STOP RUST NOW: 7 SIMPLE SECRETS TO SHINY TOOLS

SPECIAL BONUS SECTION: ROUTER-BUILT DRAWERS & BOXES

APRIL 2004
ISSUE #140

Popular Woodworking

MASTER THE MORTISE & TENON

Tools, Tricks and A Great Project

Draw It Right

Better Plans For Fewer Errors

PLUS

- 4 Spokeshaves That Work
- Japanese Garden Bench
- Beat Blotchy Finishes

popwood.com
$4.99 U.S. $7.99 CAN
04>
0 71486 01355 6

Don Weber Builds a Table With Hand Tools

Grizzly Industrial®

NO DEALERS, NO MIDDLEMEN • BUY DIRECT & SAVE!

2 HP DUST COLLECTOR

- Motor: 2 HP, 220V, single-phase, 3450 RPM
- Air suction capacity: 1550 CFM
- Static pressure: 11"
- 6" inlet has removable "Y" fitting w/ two 4" openings
- Standard bag filtration: .3 microns
- Height w/ bag inflated: 78"
- Approx. shipping weight: 123 lbs.

.3 MICRON BAG!

FREE 2-STAGE CYCLONE SEPARATOR WITH PURCHASE OF G1029Z

MADE IN ISO 9001 FACTORY

G1029Z

$55 shipping ANYWHERE IN LOWER 48 STATES

ONLY $259.95

THE ULTIMATE 10" CONTRACTOR-STYLE TABLE SAW

- Motor: 2 HP, 220V, single-phase
- Precision ground cast iron table w/wings measures: 27" x 39⅝"
- Arbor: ⅝" • Rip capacity: 30"
- Cutting capacity: 3⅛" @ 90°, 2⅛" @ 45°
- Shop Fox® Aluma-Classic™ Fence
- Approx. shipping weight: 298 lbs.

New!

MADE IN AN ISO 9001 FACTORY!

G SERIES

PRECISION-GROUND TABLE & WINGS FOR A MIRROR-LIKE FINISH & THE ULTIMATE IN ACCURACY!

G0444Z

INTRODUCTORY PRICE

$75 shipping ANYWHERE IN LOWER 48 STATES

ONLY $525.00

10" TILTING ARBOR SUPER HEAVY-DUTY TABLE SAW

- Motor: 3 HP, 220V, single-phase
- Precision ground cast iron table
- Table size w/ wings attached: 27" x 40"
- Arbor diameter: ⅝" (accepts dado blades up to 13/16")
- Cutting capacity: 8" left & 26" right of blade
- Approx. shipping weight: 420 lbs.

INCLUDES SHOP FOX® CLASSIC FENCE

G1023S ~~$895.00~~

$75 shipping ANYWHERE IN LOWER 48 STATES

ONLY $825.00

POWER FEEDERS

½ HP POWER FEEDER

- Motor: ½ HP, 220V, single-phase, 4 amp
- Number of speeds: 4
- Feed speeds: 9.5, 15, 25 & 38 FPM
- Rotation: forward & reverse
- Rollers: 3 synthetic rubber
- Roller size: 2" W x 4" dia.
- Approx. shipping weight: 107 lbs.

MADE IN ISO 9001 FACTORY!

G4179

$55 shipping ANYWHERE IN LOWER 48 STATES

ONLY $599.95

¼ HP POWER FEEDER

OUR MOST POPULAR FEEDER!

- Motor: ¼ HP, 110V, single-phase, 1.8 amp
- Number of speeds: 4
- Speed range: 20, 26, 33 & 43 FPM
- Rotation: forward & reverse
- Approx. shipping weight: 80 lbs.

MADE IN ISO 9001 FACTORY!

$40 shipping ANYWHERE IN LOWER 48 STATES

G4176 ONLY $399.95

1½ HP SHAPER

(SHOWN WITH OPTIONAL WING G1706)

- Motor: 1½ HP, 110V/220V, single-phase
- Precision ground cast iron table
- Table size: 20¼" x 18"
- 2 interchangeable spindles: ½" & ¾"
- Spindle travel: 3"
- Spindle openings: 1¼", 3½", & 5"
- 2 spindle speeds: 7000 & 10,000 RPM
- Max. cutter diameter: 5"
- Approx. shipping weight: 220 lbs.

INCLUDES MITER GAUGE & FENCE

G1035

ONLY $425.00

$55 shipping ANYWHERE IN LOWER 48 STATES

3 HP SHAPER

- Heavy-duty 3 HP, 220V, single-phase motor w/reversing switch
- Precision ground cast iron table
- Table size with standard wing attached: 30½" x 28¼"
- 3 interchangeable spindles: ½", ¾" & 1"
- 2 spindle speeds: 7,000 & 10,000 RPM
- Spindle travel: 3"
- Spindle openings: 1⅜", 2¾", 4", and 5½"
- Approx. shipping weight: 357 lbs.

HOTTEST SHAPER IN THE USA!

INCLUDES MITER GAUGE & FENCE W/ HOLD-DOWN SPRINGS

G1026

ONLY $835.00

$75 shipping ANYWHERE IN LOWER 48 STATES

6" X 47" JOINTER w/ HANDWHEELS

- Motor: 1 HP, 110V/220V, single-phase
- Precision ground cast iron table
- Cutterhead: 3 HSS knives
- Maximum depth of cut: ½"
- Rabbeting capacity :½"
- Handwheels for table height adjustment
- Heavy-duty center mounted fence
- Approx. shipping weight: 225 lbs.

FREE PAIR OF SAFETY PUSH BLOCKS

G1182HW

ONLY $325.00

$55 shipping ANYWHERE IN LOWER 48 STATES

6" x 60" ANNIVERSARY EDITION JOINTER w/ SPIRAL CUTTERHEAD

- Motor: 1½ HP, 110V/220V, single-phase
- Precision ground cast iron table
- Table size: 7¼" x 60"
- Cutterhead speed: 4800 RPM
- Maximum depth of cut: ⅛"
- Heavy-duty center mounted fence
- Approx. shipping weight: 280 lbs.

New!

FREE PAIR OF SAFETY PUSH BLOCKS

G0526

INTRODUCTORY PRICE

ONLY $850.00

$55 shipping ANYWHERE IN LOWER 48 STATES

8" X 75" JOINTER w/ SPIRAL CUTTERHEAD

- Motor: 2 HP, 110V/220V, single-phase, TEFC
- Precision ground cast iron table
- Table size: 8" x 75" includes two 5" extensions
- Spiral cutterhead reduces tear-out
- Cutterhead speed: 5500 RPM
- Maximum depth of cut: ½"
- Heavy-duty center mounted fence
- Approx. shipping weight: 484 lbs.

New!

G0543

INTRODUCTORY PRICE

ONLY $1195.00

$75 shipping ANYWHERE IN LOWER 48 STATES

FREE PAIR OF SAFETY PUSH BLOCKS

5667R

MEDIA CODE AD2034

LEASE FINANCING AVAILABLE Call for Details

1-800-523-4777

CUSTOMER SERVICE: 570-546-9663 CSR@GRIZZLY.COM FAX: 1-800-438-5901

3 SHOWROOM LOCATIONS:
BELLINGHAM, WA
SPRINGFIELD, MO
MUNCY, PA

CIRCLE NO. 122 ON FREE INFORMATION CARD.

PURVEYORS OF FINE MACHINERY®

- ALMOST A MILLION SQUARE FEET PACKED TO THE RAFTERS WITH MACHINERY & TOOLS
- 2 OVERSEAS QUALITY CONTROL OFFICES STAFFED WITH QUALIFIED GRIZZLY ENGINEERS
- HUGE PARTS FACILITY WITH OVER 1 MILLION PARTS IN STOCK AT ALL TIMES
- TRAINED SERVICE TECHNICIANS AT EACH LOCATION • MOST ORDERS SHIPPED THE SAME DAY

THE NEW GRIZZLY 2004 CATALOG!
516 FULL-COLOR PAGES OF HIGH QUALITY MACHINES, TOOLS & ACCESSORIES!
CALL FOR YOUR FREE COPY!

THE ULTIMATE 14" BANDSAW

- Motor: 1 HP, 110V/220V, single-phase, TEFC
- Precision ground cast iron table
- Table tilt: 45° right, 10° left
- Floor to table height: 43 5/16"
- Deluxe extruded aluminum fence
- Cutting capacity/throat: 13½"
- Maximum cutting height: 6"
- Blade size: 92½" - 93½" long (⅛" – ¾" wide)
- 2 blade speeds: 1500 & 3200 FPM
- 4" dust port
- Approx. shipping weight: 198 lbs.

BEST NEW TOOL POPULAR MECHANICS

MADE IN ISO 9001 FACTORY!

$55 shipping ANYWHERE IN LOWER 48 STATES

G0555
ONLY $375.00

17" HEAVY-DUTY BANDSAW

- Motor: 2 HP, 110V/220V, single-phase, TEFC
- Precision ground cast iron table
- Table tilt: 45° right, 10° left
- Floor to table height: 37½"
- Cutting capacity/throat: 16¼"
- Maximum cutting height: 12"
- Blade size: 131½" long (⅛" - 1" wide)
- 2 blade speeds: 1600 & 3300 FPM
- Two 4" dust ports
- Approx. shipping weight: 342 lbs.

CAST IRON FENCE, MITER GAUGE & ½" BLADE INCLUDED

MADE IN ISO 9001 FACTORY!

$75 shipping ANYWHERE IN LOWER 48 STATES

G0513
ONLY $750.00

19" HEAVY-DUTY BANDSAW

- Motor: 2 HP, 110V/220V, single-phase, TEFC
- Precision ground cast iron table
- Cutting capacity/throat: 18¼"
- Max. cutting height: 12"
- Blade size: 143" long (⅛" - 1¼" wide)
- 2 blade speeds: 1700 & 3500 FPM
- Two 4" dust ports
- Approx. shipping weight: 385 lbs.

CAST IRON FENCE, MITER GAUGE & ¾" BLADE INCLUDED

MADE IN ISO 9001 FACTORY!

$75 shipping ANYWHERE IN LOWER 48 STATES

G0514
ONLY $950.00

12½" LEAN & MEAN PORTABLE PLANER

- Motor: 2 HP, 110V, single-phase
- Max. cutting width: 12½"
- Max. cutting depth: 3/32"
- Max. cutting height: 6"
- Min. board thickness: 13/64"
- 2 double edged HSS knives
- Feed rate: 32 FPM
- On/off toggle Switch
- Cutterhead speed: 10,000 RPM
- Cuts per inch: 52
- Approx. shipping weight: 78 lbs.

HOT!

$35 shipping ANYWHERE IN LOWER 48 STATES

G0505
ONLY $195.00

15" PLANER w/ CLOSED STAND

- Motor: 3 HP, 220V, single-phase
- Max. cutting width: 14⅞"
- Max. cutting depth: ⅛"
- Max. cutting height: 6½"
- Min. board thickness: ¼"
- 3 HSS knives
- Feed rate: 16 & 20 FPM
- Cutterhead speed: 5000 RPM
- Cuts per minute: 15,000
- Approx. shipping weight: 560 lbs.

New!

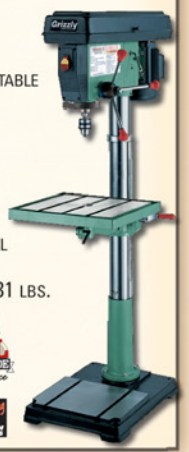
ROLLER EXTENSION TABLES FEATURE 3 ADJUSTABLE ROLLERS

G0551
INTRODUCTORY PRICE
ONLY $675.00

$125 shipping ANYWHERE IN LOWER 48 STATES

12 SPEED 20" FLOOR DRILL PRESS

- Motor: 1½ HP 110V/220V, single-phase
- Precision ground cast iron table
- Table size: 18¾" x 16¾"
- Spindle taper: MT#4
- Spindle travel: 4¾"
- Swing: 20"
- Drill chuck: ⅝"
- 12 Speeds: 210 - 3300 RPM
- Drilling capacity: 1¼" steel
- Overall height: 70"
- Approx. shipping weight: 331 lbs.



NICE MACHINE!

Popular Woodworking TOOL BUYING GUIDE Editor's Choice

G7948
ONLY $425.00

$75 shipping ANYWHERE IN LOWER 48 STATES

OSCILLATING SPINDLE/ 12" DISC SANDER

- Motor: 1 HP, 110V, TEFC
- Cast iron 14½" square oscillating sander table
- Cast iron 17½" x 10" disc sander table
- Four spindle sizes: ¼", ⅝", 1½" & 2"
- Spindle speed: 1725 RPM
- Spindle oscillations: 60 SPM
- Stroke length: 1"
- 2 – 2" dust ports
- Approximate shipping weight: 180 lbs.

MADE IN ISO 9001 FACTORY!

$55 shipping ANYWHERE IN LOWER 48 STATES

New!

G0529
INTRODUCTORY PRICE
ONLY $395.00

24" DRUM SANDER W/ VARIABLE SPEED

- Drum motor: 5 HP, 220V, single-phase
- Conveyor motor: ¼ HP, variable speed
- Sanding drums: 2 computer balanced aluminum
- Max. stock size: 23½" x 4¼" thick
- Hook & loop sandpaper
- Control panel w/ amp load meter
- Dust ports: Two 4"
- Approx. shipping weight: 489 lbs.

VARIABLE SPEED!

Z SERIES

$75 shipping ANYWHERE IN LOWER 48 STATES

G1066Z
ONLY $1595.00

15" WIDE-BELT SANDER (OPEN END)

- Sanding drum motor: 5 HP, 220V, single-phase
- Feed belt motor: ¼ HP
- Conveyor speed: 13.1 & 16.4 FPM
- Amp meter
- Pneumatic belt tensioning & tracking
- Disc brake for emergency stops
- Includes extended support bar for wide boards
- Approx. shipping weight: 908 lbs.

$150 shipping ANYWHERE IN LOWER 48 STATES

G9983
ONLY $2795.00

VISIT OUR WEBSITE FOR INFORMATION ON CURRENT SPECIALS & COMING EVENTS!

grizzly.com

VISA MasterCard AMERICAN EXPRESS DISCOVER NOVUS

FULL YEAR WARRANTY GRIZZLY Power Tools & Machinery

CIRCLE NO. 122 ON FREE INFORMATION CARD.

The Best Wood Glue Ever

What makes Titebond® III Ultimate Wood Glue the best ever? It's waterproof, yet cleans up with water. It allows eight minutes of open assembly time and offers an application temperature as low as 47°F.

Plus it's vastly stronger, safer, easier to clean up and less expensive than polyurethane glues.

Titebond® III. We see it as a natural progression of tradition and excellence. You'll see it as the ultimate wood glue.

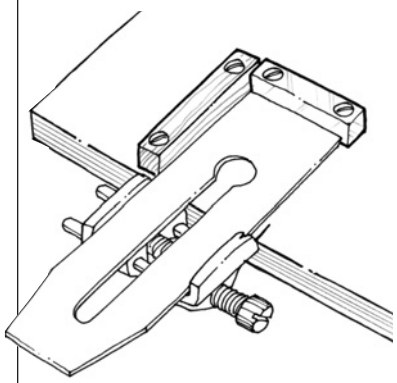
1-800-347-4583
www.titebond.com

CIRCLE NO. 116 ON FREE INFORMATION CARD.

contents

Popular Woodworking

IN EVERY ISSUE



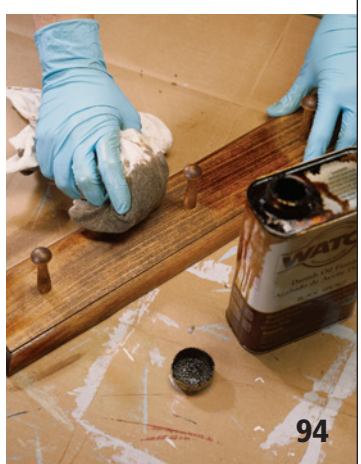
20

32

36

30

34



94

Popular Woodworking (ISSN 0884-8823, USPS 752-250) is published seven times a year in February, April, June, August, October, November and December by F&W Publications Inc. Editorial and advertising offices are located at 4700 E. Galbraith Road, Cincinnati, Ohio 45236; tel.: 513-531-2222. Unsolicited manuscripts, photographs and artwork should include ample postage on a self-addressed, stamped envelope (SASE); otherwise they will not be returned. Subscription rates: A year's subscription (7 issues) is $28; outside of U.S. add $7/year ▪ Canada Publications Mail Agreement No. 40025316. Canadian return address: 2744 Edna St., Windsor, ON N8Y 1V2 ▪

Copyright © 2004 by *Popular Woodworking*.

Periodicals postage paid at Cincinnati, Ohio, and additional mailing offices. Postmaster: Send all address changes to Popular Woodworking, P.O. Box 5369, Harlan, IA 51593 Canada GST Reg. # R122594716 ▪ Produced and printed in the U.S.A.

Cold,

Look for these qualifying products:

Stock No. 629004K
$799*

Stock No. 1791210
$1499*

Stock No. 1791279K
$749*

Stock No. 1791216K
$849*

Stock No. 1791220K
starting at **$649***

Stock No. 710002
$599*
Available November 1, 2003

Stock No. 708528
Stock No. 708584
$1399*

Stock No. 708775K
starting at **$849***

Stock No. 708639 **$299***
Stock No. 708626CK **$449***

Stock No. 354169
$399*

Stock No. 708115K **$499***
Stock No. 710115K **$599***

Stock No. 708457K
$549*

Stock No. 708301K
starting at **$599***

Stock No. 708531
$899*
Available November 1, 2003

Stock No. 708750B
$1099*

*Price shown is Manufacturer Suggested Retail Price. Offer valid September 1, 2003 through April 30, 2004. For promotion details, visit your dealer, see our website at www.jettools.com, or call 1-800-274-6848.

LIMITED LIFETIME WARRANTY
JET® Performax® Powermatic®

Now with Lifetime Warranty!

As expected from the industry innovator, only the JET Family of Brands offers you a Limited Lifetime Warranty on many of our most popular products.

hard cash

$50 or $100?
It's your choice.

Buy one of the qualifying products and we'll reimburse you $100 on the purchase of a second JET®, Powermatic®, or Performax® machine (with net purchase price of $349 or more) OR up to $50 on the purchase of JET branded accessories. Pick up your second machine or accessories immediately — or until April 30, 2004.

Look for the green tags on the industry's hottest sellers at participating dealers.

Cold, hard cash. It's an easy choice.

JET®

Powermatic, Performax and JET
A Family Of Brands

CIRCLE NO. 125 ON FREE INFORMATION CARD.

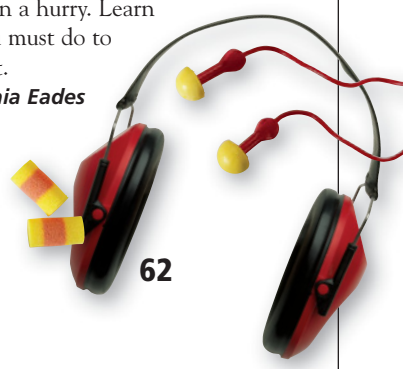
ON THE COVER

Don Weber is a chairmaker. While this is a noble calling, what makes him even more special is that for most of his wares, he crafts them all by hand. Turn to page 68 to learn some of the master bodger's tricks and build a small table.

Cover photo by Al Parrish

DEPARTMENTS

PROJECTS, TOOLS AND TECHNIQUES



CIRCLE NO. 140 ON FREE INFORMATION CARD.

INTRODUCING A NEW WAY TO LOOK AT ROUTERS.

FOR A LIMITED TIME, GET A FREE ABOVE-THE-TABLE HEIGHT ADJUSTMENT KIT WITH PURCHASE.*

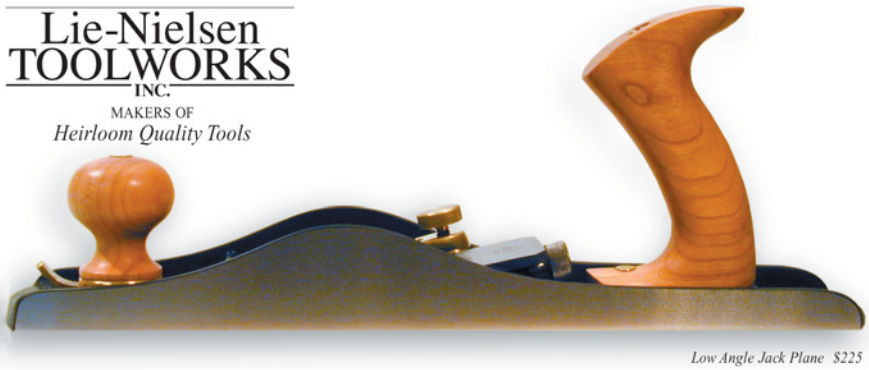
ABOVE THE TABLE AND BELOW, THE NEW 890 IS A ROUTER UNLIKE ANY OTHER. Replace bits and adjust heights without reaching under the table. Shut down from any grip. Change speeds for any project. What's more, the 2¼ HP soft-start motor moves effortlessly between fixed, plunge, even model 690 bases. In other words, it's the most versatile router on the market. Looks like someone has turned the router world on its head. For the offer coupon and details, call 1-800-4US-TOOL or visit porter-cable.com today. **SMOOTH TRANSITIONS AT YOUR FINGERTIPS.**

PORTER CABLE

REDEFINING PERFORMANCE™

*Only available with purchase of models: 891, 892, 893PK, or 894PK. Completed coupon is required for redemption. Accessory kit's suggested retail value: $32. Offer not valid in Canada.

Lie-Nielsen
TOOLWORKS
INC.
MAKERS OF
Heirloom Quality Tools



Low Angle Jack Plane $225

P. O. Box 9 • Warren, Maine 04864 • 1-800-327-2520 • www.lie-nielsen.com

CIRCLE NO. 132 ON FREE INFORMATION CARD.

Overnight Miracles

EpoxyHeads

Build or fix anything to last forever.

"Well, nearly anything."

Contact us soon for product and price information.

Toll Free: 866-EPOXY IT (376-9948) Fax: 989-671-9921
www.epoxyheads.com

Address: P.O Box 2280 Bay City, MI 48707

CIRCLE NO. 112 ON FREE INFORMATION CARD.

Popular Woodworking®

April 2004, Vol. 24, No. 2
popwood.com

Editorial Offices 513-531-2690

Editor & Publisher **Steve Shanesy**
ext. 1238 • steve.shanesy@fwpubs.com

Art Director **Linda Watts**
ext. 1396 • linda.watts@fwpubs.com

Executive Editor **Christopher Schwarz**
ext. 1407 • chris.schwarz@fwpubs.com

Senior Editor **David Thiel**
ext. 1255 • david.thiel@fwpubs.com

Associate Editor **Kara Gebhart**
ext. 1348 • kara.gebhart@fwpubs.com

Associate Editor **Michael A. Rabkin**
ext. 1327 • michael.rabkin@fwpubs.com

Project Illustrator **John Hutchinson**

Photographer **Al Parrish**

Contributing Editors
Nick Engler, Bob Flexner, Glen Huey, Don McConnell, Troy Sexton

Magazine Group Head **David Hoguet**
Executive Vice President Magazine Advertising
Jim Gleim

CIRCULATION
Mark Fleetwood, *Group Circulation Manager*

PRODUCTION
Barbara Schmitz, *Vice President*
Vicki Whitford, *Production Supervisor*

ADVERTISING
Don Schroder, *Advertising Director*
331 N. Arch St., Allentown, PA 18104
Tel. 610-821-4425; Fax 610-821-7884
d.schroder@verizon.net

Marketplace/Classified Advertising Sales
Barbara J. Gasper
6552 Kings Highway S., Zionsville, PA 18092
Tel./Fax 610-967-1330
bjgasper@entermail.net

Advertising Production Coordinator
Debbie Thomas, Tel. 513-531-2690 ext. 1219
debbie.thomas@fwpubs.com

SUBSCRIPTION SERVICES: Subscription inquiries, orders and address changes can be made at popwood.com (click on "Customer Service FAQs"). Or by mail: Popular Woodworking, P.O. Box 420235, Palm Coast, FL 32142-0235. Or call 877-860-9140 or 386-246-3369. Include your address with all inquiries. Allow 6 to 8 weeks for delivery.

NEWSSTAND DISTRIBUTION: Curtis Circulation Co., 730 River Rd., New Milford, NJ 07646

ATTENTION RETAILERS:
To carry *Popular Woodworking* in your store, call Steve Hudziak at 800-894-4656 or write Magazine Retail Sales, Steve Hudziak, P.O. Box 5014, Iola, WI 54945-5014.

Back issues are available for $7 ($9 Canada; $11 other foreign). Send check or money order to: *Popular Woodworking* Back Issues, F&W Publications Products, 700 E. State St., Iola, WI 54990. Or call 800-258-0929. Please specify publication, month and year.

SAFETY NOTE:
Safety is your responsibility. Manufacturers place safety devices on their equipment for a reason. In some photos you see in *Popular Woodworking*, these have been removed to provide clarity. In some cases we'll use an awkward body position so you can better see what's being demonstrated. Don't copy us. Think about each procedure you're going to perform beforehand. Safety First!

What Has A Thin Body, Big Teeth & Always Stays True?

LU83R
Thin Kerf Combination Blade

The New Industrial Thin Kerf Saw Blade Series from Freud

A Must For Underpowered Saws

Less Power Needed

These new Industrial Thin Kerf Saw Blades remove less material, which reduces waste and feeds easier.

Extra Long Cutting Life

Freud develops and manufactures highly specialized MicroGrain carbide blends designed exclusively for a variety of cutting applications. Every cobalt and titanium formulation provides the perfect balance of long cutting life and razor sharp precision for each application. The oversized carbide teeth are 50-60% larger than standard carbide teeth resulting in up to 4 times more sharpenings.

No Stabilizer Needed

These blades also feature Freud's innovative anti-vibration technology that practically eliminates the sideways movement of the blade against the material. This design results in a quieter, smoother cut with a superior finish, and long cutting life that always stays true. For further performance, these new blades feature Freud's trademarked Perma-SHIELD™ Permanent High Performance Coating making the blade resistant to heat build-up and corrosion.

This new full range of thin kerf blades are designed for a variety of cutting applications in a wide range of sizes. Choose the blade that fits your application precisely, and maximize the performance of your saw.

Range includes but not limited too:

LU88R–Crosscutting

LU86R–General Purpose

LU87R–Ripping

LU96R–2-Sided Laminate

freud®
Precisely what you need.

For Freud's full line of high quality saw blades go to:
www.freudtools.com
(U.S.) 1-800-472-7307
(Canada) 1-800-263-7016

Red saw blades are a registered trademark of Freud TMM, Inc.
CIRCLE NO. 117 ON FREE INFORMATION CARD.

Pricey Tools are Worth the Pain

While growing up in my house, "making do" was a cardinal principle by which we all lived. It was accepted as fact that a new baseball glove wasn't going to make you a better baseball player, nor would a fancy bike be necessary to win a race.

While I continue to believe the conclusions we reached about "making do," I have learned, although it took a long time, to get past "making do" and allow myself to appreciate the merits of having better things. Tools illustrate this point.

First, let me just say I'm no tool snob. Tools and machines are just a means to an end, not an end in themselves. The hands guiding the tool are far more important than the tool itself. My foremost expectation from a tool or machine is that it's ready to work when I pick it up or turn it on.

But during the past several years, I've been selling off some of the equipment that I have "made do" with and substantially upgraded it. Also, when I'm buying a new tool or machine for the first time, I buy more "up market" than in the past. Sometimes this means I put off buying something else for a while, but that's OK. (I'm not altogether free of the "make do" syndrome.)

At first I had a bit of guilt about spending the extra money, but I soon got over that. After a while, I started realizing certain things I'd never considered. I got a lot of satisfaction from using a better piece of equipment. Not just the temporary pleasure of simply having something new, but a deeper satisfaction. You might say it's a bit like being in a partnership with someone you know you can rely on, someone you can work with. Better machinery brings me more joy during the time I spend in my shop.

I've also learned that better equipment is easier to set up. The fence, the height adjustment and other elements stay put once locked down. The quality of the cut from hand planes, table saws and lathes is improved either because of an absence of vibration or machining tolerances. I pick up a chisel with a well-formed handle and it just feels good in my hand.

All these improvements add up to some better-quality time in the shop. And I do spend a lot of time there, including most evenings and weekends. I figure that my added expense will pay back in the long run anyway. One of these years I'll semi-retire and all these tools will really see a workout. With better things, it's not unreasonable to expect they'll last another 20 years as long as I take care of them.

You can make the argument that searching the classified pages and chasing auctions will land you good buys in tools. I've spent my share of time and miles chasing down a lot of disappointments. And I've found my share of bargains, too. Of course, they always take a good bit of time to rehab and put in good working order; some even require parts that aren't cheap. I saved some money, to be sure, but throughout the years, I've learned that it's often easier to replace money than it is to find more time. I've also learned after 25 years in the shop that it's woodworking I love, not fixing tools and equipment.

Like most of you, I don't have an open checkbook for tools and I don't buy anything big on a whim. But I have concluded this: The continuing joy and satisfaction of using a well-made tool can last forever – long after whatever minor guilt or hardship experienced from spending the extra money has long since been forgotten.

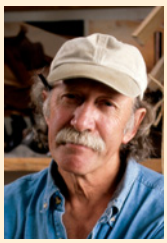
And no, I'm not a better woodworker – well, maybe a little better – for having better tools, but I know I'm a happier one. **PW**

Steve Shanesy
Editor & Publisher

CONTRIBUTORS

DON WEBER

Don's a bodger – a 19th-century term used to describe a kind of chairmaker, mostly in Britain. Born in New York and raised in Wales (where he apprenticed as a joiner), Don specializes in building English- and



Welsh-style stick chairs in the tiny town of Paint Lick, Ky. Also a teacher and blacksmith, Don works hard to keep traditional chairmaking alive. He preserves the woodland crafts by building all of his furniture almost entirely by hand, just as Welshmen did in the forests years ago. A lover of education, tradition and quality Scotch, Don travels the world (with his dog, Bronwyn) to share his knowledge and demonstrate his skills. To learn more about the tools Don uses and to build one of his tables on your own, check out page 68.

CYNTHIA EADES

Cynthia's interest in hearing protection started at an early age as she helped her father with his woodworking tools. With a master's from Gallaudet (the Washington, D.C., university for deaf and hard-of-

hearing students) and an almost-completed doctorate from the University of Arizona, she has been an audiologist for 13 years, teaching people about the dangers of noise exposure (see page 62). When traveling by air, she often hands out hearing protection to her fellow passengers who want to reduce on-board noises. Even when she's at the movies, she finds herself warning people about loud previews for action films. Her favorite type of hearing protection is custom plugs, and her biggest pet peeve (naturally) is people using power tools without using hearing protection.

Our Privacy Promise to You
We make portions of our customer list available to carefully screened companies that offer products and services we believe you may enjoy. If you do not want to receive offers and/or information, please let us know by contacting us at:
List Manager, F & W Publications,
4700 E. Galbraith Road, Cincinnati, OH 45236

CREATE PROJECTS. NOT DUST.

Only Delta offers a Dust Management System to fit every budget. From portable units to top-of-the-line OSHA-required two-stage industrial systems, Delta makes it easy to add on as your shop grows. Plus, these tools don't take up precious floor space so you have more room to perfect your project. For specs and the dealer nearest you, visit deltamachinery.com or call 800.438.2486 (US), 800.463.3582 (Canada).

NEW AIR PURIFIER AP100

NEW DOWN DRAFT TABLE AP075

PORTABLE DUST COLLECTOR AP400

INTRODUCTORY OFFER: GET A $15 REBATE ON ONE OR $50 ON ALL THREE*

Delta is a proud sponsor of these PBS programs. *Offer expires 6/30/04.

CIRCLE NO.110 ON FREE INFORMATION CARD.

WOODCRAFT® UNIVERSITY

There's a Woodcraft University location near you

Alabama
Birmingham Area
Arizona
Tempe
Tucson
California
Orange County
Sacramento
San Francisco Bay Area
Santa Rosa
Colorado
Colorado Springs
Denver
Connecticut
Hartford Area
New Haven Area
Delaware
Wilmington
Florida
Casselberry
Clearwater
Jacksonville
Georgia
Atlanta Area
Hawaii
Honolulu
Idaho
Boise
Illinois
Palatine
Peoria
Indiana
Evansville
Indianapolis
Iowa
West Des Moines
Kansas
Lenexa
Kentucky
Louisville
Maryland
Towson
Massachusetts
Springfield
Woburn
Michigan
Canton
Sterling Heights
Minnesota
Bloomington
Missouri
St. Louis Area
New Hampshire
Portsmouth Area
New Mexico
Albuquerque
New York
Albany
Rochester
North Carolina
Charlotte Area
Greensboro
Raleigh
Ohio
Cincinnati Area
Cleveland Area
Columbus Area
Dayton
Oklahoma
Oklahoma City
Tulsa
Oregon
Eugene
Portland Area
Pennsylvania
Harrisburg
Philadelphia Area
Pittsburgh Area
Rhode Island
East Greenwich
South Carolina
Charleston
Tennessee
Johnson City
Knoxville
Nashville
Texas
Austin
Dallas Area
Fort Worth
Houston
San Antonio
Utah
Salt Lake City Area
Virginia
Richmond
Virginia Beach
Washington D.C. Area
Washington
Seattle
West Virginia
Parkersburg
Wisconsin
Appleton/Fox Cities Area
Madison
Milwaukee Area
Woodworker's Club:
Connecticut
Norwalk
Maryland
Rockville

WOODCRAFT®
For your local woodcraft store, visit www.woodcraft.com, or for a free catalog, call 800 542-9115
Dept.04PW04BE
CIRCLE NO. 154 ON FREE INFORMATION CARD.

Grandkids Help This 'Old Dog' Work Well

'Bird Feeder' Lessons Teach One Grandfather to Think Young

As a lifelong perfectionist and woodworker, and now a grandfather of 4- and 2-year-old boys, I can't tell you how meaningful "Lessons from a Bird Feeder" (Out of the Woodwork, December 2003) was for me. The project sessions I've been planning with my grandsons have now taken on a whole new light and meaning. The story hit home like nothing I've experienced lately.

Thank you for reminding me that when dealing with young minds, one has to think young or be doomed to failure. It's funny how sometimes we convey in our craft things far removed from the simple project at hand.

Joe Tallant
Big Canoe, Georgia

Chessboard's Joints Won't Fail You

Regarding Barry Black's "Classic Chessboard" (December 2003): When doing the final glue-up of the top, the joints are end-grain-to-end-grain, which normally is a very weak joint. Granted, chessboards are rarely subjected to any great weight or force, but still, are there any special gluing strategies involved? Would the use of splines make for sturdier joints? Because the top isn't attached to any substrate, these joints must be fairly strong. Will the joints as described hold up over time, or am I just being paranoid?

Chris Green
Lebanon, New Jersey

Barry Black responds: So far I have not had the glue joints in a chessboard fail. It's true that end-grain joints typically are weak and I wouldn't do this where strength is an issue. But in this context, the joints are surprisingly strong. In fact, I sometimes make an extra strip or two to cut banding out of, and these pieces never seem to break at the glue joint.

However, if more strength is needed, either splines or dowels would indeed improve the end-grain glue strength, as would the use of epoxy rather than the white carpenter's glue that I use. During the last 20 years of making these chessboards, I have had the occasional one slip and fall on the cement floor in my shop; so far, none has come apart. (Needless to say, the next one I drop will disintegrate now for sure.)

How Were the Angles Developed For the Drop-leaf Table?

I loved the simple elegance of the "Shaker Drop-leaf Table" (December 2003). I noticed the aprons are cut at 4° and the ends of the legs are beveled to 5½°. Being a novice woodworker, I'm curious why this is and how these angles were determined.

Bob Pfohler
Morrisonville, New York

Editor's Note: The table is a reproduction of one made by the Shakers in the 19th century. The dimensions were determined largely by looking at the original. That's how the 4° angle was arrived at. With the 4° angle on the apron, the 5½°angle of the leg was arrived at by a bit of trial and error on my part.

– Steve Shanesy, editor & publisher

continued on page 14

WRITE TO US

Popular Woodworking welcomes letters from readers with comments about the magazine or woodworking in general. We try to respond to all correspondence. Published letters may be edited for length or style. All letters become the property of *Popular Woodworking*. How to send your letter:

- E-mail: popwood@fwpubs.com
- Fax: 513-891-7196
- Mail carrier:
  Letters • *Popular Woodworking*
  4700 E. Galbraith Road
  Cincinnati, OH 45236

is your work in a class by itself?

PERGULA LIGNARIUS

WOODCRAFT®
UNIVERSITY

Go to the head of the class with skills you'll gain from the Woodcraft University College of Scroll Sawing.

Woodcraft University classes will improve your skills in Scroll Sawing, Power Carving, Sharpening, Joinery, Routing, Turning and Bandsawing. You'll learn from experienced artisans, share sharpening secrets, learn power tool techniques from recognized experts and much more.

Woodcraft University offers you the opportunity to learn in classes certified for continuing education credit.

Visit your local Woodcraft store, Woodworkers Club or www.woodcraft.com for class schedules and details on how to get your woodworking education started at Woodcraft University.

Experience the finest in woodworking tools, supplies and education at Woodcraft.

THE FIRST AMERICAN WOOD WORKER

WOODCRAFT®
Helping You Make Wood Work®

CIRCLE NO. 154 ON FREE INFORMATION CARD.

continued from page 12

Won't Moisture in Glue Cause a Workbench's Plywood Top to Warp?

I was impressed with your plans for the "24-hour Workbench" (December 2003), but I have a question about the benchtop.

I'm concerned about using plywood for the top because I'm not sure if it will come out of the laminating process perfectly flat and if it will stay that way. Will the moisture in the glue cause it to warp even a little? I want to use my bench with lots of traditional hand tools, so I will need a flat surface. Many people seem to think that a benefit of a solid top is that it can be reflattened periodically if necessary. But plywood's top veneer layer has very little thickness to work with, so it really has to stay flat. Will it?

Dave Brown
Jacksonville, Illinois

Editor's Note: I do a good deal of work by hand and have had no problems with the flatness of the top of this workbench. After two years, it's still dead flat. I don't think the glue moisture will introduce any problems.

If it does warp, you can flatten it with a hand plane with little difficulty. Sure, it may look a little odd once you get below the face veneer, but it is a workbench, after all.

– Christopher Schwarz, executive editor

'Workbench' was Interesting, but Reader Found Some Other Options

After going over your article about building the "24-hour Workbench," I came up with some suggestions for things that have worked better for me, and might even help some readers who want to build it:

- First, instead of using weights and cauls to glue the last piece that makes up the top, you can use screws and just turn the top over to hide the holes. The screws should then be removed after the glue sets.
- Second, drill clearance holes for the screws in the piece that's being screwed down. Countersink the bottom side of the holes so there's no "bulge" to keep the pieces apart. Put the first screw in the center and work outward to squeeze out any glue pockets.
- Third, you can put a piece of scrap behind the top when drilling the dog holes so the hole edges don't splinter or tear out.

Mike Turner
Renton, Washington

Will Pledge Furniture Polish Cause Those Dreaded 'Fish Eyes'?

Bob Flexner recently wrote about myths and common errors of furniture finishing ("9 Myths of Finishing," December 2003). One of these was about why "fish eyes" appear when a table is refinished after years of "dusting" with a modern polish that contains silicone. Is Pledge in this silicone category? My wife uses non-aerosol Pledge and there is no mention on the container if silicone is in it. What is safe to use when dusting?

Don Esterberg
Destin, Florida

Bob Flexner responds: Yes, Pledge contains silicone, a very slick oil that remains on the surface for a considerable time that creates the shine, depth and scratch-resistance. Other furniture polishes that contain silicone include Favor, Behold, Orange Glo, Klean & Shine and Old English in the aerosol can.

Silicone has gotten a bad reputation from refinishers and conservators because the oil causes finish-repair and refinishing problems. But silicone causes no damage to finishes or to wood. Silicone is a totally inert oil, like mineral oil.

If your wife has been using Pledge and likes it, I'd stay out of her way. The surface has already been contaminated, meaning that repair to the finish or refinishing will be more difficult, but no harm has been done – or will be done if she continues using the product.

If you should have to refinish the furniture at some time in the future, clean the bare wood surface thoroughly with mineral spirits or household ammonia and water, or seal the wood with shellac before applying the finish of your choice. The cleaning will remove the residue oil and the shellac will "seal in" the oil so your finish won't have any dreaded "fish eyes."

Another Option for Pine Finishers

I have to add another alternative to the stains Bob Flexner proposes to control blotching on pine ("The Pine Problem," November 2003): nothing. Leave it alone to age to its own color. No matter what shade you stain pine (or fir), it still looks like stained softwood, and I don't like it very much.

When I built the kitchen and bathroom cabinets for our log house, I used No. 3B Ponderosa pine, ripped and edge-glued for the cabinet ends, face frames and doors. I allowed a few tight knots. The hidden partitions and cabinet bottoms were particleboard; the backs were ¼" pine plywood.

Ponderosa pine is photosensitive, so some of the glue-ups aged to varying shades and patterns of brown before I got around to finishing the cabinets. I found it quite attractive. After testing some stains, I decided they looked better with none; just four coats of an oil-based polyurethane varnish.

The pine continued to darken for about five years, and now the cabinets are much more attractive than if they had been stained.

Barney Howard
Sisters, Oregon

Remember Why the Low-angle Jack Plane was Invented

It was with great interest that I read the review of the Lie-Nielsen Low-angle Jack Plane (Endurance Test, November 2003). I have owned one for some time and really love it. Despite some very good tips on how to make the plane more versatile, the author neglected to mention the original purpose for this plane – when designed by Stanley, it was intended for butcher-block makers to flatten and finish the exposed end-grain surface. Considering that butcher blocks are a very popular woodworking project, I feel this omission may have left out the largest user group for this plane.

Brian Blazer
Ellison Bay, Wisconsin

Which of These Two Ways is Best to Clean Blades & Bits?

In your November 2003 issue, there were two references to cleaning carbide-tipped blades or router bits. In "Woodworking Essentials," you suggest using oven cleaner. I've heard that oven cleaner is corrosive of the silver solder used to attach carbide points. The source of that information suggested using automotive carburetor cleaner instead. The second cleaning reference was made in Paul Anthony's "Table Saw Tune-up," where he recommends using citrus-based cleaner.

John Wilson
Charlotte, Michigan

Jim Brewer of Freud responds: Many people fear the cleaner they are using is harmful to the coatings or to the brazing compound. The clean-

ers that we have research on do not indicate any effect on Freud's blade coatings or the brazing; however, they do affect the carbide. All of the commercially sold blade cleaners in our research have a negative effect on the carbide, which could lead to the blades becoming prematurely dull. Oven cleaners are even worse. We recommend cleaning blades by soaking them overnight in a sealed container of kerosene and then brushing the deposits left on the teeth with a soft brush.

Hand Tools are a Great Way to Learn Woodworking – Tell Us More!

I read a number of your articles on hand planes with a great deal of interest. I would enjoy more articles of this genre, including some stories about what types of planes one might like to have in the ideal shop, maintenance, sharpening and tips on the intended uses for bench planes, rabbet planes, smoothing planes and more.

Though I have most of the "power tools," I have virtually no knowledge or experience with hand tools such as drawknives, planes, spokeshaves, carving chisels and the like. Perhaps a series of articles on this subject would be welcomed by some other readers of *Popular Woodworking*.

Bill Jordan
Andalusia, Alabama

Editor's Note: We'll be featuring lots of hand tool articles this year (along with our "From the Bench" column by Contributing Editor Don McConnell) and a heavy dose of the power-tool stuff. If you're looking to jump-start your adventure, I recommend "The Handplane Book" by Garrett Hack (Taunton) and "Traditional Woodworking Handtools" by Graham Blackburn (Lyons) as two good places to begin.

– Christopher Schwarz, executive editor

New Reader Enjoys 'Woodworking Essentials' All About the Router

I recently subscribed to your magazine and I feel that I have made a good investment. You are doing a great job based on what I have seen so far (November and December 2003). I never knew how involved this kind of work could get. I even read the ads – not only to see what I have been missing, but because I am also learning from them.

I've really enjoyed the "Woodworking Essentials" series on routers. I never knew routers could be used for so many different purposes. I feel like the 6-year-old wide-eyed child discovering the possibilities that life has to offer. Keep up the good work. **PW**

Sven Timpe
Wichita, Kansas

CORRECTION

The chart that accompanied the review of "Orbital Jigsaws" in the November 2003 issue was incorrect. The Ridgid R3120 comes with a dust blower.

CIRCLE NO. 111 ON FREE INFORMATION CARD.

Why Shouldn't I Rip With My Left Hand?

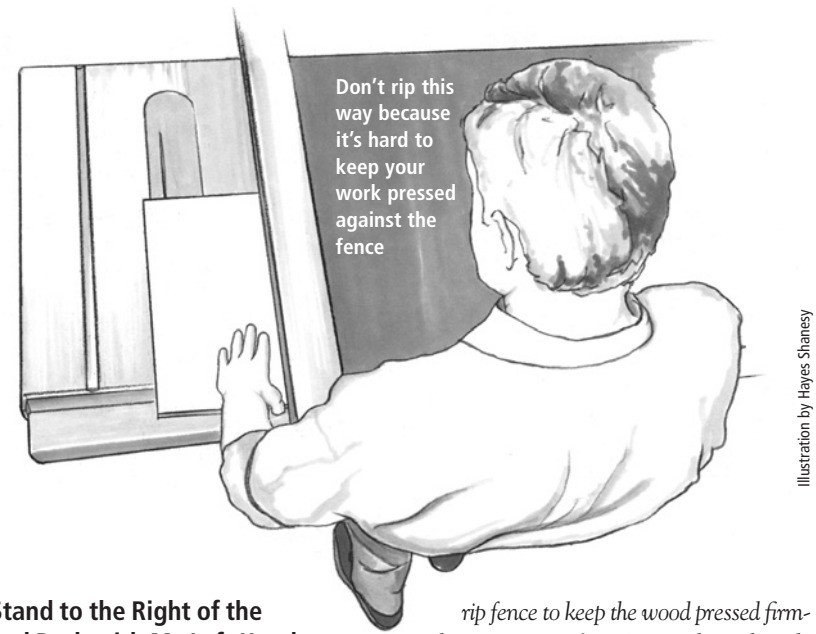


Illustration by Hayes Shanesy

Now I Stand to the Right of the Fence and Push with My Left Hand

I've been having trouble using my table saw's rip fence on the right side of the blade for ripping. I felt uncomfortable reaching across the blade with my right hand and standing to the left of the blade, so I switched hands and now push stock through the cut with my left hand. This puts me out of the path of the work and the blade, and I don't have to lean over the blade to push work through.

I think people should be taught to rip with their left hand because it is a simple, clean movement. The positioning of a person standing straight while making the cut improves his/her balance and safety.

Bob Bean
Hayward, California

I can't support left-handed feeding for two reasons. First, while a percentage of the population is more comfortable with the left hand, the great majority are right-hand dominant, and that is the hand I'd prefer to direct lumber past a spinning blade. Second, one of the advantages to guiding from the left side of the saw blade is being able to apply proper pressure against the rip fence to keep the wood pressed firmly against it. If you're on the right side of the fence, it's difficult to maintain the proper pressure against the fence during a cut with your left hand. (This is even more pronounced when feeding long stock.) Adding featherboards may help, and if you continue to work this way I strongly recommend them.

— David Thiel, senior editor

Should My Mortiser's Head Wiggle?

My new Jet mortiser works really well except for one small issue. There's some "play" in the head assembly (the motor and head assembly seems to wiggle). There are four different screws toward the back of the mortiser to adjust the play. You can tighten everything up nicely so it rids the mortiser of any free play. However, by doing this, you lock everything up so the mortiser head won't travel at all. Is this right?

Kevin Bradley
Battle Creek, Michigan

There is going to be some play – it's inevitable. There was play in the four Jet machines I've tested (and the dozen or so machines I've tested from other manufacturers). The real question of whether you have too much play is if your cuts are straight and square. I set my adjustment screws as close as possible and you can't discern any problems in the cut.

— Christopher Schwarz, executive editor

Can You Face-joint Boards Wider Than 6" on a 6" Jointer?

I just bought a 6" jointer and a 13" planer. After reading your article on using the jointer (our special "Furniture Building 2003" publication; back issue available at popwood.com) I wonder: How do you flatten lumber wider than the width of your jointer?

Pete Jansz
Sacramento, California

You'll have to remove your jointer's guard to do this, so be careful. Face-joint as much width on one face as you can – in your case, about 6".

Then go to the planer. Get a piece of ¼" plywood about 6" wide and as long as your board. Place it below the jointed portion of the board. Run the plywood and partially jointed board face-down through the planer until the board's opposite face is flat and smooth. Then turn the board over and plane the other partially face-jointed side. Make sure the piece of plywood is in contact with only the partially face-jointed section of the board during the planing operation. Don't let it overlap onto the non-jointed part.

— Steve Shanesy, editor & publisher

Should I Try Sandpaper Sharpening?

I thought your article on sharpening ("Sharpening Plane Irons and Chisels," April 2003) was excellent. I must have switched my sharpening methods three times, which is probably why I don't get a very good edge on my hand tools. In fact, the one thing that holds me back from using my hand tools more is that I'm not able to sharpen them well.

I have only a two-sided #250/1,000-grit waterstone. So clearly I need some finer grits to get a better edge. How do you rate the sandpaper-based "Scary Sharp" method? I like your suggestion of getting a diamond stone to both flatten my waterstones and grind my edges. This is what always draws me to buying a Tormek grinder – I still haven't got anything to grind my tools.

Gidon Reid
Devon, England

I'm not the biggest fan of sandpaper sharpening because I find that the paper clogs too quickly for my taste. And – perhaps because of this loading – it seems more likely to round over (or dub) the edge of my tools. That said, many people have great success with sandpaper sharpening, and because it isn't a huge investment (about $15 or so) it might be worth a try.

Also note that the diamond stones are indeed good for grinding your tools' edges – as long as you aren't in a hurry or trying to remove big chips in your tools.

— Christopher Schwarz, executive editor

How Deep Should I Drill Holes for My Bench Dogs?

I'm a beginner who has decided to invest the effort and build a bench. It's a fusion of your "$175 Workbench" (February 2001), "Power-tool Workbench" (August 2002) and "24-hour Workbench" (December 2003). My question shows my lack of experience: How deep do I drill the holes for the bench dogs?

Randall Warren
Coon Rapids, Minnesota

The dog holes in the top of the bench go all the way through the top. This allows you to set the dogs at any height (very handy) and push them below the top to store them when they're not in use (also quite handy).

The dog holes in the front edge (from the Power-tool Workbench, my bench at home) are just deep enough to let the angled face of the dog stick out to grab my boards.

— Christopher Schwarz, executive editor

WRITE TO US

Every day we get questions from readers on all subjects about their woodworking. Some are letters; many are e-mail messages. We are more than happy to share our woodworking experience with you by answering your questions or adding some clarity to whatever aspect of your craft you are unsure about. In addition to the hundreds we answer privately every month, we want to share the best questions here with readers.

Send your questions via e-mail to popwood@fwpubs.com. Or send us a note by mail to: *Popular Woodworking*, Q&A, 4700 E. Galbraith Road, Cincinnati, OH 45236.

How Flat Should I Make the Top of My Cabinet Saw?

I'm having trouble with my cabinet saw. I've noticed that I can't square the table to the blade on both sides of the blade. I took a precision straightedge and laid it across the top diagonally from corner to corner. From the lower left corner to the top right, the straightedge rocks. It looks like it has a 1/32" hump. From the top left corner to the lower right, there's a smaller gap in the center.

Should I consider contacting a machine shop and have them grind the top flat?

continued on page 18

CIRCLE NO. 153 ON FREE INFORMATION CARD.

Router Bits and Shaper Cutters
WOODLINE USA
66 Pieces
Sam Maloof Signature Series by WOODLINE USA
Master Craftsman Woodworking Collection
Only $189 set
Includes Deluxe Wall-Mountable Wooden Case
8 Straight Bits
5 Dovetail Bits
3 Core Box Bits
3 Roundnose Bits
2 Flush Trim Bits
3 Mortising Bits
1 Plunging Panel Bit
1 Laminate Trim Bit
1 Bevel Bit
3 90 V-Groove Bits
2 Roman Ogee Bits
6 Roundover Bits
1 Point Cutting Roundover
1 Ogee With Fillet
1 Plunging Roundover W/ Bead
1 Double Roman Ogee W/ Cove
1 Plunging Roundover
1 Stepped Cove
2 Edge Beading Bits
1 Multibeading Bit
1 Bowl & Tray Bit
1 Key Hole Bit
1 Double Roman Ogee
1 Classic Double Roundover
1 Flat Bottom 60 V-Groove
1 Standard 60 V-Groove
3 Rabbeting / Slot Cutters
4 Chamfer Bits
6 Cove Bits
WL 2066 For 1/2" Shank
WL 2065 For 1/4" Shank
ANNOUNCING
Your Favorite Source For Router Bits And Shaper Cutters Has Teamed Up With Americas Favorite Master Craftsman To Bring You...
...A Premium Line Of Professional Tools From Our Workbench To Yours!
WL-2008 $189 VALUE
OUR PRICE ONLY $75 set
PICTURE FRAME SET
8 Pcs
Perfect for making great looking picture frames. Bits can be combined to form complex mouldings or decorative frames.
MOULDING SET
5 Incredible Profiles
OUR PRICE ONLY $99 set
1/2" Shank Router Bits
WL-2011 $175 VALUE
3 Piece CABINET DOOR SET
1/2" Shank Router Bits
2-pc Roman Ogee Rail & Stile
3 1/4" Panel Raiser
WL-2019-1 $129 VALUE
OUR PRICE ONLY $69 set
Other Profiles Available
MOUNTED LASER CUTTING GUIDE
Quality made. Precision cutting accuracy. Economical battery operated. (included) Versatile, easily mounts to your chop saw, compound miter saw, radial arm saw, or drill press.
Quality • Precise • Economical • Versatile
LASER CUTTING GUIDE
WL LAZ $39
Router Bits and Shaper Cutters
WOODLINE USA
GREAT ROUTER BITS AND SHAPER CUTTERS
BEST SELECTION / BEST PRICE!
ORDER TOLL FREE 1-800-472-6950
WOODLINE USA • 111 WHEELER ST • LA VERGNE, TN 37086
Visit us at our Web site: WOODBITS.COM
E-mail: woodline@woodbits.com
PREMIUM CARBIDE
• Euro Anti-Kickback Design
• Super-Slick Non-Stick Finish
• Super Low Prices
QUALITY Guaranteed
6 Piece CABINET DOOR SET
1/2" Shank Router Bits
• 2-pc Rail & Stile (Roman Ogee) • Drawer Lock
• 3 1/4" D Panel Raiser (Ogee) • Door Lip • Glue Joint
WL-2020-1 $175 VALUE
OUR PRICE ONLY $119 set
• INDIVIDUAL BITS ALSO AVAILABLE • ALL MAJOR CREDIT CARDS • SAME DAY SHIPPING •
CIRCLE NO. 156 ON FREE INFORMATION CARD.

Q & A

continued from page 17

Another thing I'm having a problem with is my crosscut sled. I placed my straightedge across the sled's fence and it appears to be completely true. And if I put my machinist square on the left side of the sled's fence, it is indeed square to the blade. But on the right side it's off a bit.

Afrim Hoxha
Emerson, New Jersey

A 1/32" gap is too much for accurate work in my opinion. If your straightedge is true, the next thing to check is the base of the saw to make sure it's sitting flat on the floor. A radically uneven floor can twist a cast-iron top out of true – this can happen easily to contractor-style table saws.

If that's not the problem and your saw is new, call the manufacturer and ask what they can do about it (such as sending you a new top). If the warranty has expired, you have two options. Go to a machine shop as you suggested, or – if you can localize the high spot and it's quite small – use a diamond stone or coarse sharpening stone to grind it down yourself.

As to your crosscut sled issue, have you checked the squareness of the work you cut with your sled? Is the keeper piece on the left side square and the piece on the right not (an unlikely occurrence)? I would judge your sled not as much by what the straightedge says but by what results it produces. And if it cuts square on the left side only, that's acceptable. Work only on the left.

— Christopher Schwarz, executive editor

Most Doweling Jigs Can't Handle 5/8" Bit

I am new to woodworking and I am going to build the "24-hour Workbench" (December 2003). I have a question about using a doweling jig and a 5/8" bit to drill out the bench-bolt holes. I haven't purchased a doweling jig, but I noticed that most have up to a 1/2" guide bushing at most. My question is how to drill the 5/8" hole with the 1/2" bushing.

John Mitchell
Aurora, Colorado

I neglected to mention in the article that my doweling jig (an antique Stanley) has a 5/8" bushing but that most jigs do not. Fear not, it's an easy fix. Drill the hole with a 1/2"-diameter bit using your jig. Then "chase" the hole with the 5/8" bit. The existing hole will guide the bit. I've done this many times and it works like a charm. **PW**

— Christopher Schwarz, executive editor

More power. More capacity.

TurboIII Dust Extractor

Introducing the NEW FEIN Turbo III Portable Vac.

The new 9-77-25 makes dust-free sanding and wet/dry cleanup easy and practical. The perfect size for big jobs, the Turbo III features 14.5 gallon capacity, an automatic on-off switch and a three-second hose-cleaning delay. The powerful two-stage motor offers bypass cooling to prevent electrical damage and prolong the life of the motor. And with 10% more suction power than the Turbo II, it can run two 6" or one 8" Random Orbit Sander.

For more information and the name of a local dealer, visit us at **www.feinus.com** or call **1-800 441-9878**.

Finishing is just the beginning.

Fein Power Tools, Inc. 1030 Alcon Street Pittsburgh, PA 15220

Fein

CIRCLE NO. 113 ON FREE INFORMATION CARD.

CIRCLE NO. 107 ON FREE INFORMATION CARD.

CIRCLE NO. 145 ON FREE INFORMATION CARD.

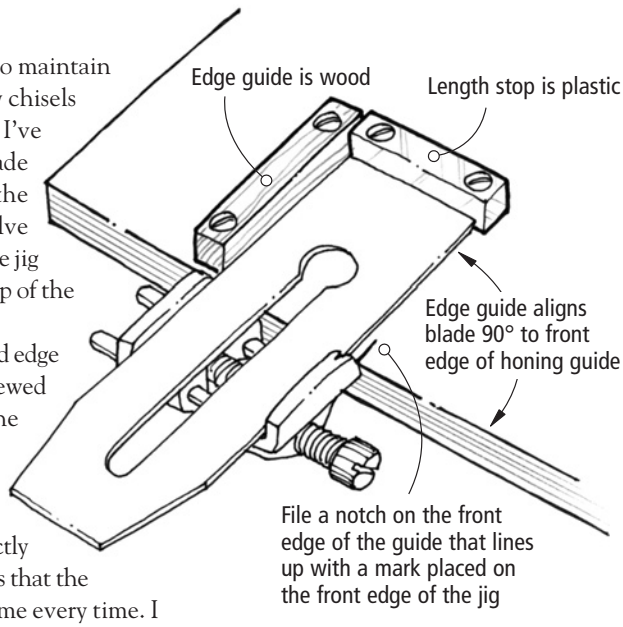
Compiled by Paul Anthony
Illustrations by Matt Bantly

Quick-set Jig For Honing Guides

THE WINNER:

I like using honing guides to maintain the sharpening angle of my chisels and plane irons. However, I've had trouble setting the blade in the guide to duplicate the existing bevel angle. To solve this problem, I made a simple jig that allows for a quick set-up of the blade in the guide.

The jig consists of a wood edge guide and a plastic stop screwed to a scrap of hardwood. The edge guide sits at 90° to the front edge of the jig and ensures that the blade locks into the honing guide at exactly 90°. The length stop ensures that the honing angle will be the same every time. I made the stop out of plastic so the blade wouldn't cut into it over time, thus changing the setting. I also filed a notch into the edge of the honing guide so that I always place the same edge against the jig, ensuring the same setup every time.



To position the edge guide and stop when making the jig, use a honing guide with a blade that has been set to the proper position. I actually made two of these jigs – one to hone the primary bevel and one for the secondary bevel on an edge tool.

Gary Downer
Cody, Wyoming

continued on page 22

CASH AND PRIZES FOR YOUR TRICKS AND TIPS!

Each issue we publish useful woodworking tips from our readers. Next issue's winner receives a **Freud SD608 Dial-A-Width Dado** set. The Dial-A-Width dado cuts splinter-free, flat-bottomed dados without using shims to adjust for your perfect width. In fact, you can sneak up on the exact setting (in .004" increments) without taking the stack off the table saw! This dado set is a $270 value.

Runners-up each receive a check for $75. When submitting a trick (either by mail or e-mail) you must include your complete mailing address and a daytime phone number. If your trick is selected for publication, an editor will need to contact you. All entries become the property of *Popular Woodworking*. You can send your trick by e-mail to popwoodtricks@fwpubs.com, or mail it to Tricks of the Trade, *Popular Woodworking*, 4700 E. Galbraith Road, Cincinnati, OH 45236.

THIS WINTER, MAKE MORE THAN A DENT IN THE CHAIR.

WITH THE RIGHT TOOLS YOU CAN MAKE JUST ABOUT ANYTHING. INCLUDING A GREAT DEAL.

For a limited time, JET tools are being offered at incredible prices, with savings of $30 to $150. So first you get a great deal. And then you get to make a project to be proud of. Choose from eight quality tools – from mini lathes to variable speed mini lathes, from dust collectors and sanders to bandsaws. No matter which one you pick, you'll get a great price.

Plus an exclusive, limited lifetime warranty that you only get from JET. So make your way to your JET distributor, jettools.com, or call 800-274-6848.

*Savings based on average retail prices.

LIMITED LIFETIME WARRANTY
JET® Performax® Powermatic®

Only the JET Family of Brands offers you a Limited Lifetime Warranty.

JET®

Powermatic, Performax and JET.
A Family of Brands.

CIRCLE NO. 126 ON FREE INFORMATION CARD.

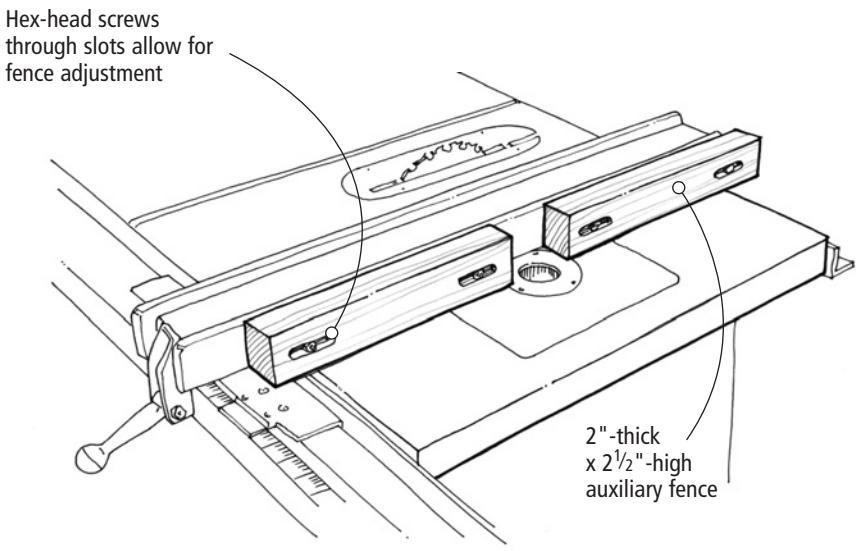
continued from page 20

Table Saw Router Fence

Like many woodworkers who need to conserve shop space, I converted my table saw's side extension table into a router table. One of the advantages of this is that I can use my table saw's rip fence as a router fence.

Although I can use the unadorned rip fence for router procedures such as grooving, the router bit needs to sit behind the face of the fence for edging and other operations. For those circumstances, I made a pair of thick auxiliary fences that screw to the rip fence, creating a 2"-deep recess for a bit. Each fence is 2" x 2½" x 16". I routed a pair of ¼"-wide x 2"-long slots in each fence to allow it to slide side-to-side to minimize the size of the opening around any particular bit. After routing the ¼"-wide slot, I routed a ¾"-wide x ⅜"-deep counterbore to accommodate a washer placed under each screw head for more secure attachment.

Make sure you choose a dense, dimensionally stable wood for the fence pieces, such as maple. Quartersawn stock would be ideal.



To attach the fences, I used ¼" x 2½" self-tapping hex-head screws that I can easily loosen and tighten with a nut driver.

To position the screw holes in the rip fence, just butt the ends of the fences together at the router bit opening, then mark for a fence-mounting screw at the outermost end of each slot. This will allow for maximum fence adjustment.

Paul Anthony
PW contributor

continued on page 24

Adams Wood Products, Inc.™
FURNITURE COMPONENTS
STOCK ITEMS • NO MINIMUM
CUSTOM COMPONENTS

FREE COLOR CATALOG
Featuring:
- Bed Posts
- Billiard Legs
- Bun Feet
- Cabinet Onlays
- Corbels
- Finials
- Island Legs
- Table Bases
- Table and Chair Kits
- Tapered Legs
- Turned Legs
- Queen Anne Legs


Island Legs

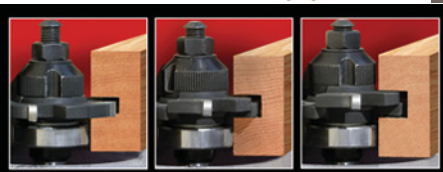
P.O. Box 728, Dept. PW18
Morristown, TN 37815-0728
Phone 423-587-2942 • Fax 423-586-2188
www.adamswoodproducts.com
Made in Tennessee

CIRCLE NO. 100 ON FREE INFORMATION CARD.

SHIM-FREE & ADJUSTABLE
IF YOU CAN TURN THE KNOB ON A RADIO, YOU CAN ADJUST AMANA TOOL'S® NEW:
EZ DIAL™ SLOT CUTTER

- Finally, a slot cutter with nothing to lose. No shims, no spacers.
- Nothing to take apart, just dial it, lock it, cut it.
- Easily makes perfect grooves for today's undersized plywood.
- Perfect for edge ("T") molding installation.
- Available in two sizes:
  - #55500 - For 1/8"-1/4" wide slots, 1/2" deep
  - #55510 - For 1/4"-1/2" wide slots, 1/2" deep
- Carbide tipped for long life.

Special Introductory Price
List price $149.95
$99.95 ea.



Amana Tool®
High Performance Cutting Tools
For Our New Catalog or a Dealer Nearest You
CALL 1-800-445-0077
Visit our website at
www.amanatool.com

CIRCLE NO. 102 ON FREE INFORMATION CARD.

The finest portable router table you can buy.

BENCH DOG TOOLS

ProTop® CONTRACTOR

NEW DESIGN!

PRO-BUILDER™ SERIES

Dual fence position. Flip the fence around for those larger jobs

Twin steel rails support the router for the ultimate in strength

MADE IN USA

Model RT150
Patents Pending

- Includes top, fence, predrilled router plate, and cabinet
- Perfect for the job site or small shop
- Fits ALL routers

FREE CATALOG! Mention Code PW9

To Order Call 800.786.8902

benchdog.com

CIRCLE NO. 106 ON FREE INFORMATION CARD.

Refinish Your Future.

Own your own business.

Let your passion for furniture lead you into a new business with a Furniture Medic franchise. We're a complete on-site repair and restoration-refinishing business servicing homes and companies as well as handling moving and insurance claims. We offer extensive training and support with a low initial investment and manageable overhead. Financing is available to qualified candidates and franchises are offered nationwide. Call today to brush up on the details.

FURNITURE MEDIC® "the prescription for damaged furniture"

www.furnituremedicfranchise.com

1•800•RUN YOURS

CIRCLE NO. 118 ON FREE INFORMATION CARD.

Build Solid Furniture for Your Home or Office Space

Whether you want to build rustic furniture in the Northwoods tradition, elegant custom tables or fresh and functional office furniture, Popular Woodworking Books has just what you need!

- You get step-by-step instructions to help complete each project with success
- Filled with full-color illustrations of all the key steps and techniques throughout each project
- Each book is suitable for woodworkers of all levels

#70493-k
$24.99/128p/pb

#70500-k
$24.99/128p/pb

#70489-k
$26.99/128p/pb

These books are available at your local bookstore or by using the Order Form attached.

ORDER FORM

Please enter number of copies wanted next to desired selection(s):

___ *Making Elegant Custom Tables*
#70493-k/$24.99/128p/pb

___ *Northwoods Furniture*
#70500-k/$24.99/128p/pb

___ *Build Your Own Home Office Furniture*
#70489-k/$26.99/128p/pb

SUBTOTAL: $_____

In the U.S., please add $3.95 shipping and handling for the first book, $1.95 for each additional book. In OH, NY and CO, please add applicable state tax. In Canada, add US$5.00 for the first book, US$3.00 for each additional book, and 7% GST. Payment in U.S. funds must accompany order.

TOTAL: $_____

☐ Check or money order enclosed - or -

☐ Charge my ☐ VISA ☐ MasterCard ☐ AmEx Exp._____

Acct.#_____

Signature _____

Name _____

Address _____

City_____

State/Prov._____ZIP/PC_____

TC04PPWA

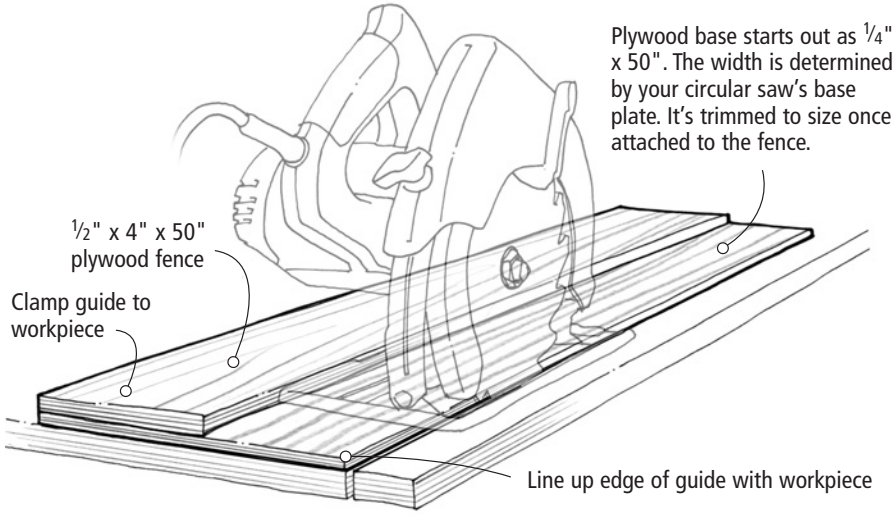
Send to: POPULAR WOODWORKING BOOKS
PO Box 9274
Central Islip, NY 11722-9274

For more information or to order by Credit Card visit
www.popularwoodworking.com
or call toll free 1-800-221-5831

continued from page 22

Shop-made Saw Guide

I don't have a panel saw, so whenever I have to crosscut a full sheet of plywood, I need to make the cut with a portable circular saw and a long straightedge. The problem with a typical straightedge is in aligning it the proper distance from the cut. Sure, you can measure the proper distance based on your saw's base plate, or even use a set-up spacer, but there's an easier way: I use a shop-made, two-part straightedge that suits my saw and lines up perfectly with the cutline. You can make the guide as long as you like, but it should be at least 50" long for crosscutting full-size sheet goods.



Make the fence by ripping a piece of ½"-thick plywood to 4" wide, making sure the edges are straight and clean. Next, measure the distance between your saw blade and the bearing edge of the saw base, and add 4½" to determine the width of the bottom panel, then make that. Glue and nail the fence to the panel, aligning the edges, then cut the panel to its final width by running your circular saw along the fence.

To use the guide, simply clamp it to your workpiece, aligning the edge of the panel with your cutline. (An added benefit of the wide lower piece is that it prevents even a very long fence from flexing during use.)

To eliminate any tear-out that might occur when crosscutting plywood, knife the cutline first, making sure to slice through the top layer of veneer.

Anthony Lias
Sonoma, California

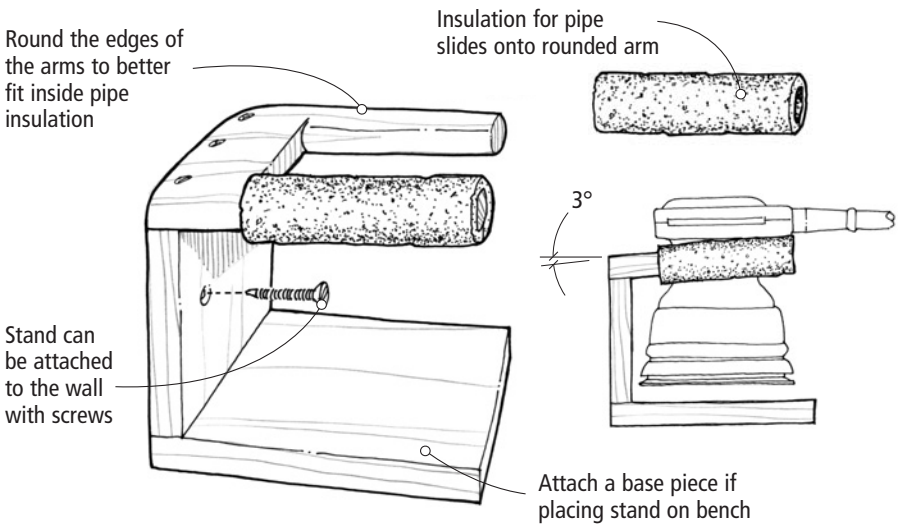
Finish Sander Holder

As a guitar builder, I do a lot of sanding between coats when finishing, so I have several random-orbit sanders that are constantly in use. During the sanding process, I often need to set my sander down while I wipe away the dust to check my progress. I got tired of having to shut the sander off and wait for it to stop before setting it on my bench, so I came up with this holder that provides a place to temporarily hang a running sander so I don't waste time. The holders also have become permanent storage spots for the sanders when not in use.

The holder is easy to make from scrap wood, and most random-orbit sanders have a mushroom head that works with this design. Size the "U"-shaped upper bracket to suit your sander. When cutting out the opening for the sander, allow for the thickness of the pipe insulation. I round over the edges of the support arms to more easily accept the insulation tubing, then apply a bit of epoxy to keep it in place.

A holder can be screwed through the back plate for permanent mounting to a wall, or you can attach a base for use on your bench.

Joel Nowland
West Point, Utah



Wax in the Woodshop

A surprising amount of energy can be spent overcoming friction when hand-planing. A low-angle block plane used on end grain typically produces a lot of friction and an annoying shriek. I keep a chunk of paraffin handy for use on all my planing jobs. A single scribble down the sole makes all the difference. Hand saws, especially those with little set to the teeth, also work more smoothly with a little wax. Paraffin can be found in your local grocery store with the canning supplies. The 1-pound container it's sold in should last a busy woodworker about 100 years and cost $3. A candle stub is a good alternative for those without $3.

Bob Plumm
Gallina, New Mexico

continued on page 26

The Toughest Glue On Planet Earth

Bonds:
Wood, Stone, Metal, Ceramic, & More!

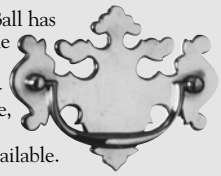
Gorilla Glue is the versatile, interior/exterior adhesive ideal for most household fixes and building projects: furniture repair, crafts, woodworking, and general repairs around the house. **Bonds wood, stone, metal, ceramic & more! Incredibly strong and 100% waterproof.**

REQUEST YOUR FREE INFORMATION KIT!
www.gorillaglue.com
1-800-966-3458

CIRCLE NO. 121 ON FREE INFORMATION CARD.

Finest Quality Reproduction
BRASS & IRON HARDWARE

Since 1933, Ball and Ball has been manufacturing the highest quality reproduction furniture hardware, builders hardware, lighting fixtures, and fireplace accessories available.



Call for our 108-page catalog available for $7.00. (catalog cost refunded on first order)

463 W. Lincoln Highway (Rt. 30)
Exton, PA 19341
610-363-7330 • Fax: 610-363-7639
1-800-257-3711
www.ballandball-us.com

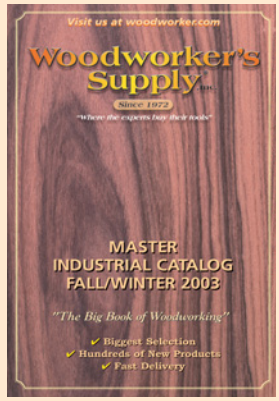
BALL AND BALL HARDWARE REPRODUCTIONS

CIRCLE NO. 104 ON FREE INFORMATION CARD.

If you are in a woodworking business... this could be the most valuable tool in your office℠.

Please call
1-800-645-9292
for your 560 page catalog.

FREE
to woodworking businesses.



visit us at woodworker.com

CIRCLE NO. 161 ON FREE INFORMATION CARD.

ARROW®
ET200™

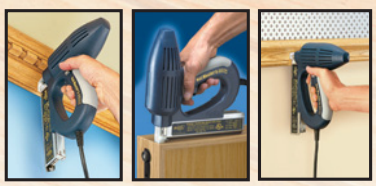
DRIVES 4 SIZES OF NAILS WITH NO EFFORT

- *Comfortable Ergonomic Styling with Cushioned Non-Slip Grip.*
- *Trigger and Surface Safety Locks.*
- *Non-Marring Bumper.*

DRIVES 4 DIFFERENT SIZE BRAD NAILS UP TO 1¼" LONG

SURGE POWER 14 AMPS

- *New Heavy Duty Nail Driving Power with Built-in 10' Cord.*

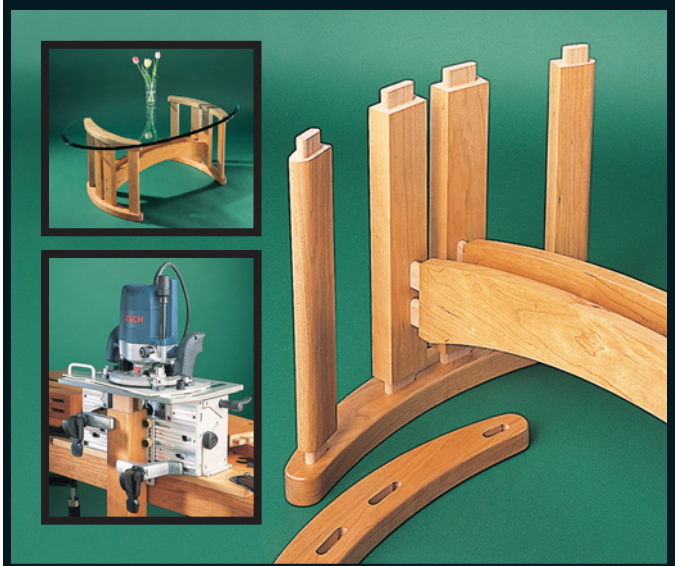


Available at home centers, lumber yards and hardware stores, wherever fine tools are sold.

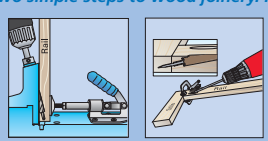
ARROW®

Arrow Fastener Co., Inc., 271 Mayhill Street, Saddle Brook, New Jersey 07663
Canada: Jardel Distributors, Inc., 6505 Metropolitan Blvd. East, Montreal, Quebec H1P 1X9
United Kingdom: Arrow Fastener (U.K.) Ltd., Unit 5 ZK Park, 23 Commerce Way, Croydon CR0 4ZS, Surrey
www.arrowfastener.com Rev.1002

CIRCLE NO. 103 ON FREE INFORMATION CARD.

NEW!
The Leigh FMT Mortise and Tenon Jig
Create mortises and tenons in one quick, easy setup!
Unique patented guide system • Joints from a tiny 1/16" x 3/32" to 1/2" x 5" in stock up to 3" x 5 1/2" • Easy fingertip adjustment of joint tightness, recordable and repeatable • Make angled and compound angled joints • Rout perfectly aligned double, triple and quadruple joints • Use virtually any plunge router • Uses 1/2" shank cutters • Cam-action speed-clamps • Integral dust port for vacuum

Call For Your Free Leigh FMT Brochure Today! 1-800-663-8932
Leigh Industries Ltd., PO Box 357, Port Coquitlam, BC, Canada V3C 4K6
Tel. 604 464-2700 Fax 604 464-7404 Web www.leighjigs.com
Joining Tradition With Today

The BLUE Mark of Quality.

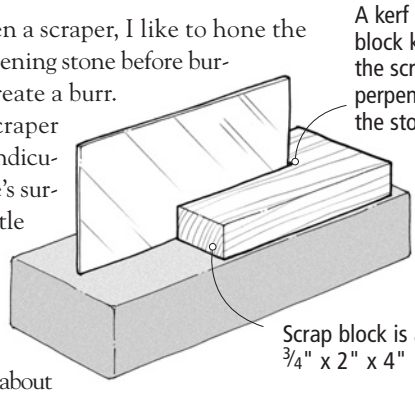
Kreg
POCKET HOLE SYSTEMS™
Quality tools, education, service and value.
Expect this and more from KREG, the leader in Pocket Hole technology.
Kreg Jig® ProPack
A better way to join wood.
Faster... No waiting for the glue to dry.
Stronger... Screws put unmatched clamp pressure on the joint line.
Simpler... Drill pocket holes in only one workpiece. Align for assembly with a single clamp.
Better! Faster assembly, stronger joints, fewer headaches. Give it a try today!
Two simple steps to wood joinery. . .

Drill pocket holes.
Drive screws.
www.kregtool.com
Kreg
800.447.8638
CIRCLE NO. 128 ON FREE INFORMATION CARD.

Tricks of the Trade

continued from page 24

Scraper Honing on the Square

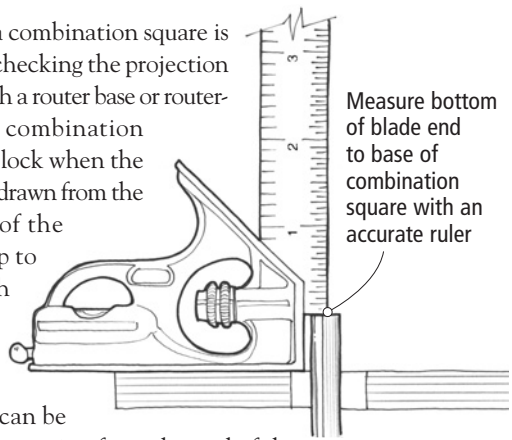
When I sharpen a scraper, I like to hone the edge on a sharpening stone before burnishing it to create a burr. Holding the scraper perfectly perpendicular to the stone's surface can be a little tricky. Rather than trying to accomplish this freehand, I take a piece of scrap (about 3/4" x 2" x 4") and cut a kerf about two-thirds of the way along its length with the band saw. Then I slip the scraper in the kerf and hone away, using the scrap piece to keep the scraper upright.



Burt Kenton
Arlington, Tennessee

Setting Bits with a Combination Square

I've found that a combination square is a useful tool for checking the projection of a cutter through a router base or router-table top. Most combination squares will still lock when the blade end is withdrawn from the square surface of the square's stock up to about 3/4", which is often as far as you want a bit to project anyway. The blade can be positioned by measuring from the end of the stock with an accurate ruler. The broad surface of the stock will stand steadily on an inverted router while extending over the bit opening.



Percy Blandford
Stratford-upon-Avon, England

Flat Things Come to Those Who Wait

I was in a hurry to build a table recently and was proud of how quickly things were moving along. After making the base, I glued up the top from several boards, then sanded it flat the next day. After applying the finish, I noticed shallow valleys on the top along the glue lines. I realized afterward that the water-based glue had swelled the wood, and I hadn't let it evaporate thoroughly before flattening the top. As a result, the affected areas shrank over time. My tip here, of course, is to let any glued-up panel dry for at least a few days in a warm room before flattening it.

Edie Gonzales
Tampa, Florida

continued on page 28

FASTEST GROWING MACHINERY LINE IN THE U.S.A.

INNOVATIVE PRODUCTS

DESIGNED FOR PRACTICAL USE

ASK ANY FINE WOODWORKER AND HE WILL TELL YOU THIS:

QUALITY MACHINES PRODUCE QUALITY RESULTS.

THAT IS WHY WE DESIGN OUR MACHINES TO THE MOST STRINGENT STANDARDS, TRIPLE CHECK EACH ONE FOR QUALITY ASSURANCE AND BACK EVERY MACHINE WITH A FULL TWO-YEAR WARRANTY!

SEE OUR EVER EXPANDING LINE OF MACHINERY AT A QUALITY DEALER NEAR YOU.

SHOP FOX® 5 HP 20" PLANER

Prepare yourself for the heavyweight champion of planers! This workhorse has all the features you need plus a few extra for ease of use. The specially designed cutterhead with a redefined blade angle leaves smoother finishes on any type of wood. With a large 20" capacity and rugged cast iron construction, this is the last planer you should ever need.

- Powerful 5 HP, single-phase, TEFC motor
- 2 Chromed upper rollers
- Rubber outfeed roller
- Anti-kickback design
- Precision ground cast iron table
- Magnetic safety switch
- Powder coated paint
- Approx. shipping weight: 840 lbs.

IN STOCK NOW!

2 YEAR WARRANTY

SHOP FOX® 6" JOINTER

W1679

This outstanding machine combines innovative features with time-tested favorites to give the discriminating craftsman the quality, convenience and performance standards he demands. Here are just a few of the features that put our 6" Jointer in a class of its own:

- 1 HP, 110V motor
- Precision ground cast iron tables
- Extra large cast iron fence
- Simple fence adjustment
- Post mounted control switch
- Silky-smooth handwheel table adjustment
- Powder coated paint
- Approx. shipping weight: 300 lbs.

SHOP FOX® 8" JOINTER

Built like a tank, yet refined and precise, our 8" Jointer is designed to handle your extra large boards with accuracy and ease. Never before has the woodworking world seen such a blend of design and style.

W1684

- 2 HP, 220V, single-phase, TEFC motor
- Extra long 70" precision ground cast iron table!
- Center mounted tilting fence
- Oversized welded steel stand
- Post mounted magnetic control switch w/thermal overload
- Silky-smooth handwheel table adjustment
- Powder coated paint
- Approx. shipping weight: 495 lbs.

CALL FOR THE LOCATION OF A DEALER NEAR YOU!

1-800-840-8420

VISIT OUR WEBSITE FOR MORE SHOP FOX® PRODUCTS

SHOPFOX.BIZ

sales@woodstockinternational.com

SHOP FOX® is a registered trademark of Woodstock International, Inc.

WOODSTOCK INTERNATIONAL INC.

4945029S8

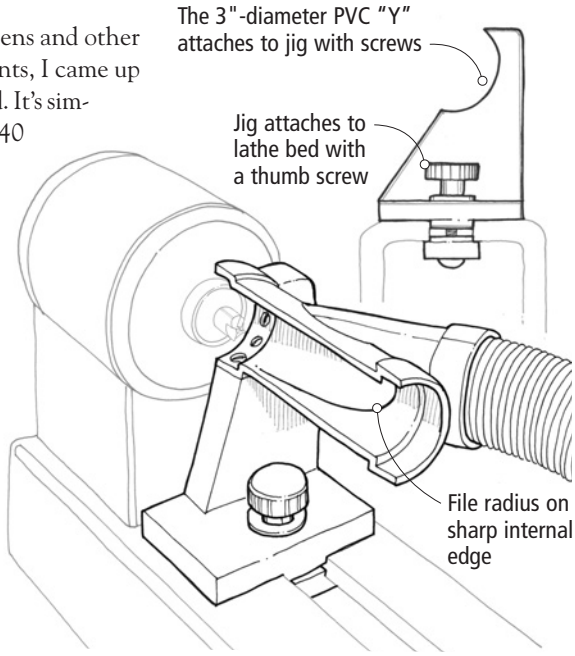
CIRCLE NO. 158 ON FREE INFORMATION CARD.

continued from page 26

Dust Collection at the Lathe

When I was turning lots of pens and other small items for holiday presents, I came up with this dust collection hood. It's simply a 3"-diameter schedule 40 PVC "Y" connection that I cut in half and mounted to a wooden base that attaches to the lathe bed. It can be slid back and forth if needed for longer objects, but it really excels with items less than 6" long. For some more efficient suction, I filed a radius on the sharp internal edge of the "Y."

Greg Strately
Truth or Consequences, New Mexico



A Cutting Mat for Getting Sheet Goods Down to Size

Wrestling with sheet goods is one of those unpleasant tasks we all have to deal with occasionally. In my case, I have to access my basement shop through the house, and it's impossible to carry full sheets to the shop. My solution is to pre-cut sheet goods into more manageable sizes on the garage floor using a portable circular saw.

To protect my saw blade, I lay the workpiece on a 4x8 sheet of 1½"-thick rigid foam insulation. I adjust my saw blade to project no more than ¼" through the workpiece and into the insulation. This allows me to easily cut in any direction with full support under the workpiece. Rigid insulation, which is available at many home supply stores, is lightweight, inexpensive and easy to store.

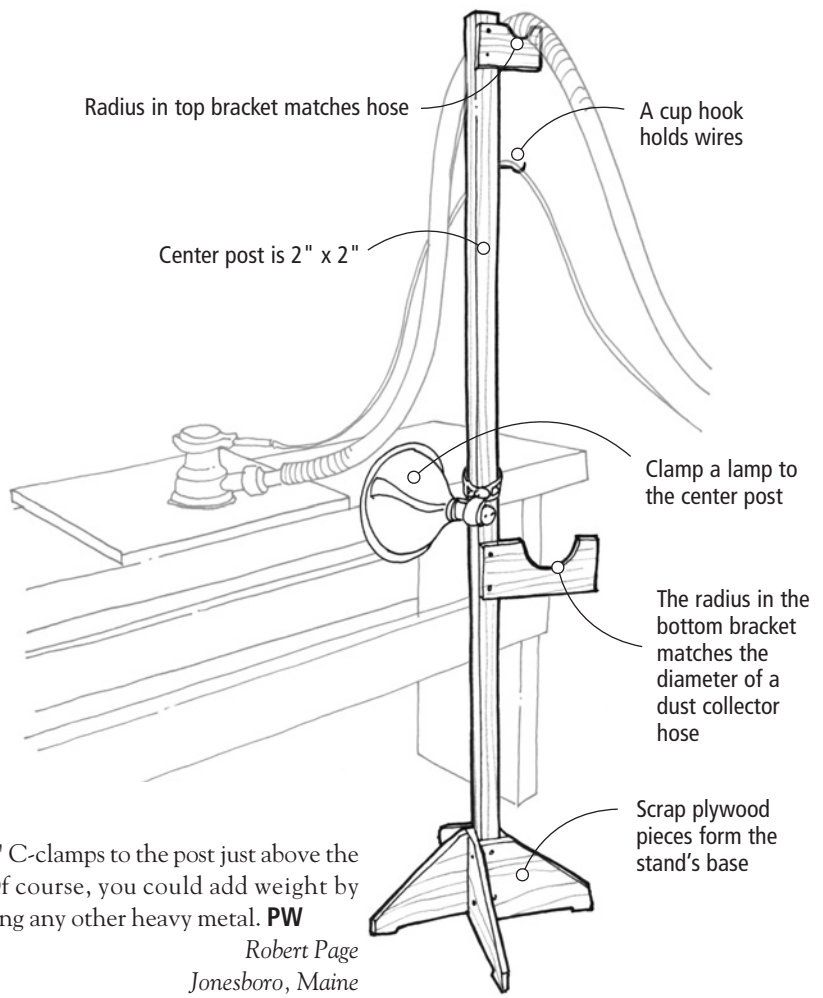
Dave Wohlwend
Columbus, Ohio

A Helper Post

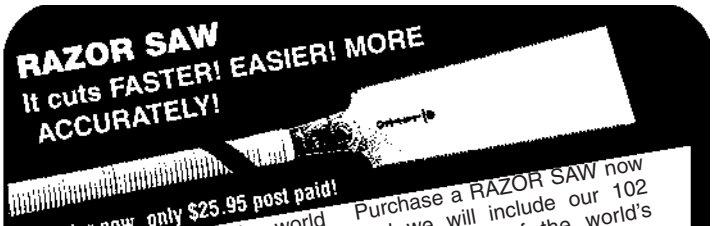
I've found that a well-placed light makes all the difference in woodworking, especially with my "mature" eyes. For example, it's critical when routing mortises that a strong light shines into the router base's opening. And if I want my hand-cut dovetails to fit properly, it's important to be able to see the cutlines. When sanding, I dim the overhead shop lights and aim a light across the work surface at a low, raking angle to highlight any defects or scratches.

To allow me to position a lamp perfectly for these purposes, I made a free-standing post to which I can fix a clamp light at any height. The post is nothing more than a 2x2 with a base made of scrap plywood panels. After using it for a while, I realized that it would also be a perfect holder to keep cords and hoses from dragging on the edge of my bench. A cup hook screwed into the upper part of the post retains a tool cord. To accommodate my shop vacuum's hose, I made a small bracket with a cutout in the top edge that matches the radius of the hose. A similar bracket placed lower on the post keeps my dust collector's flexible 4" hose from dragging on the planer outfeed table when that machine is in use. To steady the post without making the base unduly wide, I clamp a few 6" C-clamps to the post just above the feet. Of course, you could add weight by attaching any other heavy metal. **PW**

Robert Page
Jonesboro, Maine



RAZOR SAW
It cuts FASTER! EASIER! MORE ACCURATELY!



Order now, only $25.95 post paid!

Craftsmen around the world have discovered the secret of better quality work. The Razor Saw cuts by pulling and will give a cleaner, more accurate cut in half the time.

Purchase a RAZOR SAW now and we will include our 102 page catalog of the world's finest woodworking tools. Or send $2.00 for a two year subscription to our Catalog.

The Best handsaw for ALL woodworkers!

www.japanwoodworker.com
Dept P1

THE JAPAN WOODWORKER
1731 Clement Ave. • Alameda, CA 94501 • 1-800-537-7820

CIRCLE NO. 124 ON FREE INFORMATION CARD.

Who Says Good Help Is Hard To Find?

Home shop or industrial plant, cabinet making, v-carving or 3D crafts – ShopBot CNC tools are perfect for every woodworker!

2-D V-Carve 3-D

Starts at
$4,995.00

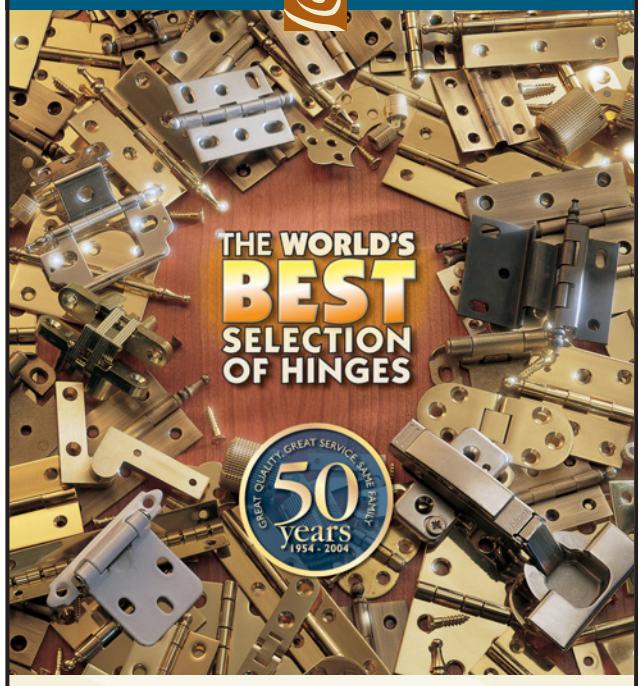
ShopBot

www.shopbottools.com
888-680-4466

Tools for tomorrow today!

CIRCLE NO. 144 ON FREE INFORMATION CARD.

ROCKLER®
WOODWORKING AND HARDWARE



Call or go online to get your FREE catalog today! Code 14020

1-800-403-9736 -or- rockler.com/go/V4338

CIRCLE NO. 142 ON FREE INFORMATION CARD.

ROUTER & TABLE SAW SYSTEMS

- Combination Router & Table Saw Fences
  Micro Adjustable, Accurate to 1/1000 of an inch
- Router Tables, Table Saw Extension and Floating Infeed/Outfeed Tables
  Available in Solid Phenolic or Melamine
- Complete Table Saw Upgrade Systems
  Available for virtually all Cabinet & Contractor Saws
- True Zero Clearance Miter/Cutoff Sled
  Micro-Adjustable, Positive Detents Every 1/2 Degree
- Table Mounted Router Lift System
  Raise & Lower a Router with 1/1000 of an inch precision
- *And Much More...*

Router Table Systems Available

Jointech Routing Center

FREE CATALOG!

CALL TODAY!
1-800-619-1288
www.jointech.com

JOINTECH®
ULTRA-PRECISION WOODWORKING SYSTEMS

Jointech, Inc. is an official dealer for products made by:
GENERAL INTERNATIONAL

CIRCLE NO. 127 ON FREE INFORMATION CARD.

NO BURNS, NO DUST !

A New Experience in Sanding: Our 6x12 MULTI-SANDER #BDS-612001

For more details and a list of dealers visit our website • fisch-woodworking.com

Fisch Precision Tools Inc • Claysville, PA • Ph: 724-663-9072

CIRCLE NO. 115 ON FREE INFORMATION CARD.

Excalibur Sliding Table

Photo by Al Parrish

A little more than seven years ago we added an Excalibur sliding table to the cabinet saw in the *Popular Woodworking* shop. Because we deal with both solid wood and oversized sheet goods, we knew a sliding table would prove useful in many ways. And it has. The Excalibur allows us to crosscut long lengths of solid wood and manage a wide variety of cuts in plywood. It was an exciting day when it came into our shop.

Over the years, Excalibur has upgraded this product in some ways, but a lot of the principles and mechanisms are identical to our unit. After thousands of uses, here's how our table has fared:

To be honest, the bloom was off the rose (a little brown on some petals) at the set-up. Adjusting the table's legs plumb – critical to proper operation – proved to be a tricky trial-and-error process. In addition, we quickly recognized an annoying problem with the way you reset the fence to square, which is necessary every time you put it back on the saw after removing it for ripping operations.

Essentially, a post on the fence drops into a round metal flange on the right edge of the table. A post on the left side of the fence slides into a track. Where you lock the fence on the track determines your miter setting.

To set the fence to 90°, you raise up a small stop on the table and lock the fence against this stop. We found this stop to be unreliable in the long run. It easily became loose and inaccurate. Consequently, every time we put the fence on the table, we had to check and re-check our setups to square the fence to the blade.

Because 90° crosscuts are most of the work we do, we wish we could attach the fence at this angle every time. We've even discussed customizing the Excalibur ourselves to do this, but have never gotten around to it.

Once you get it set, the Excalibur performs admirably. Being able to accurately crosscut small or large pieces at 90° (or any other angle) is a very handy feature. The fence itself is 64" long, and an extension bar increases that length another 32". With most parts for furniture 48" long or less, this is more than enough capacity for many.

A flip-up stop allows you to set your cutting length quickly, then move easily between rough- and finished-length cuts. The fence can be relocated at the front or rear of the table depending on your personal preferences or the work at hand. With the fence positioned at the rear of the table the SLT60 has a crosscut capacity of 62" (49½" on the SLT40) and 35" with the fence positioned at the front of the table (26" with the SLT40).

The table rides on six sealed, steel ball-bearing rollers that hug the outer rail. When set properly, the table moves smoothly. Sawdust tends to build up on the rail and bearings, so you have to keep everything clean under there to keep the smooth sliding action.

You also must steer clear of the legs. In the original design, once you adjusted the support frame adequately, it didn't take much to bump the frame and kick the unit out of alignment, sending you back to first base. Sommerville has since upgraded this design, and we're looking forward to trying it out.

We haven't found a sliding table on the market that is perfect – each has its quirks. And though we have our gripes with the Excalibur, keep in mind that it's still on our saw after seven years. The bottom line is that it's far better than any miter gauge, and that's what we say to ourselves each and every time it needs tweaking. **PW**

— David Thiel, senior editor

SPECIFICATIONS

Excalibur Sliding Table

Street price: SLT40: $650; SLT60: $860

Nice features: Crosscutting and panel operations are far easier with this product than with any miter gauge.

Recommended modifications: We wish the fence went back to 90° reliably; unit goes out of alignment if bumped too hard.

For more information: Contact Sommerville Design and Manufacturing at 800-357-4118 or www.excalibur-tools.com

ABOUT OUR ENDURANCE TESTS Every tool featured in our Endurance Test column has survived at least two years of heavy use in our shop here at *Popular Woodworking*.

INFINITY
CUTTING TOOLS
"EXPECT MORE FROM YOUR TOOLS!"

NEW Router Bits Made In USA!

Make beautiful raised panel doors with Infinity's Panel Door Sets. Ideal for stile and rail stock from 3/4" to 7/8" thick. Now with FREE Set-Up Blocks to make milling your rail/stile profiles a snap!

Your choice of Ogee or Standard Profile!

Ogee 1/2" Shank Set: No: 00-100
Standard 1/2" Shank Set: No: 00-101

Raised Panel Door Sets

PRICE: $129.90
Now Only $116.90
SAVE!
CODE: POP0104

For a review of these bits, go to www.newwoodworker.com

Call 1-877-USA-BITS for a complete full-line catalog today!
www.infinitytools.com
2762 Summerdale Dr. – Clearwater, Florida 33761

CIRCLE NO. 123 ON FREE INFORMATION CARD.

FREE PROJECT PLANS
www.popularwoodworking.com
FREE PROJECT PLANS
www.popularwoodworking.com
FREE PROJECT PLANS
www.popularwoodworking.com
FREE PROJECT PLANS

WHITECHAPEL LTD
Over 4000 fine hardware essentials

315 PAGE COLOR CATALOG $5.00
1-307-739-9478 whitechapel-ltd.com

CIRCLE NO. 152 ON FREE INFORMATION CARD.

STEVE WALL LUMBER CO.
Quality Hardwoods and Woodworking machinery For The Craftsman and Educational Institutions

Ash	4/4	Select	2.40	$ 85.00
Basswood	4/4	Select	1.95	$ 72.00
Birch	4/4	Select	2.75	$ 89.00
Butternut	4/4	1C	2.30	$ 77.00
Cherry	4/4	Select	4.90	$110.00
Hickory - Pecan	4/4	Select	2.85	$ 89.00
Mahogany (Genuine)	4/4	Select	3.90	$100.00
Maple (Hard)	4/4	Select	3.15	$ 96.00
Maple (Soft)	4/4	Select	2.30	$ 79.00
Poplar	4/4	Select	1.75	$ 72.00
Red Oak	4/4	Select	2.50	$ 88.00
Walnut	4/4	Select	4.00	$100.00
White Oak	4/4	Select	2.50	$ 88.00
Cedar (Aromatic Red)	4/4	1C+Btr.	1.80	$ 72.00
Cypress	4/4	Select	2.40	$ 80.00
White Pine	4/4	F.G.	1.20	$ 62.00
Yellow Pine	4/4	Clear	2.00	$ 74.00

Above prices are for 100 quantities of kilndried rough lumber sold by the Bd. Ft. FOB Mayodan, NC. Call for quantity discounts. Other sizes and grades available.

UPS Specials

SEE OUR CATALOG ON THE WEB!

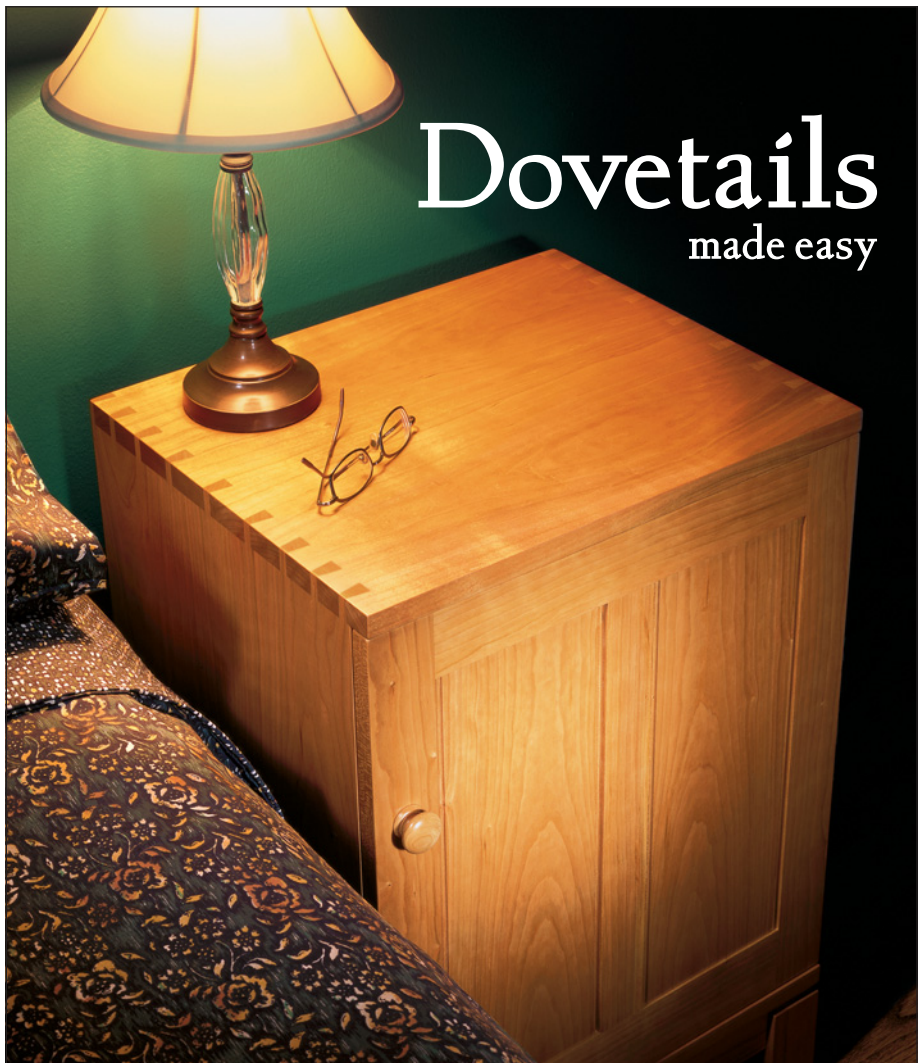
Above prices are 20 bd. ft. bundles of clear kilndried lumber 3"-10" wide 3 -7 long (Random widths & lengths) Surfaced 2 sides or rough. Delivered UPS prepaid in the Continental U.S.

NOW AVAILABLE
Custom Made Raised Panel Cabinet Doors
4/4 Log Run Walnut 100 bd. ft. $160
Also Available Exotic Lumber

STEVE H. WALL LUMBER CO.
BOX 287
MAYODAN, N.C. 27027
336-427-0637
1-800-633-4062
FAX 336-427-7588
Email: wood@walllumber.com
Website: www.walllumber.com

Send $1.00 For Lumber Catalog
Prices Subject to Change Without Notice

CIRCLE NO. 150 ON FREE INFORMATION CARD.



Create perfect dovetails easily with the Leigh Dovetail Jig. No other jig offers such versatility, precision and superb value. Whether you're a hobbyist or professional, you can rout through and half-blind dovetails up to 24" wide in boards up to $1\frac{1}{2}$" thick, with infinitely variable spacing of pins and tails – all on one jig. And you can easily rout sliding and angled dovetails too. Plus, create decorative Isoloc joints, finger joints, and multiple mortise and tenons effortlessly with Leigh attachments. Routing's never been easier.

LEIGH
Joining Tradition With Today

Call For Your FREE Leigh Catalog
1-800-663-8932

Leigh Industries Ltd., PO Box 357
Port Coquitlam, BC Canada V3C 4K6
Toll free 1-800-663-8932 Tel. 604 464-2700
Fax 604 464-7404 Web www.leighjigs.com

Porter-Cable's New Routers Cover All the Bases

Porter-Cable's new router system is playing catch-up with its multi-base kit competitors, but now it has not only caught up, it has surpassed them in many ways.

This system sports a variable-speed, soft-start, 12-amp motor with electronic feedback to maintain constant speed in use. The motor is quiet with low vibration, yet produces lots of torque. A two-position power switch (at the top and base of the motor) is designed to make hand-held or router-table use equally convenient.

There are three bases available in the system that can be purchased separately or in kits. Shown is the 895PK kit with the fixed and plunge bases. The third option is a variant of a "D"-handle base offering through-the-handle dust collection.

The fixed base offers the option of through-the-table height adjustment when in a router table. The adjustment handle is first used to release the base clamp, then is moved to the adjustment socket in the base.

For in- or out-of-table bit changes using the fixed base, the collet completely clears the base, engages a spindle lock and disengages the power switch for safe, convenient one-wrench bit changes.

The plunge base (designed to accept template guides) offers a manual shaft lock but will not let the collet clear the base. By switching base plates with the fixed base, the collet will extend beyond the base.

In testing the 895PK kit in our shop, we found switching the bases to be smooth and simple. The performance of the motor was very good and the plunge action was reasonably smooth. We did notice some plunge hesitation when pressure was not applied evenly to both handles, and we thought the switch on the plunge base was further away than preferable. Also, the plunge base would benefit from an active fine-height adjustment.

The fixed base was our favorite of the two, with the switches conveniently located, and the height adjustment smooth and precise.

Overall, Porter-Cable's 895PK kit is a strong competitor and is priced well for the performance offered. — *David Thiel*

For more information, circle #170 on Free Information Card.

SPECIFICATIONS

Porter-Cable 895PK Router Kit

Street price: $250
Motor: 12 amp, 2¼ hp
Speed: 10,000-23,000 rpm
Cord: 10' rubber
Collet: ¼" & ½"
Performance: ●●●●○
Price range: $$$$$
Porter-Cable: 800-321-9443 or porter-cable.com

Fisch's Improved Benchtop Mortiser

When we reviewed benchtop mortisers in August 2001, we had a lot of complaints about the crop of machines available at the time. The biggest two flaws were that the slow-speed machines tended to stall too much and the devices that held your stock in place came loose too often as you worked.

Since then, Fisch has made some significant upgrades to its machine that make it a serious contender in the benchtop market.

The three biggest changes are a beefier motor, a more robust depth stop and a much-improved holddown system.

The motor is rated at ¾ horsepower (up from ½ hp). It still runs at the slower speed (1,720 rpm), but it's less likely to stall in white oak and hard maple.

The depth stop is now bulletproof. On the old machine we could make the depth stop slip during normal working conditions. This new version always stays put.

But our highest praise goes to the improvements made on the holddown system. Most mortisers are a pain because the holddown's post will pull out of the fence or the forks will pull off the post at the top. When this happens, all work stops.

To fix this, Fisch added a notch in the post that secures it to the fence – it never slips. And the top forks are now attached to the post with two setscrews instead of one.

Regarding the machine's other features, the spring-loaded micro-adjustable fence takes some getting used to. I'm more comfortable with a simpler fence system (I took the spring off so it now works like I am accustomed to). However I know many woodworkers who really like this fence system.

All told, the Fisch upgrades are impressive. If you are considering purchasing a benchtop mortiser this year, the Fisch belongs on your short list.

— *Christopher Schwarz*

For more information, circle #171 on Free Information Card.

SPECIFICATIONS

Fisch BTM99-252

Street price: $240
Max. chisel capacity: ½"
Speed: 1,720 rpm
Weight: 63 pounds
Performance: ●●●●○
Price range: $$$
Fisch: 724-663-9072 or fisch-woodworking.com

Bridgewood MS-25T Tilt Head Mortiser

Dedicated mortising machines aren't necessary for all woodworkers. But if mortises are an important part of your woodworking, especially if you happen to enjoy making chairs, there's no machine that will save you as much time as a tilting-head mortiser. The holes necessary to accurately attach splayed legs and back pieces to chairs can take hours to set up. This makes it a science.

The 1-hp motor (1,725 rpm) provides excellent power for cutting mortises through hardwood. The fit and finish on the machine are good and the two-axis movable table and canted holddown make mortising very user-friendly. Stops for the left-to-right travel on the table, and also on the depth-of-cut on the mortising head, make multiple mortises easily repeatable.

Then there's the tilting head, capable of moving 45° to the left or right for angled mortising. To set the head in motion, you loosen two bolts, then retighten them once the proper angle is achieved. While the tilting head is nice, we would have preferred a tool-free option for this procedure.

There also is a nice angling feature to the fence (0° to 30° from parallel) that is tool-free and adds a third dimension to the angled mortising opportunities.

All-in-all this is a useful and valuable machine for many operations. Well-made and reasonably priced, our only gripe is the wrench required for tilting. — *DT*

For more information, circle #172 on Free Information Card.

SPECIFICATIONS

Bridgewood MS-25T Tilt Head Mortiser

Street price: $840 w/stand ($700 without)
Motor: 1 hp, 220 volt
Spindle speed: 1,725 rpm
Table travel: 3" x 14½"
Max. chisel capacity: 1"
Performance: ●●●●○
Price range: $$$$$
Wilke Machinery: 717-764-5000 or wilkemachinery.com

EZ Smart Circular Saw Guide is Great for Plywood

While woodworkers usually don't consider a circular saw to be a refined tool, they still own one and use it. Why? Because plywood is sold in 48" x 96" sheets. And unless your shop is large and well-equipped, these sheets are hard to maneuver. A circular saw is a reasonable tool to reduce the size of these sheets, but the cuts aren't as accurate or neat as woodworkers would prefer. That's where this guide system comes into play.

The system starts with the Smart Base. This simple phenolic base fits any circular saw and has replaceable zero-clearance inserts that make splinter-free cuts.That in itself is a good thing, but when you add the Smart Guide, the system is sweet. The aluminum tracks have replaceable anti-chip edges (even less tear-out) and allow the saw to guide perfectly straight like you're following a miter slot. The anti-chip edge will work in straight or beveled cuts and the cuts can be made from either side of the guide. The guide mounts to the work from underneath with two integral clamps, so there are no clamps to hinder the cut. It's a simple and, as the name asserts, smart system.

How can it get better? Eureka Zone is adding a universal router plate for the same track system. We can't wait for that. — *DT*

For more information, circle #173 on Free Information Card.

SPECIFICATIONS

EZ Smart Guide System

Street price: $225 (base: $19.95)
Fits: Any circular saw
Included: 1-50" & 2-25" rails, smart base, two anti-chip inserts
Performance: ●●●●○
Price range: $$$$$
Eureka Zone: 888-938-7352 or eurekazone.org

MORE NORTON 3X SANDING PRODUCTS

Norton Abrasives (770-967-3954 or nortonabrasives.com) has expanded its 3X sandpaper line to fit random-orbit sanders. We were impressed with the 3X in sheet form and are now really pleased that we can put it on our shop's sanders. The paper is aggressive, durable and resists clogging. The 5" discs fit five- and eight-hole vacuum sanders thanks to a universal hole pattern. The discs also last longer because of a specialized resin bonding system that secures the abrasive to a fiber-reinforced, heavier paper backing. It's available in packs of three and 10 discs in the following grits: 40, 60, 80, 100, 120, 150, 180, 220 and 320. — *DT*

ASHLEY ILES TURNING TOOLS NOW IN AMERICA

Long a favorite among turners in Britain, Ashley Iles turning tools are becoming available in the United States from Tools for Working Wood (800-426-4613 or toolsforworkingwood.com). About 100 tools are available, plus additional tools specially made for pole lathe turners. Though pricing wasn't available at press time, they should cost less than comparable Sorby tools. We've been impressed with Ashley Iles steel, so these tools should be a hit with U.S. turners. — *CS*

TOOL RATINGS

Performance is rated on a one-to-five scale. You won't see a low rating ("one" or "two") because we don't publicize inferior tools. "Five" indicates the leader in the category. Five dollar signs indicates highest price in the category. Three indicates an average price. If you have tool questions, call me at 513-531-2690 ext. 1255, or e-mail me at david.thiel@fwpubs.com. Or visit our web site at popwood.com to sign up for our free, e-mail newsletter.

— *David Thiel, senior editor*

A Jig for Precision Trimming

Turn your laminate trimmer into a tool that flushes surfaces with incredible finesse.

Photo by Al Parrish

Once upon a time I had the brilliant idea to use a strip of hardwood to trim out the edge of a laminate countertop. And not just any laminate, either. This stuff was so expensive that if you asked how much it cost, the salesperson presumed you could not afford it. So scratching it during installation was not an option.

The challenge, I realized the moment the glue set upon the wood trim, was that I had to plane the top surface of the trim flush with the laminate without touching the laminate itself. If the blade touched the laminate, I would remove the thin layer that held the color, revealing the dull substrate (which the manufacturer thoughtfully made a flat white to provide maximum contrast and advertise my slip-up to the world).

I searched the 40 billion tool catalogs I receive each month (give or take), looking for something that would shave the wood without touching the laminate. I found nothing that would do the trick.

Now, we all know what happens when you have a perfectly good excuse to buy an expensive new tool and you can't find anything suitable – you buy something that's unsuitable and make it work. As a result, I bought a small laminate trimmer and built the jig shown here to turn it into a tool that I hoped would not mar the laminate.

Making a Router Cut Like a Hand Plane

What I made is sometimes called a "router plane," although it does something quite different from the hand tool of the same name.

An old-time router plane rides on the surface and reaches down into a recess to trim the bottom. This jig lets you adjust the depth of the router bit to cut adjacent surfaces flush to or higher than the surface on which the router is riding.

In my case, I wanted the tool to ride on the laminate and shave the top surface of the wood trim ever-so-slightly higher than the laminate it was attached to.

by Nick Engler

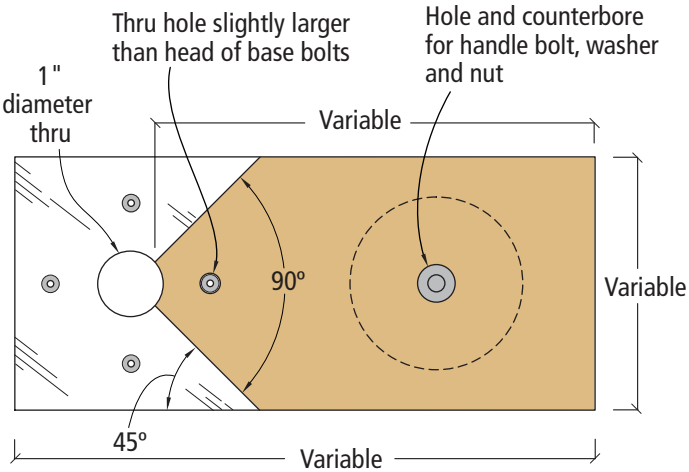
Nick Engler, the author of more than 50 books on woodworking, has built and flown a replica of the 1903 Wright Flyer, the first true airplane. He is now working on the 1905 version.

The first thing to do is to make a mounting plate from clear acrylic. (This lets you see what you are planing.) The plate should be rectangular and about twice as long as the laminate trimmer's base is wide.

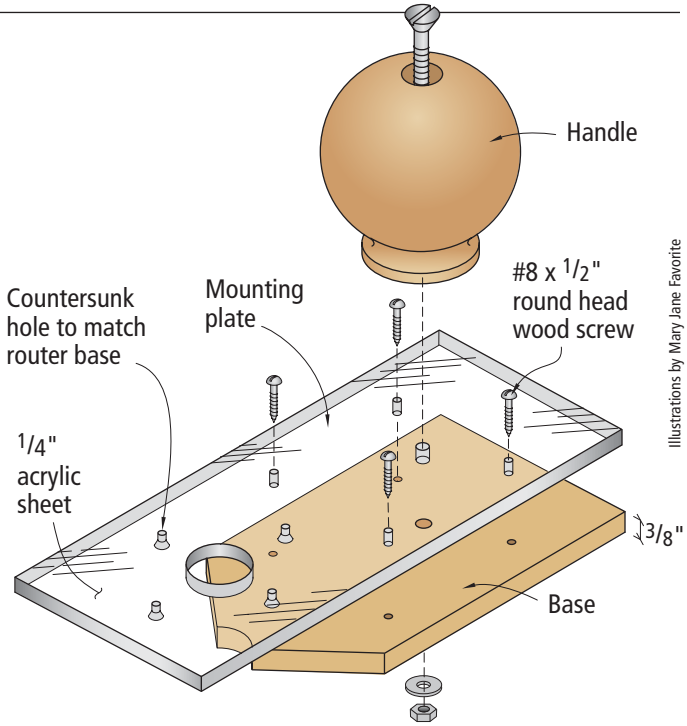
Mount the router at one end of this plate, centered over a 1"-diameter opening for a bit. On the end of the plate, mount a ⅜"-thick wooden base and a handle, as shown in the drawing at right. The base rests on one surface and lets you cantilever the router over another surface that you want to shave parallel to the first.

The handle not only helps you control the router, it lets you counterbalance the router's weight and keep the base flat on the reference surface as you work.

The fasteners you use to assemble the plate, base and handle must not protrude below the bottom surface of the base – after



Bottom view



Exploded view

Illustrations by Mary Jane Favorite

all, you don't want metal hardware dragging over the surface you're trying not to cut.

Using the Jig

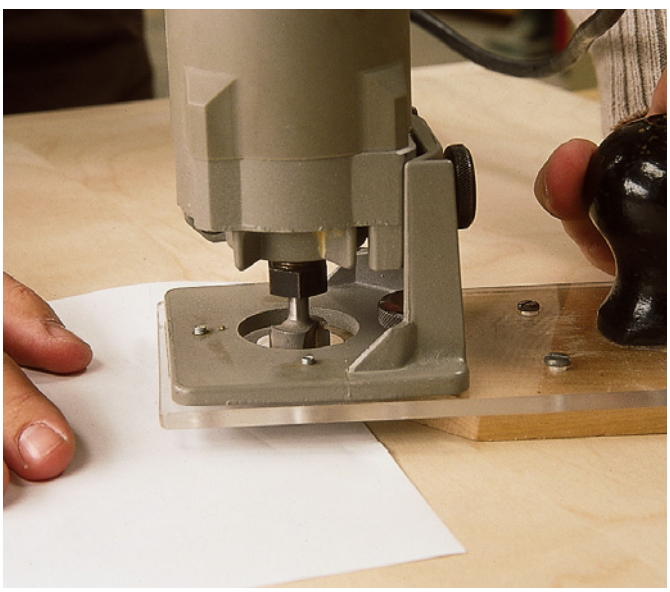
Mount a straight bit in the router. I commonly use a ¾"-diameter bit, but any bit smaller than the plate opening will do.

Adjust the depth of cut to the level you want to rout. If you want to trim one surface flush to another, raise or lower the bit until the tip barely touches the surface on which the base rests. If you want to cut slightly above a surface, as I did, simply raise the bit to the proper height.

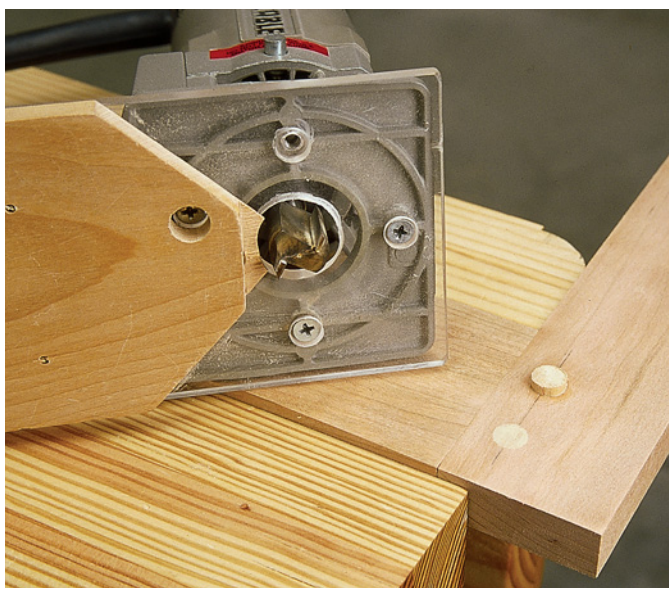
I used a piece of paper as a feeler gauge to position the tip of the bit about .003" above the surface – close enough to look flush, but far enough away to make sure it wouldn't cut the laminate on which the jig rested. Then make a test cut to check your setup.

As you cut, pay close attention to the direction of rotation and the direction you move the trimmer. I cut with the router so the bit rotation pulled the router through the wood trim and away from the laminate surface I was trying to protect.

If you have to "back-feed" (where you move the router so the bit pulls in a direction you don't want to go), move the router very slowly and keep the base pressed firmly against the guiding surface. For delicate work, cut the wood in several passes, lowering the router a tiny fraction of an inch between each pass. **PW**



You can use a piece of paper to position the bit about .003" above the surface. This will look flush but still ensure you don't hurt the surrounding laminate.



This jig also will trim wooden plugs flush with the surrounding surface without cutting or marring that surface.

Tight Joints on the Loose

Two matching mortises connected with a strong 'loose tenon' will help strengthen any project.

Photos by the author

A plunge router, an edge guide and a shop-made jig are the foundation for loose-tenon joinery.

I may be a power tool kind-of-guy, but I still favor traditional joints, those proven through centuries of use.

The mortise and tenon is one of those joints. It has been in use for hundreds, if not thousands, of years, with examples found in ancient Egyptian furniture.

I've pretty much settled on loose-tenon joinery as my mortise-and-tenon variant of choice. Just about anywhere you'd use a traditional mortise-and-tenon joint, you can use a loose-tenon setup. I've used it for commonplace frames, post-and-rail constructions and leg-and-apron assemblies. I've also used it to reinforce cope-and-stick joints.

A loose-tenon joint is created by cutting mortises into both mating parts, then using a separate strip as a tenon to link them. With a horizontal boring machine, this joint is a cinch, but that's not a common shop tool. And a hollow-chisel mortiser isn't specifically designed to do end mortises.

My approach hinges on a plunge router, a quality edge guide and a shop-made mortising jig, shown on page 37. Overall, this system satisfies me in terms of initial cost, ease of setup, accuracy and versatility.

Setup Convenience

How's this for simplicity? I lay out one mortise to set up the jig, the router, then the edge guide. Even that is rudimentary – just use the ends of the mortise and its centerline. The other edge mortises simply are marked using the mortise centerline. One end mortise must be delineated by a centerline, but the others don't need any layout at all.

And how's this for a simple work sequence? Set the workpiece on the jig's workrest, align the mortise centerline on it with the setup line on the jig and clamp it. Set the router on the jig and rout, plunging progressively deeper as you move the tool from stop to stop on the jig. When the router is bottomed against its plunge stop, the mortise is complete. Unclamp the workpiece and realign it (or switch pieces) to rout the next one.

Switching from edge-mortising to end-mortising requires only a workrest swap. Nothing else changes. When I'm doing rails and stiles – making doors or web frames, for example – I'll rout all the edge mortises in the stiles, then switch workrests and rout the end mortises in the rails.

With all the mortises routed, making tenons is a matter of resawing and planing strips of suitable stock to fit. Rip the stock to width, round the edges on the router table, then crosscut the individual tenons.

Joint Design

More often than not, I scale a joint as I'm laying it out. If I'm making the joint in a traditional manner, I'll use a uniform shoulder width all around the tenon because it's easy to cut. With a loose-tenon joint, I can make the end shoulders wider and it has no impact on cutting the mortise or the tenon slips.

In general, the tenon should be as wide as possible. Remember, though, that wood moves across the grain. So the wider the tenon is, the more it's going to move (that's true whether the tenon is a separate piece or is integral). The mortise, on the other hand, isn't moving at all. The resulting cross-grain stresses can bust the joint. If you need a very wide tenon, divide it into two or more equal parts. (And when you glue that joint, by the way, put the glue on only one tenon.)

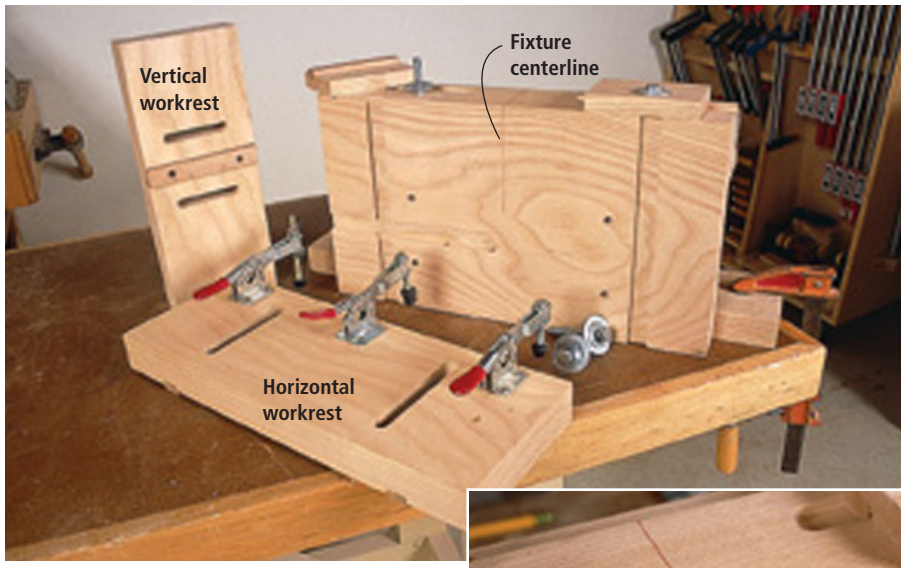
by Bill Hylton

Bill Hylton is the author of several books on furniture construction and router operations. When he isn't writing about woodworking, he's doing it in his home shop.

In practice, for a door frame I'll use a rail to mark the joint location, scribing along its edges on the stile edge. From those marks, I'll measure in to locate the ends of the mortise. (Whether the ends are equal distances from the edges isn't relevant.) To complete the setup, measure from shoulder to shoulder, divide the distance in half and mark the mortise centerline.

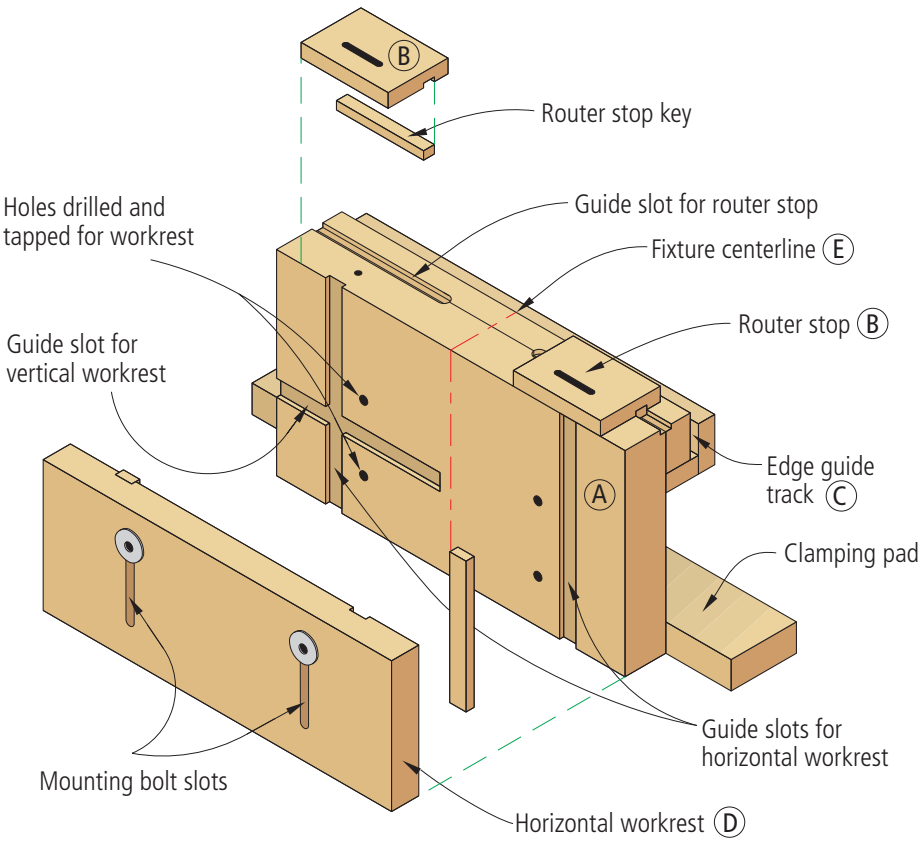
I usually make the mortise width half the stock thickness. This yields a well-balanced joint, with half the overall thickness allocated to the mortise and half to the tenon.

But how deep should you make the mortises? The critical half of the joint is in the stile or leg, where the tenon's grain runs perpendicular to that of the mortised piece. Wood movement may actually make a long-tenon joint weaker than a short-tenon joint. The best compromise? Mortise about half the stile's width, a bit more in narrow pieces. For example, rout the mortise 1½" deep in a 3"-wide stile, but rout it 1" deep in a stile that is only 1½" wide.



My mortising jig consists of a mortising block with separate, bolt-on router stops and two workrests. The horizontal workrest (with the toggle clamps) is for edge-mortising; the vertical one is for end-mortising.

Align the centerline of the mortise with the red setup line on the jig. After the jig, router and edge guide are set up, the centerline is the only layout marking you will need.



Router mortising jig

A) Mortising block
This is the body, composed of a 1½" x 9" x 16" block, with an extra support strip and a clamping pad glued to the back face. The block's face has keyways and mounting bolt holes for the workrests. It's critical that the top surface be perpendicular to the face.

B) Router stops
The travel of the router along the mortising block is limited by the two stops. A key dadoed into the underside rides in a groove in the block top. The mounting bolt passes through a slot, which allows for easy adjustability.

C) Edge guide track
A facing attached to the edge guide catches in the track, preventing the router from drifting off course. (To cut twin mortises, expand the width of the track and use a spacer next to the facing. Put the spacer on the inside and the bit is close to the block face. Switch the spacer and put it on the outside and the bit shifts away from the block.)

D) Workrests
Horizontal and vertical rests hold the workpiece for mortising. Mounting bolts passing through the slots allow for adjustability; keys keep the rest either parallel or perpendicular to the block top as you adjust its position.

E) Fixture centerline
All of your equipment setups and workpiece alignments pivot around this line. On my jig, the line is red.

In the other half of the joint – the rail or apron – the grain of the tenon slip is parallel to that of the mortised piece. Depth is less of an issue, so I rout this mortise to the same depth as its partner in the stile or leg.

Setting Up

The mortise width is established by the diameter of bit used, while the mortise depth is controlled by the plunge of the router. The length is governed by stops on the jig. And the alignment of the mortise on the work's edge is controlled by the edge guide.

Position the bit at the mortise's end mark, slide the stop against the base of the router and secure the stop. Then repeat this at the other end.

With the mortising block clamped to the bench and the horizontal workrest mounted, set the piece on the workrest and align the mortise midpoint with the setup line on the block. Clamp the piece to the jig.

Secure the bit in the router collet. Attach the edge guide to the router, set the router on the mortising block and, by eye, adjust the edge guide to center the bit across the stock. (We'll do a test cut and fine-tune this setting momentarily.) Bottom the bit against the workpiece and set the plunge depth to equal the desired mortise depth.

Set up the router stops next. Move the router to the left, aligning the bit inside the mortise boundaries at the mark. Slide the stop up to the router base and tighten the bolt. Move the router to the right, again aligning the bit at the shoulder mark. Position and lock the second stop.

I like my mortises to be centered on the thickness of the stock. This simplifies and expedites the routing, and it eliminates a lot of problems and frustration that can arise during final assembly.

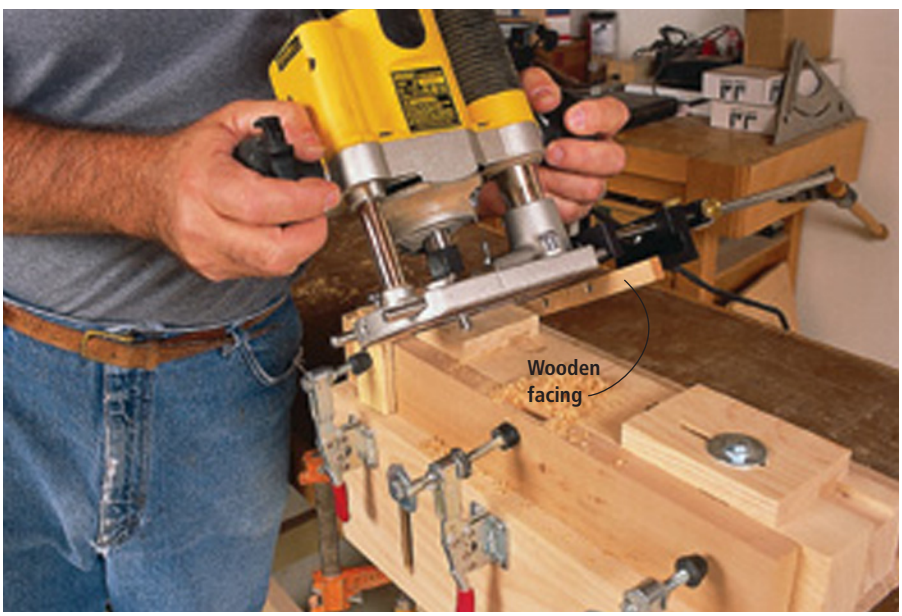
To do this, make a shallow test cut in the layout piece. Mark the outside face of the work (so you know which direction to adjust the setup) and remove it from the jig. With dial calipers, measure the widths of the shoulders. Subtract the narrow width from the broad width and move the bit half the difference toward the narrow shoulder.

I use the MicroFence – a fence so good I've even done some work for the company (800-480-6427 or microfence.com) – which has an adjuster calibrated in thousandths so this fine adjustment is manageable. If you're working with a less-precise guide, there are two ways to work around it.

- First, you can choose to mark a reference face on each workpiece, orienting that face the same way in relation to the mortising jig. When you assemble the work, orient the reference faces the same and all the parts will be cut flush.

The drawback to this method arises if the centerlines of the end mortises aren't congruent to the work's centerlines. Maybe one end is ¼" from the edge, the other ½". To fix this, you either have to shift the workrest

continued on page 40



The wooden facing on the edge guide drops into the channel at the back of the jig, allowing you to move the router back and forth without worrying if it will wander off course. The stops control the router's travel, ensuring the mortise will be the correct length.

Here I'm cutting twin mortises. A spacer shares the channel with the edge-guide facing. With the spacer between the jig and the facing, the router can cut the first mortise. Moving the spacer behind the facing bumps the router out, so it can cut the next mortise.

CIRCLE NO. 160 ON FREE INFORMATION CARD.

Glen-Drake Toolworks

Feel the Difference !

left and right-handed hammers for left and right-handed people

1-800-961-1569 • glen-drake.com

CIRCLE NO. 120 ON FREE INFORMATION CARD.

CIRCLE NO. 119 ON FREE INFORMATION CARD.

Fine Tune Your Band Saw for Great Cutting Performance!

Cool Blocks are made from a non-metallic composite called "Graphite Impregnated Phenolic Laminate". These high-tech Band Saw Blade Guides lubricate the blade without making it oily. Old metal guide blocks create heat, friction, premature blade wear and breakage.

Eliminate these problems with Cool Blocks. Your Band Saw Blades will run cooler and last longer with less friction!

Visit your Olson Dealer and ask for Cool Blocks Band Saw Blade Guides!

Top Rated by *Fine Woodworking* Magazine, Mar/Apr. 2001

Dealer inquiries are welcome! Call 203-792-8622

OLSON

The Olson Saw Co.
16 Stony Hill Road,
Bethel, CT 06801 USA
www.olsonsaw.com

CIRCLE NO. 137 ON FREE INFORMATION CARD.

MD MILLER DOWEL CO.

INTRODUCING THE NEW MINI-X

SUPERIOR FASTENERS FOR SOLID WOOD JOINERY

SIMPLE
fast and easy to use

STRONG
solid, longer-lasting joints

ECONOMICAL
minimal tools required

VERSATILE
use in any woodworking project

UNIQUE
1/4" cap diameter;
1 5/8" overall length

EXCELLENT RESULTS
an appealing and durable alternative to metal fasteners

Our new "Mini-X" Miller® Dowels are designed for joining 1/2" stock. Available in Birch, Cherry, Red Oak and Black Walnut. Use with the Mini-X TruFit® Drill Bit–sold separately or in our new Mini-X Joinery Kit.

For a complete list of our retailers, visit us at **www.millerdowel.com,** or call us toll free at 866-WOODPEG.

U.S. Patent No. 6,267,527 U.S. Patent No. D456,700 TM 2003 Miller is a trademark of the Miller Dowel Company.

FURNITURE • CABINETRY • DRAWERS • FRAMES • WOODCRAFT • MILLWORK

CIRCLE NO. 135 ON FREE INFORMATION CARD.

continued from page 38

position for half of the end mortises or you must use a spacer between the work and the workrest for half. Either way, it's more work.

• Another option is to rout every mortise twice to center it. Start by routing a mortise. Then turn the workpiece around on the jig and rout it again. This is an extra step and widens the mortise, of course, but it also produces a uniform shoulder width.

Routing the Mortises

Dialing in the edge guide is the final step. Once that's done, routing the mortises themselves is almost anticlimactic. Almost.

You want to excavate the mortise quickly by making a series of light cuts. Ideally, you want to plunge the bit into the work, feed quickly to the far stop and then retract the bit from the cut as you return the router to your starting position. (Note that if the edge guide's facing is in the jig's edge-guide track, you can feed the router either way without consequence.)

You don't want the bit to dwell in the cut because that generates heat, which can dull the router bit and scorch the wood. Scorched surfaces don't glue well.

(Note: Using a router with dust extraction is good in this regard. Chips packed in the cut around the bit retain the heat. Pulling out those chips as they're generated helps lower the temperature.)

You can use the router's adjustable turret to stage your depths, but that probably will feel like an intrusion – at least it does to me. Estimate the depth of each pass. If the feed resistance seems high and the bit chatter resonates (even when using hearing protection), then you need to back off.

It's most efficient to do all the edges, then swap workrests and do all the ends. Swapping workrests on my jig simply entails backing out a pair of mounting bolts. Nothing in the setup changes, so your end mortises will duplicate the edge mortises.

End mortises generally involve no additional alignment. Tucking the work against the rest aligns it for the cut. What I've found is that the rubber tips of toggle clamps allow the work to deflect when the bit plunges against it. As a consequence, I use a deep-throat clamp or two to secure the work to the jig for end mortises, as you can see in the photo above right. This works well.

Switching the jig for end mortises is a matter of removing the horizontal workrest and replacing it with the vertical one. Clamp a rail to the jig with its centerline aligned with the jig's setup line to locate the workrest while you secure it. Nothing else changes in the setup.

The rubber tips of toggle clamps have too much give, so I use deep-throat clamps to secure the work for end-mortising.

Making the Tenons

The common way to produce the loose tenons is to mill strips of stock to the appropriate thickness, rip the strips to width, round the edges with a roundover or small half-round bit and crosscut them to length. Some people rout grooves in their tenons to provide a reservoir for excess glue.

You can save a step, and provide yourself with a little assembly flexibility, if you make the tenons square-edged.

The critical gluing surfaces are the cheeks, not the edges. Eliminating the rounded edges doesn't degrade the strength of the joint appreciably. It does provide a reservoir for the excess glue and allows you to adjust the joint slightly as you assemble it. **PW**

The completed joint, ready for assembly.

makita®

MFORCE™ SL SHIFT LOCK™ CORDLESS DRILL SERIES

SHIFT TO FULL POWER.™

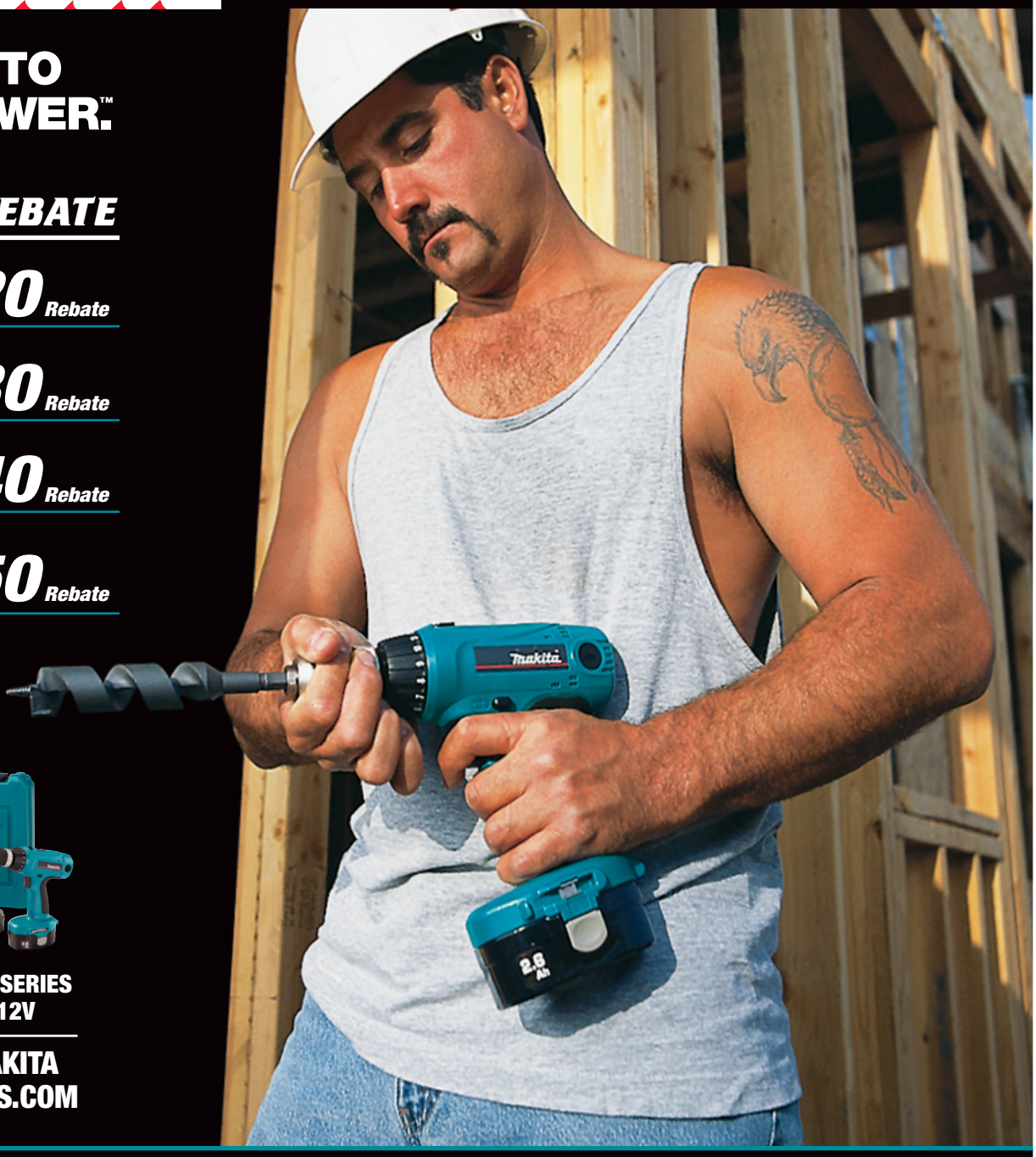
MAIL-IN REBATE

BUY 12V GET $20 Rebate

BUY 14.4V GET $30 Rebate

BUY 18V GET $40 Rebate

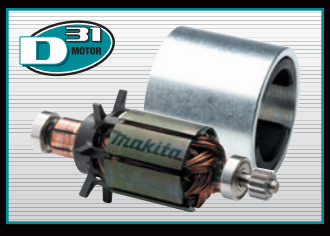
BUY 18V Combo Kit GET $50 Rebate



MFORCE™ DRILL SERIES
18V, 14.4V, 12V

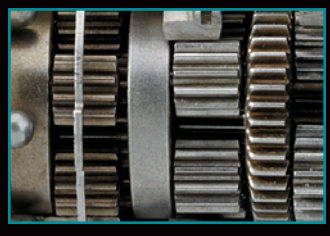
1-800-4MAKITA
MAKITATOOLS.COM

PERFORMANCE



Two-Piece D-31 motor with dual ball bearings for longer motor life

DURABILITY



All metal gear transmission creates efficient power

POWER

Shift-Lock™ Drive System instantly shifts from "drill" to "driver"

RUN TIME

2.6Ah (Ni-MH) batteries outlast Ni-Cd with no memory effect

CIRCLE NO. 133 ON FREE INFORMATION CARD.

Mortise & Tenon BASICS

A superior way to cut this superlative joint.

A lot of woodworkers spend a lot of time, effort and money to avoid making mortise-and-tenon joints. Biscuits, dowels, commercial loose-tenon jigs and expensive router bits are just a few of the "work-arounds" developed this century so you don't have to learn to make a mortise and its perfectly matched tenon.

But once you learn how straightforward and simple this joint can be, you will use it in every project. Why? Well, it is remarkably strong. A few years ago we decided to pit this venerable and traditional joint against the high-tech super-simple biscuit. So we built two cubes, one using biscuits and one with mortises and tenons. Then we dropped a 50-pound anvil on each cube. The results were eye-opening.

Both cubes were destroyed. The biscuit cube exploded on impact. Some of the biscuits held on tightly to the wood, but they pulled away chunks from the mating piece as the joint failed.

The second cube survived the first hit with the anvil – the joints held together even though the wood split at the points of impact. A second hit with the anvil ruined the cube entirely, though most of the tenons stuck tenaciously to their mortises.

The lesson here is that biscuits are indeed tough, but when they fail, they fail catastrophically. The mortise-and-tenon joints fail, too, but they take their time, becoming loose at first rather than an immediate pile of splinters.

So when you're building for future generations and you know how to make this stout joint with minimal fuss, you won't say "Why bother?" You'll say "Why not?"

by Christopher Schwarz

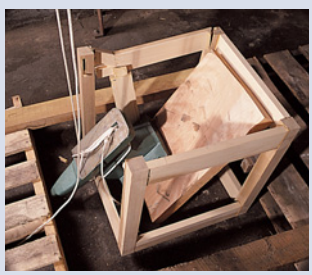
Comments or questions? Contact Christopher at 513-531-2690 ext. 1407 or chris.schwarz@fwpubs.com.

THE 'ANVIL' TEST

1) The anvil is about to hit the cube made using #20 biscuits.

2) The cube made out of biscuits is destroyed on impact.

3) The mortise-and-tenon cube held together after the first hit.



4) The mortise-and-tenon cube collapsed after the second hit.

Choosing the Right Tools

There are so many ways to cut this joint that one big obstacle to mastering it is choosing a technique. I've tried many ways to cut this joint – backsaws, commercial table-saw tenon jigs and even the sweet $860 Leigh Frame Mortise and Tenon Jig.

Each technique or jig has advantages in economy, speed or accuracy. The technique I'm outlining here is the one I keep coming back to year after year. It uses three tools: a hollow-chisel mortiser for the mortises, a dado stack to cut the tenons and a shoulder plane to fine-tune your joints. Yes, this is a little bit of an investment, but once you start using this technique, these tools will become the foundation for much of your joint-making.

(For another good way to make this joint, see "Power-tool Joinery," which begins on page 36.)

Photo by Al Parrish

• **Hollow-chisel mortisers:** These machines are nothing new, but the benchtop ones are now cheaper, more powerful and more accurate than ever. For about $240, you'll get a good machine.

Essentially, a mortiser is a marriage between a drill press and an arbor press that's designed for metalworking. The drill press part has a spinning chuck that holds an auger bit that chews up the waste wood. The auger bit is encased in a hollow four-sided chisel that cleans up the walls of your mortise, making the auger's round hole a square one.

The arbor press part of the machine is the gear-and-lever system that pushes the tooling into your wood. This mechanism gives you an enormous mechanical advantage compared to outfitting your drill press with a mortising attachment – an accessory I don't recommend for all but the most occasional mortising jobs.

Shopping for the proper mortiser is tough. I don't consider all the machines equal. Some are weak and stall in difficult woods such as oak, ash and maple. Many have problems holding your work down against the machine's table. In a review of the machines on the market in our August 2001 issue, we preferred the fast machines (3,450 rpm) instead of the 1,750-rpm slow machines (*back issues are available by calling 800-258-0929 or going online at popwood.com*). The fast machines were almost impossible to stall. However, the marketplace seems to prefer the slow machines. While none of the machines is perfect, I prefer the fast-speed Bridgewood and Shop Fox and the slow-speed Jet and Fisch machines (see "Tool Test" on page 32 for a review of the Fisch and a new Bridgewood floor-model mortiser).

• **Dado stack:** A good dado stack will serve you in many ways, but I use mine mostly for cutting tenons and rabbets. When it comes to choosing one, buy a set with 8" blades instead of 6" blades, unless you own a benchtop table saw.

Stay away from the bargain sets that cost $50 or less – I haven't found them to be very sharp and the teeth aren't well-ground. The expensive sets ($200 and more) are nice, but they're probably more than you need unless you are making your living at woodworking. My favorite mid-priced set is the Freud SD208. It's about $80 and does a fine job.

Hollow-chisel mortisers excel at boring square holes. Here you can see the holddown (which is usually inadequate with other machines), the table (which must be squared to the chisel before use) and the lever (which makes the machine plow through almost any job).

• **Shoulder plane:** No matter how accurately you set up your machines to cut mortises and tenons, some will need a little tuning up before assembly. And nothing trims a tenon as well as a shoulder plane. These hand tools really are secret weapons when it comes to joints that fit together firmly and are airtight.

Why is that? Well, shoulder planes are designed to take a controlled shaving that can be as thin as .001". I can tweak a tenon to a perfect fit with just a few passes. Trying to tweak a tenon with a chisel or sandpaper is more difficult. You are more likely to gouge or round over the surface of your tenon and compromise its mechanical strength.

Buying a shoulder plane gets easier every year because there are now many quality tools on the market. Unless you build only small projects, you are going to want a plane that is at least 1" wide. Most casework tenons are 1" long, so a 1"-wide plane is perfect for trimming up the face cheeks and shoulders of the tenon.

My advice is to stay away from the newly made Stanley shoulder planes. I've had some sloppily made Stanleys go though my hands (vintage Stanley shoulder planes can be good, however).

A shoulder plane tweaks tenons to fit perfectly. Avoid the modern Stanley shoulder planes (not shown). Spending a few dollars more will get you a much better tool.

Lie-Nielsen makes two shoulder-trimming planes worth saving your money for. The #073 is a tool of great mass and presence and does the job admirably – it's a $225 investment. Lie-Nielsen also makes a rabbeting block plane that can be easily used as a shoulder plane; it costs $150. It's the tool I recommend to most people because it does double-duty as a low-angle block plane.

Veritas, the tool line made by Lee Valley Tools, has a smaller shoulder plane that's almost ¾" wide, quite comfortable to use and reasonably priced at $139. I wish the tool was wider, and officials at Lee Valley say I might get my wish soon. Other new and vintage brand names worth checking out include Shepherd Tool (made in Canada) and the British-made Clifton, Record, Preston, Spiers and Norris.

Of course, you'll need to sharpen the tool. And that's why we offer a free tutorial on sharpening on our web site – click on the "Magazine Extras" link to find it.

Designing a Joint

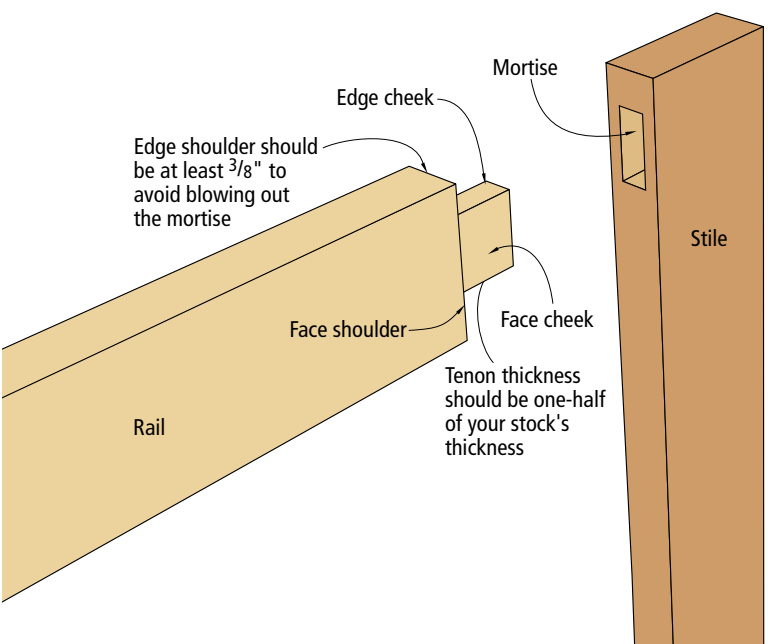
Once you have the tools you need, you can learn about the mechanics of the joint. Study the illustration below to learn what each part of the joint is called.

The first question beginners always ask is: How thick and how long should my tenons be? As far as thickness goes, the rule of thumb is that they should be one-half the thickness of your workpiece. So a tenon on a piece of ¾" material should be ⅜" thick.

As for length, that depends on your project. Typical casework tenons that are 1" long will be plenty strong. For large glass doors, make them 1¼" long. For small lightweight frames and doors, stick with ¾"- or ⅝"-long tenons.

What beginners often don't ask about is the size of the edge shoulders on their tenons. This is a critical measurement. If you make these edge shoulders too small, say 3/16" wide or so, you could run into huge problems at assembly time when building frames and doors.

Here's why: If your tenoned piece forms one of the outside members of a frame, your mortise wall is going to be only 3/16" wide and it's going to be weak. The hydraulic pressure from the glue or the smallest amount of racking will cause the tenon to blow out this weak mortise wall, ruining everything. It is because of this that I recommend edge shoulders that are ⅜" wide in most cases. Note that your edge shoulders



These sample mortises are useful for sizing your tenons. I usually make a new one every season or two, because they can get worn from use.

can be too big. Once they start getting larger than ½", you run the risk of allowing the work to twist or warp in time, ruining the alignment of the parts.

Of course, if your tenoned piece is not on the edge of a frame, you can have narrow edge shoulders without any worries.

Designing the mortise is a bit simpler. It should be the same dimensions as your tenon with one exception: Make the mortise 1/16" deeper than your tenon is long. This extra depth does two things: It gives your excess glue a place to go and it ensures your tenon won't bottom out in the mortise, which would prevent you from getting a gap-free joint.

Beware of other tune-ups that some books and magazines suggest. One bit of common advice is to chamfer all the sharp edges of your tenons to improve the fit. Another bit of advice is to chamfer the entry hole of the mortise. These are unnecessary if you design your joint properly.

One thing that is important, however, is to mark the outside faces on all your parts. It's important to keep these straight during machining and assembly.

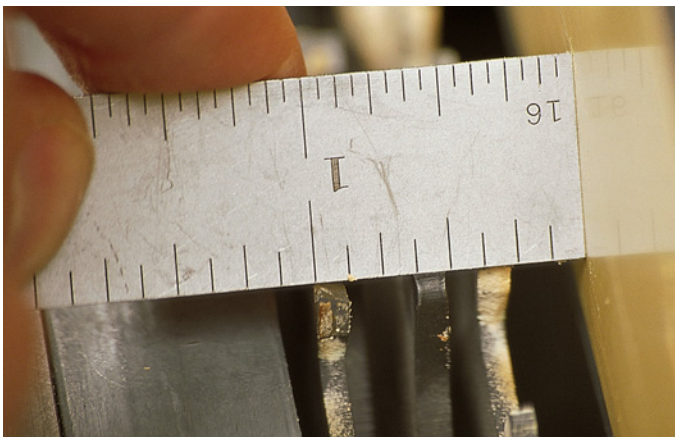
Tenons First

Some traditional woodworkers tell you to make all your mortises first and then make your tenons fit that. This is good advice if you cut the joint by hand with a backsaw and a mortising chisel because there is more opportunity for the mortise to be irregular in size. But you will work much faster and with much less measuring if you try it my way.

Before you cut your first tenon, you should fire up the hollow-chisel mortiser and make a sample mortise with each size of bit you use. The three most common sizes are ¼", ⅜" and ½". These mortises should have perfectly square walls and be 1 1/16" deep and 2" long. Write the month and year on each mortise and make a new set next season.

Why make these sample mortises? Well, because the tooling to make your mortises will always produce the same width mortise, you can merely size all your tenons to one of these sample mortises as you cut them on your table saw. This will save you time down the road, as you'll see.

With your sample mortise in hand, set up your table saw to cut



A 6" rule will help you set the length of your tenon. Once you do this a couple of times you'll hit this measurement right away every time.

your tenons. Install the dado stack blades and chippers on the saw's arbor. The rule here is to install enough blades to almost cut the length of the tenon in one pass. For example, to cut a 1"-long tenon, set up enough blades and chippers to make a ¾"-wide cut.

Next, position your saw's rip fence. Measure from the left-most tooth of your dado stack to the fence and shoot for the exact length of your tenon. A 1"-long tenon should measure 1" from the left-most tooth to the fence, as shown in the photo above.

Get your slot miter gauge out and square the fence or head of the gauge to the bar that travels in the table saw's slot. Attach a wooden fence to the face of the gauge (usually this involves screws through holes already drilled in the gauge). This wooden fence stabilizes your workpiece and controls tear-out as the dado stack blades exit the cut.

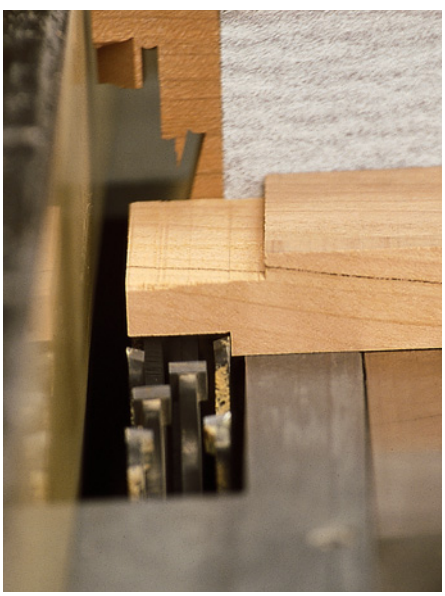
Set the height of the blades to just a little shy of the shoulder cut you're after. You want to sneak up on the perfect setting by raising the arbor of the saw instead of lowering it. This does two things: One, it produces fewer waste pieces that result from overshooting your mark. And two, because of the mechanical backlash inherent in all geared systems such as your table saw, raising the arbor eliminates any potential for it to slip downward because of backlash.

You are now ready to make a test cut. First put a scrap piece up against your miter gauge, turn on the saw and make a cut on the end of the board. Use firm downward pressure on the piece. Don't let the end of the board touch the saw's rip fence. Then bring the scrap piece and miter gauge back and make a second pass, this time with the scrap touching the rip fence as shown below.

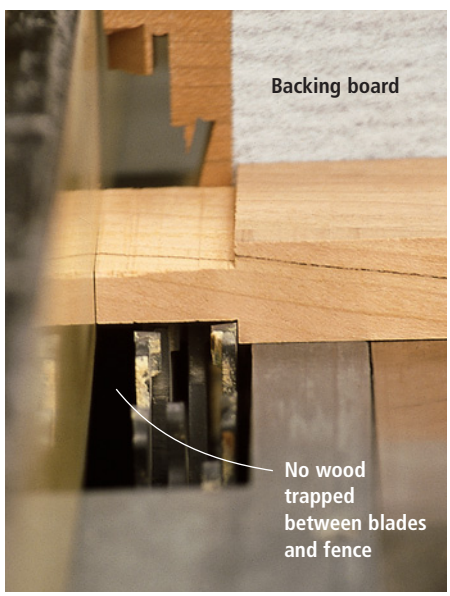
Flip the scrap over and repeat the process on the other face. Usually you aren't supposed to use your rip fence and miter gauge in tandem, but this is an exception. This cut is safe because there isn't any waste that could get trapped between the blades and the fence, producing a kickback.

Check your work with your dial calipers and see if the tenon will fit your sample mortise. The tenon is likely going to be too thick. Raise the blades just a bit and take passes on both faces of the scrap until the tenon fits firmly and snugly into the sample mortise with only hand pressure.

If you can shake the sample mortise and the tenon falls out, you've overshot your mark and need to lower the arbor and try again. If the fit is just a wee bit tight, you can always tune that up with a shoulder plane. Let your dial calipers be your guide. Sometimes you haven't used enough downward pressure during the cut to make a consistent

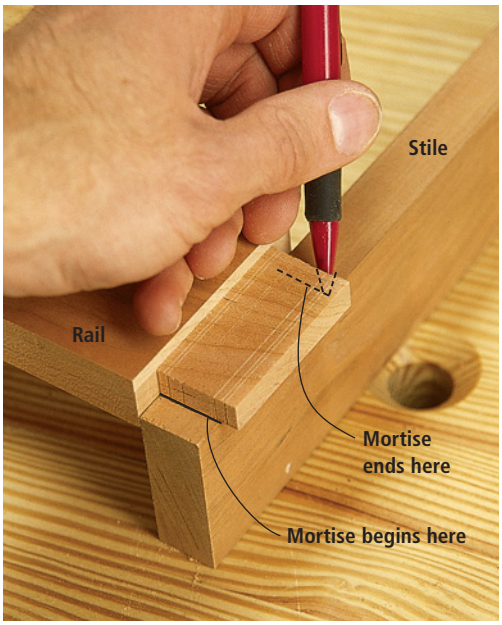


When making tenons with a dado stack in your table saw, the first pass should remove the bulk of the material. Keep firm downward pressure on your work, which will give you more accurate cuts.



The second pass has the work against the fence and defines the face shoulder. Note there isn't any wood between the fence and blades, so the chance of kickback is minimal. The backing board reduces the chance of tear-out at the shoulders.

Cut the edge shoulders the same way you cut the face shoulders and cheeks.



To locate the mortise, put the tenon across the edge of the stile where you want your mortise to go. Use a sharp pencil to mark the tenon's location on the edge. Bingo. You've just laid out the mortise's location.

tenon. If something doesn't fit when you know it's supposed to, try making a second pass over the dado stack and push down a little harder during the cut.

Using this setup, mill all the face cheeks on all your tenoned pieces. When that's complete, raise the arbor to 3/8" and use the same routine to cut the edge shoulders on all your boards. Your tenons are now complete.

Use Your Tenons Like a Ruler

One of the major pains in laying out the mortise is figuring out exactly where you should bore your hole. You end up adding weirdo measurements and subtracting the measurements of edge shoulders. If you lay out mortise locations using math only, you will make a mistake someday.

Troy Sexton, one of our contributing editors, showed me this trick one day and I've never done it any other way since. Say you are joining a door rail to a stile – quite a common operation. Simply lay the tenoned rail onto the edge of the stile and line up the edges of both pieces so they're flush. Take a sharp pencil and – using the tenon like a ruler – mark where the tenon begins and ends on the stile. That's it; you've just marked everything you need to know to make your mortise.

If you are placing a rail in the middle of a stile, there is one more step. You'll need to mark on the stile where the edges of the rail should go. Then line up the edge of the rail with that mark and fire away. There's still no addition or subtraction. With all your mortises laid out, you can then get your hollow-chisel mortiser going.

A Finicky Machine

I've used a lot of hollow-chisel mortisers and find them fussy to adjust. Along with our review of the machines, we published a complete tutorial on the topic in our August 2001 issue. In a nutshell, here are some of the important adjustments not covered by some manuals:

• Make sure the chisel is at a perfect 90° angle to the machine's table. I've set up a dozen of these machines and only one has ever been perfect. The solution is to use masking tape to shim between the table and the machine's base.

• Set the proper clearance between the auger bit and the hollow chisel that surrounds it. Some people use the thickness of a dime to set the distance between the tooling. Some people measure. Either way is fine. If the clearance is too little, the machine will jam and the tooling can burn. Too much distance makes a sloppy-bottomed mortise.

• Square the chisel to the fence. The square holes made by the chisel should line up perfectly. If the edges aren't perfectly straight, your chisel isn't square to the fence. Rotate the chisel in its bushing and make sample cuts until everything is perfect.

• Center the chisel so it's cutting in the middle of your workpiece. There might be a clever trick to do this, but I've found that the most reliable method is to make a test cut and measure the thickness of the mortise's two walls with a dial caliper. When they're the same, your mortise is centered.

Simplify Your Mortising

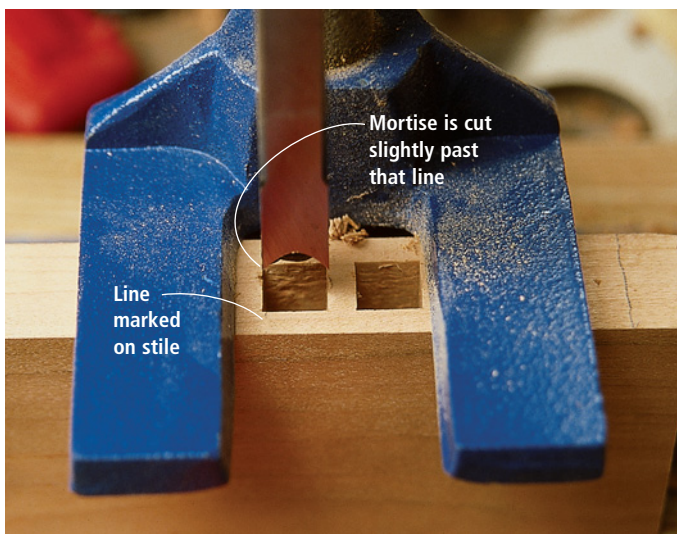
As you make your mortises, here are a few tips for making things a whole lot easier.

• I like to cut a little wide of the pencil lines that define my mortise. Not much; just 1/32" or so. This extra wiggle room allows you to square up your assembly easier. It doesn't weaken the joint much – most of its strength is in the tenon's face cheeks.

• As you bore your mortises, don't make your holes simply line up one after the other. Make a hole, skip a distance and then make another hole (see the photo below). Then come back and clean up the waste between the two holes. This will greatly reduce the chance of your chisel bending or breaking.

• Keep your chisel and auger lubricated as they heat up. Listen to the sounds your machine makes. As the auger heats up, it can start to rub the inside of the chisel wall and start to screech. Some dry lubricant or a little canning wax squirted or rubbed on the tooling will keep things working during long mortising sessions.

• Finally, make all your mortises with the outside face of the work against the fence. This ensures your parts will line up perfectly during assembly.



By cutting over your line slightly, you give yourself just enough forgiveness at assembly time. A little wiggle can mean a lot when you are trying to close up the gaps as you clamp up your work.

Shoulder planes are capable of extraordinarily precise work. Just try to set your table saw to remove .001". It's not possible. For a shoulder plane, it's simple.

Final Tweaks

No matter how careful you have been, some of your tenons might fit a little too tightly. This is where the shoulder plane shines. Make a couple of passes on both face cheeks and try fitting the joint again. Be sure to make the same number of passes on each cheek to keep the tenon centered on the rail. If your parts aren't in the same plane when assembled (and they're supposed to be), you can take passes on only one cheek to try to make corrections.

If the joint closes up on one face but not the other, you might have a sloppy shoulder. The shoulder plane can trim the fat shoulder to bring it in line with its twin on the other side of the tenon. If the tenon still won't seat tightly, try chiseling out some meat at the corner where the edge shoulder meets the face cheek – but don't trim the outside edge of the edge shoulder itself.

Finally, get a sharp chisel and clean out any gunk at the bottom of the mortise. Keep at it – a tight joint is worth the extra effort.

Assembly

You really don't want any glue squeeze-out when you assemble your mortise-and-tenon joints. The trick to this is learning where to put the glue and how much to use. I run a thick bead of glue at the top of each mortise wall and then paint the inside of the mortise wall with glue using a little scrap piece. I try to leave the glue a little thick at the top of the mortise wall. Then, when the tenon is inserted, this paints the tenon with glue but drives the excess to the bottom of the mortise.

When clamping any frame – regardless of the joinery you used – you don't want to use too much pressure or you will distort the frame. Tighten the clamps until the joints close and no more. You also want to alternate your clamps over and under the assembly to keep the frame flat – no matter how fancy your clamps are.

Once you do this a couple of times, I think you'll find a whole new level of woodworking open to you. Web frames for dressers (or Chippendale secretaries) will seem like no problem. Morris chairs with 112 mortises will be within your reach. And your furniture is more likely to stand the test of time – and maybe even the occasional anvil. **PW**

Editor's Note: Now that you know the basics to producing this extraordinarily strong joint, you should give it a try yourself on a project. We've included plans in this issue for a Stickley Ottoman on page 57 – it's a great introduction to the world of mortise-and-tenon joinery.

A thick bead of glue at the top of the mortise wall makes the joint strong without squeezing out a lot of glue. Use a small piece of scrap to paint the mortise wall before inserting the tenon.

SUPPLIES

Freud
800-334-4107 or
freudtools.com
- Dado stack set #SD208 (check online or call for nearest retailer)

MORTISERS

Bridgewood
800-235-2100 or
wilkemach.com
- Bench mortiser #HM-11, $235

Woodstock International
800-840-8420 or
woodstockinternational.com
- Shop Fox mortiser #W1671, $230 (check online or call for nearest retailer)

Jet (WMH Tool Group)
800-274-6848 or jettools.com
- Jet mortiser #JBM-5, $200 (check online or call for nearest retailer)

Fisch
724-663-9072 or
fisch-woodworking.com
- BTM99-44252, $240 (check online or call for nearest retailer)

SHOULDER PLANES

Lie-Nielsen Toolworks
800-327-2520
or lie-nielsen.com
- Large shoulder plane #073, $225
- Rabbet block plane #60½R, $150

Lee Valley Tools
800-871-8158 or leevalley.com
- Veritas medium shoulder plane #05P41.01, $139

Price as of publication deadline.

WOODWORKING ESSENTIALS

BY NICK ENGLER

CHAPTER 5

Use Your Router to Build Boxes & Drawers

Woodworkers have been building boxes for at least 5,000 years. For much of that period, boxes were made using a single chunk of wood with the insides dug out to create a cavity. That's because up until about 600 or 700 years ago, turning trees into boards was an extremely expensive process – the boards had to be hand-sawn (or rived) from logs, then smoothed with planes. Consequently, only the very rich owned furniture made from boards. Most people simply found suitable logs and chopped or burned away the insides.

The invention of the water-powered sawmill in 1328 caused a revolution in woodworking, including the art of making boxes and drawers. The sawmill made it possible for everyone to own boxes made out of sawed lumber, and woodworkers began to build storage units from more than just one board.

This multi-board box remains a rather practical and popular method of construction. While the joinery isn't much of a concern when making a one-piece box, it becomes paramount once you begin building boxes and drawers from multiple boards.

With the advent of multi-board drawer construction, a variety of woodworking planes and saws were developed with box and drawer joinery as their sole purpose. As power tools started to replace hand tools (or at least become a serious option for many woodworkers), the router took over many of the box and drawer joinery duties. In this chapter, I'll take a look at a number of joints that can be created with a router to help you build furniture, drawers and many other boxes.

Grain can run any direction with plywood bottom

PRO TIP:

Read Grain Direction To Get a Jump on Expansion

When you make a drawer with a solid-wood bottom, the grain direction should run from side-to-side so the drawer bottom will expand front-to-back. If the bottom were to expand side-to-side, it would press the drawer sides out, making the drawer bind or stick in its opening.

TIPS & TRICKS

PRO TIP:

Drawer Sides Can Extend Past the Back

Some traditional and modern drawer designs call for the sides to extend ¼"-½" beyond the back of the drawer. This makes the drawer simpler to build and slightly stronger than if the sides are merely flush with the back. For inset drawers, the back ends of the sides often serve as stops to keep the drawer from being pushed in too far. The sides also make more stable stops than the back. Should the back cup or warp, the drawer may protrude from its case slightly. Should the sides cup, the position of the drawer won't be affected.

PRO TRICK:

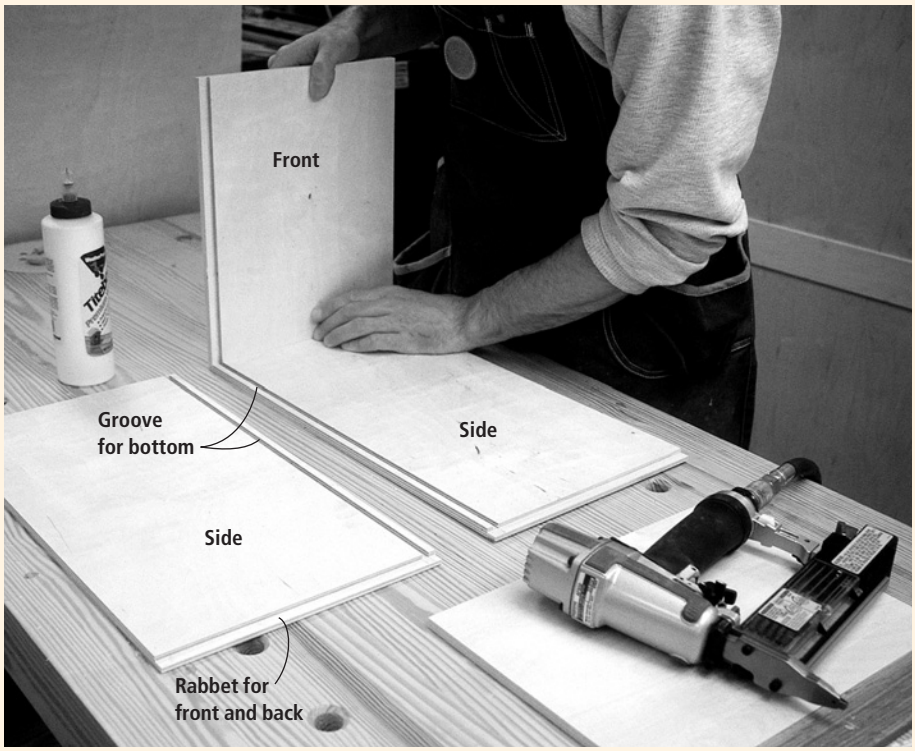
Size Drawers to Holes, Then Plane Them to Fit

Make the drawers precisely the same size as the drawer openings. They'll be too big to work properly, but you can use your hand plane or belt sander to take just a little bit of stock from the outside surfaces to get a perfect fit.

GREAT TRICK:

It May Take some Time, but Rout Cavity in Many Passes

If you're making a one-board box with your router, make sure you rout out the cavity in several passes, cutting no more than ⅛" deeper with each pass until you reach the desired depth. Begin by routing the circumference of the cavity, keeping the pilot bearing pressed against the pattern. Then move the router back and forth to clean out the waste in the middle of the cavity. (This technique is used only for small boxes these days – usually jewelry boxes with an odd or organic shape to them.)



This drawer box is made pretty easily with rabbets. The front and back rest in ½"-wide x ¼"-deep rabbets in the side pieces. The bottom slides into a ¼"-wide x ¼"-deep groove in the sides and front. The back is ½" shorter than the front to allow the bottom to slide in.

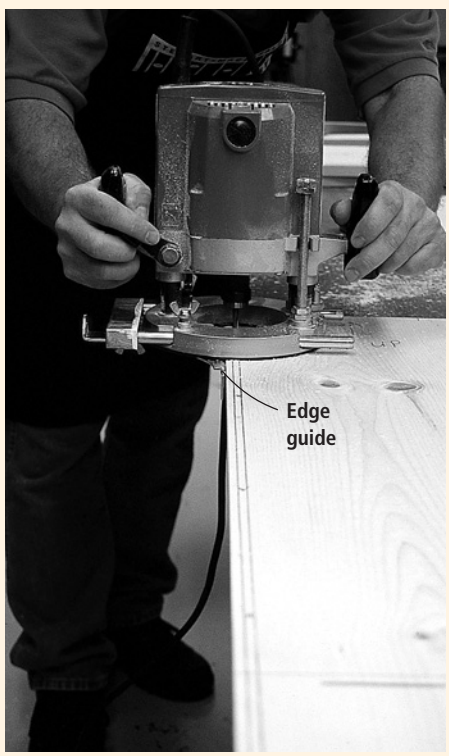
Corner Joints

A variety of joints formed by routers can be used to attach the rigid corners of boxes and drawers. The best choice of joint will depend on how the box or drawer will be used:

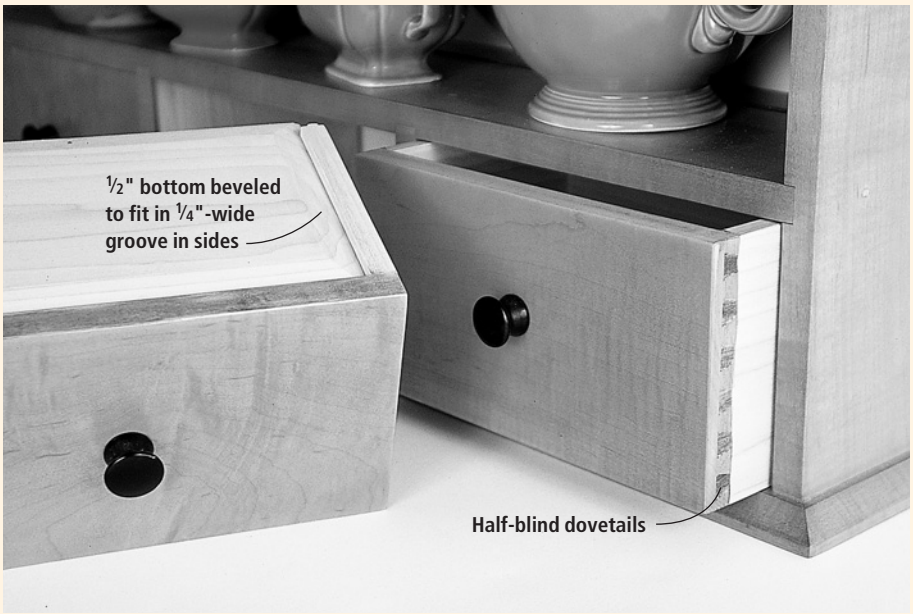
- Will it be a strictly utilitarian storage unit or will it be decorative as well?
- Will it see light duty or will it be subjected to heavy use?
- Will it remain stationary or will it be moved from place to place?

No matter what you decide to use your box or drawer for, we've got the joint for you. Here are some of the most common corner joints (*many of these joints were discussed further in Chapter Four of this series*):

- **Butt Joints:** These are usually reinforced with screws or glue blocks and work well for light-duty, utilitarian boxes. No routers are necessary here. It's the simplest and weakest corner joint.
- **Rabbets & Grooves:** These look similar to butt joints when assembled, but they are strong enough to be used for medium-duty utilitarian boxes. Rabbets



Rabbets and grooves are pretty easy to make with a hand-held router. Here you see a router cutting a ¼"-deep groove with a ¼" straight bit and an edge guide.



The drawer bottoms in the drawers shown at left are ½" thick but are beveled to slip into a ¼" groove, a traditional drawer construction method. Also, you can see the half-blind dovetails connecting the side with the front.

of many sizes are formed easily using a rabbeting bit in a hand-held or table-mounted router. Rabbets and grooves also can be made with a straight bit in a hand-held router if you use a base-mounted edge guide. If the router is in a table, the fence guides the wood to quickly form the rabbets or grooves.

• **Miter Joints:** These are a more aesthetically pleasing option, hiding the end grain on the adjoining boards so that all you see is uninterrupted face grain. However, these are comparatively weak and are best suited for light-duty projects unless reinforced with biscuits or splines (which we will discuss in greater detail next). Routers seldom are used to form miter joints, and are used instead to reinforce and decorate them.

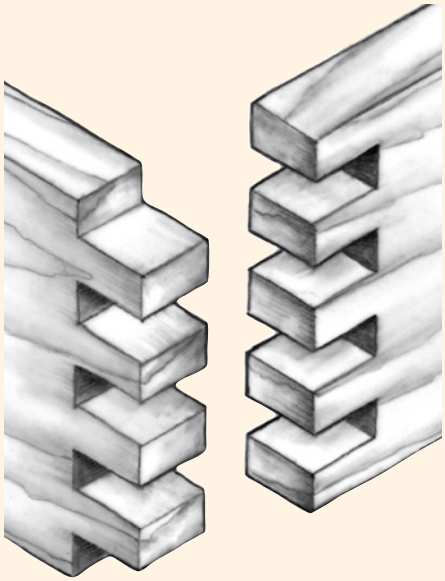
• **Splined Miters:** These are much stronger than regular miters and can be used for medium- or heavy-duty decorative boxes. The splines can be hidden or visible, depending on your project's style. They can be made with hand-held or table-mounted routers using a spline-cutter bit, which is essentially a tiny table saw blade with the shaft of the bit serving as an arbor. Available as many bits of different thicknesses or one bit with adjustable thicknesses, these are very versatile router accessories.

• **Finger Joints:** Also known as "box joints," these are strong enough to qualify for heavy-duty boxes and drawers. The interlocking tenons create a vast gluing surface that holds firmly. These were once considered strictly utilitarian (many packing crates in the late 19th and early 20th centuries were made using finger joints), but in recent years they have been used in decorative applications as well. These joints are best formed with a table-mounted router using a straight bit and a miter gauge or a specially made jig.

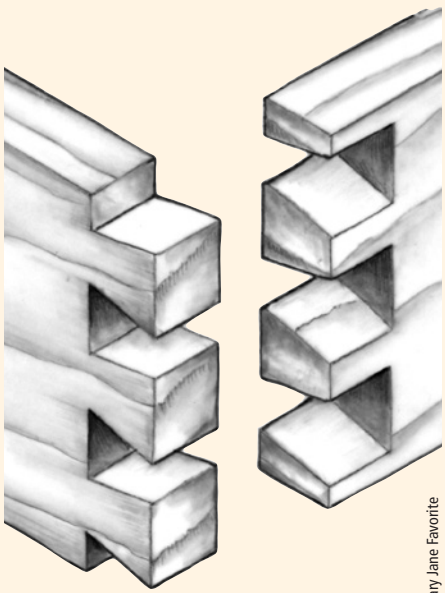
• **Through-dovetails:** The strongest of all common joints for boxes and drawers, these are suitable for heavy-duty projects. Similar to finger joints, through-dovetails were once thought of as utilitarian, but today they are used just as much for decorative pieces. Routers make quick work of dovetails using specialized bits and jigs to make precise and tight joinery.

(Note: While some people will use contrasting colors or species of wood when making finger joints and dovetails to make the joinery stand out, just as many want to use the same type of wood for both parts of these joints to make them look more subtle.)

All of these joints can be used to make standard boxes or the more-common open-topped boxes we use every day – known more commonly, of course, as drawers.



Finger joint



Through-dovetail

Illustrations by Mary Jane Favorite

TIPS & TRICKS

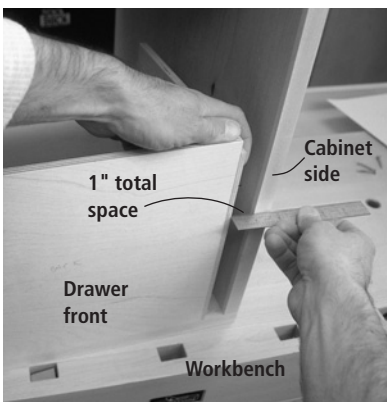
GREAT TRICK:

Tape Helps You Fit Fabric

To fit a fabric lining in a drawer (for storing silverware, etc.), cover the bottom surface of the material with double-sided carpet tape and cut the pieces to size with scissors or a utility knife. The tape will stiffen the fabric, making it easier to cut and fit. To install the lining, just peel the paper backing off the tape and press the fabric in place.

PRO TRICK:

If Your Drawer has Slides, Key Measurement is Width

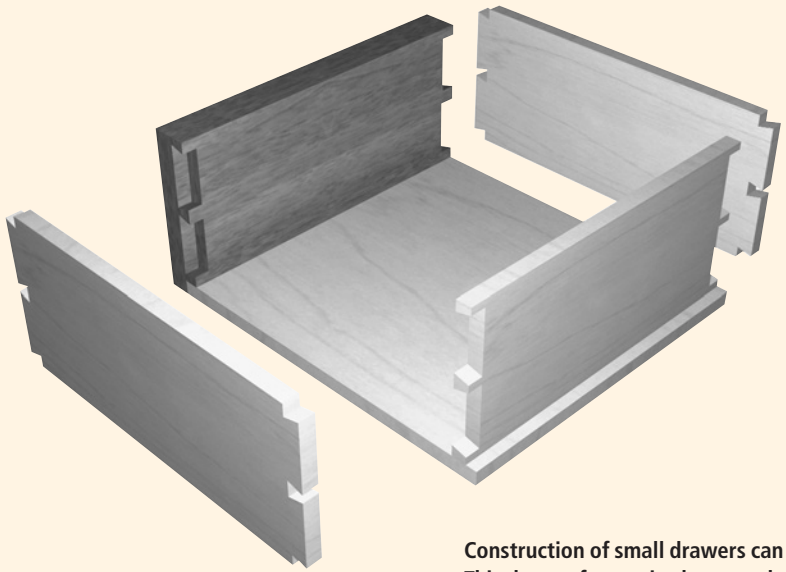


When building drawers with slides, the most critical dimension is the width of the assembled box. If you're off by more than 1/32", the slides won't work. It pays to mock up an assembled drawer to get the fit just right. Standard drawer slides usually need 1/2" of space between the drawer and case, so shoot for a drawer that's 1" less than the total case opening.

PRO TIP:

Finishing Might Not Always be a Good Idea

Think about what you will be storing in the drawers before you decide to finish the interior surfaces. Many finishes, especially linseed oil, emit an odor long after they've cured, and they may impart chemical smells.



Construction of small drawers can be simple. This drawer for a spice box uses half-blind dovetails to mate the front with the sides and through-dovetails to mate the back with the sides. The bottom is tacked to the sides and back using brads.

Making Drawers

As mentioned earlier, a drawer is a box without a lid that slides in and out of a larger box, chest or case. Most drawers have five parts – a front, a back, two sides and a bottom.

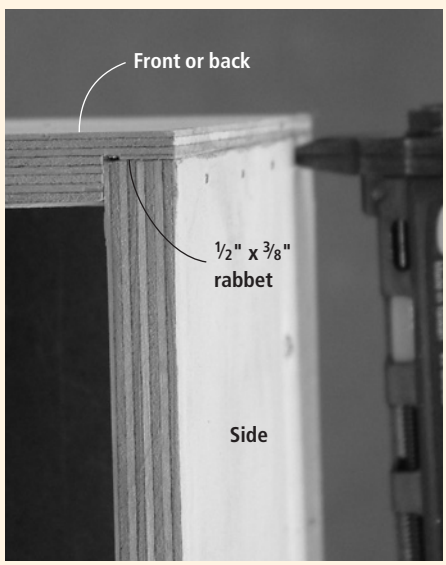
Drawers are classified according to how the fronts and faces fit their openings. They can be "inset" within the opening, they can "overlay" the face frame or front edges of the case, or they can be rabbeted or "lipped" so that only the lips overlap the case.

To a large degree, drawers are made the same way as the cabinets that hold them. The front, back and sides are arranged to expand and contract in the same direction and are joined rigidly at the corners. The bottom usually floats in a groove in the sides, free to move independently so its shrinking and swelling won't affect the overall drawer structure.

But there are significant differences between drawers and boxes. Typically, a drawer must withstand more punishment than a box. As you push or pull a drawer in and out, there is a good deal of stress placed on the corner joints. And because the drawer handles or pulls are attached to the front, most of this stress is concentrated on the front corners.

Consequently, drawers commonly are built with extremely strong joints at the front corners, while the back corners and the bottom are assembled with much simpler joinery.

There is another reason people opt to use different joints at the front of the drawer – traditionally, the drawer faces looked a lot like solid boards or panels in



Joining drawer sides to the front and back can be as simple as cutting a rabbet. Then you can use glue and nails to complete the joint.

a frame. So, the front joinery had to be hidden when the drawer was closed.

The joints listed below are common router-made joints used in drawer joinery (*many of these joints also were discussed in Chapter Four*):

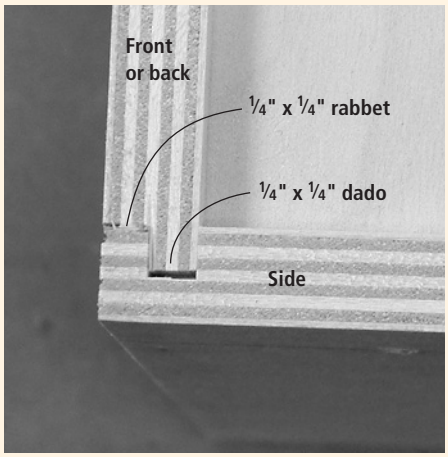
• **Reinforced Rabbets:** These are sufficient for light-duty drawers (shown below in the inset drawer). Just rabbet the drawer front, then secure the sides in these rabbets with glue, nails, screws or pegs. This joint also is frequently used to mate the drawer back and sides.

• **Lock Joints, or Tongue-and-rabbet Joints:** These work well for light- or medium-duty drawers. Cut dados in the drawer sides, and a tongue is formed when you cut a rabbet in the drawer front and back. Then insert the tongue in the dados. This joint (seen in the photo above right) can be used for the front and back joint in drawers, providing extra strength over a reinforced rabbet. Made using rabbeting, spline or straight router bits, these joints are a mainstay in commercial drawer joinery.

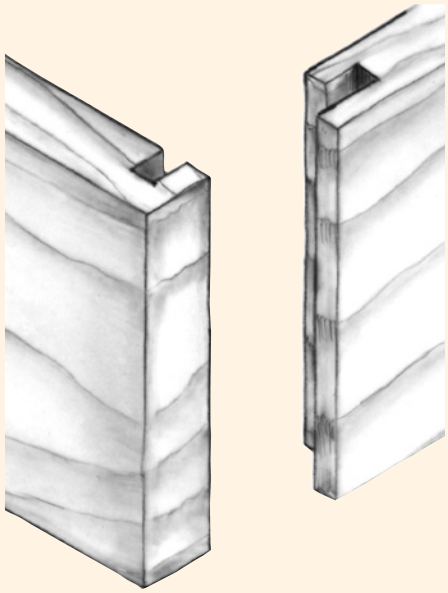
• **Sliding Dovetails:** These are strong enough for medium- and heavy-duty drawers. Simply cut a dovetail groove in the drawer front with a dovetail bit in your router, then cut matching tenons in the sides and slide them together. It's unlikely to be used for any drawer joinery other than attaching drawer fronts.

• **Half-blind Dovetails:** These are the traditional choice when you need heavy-duty drawers. The interlocking tails and pins offer an enormous amount of strength and they are relatively easy to make with a store-bought jig. Because they are "half-blind," they meet the requirement for being invisible with the drawer closed.

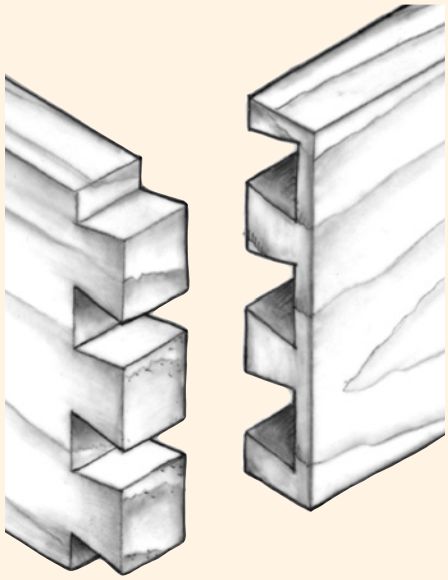
• **Through-dovetails:** These are a close cousin to the half-blinds. While they are easier to create, these joints will be visible from the front of the drawer. Because of this, a through-dovetail is often used for the back joinery in a drawer, while the more complicated half-blind dovetail adorns the front.



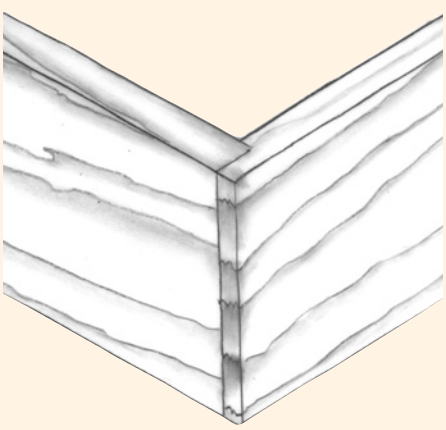
A simple and very common drawer joint in commercial furniture is the tongue-and-rabbet (or dado-and-rabbet) joint. It's made by simply running a dado in the drawer sides and then rabbets on the drawer fronts and backs. Both operations are best made with a router in a table.



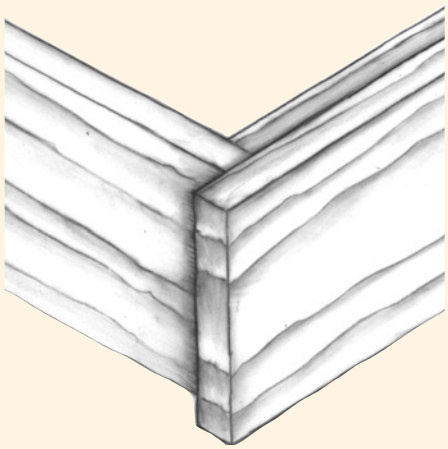
Half-blind tongue-and-rabbet



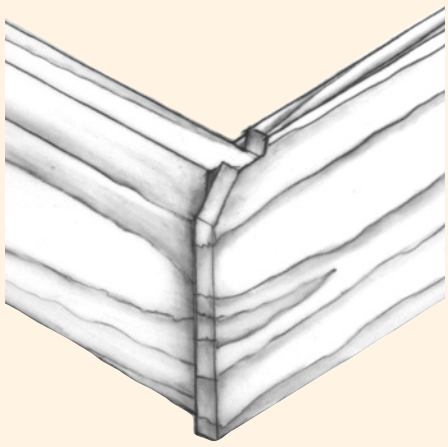
Half-blind dovetail



Inset drawer



Overlay drawer



Lipped drawer

TIPS & TRICKS

PRO TIP:

Plunge Router is Great When Cutting Box Cavities

When selecting a straight bit for cutting box cavities, look for one designed to be used with a plunge router. On these bits, the flutes protrude below the body of the bit so it can be used for boring as well as side-cutting. This makes it easier to rout a starter hole. Then simply enlarge it to make the cavity. Some bits are intended solely for side-cutting. Their flutes are almost flush with the bottom of the bit, making it difficult to plunge the bit into the stock. Also, these bits will burn the bottom of the cavity.

GREAT TIP:

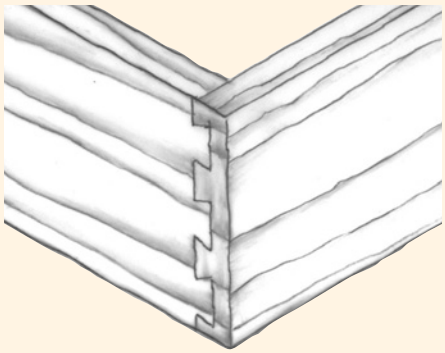
Work Loose when it's Cold, Tight when it's Warm

If your doors or door frames are made from solid wood, fit them loose in winter (when the wood has shrunk) and tight in summer (when the wood has expanded).

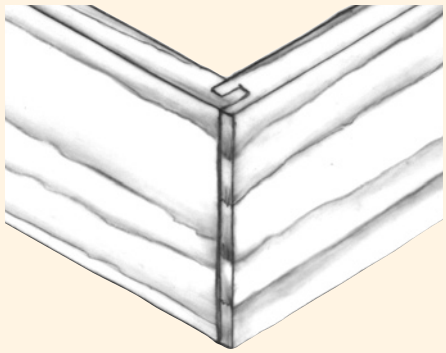
PRO TRICK:

Fake Out Your Family with False Fronts for Drawers

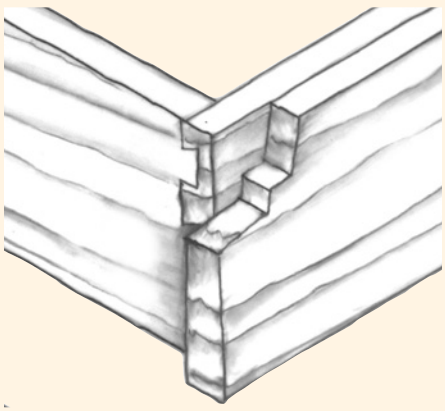
When making overlay or lipped drawers, fitting the drawer can be much easier if you use a false (or faux) front. After you complete the drawer box and install it, just apply a false front (either with screws or glue). Only the front needs to be fit to the cabinet opening, not the drawer. Double-sided tape makes a good temporary bond while you're fitting the fronts, and it will definitely make fitting your drawer fronts easier.



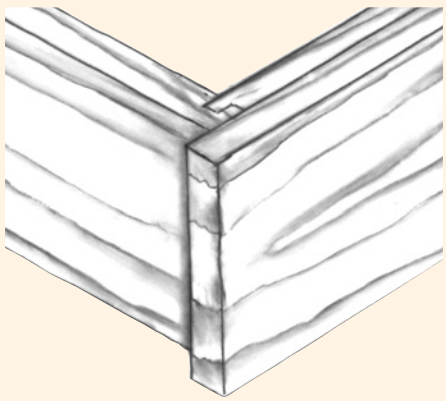
Half-blind dovetail



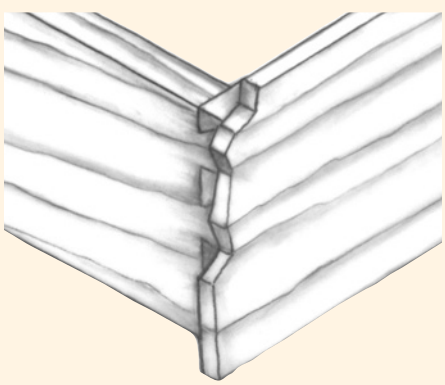
Half-blind tongue-and-rabbet



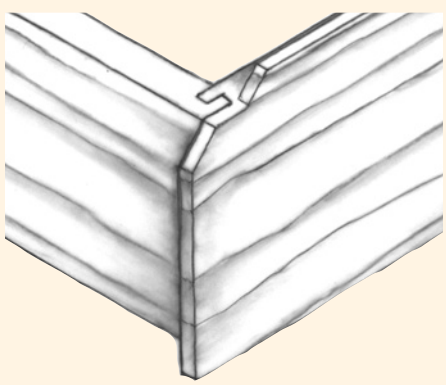
Half-blind dovetail with overlay false front



Tongue-and-rabbet with overlay false front



Lipped half-blind dovetail



Lipped tongue-and-rabbet

Joining the Bottom

The final piece of joinery in a drawer is finding a way to hold the bottom in place in the sides, front and back. Because the bottom usually floats, your choice of joints is more limited when looking to attach this piece.

Traditional solid-wood bottoms originally were made from ½" material and the edges were beveled or raised similar to the center section on a raised-panel door. This allowed the bottom to be captured in a relatively narrow groove (¼" or so) without losing any strength in the bottom. Raised-panel and straight router bits in a table-mounted operation make this joinery safe and fairly easy.

With today's wood technologies, ¼" plywood often is used to create very strong drawer bottoms with no extra milling required.

On many boxes and drawers, the

bottom is captured in a groove that is cut in the inside surfaces of the front, back and sides. Just slide the bottom into the grooves at the same time you assemble the box, making sure you don't get any glue in the grooves. Once the glue has had time to dry, the bottom will be permanently locked in place.

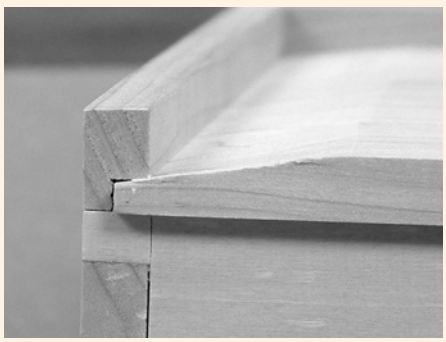
One common variation in drawers is to cut a groove in just the drawer front and sides, cutting the back narrower to stop at the top of the bottom groove. This allows you to slide the bottom into place after the drawer is assembled. Then the bottom is tacked in place on the drawer back. With less mess and haste while the glue is drying, this method also gives you a chance to square the drawer to the bottom.

Another drawer bottom joint can be made by cutting grooves into small strips of wood, then gluing the strips to the inside surfaces of the drawer. The kind of drawer bottom that rests in grooved slips is sometimes called a "French bottom."

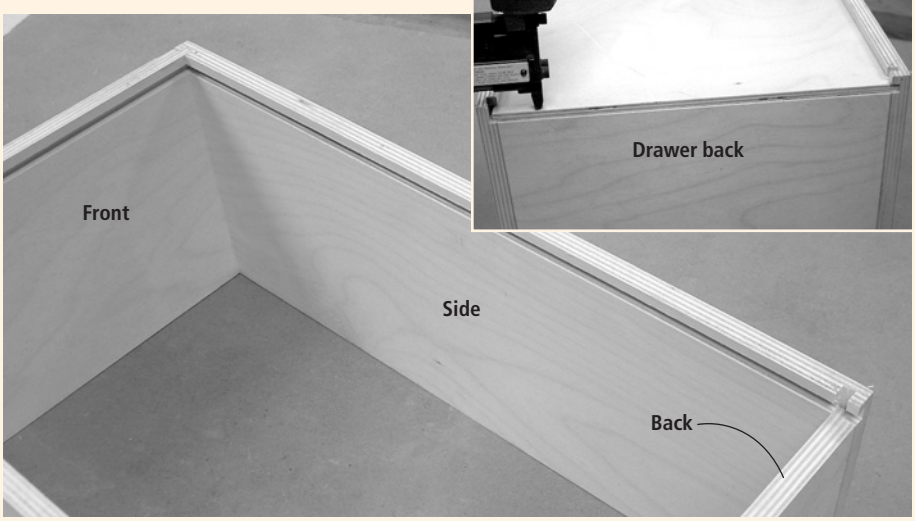
Or, if the drawer is particularly wide – so wide that a thin bottom might sag – you can divide the bottom into two or more sections with grooved dividers, also called "muntins."

If your project requires a removable bottom or if you must install the bottom after the rest of the parts are joined, you can rest the bottom on ledges or cleats, or you can screw it to the bottom edges of the box in some cases.

(Note: When you are fitting a solid-wood bottom in your drawer, you must remember to leave space for expansion. How much space depends on the width of the bottom. The rule of thumb is to allow ¼" for every 12" across the grain with plain-sawn wood and ⅛" with quartersawn wood.) **PW**



Traditional drawers used raised panels made of solid wood for the bottoms. These are easily made on a router table with a raised-panel bit, then fit into a standard groove in the drawer sides.



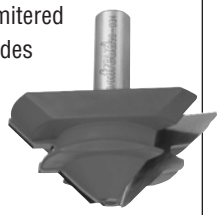
A simple drawer bottom is easily made from ¼" plywood. The sides and front of the drawer are grooved with a straight router bit, ¼" up from the bottom edge. The back is held short at the top of the groove. With the bottom slipped into the groove (shown in the inset photo), you can square up the drawer, then nail the bottom in place into the drawer back.

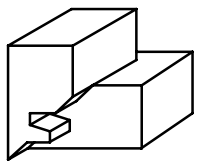
A BIT OF ADVICE

A router bit consists of a cylindrical shank (¼" or ½" in diameter) and one or more flutes or cutting wings, usually comprised of a piece of carbide brazed to the metal body of the bit. Throughout this series, we will be providing a closer look at many of the common and specialized bits that can be used with your router. These bits are great when using your router to make boxes and drawers.

Lock-miter Bit

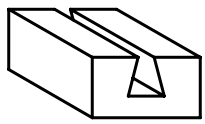
An excellent joint for mitered drawers, this bit provides extra gluing surfaces and locking strength. The same bit creates both joining edges by cutting one board vertically and the other horizontally with the same set-up.





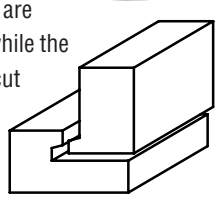
Dovetail Bit

This classic drawer joint adds extra locking strength and also a decorative feature. This bit is available in a number of different angles for use in softwoods or hardwoods.



Drawer-lock Bit

This bit lets you form a stronger rabbet joint between the sides and front of a drawer. The drawer fronts are cut horizontally, while the drawer sides are cut vertically against the fence of a router table.



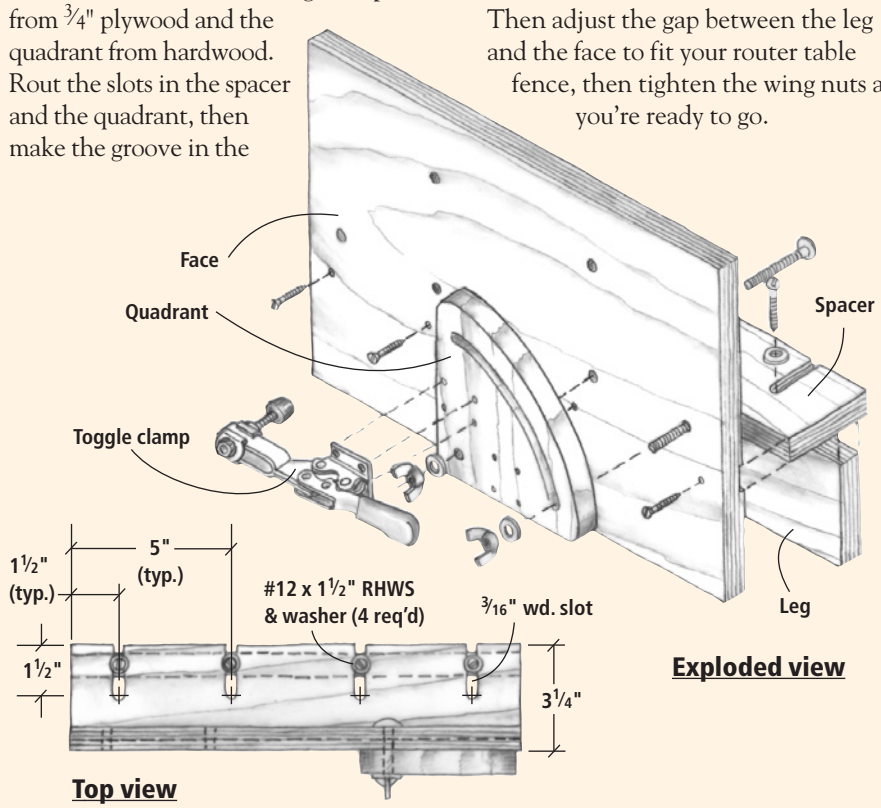
Tenoning Jig

A tenoning jig holds a workpiece vertically to make a cut in its end. This particular jig rides along the router table fence; the workpiece rests against a quadrant and a clamp secures the workpiece to the vertical face of the jig. You can adjust the angle of the workpiece between 45° and 90° by rotating the quadrant.

Make the vertical face, leg and spacer from ¾" plywood and the quadrant from hardwood. Rout the slots in the spacer and the quadrant, then make the groove in the vertical face. Next, drill the holes needed to mount the quadrant and the clamp.

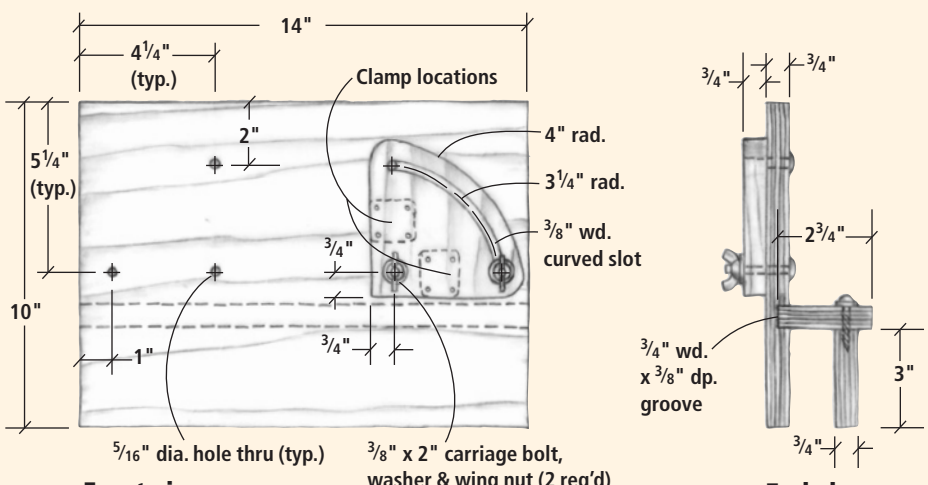
Glue and screw the spacer to the face. Secure the quadrant to the face with carriage bolts, washers and wing nuts. (Note that there are six mounting holes and the quadrant can be attached in four different positions.)

Attach the leg to the spacer with roundhead wood screws and washers. Then adjust the gap between the leg and the face to fit your router table fence, then tighten the wing nuts and you're ready to go.



Exploded view

Top view



Front view

End view

Everything you need to know about the router in our special series!

For many woodworkers, one of their first tools is the router, but there often isn't enough instruction about how to use it. This series aims to fix that by giving you everything you ever wanted to know.

Chapter 5
Use Your Router To Build Boxes And Drawers
An excellent application for a table or hand-held router, we'll show you a variety of ways to put your skills to use!

COMING IN FUTURE ISSUES

Chapter 6 (ISSUE #141)
Edge & Surface Treatments
Spice up your projects with these special edge shapes.

Chapter 7 (#142)
Advanced Techniques
We comb our resources to give you some special tips and projects to work on.

IN PAST ISSUES

Chapter 1 (#136)
Fixed-base Router
The basics of router set-up and rules every woodworker should know.

Chapter 2 (#137)
Plunge Router
An in-depth look at versatile plunge routers.

Chapter 3 (#138)
The Router Table
Learn which routers work best in a table and get lots of table tricks.

Chapter 4 (#139)
Router Joinery
A great tool for joinery, we tell you how to rout all kinds of tight joints.

Photo by Al Parrish

STICKLEY OTTOMAN

After half a dozen Morris chair plans, we decided it was time to help you put your feet up and relax.

A Morris chair (heck, almost any chair) just isn't complete without an ottoman to prop your feet on. Sadly, by the time you finish building the chair you're usually so glad to have completed the project that the ottoman gets delayed until later. Well, now is the time!

We've published a number of plans for Morris chairs in *Popular Woodworking* (most recently in

by David Thiel

Comments or questions? Contact David at 513-531-2690 ext. 1255 or david.thiel@fwpubs.com.

our special "Great American Furniture" publication, available online at popwood.com) in varying styles and by several designers. After looking at dozens of comparable ottomans, we selected a traditional and simple design from Gustav Stickley.

The #300 ottoman we used as a model is one of Stickley's earlier pieces. Originally offered with a hard leather seat, it sold for $7.50 in the 1912 catalog. Recent auctions have seen this simple piece sell for as much as $800.

The dimensions on our project match Stickley's, but we've updated the seat material to adjust the cost (as well as to make it a little more comfortable).

How to Build It

As far as furniture projects go, this is pretty simple. But it does give you a chance to work on a hallmark joint of Arts & Crafts furniture – the mortise and tenon.

There are four mortises per leg, but for the first-time builder the construction method used is very forgiving. The blind tenons, including the ones in the top rail joints (which ultimately are hidden by the upholstery) make this project pretty simple.

The simplicity of the mortise-and-tenon joint is spruced up a little on this piece with the addition of pegs, which make the joints more solid and add a nice decorative touch.

The more significant step only sharp-eyed woodworkers will notice at first is to make the legs from multiple pieces of wood. By doing so, the highly figured quartersawn white oak shows on all four sides. Mother Nature hasn't figured out how to do this yet, but we have.

Also, if upholstery is something that has kept you from trying this type of project before, don't sweat it. I'm hardly an upholsterer myself, and everyone who has seen my ottoman seems to think it turned out pretty well, so we've included a short story about the upholstery (see "Upholstery Made Easy" on page 61).

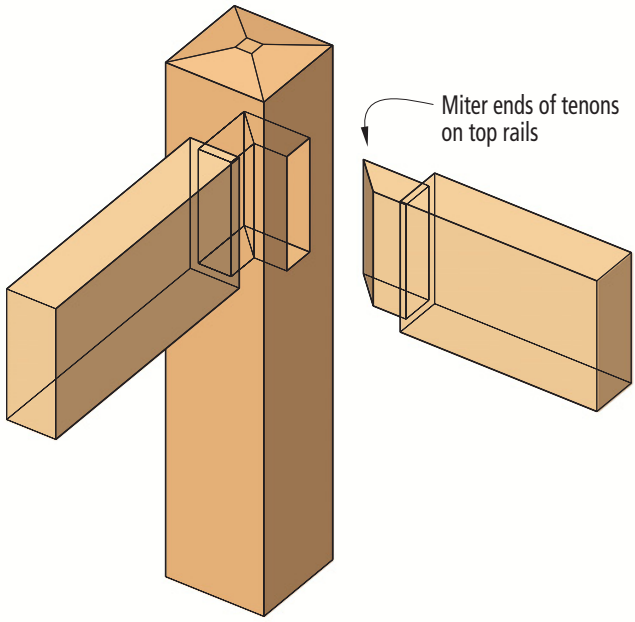
Four-faced Legs

Quartersawn white oak is one of the features that dresses up the plain styling of Arts & Crafts furniture. Cut from the center of the log out to the bark, the orientation of the growth rings runs almost perfectly perpendicular to the face of the board. This reveals splashes of "ray flake" that are beautiful to behold, but they only happen on the perpendicular faces.

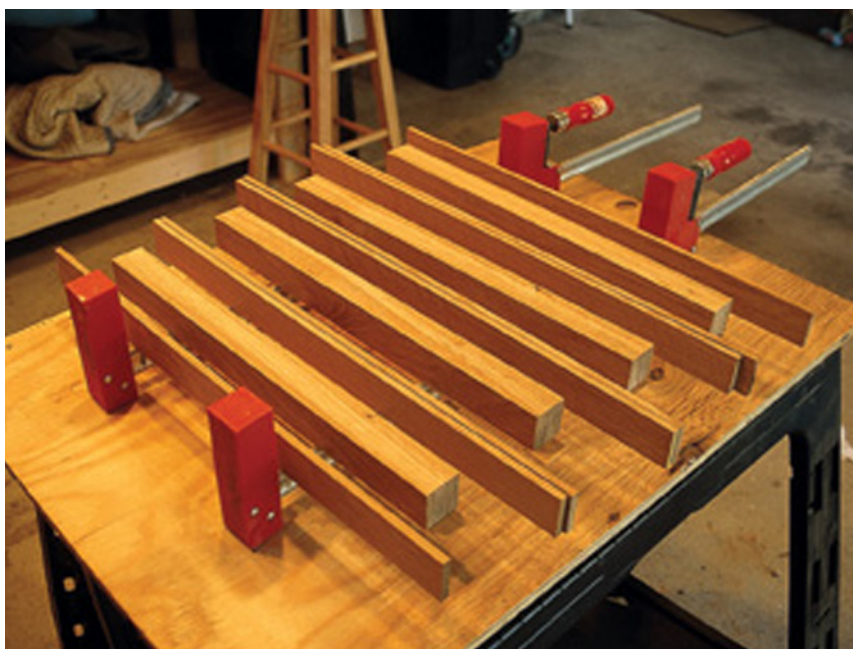
There are a couple of good ways to give the legs this "ray flake" on all four faces, but Stickley chose to simply add quartersawn veneer to the two flatsawn faces, which I copied.

Start making the legs by cutting eight leg halves that are $\frac{7}{8}$" x 2" x 16". The $\frac{7}{8}$" thickness will require you to start with 4/4 rough lumber, but ultimately the oversized dimensions will be to your benefit, as you'll see.

First, glue each of the four leg



Top rails and leg joint



To offer four faces with quartersawn white oak on each leg, the leg centers are glued then planed to $1\frac{5}{8}$" x $1\frac{3}{8}$". Then the $\frac{1}{8}$" or $\frac{1}{4}$" oversize "skins" of quartersawn veneer are glued to the flat-sawn faces. After the glue dries, plane the legs to their finished $1\frac{1}{2}$" x $1\frac{1}{2}$" dimension.

Choosing the best grain pattern to face "forward" is a tough call. In any case, take a close look at the grain on the pieces for your legs and mark the tops to offer the best look.

pairs together, face-to-face, orienting the best quartersawn grain pattern to the outside. When the glue has dried, square one corner of each piece on the jointer, then size each leg (using your table saw, then your jointer for a final pass) to 1⅝" (across the face that shows a seam) x 1⅜" or slightly larger (across the quartersawn face).

These dimensions will allow you to add ⅛"-thick veneer to the two layered faces, then run the entire leg down to 1½" square, leaving an almost invisible veneer face on two sides.

Next, run eight veneer pieces to ⅛" x 1¾" x 16". If ⅛" is thinner than you're comfortable running on your planer, leave it at ¼" – just know that you'll have to plane more off those faces after glue-up. Glue the veneer pieces to the leg blanks, making sure the veneer extends over all the edges.

After the glue has dried, trim the veneer pieces flush to the leg centers (I used a No. 3 hand plane). Then run the veneer faces through the planer (alternating sides on each pass) until the leg is 1½" square. Trim the legs to length for a four-faced leg.

Making the Holes

The next step is to find where you want the mortises to be on the legs. First determine the orientation of the legs (best faces out), then use the illustrations on page 60 to mark the mortise locations.

The mortises can be ⅜" wide, and that's fine, but to be honest with you, I had a ½" mortise chisel in my mortiser, so that's where they ended up. I cut the mortises 1 1/16" deep to allow an extra 1/16" for glue squeeze-out. Cut the mortises, then be sure to clean the chips out of the bottoms so the tenons will seat properly.

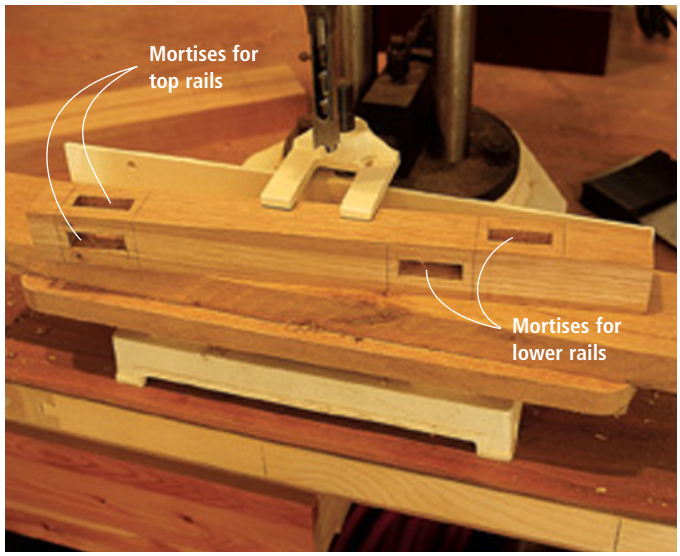
Filling the Holes

I cut my tenons on the table saw with a single combination blade. If you have a dado stack on hand, use it. A dado stack will allow you to cut your tenons faster.

Because my mortises are ½" wide, all of the shoulders on my tenons are ⅛". This makes it unnecessary to change the blade height when moving from face to edge shoulders.

Because the top rails all are at the same height on the legs, the tenons will bump into each other before fully seating against the leg. Take a minute to miter the ends of the tenons on the top rails so they can meet without interfering with the fit. Because the lower rails are staggered in height, this isn't a problem.

With all the tenons cut, test-fit the ottoman. Assemble both ends, then insert the longer rails between the two assemblies. The tenons should require a little wiggling to slip all the way into the mortises, but you shouldn't have to bang on them with a hammer. Check to be sure that all the shoulders fit flush against the legs without any gaps. When all the joints are acceptable, go ahead and disassemble the frame.



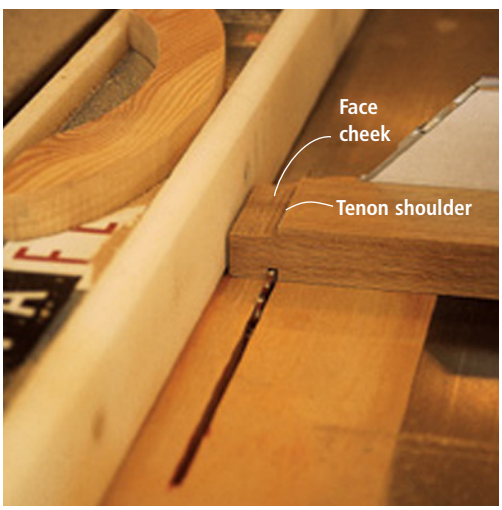
The mortises for the top rails are on adjacent inside faces and intersect in the middle of the leg. The mortises for the lower rails are staggered to fit one on top of the other. I used a benchtop hollow-chisel mortiser to make quick work of the mortises, but a router (or even a chisel and mallet) will work just as well.

Topping the Legs

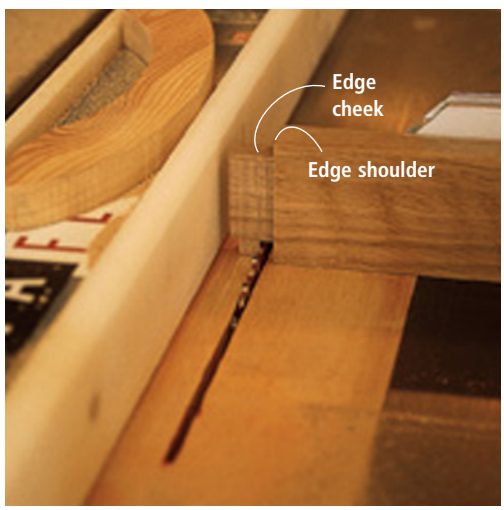
When laying out the mortise locations on the legs, you will probably notice that the top rails will sit 1" short of the tops of the legs. Don't freak out – you didn't do anything wrong. This extra space leaves room for the upholstery material and space for you to bevel the tops to dress them up a little.

Dig through your toolbox for a combination square or other similar tool that will help you mark a line ⅛" down from the top of the leg on all four faces.

Then set your disc sander's table to a 12° angle and, using a miter gauge on the sander, slowly bevel the tops of the legs on all four sides. This will leave a ¼" x ¼" square at the top. This bevel is a great detail.



The shoulders for all the rail tenons are made with little fuss on the table saw. Define the shoulder on the first pass using a miter gauge for support, then nibble the rest of the material away, backing the piece away from the rip fence.



Cut the adjacent shoulders and cheeks in the same manner. I'm using a combination blade here, which leaves a corduroy-like finish on the cheeks. Because of that, I've left the tenons oversized and will use a shoulder plane to pare them to fit.

One of the most visible details on the ottoman is the shallow bevel on the leg tops. You could make the cuts using a table saw or miter saw, but I took advantage of a benchtop disc sander that let me fine-tune the bevels as I went.

Steel Edge or Mineral Grit?

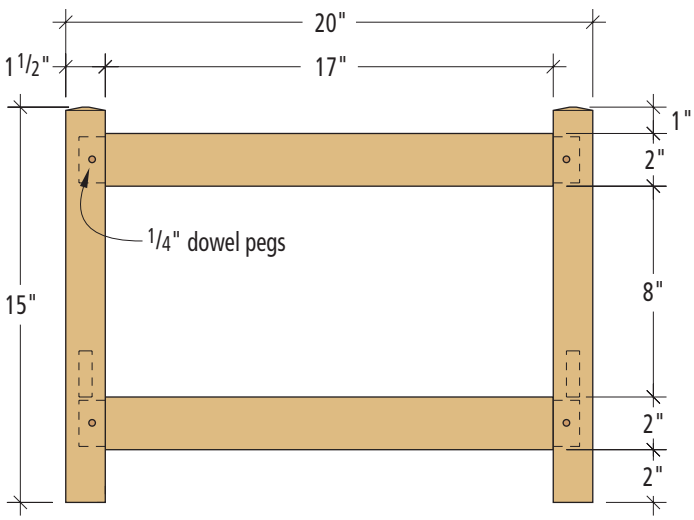
Now is the appropriate time to smooth the wood to the surface finish that you prefer. While we'll often just tell you to sand through grits from #100 to #220, there is another option here.

Because of the possible dramatic effect of the grain in the quartersawn white oak, preparing the wood to best present the grain is important. When you sand wood you effectively tear the ends of the fibers to smooth the wood surface. This leaves a feathery end to the grain structure and can obscure the grain pattern and affect the way the wood takes a stain.

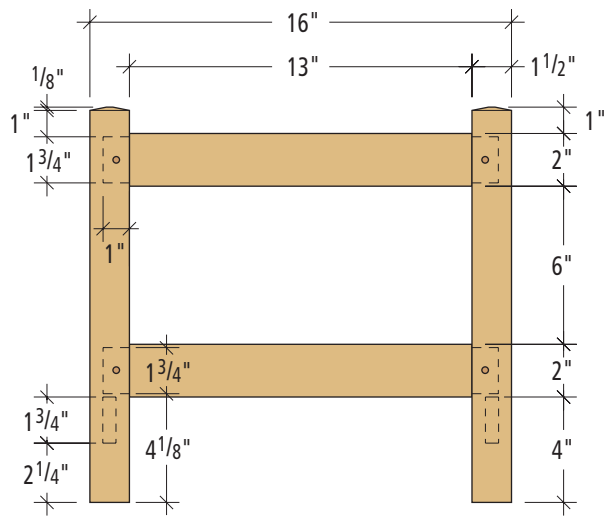
A better method for this project is to cut the ends of the fibers using a hand scraper or scraper plane. With a little extra effort (and a lot less dust) you can leave crisp ends on the fibers that will really let the ray flake pop when you add the finish.

Ready for Assembly

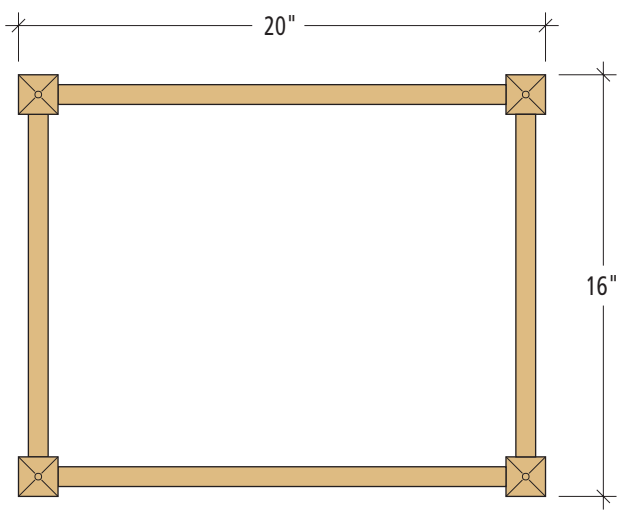
With all the pieces test-fit and sanded (or scraped), you're ready to put the ottoman together.



Elevation



Profile



Plan

STICKLEY OTTOMAN

	NO.	ITEM	DIMENSIONS (IN.) T	W	L	MATERIAL	COMMENTS
❑	4	Legs	1 1/2	1 1/2	15	White oak	
❑	2	Lower rails	3/4	2	19	White oak	1" TBE
❑	2	Lower rails	3/4	2	15	White oak	1" TBE
❑	2	Top rails	3/4	2	19	Poplar	1" TBE, mitered
❑	2	Top rails	3/4	2	15	Poplar	1" TBE, mitered

TBE = tenons both ends

Just as with the test run, assemble the ends first, applying glue to the inside of the mortises, lightly covering all four walls. Applying the glue to the mortise rather than the tenon will keep glue squeeze-out (and clean up) to a minimum.

With the ends assembled and clamped, go ahead and insert the long rails and clamp them as well. You're nearly done.

A Bunch of Pegs

The last detail before finishing is to peg all the tenons. I use ¼" red oak dowel stock for this step. You can use white oak, but the white oak dowels are harder to find at the store, and the red oak makes the pegs stand out a bit more on the leg once color is applied.

Chuck a ¼"-diameter bit into your drill and use a drill stop collar or a piece of tape to make the 1" depth necessary to drill through the tenon and into the opposite wall of the mortise.

Mark all the peg locations, then start drilling. You can peg the holes as you go (add the glue to the hole, not the peg) or wait until all the holes are drilled before starting to glue.

Cut all the pegs ¼" longer than the depth of your holes. Then, when the peg is fully seated in the hole, trim the excess with a flush-cut saw with little or no set to the teeth. If you don't have such a saw, slide a piece of cardboard under the blade to keep from scratching the face of the leg. (Another option is to build "A Jig for Precision Trimming" that Nick Engler discusses in "Ingenious Jigs" on page 34.)

Do a little more sanding or scraping around the pegs and you're ready to break out the dye.

Color Me Nutty Brown

As mentioned, quartersawn white oak can be amazing to look at, but a finish designed to enhance the wood helps a lot.

I use a water-based aniline dye to put the first layer of color on the wood. Because the dye is water-based, it will raise the grain when applied. So to prepare the wood for finishing, I first wipe down the entire piece with a damp cloth (just water) then hand-sand the piece with #220-grit paper to knock off the burrs.

Next, add the aniline dye and let it dry overnight. Then it's time for a coat of brown glaze. The glaze is a stain, but it's the consistency of thin pudding and will lay on the wood and fill the grain slightly. Let the color infuse the grain, but be sure to wipe off the excess or it will hide the wood.

Let the glaze dry overnight again, then you're ready for your favorite clear, protective top coat. With a project this size, I often use lacquer in a spray can with good results. The rest is upholstery. Use the story below to help you through these steps.

Then you're ready to put your feet up and relax. **PW**

SOURCES

Woodworker's Supply
800-645-9292 or
woodworker.com

1 oz. • J.E. Moser's Golden Amber Maple water-based aniline dye #844-750, $13.99

Woodfinishingsupplies.com
866-548-1677

1 qt. • Valspar warm brown glaze, #WL6100-25, $10.99

UPHOLSTERY MADE EASY

If you've been waiting to tackle a first upholstery project, this is a simple one. All you need are a few yards of black muslin (or similar material), some foam block, batting and a finished cover of your choice.

You can find all the materials you need to upholster furniture at your local craft-supply store or fabric store. I bought all of my materials at a local Michael's.

As you can see, I used my pneumatic stapler (a wide-crown is great if you have one, but narrow-crown will work in a pinch), but you can use standard upholstery tacks as well. The photos walk you through all the steps except the finished cover, which is the same as the last batting layer (shown in photo 4).

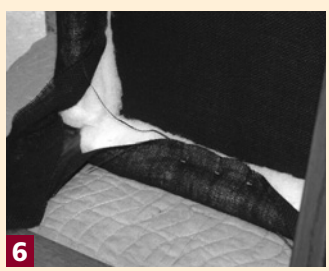
Start by mitering the corners of the muslin around the legs and tacking the edges to the inside of the rails, tightening the material as you go.

Cut out the corners of the batting sheet and wrap it around the legs and rails, tightening as you go. Tack the batting to the inside of the rails.

A layer of 2" foam will add cushion. The piece should be cut to fit just inside the rails and will lay in place on the first batting layer.

A second layer of batting holds the foam in place. It is cut and attached exactly as the first layer, but keep tightening the material to maintain a uniform look.

A top layer of muslin covers the batting and foam. The corners are miter-cut, then folded around the legs to avoid loose strings and unraveling.



The final muslin layer is tucked around the rail and tacked at the center. Then work out towards the legs, rolling and tacking as necessary. Trim any excess.

CAN YOU HEAR ME NOW?

Good.

Woodworking can destroy your hearing in a hurry. Learn the right ways to protect it.

Safety devices are commonplace around our homes and workshops. We wear gloves to protect our hands, boots to protect our feet and eyeglasses to protect our eyes, but when it comes to our ears, more often than not we can't be bothered with the extra effort. Hearing protection often is overlooked or ignored.

And we always have a good excuse for not wearing hearing protection. Which of the following more-common ones sound familiar to you?

- "I'm only using the tool for a minute or just one cut."
- "I didn't think about it until after the job was done."
- "They're uncomfortable."
- "I couldn't find them."
- "My hearing is already shot."

Well, I'm here to tell you that whatever your excuse might be, there is no excuse for going without hearing protection. As you will see from research and the charts on the following pages, power tools (either while cutting wood or just running idle) are more dangerous to your hearing than you probably suspected.

I'll also show you some of the easiest (as in cheapest) ways you can protect your ears, as well as some of the better (and a bit more expensive) ways to prevent hearing damage and loss.

by Cynthia S. Eades

Cynthia Eades has been a board-certified audiologist for 13 years and is currently completing her doctorate in audiology with an emphasis on recreational noise exposures and hearing loss.

The Research

In the workplace, hearing protection is strongly recommended and monitored. In the early 1970s, the Occupational Safety and Health Administration and the National Institute of Occupational Safety and Health (NIOSH) established guidelines for occupational noise exposures. These guidelines were to protect workers from noise-exposure levels that were known to cause irreversible hearing loss.

Noise levels in workplaces are measured in decibels (dB) that are "A-weighted" (dBA). A-weighting places emphasis more on the frequencies that the human ear is most attuned to (500-8,000 hertz) and gives a more accurate guide to the noises that will im-

pact human hearing than other scales that measure noise.

A 1998 NIOSH report said that 8 percent of workers without hearing protection who are exposed to noise levels of 85dBA during an eight-hour workday will experience some permanent hearing loss in their lifetime. For every 3dB increase, a worker should spend half as long exposed to the noise to prevent significant permanent hearing loss.

Industrial companies pay very strict attention to these workplace hearing safety recommendations. However, when it comes to leisure time noise concerns (such as woodworking), the only monitoring agency is you.

I've also heard woodworkers argue against hearing protection because they say they can't communicate easily while wearing it. If the noise levels in the workshop are below 80dBA, then yes, the ability to understand speech can be affected by hearing protection. However, when the noise pushes above 85dBA, it's been proven that hearing protection devices improve speech recognition (*Noise & Hearing Conservation Manual; American Industrial Hygiene Association, 1986*).

Why? As the noise gets louder, the lower frequencies (less than 1,000 hertz) in the noise will mask the higher speech frequencies (1,000-8,000 hertz). However, when a hearing protection device is used properly it will reduce the overall noise levels (mostly the lower frequencies) and the auditory system is able to regain use of the frequencies in the speech spectrum (500-8,000 hertz).

For those of you who think your hearing is already damaged and don't know why you should bother with protection, know this: Carelessly exposing yourself to even more damaging noise can only make your hearing loss worse. So take a few simple steps to protect the hearing you still have.

How Loud is Your Shop?

The chart at right displays the noise levels of common power tools (running idle and while doing work) in the *Popular Woodworking* shop. While these tools may not be the same ones in your shop, the list should give you a good indication of the noise levels you're experiencing.

We've also included a chart on page 64 that illustrates the noises that are dangerous to your hearing. The colored column of the chart shows the amount of time you can safely be exposed to each noise level without causing hearing damage.

Once you use the charts to get an idea of how noisy your workshop really is, you're ready to learn all about the different types of hearing protection available, which are generally categorized as either muffs or plugs.

How Noisy is the *Popular Woodworking* Shop?

Woodworking tool or machine*	dBA @ 3' (no load)	dBA @ 3' (under load)
Table saw (10" Powermatic 66)	77	85
Jointer (Bridgewood 12")	80	92
13" portable planer (DeWalt DW735)	94	101
20" planer (Bridgewood BW20PV)	84	99
16" band saw (Jet JWBS)	65	93
Drill press (Fisch 17½", ¾-hp)	70	83
Router (Makita RP1101, 11-amp)	88	93
Router table (Bosch 1617EVS in Bench Dog)	100	97
Corded drill (Craftsman 279940)	90	88
Cordless drill (Metabo BST 12 Plus)	77	85
5" random-orbit sander (Ridgid R2600)	83	84
Biscuit joiner (Porter-Cable 557)	95	94
Dust collector (Delta 50-840, 1-hp)	80	n/a
Dust-collection system (Oneida cyclone)	adds 6dBA	

*Measurements were made with each tool used separately. The levels were higher with multiple tools in use.

Two Kinds of Muffs

All muffs are designed to completely surround the outer ear (technically called the "pinna"). Some specialized muffs are designed specifically with visors, safety glasses and helmets.

Muffs vary in weight and comfort by the size of the headband, the earcup and the amount of

WHAT ARE THE EARLY SIGNS OF HEARING LOSS?

Noise-induced hearing loss is caused by exposure to high levels of noise in a work or recreational environment. Of the 28 million people in the United States with hearing loss, nearly one-third of them attribute their loss (at least partially) to noise exposure.

While it's not curable with medical treatment or surgery, it is preventable. Hearing loss can be temporary following exposure to noise, or it can be permanent following extreme, frequent or prolonged noise exposures.

While the degree or amount of hearing loss varies, there are some common signs:

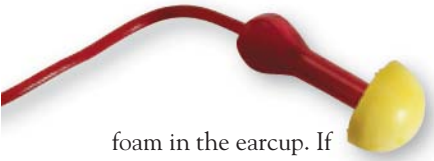
- Increased difficulty communicating with family or friends.
- Increased difficulty communicating in social environments.
- People say you like the television or radio too loud.
- Increased difficulty talking on the telephone (either cellular or a land line telephone).

Another symptom of hearing loss is a noise heard internally that some people describe as ringing, buzzing or humming, called "tinnitus." More than 50 million Americans have tinnitus to some degree. Severe tinnitus can be annoying, distracting, distressful and can lead to loss of sleep.

Besides noise exposure, there are other causes of tinnitus, such as too much wax in the ear, head and jaw injuries, stress, cardiovascular disease, hypertension and medications (both over-the-counter and prescription). For people who experience tinnitus, suspect they have a hearing loss or have been exposed to loud noise, it is recommended they request a referral for a hearing test by an audiologist from their physician.

If you already know you have hearing loss, continuous or prolonged exposures to noise can further damage your hearing sensitivity. Take the steps to protect what hearing you have:

- Use hearing protection devices properly and regularly.
- Limit the time you are exposed to noise.
- Get your hearing checked by a professional. – *CE*



foam in the earcup. If your muffs aren't quite comfortable, you shouldn't alter the headband or foam to make them fit better – this will reduce or eliminate their effectiveness. Instead, you should purchase a more comfortable set of muffs.

Muffs can be divided even further into two designs – passive muffs and active muffs.

Passive muffs are the most common and can be found at your local hardware or sporting goods store. They should sit flush to the head without hair or glasses compromising the seal. The headbands usually are intended to be worn over the top of the head; changing the orientation can reduce the muff's effectiveness, so be sure to check the manufacturer's labels before changing the way you wear them.

Active muffs are battery-powered with a volume control and are either level-dependent or have Active Noise Reduction (ANR) technology. Level-dependent active muffs reduce the noise level when the environment or equipment noise level gets above a certain decibel level set by the manufacturer (typically 85dBA).

ANR muffs work by monitoring sound at the ear. A microphone measures or predicts the noise spectrum and creates an out-of-phase signal to reduce the sound spectrum. This technology is practical only for continuous noise spectra (i.e., airplane noise, manufacturing, trucking, etc.) where the noise is on for a sufficient time, allowing the circuitry to detect it. It isn't practical for random or intermittent noise because the circuitry may not have enough time to actively control for short duration noise exposures (such as when using a miter saw).

There is an added risk with these kinds of muffs – you must be sure they don't cancel warning or alarm noise, which would be a huge safety issue. Check with the muffs' manufacturer for more information on this.

All active muffs allow you to hear voices and other sounds in your work environment and are best used where there are multiple pieces of equipment running continuously. They also are helpful for people with existing hearing loss because the muffs let them hear their environment while still protecting their ears from further damage. Caution should be used in setting the volume control on these devices.

While it sounds like a good idea, stereo headphones should not be worn under any muffs. The wires of the headphones (much like eyeglass frames) will compromise the seal on the muffs and reduce or eliminate effectiveness. More likely, people usually set the volume high enough to be heard over the background noise, effectively increasing the noise level experienced so it's louder than the machines and moving the noise right up to the ear.

There are, of course, muffs designed with stereo devices built into the headset. If you're considering this type of device, you need to be cautious and set the volume to the point where you

SAFE EXPOSURE TIMES FOR COMMON NOISES

dB	NIOSH* max. time unprotected exposure	Sounds and noises
180		Rocket launch pad
170		Car's air bag deployment
165		Cap gun, starter pistol, 12-gauge shotgun
160		30.06 rifle
155		Revolver
150		Helicopter
140		Jet engine at 40 feet
130		Jet take-off at 150 feet, air-raid siren
125		Rock concert, ambulance or fire engine siren
120	Not recommended	Car horn, nightclub
115	30 seconds	Sand blasting, pneumatic percussion drill
110	1 minute 30 seconds	Chainsaw, symphony orchestra, airport runway
105	5 minutes	Woodworking shop, jet at 1,000 feet
100	15 minutes	Garbage truck, cement mixer, cafeteria
95	48 minutes	Circular saw, farm tractor, movie previews
90	2 hours 30 minutes	Lawnmower, subway, alarm clock, hair dryer
85	8 hours	Blender
80	No limit**	Garbage disposal, vacuum cleaner, phone ring
75	No limit	Washing machine, average radio
70		TV at 6 feet, small party (4-6 people)
60		Normal conversation
50		Rainfall, ambient house noise
40		Refrigerator humming
30		Whisper
20		Rustling leaves
10		Normal breathing

*National Institute of Occupational Safety & Health **Protection recommended, but not required. More available in "Noise Exposure From Leisure Activities: A Review" in Journal of Acoustical Society of America (1991) – asa.aip.org

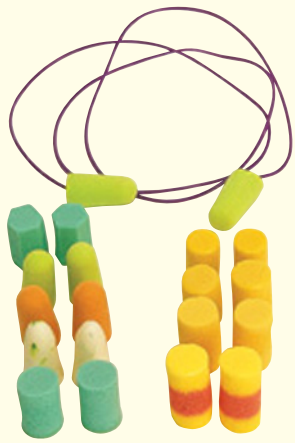
MUFFS AND PLUGS: PROS & CONS

PASSIVE/ACTIVE MUFFS

PRO: Both muff types are easy to use, easy to find in the workshop and easy to put on and remove. They also offer different types of fit: tight to the ear or with more ear space (shown at right in close-up).

CON: Muffs have a moderate initial cost and you must inspect and replace the earcup seals periodically. They offer more variable Noise Reduction Rating (NRR) values (10-28dB) compared to other devices. Performance is reduced by the wearing of eyeglasses, helmets, visors and hard hats. Active muffs are more expensive and have to be maintained to ensure adequate performance.

FOAM EARPLUGS



PRO: Inexpensive (less than $2/pair), readily available, comfortable, disposable, available with or without safety cords, moderate-to-high NRR values (25-30dB).

CON: Effective for no more than two or three insertions with care, can be difficult to position properly, easily contaminated, can compact earwax, easy to lose. The depth of insertion significantly affects performance if not installed properly.

CUSTOM PLUGS

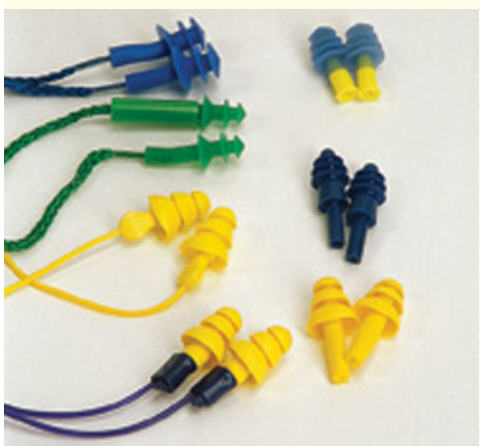
PRO: Comfortable, washable, easy to use with instruction, moderate-to-high NRR values (25-30dB).

Con: Expensive ($35-$50), can compact earwax, easy to lose, must watch for hardening and cracking, best if replaced every one to two years depending on amount of use.

PLASTIC EARPLUGS

PRO: Inexpensive (less than $5/pair), washable, disposable, moderate-to-high NRR values (25-30dB).

CON: Don't fit everyone, can be difficult to position properly, easily contaminated, can compact earwax, easy to lose, must watch for hardening or cracking, best if replaced every three to six months depending on amount of use. The depth of insertion significantly affects performance if not installed properly.



EARCAPS

PRO: Inexpensive (less than $10/pair), easy to use, easy to remove and replace with dirty hands, lightweight, comfortable, compact, have washable replacement pods. These are designed for intermittent or short-duration noise exposure.

CON: Do not fit all individuals, can be difficult to position properly, can compact earwax, low-to-moderate NRR values (15-25 dB).

– CE

can still hear a person talking to you from three feet away. Using stereo earpieces (whether they are plug or muff design) as hearing protection won't work. These devices are not rated or evaluated for hearing protection.

Lots of Plugs

Plugs can be found in many shapes, materials and colors. They are either one-size-fits-all or they can be custom-made.

Plugs that are one-size-fits-all usually are made out of a foam or soft plastic material. The foam materials usually are designed for a single use or for a few insertions (if the plug remains dirt-free). Those made of a soft plastic material are designed for multiple uses and can be cleaned with soap and water.

Plugs can be shaped as cones, mushroom caps, cylinders or bullets. They are designed to fit almost completely into the ear canal (with only a small bit of the plug showing, see "Proper Fit for a Foam Plug" at right) or they are designed to seal only the ear canal opening. It's extremely important to review the insertion instructions from the manufacturer prior to use.

Plugs are only as good as the seal they create for your ear. If you try a particular type and find that it doesn't fit well, try another. Plugs with a handle or those on a retention band are appropriate for use with short duration noises or when your hands are dirty. Be sure to clean your hands before touching the end of the plug that goes into your ear canal. Everything on the plug will come in contact with your skin, and some products in your shop shouldn't ever come in contact with skin.

Custom-made plugs are crafted from an ear-mold impression that can be taken by a licensed audiologist or a certified hearing aid dispenser (check out the story "Getting a Custom Earplug Made" on page 67 for more information).

What it Sounds Like

Here's an easy way to determine if your hearing protection device is on properly. Take your index finger and push on the skin just before the right ear canal opening to close it completely. Then say a few words out loud. Your voice should sound a bit louder in your left ear.

Next, while keeping your right ear plugged, plug your left ear canal opening in the same manner. Repeat the same words and your voice should now sound like it is near the center of your head or in the front of your throat.

When you position a plug or put a set of muffs on correctly, you should experience the same effect. If your voice sounds louder in one ear after you have positioned the hearing protection device, reposition the protector on the side that sounds the loudest.

When you are wearing hearing protection, it's normal for you to hear your own voice louder than you hear other people's voices. If you are working around others in your shop, you will need to raise your voice slightly to be heard by others around you (especially if they are also wearing hearing protection).

Even if you are wearing a hearing protection device, you should still be able to hear warning signals (such as a smoke alarm). The hearing protector will reduce the overall amount of noise but will not eliminate it completely. This is also true of active hearing protection devices that react to noise when it reaches a particular level established by the manufacturer.

Which Device Should I Use?

While each type of hearing protection device has a different level of effectiveness, the best protection is figuring out which one you will actually use. Wearing hearing protection should be as automatic as wearing eye protection or proper shoes when you operate power tools.

Hearing protection devices are rated with a number value for their effectiveness in reducing noise called the Noise Reduction Rating (NRR). I have provided images of some typical types of hearing protection and included their effective noise-reduction ranges (see "Muffs and Plugs: Pros & Cons" on page 65).

The NRR was implemented by the Environmental Protection Agency. The EPA includes a dis-

PROPER FIT FOR A FOAM PLUG

When you're using a foam plug (which are the most common types of earplugs on the market because of their cost and disposability), you need to be sure you know the proper way to install it. An improperly fitted foam plug won't do you any good – and it could even do some harm.

As you can see from the photos, there is a wrong way to install the plug (top), and a right way (bottom).

You might think that the correct version is pushed into the ear too far, but you're wrong. There's a lot of space in there, and you want to make sure you seal the ear canal opening.

It's very important that you read the insertion instructions from the manufacturer before using any of these products. – *CE*

ONLINE INFORMATION ON HEARING SAFETY AND HEARING LOSS

American Academy of Audiology – audiology.org

American Speech-Language-Hearing Association – asha.org

American Tinnitus Association – ata.org

Better Hearing Institute – betterhearing.org

League for the Hard of Hearing – lhh.org

National Hearing Conservation Association – hearingconservation.org

National Institute of Occupational Safety and Health – www.cdc.gov/niosh

claimer that the rating of a device does not guarantee its effectiveness. Why? Because the manufacturers don't know if you're using the device correctly.

Also, hearing protection devices are tested and rated under laboratory conditions where participants are monitored and educated and, in some cases, another person inserts and positions the devices. Muffs are easier to position properly than plugs.

If you know that the noise level of your planer while in use is 99dBA and you choose a pair of muffs that have an NRR of 20dB (which is about 10dB of effective protection), then the noise level at your ear when you are working with your planer will be about 89dBA. With these conditions and muffs, you can afford to work for about four hours and be adequately protected.

Oh, and wearing two hearing devices (such as muffs over plugs) simultaneously doesn't double your protection. It will increase the protection, but the increase is likely adding about 3dB to the effective protection of the plugs.

Not Just in the Shop

Hearing safety isn't only necessary in the woodshop. Yard and garden tools (lawnmowers, weed whackers, leaf blowers, edgers, trimmers, snow blowers and more) also can significantly contribute to damaged hearing.

A good rule of thumb for when you should be wearing hearing protection is if you have to speak louder to be heard. That's in a shop with equipment running, not a quiet room. The ambient noise level where you need to raise your voice to be heard three feet away is around 85 dBA.

So when you operate a tool or device where you need to raise your voice to talk to a person at arm's length you should be looking around for your hearing protection device.

The Bottom Line

I've given you a lot of information in this article about many different hearing protection devices. You now have two questions to ask yourself: Which type of hearing protection device is best for your needs? And are you willing to take the steps to protect your hearing?

I hope the information here has given you a clear look as to what hearing protection is best for you, but you'll have to decide if protecting your hearing is worth the extra effort. It's my hope that you'll decide it is, because otherwise you won't be able to hear the praise your next woodworking project will receive. **PW**

GETTING A CUSTOM EARPLUG MADE

To fit a custom earplug, the first thing you need to know should be pretty obvious – don't try this yourself. Talk to a certified audiologist or other hearing expert. These custom devices can be made in many different colors and with or without cords or removal handles.

The first thing they will do is insert a foam plug into the ear canal to protect the eardrum (seen in the photo at left). This plug has a long string attached to it that will help with removal.

Next, silicone material is inserted into the ear canal, conforming to the shape of the wearer's canal (seen in the middle photo). This process is similar to when you have teeth impressions made at your dentist's office.

The resulting impression (in the photo at right) either goes to a manufacturer to make the plug or, in some cases, it is modified directly and the plugs will fit precisely into your ear canal, affording you an individualized, comfortable hearing protection device. *– CE*

First, a foam plug is inserted into the ear canal to protect the eardrum.

Silicone material is then injected into the ear canal to make the impression.

Once the material dries, you have an impression of the ear canal that will be sent to a manufacturer.

Entirely by Hand

Chairmaker Don Weber offers a sample of how simple projects can spring from the forest and the sweat of your brow.

A few years ago, I needed a bedside table for my cuppa and a book on those rare "lie-in" mornings. The table was so simple to build that I now have similar tables all over my shop, including near my wood stove, next to my favorite chair and near my front door to hold a portfolio of my work for customers to see.

Like my Windsor and Welsh-style stick chairs, I make this table without machines and from wood harvested locally and split in the lot behind my shop and home.

If you'll follow along as I build my latest table, I'll introduce you to some of the tools of my trade and show you how they're used. And, perhaps, pique your interest enough that you might want to give it a go yourself.

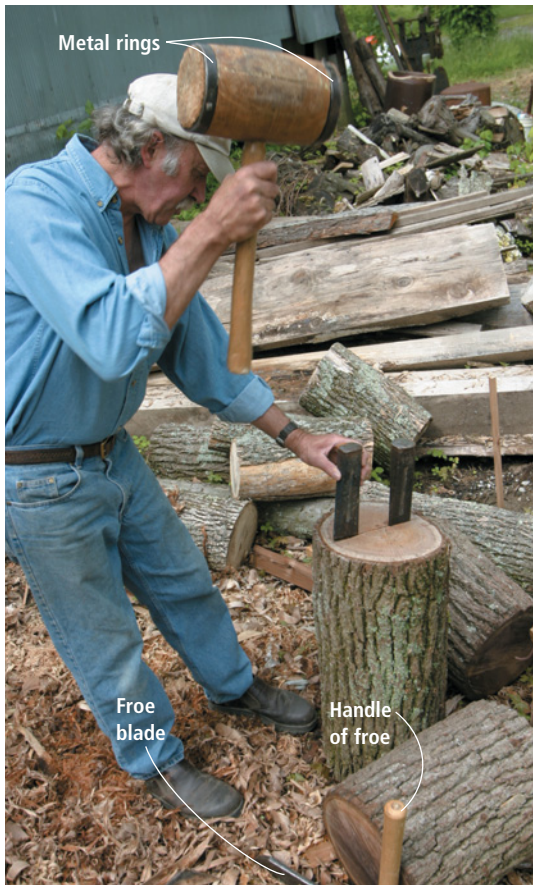
Beetle, Froe and Axe

Being a chairmaker who always works directly from the log instead of the lumberyard, I have a nice-sized cache of logs outside the back of my shop. There I also keep my beetle (a large, iron-bound mallet), wedges and a froe. The froe

by Don Weber

Don Weber specializes in Windsor and Welsh-style stick chairs. Also a teacher and blacksmith, he currently resides in Paint Lick, Ky. You can visit his web site at handcraftwoodworks.com.

Photos by Al Parrish



The metal rings on the head of my beetle prevent it from splitting. Here I'm starting a split with wedges. Once the split has opened up, the froe (near my right foot) finishes the job.

is a traditional "L"-shaped tool for splitting – or riving – green wood. Just drive the tool's wedge-shaped blade into the end grain and then work the wooden handle, pushing and pulling it to open the split. One of its charms is that it will follow the grain of your timber instead of cutting across it like a sawmill will. The result is a billet (a halved or quartered log, or roughly dressed lumber) with straight grain.

For my table, I need four 2" square pieces of wood for the legs. So, once my log was halved, I split each 24¼"-long billet into quarters and then eighths.

Once the wood is split, I dress the billet square. For this, I use a side axe. A side axe, a tool commonly used by bodgers like myself, has a bevel on only one side. This allows the tool to follow the grain easily. I prop a billet on a log and, keeping the side axe's beveled side facing out, square the leg blank with quick, short strokes, as shown below left.

To the Shaving Horse

In the shop I take the legs to my shaving horse to rough-cut the taper on all four sides. If you've never seen a shaving horse, check out the photo below – it's essentially a low bench that you sit astride. Your feet operate a jaw that holds the work in place, leaving you with both hands free.

The taper begins 2½" from the top of the leg. You want to taper the legs on all four sides from 2" square at the top to 1¼" square at the foot.

I mark the taper on one face of the leg and fetch an old Barton drawknife I bought off a restaurant wall. It makes short work of the excess material. Rotate the billet and mark out the next taper. When the rough shape is done, I take the leg to my workbench and dress it to final dimension

There are both left- and right-hand side axes (the beveled side is usually marked with an "X.") The side axe was used by medieval builders and is still in use today, as you can see.

The drawknife can be used with the cutting bevel up or down. When making a planing cut like this one, I skew the drawknife and use the tool bevel-up. I'll use it bevel-down for tight work, such as for shoulders on rounded tenons.

with my jack plane, which I fondly call "Mr. Jack."

A jack plane, also known as a No. 5 plane, usually is 14" long and is used for a variety of tasks. I grind the iron so it's slightly convex. (I like the texture.) I also grind off the corners of the iron so they cannot dig into the wood when planing across the grain – a useful attribute when flattening tabletops, as you'll soon see.

I put the legs in my shopmade kiln – a plywood box with two 100-watt lightbulbs and a recycled computer fan – to dry them to a reasonable moisture content.

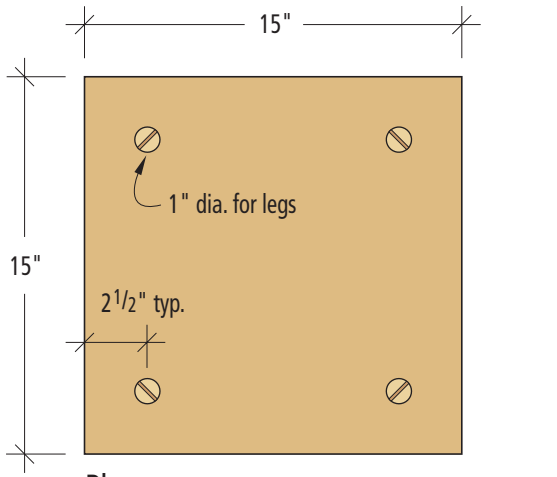
Now to the Top

Next, I dig into my pile of cutoffs (that I had saved for future projects) and select a piece of white oak (which had been air-dried in my warehouse) that is at least 15" wide with a bit of flame grain and medullary ray showing – one of the pleasant aspects of white oak. I cut this to 15" long with a sharp Disston handsaw. There is no more pleasant sound than a sharp saw cutting through a board, other than the sound of a hand plane making that swishing sound when taking a fine shaving.

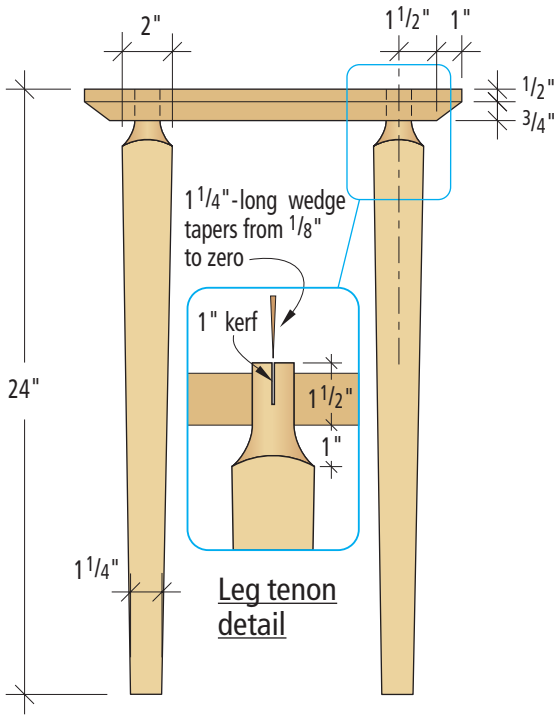
I dress the top by planing diagonally across the grain with my old friend Mr. Jack until the board is level. I check the surface with winding sticks – straight lengths of hardwood – to look for twists and cupping. Then I dress the edges with my block plane.

To make the bevel on the underside, make a mark ½" from the top edge all the way around the table's edge, then in 1" in from

Conventional wisdom is that a jack plane is named because it was such a common item – "jack" means common (think jackknife or jackboots). You also could think of it as a jack-of-all-trades because it is so useful.



Plan



Leg tenon detail

Elevation

BEDSIDE TEA TABLE

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	4	Legs	2	2	24¼*	Oak
❑	1	Top	1¼	15	15	Oak

* Length is oversized to allow tenon to be trimmed

Winding sticks are truth-tellers. They find the bow or twist in any board. Sight down one and compare it to the other to find twisting and cupping. The different colored edges make it easy to see both sticks.

A sharp block plane excels at cleaning up saw-cut edges, whether they've been cut with a hand saw or an electric saw.

The simplest and most useful of tools, a properly tuned card scraper is the tool to use to prepare a surface for finishing at all stages of the project.

the edge on the bottom. I clamp the top upright in a bench vise and shape the bevel with Mr. Jack, then fine-tune it with a block plane. Once complete, I dress the underside of the top by planing diagonally across the grain. Then I smooth both sides with a smoothing plane and scrape them flat.

Next up is the four holes through the top to hold the legs. A brace, a 1" bit and a steady hand do the job, as shown at right.

Back to the Legs

Once the legs get to about 8 percent moisture content, I bring them out of the kiln to work on them. Being a bodger, I prefer a pole lathe to turn the tenons. I use a shallow 1½" gouge with a fingernail grind for this. The tenon begins 2½" from the end of the leg and ends up 1" in diameter. Make sure at least 1½" of the tenon will seat into the holes bored in your top.

Use your body weight to hold the workpiece in place as you bore the holes for the legs. Beginners should place a square (or two) near the bit to guide their progress.

To hold the legs in place I wedge them. To do this I cut a kerf into the end of each tenon that's about 1" deep to accept the wedges. The wedges are ⅛" thick at one end and taper down to nothing at the other. See the illustration for how to orient the kerf – the angle shown will help prevent your top from splitting when you drive the wedges home.

I use hide glue in my shop. To spread it evenly I use a toothbrush. The table is turned over and the wedges, of a contrasting wood, are inserted.

When the glue is dry, trim the tenons flush with the tabletop. The final smoothing is done with a cabinet scraper.

To make the legs sit flat on the floor, place the table on a flat surface. I measure from my flat surface (use a table saw's top, a true workbench, etc.) to the top of the table, then use wedges to level the top to the flat surface. With the tabletop level, I then cut a spacer that fits under the shortest of the four legs. With the tabletop still level and wedged below the legs, use that spacer to mark the other three legs. Crosscut the three legs at that line and the table should sit flat on the floor. (I use this method to level my chair legs as well.)

For finish I use a shellac-based sanding sealer, then either a shop-made oil/varnish blend (marine-grade spar varnish, tung oil and gum serpentine) or Minwax Antique Oil Finish. Lastly, I wax the table with a hard finishing wax. Buff it up and you're ready for your cuppa (we say "cup of tea" on this side of the Atlantic) and your scones. **PW**

BOOKS TO READ

"Make a Chair From a Tree" (Taunton) by John D. Alexander

"Living Wood: From Buying a Woodland to Making a Chair" (Living Wood Books) and "Green Woodwork: Working With Wood the Natural Way" (Sterling) by Mike Abbott

"Gimson and The Barnsleys" (Alan Sutton) by Mary Greenstead

Using a pole lathe is a bit different than using a motorized one. The work rotates toward you on the downstroke and away from you on the upstroke. You cut only on the downstroke. It takes a bit of practice, but you can get used to it.

The wedges lock the legs in place and tighten up the fit between the tenon and its mortise.

This is an old chairmakers' trick. With the table on a perfectly level surface, you can wedge the legs to make the tabletop sit flat. Then use a spacer that fits under the shortest leg to mark how much you should trim off the other three.

Computer illustration by Mark Naher

BUILDING A DRAWING

Some classical guidelines to technical drawings.

A few months after my "CAD for Woodworkers" article appeared in the June 2003 issue of *Popular Woodworking*, I noticed a recurring frustration in reader feedback. It was usually a variation on, "OK, I've installed some computer-assisted design software on my computer, and I'm beginning to get the hang of it. So now what?"

The dreaded all-dressed-up-and-nowhere-to-go syndrome usually could be attributed to the reader's unfamiliarity with the basics of drawing. As woodworkers, we're primarily interested in producing what's known as a technical drawing. In it, we attempt to explain (at least to ourselves) the size, shape and relationship of various components that can be developed into a parts list and, in the end, a successful project.

Although it might sound like a giant leap backward, my advice to those suffering from the "now-what" blues is to pick up a used, pre-CAD edition of Henry Cecil Spencer's classic "Basic Technical Drawing" (MacMillan Publishing). I own, and refer to often, a vintage 1954 edition that I purchased through Amazon for $5. It's a well-

by John Hutchinson

Twenty years with a pencil and 10 years with a mouse have given John Hutchinson, a practicing architect and our technical illustrator, a look at both sides of the drawing board. Questions or comments? John can be reached at jhutchi2@columbus.rr.com.

worn classroom textbook that was written for the beginning student of technical drawing.

I specifically recommend a pre-CAD edition because it's a constant reminder that good drawing practice has nothing to do with the sophistication of the drawing instruments at hand: mud tablet and stick, paper and pencil, or computer and mouse.

For this article, which will detail the development of a basic set of drawings, I chose to adapt a mid-20th century design by Finnish architect/furniture designer Alvar Aalto that's known as the Tea Trolley 900.

Although my tea parties are few and far between, this project presented an excellent opportunity for reviewing some basic principles of technical drawing in addition to harnessing the power of a CAD program (the commands used in QuickCAD are shown in all capital letters throughout the text). For those interested in stepping up to true 3-D drafting, I've discussed that briefly at the end of this article.

A Little Research

The same computer screen that is now your drawing board can also be your window into what's out there beyond the usual plans found in woodworking catalogs.

When I searched online, I found that Artek Furniture (www.artek.fi), a company founded by Aalto and his colleagues in 1935, is still producing the tea trolley commercially.

Besides some inspirational photos, a simple three-view drawing (plan, elevation, profile) was included with dimensions of 90 (long), 65 (wide) and 60 (high). Because I was visiting a Finnish web site, I surmised that the dimensions were being given in centimeters. After a few divisions by 2.54 and some rounding off, I set the limits of my project at 35" x 25½" x 23½".

By the Book

With the basic parameters established, it's time to start laying down some lines. But what lines should come first?

As we progress through the development of the drawings, I'll be following the path suggested by Spencer in his landmark book, quoting directly from the text and (I hope) demonstrating that the fundamentals of technical drawing are timeless.

Freehand Sketching

"Remember, the secret of sketching is to draw the large area first in correct proportion, and then to add the smaller features in their correct relative size."

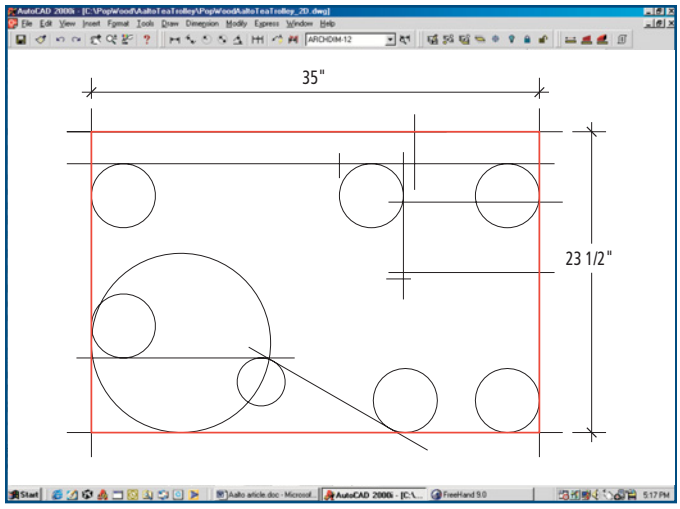
I always start my drawings with my feet planted firmly on the ground. A simple horizontal line across the screen establishes it.

In the case of the trolley, an OFFSET command of 23½" from the ground gave me the top edge. With the addition of a vertical line, and an offset of 35", I had a rectangle that defined the correct proportions of the trolley. Although not much to look at, it's the foundation upon which all successive lines, views and dimensions were constructed.

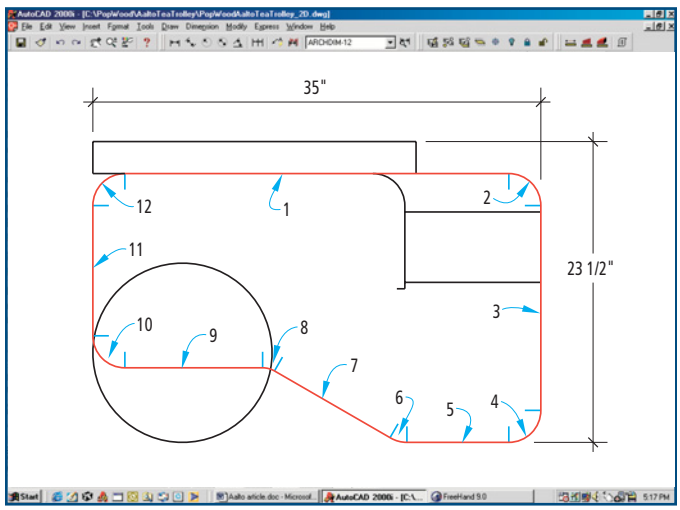
Steps in Sketching a View

"1. Sketch in the large main areas lightly. 2. Block in construction for areas and circles. 3. Heavy-in all final lines, making them clean-cut and dark."

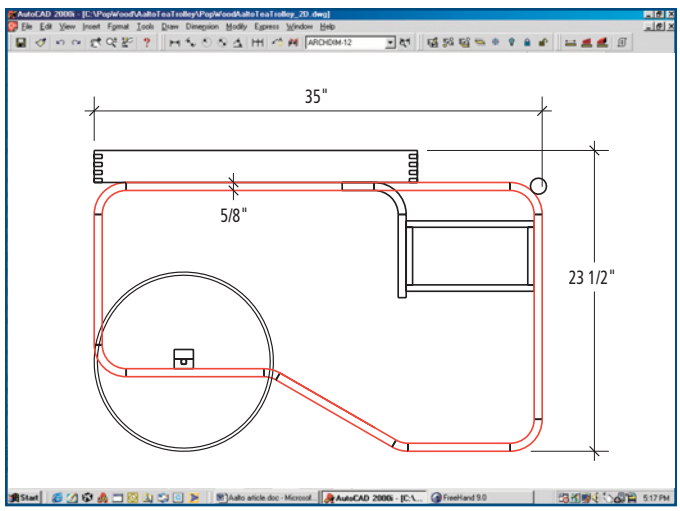
After establishing the correct proportions, shown with red lines in Screen 1, I began sketching in the major areas and radiused corners. The corners were drawn with a TANGENT TO TWO ENTITIES command. By entering a radius dimension and then clicking on two perpendicular



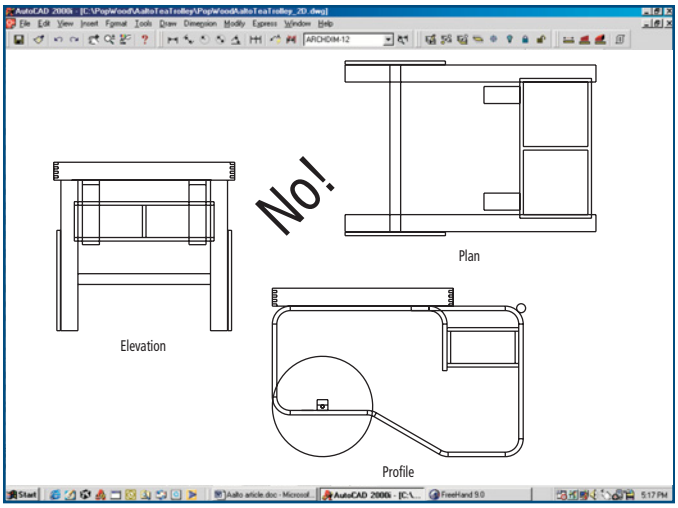
Screen 1



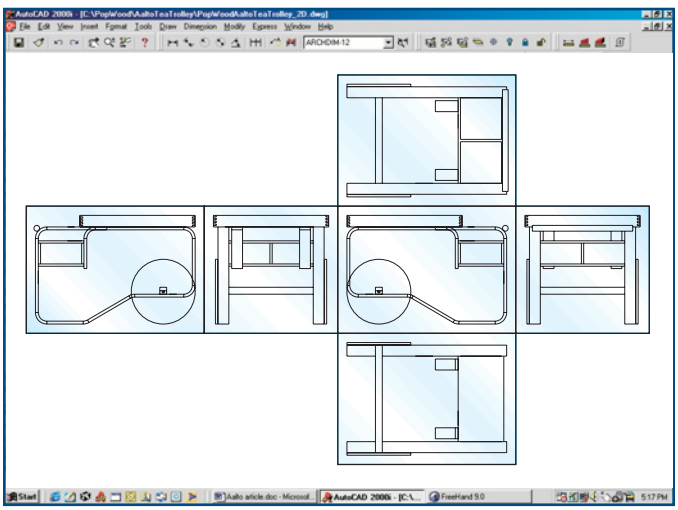
Screen 2



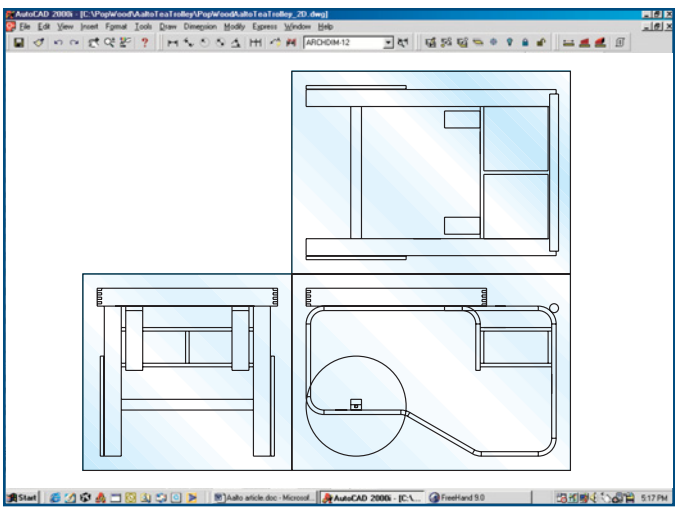
Screen 3



Screen 4



Screen 5



Screen 6

lines, the circles snapped into place. This degree of precision isn't required in freehand pencil sketching, but it makes later CAD refinements possible.

Screen 2 shows the results of some selective erasing. The perpendicular lines extending beyond the circles were removed with a TRIMMING TO EDGE command. I first selected a circle and then clicked on the straight-line portions beyond it that I wanted to remove. To reduce the circles to arcs, I went through the same steps, this time selecting straight lines first and then erasing the unwanted portion of the circle within those lines.

The remaining collection of arcs and lines become even more useful when they're combined into entities known as "polylines." The line that defines the perimeter of the frame on Screen 2 is actually a series of 12 line segments (1-12) that are joined into a single entity with the POLYLINE command. Once joined, this meandering path responds to all of the commands applicable to a single straight line.

In Screen 3, I began to transform the polylines into objects that resemble the true parts of the trolley. After deciding that all of the framework components were to be 5/8" thick, I again used the OFFSET command to produce the interior edge of the outer polyline, separated by exactly 5/8". Similar offset operations gave me the finger-joint detail at the corners of the tray, the wheel tread and the framework of the basket.

Drawing Placement

"The worst mistake you can make in technical drawing is to draw a view out of place."

One of Spencer's favorite devices for explaining some principle of technical drawing was to provide an incorrect example and then stamp it with an emphatic "No!" It was effective then so I'm using it here.

It's difficult enough to keep the size and relationship of parts correct without shotgunning random thoughts across the screen. My arrangement of views in Screen 4 is begging for a failing grade. The same organizational skills that we apply in the shop should be exercised in our drawings. So what is the correct location for the various views of the trolley? Let's continue.

The Glass Box

"Since any rectangular object has six sides, we can obtain six views by placing six planes parallel to the six sides. Together, these planes form the Glass Box."

Scratching your head? Don't worry too much about it. A little visualization will help.

For a moment, let's imagine walking into a museum where Aalto's first trolley is on display, protected from patrons' hands by a glass case. As we approach it from the front, we're looking at the trolley in elevation. As we walk around it, we see a right profile, back view and left profile in succession. Approaching still further, and looking down, we see it in plan. If cables suspended it, we could get a bottom view.

Together, these six planes of view make up what is known as the "Glass Box" in technical drawings. When the box is unfolded, as shown in Screen 5, the individual views automatically fall into their correct relationship to all other views when translated to a drawing.

Choice of Views

"All of the possible six views may not be needed to describe completely the shape of the object. Only those views that are necessary to describe the shape of the object should be drawn."

In the lingo of technical drafting, there are two-view and three-view drawings. A two-view is all that's necessary for a square-topped table with four legs. The elevations and profiles convey exactly the same information. Drawing both would be redundant.

Aalto's trolley, however, is a little more complex and requires a three-view. In Screen 6, you can see it was time to toss out the bottom, back and one of the redundant profile panes of the "Glass Box" and focus on the three views (plan, elevation and profile) that gave me the most information – or "bang for the buck."

Supplementary Views

"Sometimes an additional view is needed to support the three-view."

The trolley is really two projects in one – a wheeled base and a tiled tray. Placing the tray on the base in the plan view would confuse both issues.

THE MAN BEHIND THE CLASSIC: 'BASIC TECHNICAL DRAWING'

The late Henry Cecil Spencer was professor emeritus and director of the Department of Engineering Graphics at Illinois Institute of Technology from 1941 to 1962. Previously, he taught engineering drawing at Texas A&M University and mechanical drawing at Ballinger High School in Ballinger, Texas. He is the author or co-author of 11 books about technical drawing. In 1958, he received the Distinguished Service Award from the Division of Engineering Graphics of the American Society for Engineering Education, and in 1948-49 he was national chairman of that division. We salute him.

The introduction of a supplementary plan of the tray in Screen 7, removed from the base but still kept in its correct orientation to the original three views, allowed me to think through the projects independently while keeping in mind their relationship to each other. Occasionally, bending the rules is a good thing.

Placement of Dimensions

"Never place a dimension on a view unless something in clearness or directness of application is gained thereby."

Now there's some classical language with a timeless message. Dimensioning in CAD has been reduced from a studied art form in classical pencil drafting to a couple of clicks of the mouse.

I can bang out strings of dimensions all day until the drawing becomes a road map of lines and numbers. The problem is this web of lines eventually begins to compete with the lines describing the subject of the drawing.

The number of dimensions in Screen 8 looks just about right – nothing there that I won't eventually need in the shop.

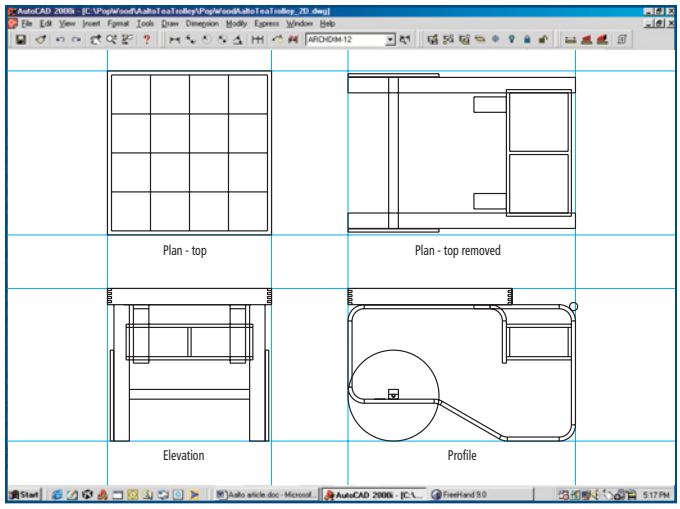
Superfluous Dimensions

"If you cannot give a definite reason for a dimension, delete it."

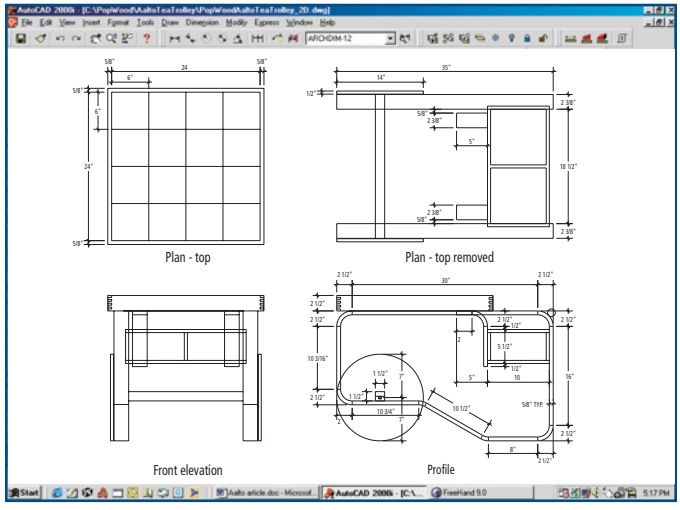
Let's take a look at Screen 9 and I'll show you what Spencer was referring to. All of the dimensions shown are absolutely correct, yet I'd be hard-pressed to explain how any of them would be helpful in the cutting or construction processes.

They were quick and easy to generate, but they're all worthless. Time to break out the trusty "No!" stamp again.

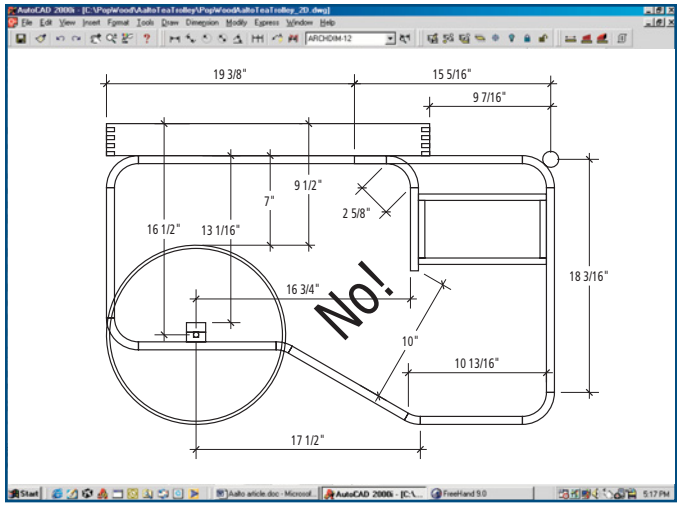
Do I really care that the back of the tray is $9\frac{7}{16}$" from the center of the handle? That's where it will eventually end up, but the placement of the tray is controlled



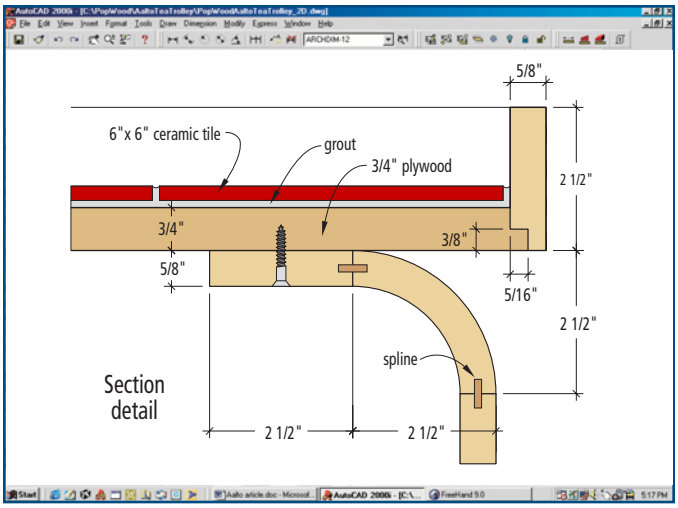
Screen 7



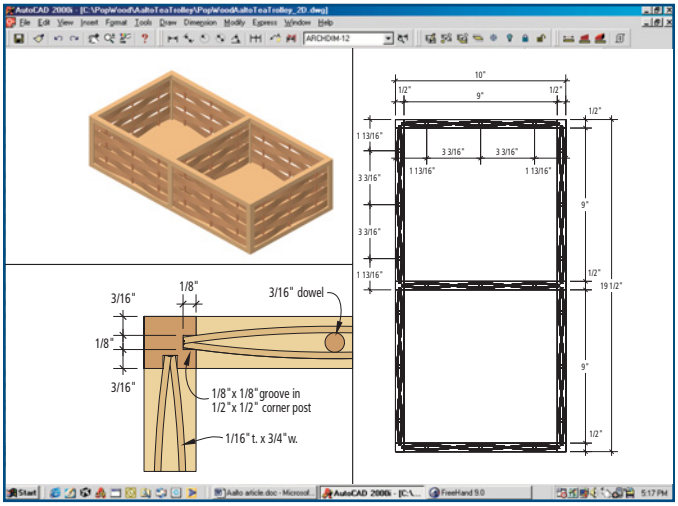
Screen 8



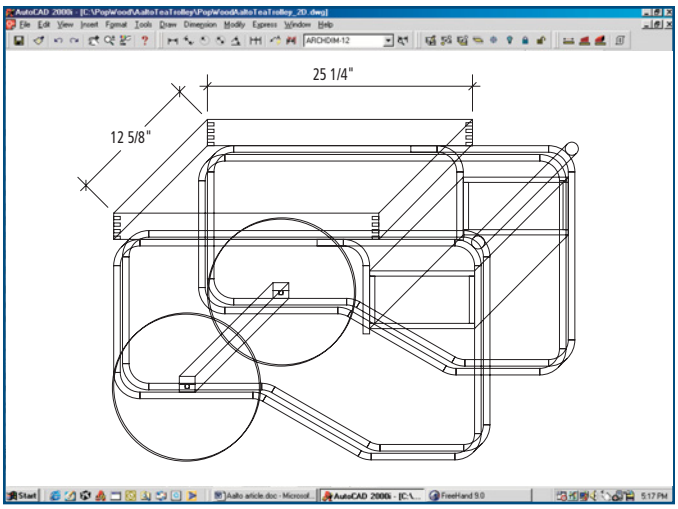
Screen 9



Screen 10



Screen 11



Screen 12

by aligning the front of the tray with the front of the cart. The 9 7/16" dimension is merely the result of that alignment. Put a little sign at the top of your screen that reads, "Just because you can doesn't mean you should" and you'll save lots of time.

Broken-out Sections

"Often only a small part of a view needs to be sectioned to show some small detail of inside construction."

We're all familiar with the expression "Don't sweat the small stuff." In woodworking, however, it's usually some hidden "small stuff" that makes or breaks a project. These elements usually are best explained in what's called "partial" or "broken-out" cross-section, as shown in Screen 10.

The three-view is a powerful tool. A complete cross-section through any project is usually unnecessary and (here's that word again) redundant. The tray in my project called for a little surgery to visualize its interior workings.

One of the joys of working with CAD is the ability to work in plan, detail and a pictorial view simultaneously while solving a complex problem. I used this technique for the trolley basket exercise depicted in Screen 11. By switching between the multiple views I fashioned a reasonable facsimile of the original trolley's rattan basket out of a few dowels, slats and corner posts.

Pictorial & Oblique Drawing

"A pictorial drawing is one in which the object is viewed in such a position that several faces appear in a single view."

"A simple way to sketch a rectangular object pictorially is in the oblique. Sketch the front of the object in true size and shape and then sketch in the depth lines parallel to each other at any convenient angle with the horizontal."

The oblique is a great place for the novice CAD user to start visualizing a project in three dimensions. In just a few minutes, you can recycle an elevation or profile from the three-view and begin to give it some depth.

In Screen 12, I started by pasting in a copy of the trolley profile. From major corners, I drew lines at a 45° angle, each at half their true length, to represent the depth edges. For example, the true dimensions of the tray are 25¼" x 25¼". In the oblique, the profile dimension remains at 25¼", but the depth is reduced to 12⅝". The depth axis may be drawn either full- or half-size, and both ways are classically correct.

When the depth axis is drawn full-size, the oblique drawing is given the name "cavalier drawing." Cavalier drawing is perfectly satisfactory for representing many objects, but in others the distortion is excessive. If the depth is reduced to half-size, the look of the drawing is more natural. This is called "cabinet-drawing" because of its early use in the furniture industry.

In my oblique drawing of the trolley, I've intentionally left many of the hidden lines that would be removed in a finished drawing. I like to think of the oblique as a quick tool for looking at where I'm headed with a project rather than something suitable for framing. When I'm drawing primarily to convey a message to myself, the shorthand of the oblique has no equal.

Isometric Drawing

"One of the most effective ways to sketch an object pictorially is to sketch it in the isometric. Take the object in your hand, and tilt the top toward you. The front edge (and those edges parallel to it) will appear vertical, and the two lower edges (and those parallel to them) will ap-

pear about 30° with the horizontal."

The isometric is full of the proverbial "good news" and the "bad news." With my optimist hat on, I'll start with the good news. First, the "look" falls somewhere between the oblique and the true perspective relative to the way we perceive things in the real world. And second, all edges are drawn at their full length and may be given true dimensions in the drawing.

And now for the bad news. First, unless you're working with true 3-D CAD software, you'll need to start the isometric from scratch as a separate drawing – no importing of work from the three-view recycle bin. Second, when a circle is viewed in isometric, it becomes a geometrically complex ellipse. In Spencer's text, he devotes three entire pages to the subject of drawing the isometric curve and ellipse. I think he was trying to warn us.

In Screen 13, I switched to the 3-D software in my more-expensive AutoCAD program to create an isometric "wireframe." The jumble of twisted lines defines all of the edges in the project at their correct length. The cost differential between 2-D and 3-D software becomes more understandable when working at this level of complexity.

In 3-D, I can reuse my initial 2-D outlines and transform them into solids through the process of "extruding." I simply click on one of my three-view polylines and enter a distance for it to be extended into space. Bingo! Lines are now parts that can be copied, mirrored, rotated or positioned anywhere in relation to neighboring components.

"Although art training is required to (get) professional results, the ordinary draftsman can learn to do all the shading necessary for him to do."

For my final colored and shaded isometric in Screen 14, I reached into my CAD bag of tools for an unlimited number of colors and shadings. The work was done and it's time to play.

Perspective Drawing

"The eye and the camera both are constructed so that objects appear progressively smaller as they are farther away. Hence, all parallel lines have the same vanishing point, and if they are on or parallel to the ground, the vanishing point will be on the horizon."

Perspective drawing (shown in Screen 15) is best left to a book devoted to the subject. It is, however, a natural progression in the drawing process.

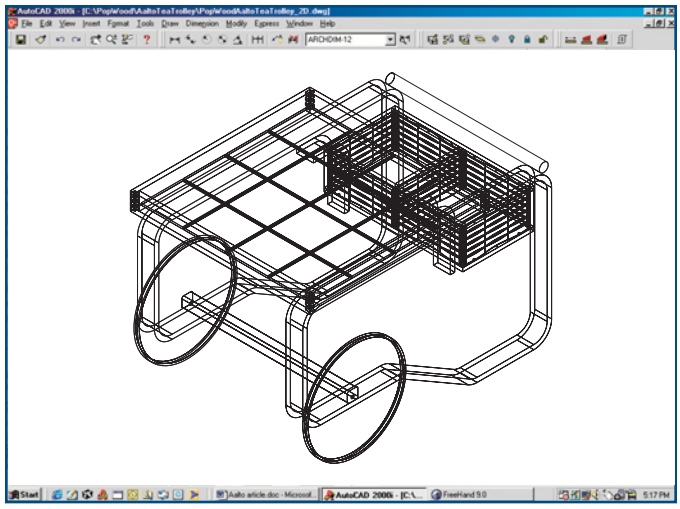
The initial ground line I drew in Screen 1 was incorporated into the opening illustration on page 74, produced by Mark Naher. That illustration is an excellent example of the full potential of CAD in the hands of a master.

Mark, however, didn't start his illustration from scratch. Just as I passed my 2-D outlines off to my 3-D software, Mark imported my 3-D objects into his scene where he added textures, perspective and lighting.

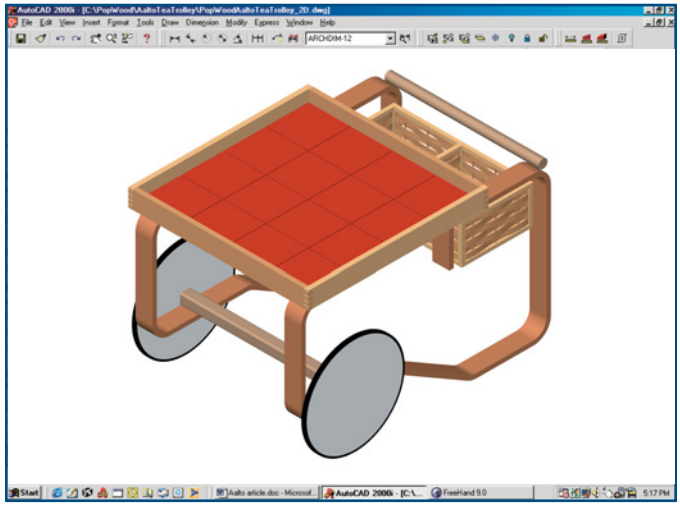
Class Dismissed

How many times have you heard someone say, "Oh, I guess we'll have to draw him a picture?" If a person has good ideas but no effective way of expressing them to himself or other people, the ideas are apt to get nowhere.

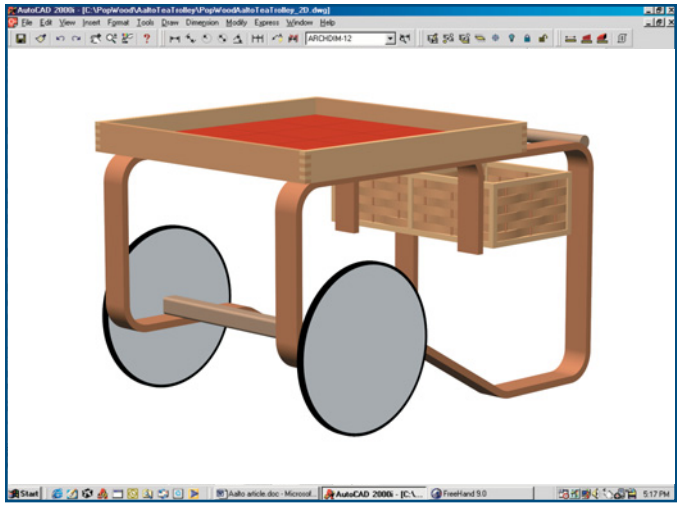
We're not taking sides in the ongoing pencil vs. computer debate. Both are effective tools for the expression of an idea. The famous line from the film "Field of Dreams" ("If you build it, they will come") can be paraphrased a bit here to help you understand the true importance of technical drawings – "If you can draw it, it can be built." **PW**



Screen 13



Screen 14



Screen 15

Japanese Garden Bench

Combine five 2x4s, a handful of screws and a long afternoon to build a handsome and sturdy sitting spot for your deck or garden.

We used a miter saw to cut our pieces to length. Here you can see that we clamped all the top boards together and "gang cut" them to length simultaneously.

My father always has had a knack for doing more with less. He built the first house on our farm using a Skil saw, a drill and a hammer.

Sometime during my childhood he built a pair of these Japanese-looking benches using leftover 2x4s and framing nails. While visiting him one recent summer, I was struck by the fact that they have survived more than a dozen winters and still look good.

This project is really great for the beginning woodworker who doesn't have a lot of tools, skills or confidence. But the end result will make you look like you've got all three, in spades.

Trip to the Lumberyard

This bench is designed to be built using just five 10'-long 2x4s. You can build it from sugar pine, paint it and spend less than $10. I always liked redwood for my outdoor projects (and that's what the originals were made from) so I spent the extra cash – about $200.

No matter what species you choose, select the straightest, most knot-free 2x4s you can find. While you're at the lumberyard, pick up a pound of stainless-steel screws. Associate Editor Kara Gebhart (who helped me build this project) and I used #8 x 2" screws. Another excellent choice would be Miller Dowels (866-966-3734 or millerdowel.com).

Back in the Shop

You don't need a jointer, planer or table saw to build this bench. You don't even need a shop. A drill, a saw, some sandpaper and a couple of sawhorses will get the job done right on your driveway.

Start by laying out your crosscuts on the 2x4s using chalk. Pick the best-looking boards for the five top pieces. Boards with too many knots or dings can be used as legs, which are mostly covered up by the top pieces.

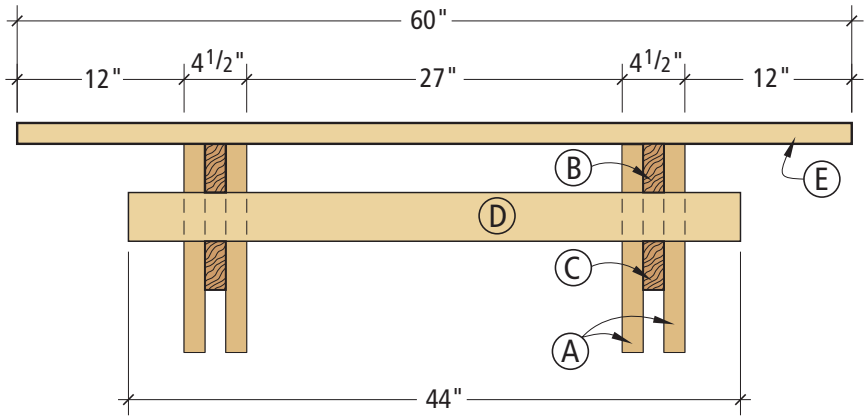
Then cut all your pieces to length as shown in the cutting list on page 82. What's important to remember here is that it's not critical if you cut your legs a bit long or cut the top boards a bit short. What is important is that you cut all the legs the same length, whatever that turns out to be. For that reason, I recommend "gang cutting" your parts.

"Gang cutting" is when you clamp together all the parts that are the same length and trim them to size simultaneously, as shown above. This works no matter what tool you use for crosscutting.

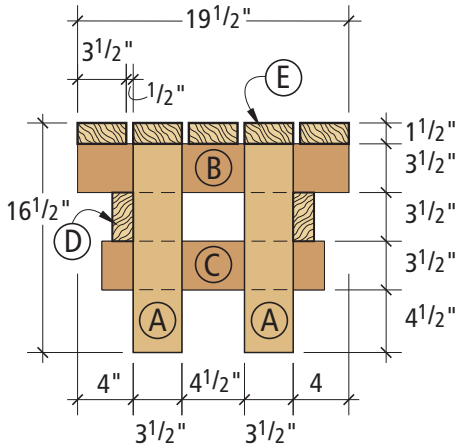
by Christopher Schwarz & Kara Gebhart

Comments or questions? Contact Chris at 513-531-2690 ext. 1407 or chris.schwarz@fwpubs.com. Contact Kara at 513-531-2690 ext. 1348 or kara.gebhart@fwpubs.com.

Photo by Al Parrish



Elevation



Profile

Sanding (Insert Groan Here)

It's tempting to screw this project together immediately, but I'd suggest you do all you can to resist the urge to assemble.

A better bet is for you to sand all your pieces to remove marks and dings. This helps get them ready for whatever finish you'll be applying (paint, deck stain, tung oil or nothing).

Once the faces and edges have been sanded, you need to "break the edges" of all the boards. This is pretty simple to do. Just grab some #120-grit sandpaper and take a couple of licks on all the edges of each board (you're trying to remove any sharp edges). This will make the bench more comfortable to sit on and less likely to splinter when it gets wet.

JAPANESE GARDEN BENCH

	LET.	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑	A	8	Legs	1 1/2	3 1/2	15	Redwood
❑	B	2	Top cross braces	1 1/2	3 1/2	19 1/2	Redwood
❑	C	2	Low cross braces	1 1/2	3 1/2	16	Redwood
❑	D	2	Stretchers	1 1/2	3 1/2	44	Redwood
❑	E	5	Top boards	1 1/2	3 1/2	60	Redwood

Leg Assembly

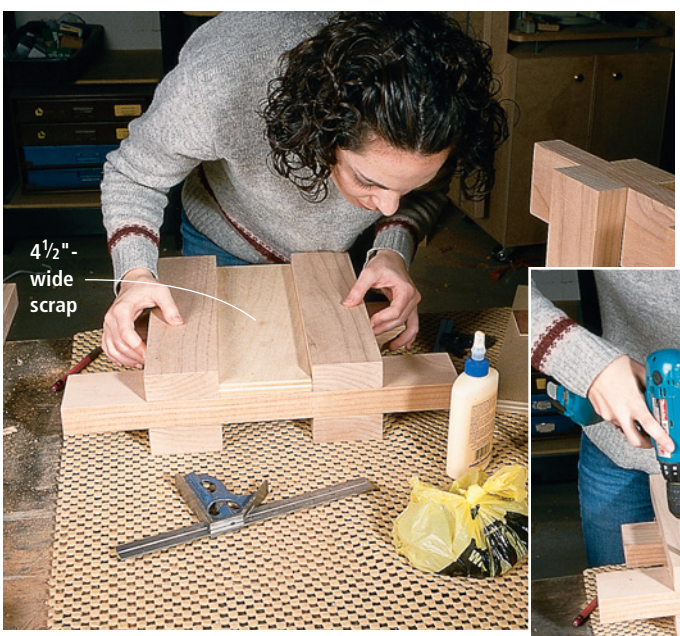
This bench goes together quickly. Chuck a bit in your drill to give you a 3/16" pilot hole and a countersink simultaneously. These bits are available from most home-supply or hardware stores.

Begin by assembling one of the leg structures. First find a piece of scrap that's 4 1/2" wide and place it between two of the leg pieces.

Center the top cross brace on the two legs, flush everything up, then glue and screw the cross brace to the legs using two screws in each. You can use polyurethane glue or a water-resistant glue such as Titebond II.

Put another piece of scrap 2x4 against the top cross brace and center the low cross brace below that scrap. Then glue and screw the low cross brace to the legs.

Next, put two more legs on top of the cross braces and place the 4 1/2" scrap spacer between them. Glue and screw these two legs to the cross braces. Repeat this same procedure for the other leg assembly. You're almost done.



Use scraps as spacers to ensure that your leg assemblies go together just right. This is a lot easier than measuring everything. Then screw it together using stainless steel screws.

Plug It Up

For a finished look, we took a few minutes to plug the holes made by the countersink. Our countersink made a 3/8"-diameter hole.

You can plug the hole with store-bought 3/8" plugs or 3/8"-diameter dowels. We took some 3/8" x 3/8" square stock, whittled one end and glued it in place. The

square corners of the wood cut the round hole into a square one. Once your plugs are glued in place, cut or sand them flush.

Final Assembly

Stand the legs upright on your work surface and put the stretchers in place between the two cross braces. Glue and screw the stretchers into place and plug the holes left by the countersink.

Then arrange the five top boards on the base. Because the pith side of flat-grained wood is more prone to raised grain, make sure you place all your boards bark-side up. (Look at the growth rings.)

To ensure everything was spaced evenly, we first attached the top pieces at the front and back of the bench using glue and screws. Then we centered the middle board between those. Finally, we put the remaining two boards in place and figured out what gap should be between each board. We then glued and screwed these two boards in place. Finally, we plugged the holes.

Check out Bob Flexner's advice on protecting exterior wood below. We chose to leave the wood in its natural state and allow it to turn a silvery-gray, which will happen when left outside. **PW**

SUPPLIES

McFeelys
800-443-7937 or mcfeelys.com
#8 x 2" • Stainless steel screws, $10.96 for 100

Prices as of publication date.

PROTECTING EXTERIOR WOOD

There is probably more misunderstanding about how to protect wood outdoors than about any other aspect of wood finishing.

The need for a quality coating to protect exterior wood is great because when sunlight or water come into frequent contact with wood, the wood can lose its color, split, warp and often rot.

The best way to protect exposed wood is to apply a paint or finish that blocks sunlight and moisture, and holds up to these elements.

• Light is the principal enemy of paints and finishes. Over time, ultraviolet rays, which are strongest from direct sunlight, break down paints. If you catch it before the paint is damaged all the way through, you can rub off the dull, chalky result with abrasives (contained in many car polishes, for example) and expose paint that looks shiny and new.

UV rays also break down clear finishes, but most of the damage here will come when they peel. The finish peels because the UV rays penetrate the film and destroy the lignin that holds the cellulose cells of wood fiber together. The surface cells separate and the finish bonded to these cells peels.

The best sun-blocking agents are pigments (contained in paints and stains). But pigments hide the wood, and many people would rather have it visible. Other good sun-blocking agents are UV absorbers, which are similar to sunscreen agents used in suntan lotions. They convert UV light energy to heat energy, which dissipates. UV absorbers don't hide wood, and they are effective at preventing deterioration, but they are expensive, and a significant amount (1 percent to 3 percent by weight) has to be in the finish to be effective.

• Moisture also causes paints and finishes to peel when it gets between the coating and the wood. Paints resist moisture penetration well, but most clear finishes don't. Water repellents, which contain a low-surface-tension waxy substance, cause water to bead but water repellents don't totally keep moisture out of the wood.

The best moisture-resistant clear finishes are varnishes called spar or marine varnish that are made to be very flexible so they can keep up with extreme wood movement. Varnishes made with phenolic resin and tung oil are best because they don't crack as quickly as those made with polyurethane resin.

The best way to protect wood outdoors is to paint it. Paint repels water and blocks UV rays effectively. There are two major categories of paint: oil-based and water-based (also called latex).

Oil-based paints are best for objects such as chairs and picnic tables because latex paints don't wear as well. Oil-based primer also is best on wood that has been exposed to the weather for a month or more because it penetrates deeper than latex primers. If the wood is freshly milled or sanded, acrylic-latex primers perform well.

Water-based or latex paints offer the best protection for wood siding because they allow moisture vapor to pass through better than oil-based paints. If the water vapor can't get through the paint and to the outside environment, it will build up behind the paint and cause it to peel. A primer coat of oil-based paint is not thick enough to stop the penetration of moisture.

No clear finishes work as well as paint if they are exposed to bright light, but expensive marine varnishes come closest. Keep in mind, however, that these finishes are very glossy and relatively soft (for flexibility), and you need to apply eight or nine coats to reach maximum UV resistance.

– Bob Flexner, contributing editor

Left unfinished, white oak and other weather-resistant woods will turn a silvery-gray. This Adirondack chair has survived 10 seasons outside with little deterioration.

Photo by Al Parrish

METAL-BODIED SPOKESHAVES

After years of having only poorly made tools to choose from, woodworkers now have some excellent new spokeshaves at their disposal.

Most woodworkers I know consider spokeshaves to be little more than wretched pieces of painted iron and steel. That's too bad, because these miniature planes are wondrous tools – in the right hands.

Armed with a pair of spokeshaves, you can shape or smooth almost any inside or outside curve (think cabriole legs). You can refine virtually every part of a traditional chair: the outside of the seat, the curved arms, the spindles and the stretchers.

But for the majority of modern woodworkers, the spokeshave is an extraordinary substitute for an oscillating spindle sander. You can shape any part on your band saw and then remove the marks left by the saw blade with your spokeshave. The surface left behind by a properly tuned shave is ready for finishing; you don't even need to sand it.

So why are spokeshaves so reviled? Until recently, there were only three types of shaves on the market: vintage wooden-bodied shaves that were used up or needed restoration, old metal-bodied shaves that needed restoration, or brand new metal-bodied shaves that needed major surgery before you could even learn to use them.

In the last decade, the rise of chairmaking classes has created a healthy demand for high-quality spokeshaves that work perfectly after only honing the cutter. Like all quality tools, these spokeshaves are considerably more expensive than the garden-variety tools. Are they worth it? To find out, we bought the current crop of metal-bodied shaves – both the inexpensive ones (Stanley, Kunz and Anant) and the premium brands (Veritas and Lie-Nielsen) – to compare them side-by-side.

Bevel Up or Bevel Down?

To understand how these shaves differ from one another, you first need to know a bit about the mechanics of this type of tool. There essentially are two major types of spokeshaves: those where the cutting bevel faces up toward the user and those where the cutting bevel faces down against the work.

by Christopher Schwarz

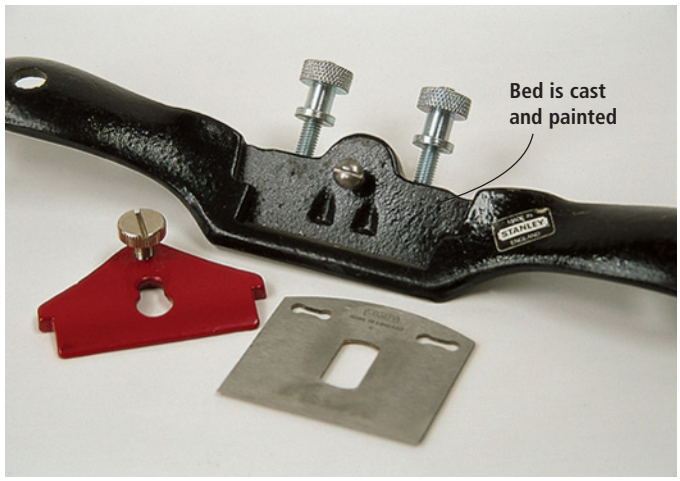
Comments or questions? Contact Christopher at 513-531-2690 ext. 1407 or chris.schwarz@fwpubs.com.

Historically, wooden-bodied spokeshaves have always had the bevel facing up, much like a block plane. This created a low cutting angle (usually about 25°, depending on a variety of factors) that allowed the tool to move easily through the work and shave end grain with ease. The problem is that the low cutting angle isn't ideal for situations where the grain switches back on you – tear-out can be a real problem. But if you pay close attention to the grain or you frequently shape end grain, these tools are great. (For more on these wooden shaves, see "From the Bench" in the November 2003 issue, available online at popwood.com or by calling 800-258-0929.)

The other type of shave has the bevel facing down against the work, much like a bench plane. These tools have a much higher cutting angle (45°). This makes the tool a little harder to push during the cut and makes it mostly useless for end-grain shaping. But the higher cutting angle makes the tool less likely to tear-out in tricky grain situations (though it's not perfect, either).

Until a couple of years ago, all the bevel-down spokeshaves had metal bodies. But then Veritas, the manufacturing arm of Lee Valley Tools, created a hybrid shave with a cast aluminum body and a cutter with the bevel facing up. (This tool is in our test, so you can see below how it performed compared to its metal-bodied half-brothers.)

The metal-bodied shaves also come with two types of soles: curved and flat. The curved soles are bellied from front to back and are useful for shaving inside curves. The flat-soled tools are ideal for outside curves. A well-equipped shop will have both. The flat-soled shaves are easier to learn to use. So if you're buying your first shave, I recommend you begin with a flat-soled one.



Machining makes the difference. Look at the bed of the Stanley 151 spokeshave. It is just cast gray iron that has been painted. This creates a poor fit between the iron and the body of the tool. The result: chatter, screeching and cursing.

Do You Need an Adjuster?

With the metal-bodied shaves, there are two major types: those that have blade adjusters and those that don't.

The adjustment mechanism on a spokeshave is a bit different than on a hand plane. With a hand plane, you generally have one knob that you turn to control the depth of your cut. With most of the spokeshaves in this test, the adjusters have two knobs. One controls the depth of cut on the right side of the tool; the other controls the cut on the left.

This handy feature allows you to fine-tune the tool in some surprising ways. You can correct an edge that is out of square by increasing the depth of cut on only one side. Or you can set the tool to take a fine shaving on one side and a thick shaving on the other.

But I suspect that the adjustment mechanism works this way to keep the tool simple to manufacture – the two-knob system is mechanically simpler than anything you'll find on a bench plane.

It's worth noting that some vintage spokeshaves (especially those from the now-vanished Preston company) had a single adjustment knob for the iron. In my limited experience with these tools, I found them difficult to set for an even cut on both sides of the tool. So in my book, the two adjustment knobs are a real plus.

The best adjustment knobs have a tight fit between the shave's iron and knobs, which gives you precise and immediate control of the iron. A knob that spins freely before engaging the iron can result in serious backlash, which is when the iron gets pushed up into the body of the tool as you work.

But do you even need the adjustment knobs? The two Lie-Nielsen tools in our test don't have adjusters. Instead you set the depth of cut by applying slight pressure to the back of the iron while tightening the cap iron. The more pressure you apply to the iron, the deeper the cut. Apply pressure in the middle and the cutter will take a consistent cut all the way across. Apply pressure to the right or left side and the cut will be deeper there.

I've seen beginning spokeshave users struggle with this technique. However, after learning an important trick (it helps to adjust the tool while it's resting on a completely flat surface) and an hour of working with the shave, adjusting it becomes easier.

The bottom line is that the adjustment knobs do not improve the tool's performance, but they are an immense convenience for beginners. With these two knobs

METAL-BODIED SPOKESHAVES

Brand	Price*	Iron Thickness	Iron Width	Body Length	Body Weight (oz.)	Throat Opening
Anant A151	$15	.074"	2 1/8"	9 7/8"	12.2	3/32"
Kunz	$18.50	.069"	2 1/32"	9 5/8"	11.7	3/32"
Lie-Nielsen Boggs	$125	.125"	2"	10 1/2"	10.8	1/64"
Lie-Nielsen Small Bronze	$75	.120"	1 3/8"	6 5/8"	4.7	1/64"
Stanley 151	$23	.061"	2 1/8"	10"	13.6	1/16"
Veritas Low-Angle	$48.50	.125"	2"	10 1/2"	6.5	Infinite
Veritas	$65	.125"	2 1/8"	10 5/8"	11.2	1/64"**

* Prices as of publication deadline. ** Tool comes with two shims that can be used to tighten the throat further.

you can set the tools much like you do a hand plane. Simply look down the sole of the tool with a light-colored surface in the background (many people use a sheet of paper). Increase the iron's projection on both sides until you see it appear as a thin black line emerging from the sole. Then retract the iron back into the tool's body by turning the knobs counterclockwise the same amount. Start making cuts on a scrap piece and advancing the iron on both sides in small, identical increments. When your tool cuts beautiful wispy shavings, you're done.

Sharpening a Big Hurdle

Of course, if your iron isn't sharp you're not going to make anything that resembles wispy. And sharpening a spokeshave beguiles many first-time users.

In general, spokeshave blades are shorter than plane blades and chisels, so they don't fit in most honing guides you can buy. You can sharpen these irons without a honing guide, but freehand sharpening is a skill that some woodworkers have yet to acquire.

If you use a honing guide to sharpen, I highly recommend the Veritas Small-Blade Holder. This ingenious little jig clamps into your honing guide and holds any spokeshave blade in place with a couple of strong magnets. It's available from Lee Valley Tools (item #05P32.03, $14.50) and is well worth the price.

Choosing a Tool

Ultimately, the differences between the inexpensive tools and the premium ones came down to the raw materials used and the amount of precision machining on the tool. The better tools are generally made from bronze or ductile iron, which is tough enough to withstand a fall from the bench without breaking. The less expensive tools are made using gray iron, which is more brittle and can crack if dropped onto a concrete floor from your bench.

The more expensive tools had thicker irons that were made using A2 steel, an alloy that stays sharper longer. Less expensive tools have thinner irons made from high-carbon steel or other alloys that aren't as durable as A2.

The biggest difference between the expensive and inexpensive tools was the machining – well-milled surfaces allow the tool's parts to fit together snugly. A precise fit between the tool, the iron and the cap iron results in a tool that will not chatter and is capable of taking a heavy cut with ease. If any of those parts doesn't mate with its neighbors, the tool will screech, skip over the wood and leave a rippled surface.

The three less-expensive tools have little – if any – machining between these parts. They were simply cast, stamped and painted. The expensive tools have a fully machined bed, precisely milled irons and cap irons that are milled on the underside and where the shavings escape. This extra effort makes all the difference in the world.

And while it's possible to soup up the inexpensive tools by altering the bed and replacing the iron and the cap iron, I consider that time and expense to be excessive. Buy a tool that works right out of the box.

Our Picks

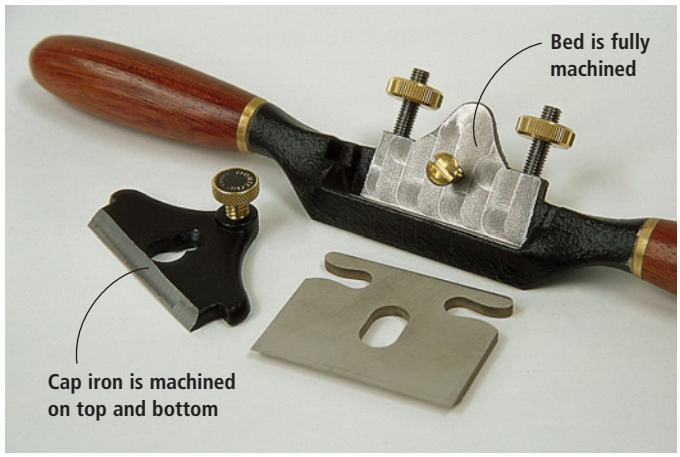
I can't recommend the three less-expensive tools: the Anant, Kunz and Stanley. They require too much work to become usable.

If money is the most important factor in your decision, I recommend you hunt the flea markets for a vintage Stanley 151 spokeshave or similar model. (You'll need to do some research first. Go to "Magazine Extras" on our web site for a couple of links that will get you started). These vintage tools were better made than the modern ones and generally require less tuning. You likely will want to upgrade the iron, and Hock Tools sells good replacement irons (888-282-5233 or hocktools.com).

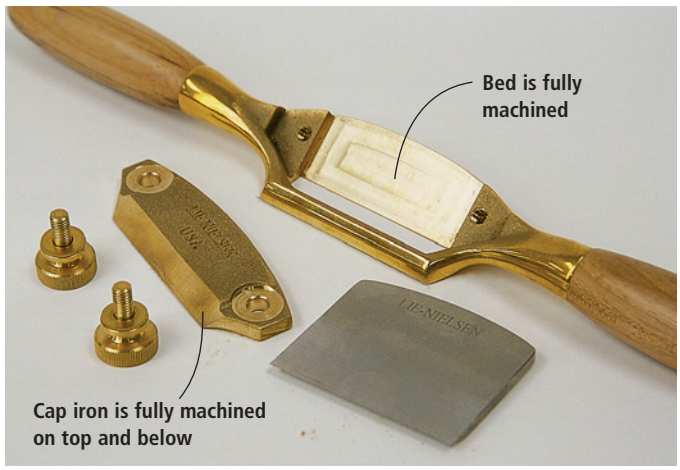
The Veritas Low-Angle Spokeshave is ideal for chairmaking and work that requires shaping end grain. The smaller Lie-Nielsen shave excels at fine small-scale work. It's not designed for hogging off material so it makes an ideal second shave.

When it comes to all-around performance, the Veritas and the Lie-Nielsen Boggs Spokeshaves are the best. Both tools are well-manufactured, durable and excel at fine and coarse work.

The Veritas's adjustment knobs make it easier for beginners to learn, but as I said earlier, the adjusters don't ultimately improve performance. These two toolmakers have done everything right, so they both earn our Editor's Choice awards.

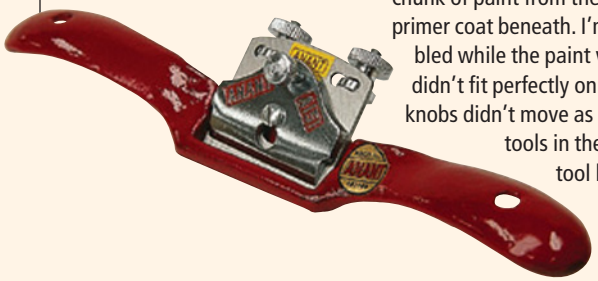


Now this is more like it. Note that the bed of the tool is fully machined. This is what you pay for with a premium tool such as the Veritas. The excellent fit between the body and iron translate into excellent cutting action. Also note the machining on the front edge of the cap iron. This helps the shavings escape.



More praiseworthy machining on the Lie-Nielsen Boggs Spokeshave. This tool is a bit different in that the cap iron contacts the iron at more points than other tools. This adds stability to the iron, which allows for fine and coarse cuts.

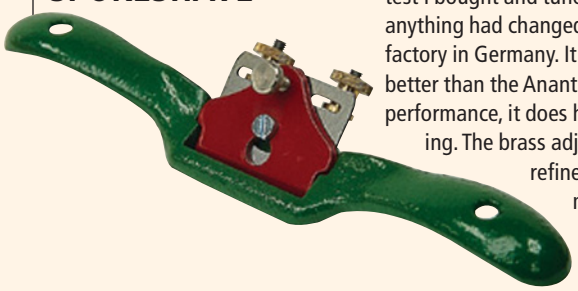
ANANT
A151 SPOKESHAVE



This was the most frustrating tool in the test to set up. Right out of the box, the underside of the iron was stuck to the tool's body. When I pried the iron off, it took a fair chunk of paint from the body with it, revealing a black primer coat beneath. I'm guessing the tool was assembled while the paint was still tacky. The iron itself didn't fit perfectly on its adjustment knobs and the knobs didn't move as smoothly as those on the other tools in the test. Overall, this India-made tool had the lowest level of fit and finish. The knobs were rough, and the cap iron didn't fit well on the iron and required quite a bit of work to get it functioning well. The red paint job was uneven in places, and the bed of the tool is not machined. Unfortunately, the tool works about as well as it looks. When faced with any wood harder than cherry it screeched in protest and chattered – no matter how tightly I set the cap iron or how lightly I set the iron. With a cost of only $15, you might think that it's at least a decent bargain tool to start with. You would be wrong. Save your money or buy a vintage tool.

Available from Woodworker's Supply, 800-645-9292 or woodworker.com

KUNZ
ADJUSTABLE SPOKESHAVE



This was actually the first spokeshave that I ever bought. And I have spent hours upon hours tuning it up to squeeze acceptable performance out of it. For this test I bought and tuned up a new specimen to see if anything had changed in the last decade at the Kunz factory in Germany. It hadn't. While the tool is a fair bit better than the Anant and Stanley in fit, finish and performance, it does have some problems worth noting. The brass adjustment knobs are a nice and refined touch, but they spin freely more than any of the others in the test. You have to twirl each knob for two full turns before it will engage the iron. The tool's bed is merely cast and painted – and roughly at that – with no machining in this critical area. As a result, this tool protested when asked to take a heavy cut or when subjected to hard maple. With a price of $18.50, this tool is an acceptable choice if you work only in softer woods or are willing (make that "overjoyed") by tuning, tuning and tuning your tools.

Available at Tools for Working Wood, 800-426-4613 or toolsforworkingwood.com

LIE-NIELSEN
SMALL BRONZE SPOKESHAVE

This little jewel is based on the British-made Preston tools that are highly desirable among collectors. But this tool isn't designed to just sit on a shelf. It works incredibly well when you need to make precise cuts. Your hands almost totally enclose the bronze body, which gives you a high level of control. Like the Boggs Spokeshave, this U.S.-made tool has a completely machined bed, a thick iron and a heavy cap iron that is machined in two places on its underside. Out of the box, I found it necessary to file and polish the leading edge of the cap iron to allow the shavings to easily escape the throat; otherwise, the tool's throat would occasionally clog. The entire procedure took about 5 minutes, which isn't too much to ask in my book. Like the Boggs Spokeshave, this one doesn't have knobs to adjust the depth of your cut. But because there is only one thumbscrew (instead of two) to tighten, this tool is quite easy to learn to adjust. Owing to the tool's small size and tight throat, it's probably not the only spokeshave you should have in your shop (you can't buy just one, by the way). But because of its outstanding performance it's a strong No. 2 choice.

Available from Lie-Nielsen Toolworks, 800-327-2520 or lie-nielsen.com

LIE-NIELSEN
BOGGS SPOKESHAVE

I've been using the Boggs Spokeshave for nearly nine months now, and it never leaves my bench. Once I got used to setting the iron without adjustment screws, I was hooked. This U.S.-made tool is capable of almost anything I ask of it. The secret to its performance lies in how the tool is made. The tool's bronze bed is fully machined and the .125"-thick iron fits snugly in a channel milled in the body. (Note that you need to sharpen the iron pretty close to square because there is only a little bit of lateral adjustment in the tool.) The cap iron is completely flat on the underside and mates with the iron over its entire face. Add to that the fact that the cap iron is secured with two large thumbscrews and you understand why this tool is so incredibly stable. The only difficulty to report with this tool lies in setting the two thumbscrews. To set the blade you need to hold the iron in place as you tighten the two screws, and this requires a little bit of finger acrobatics. Once the iron is set, however, the tool is comfortable to use for hours and hours thanks to the well-shaped hickory handles and bronze body. The Boggs Spokeshave – which was developed with the assistance of chairmaker Brian Boggs – is the most expensive tool in our test ($125), but worth the price.

Available from Lie-Nielsen Toolworks, 800-327-2520 or lie-nielsen.com

STANLEY 151 SPOKESHAVE

This tool, now made in England, is the genetic ancestor of the Kunz, Anant and one of the Veritas shaves. Too bad it has fallen on hard times. The Stanley 151 of old was a finer tool than this modern version. The fit and finish was better on the old models I've had in my shop, as was the fit between the body, iron and cap iron. In fact, the modern Stanley version has been eclipsed by the Veritas (which is far superior) and even the Kunz (which has nicer adjustment knobs). Like the other less-expensive shaves, the Stanley didn't like to take a heavy cut or work in harder woods. If you were inclined, you could tune up the bed, replace the iron – a $25 to $33 investment – and make yourself a new heavy cap iron. However, that reminds me of the joke about the guy who bought an old handsaw. He didn't like the feel of the handle so he replaced it with a more comfortable handle. After using the saw for a bit he realized that the steel in the blade was junk and so he replaced that, too. The only original parts left were the saw's nuts. If you like Stanley tools, I recommend you check antique stores, flea markets or eBay for a vintage 151. They are quite common and reasonably priced. In fact, you might find a specimen for less than the $23 you'd spend on a new version. While it's a shame that this once-great manufacturer of quality hand tools is now more focused on garage-door openers, it's the simple economics of the modern age.

Available from Garrett Wade, 800-221-2942 or garrettwade.com

VERITAS LOW-ANGLE SPOKESHAVE

This hybrid tool has a lot of things going for it. Because it has the bevel facing up, it cuts at a low angle. This makes the tool easy to use even in hard woods and it is the best tool – hands-down – for shaping end grain. In fact, you can shave off ribbons of end grain when this Canadian-made tool is freshly sharpened – try that with any other metal shave. Because the tool's body is cast aluminum, it's lightweight (like a traditional wooden shave) but the throat won't wear out like a traditional wooden shave is prone to because the body made of metal. The most unusual feature of the tool is its toe piece. It can be turned over and reattached to the body, allowing the tool to be used on outside and inside curves. You set the depth of cut by adjusting the toe piece up and down, exposing more or less of the blade as needed. You also can shift the blade forwards and backwards in the body of the tool, regulating the tool's throat. All-in-all, it's a very adjustable tool. As mentioned earlier, the lower cutting angle means you have to pay closer attention to grain direction to avoid tear-out. If you build chairs (where straight-grained spindles are riven from logs) then this tool is ideal. It's also great for any work that requires extensive shaping of end grain.

Available from Lee Valley Tools, 800-871-8158 or leevalley.com

VERITAS SPOKESHAVE

Lee Valley's newest spokeshave does everything right. The body is cast from nearly unbreakable ductile iron with nicely fitted rosewood and brass handles. The bed of this Canadian-made tool is fully machined, resulting in an airtight fit between the iron and body. The brass adjustment screws fit into the notches on the iron perfectly with no discernable play or spinning – this results in an iron that is easy to set and stays set during your cut. The iron is .125" thick and made using A2 steel, which I personally prefer. The cap iron is a massive .20" thick and is machined on the bottom where it meets the iron and the top where the shavings escape. The throat is a good size for most general work. For woodworkers who prefer a tighter throat, the tool comes with two custom-fitted shims that you can place between the blade and the shave's body. Overall the tool is a joy to use. The rosewood handles are quite comfortable (and I'm told there will be a kit offered soon that will allow you to make your own custom handles for this tool). The Veritas is easy to set and takes a fine or thick shaving without a hint of protest. Harder woods pose no problems for it. Priced at $65, this tool will become one of your best friends.

Available from Lee Valley Tools, 800-871-8158 or leevalley.com **PW**

STOP RUST NOW

Photo by Al Parrish

If it's metallic, odds are it's rusting. But why? And how can you slow it down?

Rust is the bane of woodworking tools. Once it appears, it seems to spread like cancer. For woodworkers in humid, salty climates (such as Hawaii or Florida), it's a never-ending battle. But for many, it's a skirmish that must be fought regularly.

You're probably aware of many ways to combat rust. We've looked at the science and we think we've found some good ways to deal with this problem.

But first you need to understand how rust works: When iron combines with water over time, it forms iron oxide, also known as rust. Pretty simple, right?

Well, there's more to it than that. First of all, know that iron is the most common and most useful metallic element. It is inexpensive, heavy and relatively easy to cast into shape, so you likely have it all over your shop. Odds are your planer and jointer beds, as well as your table saw's table and drill press, all are made out of cast iron.

by Michael A. Rabkin

Comments or questions? Contact Michael at 513-531-2690 ext. 1327 or michael.rabkin@fwpubs.com.

But not everything in your shop will be cast iron. Some of it likely will be steel, which is made when iron is alloyed with carbon. There are two kinds of steel most prevalent in workshops: high-carbon steel and stainless steel.

• High-carbon steel is found most in cutting tools such as saw blades, chisels and plane irons. It's great for cutting tools because it's hard and can be sharpened easily. And following Murphy's Law, because these must be the sharpest, they rust the easiest.

• The great news about stainless steel is that it resists (but is not impervious to) rust. The bad news is that it's a poor cutting tool. If you've tried sharpening a stainless-steel tool, you know that it just won't take a keen edge.

Stainless steel contains iron and chromium. The chromium forms a strong surface oxide, which is very protective. Unfortunately, the chromium also combines with the carbon in the stainless steel to form chromium-carbide particles, which rob the steel of carbon. When you sharpen the steel, these hard particles tear out of the edge, leaving the piece jagged instead of sharp. That's why you find stainless steel in jigs instead of tools that cut.

• Another common metal in workshops is aluminum, which most people assume is rust-proof. They're wrong. Pure aluminum reacts so readily with oxygen that aluminum powder is used as solid rocket fuel in space shuttles and Sidewinder missiles. Fortunately, when aluminum metal is placed in the air, a thin layer known as aluminum oxide forms on the surface and protects the aluminum from further rust.

• You also are likely to find items made of carbide, bronze and brass in your shop, but because those materials don't rust, we're not going to deal with them here.

What Causes Rust?

So now that we know what materials will rust, we need to learn what actually causes rust. "In a nutshell, steel is reacting with

WATER'S ROLE IN RUSTING PROCESS

When a water drop is present on the surface of steel, the iron atom loses two or three electrons and dissolves into the water drop as a positive ion. The free electrons wander through the steel to the other side of the water drop and combine with water and oxygen to form negative hydroxyl ions. These ions diffuse through the water until they encounter the iron ions, where they combine and precipitate, forming red rust. This process is accelerated if there are sulfates or chlorides present in the water drop.

– *MR*

AN UNSCIENTIFIC RUST EXPERIMENT

We wanted to see just how good some products currently on the market are at preventing rust, so we devised a little test.

One of the editors brought in an unrusted cast-iron wing from a table saw that he was willing to let us experiment on. We sanded it clean to remove all the excess moisture. Then we sectioned it into eight equal areas using blue painter's tape.

Next, we sprayed or rubbed seven products onto each section (Japanese Camilla Oil, Slipit, Bostik TopCote, WD-40, Fluid Film, Boeshield T-9 Rust & Corrosion Protection and Perma Blue Liquid Gun Blue, following the directions for each – see the Supplies box on page 92 for information). We left one section untreated.

We then placed the wing on two small blocks of wood outside our woodshop in a grassy area on a Friday afternoon in October. No rain fell that weekend, so we just counted on relative humidity and dew to see if the object would have any rust. (Cincinnati's average relative humidity for October is 84 percent in the mornings, 56 percent in the afternoons.)

When we returned to work Monday, we didn't know what to expect. Would these products all hold up and protect the metal for this short period outside? Would the natural environment and humidity be too much for them?

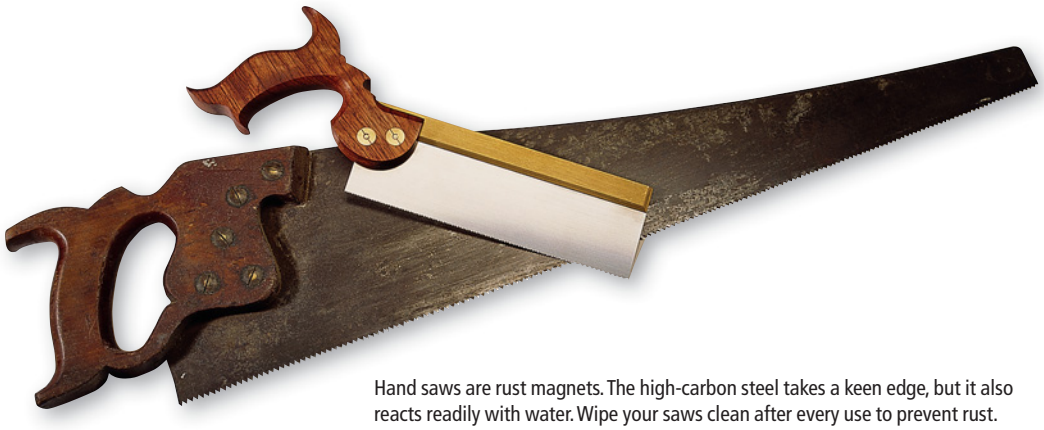
As you can see in the accompanying photo, we got a bit more than we bargained for. Here's how the products fared, from left to right:

• **Camilla Oil:** Thick, bubbly, layered rust throughout the section.
• **Slipit:** Dark splotches along both ends and a thin layer throughout.
• **TopCote:** Dark, blotchy, thick layers of rust scattered in random areas.
• **WD-40:** Slight rusting was starting to appear along edges near the tape.
• **Fluid Film:** Area was moist with either water, the product itself or a mixture of the two, but no rust visible.
• **Boeshield T-9:** Light rusting appears throughout; darker patches at ends.
• **Gun Blue:** Light layer throughout, with partial layer of darker rust in one area (perhaps from uneven application).
• **Untreated:** As expected, this had the thickest and toughest rust.

While this experiment is in no way scientific, we were intrigued by the results.

Also, after we completed this experiment, we saw a product from Empire Manufacturing (empiremfg.com) called OptiShield, a surface protectant, which we will be examining in an upcoming issue.

– *MR*



Hand saws are rust magnets. The high-carbon steel takes a keen edge, but it also reacts readily with water. Wipe your saws clean after every use to prevent rust.

water and forming a hydroxide," says David Burleigh, associate professor in the Materials and Metallurgical Engineering Department at New Mexico Tech in Socorro, N.M.

You might think your shop is dry just because it's indoors, but your tools still will rust because you don't need 100 percent relative humidity to form a water film on your tools. A little salt can jump-start your problem. Particles of dust can contain salt, and even a little bit on a steel surface is hygroscopic, meaning it wants to absorb water from air.

Table salt can start absorbing water and rusting steel at 40 percent relative humidity – this is why handling a freshly polished steel surface with sweaty hands will show a rusty fingerprint.

Pollution also can accelerate indoor corrosion because pollutants often contain sulfur compounds that start absorbing water from the air and rusting steel at 80 percent relative humidity.

"We often think that something is wet only at 100 percent humidity, but even with 50 percent humidity salt particles on the surface start sucking up the water from the air," Burleigh says.

Let's take a closer look at the process. Now you know that rusting occurs on a microscopic scale when dust particles containing salt or pollutants absorb water from the air. Within these microscopic sites, some places become alkaline and others become acidic. If chlorides are present from salt, the moisture can become a dilute hydrochloric acid (or muriatic acid) and the rusting is accelerated. The brittle rust we see on the surface is the result of the microscopic corrosion cells that are active during high humidity and might shut down completely during low humidity. This process is slow, but given enough time, the rust grows thick enough to flake off during the dry spells.

Rust can be either red or black. Red rust is caused by moisture and is what most people are talking about when they discuss rust. (Black oxide, on the other hand, is caused by heat and is actually a good protector. Black oxide doesn't grow or flake. If you know what you are doing, you can coat steel with black oxide by heating it in very hot sand or boiling the steel in high-temperature, high-pressure water.)

Salt water will cause an object to rust faster because the chlorides break down the surface oxide film, making the water a diluted acid, which causes pitting. Heat also speeds the rusting process because most chemical reactions occur faster when it is hotter. This is why caring for your tools by the sea – think warm, wet and salty air – is almost a full-time job.

But the cause of rust isn't what keeps many of us awake at nights – what we want to know is how to prevent it from invading our shop and damaging our tools.

Stay Dry to Fight Rust

Many people talk about rust as if it's actually alive and you must kill it to stop the metal from being ruined. We're not too sure about that, but it does lead us down an interesting path.

Because rust appears anywhere there is water, you should be able to protect metals if you keep them dry. But it's not that easy.

"Anything is better than nothing," Burleigh says. "Anything that works is better than just having bare steel out there to rust."

That said, there are a couple of different ways that you can combat this dreaded scourge:

• Paint or wax the metal. The paint helps prevent the iron from being directly exposed to water or air. Paste wax, applied regularly and often, should work well as long as you make sure to avoid waxes that contain water.

There are many proprietary products on the market that contain organic compounds that bind to the surface of the steel and prevent or slow rusting. These compounds work by many different methods, but mainly they provide either a thick barrier to the moisture or a thin surface that repels the water.

A common worry is that these

USEFUL RUST

What? You mean this disgusting stuff all over my tools can be useful? Say it ain't so!

Oh, it's so.

If you go camping, live someplace cold or enjoy being outdoors when it's cold (at, say, a football game) but want to stay warm, you likely already know about disposable pocket warmers. But did you know these devices are a good example of rust doing good?

When iron rusts, it gives off heat. Disposable pocket warmers are designed to use this heat. The warmers are made out of iron powder, which rusts slowly. By adding water, salt and activated carbon, the rusting process speeds up. When a warmer is removed from its packaging, the iron powder becomes exposed to air, making the iron rust and give off heat.

– MR

SUPPLIES

Lee Valley
800-267-8735 or leevalley.com

11¾ oz. • Fluid Film #AG750, $9.95

Woodcraft
800-225-1153 or woodcraft.com

12 oz. • Boeshield T-9 Rust & Corrosion Protection #03Q56, $14.99

1 can • Slipit #124948, $11.50

Japan Woodworker
800-537-7820 or japanwoodworker.com

1 bottle • Camilla Oil (8 oz.), #15.574.77, $12.95

Area porting goods store

1 bottle • Gun Blue, $5

Area home-supply stores

1 can • Bostik TopCote, $12

1 can • WD-40, $3

Prices correct at time of publication.

products will impede the finishing or staining of the wood. If you first cut a test piece with your freshly coated tooling to remove any excess rust-resistant compound, these products shouldn't affect finishing or staining. (See "An Unscientific Rust Experiment" on page 91 for what we learned about these products.)

• A breathable canvas tarp or fitted tool cover can be quite effective. The cover keeps dust and pollutants in the air from settling on your tools. But try to avoid a cover that goes all the way to the floor, as that will just trap the moisture and encourage condensation.

• A dehumidifier, which takes moisture out of the air, is a great way to prevent rust in your shop if it is a closed room or cellar. If you're in a drafty garage, it won't help, but the garage may not be as humid as a cellar, so you should be a bit safer out there.

• There are some products on the market considered to be organic rust converters. These contain acid that converts rust to black oxide and polymers that bond to rust. Instructions tell you to remove all loose rust, paint on the product and let it dry. While these products have been known to work, oftentimes the resulting surface can be black and rough, and the converted rust might be less durable.

• Manufacturers often use vapor-corrosion inhibitors to protect steel in sealed containers. These inhibitors are volatile organic compounds that condense onto steel and prevent rusting.

Our Preferred Method

Despite all these methods (each with their own positives and negatives), we've found in our years of woodworking, research, talking with experts and fighting rust ourselves, our favorite method is simply to use a tight wooden box to store small tools.

Wood is a great barrier to dust, pollution and humidity. It might even contain a natural vapor-corrosion inhibitor. Dust is a huge magnet for moisture, so if you keep dust off your tools you will discourage rust.

Of course, a toolbox isn't perfect – after all, you have to take your tools out to use them – but until a completely rustproof metal is made that can be used for woodworking, we'll stick with a tight wooden toolbox, tarps for the machines, regular cleaning and some sort of commercial rust inhibitor for the exposed surfaces.

Get Rid of Rust

To remove rust once it appears, there are some options. Surface rust is the easiest to eliminate, especially where excessive pitting has not formed, wrote Jeff Smith in a recent article for *Hot Rod* magazine called "Rust Busting." He said that while there are a number of rust-removal products, the simplest is a quick scuffing with some light-grit sandpaper.

You also can use chemical methods such as Naval Jelly, which is a phosphoric acid that neutralizes light surface rust, making removal easier with an abrasive.

Unless rust is chemically treated or physically removed, it will continue to spread. The problem is not just removing the rust, but also removing the sulfur or chloride ions in the rust that are absorbing water and accelerating corrosion by forming acids.

Burleigh says it's best to remove what you can with whatever method you are most comfortable, then wash the object with soap and water to remove the soluble sulfides and chlorides. Dry it well, then add a rust preventative on the surface.

Adds Smith, of *Hot Rod* magazine: "Fighting rust is not an easy job. Typically, shortcut cures and quick fixes only delay the inevitable, larger rust-repair job."

These are just some of the best ways we've found to remove rust. There are many stories out there from woodworkers who have come up with solutions they say are great, just as there are many different products on the market.

Until someone comes along with the perfect solution, our suggestion to you is to find something that works (whether it's a dehumidifier, an airtight wooden box or simply buying new parts when the old ones get rusted over) and stick with it. But we'll keep our eyes and ears open, too. After all, as actress Helen Hayes put it, "If you rest, you rust." **PW**

A 'SHOCKING' WAY TO REMOVE RUST

We found a cool electrolysis experiment online via metals.about.com (thepontiac-transampage.com/rust.html) that seems to work well to remove rust from your smaller metal tools. All you need is a plastic bucket, a battery charger, some baking soda and an electrode.

If you remember back to science class, a simple way to remove rust is to provide an electrical current – the rust will then move with the current. To get a current flowing, pour water into the bucket, adding about a tablespoon of baking soda per gallon of water. (Once the current is started, adding more soda will not make it go faster.)

Put the piece of rusted metal into the water with the negative lead on it. (If it is part of a tool that has nonmetal parts, remove those parts, as you don't want to ruin them.) Attach the positive lead to the electrode, which could be a nail, a screw or baking pan (stainless steel works best). Place this electrode in the water a few inches away from the rusted metal (which must be completely submerged in the water), turn on the battery charger and watch as the rust goes away.

When it looks like the tool is clean, remove it (use rubber gloves because the water is dirty) and take the leads off it. Scrub the surface with a warm, soapy pad to get the crud off it and see if the rust is all gone. If not, just repeat the process until you're satisfied. Then dry the objects and you're ready to get back to work.

– MR

After attaching the negative lead to the piece of rusted metal, attach the positive lead to a sacrificial piece of metal. Then place this object in the bucket a few inches away from the rusted piece. After a while, remove the objects and see how much rust is gone. We think you'll be pleasantly surprised.

Battling Blotching

Forget wood conditioner and go for gel stain.

Photo by Al Parrish

Many softwoods, such as pine, and a number of hardwoods blotch when stained.

You've heard me say this before, and I'm sure you'll hear me say it again: The worst single thing that can happen in wood finishing is blotching – that is, uneven stain coloration caused by uneven densities in the wood. Blotching is the only problem that can't be fixed even by stripping and starting over; you have to sand or plane off as much as 1/32" of wood to get below the dark areas.

In woods such as pine, spruce, fir, aspen, poplar and alder, blotching is almost always quite ugly. In woods such as cherry, birch and soft maple, blotching is usually ugly but can be attractive. In woods such as walnut, curly maple, bird's eye maple and most burls, blotching is usually very attractive. Woods such as oak, ash and mahogany don't tend to blotch.

Of all these woods, pine, which is the first wood used by most beginning woodworkers, blotches worst. So I'm going to use pine for my illustrations here. But almost everything that applies to reducing blotching in pine applies equally to the other woods.

There are two widely available products that reduce or eliminate blotching: wood conditioner and gel stain. Wood conditioner is marketed to solve the blotching problem, but the directions on the two most commonly available brands, Minwax and Olympic, are incorrect for eliminating blotching. Gel stain works better than wood conditioner (even when the wood conditioner is applied as I describe later on in this article), but gel stain isn't promoted to solve the blotching problem, so most people don't understand its value. Let's look at each of these products in some depth to determine which of them is best for eliminating blotching on your projects.

Wood Conditioner

Wood conditioner is a very simple product. Most brands are one part regular varnish or polyurethane varnish thinned with approximately two parts mineral spirits (paint thinner). You can easily make your own.

Some brands are thinned water-based finish. Because this finish is far more complex than varnish, merely thinning it with water isn't sufficient to make an effective product. You're better off using a commercial brand.

The effect of thinning varnish or water-based finish is to reduce the "solids" – that is, the ratio of finish to thinner – enough so the wood doesn't get totally sealed. When a stain is then applied, it still colors the wood near the surface but is prevented from going deep in those areas that will blotch.

The equivalent product used by most professionals spraying lacquer is called a wash-coat. It is most often lacquer thinned to about the same solids content as wood conditioner and sprayed on the wood before a stain is applied. Wood conditioner is thus equivalent to what is used in the best furniture factories – with one big exception. Lacquer dries within minutes; varnish and water-based finish take longer. Varnish takes overnight, and water-based finish takes 30 minutes to an hour.

It's here that the directions on the Minwax- and Olympic-brand wood conditioners cause so many woodworkers to still get blotching.

The directions on the cans of the varnish-based wood conditioners call for the stain to be applied within two hours of applying the wood conditioner. Because two hours is much too little time for varnish to cure, the stain just mixes with the still-liquid wood conditioner and still penetrates deeper in some areas than others. The result is blotching – just a little less severe because the stain is now diluted.

The directions on Minwax's water-based wood conditioner call for the stain to be applied within 15 to 30 minutes of the wood conditioner. Unless your shop is very hot and dry, the wood conditioner will not be dry and will be less effective for the same reason as explained above. Moreover, sanding the wet wood to remove the raised grain won't be very effective. The wood will still be rough after the stain has been applied.

by Bob Flexner

Bob Flexner is the author of "Understanding Wood Finishing" and a contributing editor to Popular Woodworking.

Using a Wood Conditioner

To eliminate blotching with a wood conditioner, begin by applying a wet coat using a brush or rag. Keep the surface wet for a minute or two by applying more of the product to any areas where the thinned finish soaks in, then wipe off all the excess with a clean cloth.

After drying overnight for varnish-based wood conditioner or about an hour for water-based wood conditioner, sand the wood (if necessary) to make it feel smooth. (Note that sanding is always necessary with water-based wood conditioner.) Once smooth, dust the surface and apply the stain in a normal fashion: Brush or wipe on a wet coat and wipe off the excess before the stain dries.

Though wood conditioner applied in this manner will eliminate most or all of the blotching, it will also cause the color to be much lighter because the stain is prevented from penetrating very deep into the wood. To create a darker coloring, you can leave some of the excess stain on the surface or apply a second coat after the first one dries (which has the same effect as leaving more stain on the surface). Just don't leave so much stain that you muddy the wood or cause streaking.

Gel Stain

Gel stain is regular oil- or varnish-based stain that has been thickened. Thought of another way, gel stain is gel finish with pigment, and sometimes dye, added. Thickening regular oil- or varnish-based stain reduces the tendency of the stain to flow into the wood, so blotching is reduced or eliminated.

You can easily make your own gel stain by adding pigment colorant to any varnish-based gel finish. (I've never even seen a water-based gel finish.)

Apply gel stain just as you would a liquid stain. Brush or wipe on a wet coat and wipe off the excess before the stain dries. Make your last wiping strokes go with the grain.

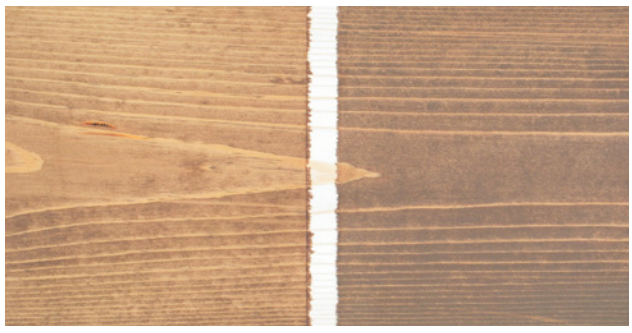
Just as with wood conditioners, the reduced penetration of gel stain leaves the wood a lighter shade than you might want. To make the color darker, leave some of the stain on the surface, but not so much that you cause muddying or streaking.

Conclusion

Both wood conditioner and gel stain have the potential to eliminate blotching. But doing so when using a wood conditioner requires an extra product, an extra step including overnight drying in most cases, and the results are not as predictable from project to project or from wood to wood as they are with gel stain. Frankly, I don't understand why anyone would use a wood conditioner over a gel stain if the goal is to eliminate blotching. **PW**

The liquid stain I applied (left) caused blotching, but the gel stain (right) didn't. You can see the deeper penetration in the blotched areas after a pass with a hand plane.

On this board, I applied a gel stain (left) and a liquid stain over a wood conditioner that had dried overnight (right). You can see that neither procedure adds much color to the wood, but both eliminate the blotching. Gel stain requires only one step, however, and wood conditioner followed by the stain requires two – and overnight drying in between.



Liquid oil-based stain (left) causes considerably worse blotching than liquid water-based stain (right) because water-based stain is naturally thicker. As a result, depending on the wood you're using, you may be able to apply water-based stain without any blotching. But to be safe, do a test on scrap from your project.

Photos by the author

In the far left panel, I applied a liquid stain directly to the wood. I then applied a varnish-based wood conditioner to the rest of the board. I applied the same stain to the second panel immediately, the third panel after ten minutes, the fourth panel after two hours and the rightmost panel the next day. You can see that the blotching problem isn't solved unless the wood conditioner is allowed to completely cure.

Cutoffs from the same board were used for all the samples shown above. Minwax products were used on all the samples except the left side of the top sample. On it I used Watco liquid stain because it showed up better in the photo.

PRODUCT INDEX

	PAGE #	CIRCLE #	WEB ADDRESS
ADHESIVES			
Epoxyheads	8	112	epoxyheads.com
Gorilla Glue	25	121	gorillaglue.com
Titebond	2	116	titebond.com
BITS, BLADES & CUTTERS			
Amana	22	102	amanatool.com
Freud	9	117	freudtools.com
Infinity Cutting Tools	31	123	infinitytools.com
Librawood	102	131	librawood.com
Olson	39	137	olsonsaw.com
Ridge Carbide	103	141	ridgecarbidetool.com
Woodline USA	18	156	woodbits.com
BOOKS			
Woodworker's Book Club	Insert	—	woodworkersbookclub.com
BUSINESS OPPORTUNITY			
Furniture Medic	23	118	furnituremedic.com
FASTENERS			
Arrow Fasteners	25	103	arrowfastener.com
Kreg Tool	26	128	kregtool.com
Miller Dowel Co.	39	135	millerdowel.com
FINISHES & SUPPLIES			
Waterlox	102	151	waterlox.com
FURNITURE & PROJECT PARTS			
Adams Wood Products	22	100	adamswoodproducts.com
Classic Designs	20	107	tablelegs.com
Osborne Wood Products	97	138	osbornewood.com
HAND TOOLS			
BrandNew Industries	102	—	brandnew.net
Fine Tool Journal	102	114	finetoolj.com
Glen-Drake Tool Works	39	120	glen-drake.com
Japan Woodworker	29	124	thejapanwoodworker.com
Lie-Nielsen Toolworks	8	132	lie-nielsen.com
Manny's Woodworker's Place	102	134	manny'swoodbooks.com
Tools For Working Wood	102	148	toolsforworkingwood.com
HARDWARE			
Ball & Ball	25	104	ballandball-us.com
Whitechapel Ltd.	31	152	whitechapel-ltd.com
Woodworker's Hardware	39	160	wwhardware.com
KITS & PLANS			
U-bild.com	102	149	u-bild.com
Woodcraft Plans	103	155	woodcraftplans.com
MISCELLANEOUS			
Dakota Alert	103	109	dakotaalert.com
POWER TOOL ACCESSORIES			
Beall Tool	102	105	bealltool.com
Bench Dog Tools	23	106	benchdog.com
Craftsman Gallery	103	108	thecraftsmangallery.com
Jointech	29	127	jointech.com
Leigh	26, 31	—	leighjigs.com
Stots Corporation	102	147	stots.com
Woodpeckers	103	157	woodpeck.com
POWER TOOLS			
Delta Machinery	11	110	deltamachinery.com
DeWalt	15	111	dewalt.com
Fein Power Tools	19	113	feinusa.com
Fisch	29	115	fisch-woodworking.com
General Mfg.	39	119	general.ca
Grizzly Industrial	C2-1	122	grizzly.com
JET Tools	4-5	125	jettools.com
JET Tools	21	126	jettools.com
Laguna Tools	C4	129	lagunatools.com
Legacy Woodworking	103	130	legacywoodworking.com
Makita	41	133	makitatools.com

	PAGE #	CIRCLE #	WEB ADDRESS
POWER TOOLS			
Porter-Cable	7	140	portercable.com
Sears Craftsman	C3	143	craftsman.com
Shopbot	29	144	shopbot.com
Smithy	20	145	smithy.com
Wilke	17	153	wilkemach.com
Woodstock Int'l	27	158	woodstockinternational.com
SAWMILLS & KILNS			
Norwood Industries	102	136	norwoodindustries.com
SCHOOL & INSTRUCTION			
The Home Shop	103	—	shakerovalbox.com
SHOP ACCESSORIES			
Airware America	103	101	airwareamerica.com
TURNING SUPPLIES			
Packard Woodworks	102	139	packardwoodworks.com
WOOD & VENEERS			
Newton Woods	102	—	walnutwoods.net
Stordco International	103	146	
Wall Lumber	31	150	walllumber.com
Woodfinder	102	—	woodfinder.com
WOODWORKING CATALOGS			
Rockler	29	142	rockler.com
Woodcraft	12-13	154	woodcraft.com
Woodcraft	97	162	woodcraft.com
Woodworker's Choice	102	159	thewoodworkerschoice.com
Woodworker's Supply	25	161	woodworker.com

See something you want? Need more information?

Use the Free Information Card in this issue to receive free advertiser information.

For ***faster service,*** go **online** at www.popwood.com and click "FREE INFORMATION" or **fax the card** to (585) 321-0043.

Win A Porter-Cable 895PK Router Kit!

When you request information, you're automatically entered in our drawing to win a Porter-Cable 895PK router. The 895PK offers a 2¼ hp soft-start motor with variable speed. The router has adjustment with 1/128" accuracy, through-the-table height adjustment, an automatically engaging collet lock, and bit changes without removing the

MEET OUR NEWEST KITCHEN ISLAND TRIO!

OSBORNE Wood Products, Inc.
www.osbornewood.com

8116 Highway 123 North
Toccoa, GA 30577
Request a catalog: 1-800-746-3233
Order line: 1-800-849-8876

CIRCLE NO. 138 ON FREE INFORMATION CARD.

I'm Bill Carroll, call me & I'll show you how you can own a Woodcraft franchise

When I think about owning my own business . . .

Bring your woodworking skill, your love of tools, and your expertise and we'll show you how you can turn your passion for woodworking into your life's work.

. . . I think of Woodcraft

WOODCRAFT®
Helping You Make Wood Work®

800 344-3348 or e-mail: bill_carroll@woodcraft.com

1177 Rosemar Road
P.O. Box 1686
Parkersburg, WV 26102-1686

Dept. F04PW04Q

CIRCLE NO. 162 ON FREE INFORMATION CARD.

ADVERTISER INDEX

The Basic Bench Hook

Three pieces of wood make crosscutting and planing easier – no matter where you work.

Photo by Al Parrish

It's difficult to imagine the wooden bench hook without its almost constant companion, the backsaw. Indeed, this association is so strong that an alternative name for this useful hand-tool appliance is "saw rest."

For lighter sawing in the shop, the bench hook excels in effectiveness and convenience. The lower extension, or stop, "hooks" against the edge of the bench, and the material being sawn is held against the upper stop, as shown in the photo at right. Because Western saws cut on the push stroke, the thrust of the saw helps hold the material in place. As a result, the bench hook and the material can be moved around at will, without any need for clamping or fastening.

Typically, the bench hook has a notch at the end of the upper stop (or a kerf is sawn into the stop) to allow the material to be fully supported while it is being cut. This arrangement also protects the benchtop from being damaged as the saw blade breaks through the work. The notch (or kerf) is located to the right of the stop for right-handers and to the left for left-handers.

The squared end of the stop can serve as a guide for the saw. For example, with the addition of a secondary "length stop" (which can be as simple as a strategically placed handscrew clamp), you can make repeated cuts of uniform length by using the squared end of the stop as a guide. This is a safe and effective way to cut short lengths of dowel stock, as shown on page 99.

However, I tend not to use the end of the stop as a saw guide. Rather, I work to knife lines on the material itself and use the notch as a "safe" area where saw cuts can be made without damaging the stop or the saw.

Building a Bench Hook

As with all shop-made appliances, bench hooks can be constructed in any number of ways, depending on their intended usage and available materials.

by Don McConnell

Don McConnell builds furniture and does ornamental carving in Mt. Vernon, Ohio. Formerly at the cabinetmaker's shop at The Ohio Village, he remains an avid student of the history of the trade, tools and shop practices.

The simplest, and possibly earliest, type of bench hook can be cut from a single piece of 4/4 material by drawing the shape of two stops and bed on the face grain and sawing them out. The hook will be quite narrow (the 1" thickness of the stock it was cut from) and you will need a pair of them to adequately support your work. Though this type of bench hook doesn't provide the same protection for the benchtop when cutting and isn't as adaptable, it is compact and portable.

The bench hook most commonly encountered today is constructed using three pieces of wood – a main bed piece of some length and width (10"-12" long and 7"-8" wide, typically), and two narrow projections, also known as "stops." These pieces are attached in various ways to the bed of the bench hook, depending on circumstances, available materials and intended use.

Because bench hooks are commonly used in a somewhat sacrificial manner, they often are made without regard for the long-term effects of cross-grain construction. Indeed, a perfectly usable bench hook can be temporarily constructed simply by nailing the stops to the bed piece. A more common method is to affix the stops to the bed using glue and wooden pegs. If it isn't too wide and the bench hook isn't subjected to extreme environmental changes, this method of construction will remain viable for a long time.

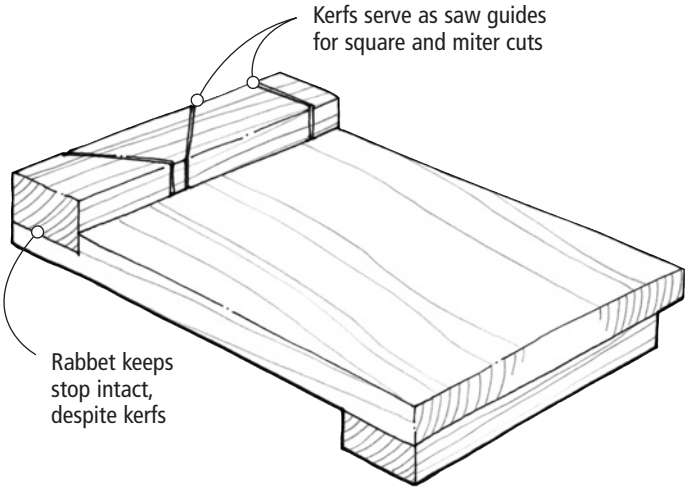
If you have suitable material and want a wider bed piece for your bench hook, it is possible to use slotted screw hole construction to attach the stops, as shown in the illustration below. The actual construction method can vary, but it is best to recess the screw heads to eliminate the possibility of running the teeth of your saw into them. The location of the fixed screw on the upper stop isn't important, but it can be critical on the lower stop if you are planning to use the bench hook as a shooting board and need the end of the stop to remain flush with the edge of the bed. This form of construction is secure enough for most uses, while the slotted holes for the screws allow for the cross-grain movement of the wider bed piece.

Cutting short pieces to accurate length is a tricky operation with a miter saw. The bench hook, backsaw and a handscrew clamp make the job safe and efficient.

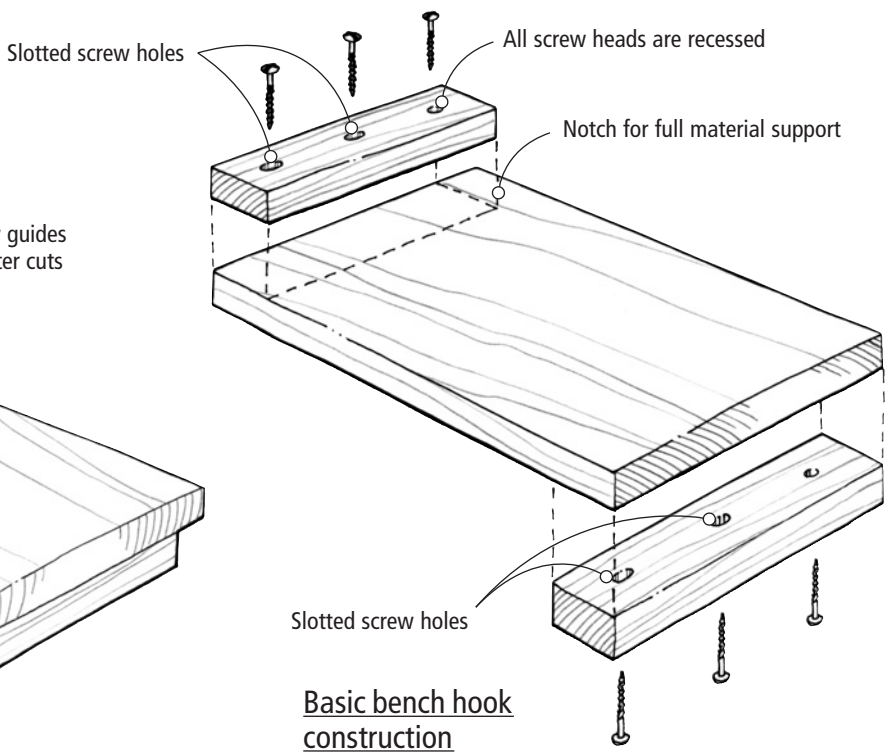
Miter Block for Precision Sawing

Though usually treated as a separate subject, the miter block (below) can be seen as a specialized form of bench hook. This has square and miter kerfs sawn into one of the stops that serve as effective guides for a backsaw.

Each kerf can be made with the aid of an accurately placed guide block, being sure to use the saw (preferably with minimal set) that will be in service for the subsequent work. When kerfs are made in a stop in this manner, it's desirable to glue the stop into a shallow rabbet in the end of the bed. This allows the stop to retain its lengthwise dimensional stability, and the integrity of the kerfs, despite the cross-grain construction.



Miter block



Basic bench hook construction

The miter block is a useful alternative to a miter box when working with small pieces. If maintained and used with care, it is capable of precise work because it fully supports the material being sawn and the location of the cut can be precisely predicted. Its utility is especially apparent with short pieces, which can be difficult or dangerous when being cut with a power miter saw.

Particularly when making miter cuts, it's often best to secure the lower stop of the miter block in the bench vise to keep it from sliding sideways during use.

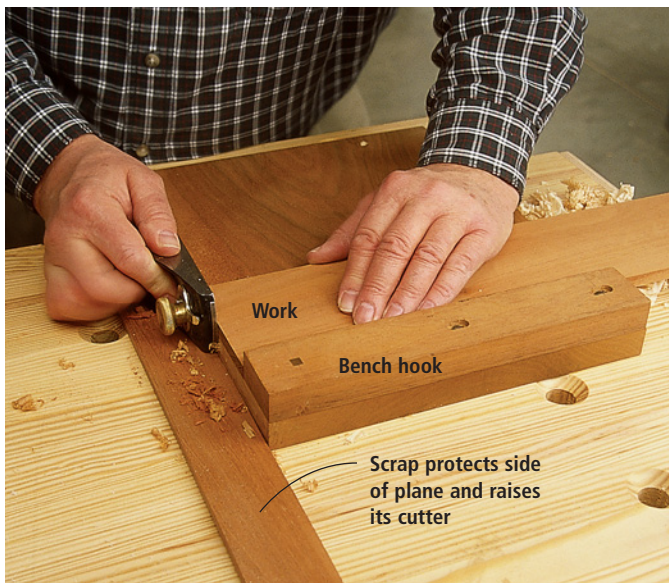
Bench Hooks and Planing

As already mentioned, a bench hook can be used in conjunction with a hand plane. For example, it can be turned over lengthwise so that the full length stop is at the top. In this orientation, it serves as a short shooting board to true the ends of smaller pieces. Sometimes it's desirable to place a thin scrap below the plane for it to run on, which protects the plane and adjusts its height so the cut takes place near the center of the iron.

Also, if you add a secondary "bed" that is slightly thinner than the stop, the bench hook can be used to plane thin stock of short lengths. Most of the time, this secondary bed can simply lie on the main bed with its end against the stop. In this usage, the bench hook serves as a small planing board.

The versatility of the bench hook also makes it a prime candidate for various kinds of on-site work. As long as there is a surface to place the bench hook on, plus an edge that you can rest the lower stop against, it can be used for all of the above-mentioned functions – all while protecting the saw or plane and the surface on which the bench hook rests. I've used bench hooks on the top tread of a staircase, the edge of a porch, on sturdy or braced household tables, and the tops of table saws and jointers.

Especially for shorter, thinner, narrower or awkward pieces, a bench hook and backsaw can provide a safe and versatile option for any woodworker, either at the bench or out on the work site. **PW**



The bench hook makes an effective shooting board for truing the ends of small pieces. The piece of scrap below the plane protects the side of the tool and centers the tool's cutter on the work.

Bench hooks can be used almost anywhere (such as on the bed of this jointer) and can do some surprising tasks. Here it is being used as a small planing board. The light-colored scrap below the work raises the work above the bench hook's stop.

BENCH HOOK HISTORY

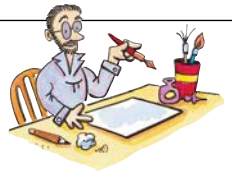
Some readers might be surprised to learn that Joseph Moxon, in his "Mechanick Exercises" (published serially between 1678-1680), uses the term "bench hook" to describe a device we know today as a bench stop or a bench dog. In other words, a device that is installed in a recess in the benchtop, that projects just above the surface and that prevents material from moving forward while being planed. The type of "bench hook" illustrated by Moxon has a lateral projection at its upper end that gives it the appearance of a hook. This usage is largely obsolete now, though it continued until at least the middle of the 19th century.

Because the wooden shop appliance we now know as the bench hook is closely associated with backsaws, it is tempting to hypothesize that it arose as a common shop accessory in conjunction with the emergence of backsaws. Because backsaws first appeared about Moxon's time, it seems likely that the wooden bench hook first emerged not long after. However, the first illustration of a wooden bench hook that I'm aware of isn't until in Peter Nicholson's "Mechanical Exercises," published in 1812.

— DM

Caption the Cartoon

Illustrated by Bob Rech
bobrech@juno.com



We Now Take E-mail Entries!

Submit your captions for this cartoon by e-mailing them to **cartoon@fwpubs.com** (be sure to put "Cartoon Caption #64" as the subject of your e-mail) with your name, address and phone number. Or send your caption to us on a postcard to: *Popular Woodworking*, Cartoon Caption #64, 4700 E. Galbraith Road, Cincinnati, OH 45236 by **May 3**. Contest winners will be chosen by the editorial staff.

This issue's winner receives Ryobi's 3-Base Router Combo Kit. The RE1803BK kit offers a variable-speed 9.5-amp soft-start motor with fixed, plunge and D-handle bases, all in a cool canvas carrying case. The kit, valued at $179, includes an edge guide and a five-piece template guide bushing set. Runners-up each win a one-year subscription to *Popular Woodworking*.

"None of these racers today tested positive for 240V."

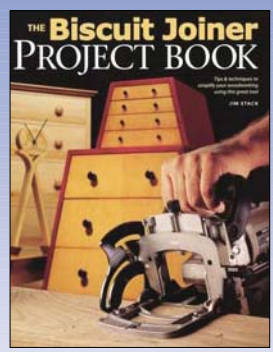
Mike Davis, of Georgetown, Ontario, won our Cartoon Contest from the November 2003 issue and will receive Amana Tool's E-Z Dial Slot Cutter. The following runners-up each receive a one-year subscription to *Popular Woodworking:*

"The distance for today's leg of the Woodworker's Triple Crown is set at a challenging 8.5 board feet." **Bill Kurtz, West Chester, Ohio**

"Charging to the lead at the first turn, it's Sawbiscuit!" **Ken Emerson, Bucyrus, Ohio**

"Thanks Jim. And now we cut to the finish!" **Philip Jacobs, St. Paul, Minnesota**

Build Furniture That Lasts!



Creating strong, durable joints has never been easier with the biscuit joiner. And now you can use this practical technique to creating wonderful new pieces of furniture for your home!

With 12 projects, including a bookcase, nightstand, chest of drawers, and entertainment center, you'll discover the value of the biscuit joiner for stylish, durable, and functional furniture. Best of all, you'll be amazed at how quickly you can turn your home into an artful display of your crafts!

Order your copy of *The Biscuit Joiner Project Book* today!
#70531-K/$26.99/128 pgs/pb/200 color illustrations

Available at your favorite bookseller or directly from the publisher using the Order Form below.

ORDER FORM

YES! Please send me _____ copy(ies) of *The Biscuit Joiner Project Book* (#70531-K) $26.99 each

SUBTOTAL: $ _____

In the U.S. please add $3.99 shipping and handling for the first book, $1.99 for each additional book. In OH, NY, CO and MI, please add applicable state tax. In Canada, add US$5.00 shipping and handling for the first book, US$3.00 for each additional book, and 7% GST. Payment in U.S. funds must accompany order.

TOTAL: $ _____

☐ Check or money order enclosed -or-
☐ Charge my ☐ VISA ☐ MC ☐ AmEx
Acct.#_____
Expiration date _____
Signature_____
Name_____
Address_____
City_____
State/Prov._____ ZIP/PC_____

Send to: Popular Woodworking Books
PO Box 9274
Central Islip, NY 11722-9274

TC04PPWB

For more information or to order by Credit Card visit
www.popularwoodworking.com/store/books
or call toll free **1-800-221-5831**

WOODWORKER'S MARKETPLACE

TWC
The Woodworker's Choice
SAVE $ - check the TWC web site for numerous BIG BARGAIN overstock & close-out items such as: saw blades, router bits, shaper cutters, clamps, etc.
You'll also find more BIG $ SAVINGS on the WEEKLY SPECIAL ITEMS we select from regular TWC catalogs.
www.thewoodworkerschoice.com
CALL TOLL FREE: 1-800-892-4866

CIRCLE NO. 159 ON FREE INFORMATION CARD.

U-BILD.COM
On-line catalog pictures hundreds of full-size woodworking plans at low prices. Free downloadable mini-plans. All skill levels. Free shipping. 48-page color catalog $2.00 (refunded on 1st order) call (800) 828-2453.

CIRCLE NO. 149 ON FREE INFORMATION CARD.

Announcing
Gladstone TOOLS
"The Tools You Keep"
ROSEWOOD TRYSQUARES
Boxed set of 4 Rosewood Squares.
12", 9", 6", 3", $75
Exclusive Distributors
MANNY'S WOODWORKERS PLACE
Order by phone 1-800-243-0713
555 S. Broadway, Lexington, Ky 40508
on the web: www.gladstonetools.com or ww.mannyswoodworkersplace.com

CIRCLE NO. 134 ON FREE INFORMATION CARD.

Get a Free Copy of our CATALOG for WOODTURNERS
Packard WOODWORKS
"The Woodturners' Source"
Call Toll Free... 1-800-683-8876
or write...
Packard Woodworks PO Box 718 Tryon, NC 28782
website: www.packardwoodworks.com

CIRCLE NO. 139 ON FREE INFORMATION CARD.

LumberMate 2000
NORWOOD INDUSTRIES INC.
$3,895.
Personal Sawmill
1-800-661-7746 ext 441 www.norwoodindustries.com

CIRCLE NO. 136 ON FREE INFORMATION CARD.

BRANDING IRONS
as low as $54.95
BRANDNEW
1-800-964-8251
www.brandnew.net

NEWTON WOODS
Featuring Superior
- Black Walnut Burl, Maple Burl, Madrone Burl and Red Gum Burl Veneers
- Burl Slabs
- Gun Stock Blanks
- Turning Wood

Phone: 559-277-8456
E-mail: calfbman@aol.com
Web: WalnutWoods.net

TUNG OIL BASED FINISHES SINCE 1916
Waterlox Tung Oil penetrates • No sanding necessary for adhesion • Great for use with Exotics • Protects against moisture, heat/cold, household chemicals • very easy to apply, maintain & re-coat • Hand-crafted for 4 generations
For more information: e-mail: info@waterlox.com, call: 1.800.321.0377 or visit www.waterlox.com.
WATERLOX
Time Tested Finishes

CIRCLE NO. 151 ON FREE INFORMATION CARD.

"Forrest" Saw Blades
10" Woodworker II - $97
10" Chopmaster - $109
12" Chopmaster - $123
8" Dado King - $237
www.librawood.com

CIRCLE NO. 131 ON FREE INFORMATION CARD.

Looking for wood?
VISIT woodfinder
It's fast, easy and FREE!
www.woodfinder.com
No computer? Call toll-free 1-877-933-4637

Hand Tools for Serious Woodworkers
Reproduction Norris A5 Infill smoother by Ray Iles.
$649.95
complete catalog online
www.toolsforworkingwood.com

CIRCLE NO. 148 ON FREE INFORMATION CARD.

Lie-Nielsen Standard or Low Angle Block Plane.
Special $135.00.
Fine Tool Journal
27 Fickett Rd.,
Pownal, ME 04069
(800) 248-8114
Always Free US Shipping on Lie-Nielsen Tools!
Full line on web. www.FineToolJ.com/LN

CIRCLE NO. 114 ON FREE INFORMATION CARD.

DOVETAILS MADE EASY!
Jigs
Free
Plans
Tips
visit
STOTS
www.stots.com

CIRCLE NO. 147 ON FREE INFORMATION CARD.

The Wood Buff 3-ON LATHE MANDREL
New accessory allows you to do all three wood buffing steps without changing wheels! Great for pens & other small items.
For information call or write: Dept. PW
THE BEALL TOOL CO.
541 Swans Road., N.E. Newark Ohio 43055
Toll Free 1-800-331-4718
Website: www.bealltool.com

CIRCLE NO. 105 ON FREE INFORMATION CARD.

WIRELESS DRIVEWAY ALARMS

Lets you know anytime anyone walks or drives into your place.

DAKOTA ALERT, INC.
BOX 130, ELK POINT, SD 57025
605-356-2772
www.dakotaalert.com

CIRCLE NO. 109 ON FREE INFORMATION CARD.

FREE PLANS CATALOG!

www.WoodcraftPlans.com

"THE place to find hundreds of plans."

Call for a catalog: 800.296.6256

CIRCLE NO. 155 ON FREE INFORMATION CARD.

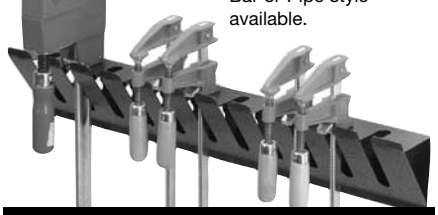
www.AirwareAmerica.com
3M Safety Products, including Power Visor, Airstream, Airmate and BreatheEasy respirators. Trend Airshield, Peltor AM/FM Worktunes & Wing Little Giant Aluminum Ladders.
www.AirwareAmerica.com
800-328-1792

CIRCLE NO. 101 ON FREE INFORMATION CARD.

NEW Steel Clamp Racks

SALE only
$19.95
2+/$18.50 ea.

Save Space!
Holds 200 lbs in 22". Bar or Pipe style available.



Order on-line www.woodpeck.com

CIRCLE NO. 157 ON FREE INFORMATION CARD.

www.legacywoodworking.com

CIRCLE NO. 130 ON FREE INFORMATION CARD.

CUSTOM ROUTER BITS, CUTTERS & KNIVES
2 week or less delivery

LIBERTY LINE
WHEN IT COMES TO ROUTER BITS WE KNOW WHAT WE'RE TALKING ABOUT.

RIDGE CARBIDE TOOL CO.
"Industry Leader In Custom Router Bits"
FAX us your custom drawings toll free at 1-888-RCT-TOOL (728-8665) or mail drawings or wood samples

RIDGE CARBIDE TOOL CO.
595 New York Ave., PO Box 497, Lyndhurst, NJ 07071
Call for complete 100 page Stock Tool Catalog or see us at www.ridgecarbidetool.com
800-443-0992 rcttool@bellatlantic.net

CIRCLE NO. 141 ON FREE INFORMATION CARD.

ABSOLUTELY CLEAR
Cabinet and Furniture Stock
Mahogany (African) Makore (African Cherry) Sapele.
4/4 - 12/4 - 3-6' Kiln Dried 6-8%
Shipped anywhere in the 48 states
$1.50 bft (+Shipping)
Ph. (516) 431-1395 Fax (516) 432-8181
E-Mail stordco@yahoo.com

CIRCLE NO. 146 ON FREE INFORMATION CARD.

Need a precise and affordable tool for routing furniture joints?

Visit us...
we are the WoodRat® specialists!

www.chipsfly.com

CIRCLE NO. 108 ON FREE INFORMATION CARD.

Build Your Own 12' Sail Boat

May 14-16, 2004
Charlotte, Michigan
$750 Class & Boat
call John Wilson
517-543-5325

Classified

Classified rate is $4.25 per word, 15-word minimum. Order must be accompanied by payment; ads are non-commissionable. Send to: Popular Woodworking, Barbara Gasper, 4700 E. Galbraith Rd., Cincinnati, OH 45236. Phone: 610-967-1330, Fax: 513-531-1843.

Bits, Blades & Cutters

PLANER KNIVES ANYONE CAN CHANGE at a price anyone can afford. Instant, accurate knife changes. Every machine, every time. German quality. Time-proven performance. Superior customer service. Dispoz-A-Blade.com. 800-557-8092.

Books

WE HAVE A WIDE VARIETY of woodworking books – from small projects, to home improvement, to enhancing your woodworking skills, and more! To see our full line of books, please visit our Web-site at www.popularwoodworking.com/store/books!

Business Opportunities

"NEW IDEA? IMPROVE A PRODUCT?
Free Invention Assessment. Patenting, industry presentation, licensing. Free information. 1-800-501-2252; www.franklinforge.com"

Finishing Supplies/Equipment

SPRAY-ON SUEDE. Line boxes easily. Free brochure with sample. DonJer, 13142 Murphy Road, Winnebago, IL 61088; 800-336-6537; www.donjer.com

Instructional Videos

CHAINSAW CARVING INSTRUCTIONAL VIDEOS
Set of 10. Everything you need to know. Fun and easy. $79.95 plus $14.95 S&H. Free Info 1-866-44CARVE

Kits & Plans

CARLYLE LYNCH MEASURED DRAWINGS Museum and private collection furniture plans by Carlyle Lynch. Catalog $2. PO Box 13007, Arlington, TX 76094; 817-861-1619.

ROCKING CHAIR PLANS Exquisitely comfortable rocker. Go to www.haltaylor.com and click on plans.

Miscellaneous

POST OFFICE BOX DOOR FRONTS,
#1 $10.00 + S&H. Coin slot plates, etc. to make banks. SASE for info. Hubbert, PO Box 1415, Fletcher, NC 28732; 828-687-0350.

School/Instruction

37-WEEK ARCHITECTURAL WOODWORKING .
Career training program.New England School of Architectural Woodworking; www.nesaw.com.

Software

DESIGN INTUITION™ -- CAD redefined! Create professional blueprints MAC OS X. www.gizmolab.com/save/pw/3

Pride for Sale

I wanted my profit margin high but my ego was knocked low.

Illustration by Pat Lewis

Like most woodworkers I dreamed of transforming my talent into a profitable career where I could pursue my passion and make a decent living at the same time. But like many of us, I became so intimately involved in my craft that I failed to take criticism very well. Call it ego if you will, but I think that products of my blood, sweat and tears deserve respect. Unfortunately for the business side, this often can hamper sales.

I found this out firsthand when I began to sell some of my carvings. The arrangements I made with various shops and galleries were easy enough because I didn't have to deal directly with customers.

However, I decided to work a few shows to gain more exposure and promote some more sales. I figured that once people saw how much care and craftsmanship went into each piece I built, they would beat a path to my booth to buy my goods.

Oh, was I wrong.

While my first show generated a lot of interest, it produced few buyers. This didn't bother me as much as a few of the irksome characters I encountered while there.

I'll be the first to admit that I've often prowled these kinds of shows with the intent of borrowing a few novel ideas, but at least I'm discreet about it. I had one man walk up and set one carving apart from all of the others. Then, without uttering a word, he produced a camera and began taking several photos of the piece. The final straw came when he set a quarter down next to my carving so he could scale the dimensions. That was when I intervened and told him I would rather not have him do that, but if he wished, he could plunk down another 149 quarters and take the piece home. He glared at me indignantly, snatched up his quarter and angrily stomped away.

Shortly thereafter, a young, ambitious-looking couple strode up and showed great interest in a line of puzzles I designed.

"Do you mass-market these items?" one of them asked me eagerly.

"Pardon me?" I said.

"Have you ever approached a manufacturer with this design?" one of them wondered. "We're sure that a manufacturer would be interested in something this unique. We specialize in marketing, and this concept could easily be adapted to produce plastic versions in any color imaginable."

As a woodworker, I jumped at the opportunity to impress upon them the fact that every piece is unique for the very reason that each piece of wood has its own distinct grain, texture and color. They blankly agreed, then picked out a particularly nice puzzle made of cherry and walked away.

I had a strange uneasiness about that pair, and I won't be the least bit surprised to find plastic versions of that puzzle on store shelves in the near future. It'll confirm the fact in their minds that I was probably the biggest marketing dud they had ever seen.

But the one who stunned me the most was the boisterous man who was impressed with the finishes on my carvings. Now, it has taken me a long time to perfect the glassy-smooth texture on my pieces. It involves laborious hand-sanding, several coats of lacquer and a hand-rubbed wax emulsion. The results are spectacular, if I do say so myself. One particular mahogany carving I had displayed at a show caught this man's eye, and he studied it intently.

"Are you sure this is made of wood?" he asked rather needlessly while feeling it over. "Something this smooth and shiny sure looks like plastic to me."

With that, he dug his thumbnail deep into the finish to see if it would give. It did.

"Gee!" he chuckled. "I guess it is wood. Do you give discounts for damaged goods?"

I was literally speechless, so much so that my once-jovial onlooker soon became unnerved and sauntered away. I knew right then that my attachment to my woodworking craft went a little too deep.

I've since come to realize that the pleasure I derive from my woodworking lies far deeper than any monetary value I might receive from selling it. Whether that comes from choosing the perfect piece of wood, seeing it take form with every process, or watching my favorite finish bring it to life, it's the feeling of satisfaction that I never tire of.

So as I watch each piece "leave the nest" in other people's hands, I can only hope that they grasp a little of the pride that went into the piece's construction. If that's what drew them in the first place, then that alone makes it all worthwhile. **PW**

by Angelo Paino

Angelo Paino is an outdoors writer and woodworker who lives in Komoka, Ontario, where he continues to take great pride in all of his carving creations.

IT WILL DRILL THROUGH WOOD, CONCRETE AND TIME.

Volt for volt, no cordless drills offer more torque than Craftsman's new EX drills. So with one in your hand, you can carve through just about anything. And every EX drill has the longest battery life in its class. So you'll spend less time changing batteries.

Get yours at Sears or Sears Hardware Stores. Or order by phone at 1-800-437-9686 or online only at craftsman.com.

SEARS
Good life. Great price.

CRAFTSMAN®
MAKES ANYTHING POSSIBLE®

© 2004 Sears Brands, LLC.

CIRCLE NO. 143 ON FREE INFORMATION CARD.

LAGUNA TOOLS

Simply the best!

800.234.1976

w w w . l a g u n a t o o l s . c o m

CIRCLE NO. 129 ON FREE INFORMATION CARD.