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POPULAR Woodworking MAGAZINE

February 2017 ■ #230

Mid-Century Bench

Build this Scandinavian Shop Workhorse



Make a Marquetry
Masterpiece



PLUS

The Best
Furniture
Glue – Page 22

Spring Joints Help You Save on Clamps
Make a Knock-Down Showcase Shavehorse



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- Max. cutting height: 6"
- Blade speeds: 1800 & 3100 FPM
- Approx. shipping weight: 246 lbs.



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17" HEAVY-DUTY BANDSAW 30TH ANNIVERSARY EDITION

- Motor: 2 HP, 110V/220V, single-phase, TEFC, prewired 220V • RPM: 1725
- Amps: 20A at 110V, 10A at 220V
- Precision-ground cast iron table size: 17" x 17" x 1 1/2" thick
- Table tilt: 45° R, 10° L
- Floor-to-table height: 37 1/2"
- Cutting capacity/throat: 16 1/4"
- Blade length: 131 1/2" (1/8" to 1" wide)
- Approx. shipping weight: 342 lbs.

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G0513ANV ONLY \$925⁰⁰

10" HYBRID TABLE SAW with RIVING KNIFE & IMPROVED FENCE

- Motor: 2 HP, 120V/240V, prewired 120V, single-phase
- Amps: 15A at 120V, 7.5A at 240V
- Precision-ground cast-iron table with wings measures: 40 1/2" W x 27" D
- Table height: 35 3/4"
- Arbor: 5/8"
- Arbor speed: 3450 RPM
- Max. depth of cut: @ 90° 3 1/4", 45° 2 1/4"
- Rip capacity: 30" R, 15" L
- Overall size: 57 1/4" W x 37 1/2" D x 35 3/4" H
- Footprint: 21" L x 19 1/2" W
- Approx. shipping weight: 330 lbs.



G0771Z ~~\$895⁰⁰~~ SALE \$775⁰⁰

12" COMPACT SLIDING TABLE SAW

- Motor: 7.5 HP, 220V/440V*, prewired for 220V, 3-phase
- Full load amps: 20A/10A
- Main blade size: 12" • Main blade tilt: 0-45°
- Main blade speed: 4000 RPM
- Depth of cut: @ 90° 3 1/2", at 45° 2 1/2"
- Scoring blade size: 4 3/4" (120mm)
- Sliding table size: 63" x 12 3/4"
- Scoring blade speed: 8000 RPM
- Scoring blade tilt: 0-45°
- Max. rip capacity: 33"
- Length of crosscut: 63"
- Max capacity of crosscut fence: 73 1/4"
- Footprint: 45" x 35"
- Approx. shipping weight: 996 lbs.



G0820 ~~\$5500⁰⁰~~ SALE \$4695⁰⁰

16" X 46" SWIVEL-HEAD WOOD LATHE with CAST IRON LEGS & DIGITAL READOUT

- Motor: 2 HP, 110V, single-phase, 14A
- Swing over bed: 16"
- Swing over tool rest: 13 1/2"
- Distance between centers: 46"
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- MT#2 spindle & tailstock tapers
- Spindle bore: 3/8"
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G0462 ~~\$675⁰⁰~~ SALE \$615⁰⁰

10" LEFT-TILTING TABLE SAWS with RIVING KNIVES & CAST-IRON ROUTER TABLES

- Motor: 5 HP, 240V, single-phase
- Precision-ground cast-iron table size with wings: 48" W x 27" D
- Arbor: 5/8"
- Cutting capacity: 26" R, 8" L
- Max. depth of cut: 3" @ 90°, 2 1/8" @ 45°
- Approx. shipping weight: 542 lbs.



G1023RLWX ONLY \$1475⁰⁰

PLANER MOULDER with STAND

- Motor: 2 HP, 240V, single-phase, 10.8A, 3450 RPM
- Precision-ground cast-iron table measures 14 1/8" x 10" x 7 1/16"
- Max planing width: 7"
- Max planing height: 7 1/2"
- Cuts per minute: 14,000
- 2 HSS knives
- Approx. shipping weight: 324 lbs.

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W1812 ~~\$1920⁰⁰~~ SALE \$1650⁰⁰

*To maintain machine warranty, 440V operation requires additional conversion time and a \$250 fee. Please contact technical service for complete information before ordering.

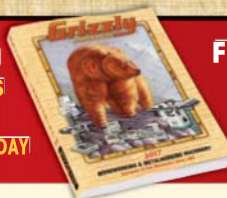


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13" BENCHTOP PLANER with BUILT-IN DUST COLLECTION

- Motor: 2 HP, 110V, single-phase, 15A
- Max. cutting width: 13", Height: 5 1/4"
- Max. cutting depth: 1/16"
- Feed rate: 26 FPM
- Number of knives: 3 (reversible HSS)
- Knife size: 13 1/8" x 2 3/32" x 1/16"
- Cutterhead speed: 9000 RPM
- Number of cuts per inch: 87
- Includes dust collection bag
- 2 1/2" dust port
- Footprint: 22 1/2" L x 14" W
- Approx. shipping weight: 80 lbs.



\$49
 shipping
 (Lower 48 states)

G0832 ONLY \$355⁰⁰

15" HEAVY-DUTY PLANER

- Motor: 3 HP, 240V, single-phase, 14A
- Max. cutting width: 15", Depth: 1/8"
- Max. stock thickness: 6 3/8", Min: 1/4"
- Min. stock length: 6"
- Feed rate: 16 and 30 FPM
- Cutterhead diameter: 3"
- Number of knives: 3 HSS
- Knife size: 15" x 1" x 1/8"
- Cutterhead speed: 5000 RPM
- Table size: 20 1/2" x 15" x 3 1/2"
- Overall size: 32" W x 28" D x 23 1/2" H
- Approx. shipping weight: 382 lbs.



\$159
 shipping
 (Lower 48 states)

G0815 ONLY \$925⁰⁰

15" PLANERS

- Motor: 3 HP, 220V, single-phase, 15A
- Max. cutting width: 15", Depth: 1/8"
- Max. stock thickness: 8", Min: 3/16"
- Min. stock length: 8"
- Feed rate: 16 and 30 FPM
- Cutterhead diameter: 3", Speed: 4800 RPM
- Power feed rollers: solid serrated steel
- Precision-ground table size: 15" x 20"
- Overall size: 32 1/2" W x 42" D x 45 1/8" H
- Approx. shipping weight: 675 lbs. (G0453), 672 lbs. (G0453Z)



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3 KNIFE CUTTERHEAD

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COMBINATION JOINTER/PLANNER with FIXED TABLES

- Motor: 2 HP, 120V/240V, single-phase, 15A/7.5A
- Jointer table size: 7 3/8" x 45 1/4"
- Cutterhead knives: 3 HSS-Single sided
- Knife size: 6 1/4" x 3/16" x 1/8"
- Cutterhead diameter: 2 1/16", speed: 5400 RPM
- Max. planing height: 6"
- Planer feed rate: 11, 22 FPM
- Planer table size: 19 1/4" x 14 1/8"
- Fence: 4 3/4" x 41 1/8"
- Bevel jointing: 0-45° L/R
- Overall dimensions: 46" W x 33" D x 46 1/2" H
- Approx. shipping weight: 418 lbs.



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G0809 ONLY \$2995⁰⁰

6" JOINTERS with MOBILE BASE

- Motor: 1 HP, 110V/220V, single-phase, 14A
- Previred voltage: 110V
- Table size: 6 3/8" x 47 3/8"
- Number of knives: 3
- Cutterhead speed: 5000 RPM
- Cutterhead diameter: 2 1/2"
- Max. depth of cut: 1/8"
- Max. rabbeting depth: 1/2"
- Cuts per minute: 15,000
- Fence size: 29 1/8" L x 4" H
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G0813
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WITH CABINET STAND

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- Sliding table surface: 31" x 12"
- Table counterbore: 3 1/2"
- Table insert openings: 1 1/8" & 2 5/16"
- Table height: 34"
- Fence size (x 2): 3" x 12"
- Overall size: 40" L x 30" W x 42" H
- Footprint: 40" L x 30" W
- Approx. shipping weight: 132 lbs.



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\$89
 shipping
 (Lower 48 states)

G0528 ONLY \$499⁹⁵

8" JOINTER

- Motor: 3 HP, 240V, single-phase, TEFC, 3450 RPM, 9A
- Max. depth of cut: 1/8"
- Max. rabbeting capacity: 1/2"
- Precision-ground cast-iron table size: 9" x 72 1/2"
- Cutterhead diameter: 3", Speed: 4800
- Cutterhead knives: 4 HSS: 8" x 3/4" x 1/8"
- Cuts per minute: 20,000
- Deluxe cast-iron fence size: 35" L x 5" H
- Approx. shipping weight: 522 lbs.



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G0656 ONLY \$895⁰⁰

3/4 HP SHAPER with ROUTER BIT ADAPTER

- Motor size: 3/4 HP, 110V, single-phase • Amps: 10
- Table size: 15 1/8" x 17 3/4"
- Floor-to-table height: 34 1/4"
- Table counterbore: 3" Diameter x 5/16" Deep
- Spindle travel: 1/8"
- Spindle diameter: 1/2"
- Spindle length: 3"
- Spindle capacity under nut: 2 3/8"
- Spindle speed: 8900 RPM
- Overall dimensions: 27" W x 23" D x 40 1/4" H
- Approx. shipping weight: 172 lbs.

Z-SERIES



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G0510Z ONLY \$435⁰⁰



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with 8" Blade, 6" Handle

1281 Square
with 12" Blade, 8" Handle



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Did your glue start out as livestock? If not, it might not be the best adhesive for the job. Slower to set up than PVAs and reversible, liquid hide glue is often the right choice for furniture making – find out why.

BY CHRISTOPHER SCHWARZ

ONLINE ► Do an Undo

Watch a video of a hide glue joint being reversed with water and a clothes iron. popularwoodworking.com/feb17

30 Scandinavian Workbench

Over Roubo and Nicholson? Build a Tage Frid-inspired workbench, updated from its mid 20th-century roots with modern vise hardware and contemporary techniques.

BY WILLARD RAINFORD

ONLINE ► Add a Deadman

Read about the author's Tage Frid-style deadman, a perfect addition to this bench. popularwoodworking.com/feb17

40 Design & Create a Marquetry Panel

A marquetry panel can lend an elegant and eye-catching touch to your furniture builds (or your walls). Learn to create almost any picture in wood with this step-by-step instruction from an award-winning maker.

BY CRAIG THIBODEAU

ONLINE ► Scroll Work

Watch a video of the author using a scroll saw to cut the marquetry pieces in this article. popularwoodworking.com/feb17

47 How & Why of Spring Joints

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BY CHRISTOPHER SCHWARZ

ONLINE ► More Edge Joints

You can make spring joints with a powered jointer too – watch this video to learn how. popularwoodworking.com/feb17

50 Knock-down Shaving Horse

Featuring Windsor-style legs, built-in storage and an antique tractor seat, this knock-down shaving horse is both handsome and practical.

BY WILLARD ANDERSON

ONLINE ► Inside the Shop

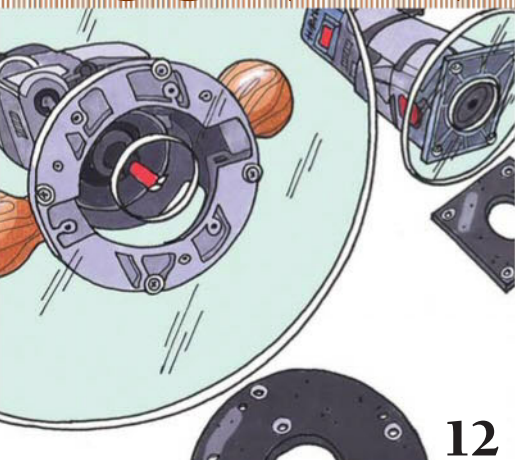
Take a video tour of the author's workshop on the Edwards Mountain Woodworks site. popularwoodworking.com/feb17



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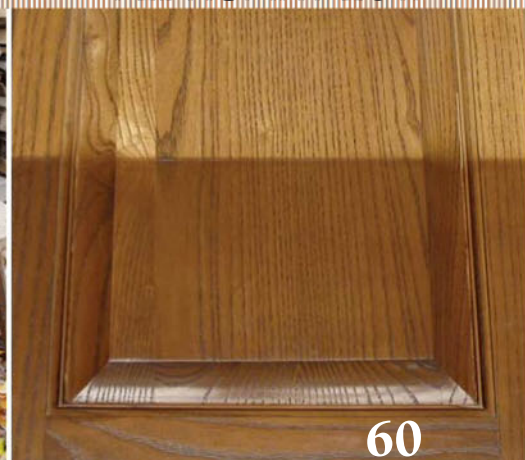
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We have many tool reviews available for free on our website.

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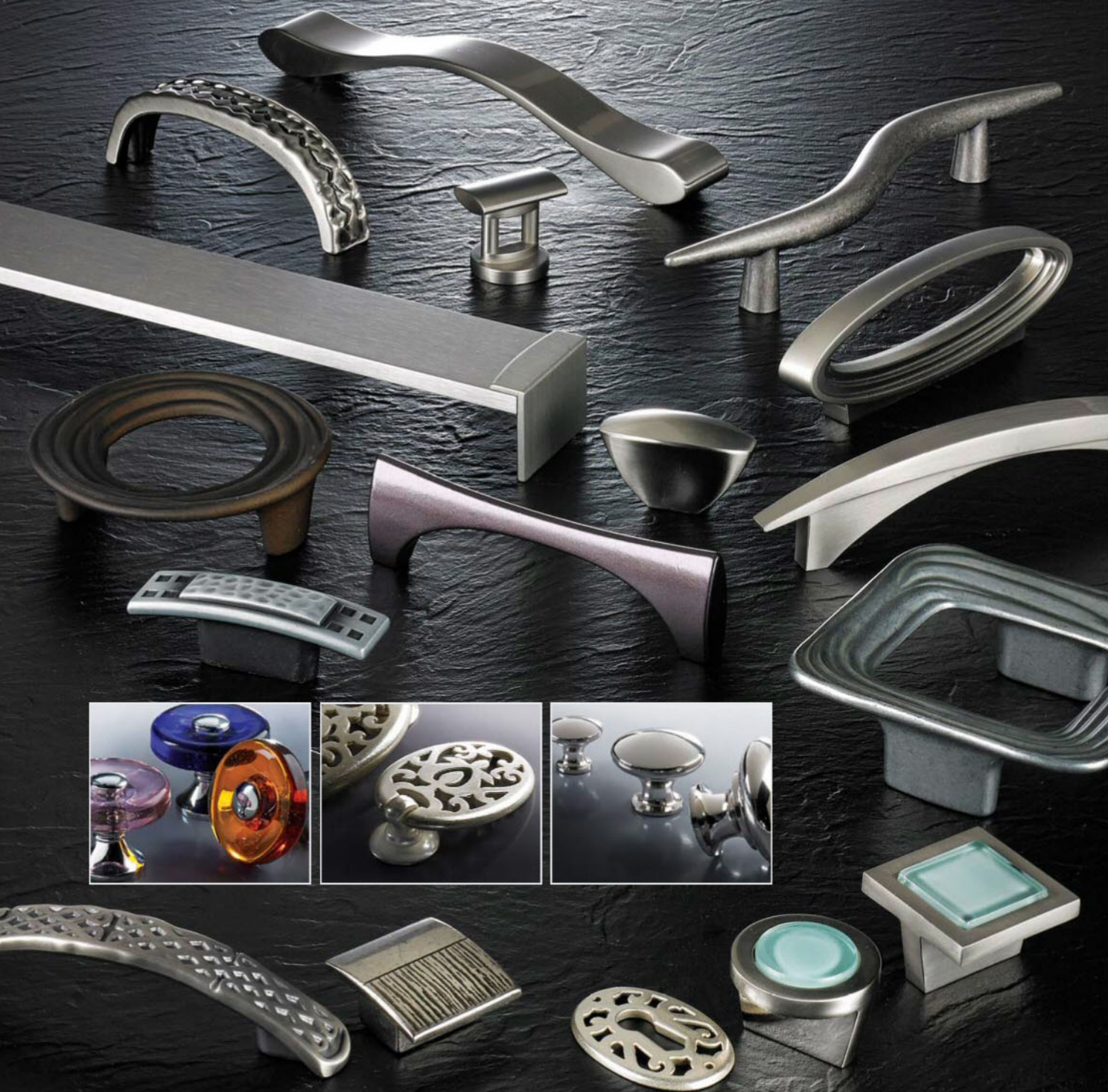
BY GRANT BURGER



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POPULAR
Woodworking
MAGAZINE

Number 230, February 2017, *Popular Woodworking Magazine* (ISSN 0884-8823, USPS 752-250) is published 7 times a year, February, April, June, August, October, November and December, which may include an occasional special, combined or expanded issue that may count as two issues, by F+W Media. Editorial and advertising offices are located at 8469 Blue Ash Road, Suite #100, Cincinnati, OH 45236. Unsolicited manuscripts, photographs and artwork should include ample postage on a self-addressed, stamped envelope (SASE); otherwise they will not be returned. Subscription rates: A year's subscription (7 issues) is \$24.95; outside of the U.S. add \$7/year • Canada Publications Mail Agreement No. 40025316. Canadian return address: 2835 Kew Drive, Windsor, ON N8T 3B7 • Copyright 2017 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.



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Pursuit of Perfection

One of the reviews I wrote for this issue, on David Charlesworth's drawer-making video (page 14), got me thinking about the level of precision for which I strive in my work on both furniture and house rehab projects—and how my definition of “acceptable” and the choices I now make have changed over a decade.

I cut my first dovetails in 2006, following Christopher Schwarz's “Dovetail a Day” prescription. I recall clearly my glee the first time the joints went together “off the saw” – never mind that you could fit a stack of playing cards in the gaps. At the time, I found that result wholly acceptable.

It wasn't until 2008, however, that I was brave (or perhaps foolish) enough to display my wood-on-wood joinery in the magazine. Looking at those '08 dovetail joints up close (right), I'm shocked I felt they were good enough for prime time. (We showed them from farther away, thus the gaps weren't visible.)

That was the best work I could do at the time – and at the time, I always did my best...because my best was barely acceptable.

Since then, I've cut a lot of joints of all sorts, and as one would hope, my work has improved. Is it now “perfect?” Never. But I can now come a lot closer – when I choose to do so.

“Always do your best work.” No doubt you've heard that mantra. But a former boss of mine (pre-magazine days) used to often say, “Perfect is the enemy of good enough.” With enough practice now under my belt to be able to make that choice, I find the pursuit of perfection can get in the way of getting

done. It's sometimes the enemy of what I now think is good enough.

These days, when destined for publication, my joints are ready for a close-up – or at least the front corners of my drawers are, because that's all anyone who encounters my drawers first-hand might notice. If I have an overcut on the through-dovetails at the back, I don't cry about it (much).

Most of my time at work is spent at my computer, at my desk with red

pen in hand or in meetings (the worst!). My shop time is precious, so I save the fussing for where it counts – what will show in the magazine, and what would embarrass me if, say, David stopped by to take a look at my recent work.

Even he wouldn't be able to tell which stair tread I had to shim out from the wall after I cut it slightly out of square; the shim will be covered

by moulding...that I will fuss over.

But you know what? Those gappy 2008 drawers are still working just fine. I use them every day; the chimney cupboard of which they're a part is my bathroom storage cabinet. And I almost never notice the dovetails.

But I'm now wondering if I could make a piece with ultra-high-end drawers like the ones David teaches in his video. I want to try. By striving for something closer to perfect, my “good enough” continues to get better. **PWM**

Megan Fitzpatrick

P.S. Read “A Dovetail a Day” free online at popularwoodworking.com/woodworking-blogs/editors-blog/a-dovetail-a-day.



FEBRUARY 2017, VOL. 37, NO. 1

popularwoodworking.com

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Email: popularwoodworking@emailcustomerservice.com

NEWSSTAND DISTRIBUTION:

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

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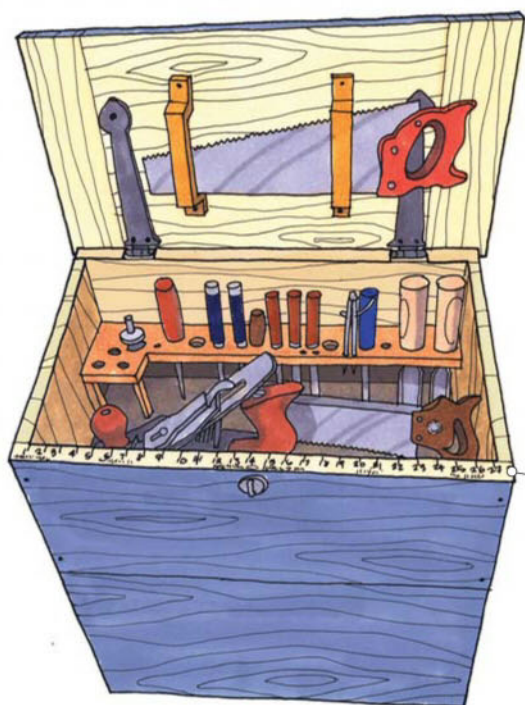
Creative Use for a Vintage Yardstick

In one of Megan Fitzpatrick's blog posts about her house rehab, she mentioned uncovering a 1950s yardstick with an old phone number and hardware store promoted on it.

The same thing happened to me! I think I found mine used as a shim in a door frame I was removing. (I rehabbed an old house too; I'd much rather read about dirty, dusty projects than do them.)

She mentioned not being sure what to do with the yardstick. One idea is to use it the next time she builds something for the shop – after all, it is wood. I cut mine a little shorter and affixed it to the lip of my tool chest. I've even used it once or twice when I needed only an "ish" sort of measurement. Mostly it's just there for whimsy.

Brian Crawley,
via email



Vintage promotional yardstick

Right-angle Drill Attachment

We received inquiries about the drill attachment shown on page 30 of Christopher Schwarz's "Danish Modern Campaign Chest" (November 2016, issue #228).

It is a Milwaukee "Right Angle Attachment" (milwaukeetool.com, item #49-22-8510), and retails for about \$47 from various retailers.

It is about 2" wide (without a bit inserted) and fits most corded and cordless drills. The quick-change chuck accepts hex-shank bits.

Chris has used it for about five years, and reports it has performed well as an alternative to a dedicated right-angle drill.

Megan Fitzpatrick, editor

Outdoor Furniture Finish

What is the most durable finish to use on lawn furniture?

Edward Keckeisen,
via email

Edward, Bob Flexner has written about this subject in this magazine and in his books, so I referred to those for expert advice.

In short, there is no better exterior finish than paint because the thick film blocks water, and the pigment blocks UV light (the two most destructive forces).

A pigmented stain is Bob's second choice because, due to its binder and pigment, it resists both moisture and UV-light damage – but there's less film-build than with paint. That, however, makes maintenance easier because there's rarely any scraping involved before recoating, which is needed every year or two dependent on the climate and exposure.

A clear film-building finish will protect against water but not UV light – so if you want a clear finish, make sure you choose one with UV absorbers, such as a marine varnish. But get it from a marine store, not the home center. Note that this finish will be glossy and you will need eight or nine coats to get enough build for the UV absorbers to be effective.

And regardless of which you choose, assess the finish regularly. If you see scratches or cracks that will allow water to get in, it's time to re-coat.

Megan Fitzpatrick, editor

Horseshoe Nails in Furniture

I just received the December 2016 issue (#229) with Christopher Schwarz's article "Fall in Love with Nails," which discusses the benefits of cut nails and Roman nails.

I built a nailed project and used horseshoe nails, which are very inexpensive and available without having to mail order, as a substitute for cut nails.

John Webb,
via email

John, Horseshoe nails can indeed be pressed into service in woodworking joinery, but they have limitations.

CONTINUED ON PAGE 10



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First, the good points: If you live in a rural area, the nails are readily available. Tractor Supply, here in Kentucky, sells them in packages of 100 and up. And their shape is roughly the same as that of a wrought nail—the shank is rectangular and tapers on all four sides.

The downsides: They are available in a limited range of lengths—usually between 1½" long and 2½" long. So nailing thin stock and thick stock isn't going to happen with horseshoe nails.

The bigger downside in my experience is the shape of the head. Unlike cut nails and wrought nails that have a flat hat-like head (think: sombrero), the head of a horseshoe nail is bugle shaped. So the shank of the nail swells dramatically as it transitions into the head.

The result is that these nails are likely to split dry hardwoods, no matter what sort of pilot hole you use. In softwoods, I've had good luck with these nails. The soft fibers don't mind being pushed aside by the bugle-shaped head.

Bottom line: Experiment with horseshoe nails before you buy a lifetime supply for woodworking purposes. They can work, but they might not be right for the woods you use.

Christopher Schwarz,
contributing editor

Where Can I Get Back Issues?

For six months or so now, we've been posting project images and short excerpts of vintage technique articles on our Instagram feed (@popularwoodworking), and we often get inquiries both there and via email about finding the issues in which those images first appeared.

We have available at shopwoodworking.com comprehensive compilation DVDs available of Popular Woodworking Magazine (1990-2015), American Woodworker (1985-2014), Woodwork Magazine (1989-2014) and Woodworking Magazine (all 16 issues). The easiest way to find them is under the "Shop by Product" category in the top navigation bar—you'll see in the drop-down menu there individual pages for each title.

— Megan Fitzpatrick, editor

Sutherland Welles Products

In the early 1980s, I used several gallons of Sutherland Welles products, so it was gratifying to see the column "Explaining Polymerized Oil" in the November 2016 issue (#228) that mentioned it.

Several pieces of my personal furniture were finished with this product, and I can attest to its quality and durability.

However it was a little disturbing to see the company name misspelled in every mention of the product (except on the label shown in the picture).

Jerome Weilmuenster,
via email

Jerome,
I'm chagrined—and wholly at fault for this one. Bob's columns are usually submitted with not so much as a comma out of place, so I was lazy and didn't check the manufacturer names in his piece (as I absolutely should have).

It is indeed "Sutherland Welles," not "Southerland Welles."

Thanks for bringing it to my attention.
Megan Fitzpatrick, editor

Fixperts Contact Correction

In the "Custom Design, Creative Process" End Grain column of the December 2016 issue (#229), we had in the text an erroneous URL for Fixperts, a social project that pairs makers with clients who have particular needs. The correct URL is fixperts.org. PWM

Rodney Wilson, managing editor

ONLINE EXTRAS

Letters & Comments

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

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Highly Recommended

I've had my French-made Arno bur-nisher for many years (available from \$32 online). It has a V-shaped-edge insert on one side (which I use only for steel that is crazy hard) and a rounded-edge carbide insert on the other (the edge I typically use), and both are perfectly smooth—they need to be to turn a good edge on a scraper. I have yet to encounter steel that will defeat this tool. I also appreciate its cast-aluminum handle with guards; it keeps my sausage fingers protected from the sharp scraper edges.

— Christopher Schwarz



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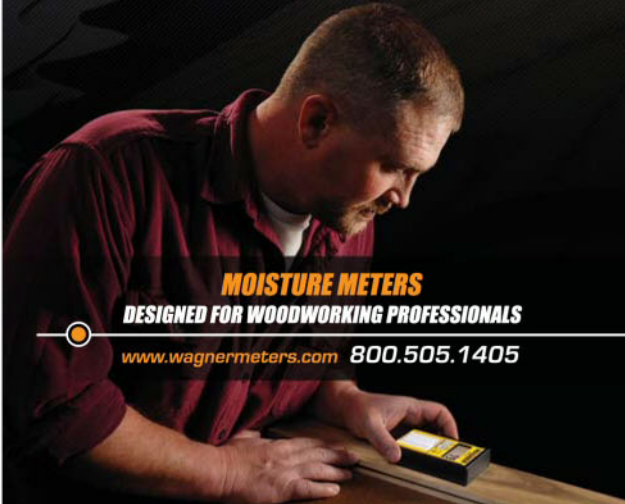
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Safety Note

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.

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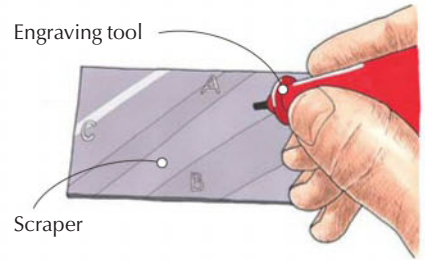
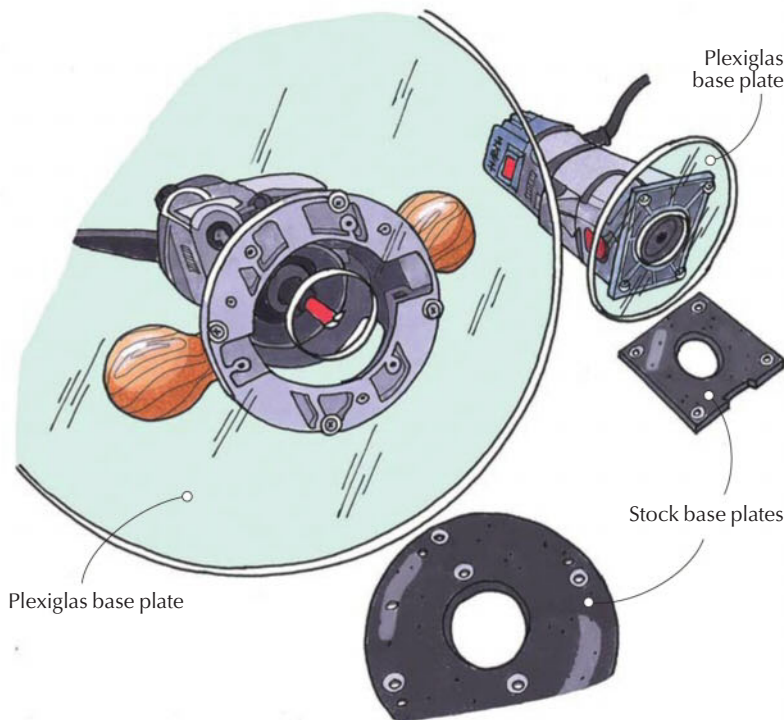
A Clear Improvement For Router Base Plates

I cut custom base plates for my routers, which not only allows me to adjust the size for better stability, but to better see the work.

They're 1/4"-thick Plexiglas that I cut to size and shape on the band saw, then smooth with a belt sander.

I use a hole saw to remove the center, then file the rough edges with a half-round file. I also wrap a camping head lamp onto my routers to light up the bit through the clear plate.

Brian MacAllister,
Salt Spring Island,
British Columbia



Know Your Sharp Edges

It seems like every time I pick up my card scraper I find myself running my fingers along every edge, trying to find the side that I'd last honed and burnished. Occasionally I will leave a square edge on one side of my scraper, while putting a large hook on the adjacent side, for smoothing and shaping purposes, respectively. And at times, my fingertips betray me, so I spend a few minutes testing out each edge on my workpiece, trying to decipher which is appropriate for the task at hand.

A good tip I've found for this is to mark each face of the scraper so that I know which one I should be using. At one time I used a Sharpie for this, but I found the marker rubbed off after a bit of work, leaving me marking and re-marking over the course of a project.

Finally I invested in a small engraving tool and marked each edge with "A," "B," "C" and "D." This leaves me with no question as to which edge of the scraper to put to the wood when the time comes (as long as I remember what letter goes with what edge!).

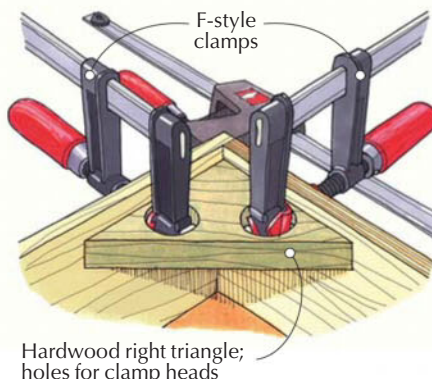
Grant Burger,
Boston, Massachusetts

Triangle for Square Corners

If you have trouble getting corners clamped up square, this will help. Cut a right triangle out of a hardwood scrap, then cut holes in it to accommodate the heads of simple F-style clamps.

Put the triangle in the corner and clamp it in place before securing clamps across the width and length of your glue-up.

Stephen Morris,
Uttoxeter, Staffordshire



Emery Boards for Sanding

Among the most useful sanding tools I have are emery boards. I like them because they are flexible enough to sand inside or outside curves, and if they are too wide or too long, it's easy to cut them to the size you need.

Plus, emery boards are cheap (about \$5 for two dozen) and available at just about any drugstore or grocery.

Jim Glosimodt,
Watertown, South Dakota

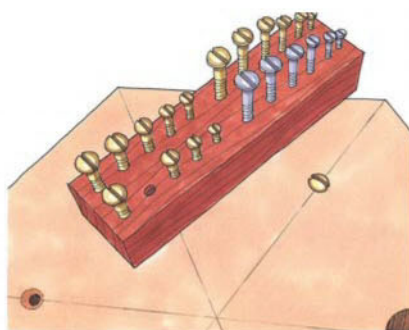
Screw-selection Block

After all the hard work that goes into finishing a piece of furniture, the last thing I want to do is make it look awkward by selecting the wrong screw. But will a #8 or #10 look more proportionally correct for this project? Should I use a flathead screw or would a round or oval head look nicer? Brass or steel?

I'm not smart enough to get that right on every piece I build, so years ago I took a small scrap of wood and drove in an array of screws varying in size, head style and material. Now I simply remove the screws I'm interested in and swap them out until I'm satisfied

with the appearance. Then I measure how long the screw needs to be and hit the hardware store (or Internet).

Aaron Moore,
Fairport, New York



Use Blue Tape to Quickly Align a Hollow Chisel

While excavating several mortises with my hollow-chisel mortiser, I figured out a way to quickly align the chisel at the edges of the mortise and to also know how much to move the board each time for the next plunge cut.

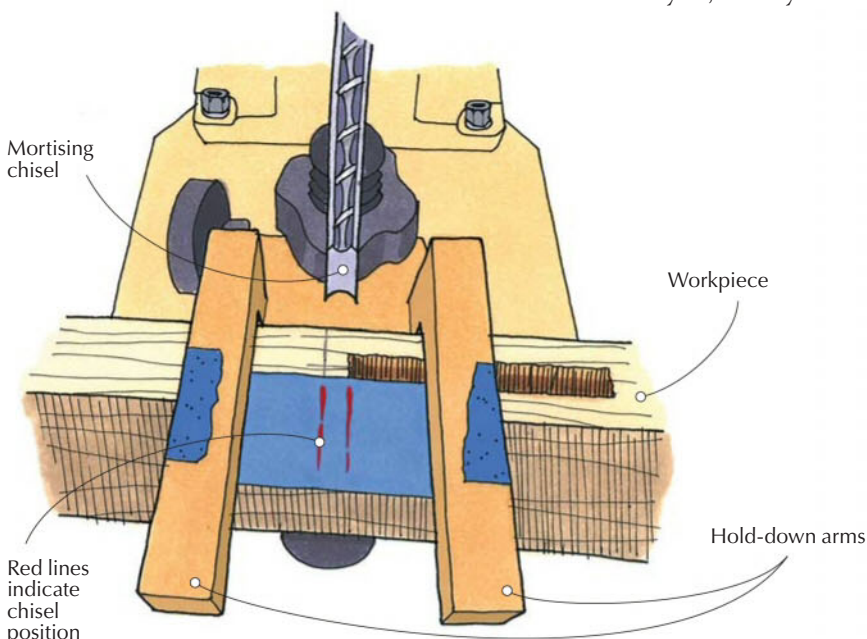
With the machine off, place a strip of blue tape between the hold-down arms, just in front of the chisel. Then, lower the chisel and make two marks on the tape to delineate the chisel's width,

and extend those lines to the back of the tape. (I use a fine red Sharpie so I can easily see the marks.)

Now I know exactly where the chisel will land without the trial and error of lowering it; that speeds up the process substantially. I just blow the chips off after each cut so the lines are visible as I reposition the work for the next cut.

For larger benchtop mortisers that use front clamps, you can place the tape on the fence. **PWM**

Cesar Orosco,
Wayne, Pennsylvania



Use Your Nail Gun to Set Nails

Sometimes my nail gun doesn't set nails to the desired depth – but a carpenter friend showed me an easy fix. Just empty the gun, then set the nose in the same location and dry fire.

I find this is a lot faster than hunting for my nailset.

Rick Prevatt,
Jacksonville, Florida

Editor's note: Perhaps this is obvious, but this trick doesn't work if your gun has a lock-out feature to prevent firing when empty (unless you can override it).

ONLINE EXTRAS

For links to all online extras, go to:

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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 website (leevalley.com). (The tools pictured below are for illustration only and are not part of the prize.)

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‘Drawer Making and Fitting’ Video

Well-made and well-fit drawers are a calling card of the best furniture makers; David Charlesworth’s video “Drawer Making and Fitting” (Lie-Nielsen) can help you achieve such mastery in the high-end English Arts & Crafts tradition.

What this means is drawer construction with excellent materials, perfect joint layout for the stock thickness and drawer size, drawer slips, stops and perfect reveals – but it also means a drawer that glides out for about two-thirds of its travel from the carcass,

then slightly tightens in its opening to prevent the user from pulling it out by mistake.

As with all of Charlesworth’s videos, the amount of detail he goes into on almost every step of the high-end drawer process is remarkable. While it’s not intended for beginners (he doesn’t teach you herein to cut dovetails, for example), if you already know the basics of construction, drawer joinery and fitting, this video will make you better at all three.

Even if you don’t aspire to the insane level of precision he displays, Charlesworth’s techniques can be adapted piecemeal to solve many construction and fitting problems – and who among us doesn’t have a drawer-fitting problem from time to time? (And perhaps you’ll resolve to try a new technique – look for drawer slips from me in the near future.)

Some might argue the pace of in-



struction is a little slow (the video runs 162 minutes) – but I find Charlesworth’s methodical approach allows even the most perplexing concepts to sink in.

The DVD is available at both shop.woodworking.com and lie-nielsen.com; a download is available only from Lie-Nielsen.

—Megan Fitzpatrick

Drawer-making Video

Lie-Nielsen ■ lie-nielsen.com or
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■ **ARTICLE** Read David Charlesworth’s “Precision Band Saw.”

Price correct at time of publication.

Lee Valley Small Double Square

A diemakers’ square with a narrow blade is an excellent tool for determining minute problems with your joinery, allowing you to get in between narrow dovetail pins, for example, to check for sloping walls. But a true diemakers’ square (on which the blade angle can be adjusted for patternmaking) is quite expensive, even on the secondary market (though Lie-Nielsen sells a well-priced version if you don’t need a narrow blade).

Enter the “double square” – a similar tool, minus angle adjustment.

Lee Valley has just released a small double square (\$49.50) that comes standard with two 2½"-long blades; one is ½" wide, the other just more than ⅜" wide, with a ⅜"-wide, ½"-long probe on one end for sneaking into the smallest of places.

The stock is dead-square to the blades, and the rules are easy to change – though the center pin (the rule catch) does rotate in the body. (It does not on the \$140 double square from Vesper Tools, which comes standard with three blades and also includes a 45° reference bevel on the stock, where the Lee Valley one does not.)

Out of the box, the edges of the pre-production model I used are sharp enough to cut flesh, so I took a few minutes to burnish them. (I’m told the production versions are less sharp, which in this case is a good thing.)

I sure wish that probe were longer



– the ½" length limits its use to thin stock. But if you don’t cut quite narrowly spaced dovetails, it’s a non-issue.

All in all, this small double square is a good tool for the price.

Oh – and about that box it comes out of? This is a precision tool that should be stored with care, not just tossed in a tool tray; the French-fit box makes that a no-brainer.

—MF

Small Double Square

Lee Valley ■ leevalley.com or
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■ **ARTICLE** Read our review of the Vesper Tools double square.

Price correct at time of publication.

CONTINUED ON PAGE 16

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Crowned CBN 6" Grinding Wheel

We've been using Norton 3X Super Cool ceramic alumina oxide wheels on our dry grinders since we first reviewed them in 2006; they cut fast and don't easily overheat a tool's edge—that means you can get your heavy grinding done fairly quickly, because you don't have to stop and cool the tool in water or oil every few passes. But they need regular dressing to deglaze them and to keep the wheel slightly crowned.

The new WoodTurners Wonders crowned cubic boron nitride (CBN) wheel, which has the abrasive bonded

to a machined aluminum wheel, runs even cooler. The metal plate absorbs much of the generated heat (I had to grind aggressively and for more than 30 seconds to get a blade hot enough to need dunking). And, because the wheel comes crowned out of the box, there's no need to dress it for shape—or at all. If used only for ferrous metals as recommended, it won't glaze. I tried it on about 10 chisels and half as many plane blades, both for grinding off chips and large secondary bevels, and for reshaping the cutting edges of a plane blade. I had good results on O1, A2, high speed steel and PMV-11. (Bonus: It's impossible to engage in the dangerous practice of side-grinding on this wheel.)

The $\frac{3}{4}$ "-wide wheels, available in #60 and #80 grit, come only in 6" diameters, and fit a $\frac{1}{2}$ " arbor. To use it on my 8" grinder, I simply had to modify the tool rest by adding a wood block. But getting



the wheel on and off is a bit difficult; I had to basically thread it (and dethread it) while holding the shaft with pliers. That's a bit annoying, but...

This CBN grinding wheel costs about twice as much as the Norton 3X; what I can't tell you (yet) is if it will last twice as long. Stay tuned. —MF

CBN Grinding Wheel

Tools for Working Wood ■
toolsforworkingwood.com or
800-426-4613

Street price ■ \$109.95

■ **ARTICLE** Read a Norton 3X wheel review.

Price correct at time of publication.

Toothed Planing Stop from Benchcrafted

Most woodworkers have the skill to engineer a makeshift planing stop from a block of wood and a bit of old saw blade, but the precision engineering and price point of the new toothed planing stop from Benchcrafted beg the question: Why would you want to?

The folks at Benchcrafted have made a name for themselves by reinventing and elevating classic workbench hardware, and the toolmakers' toothed planing stop is no different. The finish of the stop is less refined than some of Benchcrafted's other offerings, but the two-point bolt-and-barrel nut mount-

ing design is sturdy and smart. Off-the-shelf mounting hardware keeps the price reasonable, while also allowing for quick installation and easy maintenance during a lifetime of use. I was able to mortise and install the hardware into an existing wooden stop with tools common to most workshops. Simple enough, and I was back to work in less than 30 minutes.

The teeth are sharp and they will leave marks in end grain, but they are also tenacious. In conjunction with a notched batten and holdfast, this stop rivals the holding power and utility of a tail vise. Working thick stock was no problem, and I was able to lower the stop far enough to secure boards as thin as $\frac{1}{4}$ " with ease. The low profile design kept the teeth in the sweet spot on the wood and out of the way of my plane blades.

Toothed planing stops are an abso-



lute necessity for serious handplane users, and Benchcrafted has managed to put a unique stamp on this classic form. They've also found a way to offer it at a price that anyone can afford (\$24). Highly recommended. **PWM**

—James McConnell

Benchcrafted Planing Stop

Benchcrafted ■ benchcrafted.com

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■ **BLOG** Improve your workholding by using a planing stop with a doe's foot.

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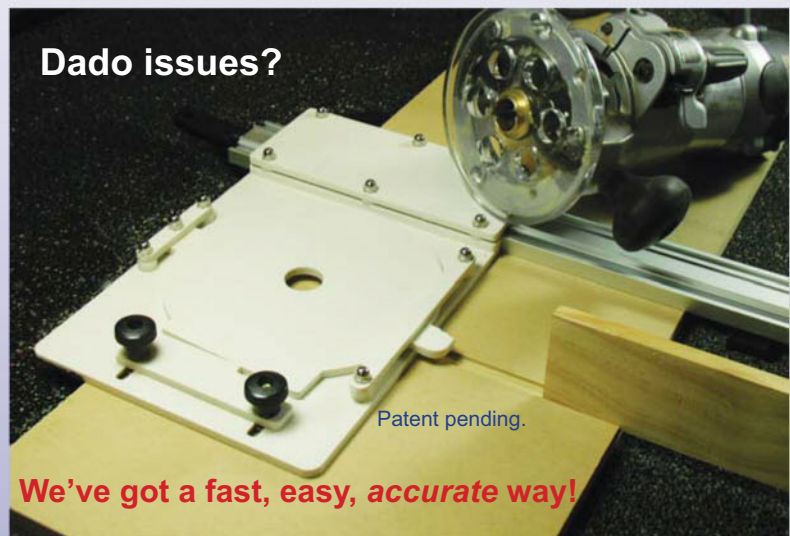
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Small Surprises, by Design

New Hampshire designer Jim Zink's organic pieces are filled with lessons.

Every time the subject of design comes up with a builder, I'm keen to know what inspires them – what is at the center of their inner drive.

Many talented designers have a background in art. This is not surprising, as an artist has usually honed imagination and skills to bring ideas to life. Others look to our woodworking tradition, building on the best work of our ancestors perfected over many generations. And some are driven by a deep connection with the material itself and listen to what that chunk of curly cherry says to them before lifting a saw to it.

I can relate to all three; design, just like the forest where we harvest our wood, has many layers. But that last drive – the connection with our material – is not easy to describe with words. Wood is an organic thing, each board with its own character and quirks. And there's more to this than just understanding how to match grain for a pleasing effect.

Furniture maker Jim Zink, who works alone in his corner of New Hampshire, is a maker who I believe has tapped into that deep, hard-to-describe connection with wood.

Simple & Surprising

I'm a firm believer in taking time to look closely at good work, and Zink's furniture offers many lessons. When I look at his pieces, I'm struck by the simplicity of the forms. All the parts knit together seamlessly, as if the piece grew that way. He's resisted the temptation to show off his skills with fancy joinery or ornament, instead letting the beauty of figured wood showcase itself.

Zink shared that he seldom uses stains and likes to let the wood's character shine through. That's a thought



Delightful surprise. Though simple in form, this desk is full of small surprises such as echoing curves and simple reveals that delight the eye and the touch.

many woodworkers might strive for, but it's not as easy as it sounds. It's tempting to get hooked on highly figured wood (I speak from experience) and think that bigger is always better.

Take a closer look at Zink's selection and careful use of figured boards – note that he lets you enjoy his choices by

not emphasizing them. There are no borders or inlays pointing the eye to a focal point with spectacular grain – instead, quiet details keep the eye in motion to take in small surprises. These details include a gentle arc on the front of a desktop that's echoed in the shelf below (above). He's also raised the shelf just above the structure that supports it, creating a slight reveal. It's one of those small surprises you might not see coming, but after you take it in you know it could be no other way.

Speaking of surprises, Zink likes to add a special touch to his turned pulls. He cuts his material, in this case ebony, into inch-square cubes. At the lathe he turns each knob freehand to some pleasing shape, but makes no special effort to ensure knobs in a set turn out exactly the same. The result is that they



Every pull an individual. By freehand turning every knob, each has its own unique feel only the fingers can sense.

CONTINUED ON PAGE 20

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Weave a wooden lamp? This lamp is part of Zink's Wishbone series.



This or that. Is this coat rack architecture mimicking nature, or nature hinting at architecture?

have small differences built into their shapes, and our fingers can feel a bit of personality in the differences.

Another one of Zink's noteworthy designs is his Wishbone series. This began as a design challenge while enrolled in the Center for Furniture Craftsmanship's (CFC) nine-month comprehensive program in Maine. That's where he formed his idea for weaving thin strips of figured material into the body of a table lamp.

Over time he's expanded the concept into taller forms, including a floor lamp and a coat rack. We talked about the

difficulty of stretching the limits of a form like this short table lamp into a tall, graceful coat rack. Zink made it sound easy, but he did admit it took quite a bit of experimentation to find the right spacing on the braces that tie the strips together. Somehow Zink is able to pack a lot of motion into a simple form – not easy to achieve.

Chasing the Dream

Zink credits his time at CFC with helping him hone his eye for design and master some of the finer points of furniture building.

"School taught me so much that I didn't know about furniture making," he says. "I learned how to fit drawers, execute dovetails, make multiples and, most importantly, how to finish. My favorite part was learning how to bend and veneer wood."

He often finds inspiration in the wood itself, especially in designs that incorporate large slabs or live edges. His designs usually begin with drawings worked out in SketchUp, then quickly mocked up using either cardboard or poplar. Like many furniture makers, his best work goes out to clients while the poplar mockups end up in his own home.

Although relatively new to the New Hampshire furniture scene, Zink started his furniture-building career later in life to fulfill a lifelong dream. He learned basic carpentry in high school woodworking classes and adult education courses, and he put himself through college by building houses.

"Making furniture was always in the back of my mind," he says. "I guess you can say I spent most of my life dreaming about becoming a craftsman."

Zink's different from thousands of other "would-be" furniture artisans in that he took the plunge and went all in.

That and he's developed an extraordinarily good eye for design. **PWM**

George is the co-author of two design books and writer of the By Hand & Eye blog (with Jim Tolpin).

ONLINE EXTRAS

For links to all these online extras, go to:

■ popularwoodworking.com/feb17

WEBSITE: Check out Jim Zink's work online.

BLOG: Read more from George R. Walker on the By Hand & Eye blog.

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About This Column



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

A builder at home.
Zink in his shop doing his favorite thing – building.



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THE Best Glue FOR Furniture?

BY CHRISTOPHER SCHWARZ



Why liquid hide glue
should be your first
choice as an adhesive.

Since the beginnings of civilization up until World War II, most pieces of furniture were assembled using animal-based glues. That fact changed almost overnight in the 20th century, however, with the introduction of polyvinyl acetate (PVA), what we call yellow or white glue.

In some ways, these modern glues are great. They are cheap, easy to use and available everywhere – even the grocery store. But they might not be the best choice for the individual woodworker making furniture.

Modern glues aren't reversible – so fixing furniture or undoing your mistakes is agonizing. They set up fast – sometimes too fast when you're working alone. And PVAs are prone to show up as white splotches when coated with a finish if you aren't fastidious about cleaning squeeze-out.

Frustrated by these downsides to yellow and white PVAs, I began looking for an alternative. As is usually the case in woodworking, the problem could be solved by investigating traditional shop practices.

More than a decade ago, I began using liquid hide glue. And now it's rare for me to use anything else. I don't use hide glue because I build historical reproductions, wear frilly shirts or work at a living history museum. I use it because it simply is the better glue for me—a guy who builds pieces of furniture one at a time in a small shop. The guy who occasionally puts slot A into tab B by accident and needs to fix the mistake.

Patrick Edwards, who makes the liquid hide glue called Old Brown Glue, summed it up best for me: "I think protein glue is..." he said, a bit exasperated, "it's not even a choice. You should use protein glue if you are a woodworker."

Objection!

If you use yellow glue, I suspect you are squirming in your chair right now or about to call this out as bull pucky. Most woodworkers have objections to all forms of hide glue. Even if you've never used it, I'm sure you've heard it smells like rotting flesh, it has a short shelf life, it doesn't bond as well as PVA



Group of glues. Once you go brown...



Don't blink. Yellow and white glue cure much faster than liquid hide glue, so if you use a PVA you need to work quickly, especially with complex assemblies. Once your yellow glue looks like this, you are in deep trouble.

and is generally difficult to use.

I won't lie to you: Both hide glue and PVAs have advantages and disadvantages. But during the last 50 years, the reputation of hide glue has suffered from a lot of misinformation while the downsides to PVAs have been ignored.

Hide glue has been used to assemble furniture for thousands of years. Once you try liquid hide glue, you'll find that it is as straightforward to use as PVA.

This article will lay out the pluses and minuses of liquid hide glue and PVA glue from the perspective of an individual furniture maker, not a glue manufacturer, furniture factory, luthier or museum conservator. I chose to focus on liquid hide glue instead of hot hide glue in this article because the liquid hide is more convenient, more similar to PVA and more readily available than hot hide glue.

Let's examine the major differences by starting with where you live.

It's Not Just the Heat...

In my opinion, the biggest advantage of PVAs is they are more consistent

than hide glue. Whether you work in a swamp, desert or prairie, yellow and white glues will bond your joints with few complications. A dry or cold day might speed or slow curing, but you'll almost always end up with a tough and stable joint.

Hide glue, on the other hand, is more sensitive to heat and humidity. In semi-tropical areas, such as the Deep South, it can be difficult to get hide glue to cure completely on humid summer days, especially in a shop without climate-control. The glue can stay tacky for weeks or months. (If this happens, take the piece into an air-conditioned room to allow the glue to cure. If this continues to happen, you're probably better off with a PVA.)

Open Time & Assembly Time

PVAs set up fast. With a typical yellow glue, you have four to six minutes to get your joints together before the glue will start to set (this is called "open time"). And you have 10-15 minutes total to get the clamps on and walk away (this is called "total assembly time").



Important dates. With liquid hide glue, look on the bottle for an expiration date or a manufacturing date. Titebond has recently changed to printing a code on the back of its bottles. The first character is a country code. The second is the year. The next four are month and day. So a code that reads A608190073 means the glue was made on Aug. 19, 2016. (The last four digits are the glue's lot number.) So with properly stored Titebond glue you have about two years (or more) from that date to use it.

Typically with a PVA you can remove the clamps after 30 minutes. So if you must work quickly (think: production work), PVA is your friend.

Liquid hide glue sets up more slowly. The open time is typically 10 minutes, with a total assembly time of 20-30 minutes or even more in a cold shop. You also need to let things stay clamped up for a longer time. While Titebond's Liquid Hide Glue says you can release the clamps in 30 minutes, I've found it best to leave things in the clamps as long as possible. One hour of clamping is better; overnight is best.

As a woodworker who builds pieces by myself and one at a time, the longer open time is helpful with complex assemblies, and I don't mind letting my assemblies sit overnight (you do have to sleep sometime).

The Smell

For me, this issue is a red herring. Both PVA and hide glue have a slight odor. Hide glue doesn't smell like a slaughterhouse. In fact, it smells a lot less than any barn I've ever been in. To me, PVA doesn't smell particularly pleasant, either. So let's say that after a few times of using either glue, you won't notice the smell.



Lots of choices. PVAs come in many different flavors: water-resistant, waterproof, slow-setting, thick and more. Liquid hide glue comes in one flavor, but you can alter it yourself fairly easily.

Shelf Life

Both glues have a long shelf life. Though most manufacturers recommend you use your PVA up within two years, I've found that it can last much longer when sealed in the bottle. Liquid hide glue typically lasts 18 months to two years if kept sealed in a cool and dry environment. Though that can also be extended. (See "How to Extend Your Shelf Life" below.)

In other words, if you can't use up a little bottle of glue in two years, maybe you should take up a different pastime.

Availability

PVA is everywhere. And you can readily buy PVAs that have been modified at

the factory to be water-resistant, waterproof, ultra-thick so it won't run, thinned out so it has a longer open time, with UV additives to find squeeze-out and on and on.

Liquid hide glue is available in only one basic form, so it's up to you to tweak its chemistry for different effects. But you can make it do a lot of great things if you are willing to learn. (See "Liquid Hide Glue Tricks" on page 25.)

Reversibility

The biggest disadvantage to PVA glue is that it is not reversible. Once the glue cures, it is difficult to undo the joint without destroying the wood in the process. Liberal amounts of heat and

HOW TO EXTEND YOUR SHELF LIFE

A lot of woodworkers have criticized liquid hide glue as having a short shelf life. Chances are, they have only themselves to blame.

Liquid hide glue is supposed to last 18 months to two years if it has been stored properly – sealed and in a cool place. So if you have stored it properly and you have let it sit for two years, maybe you should try to do some more woodworking.

Another way to ruin the glue is by exposing it to extreme heat. Think about how hot it can get in your car on a summer day – that will do it.

On the flipside of this equation, you can greatly increase the shelf life of liquid hide glue by storing it sealed up in a cool, dry place, such as a basement.

Recently the glue technologists at Franklin International tested old bottles of Titebond's Liquid Hide Glue to see if it would cure. Surprisingly, properly stored bottles of liquid hide glue that were 18 years old cured just fine.

Some liquid hide glue enthusiasts recommend storing hide glue in the fridge or freezer to extend its life. This works – freezing doesn't hurt hide glue – but the thawing process can cause water to condense on the glue if you aren't careful.

—CS

LIQUID HIDE GLUE TRICKS

Hide glue is made from the hides, soft connective tissue and bones of barnyard animals (so no, it's not vegan). Dry out this material and you have hard, hide-glue pearls, which can be soaked in water and heated to make hot hide glue.

But how do you make this glue liquid at room temperature? Usually by adding either urea, salt or other chemicals. (There are many recipes on the Internet for making your own liquid hide glue from pearls.)

All hide glue can be modified to do special tricks. Below is a short list of common modifications. For a full list, check out "Hide Glue: Historical & Practical Applications" (Full Chisel Press) by Stephen A. Shepherd.

- **Reversing hide glue.** In addition to using heat and moisture to reverse the bond of hide glue, you can also use denatured alcohol or acetone. These chemicals will desiccate the glue and make it brittle. A sharp rap on the joint with a mallet will then release the bond. Using alcohol or acetone is ideal for large-scale work (which would take a long time to heat) because the liquid can be injected into the joint with a syringe. Hide glue that has been desiccated can be renewed with new glue without a problem.

- **Add flexibility.** Hide glues don't creep, which is ideal for veneering and bent lamination. If you want to add some flexibility to the joint so it will behave more like a PVA, add glycerine to the glue (up to 5 percent) to add flexibility. Other old recipes I haven't tried say that adding a little sugar or molasses will also render the glue more flexible.

- **Make it water-resistant.** Add aluminum sulfate (up to 1 percent) to make the glue water-resistant.

- **Crackle finish.** To simulate a crazed or crackle finish, paint a base coat on your project. Then brush on a layer of hide glue over the paint. The thicker the coat of glue, the more pronounced the crackling will be. Then paint a second coat of paint over the glue to begin the crackling effect.

- **Filling gaps.** Mix in some chalk to your hide glue until it turns into a putty that can be used to fill cracks and gaps. The amount of chalk needed depends on the humidity and moisture content of the glue, so start by adding small amounts of chalk.

- **Bonding unusual materials.** To glue teak or other oily woods together, rub the surfaces to be glued with a garlic clove before applying the hide glue. You can also adhere wood to brass by rubbing the brass with garlic before applying the glue.

—CS



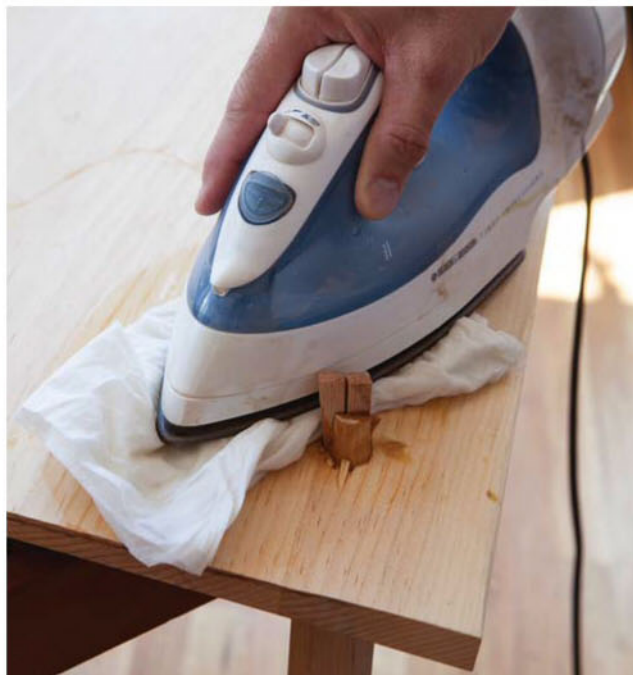
Make paint crackle. By painting on a coat of hide glue between layers of paint, you will cause the top layer to crackle.

moisture can get the joint to release – especially if the joint is new – but it's a difficult job that could end up ruining the entire piece.

Liquid hide glue is easily reversible. A little heat and moisture will re-liquefy hide glue that is older than you are. This is one of the primary reasons I prefer hide glue.

Let's say that you glue up a door. The next day you realize that everything is backward and reversed. If you used hide glue you can undo the assembly with ease and set everything right.

The reversibility of hide glue has saved me a few times in my shop and many times more in the classroom. It also has allowed me to make design changes to a project – moving or changing mouldings, for example – without remaking the entire piece.



The 'undo' button in woodworking. A little heat and moisture will cause hide glue to reverse its bond.



Risky business. Scraping PVA off a tenon can result in removing wood below the glue (at left). This will weaken the joint. With hide glue, you can just reapply more hide glue and assemble the joint (above).

Repairs to Joints

PVA doesn't stick to itself. So if you have a tenon that has dried PVA on it, for example, a new coat of liquid PVA will not stick to the old glue. You have to scrape away the old glue down to the bare wood, so there's a good chance you

will remove some of the wood fibers and reduce the strength of the new joint.

Hide glue, on the other hand, sticks to itself. If you have a disassembled tenon with dried hide glue on it, you can reactivate it by brushing on some warm water then adding a new coat

of fresh glue. The new and old glues will mingle to create a fresh bond. The first time you do this, you will hear angels sing.

Water-resistance

Both standard PVA and hide glue are susceptible to water. Don't use them for outdoor furniture, cutting boards or anything else that will see more than the occasional splash of water.

If you need glue that is water-resistant or waterproof, you'll need a special PVA or a different glue entirely, such as epoxy. Most PVA manufacturers make a water-resistant PVA.

And you can make your hide glue water-resistant by adding to the glue a little aluminum sulfate, a chemical that is usually used to adjust the soil acidity of houseplants or in tanning hides. Add about 2 grams of aluminum sulfate (half a teaspoon in the real world) to an 8-ounce bottle of liquid hide glue to make it water-resistant. Note that this additive will also make the bond irreversible with water.

A HISTORY OF LIQUID HIDE GLUE

Liquid hide glue has been sold commercially since the early part of the 20th century. Franklin International in Columbus, Ohio, was likely the first to sell the glue in the United States when the company was founded in 1935. And Franklin's formula for the glue has remained basically the same for the last 81 years, according to company officials.

But liquid hide glue has been known to woodworkers for a much longer time. Somehow someone figured out that by adding urea (urine) to hot hide glue you could make it remain liquid at room temperature.

One unconfirmed story is that early French apprentices tried to sabotage their master's hot hide glue by urinating in it. But their stunt ended up producing liquid hide glue instead.

While that may be lore, there are several 19th-century references to making liquid hide glue with the assistance of nitric or acetic acid.

But recent research suggests that liquid hide glue has been around a lot longer.

In 2010 archaeologists published a paper in the journal *Archaeometry* that concluded that liquid hide glue was used in the construction of a mosque in Uzbekistan in 1540.

Some exterior "muqarnas" (a decorative feature of a

dome that can look like a honeycomb) were found to be held in place for the last 500 years by only animal glue and small dowels. When the glue was examined, some samples clearly showed the glue had been mixed with urine. Adding up to 4 percent urea makes the glue liquid at room temperatures and makes it easier to spread, according to the findings of the archaeologists.

So if anyone questions how long your liquid hide glue will last, you can safely say that it can last 540 years – or more.

—CS



Early liquid hide glue. Franklin was the first to sell liquid hide glue.



Sticky when wet. By adding a little aluminum sulfate to your liquid hide glue, you can make it water-resistant.



Bye-bye blotches. Small smears of hide glue are transparent to finishes (top) while small smears of PVA show up as white blotches. The left side of the board has a mahogany stain, the middle stripe is bare wood and the right has a black aniline dye.

Transparency to Finishes

If you don't remove all the PVA from the surfaces of a project before applying a finish, the remains will show up as ugly white blotches. Hide glue, however, is transparent to many stains and finishes, including boiled linseed oil, most of the varnishes I've tried, lacquer and shellac.

To be sure, if you leave big globs of hide glue behind, your project will look ugly. But small hide glue smears and fingerprints that are invisible before you put on the finish will usually stay invisible.

Joint Lock

One of the struggles with any adhesive is getting a complex assembly together before the glue's open time expires. A big row of carcass dovetails is a prime example. Many complex joints that go together fairly easily when they are assembled dry will lock up before they are completely closed when glue is added.

I have found that liquid hide glue is much less likely to seize your joints during assembly. While some people have theorized that this is because hide glue has less water in it than PVA does, that's probably not the reason. The truth is that both glues' water content



Less stress. With hide glue your dovetails are much less likely to lock up during assembly than when using PVAs. The reason is that liquid hide glue has a longer open time. In situations where you have to use PVA, it's always best to have an assistant for big glue-ups.

is about the same: PVA is 54 percent water; liquid hide glue is 48 percent water, according to glue experts at Franklin International.

The real reason liquid hide glue is less likely to lock up your joints mid-stream is because of liquid hide's longer open time. Liquid hide glue simply works more slowly than PVA.

Strength

Hide glue and standard PVA have about the same strength at room temperature. You can do all sorts of strength

and temperature tests, but the bottom line is this: A good, clean joint made with PVA or liquid hide glue is plenty strong enough for furniture inside a home. Bond strength isn't a problem with either glue.

One wrinkle to this discussion involves the use of "toothing planes" when using hide glue for veneering. Old woodworking textbooks state that you should tooth all of your veneered surfaces before using any sort of hide glue—liquid or hot. The rationale is that toothing the surface will increase your

"Something has got to hold it together. I'm saying my prayers to Elmer, the Greek god of glue."

—Tom Robbins, (1932-) writer

W. PATRICK EDWARDS AND 'OLD BROWN GLUE'

Most people know W. Patrick Edwards for his stunning marquetry work or for founding the American School of French Marquetry in San Diego. But what few people know is that he also runs a glue empire from his bathroom.

Like any furniture conservator, marqueteer or maker of historical pieces, Edwards has long been a devotee of hide glue because of its many furniture-friendly characteristics. But during the early part of his career there was always one task he was trying to accomplish that hot hide glue wasn't suited for: veneering columns (particularly those with a tight radius).

After studying marquetry and conservation in France in 1992-93, Edwards was invited to join an international marquetry conservation group. And one year the group took up the topic of how to lower the gel point of hot hide glue so it was liquid at room temperature.

The conclusion: Add "thiourea" (a chemical similar to urea but a carcinogen) to hot hide glue and that will lower its gel point so it's liquid at room temperature.

Edwards knew that thiourea was similar to urea and began cooking up different batches of glue with urea and water back at his shop in California. After 37 different recipes, he found the mixture that had the properties he wanted.

For the next 10 years he used his liquid hide glue in his personal work. He finally veneered his columns ("It worked perfectly on the first try!") and eventually he began using the glue in about 80 percent of his work.

Then Edwards gave a bottle to chairmaker Brian Boggs. Boggs loved it and told Joel Moskowitz at Tools for Working Wood about it. Moskowitz called Edwards.

"Joel said: 'I want to sell it,'" Edwards said. "He said: 'Put it in a small bottle and a big bottle and we'll sell both.' The rest is history."

Today Edwards makes Old Brown Glue in a bathroom of his San Diego workshop using double boilers. It takes him about 90 minutes to fill 200 bottles and he makes hundreds of bottles a month.

"I am a reluctant glue maker," Edwards said. "I want to build, restore and teach. But (making glue) may be the thing that I do full time after I retire. It's brainless."

While the process of making it might seem brainless now, getting to the brainless part required a stroke of both genius and persistence. —CS



After 37 tries, W. Patrick Edwards cooks up Old Brown Glue in the bathroom of his San Diego shop and ships it all over the world. It is made using only three ingredients: collagen, water and urea.

gluing area and therefore the bond.

While some long-time woodworkers still swear by the advice (and I won't contradict them), the scientists at Franklin International contend something different. While you will increase the gluing surface with a tooth-thing plane, they say, you'll also increase the incidence of wood failure when the joint fails because of the shredded wood fibers (and I won't contradict them, either).

As many veneered surfaces have survived hundreds of years (and others haven't), you'll have to draw your own conclusions.

Another thing that can reduce the strength of PVA and hide glue is when the wood has been burnished, usually by a dull cutter in a machine. A burnished surface will generally look shiny and sometimes black. The water in any glue has a difficult time penetrating a burnished surface, and the joint ends up being weak.

How do you test for a burnished surface? Easy. Put a drop of water on the surface to be joined. If the droplet sinks in quickly, the wood is good to go. If the drop stands on the surface for a long time, the surface is probably burnished.

Glue Creep

PVAs are flexible, which can be an advantage when you are gluing joints where there is a lot of cross-grain wood movement. A good example of this is an 8"-wide apron for a sideboard that is tenoned into the legs. Flexibility in that joint is good.

But flexibility is bad when it comes to veneering or bent laminations. Flexibility—called "creep"—can cause gaps to open in veneered work or bent laminations to become slightly unbent. These are two examples where hide glue in any form really excels.

How to Measure Glue Strength & Freshness

Hide glue tends to give off a strong ammonia smell when it has turned bad. But is it possible to judge its freshness and strength before the glue turns totally bad?

Don't be a creep. PVAs are not ideal for bent laminations, such as this leg. The flexibility of the glue will allow the leg to straighten out a bit. Hide glue or a plastic resin glue are superior choices.



Recently I spent a day with two glue scientists at Franklin International – Bob Behnke, the technical service manager for Titebond Products, and Dale Zimmerman, a technical service specialist. While both work for Franklin, both men have always put science first in my experience. They offered two ways to test hide glue to make sure it is still good.

Method 1: Smear a thin layer of liquid hide glue on a piece of typing paper. To get it to dry quickly, put it on the



The paper test. If a thin layer of hide glue can cure hard and brittle on a sheet of typing paper, then it's good to go. Here you can see the cracks in the hide glue from simply flexing the paper.

floor in front of your refrigerator – the warm air expelled from the appliance will speed the drying. Or you can put it in an oven set to 150° F for 10 minutes to see if it will dry.

After trying to force-dry the glue, tap the glue film with your fingernail to see if it is hard. You also can bend the paper to see if the film of glue will crack or pop – those are both indicators that the glue is still good.

Method 2: Take three blocks of wood that measure $\frac{3}{4}$ " x $\frac{3}{4}$ " x 2". Glue



The hammer test. Glue up three blocks as shown. Clamp them up overnight. The next day put the assembly on your benchtop and strike the middle block. If the glue fails, buy some new glue. If the wood fails (as shown in the photo), use the glue in your projects.

them together edge-to-edge so that the middle block is offset 1" from the two others (see the photo below for details). Clamp up the assembly and let it sit overnight. In the morning, place the assembly on the benchtop and hit the protruding center block with a hammer to try to destroy the joint. You will quickly know if the glue is good (wood failure) or it has gone bad (immediate glue failure).

Conclusions & Personal Notes

It's difficult to get woodworkers to switch to a new (or very old) glue, even if the facts are persuasive. I've spent many years demonstrating the advantages of both hot hide glue and liquid hide glue. The only method that seems to convert people is this: Lock a woodworker in a classroom where the only adhesive available is hide glue. They'll use it successfully and will then readily accept it into their shop, usually side-by-side with their PVAs.

And that's OK. As I said before, few of us work in living history museums, so we don't have to be purists. We can use any glue technology we want to get the job done.

Now because I cannot lock you in a shop with hide glue, you will have to take the first step. Order a bottle and give it a try. It is a small investment (about \$8), but the payoff is enormous – especially if you've ever accidentally put slot A into tab B.

I know I have. **PWM**

Christopher is the editor at Lost Art Press and the author of "The Anarchist's Design Book."

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/feb17

VIDEO: Watch a hide glue joint being reversed.

WEBSITE: Read more about Old Brown Glue and Titebond's Liquid Hide Glue.

BOOK: Buy Stephen A. Shepherd's "Hide Glue: Traditional & Practical Applications."

IN OUR STORE: "10 Essential Furniture Repairs" with Joshua Klein.

Our products are available online at:

■ ShopWoodworking.com

Scandinavian Workbench

BY BILL RAINFORD

Modern hardware and techniques update this Tage Frid-inspired bench.



Scandinavian- or Continental-style workbenches are the vinyl LP records of the woodworking world. These iconic benches have never left the scene. A few are classics and others are the flavor of the month. Some benches in this style are masterworks and some are poor approximations of an archetypical form. The trick is finding the workbench that hits all the right notes for how you work so you can go on to create your own opus.

What's Old is New Again

Much as how Roubo and Nicholson benches have re-surfaced in recent years and have their merits—they were products of their times, the needs of the craftsman and the availability of wood and hardware—so too has the Scandinavian style of workbench, most popular in the late 19th and 20th centuries. This newer style of bench made use of a changing tool landscape and scarcity of wood, and often required a higher level of skill and/or mechanization to produce. All of those forces are still present in our modern world, where we want to conserve natural resources, mix old and new techniques and tooling and build something that is both functional and aesthetically pleasing.

When Tage Frid wrote about workbenches in the third volume of his iconic “Tage Frid Teaches Woodworking” (Taunton) he described a state of time (1948) wherein a good workbench could not be obtained in this country. His solution was to design and build a bench similar to the one he was trained on. Almost 70 years later, things are not much better on the retail front, with the majority of mass-produced benches lacking in heft, design and quality. Thankfully we’ve had a resurgence in traditional woodworking and have a much wider variety of tools, hardware and literature, making today one of the best times to be a woodworker since World War II.

Design Considerations

My formal training at the North Bennet Street School was on a German workbench in a classroom setting, so when it came time to build my own workbench,

“Take a piece of wood – plane, sand, and oil it, and you will find it a beautiful thing. The more you do to it from then on, the more chance that you will make it worse.”

*Tage Frid (1915-2004),
Danish-born woodworking teacher,
furniture maker and author*

I was inspired by Frid’s bench – but I also listened to the criticisms. Some folks complained about the relatively short length, which was designed for a modest cabinetmaker in a classroom setting, and the fact that larger folks aggressively planing could potentially move the middle-weight bench around if it wasn’t bolted to the floor. Others suggested that the joinery for the tail vise was too complex, and some noted that the hardware Frid used is no longer available.

To address some of those issues, I made several design modifications and incorporated some new hardware to build a bench that I am very happy with. I have, however, used the same or similar part names, listed in the same order, as Frid did in his book (in case you wish to view them side by side).

Here are the highlights of my revised bench:

- It is almost 2' longer than the original, coming in at about 7' long.
- It is a few inches wider (making it perfect for my armspan).
- I incorporated modern hardware – a Dieter Schmid shoulder and tail vise (Lie-Nielsen Toolworks has similar vises), square metal bench dogs, the Veritas Bench Bolt Kit, slotted washers and more.
- The traditional joinery – dovetailed vises and skirt board, wedged tenons, etc – cut by hand.
- I beefed up the stretchers to add additional weight, and decided on larger shoulders to further stiffen the trestle legs to resist racking. (The thicker stretchers also allow me to conceal the bench bolts for a cleaner look.)

Supplies & Raw Materials

I took my time to select nice, dense, clear and straight-grained hard maple;

it’s well-suited for workbench building and relatively plentiful in New England, where I live. Buy your wood well in advance so that you can bring it into your shop, sticker it and allow it to acclimate to your shop for at least a week.

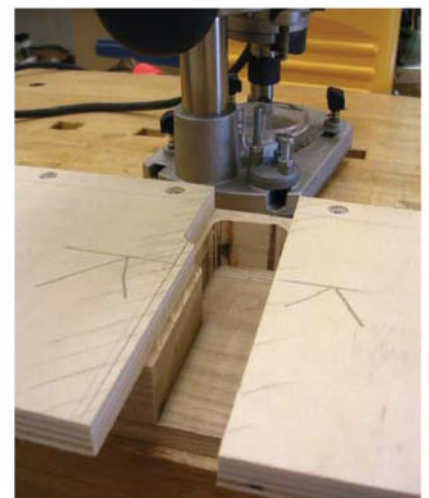
While the wood acclimates, gather all your hardware and vises, and note any changes you need to make to your joinery or design to fit your hardware. Once the wood is acclimated, plane, rip and buck the pieces close to their final sizes – but leave them a bit oversized and again sticker them for a couple of days. (If you have a moisture meter, you can monitor the wood as it reaches equilibrium.)

I built the bench in three major assemblies: the benchtop, the trestle legs and the vises.

Benchtop & Square Dogs

I started with the large slab that makes up the majority of the top surface (it finishes at 1³/₄" x 12¹/₄" x 74¹/₂"). You’ll want at least two 8/4 boards for this. If you can’t find wide clear stock, you can use three narrower boards to make up the blank. Make sure that the grain is oriented in the same direction for handplaning during the final flattening.

Joint the boards, thickness plane them to 1¹/₃₂" heavy, then rip a little wider than needed. I used my jointer



Slightly off. With a simple jig, you can rout then repeat for a matching row of dog holes angled at 4°, then square the corners with a chisel. My holes are 1³/₁₆" from side to side at the top, and 7/8" front to back – but measure yours off your dogs.

Once the glue dries, cut the slab to its final length, making sure to leave sufficient length for the tenons for the end caps.

The 8/4 piece is oriented so it will be in the inside of the joint and receive the groove; the 5/4 piece makes up the exposed face of the piece. Make sure the grain is going in the same direction for ease of planing and try to pick clean, clear grain – this will show in the finished bench.

I've worked on benches with square dogs, round dogs or a mixture of both. I prefer square bench dogs because they're in my opinion stronger, taller, have more surface area on the face to

engage the wood you're holding and less finicky than round ones. (If you prefer round dogs, you can always add a few well-placed $\frac{3}{4}$ " round holes to your bench for them and for holdfasts.)

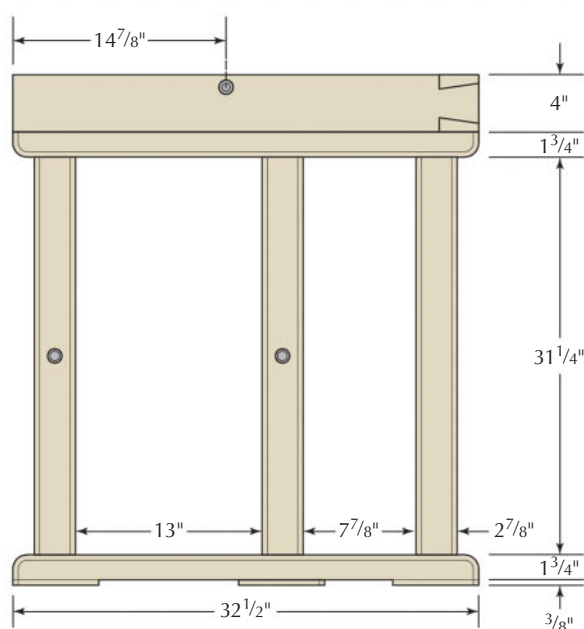
I chose 8/4 stock and used a shop-made template and plunge router to rout the square holes, which are angled 4° to the right off vertical. Note: The slots in the tail vise lean 4° to the left – the opposite direction to those on the benchtop. Cut these two runs from the same board (with plenty of waste



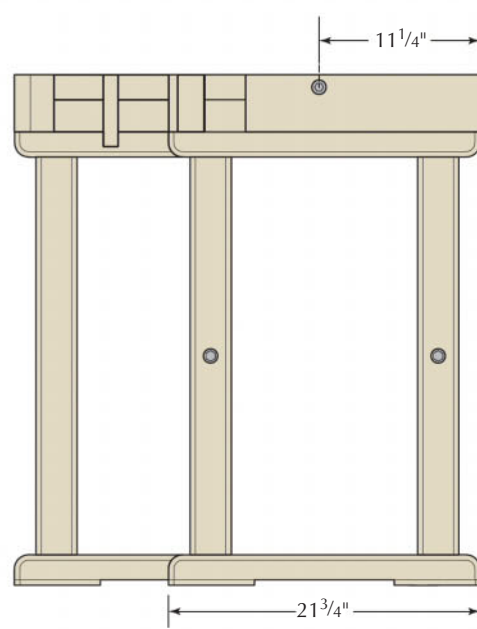
Scandinavian Bench

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
❑ 1	Benchtop	1 ³ / ₄	12 ³ / ₄	74 ¹ / ₂	Hard maple	5/8" tenon both ends
❑ 1	Cap piece	5/8	4	55 ⁵ / ₈	Hard maple	
❑ 1	Left doghole strip	1 ⁷ / ₈	4	55 ⁵ / ₈	Hard maple	
❑ 1	Left end cap	3/4	2 ³ / ₄	32 ¹ / ₂	Hard maple	
❑ 1	Right end cap	4	2 ³ / ₄	16 ³ / ₈	Hard maple	
❑ 1	Back apron	1	4	77 ¹ / ₂	Hard maple	
❑ 1	Tool tray	1/2	7	73 ¹ / ₂	Maple ply	
❑ 2	Tool tray ramps	1 ³ / ₄	1 ³ / ₄	5 ¹ / ₂	Hard maple	
❑ 2	Stretchers	1 ¹ / ₄	6 ¹ / ₂	44 ³ / ₈	Hard maple	3/8" tenon both ends
❑ 5	*Legs	1 ⁷ / ₈	2 ⁷ / ₈	31 ¹ / ₄	Hard maple	1 ³ / ₄ " tenon both ends
❑ 2	Base right	1 ³ / ₄	2 ³ / ₄	21 ³ / ₄	Hard maple	
❑ 2	Base left	1 ³ / ₄	2 ³ / ₄	32 ¹ / ₂	Hard maple	
❑ 4	Foot pads	3/8	2 ³ / ₄	6	Hard maple	
❑ 2	Filler blocks	1 ³ / ₄	2 ¹ / ₄	18 ¹ / ₄	Hard maple	1/2" x 6" notch one end
❑ 1	Left vise filler block	1 ³ / ₄	7 ³ / ₈	8 ³ / ₄	Hard maple	3/8" tenon both ends & left side
❑ 1	Left vise	2 ³ / ₄	4	20	Hard maple	
❑ 1	Left vise jaw	1	5	16	Hard maple	
❑ 1	Right doghole strip	1 ⁷ / ₈	4	22 ⁷ / ₈	Hard maple	Cut at same time as top strip; reverse jig
❑ 1	Right vise cap	5/8	4	22 ⁷ / ₈	Hard maple	
❑ 1	Right vise long jaw	2 ³ / ₄	4	12	Hard maple	
❑ 1	Right vise short jaw	2 ³ / ₄	4	5 ³ / ₈	Hard maple	
❑ 1	Right vise large filler	15/32	3 ¹ / ₈	17 ¹ / ₄	Hard maple	
❑ 1	Right vise top filler	7/8	2 ⁷ / ₈	18 ⁷ / ₈	Hard maple	
❑ 1	Right vise small filler	7/8	3 ¹ / ₈	2 ³ / ₈	Hard maple	
❑ 1	Right vise bench filler	2 ¹ / ₄	5 ⁷ / ₈	21 ¹ / ₂	Hard maple	L-shape; can make from 2 pieces

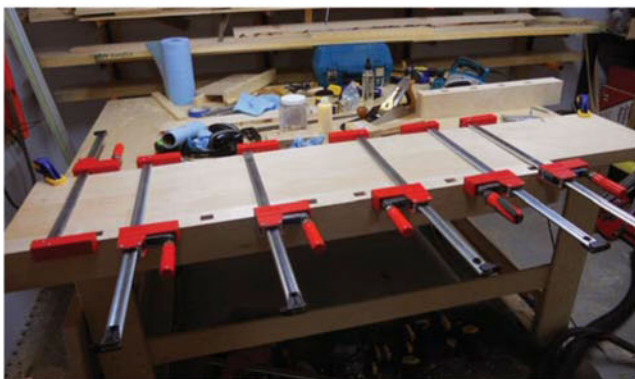
*Four legs get 1"-wide x 5"-long stretcher mortises centered across width, 11³/₈" from top shoulder



LEFT PROFILE



RIGHT PROFILE; END VISE REMOVED



Keep it square. As you glue on the dog-hole assembly, be sure to attach it square and level to the benchtop.



Slice it clean. Make sure to engage the nicker on your rabbet plane when starting this joint and retract it before the joint reaches its full depth (so as not to cut the fibers in the tenon and weaken the joint).



Knife then cut. Use a cutting gauge and knife to lay out the stopped dado for the left vise filler, then chop it out.



Hip to be square.
There will be a lot of pressure on this left vise filler block, so you want clean tenons on both ends and the left edge.



between) and simply flip the jig for the tail-vise portion.

For the 5/4 cap piece that is glued on over the dog holes, choose a clean piece and be careful during your glue-up to avoid getting glue into the slots. I used a pneumatic nailer to shoot a couple of nails into the waste on each of these blanks to help ensure things did not move around during clamping.

Once the glue is dry, cut the waste off the end of the blank that will be affixed to the benchtop and glue and clamp

it to the benchtop. (Here again I used biscuits to help line everything up.) Make sure to remove any mill marks from the cap.

Once the glue is dry, rip the assembly, at the back edge, to final width (15 1/4" for me) and clean up that edge with a handplane.

Benchtop Joinery

I used a router bit in a router table to cut the grooves on the end caps. But I turned to my skew rabbet plane to cut

the rabbets that form the tenons on the ends of the benchtop blank; that was easier than trying to muscle this large assembly onto machinery. The result was a nice crisp joint with no tear-out.

Work carefully and test-fit as you go to make sure the end caps fit nicely.

At the front of the bench is a spacer block – what Frid called the “left vise filler” – that supports the shoulder vise. To cut the groove for it in the front of the benchtop, after laying out the location with a cutting gauge and knife, I removed the material with a mortising chisel, then cleaned up the stopped dado sides with a wide chisel and the bottom with a router plane.

Next, cut rabbets to form 3/8"-long tenons on both ends and the left side of the filler block. Orient the grain front to back so that when this piece expands and contracts, it does so from left to right, thus expanding into open space rather than into the joint.

The front of the shoulder vise – a 2 3/4"-thick x 4"-wide x 20"-long block, which Frid calls simply the “left vise” – is connected to the left end cap via one massive dovetail (pin on the cap, socket on the vise). I laid that out with a 1:7 ratio and cut it by hand.

After dry-fitting the dovetail, cut a stopped dado in the back of the left vise for the spacer block, then fine-tune the fit (shape the profile on the right end later, after fitting the vise hardware).

Now clamp up all the pieces you’ve cut for the benchtop so far: shoulder vise arm, filler block, main benchtop slab and both end caps.

Lay out the three bolt holes—one on

either end and one through the shoulder vise filler block – that will eventually secure these parts to the benchtop (see the illustrations on pages 32 and 33).

Take the end caps and shoulder vise arm to the drill press and use a brad-point bit to drill the through-bolt holes, then drill shallow counterbored holes with a Forstner bit to accommodate the bolt heads and washers. Make sure these holes go through the center of the dados on each of these pieces. Then re-assemble and re-clamp the pieces.

Using a $\frac{3}{8}$ " brad-point bit and the hole in the end cap as a guide, drill with a hand drill as far into the top as you can. Remove the end cap and continue the hole using a longer drill bit with some tape to mark the depth, and drill the hole a little deeper than the max length you expect the bolt to enter the benchtop. (Note: You'll need a long $\frac{3}{8}$ " bit or bit extender for these holes.)

When drilling through the shoulder vise filler block, once you get the

initial hole started, you might want to remove it from the bench and use a drill press or doweling jig to ensure the hole goes straight through. This hole needs to pass through the filler block into the dado slot in the bench and into the benchtop. (Make the hole in the filler block a little wider than the bolt to accommodate wood movement; you can correct for a little bit of being off when drilling this hole without affecting the strength of the joint.)

From the underside of the benchtop, lay out the Forstner-bit holes that will accommodate the square nuts and washer used to secure the ends of the bolts. To make sure they are drilled perpendicular to the bench bottom, I used a portable drill guide with a depth stop.

I was not able to find a bolt long enough to go through the shoulder vise support arm, through the support block and into the benchtop, so I had to make my own from $\frac{3}{8}$ "-threaded rod by using thread locker to secure a nut to one end.

(If you go this route, file off any rough edges because this frozen nut will be visible from the front of the bench.)

Re-assemble the benchtop and test out the fit of your bolts.

To cut the top to accommodate the tail vise (and save my back), I used a track saw, then finished up the inside corner of the joint with a handsaw and cleaned it up with a chisel.

The rear skirt board is made from $\frac{5}{4}$ -thick maple. After milling it to size, remove any tool marks with a hand-plane, then use it as a straightedge to make sure the end caps terminate at the same point (as they must in order to fit the tool tray).

The $\frac{1}{2}$ "-thick plywood tool tray bottom gets rabbeted to fit into a $\frac{1}{4}$ "-wide groove on the inside of this skirt, and is secured on the underside to the bottom of the benchtop with panhead screws (in slots to accommodate seasonal changes). Lay out and cut this groove (on my bench, it's $1\frac{3}{4}$ " from



Know your depth. Test the hole depth with a bolt taped off at the max depth you expect it to reach, given the depth it will be into the end cap.



Access holes. The size of the holes on the underside of the bench doesn't really matter – they just need to be large enough to accommodate attaching and securing nuts and washers on the ends of the bolts.



Bolt stretcher. I used Loctite Threadlocker Red 271 to permanently (I hope!) affix a nut to the end of my threaded rod. The break point for the thread locker was sufficiently high that I could really cinch things down. Use a torque wrench set lower than the break point of the ThreadLocker and you'll be fine.



On track. A track saw or circular saw with a guide makes quick work of removing the waste where the tail vise goes.



Pin layout. When laying out the half-blind dovetails on the rear skirt, make sure the groove for the tool tray falls in a socket, where it will be covered by a tail.



Test-fit. Use a scrap to test the fit of the tool tray bottom to its rabbet. Once you have it dialed in, you use a shoulder plane to fine-tune the joint.



Screw it. Pan-head screws in slots secure the tool tray bottom to the underside of the benchtop.

the top edge), then lay out the dovetail joint, burying the end of the groove in a socket.

Make the saw cuts by hand, then remove as much waste as you can with a Forstner bit before finishing off the joint with a chisel.

Transfer the pin joinery to the skirt board and cut your tails. Strive for tight, clean joints. This skirt board will be held in by tight joinery and some pocket screws – but no glue – in case you ever need to disassemble and repair the bench.

Tool Tray

The bottom of the $\frac{1}{2}$ "-thick plywood tool tray is 7" wide x $73\frac{1}{2}$ " long. Cut a $\frac{1}{4}$ "-thick rabbet on the top rear edge to fit the groove in the skirt board. (I recommend using a plywood scrap to test your tooling setup and fine-tune the fit before cutting the rabbet.)

On the other edge of the tool tray bottom, saw a series of slots for panhead screws that will secure it to the bottom of the benchtop and allow for seasonal wood movement.

From some benchtop cutoffs, I made two clean-out ramps (one for either end of the tool tray); screw them in place from underneath, leaving enough of a gap at the ends for seasonal movement of the benchtop.

Filler Blocks

The two "filler blocks" are simply cross-members that fill the thickness differ-

ential between the top of the leg assemblies and the underside of the benchtop. Each $1\frac{3}{4}$ " x $2\frac{1}{4}$ " x $18\frac{1}{4}$ " piece gets a $\frac{1}{2}$ " x $6\frac{3}{4}$ " notch at the back end to fit under the tool tray bottom. After cutting the filler blocks to shape, mark out their locations, making sure the leg assemblies beneath won't block any of your dog holes. Leave room for the top to expand and contract – this means lateral space between the filler block and the tray bottom and an elongated

hole (and expansion washer) securing the block to the rear of the benchtop.

I used Kreg heavy-duty $2\frac{1}{2}$ " pocket-hole screws to secure the top to the filler blocks because they were the only large panhead screws I could find in the length needed. (You don't need the heavy-duty jig, just the screws and a #3 square driver for this application.) Using a standard pocket-hole jig, I used two $\frac{3}{4}$ " pocket-hole screws to keep the rear skirt firmly attached to the bench.



The view from below. Expansion washers and screws secure the filler blocks and allow for seasonal movement.



Tail vise filler. I used the offcut from the vise recess to block in the edge of that recess with $2\frac{1}{4}$ "-thick pieces in an L shape – that beefs up the opening to the same thickness as the vise to come. I glued it and pocket screwed it (just in case the glue ever fails).



Know when to stop. The saw kerfs for the wedges should stop about $\frac{1}{4}$ " above the shoulder.



Beat the clock. Use liquid hide glue to give yourself the long open time needed to get everything together. My $2\frac{1}{2}$ "-long wedges tapered from $\frac{5}{16}$ " to nothing.

Using a piece of the benchtop waste from the tail-vise cutout, make a filler block for the tail vise hardware. (Note: This piece does not appear on Frid's bench; it's my modification to accommodate the modern tail-vise hardware.) It's secured with glue and pocket screws.

Trestle Base

Mill the four base pieces to size (a matching pair of each), then cut the $\frac{1}{2}$ "-wide x $2\frac{7}{8}$ "-long through-mortises for the leg tenons in the top and bottom pieces before shaping the ends and edges. Drill a hole, 8" from the front, in each top piece for the lag screws that will affix it to the benchtop. Now mill the leg pieces to size, cut and fit the tenons on both ends and mark each to match its mortise. Cut two saw kerfs on the end of each tenon to accept wedges.

Now lay out 1"-wide x 5"-long x $\frac{1}{2}$ "-deep mortises on the inside of four legs for the stretchers. On my legs, the mortises begin $11\frac{3}{8}$ " from the top shoulder; your location will vary if you've adjusted the leg length for a bench of a different height.

Drill $\frac{3}{8}$ " bolt holes through each of those four legs, centered left to right and top to bottom in the mortises. To remove the mortise waste, I used a

Forstner bit to drill out as much waste as possible before finishing up with a chisel and router plane. (Note: The fifth leg supports the shoulder vise and needs no mortise or bolt hole.)

Using a chisel and a planemaker's float, I tapered the top and bottom edges of the mortises a little bit to allow room for the wedged tenons to expand and lock into place.

With the joinery cut, now you can round over the edges.

For the large radii on the ends of the four base pieces, I laid out a pleasing curve using a compass and pencil, cut off the bulk of the waste at the band saw and cleaned off the mill marks using files and rasps. I eased the bottom edges of the top pieces, and the top edges of the bottom pieces with a $\frac{1}{4}$ "-radius roundover bit in a router.

Before assembling the bases, do a test-fit to make sure you have all the necessary clamps and supplies ready to go. You'll need to work fast in order to assemble this joint and get the wedges driven before the glue sets. Once the glue sets, flush the wedges to the base pieces.

The stretchers on this bench—which are thicker and wider than on Frid's—employ a fully housed tenon (that is, there's a shoulder on all sides) and Lee



Specialty hardware. The 6"-long bolts go into the middle of the stretcher and are secured on the backside of the stretchers with brass barrel nuts.

SUPPLIES

Dieter Schmid Fine Tools
www.fine-tools.com

1 ■ Bench screw
 #300659, \$62

1 ■ Tail vise, large
 #300650, \$132

Lie-Nielsen Toolworks
lie-nielsen.com or 800-327-2520

1 pair ■ Metal bench dogs
 #1-MBD-Pair, \$75

2 ■ Wooden vise handles
 #1-WVH, \$45 each

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

1 pkg. ■ Veritas Special Bench Bolts
 #05G07.02, \$29.50

1 pkg. ■ #10 Expansion Washers
 #50K35.01, \$5.80

1 ■ *Shoulder-vise screw
 #70G01.51, \$31

1 ■ *Handle, 05G12.03, \$8.50

*Lower-price alternatives to Dieter Schmid vise screw & Lie-Nielsen handle

General Hardware

2 ■ $\frac{3}{8}$ " x 5" lag screws

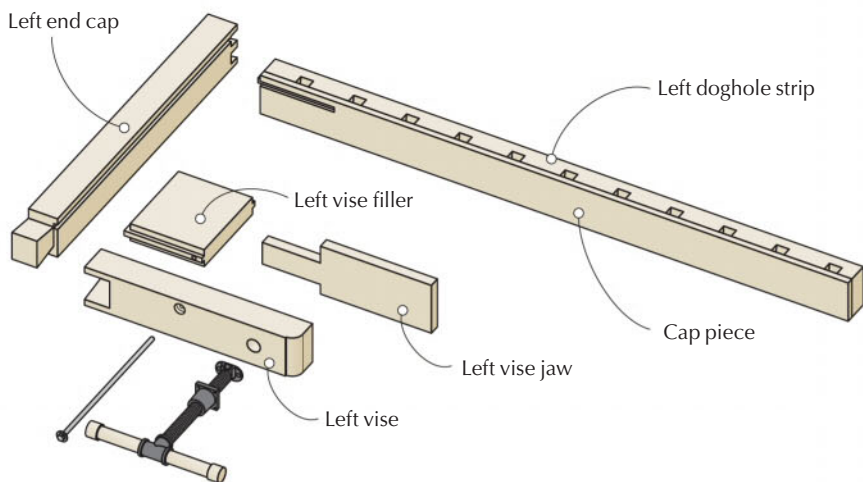
4 ■ $\frac{3}{8}$ " x 6" machine bolts

1 ■ $\frac{3}{8}$ " x 14" threaded rod
 $\frac{3}{8}$ " nuts & washers

1" Kreg pocket screws

2.5" Kreg heavy-duty pocket screws

Prices correct at time of publication.



SHOULDER VISE – EXPLODED VIEW

Valley's "Special Bench Bolts." Mill the stretchers to size, then cut 1"-thick x 5"-wide x $\frac{3}{8}$ "-long tenons on all four ends.

Now lay out and drill 1"-diameter holes on the backs of the stretchers, located $3\frac{1}{4}$ " on center from the shoulders, and centered top to bottom. These need to be just deep enough to accommodate the bench bolt's large brass barrel nut.

Clamp the stretchers in place and use the same technique you used on the end caps to accurately bore $\frac{1}{2}$ "-diameter, 6"-deep holes centered in the stretchers.

Screw footpads to the bottom of the leg assemblies to fine-tune the bench's final height. Note: My pads are $\frac{3}{8}$ " thick; yours may vary to help keep the base stable on an uneven floor, for example.

Use lag screws (with a washer under the heads) to attach the base assemblies to the filler blocks and let the bench stand on its own for the first time.

Shoulder Vise Hardware

Drill a $1\frac{1}{4}$ "-diameter clearance hole for the Acme-threaded rod of the shoulder vise to pass through the left vise (the dovetailed piece in front). Then, using that hole to orient the fixed nut, trace the outline and screw holes for the nut onto the support arm. Drill a larger hole to accommodate the body of the fixed nut. Then, using a chisel and a router plane, set the fixed nut so that it is flush with the inner surface of the left vise, then secure it with screws.

With the hardware fit, you can dress up the right end of the left vise to suit. I used a skew rabbet plane to create a fillet, then cut an ovolo on the band saw and refined it with rasps then sandpaper.

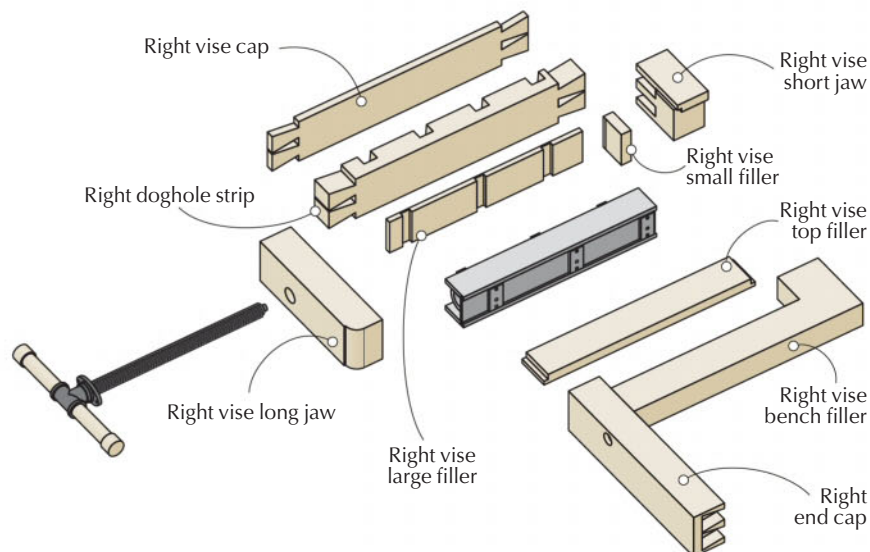
Remount the left vise arm and bolt it in place, then insert the Acme-threaded screw and its handle. Put paraffin wax on the screw threads to make sure it turns easily.

Cut a paddle-shaped 1"-thick x 5"-wide x 16"-long wooden face for the shoulder vise – the left vise jaw (Frid's Part X) – notching it top and bottom at the left end to form a $5\frac{1}{2}$ "-long tail that fits between the benchtop and top of the trestle legs. (Wax any moving

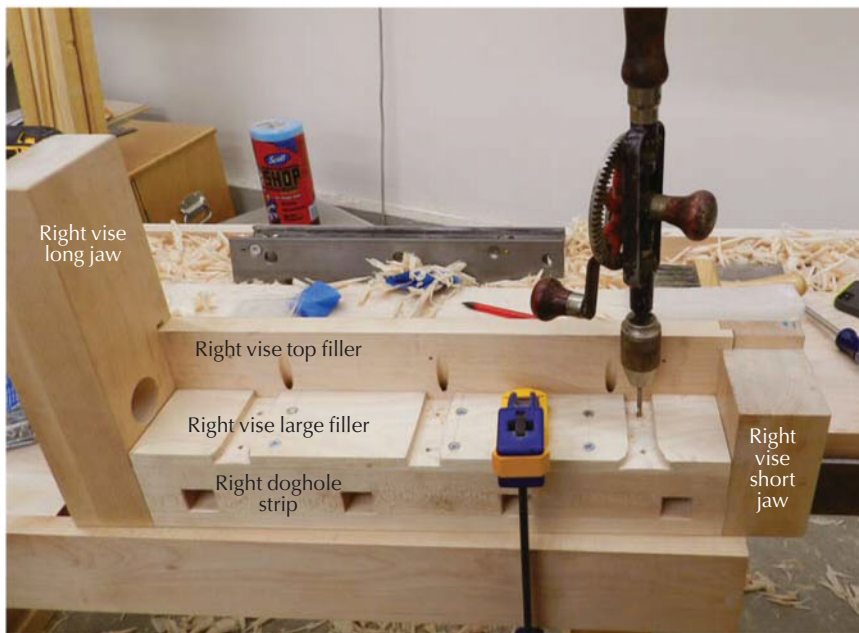


Shoulder vise screw. After drilling a clearance hole, use that to locate the plate of the screw hardware, and trace around it. After removing the waste to inset the plate, screw the plate in place.

part that rubs wood to wood). Then mount the jaw hardware to the front of it so that it can be removed. The long tail on the face will keep the jaw from falling out, and the flexibility to swap in a customized face for curves or jigs is a nice option to have.



TAIL VISE – EXPLODED VIEW FROM REAR



Tail vise. Shown here is the vise on its backside. Note the dados in the back of the “Right vise large filler” to accommodate the metal plates of the tail vise hardware, and that they are not all the same. Cut dados to fit your particular vise.

Tail Vise Hardware

For the tail vise jaws, the right dog-hole strip and the right vise cap, lay out and cut large half-blind dovetails (I recommend using the same layout as for the back skirt, for appearance). Drill a hole in the right vise cap for the vise screw. Cut stopped dados in all three of those pieces to accommodate the top filler block and leave room for seasonal movement.

Use pocket screws to keep it flush with the dog block. Add additional fillers as needed to shim the tail vise carriage.

Home stretch. Adjust the screws on the carriage (the piece on the vise assembly) until the tail vise slides smoothly along the fixed plate on the bench cutout.



Mount the fixed plate of the metal vise to the cutout in the side of the benchtop (the sliding carriage rides on this plate), and mount the sliding carriage to the wooden vise assembly; wax the screw and the areas where the carriage rides along the plate. Also make sure you hog out just enough wood from the left cap to allow you to get the tail vise on and off as needed (see “Home stretch” below).

Secure the large Acme screw to the moving portion of the tail-vise assembly and mount it to the bench. Insert the

handle and make sure the vise moves easily.

Final Details

Flatten the benchtop (I use jack, jointer and smoothing plane in that order, and use a straightedge to identify any high or low spots), making sure to keep the top perpendicular to the front skirt. Break any sharp edges with a block plane and clean up any rough spots with some sandpaper.

An easily renewable oil finish is ideal for a workbench. Linseed oil or tung oil are good choices. I finished my bench with a tung-oil varnish on the legs, underside of bench and skirt, and pure tung oil on the top, as I don’t want it to be too slick a surface to work on.

The tried-and-true combination of a shoulder vise, square dogs and tail vise is a great setup for traditional woodworking. By building this sort of bench, you are joining the ranks of many classic woodworkers including Tage Frid, Frank Klausz and countless craftsmen that came before them. And as Tage wrote, “Now your bench is completed, and looks so beautiful that you hate to use it. If you take good care of it, working on it but not into it, it should stay beautiful for years.” **PWM**

Bill Rainford is a traditional joiner, woodworking instructor and author of the forthcoming Lost Art Press book “Go, Go, Go: The Life, Woodworking and Influence of Tage Frid.”

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/feb17

BLOG: Read about the author’s Tage Frid-style deadman, for use in the tail vise.

WEBSITE: Read more from the author – including his article on how to make face-mounted clamps for this bench, on his blog at rainfordrestorations.com.

MODEL: Download a free SketchUp model of this bench at the Popular Woodworking SketchUp Warehouse.

IN OUR STORE: “Workbenches: From Design & Theory to Construction & Use” (revised edition), by Christopher Schwarz.

TO BUY: “Building the Portable Moravian Workbench” with Will Myers.

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Design & Create a Marquetry Panel

BY CRAIG
THIBODEAU

You'll need three drawings, a stack of veneers and a little patience.



I've been using marquetry as a way to enhance my custom furniture pieces for a number of years and during that time have developed a series of simple steps that make creating marquetry pictures fairly straightforward. I'll take you through all the necessary steps, from creating the initial drawing to gluing up the cut and sand-shaded marquetry veneer.

Draw First

The first step in creating a marquetry panel is to determine the size of the image. In this case I am making a small panel of birds and flowers for a large piece of furniture. To create initial drawings, I typically search for clear

Inspiration. I refer to a variety of printed reference material for the birds and flowers as I create the finished drawing.



photographs of my chosen subject matter. There are a variety of places where free images can be downloaded and printed; with a home printer or copier, you can scale the images to suit your project size. Once you have the photographs scaled and printed, make a rough pencil sketch showing how you plan to lay out each of the details in your picture. This can be very rough; it's just to give you a good reference for where to place—in this case—the birds, flowers and branches.

Begin tracing the outline of the images you've chosen to use and try to orient them in ways that look realistic. It's not necessary to exactly trace the photos; in many cases you can improve the look of the drawing by making slight adjustments as you progress. This stage can take some time, and typically after completing the initial tracing I'll go back and redraw the entire image several more times, making alterations and improvements along the way.

Once you have a final drawing, make three copies: one for cutting; one for assembly; and one to use as a shading template.

Make the shading template by coloring in with a colored pencil the areas you'd like to see shaded. It can take some trial and error to get the shading to look correct, but this will be useful when you start shading the veneer.

Take another copy and use spray adhesive to attach it to a piece of cardstock that's about .040" thick. Cut another piece of cardstock to the same size as the drawing; this will become the bottom layer of your marquetry packet.

Veneer Selection & Packet Assembly

Now you need to select the veneers that will make up the marquetry image. First, you'll need two pieces of veneer cut to the overall size of your marquetry panel – one for the show face (pick a nice one that contrasts with the image) and one for the backside (the glue face) of the final panel glue-up.

Now, let's concentrate on my flower and bird colors.

Most of my marquetry flowers are made with holly veneer because it is very white and looks quite dramatic against most background veneers once it has been shaded. Centers of flowers are typically in a contrasting color, usually satinwood or another brightly colored material.

You can use natural wood veneer for essentially everything except the green

leaves in this image; there isn't a green veneer that will stay naturally green over time, so I order dyed veneer in several shades of green to make leaves. (If you want to make colorful flowers, you'll also need to order pieces of dyed veneer for those.)

I make most branches with either straight-grained mahogany or walnut burl veneer, depending upon the background veneer color (walnut burl on a walnut background would be difficult to see).

Both of the birds in this panel are made with natural wood veneers. I use lighter woods such as maple for the underbelly and a variety of darker shades (walnut, mahogany and teak) for the upper body and wings. And I will typically use dark veneers such as ebony to make my beaks.

I always add the eyes after the marquetry panel is glued up. I find the small eye quite difficult to cut accurately with the scroll saw, so I drill a small oval hole and glue in a piece of solid ebony.

Select colors that give your birds a natural look, and know that the sand shading (we'll get to it below) will add shadows that really improve the look of the birds.

Once you have all the veneer selected, it's time to create the packet for sawing the marquetry. Set the background veneer on top of the bottom piece of cardstock and tape it in place around the perimeter.



Spray n' stick. Use spray adhesive to attach one copy of your drawing to cardstock, tape the background veneer to another piece of cardstock, then tape them together on one edge.

Now place the cover piece with the drawing on top of the background veneer. Tape them together along one side so you can flip the drawing up to accurately place pieces of veneer onto the background to build a veneer packet.

Before building the packet, cut each veneer piece oversize by 1" all around the size of the part it matches; this little bit of extra will help keep you cutting on the right veneer in case you don't follow the drawing exactly.

Now build your veneer packet in a methodical manner, taping down your chosen veneer for each part of the image under that section of the drawing. I always work in a specific order: branches first, then leaves, then flowers and finally birds. This way, I

can double-check that I have finished inserting one type of piece completely before moving on to the next.

The easiest way to locate the veneer pieces correctly is to bend the drawing up a bit while looking at both the background and the drawing together. You can see fairly well where each piece needs to go – and when they are not in quite the right location.

As you place each piece of veneer onto the background, tape it on all sides with blue tape to secure it, then mark the drawing with a colored pencil to note which piece has been placed. Continue placing each piece of veneer until they're all taped in place.

Close the packet and tape tightly around the perimeter of the drawing

to hold everything firmly together. You're now ready to start cutting the marquetry.

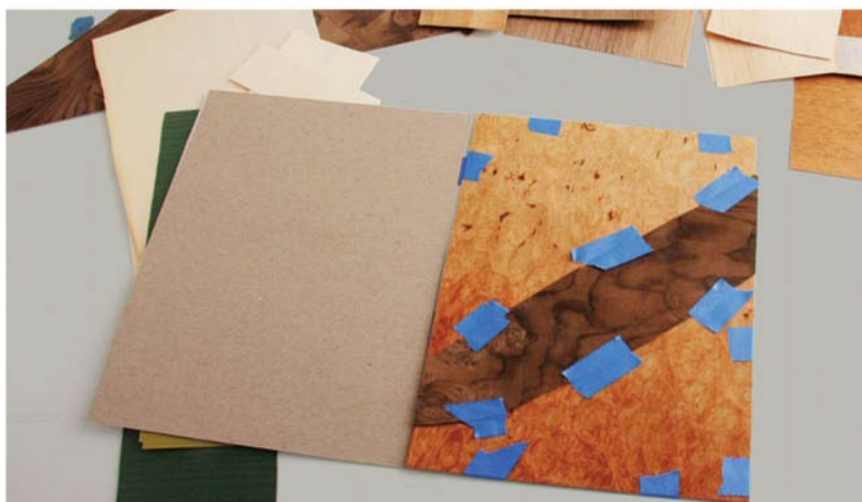
Make the Cuts

I use a DeWalt scrollsaw to cut nearly all my marquetry, typically with a 2/0 blade and the saw set at fairly low speed. High blade speed can make it difficult to follow the drawing accurately; it also increases the chances of you mis-cutting or overcutting a line somewhere along the way. Tighten the blade until it has a high "C" ping when you flick it with your finger. The pitch doesn't need to be exact (no tuning fork is required), but slightly tighter is better than slightly looser.

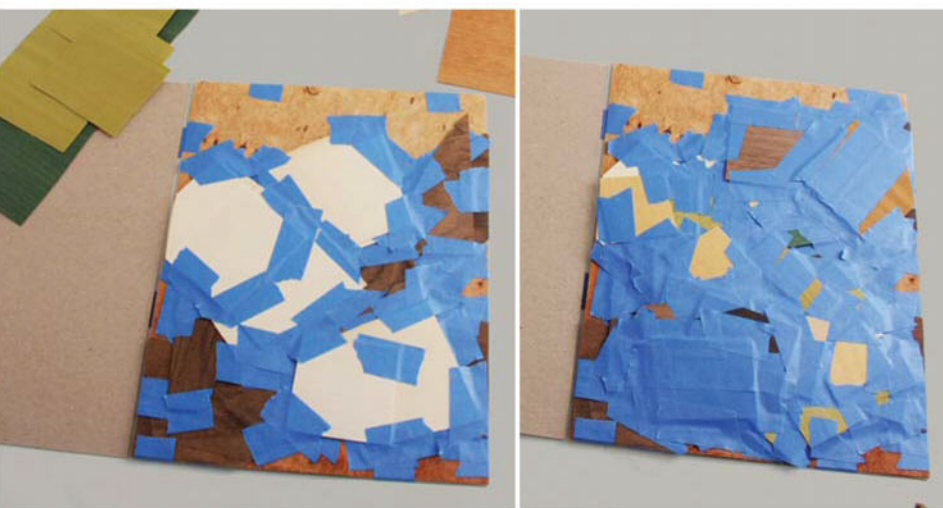
Begin cutting inward from one of the outside branch pieces, making sure to hold the packet down near the blade to prevent it slapping around while cutting (the worst injury you'll get if you accidentally touch the blade is akin to a small paper cut). Carefully saw your way around the entire perimeter of this first piece, then use an awl or other sharp pointed tool to press it out of the packet – this allows you to remove the correct piece of veneer from the stack of parts.

If you are careful, they will remain in a clean stack and you should be able to locate the correct branch part and remove it quite easily. Place this piece on the second copy of your drawing – this helps you keep the pieces straight – then cut the rest of the image.

Note that the pieces of the background also need to be removed as they are cut away. Take them out of the stack of parts just as with the other components and place them in the correct location on the drawing.



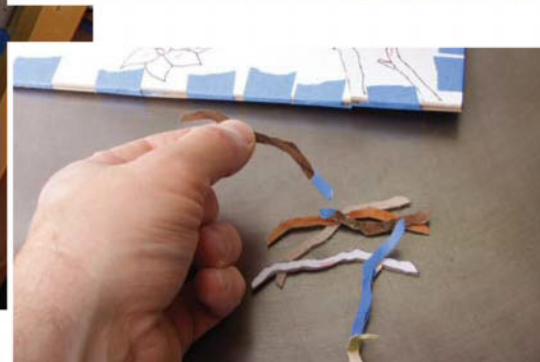
Orderly taping. Build your veneer packet a piece at a time.



Halfway, then home. On the left is my packet with about half of the veneer pieces taped in place, and on the right you see it with all the pieces inserted.

"The cabinetmaker should well understand design of all kinds and possess knowledge of the tone and nuance of colors in order to represent as perfectly as possible all sorts of subjects, like buildings in perspective, ornaments, flowers, landscapes, figures, etc."

— André-Jacob Roubo (1739-1791),
French woodworker & author



Outside in. Start with a piece on the edge, in this case a branch, and work your way in, then back out, as you cut around the part. Then press it out with an awl.

Cutting smooth, curved flower petals and bird bodies can take some practice. I find it best to cut curved lines without stopping and to continuously turn the packet as I cut.

When it comes to sharp corners, cut right up to the point of the corner and stop, then gently rotate the packet around the saw blade while pulling the blade forward slightly with the packet to prevent it from cutting. Once the packet is rotated to the new direction, continue cutting as before.

When all the pieces have been cut and placed on the drawing, begin removing the remaining background veneer from the packet. Carefully peel back the tape holding the packet together and the tape holding the various veneer colors to the background; be careful because the background now has lots of holes in it and is quite delicate.

Once you have the background free of the packet remnants, place it show-face down on your bench. Cover the entire back of the glue face of the background veneer with a layer of blue tape.

Now flip the veneer over so you can begin assembling your marquetry image. Pick up the veneer pieces one by one with a pair of tweezers and place them in their respective locations in the background.



All the little pieces. Here are all the image parts laid out on the drawing, with the background pieces to the sides.



Background. Be careful while assembling and taping the glue side of the background veneer; the pieces are full of holes and delicate.

Assemble. To handle the small pieces, I recommend using tweezers. Insert the branches first, then the remaining pieces – but don't press them down hard.



It's usually easiest to start with long branches as they seem to nest nicely into the background and give you a good reference for placing the other parts correctly. Don't press the veneer down hard onto the tape; you'll need to pick up each piece again for sand shading and they break easily.

Sand Shading

To give your marquetry image a more lifelike look, each of the pieces needs to be sand shaded on the edges.

Sand shading involves dipping each piece of veneer into a container of hot sand to scorch the veneer slightly. I use an electric hot plate with an inexpensive metal pan about 2" deep filled halfway with terrarium sand from a pet store. Terrarium sand is much finer than play sand or beach sand, so the scorching effect is more subtle. (You'll also need some blocks to hold the veneer flat—I use 6"-square, 1"-thick

pieces of particleboard – and a small bowl of water.)

Before turning on the hot plate, on the third copy of your drawing, shade with pencil the areas you want to sand shade.

Now heat the sand at medium heat and use some scrap veneer to determine how fast the veneer burns.

Try to avoid leaving the veneer in the sand long enough to cause it to burn. A little smoke is normal, but when it starts to turn black you've gone too far. And don't completely submerge the pieces in the hot sand; that tends to shade the entire piece and the natural veneer color disappears. You want to toast only the edges.

Some veneers, including holly and light green-dyed veneer, sand shade very quickly and end up with nice

subtle change. On the other hand, dark green veneer shades very slowly and will take longer in the hot sand to achieve the same shaded look. The best method for determining the proper amount of time to shade each veneer is to test a few samples until you get the desired shading effect.

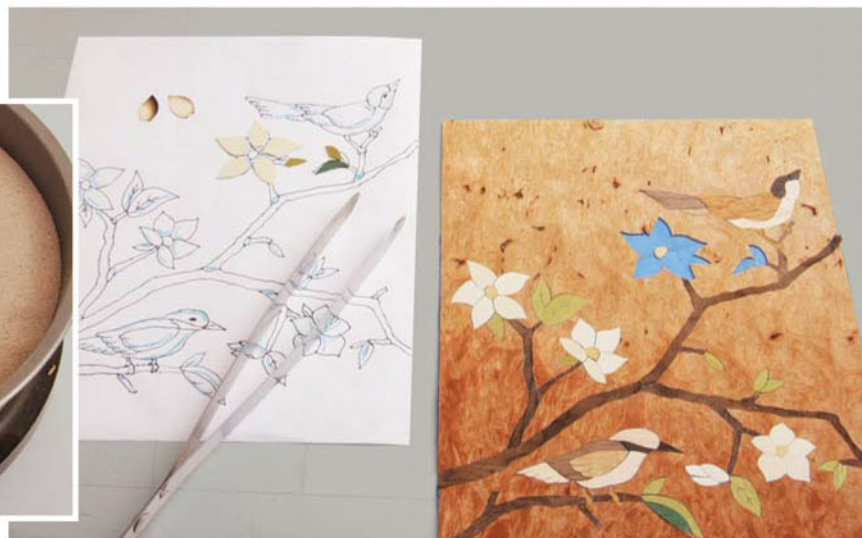
Hold the veneer piece with a pair of tweezers (the sand is hot) and dip it into the sand about 1/4" or so. Repeatedly insert and remove the veneer every few seconds until the shading is at the level you want, ideally a nice even dark brown that fades away quickly to the natural veneer color. Some pieces will require shading in multiple areas; simply shade each area one by one until the part is correctly shaded.

To keep track of parts while shading, I remove an entire small section of veneer pieces from the tape and lay them out on the shaded copy of my drawing. Then I sand shade those pieces, making sure to keep them in the proper orientation, before moving on to the next small section of the image.

The parts will shrink a bit from the sand shading and need to be slightly rehydrated. I do this by dipping my fingers slightly into the bowl of water and pressing each piece of veneer one at a time with my fingers. You don't need much water; too much and the veneer will swell beyond the size of the hole it goes into.



At tweezers' length. To avoid burning yourself, use tweezers to hold each veneer piece on edge in the hot sand.



Shady solution. The third copy of the drawing gets penciled shading in the areas to shade on the veneer.



Cover up. Blocks of particleboard hold the wetted veneer in place to prevent distortion as it dries.

After moistening each piece, place it back into the background in its proper location. Once all the pieces in a discrete area are inserted, cover that area with a block to hold the veneer flat until it dries (usually 30 minutes or so). Repeat this procedure for all the veneer parts that need shading, then leave the veneer to dry for 30 minutes to an hour.

Taping & Gluing

At this point your marquetry image probably looks pretty nice; all the shading is complete and the parts are in roughly their final locations. So it's on to the final steps. Start by covering the entire show face of the veneer with a layer of blue tape.

Then flip your panel over and carefully remove the tape from the glue face of the veneer. Be careful, and go slowly because small pieces tend to stick to the tape while it's being removed. To replace any lifted pieces, just push the tape back down and hold the veneer piece in place with the tweezers while removing the tape.

Once all the tape on the backside is removed, use your tweezers or a small awl to make any final adjustments; some of the veneer pieces have probably moved a bit during taping.

Try to push them outward toward the background veneer edges. That way, any spaces between them are located at the intersection of the marquetry parts rather than between the background and the parts.

Flip the panel over and burnish the blue tape firmly with a brass brush. This



Covered up. With the sand shading done and all the parts in place, put tape over the entire show surface.



Final adjustments. Use your tweezers or a small awl to push any moved pieces back in place.

helps to hold the small pieces of veneer in place until they are glued down.

For glue-up, I always use Pro-Glue urea formaldehyde glue; it dries hard and does a good job of filling the saw kerfs between the veneer pieces. Pro-Glue is a dry powder mixed with water

and takes roughly 6 to 8 hours to dry. Follow the instructions on the container to mix it properly.

You can use clamps to press veneer panels, but my preference is to use a vacuum bag; either method will work as long as the pressure is evenly spread

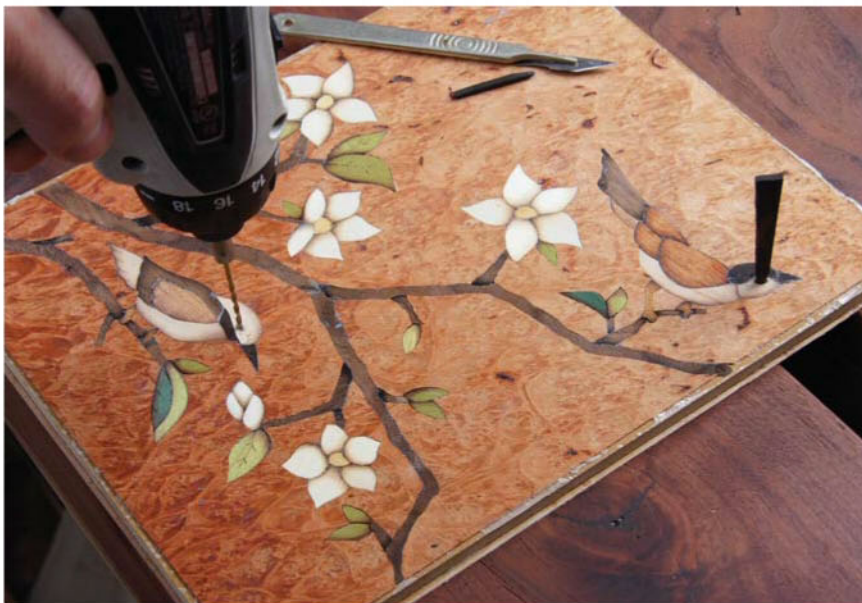
Burnish. I use a brass brush to burnish the tape on the show face.



Get ready to glue. To glue up your panel, you'll need a glue roller and glue. Then, the order in which the stack will be pressed is: a caul, a sheet of plastic, your marquetry image, 1/4"-thick MDF, a sheet of plain veneer, another sheet of plastic and the bottom caul.



Heat & release. A few seconds with a heat gun set on low will release the tape adhesive and make the tape easy to remove.



Poke in the eye. Drill small holes in the eye locations, then carve a point on a dark piece of wood to fit the hole tightly. Here, ebony has been glued in place for the first eye.

over the panel and the pressure is high enough. Do what works best for you, but both approaches require a caul on top of the veneer with a layer of plastic between the veneer and the caul. If you're using clamps, make cauls from $\frac{3}{4}$ "-thick MDF; for a vacuum bag, the cauls can be $\frac{1}{4}$ "-thick MDF.

Pour a thin line of glue onto your substrate (I use $\frac{1}{4}$ "-thick MDF) and roll it out with an adhesive roller until the surface is uniformly coated.

The spread-out glue shouldn't be thick enough to have puddles, but it also shouldn't look dry after a minute or two. If it looks dry, roll it out again with a bit more glue.

Place your marquetrie veneer sheet onto the glue and cover it with a layer of plastic. Flip the panel over, spread

glue on the back and put the full sheet of veneer in place. Add the cauls and either place the stack into a vacuum bag or start adding your clamps. (If you're using clamps, I recommend deep-reach ones to get to the center of the panel, and suggest you use as many as you can get on the panel. Once a panel gets beyond 8" to 10" wide, though, you're better off with a vacuum bag, unless you happen to have a screw-clamp fixture handy.)

After 6 to 8 hours, the glue will be dry. Pull the panel from the bag or clamps, then remove the tape. Use a heat gun set on low to soften the tape adhesive and prevent the veneer from tearing.

The final step is to add the eyes. I find that drawing the eye on the veneer

SUPPLIES

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Certainly Wood

certainlywood.com or 716-655-0206

with a pencil allows me to fine-tune the placement before drilling.

Use a small drill bit (about $\frac{1}{16}$ " in diameter) to drill a shallow hole in the location you've chosen for each eye. If you want to make the eye more oval, gently rock the drill back and forth to make the hole slightly oblong. Carve a small piece of ebony or other dark wood with a chisel or knife to fit each hole tightly. Apply a small drop of glue in each hole and insert the wood.

Once the glue for the eyes is dry, flush the eyes to the surface with a flush-cut saw or chisel – carefully.

Your panel is ready to be sanded. I use a random-orbit sander, typically progressing from #120- to #320-grit sandpaper, while being careful not to sand through the thin veneer.

With the panel complete, you can incorporate it into a furniture project like I often do, or you may choose to frame it and hang it on your wall. While this panel is for the birds (and flowers), if you can draw it, you can make it in marquetrie. **PWM**

Craig is the 2013 and 2016 winner of the Veneer Tech Craftsman's Challenge among numerous other awards, and his work has been featured in many publications. He makes custom furniture in San Diego, Calif.

ONLINE EXTRAS

For links to all online extras, go to:

■ popularwoodworking.com/feb17

VIDEO: Watch how the author cuts the marquetrie for this panel on the scroll saw.

VIDEO: Watch the author's Puzzle Cabinet video to see how the author used this panel design in a furniture piece (it's astounding!).

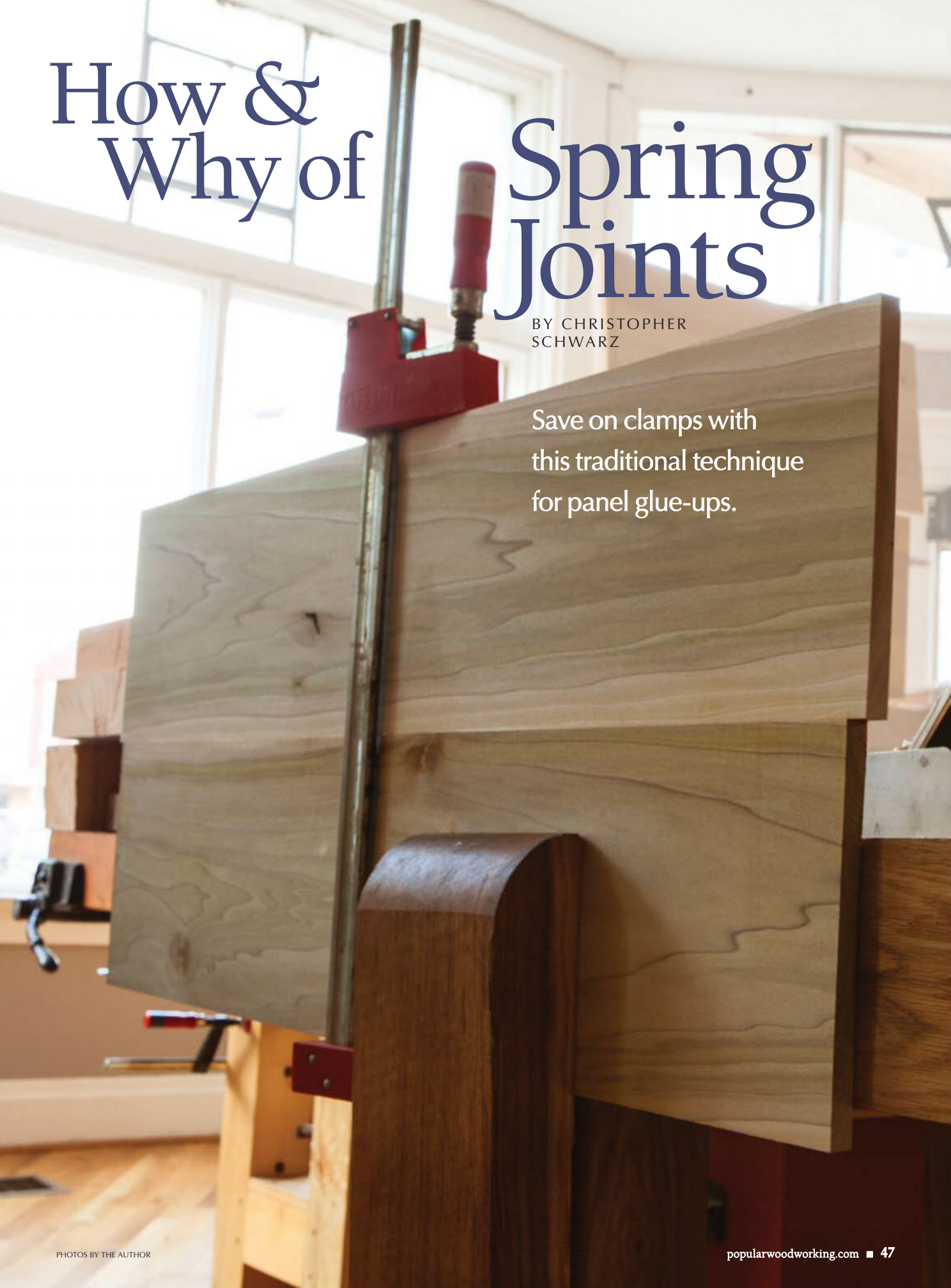
WEBSITE: Visit ctfinefurniture.com to see more of the author's work.

IN OUR STORE: Watch "Simple Parquetry Techniques" by Don Williams to learn traditional parquetry techniques using hot hide glue.

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How & Why of Spring Joints



BY CHRISTOPHER
SCHWARZ

Save on clamps with
this traditional technique
for panel glue-ups.

A “spring joint” is a traditional method where you join the edges of two boards to make a wider panel and leave a tiny gap in the middle of the joint. The gap reduces the number of clamps you need to make the panel and can help keep the completed panel intact through dramatic seasonal changes in humidity.

The 21st-century wisdom on spring joints is that they are not necessary. Modern glues, the wide availability of clamps and humidity control have rendered the method obsolete.

I completely agree that you can make an edge-to-edge joint without any “spring” and with any glue and have it last indefinitely. Yet the spring joint remains an effective way to work

faster and with fewer clamps. And so I use it regularly in my shop to make my work more efficient.

If you are interested in how to make a proper spring joint based on my 20 years of making them, read on.

The Theory

There are lots of theories about why spring joints work and are helpful. The most common one is that the ends of boards take on and release humidity faster than the middles. So it's best to keep the ends under pressure throughout the seasonal humidity changes.

While true in theory, I have had good luck making joints without any spring, so I don't push this theory down the throats of my students. Though

if dealing with wet woods, I think a spring joint can keep things in place as the panel reaches equilibrium with its environment.

For me, the more compelling reason to use a spring joint is to reduce the number of clamps needed to glue up a panel. A typical 48"-long panel with two perfectly flat edge joints can require about five bar clamps to get the job done. If I spring that same joint, I'll use one (maybe two) clamps.

Clamps are expensive.

The Practice

Making a spring joint is easy: Make the edges of the boards you plan to join slightly concave. But how? And how concave should they be?

I make the spring joint with a jointer plane using a “stop shaving.” A stop shaving is where you begin the cut on an edge about 4" to 6" away from the end of the board and stop it (by lifting the heel of the plane) about 4" to 6" away from the end. You are, essentially, planing away the middle of the edge and creating a concavity.

With a panel 48" long or shorter, I'll make the spring joint with one stop shaving on each edge. That should make a gap between the two boards of about .004" to .006", depending on the depth of cut of your plane. For longer boards, I'll use two strokes on each edge.

The goal is to get a gap in the center of the two boards that you could put



Here's the scoop. A stop shaving makes the edge of a board slightly concave. Start the cut 4" to 6" away from the end of the board. As you get 4" to 6" away from the other end of the board, lift the heel of the plane to stop the cut.



No drag. A straightedge placed on a second edge can tell you if the edge is convex, or if it is flat or concave. If the straightedge spins on the work, the work is convex. If the ends of the straightedge drag, then the edge is flat or concave.



Spin it. Here one of the two mating edges is convex, so the top board spins on top of the bottom board with amazing ease.



A little pressure now. A spring joint should be slight. You should be able to get a piece of paper or, at most, a business card in between the panels.

a piece of typing paper into, or maybe a business card. In any case, the ultimate test for me is to see if I can close the spring joint with hand pressure. If I can, then the spring will be easily closed by clamp pressure.

The Procedure

Begin with one of the boards clamped in your face vise. True the edge with your jointer plane, making sure the edge is square to the true face of the board and is not convex.

You can determine if the edge is convex by placing a wooden straightedge on top of your board's edge. If the ends of the straightedge don't drag against the board – the straightedge tends to spin a bit like a top – then the edge is convex. Use stop shavings to make the edge flat or ever-so-slightly concave.

"There are two men inside the artist, the poet and the craftsman. One is born a poet. One becomes a craftsman."

—Emile Zola (1840-1902),
French novelist & playwright



A little drip. The glue squeeze-out will tell you if you have done your job. Don't be ashamed to add an extra clamp with long panels.

Finally, take one long stop shaving to introduce a concavity to the edge.

Once that edge is complete, remove it from the vise. Put the mating board in the face vise and make it straight and true. Show the edge of your first board to the one in the vise. The ends should meet tightly and drag against one another when you pivot the top board. If the top board spins, then one of the edges is convex and more stop shavings are needed.

Look at the middle of the joint. You might see a tiny sliver of light. If this is your first spring joint, try to get a sheet of typing paper in there. Try to close the joint with hand pressure.

If you can see a sliver of light and can close the joint, glue up the panel. If you cannot, take some stop shavings on the board in the vise until the concavity appears.

To glue up the panel, paint a thin film of glue on the edge of the board in the vise. Position its mate in place. With the panel still in the face vise, apply one clamp to the center of the panel (thanks to Bob Van Dyke for showing me this dodge). Apply a little pressure,

make adjustments to the seam of the panel, then apply full pressure that will close the spring.

You can now remove the panel from the face vise and move to the next panel.

That's all there is to it. Give it a try before you dismiss it, because it could change the way you work (and save on clamps). **PWM**

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

ONLINE EXTRAS

For links to all online extras, go to:

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BLOG: Read Christopher Schwarz's blog at popularwoodworking.com.

BLOG: Read the author's blog at lostartpress.com.

VIDEO: Use a powered jointer to make a spring joint.

ARTICLE: "Three Ways to Make Edge Joints."

IN OUR STORE: "Mastering Hand Tools: Basic Skills for Balanced Woodworking," by Christopher Schwarz.

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Knock-down Shaving Horse

BY WILLARD ANDERSON

Windsor turnings lend personality; storage drawer adds functionality.

I recently had a roof built over the deck on my shop, so now I have a great place to store lumber (plus I put a rocking chair out there to enjoy the evening air). But what I really wanted was a shaving horse for the deck so that I could work outside while shaping Windsor chair parts.

There were several specific things I wanted from this project:

1. A cooper's-style horse (that is, not the kind with a dumbhead) because I hope to get into coopering a bit
2. Four legs for stability
3. A structure sized to my frame
4. To use some of the lumber stored on the deck
5. To display my turning and joinery skills.

6. Use a really cool cast iron tractor seat I found at a flea market

7. The ability to completely break down the shaving horse into components for easy transport.

The basic design is pretty much as described by Jennie Alexander and Peter Follansbee in their book "Make a Joint Stool from a Tree" (Lost Art Press), but mine – thanks to the storage drawer in the riser and turned pieces – is tricked out a bit more than one might expect for such a folk-style appliance.

While I've included the measurements for my horse in the text that follows, dimensions have intentionally been left out of the drawings—a shaving horse really should be sized to suit the user, so build yours accordingly.

Bench Work

The horse begins with a 9"-wide x 5'-long 8/4 poplar blank. I ripped this board lengthwise into three 3"-wide pieces. This allows me to build in a track for the seat without having to mortise it (it would be a large mortise).

I wanted the front (working) end of the horse to be about 2' long and the middle part (with the seat track) to be as long as I can stretch out my legs to the middle of the working end, with about 1' behind me. So I cut that length (about 22" long, beginning about 16" from the back end of the bench) out of the middle piece, then glued the pieces back together – instant seat track!

I cut the middle portion of the bench to an hourglass shape that's about 6"

wide along each side; this narrower section corresponds to the location of the front edge of the tractor seat when it's even with the end of the slot. The hourglass shape provides a comfortable space for my legs when the shavehorse is in use. The final length of my bench ended up at 56".

The tractor seat is attached to a 1"-thick riser to elevate it enough so that the downward-curved wings don't drag on the edges of the bench frame. The seat was originally bolted to the tractor with one central hole and a squared-off carriage bolt. But to make it more secure for my use, I drilled four holes through the cast iron into the seat support, which I shaped to fit to the underside dimensions of the seat. Before I screwed the seat onto this support, I attached a 4½"-tall keel to the support, which allows the seat to travel on the bench.

The keel is cut from a solid piece of wood, with the mortise chopped so that



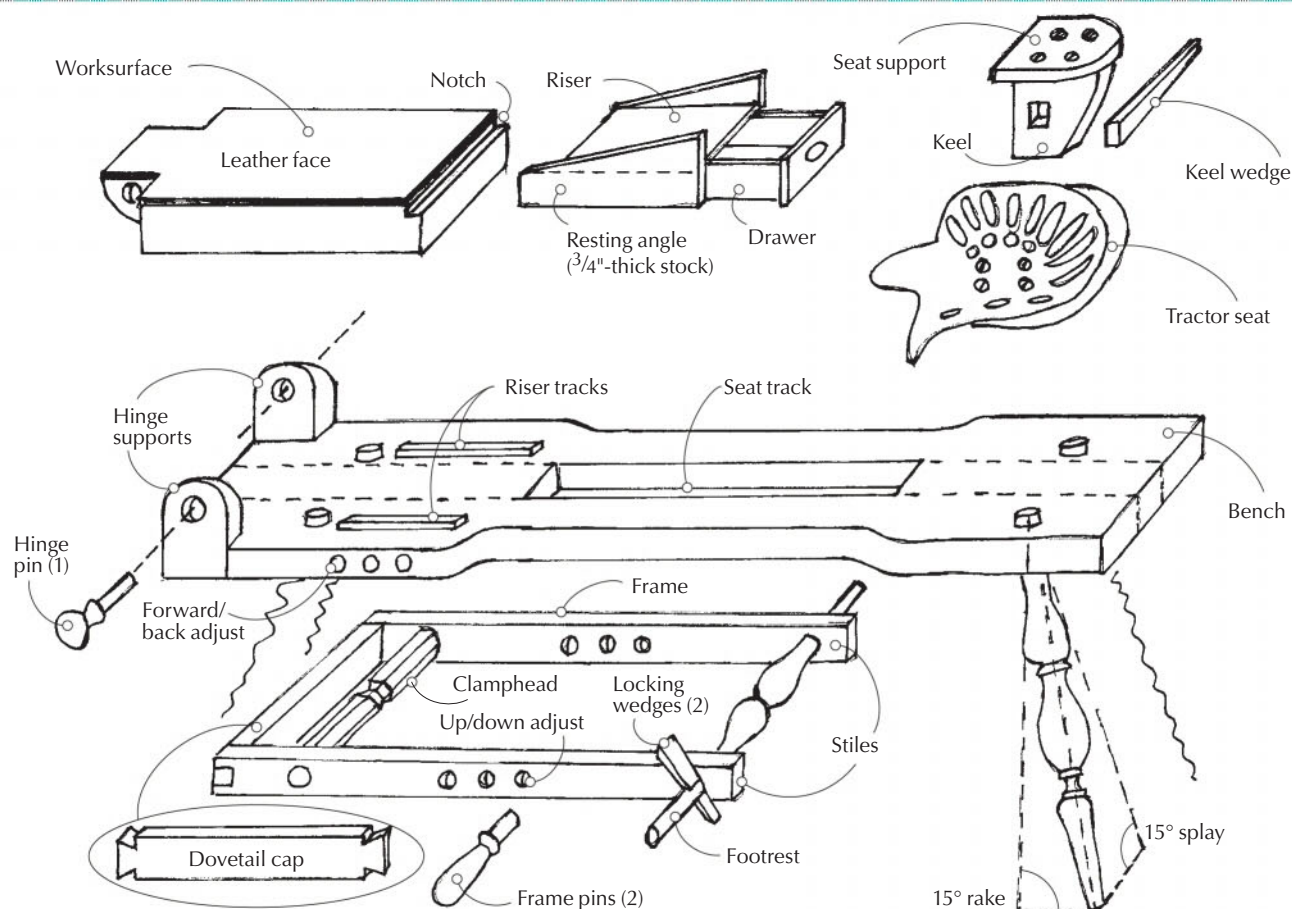
Hourglass shape. I relieved to about 6" wide overall the middle section; that provides a comfortable space for my thighs.

it overlaps the bench underside a bit to facilitate inserting a wedge. When the wedge is tapped in, this locks the keel to the bench, keeping the seat where I want it while I'm using the horse. I cut a wedge long enough so that I can see and access its ends while I'm sitting on the horse. That makes it easy to whack in or out to adjust the seat position. (But the keel fits snugly, so with my weight in the seat I don't always need to wedge it in place.)



Even keel. This keel is sized so that the mortise is just below the bench of the horse; the wedge is inserted to keep the seat securely in place in its track.

SHAVING HORSE ANATOMY





Shapely legs. While you don't have to turn Windsor-style legs for this shavehorse to work, they're a fun way to grow – or show off – your lathe skills.

Leg Up

The walnut legs are turned in a classic Windsor baluster style, with the top ends turned to a 6° taper. I turned them overlong so that I could trim off the top and the bottom after they were fitted to the bench.

To seat the legs in the bench, I wanted the rake (the front-to-back angle) to remain under the footprint of the bench, and the splay (the side-to-side angle) to be as wide as needed for stability, but no wider. I decided on 15° for both. The leg holes are located 6" from the ends of the bench and 2" inside the long edges.

Prior to boring these holes, I determined the boring angle and sightline to achieve this compound angle. Sure, there are calculations for this, but I took

a more direct approach.

I set the bench on buckets and shimmed it until it was at my correct seat height (seat in place) and level. The correct seat height is measured from the top surface of the seat, which in my case is about 1" above the bench, to the floor (for me, that's 17"). I dropped a line from the hole position on the underside down to the floor, made a mark there, then drew two intersecting lines through this point, square with the axes of the bench.

To mark the reach of the rake, I clamped a stick to the long edge of the bench at a 15° degree angle, even with the hole position. Where the stick hit the floor I made a mark and drew a line through this point parallel with the end of the bench.

"When we merely follow another, we take a potentially creative mind out of service – our own."

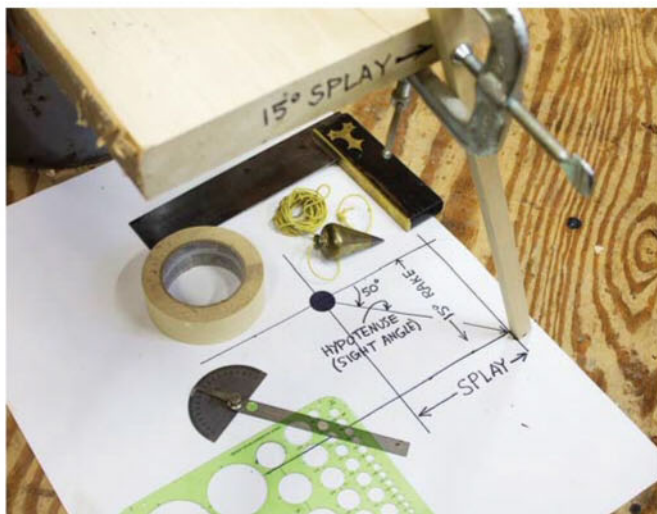
—William Coperthwaite (1930-2013),
American author & craftsman

I then moved the stick to the end of the bench, set it to a splay of 15° and made a mark and a line parallel to the long edge.

With these marks, I defined two corners of a rectangle on my shop floor, the diagonal of which represents the sightline. The boring angle is the angle of the hypotenuse defined by the height of the seat and the length of the sightline.

I drew in my sightlines on top and underneath the bench, through the hole prick marks. To bore these holes, I used a bit slightly smaller than the top ends of my legs and bored from the top, aligning the brace angle to a bevel gauge set to 70° (the boring angle) and to a square set on and at a right angle to the sightline.

The holes are reamed from the underside using a tapered reamer (6°). To keep yourself reaming at the correct angle, set your square midway along the sightline. Keep the point of the reamer, the square and the end of the sightline all aligned with each other. Reset your bevel gauge to account for the taper angle of the reamer (one half of the reamer angle, or 3° in my case)



Splay & rake. Put the bench on buckets and shim it to the correct height. Then a piece of paper and some sticks make it simple to set the leg angles.





Good mates. Because the shavehorse is knock-down, mark all mating parts. This will make it easier to set up quickly for use.

and set it on the sightline as close to the reamer as possible.

Once the legs are seated tightly in their holes, cut them to about $\frac{1}{2}$ " proud of the bench.

I marked each leg and its corresponding hole with Roman numerals, incised with a chisel. (After finishing, I filled the chisel marks with contrasting wood filler to make them easier to see.)

I followed this habit for all parts that had a specific orientation. To get the bench level and at the right height, I used wedges under each foot to level the horse, then marked the bench height around each leg. Because the legs are loose and will be oriented differently as they wear in, I cut them square, not flat to the floor. I can always adjust later if need be.

Business End

The working end of the shaving horse is actually a rising platform (the work-surface) that has a wooden hinge at the front end. I made this surface out of 2"-thick poplar, as wide as the bench and as long as the space in front of my seat slot.

To make the hinge recesses, I cut out 2" x 3" notches in the two front corners of the bench. The two hinge supports are just tall enough (about 3") so that the top of the curves are even with the top of the worksurface, and allow about $\frac{1}{8}$ " clearance underneath it. Before the glue-up, I clamped the two supports together and drilled $\frac{3}{4}$ "-diameter holes through them and glued them onto the bench.

I rounded the bottom front edge of

the worksurface with a plane to keep the rotation smooth, then marked the hole centerlines and squared these marks across the worksurface so that the hinge holes would be perfectly in line.

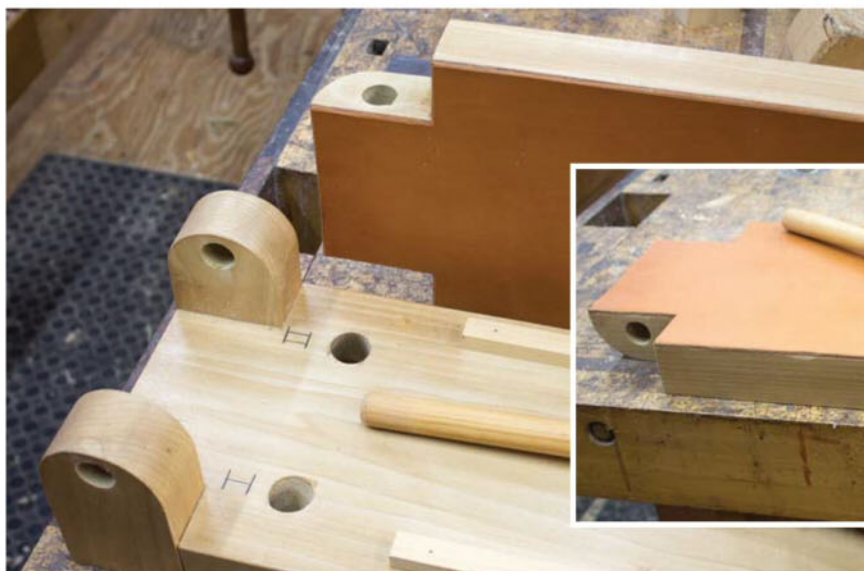
I drilled a $\frac{3}{4}$ "-diameter hole completely through the hinge end of the worksurface (halfway from either edge to meet in the middle), then inserted a $\frac{3}{4}$ " dowel with a turned handle to serve as the hinge pin. The location of this hole is aligned with the holes in the two hinge supports.

To determine the three forward and backward adjustment holes that get drilled in the side of the bench, I clamped a stile to the side of the working surface, then tilted it so that with a 2"-diameter clamphead, it would touch the worksurface at least 2" behind the leading edge for 1"-thick stock and for 3"-thick stock.

After drilling these three 2"-deep $\frac{3}{4}$ " holes in the bench on each side, I turned the two frame pins that fit through the frames and into the bench. These allow me to reposition the frame forward and back to clamp stock in the optimal position.

At the working end of the worksurface, I planed a square rabbet across the width. This, along with a $\frac{1}{4}$ "-thick piece of cowhide glued to the top, helps to keep pieces secured in the horse.

The angle and height of the worksurface are regulated using a loose wedge-shaped riser underneath. When using a drawknife, you generally want to be able to pull back straight (as in a rowing motion), aiming for your belly button.



Hinge detail. The top of the hinge supports and the bottom of the working surface are both rounded to allow adequate clearance when the angle of the working surface is adjusted.



Grab it. After planing a rabbet on the business end, glue a thick piece of cowhide to the worksurface. Trim the leather to fit with a knife and block plane.

Drawer & riser. The riser is simply two triangles of poplar, with a 1/4"-thick piece seated in grooves that acts as the drawer top and another 1/4"-thick piece in rabbets at the bottom. The door is dovetailed, with an applied front that acts as a stop against the riser.



This angle depends on where you are sitting along the horse and how thick the stock is.

Most often I work 1"-square stock that is anywhere from 10" to 6' long, though occasionally I shape billets that are at most 3" square and maybe 30" long. So for some tasks I need to sit close, and with others sit farther away.

So I got some scraps of the two dimensions and experimented with each at different seat positions. I measured the height of the worksurface for each situation, using a straightedge to align with my belly button. The riser needs to be of a size so that I can move it forward or back to achieve worksurface slopes that span my potential needs. The "resting" angle of the riser (the slope of its

top when flush with the underside of the worksurface) assumes I am working with 1"-thick stock.

I also wanted the riser to be long and tall enough at the end facing my belly to incorporate a drawer in the structure to hold a pair of spokeshaves (that is, about 10 1/2") and other, smaller tools. It turned out I had 11 1/2" of play and the drawer could be 2" deep – perfect!

To keep the riser assembly centered on the working surface as I slide it to and fro, I tacked on two tracks to the bench surface.

I made my dovetailed drawer out of 1/4"-thick stock, and set the bottom into a rabbet to maximize the depth. The drawer front is a piece of walnut cut to the riser width; it acts as a drawer stop.

Frame Job

The last step is to position the frame that will hold the foot rests and clamping head. The frame hangs from the work surface and can be adjusted up and down as well as forward and back. This gives you options about where the clamping head touches your workpieces – and that depends a lot on the thickness of stock you are working.

Because the frame will be subjected to considerable pressure, I made the stiles out of thick stock – about 1 1/2" x 3" – and cut them overlong at 36" so that I could adjust them to final length later.

First, I set the riser on the bench at the midpoint of its play. For the vertical adjustment, I drilled the first 3/4"-diameter hole measuring up from the bottom of the stile so that the stile would just clear the floor by an inch. This represents the lowest mark to which I could set the clamp frame. I also drilled two holes farther down on the stile by 1 1/2" each. These allow the frame to be adjusted upward by 1 1/2" or by 3" to accommodate thicker stock.

I located the first hole, for 1" stock, about 11 1/2" from the hinge end of the working surface. The remaining two holes are located 13" and 14 1/2" back from the hinge end. These get drilled into the edge of the working surface



Here's the drill. Each stile gets five holes. The 1"-diameter holes at the top and bottom hold the round tenons of the footrest and clamphead. The three 1/2"-diameter holes are for the frame pins that hold the frame at the correct working height.



Framed. The image at left shows the footrest, top cross-piece, clamping head and frame pins. In the assembled frame at right, note the wedges in the footrest.



as well. (Note: You should choose the location of these holes based on the thickness of the work you commonly use, how high your bench is from the floor and how close to the work you like to sit.)

In general, the best clamping action is achieved with the least amount of frame pivot; thus the clamping head should be as close to the working surface as possible in its resting state – about 3¼" from the top of the stiles in this case. Clamp the stiles together, then mark and drill 1" holes for the clamphead tenons.

Knowing the general location of the clamphead along the stile, you can now trim the top ends of the stiles to length (3¼" from the clamphead tenon hole in my case). Now trim the bottom ends to length so that with the top-most hole in the stiles aligned to the bench, the stiles just clear the floor at 90° to the bench.

With the stiles at final length, I fashioned the cross-pieces. The first of these, the footrest, ends up as a hefty 2" cylinder with 1"-diameter x 6"-long tenons on each end (for your feet).

The shoulder-to-shoulder spacing is ⅛" longer than the width of the bench.

But before turning the footrest, mortise the square stock to accept wedges just outside the assembled frame (that

is, the width of your bench, the width of the stiles plus ⅛"). The mortises must overlap the stile thickness a bit.

Now turn the footrest to your desired shape. (Here again I chose a traditional Windsor profile, this one from a stretcher).

When the footrests are assembled, the mortises angle so that the wedges match the resting angle of the feet.

The other end of the frame is a dovetail joint, and again the shoulder-to-shoulder length is ⅛" longer than the benchtop. Make this joint tight enough so that it stays put, but can be tapped apart. Note that it is just high enough above the clamphead that you can reach in between the two to tap it out of the joint; any higher up and it would interfere with your drawknife in use.

The clamphead is an octagon, approximately 2" in diameter, made of white pine, with 1"-round tenons on either end that turn freely in their mating stile holes. The shoulder-to-shoulder length is the same width as the benchtop. I used a block plane to cut the eight facets of the head, then chiseled a ½"-deep V-notch around the circumference at the center for secure clamping of square stock.

The soft pine provides good clamping pressure, and is easily replaceable as necessary.

Get Ready to Ride

To assemble the shaving horse, I first set the legs into the bench and tap them in tightly. I then fully assemble the frame-and-clamp assembly, and place it on the floor at a right angle to the bench, with the front feet inside the frame. It's then just a matter of lifting and turning the frame to vertical, then inserting the frame pins and the pins for the working surface, and sliding the riser in place.

After that, I drop the seat on its keel into the track, and wedge it in place.

Taking the horse apart is just as easy. Because all the joints are tusk-tenoned or tapered mortises (and in one case just tight joinery), a few taps of the mallet break the assembly down completely. Here is where my Roman numeral numbering system comes in handy, because for the most part, all of the joints are



By the numbers. All the knocked-down parts are shown here, marked to match their matching mortises.

specific to their orientation.

My shaving horse is finished with Minwax Antique Oil Finish, which I like because it dries quickly, has good build and provides a low-lustre look.

I expect I'll be riding my steed for years to come. **PWM**

Bill is a retired scientist who lives and works in North Carolina. You can take a class with him at the Woodwright's School.

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Almost ready. After knocking the legs in place, put the bench inside the assembled frame, then lift and turn it into place.

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Wood Too Good to Burn

Look to your firewood pile for plenty of project inspiration.

I've been cutting up my leftover bits of green wood for firewood to use in my new workshop. It's not going well. I have a feeling that we green woodworkers freeze to death in the end. It's because when we're splitting firewood, we keep finding interesting pieces that will make good bench legs, shrink pots or what-have-you. And of course, spoons—everything is a spoon. Many of the smaller items that I keep seeing emerge in the firewood are things I learned while studying spoon carving with my Swedish friends.

I use low benches around the yard for woodworking, seating and other tasks. There might be six or seven of them right now, I really can't have too many.

For the bench, I tend to use softwoods, although a few of mine are oak too. For the legs, I prefer white oak; it lasts longer than anything else that grows around here in southern New



Project in every piece? The firewood pile is a great source of inspiration for low benches, spoons, hooks, shrink pots and more...which makes it an ever-dwindling source for heat.

England. I have some that are in red oak—they work fine, but will decay before too many years and need replacing. For these legs, the pieces I like best have curving grain, just the sort of thing I reject when splitting furniture stock. So lo and behold, I often run into them in the firewood pile. I tend to hew and shave them and then let them sit around to dry before fitting them in the bench tops. Mine taper at the top to match the mortises, which I bore with a large auger. I taper the mortises from below with a wheelwright's reamer.

Even the straight-grained offcuts can distract the firewood cutter. Clear short sections are sometimes crying out to be shrink pots. I go through bouts of shrink-pot making, and thankfully right now I have lots of them in progress, so I can leave them alone for a little while. Score some for the firewood stack.

The spoon wood that I use is usually cherry, apple or birch. The birch,



Perfect crook. A good spoon comes from a natural bend. Here, you see a finished spoon nestled in the remainder of the piece from which it came (with some hooks in front).



Hooks galore. I use hooks around the shop to hang baskets, tools and other gear.

with its low resistance to decay, has a very short shelf life, so I try to get the spoons out of that quickly. The cherry can sit around longer, and the apple is in-between. My favorite spoon blank comes from a crook, a piece of limewood that has just the right bend in its growth to create the sweep, or crank, for the spoon's profile. But there's lots



Wherever I lay my hat... I have hooks from the firewood pile all over my house and shop, inside and out.

of branches, limbs and trunk-wood that doesn't quite have the right shape or thickness. There are other uses for those shapes, and one of my favorites is the clothes hook.

This is usually a small limb branching from either another limb or the main trunk. If it's at an angle too steep for spoon wood, or one section is too thin to make the right split, then it becomes a hook. Mine tend to be pretty simple, usually just one "hook" to each. Chip carving and shaped finials lend this household fitting a bit of flash.

"Clothes hook" is a misnomer; these can be used to hang all sorts of things—tools, clothes, baskets, bags—whatever you might hang on a hook. These things are addictive beyond words.

I learned them from my Swedish spoon-carving friends; in Sweden these hooks are made in colors and shapes beyond the imagination.

To make one, find a branch section that has the right shape. This is green woodworking, while the wood is fresh it cuts easier than dry stock. Split the heavier side, and hew or shave away the pith in that section. The pith is the

De-layer. After hewing the back flat, I use a Sloyd knife to slice off the bark and the cambium layer, then to shape the hook.



Hooks & future hooks. Look for pieces in which nature has accomplished most of the work. Then get down to the bare wood, and decorate as you please.

center of the limb; if left in it can lead to a split upon drying. I use a Sloyd knife to shave away the bark and the underlying cambium layer to get down to the wood.

I try to flatten the split back so it will sit flush on the wall. Doesn't need to be dead-flat, but I take out the major bumps. From there, I just follow the wood's lead and shave away bits until it is slender enough to not be bulky, but still has enough wood on it for strength. Facets and bevels are fine, choppy cuts are not. Smooth strokes will leave a good finish. I use the same knife grasps and moves as in my spoon carving—there's lots of shifting the hook this way and that, and coming at it from many different angles.

Chip carving can heighten the hook's impact, but in use most of the decoration gets hidden. I tend to just cut some notches to create a finial at the top of the back section. Sometimes there's an upside-down finial at the bottom end, too.

There's other stuff in those firewood piles, but there's only so many hours in a day, and winter is coming. I wonder if I can cut firewood with my eyes closed. **PWM**

Peter has been involved in traditional craft since 1980. Read more from him on spoon carving, period tools and more at pfollansbee.wordpress.com.

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7 Ways to Get a Darker Color

Gain more control over your staining with these techniques.

The most popular types of stains are oil stains, also called wiping stains (though most stains are wiped after application). Oil stains are widely available at paint stores and home centers. They are very easy to use because they provide a long working time; water-based stains are more difficult to use because they dry so fast.

The problem with oil stains is that they often don't add a lot of color to the wood, especially dense woods such as maple and birch. When you wipe off the excess stain, which is the best practice for getting an even coloring, you may not achieve the intensity of color you're after.

Here are seven suggestions for getting a darker coloring on any wood.

1. Sand the wood to a coarser grit. The coarser the grit, the larger the sanding scratches and the more room for colorant to lodge. You just have to sand fine enough so the scratches don't show. You may be able to get away with #150 grit, or even #120 grit, as long as the sanding scratches are running in the direction of the grain.

If you prefer to use a random-orbit sander, you can finish up by hand sanding with the grain to line up the sanding scratches.

2. Increase the ratio of pigment to vehicle in the stain (the vehicle is the combination of binder and thinner—that is, all the liquid). The higher the ratio, the darker the coloring on the wood. There are several ways to achieve this.

■ Add more pigment to the stain. Use oil pigment or Japan color pigment for oil stains and universal color pigment for water-based stains. Keep good records if you are staining multiple objects so you can duplicate what you have done.



Sand to a coarser grit. To get a darker coloring with any stain when you are wiping off the excess, sand to a coarser grit. More of the colorant will lodge in the sanding scratches, producing a darker effect. In the example here, I sanded to #100 grit (top) and #400 grit (bottom).

■ Leave the stain on the wood longer before wiping off. This allows some of the thinner to evaporate, which increases the ratio of pigment to vehicle. (It's a myth that the stain penetrates deeper.)

■ Apply a second coat of stain after the first has dried fully. This will usually produce a slightly darker coloring with the excess wiped off.

■ Substitute a glaze or gel stain for the liquid stain. Glazes and gel stains usually contain a higher ratio of pigment to vehicle.

3. Do a "dirty wipe." That is, don't wipe (or brush) off all the excess stain. Leave a dampness of stain on the wood that dries to a darker coloring. It will take practice to get the coloring even, especially on large and multiple surfaces.

There are two downsides to doing a dirty wipe. One is that it will muddy the wood more than if you wipe off all the excess. The other is that it could cause a poor bond to the wood if left too thick.

The finish needs to penetrate the stain and establish a bond to the wood. If it can't do this, it may separate at the stain layer if it gets knocked or scratched.

Nevertheless, a dirty wipe is such an effective and often-used method that it has its own name.



Dirty wipe. A "dirty wipe" (right) produces a darker coloring by leaving more of the stain on the wood. But it takes more practice to get the coloring even, especially over large or multiple surfaces. You usually have more control brushing off the excess stain rather than wiping.

CONTINUED ON PAGE 63

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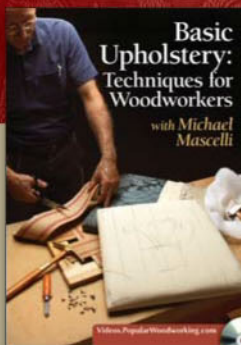
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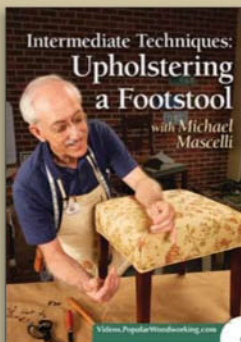
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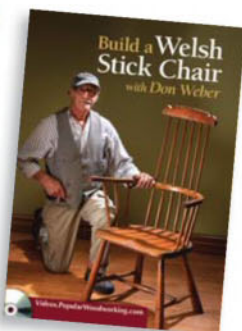
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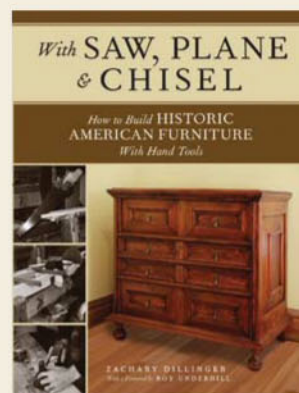
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4. Wet the wood with water and let it dry before applying the stain to raise the grain and create a rougher surface for more colorant to lodge. You could shorten the procedure to one step by using a water-based stain. It will raise the grain, and the coloring will be darker when you wipe off the excess. But water-based stains dry fast, so you may need someone to help apply or wipe off on larger objects.



Wet the wood before staining. Wetting wood with water and letting the wood dry thoroughly, usually overnight, causes the grain to raise, making the wood feel coarse. The coarseness retains more of the stain when you wipe off the excess, leaving a darker coloring (right). Apply a coat or two of finish before sanding smooth so you don't sand through.



Use dye. Common oil stains that contain a binder (left) are much less effective at developing darker colors on dense woods than dye stains without a binder (right). Dye stains can be applied in higher concentrations or with multiple coats without fear of weakening the bond of the finish to the wood, as might be the case with binder stains.

Wait to sand smooth until after the first or second coat of film-building finish (not oil) or you may lighten the color in places. In other words, “bury” the raised grain.

5. Use dye instead of stain with a binder. Dyes are available in liquid form, usually called non-grain-raising (NGR) or TransTint, and in powders that you dissolve in water or alcohol. You can get dense woods as dark as you want by either using a higher concentration of dye to liquid or by applying multiple coats. There's no risk of separation at the stain level because there's no build.

For staining, I've always preferred the water-dissolvable powders from W.D. Lockwood or J.E. Moser (they are the same and available from catalogs) because I have much more control for achieving darker colors.

6. After applying a stain using any of the above methods, spray a toner between coats of finish, usually after the sealer coat. A toner is pigment or dye added to your finish, and it is always sprayed on the wood. Pigment will muddy the coloring. Dye will darken the color without muddying. So most toning is done with dye, and here I prefer NGRs and TransTint (which are also the same, just different concentrates). These are designed for tinting.

In addition to darkening the coloring, you can also tweak it for a better match. Add some red or orange dye to the finish to warm the coloring, and green or black to cool it. Always thin the finish and colorant a lot (even as much as six times) for better control of the color development.

7. After applying a stain and sealer (first coat), apply a glaze. This is a thickened oil or water-based stain. It's thickened so it's easier to control and doesn't run on vertical surfaces. Leave a little on the surface to darken it.

The easiest method to apply glaze is to brush or spray it on the wood and brush it out thin. It will take practice to do this effectively without leaving noticeable brush marks. Glazes are



Toning. Toning is done by adding pigment or dye to the finish and spraying it, usually over the sealer (first) coat. Pigment may muddy the effect some. Dye usually produces more clarity. Both make the coloring darker (bottom). Be sure to thin the finish/colorant a lot for better control of the color development, especially on large or multiple surfaces.

always pigmented, so they can't help but muddy the wood a little.

Because of the difficulty in getting a glaze brushed out evenly, toning is usually the better method of darkening, or tweaking, a color. But glazing can be useful if you don't spray.

Glazing is more effective for highlighting—for example, leaving some of the coloring in recesses to darken them, or wiping or brushing off in selected areas to create figure patterns. **PWM**

Bob is author of “Flexner on Finishing,” “Wood Finishing 101” and “Understanding Wood Finishing.”

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With most things in life, you either pay with your time or your money.

Say you want to build a box using 3/4 black walnut. You have three options: Buy boards milled to final thickness from a lumberyard (least time, most money); purchase rough-sawn 4/4 boards to mill yourself (more time, less money); or fell a walnut tree, have a sawyer cut it into flitches, wait years for the wood to dry and mill it to your final dimensions (least money, most time).

This time:money ratio came to mind recently when I was asked about my decision to attend the North Bennet Street School (NBSS) as a Cabinet and Furniture Making student. I'd been aware of the school, established in the North End of Boston in 1885, since I began making furniture and seeking out woodworking wisdom – and as a veteran of the United States Marine Corps, I paid for the opportunity to attend with my time. After years spent serving in the military, I am fortunate to have earned education benefits that allow me to explore my woodworking passion. Living and training in Boston can be a financial challenge, but veterans' benefits allow students like myself to focus solely on studying.

Upon arrival, I was surprised to learn the school's current veteran attendance is at its highest since the post-Vietnam era. As of this writing, one in five of the students is a veteran, and that number is expected to rise in coming years.

But why are so many veterans attracted to the craft? I can only figure that, as craftsmen and craftswomen, we train in pursuit of that high we get from making something with our hands, stepping back and admiring it.

Beyond this primal thrill, though,



I've found many lessons taught in the military parallel the values of fine crafts and trades. Both in the Marines and school, I've grappled with a need to succeed the first time and the necessity of precision. I daily consider the value of hard work, a thorough plan and an ability to anticipate possible failures.

In the military, these lessons are burned deep into a soldier's subconscious – failure to learn them can have deadly effects. In the world of woodworking and fine craftsmanship, it's your product, your reputation and your fingers that hang in the balance.

But some military lessons just don't apply to the world of craft. Instructing a budding woodworker to build his or her project "by any means necessary" isn't the best advice. Neither is the concept of achievement through brute force particularly helpful.

I tried to note a distinguishing factor of veteran NBSS students but realized that, similar backgrounds aside, we're really identical to other students.

Most, if not all, of us will tell you without hesitation that the first day of

school marked a new chapter in our lives. Walking through the halls and machine rooms, stepping around students' benches, looking at freshly varnished furniture – the only way to tell a veteran student from others is to ask.

Woodworkers arrive at school with a singular mind, just as we all felt the same inner tickle with our first step into a woodshop. And the belief that led us veterans into recruiting stations also pushed many toward woodworking programs: the belief we can create something greater than ourselves. **PWM**

Grant serves as public affairs director for the North Bennet Street School's Student Veteran Organization. He's a former screen printer, cage fighter & carpenter.

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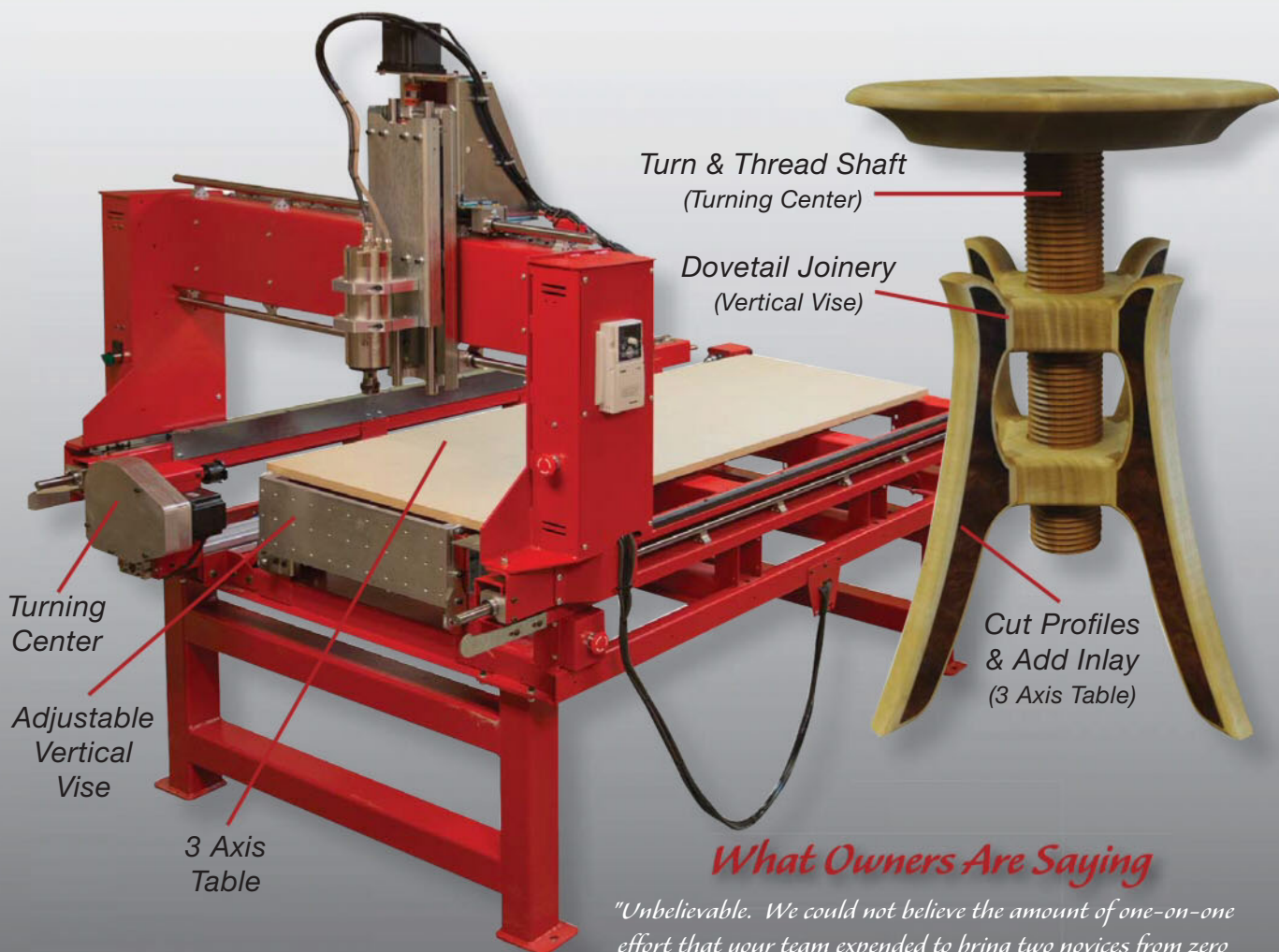
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