When to Use 'Water-Based' Lacquers

Festool Sander

Popular Woodworking Magazine

April 2016 ■ #224

Roubo Moulding Planes

Easy-to-Make Traditional Tools

popularwoodworking.com

Guerrilla Guide to HVLP Spray Finishing

The Core Hand Tools – a 'Must-Have' List

Build a Baille Scott Arts & Crafts Side Table

WOODCRAFT®

QUALITY WOODWORKING TOOLS • SUPPLIES • ADVICE®

Spray Finishing the Wagner Way – Quick and Easy!

Wagner's new Home Décor Paint Sprayer makes it easy for everyone to paint or finish like a professional, even someone new to HVLP spraying. Lightweight and compact, this tool sprays pretty much any type of finish – chalk paint, milk paint, water-based finishes and stains, and more. Sprayer setup is simple, and features include paint-saving control and pattern options. Gun and cup are easy to clean, so changing color is a snap.

Features:

- **Sprays Chalk-Style/ Milk And Other Decorative Paints, Stains, Sealers And Lacquers**
- **Easy To Maneuver For Small Projects**
- **Powerful Enough For Medium Projects**
- **6' Air Hose For Added Manueverability**

161374

Try this sprayer with NEW Black Dog Salvage Furniture Paint! Available Soon In 15 Colors plus Satin and Matte Topcoats!

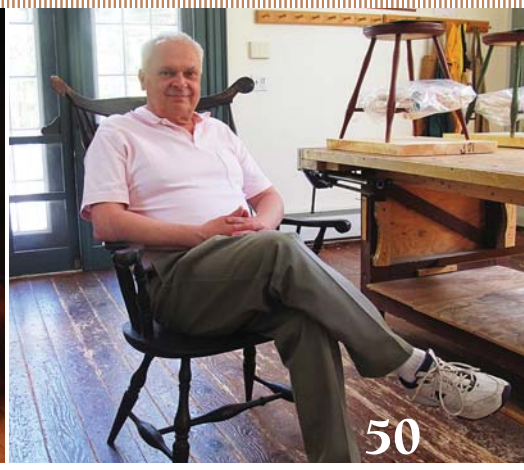
For A Free Catalog Or To Find Your Local Woodcraft Store, Visit woodcraft.com Or Call 800-225-1153. 16PW04P

For Information On Woodcraft Retail Franchise Opportunities, Visit woodcraftfranchise.com

CARD #49 or go to PWFREEINFO.COM

CONTENTS

APRIL 2016

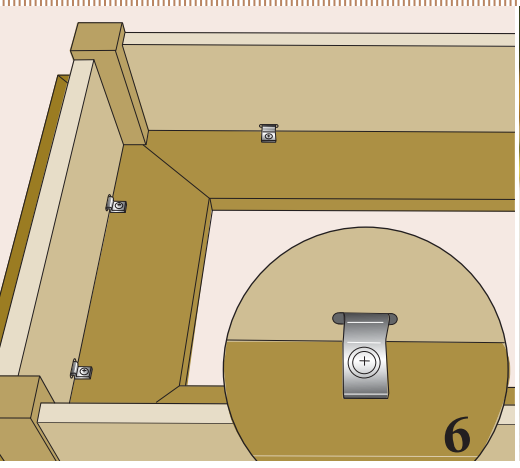


FEATURES

COVER PHOTO BY DANIEL DUBOIS PHOTOGRAPHY; SPRAY FINISHING PHOTO BY AL PARRISH; SIDE TABLE PHOTO BY MITCH ROBERSON

CONTENTS

APRIL 2016



REGULARS

POPULAR Woodworking MAGAZINE

Number 224, April 2016. *Popular Woodworking Magazine* (ISSN 0884-8823,USPS 752-250) is published 7 times a year, February, April, June, August, October, November and December, which may include an occasional special, combined or expanded issue that may count as two issues, by F+W Media. Editorial and advertising offices are located at 8469 Blue Ash Road, Suite #100, Cincinnati, OH 45236. 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 $24.95; outside of the U.S. add $7/year ▪ Canada Publications Mail Agreement No. 40025316. Canadian return address: 2835 Kew Drive, Windsor, ON N8T 3B7 ▪ Copyright 2016 by *Popular Woodworking Magazine*. Periodicals postage paid at Cincinnati, Ohio, and additional mailing offices. Postmaster: Send all address changes to *Popular Woodworking Magazine*, P.O. Box 420235, Palm Coast, FL 32142-0235 Canada GST Reg. # R132594716 ▪ Produced and printed in the U.S.A.

ILLUSTRATION BY MARY JANE FAVORITE; CHEST PHOTO BY GEORGE R. WALKER; BRAKE PHOTO BY PETER FOLLANSBEE; FINISHES PHOTO BY BOB FLEXNER

SHOP FOX® INNOVATIVE PRODUCTS SINCE 1989!

2 YEAR WARRANTY
SHOP FOX® machines are backed by a 2 Year Warranty!

5 HP, 26" DUAL DRUM SANDER

- Motor: 5 HP, 220V, 25A, single-phase, 3,450 RPM
- Capacity: 4¼" thick x 26" wide
- Conveyor motor: ⅓ HP, 2A, universal
- Conveyor table size: 26⅛" x 30¼"
- Footprint: 36¾" W x 23¾" D
- Powder coated paint
- Surface speed of drums: 2,300 FPM
- Two 6" x 27¾" aluminum drums
- Dual 4" dust ports

W1678 5 HP, 26" Dual Drum Sander

1 HP, 14" BANDSAW

- Motor: 1 HP, 110V/220V
- Precision-ground cast iron table size: 14" x 14" x1½"
- Blade size: 93½" (⅛" to ¾" wide)
- Cutting capacity 13½" (throat)
- Cast iron frame and wheels
- Ball bearing blade guides
- Includes fence and miter gauge

Feature packed, and an incredible value

CSA C US 177335

W1706 14" Bandsaw

VARIABLE SPEED PLANER MOULDER with Stand

- Motor: 2 HP, 240V, single-phase, 10.8A, 3450 RPM
- Precision-ground cast iron table size: 14⅛" x 10" x 7/16"
- Max. planing width: 7"
- Max. planing height: 7½"
- Cuts per inch: 64-300
- 2 HSS knives

CSA C US 177335

PATENT OWNED BY WOODSTOCK INTERNATIONAL INC.

W1812 Planer Moulder with Stand

2 HP, 10" OPEN STAND HYBRID TABLE SAW

New

- Motor: 2 HP, 15A at 120V, 7.5A at 240V, single-phase, 3450 RPM
- Footprint: 21" L x 19½" W
- Max. depth of cut at 90° angle: 3¼", at 45°: 2¼"
- Precision-ground cast iron table size: 57¼" W x 37½" D x 35¾" H
- Built-in mobile base
- 4" dust port

Made in an ISO 9001 factory

ETL C US Intertek 3092372

W1837 2 HP, 10" Open Stand Hybrid Table Saw

¾ HP, 13" BENCH-TOP DRILL PRESS

- Motor: ¾ HP, 110V, 1725 RPM
- Overall height: 38"
- Spindle travel: 3¼"
- Swing: 13¼"
- Drill chuck: ⅝"
- Speeds: 12, 250–3050 RPM
- Table: 12⅜" dia.
- Table swing: 360°
- Table tilt: 45° left & 45° right

PATENT OWNED BY WOODSTOCK INTERNATIONAL INC.

W1668 ¾ HP, 13" Bench-Top Drill Press

POCKET HOLE MACHINE

- Motor: ½ HP, 120V, single-phase, 3A, 17,500 RPM
- Two flip stops for drilling consistency
- Auto start/stop motor actuation with pull of handle
- Auto-adjust clamping foot mechanism for workpiece thicknesses between ½" to 1½"
- Cuts both diameter holes for pocket screws at the same time
- Ideal for face framing

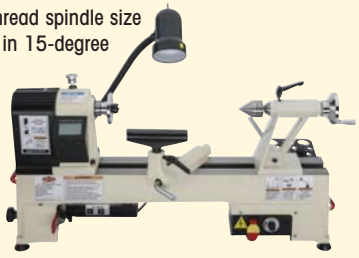
PATENTED!

W1833 Pocket Hole Machine

12" X 15" BENCHTOP WOOD LATHE

New

- Motor: ¾ HP, 110V, single-phase, universal motor
- Electronic variable-speed spindle control with digital RPM readout • 12" swing over bed • 15" between centers
- Two spindle speed ranges: 500-1800 RPM & 1000-3800 RPM
- 1" x 8" TPI RH thread spindle size
- Spindle indexing in 15-degree increments
- Heavy-duty cast iron construction
- Rubber feet for increased stability



W1836 Benchtop Wood Lathe

1½ HP DUST COLLECTOR

Improved Filtration

- Motor: 1½ HP, 110V, single-phase, 3,450 RPM
- Motor Amp draw: 110V - 16A
- Portable base size: 21½" x 33½"
- Bag volume: 5.4 cubic feet
- Height (with bags inflated): 78"
- Bag size: 19" x 33" (2)
- Air suction capacity: Approx. 1,280 CFM
- Static pressure: 10.1"
- Standard bag filtration: 2.5 Micron

W1685 1½ HP Dust Collector

16" SCROLL SAW

- Motor: ⅛ HP, 120V, single-phase, 1.2A, 60 Hz • Variable speed motor
- No load speed: 550–1650 SPM
- Max. cutting thickness: 2"
- Max. cutting width: 16"
- Blade stroke: 51/64"
- CSA certified

CSA C US 226002

Uses Plain or Pin-Type Blades

W1713 16" Scroll Saw

WOODSTOCK® INTERNATIONAL, INC. IS ALSO HOME TO ROMAN CARBIDE®, PLANER PAL®, JOINTER PAL®, AND MANY OTHER FINE BRANDS.
PLEASE VISIT OUR WEBSITE OR CALL TOLL FREE TO FIND AN AUTHORIZED DEALER NEAR YOU.

SHOPFOX.BIZ
sales@shopfox.biz WHOLESALE ONLY

WOODSTOCK INTERNATIONAL INC.

1-800-840-8420

17797

CARD #114 or go to PWFREEINFO.COM

Woodwork by the Book

If I could apply in the shop the superabundance of knowledge I've gleaned through books, I'd be an excellent craftsperson. My job involves reading about woodworking, as does my freelance editing work. Then for fun, I open a book. I'm a voracious reader.

Here are a handful of the many books I find invaluable (specific to my interests and toolset – actual and metaphoric).

Design

- "Furniture Treasury," by Wallace Nutting (Macmillan)
- "Human Dimension & Interior Space," by Julius Panero and Martin Zelnik (Watson-Guptill) (this one is new to me, but already a treasure)
- "Measured Drawings of Shaker Furniture & Woodenware," by Ejner Handberg (Berkshire House)
- "The New Fine Points of Furniture: Early American," by Albert Sack (Crown)

Finishing

- "Flexner on Finishing," by Bob Flexner (Popular Woodworking)
- "Understanding Wood Finishing," by Bob Flexner (Reader's Digest)

Tools & Shop

- "The Anarchist's Tool Chest," by Christopher Schwarz (Lost Art Press) (file also under inspiration)
- "Restoring, Tuning & Using Classic Woodworking Tools," by Mike Dunbar (Popular Woodworking)
- "The Table Saw Book," by Kelly Mehler (Taunton)
- "Workbenches," by Christopher Schwarz (Popular Woodworking)
- "The Workshop Book," by Scott Landis (Taunton)

Techniques

- "Chairmaker's Notebook," by Peter Galbert (Lost Art Press)
- "Illustrated Cabinetmaking," by Bill Hylton (Fox Chapel)
- "Modern Practical Joinery," by George Ellis (Linden)
- "Modern Practical Stairbuilding & Handrailing," by George Ellis (Linden)
- "The Perfect Edge," by Ron Hock (Popular Woodworking)
- "The Woodworker, The Charles Hayward Years: 1939-1967," (Lost Art Press) (due out in April – I edited it, and have thus read it multiple times; solid gold)
- "Woodwork Joints," by Charles H. Hayward (Evans Bros.)

Materials

- "Woods in British Furniture Making 1400-1900," by Adam Bowett (Royal Botanic Gardens)
- "Understanding Wood," by Bruce Hoadley (Taunton)

Inspiration

- "A Reverence for Wood," by Eric Sloane (Ballantine)
- "The Soul of a Tree," by George Nakashima (Kodansha)

In a 1980 interview, Charles Hayward said, "Books can guide you, explain about techniques, tools, materials, present ideas, steer you away from pitfalls…Books include a great deal of valuable information but it is up to the reader to apply that information."

Go forth and read. Then get thee to the shop. I'll see you there. **PWM**

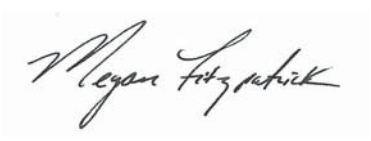


PHOTO BY AL PARRISH

POPULAR WOODWORKING MAGAZINE

APRIL 2016, VOL. 36, NO. 224
popularwoodworking.com
EDITORIAL OFFICES 513-531-2690

VICE PRESIDENT & GROUP PUBLISHER ■ Jamie Markle
jamie.markle@fwcommunity.com, x11452

GROUP EDITORIAL DIRECTOR & EDITOR ■ Megan Fitzpatrick
megan.fitzpatrick@fwcommunity.com, x11348

SENIOR ART DIRECTOR ■ Daniel T. Pessell
daniel.pessell@fwcommunity.com, x11596

ONLINE EDITOR ■ Jon Russelburg
jon.russelburg@fwcommunity.com, x11434

CONTRIBUTING EDITORS ■ Bob Flexner, Christopher Schwarz, Steve Shanesy

PHOTOGRAPHER ■ Al Parrish

PROJECT ILLUSTRATOR ■ Donna R. Hill

ONLINE CONTENT DEVELOPMENT MANAGER ■ David Thiel
david.thiel@fwcommunity.com, x11255

ONLINE CONTENT DEVELOPER ■ Jacob Motz
jacob.motz@fwcommunity.com, x11005

ONLINE EDUCATION MANAGER ■ Nick Lieurance
nick.lieurance@fwcommunity.com, 970-279-4254

CONTENT EDITOR, BOOKS ■ Scott Francis
scott.francis@fwcommunity.com, x11327

F+W, A Content + eCommerce Company
ACTING CEO, COO & CFO ■ James Ogle
PRESIDENT ■ Sara Domville
SENIOR VICE PRESIDENT, OPERATIONS ■ Phil Graham
VICE PRESIDENT, COMMUNICATIONS ■ Stacie Berger

ADVERTISING
VICE PRESIDENT, SALES ■ Dave Davel
ADVERTISING DIRECTOR ■ Don Schroder
331 N. Arch St., Allentown, PA 18104
TEL. 610-821-4425; FAX. 610-821-7884
d.schroder@verizon.net
ADVERTISING SALES COORDINATOR ■ Connie Kostrzewa
TEL. 715-445-4612 x13883
connie.kostrzewa@fwcommunity.com

NEWSSTAND
For newsstand sales, contact Scott T. Hill:
scott.hill@procirc.com

SUBSCRIPTION SERVICES:
For subscription inquiries, orders and address changes go to: www.popularwoodworking.com/customerservice

U.S. Subscribers: 877-860-9140
International Subscribers: 386-246-3369
Email: popularwoodworking@emailcustomerservice.com

NEWSSTAND DISTRIBUTION:
Curtis Circulation Co., 730 River Road, New Milford, NJ 07646. PHONE: 201-634-7400. FAX: 201-634-7499.

SHOPWOODWORKING.COM
Visit ShopWoodworking.com for woodworking books, projects, plans and back issues of this magazine.

Sharpening Pond's Top Attachment

I am building William Ng's "Sharpening Pond" from the November 2015 issue (#221). How is the top fastened to the base?

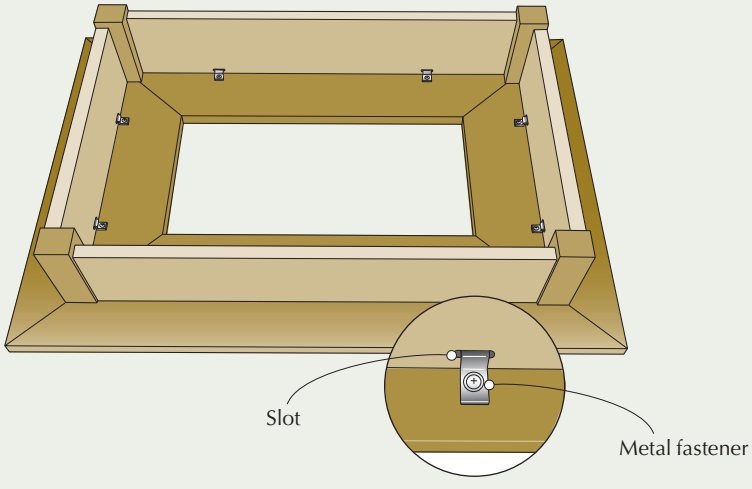
Bob Wood,
via email

Bob,
I'm sorry I missed that step. I took it for granted that people would use their preferred method for attaching any tabletop (shop-made buttons, metal fasteners or even pocket holes).

I use "tabletop fasteners" (available at any woodworking supply store or online).

I cut the slots using an 1/8" spiral bit at the router table. The slots are 7/8" in length x 1/4" deep. If the pond base is glued up, there's enough head space to rout with a fence. I set the fence 1/2" from the top edge.

William Ng, contributor



Weight of Workbench Parts

How much does each component of the November 2015 (issue #221) "Knockdown English Workbench" weigh?

Browne Altman,
via email

Browne,
Wow. Some guesses:

The top is the heaviest – maybe 80 pounds or a little more. The end assemblies are about 35-40 pounds each. The aprons are about 20 pounds each. Same with the shelf.

If you need a more exact weight, I recommend figuring out how many board feet are in the project then multiplying that by the average weight per board for the species you are using. The weight per board foot and board footage calculators are both widely available on the Internet.

Christopher Schwarz,
contributing editor

What is Meant by 'Anarchism?'

Two recent articles uses the word "anarchist." What does this word mean in context, and why is it used?

John Stroud,
via email

John,
It's a reference to (and shorthand for) some of the philosophy espoused in "The Anarchist's Tool Chest" (Lost Art Press), a book written by contributing editor Christopher Schwarz.

In a nutshell, he argues that American anarchism is a non-violent, anti-consumer approach to living. It's a tendency of individuals to eschew large organizations, corporations, governments and religions – a preference for individual action as opposed to mandates and mass-manufacturing.

In a woodworking context, it's a tendency to build rather than buy.

Megan Fitzpatrick, editor

P100 Dust Mask & Eyeglasses

On page 12 of the December 2015 issue (#222), the "Highly Recommended" shows Megan Fitzpatrick wearing a P100 dust mask. It looks like a great value for the price, but I always have trouble with my glasses fogging up when I wear any dust mask – even the fancy ones with a rubbery strip.

Did your glasses fog up with the P100?

Chuck Strauss,
via email

Chuck,
That's one of the things I like most about the P100 – my glasses don't fog up with it (and I always wear glasses; I can't see without them).

I have heard – though I have no experiential knowledge of course – that the mask's effectiveness is somewhat undermined by having a beard, but that it's still pretty effective.

Megan Fitzpatrick, editor

Sliding Lid for Japanese Box

I have been studying the "Japanese Sliding-lid Box" article in the December 2015 issue of *Popular Woodworking Magazine*, and I do not see how the lid "slides." What am I missing?

Karl Schwab,
Warren, Michigan

Karl,
The lid hangs on its three battens. The three battens prevent the lid from dropping to the bottom of the box.

To "lock" the lid, you slide the lid

CONTINUED ON PAGE 8

ILLUSTRATION BY MARY JANE FAVORITE

I CAN DO THAT

New Video Series!

Learn the simple skills and tools you need to build great-looking projects in our new "I Can Do That" video series, with host Chad Stanton. Each episode is free on the PWM site for four weeks.

Plus, you'll find articles from the magazine, and the downloadable ICDT manual. It's all free at: **popularwoodworking.com/icandothat**

sponsored by

WOODCRAFT®

CONTINUED FROM PAGE 6

toward either of the two end battens that are nailed to the carcase. Then the top surface of the top encounters the case's end battens. The friction between the end battens and the lid prevents the lid from sliding open unless you want it to move.

Christopher Schwarz, contributing editor

Bamboo Harvesting at Home

Thank you for William Ng's excellent "Sharpening Pond" article in the November 2015 issue.

Here's my advice to those who want to harvest their own bamboo:

This species will last for only two to three years after harvesting if untreated. Bamboo is related to sugarcane and it contains sugar (starch), which encourages microorganisms.

Harvest the branches during the new moon, when the sap is at minimum concentration, and thus the sugar content is lowest.

Treat bamboo by soaking it in a 10-percent solution of boric acid/Borax for several days. This is said to eliminate the sugar and add protection against decay.

Also, don't use your finest tools on this material; it contains a great deal of silica, so it is quite abrasive.

Pedro Ribeiro,
Embu, Brazil

Portable Planer Points

I enjoyed Christopher Schwarz's February 2016 (issue #223) article on portable planers. Having owned and run thousands of feet of wood through a DeWalt 735 planer for years now, I think of my "little" planer as an absolute necessity in the shop.

I would like to point out a couple of things not mentioned in the article that may or may not be unique to my particular model.

First, the blades are double sided, so when they get dull all you have to do is flip them around and you get twice the life out of a set.

Also, Christopher mentions that some added-on features are almost worthless – but I have come to love the turret depth stop on the 735. I can change the cutter height to whatever I need it to be and always return to the exact same thickness as previously planed wood with this feature.

Jacob Morrill,
via email

Ductile Plates for Workbench: How Many & Where?

In the "Knockdown English Workbench" article (November 2015), one photo shows a metal plate attached to the underside of the benchtop. What is this and why?

Also, the materials list show 15 ductile mounting plates and 15 bolts. I count only 14 (two in each leg through the aprons and six in the top). Where does the 15th go?

Marlin Collier,
Carthage, Mississippi

Marlin,

The metal plate shown in some photos was a little insurance I added to the benchtop. I was worried that the planing stop might split the thin benchtop. So I added the plate – an inexpensive mending plate from the home center – with screws.

The 15th ductile plate is used to help hold the crochet in place. I thought I had included that in the article, but I must have cut it. My apologies. PWM

Christopher Schwarz, contributing editor

ONLINE EXTRAS

Letters & Comments

At popularwoodworking.com/letters you'll find reader questions and comments, as well as our editors' responses.

We want to hear from you.

Popular Woodworking Magazine welcomes comments from readers. Published correspondence may be edited for length or style. All published letters become the property of *Popular Woodworking Magazine*.

Send your questions and comments via email to popwood@fwmedia.com, or by mail to 8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236.

PHOTO BY THE AUTHOR

Highly Recommended

If you're in the market for a mallet, consider Blue Spruce Toolworks. This maple acrylic-polymer-resin-infused tool won a "Best New Tools" award from us in 2009. The one I bought then looks almost as pristine as the day I pulled it out of the box – despite using it to chop countless dovetails in the last six years. It's available in two sizes: 16-ounce ($80) (what I have) and 13 ounce ($70). — *Megan Fitzpatrick*

POPULAR WOODWORKING MAGAZINE

Customer Service

How can I contact customer service with questions regarding my subscription, including a lost or damaged issue?
Visit popularwoodworking.com/customerservice. Or write to Popular Woodworking Magazine, *P.O. Box 421751, Palm Coast, FL 32142-1751. Or, if you prefer the telephone, call 1-877-860-9140 (U.S. & Canada), 386-246-3369 (International) and a customer service representative will be happy to help you.*

When does my subscription expire?
The date of your subscription expiration appears on your magazine mailing label, above your name. The date indicates the last issue in your subscription.

Can I get back issues of *Popular Woodworking Magazine*?
Back issues are available while supplies last. Visit popularwoodworking.com/backissues. Or if you know the exact month and year of the issue you want, call our customer service department toll-free at 855-840-5118 to order.

What if I want more information about the projects or tools I read about in *Popular Woodworking Magazine*?
For all editorial questions, please write to Popular Woodworking Magazine, *8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236. Or send an e-mail to popwood@fwmedia.com.*

Does *Popular Woodworking Magazine* offer group discounts?
Group discounts are available by special arrangement with the publisher. For more details, send an e-mail to Debbie Paolello at debbie.paolello@fwcommunity.com or call 513-531-2690 x11296.

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 Media, Inc.
10161 Carver Road, Suite 200
Blue Ash, OH 45242

Safety Note

Safety is your responsibility. Manufacturers place safety devices on their equipment for a reason. In many photos you see in *Popular Woodworking Magazine*, 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.

THE WINNER:

Dust Collection for Ports of All Sizes

I made this adapter to hook up dust collection to the odd-size fitting (2") on my oscillating sander. Start with a hardwood block that is (in my case) is 3" x 4" x 1¼" thick. I required a 2" hole, so I used a 2" hole saw to drill in the middle of the block.

The next thing is to drill the holes for the split-block-clamping and block-attachment holes. I drilled a 3/16" clearance hole, 1⅝" deep. Drill the hole just more than halfway deep – that way, when you split the block, you'll have a location for drilling the rest of the way through with a 3/32" drill bit for the pilot for the screw.

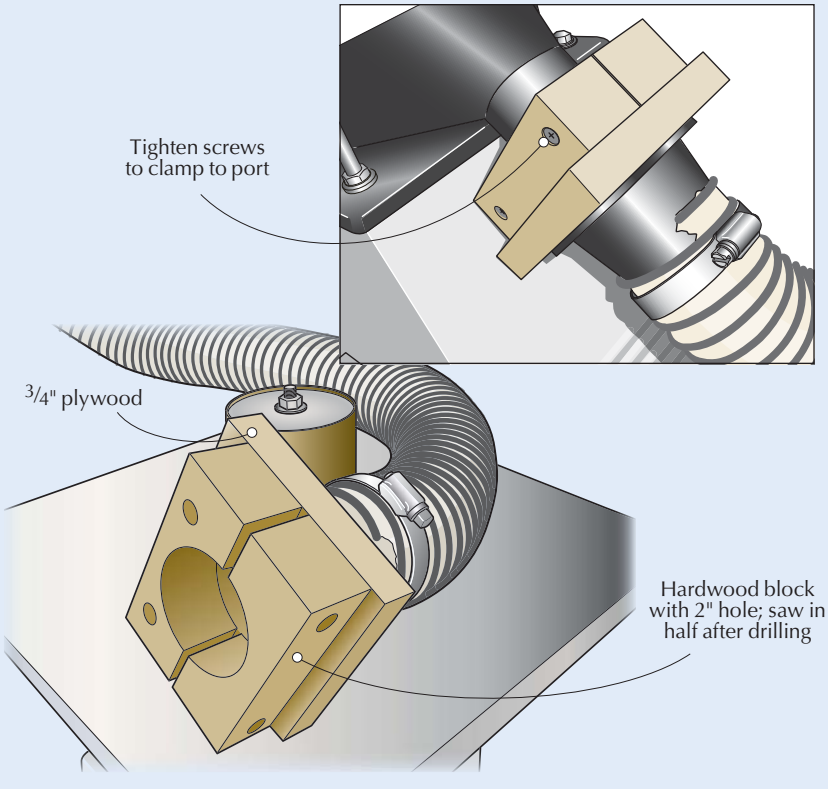
Now drill holes on the face side to attach the ¾" plywood piece; locate them so they don't intersect the clamping holes.

Now you're ready to split the block (I used my band saw). After sawing it in half, I touched up the faces on my belt sander to remove just a little bit of material so that it would clamp solidly on the 2" fitting.

With the block split, drill a 3/32" pilot the rest of the way through for the 3" clamping screws.

Drill a 2" or 2½" hole in the plywood, then install the adapter for the hose and screw the split-clamping block to the plywood piece, with elongated holes on one piece to allow it to open and close.

Dan Martin,
Galena, Ohio



Boot Tray Soaking Setup

Many woodworkers like to clean their vintage tools by soaking them in a rust remover or citric acid solution. For long, flat tools such as a panel saw, it can be difficult because of the need for a long container. Storage bins are large and bulky and buckets are not deep enough.

I've found that a plastic boot tray is the easiest solution both in use and clean-up. Most boot trays are inexpensive (less than $10), about 1" deep, at least 1' wide and more than 2' long. The depth is plenty enough to hold enough solution, and offers the advantage of easy access to scrub the tools as they are soaking without getting up to your elbows. The length and width can easily hold several full-size panel saws simultaneously, as well as other tools such as drill bits and chisels.

The best part is that clean up of both the solution and tray is dead simple.

Bill Lattanzio,
Spring City, Pennsylvania

Editor's note: Contributing Editor Christopher Schwarz keeps his sharpening stones in a boot tray, stored under his bench. It contains the mess when sharpening, and it's out of the way when not.

Quick & Easy Filing Cleanup

When sharpening handsaws or flattening plane soles, metal filings can accumulate quickly. If you are like me and don't have a dedicated metal-working area, the metal filings run the risk of becoming embedded in your workbench or anything else they touch.

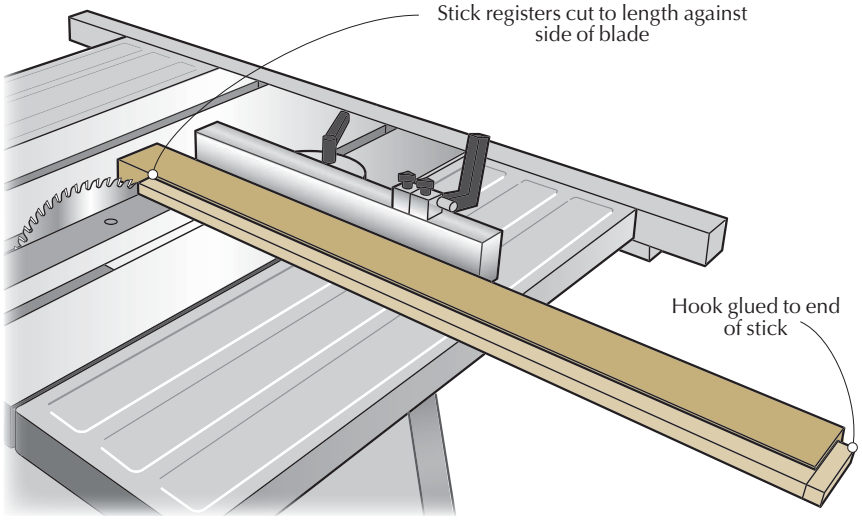
To easily remove them, I place a rare-earth magnet in a small envelope, then run the outside of the envelope over the affected area to pick up all of the filings. I then go over to the trash can, open the envelope and remove the magnet.

All of the filings instantly fall into the trash and the magnet is spotless. No more trying to remove those filings from rare-earth magnets anymore, and your workspace is clean!

Jason Thigpen,
Cedar Park, Texas

ILLUSTRATIONS BY MARY JANE FAVORITE

Hook Rule Story Stick For Cutting Multiple Parts



While working on a project, I needed to cut 10 pieces of the same length: 43½". My table saw's miter gauge cut-off feature doesn't extend far enough, and I didn't want to fuss with a repeated measure-and-mark method (not to mention the opportunity that presents to introduce an error).

After puzzling a bit, I came up with the following setting device for these repeat cuts.

I cut a ¾" square piece to the length needed (in my case, 43½"). On one end I glued a short perpendicular piece to act like the hook on a hook ruler.

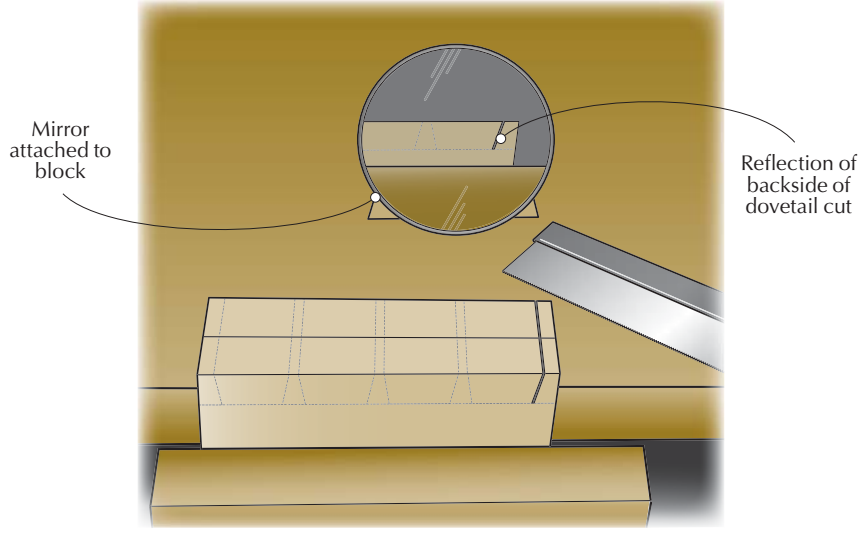
Then I carefully placed the hook against an already cut and squared end of the workpiece.

While carefully retaining the hook's contact with the square end, I placed the board against the miter gauge and slid the other end of the "story stick" against the left side of the blade.

While holding the board against the miter gauge and the tabletop (so as to not lose indexing), I removed the story stick, set it aside and made the crosscut.

It worked perfectly to allow me to cut 10 boards (plus a couple extra pieces) to the exact same length with no measuring.

Cordell Roy,
South Jordan, Utah



Baseline Reflections

Gang-cutting dovetails has its pros and cons. One common complaint is that it is easy to overcut on the far side, thereby marring not one but two boards' faces.

I solved this problem by attaching a block to the back of a mirror, then placing the mirror on my bench to reflect the work. I can tell at a glance when it's time to stop cutting. PWM

Charles Mak,
Calgary, Alberta

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/apr16**

TRICKS ONLINE: *We post tricks from the past and film videos of some Tricks of the Trade in use in our shop. They're available online, free. Visit popularwoodworking.com/tricks to read and watch.*

Our products are available online at:

- **ShopWoodworking.com**

Cash and prizes for your tricks and tips!

Each issue we publish woodworking tips from our readers. Next issue's winner receives a $250 gift certificate from Lee Valley Tools, good for any item in the catalog or on the web site (leevalley.com). (The tools pictured below are for illustration only and are not part of the prize.)

Runners-up each receive a check for $50 to $100. When submitting a trick, include your mailing address and phone number. All accepted entries become the property of *Popular Woodworking Magazine*. Send your trick by email to popwoodtricks@fwmedia.com, or mail it to Tricks of the Trade, *Popular Woodworking Magazine*, 8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236.

ETS EC125/3 Eccentric Sander

Festool's newest 5" compact tool delivers on comfort and performance.

A well-sanded surface makes a huge difference on a finished piece. Unlike many woodworkers I know, I appreciate the relatively mindless nature of sanding. In addition to recently using the Mirka DEROS for benchmarking purposes, my go-to power sander has been a 10-year-old 6" Ridgid model. It's heavy, has a high center of gravity and is less than graceful on small parts. So I was excited to take Festool's new 5" brushless model for a test drive.

The tool comes in Festool's standard "Systainer" hard case, including a separate power cord. The kit included only one sheet of #120-grit sandpaper – considering the cost, it would have been nice for the factory to include a few more sheets. For this test, I used Festool's #80-, #100-, #120-, #150- and #180-grit sanding discs on walnut and cherry.

This tool is everything my current sander isn't. It's quiet, compact and light, weighing in at only 2.65 lbs. Plus, it has a much lower center of gravity than other Festool models I've used. This is a plus; I've found that sanders with a high center of gravity can fatigue your hands with extended use. The balance of the tool is a bit different than an even lower profile tool like the DEROS. After a bit of trial, I found the right hand position (a modified pistol grip with my thumb atop of the tool), makes it comfortable to use.

EC125/3 Sander

Festool ▪ festoolusa.com or 888-337-8600

Street price ▪ from $385

▪ **ONLINE** *Read a review of the Mirka DEROS mentioned above.*

Price correct at time of publication.

Low profile. *The Festool EC125/3 delivers good performance and comfort in a low-profile tool. The dense backer pad (right) accepts any hook-and-loop sanding disc.*

The power switch, positioned at the top front of the tool, is easy to reach while in use, however the speed-setting dial requires a bit of a reach-around.

Initially at start up, I found the tool produced a slight uneven wobble when it contacted the wood surface; this was alleviated by dialing down the dust-collector suction by about half. The off button smoothly stops the motor in less than 0.5 seconds, reducing the chance of leaving power sander loop marks on your piece or bench. I love this feature.

This tool is compatible with my Festool CT-26 dust collection system, including the convenient automatic on/off feature when the tool powers up and down. I also tested this tool with the D27/22 antistatic hose, which is sold separately ($250). Unlike my usual sanding setup, this experience was static-free. Overall I found the dust collection sufficient on a variety of sanding grits across its variable 6,000-10,000 rpm operating speeds.

The tool's 400 watts give it plenty of power to hog through bark and sapwood with 80# on a natural-edge surface, while still allowing enough control with #180 grit on a flat surface. (Full disclosure: I also tested it with Abranet discs – the tool accepts any hook-and-loop disc – and found them better than Festool's discs when it comes to fewer surface marks.) The tool's dense foam backer pad allowed for just the right amount of cushion to work around convex and concave surfaces without fear of creating a giant flat spot. Festool also offers softer backer pads for this type of application.

Because this tool has a lower profile and lower price point than most of Festool's models, I consider it worth the money.

— Andy Brownell

CONTINUED ON PAGE 14

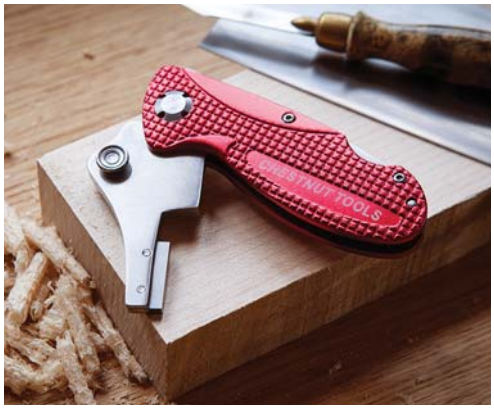
PHOTOS BY THE AUTHORS

CONTINUED FROM PAGE 12

Chestnut Tools Universal Sharpener

Sometimes a small advance in technology makes an enormous difference in everything. The Chestnut Tools Universal Sharpener – just $18.50 from Lee Valley Tools – will absolutely change the way you sharpen tools.

It looks like a folding pocketknife, but instead of a blade the sharpener has a piece of sub-micron carbide about 1/8" wide and 7/8" long. The carbide has sharp corners, unlike a carbide burnisher. And it's the combination of the incredibly fine carbide and its shape that makes it a game-changer when sharpening.



For starters, it makes short work of marking knives, pocket knives, scissors and a variety of tools that are difficult to sharpen. The carbide works like a scraper. You tilt the tool slightly, rub it with gentle pressure on the steel and it shaves steel away as if it were wood.

Full instructions are included with the tool, which show you how to create a burr with the tool and remove it from the back with a slightly different stroke. It's like a miniature grinder and can even straighten out a dubbed-over bevel on an incannel gouge (tricky stuff, indeed).

I love it for sharpening card scrapers and use it instead of a file. Clamp the sharpener upright in your vise and you'll create a perfect square edge on your scraper. Of all the steps in sharpening a scraper, getting a square edge with sharp corners is the most difficult. Stone the scraper a bit and you are ready to turn a burr with your regular burnisher (the corners of the Universal Sharpener are too sharp to turn a burr).

All I can say is this: Get one. You'll thank me.

— Christopher Schwarz

Universal Sharpener

Lee Valley ■ leevalley.com or 800-871-8158

Street price ■ $18.50

■ **BLOG** *See the Universal Sharpener in use on a card scraper.*

Price correct at time of publication.

CMT's Inexpensive Moisture Meter

If you ever work with wood from unreliable or unusual sources, such as one-person sawmills, it pays to own a moisture meter. I slip mine into my pocket whenever I head to the lumberyard and it has saved my skin several times in the last 20 years.

But not everyone can afford an expensive pinless meter with all its features.

So I was interested to try the new CMT DMM-001, a pin-activated moisture meter that costs about $40, or about one-fifth of the price of a nice commercial meter.

On the plus side, the CMT has a rugged case, is simple to operate and comes with the 9-volt battery that runs it.

On the minus side, all pin moisture meters have limitations. You have to drive the pins in fairly deep to activate the meter, and so you don't want to use the meter on wood that will be a show surface – the pins leave obvious holes.

The other limitation is you cannot calibrate the meter for the specific gravity of the wood species. Expensive meters allow you to adjust for wenge or white pine. So you are unlikely to get a dead-on correct reading. After comparing the CMT to my own meter, I think the CMT is calibrated for something between oak and maple, which is a perfectly reasonable setting.

This limitation means that you can get only relative readings instead of absolute ones. So test some maple that has been sitting in your wood rack all year then compare it to the maple at the lumber yard. You'll know whether the maple is wet or dry.

In other words, it's definitely useful, and at $40 it's silly not to have one from a reputable company such as CMT. **PWM**

— CS

DMM-001 Moisture Meter

CMT ■ cmtutensili.com or 888-268-2487

Street price ■ from $40

■ **BLOG** *Read more about moisture meters and how to use them.*

Prices correct at time of publication.

Graduated Drawers

Ancient architecture provides a starting point for tall chest design.

Far back in our past, one of our early ancestors cobbled together a box with a lid and created a furniture form still in use today. Wooden chests, sometimes equipped with fancy locks and hinges, were used store everything from blankets to tools, toys, treasure and grain.

Chests perform basic storage tasks by keeping our valued possessions safe from the elements and unwanted critters, while providing a handy bench to sit on and don our shoes in the morning.

But as useful a piece of furniture as it is, the chest form has some drawbacks. For one, its height is usually limited to the length of our arm. Any deeper and we cannot easily retrieve items that migrate to the bottom. This also points to another drawback. A chest at its simplest is just a large cavity. That's perfect for storing flour or sugar, but it can be frustrating when we want to house sweaters and socks. That favorite pair of argyles will always hide in the most remote corner of a chest.

Then a genius came along and started filling chests with drawers. Drawers give us the storage advantages of a chest but allow us to keep underwear and socks in their own neighborhoods.

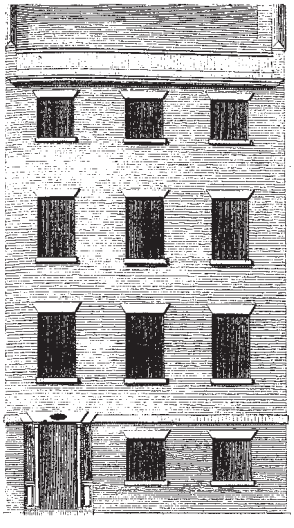
The blanket chest became a chest of drawers and was no longer limited in height by the length of our arms. We could stack up drawers as high as we could conveniently reach. Chest-on-chests, highboys and simple tall chests became the "walk-in closets" of their day, and they continue to provide practical and attractive storage solutions.

Graduation. *Even on a small scale, drawers that diminish in size from the bottom up lend a lightness to this bank of drawers.*

Architectural Aesthetics

Multiple rows of horizontal drawers pose some aesthetic challenges. If we simply make all the drawers the same height, like a stack of pancakes, the effect can look static. Boring repetition might be efficient and lend itself to mass production, but our eye usually doesn't respond to it.

This is one problem where furniture designers looked to architecture for a solution. Roman architects first tackled this when they perfected construction using bricks and concrete. This innovation allowed them to build the first large-scale multi-story buildings. To help draw the eye upward, they made the height of each story slightly shorter than the one below it. They achieved it by using support columns with a slightly smaller diameter (thus shorter) for each successive floor. To this day, builders continue to use this

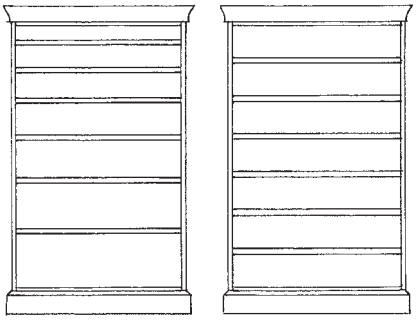


Going up. *The window heights on this townhouse façade pull the eye upward.*

CONTINUED ON PAGE 18

LEAD PHOTO & DRAWINGS BY THE AUTHOR EXCEPT WHERE NOTED;
HOUSE FAÇADE ILLUSTRATION FROM BENJAMIN ASHER, "THE AMERICAN BUILDERS COMPANION"

CONTINUED FROM PAGE 16



Tall chest pitfalls. *Graduating too many layers squeezes the drawers at the top, while piling up identical drawers like pancakes tends to look static.*

to trick to the eye, even if all the stories are the same height – sometimes by using windows to organize the façade, making them shorter as they climb up the building.

Furniture makers borrowed this idea and employed graduated drawers in their chests to draw the eye upward. Graduated drawers are simply a sequence where, starting at the bottom, each successive drawer gets slightly shorter in height as they climb to the top. (It's a good solution for a chest with three to five drawers, but we can run into some pitfalls when we push the height of the chest upward and increase the number of drawers.)

So let's look at some of the problems and solutions that come with designing a tall chest with a bank of graduated drawers. Here are a few key design considerations to keep in mind.

To avoid problems similar to finding stuff in a blanket chest's deepest recesses, we want to avoid drawers at the bottom that are so deep as to become a black hole. Overly large, deep drawers are unwieldy and, because of their weight when full, do not always slide smoothly.

One of the pitfalls of graduating all the drawers in an unbroken sequence on a tall chest is that we can end up with a very deep drawer at the bottom and a thin tray-like drawer at the top.

Roman builders faced this same dilemma when buildings soared more than five stories. To avoid a cramped top floor, they often divided the façade into sections, each graduated separately, or they chose not to apply graduation to the bottom or top floors.

Tall Stacks

Here are some practical solutions to arrange a tall array of drawers and avoid these pitfalls. The most common can be found in a form called a chest-on-chest. In this traditional form, the case is divided into two parts, usually a shorter square case on the bottom with a taller rectangular case on top. The two chests were frequently separated by a thin strip of moulding that provides a transition between the two cases.

Often in these chests, the bottom portion is graduated, usually three or four drawers, then the sequence starts over anew in the top case, with a new set of graduated drawers independent of the lower case. Usually, the first drawer in the upper case is taller than the one directly below it in the bottom case.

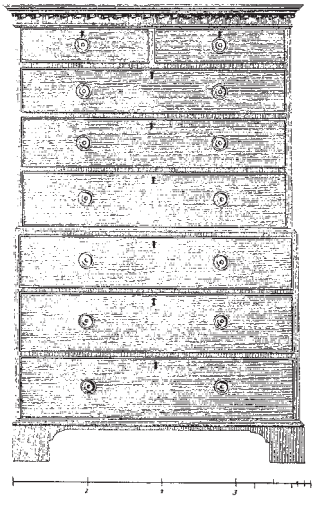
This would seem to contradict the idea of a progression of ever-shrinking drawers, but that's now how our eye perceives it. We just see two cases both reinforcing this seemingly upward motion.

Another solution, especially in a tall continuous case, is to treat the top two drawers as one unit, then just divide them in half or thirds. By treating the top two drawers as one unit we reduce the graduating sequence by one.

Finally, we can simply leave the bottom two or three drawers the same height, then graduate the sequence of drawers above them.

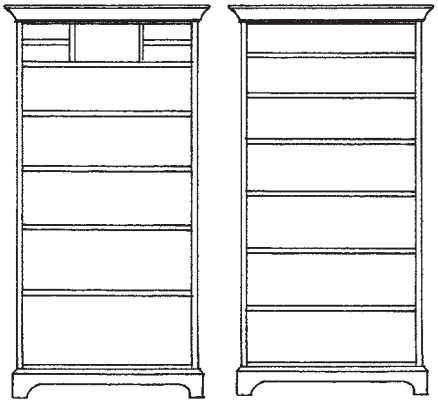
All three of these solutions buffer the effect of graduating too many drawers while still helping to draw the eye upward.

Hopefully you can use this knowledge to design an attractive tall chest of drawers that keeps your socks at the ready. **PWM**



And again. *A "do-over" creates a trick of the eye in this traditional chest. Graduate the bottom case then start over with the top case.*

George is the author of two design DVDs (Lie-Nielsen Toolworks) and writer of the Design Matters blog.



Simple solution. *Soften the effect by either treating the top two drawers as one unit (left) or simply repeat the bottom three drawers and only graduate the top four (right).*

ONLINE EXTRAS

For links to all these online extras, go to:

- **popularwoodworking.com/apr16**

BLOG: *Read more from George R. Walker on his Design Matters blog.*

IN OUR STORE: *George R. Walker's DVDs.*

Our products are available online at:

- **ShopWoodworking.com**

About This Column

Design Matters

Design Matters dives into the basics of proportions, forms, contrast and composition to give you the skill to tackle furniture design challenges with confidence.

TRADITIONAL CHEST ILLUSTRATION FROM GEORGE HEPPLEWHITE, "THE CABINET–MAKER AND UPHOLSTERER'S GUIDE"

Popular Woodworking Presents

Woodturning with Tim Yoder

— Tune in now. Shows airing each Saturday! —

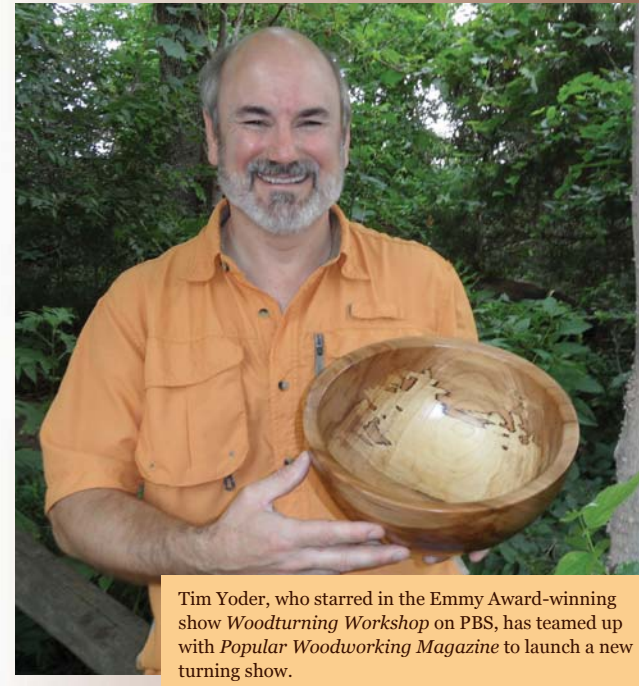
Popular Woodworking Magazine has teamed up with well-known PBS star Tim Yoder to launch a new online video show, filled with expert and friendly advice that will teach you how to become a better woodturner.

In each 30-minute episode, Tim takes you through the process of making beautiful woodturning projects, from wine stoppers and duck calls to platters and bowls. Along the way, you'll learn his favorite turning tips and techniques, and he'll offer reviews of the latest lathe tools, chucks and accessories to help you determine the best products to buy.

Whether you're an experienced woodturner who wants to improve your skills or you're new to the hobby and want to learn basic woodturning, *Woodturning with Tim Yoder* is a show you'll want to watch.

Visit **www.popularwoodturning.com** every Saturday for the latest episode of *Woodturning with Tim Yoder*.

This show is brought to you by: Easy Wood Tools, Robust Lathes, Titebond Glue, Thompson Lathe Tools, Woodworkers Emporium, and Rikon Power Tools.



Tim Yoder, who starred in the Emmy Award-winning show *Woodturning Workshop* on PBS, has teamed up with *Popular Woodworking Magazine* to launch a new turning show.

Woodworking in America

SEPTEMBER 16-18, 2016
CINCINNATI, OH

Registration now open
for your 2016 woodworking getaway!

Popular Woodworking Magazine **brings the ultimate woodworking weekend to you!**

- Talk shop with dozens of power tool vendors, woodworking suppliers, hand tool makers and browse the best—all under one roof
- Enjoy in-depth sessions on joinery, furniture design, tool techniques, finishing and more
- Learn new techniques, directly from woodworking's legends and masters of the craft

Save your seat—register today!

WOODWORKINGINAMERICA.COM

Get connected:

fw events
a content + ecommerce company

Popular Woodworking Magazine

WORKSHOP MAKEOVER GIVEAWAY

This $9,200 Workshop Could Be Yours!

ENTER ONLINE TODAY for your chance to **WIN A COMPLETE SHOP** that features **ALL** you see here!

ENTRY DEADLINE: Midnight, Eastern Daylight Time, May 31, 2016

10" Proshop Table Saw
JPS-10

16" Planer
JWP-16OS

Lathe
JWL-1015

6" Jointer
JJ-6CSDX

14" Band Saw
JWBS-14SF

1½-HP Dust Collector
DC-1100VX-CK

K-Body REVO JR 4 - 36" Clamps
KRJR-36

Bar Clamp Assortment with Mobile Rack
BTB30A

DuoKlamp Combo
2 - 6" Clamps
2 - 12" Clamps
2 - 18" Clamps

Router Table
PRP-4-V2420

Saw Gauge
SG-WP

Coping Sled
COPESLED1

Drill Press Table
WPDPPACK2

Two Variable Pressure Featherboards
VPFB

ENTER NOW! Complete prizes and contest rules are also available at www.popwood.com/winshop.

www.popwood.com/winshop

Popular Woodworking Magazine's "WORKSHOP MAKEOVER GIVEAWAY" SWEEPSTAKES: These are only abbreviated rules. The "Workshop Makeover Giveaway" Sweepstakes is subject to Official Rules available during promotion period (Jan. 1, 2016 - May 31, 2016) at www.popwood.com/winshop. See Official Rules for complete entry details and prize descriptions. NO PURCHASE OR SUBSCRIPTION NECESSARY TO ENTER OR WIN. Must be a legal resident of the U.S. or Canada (excluding Quebec) who has reached the age of majority in the participant's jurisdiction of residence to enter. One Grand Prize–Woodworker's Home Workshop valued at US $9,200. Odds of winning depend on number of entries. Void in Quebec and where prohibited. Sponsor: F+W Media, Inc., 10151 Carver Rd., Suite 200, Blue Ash, OH 45242 USA.

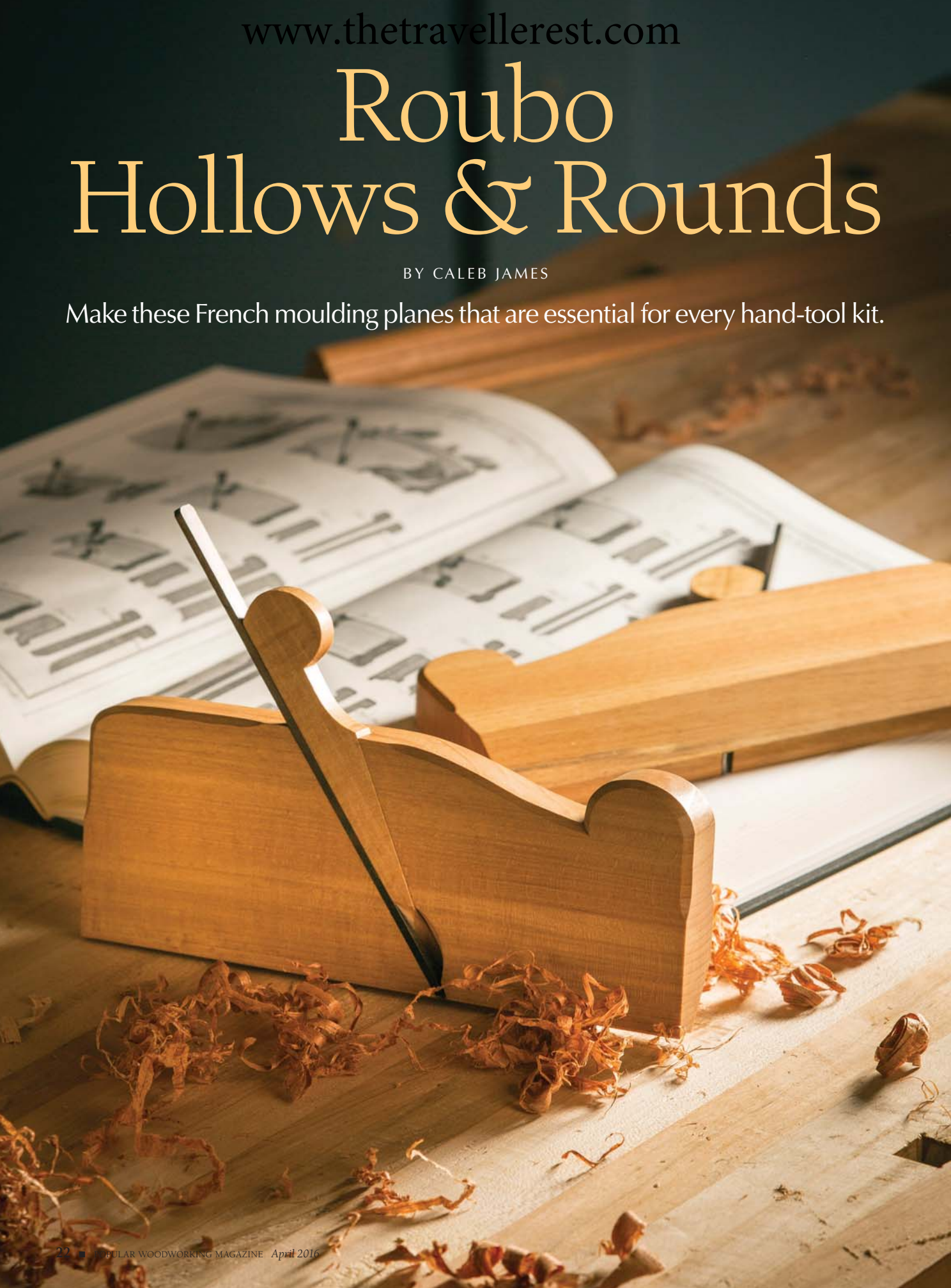
The WORKSHOP MAKEOVER GIVEAWAY is sponsored by:

JET BESSEY Woodpeckers® Popular Woodworking Magazine

Roubo Hollows & Rounds

BY CALEB JAMES

Make these French moulding planes that are essential for every hand-tool kit.



Hollows and rounds are making a strong comeback in the hand tool woodworking world. However, many woodworkers are scared off from jumping in by either a limited tool budget or the limited availability of antique ones in good condition. Don't let that hold you back any longer. You don't need a whole set to get started anyway. The three sizes in this article – Nos. 4, 6 and 8 – are the ones I most often reach for. (A No. 4 cuts a 1/4" profile, a No. 6 cuts 3/8" and a No. 8 cuts 1/2".) After you make a pair or two, you may find you never need another size to suit your working needs.

I'll teach you how to make your own planes – just like early craftsmen did. They were woodworkers, not professional planemakers, so they made planes with tools that were readily available in their tool chests. In other words, tools you likely already have.

André-Jacob Roubo shows and describe these planes in his 18th-century masterwork "l'Art du menuisier." What I'll show you reflects Roubo's plane construction coupled with British/American styling and proportions. That way, your new planes will fit nicely in your British-style tool chest, and likely match many of the planes you already have.

Choose Wisely

While you can make a plane out of just about any hardwood, some woods are clearly the better choice. Traditionally, Western planes were made mostly in beech. Other historically choices include yellow birch, and fruitwoods such as apple and even pear. If you plan to work hardwoods with your planes, choose a diffuse-porous wood such as the ones mentioned.

A non-traditional wood that is worth considering is hard maple.

Avoid ring-porous hardwoods such as oak because the soft early growth ring layers can suffer undesirable effects once they begin to wear with use. No matter what you choose, select quartersawn stock for seasonal stability.

Because many diffuse-porous woods are often hard to find quartersawn, you might find 16/4 material that is plainsawn that you can cut into quartersawn billets. Sometimes you can find wide plain-sawn boards that have been cut close to the quartersawn orientation on the outer edges of the board.

Once you've selected the stock, prepare two blanks for the bodies for each plane size – one for the hollow and one for the round. The blanks are all 3 1/2" wide x 9 1/2" long. The thicknesses will vary: 3/4" for the No. 4s; 15/16" for the No. 6s; and 1 1/8" for the No. 8s.

You'll also need 1/8"-thick O1 tool steel blade blanks (surface ground on both faces) to match the size of the profile (two each per set). Tool steel is available in short lengths at a number of online suppliers, including McMaster-Carr (mcmaster.com) and Online Metals (onlinemetals.com).

The final length of the blades shown here is 8" (7 3/8" works for the Roubo-style planes, too).

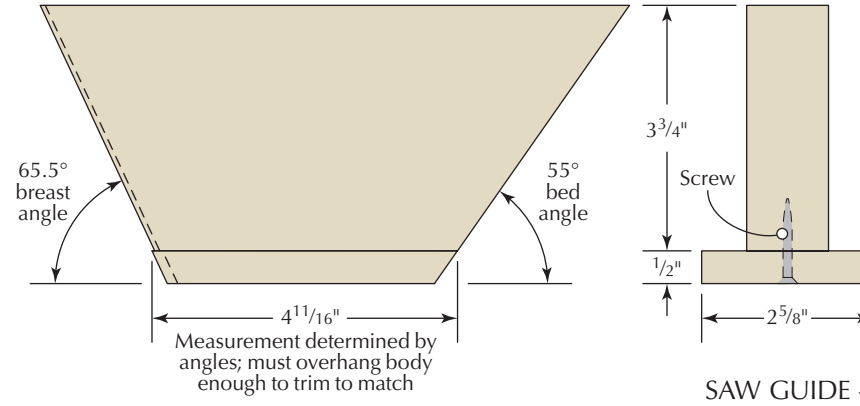
Time Well Spent

Making a jig is not how I like to spend shop time, but this saw guide is worth the investment. Consistent bed and breast angles are at the heart of efficient planemaking and this jig will help you achieve that.

Any stock that didn't quite make the cut as plane material should work fine. Lay out the angles according to the drawing below, then cut freehand with a backsaw. Don't fret if your angles aren't perfect; any variation will be worked out later in the process of fitting the wedge. Just try to make the 55° side of the guide 90° to its face as best you can. This will simplify fitting the wedge later, as you will see.

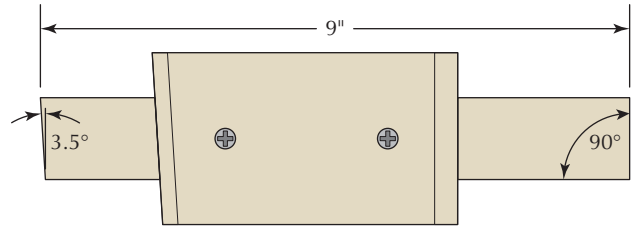
Now true up these cut surfaces with a handplane. For the fence, choose some material that will overhang the bottom in all directions. Screw this to the bottom. Use the angled surfaces of the jig's body to guide your saw in

Planemaker's helper. *A guide that registers your cuts for the bed and breast angles is worth your time to make.*



SAW GUIDE – SIDE VIEW

SAW GUIDE – FRONT VIEW



SAW GUIDE – BOTTOM VIEW

OPENING PHOTO BY DANIEL DUBOIS PHOTOGRAPHY; STEP PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY DAN PESSELL FROM THE AUTHOR'S DRAWINGS

Bed cut. *Secure your saw guide in place with a holdfast and cut down as deep as your plane blade is wide.*

trimming the fence to match their respective angles. True up these surfaces with a handplane.

Dado – Triangle Style

Creating the heart and soul of this plane is not much harder than making a dado…only it's a triangular dado.

Orient the plane body so that the grain runs downhill from toe to heel. Lay out the width of your plane blade (1/4", 3/8" or 1/2", depending on the size plane you're making) on the top and bottom of the plane body from the escapement side.

Secure the body between bench dogs, with the escapement side up and the sole toward you. Place your saw guide on the body so that the bed-angle side (55°) is facing left and the fence is pressed against the sole.

Breast cut. *For the breast angle, align your saw guide forward 5/32" at the depth or your previous saw line.*

Controlled excavation. *Use the saw guide as a reference to help remove the material without damaging the mouth. Work from the opposite side to remove the bulk of the waste.*

Position your saw guide 3 3/4" back from the toe then subtract the thickness of your sawplate. Secure the guide in place with a holdfast, then register your crosscut backsaw against the guide and cut down the layout line for the plane blade.

Flip the guide from left to right so that the breast-angle side (65.5°) is now facing left. Place the guide forward of your bed-angle kerf on the sole by 5/32". Because the breast cut is not at 90° – it's skewed approximately 3.5° – it will not create a consistent-width opening. Therefore, measure forward 5/32" at the depth of the previous saw cut. Thus, 5/32" will be the maximum width of the opening at the sole.

Now excavate the material between the two kerfs down to the blade-depth line. You can use a 1/8" chisel or, better yet, a specialty 1/10" mortise chisel (Lie-Nielsen carries a nice one) to pass through the sole opening. Follow up with a narrow blade in your router plane to achieve a consistent depth. If you don't have a router plane, simply undercut the dado slightly so that the

Sole material. *Use the thickness of your blade to mark off how much material needs to be removed so the blade can pass through the sole.*

Skewed for removal. *The skewed breast will leave a triangular bit of material that will need to be removed.*

blade and wedge will seat snuggly at the top and bottom.

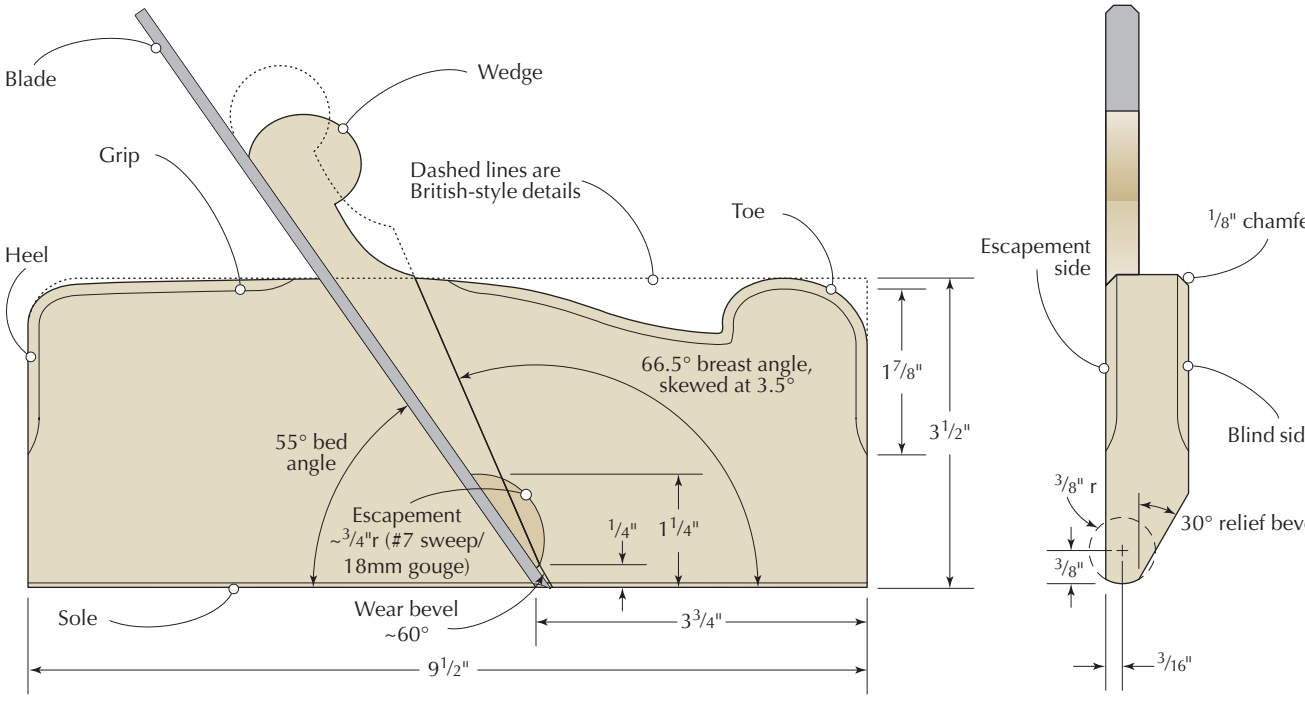
Don't Open Wide

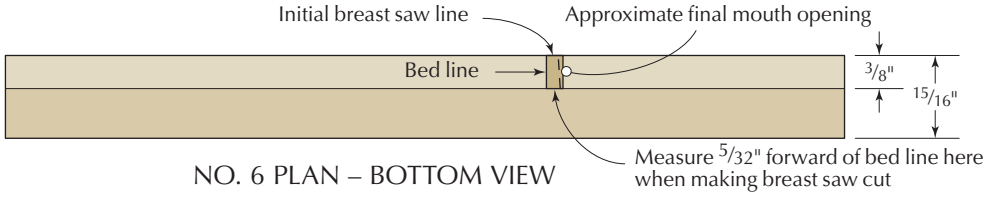
Because the breast is skewed, you will need to remove some additional material so that the blade can pass through the sole.

Use your plane blade as a guide to mark out how much material needs to be removed. Position the blade along the bed angle and let it overhang the sole. With your striking knife, mark along the front of the blade across the portion of the breast that blocks the blade's passage through the sole. Transfer this line down and square across the sole. Use a chisel, working down from the side and up from the sole, to clear this material. Be careful not to remove too much. You will refine the opening later.

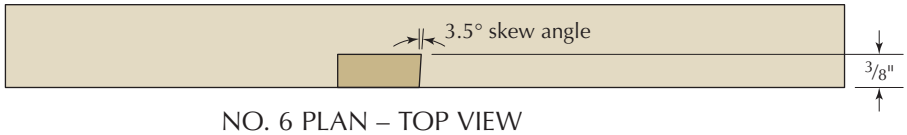
The lower and upper limit of the escapement should be about 1/4" and 1 1/4", respectively, from the sole. I find that an 18mm, No. 7 gouge works well for carving it. You want the shape to look almond-like, with the wider part toward the sole. Don't carve clear down

Leave a little. *Don't carve clear down to the bottom of the breast wall. The wedge needs to have support against the breast wall all the way to its tip.*





NO. 6 PLAN – BOTTOM VIEW



NO. 6 PLAN – TOP VIEW

to the full depth of the breast wall; allow a narrow area between the bottom of the escapement and the breast wall for the tip of the wedge to taper smoothly toward the mouth opening.

Wedge Work

Make a wedge using quartersawn material; you want the sides of the rays to be exposed on the sides of the wedge, just as they are on the plane body.

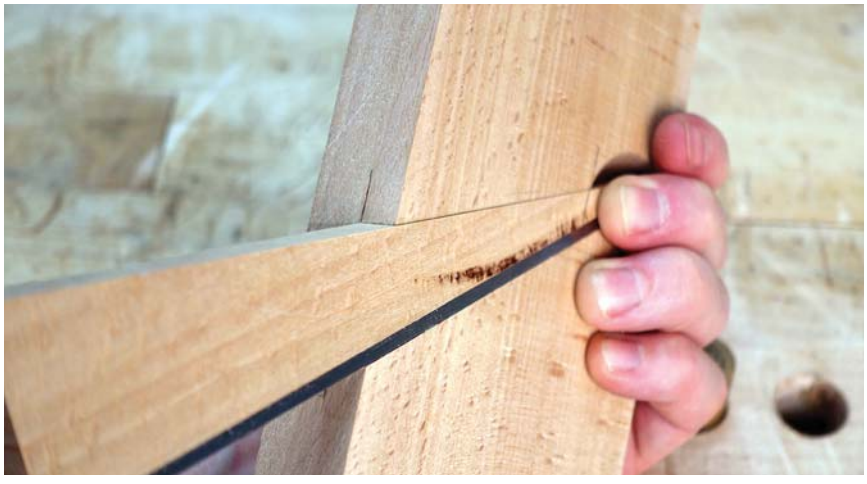
Dimension your wedge stock 7¼" long (or longer) by 1¼" thick, by the width of your blade, plus about 1/64". (This extra width will be smoothed flush to the side of the plane later.)

Mark out an 11.5° taper along the length of the workpiece, and a 3.5° skew across its width to match the breast skew angle. Place the piece in your vise and rip the wedge free. If your stock was long enough, save your offcut for making a second wedge.

True up the edges of the wedge with a small shoulder plane and check to ensure that the angles are correct (90° for the bed side of the wedge, and make sure the breast side corresponds to the breast skew angle in the body). Small adjustments can be made to the skew angle of the wedge by pivoting the iron in the shoulder plane body so that it takes a slightly deeper cut on the side that needs more material removed.

Straight as an Arrow

Now you're ready to get started on preparing and shaping the iron. Flatten the lower 2½" or so of the blade on front and back. Do this by rubbing it back and forth on a 3"-wide strip of #120-grit aluminum-oxide sandpaper adhered with spray adhesive to a flat surface. (A granite surface plate or even the bottom of jointer plane sole makes a great flat surface.)



Tight tip. *The wedge should fit tight at the tip rather than at the upper portion of the wedge. (There's a hairline gap at the top, but none at the bottom.)*

Make sure the bench is flat. *Placing both the wedge and the shoulder plane flat on the benchtop will keep the edge of the wedge square while making adjustments to its fit.*

"Tradition is not the worship of ashes, but the preservation of fire."

—Gustav Mahler (1860-1911), Austrian composer

Use enough pressure to let the paper do its work, but don't press too hard or you'll round the edges excessively. You're done when you achieve a consistent scratch pattern on both faces.

Your blade is now ready for test-fitting the wedge.

Snug Fit in All the Right Places

This is where the rubber meets the road. A well-fitted wedge and iron is half the battle in making a great-functioning plane. The key is to get the wedge to have a tight fit at its tip and to progressively diminish its tight fit as it moves away from the tip.

So in essence, the wedge will have a slightly more acute angle than the bed and breast angles. If the bed and breast have an 11.5° angle, then the wedge would be slightly less than 11.5°. This will ensure that the blade is always securely fixed where it needs it most: nearest to where the cutting action will take place.

A good clue that the wedge has a slightly more acute angle is that when you place it in the plane with hand pressure, at the top of the plane there will be a small gap between the wedge and the breast angle. If the gap closes up once the wedge is tapped with a plane hammer, then you are just about perfect. A hairline gap at the top of a wedge and a tight fit at the bottom is preferred.

To achieve this, ensure that the bed and breast areas are clear of any stray fibers in the corners. Place the blade in the body and test-fit the wedge. Determine if the angle of the wedge needs to increase or decrease.

Make adjustments to the wedge by laying the wedge flat on the benchtop and grip it with one hand. Use a sharp shoulder plane to take tapering cuts along the length of the non-skewed side of the wedge to either increase or decrease its angle.

If the fit is too tight at the top, for example, take overlapping cuts start-

Round layout. *Lay out the profile on both ends. Use a compass to accurately mark the arch.*

Don't wander. *Try to take passes straight in line from one end of the profile to the other to get consistent results.*

ing with short passes at the heel of the wedge, and make the passes progressively longer until you take a full-length pass all the way to the tip.

Making the Rounds

Now you're ready to shape the sole. You'll make the round first, because you'll use it later to shape the hollow profile. Lay out the "round" profile on the toe and the heel as shown in "Elevation" (page 25) and the photo above.

Note that the drawing shows center points for using a compass to lay out a 3/8"-radius arch (which corresponds to the No. 6). A compass is the most accurate way to do this and keep both ends of the plane profile coplanar. It's important that the profile not twist or your plane won't function correctly.

Now give the profile some clearance

HEAT TREATING

Heat treating O1 tool steel is simple. In short, bring it to critical temperature, quench it in vegetable oil, then temper it in an toaster oven or regular kitchen oven for one hour at 400˚.

Hardening steel is the easy part; minimizing warpage is another. The road to success is to evenly heat the metal. Creating an enclosure with something such as fire brick will help you achieve this.

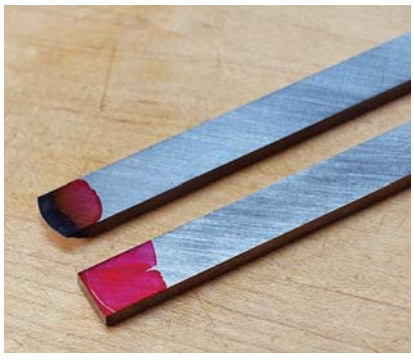
Heat the steel slowly using a simple MAPP gas torch. Heat it more slowly than you think you should. If one side is hotter than the other when you quench it in the oil it will warp. So heat slowly.

There are a few methods to determine when you have reached critical temperature. Avoid relying on color because ambient light will affect the color you see. Just like a flashlight appears brighter at night than in daylight, so too color alone in changing light conditions can be deceptive. The simplest way to check that you have reached critical temperature is to use a magnet, because O1 tool steel loses its magnetism at approximately this temperature. The stick of maple shown below has a rare-earth magnet glued to the end; it's a simple tool for safely checking the steel as it reaches critical temperature. Just periodically remove the steel briefly from the flame and check it with the magnet.

Another option is to watch the surface quality of the steel. It will change when the critical temperature is reached because the carbon begins to flow within the steel and some decarburization takes place at the surface, thus changing how it looks. It can be described as the steel "sweating" or having a "flushed" appearance. Accompanying this change will be a noticeable uptick in the "brilliance" of the steel. In other words, rather than seeing a particular color change you would simply see the color become more radiant.

Once critical temperature is reached, quench the steel in oil by plunging the blade straight down vertically, not leaning to one side or the other. Now immediately move to your oven to temper for one hour at 400˚. — CJ

Even heat. *A firebrick enclosure helps evenly distribute heat on the tool steel.*



Scribe & grind. *I use a shop-made scribe to carefully transfer the sole shape onto the blade. Then I grind to the line.*

Take it or leave it. *Make a sneck for easier adjustments or leave the iron as is. It's a preference thing.*

along the blind side (the side without the escapement) of the plane body by striking a 30° angle up and away from the corner of the profile. Go ahead and remove about 90 percent of this bevel with a plane so that cutting the round portion is easier.

Because you don't have a curved profile plane to match your radius (otherwise you wouldn't be making this, right?) you can use any flat-soled plane to cut the profile. You'll end up with a faceted surface that can be smoothed round with a few light passes of #220- or #320-grit sandpaper. Remove just the tips of the facets and no more.

Before you plane the profile, insert the blade, pull it back slightly from the mouth (so that you don't nick it), and insert the wedge. This will introduce any stresses to the plane from the wedging action before you cut the profile.

Now secure the body in your vise with the sole facing up and toe toward you – but secure it only by part of the heel section to avoid distorting the plane along its length (which could throw off the profile once you remove it from the vise). I find the opening of my tail vise works perfectly. Plane the profile from toe to heel working with the grain.

Finish up the profile by removing the remainder of the side bevel with a handplane. Secure it on the benchtop between two bench dogs as before, and plane down to the profile width. Take care to not remove the side of the mouth right up to a knife's edge; that would weaken this point and cause shavings to jam in this area and be a constant problem, so leave it a bit heavy.

Metal Work

Put machinist layout fluid on the lower edge of your blade. Wedge the blade in the plane and place it in your tail vise with the sole up. Use a scribe to trace the sole's profile onto the blade. Grind the profile, then grind a detail of your choice (or not; it's optional) on the heel of the blade.

Roubo shows a sneck on his irons – a small flag-shaped bit of material at the heel that allows the iron to be retracted or removed with a light hammer strike upward. (The alternative method to remove the iron is to strike the top of the grip at the toe with the non-metal side of a plane-adjusting hammer.)

A sneck can be made as easily as notching out a bit of the steel on the side of the iron near the heel. Or, you can replicate Roubo's sneck style by selecting a piece of steel that is at least 1/8" wider than the required blade width. Grind the lower portion down to the required blade width while leaving the last 1 1/8" or so of the heel portion the full width.

To grind the hollow profile, I use a narrow metal-working cut-off wheel mounted on my grinder.

Boxy or Curvy?

While the blade is tempering in the oven (see "Heat Treating" on page 27) take this time to round the heel of the

A little mouthy. *A mechanical pencil makes an offset line that is consistent and easy to see.*

One for show. *The wedge tip curve is actually two cuts. One makes the "eye" shape while the other visually continues the circular shape of the escapement around.*

No catch. *The wedge tip must fit tight on all three sides or shavings will catch.*

grip on the body. A carving gouge is the perfect tool for this. Simply place the body on its side and pare straight down across the heel. Cut the toe profile if desired or it leave square, then chamfer the top edges and refine the surfaces.

Sharpen

After your blade is tempered and cooled, flatten it again to remove any distortion from the heat.

Start with #120 grit as before, then follow with #180- through #320-grit sandpaper on the cutting face, then jump to a #1,000-grit stone.

Stop there and put layout fluid on the face of the blade and scribe the profile on the blade end as before. Now final-grind and hone the edge.

To sharpen the blade for the hollow, I prefer to use a ceramic slipstone.

Clear Your Throat

It's time to refine the mouth opening and, at the same time, cut the wear bevel angle.

Again wedge the blade in place, but leave it extended beyond the sole a short distance. Using a mechanical pencil, strike a mouth line on the sole by resting it against the blade as a reference while drawing that mouth opening line.

Using the mouth-opening line as a reference, mark your wear bevel angle (see the "Profile" on page 25). It will lie approximately midway between the bed and breast angle. Now, cut the wear bevel with a chisel, using a combination of cuts from the side and bottom.

Using the same gouge as before (18mm, No. 7 sweep), shape the wedge tip to match the curve of the escapement. I find a spoon-carving knife is a great tool for refining the shape.

Tune-up

Take a few test cuts (of course working with the grain). Ensure that the sole is straight and that the blade profile matches the sole as closely as possible.

If you find shavings keep getting jammed in the mouth, it is likely due to one (or more) of the following: a dull blade; a blade profile that doesn't match well or extends out too far at the blind side; a mouth that is too small for the depth of cut; a wedge tip that extends into the wear bevel; or a wedge tip that is not tight-fitting, which creates a gap in which shavings catch.

You might need to adjust the wedge angle slightly to compensate for slight thinning of the blade edge during flattening and sharpening.

Now bring the thickness of the wedge flush with the sides.

All that's left to do is cut the wedge's finial profile with your coping saw. The 18mm, No. 7 carving gouge will work well for cleaning up some of the shapes.

To make the matching hollow, follow all the steps above up until shaping the sole. For that, you'll use your new round plane to cut the hollow profile. If you were careful to make both bodies the exact same thickness, then you can align the profiles for cutting by laying both planes on their sides and sliding the round to plane the hollow.

Finish

I finish my planes with a coat of Tru-Oil Gun Stock finish. Let the finish thoroughly cure unassembled to avoid having your parts seize together. Put a light coat of jojoba oil on the blade for rust resistance and ease of adjustment. **PWM**

Caleb is a planemaker and furniture maker based in Greenville, S.C., who offers a full range of wooden planes. To see more of his work and read his blog, visit calebjamesmaker.com.

Line 'em up. *Use the finished round to shape the matching hollow profile.*

ONLINE EXTRAS

For links to all online extras, go to:
- **popularwoodworking.com/apr16**

BLOG: *Read the author's (mostly toolmaking) blog at his web site.*

INSTAGRAM: *Follow Caleb James on Instagram at instagram.com/calebjamesmaker.*

IN OUR STORE: *"Choosing, Refurbishing & Using Moulding Planes," a video by Bill Anderson.*

TO BUY: *"Making Traditional Side Escapement Planes," by Larry Williams (Lie-Nielsen).*

Our products are available online at:
- **ShopWoodworking.com**

Guerrilla Guide to Spray Finishing

BY CHRISTOPHER SCHWARZ

It's fast, forgiving and affordable – and you don't need a spray booth.

The hardest part about learning to spray finishes is becoming convinced that you can learn to spray finishes.

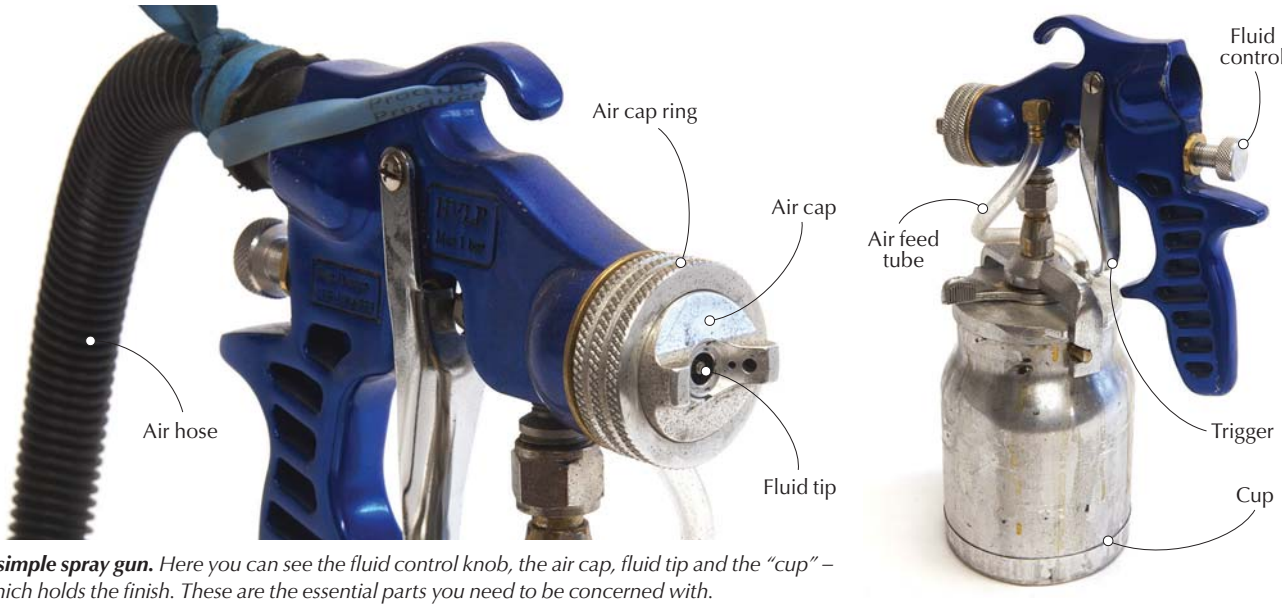
Of all the ways to apply finishes – brush, rag, rubber and spraying – there's only one method easier than spraying: ragging on oil. Spraying finish is always faster than any other application method – astonishingly so. I can spray two coats of lacquer on a chest of drawers and have the thing assembled in just a few hours (compare to a few days with a hand-applied finish).

Oh and one more thing: In my opinion, spraying produces better results.

Plus, with good spray systems now costing about as much as a half-decent cordless drill, you just ran out of reasons to avoid spraying.

If you're a professional finisher or refinisher, this story is not for you. Most of the resources I've read about finishing are aimed at people in cabinet shops or industry. This article is for the home woodworker who wants to get the speed and quality of a spray finish but doesn't have money or space for dedicated setup.

I first learned to use a spray gun as a teenager working in a door factory, and



A simple spray gun. *Here you can see the fluid control knob, the air cap, fluid tip and the "cup" – which holds the finish. These are the essential parts you need to be concerned with.*

I've used everything from industrial equipment down to the plastic DIY units. And while I could spend most of this article discussing all the differences among the systems – high-pressure vs. high-volume-low-pressure units (HVLP), bleeder vs. non-bleeder guns – I don't think that's as important as the basic techniques involved in spraying. (I do think that most home woodworkers would be better off with an HVLP system, but that's just an opinion.)

All the systems are more similar than they are different: Air is forced through the finishing material, atomizing it into a fine spray that you control with a spray gun. You control the mix of air with the finishing material, the shape of the cone of finish squirting from the gun, and (of course) when finish is coming out of the gun and when it is not.

These are easy things to learn to control.

The second part of spray finishing that bemuses people is how to actually spray the work. Where do you start and finish? How do you finish interior spaces? What about legs?

I'm going to discuss all of these aspects of spray finishing. But first, let's talk about what you can and can't spray.

What to Spray

In theory, you can spray almost any finish if you can get enough air into it to atomize it. But for a practical, do-it-at-home woodworker, it's best to spray finishing materials that are thinner than latex paint.

Finishes such as shellac, lacquer, dye and milk paint are all easily sprayed by even the most basic spray systems. You can indeed thin varnishes and heavier finishes so they will spray. But I rarely do this because lacquer and shellac dry faster and lay out evenly, so that spraying a heavy slow-drying varnish is silly in many (but not all) cases.

When buying a spray system, the more expensive units have more power and can atomize heavier finishes – that's what you are paying for (plus usually a nicer spray gun). If you are only going to spray light-bodied finishes at home, you probably don't need a heavy-duty system.

No mater which rig you purchase, you will need a few needles and matching fluid tips in different sizes for the spray gun. If a small tip won't atomize your finish, swap out to a bigger tip

Thin enough. *After stirring the finish, I pull a stick out of it to see how quickly it runs off the stick and breaks into droplets. If it looks thick enough to put on waffles, I add some thinner to the mix.*

Start small. *I have three tips for my gun. The smallest one (1.0mm) is good for shellac. The middle one (1.5mm) is good for lacquer and the largest one (2.0mm) is for thinned acrylic paint.*

LEAD PHOTO BY AL PARRISH; STEP PHOTOS BY THE AUTHOR

Nature's spray booth. *I like to have a little breeze when I spray outside and make sure I spray predominantly in the direction of the breeze. Also, I avoid direct sunlight on my spraying area. And bird poo.*

(or thin the finish). Having a few common sizes will help avoid frustrating dead ends.

Some systems come with "viscosity cups" that allow you to see if your finish is thin enough to spray. I generally don't mess with these. If the finish is thinner than pancake syrup, it probably will work fine.

Where to Spray?

For most of my career I've sprayed in an industrial spray booth. These are nice, but I don't think they are practical for the home woodworker. You could rig up a ventilation system with a special fan and curtains (see the Online Extras at the end of the article for more information), but that's a hassle for some woodworkers and it can bring a lot of solvent smells into the house.

At home, I spray outside and with a respirator. Yes, I have to wait for a decent day sometimes, but I have been amazed at how I can even spray in the Midwest in December by spraying a furniture component then taking it into my heated shop to cure. Really, there are only two months (January and February) when I don't spray.

> "Wax on, right hand. Wax off, left hand. Wax on, wax off. Breathe in through nose, out the mouth. Wax on, wax off. Don't forget to breathe, very important."
>
> — *Mr. Miyagi, "The Karate Kid"*

Set up the Gun

So now that we have the spray booth sorted, let's set up the gun. All the guns I've used let you control how much finish goes into the airstream; some systems also allow you to increase or decrease the airflow, either at the gun or from the source of the compressed air.

If you buy an HVLP system, you're probably going to be able to regulate only the amount of finishing material. So setting the gun is easy. Begin with the fluid control turned all the way down. Pull the trigger and start to open up the fluid control. You'll see the fan get bigger and denser as it fills with atomized finish. When you reach the point when you open the fluid nozzle and the fan does not change in size or density, stop.

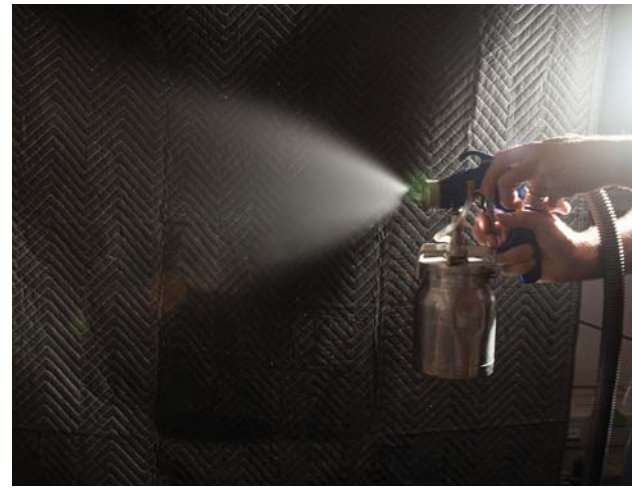
That's a good mix to begin working with on a test board.

If you have a system that allows you to also control the airflow, I recommend you read your system's instructions. It will tell you a good place to begin when regulating the airflow. Balancing airflow and finish material takes a little experience and it is a good idea to use someone else's gun that's been set up so you know what a good fan looks like.

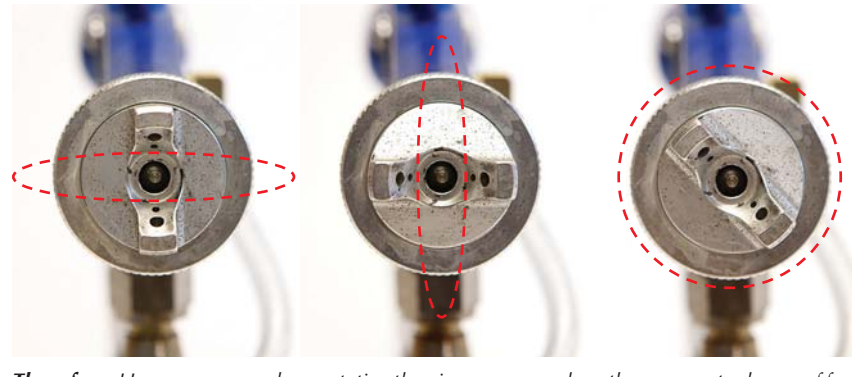
The other important adjustment on the gun is the air cap – it controls whether the fan is spraying a horizontal band of finish, a vertical one or something that is roundish.

A horizontal fan is ideal for spraying vertical components such as legs or spindles. A vertical fan is ideal for panels. I like a round pattern for working inside casework.

Oh, and you need to learn to use the trigger. It's good practice to let go of the trigger when your fan is not hitting the work, even if it's for only a second. This saves finishing material. It also helps prevent you from getting too much finish material on the perimeter of a panel.



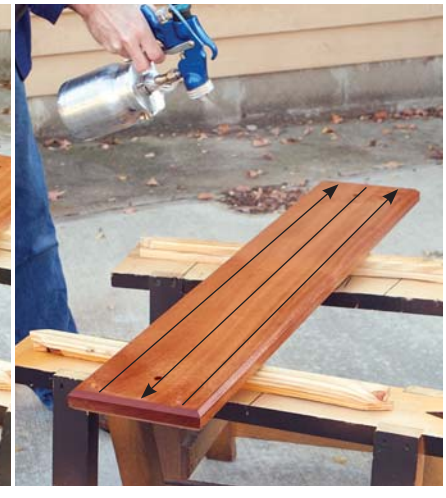
Remember this. *Here's a vertical fan on my HVLP system. I have opened the fluid control until I see this fan. Opening it up more will not change the shape of the fan, but it will deposit too much finish on the wood.*



Three fans. *Here you can see how rotating the air cap can produce three separate shapes of fans.*

Back edge. *Spray the back edge of the piece.*

Ends. *Then spray the ends of the piece.*



Front edge & face. *Spray the front edge, then continue working on the face of the panel.*

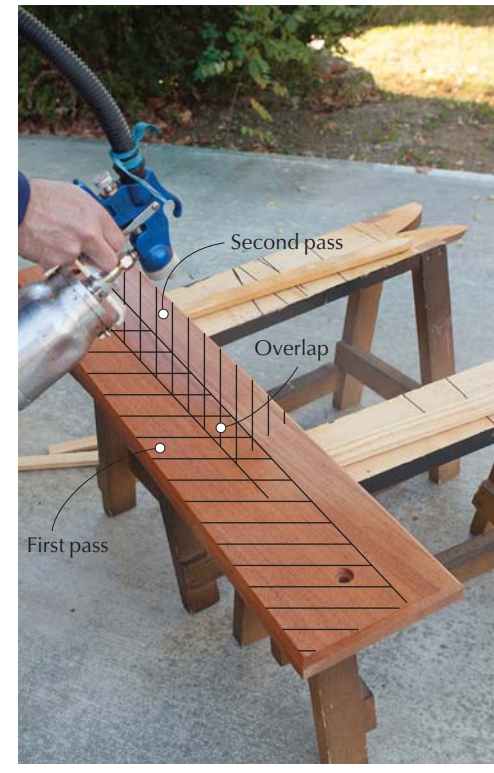
How to Spray a Board

So with you gun settings somewhat dialed in, it's time to spray a test board to see how the finish is flowing out – if your fan is too wet or dry. Some people use cardboard or Masonite for this step. I use a scrap piece that is the same species I'm spraying and that has been prepped in the same way as my project. Rough or machined lumber won't tell you what your gun is really doing. Cardboard absorbs finish too readily and is rough.

When you spray the board, keep the gun about 10" away from the work. Begin by spraying the underside of the board and start at its back edge. You want to work robotically – keep the gun at 90° to the work and a consistent distance at all times. Pull the trigger an instant before the fan will hit the board and release the trigger an instant after the fan goes off the board.

After spraying the back edge, spray the end-grain edges of the board in the same manner. Then position yourself to spray the front edge. Spray the front edge. But instead of stopping after the front edge, adjust your wrist and continue to spray the face of the board.

Film finish. *When you lower your view to the board you can see the light reflecting off the film and see if it looks somewhat consistent. This is lacquer on mahogany, about 30 seconds after it was sprayed. Open-pore woods such as this will look like this at first – kind of splotchy. After 15 or 20 minutes the film will be much more consistent. So don't panic.*



Rule of thirds. *Make your new stroke overlap one-third of your previous stroke.*

Your strokes need to overlap – I overlap one-third of my previous stroke with the next stroke. The board will change color as you spray finish on it, so that will help guide your efforts to lap your strokes.

After spraying the board, crouch down so you can see the reflection of the film lying on the board. It won't look perfect (usually) but it should look consistently wet with no bone-dry areas

Second coat. *After sanding the first coat, here is what the second coat looks like after about 30 seconds. Better, but still wrinkly. This will flatten out easily after about 20 minutes.*

Done. *The second coat after 20 minutes of drying – perfectly smooth. This is a low-luster lacquer. I don't like blindingly shiny finishes, but these same techniques work with high-gloss finishes.*

A dust-up. *If the lacquer or shellac gets white and dusty when you sand it, that means the finish is cured and hard.*

or huge puddles. If it's dry in one area only, you probably missed a spot. If it's dry in stripes on the board, then you didn't overlap your strokes or you need to open the fluid control a bit.

If you have puddles (or lakes), then you either lingered too long in one spot or you have too much fluid coming out of the tip.

Let the finish set up (for lacquer or shellac this can be about five to 20 minutes). Then evaluate the test board. It might be a little rough, like your skin after one day of not shaving. Sanding that down will fix those nibs. What's important is the film is thin and consistent. If it looks thick and gloppy, you need to reduce the fluid in the fan. If it feels like coarse sandpaper and there's no film whatsoever, you need to increase the fluid in the fan (or you held the gun too far away from the work).

If you are uncertain about your results, wait for the finish to cure some more (about 30 minutes in a warm room). Then use a #300-grit sanding sponge to remove the fuzzy nibs and level the first coat. If you get white dust when sanding lacquer or shellac, don't worry. That's good. If you don't get white dust, let the finish cure longer and try again.

Then repeat the spraying process for the test board and evaluate your results. After spraying a few projects, you will dial in the gun settings immediately – especially with a familiar finish material.

But Everything's Not a Board

Spraying complex assemblies can seem overwhelming. It helps to break down the project into interior surfaces, secondary surfaces and primary surfaces.

Interior surfaces. *Here I'm spraying the inside of a tool till for a chest. I spray one end, the bottom, then the other end. The goals are to keep the center of the fan pointed at 90° to the surface you are spraying and a consistent distance – about 10".*

Interior surfaces – such as the inside of a chest of drawers – don't need to be sprayed at all. If they get some overspray, no big deal. Historically, the inside of casework was left unfinished. This philosophy can extend to the insides of drawers and cabinets as well – but that's an aesthetic choice.

Secondary surfaces – shelves, the insides of doors, cabinet backs in open casework and etc. – need finish, but they don't have to be as perfect as the primary surfaces. Primary surfaces are the showy bits – the tabletop, the case sides, the drawer fronts.

In my shop, I don't spray the interior surfaces. So I start by spraying all the secondary surfaces. The final surfaces to get sprayed during a coating session are the primary surfaces.

So when spraying a bookcase, for example, I:

1. Don't spray the backs of the backboards.

Horizontal fan. *When spraying legs, I get them vertical and use a horizontal fan. This reduces the chance of getting dry spots on your legs.*

Stop sticking. *Lubricating the interior parts prevents things from gumming up – even a few molecules of sticky finish can prevent parts from moving smoothly.*

2. I set the air cap at a diagonal to produce a round cone and spray the interior of the case and shelves.

3. Set the air cap to make a horizontal fan and spray the front edges of the case and shelves.

4. Spray the case sides.

5. If the case has a visible top, I set the air cap to make a vertical fan and spray the top.

Another good strategy when spraying is to spray as many parts that can be laid flat as possible. If you can take the shelves out and spray them flat on sawhorses, you'll get better results than spraying them while inside the carcase.

After a coat of finish sets up, level it with a sanding sponge (or stearated sandpaper) and add a second coat. For most projects, two coats of lacquer or shellac is plenty. Three coats is fine. After three coats things will start to look plastic-y.

Final tip on leveling the finish: If it looks good but still feels a little rough, wait two weeks and rub down the finish with a brown paper bag. It is just coarse enough to level the nibs without showing visible scratches.

Clean-up

Spray equipment needs to be clean to work. Most problems that I've encountered with spraying are caused by poor gun hygiene.

When you are done spraying, run a few ounces of solvent through the gun. Shake the gun occasionally while spraying the solvent to ensure it cleans the entire cup that holds the finish.

Disassemble the gun and soak the needle, fluid tip, air cap and any other parts that came in contact with the finish in a little solvent overnight. Lubricate the needle and the trigger of the gun (most people use petroleum jelly or mineral oil; just don't use silicone).

If all this sounds simplistic, that's because it is. Yes, there are fine points to spraying finishes, especially when you get into advanced techniques, such as toning a board. But if you want to simply apply a topcoat finish and have it look dang-near perfect after a few hours of work, spray finishing is definitely something to try. **PWM**

Christopher, a contributing editor to this magazine, is a furniture maker and the editor at Lost Art Press.

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/apr16**

ARTICLE: *Find out how to make your own spray booth.*

IN OUR STORE: *"Flexner on Finishing."*

TO BUY: *"Wood Finishing 101."*

Our products are available online at:

- **ShopWoodworking.com**

Arts & Crafts Occasional Table

BY MITCH ROBERSON

Conquer some fun joinery challenges with this geometric Baillie Scott build.

As soon as I saw Mackay Hugh Baillie Scott's 1901 occasional table on display at the Museum of Modern Art in New York, I knew I had to make one.

Baillie Scott (1865-1945) was an architect at the forefront of the Arts & Crafts movement in England. His diminutive and elegant table is uncharacteristic of the often substantial and earthy furniture of the Arts & Crafts style.

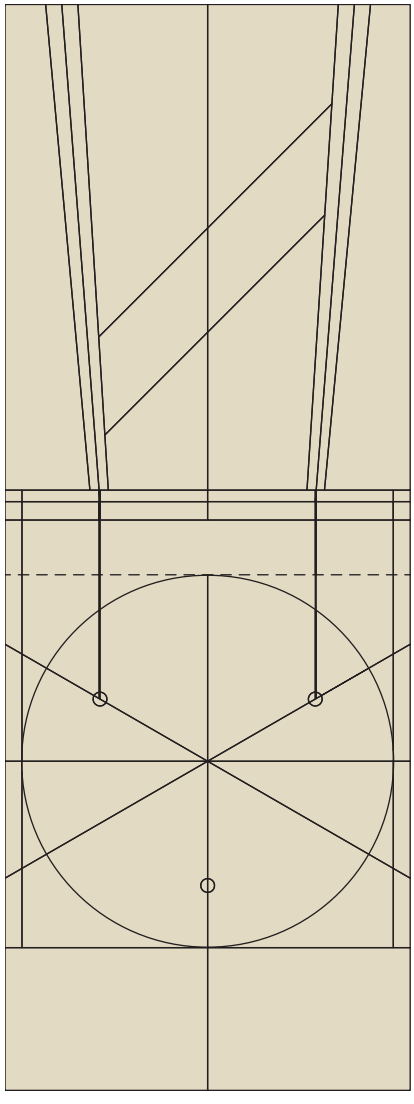
The lightness and movement of the table, which come from a play between positive and negative space, make it a true piece of sculpture that looks different from every perspective.

Though it is made from only seven parts, this little table presents several challenges. First, there is not a single right angle in sight. The three legs are splayed and joined with curved stretchers angled upward from left to right, which flow into the round top. As if all that were not challenging enough, the legs are tapered and hexagonal.

If you enjoy the problem-solving aspect of making furniture as much as I do, this project is for you. Read on to discover how to face each challenge.

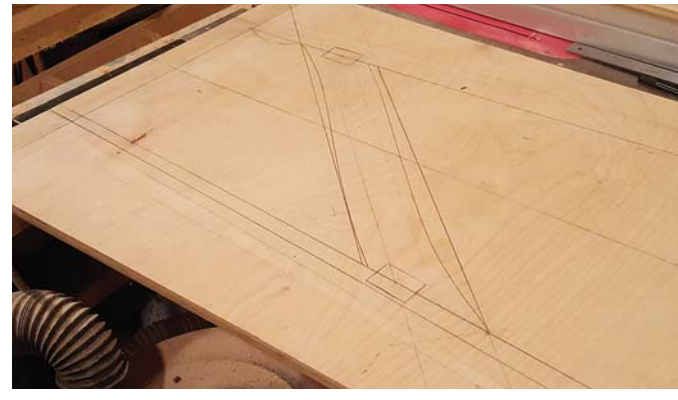
The three legs are joined to the stretchers using floating tenons. The legs and top are joined with wedged through-tenons. Figuring out where the joints go is the goal of a full-size drawing.

PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY DONNA R. HILL FROM THE AUTHOR'S MODEL

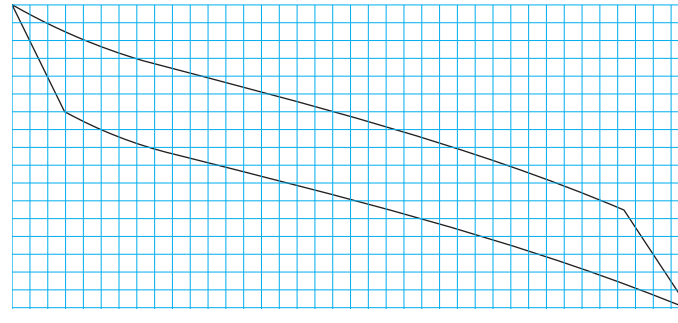


PLYWOOD LAYOUT

Start square. *Lay out the top of the table using a piece of plywood, which will make it easy to transfer the lines to the other side of the plywood, which has the elevation drawing.*



One drawing. *The three stretchers and legs are identical so you need to make only one drawing for the elevation.*



LEG PATTERN
1 square = 1/2"

Start with Full-size Drawings

This project demands accurate drawings that you can use to define angles and locate joinery. The best way to approach this table is to create full-size drawings on a piece of plywood. On one face of the plywood, you'll draw the plan view of the table. On the other face, you will draw the elevation. These two drawings work together to give you the all the angles and part sizes you need.

The other good thing to know off the bat is that you will not need to cut tenons at a compound angle. The three hexagonal legs offer joinery surfaces that are parallel to each other (very clever, Mr. Baillie Scott).

Begin by drawing the top as a 22" x 22" square on one face of the plywood. Establish a center point on the circular top and draw a vertical line through it. Mark one leg (we'll call it the back leg) on this centerline that is 3 1/2" from the back edge of the top. Then draw lines out at 120° to locate the other two legs (we'll call these the front legs). Make marks on these three lines 6 3/4" from the center. These are the locations of the mortises.

Now we're going to pull some of the important lines to the other face of the plywood for the elevation view. Pull the locations of the two front legs to the edge of the plywood and wrap them around the edge. Flip the plywood over. Working from the edge that has your marks, measure 1" off that edge and strike two horizontal lines to establish the tabletop, which is 5/8" thick, in elevation view. (The extra 1" of space gives you room for drawing reference lines.)

Stretcher joinery. *Use the drawing to precisely locate joinery, in this case the loose tenons that join the stretchers and legs.*

Draw centerlines for the two front

INDEXED TAPERING JIG

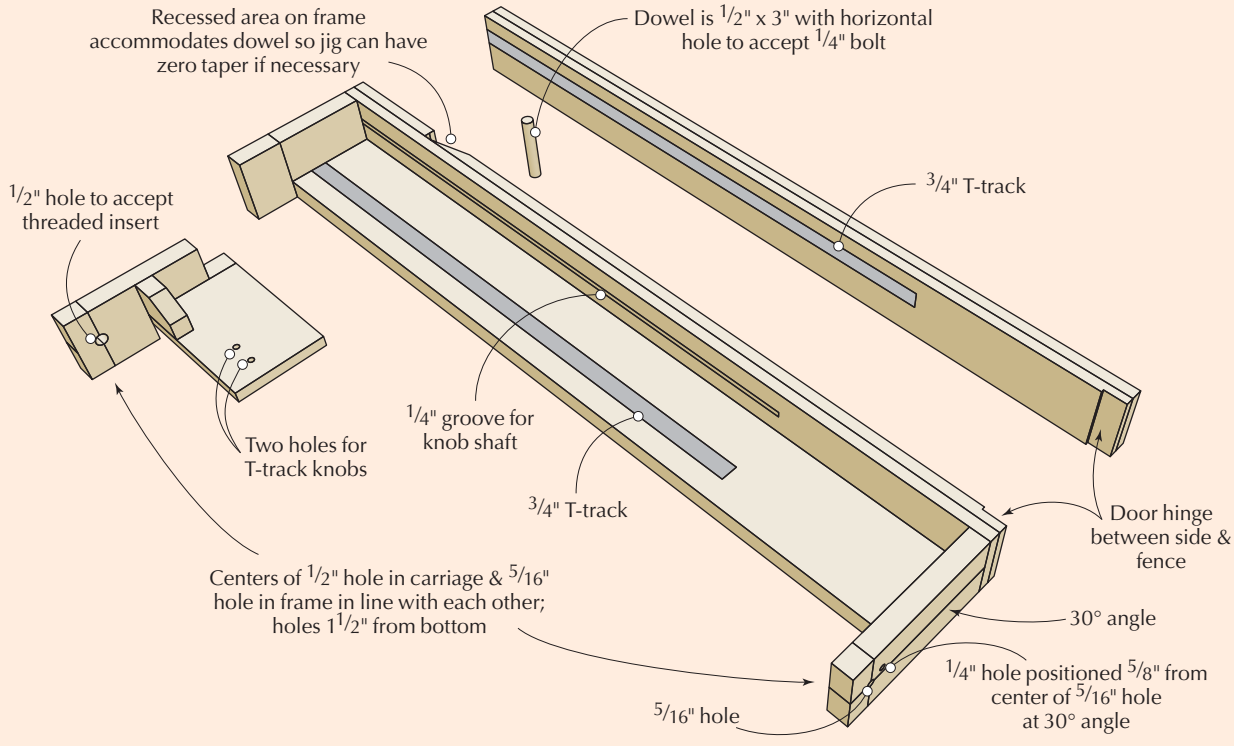
To solve the puzzle of how to cut tapered, hexagonal legs, I designed a taper-cutting jig that cuts the facets in six passes on my table saw. It works a lot like the indexing head on a lathe. The jig holds the leg on its axis so it can be turned at pre-set angles and adjusted to different tapers and leg lengths. It also holds the leg in place for mortising and sanding.

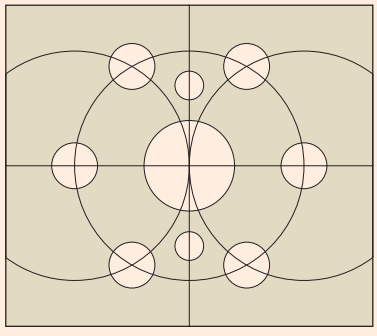
The jig is a simple frame. At one end is a movable carriage that has a hole and a threaded insert for a mounting bolt that goes into the top of the leg. At the other end is mounting hole plus a 1/4" indexing hole that will lock in a particular angle of rotation.

The rotation of the leg is controlled by a "cartridge" made of 3/4"-thick plywood. The cartridge has a threaded insert in its center that's surrounded by six equidistant holes (one hole for each face of the six-sided leg). The cartridge is screwed to the bottom of each leg. To lock in an angle of rotation, you'll pass a bolt through the jig's indexing hole and into one of the holes in the cartridge.

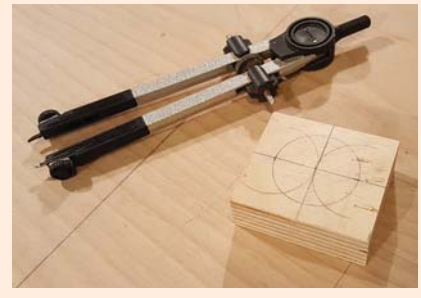
The jig's frame is attached to a second fence with a door hinge at the end that allows you to adjust the taper angle. A particular taper is locked in by wedging a dowel between the frame and the fence and locking it in place with a bolt that grabs some T-track in the second fence.

To cut the tapers, screw the cartridge to the foot of the leg. Bolt the top and bottom of the leg to the jig, lock the carriage then insert a 1/4" bolt into one of the six holes in the cartridge. Make the cut and loosen the carriage bolt. Pull out the 1/4" bolt part way, then turn the leg while putting pressure on the bolt. When the next hole lines up, push the 1/4" bolt in and tighten the jig to make the next cut. — MR

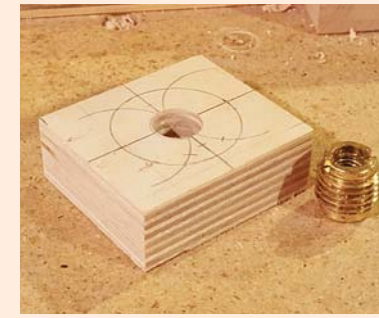




JIG CARTRIDGE



Three radii for six sides. *Use a compass to draw a hexagon the old fashioned way – by drawing intersecting circles.*



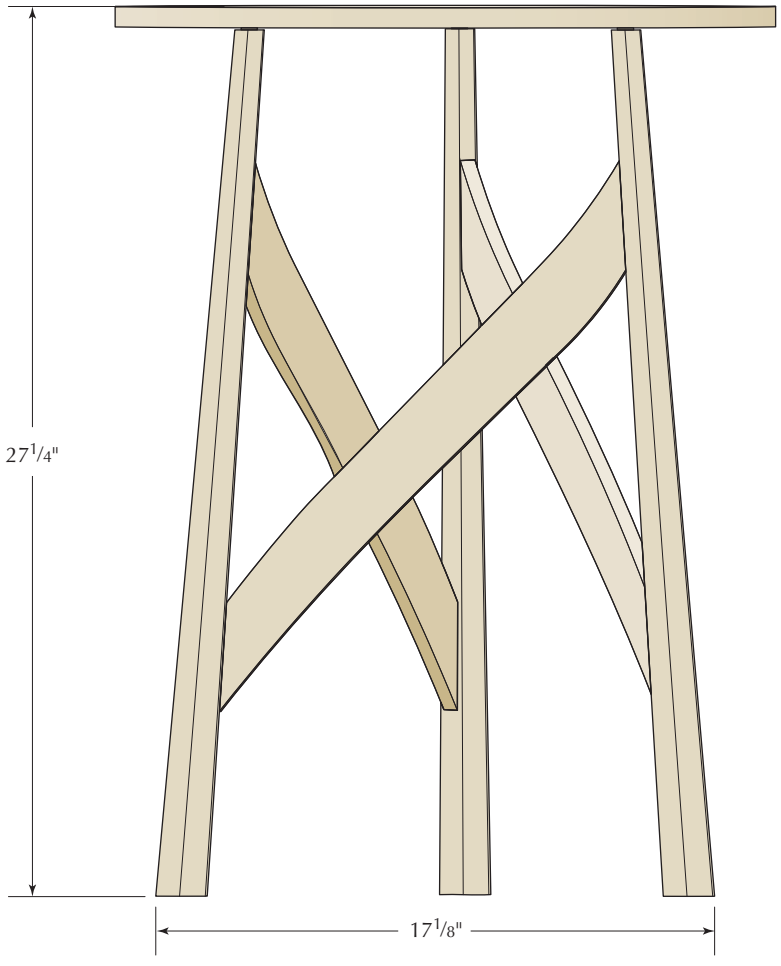
For the mounting bolt. *Drill a 1/2"-diameter hole for a brass threaded insert.*

legs at a 4.5° splay. Then draw the inner faces of the legs. The legs taper from 1" thick at the top and end up at 1¾" x 2" at the floor. In the elevation view on your plywood, the 2" width is facing you. So the inner face of the leg should taper from ½" off your centerline at the top of the leg to 1" off the centerline at the floor.

Draw the top line of the stretcher blanks pitched at 45° from parallel and intersecting the inside face of the right front leg 3" down from the underside of the tabletop. The top line establishes the angles at which the stretchers meet the legs.

You also should draw in the bottom line of the 3¼"-wide stretcher and its serpentine edges. Use the gridded drawing on page 37 to lay out the subtle curves on the stretchers.

One tricky thing is that the mortises for the legs are drilled into the underside of the top, so you need to account for the splay of the legs on your full-size drawing by scribing a perpendicular line from the edge of the plywood to where the leg's centerline meets the line representing the underside of the top on your plywood drawing. Transfer this line to the drawing of the top on the other side of the plywood.



ELEVATION

Arts & Crafts Occasional Table

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑ 3	Legs	1¾	2	30	Maple	overlong
❑ 3	Stretchers	½	3¼	22½	Maple	
❑ 1	Top	⅝	20¼ dia.		Maple	
❑ 6	Wedges	⅛	¾	¾		

Make the Tapered Legs

With the leg blanks milled to the sizes in the cutting list, draw a ¾"-diameter circle on the tops to define the tenons. Using a crosscut sled at the table saw, cut the shoulders for the tenons because it's easier with the blanks still squared. Cut the shoulders 1½" from the top of each leg.

Drill a ⅝" x ⅜"-deep hole in the top end of each leg to mount it to the indexed tapering jig (see page 38).

On the foot of the leg, attach the cartridge you made for the tapering jig with two #6 x 1" screws. Fasten a test leg to the jig.

Rotate the leg and insert the ¼" indexing bolt through the jig and into the cartridge to lock the leg at the correct angle in relation to the table saw blade. Tighten the mounting bolt for

The foot in the jig. *The leg is attached by a bolt that goes through the jig and into the threaded insert on the cartridge, which is screwed to the leg.*

At the top of the jig. *The carriage can be adjusted for legs of different lengths.*

Screwed on. *Attach the cartridge to the leg and it's ready to bolt into the tapering jig.*

the cartridge.

To get the proper taper, the best method is to lay out the taper on your test leg then sneak up on the correct pitch, using the layout lines as a guide.

With the jig firmly against the table saw's fence, cut one facet of the leg. Loosen the mounting bolt, turn the leg to the next position and tighten the bolt again. I stopped the cut just before the blade reached the cartridge, then I pulled the jig back. The waste will still be attached near the cartridge, but it can easily be broken off.

After tapering all three legs, put them aside without cutting them to length. You'll be putting them back into the jig later for mortising and sanding.

Make the Stretchers

Clamp straightedges along the lines for the legs' inner faces on the drawing and use a digital protractor to measure the angles where the stretchers meet the legs. I made a dedicated sled for my table saw to cut these angles, but if you're just making one table, a miter gauge or chop saw will suffice.

On the drawing, mark the centers of the mortises so you avoid short grain in the stretchers. Cut these mortises with a router on the ends of the stretchers, using your drawing as a guide.

The mortises should be 3/16" wide, 1 5/8" long and 3/4" deep.

Cut the curves on the stretcher using a router table, a plywood pattern and a flush-cutting bit.

More Leg Work

Make a story stick to transfer the mortise locations from your drawing to the three legs.

Put a leg back into the tapering jig and turn the facet accepting the mortise upward. It's easy to confuse the upper and lower mortises, so I marked them with blue tape.

To cut these mortises, I made a simple plywood box that encases the leg to give a larger bearing surface for the base of the router. Using your plywood pattern to determine the locations, mark the centers of the mortises on the jig. Cut the mortises for the legs using the same depth setting and lateral stops

Go time. *With the leg blank installed in the jig, cut the tapers in six passes.*

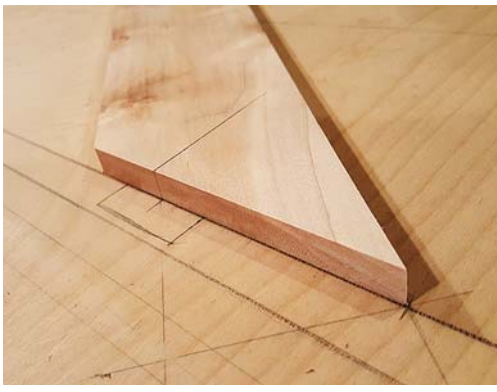
"The serene and earnest beauty of the old house is everywhere being replaced by a superficial smartness posing as art."

— Mackay Hugh Baille Scott, from "Houses and Gardens," 1906

Tighten, then cut. *Between passes, loosen the mounting bolt and remove the 1/4" indexing bolt before advancing to the next position.*

Sand as you go. *The jig holds the legs in the perfect position for sanding and mortising.*

Double duty. *This sled allows me to cut each angle on the stretchers without any adjustments. The stops are simply screwed in place.*



Drawing, meet stretcher. *With the angles cut, place the stretcher on the drawing to find the location for the mortise.*

you used with the stretcher mortises. As to the locations of the mortises: For right front leg, the center of the mortise is 5½" down from the underside of the top on the inside face. The center of the mortise on left front leg is 16⅞" down from underside of the top on the inside face. Sand the legs while they're still in the tapering jig.

Create the ¾"-diameter round tenon on the legs. Dry-fit the legs and stretchers together with the floating tenons to make sure everything fits well, then cut the legs to length.

Time for the Top

Glue up a ⅝"-thick panel and cut it into a 22" x 22" square, establish the center and draw lines at 120° angles to mark the locations for the legs. Get the locations for the legs from the drawing, remembering to mark the locations on the underside of the top. I used a circle-cutting jig with a router to cut the round top at a diameter of 20¼".

Put it all Together

Use a scrap piece of plywood with reference lines transferred from the plywood drawing for a test run for drilling the holes for the legs.

To drill the mortises, I used a jig similar to a circle-cutting jig that is crossed with a doweling jig. Cut a piece of ½"-thick scrap plywood to 3" wide and 20" long. Mark a line across the face and edge at 10" and drill a hole to accommodate the center pin used with a circle cutting jig.

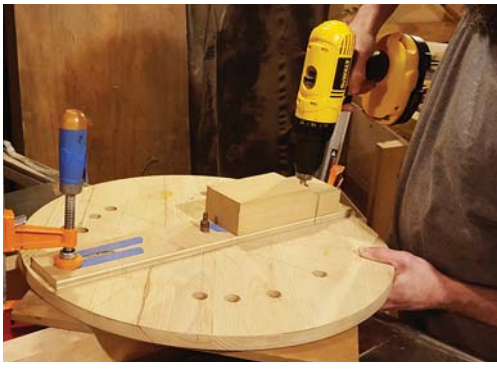
Draw a centerline along the length of

Mortising. *Because the mortises are 90° to the face of the leg there are a variety of ways to cut them. I put the leg back in the jig to hold it in perfect position to cut mortises with a plunge router.*

Test run. *With mortises cut on the stretchers and the legs, dry-fit the table together with its floating tenons.*

No lathe? *Use a handsaw and files to make round tenons.*

Simple but effective. *A circle-cutting jig doesn't have to be fancy to produce accurate results.*



Drilling jig. *Here, I'm testing my drilling jig setup on a mock-up of the tabletop.*

Seven not-so-easy pieces. *When the going gets tough, it's good to remember there are just seven parts (not counting the loose tenons and wedges).*

the plywood and carry this line around edges.

On the scrap top, drill a stopped hole on the underside to accept the pin. Now bore a hole angled at 4.5° in a block of hardwood that measures 2" thick, 3" wide and 7" long. This block will act as a bushing or guide for the drill bit. Mark a line at 6¾" away from the center hole on the jig. Attach the block of wood to the plywood with screws (not glue) so that the centerline of the hole lines up with the centerline on the jig.

Put the jig on the underside of the tabletop with the pin in the hole. Pivot the jig until it lines up with one of the three lines on the tabletop. Clamp the jig in place and bore the ¾" hole with a hand drill on your dummy piece of plywood.

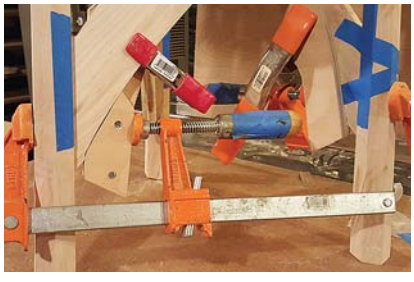
Dry-fit the legs and stretchers into the dummy top. If the dry-fit has gaps, unscrew the block of wood, move it and reattach it. Drill holes on new lines on plywood until you achieve a perfect fit.

When everything fits, bore the mortises in the real top. Patience will pay off here. Repeat this until you have an exact fit. Cut slots in the tops of the leg tenons to accept wedges.

The glue-up for this table can be a challenge because of the angles, so I made cauls to give the clamps somewhat parallel surfaces to work with. Wedge the tenons during glue-up and trim the tenons flush to the top when the glue is dry. I used crisscross wedges in homage to the original.

I finished this table with a simple wiping varnish, sanding between coats until I achieved a nice build and sheen. **PWM**

Mitch lives in Nashville, Tenn. See more of his work at humanhandswoodworking.com.



Clamp to clamp. *Their shape may be funny, but these cauls make the glue-up a lot easier by giving the clamps parallel surfaces. The cauls are clamped to the stretchers with spring clamps. Then you can clamp the joint tight with an F-style clamp.*

Clamp, then wedge. *Apply clamps to the leg joints before tapping in the wedges.*

Crisscross wedges. *This table's refined design tames the maple's wild figure.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/apr16**

WEBSITE: *See more from the author on his website, Human Hands Woodworking.*

ARTICLE: *Read about loose-tenon joinery.*

IN OUR STORE: *"Building Classic Arts & Crafts Furniture: Shop Drawings for 33 Traditional Charles Limbert Projects," by Michael Crow.*

TO BUY: *"Popular Woodworking's Arts & Crafts Furniture: 42 Designs for Every Room in Your Home."*

Our products are available online at:

- **ShopWoodworking.com**

The Core Hand Tools

BY DENEB PUCHALSKI

For the cost of one quality piece of large machinery, you can set up a complete shop.

Setting up a hand-tool-oriented shop is a fraction of the investment of setting up a power-tool shop. For the price of one large quality piece of power machinery, you can buy all of the hand tools you need to build things – from rough lumber all the way to assembly and final surface finishing. And that is if you are buying the best-quality new tools available.

To do the same work with power tools, you'd need three to four machines, a bunch of small powered hand tools, plus good dust collection to deal with all the small particles. On top of that, you need the space to put everything.

And for the home woodworker, hand tools can be just as fast as power tools. Woodworking as a craft was fully formed long before the advent of machinery and electricity, and people did not work slowly or inefficiently.

It may take some time to develop the skills to be proficient with hand tools, but it is actually easier to get started with them than it is with machines. As long as your tools are sharp they will give you results, and the more you use them the better you will become at controlling them.

One reason people have turned so readily to power tools is that they've been convinced it's much easier to learn how to set up a machine to do a task that it can then repeat over and over

PHOTOS BY JOSHUA MASSE

Layout tools. *For marking and measuring, core tools include combination squares (12", 6" and 2" are shown here, upper left), a tape measure and folding rule, a marking gauge (or two), a bevel gauge, protractor and dividers/compasses – and a pencil, of course.*

Fasten(ating). *If you plan to use any mechanical fasteners, you'll need a brace or hand drill (and bits), a drill, a hammer and a couple of screwdrivers (or a driver with changeable tips).*

than it is to learn the hand skills to be proficient at that same task. Nothing could be further from the truth – even your earliest attempts with a hand tool will give you better results than the first attempts to do the same thing with machines. And it comes at a much lower initial cost.

The list of hand tools you need for efficient work is nowhere near as daunting as you might think. As you build your kit, it is important to understand that the individual tools do not matter as much – the key is that you have the right group of tools.

The tools you get to fill out this group are completely dependent on which ones work best for you, and there may be specialty tools such as scrapers, rasps or moulding planes that you'll want to acquire as the need arises.

Plus, you'll need some measuring and marking tools for layout. I recommend a couple of combination squares – at least a 12" and 6" (it's also nice to have a 2" or 4" one), and an awl. A bevel gauge and protractor will let you work with angles. Two sets of dividers, and a compass allow for curves, and also let you lay out proportions and transfer points onto your stock. Two marking gauges allow you to transfer multiple dimensions without needing to measure. With a folding rule and tape measure, you can take specific measurements. The blade from your 12" combo square can be a straightedge when needed.

And unless you only use all-wood joinery such as mortise and tenons or dovetails, you'll also need a drill (egg-beater style or a brace) and a hammer, as well as some screwdrivers.

The basic tools for stock preparation, shaping and joinery can be broken into five groups: bench planes, detail and joinery tools, saws, tools for curved work and sharpening tools.

Bench Planes

Bench planes – the jack, jointer and smoother – allow you to handle dimensioning and finishing of stock.

The jack plane is between 14"-15" long, making it ideal for rough surfacing. As a medium-size tool, it is large enough to get things reasonably flat and short enough to get there quickly.

A roughing cut is the thickest, heaviest shaving, and is typically between .004"-.010" thick, depending on how cooperative the piece of wood is. (As a reference, a piece of printer paper is typically about .004" thick.) To use this plane for heavy roughing, sharpen the blade with an 8"-10" radius; this will make it perform more like a scrub plane.

A jointer plane has the large bearing surface (22"-24") required for flattening. It does not matter if the board you are working on is large or small; if you want it flat, grab your jointer.

A flattening cut is a medium thickness, between .002"-.004".

Remove, flatten, smooth. *These three tools – the jack, jointer and smooth planes – allow you tackle just about any stock-prep job, start to finish.*

Scrap test. *Run a small block of wood over the blade as you set up a plane. That will tell you how far the blade extends, and its position relative to the mouth.*

Joinery planes. *These tools are for cutting various joints and fitting. Clockwise from the top are a plow plane, low-angle block plane, shoulder plane, router plane, skewed rabbet plane, skewed block plane and wooden rabbet plane.*

A smoothing plane is 10" or less in length. It doesn't cut more smoothly than the other planes; it's simply a much shorter plane than a jack or jointer, so it allows you to take a thin finishing pass more quickly than the larger planes.

Finishing cuts should be as thin as you can get, usually less than .002".

None of these numbers are set in stone, just know that your roughing cut will be the thickest shaving, the flattening cut will be about half of that and the finishing cut will be about half that again.

I like to set my planes up for the cut before I go to work, so I take test cuts on a small piece of scrap to get them set to what I want them to be. The type of cut you need to take will tell you which planes to use for which task.

Detail & Joinery Tools

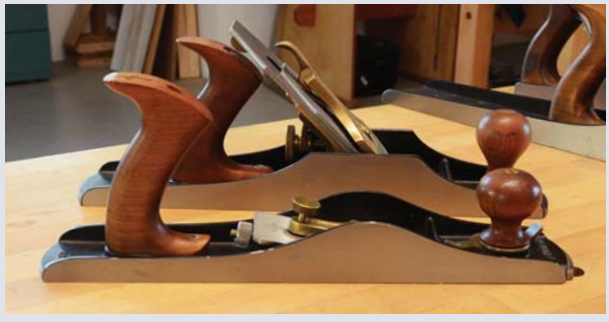
These are tools for putting things together, trimming and fitting. A block plane, shoulder plane, rabbet plane, router plane, plow plane and some chisels make up this group. Though there is less choice in the more specialized joinery and detail tools, the same principles apply as to the bench planes: Let the work dictate the tool you reach

PLANE SELECTION

While the section on bench planes explains which type of plane to use for each type of cut, it doesn't explain which plane is best in each category. This is where personal preference starts to come into play.

I reach for the heaviest plane in any category, because I find the heavier a plane is, the easier it is to use. I would grab a No. 5½ jack, a No. 8 jointer and a No. 4½ smoother – but you must also consider low-angle planes and high-angle frogs.

In very hard or highly figured woods, higher effective cutting angles (the combination of the bedding angle of the tool to the sharpened bevel on the blade) work better than lower angles. You can manipulate that angle on a bevel-up or low-angle plane by sharpening at different angles.



High or low. *If you're looking for versatility, consider a low-angle bevel-up plane (front).*

On a low-angle plane that bedding angle is typically about 12°, while the effective cutting angle can range from 37° all the way to a 102° scraping angle, depending on the bevel angle.

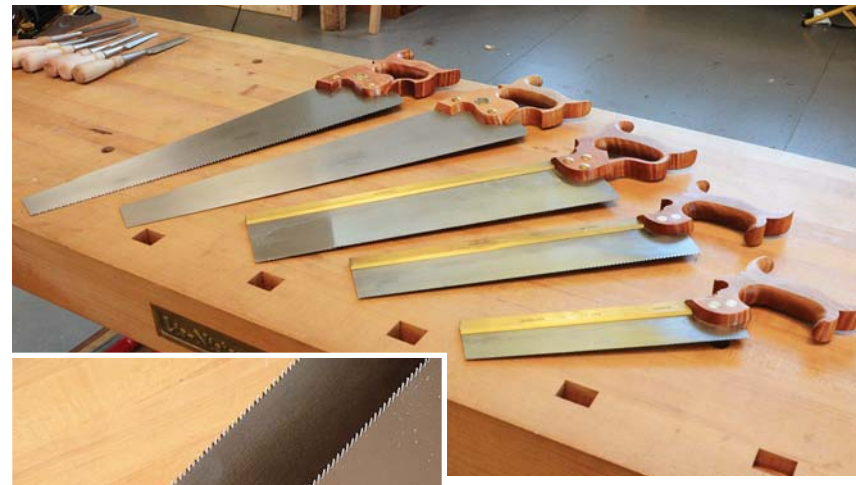
With high-angle frogs in traditional style (bevel-down) planes, you can get higher angles by changing the frog or adding a back bevel to the blade, which changes the blade's bedding angle. The higher angle of presentation means more resistance. Therefore, the more mass the tool has, the easier it is to use. These high-angle cuts are important, because you get much more control over tear-out in difficult-to-plane woods with a higher-angle cut.

As a general rule, it is far more important that you have a jack, jointer and smoother than to have specific tools such as a No. 62, No. 8 and a No. 4½ with a high-angle frog. Your preference might be a No. 5, No. 7 and a No. 4, or any other combination of tools. You might also need task-specific tools, such as the smaller No. 3 smoother to handle surfaces that need to be smooth but not perfectly flat.

Or, the versatility of the low-angle or bevel-up planes means that you might choose one (or more) of them over traditional-style bench planes. Let the type of work you do determine the exact tools that you get. —DP

"A tool knows exactly how it is meant to be handled, while the user of the tool can only have an approximate idea."

—Milan Kundera (1929-), Czech-French writer



Five saws. *While you can get away with fewer, these five saws will make your life easier. From left is shown a 12 ppi crosscut panel saw, 7 ppi rip panel saw, tenon saw, carcase saw and dovetail saw. At left is a close-up of a crosscut saw (left), with teeth optimized for cutting across grain. The ripsaw (right) has teeth shaped for cutting with the grain.*

for. (Again, if there are options, I reach for the larger tool.)

A low-angle block plane, about 6" long (or shorter), allows you to trim and fit efficiently. It can even be used as a small smoothing plane if needed.

A large shoulder plane is about 10" long and has a blade that goes out to each edge of the plane's body to allow cuts into corners – a necessity when you are creating or cleaning up rabbets, or cutting tenon shoulders. The mass and size of a large plane, such as the No. 073, gives you more control than you get with its smaller cousins.

Like the shoulder plane, the rabbet plane's blade extends to the edges of the sole; it is an essential tool for casework because you'll often cut rabbets for joinery. Frequently, these run across the grain, so a skewed blade is preferable. The best vintage option for a skewed rabbet is the No. 289 – but because it's not easy to find, a skewed wooden rabbet plane or a No. 140 skewed block plane would be good options.

A large router plane (such as the No. 71) can be fitted with a variety of sizes of blades to handle different tasks. It is ideal for creating an even depth for a dado, or trimming the cheek of a tenon.

A plow plane allows you to set a groove in the face or edge of a piece (for a drawer bottom or a panel, for example). You'll want several widths of blades for a variety of grooves. Tools such as the No. 45 and No. 55 combination planes can serve, but a dedicated plow plane is a better choice for this application.

Chisels are relatively easy to figure out: Get the sizes and types that you need.

Bevel-edge chisels are very versatile; you can use them for striking or paring. Get a range of sizes so you can handle a range of tasks (3/4", 1/2" and 1/4" tools would be a good start). If you plan to chop mortises, get appropriately sized mortise chisels.

Skewed or fishtail chisels are useful if you need to get inside angled areas, such as a half-blind dovetail socket, but are not strictly necessary.

Saws

Perhaps obviously, you need saws to cut boards to size and to cut joinery. A saw should be comfortable in your hand – and while you might want to try to get by with just one or two, having three types of backsaws and at least one panel saw will make your work easier when you need to size panels or cut boards down.

Here are the three backsaws I recommend:

- Dovetail saw. 9"-11" long, 15-18 points per inch (ppi). This is a fine-toothed small saw, typically filed with a rip tooth, for dovetailing and other small joinery.
- Carcase saw. 11"-14" long, 14-16 ppi. This fine-toothed crosscut saw is useful for cutting miters and small boards to length, and such work as cutting the shoulders on a dado or tenon.
- Tenon saw. 14"-16" long, 10-12 ppi. This large coarse-toothed rip-filed saw is useful for cutting the cheeks of tenons and for cutting large dovetails.

Panel saws are available in both rip and crosscut filings, and are about 20" long, toothed from 7-12 ppi depending on the application. If you can only have one panel saw, make it a ripsaw; a rip-tooth saw will crosscut better than a crosscut saw will rip.

If you plan on cutting any curves, you'll also want a coping saw or bowsaw; for detail work, a fretsaw or jeweler's saw is nice to have.

Chisel array. *You'll need various chisels based on the work you wish to do, such as a 1/2" and 1/4" mortising chisel, a fishtail chisel for cleaning out half-blind dovetail corners, and 1/4", 1/2" and 3/4" bevel-edge (bench) chisels.*

Cutting curves. *If you plan on working with other than straight lines, you'll need a way to cut arcs. In saws, that's a bowsaw, coping saw and fret saw. You might also want a drawknife and a spokeshave or two, and one or more rasps.*

Curved Work

The tools for curved work are more specialized. Not only do you need the saws I just mentioned, you'll also find use for a combination of spokeshaves, drawknives, scrapers and rasps.

Rasps and drawknives allow you to create rough curves (when a bowsaw or coping saw is unsuitable). And for the best finish results, I would turn to a spokeshave or scrapers whenever possible.

Sharpening

Good sharpening equipment – and the ability to use it to create a good edge – is essential to hand-tool woodworking. It does not matter what medium or method you use; what is important is that your tools are as sharp as possible.

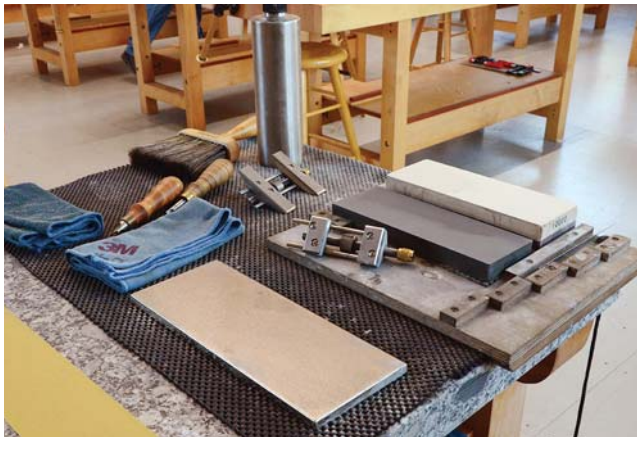
To get the most out of your tools, you must know what sharp actually is.

A sharp edge is simply the intersection of two evenly polished surfaces. The bevel should be sharpened on your roughing stone to the point where a burr is raised on the back of the blade, then honed on both the bevel and the back on your finishing stone. There are many ways to do this. What is important is that you go to as high a polish as you can, and that both the back and the bevel have the same level of polish. If you achieve this, then you will have a sharp edge.

Keep your system simple. I recommend using a honing guide (more on that in a minute) with a #1,000-grit roughing stone and either an #8,000- or #10,000-grit finishing stone.

I prefer waterstones, but you can use any medium or method; simply remember that you need to keep your stones flat and bring both the back and the bevel to the same level of final polish.

So why a honing guide? It makes for a sharpening process that is system-based rather than skill-based. If you follow a system, you get consistent, repeatable results as you build your sharpening skills. If you count on the skill of freehand sharpening (that is, sharpening without a jig), you may become frustrated with less-than-acceptable results and give up long before you develop that skill.



Simple system. *Two waterstones and a honing guide (or some sharpening system) should be the most-used tools in your shop.*

Meaningful Connection

With some practice and the right group of tools, you can build amazing things. You may choose a blended approach to woodworking, using power tools in some cases and hand tools in others. Or you may choose to work with only hand tools. In either case, you will find that you get more accurate results, your finished surfaces are cleaner and you are able to work faster than you ever thought possible.

I think one of the most valuable things in all of this is that for a relatively minimal kit, you can get started and be building things in whatever space you have available to you, and you are connected to your work in a more meaningful way.

Power tools allow you to bend wood to your will, even though it will only stay there if it wants to.

Hand tools help you learn what the wood wants to be, and enable you to help it become that. **PWM**

Deneb is the hand-tool expert at Lie-Nielsen Toolworks, and has been demonstrating and teaching hand-tool use for almost two decades. He lives in Waldoboro, Maine.

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/apr16**

VIDEO: *Watch the author demonstrate how to sharpen plane irons.*

BLOG: *Learn how to make a jig that helps you set the perfect sharpening angle, every time.*

IN OUR STORE: *"The Last Word on Sharpening," a video by Christopher Schwarz.*

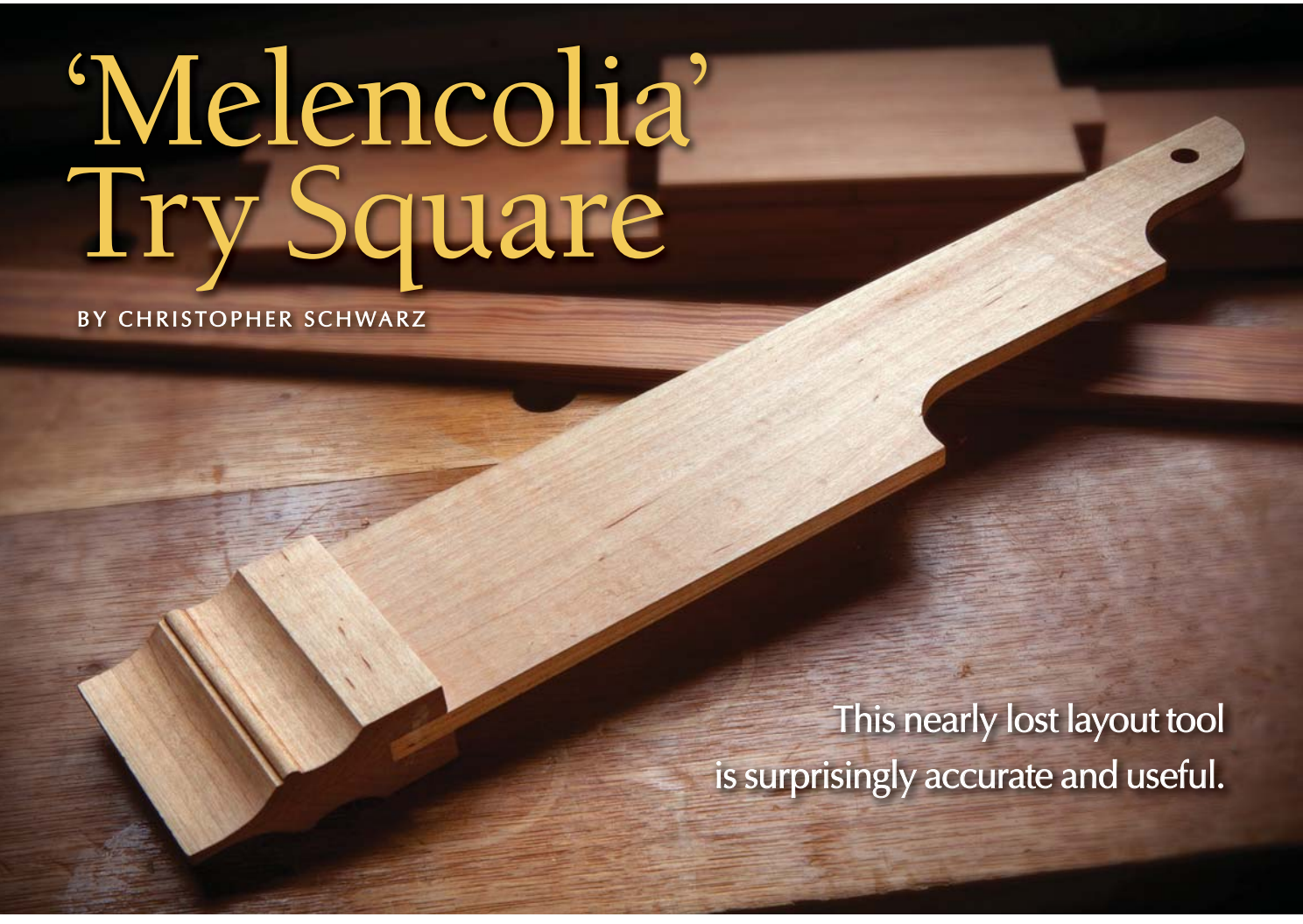
TO BUY: *"Mastering Hand Tools: Basic Skills for Balanced Woodworking."*

Our products are available online at:

- **ShopWoodworking.com**

‘Melencolia’ Try Square

BY CHRISTOPHER SCHWARZ



This nearly lost layout tool is surprisingly accurate and useful.

A surprising number of woodworking tools and furniture forms have been lost to time. Some for the better (the motorized coping saw?) and others for no apparent reason.

A lot of my research into early woodworking consists of examining old texts, paintings and drawings. Before the Industrial Revolution, almost everything was made out of wood, and almost everyone’s job had something to do with the material. So paintings are a rich source of information.

Several years ago, a fellow researcher named Jeff Burks told me to take a close look at Albrecht Dürer’s famous 1514 engraving “Melencolia I,” and my life has never been the same. This German engraving has a lot of interesting woodworking stuff in it, including an early straightedge, a now-disappeared fastener called the “clasp nail” and a fantastic try square.

After spotting the square in “Melencolia I,” Burks and I turned up similar images of it in dozens of paintings, drawings and sculptures all over Europe, from Sweden to Romania. The form appears quite a lot in the 16th century and disappears in favor of other forms, including the right-angle try square we use today.

The Square Details

I had to build a Melencolia square. After scaling its dimensions from a variety of sources, I ended up with a square with a 15"-long blade and a stock with a bearing surface of about 4". That might seem like an odd combination of dimensions, but I assure you that it is just what you want.

The 4" bearing surface gives it the same potential accuracy as a Starrett combination square. The 15"-long blade makes it ideal for working on casework. And the wooden construction makes it lightweight and easy to true up.

The stock, or handle, is moulded. Perhaps craftsmen made these squares from offcuts of moulding, chair rails or bannisters. We don’t know. The blade is usually tapered with decorative shapes. Perhaps these shapes aided layout on the job, perhaps they looked pretty or perhaps they helped keep the square true by exposing end grain to the atmosphere.

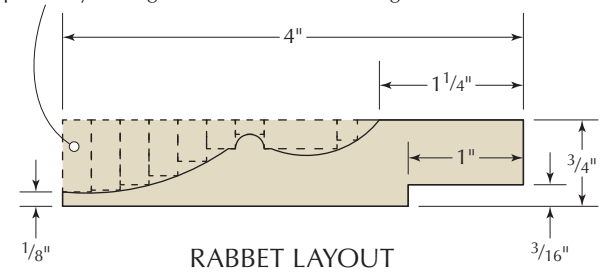
Here’s how I made mine (and I’ve made about 20 in the last two years).

Stick Some Moulding

I have made the moulded handles two different ways. I have grooved and moulded a solid piece of stock, and I

PHOTOS BY THE AUTHOR; ILLUSTRATIONS BY DAN PESSELL FROM THE AUTHOR’S MODEL

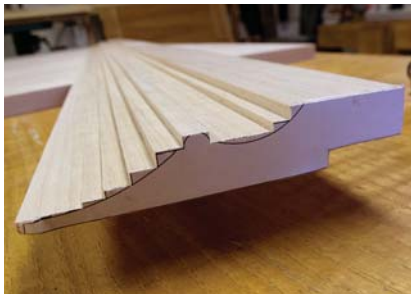
For this (or any moulding), reduce wear on hollow & round planes by cutting a series of rabbets for rough waste removal



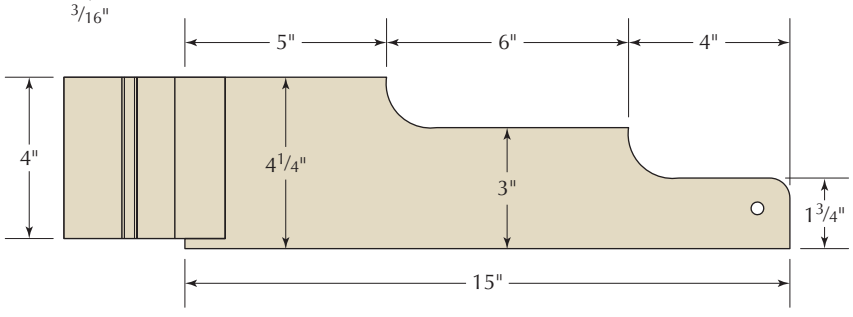
RABBET LAYOUT

'Melencolia' Try Square

NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL
❑ 2	Handle pieces	3/4	4	4	Maple
❑ 1	Blade	3/8	4 1/4	15	Maple



Any profile. *The exact profile isn't important. Use scrap moulding or something from the home center. It's just a place your hand grabs the tool.*



ELEVATION

have made the handle from two pieces of wood that are rabbeted and moulded. I prefer the second method, though it might not be authentic.

The moulding profile I used is adapted from several sources, including "Melencolia I." It is a double cove with a fillet and bead. I made the moulding using hollow and round planes on a long stick of maple. Then I cut a 3/16"-deep x 1"-wide rabbet in the underside of the moulding.

I crosscut the moulding into 4" lengths and glued two of them together to produce a handle with a 3/8"-wide x 1"-deep groove for the blade.

The Blade

The blade is 3/8"-thick quartersawn maple with straight grain. The blade is slightly wider (4 1/4") than the stock is long (4"). The extra width makes it easy to true up the square (this was a feature we found in Romanian squares).

The exact shape of the blade is immaterial, though the coved steps are common. The hole at the end is a convenient hang hole, and it gives an animistic touch to the square.

I glued the blade into the stock. After the glue dried, I trued up the square like any square in the shop. I prefer to true the blade instead of truing the handle. If you true the handle, you have to true up two surfaces instead of one. That leads to error.

Finally, I finished the square with a homemade mixture of equal parts varnish, mineral spirits and boiled linseed oil – my favorite finish for shop projects.

This square has traveled all over the world with me – and I've used it on every project since I've built it, from knocking down rough stock to laying out dados to confirming the squareness of a glue-up. It is more nimble than a framing square, and it lies flat on the work so you can focus on striking a perfect line with a pencil or knife.

Our ancestors were whip-smart when it came to working wood, and the Melencolia square is more evidence that staring at old paintings can reward your work in the shop. **PWM**

> "As I grew older, I realized that it was much better to insist on the genuine forms of nature, for simplicity is the greatest adornment of art."
>
> —Albrecht Dürer (1471-1528), Renaissance painter & printmaker

Plane to fit. *Make the blade so it's a wee bit over-thick. Then plane it to fit the groove in the completed stock.*

Christopher is the editor at Lost Art Press (LAP) and author of the "The Anarchist's Design Book," due out from LAP in March 2016.

ONLINE EXTRAS

For links to all online extras, go to:
- **popularwoodworking.com/apr16**

BLOG: *Read more about early try squares.*

WEB: *Read about the crazy theories associated with "Melencolia I."*

PLAN: *Download a SketchUp model of this project from our 3D Warehouse.*

TO BUY: *Plans for a Roubo try square.*

IN OUR STORE: *"Build a Sawbench with Christopher Schwarz."*

Our products are available online at:
- **ShopWoodworking.com**

King of Windsors

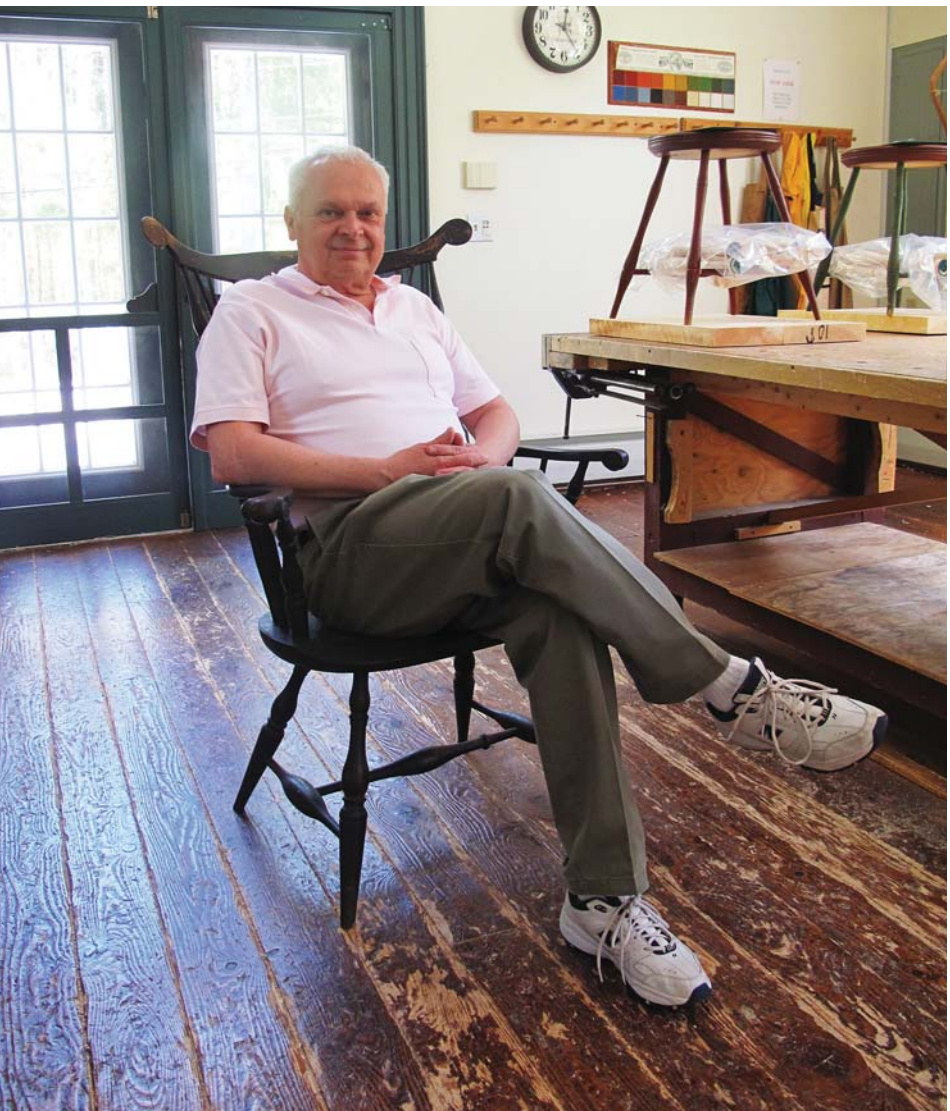
BY MEGAN FITZPATRICK

After decades of teaching, Dunbar is closing the doors to his castle.

It all started in 1971 with a black chair Mike Dunbar spotted at a yard sale in Sutton, Mass. He was looking for things to furnish his student apartment at Worcester State University in Worcester, Mass. "It was one of those times when your life turns on a dime," Mike says. "That chair so engaged me that I had to buy it. It was a quarter of my monthly rent."

If you'd suggested to a 24-year-old Dunbar that he was going to become a woodworker, he'd have scoffed. He started out as a journalist before going to college to study French (he's read Roubo in the original), and planned a life of academia.

But that chair? He couldn't stop looking at it and examining it. So Dunbar did some research and discovered he'd lucked upon an antique Windsor rod back side chair. He started visiting antique stores to find more of them. "They were beyond anything I could afford," he says. "I figured if I bought broken ones, I could fix them up."



So Mike delved into the little information he could find, teaching himself woodworking through a combination of reading and trial and error in the shop.

"I made my first chair in 1972, but it was a real labor," he says, because of the lack of information available at the time. "There was nobody around to teach me this; I thought I was alone in the world, and went down a lot of dead ends." Wallace Nutting, for example, was full of misinformation, Dunbar says. "I may not be smart, but I'm stubborn," he says. "I just kept working at these chairs until I could produce something reasonably well."

He still has that first chair, which "causes me no short amount of embarrassment." But after someone offered Dunbar money for one of his chairs, he thought he might be able to make a living out of it.

"I got my B.A., but I didn't go to graduation because I was in my shop, making chairs that weekend," he says.

He been making Windsor chairs ever since, and teaching others to do the same through his books, articles and classes.

"I'm the guy who started the whole Windsor chair thing," he says. "If you're making Windsor chairs today, you may not be aware of it, but you link back to me somewhere."

In 1976, he wrote "Windsor Chairmaking" (Hastings House), upon the publication of which he expected to hear from academics and antique dealers who wanted to discover more about these chairs. "I got bags full of letters from woodworkers who wanted to learn how to make one," says Dunbar. "This was the first realization I had that there were a lot of other woodworkers out there."

ALL PHOTOS BY MIKE DUNBAR EXCEPT WHERE NOTED;
OPENING PHOTO BY CHRISTOPHER SCHWARZ

$15 find. *This yard-sale find – a circa 1815 rod-back Windsor side chair – completely changed the trajectory of Mike Dunbar's life.*

Woodworker West. *Here, Dunbar is shown demonstrating saddling a seat, at the Woodworker West conference in 1980 at Brigham Young University.*

Level check. *In a 1989 picture from "Restoring, Tuning & Using Classic Woodworking Tools," Dunbar shows how to use winding sticks to check a wooden plane's sole for twist.*

In 1980, Dunbar was invited to speak on Windsor chairs at the Woodworking West/State of the Art Conference at Brigham Young University, then to stay a week – then two – afterward to teach classes in making the chairs.

That conference (which also included Tage Frid, Garry Knox Bennett, Art Carpenter and Wendell Castle, among other luminaries) planted the seeds for two things that have endured in Dunbar's life for more than three decades: teaching Windsor chairmaking and making quality tools available to chairmakers (they weren't at the time, as Dunbar discovered during those first classes).

Just after that historic conference, Dunbar formed a partnership with Ernie Conover to teach Windsor chairmaking (at Hiram College in Hiram Ohio), and to offer chairmaking tools that were based on Dunbar's restored antique versions.

By 1987, Conover was focusing on developing what would become the Conover Lathe (with a user-supplied wooden bed), and Dunbar was busy writing books and articles; that partnership came to close. At the same time, Dunbar was too busy teaching workshops around the country to make chairs to sell any more, and focused his efforts solely on education.

In 1990, Dunbar married his wife, Sue; in 1992, their son, Mike, was born. "I remember flying to Detroit to teach at a Woodcraft, then home for a few days, then to Halifax to speak to the guild there," Dunbar says. "I called up my wife and said 'I just want to be home with you guys.'" She suggested starting their own school. So they did.

The Windsor Institute opened its doors in 1994, in rented space in Portsmouth, N.H. "We were there for two years and grew so fast that we realized we had to move," Dunbar says.

They bought the Hampton, N.H. land in 1995, and started construction on the shop. "I taught my first class there in January 1996," he says. They soon added a building, then another to accommodate the fast-growing needs of the successful venture.

He announced his "retirement" almost two decades to the day of the school's opening. But perhaps it is better called an abdication – Dunbar has been variously known as the Prince of Windsors and the King of Windsors. To play on that, he and Sue created the Knights of Windsor – a series of titles for those who progressed through all the classes at the school.

The closing was almost as much of a surprise to the Dunbars as it is for the rest of us; they got an offer on the land they couldn't refuse, and the timing coincided nicely with Dunbar's wish to slow down a little and change his focus (he'll be 69 in March when the school offers its last class). Dunbar plans to do more writing (he has a series of young adult novels already, and has begun writing an adult novel), and to build a one-man shop on at home, where he'll once again make chairs to sell. And he plans to write more books and articles (of which he's written many over the years) about woodworking.

"I don't have any desire to not work wood anymore; it's as much a part of me as the air that I breathe," he says. But standing on his feet teaching for eight or more hours a day is now too demanding, he says (though he remains in good health).

The timing accords with his son's recent college graduation and burgeoning career in music; the Dunbars plan to help however they can to build the younger Mike Dunbar's career.

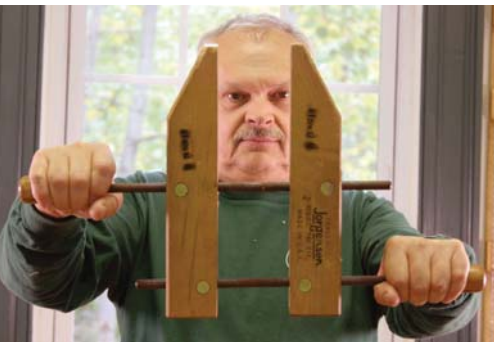
Dunbar estimates he's taught 6,000 or so students at The Windsor Institute

AUCTION DETAILS

Martin Donnelly reports that the school's workbenches, vises, hand tools and shop accessories will be included in the summer auction in Avoca, N.Y., July 21-23. Some of Dunbar's personal tools may carry over to the fall auction in Nashua, N.H.

For more information, keep an eye on mjdtools.com.

CHAIR PHOTO FROM "MAKE A WINDSOR CHAIR"; WOODWORKER WEST CONFERENCE PHOTO COURTESY OF THE WINDSOR INSTITUTE



Handscrews. *Dunbar wrote "Understanding Handscrews" for the February 2007 issue of* Popular Woodworking Magazine. *Here, he demonstrates how to open and close the jaws.*

Pull it. *In a February 2010 article on using milk paint, Dunbar shows how to pull this traditional coating with a brush.*

over the years (they came to the school from all over the world), as well as many others at various conferences, guild meetings and the like. "I hope they're still out there making chairs and retaining the craft," he says. "All my efforts have been, for 40 something years, to advance the craft and establish it on a firm footing."

But he's never romanticized chairmaking; a practical approach (including business advice from Sue for those who wanted to make a living as chairmakers) was reflected in every class he taught. While Dunbar admires traditional approaches (and doubts anyone can improve much on traditional Windsor joinery), he is firm in his belief that early makers worked with the single-minded goal of production, noting that they turned out prodigious numbers of chairs.

> "I don't have a lot of patience for guys who want to sit on shavehorses. That comes out of the Appalachian ladderback chair tradition; it has nothing to do with Windsors."
>
> —Michael Dunbar (1947-)

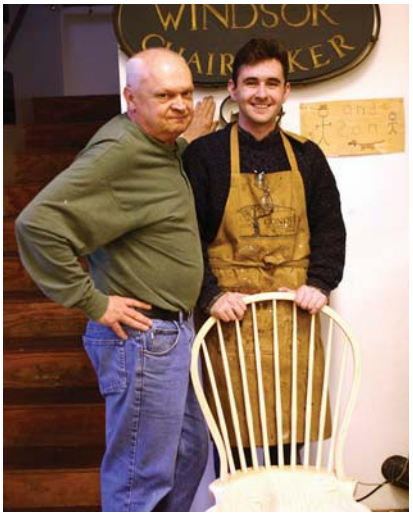
"I've always maintained that speed is an essential component of skill," he says. "You can't just do things and do them so they look good; you have to do them quickly. We use things that speed us up."

Dunbar has been seminal not only in bringing back the craft of making Windsors, but in helping several students start tool companies to further the aim he undertook with Conover to make good-quality tools available.

David Wachnicki, wooden spokeshave maker at Dave's Shaves (ncworkshops.com), Glenn Livingston at Woodjoy Tools (woodjoytools.com) and Leon Robbins at Crown Plane (crownplane.com) are just three of them (Robbins sold the business in 1999 to Jim White and his son, Jim White Jr. – they were introduced by Dunbar). "We helped to bring back the tools in addition to the chairs," Dunbar says. "In our heyday, we were supporting a lot of people through the toolmaking."

And while Dunbar is selling off the bulk of his tools he's keeping the machinery and a solid set of chairmaking tools. He's also keeping the school's URL, thewindsorinstitute.com (so check there for updates if you're interested in buying a chair).

For now, what Dunbar decides to keep will be stored in the garage. He hopes to build a new shop later this year, and get back to making the chairs he's spent a lifetime teaching to others. "I'm kind of looking forward to being able to work without interruption… to working by myself," he says. **PWM**



Father & son. *Shown here are Dunbar and his son, Mike, with a chair the younger Dunbar built in 2015.*

Megan is the editor of this magazine. She can be reached at megan.fitzpatrick@fwcommunity.com.

WOODWORKING BOOKS BY DUNBAR

- "Windsor Chairmaking" (Hastings House, 1976)
- "Antique Wooden Tools" (Hasting House, 1977)
- "Make a Windsor Chair" (Taunton, 1984; revised ed., Popular Woodworking, 2013)
- "Federal Furniture" (Taunton, 1986)
- "Restoring, Tuning & Using Classic Woodworking Tools" (Sterling, 1990; revised ed., Popular Woodworking, 2014)
- "Woodturning for Cabinetmakers" (Sterling, 1990)
- "The American Country Woodworker" (Rodale, 1993)

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/apr16**

ARTICLE: *Read Mike Dunbar's article on using milk paint (a classic Windsor finish).*

WEBSITE: *Visit thewindsorinstitute.com to stay up-to-date on Dunbar's "retirement" plans.*

WEBSITE: *Hear some of the younger Mike Dunbar's music at mikedunbar.com.*

IN OUR STORE: *"Make a Windsor Chair," by Mike Dunbar.*

TO BUY: *"Restoring, Tuning & Using Classic Woodworking Tools," by Michael Dunbar.*

Our products are available online at:

- **ShopWoodworking.com**

FATHER & SON PHOTO COURTESY OF MIKE DUNBAR

Custom Push Pads

This handle design is a safety improvement over commercial versions.

Let's face it: Many of us all too often see safety as…well, just plain boring.

We always seem to be anxious to use that little bit of free time to get to the shop and work on that next pressing project for our spouse, kids or grandkids, and safety takes a back seat.

But you can't do woodworking from a hospital bed; every bit of safety exercised actually lets you maximize your precious free time to do woodworking.

Push pads are one common safety aid. There are good push pads and there are better push pads.

Commercial push pads (the good), which are readily available and economically priced, are often used when face jointing on the jointer. The angled handle helps the operator keep the stock against the fence as the stock is fed across the jointer knives. The through "D" handle is much like a suitcase handle, with finger grooves providing a comfortable and firm grip of the push pad.

But some safety experts assert that no jig should have a handle that encloses your fingers. The reasoning is that should there ever be a mishap of some kind (kickback, trapped blade, a knot coming loose, etc.) your hand could become trapped and a serious injury could result. (If you do use these commercial push pads, I recommend holding them with your hand cupped over the top, rather than putting your fingers around and through the handle – but that is at best an unnatural grip, and the ergonomics of the thing beg you to use it in a less-than-safe manner.)

With a careful operator, the chances of such an accident might be remote, but why chance even a small risk of injury if a simple and economical alternative is available?

Closed for safety. *The closed handle of this shop-made push pad design is safer than the typical D-handle commercial version – your hand can't get caught inside this handle.*

The push pad shown here (the better) is a shop project you can make in a few hours from scraps; it's fun and will improve your safety practices. This design is an improvement over popular commercial push pads. I call it the "Safe 'T' Push Pad."

It has a stopped flute on both sides of the handle, which provides a comfortable and secure grip without the possibility of trapping your hand in the event of some machining mishap.

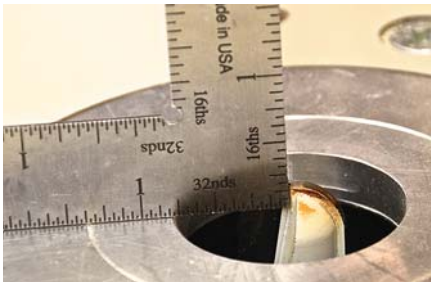
My dimensions for a handle angled at 20° are noted in the following text – but adjust the size to best fit your particular situation as needed.

And of course, keep safety in mind as you're making these. Use push sticks and featherboards as necessary to work with these small parts, and keep your fingers far from any spinning blades.

Start by cutting a $^{3}/_{4}$" x $2^{3}/_{4}$" x $5^{7}/_{8}$" handle blank from a piece of scrap hardwood of your choice.

The $^{3}/_{4}$" x 3 x $5^{7}/_{8}$" base can be of hardwood or plywood – the length should match the length of the handle; if you adjust one, adjust the other. Now follow the steps below to make the push pads shown above, plus two variations. **PWM**

Jerry is a woodworker in Bloomington, Ind., who especially enjoys designing and producing custom jigs.



1 ***Get your groove on.*** *Set up your router table with a fluting bit and set the fence $1^{1}/_{8}$" from the inside edge of the bit. Set the depth of cut to $^{3}/_{16}$".*

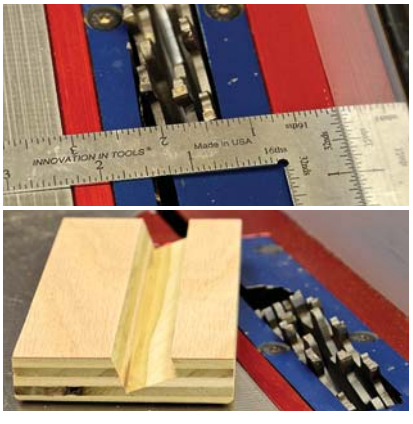
PHOTOS BY THE AUTHOR

2 *Set stops.* *Set stop blocks on the fence to register the cut 1" from each end. Then place the top edge of the handle against the fence and the back end on the router table against the infeed stop. Slowly lower the handle onto the spinning bit until the workpiece is flat to the table, then feed it forward to cut the stopped flute. Flip the handle end for end, then lower the handle to cut the second face.*

3 *Add curves.* *Draw a 1"-radius curve on both top ends, then cut close to the lines with a miter saw or handsaw. Sand to the lines with a belt sander to smooth the curves.*

4 *Add comfort.* *Make your grip on the handle more comfortable by cutting a 3/16" roundover on the ends and top of both sides at the router table.*

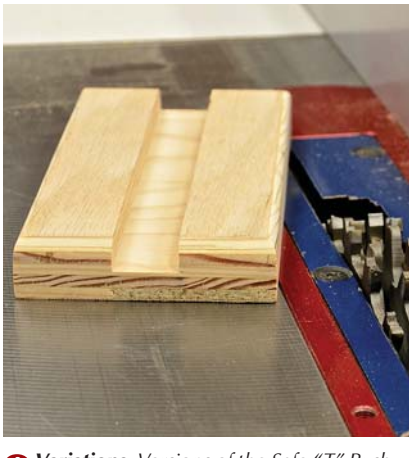
5 *20° groove.* *Set up a dado stack on the table saw to cut the groove in the base that holds the handle (and make a few test cuts to ensure it will fit snugly).Tilt the stack to 20°, and set the height to 9/16" on the deep side of the cut.*



6 *In position.* *Set the saw's rip fence to position the cut at 1 3/8".*

7 *Route the edges.* *Cut a 3/16" roundover on the top edges. Then spread glue in the groove and on the bottom of the handle; clamp the assembly to dry.*

8 *Add some grab.* *Using a spray adhesive (I like 3M's 77 Multipurpose Adhesive), apply an oversized piece of #100- or #120-grit heavy-duty sandpaper, or rubber (from an inner tube or tool drawer liner. Use a "J" roller to secure a firm bond between the push pad bottom and the friction material. With a safety knife trim off the overhang of the friction material.*



9 *Variations.* *Versions of the Safe "T" Push Pad can be made to accommodate other situations and operations. If a vertical handle is desired, only a couple of changes are necessary. Shorten the handle width to 2 5/8"and cut a 3/8"-deep centered groove in the base at 90°.*

19 *Well-heeled.* *A heel at the back of a push pad is often useful. Assemble as above, then glue on a 3/8" x 3/4" x as-long-as-the-base-is-wide hardwood piece). Don't use metal fasteners – it might come in contact with a sawblade or jointer knife. Then glue on your sandpaper or rubber.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/apr16**

WEBSITE: *Search on "jigs" on our site for free jigs, fixtures and appliances.*

TO BUY: *"Jigs & Fixtures for the Hand Tool Woodworker," by Graham Blackburn.*

Our products are available online at:

- **ShopWoodworking.com**

POPULAR WOODWORKING MAGAZINE
2016 EXCELLENCE AWARDS

Enter the 2016 PWM Reader Excellence Awards

GRAND PRIZE: $1,000

Winning work will be featured in the November 2016 issue of ***Popular Woodworking Magazine***.

The Grand-Prize Winner (as chosen by the editors and contributing editors to *Popular Woodworking Magazine*) wins US$1,000. Each of the five category Editors' Choice winners and the Readers' Choice entry with the highest number of votes overall, wins a US$100 gift certificate to **ShopWoodworking.com**.

Enter up to five pieces total in the following categories
■ Casework, Cabinets & Bookcases ■ Seating ■ Tables ■ Boxes & Smalls ■ Turnings, Carvings & Objets d'Art

The entry period is **April 1-June 17, 2016.**
To enter, and for complete rules, visit: **popularwoodworking.com/2016readerexcellence**

Woodworker's Marketplace

Classified

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 ShopWoodworking.com!

Finishing Supplies & Equipment

BLOXYGEN SAVES LEFTOVER FINISHES - Prevent oxygen or moisture damage. www.bloxygen.com or (888) 810-8311.

SHELLAC.NET — WOOD FINISH SUPPLY Large Shellac Flake Selection - Brushes - Dyes BEHLEN Finishing Supplies - Stains - Aerosols RENAISSANCE Wax. 877-245-5611.

Hand Tools

WWW.JIMBODETOOLS.COM The Largest Antique Tool Website on Earth! Fine Antique Woodworking Tools of every kind. 845-505-8665.

Kits & Plans

FULL SIZE FURNITURE LAYOUTS Drawn by Philip C. Lowe. 978-922-0615. 116 Water St, Beverly, MA 01915. www.furnituremakingclasses.com

Schools/Instruction

JOHN C. CAMPBELL FOLK SCHOOL, Brasstown, NC. Courses for all skill levels. Week and weekend classes year-round, taught by nationally known instructors. Friendly, supportive environment. Comfortable, on-campus housing. Delicious meals served three times a day. www.folkschool.org. 800/365-5724.

Seat Weaving Supplies

CHAIR CANE & SPLINT, Shaker tape, fiber & natural rush. Complete line of basketweaving supplies. Royalwood Ltd., 517-WW Woodville Rd, Mansfield, OH 44907. 800-526-1630. www.royalwoodltd.com.

Classified rate is $6.00 per word, 15-word minimum. Order must be accompanied by payment; ads are non-commissionable. Send to: Popular Woodworking Magazine, 10151 Carver Road, Suite 200, Blue Ash, OH 45242 or Don Schroder, d.schroder@verizon.net. Phone: 610-821-4425, Fax: 610-821-7884.

Advertiser's Index

	PAGE#	CARD#	WEB ADDRESS
American Fabric Filter	19	66	americanfabricfilter.com
Beall Tool Company	56	2	bealltool.com
Bloxygen	57	3	bloxygen.com
Connecticut Valley School of Woodworking	56	64	schoolofwoodworking.com
Craftsman Gallery	9	–	craftsmangallery.com
Custom Branding Irons	19	93	branding-irons.biz
DMT	17	92	dmtsharp.com
DR Power Equipment	13	–	drpower.com
Forrest Mfg.	15	13	forrestblades.com
Furniture Institute of Massachusetts	56, 57	16	furnituremakingclasses.com
Gorilla Glue	13	18	gorillaglue.com
Grex USA	9	20	grexusa.com
Harbor Freight	61	76	harborfreight.com
Highland Woodworking	13	22	highlandwoodworking.com
I Can Do That	7	–	popularwoodworking.com/icdt
Jim Bode Tools	57	24	jimbodetools.com
John Campbell Folk School	57	–	folkschool.org
Knew Concepts	13	60	knewconcepts.com
Lee Valley	17	28	leevalley.com
Leigh Industries	5	–	leighjigs.com
Lignomat USA	9	124	lignomat.com

	PAGE#	CARD#	WEB ADDRESS
Next Wave Innovations	5	127	nextwaveautomation.com
Oneida Air Systems	15	35	oneida-air.com
Osborne Wood Products	17, 19, 56	36	osbornewood.com
Popular Woodturing	19	–	popularwoodturning.com
Royalwood Ltd.	57	–	royalwoodltd.com
Rust-Oleum	Cvr 4	–	rustoleum.com
Saburrtooth	13	79	saburrtooth.com
Shellac.net	57	–	shellac.net
Tools for Working Wood	15	–	toolsforworkingwood.com
Wagner Meters	17	123	wagnermeters.com
Wall Lumber	9	47	walllumber.com
West Penn Hardwoods	13	126	westpennhardwoods.com
Whitechapel Ltd.	56	48	whitechapel-ltd.com
Woodcraft	Cvr 2	49	woodcraft.com
Woodfinder	56	–	woodfinder.com
Woodline	7	50	woodline.com
Woodpeckers	Cvr 3	52	woodpeck.com
Woodstock International	3	114	woodstockinternational.com
Woodturning with Tim Yoder	19	–	popularwoodturning.com
Woodworker's Source	56	–	woodworkerssource.com
Woodworking In America Show	20	–	woodworkinginamerica.com

Give Me a Brake

Get some splitting leverage with this simple contraption.

Reach for a froe, and you should immediately think, "Give me a brake." The brake can be a constructed workholding device, or just a couple of logs. Its function is to trap your workpiece in such a way that you can exert leverage on a section of a log as it's splitting. The froe – used to split a piece when it's in a brake – is a tool that requires some nuance to really get the most from it; the brake helps make that happen.

There are many kinds and configurations of brakes. The first one I learned is just a forked section of a tree, propped up with crossed timbers underneath.

Jam your billet into the fork with its other end on the ground, and drive the froe into the top end. As you twist the froe handle, you're pulling against the thicker part of the split. Depending on many factors, you might need to flip your workpiece this way and that to get the thick side of the split on the bottom, or near, side.

Sophisticated. *The tripod riving brake shown here is the sophisticated version of a contraption to help hold logs and billets as they're split with a froe.*

In a pinch. *A log and a split section of wood can serve as a brake if need be.*

In a pinch, I have improvised a brake with a log and a section of split oak; it's a bit awkward, but it works. In both of these cases, the workpiece is pretty close to vertical.

Many years ago, I learned of a different brake: a large tripod with two cross bars fixed to its two front legs. My latest version is about 6½' tall, and bolted together at the top. The legs are softwood 4x4s; the crossbars are oak 2x6s. The rear leg swings out between the two front legs.

Across the front legs I have variously nailed or lag-bolted two crosspieces. One is horizontal, about waist high. The other is above this rail, angled upward toward the left-hand end of things. The idea is that these two rails create a tapered fork into which you can jam your riving stock.

Another feature is that this upper rail is attached to the front face of my right-hand piece, and behind the other leg. This provides a broader range of points at which to pinch a workpiece. I often add another rail running from the left-hand front leg to the back leg, as shown above. I use this one to grab long whippy pieces between the front lower rail and the back end of this side rail.

I prefer this contraption to a forked-tree riving brake because it puts the workpiece you're riving parallel to the ground. This way, the pressure you're exerting to control the split is directly downward, not up in the air like on the first brake I used (or on the log version).

Forked. *Here, a student is using a forked-tree brake as he rives oak with a froe.*

PHOTOS BY THE AUTHOR

Oak hurdle. *Here's my a hurdle – a traditional portable fence – based on an English regional style (you've likely also seen woven willow hurdles). No matter the style, the use is the same: to keep things in or out.*

The riving I do for joiner's work is pretty simple, all that stock is fairly thick; 1"-1½"at least.

Oak 'Hurdles'

Recently I was making some garden hurdles, and for those the stuff I want to rive is often quite thin, sometimes only ½" thick. It takes finesse to get a split like that, but with good stock, a sturdy riving brake and some practice, you can split lengths up to 6' with ease.

Having the front rails in different planes helps when coercing a split that threatens to go astray. The offset between the rails means the pressure points are now spread out; the stock rests on the lower bar near you, but is pinched under the upper bar now about 4"-6" farther back.

This is helpful when you're directing the froe's action by leaning on the heavier side of the split. You can bend the stock and force the split back on track if it wanders. Longer stock achieves the same by being trapped on top of the front lower rail and under the side rail.

When riving long stock, the action is not a quick jerk of the froe, but a gentle and slight levering of the handle. The sound is not the tearing of fibers like splitting with wedges, but a "tic-tic-tic" as each push on the handle advances the split a ways.

Bore & chop. *Lay out your mortise locations, bore a hole at either end, then chop the waste between.*

Watch as you go, if the split "runs out" toward a thinner side, flip the stock over so the thick half of the split is down, and lean on the top as you push the now-thicker side down. Lever the handle – "tic-tic-tic" – and you're back on track. Easy does it.

The hurdles are simple: three uprights, several rails and a couple braces. Bore holes in the uprights, and use a chisel to chop between them to make the mortises. Hew or use a drawknife to fit the rails. All the joints and the braces are nailed or pegged in place.

Keep your hurdles light; these originally served as portable enclosures for sheep. I have no sheep here in my in-town yard, so I use a couple of hurdles to keep our kids from careening into the river when sledding in the winter. **PWM**

Peter has been involved in traditional craft since 1980. Read his blog at pfollansbee.wordpress.com.

Rails. *Use a hatchet or drawknife to shape the rails and fit the through-tenons (which needn't be tight), then peg or nail the braces in place.*

ONLINE EXTRAS

For links to all online extras, go to:

- **popularwoodworking.com/apr16**

BLOG: *Read Peter Follansbee's blog.*

ARTICLE: *"The Best Oak Money Can't Buy."*

About this Column

ARTS & Mysteries

"Arts & Mysteries" refers to the contract between an apprentice and master – the 18th-century master was contractually obligated to teach apprentices trade secrets of a given craft (and the apprentice was expected to preserve those "mysteries").

Our products are available online at:

- **ShopWoodworking.com**

Water-based Finish isn't Lacquer

The two products – both useful – are quite different.

Dating back at least 100 years, the term "lacquer" has referred to a non-crosslinking finish that thins with lacquer thinner. The most common type is nitrocellulose lacquer.

In the late 1980s water-based (or waterborne) finishes became available and some were labeled "lacquer." The reason, as one manufacturer confided at the time, was to make woodworkers think they were using a familiar finish, one that would apply and perform like the traditional lacquer they were used to. This might make them more likely to try it.

To justify the name, manufacturers claimed that their water-based finish "burned in" like traditional lacquer. That is, each freshly applied coat dissolved into the previous coat, creating in effect one thicker coat. So the example of equivalency was burning in.

To some degree this is true. Water-based finishes do bond fairly well to previous coats, but the similarities pretty well end there. In virtually every other important quality, the two finishes are very different and should have different names to avoid confusion. Manufacturers, writers and teachers should stop referring to water-based finishes as lacquer, or water-based lacquer.

Straining. *Though it's always good practice to strain a finish before applying it, straining is doubly necessary with water-based finishes because there are usually coalesced particles in them that can mess up your finish. That isn't the case with true lacquer.*

Water

The biggest difference, of course, is that water-based finishes contain a lot of water and lacquer doesn't. Consider these consequences of water.

- Water raises the grain of wood. To get a smooth final result you have to sand the raised grain level and do so without sanding through to the wood or a stain. Though you should also sand the first coat of lacquer or lacquer sanding sealer, it is much easier than sanding the raised grain caused by water.
- Water-based finish is much more sensitive to temperature and humidity than lacquer. There's not much you can do to control the drying rate of water-based finish other than control the temperature and humidity in your shop, which can be expensive. In contrast, the drying rate of lacquer can be controlled by adding lacquer retarder in hot or humid conditions and acetone in cold conditions.
- Even in moderate temperatures and low humidity, water evaporates more slowly than lacquer thinner, increasing the risk of runs and sags. Moreover, most lacquer thinners contain six or more solvents that evaporate at different rates, further reducing the likelihood of runs and sags.
- Water-based finishes often contain coalesced particles that can mess up your finish; that isn't the case with lacquer. So it's doubly important to strain water-based finishes before using.

While these characteristics can be seen as negatives, water contributes one very important positive quality: lower odor. Water-based finishes are far less smelly and irritating to apply than lacquer.

Resin

A second important difference is the resin used.

Lacquer is composed of long stringy molecules of nitrocellulose that entangle in liquid form (like stirred spaghetti in a pot of water) and form a hard film after all the solvent evaporates. This film can easily be returned to liquid form by bringing it into contact with lacquer thinner.

In contrast, water-based finishes are composed of emulsified droplets of acrylic or polyurethane resin that come together and stick to each other when the water (which evaporates first), then a solvent evaporate. Inside the droplets, the resin molecules crosslink – that is, form chemical bonds – but with few

CONTINUED ON PAGE 63

PHOTOS BY THE AUTHOR

HARBOR FREIGHT
QUALITY TOOLS AT RIDICULOUSLY LOW PRICES

QUALITY TOOLS LOWEST PRICES EVERYDAY

How Does Harbor Freight Sell GREAT QUALITY Tools at the LOWEST Prices?

We have invested millions of dollars in our own state-of-the-art quality test labs and millions more in our factories, so our tools will go toe-to-toe with the top professional brands. And we can sell them for a fraction of the price because we cut out the middle man and pass the savings on to you. It's just that simple! Come visit one of our 600+ Stores Nationwide.

SUPER COUPON

20% OFF ANY SINGLE ITEM

Limit 1 coupon per customer per day. Save 20% on any 1 item purchased. *Cannot be used with other discount, coupon or any of the following items or brands: Inside Track Club membership, extended service plan, gift card, open box item, 3 day parking lot sale item, compressors, floor jacks, saw mills, storage cabinets, chests or carts, trailers, trenchers, welders, Admiral, CoverPro, Daytona, Diablo, Franklin, Hercules, Holt, Jupiter, Predator, Stik-Tek, StormCat, Union, Vanguard, Viking. Not valid on prior purchases. Non-transferable. Original coupon must be presented. Valid through 6/16/16.

49203434

SUPER COUPON

FREE WITH ANY PURCHASE

3-1/2" SUPER BRIGHT NINE LED ALUMINUM FLASHLIGHT

LOT 69052 shown
69111/62522
62573/65020

$4.98 VALUE

LIMIT 1 - Cannot be used with other discount, coupon or prior purchase. Coupon good at our stores, HarborFreight.com or by calling 800-423-2567. Offer good while supplies last. Shipping & Handling charges may apply if not picked up in-store. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one FREE GIFT coupon per customer per day.

49235678

WOW SUPER COUPON

27", 11 DRAWER ROLLER CABINET

LOT 61485
67421 shown

Customer Rating ★★★★½

SAVE $279

- Welded Steel Joints
- Lockable Drawers

$159.99 comp at $439.97

49156201

LIMIT 4 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

27 LED PORTABLE WORKLIGHT/FLASHLIGHT

LOT 67227 shown
69567/60566/62532

SAVE 58%

Batteries included.

$2.99 comp at $7.15

49227624

LIMIT 8 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

RAPID PUMP® 1.5 TON ALUMINUM RACING JACK
PITTSBURGH AUTOMOTIVE

LOT 69252
62160/62496
62516/68053
60569 shown

SAVE $60

- 3-1/2 Pumps Lifts Most Vehicles
- Weighs 32 lbs.

$59.99 ~~$89.99~~ comp at $119.99

49155198

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

WOW SUPER COUPON

2.5 HP, 21 GALLON, 125 PSI VERTICAL AIR COMPRESSOR

CENTRALPNEUMATIC

LOT 69091/61454
61693/62803/67847 shown

Customer Rating ★★★½☆

SAVE $349

$149.99 ~~$179.99~~ comp at $499

49170514

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

60 LED SOLAR SECURITY LIGHT

Bunker Hill Security

SAVE 54%

Includes 6V, 900 mAh NiCd battery pack.

LOT 62534
69643 shown

$31.99 comp at $69.99

49178370

LIMIT 3 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

12" SLIDING COMPOUND DOUBLE-BEVEL MITER SAW WITH LASER GUIDE

NEW

CHICAGO ELECTRIC POWER TOOLS

SAVE $264

LOT 61776
61969/61970
69684 shown

$134.99 comp at $399

49200902

LIMIT 4 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

HaulMaster MOVER'S DOLLY

LOT 61899/60497/62399
63095/63096/63098/63097
93888 shown

$8.99 comp at $19.97 • 1000 lb. capacity

SAVE 54%

49166551

LIMIT 8 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

24" CLAMP AND CUT EDGE GUIDE
PITTSBURGH

LOT 66126

Customer Rating ★★★½☆

SAVE 83%

$7.99 comp at $49.23

49161204

LIMIT 6 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

18 GAUGE BRAD NAILER
CENTRALPNEUMATIC

LOT 68021

SAVE $103

$15.99 ~~$19.99~~ comp at $119

49196830

LIMIT 7 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

PACIFIC HYDROSTAR

1650 PSI PRESSURE WASHER

LOT 68333
69488 shown

Customer Rating ★★★½☆

SAVE $70

• 1.3 GPM

$79.99 comp at $149.99

49226578

LIMIT 3 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

CENTRAL MACHINERY 8" 5 SPEED BENCHTOP DRILL PRESS

SAVE $66

Customer Rating ★★★½☆

LOT 62390/62520
60238 shown

$59.99 ~~$69.99~~ comp at $126.47

49168013

LIMIT 5 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

SUPER COUPON

14" OSCILLATING SPINDLE SANDER
CENTRAL MACHINERY

SAVE $70

LOT 95088
62146
69257 shown

$99.99 comp at $169.99

49237821

LIMIT 4 - Good at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount or coupon or prior purchases after 30 days from original purchase with original receipt. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 6/16/16. Limit one coupon per customer per day.

CARD #76 or go to PWFREEINFO.COM

- 100% Satisfaction Guaranteed
- Over 30 Million Satisfied Customers
- No Hassle Return Policy
- Lifetime Warranty On All Hand Tools
- 600+ Stores Nationwide
- HarborFreight.com 800-423-2567

BOOKS · MAGAZINES · WEBINARS · EDUCATIONAL PRODUCTS
CDS/DVDS · RESOURCES · PROJECTS · AND MUCH MORE!

Enter code **WOODPUB10** at check-out and **SAVE 10%** off educational products, resources, projects and more. From the same great providers of education, articles and inspiration you experience reading *Popular Woodworking Magazine*, check out ShopWoodworking.com and save now!

ShopWoodworking.com

WOODPUB10

Promo Code Exclusions Apply: Your special discount/coupon code will allow you to take 10% OFF many (not all) of the items you find at ShopWoodworking.com. Your discount/coupon code is not valid for purchasing gift cards, subscriptions, pre-orders, value packs, VIP memberships, or items that ship directly from manufacturers. Discounts cannot be applied to previous purchases. Valid for one use per customer only. Other exclusions may apply.

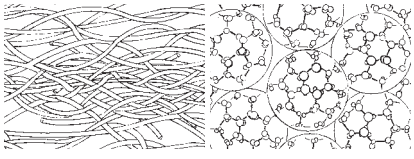
CONTINUED FROM PAGE 60

exceptions the droplets themselves just stick to each other. They can be separated with several solvents, but with more difficulty than with lacquer.

The different resins and the way they cure account for significant differences in the way the two finishes can be manipulated.

■ Lacquer can be repaired invisibly by melting (with heat) or dissolving (with solvent) more lacquer into the damage. Because of the crosslinking within the water-based droplets, however, there's usually a visible boundary with water-based finishes. This boundary has to be disguised with color, often a difficult task.

■ Lacquer is easier to rub to an even sheen because the spaghetti-like molecules are easily separated with an abrasive, while the crosslinked molecules within the water-based droplets resist separation. They have to be torn apart, creating a more uneven sheen.



Different resins. *Lacquer (left) is composed of long stringy nitrocellulose molecules that pack together when the solvent evaporates. Water-based finish is composed of emulsified droplets of crosslinked acrylic and polyurethane resins that stick to each other when the water, then the solvent, evaporates.*

Cleaning spray guns. *Cleaning is more difficult with water-based finishes than with lacquer. Usually you have to disassemble the gun and scrub the parts with a brush. To show this, I ran hot soapy water through the gun for several minutes, but white clumps of finish remain that will dry and disrupt the spray pattern.*

■ Also because of the crosslinking, water-based finishes are more difficult to strip. Lacquer can simply be dissolved and wiped off with lacquer thinner or paint stripper.

■ Water-based finishes are also more difficult to clean from a spray gun. You usually have to disassemble it to remove all the finish. In contrast, lacquer can be left in a spray gun for a week or longer and still be totally cleaned when more lacquer, or lacquer thinner, is sprayed through it.

Though the crosslinking within the droplets can be seen as a problem for manipulating water-based finishes, it's an advantage for better abrasion resistance and even some solvent and heat resistance. This is due to the entire surface area being composed of crosslinked molecules except where the droplets stick together.

Decoration

Coloring and filling steps are more difficult with water-based finishes than with lacquer. For example, lacquer can be thinned infinitely with lacquer thinner to make toners while water-based finish cannot. Adding too much high-surface-tension water causes water-based finishes to bead up.

Also, because of lacquer's ability (due to the lacquer thinner) to penetrate through layers of color (stain, glaze, pore filler) and bond to washcoats or full coats of finish underneath, it's possible to build a multi-color-step finish that has considerably more film integrity (resistance to separation at the color layers) than can be achieved with water-based finish.

As a result, factories often do their decorative steps with a solvent finish, then topcoat with water-based finish to comply with VOC laws.

Color

Finally, one of the most significant differences is color, or lack of it, the finish adds to the wood. Lacquer adds a warm orange coloring while most water-based finishes add no color.

No color. *Most water-based finishes add no color to the wood. I find this quality to be very attractive on "white" woods such as maple, birch and ash, and on this pine floor. Lacquer adds an orange coloring to the wood.*

Different colors. *Not all water-based finishes are completely colorless. As you can see on this oak, while the General Finishes acrylic water-based finish (right) adds no color, the two oil-modified examples, Zar (center) and Minwax, do add some color. If color is important to you, test first on scrap wood.*

The orange coloring warms darker woods such as walnut, cherry and mahogany in contrast to water-based finishes, which deaden the color (unless you apply a stain). On the other hand, most water-based finishes maintain the white coloring of woods such as maple, birch, ash and pine, which I find attractive.

I hope I've made the case that water-based finish is very different from lacquer and shouldn't be called lacquer.

PWM

Bob is a contributing editor to this magazine, and author of "Flexner on Finishing," "Wood Finishing 101" and "Understanding Wood Finishing."

ONLINE EXTRAS

For links to all online extras, go to:

■ **popularwoodworking.com/apr16**

ARTICLES: *You'll find many free finishing articles on our web site.*

IN OUR STORE: *"Flexner on Finishing,""Wood Finishing 101" and "Understanding Wood Finishing."*

Our products are available online at:

■ **ShopWoodworking.com**

Humble Job Endures 1,000 Years

The Tower of London provides inspiration to make an impact.

A few years ago I visited England with my wife, daughter and a few friends. It is a fascinating country – some parts of it seem right out of a mid-20th-century television show, while other places are so modern that they should be in California. My favorite places, however, were the ancient ones – castles, Roman walls, cobblestone streets.

While visiting the Tower of London, I was astonished by the amazing size of the posts and beams supporting the floor and walls. I was most intrigued by the huge oak pillar at the center of the base of the tower itself. While everyone else was admiring tapestries, I asked one of the docents if that particular piece of wood was original to the building. "Oh no!" he said. "That's new…It was replaced in the 1800s."

As I was coming to grips with the 1800s being "new," he leaned toward me and asked if I'd like to see an "old piece of wood." How could I resist?

We walked the length of the exhibit hall and stopped at a window nook. On the sidewall was a shelf built into the stone. "This was added during a remodel in the 1300s." He smiled as my jaw dropped. I properly admired the shelf – very thick, not wide, long but still unbowed after 700 years, then he said quietly, "Come with me."

We walked to the other side of the hall, stepped over the velvet rope and into a short passageway. At the end, he said, "This used to be the door into a public area. In times of danger, they would prevent the door from opening inward by pulling a thick bar out of a deep socket on one side and seating it in a short socket at the other side."

On one side I saw an 8" x 8" box made of very rough 1x lumber. Unimpressive. He shined his flashlight into the box and I could see that it was perhaps 8' deep, buried in the stones that compose the wall. More impressive, but I just didn't understand his point, as he could obviously tell. "It was built into the wall." My blank expression led him on "…in the year 1070."

Here was a utilitarian piece of woodwork that was likely quickly made by a journeyman nearly a millennium ago. Who was he? What would he say if you were to whisper in his ear as he worked that this simple piece would still exist in a thousand years? Would he disbelieve it? Or would he think about the castle as a whole and expect it to still be there? I would bet on the first.

Then I thought about my life's work. I've been a soldier, a restaurateur, the owner of a software company, a teacher and am now a public servant encouraging the adoption of technology in local governments and small businesses. How much of my work will exist in any recognizable form in a thousand years? None. In a hundred years? None. In just 20 years? None. Most depressing.

I resolved to do something that would last a hundred years and would be intentionally retained by someone for that length of time.

I have been working with wood for many years – mostly rough carpentry with power tools, remodeling my own houses, but I've also built furniture from kits as well a few original pieces.

When I returned to the U.S., I found "The Anarchist's Tool Chest" in my mailbox, and I began to see how I might accomplish my new resolution.

I retire this summer and will be concentrating on "boxes, books, boats and butterflies." (I row a single shell and raise monarch butterflies.)

I've already built a Nicholson bench and collected a load of hand tools. A tool chest is next – "Anarchist's Tool Chest," Dutch, traveling or two-day ATC, I don't know…but as I build it, and everything else from here on, I hope that I'll be hearing a whisper in my ear. **PWM**

Jim is a Pennsylvania-based writer and woodworker.

ONLINE EXTRAS

For links to all online extras, go to:

- popularwoodworking.com/apr16

TWITTER: *Follow us on Twitter @pweditors.*

Our products are available online at:

- ShopWoodworking.com

PHOTO BY THE AUTHOR

Assemble Projects THE EASY WAY

BC4-M2 BOX CLAMP

Our Box Clamps Streamline Glue-ups, Guarantee Square Assembly Every Time

Like Having an Extra Pair of Hands.

With our new M2 Box Clamps you can glue up or dry-fit any 90° joint quickly and easily and know your joint is square. Just position the clamp in the corner of the joint, give the knob or bolt a twist and equal pressure is applied while instantly squaring the joint. It's that simple. And, our new, easy setup feature with stock thickness dimensions called out on the clamp body means you can quickly adjust the Box Clamp in seconds.

Our M2 Box Clamp Has Many Uses.

These clamps work great on butt joints, miters, dadoes, rabbets; through or half-blind dovetails and box joints even when material overhangs the joint face. Its design lets you easily nail or screw along the full length of the joint. And if you are a fan of pocket-hole joinery, our Box Clamps are the answer to your prayers.

Rugged with A Full Range of Adjustment.

Our clamps are molded using a nearly indestructible glass fiber filled polycarbonate. The Box Clamp quickly adjusts for use with material ranging in thickness from ¼" to a full 1". An easy twist of the knob or hex key (depending on clamping application) provides ample torque to tighten the clamp and secure the work.

When you want square corners you just can't beat Woodpeckers M2 Box Clamps. Watch how simple and handy they are to use at **www.woodpeck.com/boxclampm2**

See our full line of American-made woodworking tools and order online at Woodpeck.com.

Woodpeckers® Inc.

13700 Prospect Road ■ Strongsville, Ohio 44149

Thicker. Faster. Stronger.

Triple Thick Poly: 1 coat

Traditional Poly: 3 coats

Get the durable finish you expect, faster than you can imagine. With new Varathane Triple Thick Polyurethane. Just one coat of Triple Thick has the strength and thickness of three coats of traditional polyurethane. With an advanced self-leveling formula that's perfect for interior horizontal and vertical surfaces. Get the protection. Get the beauty. And save your valuable time. Varathane Triple Thick Polyurethane. The Ultimate Finish In One Coat. **Staining123.com**

Varathane

THE HOME DEPOT
More saving.
More doing.