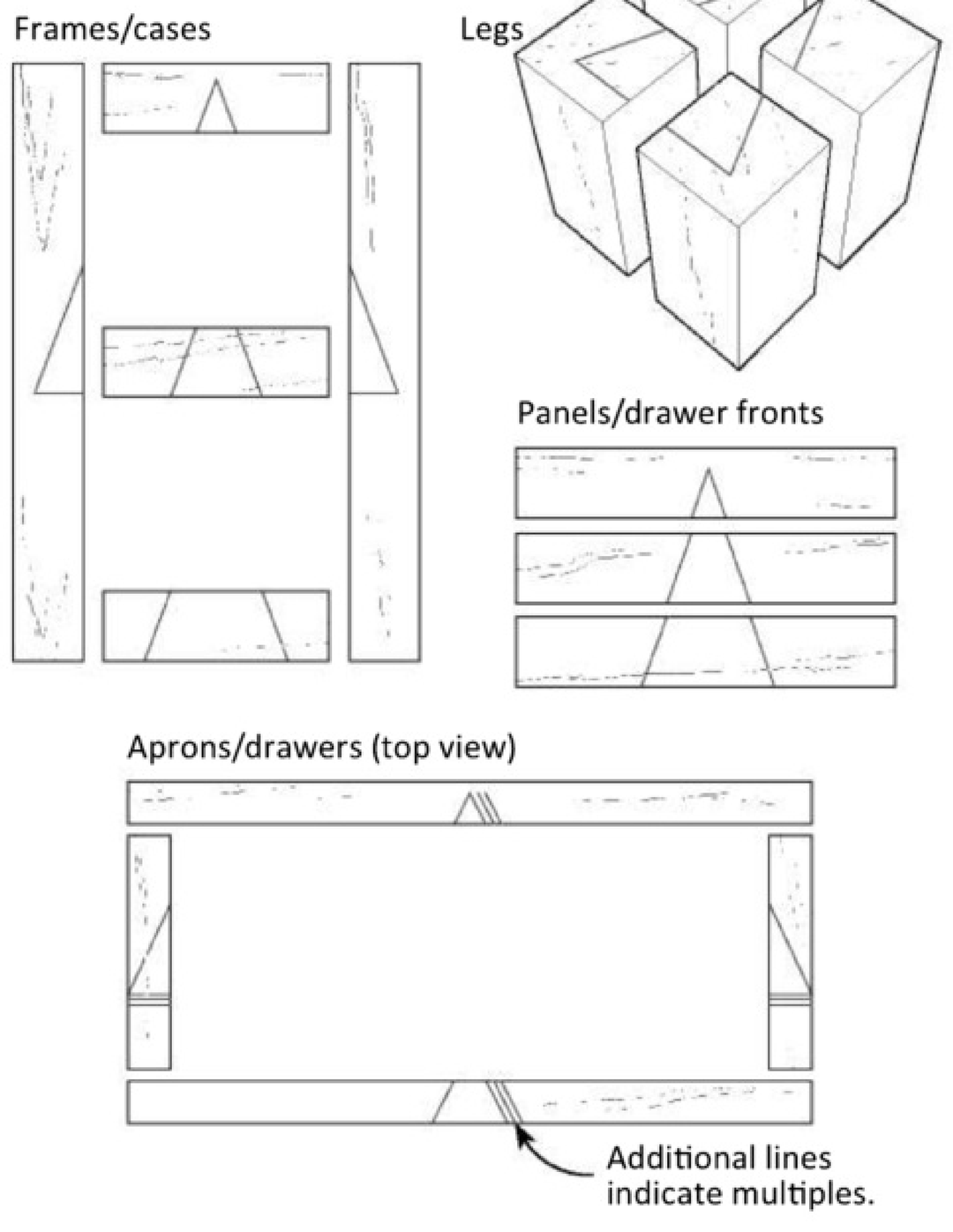
Here's your chance to help someone become a better woodworker and get rewarded for the effort. The winner of next issue's **Top Tip** award will receive a **Woodcraft Gift Card worth $250**. All others will receive **$125** for a published illustrated tip, or **$75** for a non-illustrated tip. Published tips become the property of *Woodcraft Magazine*. Send your ideas to:

Tips & Tricks, *Woodcraft Magazine*, P.O. Box 7020, Parkersburg, WV 26102-7020 or visit ***woodcraftmagazine.com***, and click on "Submit Tips." Important: Please include your phone number, as an editor may need to call you if your trick is considered for publication.

Triangle marking system

I was in my shop trying to organize a jumble of cabinet parts, when a friend dropped by and showed me an old layout trick that has since saved me lots of time and confusion. After parts are cut to size, and before you lay out any joints, select the "show" face of each piece, orient it for best grain composition, and then organize the pieces on your bench in their desired relation to each other. Now it's a simple matter of pressing the pieces together and striking a few lines across their faces to create a triangle, as shown in the drawings. A glance at the markings immediately identifies the "show" face, the top, the bottom, and the left- and right-hand sides of each piece. To identify multiples, strike additional lines that extend across the mating pieces.

—*Gary Goldthwaite, Indianapolis, Indiana*



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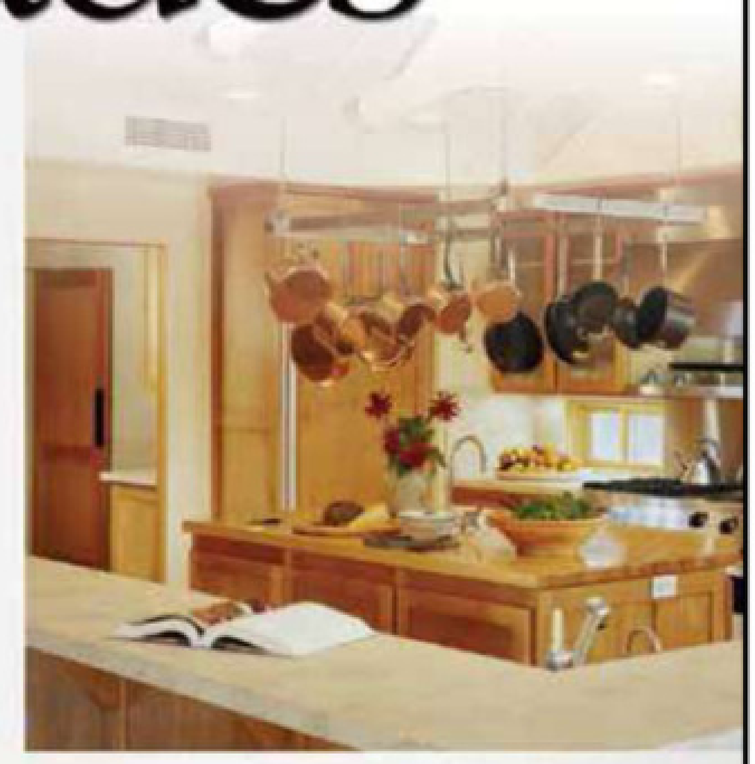

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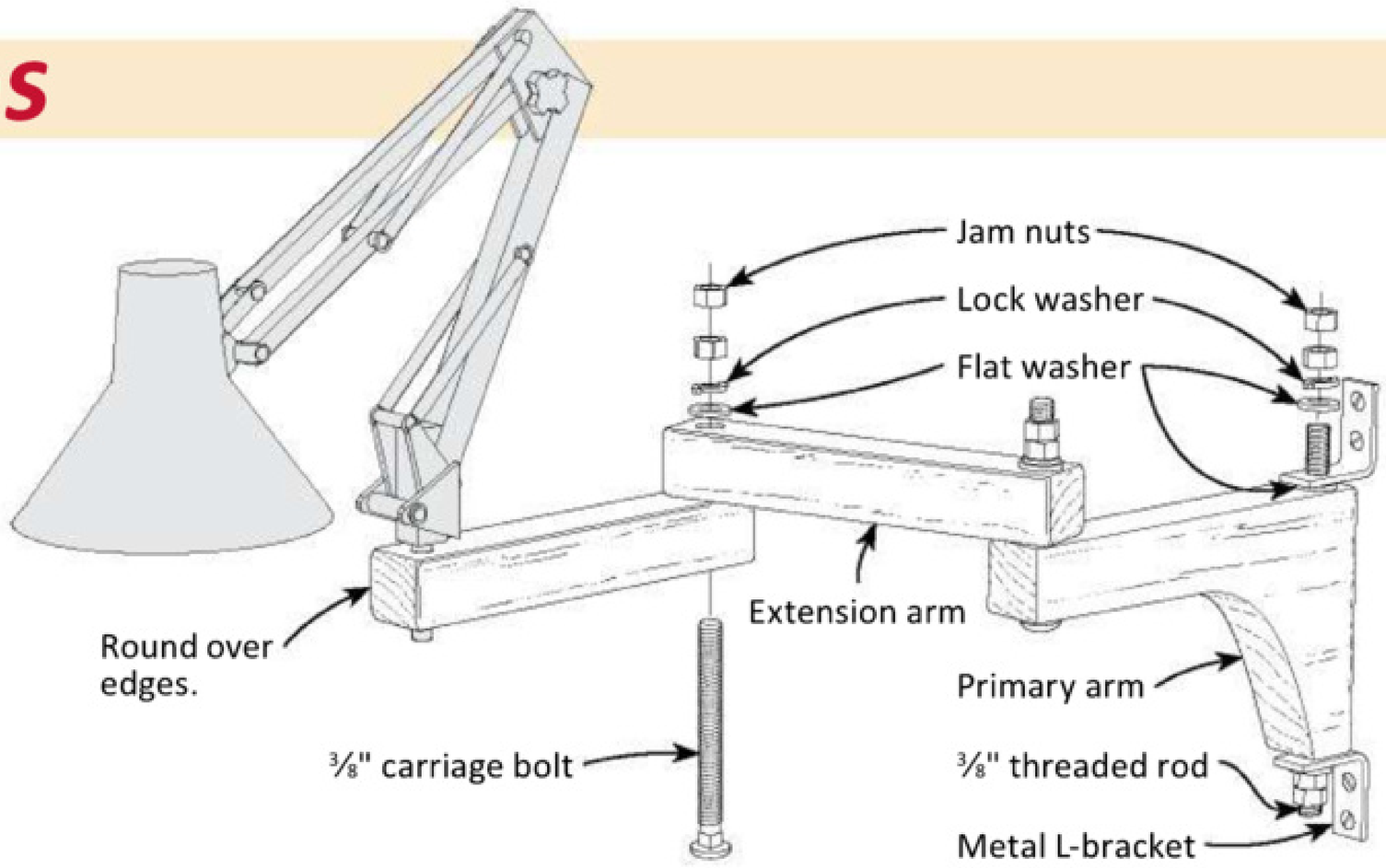
Illustrations: Chris Glowacki

Best of Tips and Tricks

Wall-mounted lamp arm



At my shop workstations, I like to use swing-arm lamps for adjustable task lighting. For convenience, I mount the lamp on a wooden arm that swings out from a nearby wall. Sometimes, a single arm does the trick, but when I need more reach and flexibility, I create an articulated arm by adding extensions as shown.

Make the primary arm from 1¼"-thick hardwood about 5" wide, tapering out to 1½" at the end. Mine is 26" long, but suit yourself. Drill a ⅜"-diameter hole through the wide end on the drill press, using a long bit. Bore as deep as your drill press allows, and then raise the table to complete the hole. Rout or sand a bullnose onto the wide end. You can drill a hole on the narrow end to carry a lamp, or add an extension or two. Make an extension 1¼" thick by 1½" wide, and attach it to its mating arm with a ⅜" carriage bolt, a washer, a lock washer, and a nylon nut or a pair of nuts jammed against each other. Tighten the hardware enough to provide both friction and adjustability. Mount two metal L-brackets to the primary arm, using a length of ⅜" threaded rod secured at each end with a pair of jam nuts, and then screw the brackets to a wall stud.

—Mike Kehs, Quakertown, Pennsylvania

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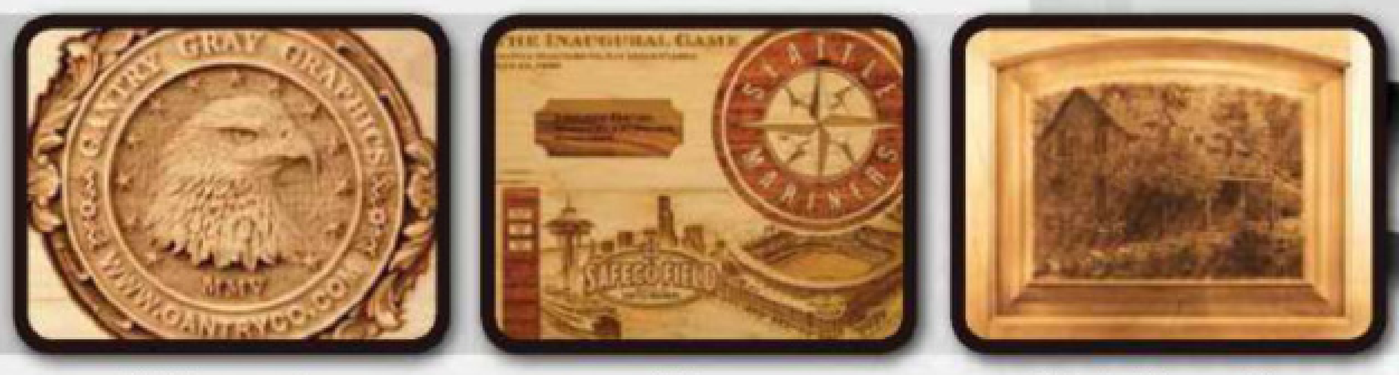

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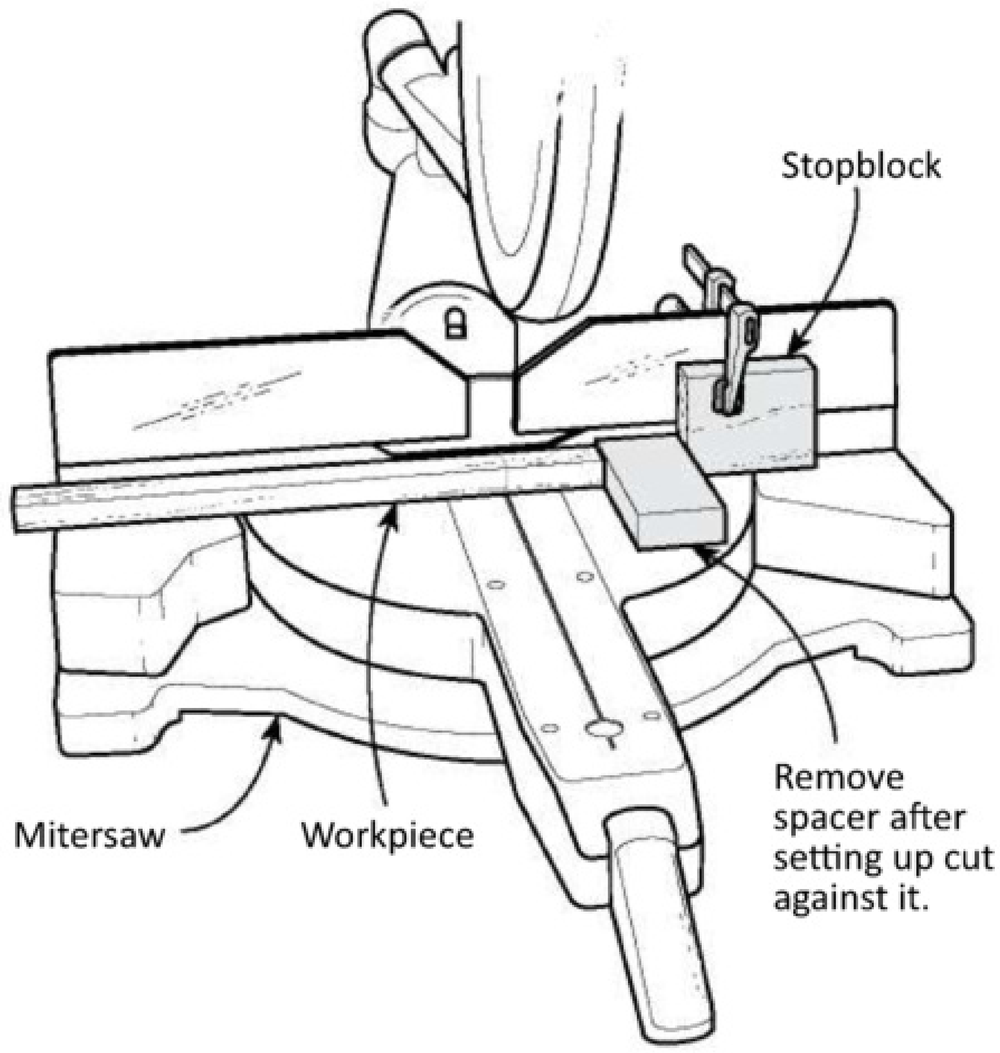
Crosscutting short multiples



Awhile ago, I was making wooden tabletop clips and needed to crosscut multiple short pieces to identical lengths. Marking individual cutlines would have taken too much time, so I decided to set up a stopblock on my power mitersaw. Unfortunately, at the end of the cut, the saw would jettison (and often ruin) the freed piece, which had been trapped between the blade and the stopblock.

After a bit of head scratching, I realized that the fix is to set up the cut with a removable spacer between the stopblock and the end of the workpiece. Hold the workpiece firmly against the fence and stopblock while removing the spacer. Now the sawn piece has room to fall freely away from the blade at the end of the cut. To further minimize the chance of kickback, allow the blade to stop fully before raising it out of the cut.

—Ralph Burns, Montgomery, Alabama

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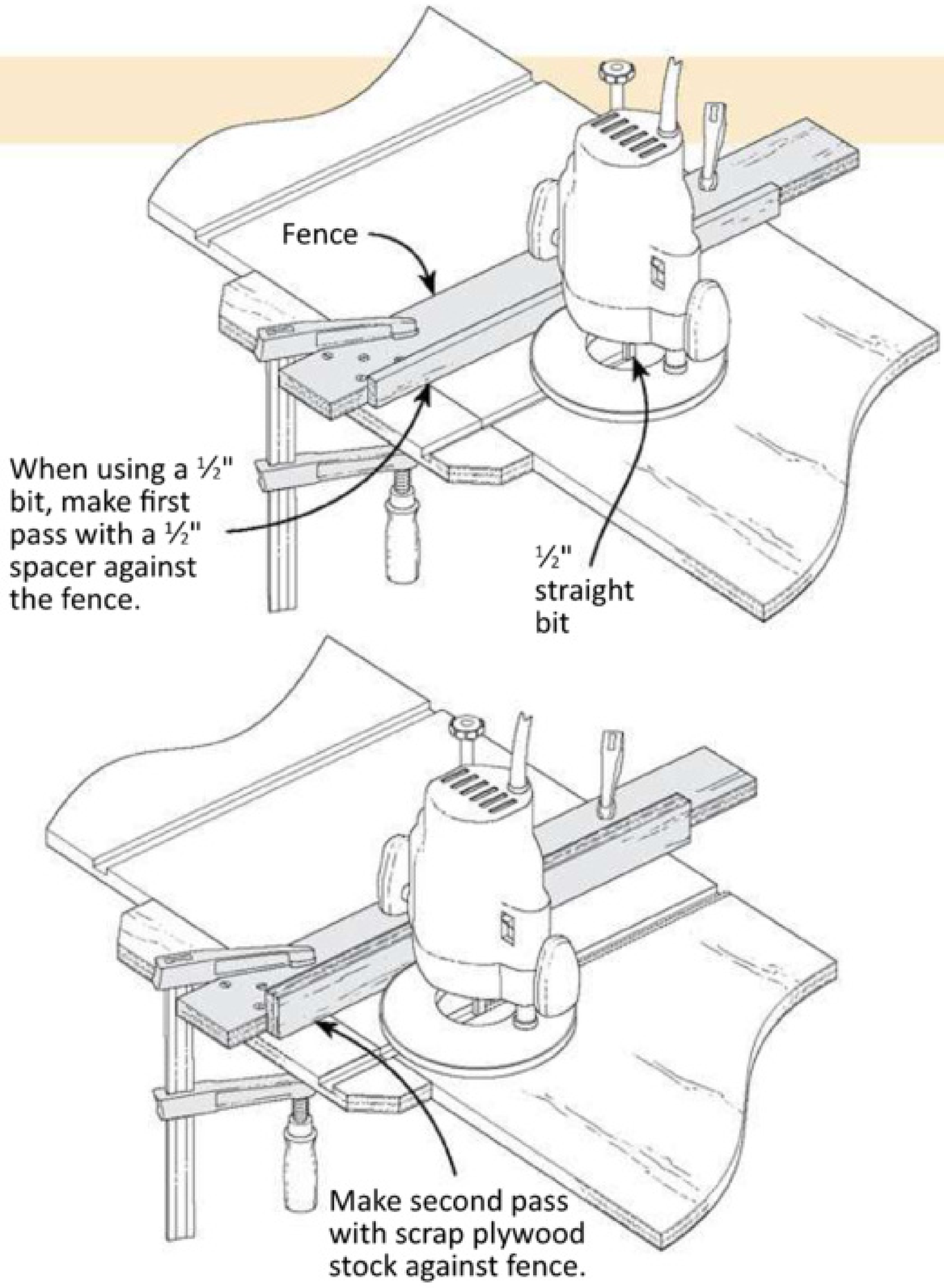
Best of Tips and Tricks

Perfect router-cut dadoes

Hardwood plywood usually doesn't match its nominal thickness; it's typically undersized between 1/64" and 1/32". Therefore, when routing dadoes, a single pass with a single bit is unlikely to yield a perfect fit. (Even "undersized" panel bits sold for the purpose may not exactly suit the thickness of your particular stock.) To solve the problem, I've come up with a two-spacer trick to rout perfectly sized dadoes. All you need is a bit that's a smaller diameter than the desired dado width, a couple of scraps of wood, and a straightedge fence to guide your router.

First, make a spacer that's exactly the same thickness as your bit diameter. To set up the cut, sandwich the spacer between the fence and router base, and align the bit with the dado layout line that is nearest the fence. Secure the fence and rout your first pass. Next, replace the spacer with a scrap strip of your plywood stock, standing it on edge. Then make a second pass with the same bit to create a dado of perfect width.

—Ryan Reese, New York, New York

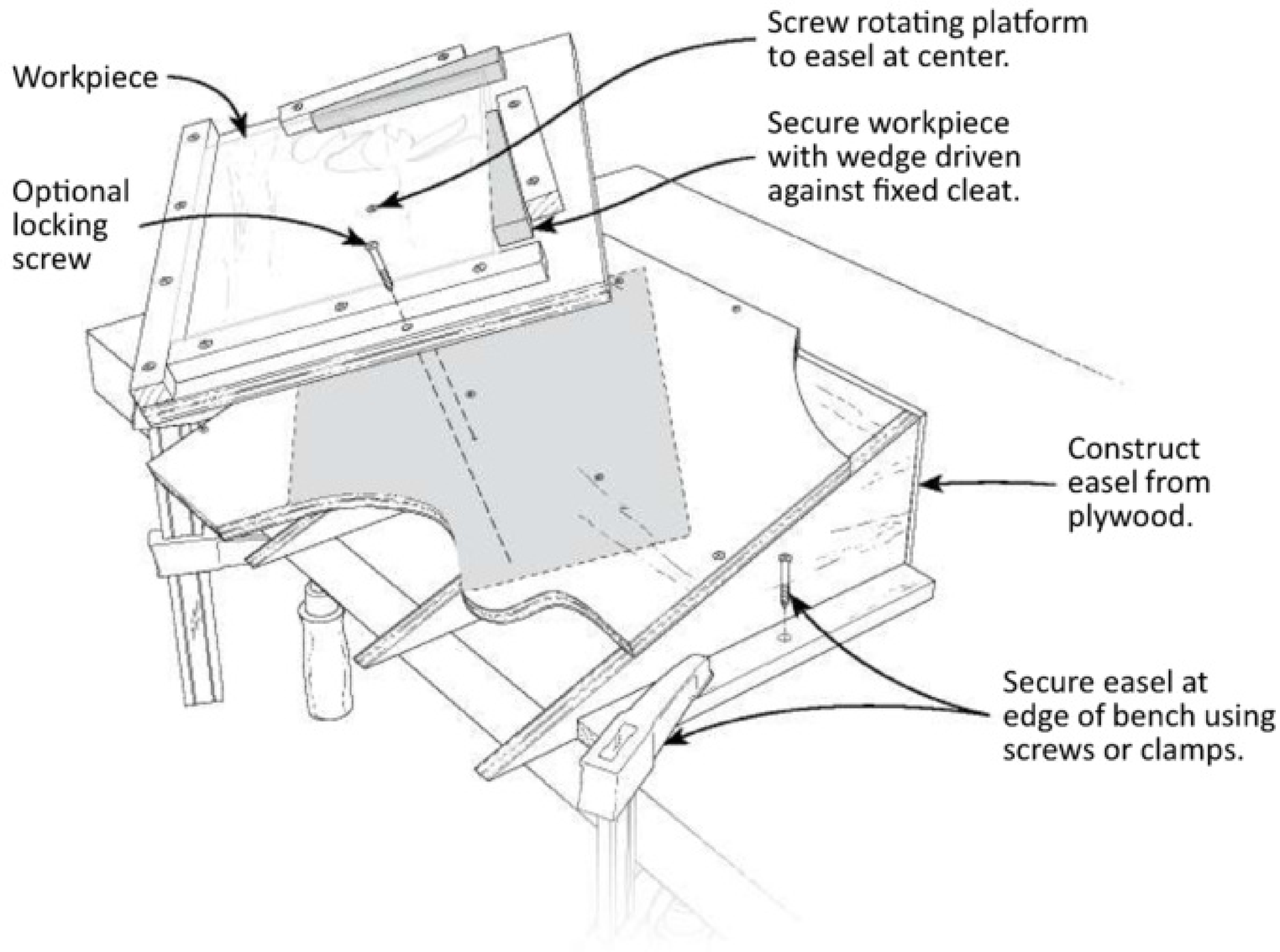


Rotating carver's easel

When I'm relief-carving panels, I prefer to work at an easel, which reduces the amount this old back has to bend. While working on an intricate design recently, I found myself constantly reorienting the panel to allow carving with the grain. To make the job easier, I screwed a rotating platform to the easel, attaching the carved panel to the platform by wedging it between cleats, as shown. Now I can simply rotate the platform and workpiece as necessary to gain the best angle of attack.

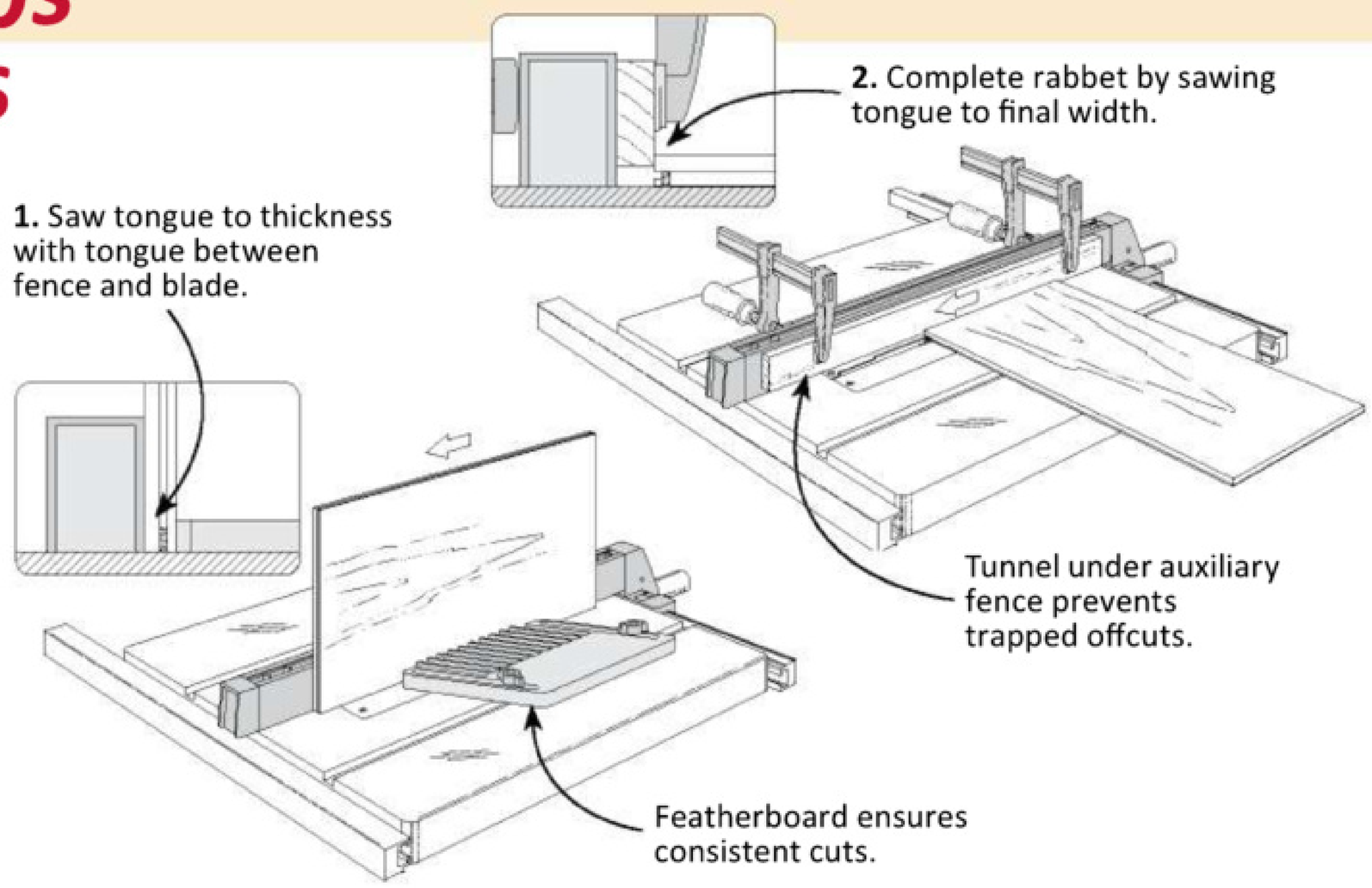
I find that the single pivot screw creates enough friction between the unfinished easel top and platform to stabilize the platform. However, if I find it shifting under tool pressure, I'll drive an additional locking screw through its corner.

—Philip Houck, Boston, Massachusetts



Best of Tips and Tricks

Perfect tongue-and-groove fits



Project plans often call for rabbeting the edges of a panel in order to create a tongue that slips into a drawer or rail groove. This is often done with a router bit or tablesaw dado head, with the work fed flat on the table. Unfortunately, done this way, any inaccuracy in the thickness of the stock is transferred to the thickness of the tongue, creating an ill fit in the groove.

One way to ensure a perfect tongue-and-groove fit is to create the rabbet by making two intersecting cuts on the tablesaw, feeding the edge to be rabbeted against the fence. Set up the first cut to rip the tongue to thickness, feeding the panel on edge with the tongue face against the fence. Use a featherboard to ensure consistency of cut. Now set up to make the intersecting cut against a thick auxiliary fence, raising it enough to create a tunnel for the freed offcut to fall away without being pinched between the blade and fence, eliminating violent ejection of the piece.

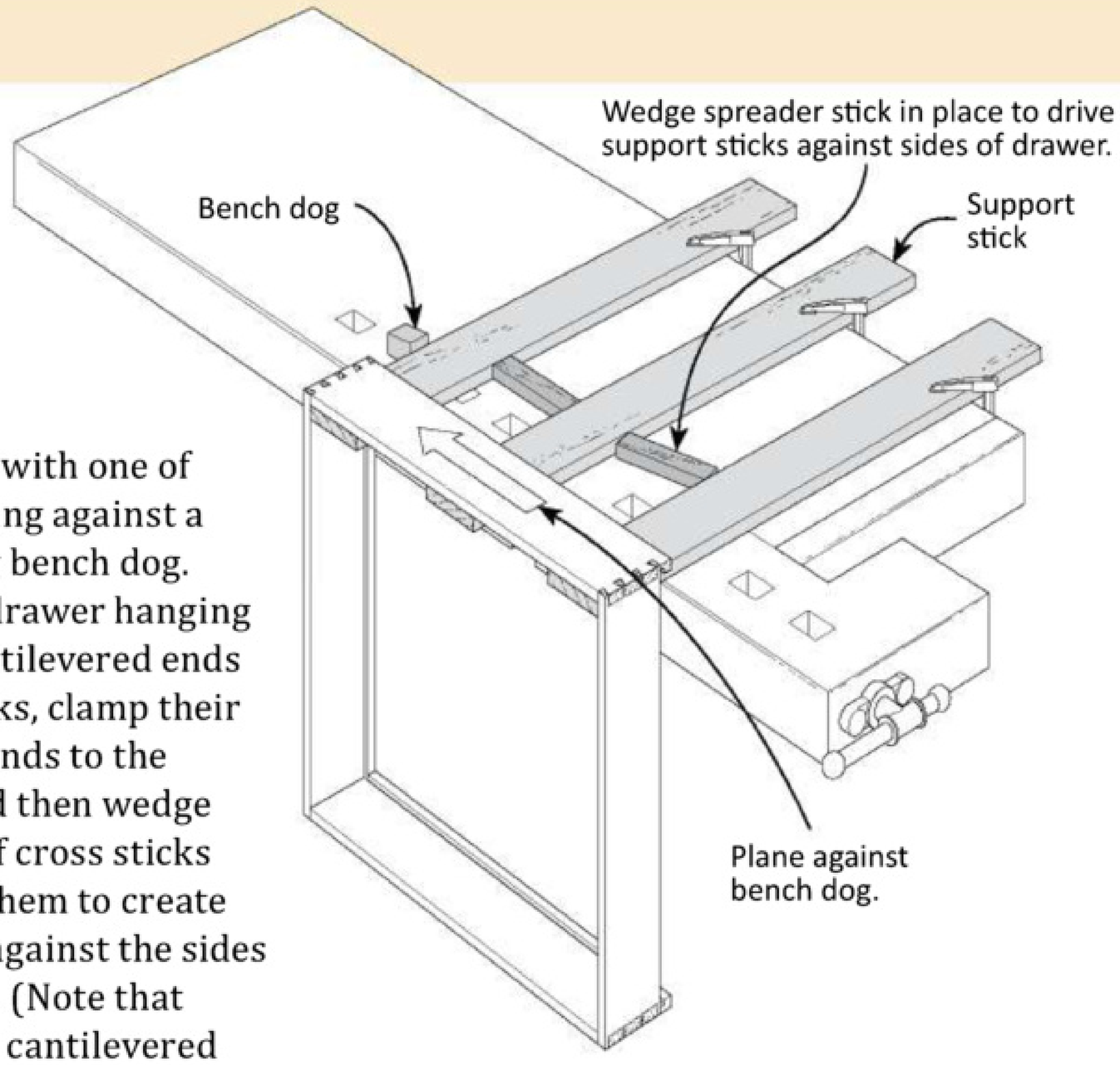
—Harvey Mickelson, Reno, Nevada

Adjustable drawer-planing perch

To plane a drawer side, you typically need to hang it on a support board that's cantilevered off the edge of your bench. The problem is that the work can shift around on a board whose width doesn't exactly match the inside dimension of the drawer box, and clamps can get in the way of planing.

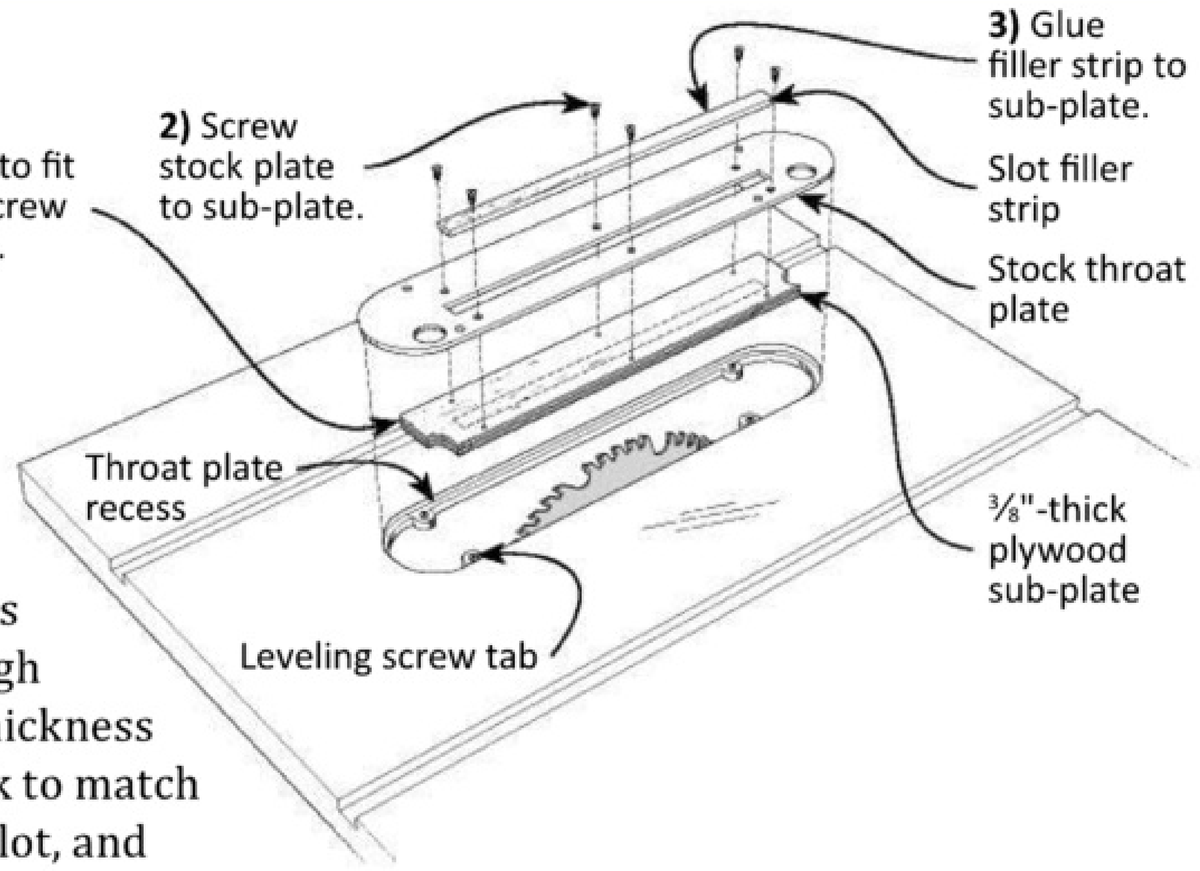
Instead of a single board, I use sticks because they can be wedged to apply pressure against the sides of any sized drawer to secure it without clamps. To create the setup, extend three stout sticks across your bench as shown, with one of them resting against a projecting bench dog. With the drawer hanging on the cantilevered ends of the sticks, clamp their opposite ends to the bench, and then wedge a couple of cross sticks between them to create pressure against the sides of the box. (Note that the center cantilevered stick supplies support for full-length planing of the drawer side. If you're just cleaning up the joints at the corners, you can omit it.) When planing, work in the direction of the bench dog.

—Philip Houck, Boston, Massachusetts



Best of Tips and Tricks

Thin-plate ZCI

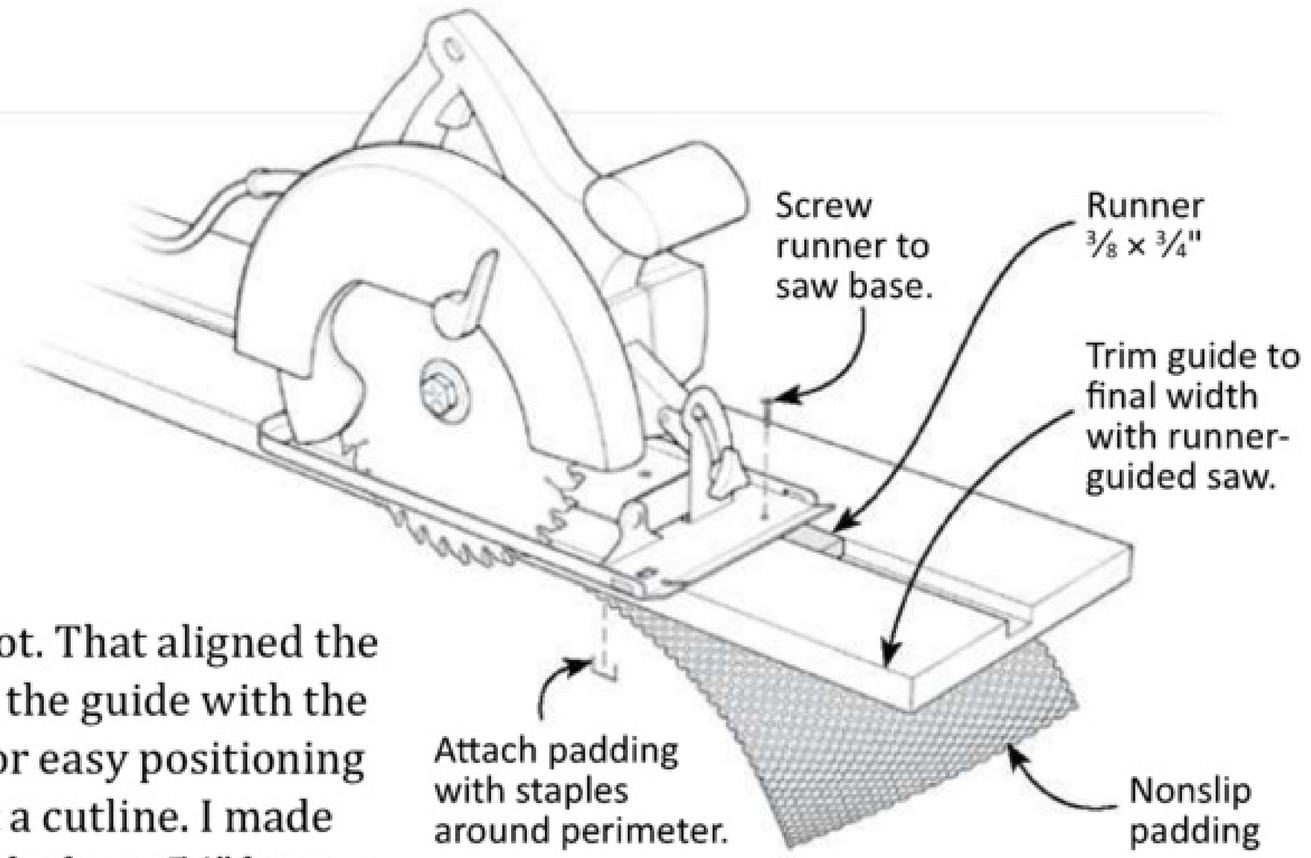


My hybrid tablesaw has a ⅛"-thick metal throat plate that sits in an opening with very shallow ledges. This shallow recess complicates making a zero-clearance insert (ZCI) for the opening in order to minimize exit tear-out and prevent narrow rippings from falling into the saw. My solution is to modify the stock throat plate.

Make a sub-plate by cutting a piece of ⅜"-thick plywood to fit between the leveling screw tabs in your table opening. Wax the underside of the stock plate and the inside edges of its slot (to resist glue when attaching the filler strip later), and then screw the plate to the plywood with flathead screws driven through six countersunk holes you drilled through the plate. Next, thickness a hardwood blank to match the width of the slot, and then rip from the blank a strip that's just a hair wider than the thickness of the plate. Crosscut this slot-filler strip to the slot length, and then glue and clamp it to the underlying plywood, topping the strip with waxed paper and a caul. After the glue dries, sand the strip flush to the plate. (To avoid scratching your plate, mask off the surrounding area with tape.) Alternatively, unscrew the stock plate, and hand-plane the strip, testing the fit as you work. Finally, clamp down the finished ZCI, and raise the spinning blade through it.

—David Schermock, Humble, Texas

Clamp-free portable saw guide



When it comes to shop-made guides for portable circular saws, there are two important criteria: The first is that the guide tracks the saw accurately. The second is that the edge of the guide aligns perfectly with the blade so that no offset needs to be calculated when setting up a cut. For tracking purposes, my ¾"-thick guide includes a ¾"-wide, ⅜"-deep slot, which guides a wooden runner that screws to my saw base. (When affixing the runner, make sure it's perfectly parallel to the blade.) I made the base oversized initially and then trimmed it to final width with the saw running in its slot. That aligned the edge of the guide with the blade for easy positioning against a cutline. I made the track about 54" long so it generously spans a 4 × 8' sheet of plywood crosswise.

The real trick here, though, is that this guide does not require clamps to hold its position. Instead, I attached a sheet of rubber "nonslip padding" to the underside of the base, keeping it back from the edges ¼" or so. The padding–designed to hold workpieces in place for routing, sanding, and other maneuvers–is simply stapled in a few places along its perimeter. It holds the guide in place remarkably well with no slippage whatsoever that could compromise cut accuracy.

—Russ Svendsen, Olean, New York

Clamp-free saw guide illustration: Christopher Mills

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Top 10 Game-Changing Tools of the Past 10 Years

INNOVATIONS WOODCRAFT magazine AWARD

Over the last decade, the editors of *Woodcraft Magazine* have seen and reviewed a multitude of new products. Some simply represented an attempt to build a better mousetrap, but a few have made fresh impressions on the woodworking world, and we're betting that they are likely to continue making ripples for years to come.

While dozens of products deserve kudos, here, we have winnowed our list to the top 10. These items deserve special mention not only for making woodworking faster, easier, and safer, but also for their likely impact on future tool and product innovations. Even for those whose woodworking feet are firmly planted in tradition, no one can deny that these tools have broken new ground.

#1 Better woodworking "by the numbers"

Lignomat Digital Moisture Meter, **$199.99**; Wixey Digital Calipers, **$39.99**; General Tools Digital T-Bevel, **$38.99**; Wixey Digital Angle Gauge, **$39.99**

Woodworkers are constantly looking for ways to improve accuracy. In the past, this typically meant combining experience with various qualitative methods and maybe a few pricey tools.

Today, digital meters and gauges offer a shortcut to hair-splitting accuracy by giving woodworkers the ability to measure their work and calibrate machinery quickly and easily. Compared to earlier precision measuring tools such as Vernier gauges and calipers, digital tools are simple to use and easy to read (a blessing for older eyes). This has really helped woodworkers home in on the detail of the craft, allowing precise assessment of joint tolerances, machine setups, and even hand-tool operations. As production costs continue to drop, manufacturers are sure to develop digital upgrades for myriad other woodworking accessories and operations.

#2 A fresh spin on turning tools

When it comes to the often tricky craft of woodturning, Easy Wood Tools (EWT) wins the "Keep It Simple" award. While traditional turning tools require the user to "ride the bevel," EWT tools take a much easier approach. To use one of these innovative tools, simply hold it flat and level on the rest, advance the cutter into the workpiece, and let the shavings fly. EWT tools' carbide tips solve another obstacle: sharpening. Taking a cue from the saw blade and router bit industries, EWT outfits their tools with carbide tips. According to the manufacturer, carbide lasts up to 20 hours longer than high-speed steel. And when the edge dulls, you simply rotate the cutter or replace it with a fresh insert.

Easy Wood Turning Tools, **$59.99-$149.99**

#3 Fully-capable cordless tools

Brand-new battery, motor, and charger technologies have allowed some manufacturers to now employ lighter-weight, lower-voltage batteries without cutting runtimes. For example, Milwaukee's 18V, 7¼" circular saw and Festool's 14.4V, TI 15 Hybrid Drill/Driver outperform many cordless tools twice their size. Their brushless motors, lithium batteries, and chargers are designed to work together, monitoring the motors and batteries in order to optimize performance and control overheating. Based on the performance of these tools, you can expect to see more heavy-duty tools–such as mitersaws and routers–"cut the cord" in the years ahead.

Milwaukee M18 7¼" Cordless Circular Saw, **$329**; Festool TI 15 Hybrid Impact Drill/Driver, **$525**

#4 Smaller bites = smoother cuts

Steel City Planer, **$499.99**; Laguna 8" Wedgebed Jointer, **$1,945**; Jet 12" Planer/Jointer, **$3,364**

For those who have felt the pain that comes when perfectly-adjusted planer or jointer knives hit a hard knot or grain of sand, relief is in sight. The latest generation of planers and jointers now sports cutterheads that have dozens of machined pockets that accept small multi-sided cutters. When a cutter becomes dull or gets damaged, simply loosen a screw and turn the cutter to expose a fresh edge. No additional setup is required. Another plus: segmented cutterheads create less tear-out when machining figured woods.

In the last few years, many higher-end machines have come equipped with segmented cutterheads, and replacement cutterheads are available for older machines. Today, segmented cutterheads are starting to filter down to more affordable machinery. We're hoping that this upgrade becomes a standard option on many more machines in the near future.

#5 Mortises made simple

Mortise-and-tenon joinery ranks as one of the strongest means of attaching parts, but cutting these joints can be time-consuming and may require an elaborate setup. That changed in 2007 when Festool introduced the Domino, a handheld machine that combined the simplicity of biscuit joinery with the strength of loose-tenon joinery. The Domino DF 500 and larger XL DF 700 employ a patented oscillating cutter that plunge-cuts and then moves from side to side to create a perfect mortise as you press the tool into the work.

In terms of speed, precision, strength, and size, no other mortiser comes close. Thanks to the Domino, furnituremakers can now focus on design and let the machine tackle the formerly tricky joinery.

Festool Domino DF500Q, **$850;** Festool Domino XL DF700, **$1,250**

Photos 1, 2, 3: Larry Hamel-Lambert; 4, 5: Manufacturer

Top 10 Game-Changing Tools of the Past 10 Years

#6 Finishing and stripping without a mask

Water-based finishes have an established reputation for being less odorous and easier to use than oil-based finishes. Today, many outperform their oil-based competition. According to the manufacturers' tests, General Finishes' High Performance finish (a polyacrylic blend) is the hardest, most durable consumer polyurethane topcoat on the market. This clear finish contains a UV stabilizer that protects underlying stains from fading and prevents the cured finish from breaking down in sunlight. Enduro-Var is an oil-modified alkyd varnish in a water-based formula that dries fast and cleans up with water, yet imparts the desirable amber tone of an oil-based varnish.

On the other side of the coin, safer products also exist for removing finishes. SOY Gel removes multiple layers of paint, urethane, acrylic, epoxy, or enamel, but does not emit toxic fumes and can be cleaned up with water.

General Finishes High Performance Polyurethane, **25.99**/qt.;
General Finishes Enduro-Var, **$29.99**/qt.;
SOY Gel Professional Paint Stripper, **$20.99**/qt.

#7 Solid, stone-simple joinery

Modern pocket-hole joinery was born in the latter half of the 1900s, and has proven to be an easy, affordable, and effective method of fastening cases, face frames, and other parts without having to wait for glue to dry. Recent developments by manufacturers have made the job even easier. The wide variety of jigs and accessories now available enables production shops and DIYers to select the tools they need to tackle ever larger projects, such as cabinets, and furniture, without an arsenal of clamps, complicated setups, or heavy machinery.

Kreg Foreman, **$399**; Kreg R3, **$39.99**

#8 Plug-and-play woodworking

A decade ago, CNC (computer numerical control) machines existed almost exclusively in commercial shops. Today, affordable tabletop models have sparked purchases by a significant percentage of small-shop woodworkers as a complement to their array of shop machines and hand tools. Many beginners are adopting CNCs because the machines enable them to rout precise inlays, cut out perfectly fitting project parts, and take on projects they previously avoided because they lacked the skills or tools.

CNC machines require a learning curve, but that may not be such an impediment in an age where many of us can set up a computer faster than we can fettle a plane. CNC-inspired technology is already appearing on other machines, including mitersaw stations and router table lifts and fences.

General iCarver 915X, **$4,699.99**

#9 Motors with brawn AND brains

Teknatool Nova DVR XP Lathe, **$2,399**

A Digital Variable Resistance (DVR) motor is a direct-drive motor that relies on electromagnets instead of brushes. A micro-computer controls spindle speed and torque by switching these magnets on and off, eliminating the need for belts or pulleys. With the Nova lathe, the DVR motor constantly senses load and adjusts torque to maintain your desired RPM, even at super-low speeds. In addition to speed control and higher torque, a DVR's use of magnets instead of rotors and brushes means that there are fewer parts to wear out.

In the next year, Teknatool plans to launch a DVR drill press that can slow a bit as it exits the back of your workpiece to reduce tear-out, and even shut down the unit if it senses that you've accidentally left your chuck key in the chuck. You can bet you'll see this technology in tablesaws and other critical machines in the future.

#10 Finger-saving saws

SawStop Tablesaws (several models available). Prices range from **$1,599** to **$2,729**.

Unlike most woodworkers, Steve Gass refused to accept the notion that working at the tablesaw must be dangerous. In 2004, Gass introduced the world to SawStop's flesh-detecting technology, and proved that it is possible to be faster than a spinning saw blade. In 1/200th of a second, the sensor detects fleshy contact and then triggers the brake to stop and drop the blade–often leaving the would-be victim with barely a scratch. Since their inauguration, SawStop tablesaws have saved thousands of digits. Aside from the safety advantage, SawStop's standard features rank it as one off the best tablesaws in today's market.

(Fun factoid: The company performs its now-famous "hotdog demonstration" almost 1,000 times each year.)

Photos 6, 7: Larry Hamel-Lambert; 8: Casey Ryan; 9, 10: Manufacturer

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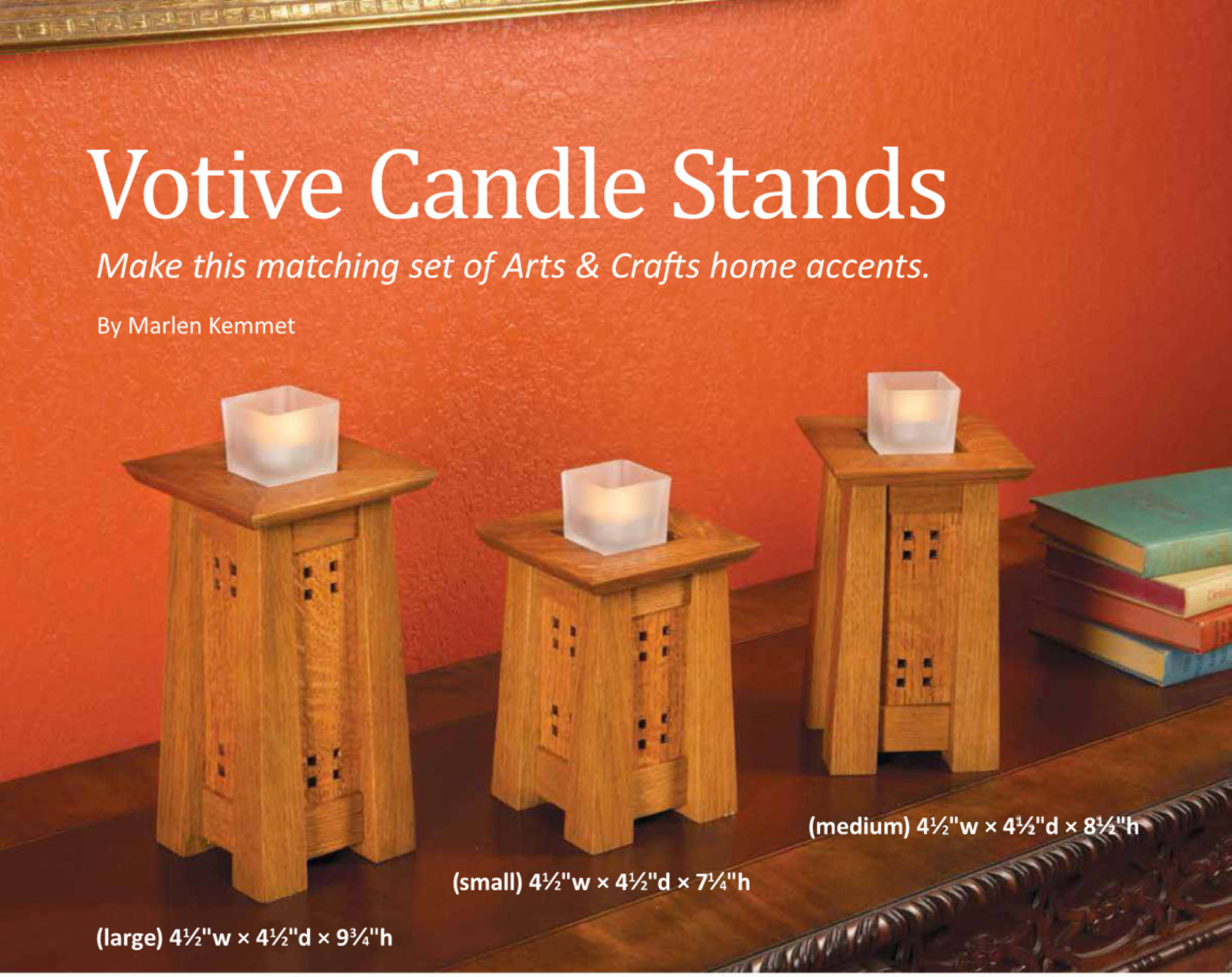
Votive Candle Stands

Make this matching set of Arts & Crafts home accents.

By Marlen Kemmet



Hone your tablesaw skills crafting a trio of stands in three heights. I used frame-and-panel construction to build them and a jig to taper-cut the uprights. For a consistent grain pattern, I chose riftsawn white oak for the uprights and quartersawn white oak for the panels.

Note: *To make this trio of stands, adjust the length of the uprights and panels. See the* ***Cut List*** *for dimensions. By lengthening parts (A) and (D), you can make three different stand heights. See the* ***Convenience-Plus Buying Guide*** *for the square, frosted votives seen here.*

Start with the Uprights

1 For the uprights (A) for all three stand sizes, cut four blanks for each stand to 1¼" square by the lengths in the **Cut List**. I laminated thinner stock to create the 1¼"-square upright blanks. (To do this, I initially cut 8 pieces a few inches longer than needed.)

Tip Alert

Consider cutting a few extra blanks for verifying your cuts in the following steps.

2 Fit your tablesaw with a dado blade and featherboard. Then cut a pair of ¼" grooves ¼" deep along two inside edges of each upright (A). Mark the taper cutlines on the outside faces of each upright for reference in the next step.

3 Build the taper jig shown in **Figure 2,** and fit your tablesaw with a zero-clearance auxiliary saw top, adhering it with double-faced tape. (I used ⅛" hardboard.) Since you are trimming narrow pieces off two edges of each upright, the auxiliary table prevents the off-cuts from falling into the blade

Figure 1: Candle Stand Exploded View

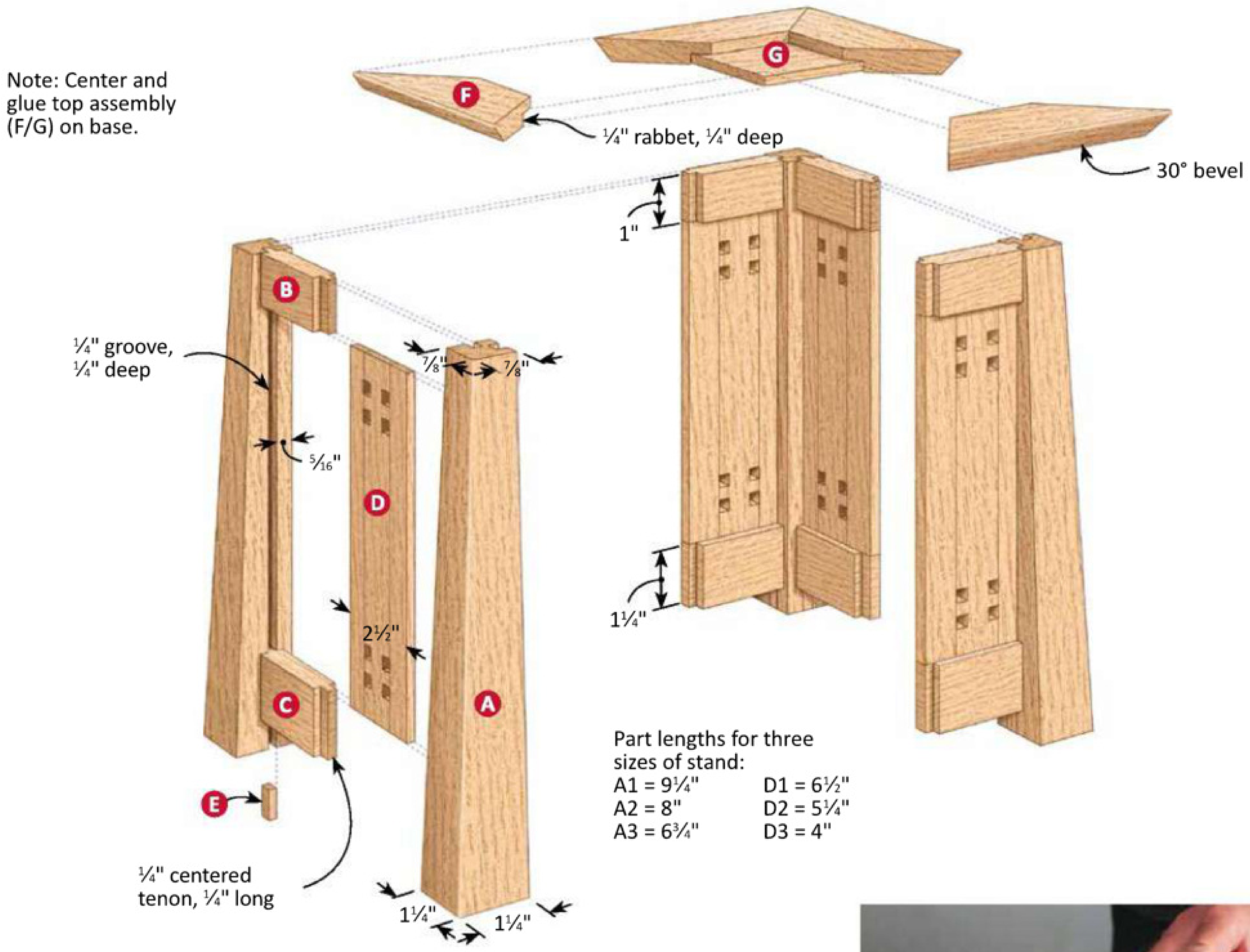
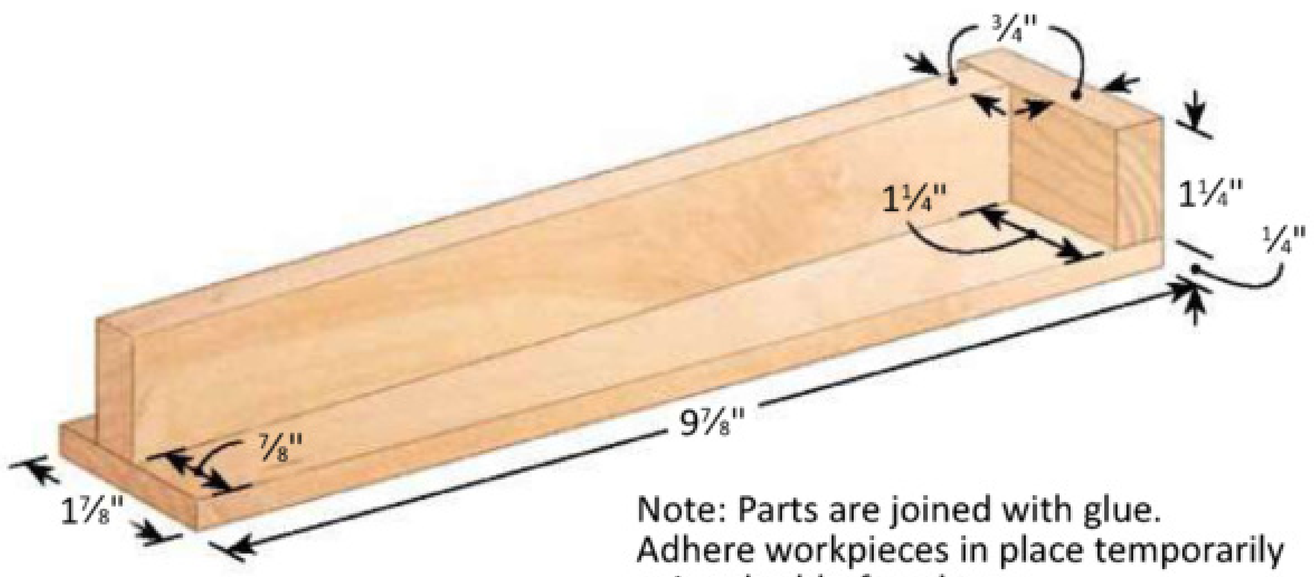
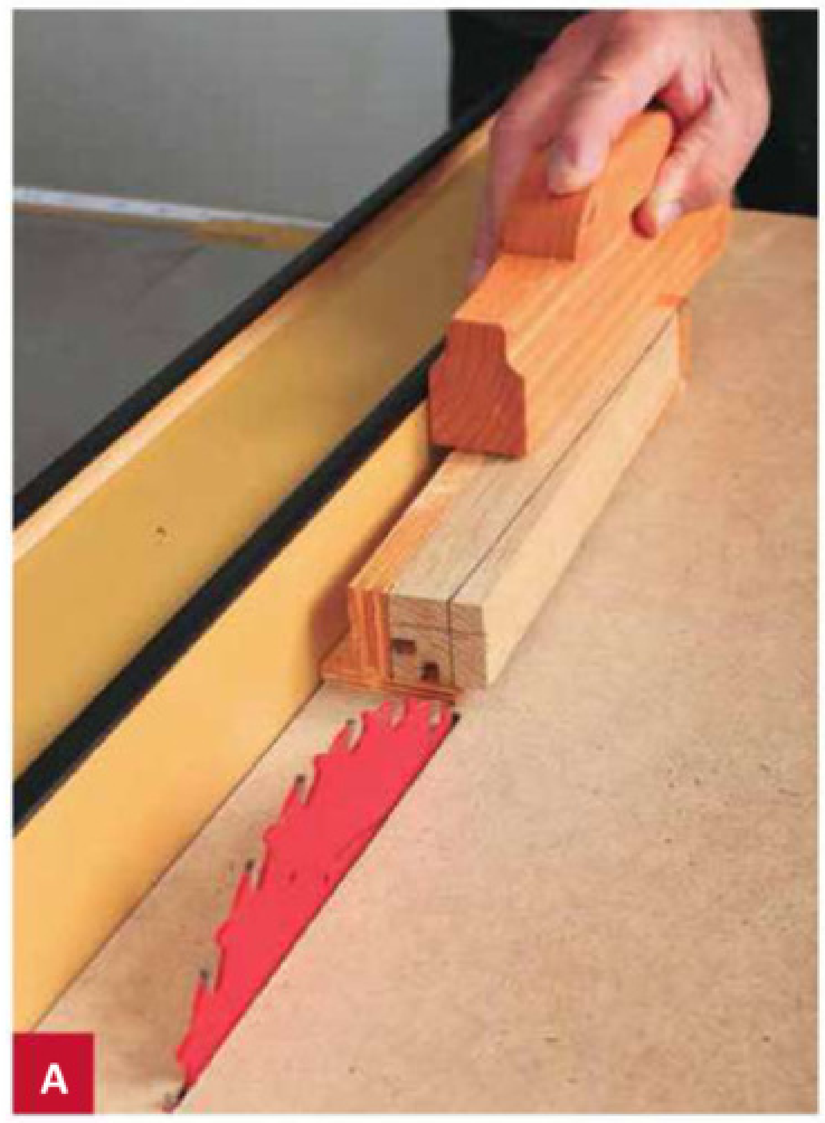


Figure 2: Taper Jig



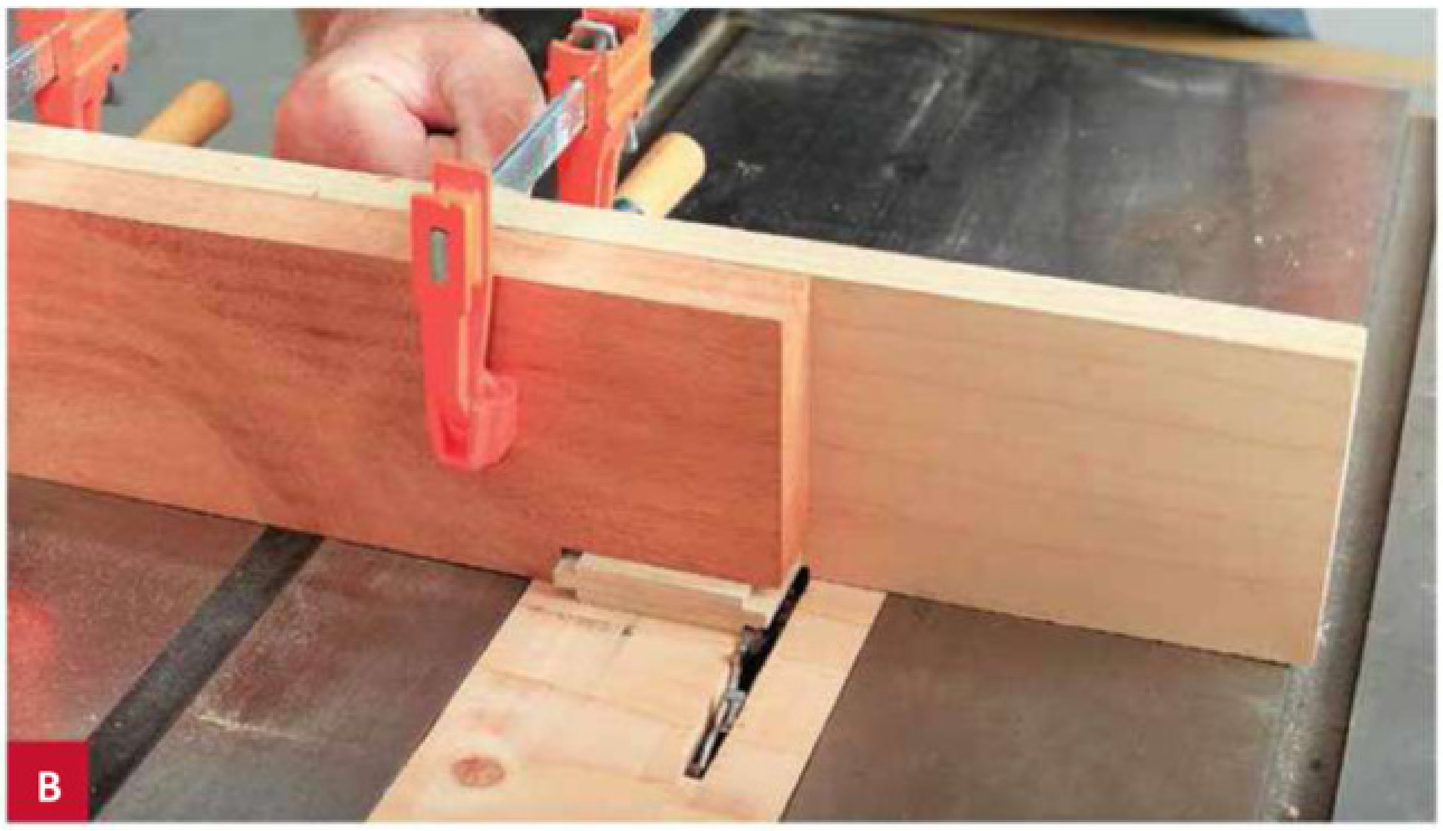
Note: Parts are joined with glue. Adhere workpieces in place temporarily using double-faced tape.

and shooting back. To push the jig and upright through the cut, use a pushblock and use the tape to adhere the workpiece to the taper jig. Make the first taper cut on each upright as shown in **Photo A**. Rotate the upright on the jig 90°, and make the second taper cut. (The taper cuts are opposite the edges having grooves.)



Adjust the fence so the blade aligns with the marked cutline, and make the first tapered cut.

Opening photo: Jim Osborn; Project photos: Caleb Rizzuti; Illustrations: Melanie Powell



When crosscutting the short rails, a notched hold-down stop is needed to secure the pieces.

Use a sharp dado blade and backer board to create near perfect notches without chipping.

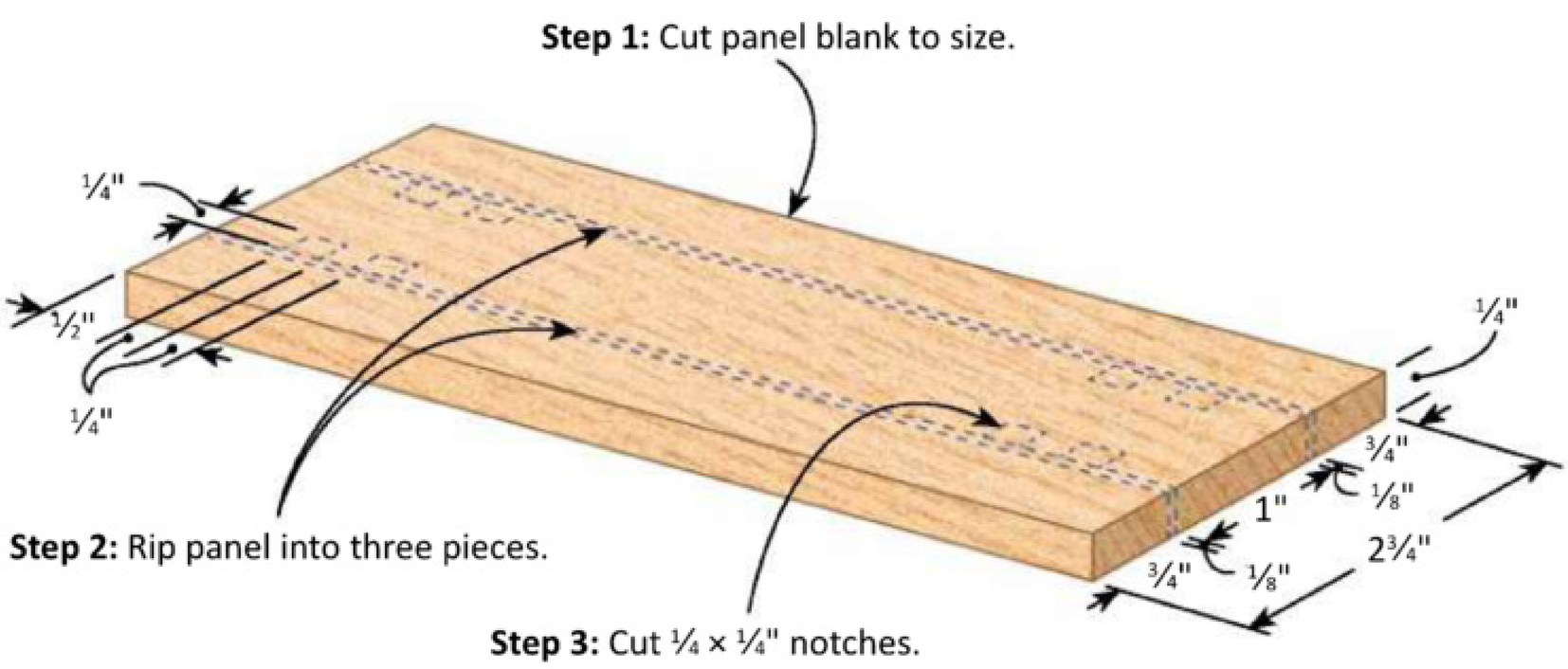
Create the frames

1 Cut the top rails (B) and the bottom rails (C) to the sizes in the **Cut List**. Fit your tablesaw with a dado blade, and cut a pair of opposing rabbets across each end of the rails so the resulting tenons fit snugly within the ¼" grooves in the uprights (A). For safety when cutting the rabbets, I used a miter gauge fitted with an auxiliary fence and hold-down stop, as shown in **Photo B**. When crosscutting short pieces, push the stock and miter gauge across the dado blade. Turn off the saw, reposition the miter gauge and workpiece, start the saw, and cut the next rabbet. Pull back the miter gauge after the blade stops.

2 From ¼"-thick solid white oak stock, cut four panels (D) to size for each stand plus ¼" in width using a standard ⅛" blade. Make two ripcuts through each panel blank, where dimensioned in **Figure 3**. Fit your tablesaw with a ¼" dado blade and cut four ¼" notches in each edge of the four center strips, as shown in **Photo C**.

3 With the surfaces and ends flush, glue and clamp the panels back together. Clamp the pieces

Figure 3: Panel-Cutting Sequence

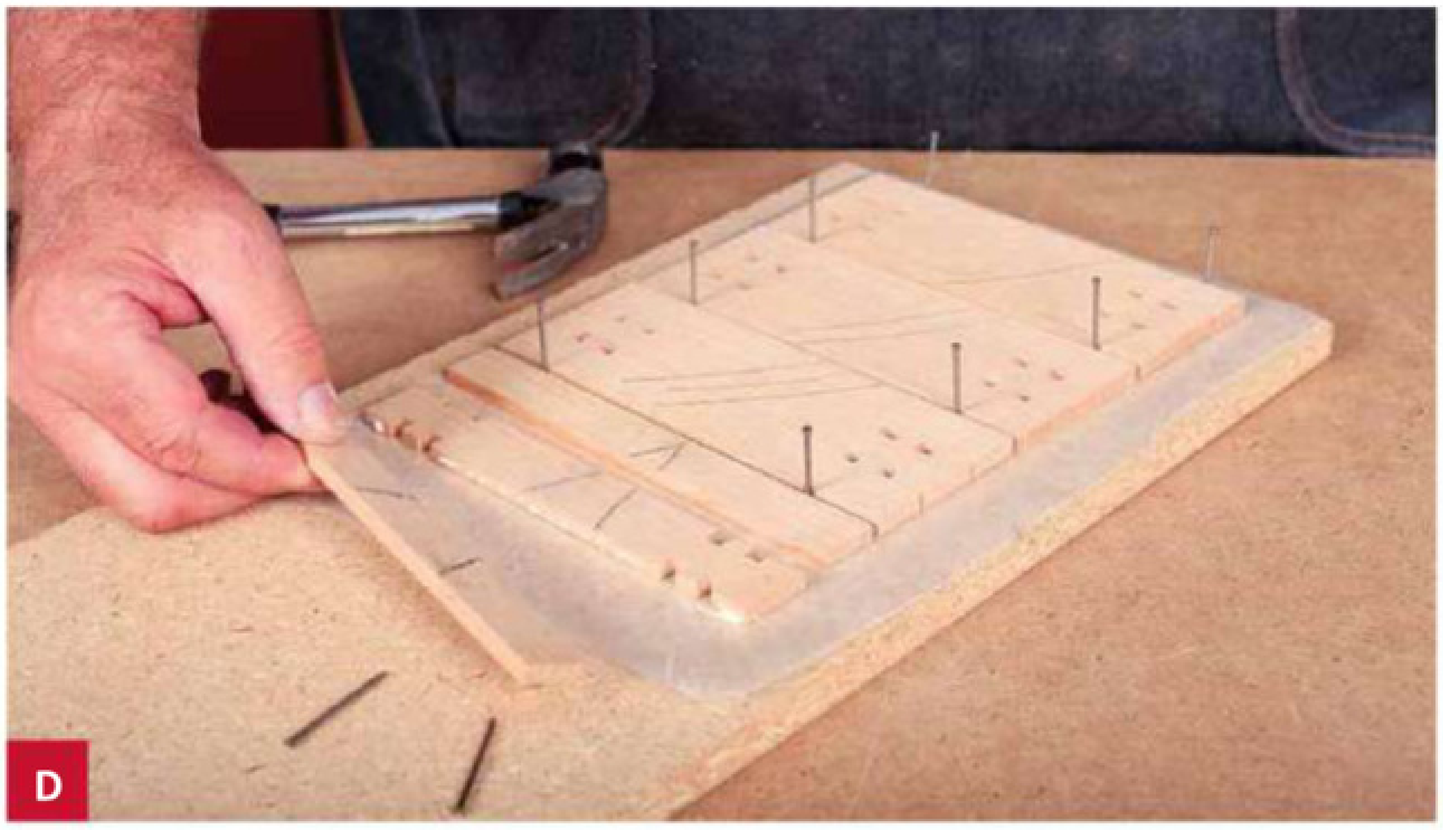


Note: Finished width of panel is 2½"

making up the panels on a length of particleboard or plywood that is covered with waxed paper, as shown in **Photo D**. Use finish nails along the edges of the panels to hold the pieces together until the glue dries. (You don't need a lot of clamping pressure here. Plus, the parts are easy to adjust.) Later, remove the nails, and sand the panel surfaces smooth.

4 Sand all the pieces (A, B, C, and D) smooth. Dry-assemble two frames in the configuration shown in **Photo E** to check the fit of the rails and panels between the uprights (A). Now, glue and clamp the frames together. Add the remaining panels and rails to form the stand assemblies.

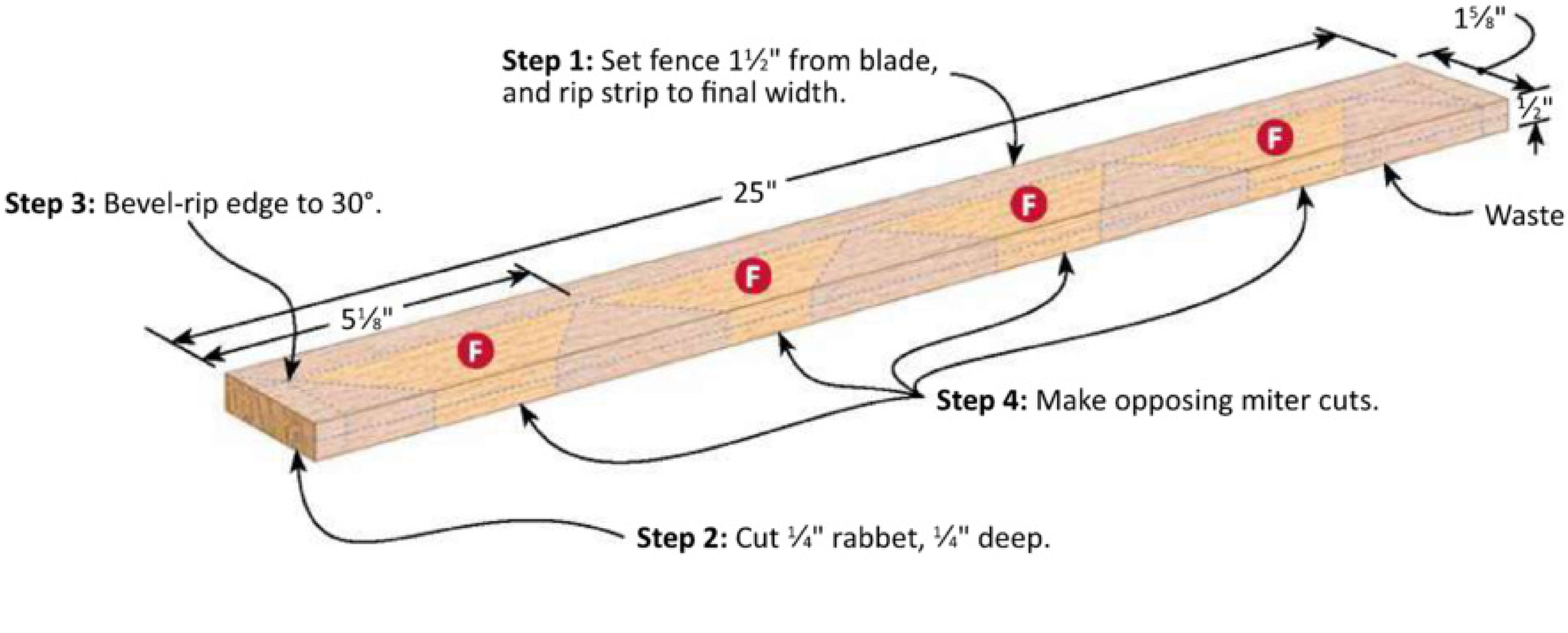
5 Rip a long ¼ × ¼" filler strip (E) to fit within the exposed groove in each upright below the bottom rails. Crosscut the filler strips to length, and glue them in place. If necessary, sand the bottom ends of the strips flush with the bottom ends of the uprights (A).

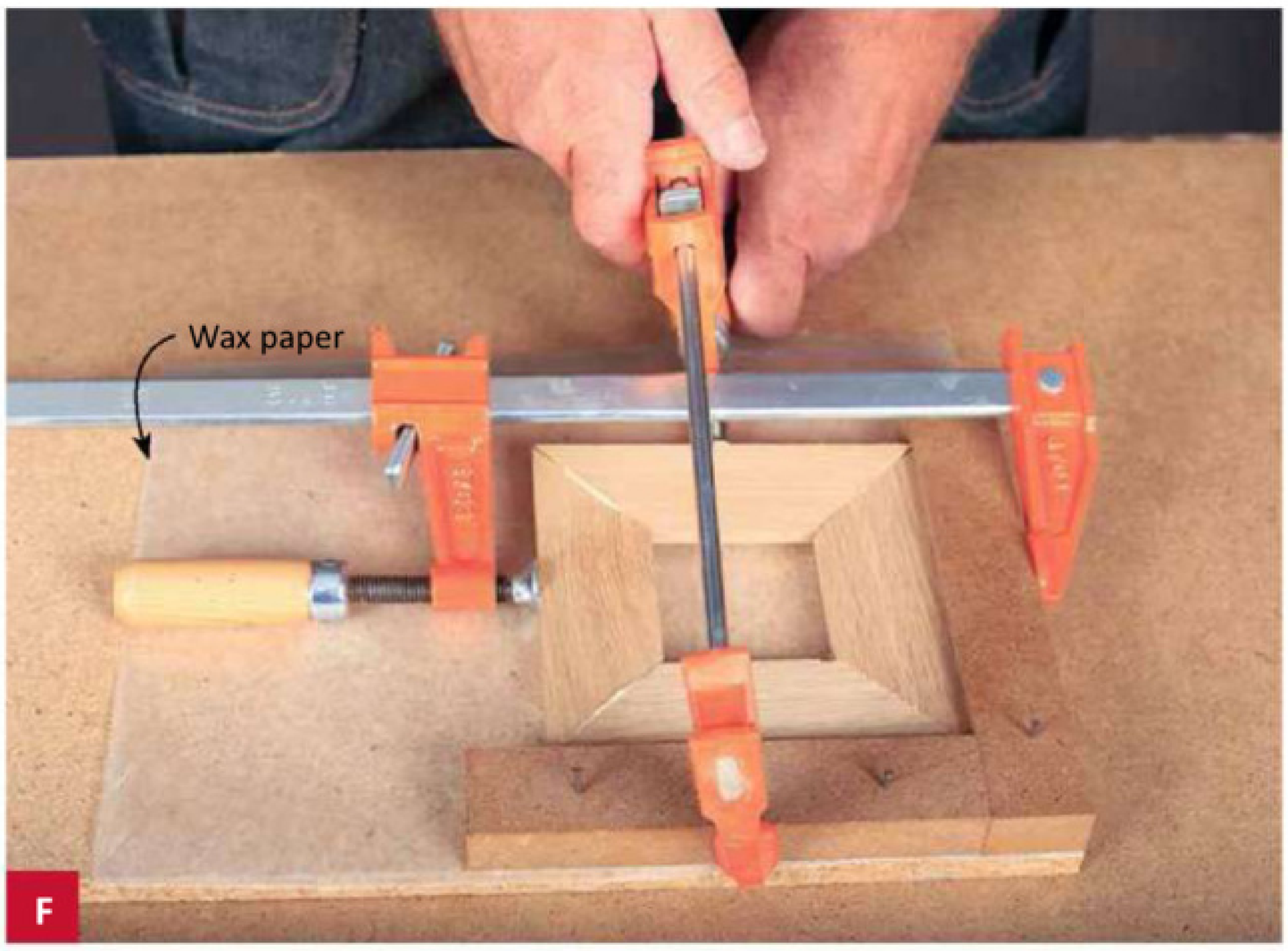


Tap in nails in the particleboard to snug up and edge-join several panels at once; the particleboard provides a flat surface on which to work.

Check for a flush fit at the assembly's top end before gluing the parts together.

Figure 4: Top Blank-Cutting Sequence





Employ a pair of corner cleats attached to a sheet good substrate to make clamping up the mitered top easier to manage.

Votive Candle Stand (materials for one stand)

	Part	Thickness	Width	Length	Qty.	Mat'l
A1*	Uprights	1¼"	1¼"	9¼"	4	RSWO
A2*	Uprights	1¼"	1¼"	8"	4	RSWO
A3*	Uprights	1¼"	1¼"	6¾"	4	RSWO
B	Top rails	½"	1"	2½"	4	RSWO
C	Bottom rails	½"	1¼"	2½"	4	RSWO
D1*	Panels	¼"	2½"	6½"	4	QSWO
D2*	Panels	¼"	2½"	5¼"	4	QSWO
D3*	Panels	¼"	2½"	4"	4	QSWO
E*	Fillers	¼"	¼"	½"	8	RSWO
F*	Top pieces	½"	1½"	5⅛"	4	RSWO
G	Top panel	¼"	2⅝"	2⅝"	1	RSWO

*Indicates parts that are initially cut oversized. See instructions.
A1 and D1 are used for the 9¾"-tall stand, A2 and D2 for the 8½"-tall stand, and A3 and D3 for the 7¼"-tall stand.
Materials: RSWO = Riftsawn Oak, QSWO = Quartersawn Oak

Convenience-*PLUS* BUYING GUIDE

☐ 1.	Freud SD208 Pro Circular Saw Pro Dado Saw Blade Set 8" × ⅝" bore	#127245	$99.97
☐ 2.	General Finishes Water-Based Stain, Black Cherry, 1 pt.	#818820	$11.49
☐ 3.	Watco Lacquer Gloss Spray, 11.25 oz.	#146946	$9.99
Above items are available at Woodcraft stores, *woodcraft.com* or by calling (800) 225-1153. Prices subject to change without notice.			
☐ 3.	Eastland Square Tealight Frosted Candle Holders, Set of 12. Size: 2"(H) × 2"(W); candles sold separately.	1151_12_TL	$12.99
Above item is available at *http://www.quickcandles.com*, or by calling (800) 928-6175. Prices subject to change without notice.			

Make the top assembly

1 To form the top (F), cut a piece of ½"-thick oak to 1⅝" wide by 25" long, as shown in **Figure 4**. Along one edge, cut a ¼" rabbet ¼" deep to fit the top panel (G) later. Bevel the opposite edge at 30° on your tablesaw for a finished width of 1½".

2 Next, using a stop, miter-cut four 5⅛" long pieces from the strip, and glue them together as shown in **Photo F**. Later, sand the top smooth and lightly sand along the outside chamfered edges to soften them.

3 Cut the top panel (G) to size, and glue it into the rabbeted bottom in the top (F).

Glue the top to the base, and finish

1 Finish-sand the top and base assemblies through 220 grit.

2 Center and glue the top assembly (F/G) to the base assembly. Remove any squeeze-out, and let the glue dry

3 Stain the votive candle stand. (I used General Finishes Black Cherry thinned 30% with water.) Finally, apply a clear finish. (I used spray lacquer.) ■

About Our Author
A founding member of the San Diego Woodworking Association, Marlen Kemmet's career in woodworking and woodworking publications stems back to the early 1980s. He likes building furniture and home accents in the Greene-and-Greene style for his home in rural Dallas County, Iowa.

10 Essential Sharpening Tricks

Hone your sharpening skills ... and your tools.

By Andy Rae

Sharpening straight-edged tools, such as chisels and plane irons, is a necessary and regular part of ownership. A dull tool is a dangerous tool. A sharp tool cuts better and is safer because you have more control, and the results speak for themselves: You get clean, flat surfaces that are free of scratches, crisp lines that hit the mark without chipping or blowing out, and the joy of pushing or pulling a tool without undue force or stress. In short, a sharp tool is a good tool. Anything less, and it's time to sharpen.

To keep your sharpening regimen accurate, effective and fast (so you can get back to working wood) I've outlined ten tactics for better edges. These sharpening methods are organized into three core categories: grinding, honing and polishing. While I use waterstones for the lion's share of my sharpening, most of the tips shown here can be used with other sharpening tools, such as oilstones, ceramic stones, diamond stones, or even–if you're so inclined–sandpaper. Implementing these strategies into your regular sharpening regimen is bound to boost your sharpening skills so you can get back in the game in short order, with edges super sharp for the most demanding tasks.

Photos: Andy Rae

Grinding Tips

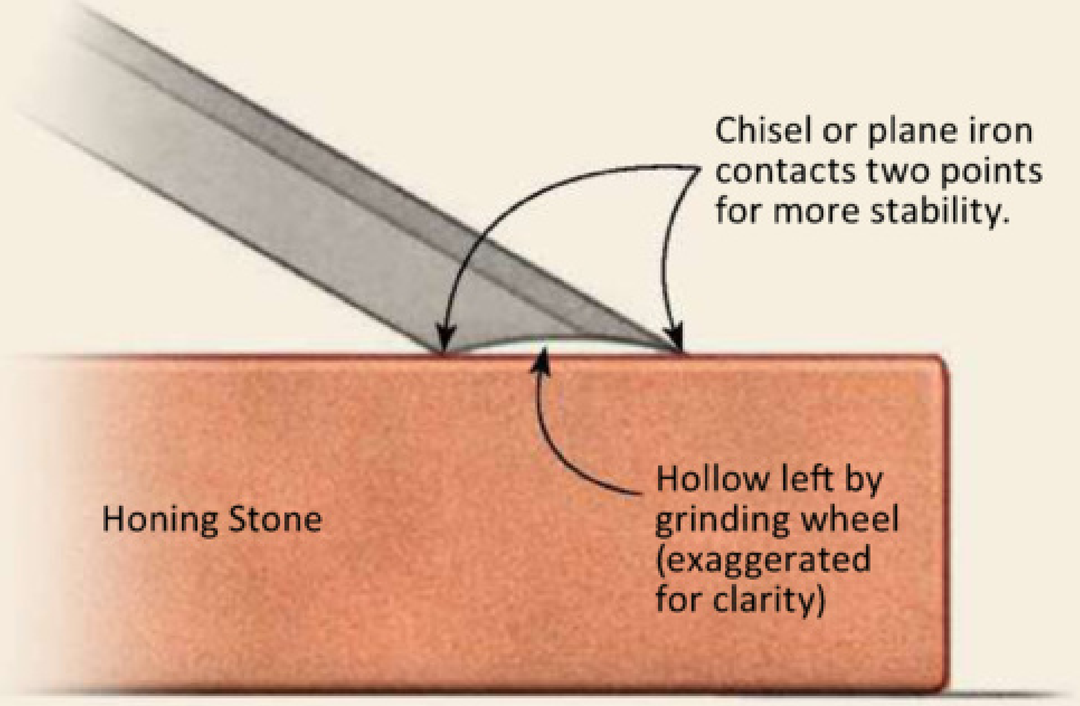
1 Set up your grinder for success

Shaping new tools, altering bevel angles, or simply removing nicks in an edge are all part of a bench grinder's job. But not all grinders are created equal. Spinning at 1,750 rpm, a slow-speed grinder generates less heat than a conventional 3,450-rpm grinder, making it less likely to burn, or "blue," your tools. Listed by the diameter of their wheels, you can choose from 6" or 8" models. Larger wheels grind more steel in less time, but will heat edges more readily; smaller models typically cost less.

For optimum control, position the grinder high, so that the center of its wheels sits at about the height of your bent elbows (typically 44" to 48" from the floor). This setup lets you lock elbows and use your upper body and forearms for smoother tool movement side to side. Of course, a sturdy tool rest is essential. Look for a large table that's easy to fine-tune for height and angle, and one that locks securely. A tool rest that's notched to surround the wheel is a handy feature for light side grinding.

Use a dressing stick to clean and shape the wheel, making a slight belly in the middle by forming a gentle arc, cutting back the sides about 1/64" (inset).

A Hollow-Ground Edge Is Easier To Hone



For most woodworking tools, a 120-grit wheel is the best choice. Look for wheels with a vitrified bond. These break down easily in use to expose fresh particles, reducing heat buildup and lessening the chance of bluing. Because wheels wear and collect metal debris, you'll need to dress the working surface periodically. I use two dressers to keep my wheels clean and to shape them. The first is a diamond dresser that cuts very fast and lets you remove deep grooves and imbedded metal particles. I follow this with a silicon carbide dressing stick to smooth the surface and refine the shape into a slight belly. The belly prevents over-grinding and provides more control, especially with narrow tools. And since you're cutting in the center, you don't have to sweep a wide tool completely off to the side of the wheel as you would with a flat wheel.

With the right grinder setup, you'll automatically grind a slight concavity into the bevels of your chisels and plane irons. This "hollow-grind" (which matches your wheel diameter) has the benefit of making the tool much easier to hone by hand, as I'll describe on page 38.

2 Reshape an edge to square

A square edge is the goal when grinding most edge tools. The tricky part is marking out an accurate reference line to work to when grinding, since steel resists pen and pencil. The fix is to spray a coat of fast-setting layout fluid, or *machinists' bluing*, on the back of the chisel or iron up to the cutting edge. Use a small square and a sharp awl or other fine-pointed tool to etch through the thin, uniform color close to the edge, exposing a precise line that's square across the face of the back. You can grind to the line, or simply use it as a mark for eyeballing straight and square. The thin paint comes right off with a swipe of denatured alcohol, or with two or three passes over your stone.

Spray the back of the tool with layout fluid, let it dry, and then scribe a clean line square to the sides and near the cutting edge.

3 Color the bevel to gauge the grind

Color the bevel, and then grind it by keeping the tool moving sideways. You're done when all the color is gone.

A consistently ground bevel is key to a well-sharpened tool. But it can be tricky to reliably assess your progress during grinding. A dark felt marker can take the guesswork out of the job, letting you gauge your progress as you grind. Mark the entire face of the bevel, and grind until all the color is removed.

Once you get the knack for grinding a smooth, consistent bevel, take a close look at your work. A pocket magnifier or a photographer's loupe will help you see the very cutting edge, and whether it's even and without large chips, or whether you need to go back to the wheel.

4 Put the heat in the sink

Upcycle a heat-sink from an old computer, and press the back of the tool on it to dissipate heat. Double-faced tape holds the sink to a piece of plywood, letting you cool your tool where you grind.

Quenching a hot blade in water is a recipe for disaster. Too hot, and the plunge can create tiny fractures in the steel, weakening the edge. Instead, you can cool off a hot blade without stressing the steel by holding it on a computer heat-sink for a few moments. They're typically free from any neighborhood computer whiz kid.

Illustrations: John Hartman

Honing Tips

1 Prep and hold your stones

For good control, set up your honing station relatively low, or about 30"-36" from the floor to the top of the stone. I use a series of waterstones for honing and polishing. For rough work, where the edge is badly deteriorated, start with an 800-grit stone. But for most sharpening, begin with a 1200-grit stone for honing, and then move directly to a 6000- or 8000-grit stone for polishing.

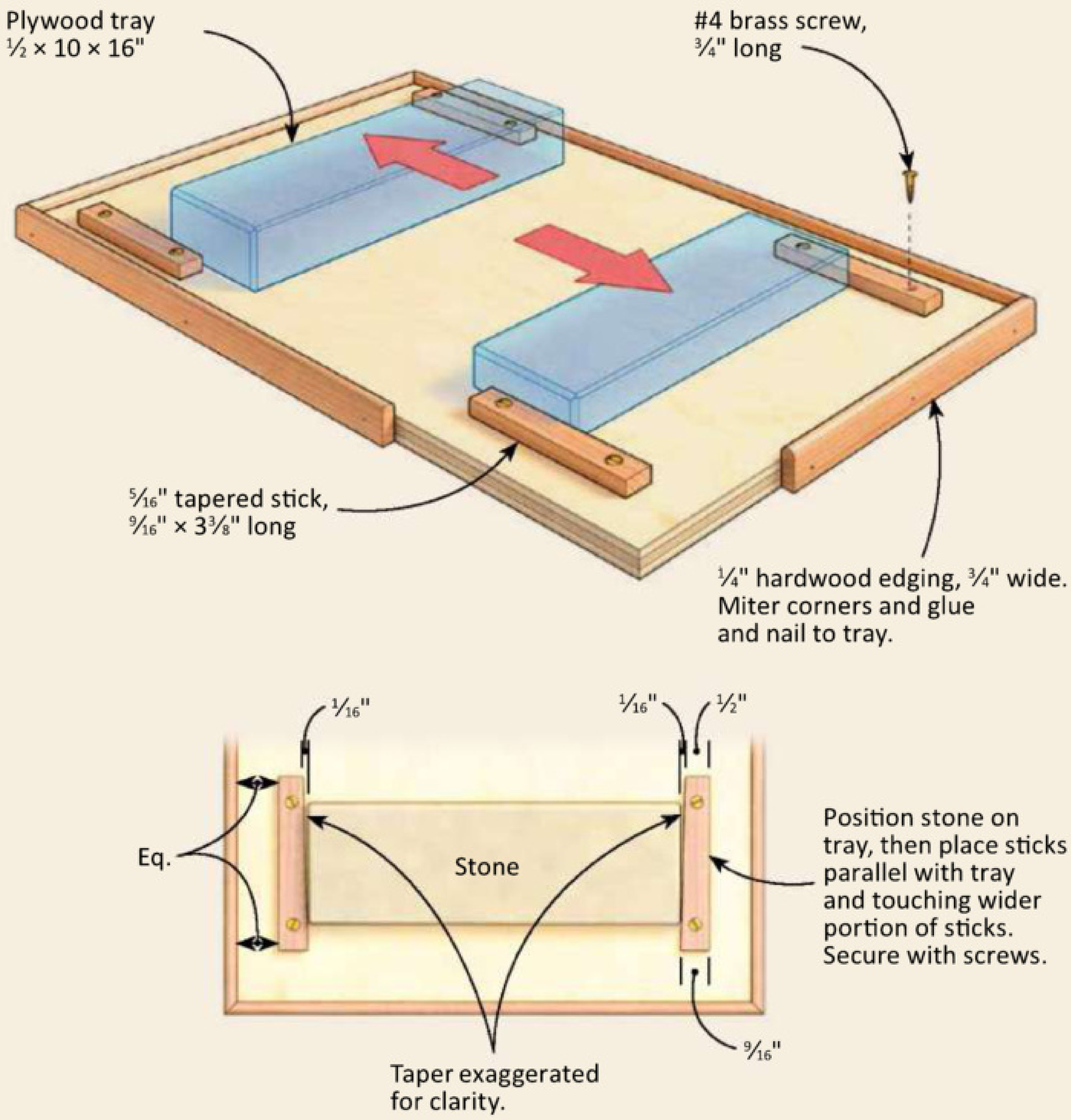
Mark the grit on your stones by labeling their ends (not their sides) with a hard, pointed object such as a carbide-tipped pen. If you use an awl instead, be prepared to resharpen it afterward.

To prevent chipping, slightly chamfer all the sharp edges on both new and worn stones by rubbing them with a 150-grit sanding block or a flattening stone (see illustration at right). Pay particular attention to the ends, where chipping is most likely, making the chamfers wider here.

A simple plywood tray will hold stones securely and can be conveniently dogged to your benchtop. Keep a spray bottle of water on hand to wet the stones as you work. When honing either the back or the bevel, I resist conventional wisdom by positioning the tool sideways on the stone and then moving it forward and backward. I find that this approach provides more control and allows greater tactile feedback while allowing me to maintain the tool at a consistent angle.

A shop-made tray holds coarse and fine stones for honing. Stones are wedged securely between tapered sticks (inset).

Honing Tray



2 Keep your stones flat

Use plenty of water, and push the flattening stone as you would a plane, with even pressure front and back. Deep grooves trap waste and speed up the flattening process (inset).

Flat stones make for precise sharpening, so it's important to true your waterstones on a regular basis. You can use any stone to flatten another, but commercial flattening stones and diamond stones are much faster-cutting. A coarse (220-grit equivilent) diamond stone cuts faster than a flattening stone and leaves a slightly smoother surface, but it typically costs three times as much. Using plenty of water, rub the flattening stone back and forth on your honing stone, pushing straight ahead and occasionally skewing it at an angle. Once or twice, turn the honing stone 180° and repeat. It's flat when it's an even color, with no dark or light spots.

3 Hone the back flat–fast

The backs of new chisels and plane irons need flattening, and regular sharpening sometimes requires a similar amount of work. To speed up what is often a laborious process, make a 1¾ × 4 × 7½" hardwood block and firmly press it 1"-2" over the leading edge as you push both tool and block over the stone. Rub until the back has an even luster.

A rubbing block, sawn to fit your hand, speeds up flattening backs. Bandsaw a series of 1/16"-deep grooves spaced every ⅛" across the bottom, and wet the bottom for increased grip (inset).

4 Hand-hone the bevel

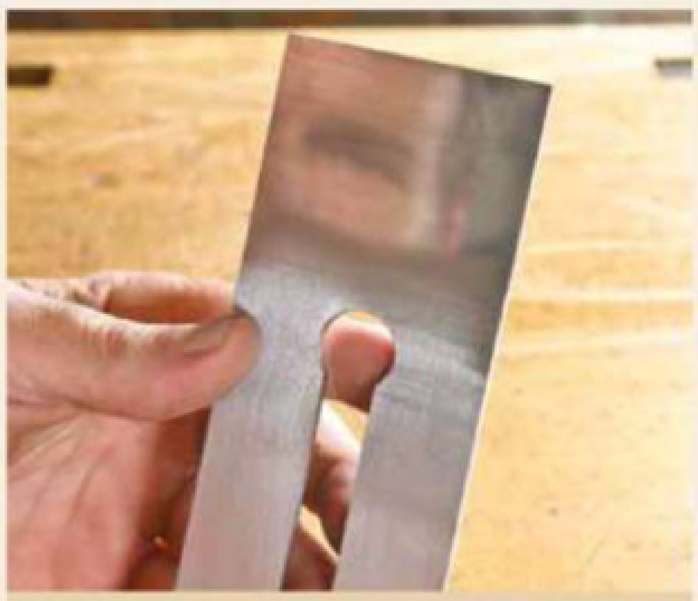
A consistent angle is paramount when honing the bevel. And thanks to the hollow-ground bevel left by the grinding wheel, honing by hand is well within the skill set of the novice. Place the bevel on the stone, and rock it slightly until you feel it firmly seated. Grip the tool with one to three fingers on the back (depending on how wide it is) and, similar to grinding, lock your elbows and move the tool with your upper body, not your arms. Your other hand simply supports the weight and helps move the tool back and forth.

Once you feel a full-length burr, flip the tool over and hone the back. For a longer-lasting, tougher edge, consolidate and refine the already sharp edge by flipping the tool repeatedly, decreasing the pressure each time until you finish with a light touch on each side.

On a wide iron, position two or three fingers close to the cutting edge, and push down hard. Rub the blade slightly past the stone's ends to prevent dishing the stone.

Polishing Tips

1 Look in the mirror



Look for a mirror polish on the bevel and the back for the toughest, longest-lasting edge.

Under a microscope, metal that's polished to a mirror-shine still reveals scratches similar to those found on a surface with a dull, or matte, finish. Although both are sufficiently sharp to cut wood, a polished surface is tougher and more durable because the edge has shallower scratches.

As you did with the 1200-grit stone, use a 6000 or 8000 stone and hone the back and the bevel, flipping back and forth to remove the burr, while decreasing pressure with each flip. If you're polishing a freshly-ground bevel, it takes only seconds to create a tiny, polished strip of metal at both the toe and heel of the bevel. The back, however, takes more work, and it's often prudent to get out your rubbing block again to initiate a shine. As before, you only need to focus on the endmost 1"-2" of the blade when polishing the back. Finish by hand, again with light pressure. It's a good exercise to inspect the surface under magnification. The goal is to rub until you can see your reflection.

2 Dub the corners

When you need to plane a wide surface, rounding over the corners of your plane irons will reduce track marks on your work. The approach is simple, but care should be taken not to groove your stone. Using a 6000 or 8000 stone, hold the iron at roughly 45° to the surface and drag the tool back towards you. On the first pass, *almost* lift the blade as you pull, then make two or three more passes with just the weight of the blade on the stone. ■

You can prevent plane track marks on your work by rounding over, or *dubbing*, the corners of your plane iron, cocking the blade at an angle, and taking three or four light passes over your finishing stone.

About Our Designer/Builder

Andy Rae is an award-winning furnituremaker whose career spans several decades. He has authored a number of books on woodworking, including *The Complete Illustrated Guide to Furniture and Cabinet Construction* (Taunton Press). He currently makes his home in the mountains of western North Carolina.

Convenience-*PLUS* BUYING GUIDE

☐ 1.	Rikon 8" Slow Speed Grinder	#158512	$139.99
☐ 2.	Aluminum Oxide 8" × 1" Grinding Wheel, White, 120 Grit	#01W47	$36.99
☐ 3.	Veritas Grinder Tool Rest	#153365	$57.99
☐ 4.	Diamond Dressing Tool, 120 grit	#158523	$17.99
☐ 5.	Dressing Stick	#11N51	$17.50
☐ 6.	P704 Pocket Magnifier 4x	#154620	$7.99
☐ 7.	King Brand Deluxe Waterstone, 800 Grit	#11H31	$30.50
☐ 8.	King Deluxe Waterstone, 1200 Grit	#11H11	$31.50
☐ 9.	King Ice Bear Waterstone, 8000 Grit	#149291	$73.99
☐ 10.	Norton Flattening Stone	#833914	$34.99
☐ 11.	DMT Duosharp 8" Diamond Stone, Coarse/Extra Coarse	#140966	$102.99
Above items are available at Woodcraft stores, *woodcraft.com* or by calling (800) 225-1153. Prices subject to change without notice.			
☐ 12.	Layout Fluid, Spray		$11.96
Above item available at McMaster-Carr, *www.mcmaster.com*.			

Hand Plane Cabinet

A fitting home for fine tools

By Geoff Noden
Designed By Craig Bentzley

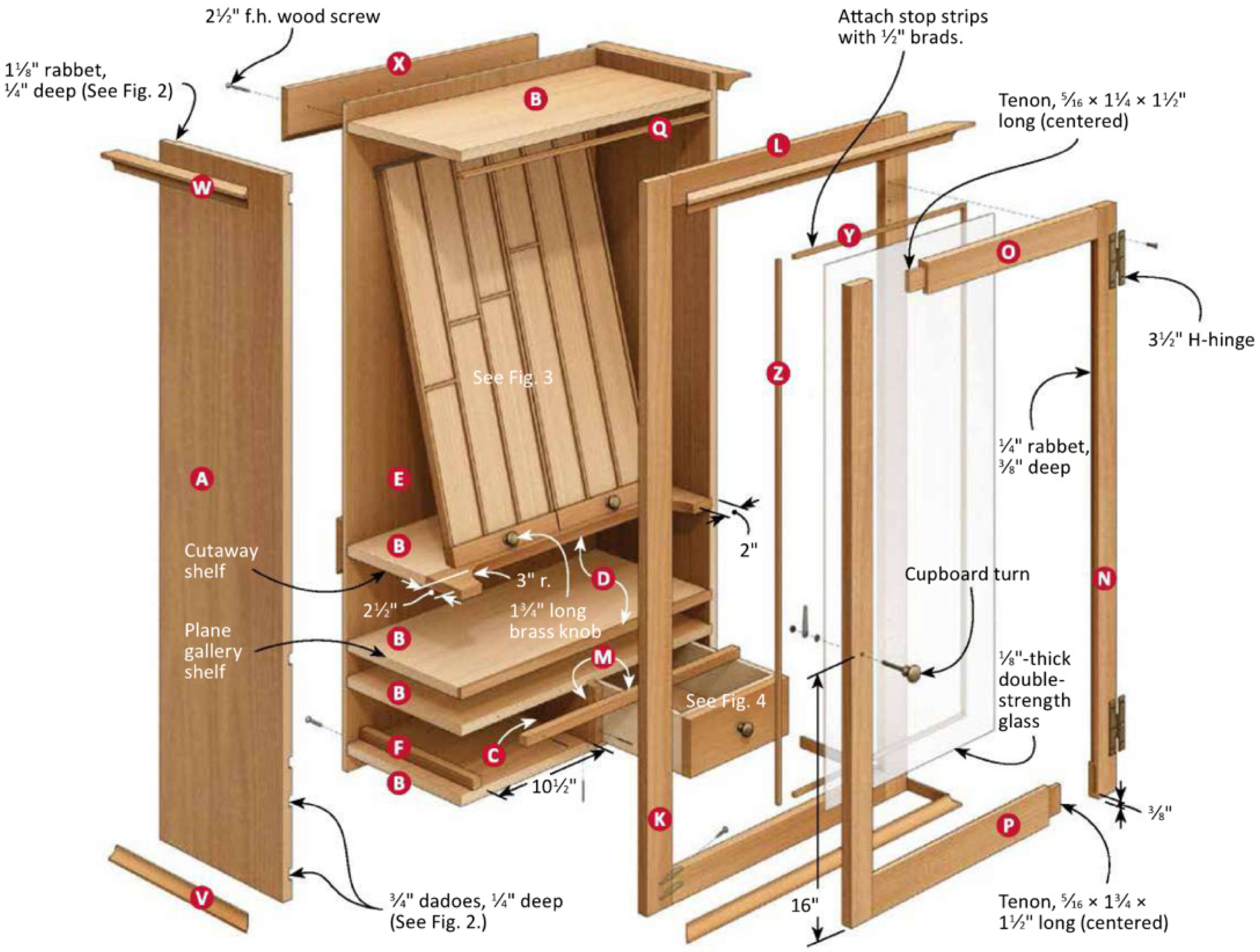
Photos: Paul Anthony

There's a long-standing tradition of cabinetmakers displaying their woodworking skills in the form of finely crafted tool cabinets and chests. Very often, the contents include a number of hand planes, which can accumulate surprisingly quickly. It's not unusual for a serious woodworker to have a dozen or more of these tools, all of which deserve care and protection.

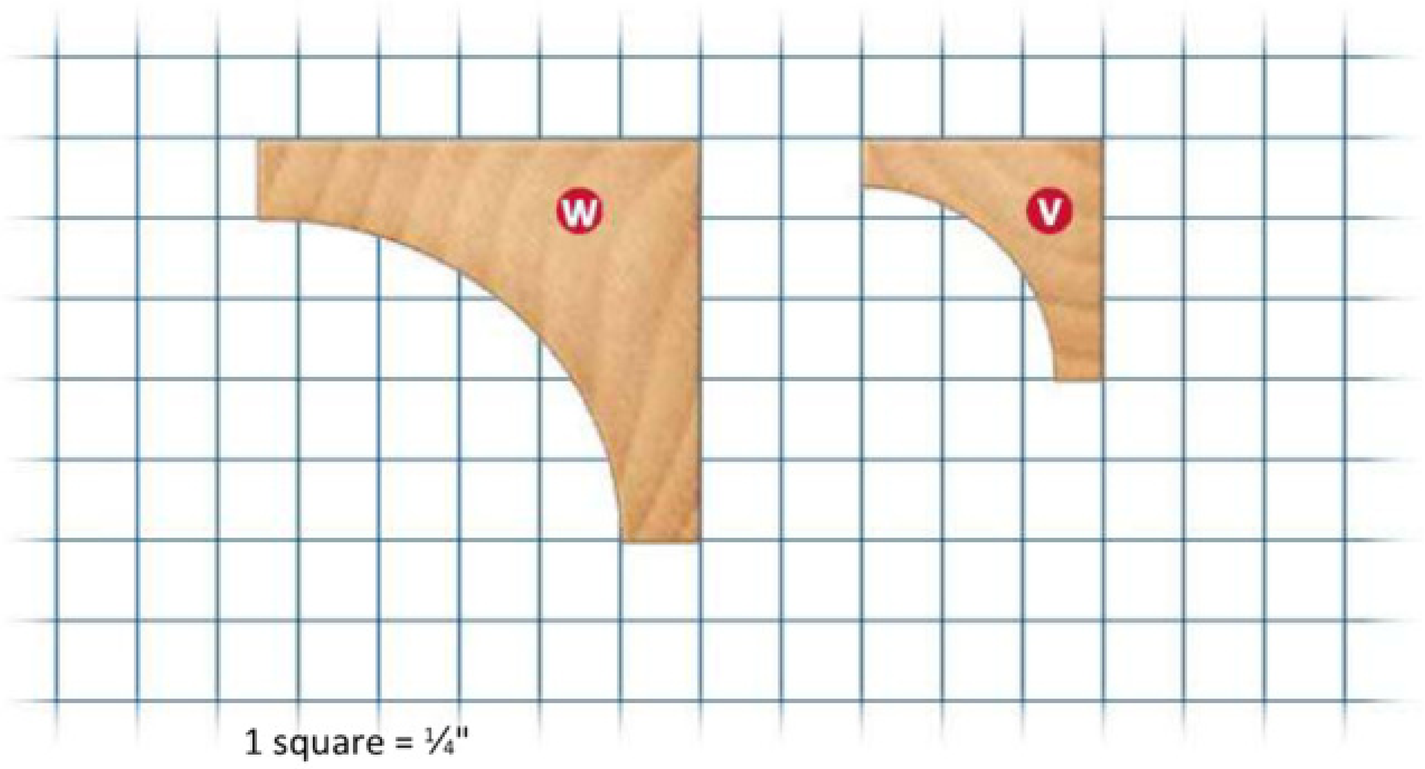
To that end, this dedicated hand plane cabinet was designed for beauty, utility, and accessibility. The cabinet is deep enough to compactly accommodate block and smoothing planes on the gallery shelf. This shelf is raised to the level of the top edge of the lower door rail for clear visibility and quick inventory when you're looking for a particular plane for a job at hand. The cutaway in the shelf above the gallery also aids visibility.

The upper ramps provide a good solution for storing long-bodied planes in a shallow cabinet, while perfectly presenting the totes for easy grasping. As an added benefit, the hinged ramps can be lifted upward to allow access to the interior space for storage of infrequently used items. Finally, two drawers offer compartments for plane-tuning tools, paraffin, and other related supplies and accessories.

Figure 1: Hand Plane Cabinet Exploded View



Molding Detail (Full-Sized)



Online Extra
For a sheet cutting diagram, go to *woodcraftmagazine.com* and click on "Online Extras."

A

For efficiency and joint accuracy, saw the dadoes in a "double-wide" panel before ripping it into two to create the case sides.

B

Glue a wide piece of solid wood between the plane gallery shelf and cutaway shelf. Afterward, rip through it to create two edged shelves.

Make the plywood case

1 Cut a single 26¼ × 47" hardwood plywood panel from which you'll ultimately make both case sides (A), as shown in **Figure 2**. Make sure the panel is square, and that you've removed any factory edges.

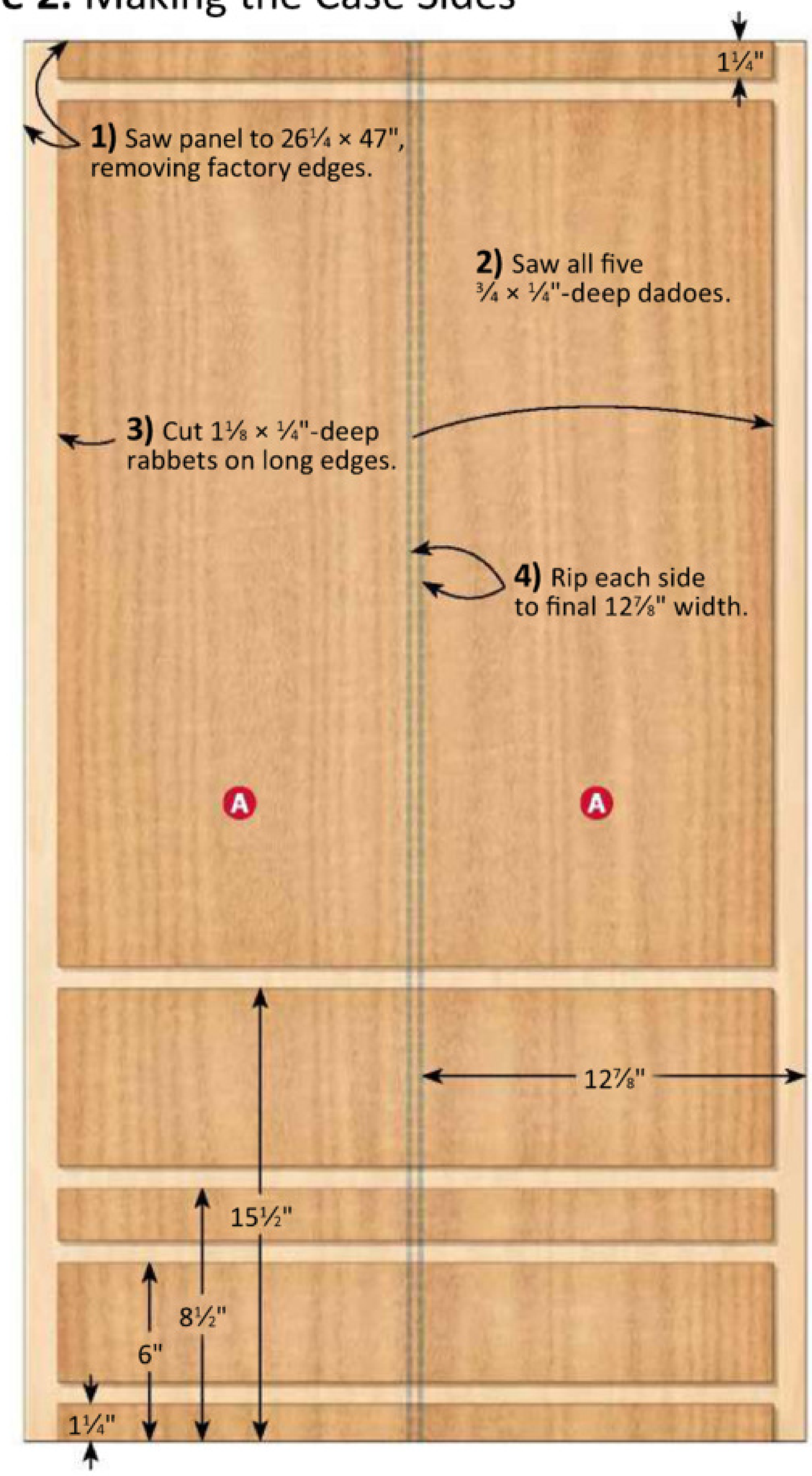
2 Referring to the **Cut List**, saw three of the five horizontal panels (B) and the drawer divider (C) to final size. For the remaining two horizontal panels, cut a single 24"-wide × 25"-long panel for now. You'll rip this "double-wide" panel into the two finished panels after cutting the dadoes for the drawer divider.

3 Referring to the spacing shown in **Figure 2**, use a dado head to saw the ¾ × ¼"-deep dadoes in the sides (A) panel (**Photo A**).

4 Saw the ¾ × ¼"-deep dadoes for the drawer divider (C) midway across the 25" length of the double-wide horizontal panel you cut in **Step 2**.

5 Saw the 1⅛ × ¼"-deep rabbets in the outermost edges of the double-wide sides (A) panel, where shown in **Figure 2**. Clamp or tape a wooden sacrificial facing to your rip fence to prevent scarring it.

Figure 2: Making the Case Sides



Illustrations: Christopher Mills

C

Use a scrap panel to square the horizontal panels to the drawer divider during glue-up, and use a carefully squared spacer panel to accurately locate the drawer guides.

6 Rip each side (A) to its final 12⅞" width. Also rip the double-wide horizontal panel into two 11¾"-wide pieces.

7 To efficiently make the edging (D) for the horizontal panels (B) that will become the plane gallery shelf and cutaway shelf, first dress a piece of solid oak to 13/16 × 3⅞ × 25". Then edge-glue it between two of the slightly oversized horizontal panels (B), as shown in **Photo B**. After the glue cures, hand-plane and/or sand the faces of the edging flush to the faces of the panel. Then rip through the solid wood section to create one panel with 3½"-wide edging (for the upper cutaway shelf) and the other with ¼"-wide edging (for the lower gallery shelf). Clean up any saw marks, and then rip each panel to its final 11¾" width.

8 Referring to **Figure 1**, lay out the cutaway on the 3½"-wide edging. Use a jigsaw or bandsaw to cut the shape, and then smooth the edge.

Tip Alert

Before assembling a cabinet like this with small, deep compartments, consider prefinishing the interior faces before assembly, avoiding any joints.

Glue up the case

1 In preparation for assembling the case, make eight thick, straight cauls, squarely crosscutting their ends.

2 Glue the drawer divider (C) into its dadoes (**Photo C**). Also, make the drawer guides (F), and glue them in place to the case bottom (B) at the same time, using 10¼"-long spacer panels to aid location.

3 Dry-clamp the case together to check the fit of the joints and to rehearse your clamping procedures (**Photos D and E**). With the unit clamped up, measure for a perfect fit of the back (E), and then cut it to size. Make sure it's dead square, as it will serve to square up the case during assembly.

4 After the divider (C) joints have cured, glue up the case.

Make and fit the ramps

1 Cut the ramp panels (G) to the size in the **Cut List**. Then saw the ¼ × ⅛"-deep grooves, as shown in **Figure 3**. I spaced them about 3" apart, which accommodates most planes, but double-check the widths of your specific tools (for a #8 plane, allow an extra 3/16"), and adjust the spacings to suit.

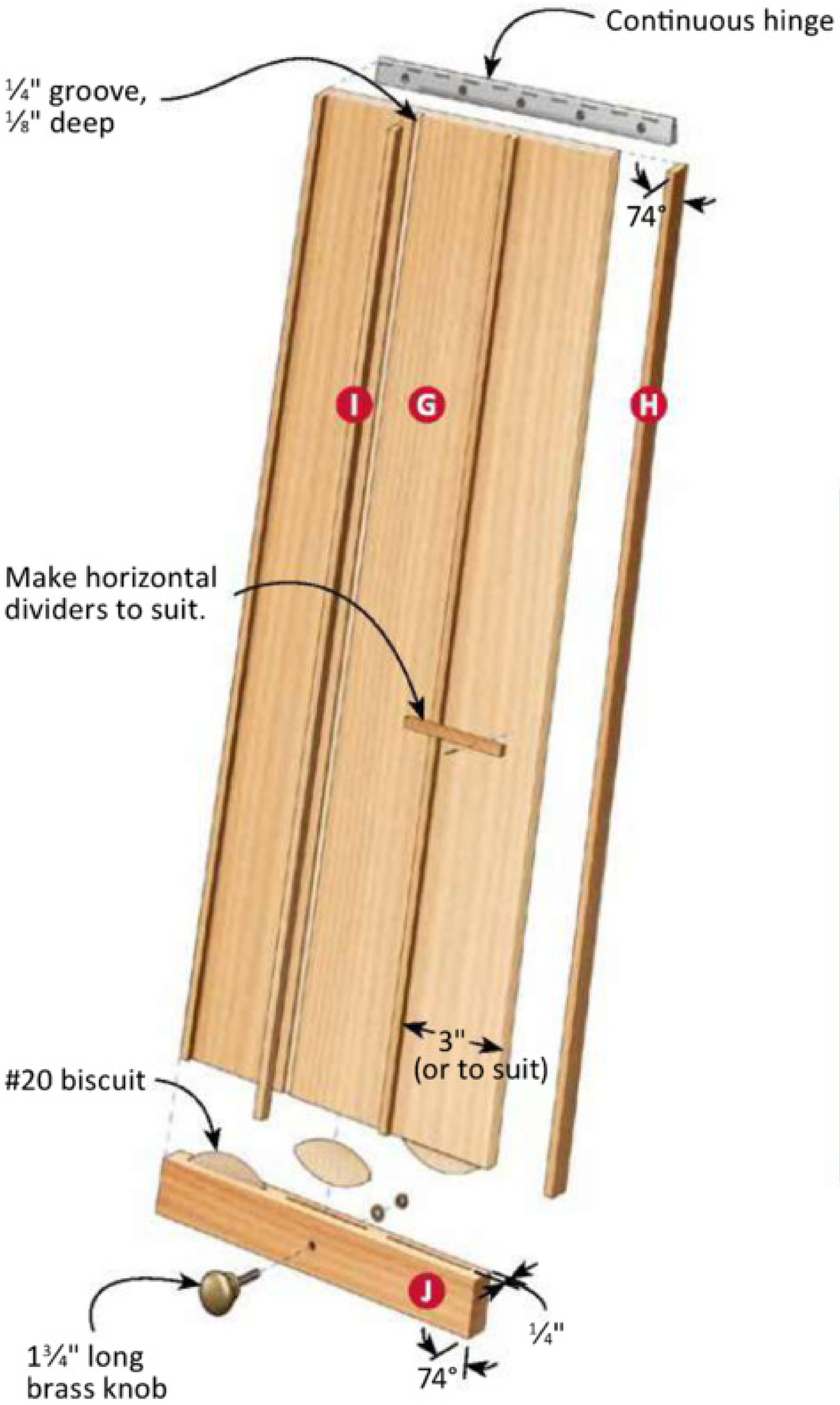
D

Rehearse the rest of the case glue-up by first clamping across the face, with the case resting on cauls overhanging the edge of the bench.

E

Next, lay the case on its front, insert the back panel, and check to make sure that all the joints mate tightly.

Figure 3: Ramp



When planning your plane arrangement, keep in mind that the ramps are designed to accommodate longer planes (numbers 5, 5½, 6, 7, and 8). Smaller bench planes (numbers 4½ and under) should be placed either in the plane gallery below, or on the upper sections of the ramps. Otherwise, when placed low on the ramps, their totes may prevent the door from closing.

With the ramps centered in the case and held back ½" from the front edge of the cutaway shelf, mark along the hinges' barrels and ends to establish the hinge locations.

2 Saw the ramp edging strips (H), vertical divider strips (I), and rails (J) to the sizes in the **Cut List**.

3 Cut the biscuit slots in the bottom edges of the ramp panels (G) and in the mating edges of the ramp rails (J). Now glue and tack the strips (H, I) to the ramps, and clamp and glue the rails (J) to the ramps. Lastly, saw a 74° bevel on the top and bottom edge of each assembled ramp, where shown in **Figure 3**. For safe sawing, this is best done using a crosscut sled or a miter gauge outfitted with a long auxiliary fence.

4 Temporarily attach a 10"-long section of continuous hinge to the rear face of each ramp at its top edge, using just a few screws for now, but drilling all of the pilot holes. (*Note that the ½"-long screws that come with the hinge will poke through the panel unless shortened. After drilling the pilot holes, I pre-threaded them by driving a screw partially in, and then removing it. I then ground about 1/16" off the tips of the screws before final installation.*)

5 Put the ramps in place, with their lower edges set ½" back from the inner edge of the cutaway shelf. Now mark the hinge locations by tracing along the hinge barrel and the ends of the hinge leaves (**Photo F**).

6 Trace along the rear edges of the horizontal panels (B) onto the back (E). Then remove the back, extend the horizontal panel centerlines across its rear face, and drill countersunk clearance holes for attaching it.

7 Detach the hinges from the ramps (G), and screw them to the back (E), again with just a few screws, but drilling all the pilot holes. (As you did for the ramp attachment, grind about 1/16" off the tips of the screws.)

8 Glue and screw the back (E) in place with #6 × 1½" screws placed approximately 6" apart.

G

Drill pocket screw holes in the ends of the face frame rails for their attachment to the stiles.

Make the face frame

1 Cut the face frame stiles (K) and rails (L) to the thicknesses and lengths shown in the **Cut List**, but make them about 1/32" oversized in width for now. Also make the piece for the drawer box edging (M).

2 Join the stiles and rails using pocket screws (**Photo G**).

3 Glue and clamp the assembled face frame to the case.

4 Cut the drawer box edging (M) to length, and glue and clamp it in place.

5 Use a flush-trim bit to rout the face frame (K, L) and edging (M) flush to the case.

Make the door

1 Cut the door stiles (N) and rails (O, P) to the sizes shown in the **Cut List**. For aesthetics and stability, use straight grained stock.

2 Lay out the mortises where shown in **Figure 1**, and then cut them. I used a hollow chisel mortiser (**Photo H**), but you could rout them instead.

3 Lay out the tenons where shown in **Figure 1**, and then cut them. I used a dado head on the tablesaw to do the job (**Photo I**).

4 Assemble the door, ensuring that it's dead-square under clamp pressure.

5 Rout the 1/4 × 3/8"-deep rabbet for the glass, and then square the corners with a chisel. Measure the distance between opposing rabbet shoulders, and subtract 1/16" in each direction. Then order a sheet of 1/8"-thick (double-strength) glass cut to that size.

6 Make the door stop strip (Q), and glue or tack it in place, flush with the front edge of the top horizontal panel (B), where shown in **Figure 1**.

7 With the case on its back, lay the door in place with a 1/16" gap between the door hinge stile (N) and the face frame stile (K). Attach the hinges, and then mark the perimeter of the door for a consistent gap all around. Remove the door, and joint or plane the edges to your lines.

Tip Alert

To prevent tear-out, begin routing the rabbet for the glass by moving the router counter-clockwise while holding it firmly. Finish up with a clockwise cut.

Make the drawers

1 Cut the drawer box sides (R), fronts and backs (S), and bottoms (T) to the sizes shown in the **Cut List**.

2 Set up a good quality dado head for a 1/4"-wide cut. Stand a piece of drawer stock on edge against the fence and position the fence so that the face of the plywood is flush with the opposite face of the saw teeth.

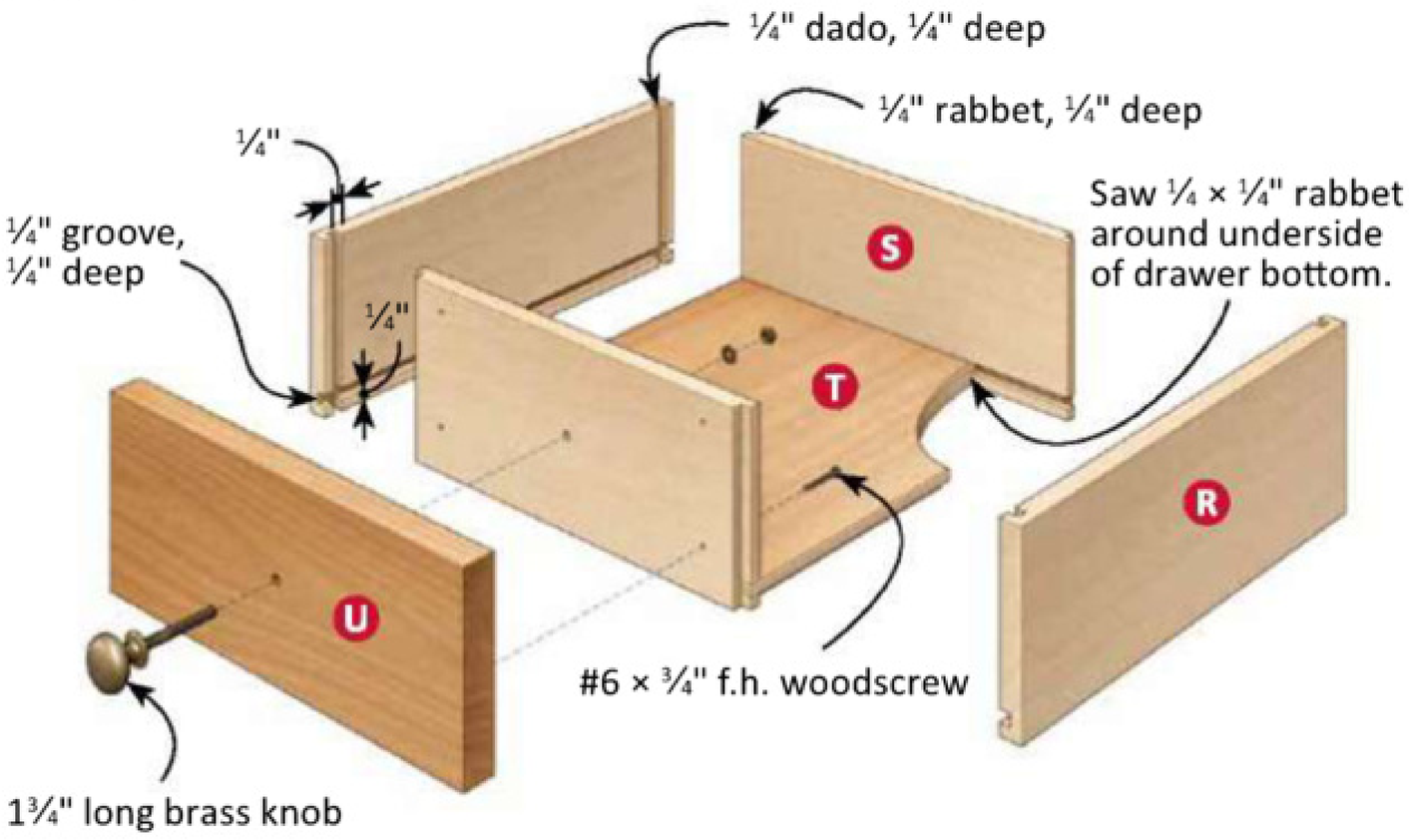
H

Cut the end mortises first, and then remove the waste between them with subsequent cuts.

I

For efficient sawing of tenons, register the stock against the rip fence for the first cut, and then remove the rest of the waste in subsequent passes.

Figure 4: Drawer



Raise the blade for a precise ¼"-deep cut, and leave it at that height for the following steps.

3 Saw the dadoes in the drawer sides (R), as shown in **Photo J**. Use the same setup to cut the drawer bottom grooves on the inside faces of the drawer sides (R), and fronts and backs (S).

4 Reposition the fence if necessary until test cuts yield a rabbet with a tongue that fits snugly into the dadoes you cut in **Step 2**. Then saw the rabbets on the drawer fronts and backs by standing the stock on end (**Photo K**).

5 Reposition the fence about 1/64" closer to the blade, and cut the rabbets on all four edges of each drawer bottom, as shown in **Photo L**. (The slight fence adjustment will allow the drawer bottoms to slide easily in their grooves for simpler assembly.)

6 Glue up the drawers on a flat surface, ensuring that they're square under clamp pressure.

7 After the glue cures, check the fit of each box in its opening, and plane or sand the parts if necessary to create a nice sliding fit with no side-to-side wobble.

Attach the applied drawer fronts

1 Make the applied drawer fronts (U). The sizes shown in the **Cut List** are theoretically perfect, but it's best to gauge yours from your actual drawer openings. Match the length of each front to the width of its opening, but make it 1/16" less than the height. Cut the fronts side by side from the same board to create a visually pleasing continuous grain pattern across both faces.

2 At the drill press, bore a ¼"-diameter hole through the center of each drawer front.

3 With the drawer boxes inserted, place the applied fronts in their openings. Using each previously drilled ¼"-diameter hole as a guide, bore a ¼"-diameter hole through each drawer box front. A brad-point bit will minimize tear-out.

4 Remove the drawers, and install the pulls. Then drill and countersink the drawer box front for four #6 × ¾" screws, where shown in **Figure 4**. Install the screws, and remove the pull.

5 Push each drawer completely into its opening against the

Saw the dadoes and grooves feeding with a miter gauge and using the rip fence as a stop.

Saw the rabbets with the stock standing on end. Use a raised featherboard to prevent tipping.

After repositioning the fence a hair closer to the blade, saw the bottom rabbets in the same fashion.

M

For stability when routing the moldings, shape the edge of a wide piece of stock, and then rip it to final width. Keep a pushstick at hand for safe feeding.

N

To clamp the moldings, use hot-melt glue to attach a stand-off strip to the thinnest section of the molding, and then span the molding with another strip used as a caul.

Tip Alert

When test-fitting drawers, apply one end of a strip of tape to the rear faces, with the opposite end extending from the cabinet front to serve as a temporary handle.

cabinet back, and cut two strips of wood a few inches long and equal in thickness to the inset. Then spot-glue these to the cabinet bottom behind each drawer to serve as stops. No need for clamping here; a rubbed joint is fine.

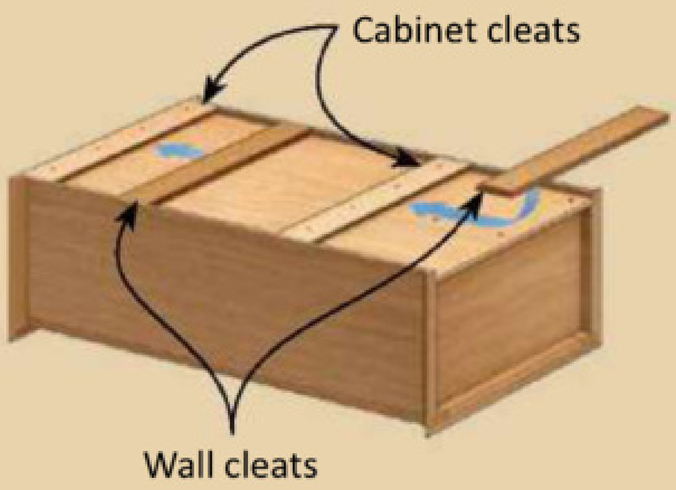
Add the moldings

1 Referring to the molding details in **Figure 1**, as well as the **Cut List**, cut the moldings (V, W) using your router table (**Photo M**).

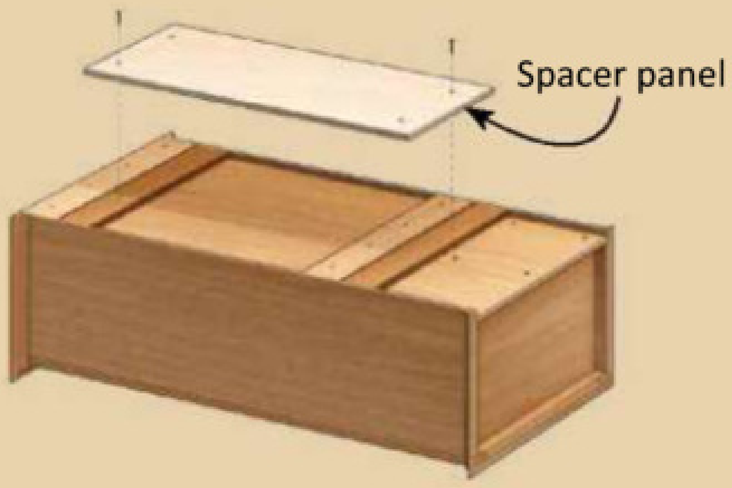
2 Crosscut and miter each pair of bottom and top side moldings

Installing Double French Cleats

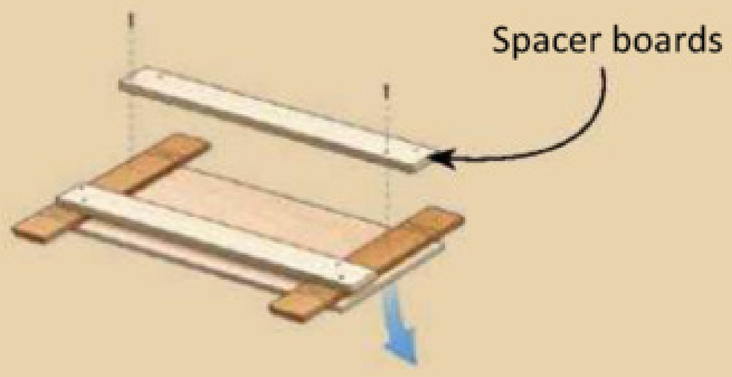
Step 1: After marking wall stud locations on the wall cleats, place them against the previously attached cabinet cleats.



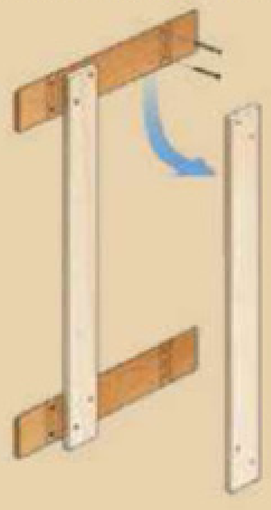
Step 2: Screw a wide panel to the wall cleats to maintain their spacing.



Step 3: Remove the cleat/panel assembly, screw two wide boards to the opposite faces of the cleats (avoiding the wall stud locations), and then detach the panel.



Step 4: Place the cleat/board assembly against the wall, screw the cleats to the studs using 2½" screws, and then remove the boards. Hang the cabinet on the wall cleats.



Tip Alert

To cleanly release a hot-melt glue bond, pour a bit of denatured alcohol into the joint.

(V, W) to length, and glue them to the case sides. After the glue cures, fit the front sections and glue them in place, too (**Photo N**).

Finish up

1 Make the cleats (X) to the size in the **Cut List,** beveling one edge of each to 45°. Then rip away the knife edge, leaving a flat about ⅛" wide. Glue and screw two of the cleats through the back (E) and into the rear edges of their respective horizontal panels using 2½" screws.

2 Sand the case, door, and drawer fronts through 220 grit, gently easing any sharp edges in the process.

3 Apply the finish of your choice. I wiped on one coat of General Finishes' Seal-A-Cell, followed up with two coats of the company's Arm-R-Seal topcoat.

4 Attach the ramps, installing all the screws this time.

5 Make the glass stop strips (Y, Z) to the sizes in the **Cut List**. Lay the door glass in its rabbets, and carefully tack the stop strips in place using ½" brads. Then hang the door, and drill for the pull.

6 Install the brass knobs and cupboard turn.

7 Hang the cabinet. Although using a single French cleat may do the job, I'm not taking any chances of it crashing to the floor filled with finely tuned hand planes, so I doubled up on the cleats. To ensure that each cabinet- and wall-cleat pair is carrying its fair share of the load, install the cleats as shown at left. ■

About Our Author/Builder/Designer

Geoffrey Noden has been working wood for over 30 years. The first American graduate of the John Makepeace School for Craftsmen in Wood in Dorset, England, Noden now builds custom furniture in Trenton, New Jersey. He is also the inventor of the Adjust-A-Bench and the Inlay Razor. For more info, visit *adjustabench.com.*

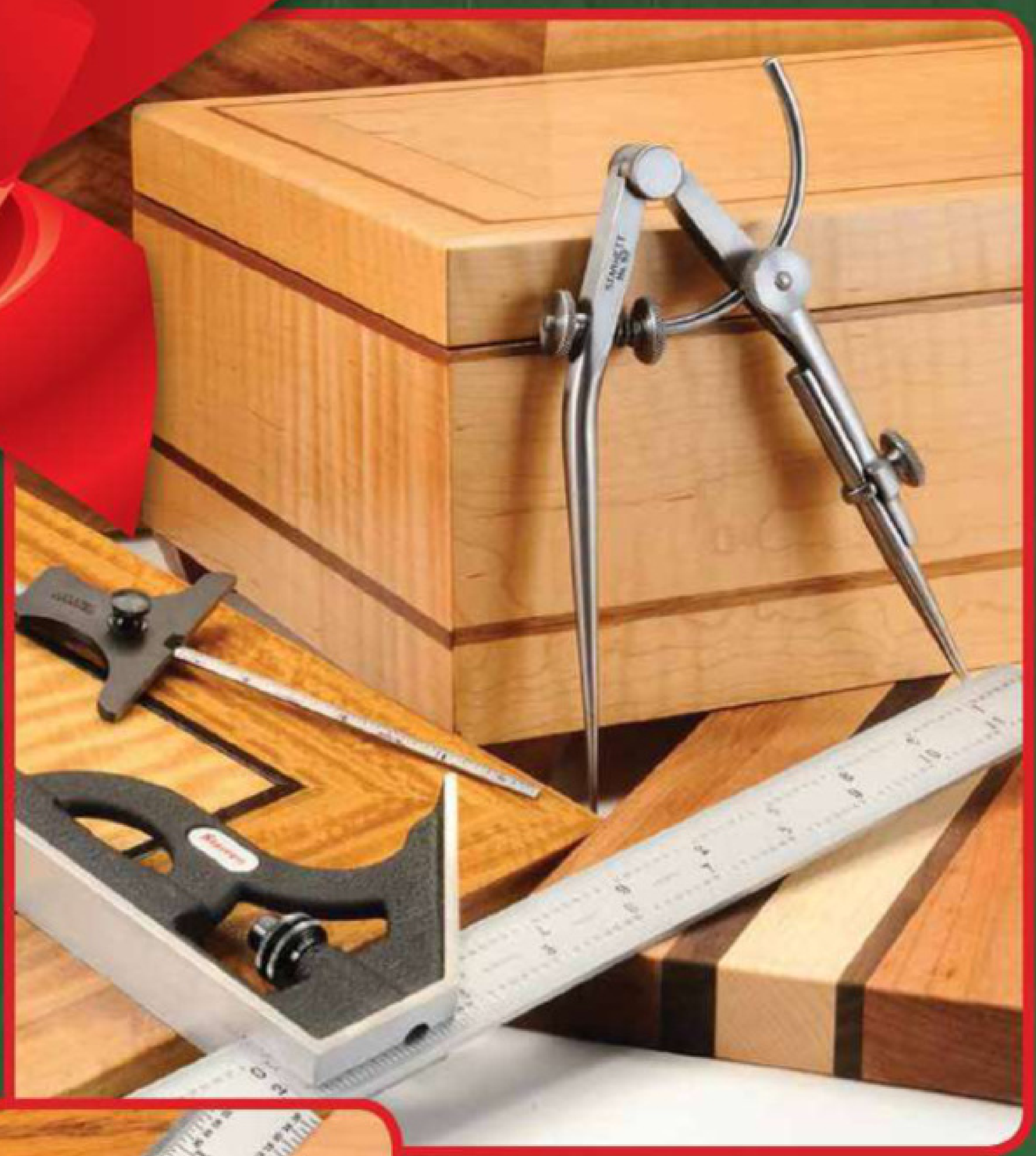
Hand Plane Cabinet

	Part	Thickness	Width	Length	Qty.	Mat'l
A	Sides	¾"	12⅞"	47"	2	OP
B*	Horizontal panels	¾"	11¾"	25"	5	OP
C	Drawer divider	¾"	4½"	11¾"	1	OP
D*	Edging	¾"	3⅞"	25"	1	O
E	Back	½"	25"	47"	1	OP
F	Drawer guides	¾"	¾"	11¾"	2	O
G	Ramp panels	½"	9½"	26"	2	OP
H	Ramp edging strips	¼"	¾"	26"	4	O
I	Ramp vertical divider strips	¼"	⅜"	26"	4	O
J	Ramp rails	⅞"	1⅜"	10"	2	O
K*	Face frame stiles	¾"	2⅜	47"	2	O
L*	Face frame rails	¾"	2"	21¼"	2	O
M*	Drawer box edging	¾"	¾"	26"	1	O
N	Door stiles	¾"	2"	38¼"	2	O
O	Upper door rail	¾"	2"	20¾"	1	O
P	Lower door rail	¾"	2½"	20¾"	1	O
Q	Door stop strip	¼"	¾"	24½"	1	O
R	Drawer box sides	½"	4"	11½"	4	P
S	Drawer box fronts and backs	½"	4"	9¾"	4	P
T	Drawer bottoms	½"	11"	9¾"	2	OP
U	Applied drawer fronts	½"	4"	10¼"	2	O
V*	Bottom molding	¾"	¾"	60"		O
W*	Top molding	1¼"	1⅜"	60"		O
X	Cleats	⅝"	4"	25"	4	O
Y	Horizontal glass stop strips	¼"	¼"	17¾"	2	O
Z	Vertical glass stop strips	¼"	¼"	33¾"	2	O

* Indicates parts that are initially cut oversized. See instructions.
Materials: OP=Oak Plywood, O=Solid Oak, P=Pine

Convenience-*PLUS* BUYING GUIDE

☐ 1.	Whiteside 1807 Cove Router Bit ½"SH ¾"R × 2"D × ⅞"CL	#811946	$62.49
☐ 2.	Whiteside 1810 Cove Router Bit ½"SH 1"R × 2½"D × 1"CL	#814814	$96.99
Above items are available at Woodcraft stores, *woodcraft.com* or by calling (800) 225-1153. Prices subject to change without notice.			
☐ 3.	P-97 Antique Solid Brass Knob with 1¾" Long Brass Shank (2 needed)	#P-97-A	$9.75
☐ 4.	H-97 Antique Cupboard Turn	#H-97-A	$13.75
☐ 5.	HH-2 3½" Antique Brass H Hinge (pair)	#HH-2-3.50-A	$56.50
Above items are available at *www.horton-brasses.com* or by calling (800) 754-9127			



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A Great Gift Idea!

Tough-Enough Bulldozer

Build an earth-moving playtime favorite.

By Tom Whalley and Marlen Kemmet

Overall Dimensions: 10¾"w × 15"l × 8⅜"h

Whether pushing sand in the sandbox or blocks across the playroom floor, this mighty mover does it all. A lifting blade allows for easier maneuvering and the realistic treads lay down tracks just like the real ones. Expect to work with a lot of small parts. That means extra caution is in order. We'll walk you through the part making and assemblies one step at a time.

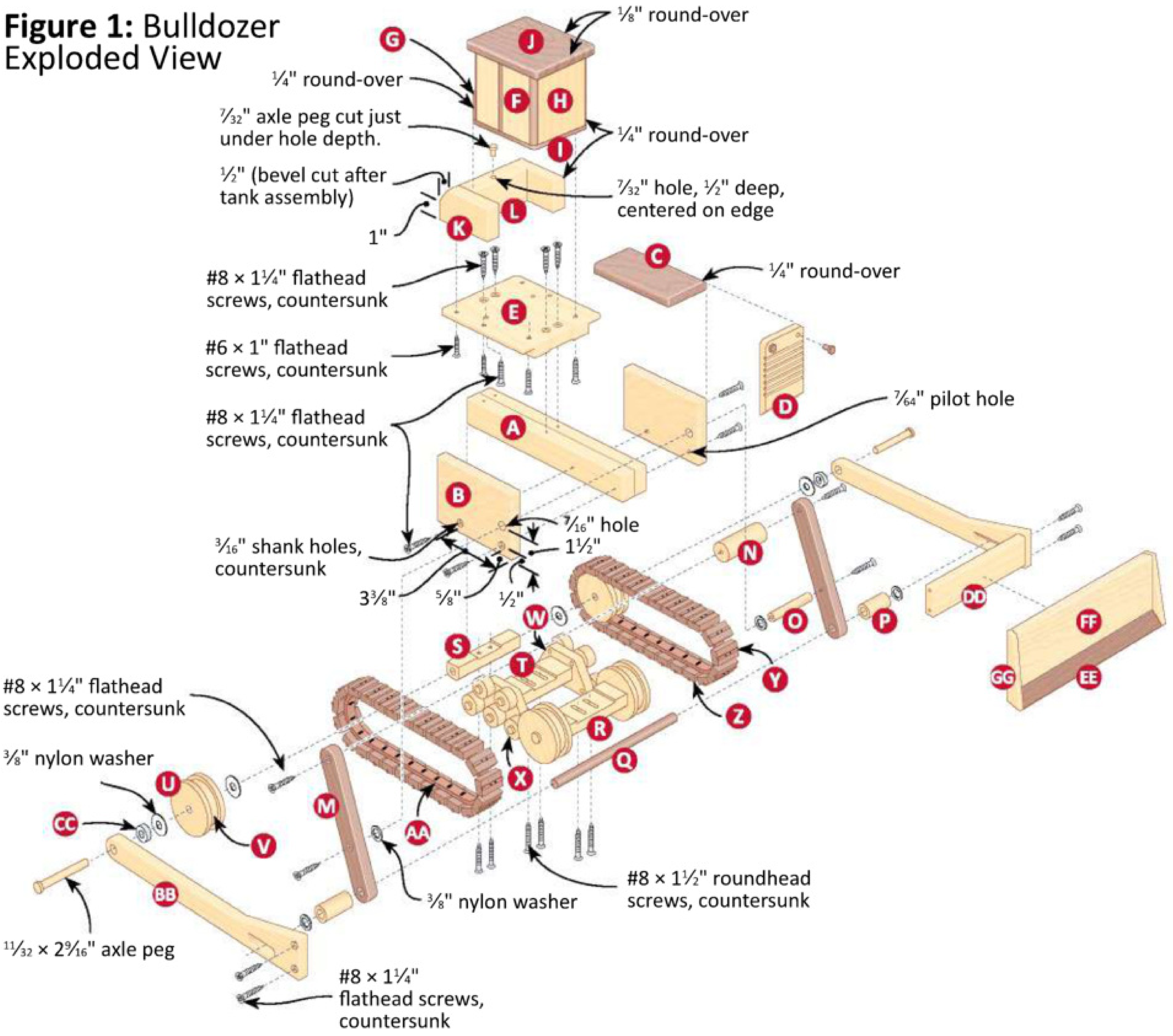
Note: For the tread, we went with ½"-wide tanned and oiled Latigo leather. It's supple and ideally suited for outdoor uses such as saddle parts. See the ***Convenience-Plus Buying Guide****.*

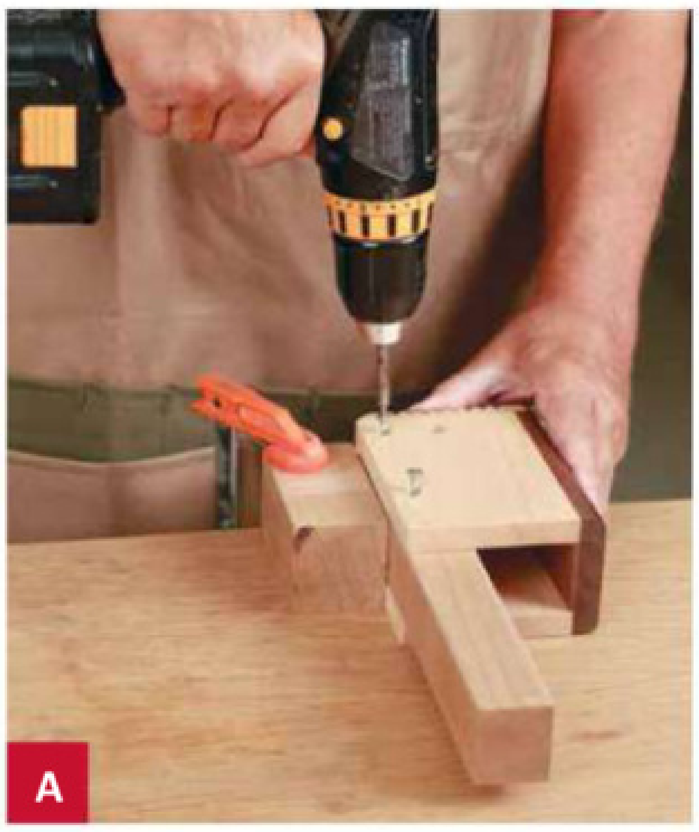
Ordering Other Tough-Enough Toys

To view and purchase the downloadable plans for the Tough-Enough Truck, Front-End Loader, and Road Grader, go to *woodcraft.com*.

Opening and group photos: Larry Hamel-Lambert

Figure 1: Bulldozer Exploded View





Position the motor assembly over the frame and screw it in place. Use a block of wood to ensure the bottom edges are flush.

Start with the frame and motor

1 Laminate two pieces of ¾ × 1¾ × 12" maple together face-to-face to form a blank for the frame (A). Now, joint, rip, and crosscut the part to 1½ × 1⅜ × 10½". (See **Figure 1** for reference.)

2 Cut the motor sides (B), hood (C), and grill (D) to the sizes in the **Cut List**. (We used a miter gauge, auxiliary fence, and stopblock, starting with extra long stock for safe cutting.)

3 To cut the grill grooves, install a flat-top blade and a zero-clearance insert (ZCI) in your tablesaw, along with a miter gauge and auxiliary fence. Raise the blade ⅛" above the saw table. Lay out the groove locations (**Figure 2**), and cut the grooves.

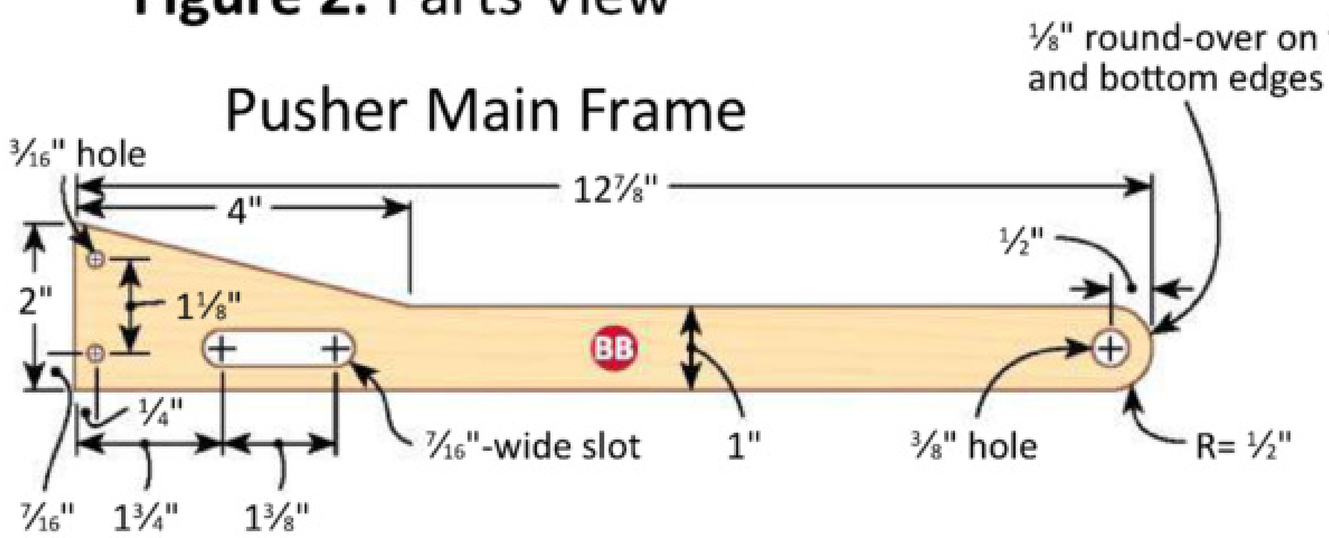
4 Drill a pair of 7/32" holes in the grill for adding the headlights.

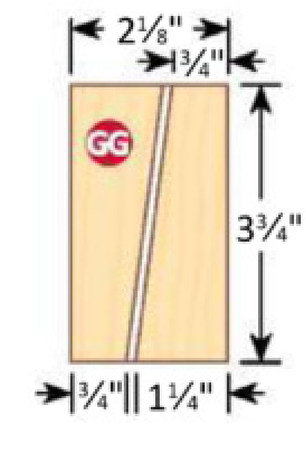
5 Using double-faced tape, adhere the motor sides (B) inside face to inside face, and drill the 7/16" and 3/16" holes where shown on **Figure 1**.

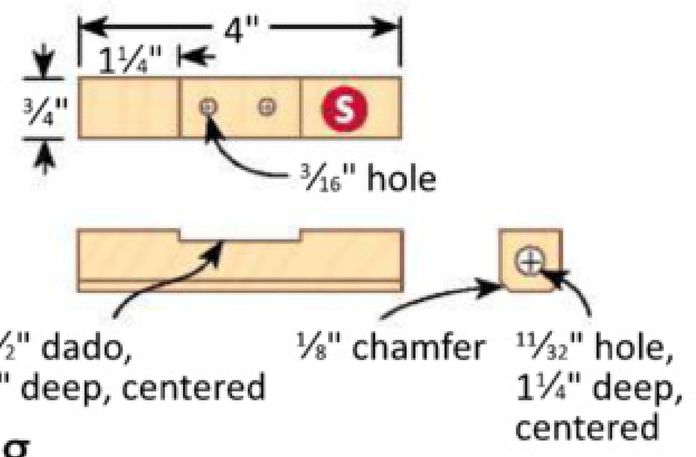
6 First dry-fit the motor assembly pieces (B, C, D), and then glue and clamp them together with the edges flush. Rout a ¼" round-over

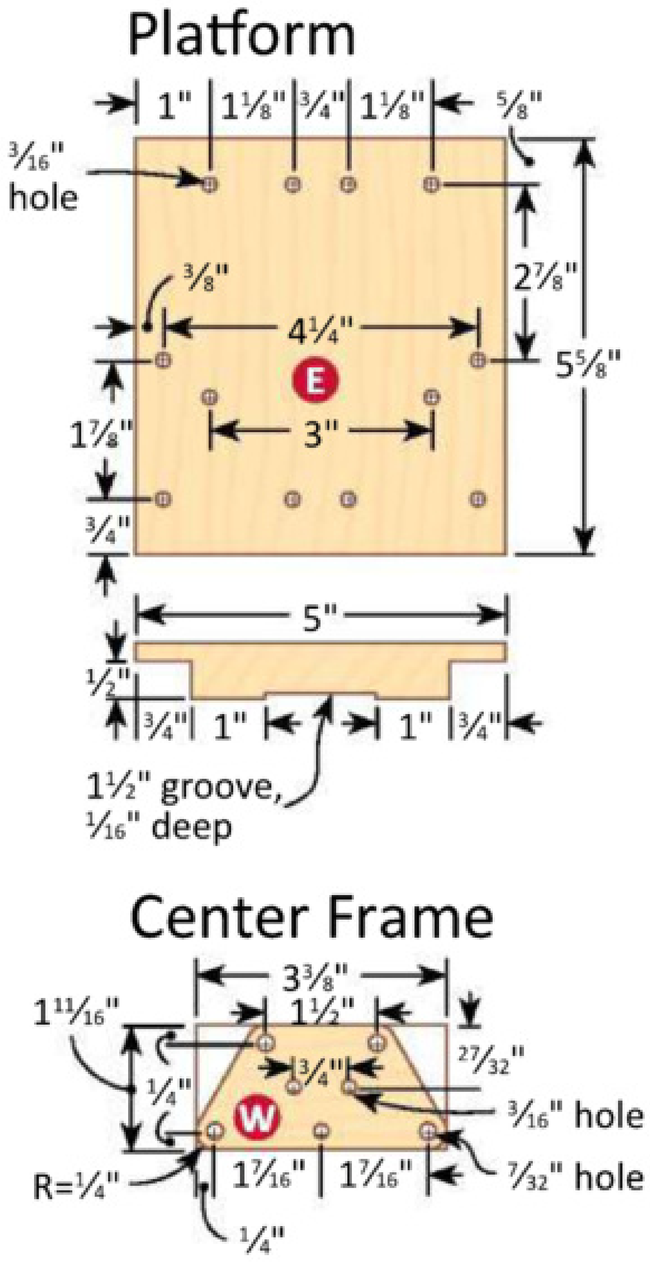
For full-sized patterns, visit *woodcraftmagazine.com*.

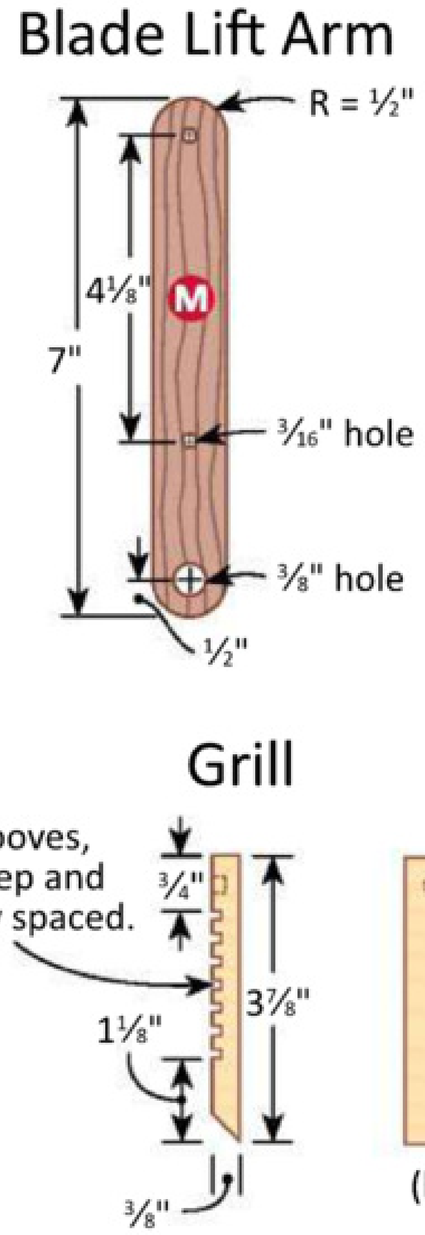
Figure 2: Parts View

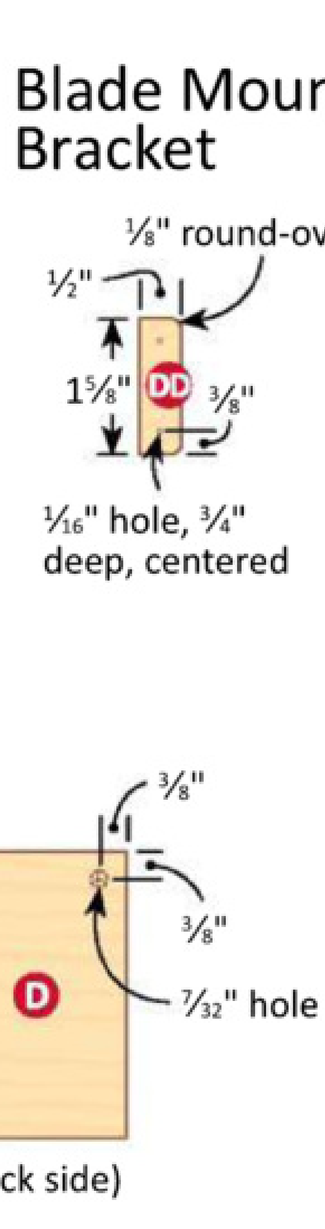


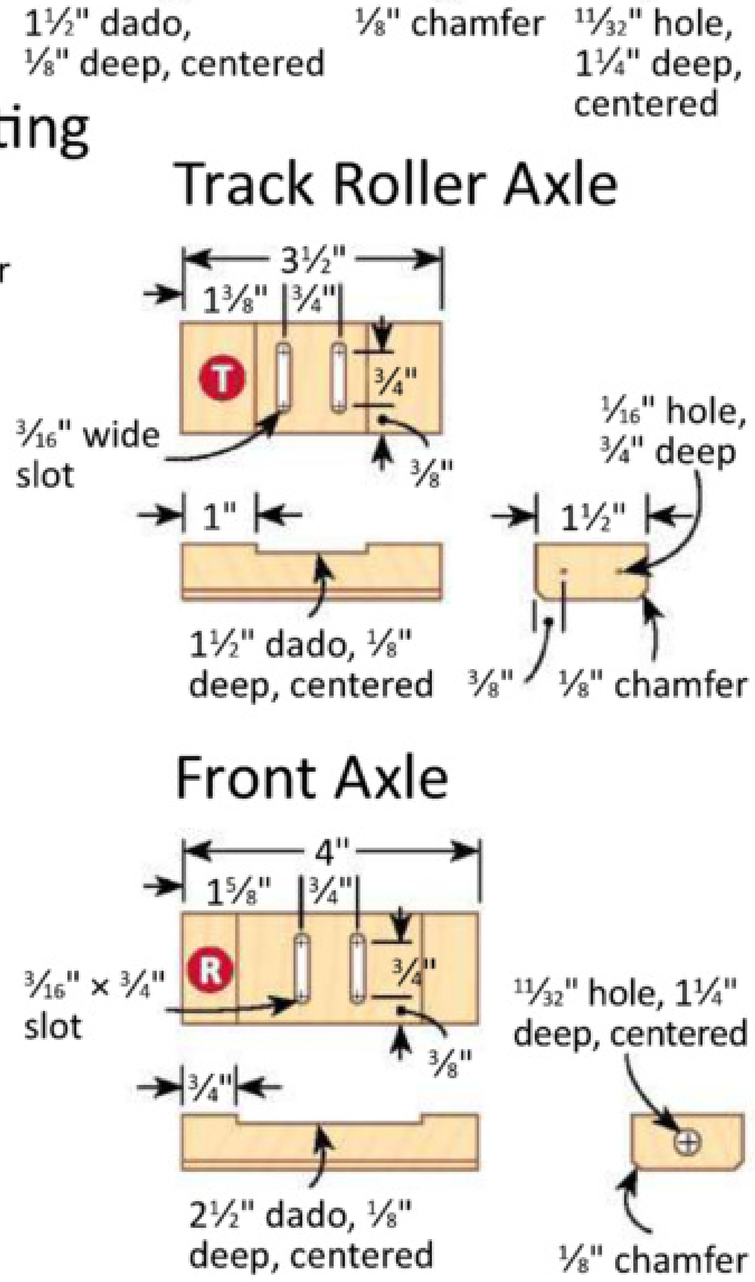


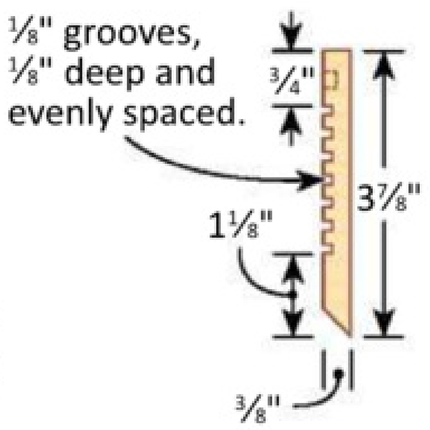


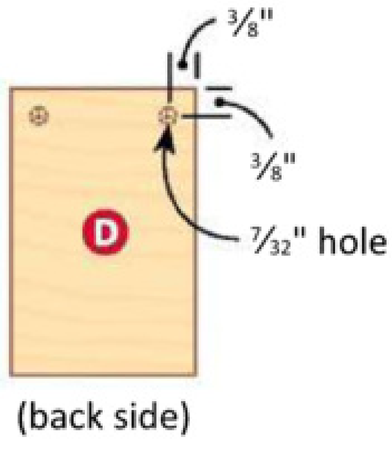












along the top edges of the assembly (C, D). Bevel-rip the tapered bottom edge of the grill at 45° at the tablesaw.

Using the shank holes in the motor sides as guides, drill 7/64" pilot holes into the sides of the frame. Screw the motor to the frame (**Photo A**).

7 Cut the platform (E) to size. Drill the 12 mounting holes where shown on **Figure 2**. Cut the centered groove and rabbets at the tablesaw where shown, using a dado set, ZCI, and pushblock. Screw the platform to the top of the frame, flushing the back edges.

Add the cab and fuel tank

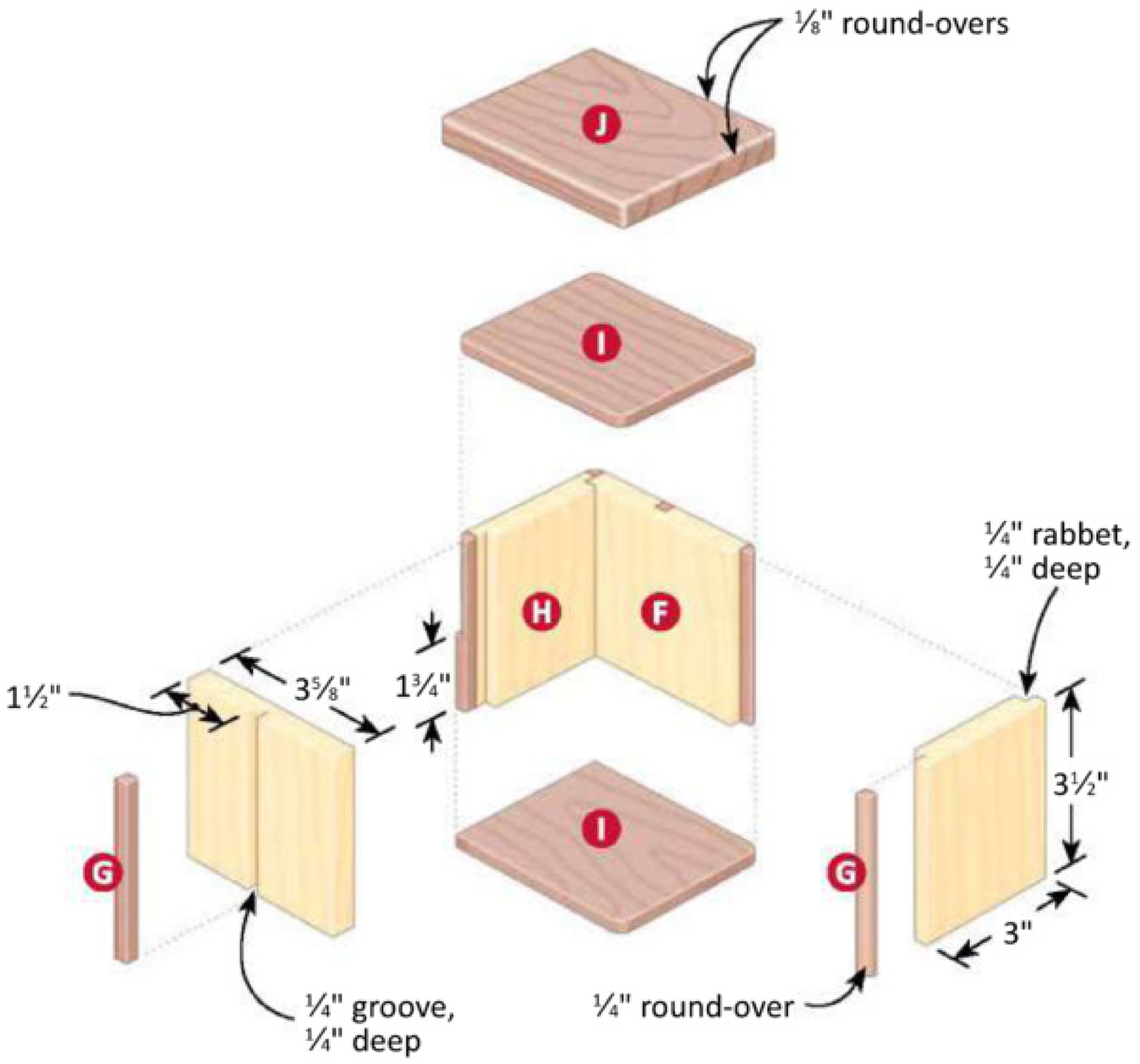
1 To form the cab sides (F), mill a piece of maple to 1/2 × 3 5/8 × 8". To form the cab (window) dividers and cab corners (G), cut a 1/4 × 1/4 × 24"-long piece of walnut stock. To cut the cab front and back (H), mill a piece of maple stock to 1/2 × 3 × 8".

2 Referencing **Figure 3**, cut a 1/4" groove, 1/4" deep, on one face of the blank for the cab sides (F). Cut the 1/4" rabbets, 1/4" deep on the cab front and back (H) where shown.

3 Crosscut an 8"-long piece from the dividers and corner blank for parts (G) and glue it in the groove in the cab sides (F) blank. Crosscut two cab sides (F/G) to length from the blank. Cut the

Glue and clamp the cab corners into the rabbets, holding them snugly in place with spring clamps.

Figure 3: Cab Exploded View



remaining walnut stock for the cab corners (G) to 3½". Crosscut the cab front and back blank for (H) to 3½". Now, glue and clamp the assembly together (F, G, H) in the configuration shown in **Figure 3** and **Photo B**. Make sure that the groove is 1½" from the assembly's back side.

Fit the fuel tank assembly onto the platform and flush at the rear end. Screw it in place.

4 From ¼"-thick walnut, cut the cab top and bottom (I) to size. Glue these pieces to the cab assembly. Rout ¼" round-overs on the cab where shown. Note where the rear cab corners (G) are not rounded over to accommodate the fuel assembly. Cut the cab roof (J) to size, and rout ⅛" round-overs along all edges.

5 Cut the fuel tank sides (K) and back (L) to size, cutting the length of L to the same width as the assembled cab. (I laminated ¾"-thick stock for the back tank.) Glue-join the parts and let them setup. Then, bevel-cut the top back edge of the assembled tank at the tablesaw using a pushblock. Drill a 7/32" hole in the back (L) for adding the fuel cap later. At the router table, rout ⅛" round-overs, where shown on **Figure 1**. Edges that touch the cab assembly or platform do not get round-overs. Screw the fuel tank assembly to the platform (**Photo C**).

6 Finish-sand and apply finish to the frame assembly (A-E, K, L). (We sprayed on Watco Lacquer, Satin.)

7 Center, glue, and clamp the roof (J) to the cab assembly (F-I). Finish-sand the assembly. Screw the cab assembly (F-J) to the platform (E). Sand a ⅛" round-over on the back two corners of the platform to match the fuel tank assembly. Note that the fuel tank fits flush with the end of the platform. Apply finish.

Tip Alert

After assembling the cab, we taped a sheet of 120-grit sandpaper to a flat surface and rubbed the top and bottom of the assembly on it to even the edges and remove glue squeeze-out.

Build the blade lift assembly

1 Cut the two blade lift arms (M) to the shape shown in **Figure 2**. Mark the three hole centerpoints on each and drill the holes.

2 Cut the handle (N) and pivot pin (O) to length from dowel stock noted in the **Cut List**. Drill a 1/16" pilot hole centered in each end of each dowel. (We used a center finder.) Glue and screw the handle and pivot pin to one of the lift arms (M). Apply a finish.

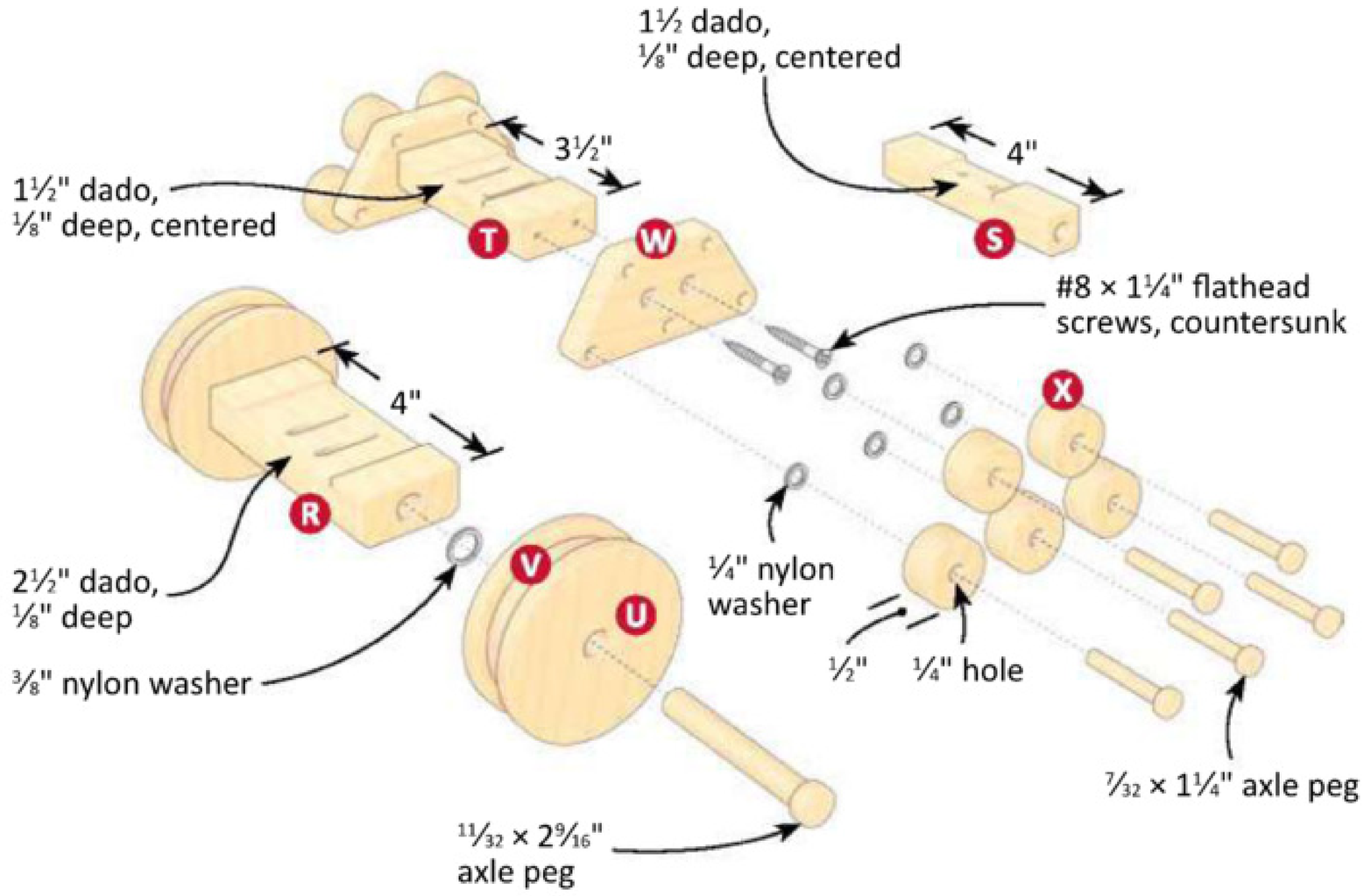
3 Cut the two front spacers (P) from ¾" walnut dowel stock. Drill a 7/16" hole centered through each. Cut the lift pin (Q) to size from ⅜" dowel stock. Apply finish to the remaining parts (M, P, Q).

4 Slide the lift pin (Q) through the blade lift arms (M). Fit the front spacers (P) onto the ends of the lift pin.

5 Fit a ⅜" nylon washer onto the pivot pin (O). Position the

Screw the blade lift arm to the pivot pin through the motor assembly.

Figure 4: Axle Assemblies



blade lift assembly onto the motor by sliding the pivot pin through the holes in the motor assembly. Fit a nylon washer onto the opposite end of the pivot pin. Screw the remaining blade lift arm (M) to the handle (N) and pivot pin (**Photo D**).

Cut the axle parts

1 From ¾"-thick maple, cut the front axle (R), rear axle (S), and track roller axle (T) to size. Cut a ⅛"-deep dado in each where shown on **Figure 2**.

2 Mark the locations and cut the adjustment slots and holes in each axle part (R, S, T) to shape. I drilled 3/16" holes at each end of each marked slot and scrollsawed the waste between the holes. Sand a slight chamfer on the bottom edges of R, S, T.

3 Mark the locations and drill the axle-peg holes in R and S and a pair of pilot holes in both ends of T.

4 To make the eight 2 9/16"-diameter outer wheels (U), cut a 3½ × 30" blank from ¼" maple. Mark the centerpoints for the eight wheels on the blank. Insert a ⅜" brad-point bit in your drill press, adjust the fence to center the bit on the centerpoints and drill ⅛"-deep starter holes in four of the eight centerpoints. These will become the outer faces of the wheel assemblies. Using a 2¾"-diameter holesaw on your drill press, cut the eight outer wheels to shape.

5 To make the four 2 3/16"-diameter inner wheels (V), cut a 3 × 15" blank from 9/16"-thick maple. Mark the centerpoints for the four inner wheels on the blank. Using a 2⅜"-diameter holesaw, cut the four inner wheels to shape.

6 To bond an inner wheel (V) between two outer wheels (U), select one outer wheel with a ⅛" recess and glue it to an inner wheel. Add a non-recessed outer wheel to the other side of the inner wheel. You don't want glue squeeze-out at the joint lines so use a minimal amount of glue. Next, insert a ¼ × 2" bolt through a washer, the hole in the wheels, through a second washer, and tighten the three pieces together with a nut. Repeat for the other three wheel assemblies.

7 Install a ⅜" brad-point bit in the drill press. Using the tool's fence and a stopblock, clamp the wheel to the fence, inserting the drill bit into the wheel's ⅜" "starter" hole. Redrill the hole so an axle peg can slip through it. Repeat for the remaining wheels, and apply the finish.

8 Cut the center frames (W) to shape. Drill five axle peg holes and two screw shank holes in each, where shown on **Figure 2**.

9 Working with 1" maple dowel stock, bandsaw the 10 track rollers (X) to ½" thick. Now, drill a centered ¼" hole in each roller. Sand to remove any bandsaw marks.

10 Using the configuration shown on **Figure 4**, assemble the front axle assembly (R, U, V) and the track roller assembly (T, W, X) with axle pegs, screws, and nylon washers. To make the bulldozer treads, see pages 56 and 57.

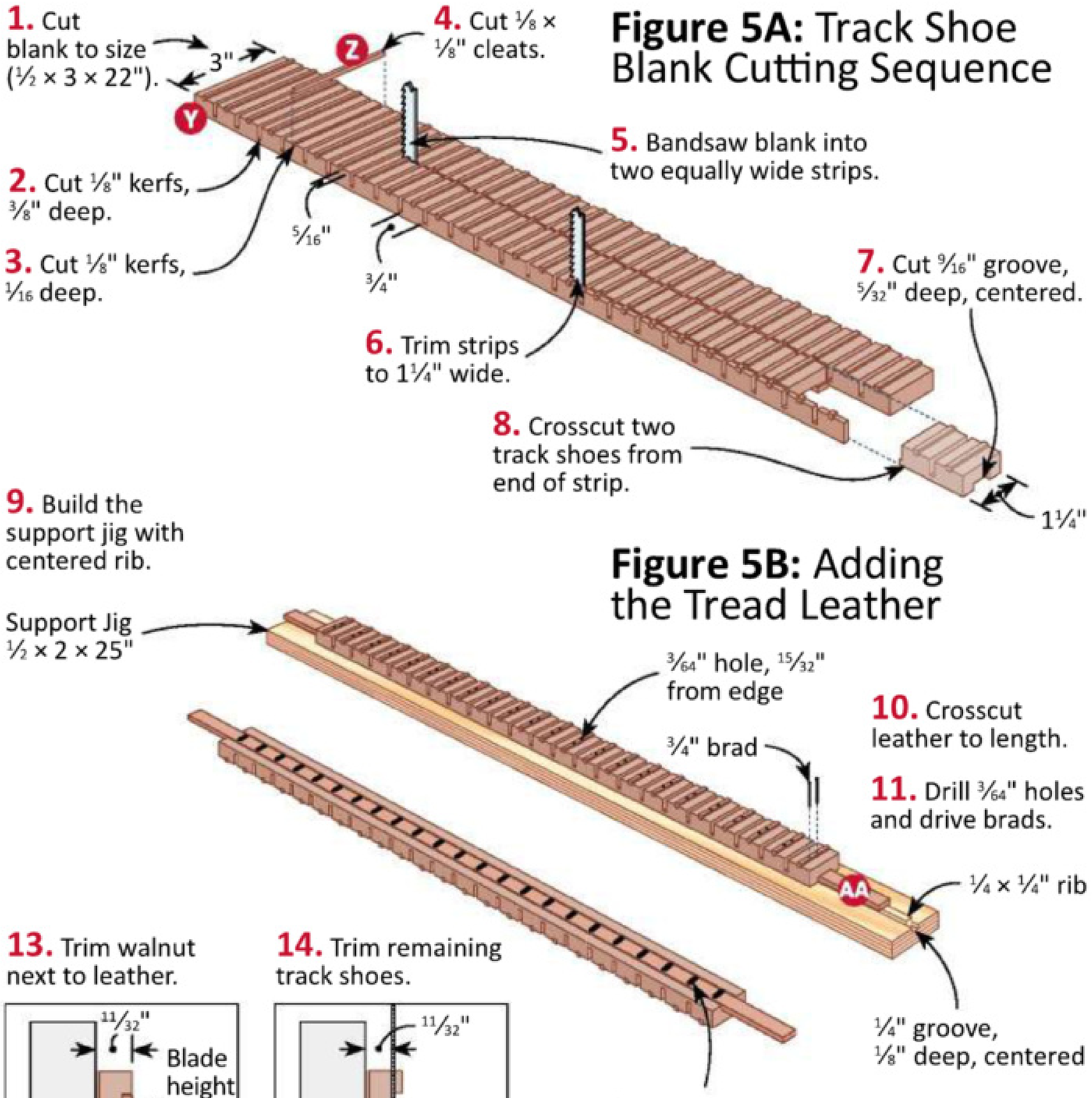


Figure 5A: Track Shoe Blank Cutting Sequence

Figure 5B: Adding the Tread Leather

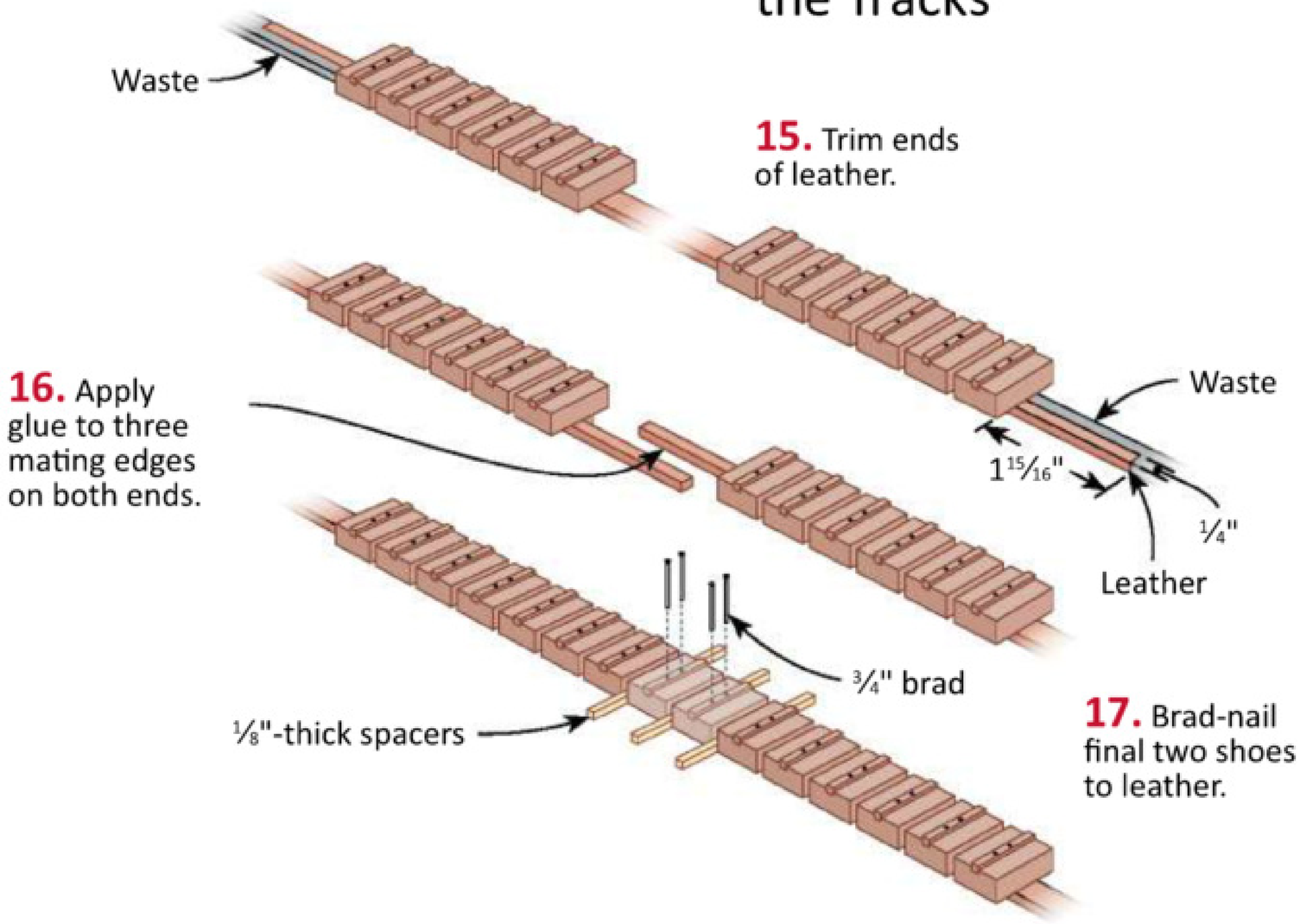


Figure 5C: Completing the Tracks

Construct the tracks

1 From ½" walnut stock, cut the track shoe blank (Y) to 3" wide by 22" long.

2 To cut evenly spaced kerfs, make an auxiliary miter-gauge fence with a protruding ⅛ × ⅛" finger ¾" from the blade. (We used the flat-top blade.) Use scrap stock to verify that the kerfs are cut exactly ¾" apart. Cut extra scrap to verify the test cuts in **Step 3**. Now, cut ⅛" kerfs, ⅜" deep and ¾" apart, along the entire length of the blank. See **Figure 5A**.

3 Lower the blade for a 1/16"-deep cut. Next, slide the auxiliary fence over so that the 1/16" kerfs to be cut for receiving the cleats (Z) will be accurately centered between two ⅜" deep kerfs. Now, using the test pieces made in **Step 2**, cut ⅛" kerfs, 1/16" deep. Once verified, cut the kerfs in the track shoe blank, as shown in **Photo E**.

4 Cut enough ⅛ × ⅛" walnut for the 24 cleats (Z). Now, at the bandsaw, crosscut the cleats to 3", and glue them into the 1/16"-deep kerfs. Remove any glue squeeze-out.

5 Bandsaw two equally wide strips from the 3"-wide blank, using a fence to ensure accuracy.

6 Bandsaw each strip to 1¼" wide, trimming the edges opposite the bandsawn edges from **Step 5**. Sand the edges of both strips smooth to remove the saw marks.

7 Cut a 9/16" groove, 5/32" deep, down the center of each 1¼"-wide strip.

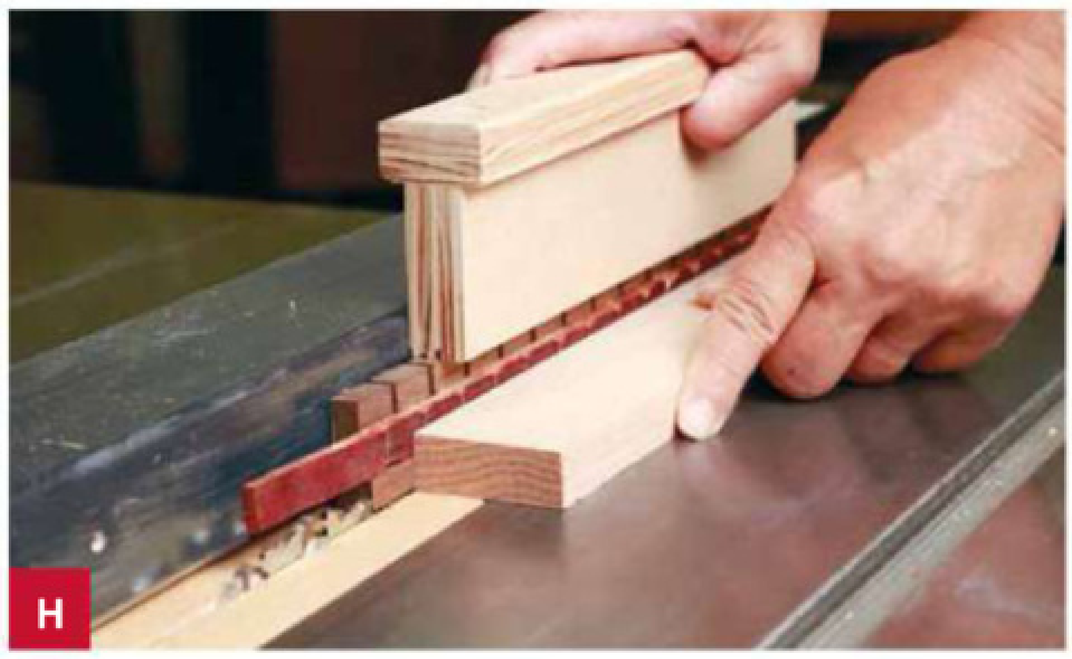
8 Drill two rows of 3/64" holes through the center of each cleat (Z) 15/32" from the edge of the tread blank. Bandsaw two track shoes from the end of each strip.

9 Cut the support jig base to the size shown on **Figure 5B**. Cut a ¼" groove, ⅛" deep, down the center of the support. Cut

At your tablesaw, use an auxiliary miter-gauge fence and protruding ⅛ × 1/16" finger to cut evenly spaced kerfs for the cleats (Z).

Drive brads through the 3/64" holes and alongside the support strip.

Bend the brads over to secure the treads to the leather strip.



Use a pushblock and sideblock to support the long track shoe strip when cutting.

a ¼ × ¼" rib to fit into the groove. Glue the rib in place.

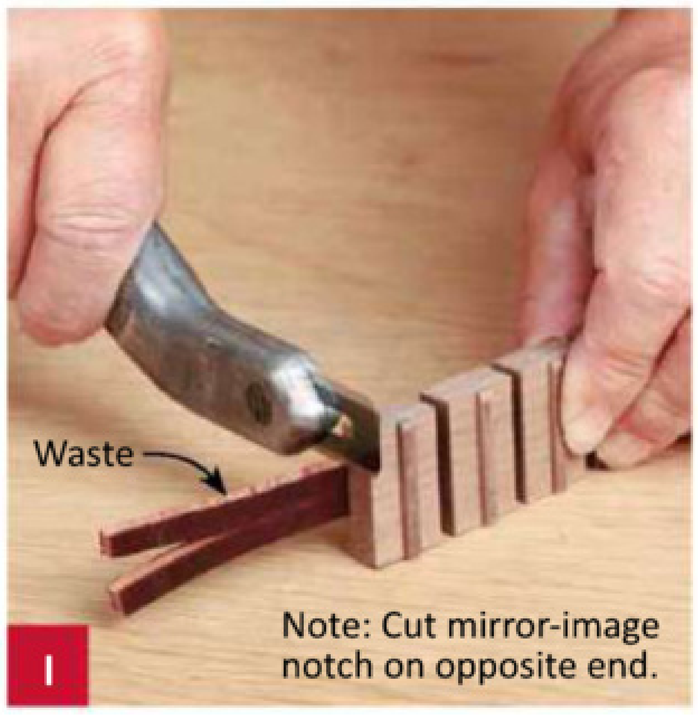
10 Using a sharp utility knife, crosscut two pieces of ½"-wide leather to 24" long for the tread leather (AA).

11 Center the trimmed track shoe blank (Y) onto the leather strip (AA). Using ¾" brads, drive a brad through each hole to securely nail the track to the leather strip (**Photo F**).

12 Flip the track assembly over and bend the brads toward the center of the track (**Photo G**). Lightly pound the bent ends flat into the leather.

13 Set the saw blade height to cut along the bottom edge of the leather, but not into the leather, to create the track shoes (**Photo H**).

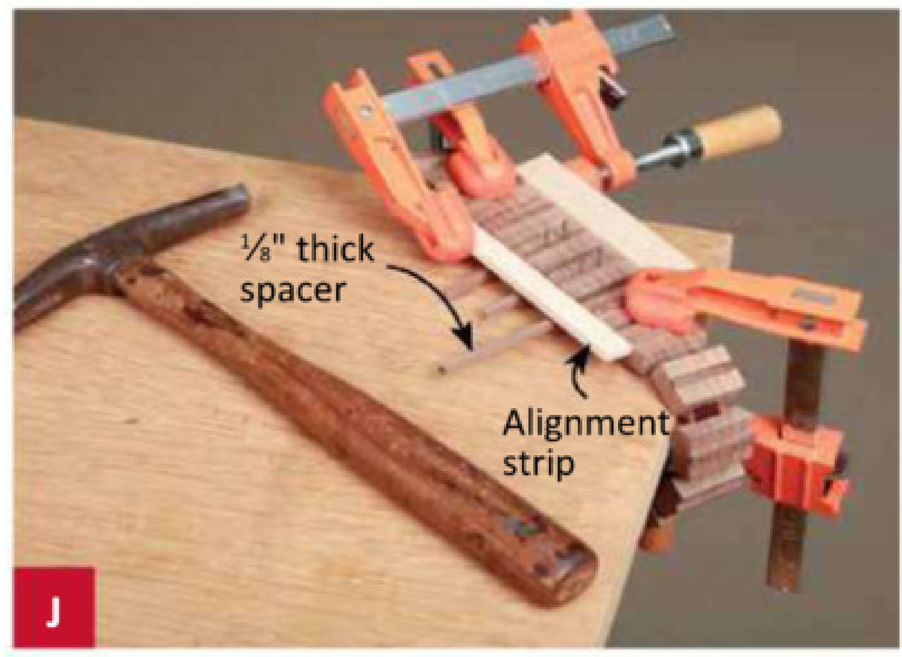
14 Bandsaw the final four track shoes from the piece cut in **Step 8**.



Notch the ends of the leather strip to mate together.

15 Using a sharp utility or razor knife, split then notch the mating ends on the leather strip nailed to the walnut tracks, as shown in **Figure 5C** and **Photo I**. Note that the notches are mirror images of each other.

16 Using Tanner's Bond Craftsmen Contact Cement, adhere

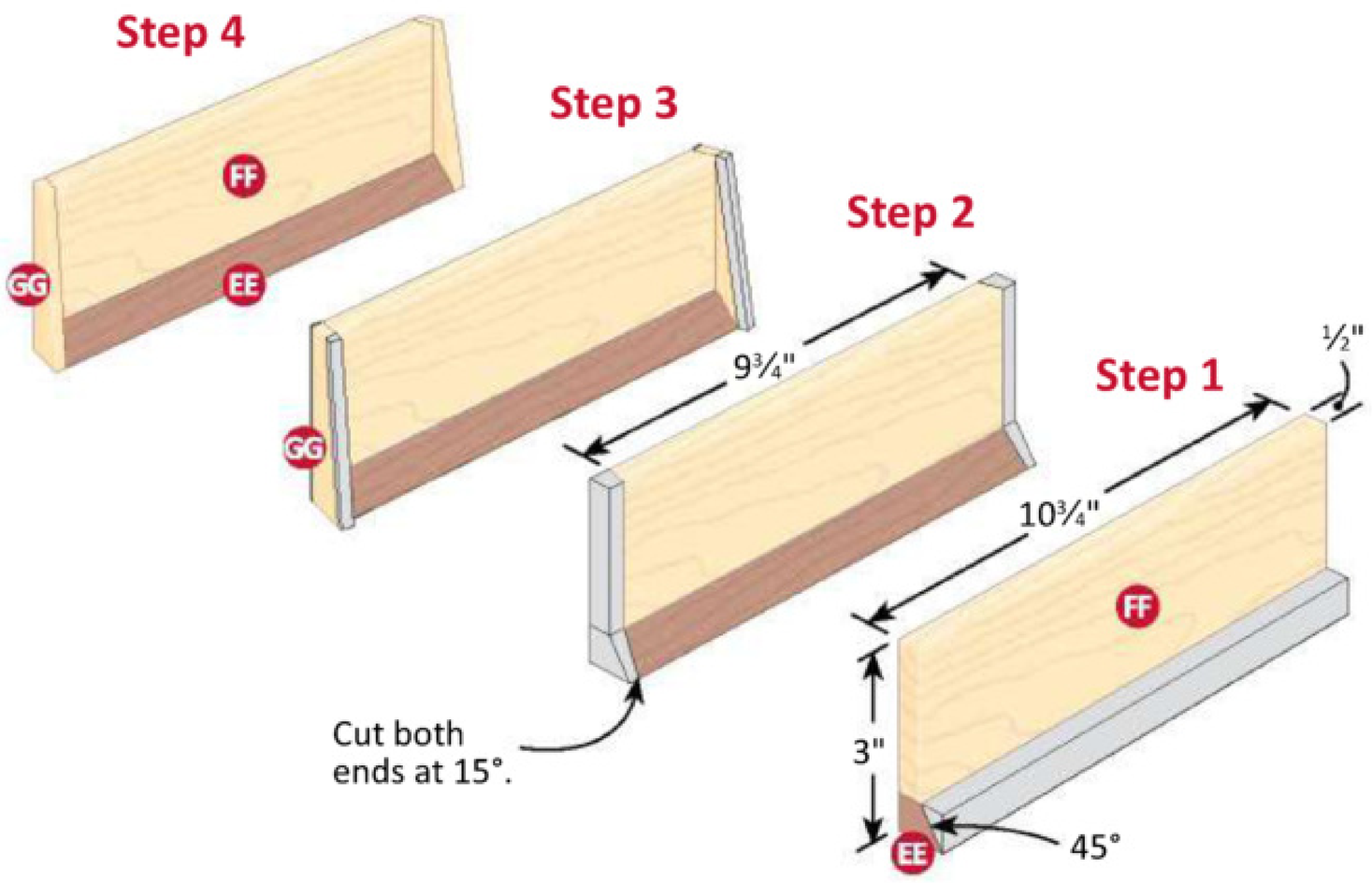


Using spacers and edge guides, brad the final two tracks to the leather strip.

the two mating ends of the leather together using small clamps. Allow the glue to get tacky.

17 Using ⅛" -thick spacers for even tread placement, brad the two remaining track shoes over the notched leather ends (**Photo J**). Clinch the ends as before.

Figure 6: Blade Assembly



Blade lift arm

1 Cut the pusher main frames (BB) to shape (**Figure 2**). Mark the 7/16"-wide slot locations, drill holes at each slot end, and cut out the waste at a scrollsaw. Now, drill a 7/16" axle peg hole and the 3/16" shank holes in each. Rout a 1/8" round-over on all but the front edges of BB.

2 From 3/4" maple dowel, crosscut the rear spacers (CC) to 1/4" thick, and drill a 3/8" hole centered in each (**Figure 1**).

3 Cut the blade-mounting bracket (DD) to size. Rout an 1/8" round-over on the top and bottom inside edges. Clamp that part between the main frames (BB), centered top to bottom with the front edges flush. Use the shank holes in each BB to drill mating pilot holes in each end of DD. Part AD will be added later.

4 Finish-sand (BB) and (DD). Apply finish to all but the front surfaces of (BB) and (DD) where the blade will attach later.

Create the blade

1 Cut the blade bottom blank (EE) and blade blank (FF) to the sizes noted in the **Cut List** and shown in **Figure 6**, bevel-ripping one edge of EE where shown. Glue the two pieces together.

2 Bevel-cut the ends of the blade assembly (EE, FF) at 15°. Cut the side plate blanks (GG) to size (**Figure 2**). Glue one to each end of the blade assembly. Sand the side plates flush with the front and back of the blade. Finish-sand the blade assembly.

With the tread tightened against the wheels, screw the front axle assembly to the frame bottom.

Final assembly

1 Position the bulldozer upside down on a soft cloth on your workbench to prevent scratching the cab top. Screw the rear axle (S) to the frame bottom 1/4" from the back end.

2 Position, but don't screw, the track roller assembly (T, W, X) and front axle assembly (R, U, V) on the frame. Place the two track assemblies over the front axle and track roller assemblies. Slide a 3/8" nylon washer onto each end of the lift pin (Q). Now, add the pusher main frame pieces (minus the blade mounting bracket [DD]) to the rear axle as shown in **Figure 1**, gluing the axle pegs into the rear axle (S). I applied glue into the holes in the

Spring clamps work well to clamp the blade to the blade mounting bracket.

rear axles (S) with a Q-tip, making sure the wheel assemblies turned freely.

3 Snug the track assemblies to the front axle assembly (R, U, V) with a small clamp. Then using the slots in the front axle assembly as guides, drill a pair of 7/64" pilot holes into the bottom of the frame, positioning the bit in the middle of each slot. Drive the two front screws as shown (**Photo K**). Center the track roller assembly between the front and rear axle assemblies and screw it in place.

4 Screw the blade mounting bracket (DD) between the pusher main frames (BB).

5 With the blade lift assembly vertical, center and glue the blade assembly to the front of the main pusher frame (**Photo L**).

6 Mask off the front end of the bulldozer and apply finish to the blade. Let it dry and turn the toy over to the up-and-coming builder in the family. ■

About Our Designer/ Builder

Urbandale, Iowa, resident Tom Whalley has been a woodworker for over 40 years and is the current president of the Des Moines Woodworker's Association. His award-winning designs have been featured in several national woodworking publications. Creating unique "one-of-a kind" projects is Tom's focus.

Bulldozer Cut List

	Part	Thickness	Width	Length	Qty.	Mat'l
A*	Frame	1½"	1⅜"	10⅜"	1	M
B	Motor sides	½"	3⅜"	4⅞"	2	M
C	Hood	½"	2½"	4⅞"	1	W
D	Grill	⅜"	3⅞"	2½"	1	M
E	Platform	¾"	5"	5⅝"	1	M
F *	Cab sides	½"	3⅝"	3½"	2	M
G *	Cab dividers/corners	¼"	¼"	3½"	6	W
H	Cab front and back	½"	3"	3½"	2	M
I	Cab top/bottom	¼"	3½"	4⅛"	2	W
J	Cab roof	½"	3⅞"	4⅝"	1	W
K	Side fuel tanks	¾"	1¾"	3¼"	2	M
L	Back fuel tank	1½"	1¾"	3½"	1	M
M	Blade lift arms	½"	1"	7"	2	W
N	Handle		1" dowel	2⅝"	1	W
O	Pivot pin		⅜" dowel	2⅝"	1	M
P	Front spacers		¾" dowel	1½"	2	W
Q	Lift pin		⅜" dowel	7¾"	1	W
R	Front axle	¾"	1½"	4"	1	M
S	Rear axle	¾"	¾"	4"	1	M
T	Track roller axle	¾"	1½"	3½"	1	M
U*	Wheel outer	¼"	2 9/16" dia.		8	M
V*	Wheel inner	9/16"	2 3/16" dia.		4	M
W	Center frames	½"	1 11/16"	3⅜"	2	M
X	Track rollers	½"	1" dowel		10	M
Y*	Track shoe blank	½"	3"	22"	1	W
Z	Cleat blanks	⅛"	⅛"	80"	1	W
AA	Tread leather	3/16"	½"	24"	2	L
BB	Pusher main frames	½"	2"	12⅞"	2	M
CC	Rear spacers		¾" dowel	¼"	2	M
DD	Blade mounting bracket	½"	1⅝"	6¾"	1	M
EE	Blade bottom blank	¾"	1"	10¾"	1	W
FF	Blade blank	½"	3"	10¾"	1	M
GG *	Side plate blank	¼"	2⅛"	3¾"	1	M

* Indicates parts initially cut oversized. See instructions.

Materials: M=Maple, W=Walnut, L=Leather

Hardware/Supplies: (10) ¼" nylon washers; (10) ⅜" nylon washers; (20) #8 × 1¼" flathead screws; (6) #8 × 1½" roundhead screws; (96) ¾" brads; ⅜" maple dowel stock; ¾" maple dowel stock; ¾" walnut dowel stock; 1" maple dowel stock; 1" walnut dowel stock; 2⅜" holesaw; 2 9/16" holesaw; 9/16 - 6" medium holesaw mandrel.

Convenience-*PLUS* BUYING GUIDE

☐ 1.	Freud LM72M010 10" Flat Top Saw Blade	#127238	$54.97
☐ 2.	Watco Lacquer, Satin, Spray, 11.25 oz. aerosol can	#146950	$9.99
☐ 3.	Groz Steel Center Finder	#143559	$34.99
Above items are available at Woodcraft stores, *woodcraft.com,* or by calling (800) 225-1153. Prices subject to change without notice.			
☐ 4.	Axle Pegs, 2 9/16" L, 1 1/32" Tenon, Bag of 12	#AP3500	$3.00
☐ 5.	Axle Pegs - 11/32" L, 15/64" Tenon, ⅜" head, 20/Pkg	#AP1003	$1.50
Available at Woodworks Ltd., *craftparts.com*, or by calling (817) 581-5229. Prices subject to change without notice.			
☐ 6.	Latigo Cowhide Leather Strap ½" (1.3cm) × 72"	4752-00	$17.99
☐ 7.	Tanners Bond Craftsman Contact Cement	2525-01	$15.99
Available at Tandy Leather, *tandyleatherfactory.com*, or by calling (877) 532-8437. Prices subject to change without notice.			

Holiday Carousel

Add a warm glow to the season with this intriguing heat-actuated decoration.

Designed and built by Tom Whalley
Written by Marlen Kemmet

Overall Dimensions: 8½"w × 8½"l × 11¼"h

The Christmas pyramid (or holiday carousel), a decoration that originated in the Erzgebirge (Ore Mountains) of Germany, has now taken root in this country, serving as an eye-catching centerpiece. It typically depicts either a Christian or secular motif such as a Nativity or charming winter scene (like the one shown here). While many buy such a table whirligig online, we developed a totally unique design for you to build, and we include patterns and processes to help shape the parts safely and accurately. Once assembled and pressed into service, you'll find onlookers enjoying how the heat from the candles propels the fan, which, in turn, rotates the evergreen tree and snowmen.

Start with the base

1 Lay out and cut the octagonal walnut base (A) to shape on the bandsaw, referring to **Figures 1** and **2**. On the top center of the base, use a Forstner bit to drill a ⅝" hole, 5/16" deep for the pyramid disk glass bearing. Then, drill a 1/16" guide hole through the center of that. On the bottom, drill the 1⅛" hole 7/16" deep.

2 Rout a ¼" round-over along all top edges of the base. Sand smooth. Glue the pyramid disk glass bearing into the hole in the bottom of the base.

Adhere the full-sized pattern to the maple lamination, and bandsaw the two curved supports from it.

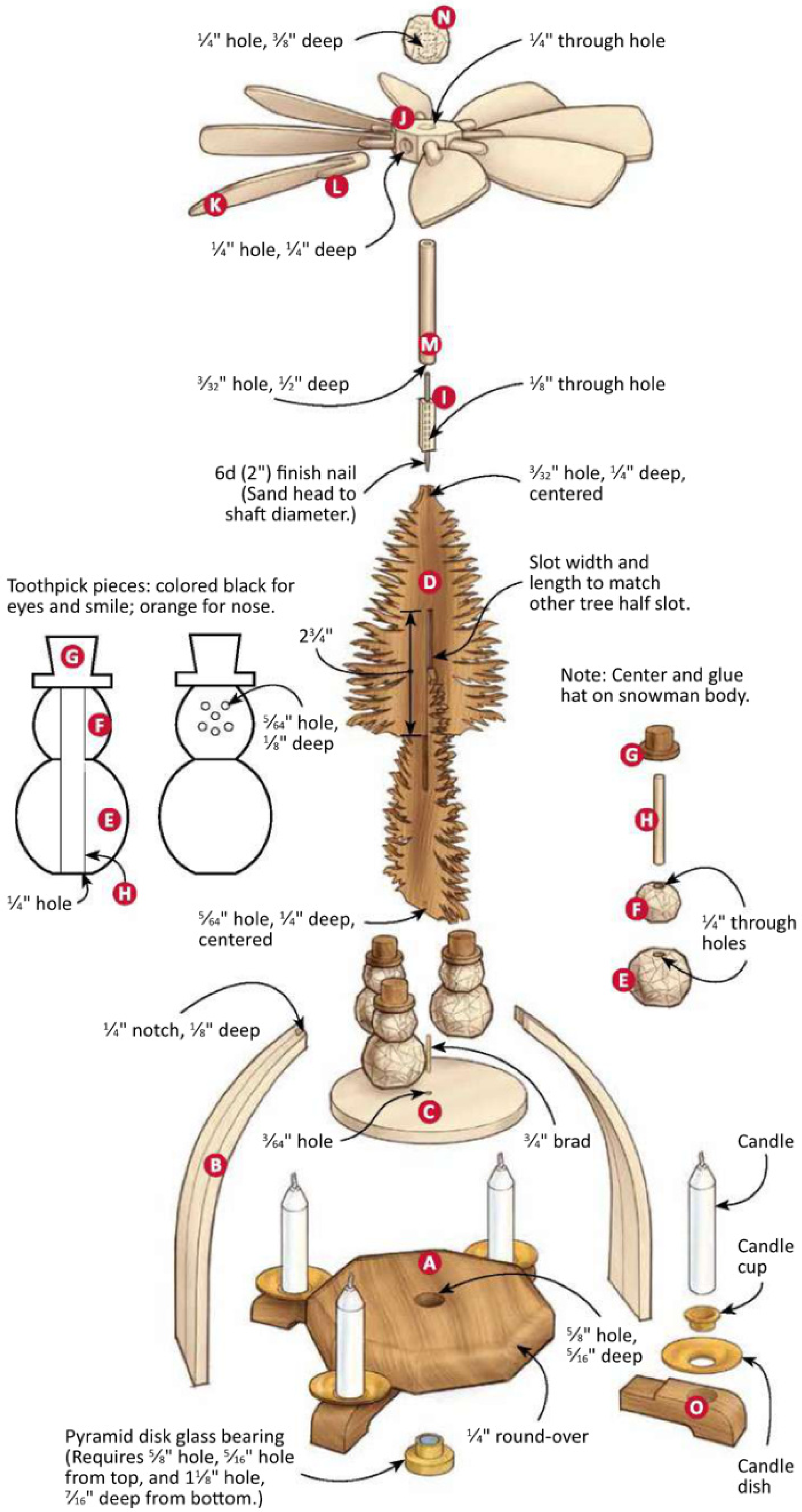
Locate a combination square on the piece of 2×4 where shown, and mark the top cutline on a clamped curved support.

Add the curved support pieces

1 Laminate two pieces of ¾"-thick maple together face-to-face to create a blank 2¼" wide by 8½" long for the curved supports (B). (See **Figure 2**.) adhere the full-sized pattern to the blank. Now, bandsaw outside the cutline (**Photo A**), and then drum- and disc-sand to the line.

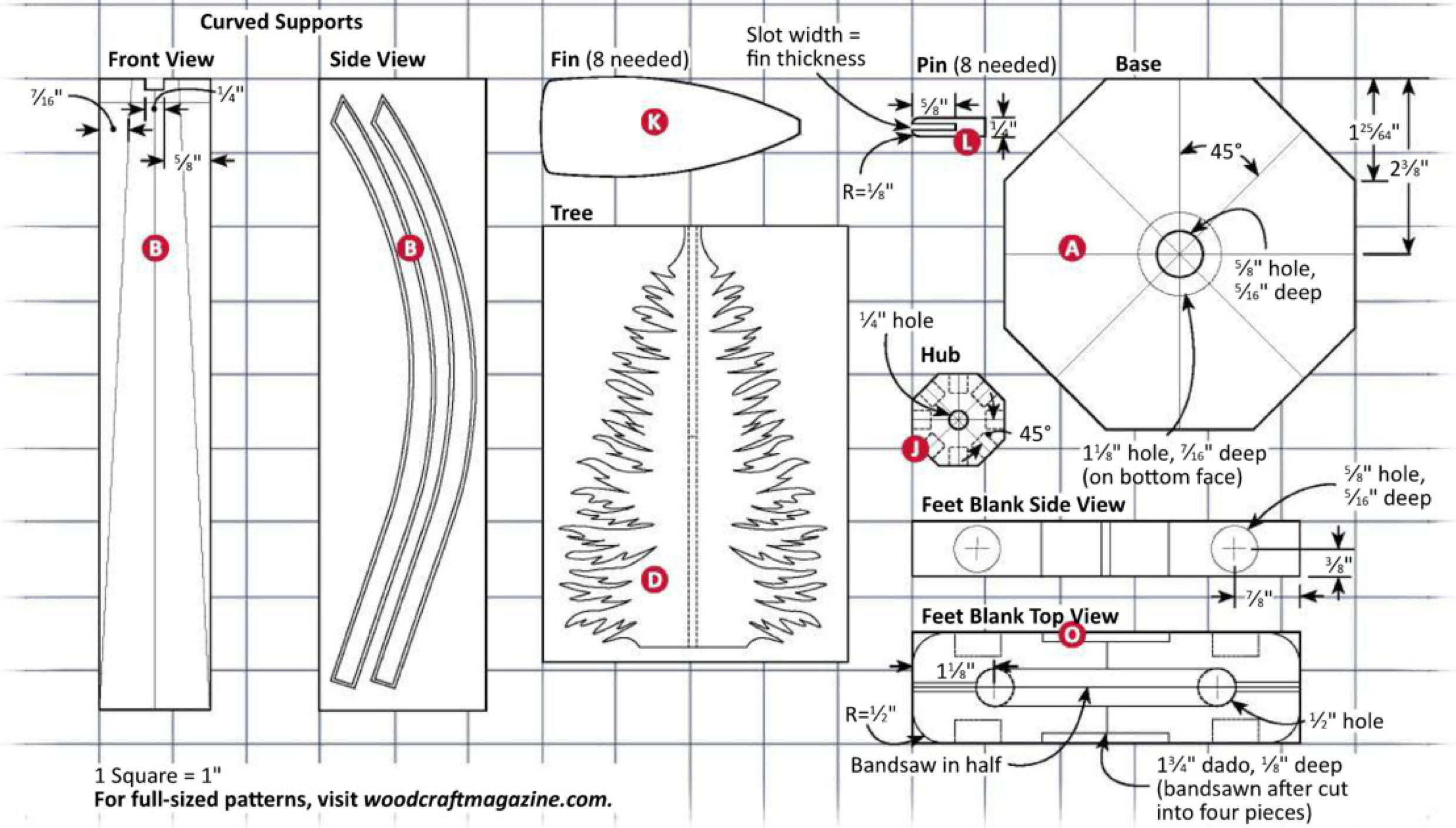
2 Clamp a curved support (B) to a piece of 2×4. Mark a line 2⅜"

Figure 1: Carousel Exploded View



Opening photo: Larry Hamel-Lambert; Project photos: Caleb Rizzuti; Illustrations: Charles Lockhart

Figure 2: Parts View and Patterns



For full-sized patterns, visit *woodcraftmagazine.com*.

from the end of the 2×4. Place a square on the 2×4, where shown (**Photo B**), and mark the cutline at the support's top end. Repeat for the other support. Bandsaw the top ends where marked.

3 To make the notching guide, cut a piece of 2×4 to 2⅜" wide by 10" long. Trace the inside edge of a curved support (B) on the guide's face, starting at one end. Now, bandsaw the 2×4's curve to shape. Add a pair of cleats to the guide to hold the curved support in place when notching. Next, position a curved support on the guide, adjust the fence as needed, and cut a centered ¼" notch, ⅛" deep, in the top end. Repeat for the second curved support, as shown in **Photo C**.

C

Using a curved block at the tablesaw, cut the centered ¼"-wide notch in the top end of each support in two passes.

4 Referring to the dimensions in **Figure 2**, lay out the tapers on both curved supports (B), using the edge of one support as a straightedge for the other. Then scrollsaw and sand the supports to shape.

5 Center, glue, and clamp the curved supports (B) to the long-grain edges of the base. Dry-fit the two curved supports together, and align them at the top. Dab glue onto the notched ends, and secure them together with painter's tape.

Create the platform and tree

1 Lay out the round platform (C). Drill a centered 3/64" hole in the part. Bandsaw, and sand the platform to shape.

2 Resaw enough walnut (**Photo D**) to create three pieces of 1/16"-thick stock to form two three-ply laminations that measure 4⅛" by 5⅞" for each tree half (D). (We worked from a longer board and then cut the two sets of plies to size. We also resawed the plies a little thicker and sanded them down to the needed thickness. You can also use layers of store-bought veneer for this.)

3 Sand the ply surfaces smooth. For each tree lamination blank, glue up three plies face-to-face for a finished thickness of 3/16", alternating the grain of the center ply at 90° to the outside plies (**Photo E**). For perfectly

Using a simple bull-nose guide, resaw thin walnut plies at the bandsaw to make the tree blanks.

Laminate three plies of 1/16" resawn walnut for each tree blank, alternating the grain.

flat panels, we clamped the blanks between two pieces of 3/4" MDF and waxed paper. (This shop-made plywood offers added strength and resistance to breakage when scrollsawing the branches.)

4 Adhere a full-sized pattern to each tree lamination. Using a #7 skip-reverse-tooth blade, scrollsaw the two tree profiles to shape (**Photo F**), cutting a notch in the top of one and a mating notch in the bottom of the other (see **Figure 1**). Fit the two pieces together so the top and bottom edges are flush. Now, glue them together, wiping off any excess. Sand the top and bottom edges flush.

5 Carefully indent a center point, and drill a 5/64" hole, 1/4" deep, in the center in the bottom of the tree, and a 3/32" hole, 1/4" deep, in the tree top (**Figure 1**). Apply a clear finish to all but the bottom of the assembled tree.

Now for the snowmen

1 Cut the snowmen blank bottoms (E) and tops (F) to size; cut an extra 3/4" square blank for the hub top (N) to use later. For the hats (G) cut two pieces of 3/4" walnut to 6" long. At a belt sander or belt strip sander, sand a hat to shape, rotating the dowel's end on the edge of the belt. Similarly, sand the dowel's other end. Sand a facet or two for a crumpled look. Repeat on a second dowel. Crosscut the four hats to length from the dowel stock, sawing 1/8" beyond the sanded cylinders to create the brim.

2 Drill a 1/4" hole through the center of each snowman blank (E, F). Drill a 3/8"-deep hole in one end of the hub top blank for part (N).

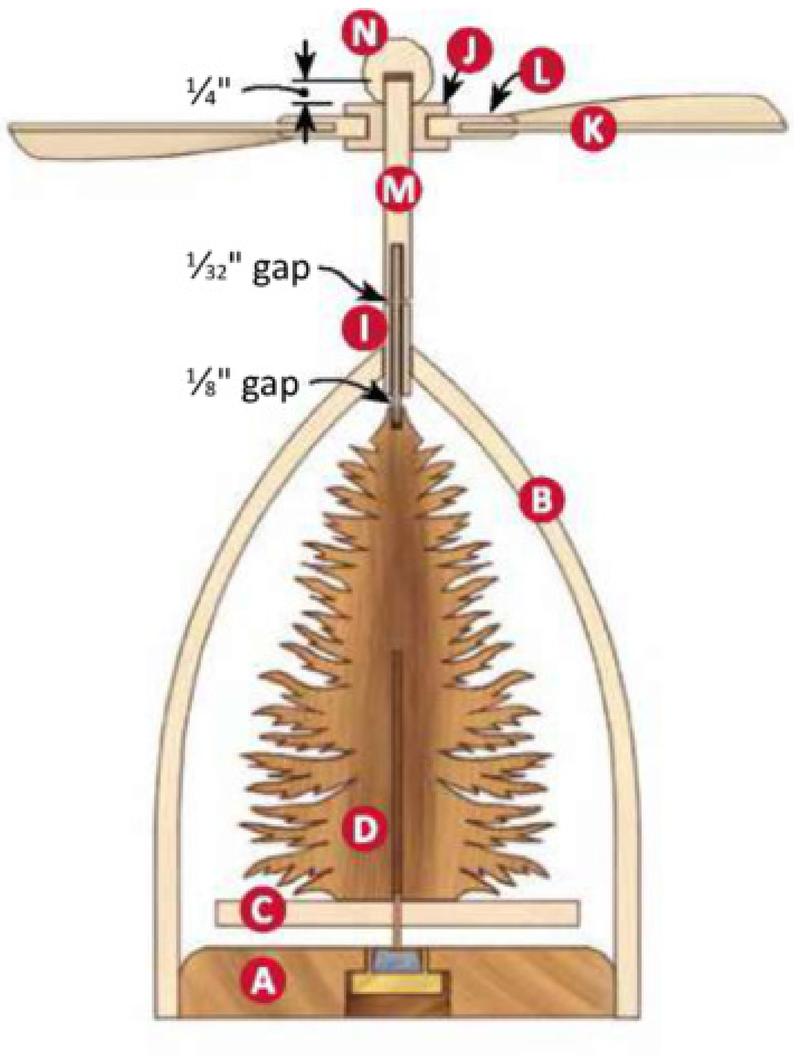
3 Dry-fit a blank on the end of a 1/4" dowel, 8" long. (Use the dowel as a handle for safe sanding.) Now, sand facets on the edges of the blank (**Photo G**). Repeat for all of the snowmen top and bottom blanks (E, F), as well as the hub top (N).

4 Mark the hole locations for the eyes, nose, and smile. At the drill press, drill 5/64" holes,

Scrollsaw the two tree halves to shape, cutting on the pattern's cutlines.

Clamp a belt sander to the workbench, and facet the blanks all around to create a rustic chip-carved look.

Figure 3: Carousel Cross Section



⅛" deep, in the snowman head pieces (F) while holding the parts on the dowel. Color the ends of two round toothpicks orange, and cut them to ¼" long for the nose. Color the eyes and nose black (**Figure 1**). Glue in the toothpick eyes and smile pieces, allowing the toothpicks to be exposed about 1/16". Cut them off. Insert the carrot nose.

5 Cut four snowman center pins (H) to size. Glue and dowel the bottom and top (E, F) snowman pieces together. Add the hats (G). Apply a clear finish to each of the snowmen.

6 Insert a ¾" brad through the hole in the platform (C) so the end extends about ¼" below the platform (**Figure 3**). Glue the tree onto the head of the protruding brad so the tree is centered on the platform. Uniformly position and glue the four snowmen onto the platform.

Add the arch top and hub

1 Cut the arch top (I) to size to fit between the notches in the curved supports (B). Drill a ⅛" hole centered through the length of the piece.

2 Position the platform assembly onto the base assembly. Position the arch top (I) between the supports (B) and glue it in place (**Figure 1**). There should be a ⅛" gap between the bottom of the arch top (I) and the top of the tree.

3 Cut a piece of ½" stock to 1¼" square, and adhere the full-sized hub (J) pattern in **Figure 2** to one face. Bandsaw and sand the hub to shape, holding the part with a small handscrew for safety. Then, as shown in **Photo H**, drill eight ¼" holes, ¼" deep, centered on each edge. These will house the fin pins (L). Now, drill a centered ¼" hole through its face. Sand and finish the hub.

4 Cut eight pieces of 1/16" plywood to 1½ × 3¾" and stack them together using double-faced tape. Apply the full-sized pattern in **Figure 2** for the fan fins (K) to the top piece and then stack-cut the pieces at the scrollsaw. Sand the edges smooth, and separate the fins.

5 To create the eight dowel fin pins (L), start with a few lengths of ¼" dowel stock. Test-fit the dowel stock in a hole in the hub and sand to fit. Bandsaw a ⅝"-deep kerf in the ends of the dowel to match the thickness of the fan fins (**Photo I**). Sand a slight round-over on the kerfed dowel ends, and crosscut the fin pins to 1" long.

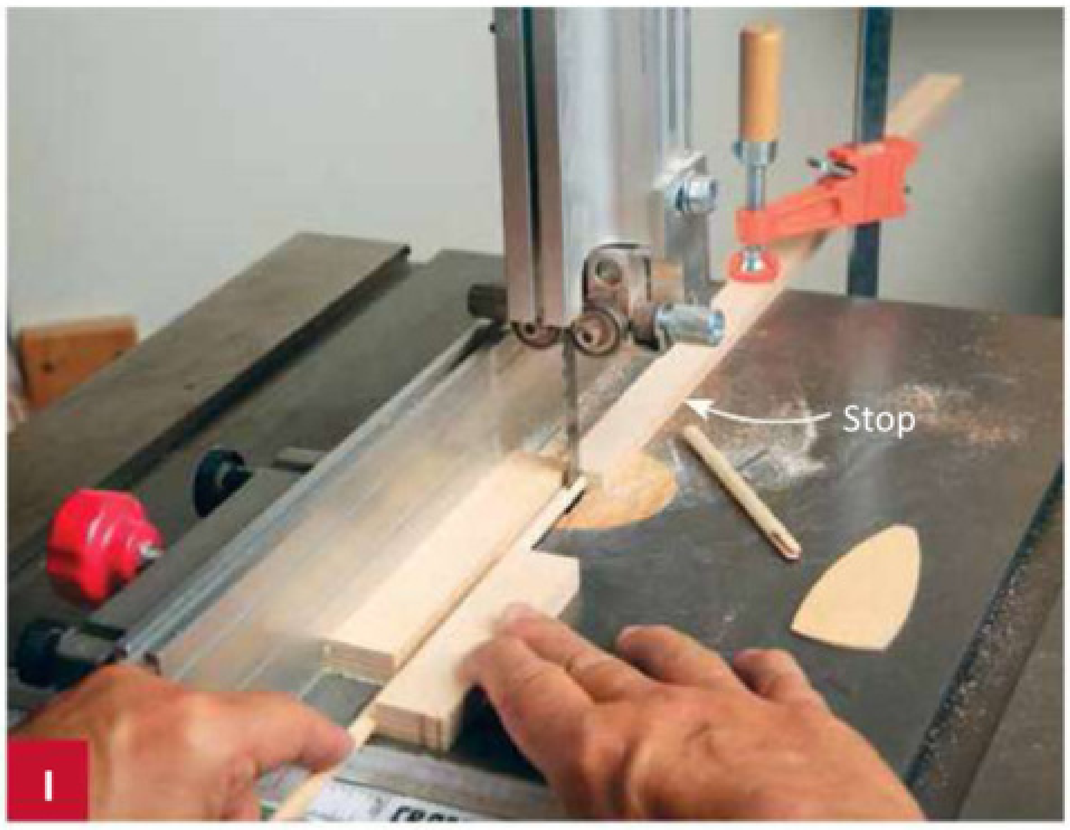
6 Center and glue the fan fins (K) to the pins. Then, using a toothpick to work the glue in the holes, glue the fan/fin assemblies (K/L) to the hub (J), angling them at 30° from horizontal (**Photo J**).

7 Crosscut the hub pivot stem (M) from ¼" dowel stock. Drill a centered 3/32" hole, ½" deep, into the stem's bottom end (**Figure 1**). (We marked a centered hole with a nail to prevent the bit from skittering off course and used a hand screw clamp to hold the workpiece perfectly vertical when drilling.) Using CA, glue the pivot stem into the hub (J) so the top end of the dowel extends ¼" above the top surface of the hub.

8 Retrieve the faceted hub top (N) made earlier, and glue it on to the top end of the hub pivot stem (M). As a fire safety precaution, do not apply finish to the fan assembly.

9 Sand the head of a 6d (2") finish nail to the same diameter as the shaft without shortening the nail. Glue the nail into the hole in the hub pivot stem (M) using CA.

Use this simple jig setup at your drill press to clamp the hub firmly in place. Then drill consistent centered holes on each edge.



Use a block to press the dowel firmly against the spacer when advancing its end into the blade to create a centered kerf.

Employ this simple setup that includes a 30° angle guide to keep the fin angles consistent during the glue-up.

Make the feet and complete the assembly

1 Cut a piece of ¾" walnut to 1½" wide by 5¼" long for the feet blank (**Figure 2**). Mark the centerpoints, and drill a pair of ½" holes through the blank. Mark the centerpoints, and drill four ⅝" holes, 5/16" deep, for housing the candle cups later. Bandsaw four feet from the blank. (They'll end up just under ¾" wide.) Sand them smooth.

2 Glue and clamp each foot (O) to the base assembly. Apply finish to the assembly, masking off the top surface of the glass bearing. Slide a candle cup through a dish, and epoxy it to a foot. Repeat for each foot.

3 Position the platform assembly on the base. Slide the 6d nail of the fan assembly through the hole in the arch top (I) and into the hole in the tree top. Maintain the 1/32" gap noted in **Figure 3**. Adjust the nail slightly in the pivot stem (M) if needed. Insert the candles. ■

Safety Alert

Do not leave burning candles unattended! This carousel is not a toy and is for indoor use only.

Candle Carousel Cut List

	Part	Thickness	Width	Length	Qty.	Mat'l
A	Base	¾"	4¾"	4¾"	1	W
B*	Curved supports blank	1½"	2¼"	8½"	2	M
C	Platform	¼"	4" dia.		1	BBP
D	Tree blanks	1/16"	4⅛"	5⅞"	6	W
E	Snowman bottom blanks	1⅛"	1⅛"	1⅛"	4	M
F	Snowman top blanks	¾"	¾"	¾"	4	M
G*	Hats		¾" dowel	½"	4	W
H	Snowman center pins		¼" dowel	1⅞"	4	M
I	Arch top	¼"	¼"	1"	1	M
J	Hub	½"	1¼"	1¼"	1	M
K*	Fan fins	1/16"	1⅜"	3½"	8	BBP
L*	Fin pins		¼" dowel	1"	8	M
M	Hub pivot stem		¼" dowel	2⅜"	1	M
N	Hub top	¾"	¾"	¾"	1	M
O**	Feet blank	¾"	1½"	5¼"	1	W

* Indicates parts initially cut oversized. See instructions.
** Note that four feet are cut from the foot blank. See **Figure 2**.
Materials: M=Maple, W=Walnut, BBP=Baltic Birch Plywood
Hardware/Supplies: (1) 6d (2") finish nail; (1) ¾" brad; epoxy; CA glue; ¼" maple dowel; ¾" walnut dowel; round wooden toothpicks.

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☐ 3.	Brass Drip Cup 14mm; (4) needed	RPBRCUPX14	$5.96
☐ 4.	Brass Drip Catcher 38mm; (4) needed	RPBRDRIP38X16	$7.96
☐ 5.	German Pyramid Candles Medium White 14mm; (50/box)	CDD050X500XW	$15.98
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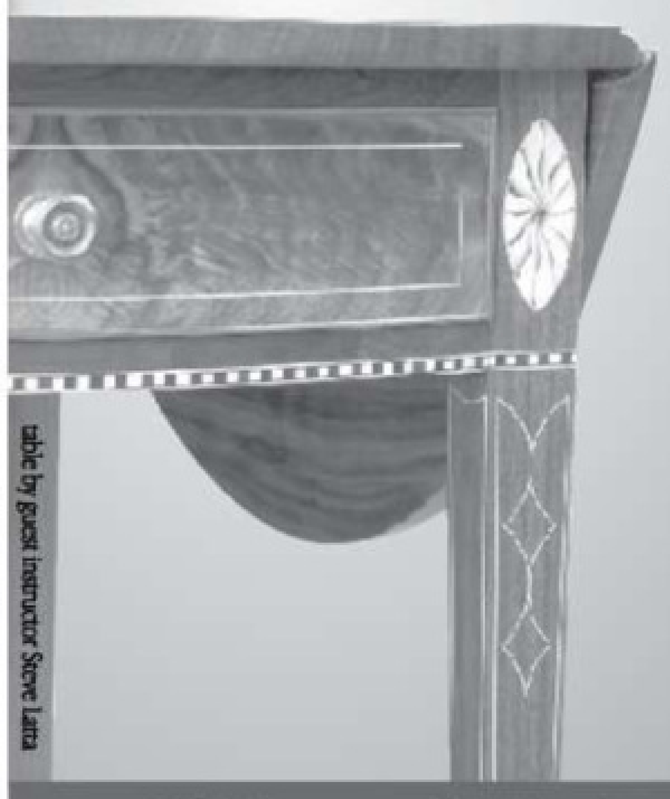

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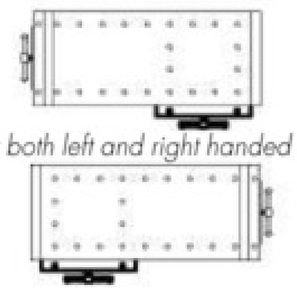

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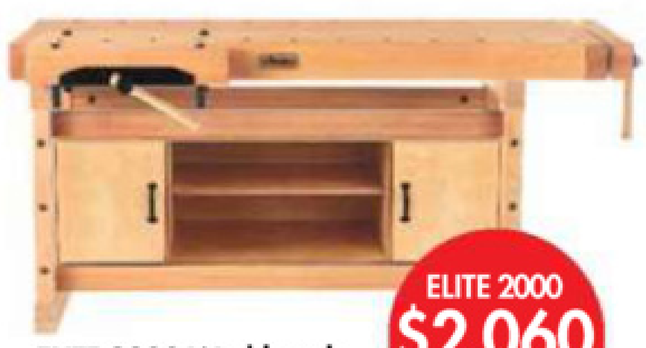

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Specialty Chisels

15 sharp problem-solvers for all sorts of tricky cuts

By Joe Hurst-Wajszczuk

Many of us remember the set of basic bevel-edged chisels that started our pursuit of fine woodworking. Likewise, we may recall encountering the first chores that required the touch of a different kind of chisel.

But selecting these newcomer specialists for our chisel arsenals can be tricky. Although a chisel is fundamentally a simple tool, over the years it has morphed into myriad configurations to suit specific tasks. The choices can be overwhelming, and selecting the wrong ones can be expensive.

Here, I've turned the focus on function. Seeing what each tool is used for can help you appreciate certain attributes and shine a light on the ones that you need to make quicker, cleaner cuts on your projects.

Photos: Ralph Anderson

Toolbox/Jobsite Companions

A sharp chisel is essential for a variety of chores, such as mortising hinges, adjusting trim, and cleaning up cuts. In addition, "jobber" chisels help ensure that your good set stays safe at your bench.

Short butt chisels are easy to control and stash in a pocket or pouch. If you prefer a longer blade, FastCap's folding handle shields the edge from receiving (and causing) damage, but is sturdy enough to withstand metal hammer blows. For quicker mortises, a corner chisel registers against the lip of routed mortises and finishes the corner with a tap.

Medium-Duty Mortisers

Mortising chisels were designed to handle the abuse of being malleted into the wood and then levered to remove waste. Modern machinery has eliminated the need to own a full set, but having a few can help you tackle chores that would blow out your bench chisels or require a pricey jig.

Sash chisels rank as middle-weights in the mortising chisel arena, but these former window-makers are nicely suited for most furniture-scale joinery. With thick blades (typically ground with 30° bevels) and unbreakable handles, sash chisels can easily handle shallow mortises with just a mallet. For deep mortises, this is the chisel you'd reach for to remove the material that's typically left after hogging out the waste with a drill press.

Consider adding a swan-neck chisel to complement your mortiser. This oddly shaped scraping tool can help clean the bottoms of blind mortises, such as those used for locksets or small tenons.

Mortising chisels sport harder handles and thicker blades in order to withstand the rigors of chopping and prying out chips. A swan-neck chisel can help clean waste from deep mortises.

Heavy-Duty Mortisers

Referred to as "framing" or "registered" chisels (depending on the size and shape of the blade), these hefty blades are designed to take a serious pounding. This type of chisel is essential when tackling large-scale projects such as timber frames and wooden boats. It is also handy for less ambitious projects, such as shaving the walls of larger mortises after removing the waste at the drill press or for cleaning up joints on outdoor projects after using a circular saw. In addition to mortising, a freshly-honed framing chisel can also be enlisted for delicate paring cuts.

When selecting a chisel, look for a socket handle (as on the larger chisel shown). Socket handles are more durable than tang handles and are easier to replace.

A corner chisel makes quick, clean work of squaring up the corners of both deep and shallow mortises. The only downside is that the tool can be tricky to sharpen.

Heavy-duty mortisers are a perfect match for substantial mortise and tenon joinery. Although designed to stand up to mallet blows, the large chisel can also pare tenon shoulders and cheeks.

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Detail Chisels

Japanese toolmakers produce a wide array of specialty chisels. Cherry-picking a few blades can flesh out any bench chisel set.

For fitting joints and getting into otherwise inaccessible corners, treat yourself to this trio of *push* chisels. As the name suggests, these tools should be hand driven, like the paring chisels below. The long handles offer a comfortable grip for one- or two-handed cuts. The blades are short (for better cutting control) but the long necks extend the reach of the blades so that they're comparable to Western bench chisels.

The angled blades of the takahashi, or skew, chisels make them a great addition to any workshop. Use them for paring end grain, trimming tenon shoulders, or cleaning inside corners. Similarly, the flared end of the bachi-nomi, or fishtail chisel, is handy for getting into tight spots in mortises and blind dovetails, without damaging the side walls.

The angled ends of these push chisels can reach into corners that are too tight for regular bevel-edge chisels. The fishtail chisel can be used for right and left corners. Skew chisels should be bought as a pair.

Paring Chisels

Despite obvious physical differences, paring chisels have one thing in common: they are designed to be driven with hand pressure. These tools can be used for a variety of shaving chores, such as fitting joints, trimming plugs, and removing glue. Selecting the right parer(s) involves balancing convenience and control. For example, the chisel plane and bent paring chisel can be used for similar chores, but while the smaller plane can sneak into tighter spots, the longer chisel is easier to control (and easier to sharpen). The 9½"-long Narex offers a reach and registration not found when using shorter-bladed bench chisels.

The long handles on some paring chisels enhance control when nestled below the user's shoulder, which allows steering the edge while simultaneously powering through wide shavings.

Paring chisels are intended to make shavings like a plane. Arm yourself with different sizes to accommodate various chiseling challenges.

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Spotlight On Red Oak

America's favorite hardwood

By Pete Stephano
Consultants: Jeff Slahor/Larry Osborn

North America boasts approximately 60 oak species–some with value as timber and others serving no commercial value. Those species we typically find in woodworking fall under the botanical surname *Quercus,* Latin for "a fine tree." Under this classification, the oaks split into two groups–red and white. The numbers of commercially available red and white species are about even.

Although northern red oak (*Quercus rubra*) is distinct and top-rated for lumber, the wood products industry lumps all red oak (about 8-10 species) together and markets them under that name. In fact, red oak represents around a third of all commercially available hardwood in the United States.

History in woodworking

Practically any wooden item you can imagine has–at one time or another–been fashioned from red oak. It was even a significant factor in America's industrialization, providing everything from barrel staves to plows and railroad ties, steamboats (and their fuel), as well as furniture and flooring. Furnituremakers in particular loved red oak because it was abundant, easily worked, and could be finished in a multitude of ways. That's true today, although red oak also finds its way into flooring, architectural millwork, molding, doors, all types of cabinets, and paneling.

Red oak has a great reputation for wear (abrasion) resistance, but is not ideally suited for outdoor use.

Where the wood comes from

Red oak principally grows from Oklahoma eastward, northward into southern Canada, and as far south as Florida, although there is one timber variety on the West Coast (*Quercus kellogii*, California black oak).

All in all, you'll find red oak abundant–of the billions of standing board feet of oak sold commercially in this country, over half of it is red.

What you'll pay

Red oak, due to its quantity on commercial timberlands, remains a very moderately priced hardwood. On average, you'll pay about $3.50 per kiln-dried board foot for flatsawn 4/4 (1") FAS stock. Lesser grades (#1 and #2 Common) cost less, while quartersawn red oak costs more. Traditional 1/42"-thick, plain-sliced red oak veneer costs about $3 per square foot. A special, more costly, veneer cut called "rift" or "comb" produces straight grain with the appearance of thin lines.

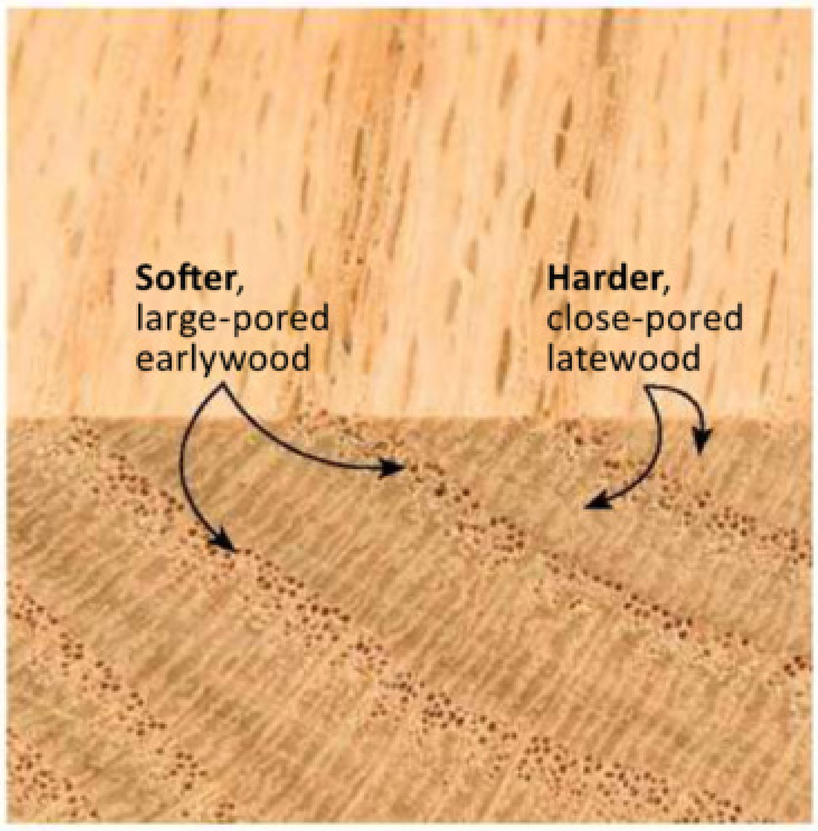
It's a fact that...

- Six states designate a specific oak as their state tree–three in the red oak family. Iowa simply proclaims "oak" as its tree.
- The porous nature of red oak makes it a poor choice for outdoor projects. You can blow air out of a length of red oak much like a straw.

How to select the best stock

Choosing good red oak boards isn't at all difficult. Keep in mind that the heartwood of red oak generally tends to be reddish pink. Although it has a thin band of nearly white sapwood, you'll seldom see it when buying the best grades of lumber. So if you'll be using a clear finish on your project, try choosing boards with similar color. Common red oak grades may have a few knots, but FAS should be relatively knot-free.

Does your plan call for quartersawn wood? Some sawmills cut and carry such boards. As with white oak, look for the characteristic ray flecks.



Working red oak in the shop

Be prepared: Freshly sawn red oak usually has a sour, often unpleasant odor. But that's about its only negative. Due to red oak's large vessels in the earlywood and smaller vessels in the latewood of each growth ring, it features a coarse, open-grain texture. Also, it machines easily with less burning than hard maple. Try the following tactics for milling success.

- **Ripping and routing**. Use a sharp blade when ripping red oak for a clean, crisp edge. Feed wood at a moderate rate into the table saw blade–too slow and it will burn. This applies to routing, too. If you do end up with burns, expect more sanding.

  Shallow passes with a router bit counter red oak's tendency to splinter, especially on end grain. As always, it's good policy to employ a backing board.
- **Jointing.** Joint flatsawn red oak with the knives rotating in the direction of the grain. This prevents gouging the wood's surface or edge.
- **Assembling**. Keep in mind that red oak's tannin content in contact with the moisture in glue squeeze-out and steel from clamp jaws or bars can create an ugly black stain on the wood. Protect the wood in the clamping areas with waxed paper. With screws, drill pilot holes to prevent splitting.
- **Sanding**. When sanding red oak, be careful that you don't remove more of the softer earlywood than the harder latewood, resulting in depressions that show up under a finish. Otherwise, the wood sands without a problem. Avoid abrading with steel wool as steel fibers tend to lodge into the grain and can later rust.

Photos: Staff; Illustration: Steve Sanford

Deciding on the right finish

Many woodworkers like the contemporary look of unstained red oak. That's simple enough because all clear film finishes work well if applied in thin coats and sanded in between.

But staining is a whole other story. Why? Red oak's large-pored earlywood (in flatsawn boards) soaks up pigment, resulting in darker areas that accentuate the wood's coarseness. What can you do? One option is to fill all the pores with a paste-type filler. The filled wood yields a less dramatic grain contrast. The result is smoother, and it takes fewer coats to build the final finish. A pickled finish offers a different way to go.

Another option: use any kind of aniline dye. It penetrates evenly, with one exception–the ray flecks of quartersawn red oak won't absorb as much. That's okay, though; they really need to stand out. ■

Red Oak Quick Take

Cost	Moderate
Weight	Moderate/heavy
Hardness	High
Stability	High (when dry)
Strength	Moderate/high
Durability	Very high (indoors)
Toxicity	None
Tool Type	Hand and carbide-tipped power tools
Common Uses	Cabinets, doors, flooring, furniture, millwork, moldings

Red oak finishing tips

- Any type of dye for wood will do, but the water-soluble kind won't color the pores as well. You can, though, add a pigment stain over the dye and wipe off the excess for even color.
- Again, for even color, you also can seal the wood with a thinned mixture of shellac, and then add a finish coat toned with either a pigment or dye.
- For the adventuresome: Use a colored wood filler or glaze to take advantage of red oak's large earlywood pores. It'll create a striking contrast with the denser latewood.

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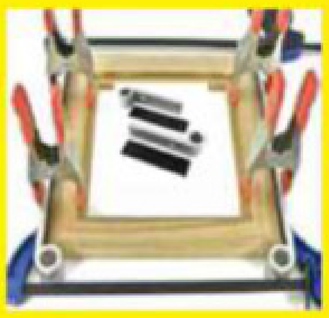

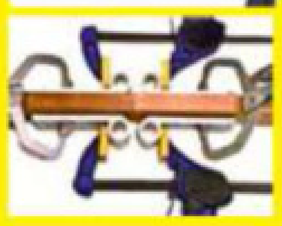

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1. Publication Title Woodcraft Magazine **2.** Publication Number 024-953 **3.** Filing Date 9/30/2014 **4.** Issue Frequency Bi-Monthly: Dec/Jan, Feb/March, April/May, June/July, Aug/Sept, Oct/Nov **5.** Number of Issues Published Annually 6 **6.** Annual Subscription Price $19.97 **7.** Complete Mailing Address of Known Office of Publication Woodcraft Magazine 4420 Emerson Ave, Suite A Parkersburg, WV 26104 **8.** Complete Mailing Address of Publisher Woodcraft Supply LLC P.O Box 1686 Parkersburg, WV 26102 **9.** Full Names and Complete Mailing Addresses of Publisher Gary Lombard 4420 Emerson Ave, Suite A Parkersburg, WV 26104; Editor Jim Harrold 4420 Emerson Ave, Suite A Parkersburg, WV 26104; **10.** Owner Woodcraft Supply LLC P.O. Box 1686 Parkersburg, WV 26102 **11.** Known Bondholders, Mortgagees, and Other Security Holders Owning or Holding 1 Percent or More of Total Amount of Bonds, Mortgages or Other Securities. None **12.** Tax Status The purpose, function, and nonprofit status of this organization and the exempt status for federal income tax purposes: has Not Changed During Preceding 12 Months **13.** Publication Title Woodcraft Magazine **14.** Issue Date for Circulation Data Below A/S 2014

15. Extent and Nature of Circulation

	Average No. Copies Each Issue During Preceding 12 Months:	
a.	Total Number of Copies (Net press run):	130,686
b.	Paid Circulation (By Mail and Outside the Mail)	
(1)	Mailed Outside-County Paid Subscriptions Stated on PS Form 3541. (Include paid distribution above nominal rate, advertiser's proof copies, and exhange copies):	99,294
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f.	Total Distribution (Sum of 15c. And 15e.):	113,012
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16. Publication of Statement of Ownership
Will be printed in the Dec/Jan 2015 issue of this publication.

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