

13 Common Finish Problems Solved

Blue Spruce
Joiner's Mallets



POPULAR Woodworking MAGAZINE

June 2014 ■ #211

‘Riveted’ Corner Joinery Solid Construction & a Touch of Brass

Contemporary Take on Cabriole Legs Plus a Clever Router Trick for a Flush Fit

Hardware Hideaway 2 Strong Joints Make the Case

Carved Spoons Beauty & Utility With Only 3 Tools

Get a Handle on Mortise Chisels Turn & Burn Your Way to a Rehabbed Tool



Elegant Esherick-Inspired Stool Gorgeous Grain & a Power-Carved Seat

fw media

US \$6.99



0 74808 01355 5 06

Display until June 23, 2014

popularwoodworking.com



Grizzly Industrial®

30TH ANNIVERSARY SPECIAL EDITION 14" DELUXE BANDSAW



- Motor: 1 HP, 110V/220V, single-phase, TEFC
- Precision-ground cast iron table size: 14" sq.
- Table tilt: 45° R, 10° L
- Cutting capacity/throat: 13 1/4"
- Max. cutting height: 6"
- Blade size: 92 1/2"-93 1/2" L (1/4"-3/4" W)
- Blade speeds: 1800 & 3100 FPM
- Approx. shipping weight: 247 lbs.



MADE IN TAIWAN

G0555LANV \$545⁰⁰
SALE \$525⁰⁰



30TH ANNIVERSARY SPECIAL EDITION 17" BANDSAW



- Motor: 2 HP, 110V/220V, single-phase, TEFC
- Precision-ground cast iron table size: 17" sq.
- Table tilt: 45° R, 10° L
- Cutting capacity/throat: 16 1/4"
- Max. cutting height: 12 1/4"
- Blade size: 131 1/2" L (1/4"-1" W)
- Blade speeds: 1700 & 3500 FPM
- Quick-release blade tension lever
- Approx. shipping weight: 342 lbs.

MADE IN TAIWAN

INCLUDES DELUXE
EXTRUDED ALUMINUM
FENCE, MITER GAUGE &
1/2" BLADE

G0513ANV \$895⁰⁰
SALE \$825⁰⁰



ULTIMATE 14" BANDSAW



- Motor: 1 HP, 110V/220V, single-phase, TEFC
- Precision-ground cast iron table size: 14" sq.
- Table tilt: 45° R, 15° L
- Cutting capacity/throat: 13 1/4"
- Max. cutting height: 6"
- Blade size: 92 1/2"-93 1/2" L (1/4"-3/4" W)
- Blade speeds: 1500 & 3200 FPM
- Deluxe heavy-duty stand
- Upper & lower ball bearing blade guides
- All ball bearing construction
- Includes 1/2" blade
- Approx. shipping weight: 196 lbs.

MADE IN TAIWAN



G0555P \$545⁰⁰ **SALE \$525⁰⁰**



17" 2 HP HEAVY-DUTY BANDSAW



- Motor: 2 HP, 110V/220V, single-phase, TEFC
- Precision-ground cast iron table size: 17" sq.
- Table tilt: 45° R, 10° L
- Cutting capacity/throat: 16 1/4"
- Max. cutting height: 12 1/4"
- Blade size: 131 1/2" L (1/4"-1" W)
- Blade speeds: 1700 & 3500 FPM
- Quick-release blade tension lever
- Approx. shipping weight: 346 lbs.

INCLUDES DELUXE EXTRUDED
ALUMINUM FENCE, MITER GAUGE &
1/2" BLADE

MADE IN TAIWAN



G0513P \$895⁰⁰ **SALE \$875⁰⁰**



19" HEAVY-DUTY BANDSAWS



- Motor: 3 HP, 220V, single-phase, TEFC
- Precision-ground cast iron table size: 26 1/4" x 19"
- Table tilt: 45° R, 5° L
- Cutting capacity/throat: 18 1/4"
- Max. cutting height: 12"
- Blade size: 143" L (1/4"-1 1/4" W)
- Blade speeds: 1700 & 3500 FPM
- Approx. shipping weight: 460 lbs.

EXTREME SERIES

DELUXE RESAW FENCE
INCLUDED

MADE IN TAIWAN



G0514X \$1495⁰⁰ **SALE \$1450⁰⁰**
ALSO AVAILABLE **G0514XF W/ FOOT BRAKE**
ONLY \$1425⁰⁰



10" LEFT-TILTING CONTRACTOR-STYLE TABLE SAW with Riving Knife

- Motor: 1 1/2 HP, 110V/220V, single-phase
- Precision-ground cast iron table with wings
- Table size: 25 1/4" x 40" • Arbor: 1/2"
- Arbor speed: 4000 RPM
- Capacity: 3 1/4" @ 90°, 2 1/4" @ 45°
- Rip capacity: 30" R, 12" L
- Encapsulated blade for improved dust collection
- Camlock fence with micro-adjust
- Fence scales on left and right side of blade
- Approx. shipping weight: 208 lbs.

MADE IN TAIWAN

FREE 10"
CARBIDE-TIPPED
BLADE



G0732 \$795⁰⁰ **SALE \$650⁰⁰**



10" HYBRID TABLE SAW



**BEAUTIFUL
WHITE COLOR!**



- Motor: 2 HP, 110V/220V, single-phase
- Precision-ground cast iron table with wings measures: 27" x 40"
- Arbor: 1/2" • Arbor speed: 3850 RPM
- Capacity: 3 1/4" @ 90°, 2 1/4" @ 45°
- Rip capacity: 30" R, 12" L
- Quick-change riving knife
- Cast iron trunnions
- Approx. shipping weight: 404 lbs.



INCLUDES BOTH REGULAR
& DADO BLADE INSERTS

G0715P ONLY \$795⁰⁰



10" LEFT-TILTING TABLE SAWS with Riving Knife & Cast Iron Router Table

- Motor: 3 HP or 5 HP, 240V, single-phase
- Precision-ground cast iron table size with wings: 27" x 48"
- Arbor: 1/2"
- Cutting capacity: 25 1/4" R, 8" L
- Max. depth of cut: 3" @ 90°, 2 1/4" @ 45°
- Approx. shipping weight: 550 lbs.

MADE IN TAIWAN

G1023RLW 3 HP \$1360⁰⁰
ONLY \$1325⁰⁰

G1023RLWX 5 HP \$1395⁰⁰
ONLY \$1350⁰⁰



PRICING CODE
14POP
MENTION THIS CODE
WHEN PLACING YOUR ORDER

VIEW VIDEOS AT
grizzly.com

1-800-523-4777

3 GREAT SHOWROOMS!

BELLINGHAM, WA MUNCY, PA SPRINGFIELD, MO

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



FREE CATALOG

760 PAGES OF HIGH
QUALITY TOOLS AND
MACHINERY AT
INCREDIBLE PRICES

SUMMER SALE

March 31 - July 31

Visit Grizzly.com to view all sale prices

10" CABINET TABLE SAW with Riving Knife & Extension Rails

- Motor: 3 HP, 220V, single-phase
- Precision-ground cast iron table
- Table size with extension: 27" x 74"
- Arbor: 3/4" • Arbor speed: 4300 RPM
- Max. depth of cut: 3/4" @ 90°, 2 1/4" @ 45°
- Max. rip capacity: 50" R, 12" L
- Max. dado width: 1 1/4"
- Approx. shipping weight: 557 lbs.



G0691 ~~\$1595.00~~ **SALE \$1525.00**



FREE 10" CARBIDE-TIPPED BLADE



8" JOINTERS

- Motor: 3 HP, 220V, single-phase, TEFC
- Precision-ground cast iron table size: 9" x 72 1/2"
- Max. depth of cut: 1/4"
- Max. rabbeting depth: 1/2"
- Cutterhead dia.: 3"
- Cutterhead speed: 4800 RPM
- Cuts per minute: 20,000 (G0656P), 21,400 (G0656PX)
- Approx. shipping weight: 500 lbs.



CHOOSE EITHER
4 HSS KNIVES
OR SPIRAL
CUTTERHEAD
MODEL

4 KNIFE CUTTERHEAD

G0656P ~~\$925.00~~ **SALE \$795.00**

SPIRAL CUTTERHEAD

G0656PX ~~\$1250.00~~ **SALE \$1225.00**



FREE SAFETY
PUSH
BLOCKS

12" JOINTER/PLANNER COMBINATION MACHINES

- Motor: 5 HP, 220V, single-phase
- Jointer table size: 14" x 59 1/2"
- Cutterhead dia.: 3 1/4"
- Cutterhead speed: 5034 RPM
- Max. jointer depth of cut: 1/4"
- Max. width of cut: 12"
- Planer feed rate: 22 FPM
- Max. planer depth of cut: 1/4"
- Max. planer cutting height: 8"
- Planer table size: 12 1/4" x 23 1/4"
- Approx. shipping weight: 704 lbs.



MADE IN TAIWAN

CARBIDE
INSERT SPIRAL
CUTTERHEAD!



WITH SPIRAL CUTTERHEAD

G0634XP ~~\$2350.00~~ **SALE \$2295.00**

ALSO AVAILABLE IN GRIZZLY GREEN

G0633 JOINTER/PLANNER WITH HSS KNIVES ~~\$2050.00~~ **SALE \$1995.00**

G0634Z W/SPIRAL CUTTERHEAD ~~\$2695.00~~ **SALE \$2550.00**

20" PLANER

- Motor: 5 HP, 240V, single-phase
- Maximum cutting width: 20"
- Maximum cutting height: 8"
- Minimum stock thickness: 3/16"
- Minimum stock length: 8"
- Maximum cutting depth: 1/4"
- Feed rate: 16 FPM and 20 FPM
- Cutterhead diameter: 3 1/4"
- Cutterhead speed: 4800 RPM
- Feed rolls: solid serrated steel
- Table size: 20" x 25 1/4" (20" x 55 1/2" with extension)
- Overall dimensions: 55 1/2" L x 39 1/2" W x 45 1/4" H
- Approximate shipping weight: 920 lbs.



POUND FOR
POUND,
THE BEST 20"
PLANER VALUE
IN THE WORLD!

G0454 ~~\$1695.00~~ **SALE \$1650.00**

WITH SPIRAL CUTTERHEAD

G0454Z ~~\$2575.00~~ **SALE \$2550.00**



15" PLANERS

- Motor: 3 HP, 220V, single-phase
- Precision-ground cast iron table size: 15" x 20"
- Min. stock thickness: 3/16"
- Min. stock length: 8"
- Max. cutting depth: 1/4"
- Feed rate: 16 & 30 FPM
- Cutterhead speed: 4800 RPM
- Approx. shipping weight: 660 lbs.

CHOOSE EITHER 3
KNIFE OR SPIRAL
CUTTERHEAD
MODEL



G0453P ~~\$1125.00~~ **SALE \$1095.00**

WITH SPIRAL CUTTERHEAD

G0453PX ~~\$1750.00~~ **SALE \$1695.00**

VARIABLE SPEED PLANNER/ MOULDER

- Motor: 2 HP, 240V, single-phase, 12 Amps
- Precision-ground cast iron table and wings
- Maximum cutting width: 7"
- Maximum planing height: 7 1/2"
- Maximum planing depth: 1/4"
- Maximum moulding depth: 3/4"
- Feed rate: Variable • Cutterhead type: Square
- Knife size: 7/8" x 1 1/2" x 1/4" HSS
- Cutterhead speed: 7000 RPM • 4" dust port
- Rubberized steel feed rollers • Powder-coated paint
- Approx. shipping weight: 324 lbs.



MADE IN TAIWAN

W1812 ~~\$1650.00~~ **SALE \$1525.00**

CYCLONE DUST COLLECTOR

- Motor: 1 1/2 HP, 110V/220V, single-phase, TEFC, 3450 RPM
- Air suction capacity: 775 CFM
- Static pressure at rated CFM: 1.80"
- Intake port: 6" with included 5" optional port
- Impeller: 13 1/2"
- Height: 65 1/2"
- Built-in remote control switch
- Approx. shipping weight: 210 lbs.



PEATED FILTER IS
PROTECTED BY A
STEEL CAGE

MADE IN TAIWAN



BEAUTIFUL
WHITE
COLOR!

FULLY MOBILE
WITH BUILT-IN
CASTERS



ONLY 65 1/2" TALL!

G0703P ~~\$825.00~~ **SALE \$795.00**

2 HP DUST COLLECTOR with Aluminum Impeller

- Motor: 2HP, 240V, single-phase, 3450 RPM
- Motor amp draw: 9 Amps
- Air suction capacity: 1550 CFM
- Static pressure: 11"
- 6" inlet has removable "Y" fitting with two 4" openings
- Impeller: 12 1/4" balanced cast aluminum
- Bag capacity: 5.7 cubic feet
- Standard bag filtration: 2.5 micron
- Portable base size: 21 1/4" x 33 1/2"
- Bag size (dia. x depth): 19 1/2" x 33"
- Powder coated paint
- Height with bags inflated: 78"
- Approx. shipping weight: 122 lbs.



MADE IN TAIWAN

W1049 2 STAGE
CYCLONE SEPARATOR
FREE WITH PURCHASE



G1029Z2P ~~\$335.00~~ **SALE \$325.00**



grizzly.com

OVER 15,000 PRODUCTS ONLINE!

FOLLOW US:



PayPal



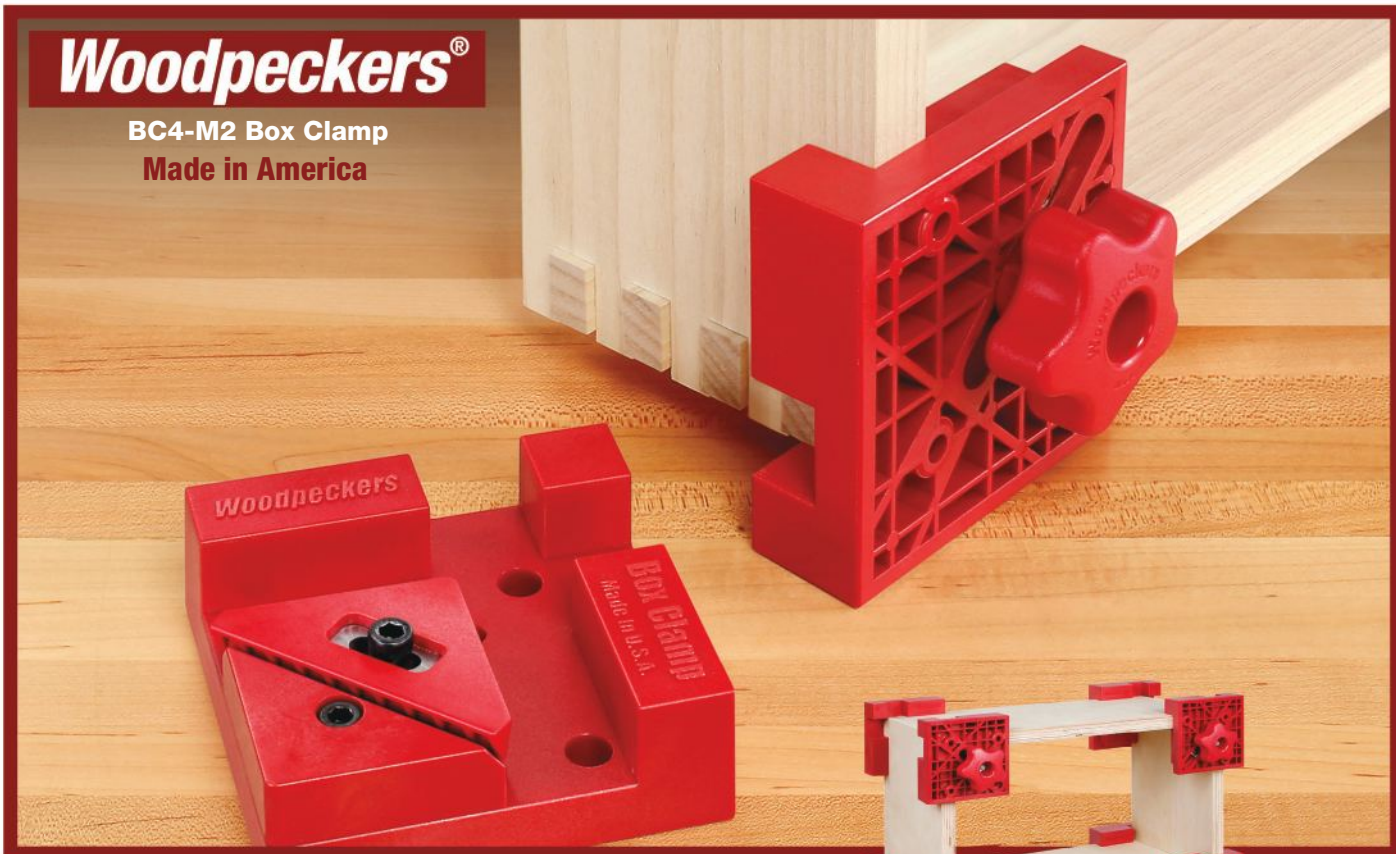
Assemble Projects the Easy Way

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

Woodpeckers®

BC4-M2 Box Clamp

Made in America



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 a twist and equal pressure is applied while instantly squaring the joint. It's that simple.

Our M2 Box Clamp Has Many Uses. These clamps work great on butt joints, miters, dados, rabbets; through or half-blind dovetails and box joints even when material overhangs the joint face. Its design let's 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 1/4" 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 at www.woodpeck.com

11050 Industrial First Ave. • North Royalton, Ohio 44133 • (800) 752-0725

WorldMags.net

CARD #52 or go to PWFREINFO.COM



26



33



38

FEATURES

22 'Rivet' Your Furniture

Use this strong and simple – but uncommon – joint to add a decorative touch to your work.

BY CHRISTOPHER SCHWARZ

ONLINE ► Campaign Hardware

Read about brass hardware like that on the cover project on Christopher Schwarz's blog. popularwoodworking.com/jun14

26 Contemporary Cabriole Legs

Bring traditional period legs into the 21st century with a streamlined look – plus learn a clever technique for a flush fit at the top.

BY JEFF MILLER

ONLINE ► Standing on Tradition

Watch Glen D. Huey lay out, cut and shape an 18th-century-style cabriole leg. popularwoodworking.com/jun14

33 Hardware Hideaway

Finger joints make a strong storage box to keep all your hardware right at your fingertips.

BY GLEN D. HUEY

ONLINE ► Strip the Zinc from Your Hardware

Discover a method for removing chintzy shine from cheap hardware in this free video. popularwoodworking.com/jun14

38 Spoon Carving

With just a few tools and "found" wood, you can create hand-carved pieces of art.

BY PETER FOLLANSBEE

ONLINE ► Joiner's Notes

Read more about spoon carving – as well as 17th-century joinery – on the author's blog. popularwoodworking.com/jun14

42 Reeds & Leaves

Nature and Wharton Esherick provide the inspiration for this graceful kitchen stool.

BY CHUCK BENDER

ONLINE ► Wharton Esherick

Discover the "Dean of American Craftsman" in this visit to the Wharton Esherick Museum. popularwoodworking.com/jun14

48 Get a Handle on Mortise Chisels

Discover a clever method for turning and "burning in" new handles on these workhorse hand tools.

BY WILLARD ANDERSON
WITH PETER ROSS

ONLINE ► Alternate Approach

There's more than one way to handle a chisel; read Derek Cohen's take on the process. popularwoodworking.com/jun14



42

30 Days for Dad Sweepstakes

It's time to give every Dad his due with a month-full of top-flight woodworking prizes. From May 17 through June 15 (Father's Day), Popular Woodworking Magazine and its sponsors are giving away a prize a day to celebrate Dads. To earn your chance, you must enter separately for each day's prize. All entrants will qualify for the Grand Prize, a Jet 10" ProShop Table Saw (Model 708494K) with 30-inch fence, cast iron wings and riving knife.

May 17



Historical Shaker Door Router Bit Set



card# 115

May 18



RIKON #62-400 Air filtration System



card# 42
www.rikontools.com

May 19



BESSEY K-Body Revo Kit KRK2440



card# 101
www.besseytools.com

May 20



Set of 3 Easy Hollowers



card# 39
www.easywoodtools.com

May 21



16 oz Joiner's Mallet



card# 104
www.bluesprucetoolworks.com

May 22



Woodworker Fret Saw



card# 60
www.knewconcepts.com

May 23



Mini-TURBO Wood-carving Blade



card# 99
www.arbortech.com.au

May 24



MPOWER CRB7MK3 BUNDLE CRB7MK3 + Edge Trim + Edge Guide



card# 116
www.m-powertools.com

May 25



Lee Valley Tools \$100 Gift Card



card# 28
www.leevalley.com

May 26



Masterpiece Wood Finish 3-Part Oil/Wax Finishing System



card# 117
www.masterpiecewoodfinish.com

May 27



20 Bd Ft of Select Cherry



card# 47
www.walllumber.com

May 28



2-piece Lock-Miter Master Jig



card# 23
www.infinitytools.com

May 29



Hamilton Traditional Marking Gauge



card# 118
www.hamiltontools.com

May 30



BESSEY 30-Clamp Kit BTB30



card# 101
www.besseytools.com

POPULAR
Woodworking
MAGAZINE

ENTER NOW for your chance
at more than \$7,500 in prizes!

May 31

EX-21K Scroll
Saw (with
Stand & Foot
Switch)

card# 17
www.general.ca



June 01

Titebond II
Premium
Wood Glue

card# 14
www.titebond.com



June 02

Figured Red Elm Slab



card# 108
www.horizonevolutions.com



June 03

Mirka® CEROS 550 CV Random
Orbit Sander with MV-912 Dust
Extractor

card# 31
www.mirka-usa.com



June 04

Precision Router Lift
V2 (PRLV2)

card# 52
www.woodpeck.com



June 05

Work Sharp 3000
Wood Tool
Sharpener

card# 119
www.worksharptools.com



June 06

8"x3" Double-Sided Diamond
Bench Stone (DWS/CP8/FC)

card# 120
www.trend-usa.com



June 07

General Purpose BGP
Clamp Kit

card# 101
www.besseytools.com



June 08

EYEMUFFS

card# 83
SellsSafety.com



June 09

R9 Plus Dovetail & Box Joint Jig

www.leighjigs.com



June 10

Woodworker II 10x30 Ripping
Saw Blade (WW10307125)

card# 13
www.forrestblades.com



June 11

Clear Cut Stock Guides
(model #04215)

card# 65
www.jessem.com



June 12

\$100 prize pack
from The Gorilla Glue Company

card# 18
www.gorillatough.com



June 13

4-Piece Super-Joint Set

card# 50
www.woodline.com



June 14

Ambrosia Maple Natural
Edge Slab

card# 47
www.walllumber.com



June 15 Father's Day

GRAND PRIZE
JET ProShop Table Saw,
708494K

card# 72
www.jettools.com



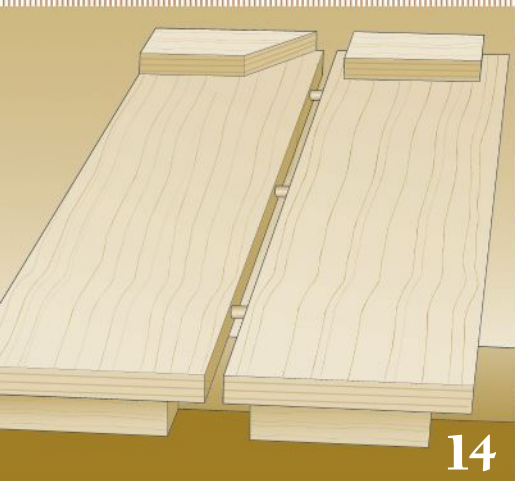
Enter every day at popularwoodworking.com/30days

Popular Woodworking Magazine and its sponsors will award one prize each day from May 17 through June 15. The prize pictured on each day in the calendar above is the prize offered for that day. To register for a chance to win each prize, you must enter on the day the prize is offered. You may enter as many of the daily contests as you like but you are limited to one entry per day. All entries from the first 29 days will be eligible for the Grand Prize: the JET 10" ProShop Table Saw (Model 708494K.). Registration starts at 12:01 A.M. EDT on May 17, 2014 and ends at midnight EDT on June 15, 2014.

WorldMags.net

CONTENTS

JUNE 2014



14



20



58

REGULARS

8 A Weekend Feast of Woodworking

OUT ON A LIMB

BY MEGAN FITZPATRICK

10 Problems with Polyurethane

LETTERS

FROM OUR READERS

14 Split Bench Hook

TRICKS OF THE TRADE

FROM OUR READERS

VIDEO ► More Tricks

Read and watch some of our favorite tricks.
popularwoodworking.com/tricks

16 Nova Comet II Midi Lathe

TOOL TEST

BY THE EDITORS

ONLINE ► Tool Test Archives

We have many tool reviews available for free on our web site.

popularwoodworking.com/tools

20 The Rule Of Three

WOODWORKING ESSENTIALS

BY MEGAN FITZPATRICK

58 Application Problems

FLEXNER ON FINISHING

BY BOB FLEXNER

64 Harness Leather On the Headstock

END GRAIN

BY DAVID WIGGINS

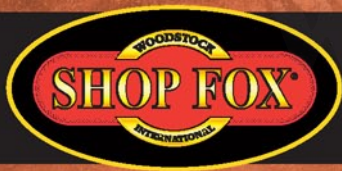


16

POPULAR Woodworking MAGAZINE

Number 211, June 2014. *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, Inc. 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 2014 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; GRINDING & LATHE PHOTOS BY AL PARRISH; FINISHING PHOTO BY BOB FLEXNER



INNOVATIVE PRODUCTS SINCE 1989!



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

TRACK SAW

- Motor: 120V, 9A, 1100 watt, 5500 RPM
- Blade diameter: 160mm (6¼")
- Cutting capacity:
With track: 1³¹/₃₂" @ 90°, 1⁷/₁₆" @ 45°
Without track: 2⁵/₃₂" @ 90°, 1¹/₈" @ 45°

New



W1832

Track Saw Master Pack
Includes: Saw, Guide Rail,
and Accessory Pack

W1835 Track Saw only
D4363 Accessory Pack **D4362** Guide Rails

14" BANDSAW

- 1 HP, 110V/220V
- Precision ground cast iron table measures 14" x 14" x 1½"
- Blade size: 93½" (⅞" 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*

W1706 14" Bandsaw

PLANER MOULDER with Stand

- Motor: 2 HP, 240V, single-phase, 10.8A, 3450 RPM
- Precision ground cast iron table measures 14⅞" x 10" x 7⅞"
- Max planing width: 7"
- Max planing height: 7½"
- Cuts per minute: 14,000
- 2 HSS knives

PATENT OWNED BY
**WOODSTOCK
INTERNATIONAL INC.**



W1812 Planer Moulder with Stand

10" TABLE SAWS with Riving Knife

- 3 HP, 220V, single-phase motor
- Cast iron table size:
27" x 40¼" (W1819) 53⅝" w/extension
(W1820) 74" w/extension)
- Max. rip capacity: (W1819) 29½",
(W1820) 50"
- Camlock fence with HDPE face



*Free 10"
Carbide-Tipped Blade*

W1819 10" Table Saw
W1820 10" Table Saw w/ Long Ext. Table

POCKET HOLE MACHINE

- ½"-1½" material thickness range
- Go from making face frames, casework, drawers etc. without stopping between operations.
- Two or more workers can share the same machine without interruption.
- Approx. weight: 56 lbs.

New

*U.S. Patent
No. 7,140,813*



W1833 Pocket Hole Machine

6" x 12" HEAVY-DUTY COMBINATION SANDER

- 1½ HP, 120V, single-phase, 10.5A, 1725 RPM
- Precision-ground cast iron tables (2)
- Sanding belt size: 6" x 48"
- Belt Speed: 1066 FPM
- Disc size: 12"
- Disc speed: 1725 RPM



*Made in an ISO 9001
factory*

W1712 Oscillating Benchtop Spindle Sander

OUTSTANDING SHOP FOX® DUST COLLECTORS

3 HP CYCLONE DUST COLLECTOR



- Motor: 3 HP, 220V, single-phase, TEFC Class F
- CFM: 1489
- Filter: 0.2-2 microns, Spun bond polyester
- 55 gal. steel collection drum with casters
- Intake: 8"
- Maximum static pressure: 10.2"
- Includes remote control
- Approx. weight: 396 lbs.



W1816 3HP Cyclone Dust Collector

WALL DUST COLLECTOR

- Motor: 1 HP, 110V/220V, single-phase
- Air suction capacity: 537 CFM
- Bag capacity: 2 cubic feet
- Standard bag filtration: 2.5 micron
- Static pressure: 7.2"



New

W1826 Wall Dust Collector

3-SPEED HANGING AIR FILTER

- Motor: ⅓ HP, 120V, 60Hz, 1A single-phase
- Air flow: 260, 362, and 409 CFM
- Outer filter: 5.0 micron
- Inner filter: 1.0 micron

New



INCLUDES TIMER
AND REMOTE!

W1830 Hanging Air Filter

WOODSTOCK® INTERNATIONAL, INC. IS ALSO HOME TO PRO-STICK®, 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

CARD #114 or go to PWFFREEINFO.COM



1-800-840-8420

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

JUNE 2014, VOL. 34, NO. 3
popularwoodworking.com
EDITORIAL OFFICES 513-531-2690

A Weekend Feast Of Woodworking

As I write this, we are chin-deep in finalizing plans for Woodworking in America (WIA), our annual conference on all things woodworking. To put it succinctly, WIA is a weekend of gorging on woodworking – it's simply the best one-stop opportunity for you to choose tools, learn how to use them and get better at the craft.

I hope you'll make plans to join us for WIA 2014, Sept. 12-14, in beautiful Winston-Salem, N.C.

This year – as always – we'll have scads of educational sessions to help you jump-start your shop skills with face-to-face instruction with some of the best woodworkers alive. You'll see and learn from many of your WIA favorites (Roy Underhill, Don Williams, Frank Klausz and Peter Galbert, to name just a few), plus we're excited to welcome some renowned woodworkers and teachers who are new to the conference, including Phil Lowe, Drew Langser, Patrick Edwards and Will Neptune.

Sessions will run the gamut of all things woodworking – from joinery methods (both hand and power) to marquetry, furniture design to finishing, orthographic drawing to carving. Plus, because we'll have several excellent chairmakers on hand, we're presenting a special roundtable talk dedicated to that challenging pursuit.

The unparalleled WIA marketplace will offer tools and personalized instruction from some of the world's best makers, from individuals who offer top-quality, individually designed tools to the best manufacturers of both hand and power tools. It's a unique setup that

allows you to try before you buy, compare tools from different makers and ask questions of the folks who know them from the inside out.

Many folks have asked, "Why Winston-Salem?" Beyond its being a lovely location, Winston-Salem is home to Old Salem and the Museum of Early Southern Decorative Arts (MESDA) – and

we're partnering with both for special behind-the-scenes tours. Conference attendees will get to see behind, inside and under the furniture that's on display at MESDA, as well as get a look at items most of the public doesn't get a chance to see – including several intriguing antique Moravian workbenches. Plus, his-

torians and makers from the museum and Old Salem will be included among our expert speakers.

By the time you're holding this issue in your hand, we'll have the entire schedule and descriptions of all the sessions on the conference web site (woodworkinginamerica.com). Plus, you'll find information there on travel and accommodations, conference pricing (which is better if you register early) and more.

So make plans to join us Sept. 12-14, 2104, in Winston-Salem, for a weekend of woodworking fun and camaraderie. Pick up some new skills, try out new tools, hang out with woodworking friends new and old, and learn from some of the best names in the business. I and the rest of the editors look forward to seeing you there. **PWM**

Megan Fitzpatrick



PHOTO BY CHRISTOPHER SCHWARZ

GROUP PUBLISHER ■ Jamie Markle
jamie.markle@fwmedia.com, x11452

PUBLISHER & GROUP EDITORIAL
DIRECTOR ■ Kevin Ireland
kevin.ireland@fwmedia.com, x11407

EDITOR ■ Megan Fitzpatrick
megan.fitzpatrick@fwmedia.com, x11348

SENIOR ART DIRECTOR ■ Daniel T. Pessell
daniel.pessell@fwmedia.com, x11396

EXECUTIVE EDITOR ■ Robert W. Lang
robert.lang@fwmedia.com, x11327

SENIOR EDITOR ■ Chuck Bender
chuck.bender@fwmedia.com, x11238

MANAGING EDITOR ■ Glen D. Huey
glen.huey@fwmedia.com, x11005

CONTRIBUTING EDITORS ■ Adam Cherubini,
Bob Flexner, Christopher Schwarz,
Steve Shanessy

PHOTOGRAPHER ■ Al Parrish

F+W MEDIA, INC.

CHAIRMAN & CEO ■ David Nussbaum

COO & CFO ■ James Ogle

PRESIDENT ■ Sara Domville

CHIEF DIGITAL OFFICER ■ Chad Phelps

VICE PRESIDENT, E-COMMERCE ■ Lucas Hilbert

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@fwmedia.com

NEWSSTAND

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

SUBSCRIPTION SERVICES:

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

NEWSSTAND DISTRIBUTION:

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

BACK ISSUES are available. Call 800-258-0929 for pricing or visit shopwoodworking.com. Send check or money order to: *Popular Woodworking Magazine* Back Issues, F+W Media Products, 700 E. State St., Iola, WI 54990. Please specify publication, month and year.

Copyright ©2014 by F+W Media Inc. All rights reserved. *Popular Woodworking Magazine* is a registered trademark of F+W Media.



Classic. Comfortable. Chair Kits.

100% Solid Wood

North American
Made

Semi-Assembled

Sturdy & Project
Ready



Request a Free Catalog

Swing into Spring

www.customlegs.com

1.866.963.5576

CARD #36 or go to PWFFREEINFO.COM



When these guys build your system, dust doesn't stand a chance.

Our craftsmen take their job just as seriously as you take your job. That's why we've never been beat in a head to head dust collector comparison... ever.

5hp Super
Gorilla



- ▶ HEPA filtration
- ▶ Built to last a lifetime.
- ▶ Ductwork design service.
- ▶ Complete line of ductwork and accessories.
- ▶ 1.5hp - 20hp Systems



Made in the USA

"Good service and the duct layout was fantastic! I'm very happy with my Gorilla system. It's a great addition to my shop!"

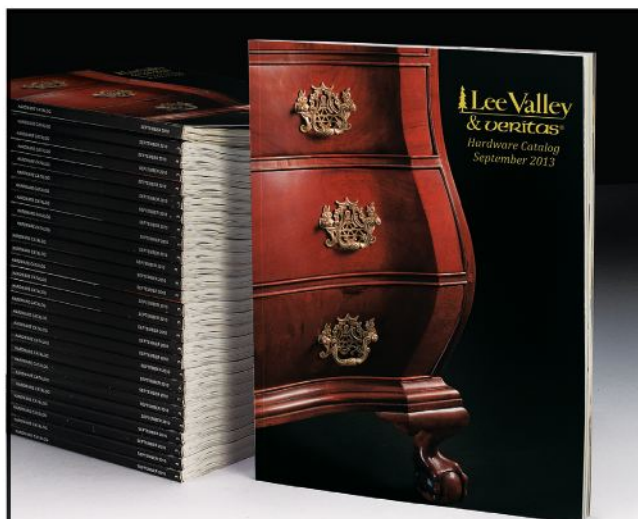
- Scott Enloe
www.scottsboatworks.com

Made By Craftsmen for Craftsmen.™

Call Today for **FREE** Catalog!
1.800.732.4065
www.oneida-air.com



Dust Collection Since 1993.



Our Annual Hardware Catalog is Now Available.

- Browse it online at www.leevalley.com
- Add it to your next order
- Download it to your iPad®



Available on the
App Store

1-800-683-8170 www.leevalley.com

Lee Valley & veritas®

CARD #28 or go to PWFFREEINFO.COM

CARD #35 or go to PWFFREEINFO.COM

Problems with Polyurethane

I'm using an HVLP sprayer and Minwax Fast-Drying Polyurethane on a project. I'm spraying product right out of the can, without additives or thinning, and I'm about 12" away from the project. Within seconds after spraying, the finish pimples up and dries as if sawdust was in the air when I sprayed.

Each time I've tried to spray, even with a fresh can of material, I have to use #220- or #320-grit sandpaper to knock off the grit and smooth the surface. If I brush on the finish, everything comes out fine.

The strange thing is that I've been using polyurethane this way for several years and my results were great.

What's wrong?

Jeff Thompson
Salinas, California

Jeff

I'm not sure I have the explanation. It's been years since I've sprayed polyurethane – I learned quickly not to do this because as the overspray settles, it sticks to everything, including me. I recommend using a pre-catalyzed lacquer instead. It's just as durable and dries quickly.

Because polyurethane dries very slowly, it's definitely not drying in the air before it hits the target.

To try and solve your problem, begin by thinning the polyurethane with mineral spirits

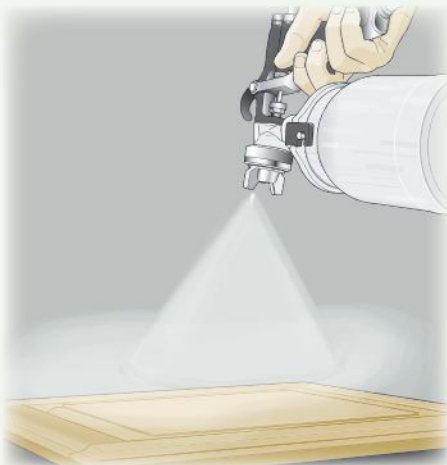
(paint thinner) to see if it helps overcome the problem.

I think that polyurethane is too thick straight out of the can. You want to apply a thoroughly wet coat, which you can see in reflected light. Maybe you're not wetting the surface enough.

Otherwise, what you have explained doesn't make sense to me. A wet coat of polyurethane thinned enough so it atomizes well out of the spray gun should level well.

If this problem has suddenly appeared, you need to identify what has changed. Is your spray gun clean? Is the spray pattern and the atomization, the same as it's always been? If these hold true, there's not much left to evaluate but the finish. Some companies are notorious for changing their products without telling anyone.

Bob Flexner, contributing editor



Not Another Mortise Option

I enjoyed Robert W. Lang's article "4 Ways to Make a Mortise" in the February 2014 issue (#209). That's a joint I use a lot when building furniture.

There is, however, a variation on one of the four mentioned methods that I find most useful. Because the dedicated mortiser is one more machine that takes up valuable real estate in your

shop, I use a mortising attachment for my drill press.

It's a bit of a fussy setup to get the fence and the chisel aligned just right, but if you have a lot of mortises to make, it's well worth the effort.

Rob Cairns
Nevada City, California

Rob,

I admire your patience in being able to get the drill press mortising attachment to work adequately. In my experience the fussy setup you mention isn't worth the time it takes.

The results are dependent on the power of the drill press motor and the amount of leverage you can achieve on the down stroke. You might be able to get it to work for 1/4" mortises, but then your drill press is tied up until the task is finished.

I deliberately didn't mention this attachment because I wouldn't want to encourage anyone to take this route.

Robert W. Lang, executive editor

Make Hide Glue Waterproof With Gelatin Hardener

In Don Williams' article on hammer veneering (December 2013, issue #208), the author makes mention of photographic gelatin hardener as a way to improve the glue's resistance to moisture.

I have great interest in any improvement on the hide glue veneering technique. What type of hardener does he use, and from what source?

Charles Miller
Fayetteville, Tennessee

Charles,

Incorporating gelatin hardener into your hide glue opens up a whole new world of possibilities. In the past, when film photography was dominant, the range of hardeners available was vast.

Now, with film-based photography nearly extinct, except perhaps as a hobby or art medium, I find the most easily available hardener is Heico NH-5, a concentrated liquid available from many photography suppliers and Internet merchants.

It is exceedingly important to experiment and practice with hardeners regard-

CONTINUED ON PAGE 12

Maximum Strength
Maximum Control



Get Control with the Strongest,
Stiffest Fret Saws on Earth
Available in
Titanium or Aluminum

www.knewconcepts.com

CARD #60 or go to PWFREEINFO.COM

WWW.RADARCARVE.NET

Wood Carving Duplicators

- Furniture
- Gunstocks
- Millwork
- Decoys
- Musical Instruments

Incredibly accurate



Thousands of Uses 505-948-0571

CARD #38 or go to PWFREEINFO.COM

THE NEW STANDARD IN DRUM SANDING

19-38 Drum Sander

Only the 19-38 has these
Exceptional SuperMax Features!

- ▶ Indexed alignment setting
- ▶ Easy height adjustments
- ▶ Extra-wide conveyor
- ▶ Drum will never go "out of alignment"
- ▶ More space for easy access to abrasive wrap

Only \$1,399 including open stand!

Check with your local dealer
or order direct.

SANDING CAPACITY

Sand 19" in a single pass, 38" in a double pass

Sand as thin as 1/32", as thick as 4",
as short as 2-1/4"

Variable Speed Conveyor 0-10 FPM

Drive Motor TEFC 1-3/4 HP

Power Requirements 110V 20 amp



Award Winning!



SuperMax
Tools

888.454.3401-SuperMaxTools.com

CARD #121 or go to PWFREEINFO.COM

Burn **SAFELY** with the Stainless Steel

Portable Burn-Cage™

Perfect For: Old Leaves and Branches
Sensitive Financial Documents
Burnable Household Waste



CLEANER MORE EFFICIENT FIRES. Perforated lid and sidewalls maximize airflow and trap burning embers. High burn temperatures mean thorough incineration with less residue and ash.

LIGHT-WEIGHT and portable.

PEACE OF MIND. It's the **SAFE** way to burn.



No more **UNSAFE** rusty barrel!

Burncage.com

CALL TODAY for **FREE** Information Kit,
Pricing and Factory Direct Coupon.

TOLL FREE **888-208-5839**



83225X © 2014

Self-Feeding

DR® CHIPPER

Just load a DR® RAPID-FEED™ CHIPPER, step back, and watch it chew up 5½" thick branches!

FREE SHIPPING
For a Limited Time



TRACTOR OWNERS
3-Point Hitch model too.

SELF-FEEDING saves time and energy. Most branches can be dropped into the hopper and will self-feed, instead of you having to force-feed them.

TOP-DISCHARGING is standard on all models, for easily collecting discharged chips in a container or cart.

PRO-SPEC™ CHIPPER KNIFE is made of forged alloy tool steel, making it exceptionally strong with an excellent edge-holding ability.

Try a DR® at Home for 6 Months!

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

TOLL FREE **888-208-5839**

DRchipper.com



83224X © 2014

ing adding them to hot hide glue – it reduces the pot life by 50 percent to 99 percent, depending on the concentration.

I find that 5 percent of the hardener to dry glue (by weight) is plenty if you are adding it directly to the glue. It does, however, reduce the working time to mere seconds.

For “sizing” the glue surfaces before glue application, the same 5 percent ratio, but of hardener to water, will yield a tough, almost completely waterproof and irreversible glue line.

Don Williams, contributor

Jointer Adjustments

I have a question regarding my 6" Delta jointer. When I run a board either on the edge or the face over the jointer, the wood chatters and cupping occurs at the end of the board.

I'm using two push blocks to apply light pressure to the board as I move it over the cutters, but the cupping on the end still occurs.

Do the jointer knives need to be adjusted? Am I not using the correct method to feed the board over the jointer knives? What do I need to do to get smooth, evenly jointed boards? Perhaps you can provide me with a few tips to get me up and running.

Harvey Hayden

North Conway, New Hampshire

Harvey,

If I understand your description, you're getting what we know as snipe on the last couple of inches of your board. In this case, the outfeed table of your jointer is set slightly below the apex of the knives.

As the board comes off the infeed table, it drops to make contact with the outfeed table; that causes the snipe.

To fix the problem, raise the outfeed table so it's aligned with the jointer knives at top dead center. It can be a fickle adjustment, so have patience.

If, however, you get a bowing cut over the entire length of your board, then you may have the outfeed table slightly above the knives as they cut. This is a common problem with power jointers because freshly sharpened knives are installed in

perfect alignment with the outfeed table, but as the sharp edge wears down, the knives eventually drop below the table. Again, the correction is to level the outfeed table with the apex cut of your jointer knives.

Glen D. Huey, managing editor

Goodbye Beeswax

In my home, a small cherry side table that I made several years ago gets a lot of use; the top could use a new coat of finish.

The table was originally finished with oil/varnish and Clapham's Beeswax Polish. I've added more polish a couple of times over the years. How can I remove the beeswax prior to re-finishing the top?

Craig Adams

Charlestown, New Hampshire

Craig,

One of the easiest ways to remove wax build-up from wood is to use naphtha or mineral spirits. It takes a good wiping or two, but you should get the surface clean and free of the unwanted wax.

If you plan to use a film finish to renew the tabletop, I'd suggest a coat of shellac to seal the wood to avoid any potential finish problems.

If you're going for a new oil/varnish finish, you should have smooth sailing after a naphtha or mineral-spirits wash. PWM

Glen D. Huey, managing 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 e-mail to popwood@fwmedia.com, or by mail to 8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236.



Highly Recommended

Titebond's No-Run, No-Drip wood glue is my choice when working with small parts, or when I need a fast-setting glue that stays put. It's perfect for edge banding around a door, adding stringing to any project or when making a small repair.

I use my finger to spread the adhesive (a brush also works), then a simple rub joint is all that's needed. The glue's strong initial tack holds pieces in position so well that clamps may not be required. Cleanup is easy; wipe with a damp cloth.

— Glen D. Huey

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 and 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 Paolillo at debbie.paolillo@fwmedia.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.
10151 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.

CUT IT. ENGRAVE IT. SELL IT.

The finishing touch starts here.

- Increase the value of all your woodworking projects with custom laser work.
- Engrave stunning photos, text and graphics with the touch of a button.
- Create custom projects with ease – jewelry boxes, humidors, cabinets and much more!



MADE IN USA
Systems Starting at \$7,995



To request a brochure, DVD, and samples, visit
epiloglaser.com/popwood or call 888-437-4564 today!



TOUGH Dries Natural Color, No Foam GLUE



Gorilla Wood Glue's premium formula creates a cross-linking bond to provide superior strength with a Type II water resistance, indoors and out.



**For the Toughest Jobs
on Planet Earth®**

www.gorillatough.com

©2014 The Gorilla Glue Company

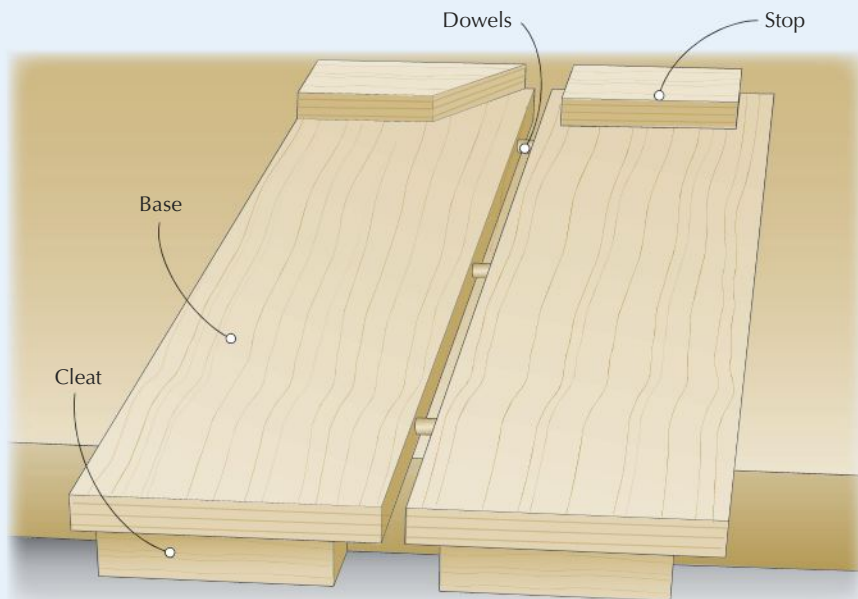
THE WINNER:

Split Bench Hook

A bench hook is an indispensable workholding device for cross-cutting. The traditional bench hook is made of a base, a stop or rest and a cleat. It is usually used against the apron or front edge of a workbench, or clamped in the vise.

To crosscut a long piece, I used to place a spacer that was the thickness of the bench hook at the other end of the stock. Frustrated with finding a scrap of the proper thickness and length all the time, I decided to cut my wide bench hook into two and use one half as the spacer. A split bench hook was born with little extra work.

To prevent either piece from getting lost in my shop, I keep the base and spacer together using dowels (Dominos would also work) set into to the edges of the two boards, but glued in to only one piece. The holes on each edge are about 1" deep while the dowels are 2½" long, leaving a ½" gap. The gap serves



two purposes: I can pull apart the two halves with ease, and I can hang the split bench hook onto a nail or hook.

Using the split bench hook is the same as using a traditional one-piece

design, but finding a spacer to support a long piece of stock will just take a split second.

Charles Mak,
Calgary, Alberta

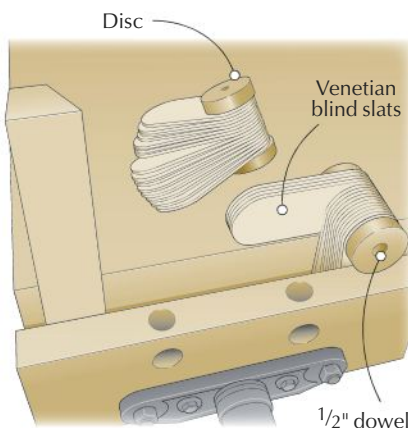
Venetian-blind Vise Spacer

Venetian blinds purchased from a home center come in a variety of standard sizes. They are cut to the correct width by the retailer, but to adjust the height you remove a number of the slats at home.

If you're like me, you hold on to these extra slats because "someday you will find a use for them." For me that day finally came; I used the extra slats to make spacers to keep my vise from racking.

Unless you are able to clamp a piece in the center of your vise, the jaws will rack, or skew, as you tighten them. This makes it difficult to firmly grip the workpiece in the vise and can damage the work or your vise.

You can always use a board of similar thickness to prevent racking, however, unless you have three hands it's



difficult to hold the workpiece and the board in place while tightening the vise. Invariably, the board or your workpiece (or both) slips loose and falls to the floor.

Commercial vise-rack stops are available, but making one out of extra

Venetian blind slats is pretty easy. Cut a number of 2"-wide x 1/8" thick-slats into 5" lengths. Round the edges using your band saw (it is best to tape them together and cut them all at once). Then, at one end, drill a 9/16" hole through the slats.

Using a 2" hole cutter, cut two discs and drill a 1/2" hole in each. Insert a 1/2" dowel through the hole in the slats and glue one of the discs to each end of the dowel.

To prevent the vise from racking, insert as many of the segments of the slats as needed to match the thickness of the workpiece being held in the vise. The discs prevent the vise-rack stop from falling through the jaws and onto the floor when you tighten or loosen the vise.

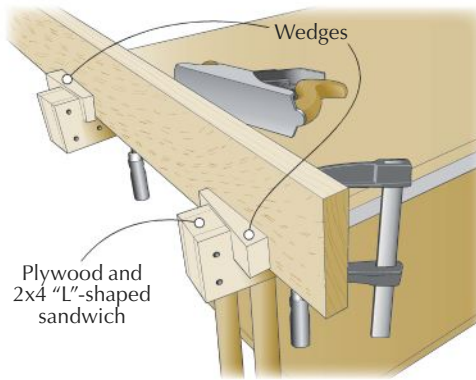
Peter Marcucci,
Woodbridge, Ontario

Wedge Edge Vise

I frequently need to clamp wood on edge to saw tenons or work the edge of a plank, but I don't have a traditional woodworking bench.

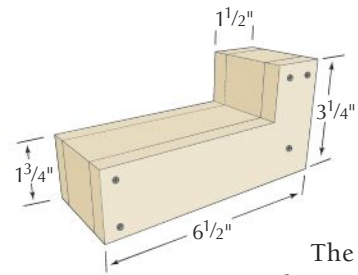
While studying at the Northwest School of Wooden Boat-building, I worked at a traditional planking bench where boards were clamped to the edge of the top. That inspired me to make my "wedge edge vise."

This simple shop-made vise clamps to a rolling cart or my assembly table. It can be adjusted to hold nearly any size piece of wood, but stores away easily and takes up little room. The vise consists of two plywood and 2x4 sandwiches that are glued and screwed together to form the jig. Each is cut out to form an



L-shape that is clamped to the tabletop. A wedge is then used to secure the board against the edge of the table.

I use $\frac{1}{2}$ " plywood and scraps of 2x4 that are $6\frac{1}{2}$ " long to make the jigs. Once they are glued and screwed together, I cut out the L shape. The plywood adds strength to the 2x4 core.



The wedges are also made from scraps; they are $\frac{3}{4}$ " thick x $1\frac{3}{4}$ " wide x 7" long, with a taper toward one end.

Put an edge on your work with this portable, versatile, adjustable vise that can be stored in your toolbox.

Erek Johnson,
North Hampton, New Hampshire

Taped Hinge Alignment

While installing piano hinges on a box lid, I came up with a good way to align the hinge to the lid.

Install the hinge on the box first. Place some shim material onto the box-side leaf so that, when the hinge is closed, it stays just proud of the hinge mortise. Close the hinge. Place a piece of double-sided tape on the lid-side leaf and press down firmly. Cut away and remove any tape that is not on the

lid-side leaf and remove the tape cover.

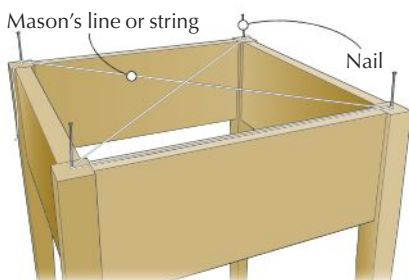
Place the lid onto the box and align it. Press firmly so the double-sided tape sticks to the lid. Gently open the lid.

If everything works correctly, the hinge will stick to the lid and everything will be perfectly aligned. Mark your holes, remove the tape from the hinge and lid, and complete the hinge mounting.

Jonathan Szczepanski,
Beltsville, Maryland

Flatten a Table With a String

When I'm building a table and know the legs are the same length, I might still get a wobble. What I do during



glue-up is run a mason's line from one corner to the other, then run the string across the other two corners.

In order to see if the table is flat the strings just need to touch where they cross. If they do not touch, or the bottom string is bowed toward the corners, the project is out of plane. Depending on whether the strings touch or not, you'll be able to figure out how to tweak the assembly to bring the assembled table base back into flat. **PWM**

Leonard Harrison,
Browns Mills, New Jersey

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

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 e-mail to popwoodtricks@fwmedia.com, or mail it to *Tricks of the Trade, Popular Woodworking Magazine*, 8469 Blue Ash Road, Suite 100, Cincinnati, OH 45236.



Nova Comet II Midi Lathe

The reversible motor turns this benchtop tool into a sterling machine.

Teknatool's new Nova Comet II wood lathe is feature-packed at a price that's hard to beat. Not only does it have variable speed, it has a reversible motor – not usually found on lathes of this size – that's tucked out of the way under the tail end of the lathe.

That might not sound like a major innovation, but many small lathes have the controls mounted on an arm off the back; the Nova's setup saves space and, because you don't have to stretch over the spinning work to reach the controls, it's safer.

I like the reversing switch because I think you can do a better job of sanding with the work spinning in the opposite direction.

An easy-to-adjust three-step pulley works in combination with the controller to vary speeds from 250 to 4,000 revolutions per minute.

The Nova has a $\frac{3}{4}$ -horsepower, direct-current motor, which gives you plenty of power, yet you can plug it into a standard wall outlet.

I tested the machine by spindle turning, because as a furniture maker, that's the operation I need most often. The machine handles a reported $16\frac{1}{2}$ " between centers (though I was able to fit $18\frac{1}{2}$ "), but an accessory bed extension takes that up to 42".

With its 12" swing (the largest diameter the machine can turn inboard), you can, of course, also turn bowls and platters on this lathe (for outboard turning,



Variable power. With a $\frac{3}{4}$ -horsepower direct-current motor, the Nova lathe also sports a reversible, variable-speed control that's tucked under the tail of the lathe for safe, easy access.

however, you'll want a bigger lathe).

For furniture makers, the 12-point index on the head is a plus; it's easy to adjust, accurate and locks the head firmly into position.

I found the Nova to be powerful enough for my needs, quiet and vibration-free; the 77-pound weight helps.

Right out of the box, this lathe is almost fully assembled. You only have to attach the hand wheel, the rubber feet (unless you're mounting it on a stand), the tailstock-adjustment handle and the tool rest. That's it. You'll be turning in a matter of minutes.

The tool rest, however, could be longer – but I have yet to meet a lathe on which this is not a common problem.

My primary complaint about this machine is that some of the edges

on the castings are rather sharp. Between and under the ways, and inside the headstock housing, could all use a little softening.

If you want accessories, this machine has them – everything from a grinding-wheel attachment, belt sander, disk sander and wire wheel, all of which mount outboard, to the previously mentioned bed extension. With the accessories added, you can get your tools sharp, turn a bowl and polish it, all without stepping away from the machine lathe.

The Nova Comet II is a full-featured turning package suitable for most home woodworkers – it's a compact and powerful midi lathe that won't break the budget.

— Chuck Bender

CONTINUED ON PAGE 18

Nova Lathe

Teknatool ■ teknatool.com or 866-748-3025

Street price ■ from \$500

■ **WEB SITE** Learn to turn with our new online wood turning show.

Price correct at time of publication.



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

Contact us to receive your
FREE 720 page

**Woodworker's
Supply**

**Big Book of
Woodworking
2014 catalog**



To order:

- Scan this QR code, or
- Go to woodworker.com/pw14 or
- Call 800-321-9841 (mention code pw14)

CARD #54 or go to PWFREEINFO.COM

Custom Branding Irons

Distinctive marking for your craft



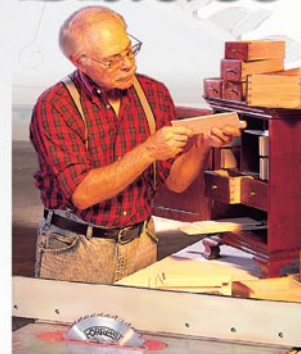
P: 586.484.7713 • www.branding-irons.biz

CARD #93 or go to PWFREEINFO.COM

Forrest Blades

Serious woodworkers count on American-made Forrest saw blades for smooth, quiet cuts, everytime...without splintering scratching or tearouts. No matter what your application, Forrest blades are simply the best money can buy. That's why discriminating craftsmen prefer them!

"[Your blades] cut true, with no vibration. I can say with confidence that Forrest blades are the best."
Carl Stude - Burbank, CA



Our Most Popular Saw Blades:

Woodworker II - This award-winning all-purpose blade is the finest of its type.

Chop Master - Produces perfect miters with smooth edges... and no bottom splinters.

Ask for Forrest blades at a fine dealer or retailer, order online,

or call the factory directly. Your satisfaction is guaranteed... or your money back!

FORREST
The First Choice of Serious
Woodworkers Since 1946

www.ForrestBlades.com
1-800-733-7111
(In NJ, call 973-473-5236)

Woodworker II
Fine Woodworking



Chop Master
Woodshop News



Duraline Hi-AT
Woodshop News



Dado King
Wood Magazine



CARD #13 or go to PWFREEINFO.COM

Code PW © 2014 Forrest Manufacturing

EDGE BANDING THE EASY WAY!

PORTABLE EDGE BANDERS



A TRADITION OF INNOVATION™



- For PVC, Veneer, Melamine and ABS applications
- For both straight or contoured panels
- Beveled edges from 90 ~ 75 °
- Automatic glue application without pre-adhesive needed
- Maximum width to 45mm
- Up to 25mm minimum inside radius.



AS SEEN ON
WOODCRAFT.COM,
HOMEDEPOT.COM
& AMAZON.COM!!

OPTIONAL ACCESSORIES



WWW.OLIVERMACHINERY.NET | INFO@OLIVERMACHINERY.NET | 800-559-5065

Visit new customer forum: www.olivermachinery.boards.net

[OLIVERMACHINERY](https://twitter.com/OLIVERMACHINERY)

[WWW.FACEBOOK.COM/OLIVERMACHINERY](https://www.facebook.com/OLIVERMACHINERY)

[WWW.YOUTUBE.COM/OLIVERMACHINERY](https://www.youtube.com/OLIVERMACHINERY)

CARD #94 or go to PWFREEINFO.COM

Blue Spruce Joiner's Mallets

For some woodworkers, building your own mallet is a rite of passage. After using dozens of student-made mallets, however, I wonder if many of us would be better off with a well-balanced, professionally made mallet. If you are a person who wants to buy a thing once and be done with it, you should look at the new rectangular joiner's mallets from Blue Spruce Toolworks.

Unlike other mallets, these are designed to last a lifetime thanks to the resin-infused heads, which are nearly indestructible. I've used a Blue Spruce resin-infused round mallet for years as

my primary striking tool, and it hardly has a mark on it. The company's new rectangular mallets are built with the same material and are holding up nicely after a few months of use in my shop.

The striking surfaces of each mallet's maple head are properly angled so you hit tools and your work with the full face. One of the two faces is covered in thick leather, which allows you to use the mallet to knock assemblies apart without denting your wood. The leather has survived surprisingly well.

The resin-infused heads add a little weight to the tools, but both sizes of mallets (16 oz. and 24 oz.) are balanced because the heads are compact. And like all Blue Spruce tools, the fit and finish is somewhere north of outstanding. The small mallet is good for light



chopping, such as removing dovetail waste and chopping out hinge mortises. The big boy is good for mortising and knocking things together and apart.

These might be the most expensive wooden mallets on the market, but a Blue Spruce mallet is likely the last one you'll ever have to buy.

— Christopher Schwarz

Blue Spruce Joiner's Mallets

Blue Spruce ■ bluesprucetoolworks.com
or 503-668-8665

Street price ■ from \$95 to \$115

■ **BLOG** Discover the maker's round mallet.

Prices correct at time of publication.

Grobet Cabinetmaker's Rasps

A good quality machine-cut rasp or two should be in every serious woodworker's tool box. Rasps come into play when a small amount of material needs to be removed, either on a flat or curved surface. It wasn't that long ago that you could walk into your local hardware store and ask for a Nicholson #49 and #50 and walk out with tools that would do the job, and last the rest of your life.

Nicholson still produces tools that bear those numbers, but when home centers moved in, production moved overseas and quality was lost in the transition. Hand-cut rasps became bet-

ter known, but they come at a higher price.

Swiss file manufacturer Grobet has long been an alternative to Nicholson, and Lee Valley now carries two versions of Grobet half-round rasps. These are comparable to early Nicholson's, and fill the gap between bargain-basement rasps and hand-cut tools.

There are two cuts available; Lee Valley calls them "medium" and "fine" instead of the earlier terms "bastard" and "second cut."

There isn't a tremendous amount of difference between the two, and if you are new to rasps, get just one and see how you like it. These are tools for intermediate work; they will remove band saw marks in a hurry, but the surface will still need to be further refined with a scraper or sandpaper. If you need to tweak the fit of a tenon or other joint,



a good rasp will get you there.

The teeth in these tools are machine cut in rows, and the rows are offset so as not to cut deep furrows. They are sharp, uniform and offer a nice balance between rapid material removal and surface quality. The Grobets aren't quite as nice as hand-cut rasps, but they do the job and should last a long time. **PWM**

— Robert W. Lang

Grobet Rasps

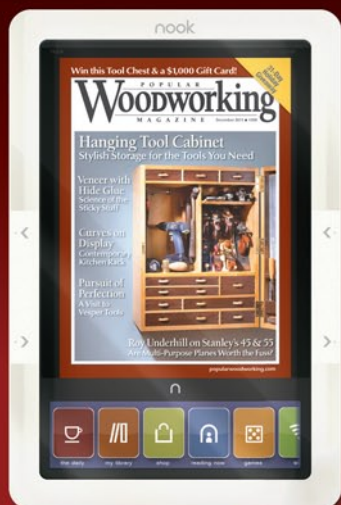
Lee Valley ■ leevalley.com or
800-871-8158

Street price ■ from \$64 to \$72

■ **BLOG** Read about refining curves with rasps and a card scraper.

Prices correct at time of publication.

NOW AVAILABLE!



nook
by Barnes & Noble



TAPERED CARCASS SAW

**Lie-Nielsen
TOOLWORKS[®]
INC.**

1-800-327-2520
www.lie-nielsen.com
Made in Warren, Maine

CARD #29 or go to PWFREEINFO.COM

STEVE WALL LUMBER CO.

Quality Hardwoods and Woodworking machinery For The Craftsman
and Educational Institutions

Ash	4/4	Select	\$ 2.60	.....	\$ 94.00
Basswood	4/4	Select	\$ 1.95	.....	\$ 80.00
Birch	4/4	Select	\$ 3.55	.....	\$ 108.00
Butternut	4/4	1C	\$ 2.95	.....	\$ 88.00
Cherry	4/4	Select	\$ 4.90	.....	\$ 117.00
Hickory - Pecan	4/4	Select	\$ 3.00	.....	\$ 100.00
Mahogany (Genuine)	4/4	Select	\$ 4.70	.....	\$ 112.00
Maple (Hard)	4/4	Select	\$ 3.45	.....	\$ 108.00
Maple (Soft)	4/4	Select	\$ 2.50	.....	\$ 88.00
Poplar	4/4	Select	\$ 1.80	.....	\$ 78.00
Red Oak	4/4	Select	\$ 2.70	.....	\$ 96.00
Walnut	4/4	Select	\$ 4.90	.....	\$ 115.00
White Oak	4/4	Select	\$ 2.70	.....	\$ 96.00
Cedar (Aromatic Red)	4/4	1C+Btr.	\$ 1.80	.....	\$ 78.00
Cypress	4/4	Select	\$ 2.60	.....	\$ 90.00
White Pine	4/4	F.G.	\$ 1.25	.....	\$ 70.00
Yellow Pine	4/4	Clear	\$ 2.30	.....	\$ 82.00

**UPS
Specials**

**SEE OUR
CATALOG ON
THE WEB!**

Above prices are for 100' quantities of kilndried rough lumber sold by the Bd. Ft. FOB Mayodan, NC. Call for quantity discounts. Other sizes and grades available. Above prices are 20 bd. ft. bundles of clear kilndriedlumber 3"-10" wide • 3'-5' long (Random widths & lengths) Surfaced 2 sides or rough. Delivered UPS prepaid in the Continental U.S.

OLIVER MACHINERY DEALER

HARDWOOD PLYWOOD

CUSTOM RAISED PANEL DOORS

CUSTOM PLANK HRDWD FLOORING

THIN CRAFTWOOD

EXOTIC LUMBER

**STEVE H. WALL
LUMBER CO.**

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

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

CARD #47 or go to PWFREEINFO.COM

World's FIRST Trimmer for Riding Mowers!

NEW FOR 2014!

The **DR® TOW-BEHIND TRIMMER/MOWER** is the perfect time- and back-saving solution for anyone who mows with a riding mower, then spends just as long (or longer!) going around their property a second time on foot to do the trimming.

**FREE
SHIPPING!**
FOR A LIMITED TIME.



Tightly trims around fence posts, trees, and other obstacles with spring-loaded action!

**TRIM FASTER,
MOW WIDER!**



TRIMS PRECISELY by automatically deflecting around obstacles!

MOWS WIDER by extending the reach of your riding mower, saving you time.

5X FASTER and more powerful than any handheld trimmer!

HEAVY-DUTY DR® TRIMMER CORD (green and blue) out-trims and out-lasts ordinary trimmer line.

Call for a FREE DVD and Catalog!
Includes models, product specifications, and special factory-direct offers.

TOLL FREE **888-208-5839**

**Try a DR®
at Home for
6 Months!**

Call for details.



DRtrimmer.com/tow

83223X © 2014

The Rule of Three

Grind, hone, polish: the basics of all sharpening.

Among the fundamental skills necessary for good woodworking, I'd put knowing how to sharpen your edge tools at the top of the list. Even if you consider yourself a power-tool woodworker, I'll bet you have at least a chisel (or two) and a block plane in your kit that need sharpening from time to time.

There are many different ways to sharpen: waterstones, sandpaper, mechanical solutions, oilstones and more. Now I'm not about to stick my head in the lion's jaw and recommend one system over another (and I'm certainly not going to tell you whether or not to use a jig).

I will tell you that I use traditional waterstones, and that when my pocket-book allows, I will buy a set of Shapton Pros (waterstones that don't require soaking). And I'll tell you that the reason I use waterstones instead of other systems is because I have waterstones – and they're what I learned on.

That final statement is the key point: I started using one system and stuck with it. Do that, and not only will your sharpening technique improve, your wallet will thank you.

No matter what media you use to sharpen, there are but three operations: grind, hone, polish. (And most of the time, you can skip the first one.)

Grind

Grinding is done with a rough grit: #40 or #80 grit on a power grinder, #40-grit sandpaper on glass, a coarse diamond stone, a hand-cranked grinder, an #80-grit waterstone.

But you don't grind every time you sharpen – do this only when you need to fix a damaged edge, shrink a secondary bevel that's become too large, or change the shape of an edge (for example, add-



Awash in options. The choice of sharpening media is legion. The key is to choose from one system a grinding, honing and polishing item (maybe two polishers) – and stick with them.

Grind. All of these are used for grinding. The #300-grit diamond stone is considered coarse; the sandpaper on the platen for a powered machine is #80 grit; the hand-cranked grinder is equipped with a #60-grit wheel.





Hone. From front to back are pictured a #1,000-grit diamond stone, a soft Arkansas oilstone, a #1,000-grit no-soak waterstone and a #1,000-grit Japanese waterstone.



Polish. Here's where things get crazy; polishing media goes to great heights on the grit scale. Pictured front to back are a #16,000-grit Japanese waterstone, a hard Arkansas oilstone, green stropping compound and an #8,000-grit no-soak waterstone (that a student gouged).

ing an 8"-radius camber to a new jack plane blade).

Hone

Unless you let your tools go for too long between sharpenings – or you damage a blade – honing is where you'll start sharpening nine times out of 10.

Honing simply erases the existing dull edge and cuts a new one.

Just run the blade on the rock until you turn a burr on the backside. That burr means you've created is a zero-radius intersection of two points – also known as a sharp edge. In fact, that's as sharp as you can get it.

For this operation, think soft Arkansas (sometimes called Washita), #200-grit sandpaper, or #800-#1,200 in the waterstone system.

And when it comes to honing media, you need only one waterstone/oilstone/sandpaper grit/sanding disk.

Polish

Everything above honing – from a #4,000-grit waterstone to the miniscule particles in a honing compound to a workaday hard or translucent Arkansas stone to a #30,000-grit Japanese waterstone – is polishing.

No matter how high you go, all you're doing is progressing up the scale to a higher polish on the blade – that is, with each higher subsequent grit, you're erasing the scratches from the previous grit (and creating new, tinier scratches).

This doesn't make the blade any sharper – you (ideally) achieved a zero-radius while honing. But polishing does make your newly sharp tool a lot more durable. Smaller and shallower scratches mean a less friable edge.

The polish level is completely up to you.

What I Do (Not That You Care)

I'm in the perhaps enviable situation of getting to try out many different types of sharpening systems and many makers within each; I put through the paces everything that comes into the shop to give it proper consideration. But in the end, I come back to what I first learned – and bought – for sharpening edge tools: waterstones (that I flatten with a diamond stone after every use).

And I typically prefer using my tools to using my waterstones. So when I need to grind, I do it on my diamond flattening stone. I hone on a #1,000-

grit stone, then polish on a #4,000-grit stone; I remove the burr on the backside with the #4,000-grit stone after polishing. (Unless I'm in the rare mood for super-shiny; then I'll go up to #8,000 grit or strop with green compound, which are equivalent.)

And while I can certainly sharpen freehand, I typically use an Eclipse-style honing guide – I appreciate the mindless repeatability. Sue me. **PWM**

Megan is the editor of this magazine. She can be reached at megan.fitzpatrick@fwmedia.com or 513-531-2690 x11348.

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

BLOG: Compare grits on sharpening media.

IN OUR STORE: Learn how to sharpen – and the whys behind the hows, from "The Perfect Edge," by Ron Hock.

About This Column

Woodworking ESSENTIALS

Woodworking Essentials takes a close look at the tools, materials and processes of woodworking.

Our products are available online at:

■ ShopWoodworking.com



‘Rivet’ Your Furniture

BY CHRISTOPHER SCHWARZ

This strong and simple – but uncommon – joint imparts a decorative touch.



A 'rivet.' This piece of early campaign hardware is held in with screws that then had their heads filed off flush to the pull. This feature shows up on other pieces and even on English handplanes.

The dealer, who had imported campaign furniture from the Indies for decades, told me that some collectors referred to that joint as a "rivet." He explained that the rivet was nothing more than a brass screw that had been driven in so its head was still proud. Then the screw head was filed flush to the carcass, eliminating the slot.

It's a surprisingly simple and (I think) attractive way to make a strong joint that looks a lot better than having 12 wooden screw plugs lined up on each corner.

This approach shows up in other applications in the woodworking field. Sometimes, screw heads are filed flush with a piece of hardware. And if you've ever seen an infill handplane, you know it is common for the maker to screw in both the wooden infills and the lever cap inside the shell then file off the heads – making for a clean sidewall of the tool.

After attempting the joint on several pieces of scrap, I decided to use it on a campaign-style trunk that features a lot of brass hardware. Making the "rivets" didn't require any new tools – just a simple jig made from two scraps of wood.

Here's how I did it.

Screw it Up

This officer's trunk is made with simple joints: The ends are captured in rabbets in the front and back of the case. The bottom is captured in a groove. The lid is made like the carcass below it, though the top of the lid is merely nailed on.

The carcass of the trunk is 15" x 15" x 26" and it sits on top of mitered bracket feet that are each 2" wide x 3" long. Many of these trunks started life with four simple sledge feet, which are square blocks of wood at each corner. Bracket feet were sometimes added to the trunk later on, perhaps when the military officer returned home or the chest passed into someone else's hands.

Many of the trunks were lined with zinc, cedar or camphor wood to protect the contents from water or bugs. The inside also typically had a till, similar to what you would find on a blanket chest, for holding small objects. Some trunks were fully fitted out with trays and cubbyholes for brandy glasses.

The exteriors of these trunks were made in pine, oak, camphor or other species. The expensive trunks had flush



Screw details. The most important detail here is the diameter of the screw's head right where the slot bottoms out. That will be the diameter of your finished "rivet" and is the maximum diameter of your countersink. With these screws, that diameter is .325".

After 20 years of making furniture, it's not every day that you stumble on a joint you've never seen before. But that's exactly what happened several years ago when I encountered a floor chest from the West Indies in a Charleston, S.C., antiques store.

The chest had a series of brass circles that ran in a line up each corner of the chest. At first it looked like brass inlay, which is a common feature of some Anglo-Indian campaign furniture pieces I've encountered in my research.

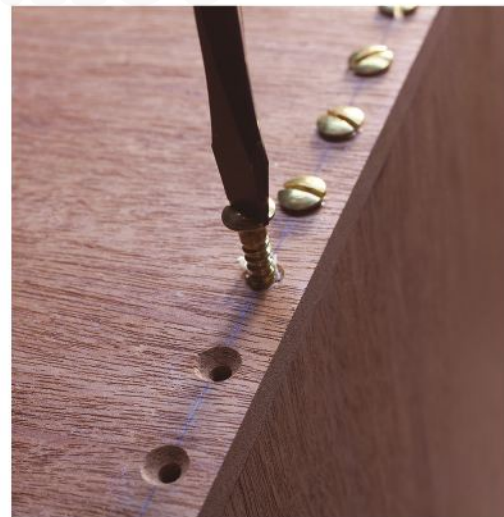
Instead of decoration, however, the brass circles turned out to be the joinery.



Walk it off. On the chests I examined, the spacing between each screw was greater than the diameter of one screw. So don't space them too tightly if you want a traditional look.



Tiny countersinks. Set the stop on your bit so it makes just a shade of a countersink. This allows the screw to compress the wood a bit and leave a seamless joint.



And screw. Drive the #10 screws in so the bottom of the slot is coplanar to the carcass. This results in the least amount of brass to remove.

brass hardware, such as the example shown here. Less expensive trunks, or those made by joiners overseas, had thin hardware that was merely nailed to the corners. So really, almost anything goes when you design a trunk such as this.

After a few experiments with test joints, I added the screws after the entire case was assembled and the glue had cured so that I didn't have to deal

"Every nail driven should be as another rivet in the machine of the universe."

—Henry David Thoreau (1817-1862),
from the conclusion of "Walden"

Filing jig. An offcut of poplar and some double-sided tape makes the basic jig. Add a fence to the jig to make it a can't-miss affair.



with driving the screws while the pieces of the trunk could still slide around on me.

For the screws, I used #10 x 1¹/₄" oval-head brass screws. While other types of screw heads will work, these screws had the particular diameter I was looking for at the base of the screw slot.

The first step is layout. Take care because small differences in screw spacing are obvious. First strike a pencil line where your screws will go. Then get your dividers and the screws you plan to use.

Decide on the spacing for the screws. After looking at several Anglo-Indian chests, I decided to measure the di-

ameter of the head of the screw, then space the screws so there would be an expanse of wood equal to 1¹/₂ head diameters between each finished rivet.

Confused? Step it off with dividers and line up some screws on your chest (start at the back of the chest where mistakes aren't as obvious) to find the right spacing. In the end, I set my dividers to 1¹/₁₆" and walked down the chest to leave 13 holes on each corner of the carcass (with two more on the lid).

With the holes pricked on all four corners, you can drill the pilot holes and just a shade of a countersink. I used a bit that drilled the pilot and countersink in one operation—and it had a stop so it made the same countersink every time. This is quite handy.

You want the diameter of the countersink to be a wee bit smaller than the diameter of your screw head where the slot terminates. This results in a gap-free fit between the brass and wood. A too-big countersink looks terrible—either part of the screw's slot will remain or you'll have a gap around the brass.

Before you start drilling, make a couple test holes in some scrap.

Then drive the screws. Use a little lubricant—I use paraffin or beeswax—and sink the screws in so the bottom of the slot is coplanar to the surface of the carcass. Do not allow the bottom of the slot to go below the surface. That's bad.



Push or pull. By orienting the file one way or the other, you can use the jig in pushing or pulling position. Both work.



Slow & steady. After 10 minutes of filing, you will reach the bottom of the slots. Then you have to clean up your work deliberately in order to avoid gouging the surrounding wood.

Filing the Screw Heads

Leveling the brass screw heads is more tedious than it is difficult. I tried a variety of ways to speed up the process: a metal-cutting blade in a Fein Multi-Master, a hacksaw and various files.

Those solutions worked. Kinda. But the Multi-Master scored the wood unacceptably, as did the hacksaw.

The best solution I found was to use a file – either a laminate file or a multi-cut file used for auto-body work. And instead of using it freehand, I did most of the work with the file in a jig that prevented an errant stroke from decimating my mahogany.

The jig is simple. It's a chunk of wood that I cut a rabbet into. The rabbet is the width of the file. The depth of the rabbet is the thickness of the file plus some double-sided tape. Then I glued a fence to the block to keep the jig at 90°.

To file the screw heads, clamp the trunk's carcass to your bench then push the filing jig across the screw heads. It took me about 30 minutes per corner to file the screws, so take your time and don't try to rush the job.

Every few minutes, clean the file (rubbing chalk across its teeth helps keep it clean). And vacuum up the brass filings from the work.

When you reach the bottom of the screws' slots, you can switch to some power sanding to help move things along. I used #120-grit sandpaper in an orbital sander to remove a little brass and wood. The sander will remove more wood than brass, leaving the brass bits a bit higher – like a mosquito bite.

Use a fine file to dress down the bumps until the surface feels smooth. Sand a little more then file a little more if necessary. The last step should be filing away the last little bit of brass bumpiness with a fine file and gentle stokes.

And that's all there is to it. Finish the piece as you normally do. And when your woodworking friends ask you, "How did you do that?" don't screw it up and spill the beans. Tell them, "It's a secret joint from the West Indies." PWM

A little abrasive action. When you reach the screw slot, you can move things along a little faster with a random-orbit sander and some #120-grit sandpaper.



Final filing. The sander will eat away more wood than brass. So level the tops of the screws with a file with a few finishing strokes.

Christopher is the editor at Lost Art Press. This trunk is from his book "Campaign Furniture" (Lost Art Press).

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

BLOG: Read more about building campaign furniture.

BLOG: The author has reviewed lots of campaign hardware; take a look.

WEB SITE: Visit the leading dealer of campaign furniture.

IN OUR STORE: "Build a Rookhee Chair" – a classic piece of campaign seating (and an excellent compact travel chair).

Our products are available online at:

■ ShopWoodworking.com

Contemporary Cabriole Legs

BY JEFF MILLER

A new approach
to a traditional
design element.

Early on in my career, I built a number of tables with different types of cabriole legs. These ranged from period-inspired pieces to designs a little farther afield. But as I began creating my own designs, I wasn't entirely satisfied with what cabriole legs offered. I liked much about the legs – the organic character and the refined subtlety of the curves – but I wanted design elements that didn't have all of the obvious historical connotations

of the cabriole. In other words, I was looking to create a modern translation of some of the ideas behind the cabriole leg.

I had seen plenty of modern interpretations, but none of them really captured what I was looking for. I realized that this was because there was often an element of the design that was missing: the connection between the aprons and the legs. On a traditional leg, these are typically in the form of

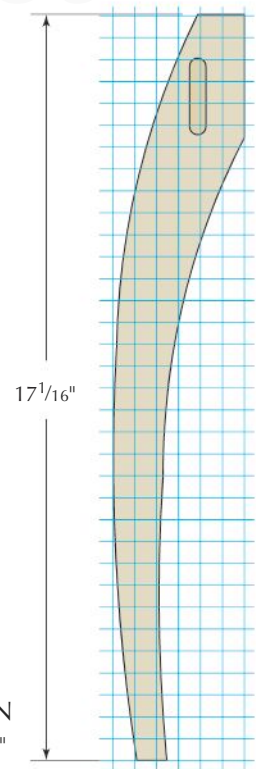




In order. Decide on a location for each of the rift-sawn legs and mark them with a triangle.



Inside job. The inner corner is the reference point on which to align the pattern and from which to locate the mortises.



knee blocks. They are important to integrating the apron and the leg, and I wanted to incorporate a version of this into my legs.

It took a few iterations to come up with something that I really liked. I finally settled on a simple leg that grows very naturally out of the apron. Part of the way that works is that the aprons have two facets; the upper one is more or less contiguous with the top of the leg. On the lower, visually recessed facet, filler pieces (a form of knee block) create the transition of the leg up to the upper part of the apron.

Patterns for the Legs

The curves are a crucial part of these legs. Whenever I work with curved parts, I develop patterns in $\frac{1}{8}$ " or $\frac{1}{4}$ " plywood (or in clear Plexiglas, when I need to see and work with the wood grain). The patterns allow me to easily refine the curves to perfection. When the time comes to lay out the curves on the wood blanks, I've got perfect lines to cut to, and a better shot at identical parts. Mark out your pattern, cut it out, then get to work refining the curves.

The ideal wood for the $3\frac{1}{4}$ "-square leg blanks has rift grain (growth rings running from corner to corner). You'll get more consistent grain patterns on all four legs this way, and grain-matching the transition blocks will also be a little easier. You'll have to find thick stock for this project; gluing up the blanks gives you unsightly glue lines.

Mark out the leg shapes on the inside



Stop short. Cut close to the end of the leg, turn off the saw, then back out of the cut. This holds the pattern in place for the next cut.



Cut, turn, cut. After making the mortises, the pattern is cut on two adjacent faces of the leg blank.

faces of the legs with the straight part of the leg sharing the inside corner. If you haven't done much of this type of work before, it helps to lay out a spare leg or two so you can practice the cutting and smoothing process without worrying about things going wrong on your first or second attempt. By leg number five, you should feel like a pro.

Next, you'll want to lay out and cut all of the mortises. I used a $\frac{3}{8}$ " x $1\frac{3}{4}$ " mortise, located $\frac{7}{8}$ " from the inside of the leg, and from 1" to $2\frac{3}{4}$ " down from the top of the leg. The adjacent mortises should not quite touch, so

they'll wind up a little less than $\frac{7}{8}$ " deep. I cut these mortises with a plunge router and fence (the leg blanks are wide enough to provide good support for the router), but use your choice of mortising methods.

Now you can cut out the shapes of the legs. To start this process, I make not-quite-complete cuts on one side of a leg; I band saw all but the last $\frac{1}{8}$ " at the bottom of the legs, then shut off the saw and back out of the cut. That little bit is enough to hold the offcuts in place as I flip the leg 90° to cut from the adjacent side. If you forget to stop,

or the blanks falls apart, you can tape the parts back together, then proceed with the second set of cuts.

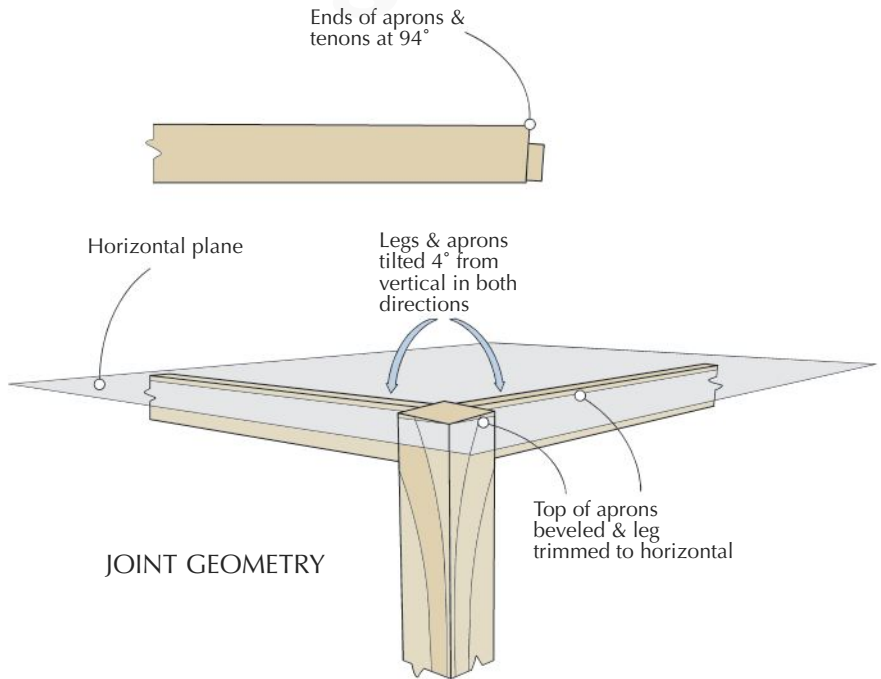
Either way, these next cuts can be made all the way down the leg. When you're done, pop off the waste and see your shaped leg emerge from the block. Save all of the offcuts – we'll use them twice before the end of the project – and mark them so you can figure out just which ones match each leg; you'll get the best grain match for your transition blocks from the matching material.

Angled Tenons

Now you can mill your rail stock and lay out the tenons. The location of the tenon will determine exactly how the rail meets with the leg, and you want the curve of the leg to cross the surface of the apron about half-way up. I hold the rail up to a leg and move the rail back and forth until it is in the right position, then transfer the mortise location to the end of the rail to locate the tenon.

You'll also need to angle the shoulders and ends of the tenons roughly 4° off of square, leaving the tops of the rails longer than the bottoms. This angle is necessary to position the legs more gracefully on the table. I made up a 14³/₈"-long wedge that tapers from 1/2" to 1 1/2" and didn't bother with a protractor.

Start by cutting the 4° bevel on the ends of the rails. Use the wedge along with the miter gauge or crosscut sled on



your table saw. Using the wedge makes layout easier, even if you're planning to cut the tenons by hand.

It's not hard to set up the table saw to do this kind of work. For the cheeks, simply use the wedge to tilt the rail forward in your tenoning jig and cut as usual. The shoulders are a more interesting challenge. It's hard to set up to cut the shoulders so they line up perfectly. But a dead-simple jig and a cool technique for the table saw can make quick work of the job. The key is to use an L-shaped auxiliary fence

on the table saw that allows you to cut away the waste safely.

Set the height of the L-shaped fence so that the end of the tenon registers against the fence, but high enough that the waste piece will be cut free. Use the wedge with the miter guide to help support the rail as you cut. Keep the end of the tenon tight against the fence. This involves using a rip fence and miter guide together, but this setup allows you to make the cut and not leave the waste piece trapped between the fence and the spinning blade.



Wise wedge. A simple wedge behind the angled aprons allows the cheek cuts to be made with this tenon jig.



Fence & wedge. The auxiliary fence prevents offcuts from being trapped between the blade and fence. The wedge is used to quickly set the proper angle.

FAIR CURVES

You want your curves to be smooth and fair. Smooth is fairly obvious – no lumps or bumps. Fair means that there are no sudden changes to the curve and that your eye can follow along with no disturbances. It's like driving on a winding road that sets up perfectly for the driving experience; there are no straight sections or sudden changes in the road where you have to suddenly pull the wheel.

I smooth my curves with a block plane for the convex curves and a spokeshave (flat or curved sole, depending on the level of curvature) for the concave. I find that I get great results very quickly. The technique may take a little practice to get the hang of, but it's an incredibly useful skill to have in your repertoire; it's worth the little bit of time invested to master it.

I keep a separate “plywood” plane for doing this work on plywood patterns (an old \$5 flea market Stanley that is nonetheless a good block plane), but the need to re-sharpen the blade on a better tool shouldn't keep you from trying this. You can also rasp, file or sand (with straight and curved sanding blocks) if you choose. —JM



Save the scrap. The waste from cutting the legs is used for support while cleaning up the concave inner surface.



Low dogs. The outer convex curves are easier to hold, but keep the dogs out of the path of the block plane.

Cutting the angled shoulders is also a perfect task for the tenoning frame and armchair maker's saw I wrote about in the February 2014 issue of *Popular Woodworking Magazine* (#209). Just lay out the tenons, use your wedge to set up the rail in the tenoning frame then saw the shoulders all around with the armchair maker's saw. You can even leave the rail in the tenoning frame to saw the cheeks.

Fit each of the joints and label the legs and corresponding joints on the rails so you can put things back together correctly.

Smooth the Legs

Smoothing the legs poses a couple of challenges; holding the legs securely for work, and then actually smoothing out the curves. Use the offcuts to help hold the legs concave-side up on your bench between bench dogs. On the convex side you won't have to worry

about using the offcuts, but be sure to keep the dogs low enough that you don't run your plane into them. You'll probably wind up adjusting the convex side a little bit after assembly to match up with the aprons, but you should strive to have the concave curve meet the flat spot exactly as laid out.

You'll need to pay careful attention to grain direction and be sure to plane “downhill.” In the areas where the grain direction changes, you will almost certainly need to follow up with scrapers; it's all too easy to get tear-out as you go beyond the fairly sudden change point. A curved sanding block (try a section of the offcuts) also helps.

Faceted Aprons

Dry-assemble the table, then mark out the profile of the upper legs on the shoulders of the aprons. Depending on your accuracy in cutting and shaping the legs, these may not be exactly the

same from one side to the next. You can adjust either the leg or the bevel to correct the problem.

You should also bevel the top of the aprons at this time, removing material



Right angle. The end of the apron falls in the middle of the curve. Fit the apron in the leg and mark to bevel the top of the apron.



Offcuts again. The waste from cutting the legs provides a flat surface that keeps the clamps from slipping as they are tightened.

toward the inside of the aprons and just touching the top outside corner. This will be roughly 4° out of the plane of the top of the table, due to the tilted tenon shoulders. You'll still need to flush off the very tops of the legs, but don't do that now; it's easier once the table base is fully assembled.

Cut grooves for the table buttons that attach the top in two opposite

aprons. These grooves should be 1/4" wide, 1/4" deep and angled at 4° so that they are parallel to the top of the aprons. Smooth the aprons in preparation for assembly.

It's not immediately obvious how you can clamp the table together. The solution is to use the leg offcuts. A piece of leather or cork added between the offcut and the leg protects the smoothed surface of the leg. Simply clamp this "caul" in place about halfway up the leg, and you've got a good place to clamp.

It's much easier to glue up in stages. Start with opposite pairs of legs and their aprons (check to make sure you have everything located properly based

on your marks). Spread glue in the mortises and very lightly on the tenons, then clamp each assembly. When the glue is dry on the two sides, you can glue together the full table. If you want, you can add the transition blocks (see below) to the sub-assemblies before gluing up the whole table, finishing up the remaining blocks when the table is fully assembled. You can also wait until the table is together.

Elegant Transition

The hardest part of preparing and gluing on the transition blocks is keeping track of what goes where. In order to keep the grain match as close as possible, you want to use the offcut from the face of the leg for its transition block. The goal is to shift that piece over while maintaining the grain orientation.

This requires a few steps and a systematic approach. I find it best to work on one transition block at a time, and to mark out carefully for orientation, because the parts are both small and easily confused.

Start by finding the appropriate offcut for the side of the leg you're working on. Rip the piece parallel to the flat face on the band saw (the table saw is too dangerous for this cut), making it about 1/16" thicker than the distance from the apron to the thick part of the leg. Handplane the just-cut face flat. You have to rip this piece to about 1 3/8" wide, but this is also too dangerous to do as a rip cut on the table saw. Instead,

"We construct and construct, yet intuition is still a good thing."

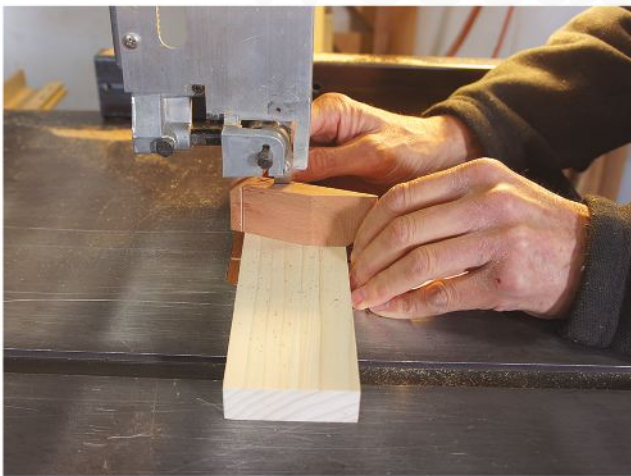
—Paul Klee (1879-1940),
painter



Straighten out. The first step in making the transition blocks is to create a straight edge that butts against the flat surface of the leg.



Direct line. With the knee block in position, mark the curved edge where the block meets the leg.



Safe & sound. A larger block beneath the transition piece makes it easier to control and keeps hands at a safe distance from the blade.



Follow along. The curve of the leg continues into the transition block. A cardboard pattern ensures consistency.

set up a hold-down clamp on a crosscut sled, and use this to safely hold the piece as you cut.

Hold this part up to the apron and tight to the leg then trace out the profile of the leg on the side of transition block. Now head back to the band saw to cut the profile of the transition block. Place the small block on a larger piece of wood so it is well supported as you cut it to shape. Now place the block back on the apron and trace the shape of the extended curve of the leg onto the face. Cut this curve on the band saw using a support piece as well. Finally, smooth out this curved edge. Don't smooth the face yet.

Spread a bit of glue on the back and edge of the block, and hold it in place for a minute until the glue tacks up, then tape it down with masking tape. Pay particular attention to the point at the top of the transition block. Make sure it gets both glue and pressure. Let the glue dry completely before you try to smooth things out.

You can start smoothing the face of the transition block flush with the leg using a block plane set very fine, but be aware that it is very easy to break off the point of the transition block. Plane on an angle from the apron toward the leg to minimize the risk of blowing out the corners. You could also switch to sanding, which is less likely to cause trouble.

Try to keep the line at the top of the block as straight as possible and in line with the apron break. If you do break off

the point of the block, carefully carve the edge of the block back a bit. The curve may not be perfect, but you'll be able to restore the point.

Finishing Touches

I find it easy to flush off the tops of the legs by drilling a 2 $\frac{1}{4}$ " hole, centered in a piece of $\frac{3}{4}$ " plywood at least 12" square



Make it match. Cut the block a bit thicker than the leg, then plane it down to blend the two pieces.



Uphill battle. Pay attention to grain direction as you work on the curved surface of the leg and knee block.

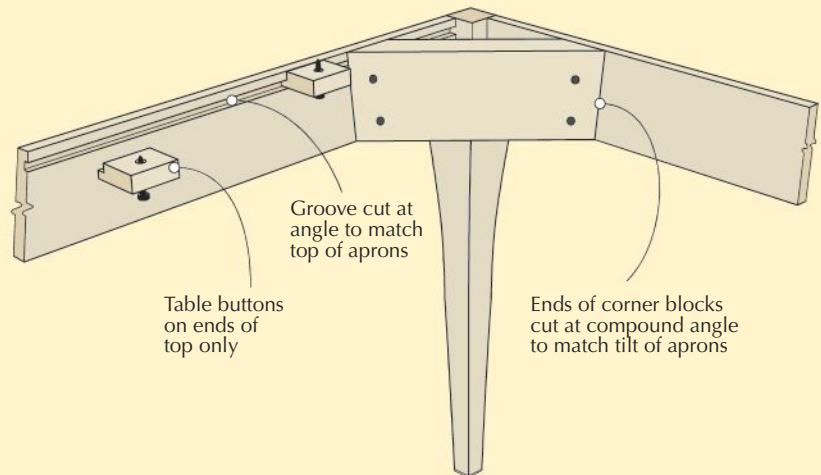
ATTACHING A TOP

All that remains is the top. This can either be a veneered panel with solid-wood edging or a glued-up solid board. In either case, the table looks best with a shaped edge that matches the shape of the top of the legs. Start by cutting a bevel close to the right shape, then plane or sand the edges slightly to round over just a bit. Finally, add a small bevel to the underside of the top at roughly 90° to the main edge shape to create a friendlier edge to the touch.

Attach the top with table buttons that hook into the slots in the two opposite aprons. Make up six table buttons for fastening down the top, insert these into the slots and screw the buttons to the top. Make sure to orient the grain of the top so that the table buttons can accommodate the cross-grain expansion and contraction (you should be attaching near the ends of the top, not along the sides).

The table should have corner blocks to reinforce the joinery. The ends of the corner blocks need to be cut at a compound angle. Cut these on the table saw with the blade set at 45° using the wedge you used to set up the angle of the tenons to match the secondary angle. Drill four pilot holes for screws – two into each apron.

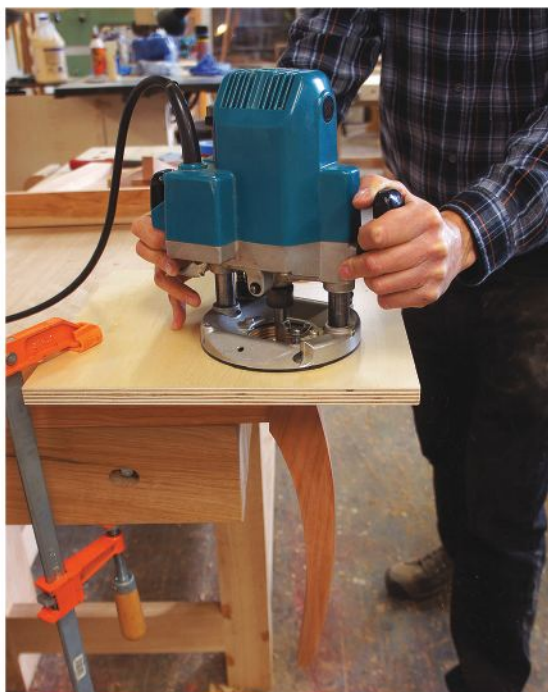
—JM



(although the exact size doesn't matter). Clamp this to the aprons of the table, with the top of a leg protruding into the hole. Then carefully rout down the top of the leg flush with the aprons. Be sure to start with a light climb cut so you don't blow out grain on your finished leg. Repeat this with each of the legs.

You can use these legs with any size coffee table – I've even scaled them up to work as dining table legs. Be sure to keep the overhang of your top fair-

ly small so the design is clearly noticed; I go with about an inch of overhang on my coffee table. Another great touch is to bevel the edges of the table (at about 12°) to complement the shape of the cabriole legs.



Magic trick. A hole in the plywood jig exposes the angled top of the leg. Set the router bit to meet the top of the apron to trim the top flat.

I've used this technique for a few different leg styles, and find it works well. Each time, the language has been translated from the traditional. But the leg design retains richness and complexity, and a strong resonance with the original. **PWM**

Jeff builds furniture and teaches woodworking from his shop in Chicago.

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

VIDEO: Watch Glen D. Huey make a traditional cabriole leg.

BLOG: Visit Jeff Miller's blog and web site.

ARTICLE: Read about Jeff's work and shop in this "Great Workshops" article.

PLAN: Download a SketchUp model of a table that features these legs.

IN OUR STORE: Jeff's book and DVD, "The Foundations of Better Woodworking."

WEB SITE: Sign up for one of Jeff's classes at his shop in Chicago.

Our products are available online at:

■ ShopWoodworking.com

Hardware Hideaway

BY GLEN D. HUEY

Store handles, hinges and fasteners in this handsome dust-free organizer.

While exploring in an antique store, I found a small, two-level lidded box that would be ideal to store the loads of extra hardware I have stowed in plastic bags. No longer would I need to search endlessly for brads, bails and back plates; everything would be in one place.

The price of the antique, however, was too rich for my wallet, so I took a photo and used the “dollar-bill” method of measuring (a piece of United States paper money is approximately 6" in length). Even if my memory was defective, my notes, measurements and pirated photo could get me close.

Build the Jig

Both the box and the tray, which fits inside and rests on the lower layer of cubbies, are assembled using box joints (also called finger joints) that I cut at the table saw. Box joints have plenty of glue surface for a strong bond, but are easier than dovetails to whip out by machine. In fact, they are perfect for shop builds. (The same basic process is also a great technique for making dentil moulding.)

Mill the sides and ends of both the box and tray to size and thickness, then set them aside and set up your table saw for making box joints.

First, attach a sacrificial fence to your miter gauge. Install a dado stack set at $\frac{1}{2}$ " wide, and raise the depth of cut to $\frac{1}{2}$ ". Make a single pass of the gauge and fence over the stack to establish the notch for the jig's key – the piece that guides the box-joint making process.

Mill a 12"-long stick of scrap that exactly fits the width and height of the notch (mine is $\frac{1}{2}$ " square; I milled it at the planer), then cut a 3"-long piece (the key) to fit and attach into the fence's notch. A couple of brads hold the key in place. With the remaining stick held tight to the right side of the table saw blade (as shown on page 34), free the sacrificial fence from the miter gauge, slide the installed key so it's tight to the right-hand side of the stick, then re-attach the fence to the miter gauge. The jig is ready to go. (As always, you should make a test cut to confirm that your joints will be tight...or not.)

For the sides of the box, begin with the workpiece positioned tight to the left-hand side of the key. Run the assembly over the dado stack to make the first notch in your workpiece, spaced $\frac{1}{2}$ " from the edge of the board. Slip the newly cut notch over the key and make another pass. Repeat these steps





Simple. Setup for box joints is easy: A sacrificial fence and a milled stick work like magic as long as you dial in your settings.



First cuts. The fingers for the box and tray sides begins with the workpiece tight to the left-hand side of the key.



Make the mates. I use the milled stick as a spacer for this step; it takes out any guess-work.

until you've reached the opposite edge of the board, then flip the board to cut the opposite end. Cut the fingers on the second side, too.

To cut joinery on the ends, begin with the edge of your workpiece set even with the right-hand edge of the fence cut-out; with the first cut, you remove the corner of the board. That corner notch then slips over the key and the balance of the end piece is cut in repetitive passes.

Tray parts are cut the same way, but before any work is done, tweak the blade height to $\frac{9}{16}$ ". Your first pass raises the cut area, but doesn't affect anything else in the setup. The idea is to slightly reduce the size of the tray to make it easier to lift the unit in and out of the box. Just as before, begin with the tray sides then finish up with the ends.

Dry-assemble the box and tray. Your fit should be tight, but not too tight. If you're working with pine as I am, there is a bit of a "smash factor" you can count on. Be more particular when using hardwoods.

Dados Add Strength

Each side of both the box and the tray has two dados for the $\frac{1}{4}$ "-thick bin dividers; the dados are almost equally spaced along the lengths (see the illustration on page 36 for more informa-

tion). The ends have a single dado that's cut dead center. I use a shop-made jig to guide my router and $\frac{1}{4}$ " spiral-upcut router bit to cut the dados (see "Simple & Accurate Router Jig" at right).

The layout work is easy. For the sides, measure the length between the joint work, then divide the result by three. Make a mark at the two locations. For the ends, find the centerline of the piece (measure between the joinery) and place a mark. Move $\frac{1}{8}$ " in both directions off the marks to lay in the location of the bin dividers.

The dados in the box parts extend up from the bottom edge 2"; those in the tray are routed completely through the parts. Use a backer board to keep from blowing out the grain as the router bit exits the cuts.

After you've cut the dados, use a $\frac{1}{4}$ "-wide chisel to square the ends of the box dados, then assemble the box and tray. To take full advantage of the



Dado strength. Router-cut dados help to align the bin dividers and increase the overall strength of the box and tray.

box joint's strength, apply glue to all the fingers then slip the sides and ends together. A couple of light mallet taps should set the joints tight—but it doesn't hurt to add a few clamps. Make sure they don't catch the fingers, which are slightly proud of the face of the units.

When the glue is dry, plane or sand the fingers flush to the sides and ends.

Divide & Conquer

Mill the dividers to size and thickness, leaving the parts a bit longer than needed. Using the assembled box and tray to measure, square one end of a divider, set the end into a dado then mark and cut the opposite end. (A well-tuned miter saw is perfect for this.) Cut the four pieces for the short dividers, and the two pieces for the longer dividers.

Use an egg-crate joint to assemble the interior of the two units. To mark the location of the cuts, I find it better to use the box or tray itself. Set the part



Watch your fingers. It's a good idea to clamp your box and tray, but as you do, make sure the fingers, which are slightly proud of the face of the units, are not captured underneath.

"The fellow that owns his own home is always just coming out of a hardware store."

—Kin Hubbard (1868-1930),
Cartoonist

– short dividers at the ends and longer dividers at the sides – in position on the box or tray. Make sure you align the dividers with the back of the dado slot. When positioned, mark both edges of the dado onto the dividers.

The slots for the egg-crate joints are best cut with another table saw jig. This setup is simply a sacrificial fence with a 1/4"-thick carrier attached to its bottom edge. Attach the unit to your miter gauge so the blade cuts the jig about 2" from the end. Raise the blade to just reach the center of the divider – don't forget to account for the carrier thickness. Once set, make a pass over the blade to cut the 1/8"-wide slot. That slot is key when using the jig.

Position your divider on the carrier and against the fence, align the right-most mark at the right edge of the slot – you can easily see the slot cut in the carrier – then make a pass. To complete the egg-crate cut, slide the left-most layout mark to the left side of the carrier slot and make the cut. If your layout marks are accurate, the



Two procedures. Set the parts – short dividers at the ends and longer dividers at the sides – in position on the box or tray as you transfer the layout.



In plain view. Drawing a bead on where to position your egg-crate cuts is straightforward because you can easily see the slot cut in the carrier.

newly formed slot should slip over the thickness of any divider. If it doesn't, no worries. Set the divider back on the jig and tweak your slot opening – the edge of the carrier slot easily identifies

where to position your divider.

Make the egg-crate slot in each divider. It matters not whether you cut the slots in the top edge, the bottom edge or both. The bin dividers are generic

SIMPLE & ACCURATE ROUTER JIG

One of the most useful shop-made router jigs I use is for cutting small dados. (This setup is best used on workpieces no wider than 10".) Make a jig for each router and router bit pairing; different combinations require different jigs. My shop is awash with them.

Each jig requires three parts: a base, guide fence and T-square. Each part comes from small pieces or scraps. For the base, I like 1/4" plywood, but I've used Masonite and even pegboard in a pinch. The fence is usually a piece of 3/4"-thick hardwood that's 1" wide, and my T-square material is most often 1/2" thick, but sometimes I use 3/4".

To begin, load a spiral-upcut bit into your router, then measure the distance from the edge of the router base to the center of the bit; approximate measurements are great, but err to the heavy side. Add 1" to your size. Grab a piece of plywood that's the width needed and a couple of inches longer than your workpiece to use as the base, then attach a guide fence to one edge – I use small brads and glue.

Hold the assembly with the fence to the left-hand side and run the router with its base tight to the fence. Your bit cuts the base and establishes the exact place of the cut each time the jig is used.

Using a square, align the T-square piece at 90° to the just-cut edge, so that its end sits flush or just behind the edge of the base. When set, attach the 1/2"-thick part to the assembly using brads. Be careful – you're driving fasteners through a thin material.

To use the jig, align its right-hand edge even with your layout line, and keep the T-square tight to the workpiece. Clamp the jig and workpiece secure, then set the bit's depth of cut – remember that you need to reach beyond the thickness of the jig's base – and rout the dado. It's easy to align, accurate and works every time. — GDH



Dialed-in location. Running the router up the assembled jig cuts the jig exactly where the edge of the router bit does its work.



Get it square. The usefulness of this jig depends on the T-square piece being set at a perfect 90° to the base.



In action. Here you see the dado jig in action – you also see a backer that eliminates any blow-out as you cut the tray parts.

as they fit to the box and tray.

After you've cut and fit your dividers, assemble the pieces in the box and tray. Glue adds little but a mess, so I forego its use here. The box dividers slip in from the bottom; tray parts fit in any direction. As you fit the center pieces in place, you may need to gently bend

or twist the shorter dividers to get the egg-crates joined. If you need stronger measures, check the layout and cuts for problems.

The bottoms of the box and tray are 1/4"-thick plywood. Cut the bottoms to fit, add a thin bead of glue around the perimeter, position the plywood then

nail the bottom in place—don't attempt to nail the dividers. I use an 18-gauge brad, but a 23-gauge pin works just fine. (Keep the fastener length to a minimum; you don't want to risk bending a brad or pin so it pierces the outside face of your box or tray.)

No Nasty Corners

Each cubby has a small piece of chamfered moulding wrapping its four sides to make retrieving hardware from the box and tray a snap. The moulding is 5/8" x 5/8" and mitered at the corners. The fit is by friction, although you could add glue as you install each piece.

I make the moulding at a router table using a chamfer bit. Begin with a wide workpiece, profile the two edges then cut the pieces at your table saw, aided by a push stick. As your workpiece gets narrow, it's better to profile from opposing faces so you have a wider support surface riding the saw's table.

Mitering the mouldings to fit each cubby could be done by hand, but I favor my chop saw. To make the operation effective, I use double-sided tape to hold a scrap tight at the saw. The scrap holds your cut away from the fence and the saw kerf provides the perfect registration for your cuts.

To work efficiently, you need only to set the saw to 45° to the left. Position one of your chamfered pieces at the chop saw with the 5/8" flats facing up and against the sacrificial fence. Make the first cut.

Measure the length of the piece

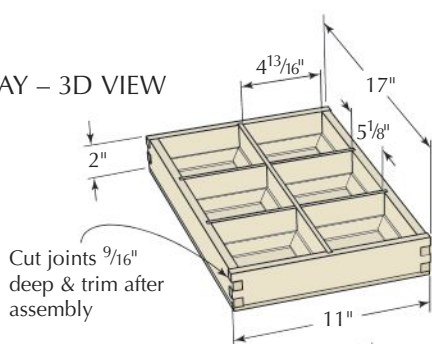


Easy does it. Your egg-crate joints should slip together easily with finger pressure only (and glue is overkill).

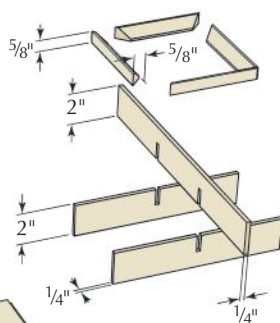
Hardware Hideaway

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
2	Box sides	1/2	4 1/2	18	Yellow pine	
2	Box ends	1/2	4 1/2	12	Yellow pine	
1	Box bottom	1/4	12	18	Plywood	
1	Box divider – long	1/4	2	17 3/8	Yellow pine	
2	Box dividers – short	1/4	2	11 3/8	Yellow pine	
2	Box lids	5/8	6 1/4	18	Yellow pine	Shiplap at center
1	Lid latch	1/4	7/8	6	Spalted tamarind	
2	Tray sides	1/2	2	17	Yellow pine	
2	Tray ends	1/2	2	11	Yellow pine	
1	Tray bottom	1/4	11	17	Plywood	
1	Tray divider – long	1/4	2	16 3/8	Yellow pine	
2	Tray dividers – short	1/4	2	10 3/8	Yellow pine	
1	Bin moulding	5/8	5/8	144	Yellow pine	

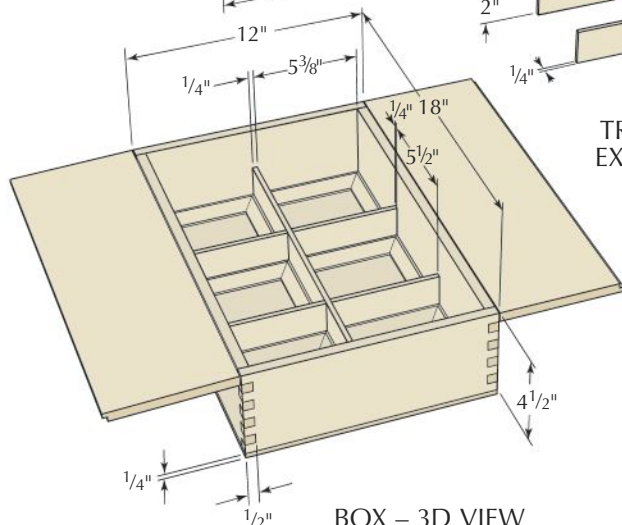
TRAY – 3D VIEW



Cut joints 9/16\"/>



TRAY DIVIDER – EXPLODED VIEW



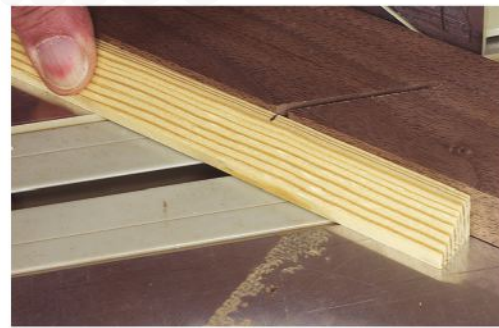
BOX – 3D VIEW



Work small. As the workpiece narrows, it's better to profile the opposing faces of the stock so you have greater support as you rip at the table saw.



One setup. Both ends of the bin mouldings can be cut with your miter saw set at 45° to the left – the first cut has the chamfered edge facing front and down.



Mark alignment. With your measurement marked on the top edge of the moulding, a good set of eyes is all that's needed to dial in the perfect cut.

needed then transfer the length to your moulding; to mark an exact layout at its top edge, position the workpiece to your box or tray. Align your mark directly at the kerf in the fence to make the second cut. I found that I occasionally had to trim the pieces to get a press-in fit, but again, the kerf makes it easy to determine where to place your workpiece. Cut and fit the 48 pieces.

Lid & Latch

The lid is simply two pieces that are shiplapped at the center. Cut the pieces over-wide, then cut the shiplap (I used a dado stack at the table saw) before you attach the lid to the box with two pair of narrow 2" fixed-pin hinges (available at any hardware store).

Position the two lid pieces on the box and center the joint, then mark and cut the outside edges so the lid fits the box, with a small gap in the middle. (I used two 6" rules as spacers.)

Take your time installing the hardware, and when you've completed the task, use a small plane to even the gap between the lid pieces, if need be. Also, you may need to reduce the width of the hinge leaf attached to the box to facilitate the installation of the tray. I used a file to flush the leaves to the inside of the box.

To hold the box closed, I whipped up a simple wooden latch using a scrap of spalted tamarind, but use whatever you like. Mill the piece to size and length. Drill a slightly oversized hole for a #10 x 7/8" roundhead brass screw in one end of your latch, and cut a slot at the opposite end. Select where you want

your latch – I chose the middle of the box – and attach the latch with one of the brass screws. Square the latch to the side of the box, then install the second screw so it fits into the cut-out area of the latch. How much you turn your screws decides how tight the fit. Yes, because they are so noticeable, I clocked these screws.

I decided to allow my box to age naturally, but I used boiled linseed oil on the latch to make sure it stood out. I



Perfect alignment. The challenge for the top is the shiplap center, but if you cut the joint first, the top is easy to trim to size.



Get square. I positioned the latch to the box holding it dead center. One screw holds the latch, the other catches it.

stripped the zinc coating off the hinges then added a coat of wax.

The box and tray are a great place to store and organize extra pieces of hardware. And this project measures up to my antique-store find, which cost way more than the dollar I used to get sized up on the downlow. **PWM**

By the time you read this, Glen will be the editor of American Woodworker; he can still be reached at glen.huey@fwmedia.com.



Fine-tune adjustment. As the hinges go in, it's possible to slightly reposition the lids – a problem that's easily corrected with a sharp handplane.

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

VIDEO: Watch how a pyromaniac might turn zinc-plated hinges into black beauties.

BLOG: Read another option to add years of age to new hardware using chemicals.

IN OUR STORE: Follow Peter Ross's guide to produce your own hand-forged hinges.

TO BUY: Pick up a copy of "Box Builder's Handbook" for more box ideas.

Our products are available online at:

■ ShopWoodworking.com

Spoon Carving

BY PETER FOLLANSBEE

This kitchen workhorse presents a surprising and rewarding challenge.

A wooden spoon – you can get one for a dollar in many places. It's just a stick with a hollow shaped at one end. Why go to any bother over such a thing? Use them to stir sauces, dole out rice and beans, then forget about them. But like much in woodworking, the hand-carved spoon is in another sphere than its mass-produced substitute.

I have worked wood for more than 30 years, and made several households' worth of furniture both simple and complex. The spoon remains a greater challenge than my most ambitious court cupboard or joined and carved

chest. This aspect of woodworking is about tradition, design, shapes, forms and function. In spoon carving, you learn about edge tools, green wood and body mechanics – all while sampling a variety of local woods that might otherwise never make it to your workbench.

The spoon carving I learned from Jögge Sundqvist, his father, Wille Sundqvist, and Drew Langsner is part of a Swedish tradition, the revival of which was really spearheaded by Wille. My first attempts were thick and clunky.

One nice thing about spoons is that you get another chance to get it right in just a couple of hours or less. Another

nice thing is that you can do most of it – other than the hatchet work – anywhere; you don't really need a dedicated shop space.

Ideally, spoon carving is a green woodworking craft. You can experiment with a great range of local woods, usually free. I've used apple, pear, cherry, rhododendron, birch, lilac, olive, mulberry, beech, maple and others. Fruitwoods are the nicest; among them, apple is my favorite.

The tool kit is small; I do most of the work with a hatchet and a few knives. Add some splitting tools and a rough saw for crosscutting the blank. The hatchet is a small, double-bevel affair, not like the large single-bevel tool I prefer for joinery work. We're cutting shapes here, not flat surfaces, so the double-bevel tool allows you to work both convex and concave areas.

The bulk of the shaping is done with a long-bladed carving knife, often marketed under the description "sloyd knife," which refers to the Swedish term relating to handicrafts.

To hollow the spoon's bowl, I use hook knives specifically made for carving spoons, but you can hollow your spoon with a carving gouge.

Some spoons are made from "crooks," sections of bent limb-wood, or places where a limb meets the trunk or a larger limb. These are some of the

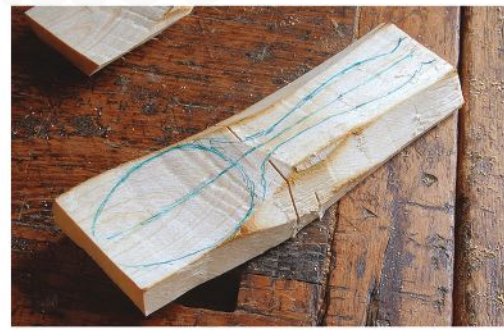




Tool kit. It takes only a few tools to shape your own spoons; I use a hatchet and two – sometimes three – knives.



Crooked blank. From a crook comes a thin but strong spoon.



Pencil it in. After sketching the outline of the spoon on top of the blank, make relief cuts with a saw or hatchet to where the bowl meets the handle.

most challenging spoons, but can be the most successful. In them, the spoon's bowl flows below the stem and handle while following the tree's fibers, resulting in thin, but strong spoons. When you work with straight-grained blanks, you have to compromise some to create the flowing shape of a graceful spoon. At some point, you're cutting across the wood fibers. But it can work either way.

I'll begin with a serving spoon from a fairly straight blank. Start with a clear piece of fresh wood, the diameter a little greater than the intended spoon's width. Split the piece down its length with a froe or hatchet. (Strike the froe with a wooden club, never metal.) Hew away the inner flat face, removing the tree's pith (the central section); leaving this bit in results in radial cracks or splits, ruining the spoon. Next I hew away the bark side so I can see where I'm going.

One big departure for me from joinery work is the pencil; I use one on spoons, never on furniture. I sketch the top view on the bark side, then make relief cuts where the handle meets the spoon's bowl. These are either sawn or chopped with my hatchet. Now I can chop down the handle's outline without risk of hitting the end grain of the bowl and splitting it.

When using the hatchet, grip and posture are critical. I set the spoon on a clean stump (sometimes called a chopping block) that's between knee and waist high. Hold the spoon on the far side of the stump and start chopping near the bottom of the spoon's handle. Make light relief cuts, breaking the

fibers toward your outline. Work your way up the spoon's handle, but stop a good ways from your off-hand that's gripping the wood.

I'm right-handed and keep my feet spread apart with my right leg dropped down behind me. That way an errant blow from the hatchet doesn't glance off the stump into my leg. Having the proper stance also brings you better balance and more power in your hatchet strokes.

To shape the outside of the bowl, it's best to support the spoon on the edge of the chopping block. Jögge showed me how he creates a notch in the edge of the block to nest the spoon into while

hewing this shape. The notch allows you to hew accurately, and it makes a stop for the hatchet. The tool's edge bottoms out on the block before cutting too far on the spoon.

Knife work is where all the refinement of shapes comes into play. There are numerous "grasps," as Wille and Jögge termed them, that allow great power in the knife work. These are designed and practiced so that the knife is slicing the wood with tremendous accuracy and power, but the grips, postures and movements also feature a "stop" for the knife, so that it only cuts what you want to cut – the spoon, not you.



Safety stance. To keep your hands out of harm's way, work at the proper height with the cut angled away from your body and into the chopping block.



Built-in stop. A notch in your block gives you more control over detail chopping work.



First grasp. Wrist and elbow are locked for the powerful first strokes with the knife. The motion comes from the shoulder. Note how the work is pointing away from all body parts.

Handle First

The first knife stroke for the handle is a powerful one, used to slice long and generous shavings off the spoon. Hold the knife with your wrist and elbow straight and locked. The movement comes from your upper body and shoulder. Raise your shoulder up as high as it goes, and with the knife engaging the wood at the butt, make a downward thrust while slicing toward the knife's tip. This stroke has no stop, so you need to position yourself and the wood in such a way that the knife travels down beside or between your legs. Make sure there is nothing in the knife's path.

Another useful grasp is the one Wille calls the "chest lever grip." I'm right-handed, so I hold the knife in my right hand, blade pointed out. The spoon in my left hand mirrors the position of the knife. To start the cut, the



'Chest lever grip.' This shows another way to make the first cuts; again, the action comes from the chest and back, not the arms.

knuckles on each hand are against my chest and my forefingers bump up against each other. The knife slices as I pull my hands apart, with the action coming from my upper chest and back. The cut ends with my elbows sticking straight out and the knife and spoon have both moved out and away from each other.

Both of the above cuts end in space; there is no stop for the knife. Other cuts have a built-in stop to keep things safe. One of my most-used cuts draws the knife toward my chest, with the spoon held against my sternum. I begin the cut with my forearms held close to my body; the movement is fairly short. The knife cuts from butt to tip as I draw it



Body stop. When my dominant hand (the right) hits my chest, the slicing motion stops.

toward me. The stop is when my right hand bumps up against my chest. As before, it's a slicing motion.

Sometimes my off-hand applies pressure on the knife's spine, helping to guide and drive the tool's edge in cutting. In one version of this grasp, I press the spoon against my chest with my left thumb and forefinger, while the other fingers push against my right hand to help slide the knife along its travel. Both forearms are braced against my body. The length of this cut is not great, but it is excellent for defining shapes of both the handle and the bowl.

A related grip I frequently use has the knife pointed away from me and my left thumb helps guide the tool. At the beginning of the cut, my left thumb is extended almost as far as it can be and is pushing on the knife handle right above the blade. The cut begins at the tip, and moves toward the hilt/butt as the knife slices into the cut. The stop is when the knife handle bumps into the spoon.

A Philosophical Stem

The spoon's design employs the wood's strength to great advantage. Think of it as having three parts: the bowl, the handle and the stem that joins the two. The deepest part of the bowl is also the widest in most examples. The stem is narrow where it meets the bowl, there-



Thumb guide. This cut slices at an angle across the work, stopping when the hilt hits the work.

"A three-dimensional object isn't just a picture. It's an infinite number of pictures, and all of the pictures must find harmony within the object."

—Wille Sundqvist,
"Swedish Carving Techniques"



A subtle 'S.' Each spoon is a slightly different shape, but I usually aim for a gentle curve.

fore it is deep to give it the strength it needs. It can be carved in the shape of a rib that hugs the bottom of the spoon's bowl.

As the stem flows into the handle, it thins out to fit your fingers better. So then you make it wider, both for comfort and for appearance. Just as the handle reaches its end, it can gain a bit of thickness. Carved finials are a pleasing touch at the end.

As I work the spoons, I think of the shapes as a series of bevels flowing one into another. I also try to focus on curves, some slight, some more pronounced (see the opening photo and the photo above for a variety of shapes).

A spoon that has too many flat places in it looks and feels lifeless. Because you hold it as you carve, it is easy to shift the spoon around for a different view. This is critical because the design has to work from all angles and from the hand as well as the eye. Cut a little, look a lot.

I try to make the side view with something of an S-shape to it. Sometimes the wood helps guide you, other times you have to make it happen. I aim for a bit of a lift right at the front end of the bowl, then a curve under the deepest part that then sweeps up toward the handle. The end of the handle can either sweep back down a bit, or take one last lift upwards again. You get to try lots of variations.

Now the Bowl

To shape the inside of the spoon's bowl, you can use a hook knife or the gouge. For my first spoons, I hollowed the bowl with a gouge (mine has a No. 8



sweep in the Swiss-made numbering system). Just as with the straight knife, you want to use your body and hands in such a way that you can cut efficiently, without having the tool's edge land in your flesh.

With the spoon in my left hand, I hold the gouge in my right, way down on the tool's shank. The heel of my right hand presses against the edge of the spoon blank; my left thumb reaches across the spoon to brace my right hand.

The action is a pivoting motion from the heel of my right hand. The gouge travels a very short distance. The cutting is across the bowl's face.

Then along came the hook knife; it makes life so much easier than hollowing with a gouge. These tools come in many shapes; some are more rounded, others shallower. Hold it with your fingers. Tuck it against your palm, and your thumb provides the leverage to pull the tool into the cut. The knife slices across the bowl most often, except when you are refining some shapes. These tools come in left- and right-handed versions. I mostly use the righty, but there are places and times when the left-handed version is helpful.

I try to do most of the general shaping when the wood is still very green – so at this stage the cuts leave a bit of a fuzzy surface. Next, let the spoon dry then take your final strokes with extremely sharp knives to give the work a fine-finished texture. Some carvers aim for a tooled finish while others use sandpaper, especially on the inside of the spoon's bowl.

When you're done, apply a finish. I use food-grade flax oil. I soak my spoons in it for a few days, wipe off

Gouge. A gouge works and is a great way to start. But if you get hooked on spoon carving, consider getting a hooked knife.



Across the bowl. A hooked knife gives you precise control as you shape the bowl.

the excess then bring my hand-carved utensils to the table.

Spoon-fed Revolution

To me, spoon carving is a revolutionary act. It helps cut through the mass-produced cheap culture that we have absorbed like zombies. It's such a simple household implement, taken to extraordinary heights. Why shouldn't our most basic kitchen stuff be beautiful? Out with plastic! I always think of Bill Coperthwaite's line from "A Handmade Life: Search for Simplicity:"

"I want to live in a world where people are intoxicated with the joy of making things." Me, too. **PWM**

Peter is the joiner at Plimoth Plantation and co-author of "Make a Joint Stool from a Tree" (Lost Art Press).

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

VIDEO: "The Spoon, the Bowl and the Knife," a documentary about Swedish craftsman Wille Sundqvist.

BLOG: Read Peter Follansbee's blog, *Joiner's Notes*.

TO BUY: "Swedish Carving Techniques" by Wille Sundqvist (Taunton).

Our products are available online at:

■ ShopWoodworking.com

Reeds & Leaves

BY CHUCK BENDER

Design and build
a Wharton Esherick-
inspired stool.

Looking at Wharton Esherick's furniture, it's easy to see how he brought nature into his designs. I'm not talking about how he simply carved abstract turkey buzzards on the front of an Arts & Crafts-style desk, but how, once he began to view furniture as sculpture, the pieces themselves abstractly represented natural elements.

Like many studio woodworkers, Esherick developed one product that kept the cash flowing. In Esherick's case that was his famous three-legged

stool. He made them from scraps of figured material laying about the shop, making each random in shape and size. Esherick sculpted the seats while shop apprentices turned the legs and did the joinery.

The design of the stools is simple—slender legs with a light, draping seat floating atop. When I look at the stools, I am reminded of reeds or rushes by a pond in fall; the willowy reeds stretch upward supporting a fallen leaf. This is the imagery I hope I've captured in my interpretation.



Pattern seating. Choosing your figure and grain direction is crucial for a sturdy stool. The nails in the pattern help locate the center of the leg holes.



Rough cut. Careful placement of the pattern allows the seat to be defect-free. The band saw makes short work of roughing out the seat blank.

Time to Design

For a period furniture maker, the hardest part of tackling a project that's inspired by an existing piece is resisting the urge to simply copy it. That goes double for a project that isn't of a period design.

I began with a general concept in mind: a three-legged stool with a low back that would work as seating at my kitchen counter. As the opening photo shows, the concept changed slightly. The final version of the stool came about after much deliberation, contemplation and plain old fear.

Esherick had it easy. His stools had three legs, and the seats were generally small. They played perfectly into his love of asymmetry.

Whenever you add a back to any type of seating furniture, the first thing you need to do is increase the size of the seat. If you don't, the surface area will be too small when used for its intended purpose. Also, there might be too little material to support the back if the seat is too small.

For my larger seat, I bypassed the scrap bin and grabbed a board that was about 10½" wide and some plywood for a pattern. I then started sketching out an asymmetrical seat. My seat demanded a fourth leg; the legs and stretchers mimic those on Esherick's stools. My intent was to design and build something he might have actually made.

Time to Choose

With a basic pattern in hand, it's time to look at the figure in the board and

decide from which part to cut the seat.

Consider a few things when selecting your material. Figure is of paramount concern when making something this simple in design. Make sure it gives the piece a sense of visual balance, while not being overwhelming.

Once you've decided on the figure, look at the grain structure of the board. The more figured the board, the less stable and strong the seat will be. At one end I had an off-center crotch. In the middle, the grain was fairly straight, but there was some curl. At the other end, the board had a knot and some good curl: I chose the knotty end.

The crotch end of the board would have made a more spectacular seat, but because it was off-center, one of the holes for a leg would have passed right through a section where the grain direction was almost vertical, making it too weak for a leg joint.

The middle of the board was just too plain for my taste. By staying off the knot, I got a seat with interesting figure that is structurally sound.

After laying out and cutting the seat, I turned back to the pattern to figure out leg-hole placement. The holes need to be in far enough from the edge of the seat so as not to weaken the board, but not so far that they end up too close together. I made the holes in the seat asymmetrical in keeping with Esherick's style.

Once you have the leg holes marked, drive a small finish nail through the plywood pattern at the center of each location. Align the pattern on the bottom of the seat blank and tap the nails to mark the center of the legs.

Time to Drill

By drilling the holes prior to shaping the seat or turning the legs, you'll find the ¾" holes easier to drill, and you'll be able to test-fit the tops of the legs as you turn them.

The angles on Esherick's stool legs varied quite a bit. Some were more vertical while others splayed outward to give the stool a greater sense of drama. In choosing the angles for my stool, I used a few offcut sticks, cut to the approximate height of the stool. With the seat inverted on my bench I held the sticks at an angle that suited my eye.

In order to drill the holes in the seat blank, there has to be a way of referencing the blank to get the legs splaying at relatively the same angle. Esherick may have eschewed symmetry, but having the legs on the stool splay at four different angles would have been a bit much, even for him.

I made a simple jig for the drill press from two pieces of plywood and a scrap of 2x4. By placing the scrap between the plywood along one edge, you create an auxiliary table that tilts toward the front of the drill press. If you like more or less splay on your stool's legs, modify the size of the spacer.

Mark a centerline that divides the slope into left and right halves. This is the line you use to set the orientation of the seat to keep the angles consistent on all four legs. Align the centerline with the drill bit on the press then clamp the jig in place.

Draw diagonal lines across the bottom of the seat through the centers of the leg holes. Now you merely have



Angle drill. Using a shop-made jig, the leg holes are easily bored at the selected angle.



Layout sticks in action. After turning the leg blank to a 1¼"-diameter cylinder, use the layout stick to plot the top and bottom, and the middle of the swelled part of the leg.



Wrench it up. A fairly simple turning trick to get consistent sizes is to use a wrench as a caliper.

to line up the center marks with the drill bit and the diagonal line with the centerline on the jig and drill away.

Time to Turn

Esherick made many legs from hickory, oak and ash, but I didn't limit myself to his choices. I've always liked the strong contrast of maple – particularly when it's curly – and walnut (which happened to have been Esherick's favorite wood). If you have other woods that you favor, use them. Just remember: When choosing a species for your legs, make sure that it can stand up to flexing under the weight of an occupant and to the abrasion of actually being dragged across a floor.

Turning the legs is a fairly simple process. Begin with a quick layout stick to ensure all your legs come out the same size. The stick doesn't have to be much more than a scrap cut a little longer than the final leg length, with hash marks showing the top, bottom and middle of the swelled area (on mine, that's 6½" from the bottom).

The only other sizes you need to determine are the final diameters at each of the three points on your stick. On my stool the top of the leg is ¾", the bottom is 7⁄8" and the middle of the swell is 1¼" in diameter.

"The beautiful thing about learning is that no one can take it away from you."

—B.B. King (1925),
Musician



Skewed turning. Work from the largest diameter towards the smaller diameters when turning. This is particularly important when turning the slender tenons on the stretchers.

Once the blanks are sawn to size, mark the centers on the ends and chuck them in the lathe. I usually make my blanks about 1⁄16" oversized in thickness and width to give me a little wiggle room in case my stock warps or I don't get things perfectly centered.

Start by turning the entire blank to a 1¼"-diameter cylinder. Hold the layout stick to the cylinder and transfer the hash marks. Using open-end wrenches of the appropriate size as calipers, turn the ends down to the proper diameters. All that's left is to flow from the middle of the swell out to the ends.

To get all four legs approximately the same size, I turned the first to size and shape then used it as a reference as I turned the remaining legs. I still transfer all the marks from the layout stick, but the comparison ensures I'm not making the subsequent legs larger or smaller in diameter. Just like using the layout stick to mark all the impor-

tant points on the leg, using the first turned leg gives you a single benchmark from which to work.

Time to Stretch

With the legs turned, it's time to dry-fit them in the seat, and to figure out the angles and placement of the stretcher holes. I've spaced the stretchers 1" above and below the swell centerline.

To figure out the angles use more scraps. Because the front stretcher acts as a footrest, I positioned it (and the back stretcher) below the centerline.

Clamp the scraps to the legs referencing off the stretcher lines. Use a sliding bevel to approximate the angle, and check that the left and right sides are the same. Transfer the angles to a layout stick and label them so you don't get confused later.

The side-stretcher angles are measured the same way. Because my seat is rectangular, the stretcher angles on the sides are different than on the front and back. Pay attention when drilling the holes because the legs are handed.

With the scrap boards clamped in place, take the rough measurements for the stretcher lengths. On my stool the side stretchers are of equal length while the front stretcher is longer than the back.

Once you have the lengths calculated, turn the stretchers. I made mine overlong and made sure the ends were 5⁄8" in diameter over the last 2½".

To drill the holes at the proper angle on the drill press, you need a way to hold them consistently. I made a simple



Angle it. Clamp scraps to the dry-assembled base and set a bevel to the centerline of the leg. This will be the angle at which you will drill the holes for the stretchers.



Double drill. Making a jig to drill the stretcher holes can be easily done with a small piece of 2x4. Drill a 1 $\frac{1}{4}$ " hole from both sides then rip the piece to $\frac{11}{16}$ " thick to create a trough in which to place the leg for drilling.

jig from a 2x4 offcut. On both ends measure and draw a center mark 1" off the back face and centered on the width. Set up a 1 $\frac{1}{4}$ " Forstner bit in the drill press. Clamp the piece into a handscrew and drill from both ends until the holes meet in the middle. The handscrew ensures the piece is held perpendicular to the table and provides a safe way to drill the deep holes.

With the hole bored all the way through the 2x4, rip the piece to $\frac{11}{16}$ " thick, referencing off the back face. This makes a jig that cradles the legs and allows a stretcher to be inserted in order to drill the second hole perpendicular to the first, and it helps minimize tear-out as the drill bit exits the leg.

Chuck a $\frac{5}{8}$ " drill bit into the press and use the layout stick to set the angles. Center the jig under the bit and drill the first holes through the legs. Insert a stretcher into the holes and readjust the table to the proper angle. Make sure the jig is still centered. Now drill the second hole in each leg. Complete the holes on all legs.

Time to Grind

It's time to shape the seat. This can be done with hand tools, power tools or a combination. I chose to use a combination.

I began by sketching a rectangular shape that encompasses all four leg holes. This represents the transition point from concave to convex shape.

The seat is dished out about $\frac{1}{4}$ " deep.



Tilted drilling. Tilt the drill press table to the proper angle using an angle layout stick.



First angle. With the drill bit centered on the jig, drill the front and back stretcher holes.



Side angle. After tilting the drill press table to the second angle, insert a stretcher into the hole in the leg, place the assembly in the jig and drill the side-stretcher holes through the legs. You'll need to drill two legs with the table tilted left and two with it tilted right.

If you plan on making multiples of the same stool – not very Esherick-like, but I can understand the need – you may want to use a Forstner bit to drill some depth guides so you are consistent; otherwise, dive in.

I set up a mini-grinder to hog out the bulk of the waste on the seat. You could also use a scorp and round spokeshave to accomplish the same.

After roughing out the dished area of the seat, I moved to rounding off the outer edge. The idea is to give the seat a drooping appearance.

To lighten the look of the seat, the underside is chamfered. To achieve the natural drooping-leaf appearance, the chamfers arch toward the top, following the shape created when rounding off the outside edge of the seat. The more you chamfer under the seat, the thinner the look; just don't go too far or you'll start to reduce the material

Grind it out. Attach the seat topside up to a stick with a couple of screws through it. This allows you to secure the work in a vise for grinding and shaping with hand tools.



surrounding the legs. For this work, I use spokeshaves.

Once the seat is roughed in on both top and bottom, I switch to a sander to smooth out all the bumps. I then round all the edges with a spokeshave, but you can also do this with a sander or grinder. Don't bother to take the seat to final smoothness. There will be cleanup to do after the stool is assembled.

Time to Glue

Dry-fit the entire stool one last time. This allows you to cut off legs or stretchers that are just far too long. You want them to protrude through the joints but not so far that you can use them for hanging plants.

At this point, mark how the wedges will be inserted into the joints. I also

THE DESIGN PROCESS

Designing a Wharton Esherick-style stool started long before I milled any lumber or made a sketch. It began with a concept. But how one turns a concept into reality is something of a mystery to many. Most folks begin with a plan, perhaps from a book or magazine, that may or may not have a cutlist. The key thing is that it's something tangible. Many never take the leap of making something that only exists in their head.

While Esherick stools don't exist only in my head, I didn't have access to one of his stools or to measured drawings; I had photos and a concept. For me, the design process usually starts with a layout stick but this project doesn't work well with section drawings. Without knowing the leg angles, SketchUp wasn't the optimal choice, either. While I tried a couple of rough perspective sketches, a mock-up seemed in order.

My first concept kept Esherick's three legs. But because my original thought included a back on the stool, I started sketching out a larger, squarish seat rather than his more triangular, rounded look so there would be room to sit on the stool once it was done. I also wanted to be sure to capture Esherick's sense of lightness.

My first seat had arched sides and arched around the back to accommodate a curved crest rail; it resembled a stylized Windsor D-shaped seat. Using 8/4 poplar, I hacked out a seat, turned three legs and drilled holes. With the first mock-up dry-assembled, it was easy to see that something wasn't right. The top was heavy, the legs looked spindly and I still had to figure out a back. A new design was in order.

I first had to lighten the look of the seat. I narrowed the depth of the pattern but kept it rectangular to give me enough width to include a back. As the seat narrowed, it was evident that the stool needed a fourth leg. It wouldn't otherwise be stable. I grabbed more poplar, hacked out another seat, turned an additional leg, drilled more holes and roughed out a seat. The new mock-up had the lightness and balance I was looking for, but left me wondering about the addition of a back.

At this point, it was best to jump into the real project. This allowed me to refine the majority of the stool and gave me more time to think about the back design. As the project took shape, the reality of adding a back continued to disappear. The more I worked on it and the more I looked at the light appearance, it became clear that adding a low back would do little to improve the design; it would make the seat appear clunky.



Inspiration. This is Wharton Esherick's bread-and-butter stool.

If you have a project idea, you might just have to jump in and give things a try. Sometimes your standard method of work just won't cut it when you're trying to work out a design.

You don't have to work out the problems on your good lumber. Don't be afraid to grab cheap scrap material and start hacking away.

You don't need to be exact nor do you need to work to final finish to get an idea of what works and what doesn't about a design. And you don't need to get stuck in one track or the other. If part of the project can be dealt with using a layout stick or SketchUp drawing, and another part using a foam or a wooden mock-up, you need to dive in and give it a try. Your design, as well as your woodworking skills, will benefit from the experience. —CB



Dry-fit. Rough assemble the stool and trim the tenons close so the wedge placement can be marked.

take the time to mark each part so they go back in the same places during final assembly.

Disassemble the stool and cut kerfs into all the legs and stretchers for wedges. Often, I'll do this with a dovetail saw if there aren't too many, or at the band saw if I have more. Just don't cut the kerfs too deep or you'll see them on the insides of the joints after assembly.

Esherick typically used wedge material of the same color, but I wanted more contrast; I used walnut. At the band saw, make a series of wedge-shape cuts into a scrap, then cut them off in groups. Don't worry at this point if the wedges are too wide for the joints; they can be trimmed just before insertion.

Use a leg and stretcher to mark off the width of the wedges. Using an offcut as a cutting board, trim each wedge to width with a sharp chisel. A touch of glue on the tip of each wedge ensures it stays in place once driven home.

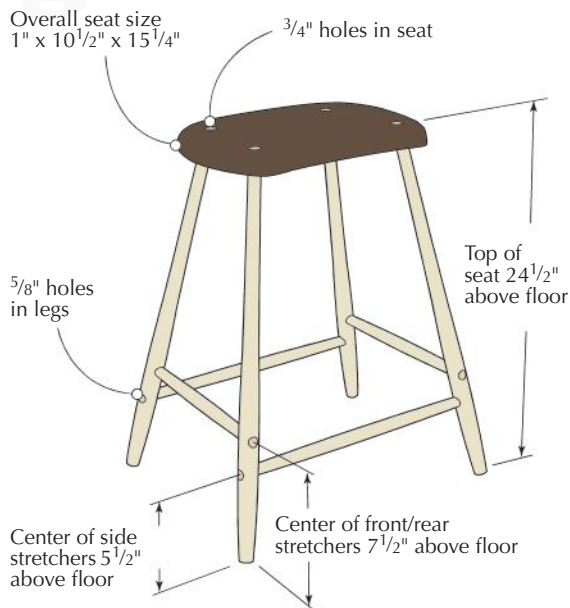
Using a small acid brush, glue each joint and begin by assembling the base. Next, glue the leg-to-seat joints. Tap the seat into place, checking to make sure it remains parallel to the floor. This is easily done by measuring to the flat part of the seat's underside and adjusting until you get the same measurement.

Install the wedges, then use a file, chisel or sander to trim the joints flush and flow them into the legs and seat.

Esherick-style Stool

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL
		T	W	L	
1	Seat	1	10 ¹ / ₂	15 ¹ / ₄	Walnut
4	Legs	1 ¹ / ₄	1 ¹ / ₄	26	Maple
1	Front stretcher	1 ¹ / ₄	1 ¹ / ₄	18 ⁵ / ₈ *	Maple
1	Back stretcher	1 ¹ / ₄	1 ¹ / ₄	18*	Maple
2	Side stretchers	1 ¹ / ₄	1 ¹ / ₄	13 ¹ / ₄ *	Maple

*Add 2" to length for turning



Wedge it. Taking time to mark the placement and orientation of each wedge will save frustration later.



Walnut wedges. At the band saw, cut wedges from a scrap.

Split wedge. Using the stretchers and legs as a pattern, it's easy to trim the wedges to final width.



Time to Back Out

When my stool was fully assembled, I looked at the overall appearance. It had achieved all the goals I set forth at the beginning of the project: It was light in appearance and harkened back to Esherick's own stools.

The concern at this point was how a back would change the balance. The seat was larger than many of Esherick's stools, but still on the small size for a seating piece with a back.

After mocking up a few different versions, some taller and others shorter, I decided a back was only going to make the stool look clunky and heavy. So I dropped it.

All that remained was leveling and finish prep. I placed the stool on the table saw and made shims to temporarily level it. Using a 1/2" scrap of plywood, I scribed around all four legs and trimmed them off with a handsaw at the bench. If your stool still doesn't sit

perfectly level, a little fiddling with a chisel or rasp makes short work of that.

Time to Finish

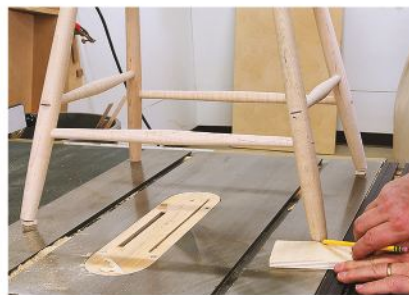
Finishing in the Esherick style isn't very difficult at all; he used tung oil.

After sanding the entire stool to #180-grit, I rubbed on a few coats of tung oil and allowed it to fully cure between coats. I also lightly sanded be-

tween coats with #320-grit sandpaper and wiped the entire stool down with a tack cloth prior to subsequent coats. At the end, I used #0000 steel wool to rub out the finish then applied a light coat of paste wax. The wax isn't necessary on an oil finish, but it leaves the surfaces smooth and tactile.

Not only were Esherick's stools and other pieces very touchable, they were fluid. It's that fluidity that I sought in my stool. I even found it in the design process. Stepping outside my regular sphere of work helped me remember not to get locked into one train of thought or one method of work. Sometimes it's liberating to go where the work and the wood take you. **PWM**

Chuck is senior editor of this magazine and can be reached at chuck.bender@fwmedia.com.



Level it. Shim the stool on a level surface and use a scrap of plywood to scribe all four legs. Saw to the lines and it might just be perfect the first time.

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

ARTICLE: Read more about Wharton Esherick in an article from the June 2013 issue.

IN OUR STORE: Learn basic spindle turning techniques from Steve Shanesy.

WEB SITE: Take a virtual tour of Wharton Esherick's studio.

Our products are available online at:

■ ShopWoodworking.com



Inside & out. An X-ray reveals the tangs inside oval-bolstered mortise chisels.

Get a Handle on Mortise Chisels

BY WILLARD ANDERSON WITH PETER ROSS

Period tools provide an opportunity for study – and for rehandling.

Mortise chisels get a lot of heavy use – and sometimes abuse. Over the years, I've collected a number of chisels without handles and with seriously damaged handles. These chisels are so well designed for their job, but not so readily available, that it behooves us to bring them back to full functional status.

I've made detailed measurements on about 50 chisels (including a modern tool by Ray Iles), looking primarily at the amount of taper in the handle, how regular the handle taper is, how long

the handles are and how many of the chisels have significant relief front to back in the shaft.

A Bit of Background

Historically, mortise chisels were offered in two grades. The less expensive, called "Mortise Chisels," came with octagonal bolsters, while a better grade, called "Best Joiner's Mortise Chisels," were made with oval bolsters.

Early pattern books such as Smith's Key (circa 1816) show these and their associated prices with the Best grade

at almost twice the cost. Modern users tend to call these tools "Oval-Bolstered Mortise Chisels," or OBMC for short.

The chisels are characterized by a shaft that is thicker than it is wide, that is often relieved along the sides so that the chisel has a slight trapezoidal cross-section. This helps keep the chisel sides from binding as a mortise is deepened.

The chisel shaft also tapers front to back along its length so that it's thicker at the bolster. The tangs, which are of varying lengths, taper evenly to the bolster, and have a rectangular cross-

section in the direction of the oval of the bolster.

The handles are oval in cross section, generally matching the major and minor diameters of the bolster, but also tapered along their length. Grasping the oval-shaped handle makes orienting the chisel square to the work easier.

The average handle length of those in my collection is $5\frac{1}{4}$ ", with no handles longer than 6" or shorter than $4\frac{3}{4}$ ". This length is approximately 1" longer than the average width of a man's hand. On average, the taper from the bolster to the top of the handle is $\frac{1}{4}$ " per foot off the centerline in both dimensions (there was considerable variation among the chisels studied, however). In other words, a 6" handle would be $\frac{1}{4}$ " wider in both dimensions at the top than at the bolster. (The chisel made by Ray Iles had the greatest taper – $\frac{3}{8}$ " per foot in both dimensions.)

How Mortise Chisels are Made

Most mortise chisels of the late 18th through mid-19th century were made in shops that specialized in edge tools. The octagonal and oval bolster shapes require special dies to produce clean forgings, even when production is by hand. The dies shape the bolster and the base of the tang only; the rest can be forged freehand. Without several sets of dies (for different chisel sizes), a general blacksmith cannot hope to achieve the efficiency and clean shape evident in surviving tools.

In general, these chisels are of laminated construction. That is, the bulk of the tool is made of wrought iron (which is soft and relatively inexpensive) with a small layer of high-carbon steel forge-welded along the cutting edge of the blade. The steel provides good edge-holding characteristics but is too expensive to have been used for the entire tool.

The performance of a chisel relies on its cutting edge, but the challenge in forging is the bolster.

There appear to me to have been two common methods. A few chisels were made from thick bar. The tang and blade were forged down to finished size, leaving a lump of the original bar

to form the bolster. Most of my vintage tools, however, were made by wrapping a collar or ring around the bar and forge welding it solid. This provides the extra bolster material with less manual labor.

With either method the swell can be forged to the shape of the bolster, then the tang and blade can be shaped. The steel is welded on while the blank is oversized, then forged slightly large to allow for grinding later. The tang is forged freehand to finished size. With constant practice, the tools can be forged by eye to startling regularity.

After forging, the tool is hardened and tempered, filed and ground. The forging, filing and grinding are all done freehand by experienced workmen, so although the tools look uniform, they differ slightly in shape and size.

Get a Grip

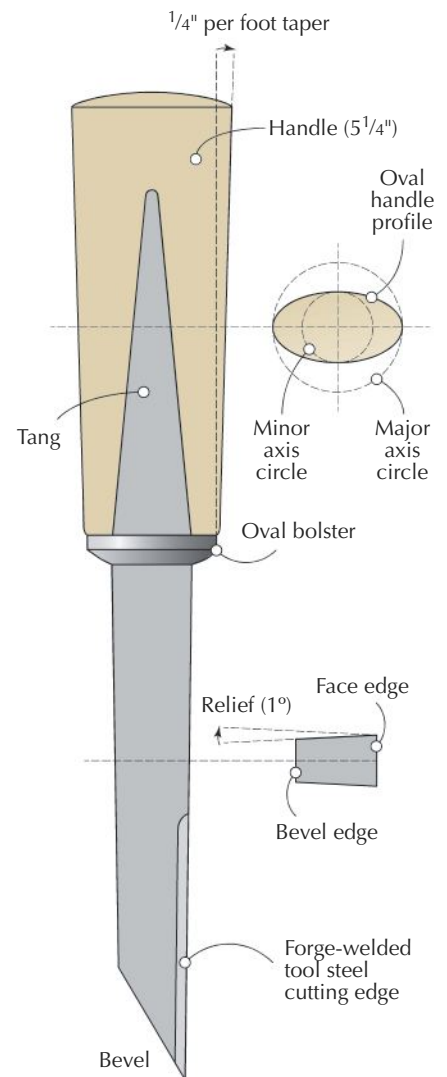
While it's certainly an option for re-handling a mortise chisel, chopping out a deep tapered mortise for the tang seems a daunting task (see the Online Extras for Derek Cohen's approach). My good friend Peter Ross (everyone needs a blacksmith friend) has an elegant solution to this problem—a technique that is useful for making handles for any tapered tool.

I have a dozen split or shattered handles, a number of which show a blackened interior surface commensurate with having been burned in. Part of the black color is probably due to iron staining, as the color appears to follow the grain lengthwise along some of the handles (see photos on page 50).

All of the handles show some evi-



***Naked steel.** Here are two vintage chisels – one with a handle, one without. Notice the shape of the tang and the oval bolster on the steel.*



MORTISE CHISEL – SECTION



Scorched remains. The black coloring inside these broken handles provides evidence that the tangs were burned in to the wood.

dence of having been drilled out, in some cases with two or three steps, with a jobber-type bit. Some of the handles were reamed out in the upper part of the mortise, with angled drill cuts leveraged against one edge of the mortise shoulder to work the opposite wall of the slot. One handle had a square bottom, possibly drilled with something like a nosing bit. Another was drilled with a long tapered bit, possibly a gimlet bit. I suspect that many or all of these handles were user-made replacements.

But I wanted to look at original handles, so I selected the ones shown in the opening photos as the most likely candidates.

The X-rays were shot by my local veterinarian, who has a state-of-the-art digital setup, which allowed moderation of the contrast between the wood and the metal so that details of the mortise can be seen.

The chisel at bottom left in the opening photos is a modern one manufactured by Ray Iles; it has a square post that's compression-fit into a straight-sided drilled mortise. The top right chisel is one that Peter and I re-handled some time ago. In all of these, there is evidence of drilling or stepped drilling, or the tang appears to fit perfectly against the wood with no apparent gaps except for a drill hole (I suspect those were drilled a bit short with a fine bit, then burned to full length).

While it's a bit difficult to generalize from this limited survey, Peter and I believe that original handles were drilled to the full length of the tang, and possibly a bit longer, often with a series of holes of increasing diameters. The mortises were then burned in with a "burner" tang and the chisel tang fitted precisely to this hole by various means (chisels and rasps).

I suspect that if a handle was broken, a user was likely to resort to the "quick and dirty" method of drilling and reaming out the mortise, then chopping with narrow chisels to fit the chisel tang, followed by shaping the handle by hand.

Workflow Choices

Before we move on to re-handling, let's look at three possible work sequences.

1. Burn then shape by hand. Burn in and fit the tang in rough stock, then shape the oval profile by hand. The advantage of this method is that misalignment of the handle on the burner tang during burning can be easily corrected; also the handle can be precisely dimensioned to the oval bolster.

The disadvantage of this method is that it is a more time-consuming process, and any variation in grain on the handle makes shaping more difficult.

2. Turn then burn. Drill a set of stepped pilot holes, turn the handle to an oval shape, then burn in the mortise and fit the tang to the mortise.

The advantage of this method is that it can be quicker than hand shaping and more reproducible for making multiples.

The disadvantage is that any misalignment during burning cannot be corrected. Plus, the pilot hole at the bolster end of the handle can interfere with chucking the handle stock for turning.

3. Burn then turn. Drill a set of stepped pilot holes, burn the mortise in the rough stock, fit the chisel tang to the mortise, then turn the oval profile on the lathe.

The advantage of this method is that the most fraught step (burning) is done first, and any misalignment of the tang in the square stock can be compensated for when laying out the oval shape prior to turning.

The disadvantage is that the large burned mortise will interfere with the placement of the two offset points on the tail stock end.

The reality is that burning-in requires some skill, and if the handle is already shaped, your options are limited. For this reason, we will focus on the first and last options.

Stock Preparation

I used straight-grained American and European beech because these seem to be the most traditional wood for tool handles. Oak and other coarser-grained hardwoods (hickory or ash) clearly have been used. I suspect that maple or birch would make a great handle. The most important factor is to use riven wood, or to cut your stock so that the grain runs true on adjacent faces.

For turning blanks, an argument could be made for using square billets because the first step in making an oval handle is to turn a tapering cylinder. The beech, however, is hard to come by, so I dimensioned the stock to be just a bit thicker in each dimension than the major and minor axes of the handle. This saves wood, though turning it involves a tad more skill.

The blanks are 6" long. This allows me to chuck the stock for drilling the pilot holes and to eventually part off at the headstock to complete the handle and get a good, clean crown.

Find the center at both ends of the stock, and then lay out intersecting lines that define the minor and major axis of the handle.

Drill the first pilot hole in the blank to the length of the tang. I used a $\frac{3}{16}$ ", 6"-long jobber bit to do this. The $\frac{1}{8}$ " bit is just too fine for a deep hole. The second (stepped hole) is half the length of the tang and the diameter of the bit is equal to the narrowest dimension of the tang at that point. For the chisel we used here, we drilled a $\frac{3}{16}$ " hole $3\frac{1}{2}$ " deep and a $\frac{5}{16}$ " hole $1\frac{3}{4}$ " deep. For hand shaping, I cut the blank to final length ($5\frac{1}{4}$ ") after the pilot hole(s) were drilled.

Burning-in Process

It's not a good idea to use the actual chisel to do the burning, because heating the tang enough to do the job will likely deform the chisel blade and soften the steel laminate, leaving you with a seriously diminished tool.

The first step is to produce a full-size mock-up of the chisel tang. We'll use this expendable "burner" to burn out the hole. The important thing is to

make a good copy of the tang with the same taper, cross section and length. You can do this by sawing, grinding, filing, or machining. With moderate forging skills it should take only a few minutes to hammer out a very close mockup. (Mild steel is a good material for this purpose.)

It's almost impossible to push hot iron into a solid piece of wood, but a pilot hole makes it nearly effortless. The handle is drilled to the same depth as the finished mortise. The burner is heated to glowing red or even orange (approximately $1,500^{\circ}\text{F}$ - $1,800^{\circ}\text{F}$). While Peter used his forge, you can also heat the burner with an oxy-acetylene torch. (Smaller propane torches won't produce enough heat.)

Quickly push the glowing steel into the pilot hole. As it burns the hole to size, the burner cools and progress stops. You may find that it takes two or three re-heatings and pushes to get to full depth; after each push, check that the burner is tracking correctly. It's easy for the burner to work more on one side of the centerline and small corrections are usually necessary with

"When you do common things in life in an uncommon way, you will command the attention of the world."

—George Washington Carver
(1864-1943),
American educator & inventor

each new push (you can correct twist or off-center orientation if you catch it early).

With each check, assess the size of the hole. If you see the large end of the hole is approaching target size, don't get the burner hot in that area the next time; heat only the section of the burner that needs to keep working.

It's easy to burn the hole too large. The best practice is to stop burning when the chisel tang snugs up $\frac{1}{4}$ " or $\frac{3}{8}$ " before the handle seats on the bolster. It won't damage the chisel to use it to test the fit it in the hole during the burning process.

As you test the fit of the tang, it's important to make a reference mark on the bolster and a matching mark on the small end of the handle to keep track of

BURN TO FIT



Smith. Peter Ross shapes the "burner" tang at his anvil (if you're smithless, you can shape your burner by sawing, grinding and filing).



Burner. Here's the finished burner.



Burn. Peter inserts the heated burner into the pilot hole.



And test. With the hole burned out, I test the fit of the chisel tang.



Handle gauge. This shop-made layout jig keeps my lines centered off the chisel's shaft.



Shaping setup. My clamp for this sort of work resembles a lathe's headstock and tailstock. It holds the work securely as I shape the oval handle with a drawknife, block plane and spokeshave.



Crown. A crown about $\frac{1}{8}$ " down from to top of the handle adds good looks and comfort.

the orientation. Fit the tang so that it's tight to about a skinny $\frac{1}{8}$ " shy of the bolster. This allows you to see that the handle will seat square to the bolster and eventually allow the handle to be driven onto the tang without splitting the wood.

Layout & Hand-shape

Because the chisel shaft is tapered along its length and heaviest at the bolster, it's important to lay out the handle's oval shape at the crown so that it is in line with the mass of the chisel. I made a layout jig that I can easily reference against each face of the shaft of the chisel, and trace a series of lines up to the crown.

This allows me to lay out a rectangle on the crown that is directly centered on the chisel shaft, and corrects for any twist in the mortise during the burning in. Make a cardboard template of the oval shape and align it to your rectangle and trace around it. Then draw a larger oval, adding $\frac{1}{8}$ " to the diameter in all dimensions. Remove the handle from the chisel.

To fair the shape, clamp the handle between a pair of dog hole-seated heads, much like the headstock and tail stock of a lathe. (This design was copied from a similar device I saw at Colonial Williamsburg many years ago.)

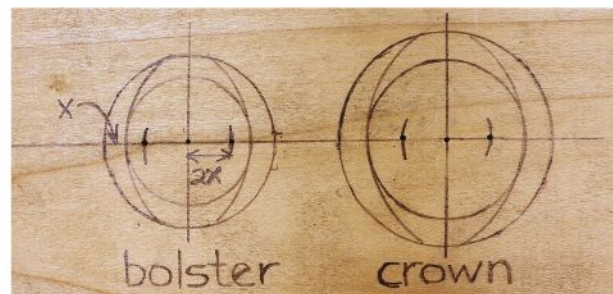
I use a drawknife, block plane and spokeshave to reduce the stock in a series of finer polygons until I achieve an evenly tapered oval handle.

The handle is driven onto the tang with a mallet blow.

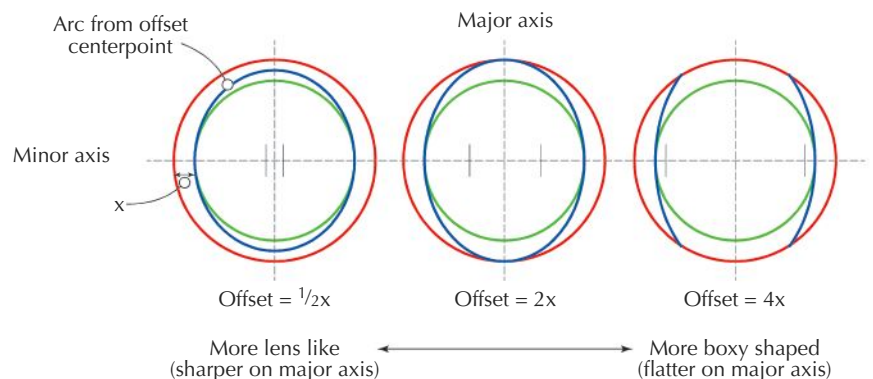
Lay out the crown by scribing a light line $\frac{1}{8}$ " down from the end of the handle. Rasp and sand from the line to the center of the oval to make a smooth crown when viewed from several directions.

Offset Turning

Offset turning is a technique that allows you to turn oval shapes – but it can be hazardous. It is critical to position your tool rest carefully and to have good tool control at all times. During this process, the stock will be seriously out of balance, so you need to carefully adjust the balance between speed of the lathe and stability of the piece between the chucks. Eye and face protection



Layout. Use a compass to draw two concentric circles on each end of the handle (shown here on a piece of scrap).



are necessary. You also need to know exactly where your fingers are at all times. With a piece of similar stock, do a “dry run” first to get a feel for the setup.

An oval can be said to be the synthesis of two circles, one based on the major axis of the oval and the other on the minor axis. For these chisels, the two axis dimensions are taken from the widest and narrowest dimensions of the bolster. At the crown of the handle, these circles are about $\frac{1}{4}$ " greater in diameter to account for the taper.

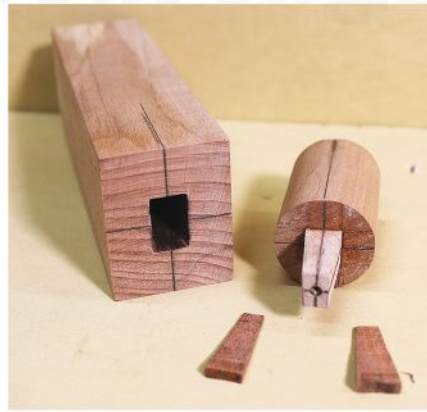
Lay out these circles concentrically on a piece of scrap stock using a compass.

A pair of off-center “centers” will be laid out along the minor axis of the turning stock. The exact position of these offset centers is determined by what the final shape of the oval is to be. The critical dimension to keep track of is the difference in diameters of the two circles (x in the illustration on page 52). The red and green circles in the illustration represent the major and minor axis circles, respectively, and the series of blue arcs represent how the oval shape will come out after being turned and faired out to the major axis.

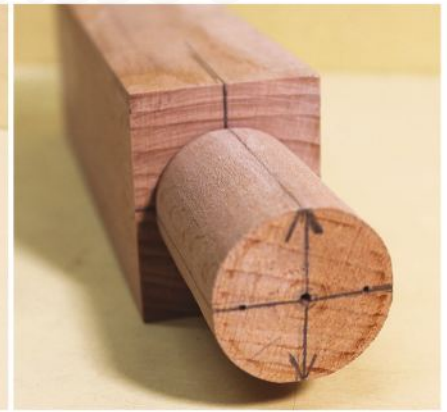
The offsets are some fraction or multiple of x. If you make x a small fraction ($\frac{1}{2}$ x is shown), the offsets will be slight and the oval will have a more lens-like shape; it will be faired to the major axis. As you use a larger value for x (multiples of two and four are shown), the handle oval tends towards boxy. In general, setting the offset to be one and a half to two times the diameter difference is a good place to start.

You can get a general idea of the oval shape by setting one limb of a compass on one of the offsets, adjusting the other limb to the far diameter of the smaller circle and scribing an arc. Repeat this process from the other offset. You'll see that the arcs somewhat determine an oval. It is clear that at the two ends of the major axis, some shaping (sanding, spokeshave or scraper) will need to be done to fair out the oval shape to merge with the major axis.

The large rectangular mortise presents a problem for chucking the handle in the lathe for offset turning because



Chuck up. The tapered tenon on this turning jig fits into the mortise burned into the workpiece; the wedges secure it in place. On the round end, mark your centerpoints and offset centers.



the hole is larger than the location of the offset centers. I made a chuck device to solve this problem.

I mortised a piece of square stock (the size of the smaller dimension of the burned hole) 1" deep into the end grain of a 2"-long billet and glued it in. Be sure to lay out centerlines from each face of the billet and the square stock so that these can be aligned when mortising them together. I then turned the device to the minor diameter of the bolster, and cut the tenon off to about an inch. Relieve each face of the tenon that is parallel to the major axis until the device slides into the mortise. To lock this device into the mortise, cut two small wedges to fill in the long axis of the mortise, and press the handle down onto the tenon and wedges. This will lock the handle in place. You can reuse this device for any mortise with the same narrow width.

Lay out your centerpoint and offsets on the opposite face of the jig.

Chuck it Up

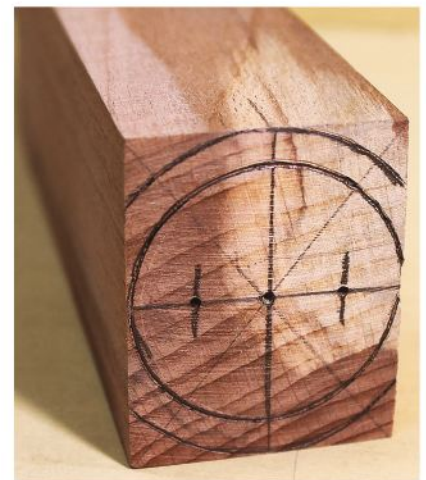
Each end of the billet should have three centerpoints—one true center and two offset centers. These offsets should be pricked on the minor axis of the handle and be the same at both ends of the handle. Chuck the billet between the true center points. I use Steb centers for both the head and tail stock of the lathe, but a combination of a spur center for the headstock and a cone point for the tail stock might work just as well, unless the offsets are very close to the edge of the work.

Set two pairs of calipers to the two major diameters (crown and bolster ends of the handle). I make these settings just a bit fat so that I have room to sand or shave the oval to final shape after turning. Use a compass to draw the two concentric circles centered on the true centerpoint at the crown end of the handle for visual reference.

Hand turn the lathe to adjust the tool rest to as close to the work as possible. Because the billet is not square, this is a critical step.

Turn a narrow section of each end of the handle to its major diameter using a bedan or other parting tool.

Connect these two diameters using a small roughing gouge followed by a skew chisel. After turning off the lathe, check the straightness of the taper with a straightedge. I evaluate my progress



Centerpoints. Lay out one true center and two offset centerpoints on each end of the handle billet.



Major diameters. Use a bedan or other parting tool to turn each end to a shade more than the final diameter.



Still centered. Use a roughing gouge and skew to turn the equivalent of a tapered cylinder. After turning is complete on the true centers, connect the major axis lines down the length of the billet before resetting it in the near offset centers. The lines will help guide your next cuts.



Parting. Use a skew to turn each side of the billet to close to the major axis line. Note that the edge of one face is penciled in for clarity of observation. Fair the profile to the axis lines by sanding (lathe on) or rasping (lathe off). After this last step, the handle is ready to be parted off.



And done. A couple coats of shellac and your old mortise chisel is ready for new work.

by watching the “shadow” of the edges as I take the material down. At this point, you’ll have the equivalent of a tapering cylinder.

From each end of the handle, pencil in a line to connect the two major axis lines down the length of the handle.

Reset the billet to the near pair of offset centerpoints, reset the tool rest then turn the lathe by hand to ensure the billet doesn’t whack the tool rest throughout its rotation. The billet will be seriously off center at this point. Note that you will be turning one side of the billet with one pair of offset centerpoints, and the other side with the opposite pair of offset centerpoints.

I went right to the skew chisel because the roughing gouge is too aggressive for this cut.

Stop the lathe periodically to gauge your progress; you want to approach the pencil lines along the length of the billet evenly. Stop when you are at the minor diameters on the ends of the billet and as close as possible to the lengthwise line.

Now reset the billet to the other pair of offset centerpoints. Repeat as above, then return the billet to the true centerpoints. The transition between the minor axis and major axis faces (near the two midlines) may need to be faired.

Depending on the shape of the oval, the shape can be faired by light sanding while the handle is turning on the lathe (remove the tool rest before sanding). Alternatively, for heavier fairing out, you could stop the lathe, rasp or spokeshave the transitional areas, then turn the lathe back on and fair out with sanding.

Part & Finish

The handle is ready to be parted off. In doing so, you can create the crown. Because the handle is an oval, the crown will have an arching arris around the edge, peaking in the middle. The least nerve-racking solution, however, is to part the handle with it chucked in the true centerpoints, then hand-shape the crown to final appearance with a fine rasp (the work of a few minutes).

The tool will make intermittent contact with the wood as you part, so excellent tool control and support is necessary. I part using a combination of a skew chisel and a fine spindle gouge, clearing waste from the headstock end of the handle to give me tool leverage.

I sand my handles to #320 grit, then apply several coats of shellac (you may prefer an oil finish).

Which of the three techniques presented above do you think Benjamin Seaton used for his mortise chisel

handles in 1796? You can either go to England to examine the chest, read “The Tool Chest of Benjamin Seaton” or get an answer right now. Seaton’s chisel handles clearly show the marks of shaping by file: Burn then shape by hand.

Now seat the tang of your chisel in its new handle, and you’re ready to put that old tool to work by chopping out some mortises. **PWM**

Willard is a retired research scientist who lives and works in Chapel Hill, N.C. Peter is a blacksmith in Siler City, N.C. Both teach classes at The Woodwright’s School.

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

BLOG: Read Derek Cohen’s technique for rehandling an oval-bolstered chisel.

BLOG: Read about how Ray Iles puts handles on chisels on Joel Moskowitz’s blog.

ARTICLE: “Workbench Clamping Jig” by Willard Anderson, from Woodwork magazine.

WEB SITE: Visit Anderson’s web site.

WEB SITE: Visit Peter Ross’s web site.

IN OUR STORE: Read Anderson’s step-by-step instructions for making a fixed-width panel-raising plane.

Our products are available online at:

■ ShopWoodworking.com

Woodworking in America

WINSTON-SALEM, NORTH CAROLINA

9.12 - 9.14 | 2014

EXPERIENCE THE ULTIMATE WOODWORKING WEEKEND— NOW IN WINSTON-SALEM.

All woodworking, all weekend long! Learn from an elite lineup of woodworking legends including Roy Underhill, Frank Klausz, Peter Galbert, Patrick Edwards and more. See the latest tools and try before you buy while talking with exhibitors who truly know their stuff—including many of the industry's best hand-tool makers, power-tool vendors and woodworking suppliers.

AND NEW THIS YEAR: A full day of offsite activities for full conference pass holders, including special access to the furniture, tools and workshops at Old Salem and the Museum of Early Southern Decorative Arts.

All brought to you by the editors of
Popular Woodworking Magazine.

GET YOUR TICKETS TODAY!
www.woodworkinginamerica.com



SPONSORED BY

AMERICANWOODWORKER®



BOSCH
Invented for life



FAST DOVETAILS

Set up in under 5 minutes.
Order your Keller Dovetail System now!
(800) 995-2456

Made in the USA since 1976 • DVD/Video \$8.95 + \$2 p/h

www.fastdovetails.com

CARD #26 or go to PWFREEINFO.COM

Looking for wood?

VISIT
woodfinder

It's fast, easy and FREE!
www.woodfinder.com
No computer? Call toll-free 1-877-933-4637

www.whitechapel-ltd.com 1(800) 468-5534

WHITECHAPEL LTD
est. 1987
Fine Brass and Iron Hardware



CARD #48 or go to PWFREEINFO.COM



Windsor Chair Shop
of
Lancaster County LLC
Ever thought about making a
Windsor Chair?
Come to beautiful Lancaster County, PA

CHAIR CAMP
• Small Classes
• Expert Instruction
• All Tools Provided

See website for class schedule
pachairmaker.com
Brian R. Cunfer
717-587-5253

CARD #113 or go to PWFREEINFO.COM



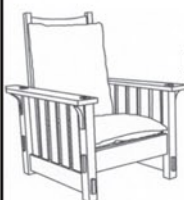
THE FURNITURE INSTITUTE
of MASSACHUSETTS

Study with Philip C. Lowe
Classes range from 1 day to 1 week
and 2 and 3 year mastery programs.

See new class schedule on:
(978) 922-0615 www.furnituremakingclasses.com

CARD #16 or go to PWFREEINFO.COM

CRAFTSMAN PLANS



Authentic
Reproduction
PLANS
BOOKS
HARDWARE

Measured & Drawn by Robert W. Lang
author of
"Shop Drawings for Craftsman Furniture"
www.craftsmanplans.com



Your Perfect Workbench
Deserves The Perfect VISE

- Hard maple large vise screws
- 2-1/2 in. diameter x 24 in. length
- Fast action 2TPI thread

www.lakeerietoolworks.com
814-528-4337

CARD #70 or go to PWFREEINFO.COM

Hands on Instruction for All Skill Levels

Mario Rodriguez - Alan Turner

For more info on Courses:
215.849.5174



PhiladelphiaFurnitureWorkshop.com

The **Beall** *Wizard* *Raises the art of pen turning to a new level*

THE BEALL TOOL CO.

541 Swans Road N.E. Newark Ohio Dept. PW
1-800-331-4718 www.bealltool.com

CARD #2 or go to PWFREEINFO.COM

100+ Hardwoods

- ✓ Hand selected orders
- ✓ 100 woods in stock
- ✓ Expert knowledge
- ✓ 100% satisfaction



800-423-2450

No one has a better website for ordering wood:
www.101woods.com



PayPal

CARD #53 or go to PWFREEINFO.COM

CraftsmanStudio.com

TOOLS TO BRING OUT
THE BEST IN YOUR WORK

Authorized dealers for
Auriou, Lie-Nielsen,
Shapton, Veritas &
TANOS sustainers®



FREE SHIPPING ON ONLINE ORDERS - SEE WEBSITE FOR DETAILS - 888-500-9093

CARD #5 or go to PWFREEINFO.COM

The Web's BEST Woodworking Source!

We now offer one of the largest collections of free woodworking content on the web, all searchable. You'll find fresh project plans, articles and techniques every day of the week at popularwoodworking.com – and these FREE resources are already available for use:

**Streaming Video • Projects
Techniques & Tool Reviews
PW Staff Blogs • Online Bookstore
And More**



Get a daily dose of **FREE**
woodworking insight at
popularwoodworking.com!

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 - Inert Gas Preservation System.
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

MISTER GLUE! Industrial strength cyanoacrylate that will not dry in the bottle. Extremely fast, permanent bond. www.MisterGlue.com

Hand Tools

DI LEGNO WOODSHOP SUPPLY Quality woodworking hand tools at an affordable price.
www.dlws.com or 1-412-331-1236.

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, Brass-town, 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.

CREATE YOUR OWN FURNITURE DESIGN BUSINESS. Intensive course at **CHIPPENDALE SCHOOL**, UK's leading furniture school in Scotland. www.chippendaleschool.com.

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.

Wood

REAL WOOD INLAY BANDINGS, stringing, and other inlay materials. Holly, ebony, and custom inlays. www.inlaybanding.com 704-221-2147

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
Amana Tool	4	115	amanatool.com
Arbortech PTY Ltd	4	99	arbortech.com.au
Beall Tool Company	56	2	bealltool.com
Bessey Tools of North America	4,5	101	besseytools.com
Bloxygen	57	3	bloxygen.com
Blue Spruce Toolworks	4	104	bluesprucetoolworks.com
Chippendale Int'l School of Furniture	57	111	chippendaleschool.com
Craftsman Plans	56	-	craftsmanplans.com
Craftsman Studio	56	5	craftsmanstudio.com
Custom Branding Irons	17	93	branding-irons.biz
Di Legno Woodshop Supply	57	6	dlws.com
DR Power Equipment	11, 19	-	drpower.com
Easy Wood Tools	4	39	easywoodtools.com
Epilog Laser	13	56	epiloglaser.com
Forrest Mfg.	17	13	forrestblades.com
Franklin International (Titebond)	5	14	titebond.com
Furniture Institute of Massachusetts	56, 57	16	furnituremakingclasses.com
General International USA	5	17	general.ca
Gorilla Glue	5, 13	18	gorillaglue.com
Grizzly Industrial	Cvr 2, 1	57	grizzly.com
Hamilton Woodworks	4	118	hamiltontools.com
Harbor Freight	61	76	harborfreight.com
Highland Woodworker, The	59	91	thehighlandwoodworker.com
Horizon Wood Products	5	108	horizonevolutions.com
Infinity Tools	4, 59	23	infinitytools.com
InlayBanding.com	57	123	inlaybanding.com
JessEm	5	65	jessem.com
JET Tools	5	72	jettools.com
Jim Bode Tools	57	24	jimbodetools.com
John Campbell Folk School	57	-	folkschool.org
Keller & Company	56	26	kellerdovetail.com
Knew Concepts	4	60	knewconcepts.com
Lake Erie Toolworks	56	70	lakeerietoolworks.com

	PAGE#	CARD#	WEB ADDRESS
Lee Valley	4, 9	28	leevalley.com
Leigh Industries	5	-	leighjigs.com
Lie-Nielsen Toolworks	19	29	lie-nielsen.com
M. Power Tools	4	116	m-powertools.com
Masterpiece Finishes	4	117	masterpiecefinishes.com
Mirka Abrasives	5	31	mirka.com
Mister Glue	57	122	misterglue.com
Oliver Machinery	17	94	olivermachinery.net
Oneida Air Systems	9	35	oneida-air.com
Osborne Wood Products	9	35	customlegs.com
Philadelphia Furniture Workshop	56	-	philadelphiafurnitureworkshop.com
Popular Woodturning	59	-	popularwoodturning.com
Powermatic	Cvr 4	58	powermatic.com
RadarCarve	11	38	radarcarve.net
Rikon Power Tools	4	42	rikontools.com
Royalwood Ltd.	57	-	royalwoodltd.com
Sells Safety	5	83	sellsafety.com
Shellac.net	57	-	shellac.net
SuperMax Tools	11	121	supermaxtools.com
Trend Routing Technology	5	120	trend-usa.com
Wall Lumber	4, 5, 19	47	walllumber.com
Whitechapel Ltd.	56	48	whitechapel-ltd.com
Windsor Chair Shop	56	113	pachairmaker.com
Woodcraft	Cvr 3	49	woodcraft.com
Woodfinder	56	-	woodfinder.com
Woodline.com	5	50	woodline.com
Woodpeckers	2, 5	52	woodpeck.com
Woodstock International	7	114	woodstockinternational.com
Woodworker's Source	56	53	woodworkerssource.com
Woodworker's Supply	17	54	woodworker.com
Woodworking in America Show	55	-	woodworkinginamerica.com
Work Sharp	5	119	worksharp.tools.com

Application Problems

Solutions to a baker's dozen of common finishing difficulties.

It's easy enough to provide instructions for applying finishes. But in the real world, things go wrong; problems occur that you have to deal with.

With the combined goals of defining the problems, providing ways to avoid them, then fixing them after they occur, here are a baker's dozen of the most common application problems in alphabetical order.

Bleeding in oil finishes: the oil bleeds out of pores after any excess oil has been wiped off.

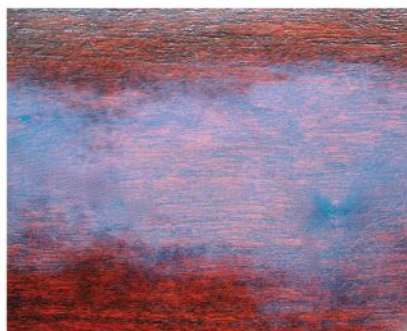
- To avoid, continue wiping off every half-hour or so until the bleeding stops.
- To fix, if the bleeding has dried, disguise it by sanding or rubbing with steel wool, and apply another coat – or strip and start over.

Bubbles dry in brushed alkyd or polyurethane varnish: more likely in hot weather.

- To avoid, work in cooler temperatures.
- To avoid, “tip off” (use light passes while holding the brush nearly vertical) after each couple of strokes to break the bubbles.
- To avoid, add 5-10 percent mineral spirits (paint thinner) to the varnish so the bubbles are more likely to pop out on their own.
- To fix, sand level and apply another (thinned) coat.

Blushing: a milky whiteness that appears in a lacquer or shellac finish on a humid day within seconds after application.

- To avoid, wait for a drier day.
- To avoid, add lacquer retarder (for shellac, use butyl cellosolve).
- To fix, mist on the retarder.
- To fix, rub with fine steel wool.



Blushing. Lacquer and shellac can turn milky white in humid weather right after application. To avoid this, slow the drying of the finish by adding a retarder (a slower evaporating solvent).

- The blushing often disappears on its own by the next day if you can wait.

Brush marks: ridges in the finish caused by the brushing.

- To avoid, add enough of the appropriate thinner to the finish to allow it to flow out level.
- To fix, sand level and apply another (thinned) coat.

Cotton blush: small white clumps appearing in a lacquer-type finish when it dries, caused by using too weak a lacquer thinner that is meant just for cleanup.

- To avoid, use a lacquer thinner meant for thinning lacquer, not for clean up.
- To fix, sand out and apply another coat using the proper lacquer thinner.

Dry spray: a sandy looking and feeling surface caused by spraying shellac or lacquer that is drying too fast. It's common when spraying the insides of cabinets and drawers.

- To avoid, add lacquer retarder (butyl cellosolve for shellac).
- To fix, sand level and apply another coat with retarder added.



Cotton blush. If you add a lacquer thinner meant for cleanup rather than thinning to lacquer, the finish will come out of solution and show up on the wood as white fuzz resembling small pieces of cotton. Always thin with a proper thinner.

Fish eye: the finish bunches up into craters or ridges (most common when refinishing, due to silicone from furniture polishes getting into the wood).

- To avoid, wash the wood thoroughly with any solvent, ammonia or trisodium phosphate.
- To avoid, seal the wood with shellac.
- To avoid, add fish-eye eliminator to the finish. When adding to alkyd or polyurethane varnish, thin the eliminator first with mineral spirits. Use an emulsified eliminator with water-based finishes.



Fish eye. Finish doesn't flow out well over silicone (which has a low surface tension), which is often included in furniture polishes. So when refinishing, the finish may bunch up into craters or ridges if you don't first wash off the silicone, seal it in with shellac or add a fish-eye eliminator to the finish.

CONTINUED ON PAGE 60

free WEBTV for woodworkers.



coming this season

Christopher Schwarz • Mary May • Glen Huey
George Walker • Don Williams • Scott Phillips



www.thehighlandwoodworker.com

CARD #91 or go to PWFREEINFO.COM

SUPER GENERAL™ 10" x 40 Tooth Blade

INFINITY

- ✓ Ripping & Crosscutting
- ✓ Hard & Softwoods
- ✓ Laminates & Melamine
- ✓ Full & Thin Kerf Versions



Item: 010-044

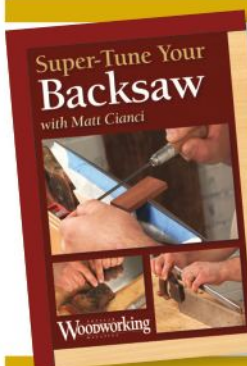
SALE: \$99⁹⁰



infinitytools.com | 877-USA-BITS

Scan for Info

CARD #23 or go to PWFREEINFO.COM



'Super-Tune Your Backsaw'

Get all your backsaws in perfect working order – whether they're flea-market finds or old tools in need of tuning and sharpening from years of use – with Matt "the saw wright" Cianci's expert step-by-step instruction.

Available now at ShopWoodworking.com

Popular Woodworking Presents *Woodturning with Tim Yoder*

— Starting April 5, 2014! —

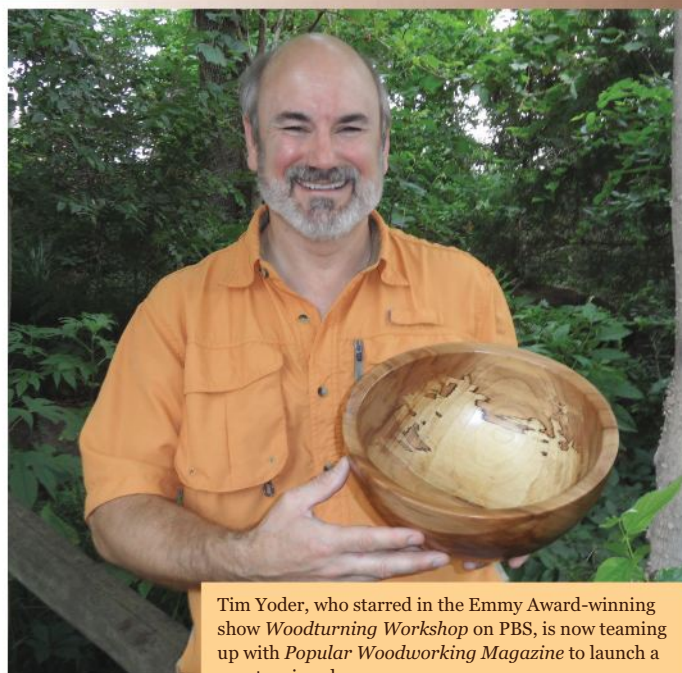
Popular Woodworking Magazine is teaming up well-known PBS star Tim Yoder to launch a new online video show, filled with expert and friendly advice that will teach you how to become a better woodturner.

In each 30-minute episode, Tim will take 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 other Saturday starting April 5 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, Rikon Power Tools and Cook Woods.



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

- To fix, sand level and add fish-eye eliminator to the next and all following coats, or strip the project and start over.

Glue slotching: usually shows up as lighter areas around joints or from fingerprints, especially under a stain.

- To avoid, put less glue in the joints.
- To avoid, quickly wash off all the glue seepage and sand smooth.
- To avoid if the glue has dried, sand or scrape it off.
- To fix after stain application, sand out with sandpaper that is wet with more stain.

- To fix after a coat of finish has been applied, disguise using markers or an artist's brush with colorants, and apply another coat.

- To fix, strip the project or sand it to an even color and restain.

Orange peel: a sprayed surface that resembles the bumps on the surface of an orange.

- To avoid, thin the finish more or increase the air pressure.
- To avoid, watch what's happening in a reflected light and adjust your speed and distance to get an evenly wet coat just short of runs and sags.
- To fix, sand level. Then thin the next coat, or adjust your speed or distance.

Pinholes: small bubbles in a sprayed lacquer finish that appear right over the pores on porous woods such as oak



Orange peel. The most common spraying problem is orange peel, which is caused by spraying too thick a finish with too little air pressure, or moving the gun too fast or too far from the surface. Knowing the causes makes the ways to avoid orange peel obvious.



Pinholes. On open-pored woods, air can come back out of the pores and cause bubbles in the finish. These turn into pinholes when you sand them level. The best way to avoid this problem is to spray "dust coats" to begin with until you get enough of a build to spray wetter coats.

and mahogany. They are caused by air trapped in the pores coming into the finish and forming bubbles. These become pinholes when you sand them level.

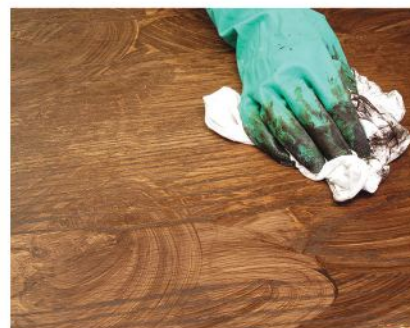
- To avoid or fix, "dust" with almost dry coats by holding the gun farther away and move it faster. Follow with increasingly wetter coats with plenty of drying time between each.
- To avoid, fill the pores of the wood and avoid really wet coats at the beginning.

Runs & sags: areas where thick finish is applied and gravity causes it to droop.

- Least likely to occur with lacquer-type finishes because they set quicker.
- To avoid, watch what's happening in a reflected light during application, and brush out the sagging as it occurs.
- To avoid if spraying, apply coats thinner on the wood.
- To avoid if brushing, stretch coats out thinner.
- To fix, sand or scrape level, then apply another coat.

Sticky finish: the finish is still tacky or gums up sandpaper after a reasonable drying time for that finish.

- To avoid, work in a warmer temperature.
- To avoid with a lacquer-type finish, add acetone.
- To avoid on naturally oily woods, wipe over with naphtha or acetone just before applying the finish, or apply a shellac sealer coat.



Stain streaks. Water-based and lacquer stains dry very fast, especially in warm temperatures. To apply and wipe off the excess successfully, work faster or on smaller surfaces at a time, or get a second person to help.

- To avoid with shellac, use more recently dissolved shellac.

- To fix, raise the heat, or strip and start over taking one of the above precautions.

Streaking from stain application: occurs when some of the stain dries before it is wiped off and shows up as opaque streaks (most common with fast-drying lacquer and water-based stains).

- To avoid, use a slower-drying stain, or work faster or on smaller areas at a time.
- To avoid, have a second person wipe off quickly after you apply.
- To fix, strip the wood and start over. You may be able to use the thinner for the stain or acetone, or even more of the same stain, if you catch the problem quickly. **PWM**

Bob is author of "Flexner on Finishing," "Wood Finishing 101" and "Understanding Wood Finishing."

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

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

IN OUR STORE: "Flexner on Finishing" – 12 years of columns illustrated with beautiful full-color images and updated, and "Wood Finishing 101."

Our products are available online at:

■ ShopWoodworking.com

500 Stores Nationwide

HARBOR FREIGHT

QUALITY TOOLS AT RIDICULOUSLY LOW PRICES

LIFETIME WARRANTY
ON ALL HAND TOOLS!

Why a FREE GIFT with NO PURCHASE REQUIRED and NO STRINGS ATTACHED?
Because once you see our GREAT QUALITY and RIDICULOUSLY LOW PRICES,
YOU'LL NEVER BUY TOOLS ANYWHERE ELSE!

SUPER COUPON!

\$4.99
VALUE

FREE

NO PURCHASE REQUIRED
PITTSBURGH

**6 PIECE
SCREWDRIVER SET**

Item 47770
ITEM 47770/61313

LIMIT 1 - Cannot be used with other discount coupon. Coupon good at our retail stores only. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 8/29/14. Limit one coupon per customer and one coupon per day.



67937520

SUPER COUPON!

\$6.99
VALUE

FREE

NO PURCHASE REQUIRED
PITTSBURGH

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

Item 69080
ITEM 69080
69030/69031/47737

LIMIT 1 - Cannot be used with other discount coupon. Coupon good at our retail stores only. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 8/29/14. Limit one coupon per customer and one coupon per day.



20025414

SUPER COUPON!

FREE

NO PURCHASE REQUIRED
CENTECH

**7 FUNCTION
DIGITAL
MULTIMETER**

Item 90899
shown
ITEM 90899
98025/69096

LIMIT 1 - Cannot be used with other discount coupon. Coupon good at our retail stores only. Offer good while supplies last. Non-transferable. Original coupon must be presented. Valid through 8/29/14. Limit one coupon per customer and one coupon per day.



43846222

SUPER COUPON!

"The Perfect Compressor with Powerful,
Quiet and Consistent Airflow...
Plus we Love the Low Price"
- Street Trucks Magazine

**SAVE
\$70**

**2.5 HP, 21 GALLON
125 PSI VERTICAL
AIR COMPRESSOR**

CENTRAL PNEUMATIC

\$149.99

LOT NO. 67847
61454/61693

REG. PRICE
\$219.99

Item 67847
shown



77875764

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 8/29/14. Limit one coupon per customer per day.

SUPER COUPON!

**20%
OFF**

ANY SINGLE ITEM!

LIMIT 1 - Save 20% on any one item purchased at our stores or HarborFreight.com or by calling 800-423-2567. Cannot be used with other discount, coupon, gift card, Inside Track Club membership, extended service plans or on any of the following: compressors, generators, tool storage or carts, welders, floor pads, Swaddle Ride-On Trencher (Item 65162), open box items, in-store event or parking lot sale items. Not valid on prior purchases after 30 days from original purchase date with original receipt. Non-transferable. Original coupon must be presented. Valid through 8/29/14. Limit one coupon per customer per day.



14149006

SUPER COUPON!

**CENTRAL
MACHINERY**

**2 HP INDUSTRIAL
5 MICRON
DUST COLLECTOR**

• 70 Gallon
Capacity

\$159.99

LOT NO.
97869/61790

REG. PRICE
\$249.99



17628384

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 8/29/14. Limit one coupon per customer per day.

Customers Say and Experts Agree Harbor Freight WINS in QUALITY and PRICE

SUPER COUPON!

**CENTRAL
MACHINERY**

**8", 5 SPEED
BENCH MOUNT
DRILL PRESS**

LOT NO.
44506/60238/38119

Item 60238
shown

\$54.99

REG. PRICE
\$99.99

**SAVE
\$45**



11300950

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 8/29/14. Limit one coupon per customer per day.

SUPER COUPON!

**1/4" TRIM ROUTER
drillmaster**

LOT NO.
44914/61626

Item 44914
shown

**SAVE
42%**

\$19.99

REG. PRICE \$34.99



92453982

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 8/29/14. Limit one coupon per customer per day.

SUPER COUPON!

**14" OSCILLATING
SPINDLE SANDER**

LOT NO.
69257
95088

Item 69257
shown

**SAVE
\$60**

\$89.99

REG. PRICE
\$149.99



47224446

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 8/29/14. Limit one coupon per customer per day.

SUPER COUPON!

**60" WORKBENCH WITH
FOUR DRAWERS**

LOT NO.
93454
69054

Item 93454
shown

**SAVE
\$110**

\$139.99

REG. PRICE \$249.99



25494398

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 8/29/14. Limit one coupon per customer per day.

SUPER COUPON!

**12" x 33-3/8"
WOOD LATHE WITH
REVERSIBLE HEAD**

LOT NO.
34706

\$199.99

REG. PRICE
\$349.99

**SAVE
\$150**



28389665

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 8/29/14. Limit one coupon per customer per day.

SUPER COUPON!

"We Are Impressed With the
Quality...The Price is Incredible!"
- Car Craft Magazine

**SAVE
\$280**

**44", 13 DRAWER
INDUSTRIAL QUALITY
ROLLER CABINET**

• 2633 lb. Capacity
• Weighs 245 lbs.

• Super High
Gloss Finish!

\$369.99

REG. PRICE
\$649.99



56470865

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 8/29/14. Limit one coupon per customer per day.

SUPER COUPON!

**10" SLIDING
COMPOUND
MITER SAW**

LOT NO.
98199
61307

Item 98199
shown

**SAVE
\$120**

\$79.99

REG. PRICE \$199.99



44747252

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 8/29/14. Limit one coupon per customer per day.

SUPER COUPON!

PITTSBURGH

LOT NO.
68048/69227/62116

**RAPID PUMP®
3 TON
HEAVY DUTY
STEEL FLOOR JACK**

\$69.99

REG. PRICE \$159.99

**SAVE
\$90**



83470540

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 8/29/14. Limit one coupon per customer per day.

Order at HarborFreight.com or 800-423-2567
We FedEx Most Orders in 24 Hours for \$6.99

**If You Buy Tools Anywhere Else,
You're Throwing Your Money Away**

EXCLUSIVE OFFER *now at* ShopWoodworking.com

ENJOY **10% OFF** educational products, resources, projects and more – enter code **WOODPUB10** at check-out and save 10% off select products.

**SAVE
10%**
Off Your Next
Purchase

No minimum order
and no end date.



From the same great providers of education, articles and inspiration you experience reading *Popular Woodworking Magazine*, **check out ShopWoodworking.com and save now!**

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.

WORKSHOP MAKEOVER GIVEAWAY

This
\$8,000 Workshop
Could Be Yours!
ENTER **ONLINE** TODAY!

Enter for your chance to **WIN A COMPLETE SHOP** that features **ALL** you see here.

ENTRY DEADLINE: Midnight, Eastern Standard Time, May 31, 2014



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, 2014-May 31, 2014) 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 \$8,000. 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:



Harness Leather on the Headstock

Childhood memories from 40 years in the past are rediscovered with a gift.

The old man winked and reached under his workbench to retrieve a rusty paint can. He whispered, "Your grandma back in the house?" I nodded yes. From the can he extracted a well abused pint of bourbon, took a nip and returned his stash to its hiding place. "Medicine. Whew. Now, let's curl some wood," he said, winking again as he lifted a jack plane from its perch. We were about to craft a sword fit for a 6-year-old swashbuckler's raid on a citadel of garden mulch.

Granddad was a railroad man before two heart attacks retired him to his backyard woodworking shop, a 10' x 20' lean-to with cypress shavings for the floor. And not one power tool was on the premises.

In his shop, he fashioned small furniture, lamps, bowls and other goods for family and appreciative customers. My favorite tool was his homemade lathe, its headstock driven by a pedal and a thin strip of harness leather.

He pedaled and steadied my hands on the roughing gouge as we shaped a rocket, sword hilt or any other creation I fancied. Despite granddad's patience, this aspiring pirate's attention deficit afforded little opportunity for the craftsman to impart his encyclopedic knowledge of turning, joinery and the use and care of hand tools. Before I turned 10, granddad's health deteriorated, and our visits to the woodshop ended.

Fast-forward 40 years, a span in which I seldom thought about those times with granddad. I owned no woodworking tools, and was so deeply immersed in my career that, if asked, I might have identified a dado as extinct poultry. Still, as we age, impressionable childhood memories have a way of breaking through cerebral cobwebs.

Feeling unusually nostalgic a few weeks before Christmas that year, I recounted a fond memory of granddad's woodshop to my wife. I had no intention of working with wood, and gave the matter no further thought.

Imagine my surprise when on Christmas morning I opened a gift from my wife to find a 1½-horsepower router and six high-speed steel router bits.

I said all the gracious things propriety dictates in such moments, but I was dumbfounded, thinking "what the heck am I supposed to do with this thing?" Nevertheless, to make a good show of appreciation, I took the router to my barn, read the operating instructions, chucked a straight bit in the collet then freehanded initials on a pine plank.

That did it! Once again, I could feel cypress shavings underfoot, hear the slap-slap of harness leather and catch a faint whiff of bourbon and newly worked pine. I could hear the old man's voice through time, "Hand me the rabbit plane." "No, no, chamfer the end grain first to avoid blow-out." Perhaps I had picked up more from his tutelage than I thought.

Within the year I converted half the barn into a shop and added another router, table saw, bench and

Last weekend my 4-year-old grandson ambled from workstation to workstation then stopped at a display case holding a careworn but lovingly restored jack plane. "What's that?" he asked. "Does it make loud noises, too?"



(There's no shortage of power tools in my shop.) "Let's see," I said. With his hands on mine, we were soon taking long curls of cypress to his exclamations of "Awesome! This is cool, granddaddy." And, indeed, it was.

I suspect that he, unlike his granddaddy, won't wait 40 years before he claims a router for his own. **PWM**

David, a retired newspaper editor and longtime hobbyist woodworker, lives in DeLand, Fla., where he operates a licensed service specializing in interior finish carpentry and woodwork repair.

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/jun14

TWITTER: Follow us on Twitter @pwweditors.

Our products are available online at:

■ ShopWoodworking.com



DREMEL Fortiflex Heavy-Duty Flex Shaft Tool

The Fortiflex is designed to be the ideal rotary tool for people engaging in detailed projects that require both precision and power. The tool's powerful 2½ amp (⅓ HP) motor provides high torque at low speeds, making it perfect for power carving, shaping and grinding applications. Its flexible shaft includes a patented bearing system for durability and cool operation.

The precision handpiece is engineered for control and comfort even during extended use, and its three-jaw chuck enhances versatility by accepting accessories with shank sizes from 0" to 5/32". Can be used with all Dremel Rotary Tool Accessories. Includes Dremel Fortiflex motor unit, variable-speed foot pedal, heavy-duty flex shaft, handpiece with three-jaw chuck, wall hook, chuck wrench, 21 accessories and owner's manual.

DREMEL®

Specs:

- Model Number 9100-21
- Powerful 2½ Amp, 120V (⅓ HP) High-Torque Motor
- Speed: 0-23,000 RPM
- Foot-Operated Speed Control
- Cord Length: 8'
- Height: 9"
- Warranty: Two-Year Limited



159096

For A Free Catalog Or To Find Your Local Woodcraft Store, Visit woodcraft.com Or Call 800-225-1153. 14PW06P
For Information On Woodcraft Retail Franchise Opportunities, Visit woodcraftfranchise.com

INTRODUCING THE NEW **PM1000 TABLE SAW**



POWERED FOR PERFECTION



115 VOLT POWER

Wired to bring performance to any shop.



DUST COLLECTION

Uniquely designed system maximizes efficiency.



ACCU-FENCE

Legendary Powermatic innovation and reliability.



VISIT: **POWERMATIC.COM**
TO LEARN MORE



© 2014 JPW Industries. All Rights Reserved. The color GOLD is a registered trademark of JPW Industries.

WorldMags.net
CARD #58 or go to PWFREEINFO.COM