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- **Dovetailed drawer**
- **Windsor chair**



Guide to glues, p. 38



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10" 5 HP SLIDING TABLE SAW

- Motor: 5 HP, 230V, single-phase, 19A
- Rip capacity: 33"
- Crosscut capacity: 63"
- Blade tilt: 0–45°
- Max. depth of cut @ 90°: 3 3/8"
- Max. depth of cut @ 45°: 2 1/4"
- Main table size with extensions: 14 3/8" x 27"
- Sliding table size: 12 1/4" x 63"
- Floor-to-table height: 33 3/4"
- Main blade size: 10"
- Main blade arbor: 3/8"
- Main blade speed: 4000 RPM
- Max. width of dado: 1 1/8"
- Dust port sizes: 2 1/2", 4"
- Footprint: 25 1/2" L x 28" W
- Overall dimensions: 76" W x 125" D x 46" H
- Approx. shipping weight: 688 lbs.



12" 7-1/2 HP 3-PHASE EXTREME SERIES® TABLE SAW

- Motor: 7 1/2 HP, 220V/440V* (prewired for 220V), 3-phase, 19.5A/10A
- Rip capacity: 36"
- Max. depth of cut @ 90°: 4"
- Max. depth of cut @ 45°: 2 3/4"
- Table size with extensions: 30 3/4" x 48 1/4"
- Distance from front of table to center of blade: 17 1/4"
- Floor-to-table height: 35 3/4"
- Arbor diameter: 1"
- Arbor speed: 3600 RPM
- Max. width of dado: 3/4"
- Dust port size: 4"
- Footprint: 22 1/2" L x 24" W
- Overall dimensions: 75" W x 44" D x 42 1/2" H
- Approx. shipping weight: 756 lbs.



12" X 80" Z SERIES JOINTER W/ SPIRAL CUTTERHEAD

- Motor: 3 HP, 220V, single-phase, 16A
- Max. width of cut: 11 13/16"
- Max. depth of cut: 5/16"
- Cutterhead diameter: 4"
- Cutterhead type: 6-row spiral with 84 inserts
- Insert size and type: 14 x 14 x 2mm indexable carbide
- Cutterhead speed: 5900 RPM
- Table size: 12 1/2" x 80"
- Fence size: 39 1/4" L x 4 3/4" H
- Min. stock length: 14"
- Min. stock thickness: 1/2"
- Dust port size: 4"
- Footprint: 20" x 41"
- Overall dimensions: 80" W x 34 1/8" D x 40 1/2" H
- Approximate shipping weight: 1241 lbs.



24" 5 HP INDUSTRIAL BANDSAW

- Motor: 5 HP, 220V, single-phase, 23A
- Table size: 33 1/2" x 23 5/8" x 2"
- Table tilts 45° right
- Floor-to-table height: 32 1/2"
- Max. cutting width left of blade: 24 1/2"
- Max. cutting height (resaw capacity): 16 1/4"
- Blade size: 180" – 181 1/2" long (1/4" to 1 1/2" wide)
- Blade speed: 5300 FPM
- Footprint: 41 5/8" x 23 1/2"
- Overall dimensions: 48" W x 32" D x 83 1/2" H
- Approx. shipping weight: 951 lbs.



20" 5 HP PLANER

- Motor: 5 HP, 230V, single-phase, 23A
- Max. stock width: 20"
- Max. stock thickness: 8"
- Min. stock thickness: 1/4"
- Min. stock length: 7"
- Max. cutting depth full width: 3/32"
- Cutterhead diameter: 3 1/4"
- Cutterhead type: 4-knife
- Knife size & type: 20" x 1" x 1/8", HSS
- Cutterhead speed: 5000 RPM
- Feed rate: 16 & 28 FPM
- Table size with extensions: 25 3/4" x 58"
- Dust port size: 5"
- Footprint: 22" x 28"
- Overall dimensions: 39" W x 58" D x 41" H
- Approx. shipping weight: 820 lbs.



3 HP SHAPER

- Motor: 3 HP, 240V, single-phase, 12A
- Maximum cutter height: 2 1/2"
- Maximum cutter diameter: 5 1/2"
- Spindle diameters: 1/2", 3/4", 1"
- Spindle lengths: 2 1/4", 3", 3 1/2"
- Spindle capacity under nut: 2", 2 1/4", 2 1/2"
- Spindle speeds: 7000 & 10,000 RPM
- Spindle travel: 3"
- Spindle openings: 1 1/2", 3", 4", 7"
- Table counterbore: 7" dia. x 3/8" deep
- Table size: 28 1/4" x 30 1/4"
- Floor-to-table height: 34"
- Footprint: 21" x 23 1/2"
- Overall dimensions: 30" W x 30 1/2" D x 39 1/2" H
- Approx. shipping weight: 392 lbs.



37" 10 HP DRUM SANDER

- Sanding drum motor: 10 HP, 240V, single-phase, 47A
- Conveyor motor: 1/3 HP
- Max. board width: 36 1/2"
- Max. board thickness: 4"
- Min. board length: 9"
- Min. board thickness: 1/16"
- Surface speed of drums: 2800 FPM
- Conveyor feed rate: Variable, 6–18 FPM
- Sanding drums: 2, steel/rubber-coated
- Drum diameter: 6"
- Sandpaper size: 6" x 138"
- Overall Dimensions: 68" W x 50 1/2" D x 49" H
- Approx. shipping weight: 1406 lbs.



3 HP CYCLONE DUST COLLECTOR

- Motor: 3 HP, 220V, single-phase, 22A
- Intake hole size: 8"
- Impeller: 15 1/2" steel
- Airflow capacity: 1654 CFM @ 2.0" S
- Max static pressure: 14.2"
- Filter surface area: 113 sq. ft.
- Filtration: 0.2–2 micron
- Collection size: 55-gallon drum
- Sound rating: 83–85 dB
- Overall dimensions: 60 1/4" W x 38 1/2" D x 109" H
- Approximate shipping weight: 400 lbs.

Shown with H7509Z optional stand



6" X 80" EDGE SANDER W/ WRAP-AROUND TABLE

- Motor: 1 1/2 HP, 110V/220V (prewired 220V), single-phase, 20A/10A
- Rubber idler roller: 2 1/8", shielded ball bearing
- Drive roller: 4 1/2", cast aluminum
- Table size: 24" x 42 1/4"
- Table height: 33"–39"
- Platen: 6-1/4" x 31 1/2", graphite coated
- Sanding belt size: 6" x 80"
- Belt speed: 1800 FPM
- Footprint: 32" L x 14 1/2" W
- Overall size: 52 1/2" W x 24" D x 48 3/4" H (with handle up)
- Approx. shipping weight: 251 lbs.



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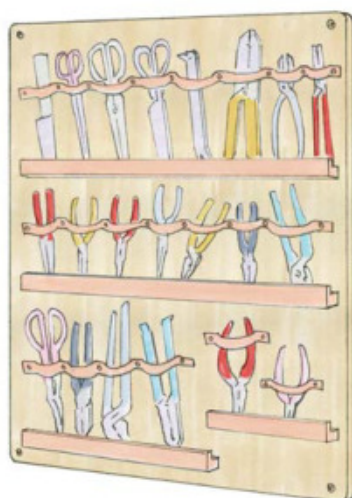
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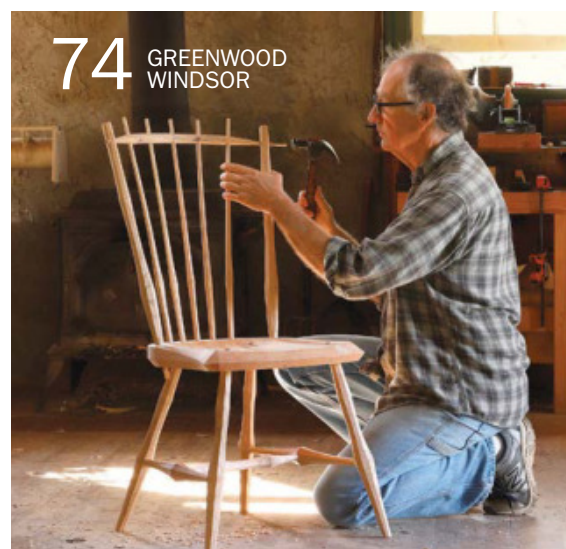
Extraordinary Drawers



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For members

VIDEO

Inspired designs

Garrett Hack (p. 54) discusses various pieces that have informed and inspired his designs throughout his career.



VIDEO

Rebuilding a dream shop

Join Karen McBride (p. 82) as she relives her journey from dilapidated house to snug, humming shop.

Online extras

Free content at finewoodworking.com/294



VIDEO

Marked improvement

In this video, Curtis Buchanan (p. 74) demonstrates how he uses black milk-paint powder in a test mortise to help him identify the areas on his tenons that need shaving for a perfect fit.



VIDEO

Glue squeeze-out tip

Bob Van Dyke (p. 38) demonstrates his proven and simple technique for keeping glue from marring your project.

VIDEO

Machine speed bumps

Using a trick he learned at the Center For Furniture Craftsmanship, Jonathan Brower (p. 48) uses these simple machinery speedbumps as a reminder to slow down and focus while using each tool.

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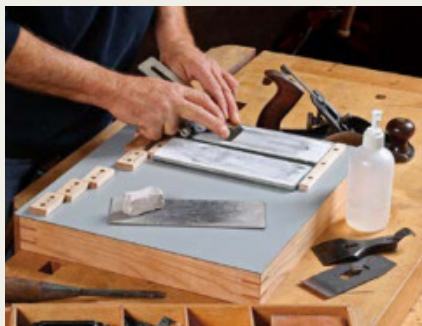


VIDEO WORKSHOP

Sharpening Fundamentals

In this updated video series, Bob Van Dyke covers the tried-and-true sharpening basics you need for the successful use of hand tools. Watch and learn:

- the basics of all the popular sharpening mediums
- bevel angles, micro-bevels, and hollow grinding
- Bob's methods for sharpening chisels, handplanes, and carving gouges



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COLLECTOR HOSES



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FRONT

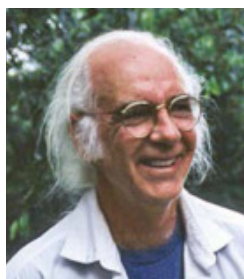
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contributors

David Lamb (“Pedestal Dining Table”) has made a career out of blending past and present. His training started while growing up in the Canterbury Shaker Village and his simultaneous apprenticeship, heavily focused on bench work, with cabinetmaker Alejandro de la Cruz. With that foundation, he studied at Boston University’s vaunted, forward-thinking Program in Artisanry under Jere Osgood and Alphonse Mattia. He’s held those two worlds superbly in conversation for almost 50 years, earning two terms as New Hampshire’s artist laureate and The Society of American Period Furniture Makers’ Cartouche award. He is a founding member of the New Hampshire Furniture Masters Association.



Though he was born in California, **Jonathan Brower** (“Mosaic Cutting Boards”) was raised in Rhode Island. After earning a degree in painting and then teaching at Syracuse University, he started working in cabinet and furniture shops. In 2012, he trained at the Center for Furniture Craftsmanship in Maine, then moved back to Rhode Island, where he has been designing and building custom furniture and cabinetry for designers, architects, and private clients for nearly 20 years. Jonathan, his wife, three kids, and shop dog Riley live in Newport.



Hank Gilpin (Designer’s Notebook) sort of fell into woodworking. While in Vietnam as a combat photographer, he was accepted into the Rhode Island School of Design for photography. He took an elective in the woodshop, saw Tage Frid tie a piece of ash into a knot, and that was that. He fell in love with wood. Hank’s work ethos is to do good work for the love of good work. “I had a great teacher (Tage Frid) and lots of practice. Lots. I think we (my assistants and I) have banged out about 3,000 pieces since 1973,” he says.

Garrett Hack (“Developing a Furniture Style”) has been building furniture for more than 40 years and writing for *FWW* for more than 25. He continues to make custom furniture in the shop he built on his farm in Vermont. The lovely Shaker-inspired table he wrote about in his first article for us, “Building a Strong, Light Carcase” (*FWW* #104), also makes an appearance in this issue, as he describes how his furniture designs have evolved. Also making an appearance is Garrett’s second grandchild, Riley, born earlier this year.



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Spotlight

An unfinished outfeed table

This is not a novel shop tip, it is just a simple outfeed table for my tablesaw. What makes it unique is that my 5-year old grandson, Jack, was my shop helper on the build. Many activities in life that we pursue as adults—cooking, fishing, golf, gardening—were often handed down to us when we were young. I learned to use tools from my dad; he learned from an older brother-in-law. My son-in-law is a good husband and dad, but truth be told, my daughter is the do-it-yourselfer in the family. If Jack is going to learn about woodworking, then I am the likely conduit.



No disagreement here

My friend Peter Follansbee recently wrote a response to my column, “Confessions of a hand-tool woodworker” (*FWW* #291). In it, Peter highlighted the value of his 20 years of experience learning and practicing craftwork in a museum context, something he understood my article to be dismissive of. I had intended to communicate precisely the opposite.

What I had hoped to emphasize was that I choose hand tools for reasons other than what the broader public thinks they’re good for. I’m sure many demonstrators of pre-industrial craftwork can relate to my experience demonstrating handcraft skills, only to have visitors relegate it as “quaint” or “olde timey.” My case, stated simply, was that in spite of what the broader public thinks, “my attraction to hand tools is not founded upon a nostalgia ... but with the freedom they offer.”

—JOSHUA KLEIN, Sedgwick, Maine

Windfalls and wood curls

Editors, I experienced a small-scale windfall of lumber like Zal Sarkari’s trove last year (From the Bench, *FWW* #292); literally a windfall as a freak storm blew down thousands of mature hardwoods here in Salt Lake City. With only my battery-powered chainsaw I still managed to cart home and mill a fair stack of slabs, which are now drying in what will be my indoor shop. I read in envy about his clear walnut boards, and then his aside about 12-in. jointers stopped me cold. I swear I heard Joshua Klein’s yelp of pain from across the country as he dropped his wooden try plane on his toe. Bring the tool to the wood, gentlemen. Don’t delegate the sheer sensual pleasure of wood sole and sharp steel lifting silky chocolate curls to a dusty, noisy machine. Tune up, sharpen up, and enjoy! Or call me and I might just book a ticket there to help out.

—JOHN GRISWOLD, Millcreek, Utah



Jack and his two younger siblings came to visit my wife and me for the month of August. Even as a toddler, Jack was my shadow on home projects. A bit older now, Jack has a longer attention span and more of an interest to learn.

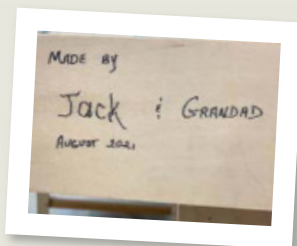
So off and on during the month we worked on the outfeed table from planning to fabrication. Safety was paramount. Machinery was unplugged or breakers turned off and Jack

wore his safety goggles and ear protection when needed. He’d

help spread glue, stack cut boards, hold a tape measure, and take the last few whacks with a hammer on the finishing nails. I was trying to set a good example, so we would put away tools and clean up after each work session—something I am not always religious about. Jack enjoyed brushing the workbench and handling the push broom like a bulldozer.

This was not a quick project. The processes you and I zip through in seconds took minutes to explain to a 5-year-old. And then there are the questions ... and more questions. Which is just fine. Learning to use a Speed Square, he asked “Why is it called a square when its shaped like a triangle?” Fair question, but my answer was lacking. At the end of the month, my daughter, her husband, and the children left for their six-hour drive home. The outfeed table was not finished but the most important parts were—the memory and maybe the seed of another woodworker planted.

—JIM DUGAN, Easton, Md.



About your safety

Working wood is inherently dangerous. Using hand or power tools improperly or ignoring standard safety practices can lead to permanent injury or even death. Don’t perform operations you learn about here

(or elsewhere) until you’re certain they are safe for you. If something about an operation doesn’t feel right, find another way. We want you to enjoy the craft, so please keep safety foremost in your mind.

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CREATE WITH CONFIDENCE

Simple router jig for mortises in chair parts and narrow pieces

I recently built a set of chairs with lots of curves, which made it difficult to mortise some of the parts. My first thought was simply to clamp on a support rail, level with the surface to be mortised. While this would provide a wider base for the router and a reference surface for its edge guide, clamping the two together would place an obstacle in the path of the edge guide's fence.

My solution takes advantage of a new Bessey clamp, designed to fit into a T-groove in a worktable or jig. In this case, I inserted the ends of the clamps into $\frac{1}{2}$ -in. holes in my support rail, leaving a clear path for the edge guide. Clamps designed to fit into dovetail grooves will work also.

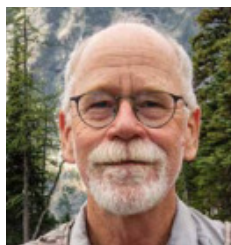
I had my solution for holding the support rail and chair part together, but I still needed an effective way to hold the whole assembly steady for routing, again without getting in the way of the router. To do that I simply attached the support rail to a vertical block, which I grab in my bench vise.

The system works wonderfully for curved chair parts, as long as there is a flat spot for registering the rail. It also works great for other complex parts, and parts too narrow to safely support the router.

Any hardwood will work for the jig, you can join the vertical and horizontal parts any way you like, and the dimensions are somewhat arbitrary. To use it you simply align the face you plan to mortise with the top face of the jig, and clamp it there. I use a standard edge guide with an extended fence, and an up-spiral mortising bit in my plunge router. The fence of the edge guide rides the far edge of the support rail, and the rail provides a broad, stable surface for the router to balance on. The Bessey clamps pivot freely in their holes, accommodating curved shapes.

—JIM CLEMENT, Winthrop, Wash.

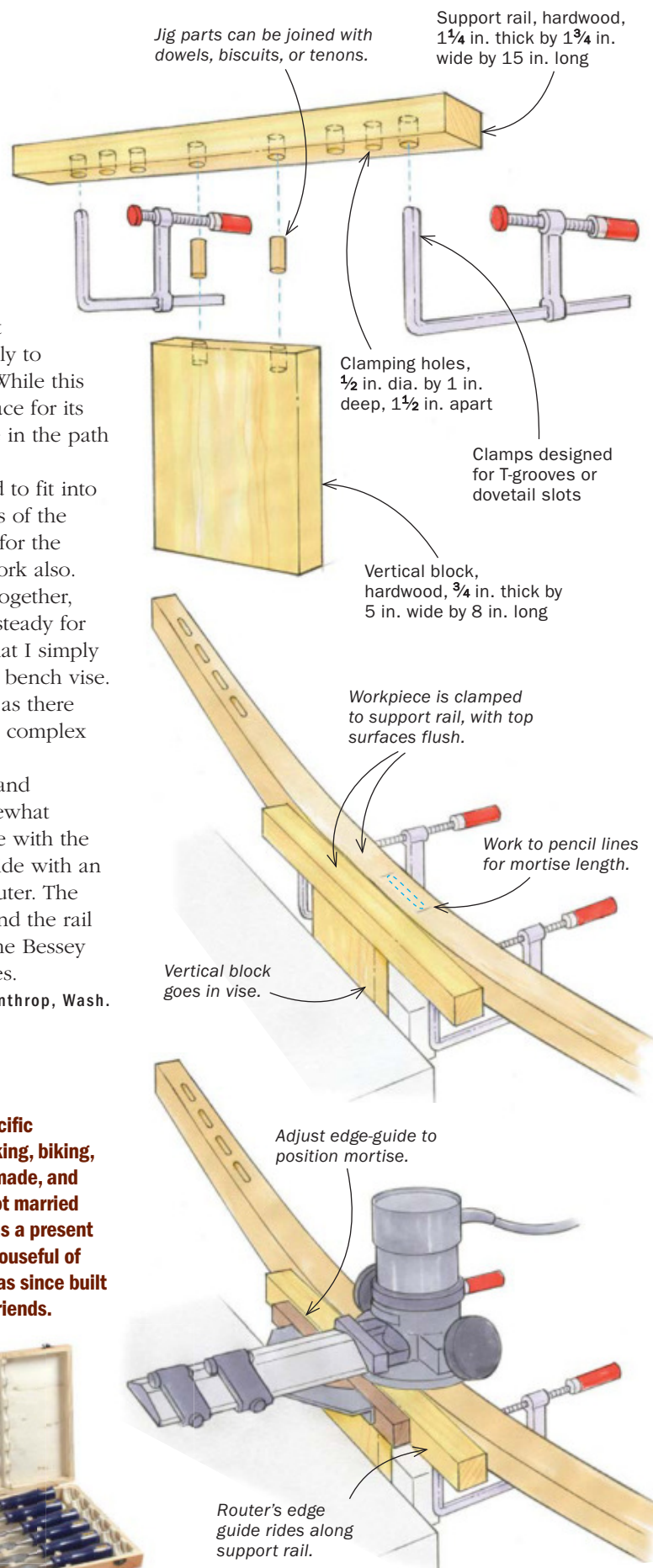
Best Tip



Jim Clement is a semi-retired doctor in the Pacific Northwest who spends his free time woodworking, biking, hiking, skiing, sledding on toboggans he has made, and canoeing in handmade watercraft. When he got married decades ago, Clement requested a tablesaw as a present from his mother-in-law, promising to make a houseful of furniture. He delivered on that promise, and has since built dozens of pieces and projects for family and friends.

A Reward for the Best Tip

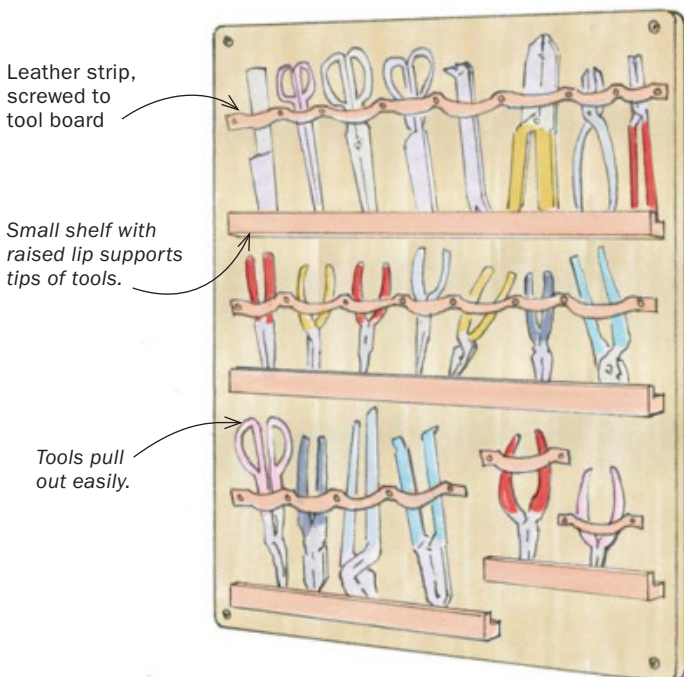
Send your original tips to fwtips@taunton.com. We pay \$100 for a published tip with illustration; \$50 for one without. The prize for this issue's best tip was a 29-piece Irwin Marples Turbomax drill bit set and 6-piece bench chisel set.



Leather straps hold irregularly shaped tools

Wall-mounted panels are a great way to keep tools organized yet easily accessible, and making custom tool holders is fun. For odd-shaped utility tools like pliers, wrenches, and scissors, screw a leather strap to the tool board, leaving whatever slack is needed to secure the top of the tool, with a small, lipped shelf below to support the tips. The tools will be safe and secure, yet easy to pull out of their loops.

—ROBERT McCLUSKEY, Evanston, Ill.



Quick Tip

Rare-earth magnet makes a handy stud finder

Many woodworking projects—clocks, shelves, cabinets, picture frames, and more—are hung on walls, and I've struggled for years with electronic stud finders. I now use a 1/2-in.-diameter, 1/8-in.-thick rare-earth magnet (leevalley.com), with a piece of self-adhesive felt attached to keep it from marring the wall paint. Move it around until it sticks to the head of a screw or nail, and there's the center of the stud. Two benefits of the magnet approach: It helps you avoid the screw or nail the magnet is sticking to, and the magnet stays on the wall, freeing your hands to drive fasteners.

—TODD BRADLEE, Bishop, Calif.



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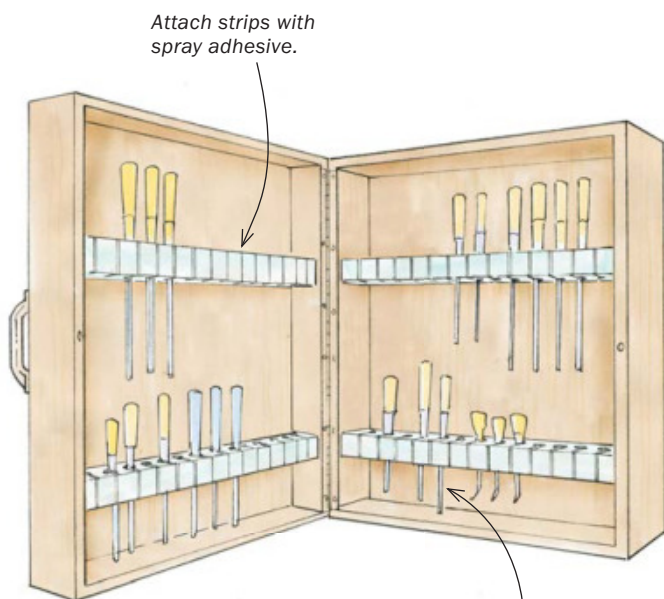
MADE IN USA
SINCE 1993



Foam strips secure chisels and gouges

When I first got into woodworking, I built a carved cradle that was featured in the *FWW* #200 Gallery. The more I got into carving, the more the gouges piled up. Rather than buy additional tool rolls to store them in, I came up with this simple system, which uses strips of medium- to high-density foam and allows much easier access. The strips will hold all sorts of files, rasps, rifflers, chisels, gouges, and other slim hand tools, and it works inside a cabinet or on a wall-mounted tool board. You can cut the foam with standard woodworking tools, and the strips attach to the backer board with spray adhesive. My foam strips are 12 years old now and still work as good as new.

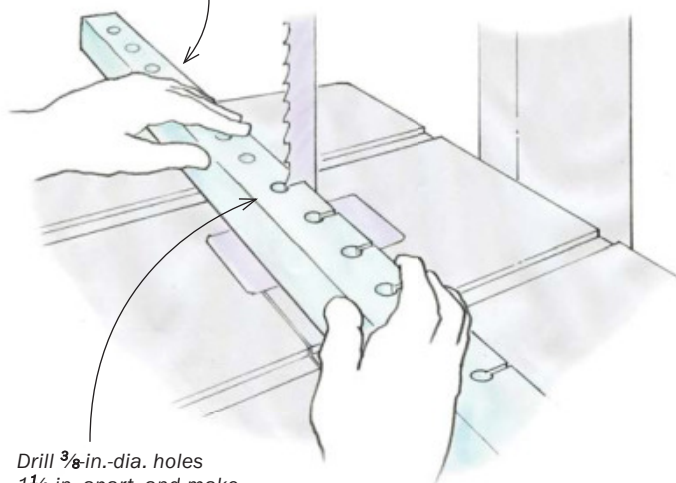
—JIM SCHMIDT, Healdsburg, Calif.



Attach strips with spray adhesive.

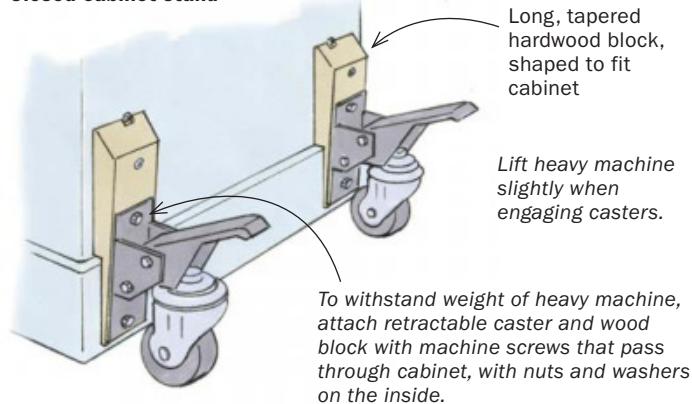
Medium- or high-density upholstery foam, $1\frac{1}{4}$ in. to $1\frac{1}{2}$ in. thick, sliced into 2-in.-high strips

Narrow hand tools press easily and securely into place.



Drill $\frac{3}{8}$ -in.-dia. holes $1\frac{1}{2}$ in. apart, and make bandsawn cuts as shown.

Closed cabinet stand



Long, tapered hardwood block, shaped to fit cabinet

Lift heavy machine slightly when engaging casters.

To withstand weight of heavy machine, attach retractable caster and wood block with machine screws that pass through cabinet, with nuts and washers on the inside.

Open stand, leg mount

Tapered hardwood block, shaped to fit inside leg

Retractable caster, attached with large hex-head wood screws

Attach block with pan-head screws driven through leg.

To attach optional leveling foot, drill hole sized so stem cuts its own threads in wood.

Open stand, cross-brace mount

Use mounting holes for cross-brace to attach mounting blocks.

Additional wood screw stabilizes block.

Hardwood block, shaped to fit inside frame

Caster attached with machine screws and nuts.

Add retractable casters to any machine

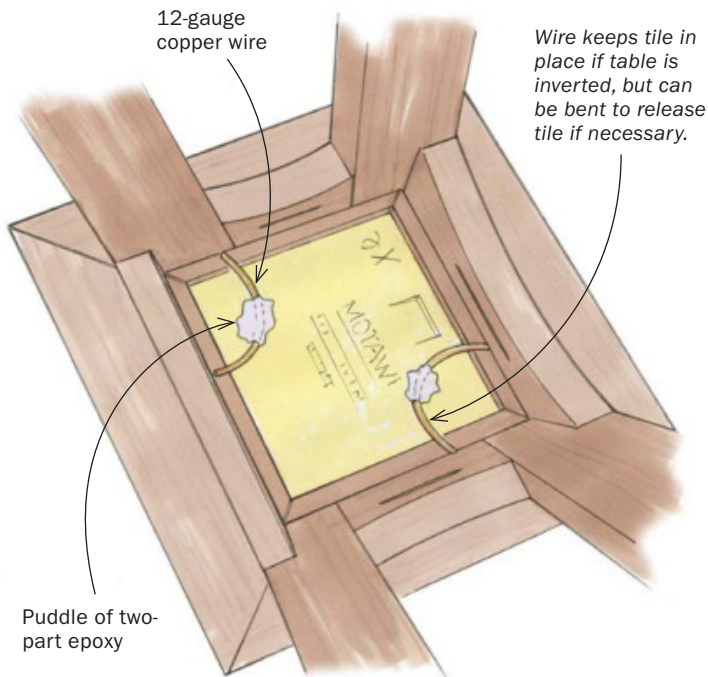
My shop has limited floor space, so I put everything I can on casters. I dislike mobile bases, however, as they collect too much sawdust, raise the height of the tools, and are just plain unattractive to my eye. So I figured out a way to add retractable casters—sold by Rockler and Powertec—to all of my stationary tools. I did this by making custom mounting brackets from hardwood, and painting them to match the tool they are mounted to. Each tool required different mounting blocks, but none required any special skills. In each case the blocks are shaped to fit the machine stand while positioning the caster bracket square to the floor. See the drawings for how this works on a variety of tool stands and cabinets.

—STEVE FIKAR, Shalimar, Fla.

Flexible wire clips hold tile in a tabletop

I recently built a Stickley-style table around a lovely Motawi tile. In case the tile ever needed replacement, I didn't want to cement it in. I also didn't want it to fall out if the table was inverted for carrying. My solution is simple but effective. I created two clips by attaching 12-gauge copper wire to the tile with a small puddle of epoxy and fitted the ends of the wire into a groove. The wires can be bent with pliers to release the tile.

—TERRY KOVACS, Morrisville, Vt.



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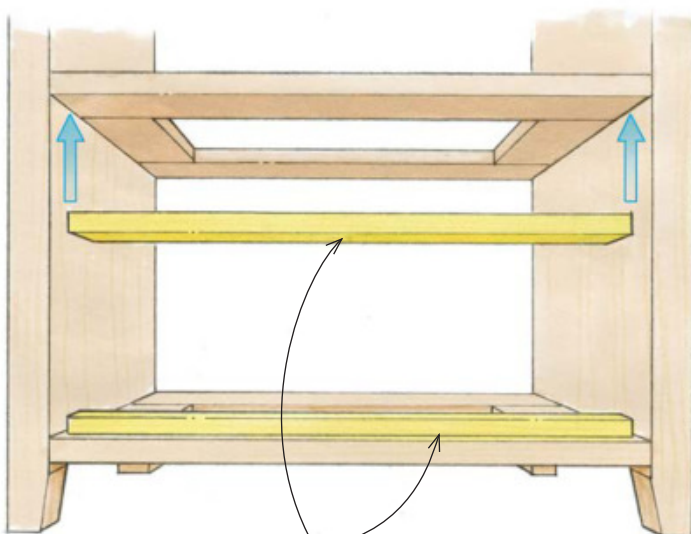
SINCE 1993



Ledger boards make it easier to fit and hang inset doors

To make it less awkward to hang inset doors, I lay the cabinet on its back and use double-sided tape to attach temporary ledger boards just inside the opening. This supports the doors while I'm dialing in the gaps around them (with a series of trim cuts), and does the same when I am transferring hinge locations from the cabinet to the door.

—MARK GOLDBAUM, Saugerties, N.Y.

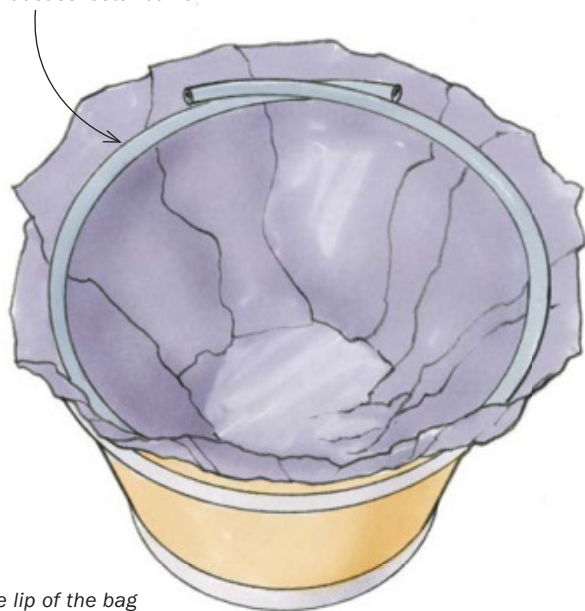


Use double-sided tape to attach ledger strips inside the door opening.



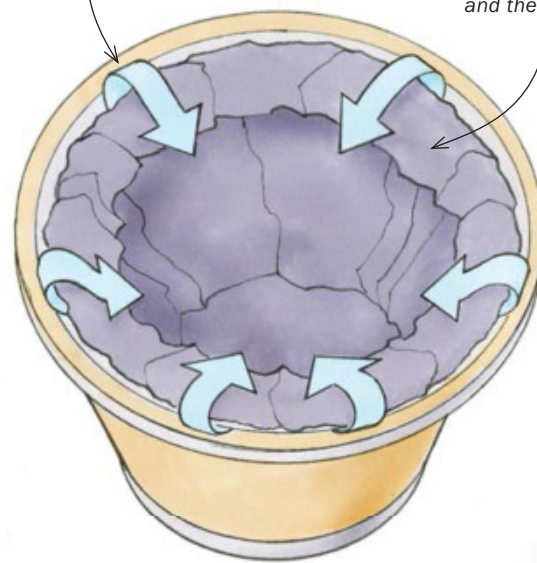
With cabinet on its back, doors lie in position on ledgers, letting you set gaps and transfer hinge locations.

Cut stiff plastic tubing to fit inside the dust-collector barrel.



Fold the lip of the bag over the tubing.

With the entire bag inside the barrel, pressure is equalized and the bag stays put.



Plastic tubing keeps bag in dust-collector bin

Some dust collectors deposit chips into a barrel. Placing a plastic bag inside makes the barrel easier to empty. However, if the lip of the bag wraps over the edge and there is any sort of air leak in the barrel—whoosh!—up goes the bag into the vacuum. Here is a very simple solution. Cut a length of stiff but flexible plastic pipe (lawn irrigation pipe, Hula Hoop, etc.) to fit inside the barrel, and fold the lip of the bag over the tubing and down into the barrel. Bingo, the pressure is the same across the whole bag, and it stays put.

—ALAN CAMPBELL, Lexington, Ky.



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■ MACHINES

Heritage brand bandsaw

THE RECENT RESURRECTION of the South Bend brand of machines brings a renowned name back to the marketplace, and the SB1080 16-in. bandsaw is a worthy part of the company's lineage. I made a bunch of sawdust with various soft and hard woods and was impressed with the saw's smooth power and vibration-free operation. This massive bandsaw should serve any woodworker well.

The saw's a beast, with a 3-hp motor (230 volt/12 amp), heavy cast-iron wheels, and an overall weight exceeding 475 lb. The wheels are very well balanced. Their weight provides a lot of inertia, helping the blade maintain a constant speed so it cuts at its most efficient rate—an important factor for a machine with 14 in. of resaw capacity. A very effective foot brake can easily and quickly bring the rotating mass to a halt.

The large table, measuring 20 $\frac{7}{8}$ in. by 25 $\frac{5}{8}$ in., is a very heavy casting that is supported on stout trunnions. Angling it for bevel cuts is no issue thanks to a rack-and-pinion system. The two-position aluminum fence slides smoothly and locks accurately. The distance from the guides to the saw frame is 13 in. with the fence and 15 $\frac{3}{4}$ in. without.

Smooth-running roller guides keep the blade tracking and require an Allen wrench for adjustments. The lower guide set has the thrust bearing mounted beneath the side roller guides; that creates extra space between the upper and lower thrust bearings, but it didn't detract from the saw's performance.

A small storage space below the lower wheel is separated from the dust and has its own door to provide a place for extra blades or accessories.

—Roland Johnson is a contributing editor.



Two dust ports.

Dust collection is adequately handled through two 4-in. ports. One is positioned immediately beneath the lower blade guides and the other is at the bottom of the lower wheelhouse.



Angling the table is easy and accurate. The heavy table tilts using a rack-and-pinion system, making adjustments for bevel cuts very accurate with little frustration.

■ POWER TOOLS

Handy spindle sander

THE LITTLE TRITON TSPSP650 oscillating spindle sander is ideal for sanding edges on irregular-shaped parts that are too large or awkward to sand with a table-type spindle sander. The variable-speed motor provides enough power that coarse 80-grit sanding sleeves can be used fairly aggressively without bogging it down. The spindle's $\frac{1}{4}$ -in. of oscillation travel is enough to help clean the detritus out of the abrasive and keep the sanding action consistent. An included edge guide can be set to limit the depth of cut and better control the sanding process for a cleaner edge.

The sander can be mounted upside down on a bench with the included clamps and non-skid pad, becoming a handy little spindle sander for shaping small parts or edging tiny pieces. An adapter is supplied for attaching the sander to a standard 1-in. vacuum hose for excellent dust control.

The spindle sizes are $\frac{1}{2}$ in., $\frac{3}{4}$ in., 1 in., and $1\frac{1}{2}$ in. Replacement sleeves are available.

—R.J.



Spindle sander by Triton
Model TSPSP650
\$120

■ HAND TOOLS

Chairmaking tools

I BUILD CHAIRS WITH BOTH SOFTWOODS and hardwoods, and scraping to level tool marks is a regular activity. I typically use handheld scrapers, simple tools that left me skeptical of anything else. But after using a pair of tools from UK-based The Windsor Workshop (TWW), I've added them to my arsenal.

The tools are the Traviscraper and Spokescraper. The first is designed to work on concave surfaces, the second on convex and flat surfaces. Made of Delrin, a high-density polymer, and brass, they feel wonderful and have a bit of weight. The blades are also beefy, much thicker than the hand scrapers that I normally use.

In practice, the tools are similar to scraper planes like the Stanley #80, with the blade secured at a constant, steep angle. Reforming the burr was easy and similar to the way I sharpen and form a burr on my handheld scrapers. TWW has two videos on how to use and sharpen these tools. The depth of cut is controlled by adjusting the blade. The throat is pretty fine, but I didn't find it terribly limiting when I wanted a heavier cut.

Both tools performed wonderfully on both softwoods and

hardwoods, including pine and elm, which are notoriously prone to tearout. What little tearout I got was quickly fixed by adjusting the direction and angle at which I presented the tool to the wood. All that was left was a little bit of sanding.

—David Douyard is a chair maker in New Hartford, Conn.



Scraper planes by The Windsor Workshop
thewindsorworkshop.co.uk
Traviscraper and Spokescraper
\$140–\$200 at current exchange rates

■ NEW TO MARKET

New tools to look out for

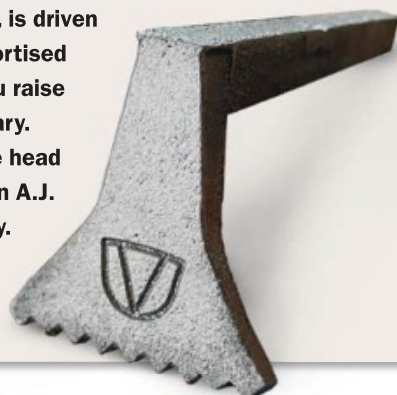
Pair of random-orbit sanders

For fans of 5-in. and 6-in. random-orbit sanders, Bosch has announced a pair of new models that replace earlier versions. The GEX335N is the smaller model, and the GEX336N is the larger. Both use hook-and-loop pads to secure sanding disks. The company says the sanders' on-board dust collection can catch particles as small as $\frac{1}{2}$ micron in dia. Both come with high and low grips near the head, as well as a longer handle out the back.



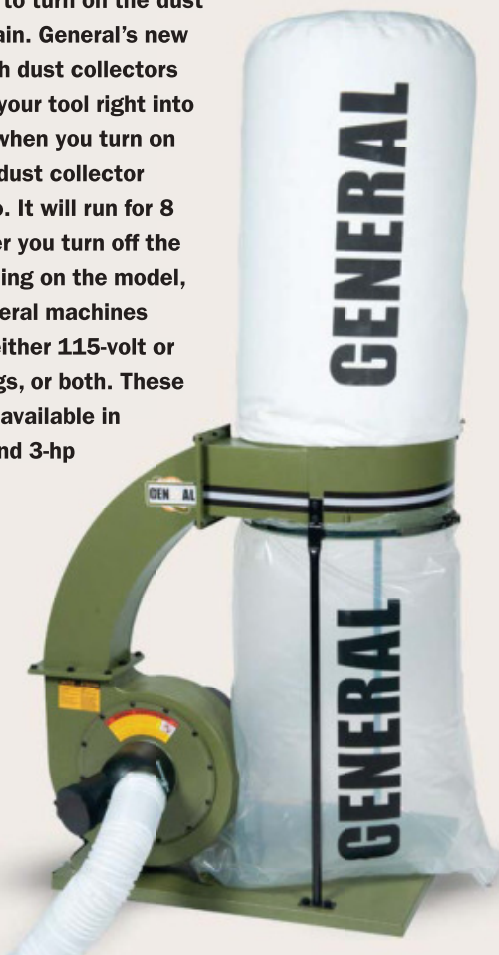
Traditional-style planing stop

Effective workholding, including jigs and fixtures, is critical to any bench. To that end, Crucible is nearing production of a cast planing stop made from ductile iron. This traditional style of stop uses teeth to grip boards as you plane against them. The spike on the lower end, at 90° to the teeth, is driven into a block that then gets mortised into your benchtop, letting you raise and lower the stop as necessary. The teeth and the angle of the head of Crucible's stop are based on A.J. Roubo's from the 18th century.



Auto-start dust collection

Never forget to turn on the dust collector again. General's new Smart Switch dust collectors let you plug your tool right into the unit, so when you turn on the tool the dust collector starts up too. It will run for 8 seconds after you turn off the tool. Depending on the model, the new General machines will accept either 115-volt or 230-volt plugs, or both. These units will be available in 1-, 1½-, 2-, and 3-hp models.



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Rails and stretchers

IT'S ALL ABOUT
STRENGTH, STYLE,
AND INTRIGUE

BY HANK GILPIN

No matter how we discuss the purpose of rails and stretchers, their primary reason for existing is to add strength. Rails and stretchers can be big and important, as on a trestle dining table, or small and delicate, as one might find on a small end table. The big ones, like those connecting leg structures, offer a much-needed anti-racking solution, with shouldered tenons that are often wedged to pull the leg parts snug. The small ones, curved, straight, and even crisscrossed, also ensure strength but add interest and vitality.

Yes, rails and stretchers are really about strength, except when you want to add a little pizzazz to a piece. I like the idea of including a little something extra with the rails and stretchers, one of those details that swims around in your head looking for a place to go. I know we're making nice, usable furniture, but sometimes you just must go for it and include something just for the pleasure of doing so.

Hank Gilpin makes furniture and wood sculpture in Lincoln, R.I.

High stretchers and low rails

Both of these tables use long stretchers placed up high to provide lateral control, and side rails down low, adding front-to-back strength. The American elm table (top) is Gilpin's solution to working with a thin ($\frac{3}{8}$ in.), potato-chip top. The rails are located close to the bottom of the legs where they splay out. The sea grape table (bottom) has subtly curved rails and stretchers that mirror the shapes of the top. The stretchers double as supports for the drawer box.



Add a stretcher

Sometimes side rails alone aren't enough. When you need additional support, add a stretcher to lock those rails together.

Rail to rail. The curved stretcher connecting the rails on either side of this maple desk is located toward the back to allow for a chair and a person's legs. Two verticals support the stretcher from above, for more stability and a cool design.



Six legs and three rails to design around. On Gilpin's figured birch sideboard a double-arched stretcher spans the piece, tying into all three rails. With all the upper structure of the case, this was an aesthetic detail, not a structural one.

Multiple stretchers

Extra stretchers open design options, and each added connection diminishes the potential for an “oops” moment when a leg is kicked or dragged across the floor. Everything is stiffened.



An experiment with scraps. These small tables made with shop scraps of maple, buckeye, and Jamaica dogwood play with the rail-to-stretcher idea. On the narrower table Gilpin uses one stretcher between the rails, but he added a second rail on the wider ones. They firm up the structure and evolve the design.



Elevate a simple form. The long, low, double stretchers on this quartersawn sycamore hall table curve in toward each other and connect to the side rails with through-tenons. They stabilize the structure while their curves lend the piece more intrigue and complexity, playing off the subtle curves of the legs and the ends of the table.

Repetitive patterns. This sea grape display table, designed in an updated Arts and Crafts style, was built to house a collection of tiles. With its multitude of legs, rails, and stretchers, it is structurally bombproof.



Pull out all the stops

Gilpin's advice: Don't limit yourself to the conventional. Use joinery and construction to play with design. Your stretchers and rails don't have to be squares and rectangles.



Tenons and lap joints take over. The lean structure of this wavy red oak and walnut table is shored up with intersecting, overlapping stretchers that lock all four legs together.

Rounding it out. The round top on this English yew end table is mirrored below where the stretchers meet. The stretchers are all elegantly locked together and strengthened with the little shelf that provides what Gilpin calls "a double whammy addition of strength and use."



Crisscross apple sauce. This mahogany and birch table is a bit of a showoff. Made from wood salvaged from a 1930s dining table, the four splayed legs connect with six alternating stretchers (three between each pair of opposing legs) that cross and overlap each other in the center.



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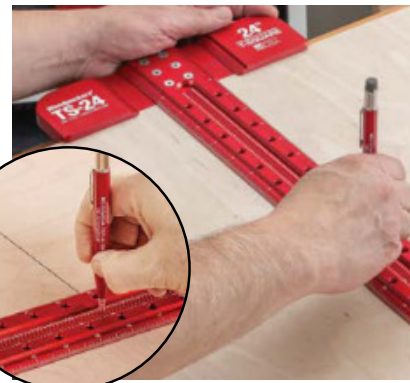
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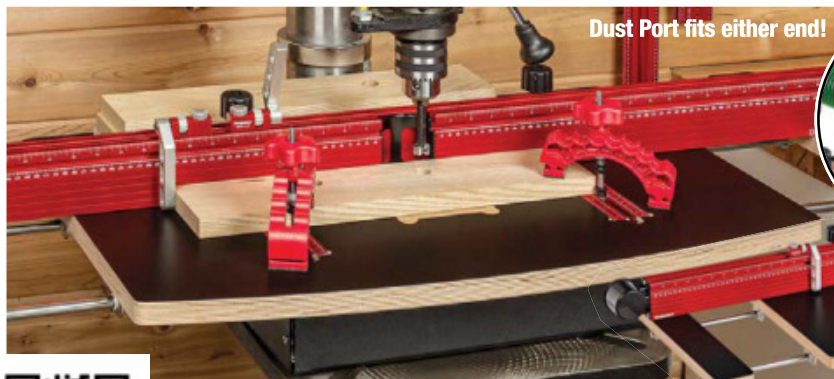
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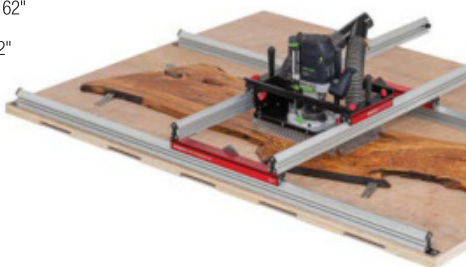
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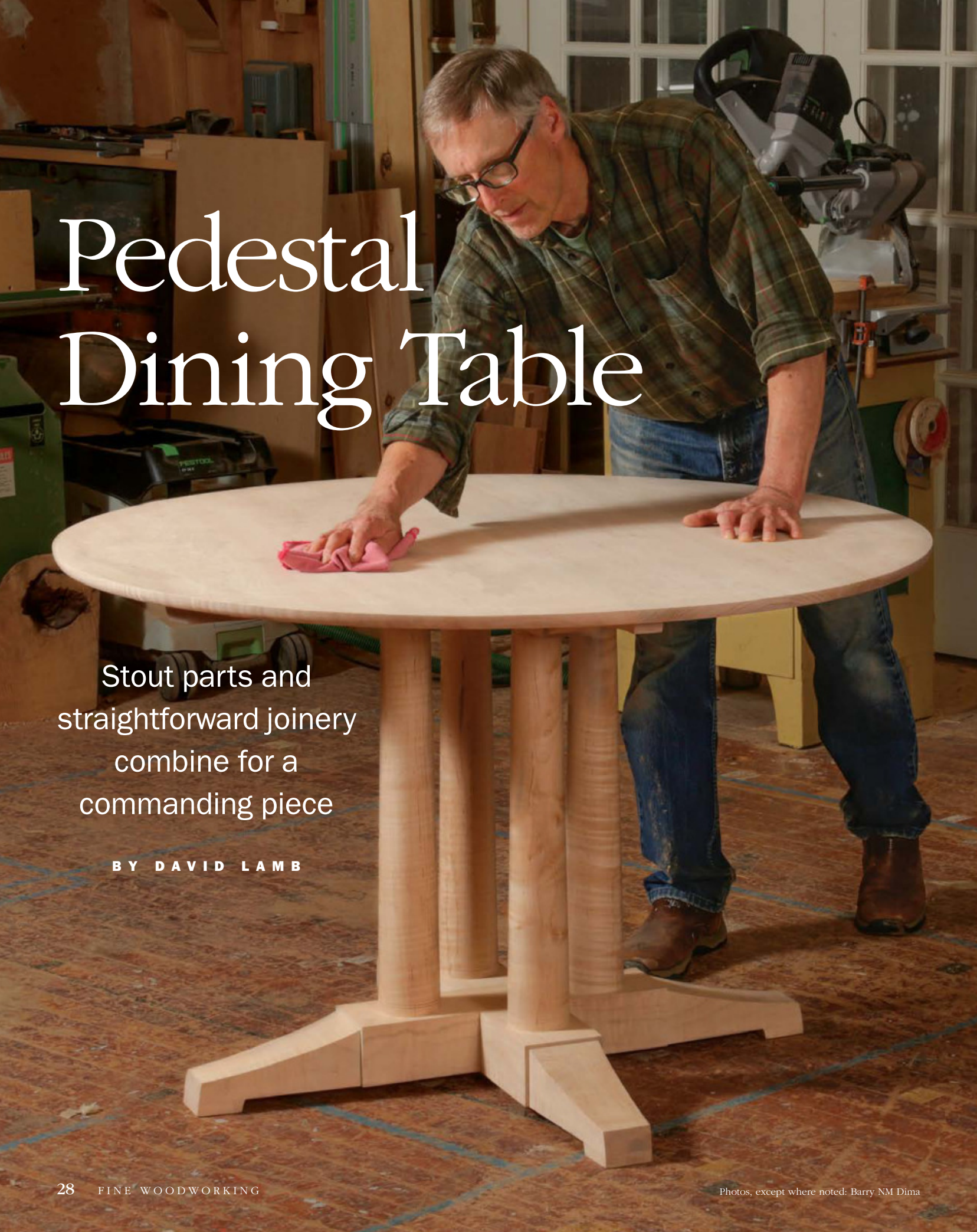
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A man with glasses and a plaid shirt is in a workshop, leaning over a round wooden dining table. He is using a pink cloth to wipe the surface. The table has a thick, round top and four thick, tapered legs that flare out at the base. The workshop background is filled with various tools and wood pieces.

Pedestal Dining Table

Stout parts and straightforward joinery combine for a commanding piece

BY DAVID LAMB

Large turnings



Turn the tenons to fit in their mortises. Lamb creates each post's tenon by first creating the shoulder with a parting tool and then roughing away much of the waste with a gouge. Then he sneaks up on the final dimension by taking light cuts with a scraper (far left), checking the fit regularly in a test hole (left).

This elemental table is a stripped-down version of a breakfast table I built, which had a drop leaf and a telescoping base. The original was a rewarding build, and the final product inspired this simpler version. I love the new table's direct aesthetic. A standout for me is the substantial visual feel of the cluster of posts and the cantilevered top. Gentle curves throughout keep the piece from looking too clunky. There's room to vary the details on the design too. While this top is circular, the table can be successful with a slightly oval top as well.

Patterns and story sticks

As always, I created a full-size drawing for this table. I recommend taking the time for this, as the drawing process gives the maker a more complete idea of how parts work together and the potential issues and pitfalls. Most importantly, erasing a misdrawn line is always easier than starting over in wood. The drawing also functions as the source for patterns and story sticks, which are necessary for this work. I frequently use 1/16-in.-thick pasteboard or 1/4-in.-thick hardboard or wood for patterns that I trace around, like for the feet. If I use the pattern at the lathe, I always choose wood because of its stiffness and readability. I make sure all my patterns contain relevant joinery information as well.

Turn the posts

This design calls for 16/4 stock for the turnings and the bottom braces. I'm using



Posts get a gentle taper. With the tenons done, Lamb turns his attention to shaping the posts. He plunges to final depth at the middle to help him taper evenly from end to end.



Carve channels for the glue. This big, long tenon can easily seize during glue-up. To mitigate this, Lamb cuts small grooves around each tenon with a V-tool. He drills a small air-escapement hole through the bottom of each mortise for the same reason.

PRESENCE AND ELEGANCE

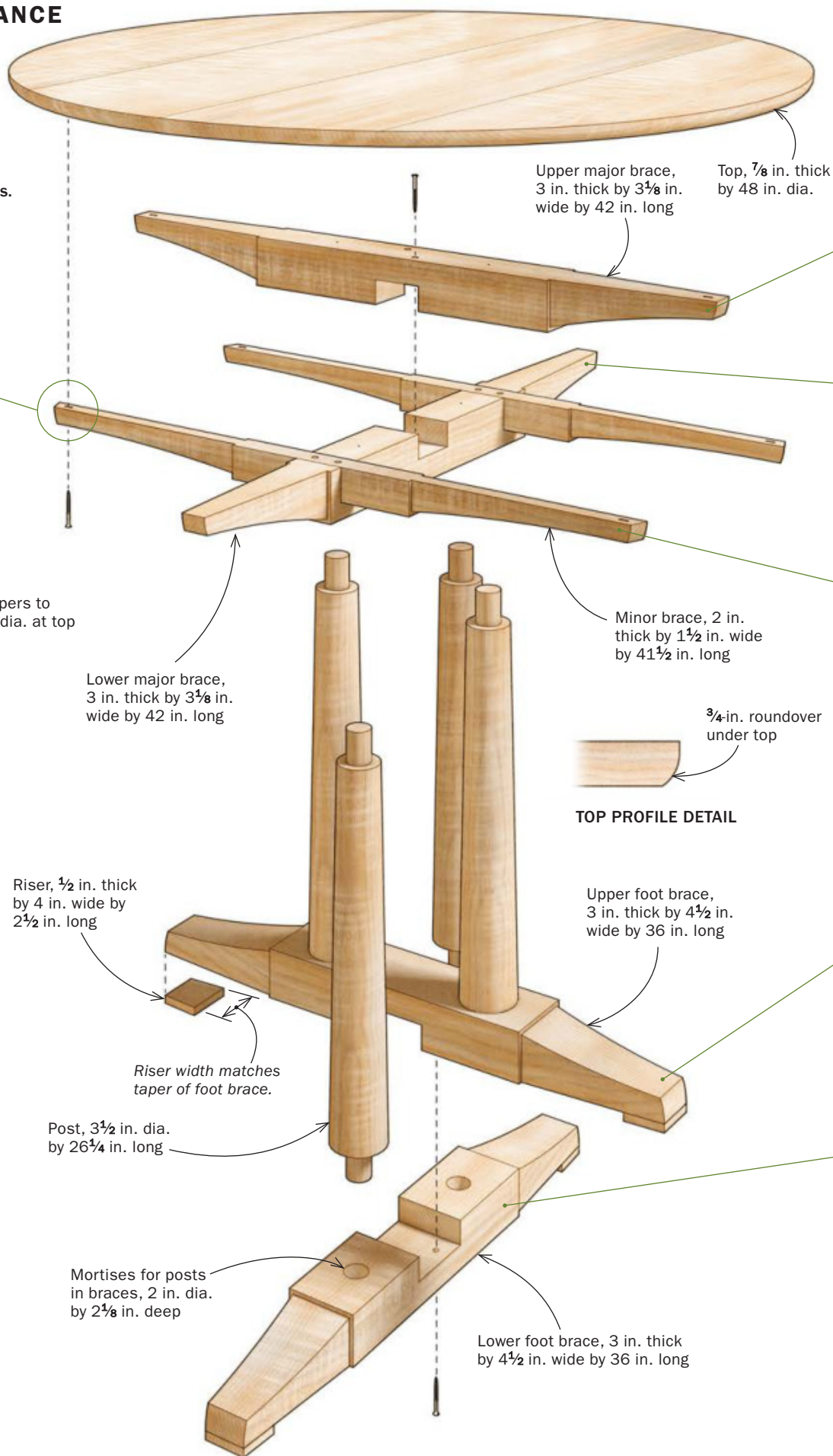
This pedestal table is a balancing act. The size of its components gives it considerable visual weight. But as the eye draws in, it also finds soft, considered angles and curves. If you don't have a lathe capable of turning these posts, consider tapered octagons.

Minor braces slightly curved at ends in plan view.

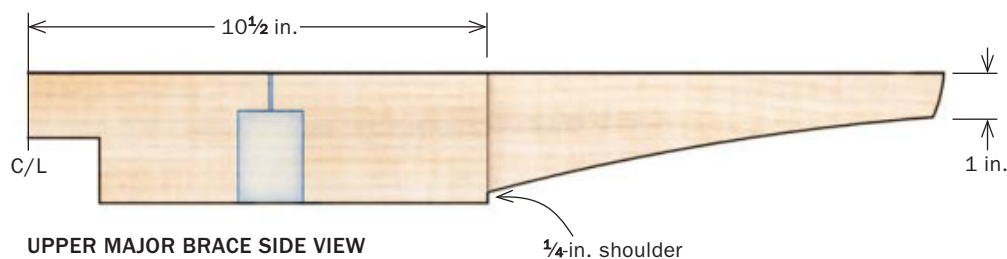
MINOR BRACE TOP VIEW



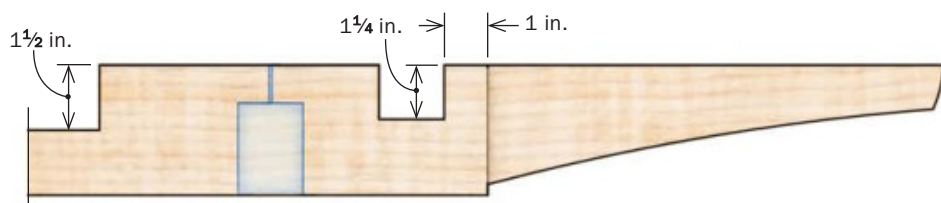
POST



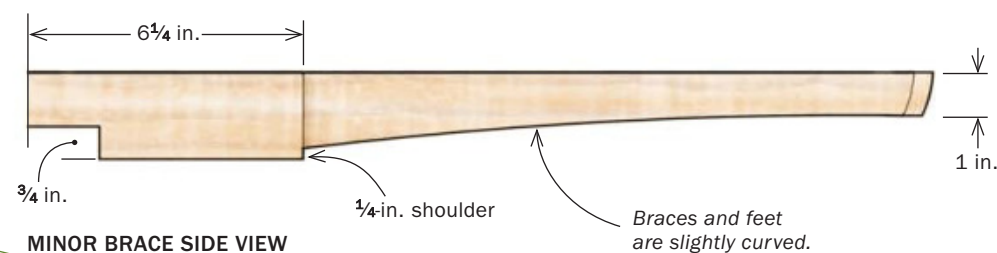
TOP PROFILE DETAIL



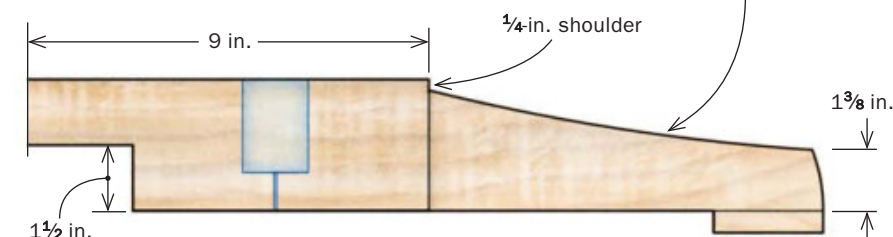
UPPER MAJOR BRACE SIDE VIEW



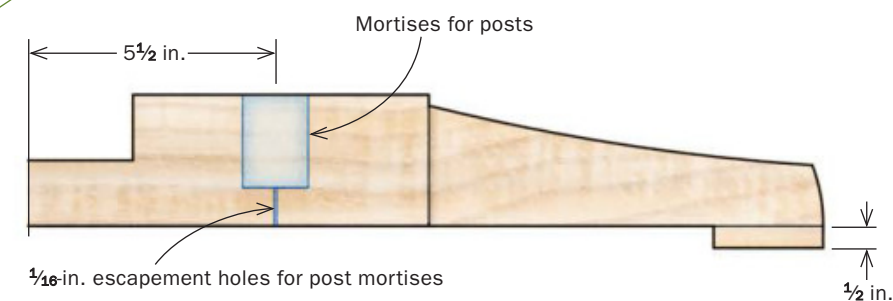
LOWER MAJOR BRACE SIDE VIEW



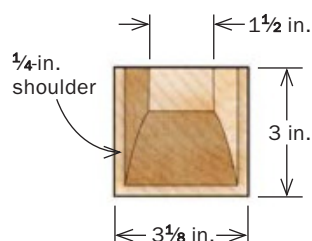
MINOR BRACE SIDE VIEW



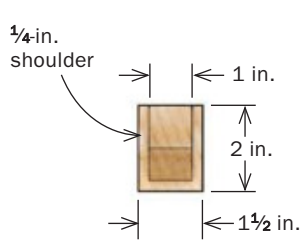
UPPER FOOT BRACE SIDE VIEW



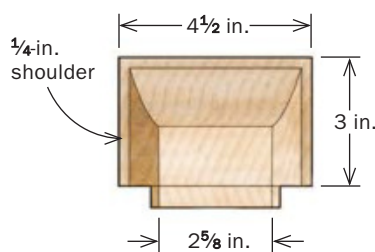
LOWER FOOT BRACE SIDE VIEW



UPPER MAJOR BRACE END VIEW



MINOR BRACE END VIEW



FOOT BRACE END VIEW

curly maple for this project, a choice that strongly directs me to use full thickness stock rather than laminating thinner boards because matching curly figure in a laminated glue-up is a nightmare. And with glued-up stock you will likely cut through the gluejoint when you shape the foot. If 16/4 stock is not available, gluing up 8/4 stock is your best bet. If that's the case, consider straight-grained wood to ease achieving a good grain match, paying close attention to where the boards meet at the glue joint. You'll want 8/4 stock for the upper braces and 4/4 stock for the top.

After milling the material, go to the lathe to turn the post blanks to 3 1/2-in.-dia. cylinders. Using the pattern, lay out the tenons, then turn them. I use a test hole drilled into scrap to check the fit. A good, slop-free fit is important here because these posts will be doing a lot of work. Finish the tenons by lightly grooving them with a V-tool, which will help alleviate glue pressure during assembly.

Once I form the tenons, I turn the post to a taper, add the four decorative score marks, and finish-sand.

Shaping before joinery

Working at this scale, with large stock and stout joinery, requires special considerations, which I will point out when necessary. But it also affords some freedom.

For example, I can roughly shape the braces before joinery. Normally that process is flipped, since cutting joinery is typically simpler when the stock is square. After all, the more you cut away, the less reference surface you have. But with large parts like those in this table you have plenty of reference even after cutting curves. So I cut the sweeps on the upper and lower braces now to let me see the design coming together early on.

Last, glue the risers onto the foot brace. Making the risers with off-cuts from the profiling cuts should help with a good grain match.

Note that both the braces and risers get slight curves in the side

Shape the feet

Lay out each foot brace's plan view and elevation using templates. These one-sided templates flip around the foot brace's centerline, guaranteeing symmetrical layout.



view, including the foot on the inside end. These curves echo the gentle slopes throughout the table. I accomplish them with files and sandpaper. The ends of the minor braces get a slight curve in the plan view for the same reason. They're small details, but trust me, they add up. With the table's otherwise stout, elemental form, these gentler, flowing accents soften the hard lines and add a designer's touch.

Half laps and mortises

The posts' tenons connect to mortises in the upper and lower braces. The braces themselves come together with simple half laps. But don't let their simplicity entice you to breeze through these joints. This is



Knife in the half-lap's width and depth. The base comes together with a half-lap. To mark the width, Lamb lays one member over the other, letting him directly scribe the joint's exact width. He then uses a marking gauge to scribe the depth.



Saw the profile's cheeks after its shoulders, but stop short. Lamb cuts to just before the shoulder, maintaining the reference surface and layout lines until he's ready to snap off the waste by hand.



Offcut becomes a riser. To elevate the feet off the ground, Lamb glues on an offcut from the previous step. If you can't achieve a good grain match, consider cutting a small V-groove around this joint.

Simple joinery



Start the half-laps at the miter saw. Cutting a bunch of closely spaced kerfs makes it a snap to break away the waste. Lamb sets the miter saw's depth stop to just a hair above the scribed baseline. He eyeballs the shoulder cuts.



Finish by paring to depth by hand. Rather than relying on a power tool to finish the joint, Lamb prefers to use a sharp chisel. This is why he knifed in the baseline: It provides definite, reliable registration for a chisel. Come in from both sides of the joint to avoid blowout.



Bore the mortises at the drill press. Drill these $\frac{3}{8}$ in. deeper than the length of the tenons so they won't bottom out. This extra space also provides an area for excess glue.



Flip the piece over and drill a small escapement hole. This hole serves the same purpose as the grooves in the tenons. Because there's so much contact surface in this joint and glue can be viscous, a lot of pressure can build up if the air is trapped and has no escape.

a heavy table with big parts, so it's necessary to carefully lay out, cut, and fit these joints to maintain their strength.

When laying out the half laps, use a knife and marking gauge for precise cross-grain marks and a marking gauge for depth marks. Do this after making sure the stock is free of tearout and other defects. If you clean up your workpieces after cutting the laps, you'll end up with a poor fit.

To cut the half laps, I use a chopsaw to bulk out most of the waste before paring to my scribe lines with a sharp chisel. The lower brace gets a single lap right in the middle. The upper brace gets three laps: a central lap plus one on either side. The two outer laps are for the minor braces,



Refine the shapes. To smooth the bandsawn surfaces of the figured maple, Lamb starts with rasps and files, then moves to scrapers and sandpaper. He repeatedly feels the surface, examining for bumps and irregularities.

Glue up the braces and posts



Begin by assembling the upper and lower X-braces. With the braces elevated on blocks, Lamb can easily clamp right at the center of the joint. Pine cauls keep the clamp from denting the joint. Lamb adds screws, which will be hidden in the final assembly, to each center joint for extra security.



Caul with holes helps clamp posts to lower assembly. Applying good pressure to the posts can be tricky, so Lamb makes a caul with two holes that fit around the tenons. When he clamps the caul, it directs pressure against the shoulders to close the joint evenly.

which help support the top and keep it flat. Remember to change the depth stop for these shallower cuts, since these are not exactly half laps.

Next, drill the mortises for the post tenons. Use the patterns to locate these holes, since it's critical they line up on each brace. Otherwise, your table won't come together square. Bore these holes $\frac{1}{8}$ in. deeper than the length of your tenons to keep them from bottoming out and as a place for excess glue. I also drill a small hole through the mortise to help air and glue escape the sizable joint during glue-up, which helps to keep it from seizing up.

Later, the top will be attached to the base with screws. Drill the holes for them now, being sure they allow the top to expand and contract seasonally. I seat my screws in stepped elongated holes.

Glue up the base

Now you're ready to glue up the base. I assemble the lower brace with glue and screws before adding the posts one by one. Then I glue and screw the upper brace. I finish by gluing the whole base together.

The posts are where the rubber hits the road. They need to go in square while having zero wiggle or slop but still be clampable. These are generally the criteria for any joint, but the mass of these joints, their quantity, and their structural role in the table mean a dry-fit is particularly advisable here. Check for gaps, square, and twist.

When you're ready for the glue-up, do it in stages. Gluing one post at a time and allowing it to set up and cure can save a lot of aggravation compared with doing all four at once.

To help distribute clamping pressure when gluing the second post to a brace, I make a simple, stout caul and drill it at the same mortise locations as the braces. Its holes are slightly larger so it doesn't get hung up on the tenons. I also recommend a slow-setting glue, like Titebond III.

Circular top

The top gives you the chance to showcase some really exceptional wood. As I have chosen curly maple for the table, finding matching stock can be



Add the minor braces to the upper lap assembly. These smaller braces help support the top and are half-lapped into place. Screw these in place as well.



Bring the base together. Lamb assembles the two components upside down, letting him clearly see the mortises in the upper brace. Because the members are large, you may need a clamp on either side of the post to ensure even clamping.

Cut and shape the top



Attach a sacrificial pivot point block. Lamb routs the top to final shape with a router on a trammel. To provide the pivot point for the trammel, he temporarily affixes a block at the middle using a paper joint.

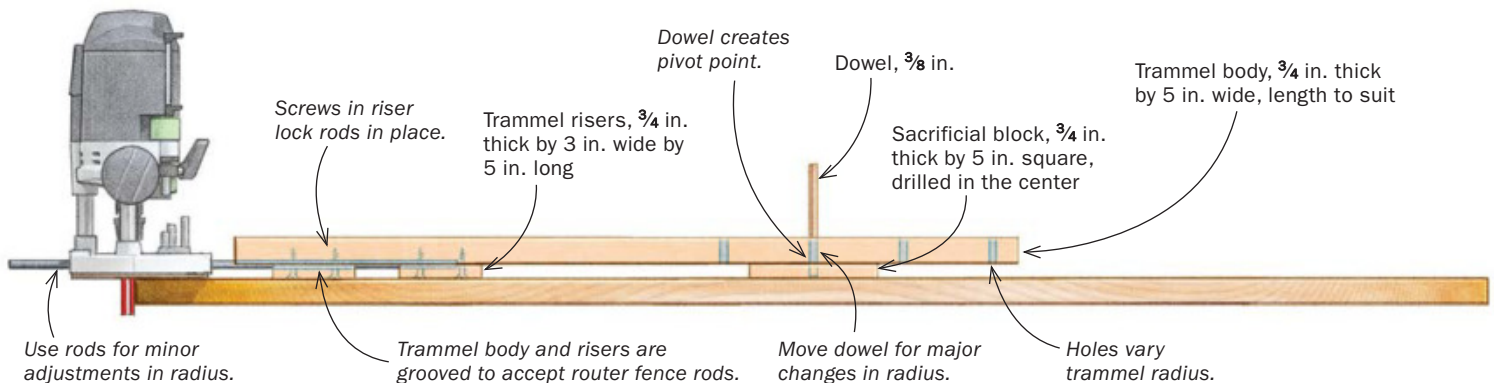


Jigsaw close to the line. Cut within $\frac{1}{16}$ in. of your line to save wear and tear on your router and bit during the next step.

Trammel locates in pivot point block using a dowel. To swing the trammel around the top at a fixed distance, Lamb uses a dowel, providing a reliable connection between the trammel and sacrificial block.



TRAMMEL JIG





a huge challenge. I advise looking for planks cut sequentially from the log for best matching. Specialty lumberyards with good stock can help in your search. If sequentially cut boards are not available, just going for similar figure and base color tone of the boards is a reasonable direction. I would also go for wide boards to minimize the number of boards needed. Whatever the species of the boards you're choosing, it is often advisable to skim their outer surface with a handplane to see the figure and grain.

After milling and gluing up the boards, shaping the top is next. Start with a jigsaw, cutting close to your final shape, staying a skinny $\frac{1}{16}$ in. away from your line. I then rout the top to its circular shape while also profiling it. I do this with a router on a trammel. The trammel pivots around a temporary base, which I locate on the top using centerlines on both the base and the top. When routing, I use a $\frac{3}{4}$ -in. roundover bit, aiming for an asymmetrical curve. This is partly why I use a trammel, since it allows me to



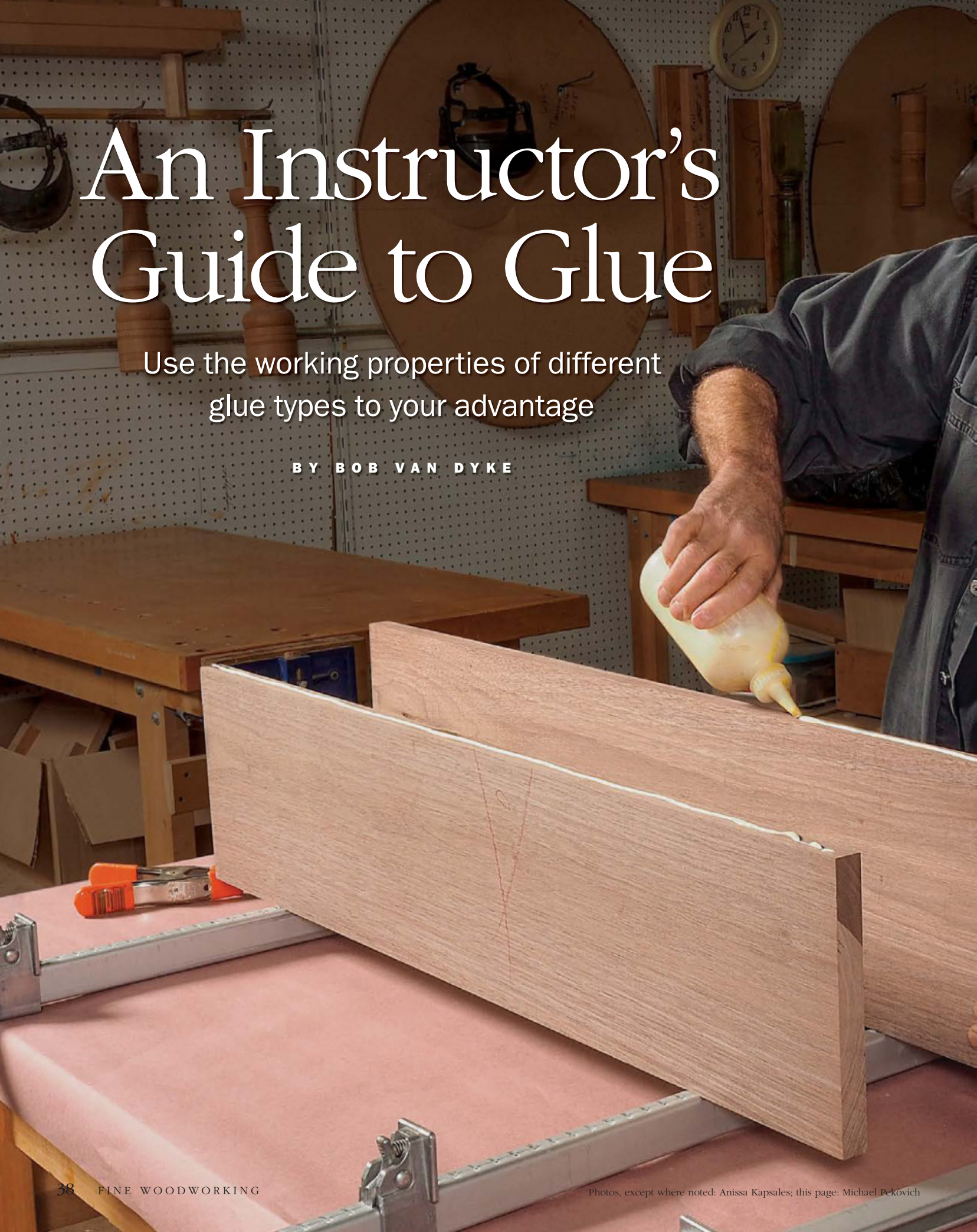
Lower the bit between passes as you rout the roundover.

This profile requires removing a lot of waste in maple, so Lamb sneaks up on his final cut by starting light and lowering the bit after each pass. Alternatively, you could use the rods to slide the router slightly inward each time.

micro-adjust the profile's radius by moving the router toward or away from the center point. If I routed the circular shape with a straight bit and then used the bearing on a bit to create the roundover, I'd be limited to the router bits I had. The trammel means I don't have to limit my designs as much, giving me much more control over the final result. □

David Lamb is 2021 Cartouche award recipient from the Society of American Period Furniture Makers, recognizing excellence in period furniture making.



A woodworker in a workshop is shown from the side, wearing a dark blue long-sleeved shirt. They are using a yellow plastic glue bottle with a nozzle to apply glue to the edge of a long, light-colored wooden board. The board is resting on a workbench with a pinkish-red surface. In the background, there is a pegboard wall with various tools hanging on it, including a clock and some wooden pieces. The scene is well-lit, showing the texture of the wood and the workshop environment.

An Instructor's Guide to Glue

Use the working properties of different glue types to your advantage

BY BOB VAN DYKE



I can't think of a more mundane subject in woodworking than glue, but knowing the working properties of the various glues available and matching their specific traits to a particular glue-up is important. It can turn a stressful situation into a very methodical and precise task. I teach my students to learn the pros and cons of each glue type and then choose the one that best fits the task at hand.

Almost all woodworking glues, when used according to the manufacturer's instructions, yield a bond that is as strong, or stronger, than the wood itself, so strength is not the issue. While I definitely lean on yellow glue and Old Brown glue for the bulk of my glue tasks like panel glue-ups, joinery, and carcass glue-ups, I do turn to epoxy, cyanoacrylate, hot hide glue, and urea formaldehyde glues for certain other things like veneering, laminating, sizing templates, and filling voids. When choosing what glue to use for a specific task I think about what is going to get the job done most efficiently, with the lowest amount of stress possible, and with the best end results.

Contributing editor Bob Van Dyke runs the Connecticut Valley School of Woodworking.

FIVE ESSENTIAL GLUES FOR THE SHOP



A glue for all occasions. From PVA and epoxy to cyanoacrylate, urea formaldehyde, and liquid hide glue, with this arsenal of glues at your fingertips you should be able to tackle any woodworking glue-up you come across in your shop.



Yellow glue is a shop standard

Most woodworkers use yellow glue (aliphatic resin or PVA) for most, if not all gluing tasks, and it is always on hand in my shop. It is easy to use, readily available, dries quickly, and has a proven track record.

But it does come with a few drawbacks. Yellow glues have an extremely short working time. The label on Titebond Original states about 15 minutes and Titebond III adds another 5 to 10 minutes, but I have found in most cases that is just wishful thinking. Sliding a tenon up or down in its mortise is virtually impossible after just two or three minutes of assembly. This leads to a huge amount of stress and can result in misaligned joints after the glue has dried. I don't recommend PVA for tricky joints or glue-ups involving a lot of parts, unless you are able to break the glue-up into stages.

Yellow glues are also well known for their tendency to creep, making them a poor choice for veneer work that involves visible joints or inherently unbalanced woods like crotch and burl veneers. There is nothing worse than spending hours making a complex veneer pattern and seeing the joints open up after a week or two.

Yellow glue does excel in a lot of areas though, and that's why it's such a workhorse in the shop. There is no point in using any other glue for simple everyday glue-ups if the advantages the other glue offers are not important in a given situation. Take advantage of yellow glue's simplicity when it works for you. Since the clamp time on yellow glue is short, I regularly use it to glue up panels. In a porous wood like pine or walnut, I can remove the clamps after 20 minutes.

The stats on PVA—It's an all-around shop glue, with about 5 to 10 minutes of open time. You can usually unclamp between 30 and 60 minutes, and clean up with water.

MINIMIZING SQUEEZE-OUT ON JOINERY



A smart glue-up strategy. Brush the glue into the mortise, and around the tenon, putting a thin coat on the end grain shoulders of the tenons. Before you seat the tenon all the way in the mortise, stop and brush out the roll of glue that forms as the tenon goes into the mortise. This will help eliminate squeeze-out.

TIP

REMOVING SQUEEZE-OUT WHEN IT HAPPENS

If you can't prevent squeeze-out, use the straw trick. Cut an angle on a plastic straw and scrape the wet glue off the work into the straw.



MULTI-PANEL GLUE-UPS



Don't waste any time. Because yellow glue skins over quickly, Van Dyke starts by running a bead of glue along both edges to be joined. It is then quickly spread with a finger. Rubbing both edges back and forth ensures a thin, even layer on both surfaces.



A level glue-up makes flattening easier later. Use spring clamps to hold the boards flush, testing flatness with a finger. Before adding clamps across the top, scrape off any squeeze-out. This allows the glue joint to dry faster. Add the top clamps, then flip the panel and remove the glue from the bottom as well.





Liquid hide glue

I discovered Old Brown Glue (OBG) several years ago, and it is my go-to glue for anything other than a straightforward glue-up or a panel glue-up. It is basically traditional hide glue to which urea has been added, making it liquid at room temperature. Because of its extremely long working time and simple cleanup, it is ideal for any complex glue-up. Another trait of OBG is its slipperiness. It acts like a grease when you're assembling tight joinery. This, coupled with the fact that it does not swell the joints quickly, makes it my glue of choice for all dovetail joints, complex glue-ups, and any mortise-and-tenon assembly that involves more than four or five joints.

I don't use it for glue-ups where its unique working characteristics are unnecessary. Its long working time (30 to 45



TIP

A LITTLE HEAT WILL DO

Though it's liquid, Old Brown Glue is too thick to use out of the bottle. But if you transfer what you need for a glue-up into a container and heat it until it thins, you are ready to go.

Plenty of time to work. Not only does liquid hide glue provide a long open time making complex glue-ups less stressful, the slippery nature of the glue when it's heated helps the parts go together easily, so you won't have multiple parts seizing up quickly.



minutes) means it has a correspondingly long clamp time (the time required for the glue to set sufficiently to allow the clamps to be removed without compromising the joint), which becomes an unnecessary disadvantage when that long working time is not needed. Removing the clamps on an unstressed glue joint in less than four hours is asking for trouble. Leaving the joint in clamps overnight is safer but can be inconvenient.

At room temperature, OBG is too thick to spread and should be heated to at least 110°—putting the bottle under hot running water or into a glue pot or crock pot for a few minutes is sufficient. Don't microwave it.

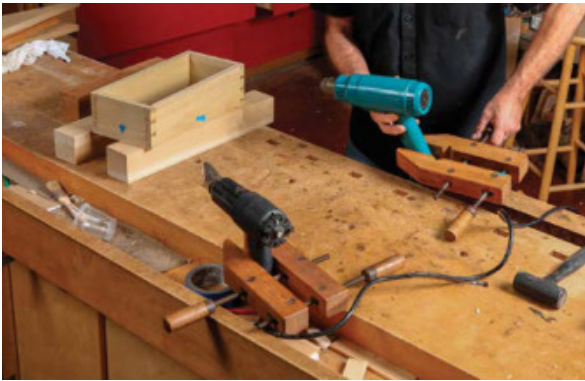
Reversibility is possible. I have heated misaligned joints that were put together with Old Brown Glue, taken them apart, and easily re-glued them correctly. Doing that with any other glue involves drastic repairs.

The insider's take—Liquid hide glue is reversible, perfect for complex glue-ups, invisible under a finish, and has a long open time. Clamp time is 6 to 12 hours, and it cleans up with water.



Cleanup is easy. Water is all it takes. Whether you are cleaning squeeze-out while it's still wet or after it has been dry for days, the answer is always the same. Use warm water on a rag or brush and you can work the glue away.

NEED TO TAKE IT APART?



Disassemble a dried joint. With liquid hide glue, it's easy to take a joint apart after the glue sets. In this case, the dovetailed box was glued up before it had a groove to hold the bottom. No problem. Just heat the corners until the glue softens and the joints come apart. Van Dyke uses opposing wedges to force the box open. He sets a pair of wedges on either side, and uses clamp pressure to move them toward each other, pushing the joint apart.

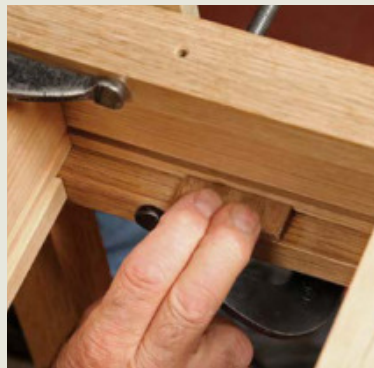


Hot hide glue has its uses



Animal protein glue (hide glue) was the glue used in almost all furniture built before 1940, and it is still very popular among traditional furniture makers. It sets quickly, is not visible under finishes, and is easy to clean up with water. Hot hide glue has an even shorter working time than yellow glue. Because it starts to set as soon as the temperature gets below 120°, you have little time to spread glue, let alone assemble and adjust the parts. Many furniture makers use this working trait to their advantage when making a rub joint. Traditional hammer veneering with hot hide glue exploits this same characteristic and is a very efficient way of applying veneer.

Add water to granules. Mix 6 parts granules to 11 parts water by weight. Let them sit for about half an hour at room temperature to bloom, and then put the mixture in the glue pot and heat until it is liquid. Keep a top on the glue pot so the heated glue does not thicken. Store unused glue in the refrigerator.



Rub joints and veneer. The quick-setting glue is good for attaching glue blocks and drawer stops. Rub it back and forth, and within a minute it will stay in place without clamps. For hammer veneering, quickly spread glue on the substrate and both faces of the veneer. Use a veneer hammer to rub and press over the surface, forcing out the excess glue as it cools and grabs. The surface glue lubricates the hammer while it fills the grain.





Urea formaldehyde

Rather than being all-around adhesives, urea formaldehyde glues are formulated for specific tasks. I use them primarily for veneer work and bent laminations, at which they excel. Both tasks require a long open time and a hard glueline. Hide glue and polyurethane glue fit this category, but urea formaldehyde glues such as Unibond 800 are the best. The open time and clamping time of Unibond 800, developed by veneering expert Darryl Keil, can be easily adjusted by altering the ratio of resin to hardener. And clamping time can be sped up by increasing the room temperature. I learned the hard way that it requires a minimum room temperature of 70°. Years ago, I ran a class in the winter and the veneered projects were left to cure overnight. When the heat was turned down at night it caused the glue to fail and the next day we had to peel up all the veneer. I now cover a urea formaldehyde glue-up with an electric blanket.

Unibond 800's long open time and rock-hard glueline make it the perfect choice for bent laminations. Once cured, there is no spring-back at all. Squeeze-out is nearly impossible to remove, short of cutting it off. Make parts oversize so you can trim them to size once the glue is fully cured, removing the squeeze-out.

While I do not normally consider expense or shelf life with glue, it should be noted that Unibond 800 does have a one-year shelf life and will fail if used beyond its expiration date. If the resin thickens up like honey, it is no longer usable. Always buy the smallest amount you think you will use in a year.

The lowdown on urea formaldehyde—Great for bent lamination and complex veneering. Open time up to an hour, clamp time between 5 and 13 hours depending on temperature and mix. Clean up with water.



Measure and mix. Unibond, a urea formaldehyde glue, is available in a two-part system, like epoxy. Once you've measured out the powder and the liquid (1 part powder to 4 parts liquid or 1:6 for a slower dry time) mix them together. Van Dyke pours the mixture into a paint tray and rolls it onto the work. Unibond cures to a rigid, strong bond, making it a solid choice for bent laminations. Roll the glue on one side of each lamination as you stack them.





Into the vacuum. Use shrink wrap to keep the laminations together and positioned on the form. Once it's in the vacuum bag, the suction will pull the laminates tight to the form.



Put it to bed. Unibond requires a minimum air temperature of 70° while curing and extra heat speeds up the cure, so throw an electric blanket over it, turn it to high, and let it all set overnight.

TIP

MINIMIZE BLEED-THROUGH

When you're working with certain veneers such as burl or crotch, this glue can seep through. If you add blocker to Unibond (1 part powder, 1 part blocker, 4 parts liquid) bleed-through will be radically reduced or eliminated.



Epoxy, the problem solver

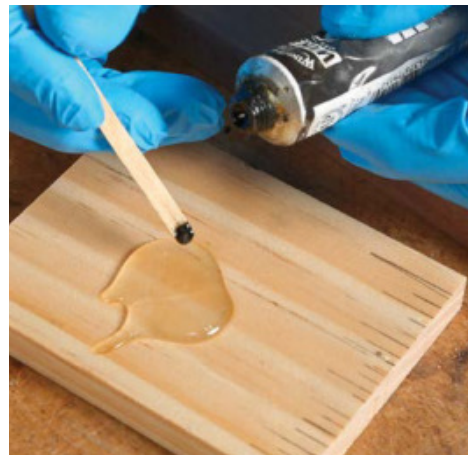
Epoxy is the only gap-filling glue on the market, and this characteristic can be a life saver when it comes to filling knot holes and gouges, and when gluing parts that do not have good mating surfaces. I also use it to prevent fissuring in crotch veneers. When faced with an outdoor project, my glue of choice has always been epoxy.

The working and clamp time of epoxy is easily adjusted by using different hardeners, and adjusting the viscosity is a matter of adding various thickeners to the mix. Thickeners can even be added to transform the glue into a “fairing” putty, which is used extensively in boat building, and thin epoxy can be used to repair damaged or rotted wood.

There are many epoxies on the market, and I recommend choosing one such as West System or System Three, learning the product, and staying with it.

The straight facts on epoxy—It is the standard for marine use and any outdoor project; also suited for gap-filling repairs, and it will stabilize crotch and burl veneer panels. Open time can vary from 5 to 60 minutes, and clamp time can vary as much as 45 minutes to overnight. Clean up with acetone.

FAST VOID FILLING



Mimic a natural defect. Rather than trying to hide a void by camouflaging it, you can use tinted epoxy to fill a hole and imitate naturally occurring flaws like knots or pitch. Mix equal parts of 5-minute epoxy and add a dab of oil pigment to tint. Drop the colored epoxy mixture into the defect, and let it cure, then scrape it flush. Let it fully cure overnight before scraping and finishing.



STABILIZE VENEERS



24-hour epoxy eliminates cracks. Because crotch veneers typically develop fissures over time, Van Dyke coats them with standard epoxy after the veneer is glued to the substrate. The epoxy's thin viscosity allows it to completely saturate the unstable veneer. Because 5-minute epoxy is thicker, it will not saturate the veneer as well. He uses an old credit card to spread the glue and remove any excess before it sets. After it is fully cured all the epoxy is scraped off, leaving behind only the clear glue left in the pores of the wood. The surface is 100% grain filled, speeding up the finishing process drastically.



Cyanoacrylate

When I need to bond something instantly, cyanoacrylate (CA) glue is an obvious choice. CA glue, with or without an accelerator, yields an instant bond. But I have heard of long-term failures, so I limit its use to workshop jigs or other non-furniture applications. I use it to harden the edges of MDF router templates and mat board tracing patterns. Once the CA glue soaks into the edges, it is rock hard.

The skinny on CA glue—Use it to make small, non-structural, fast repairs, and to harden edges of templates. Open time and clamp time are less than a minute. Clean it up with acetone.



Seal and harden. Spreading medium thick CA glue and spraying an accelerator on MDF templates seals the edges and hardens them, allowing a single template to last through years of repeated use.



Mosaic Cutting Boards

Simple, repetitive steps elevate your shop scraps into beautiful, useful kitchen tools

BY JONATHAN BROWER



Like a lot of woodworkers, I realize it must be time to make cutting boards when the scrap pile is at fire-hazard status. I have made many end-grain cutting boards over the years. I prefer them because they stand up well to the use and abuse of knife work, liquids, and the general torture of meal prep and food service. They are great gifts that get a lot of use. A large cutting board can be a focal point for a family preparing and sharing a meal and can become a treasured item in the kitchen.

When I build my mosaic boards, I use a carefully calibrated process to yield specific final dimensions. It is a material heavy process; lots of cuts and surfacing. So, typically, three to four times the board footage is required to net one board foot of finished board. You can dry-clamp the scraps at the beginning and know pretty well where you're heading. I start by gluing together pieces of different widths and lengths much as with any other edge glue-up for a cutting board. After the first glue-up is surfaced, I crosscut it at 90°, and then cut it into strips. I turn the strips end-grain up, and playtime begins as I rearrange the strips and then glue them back together.

Once this end-grain-up assembly is done, I really start slicing, dicing, and reassembling. Instead of making the next crosscut at 90°, I do it at a couple of degrees off 90 before ripping the panel into strips. In the end, I'll have done five separate glue-ups, the last three with strips cut on an angle.

The first batch

For the first assembly, as I'm edge-gluing the long scraps, I try to keep similar pieces of wood together as a bundle: pieces of simi-



It starts with long-grain blanks

The first stage is edge-gluing long offcuts into a panel. Sticks should be similar in height, but width and species can vary.



lar length and width but varied thicknesses. I also consider my machine capabilities here, keeping the bundles under 13 in. wide, under 2 in. thick, and of a manageable length for clamps and crosscuts. Once I prep all the stock and choose the way they'll go together, I glue up and clamp the pieces.

After the first glue-up has been surfaced and crosscut into 2-in.-wide strips, I flip each piece so the end grain is facing up. Here is the sea of possibility. While keeping the end grain up, I begin rotating, turning, and trading the strips until nothing looks the same and it all looks a bit random. Once I am happy with the arrangement, I do the first end-grain-up assembly. When that dries, I unclamp the assembly, scrape any glue, and pass the board through the planer until it is just clean enough to lie flat and safe for a crosscut.



Roll it on and clamp it up. Brower uses a paint roller to quickly spread Titebond III on the sticks. He lines them up on their sides, applies glue, and then flips them upright. With risers beneath to keep the sticks in plane, alternate clamps on top and underneath the assembly and clamp tightly. Use a damp rag to wipe off any squeeze-out.



Flatten it out. After the glue-up has dried, run the assembly through the planer to skim off any remaining glue and flatten it.



Rip and flip

Crosscut your first assembly, rip it into strips, then glue the strips together with their end-grain facing up.



Cut it clean, and rip. With the miter gauge, crosscut the uneven end at 90°, and begin to cut uniform 2-in. strips off the assembly.

A different way to introduce work to the machines

From this point on you'll be working with end-grain-up blanks, and the machine use will need to be slightly adjusted. If you straighten an edge on the jointer by standing the cutting board upright against the fence, you will be jointing across the grain and it will tear out at the end of the cut. You can let that happen and take care of it later by trimming it off, or chamfer the end before jointing to minimize tearout. Similarly, when you send the board through the planer as an end-grain-up piece, the trailing end will tear out. Chamfer that end as well or glue or adhere a temporary support block to minimize or eliminate the tearout.

Also, when cutting the end-grain boards into strips on the table-saw, although you are technically making a ripcut, cutting with the grain and not across it, it's my experience that the tablesaw has to work a little harder. So I slow down my feed rate and use a high-quality rip blade. This gives a safe and clean cut for glue-ups.



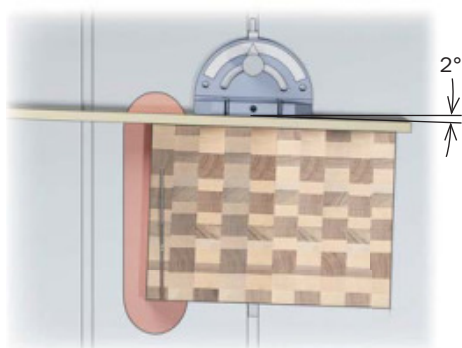
Rip against the fence. When the assembly is narrow enough to safely rip against the fence, Brower sets the fence to the desired width and rips the rest of the assembly into strips.



Arrange and reassemble. Now with the strips oriented end-grain up, twist them, turn them, flip them until you are happy with the pattern. Then apply glue and clamp them into another assembly.

Re-rip at an angle

To create the mosaic effect, Brower introduces angles when ripping the strips apart. This is the first of three angled cuts.



Start with the 2° angle

The three crosscut angles I typically use to create the mosaic pattern are 2°, 4°, and 6°, but I have experimented with slightly higher angles as well. The first of the three angled cuts begins here, with a 2° setup. You'll need an angle-cutting jig or holding system. I use a miter gauge with an extended backer block made from wood or plywood and set the angle.

Make the first angled crosscut to trim one end and establish the angle. Then you can either keep crosscutting with the miter gauge or take it to the rip fence and finish the cuts. You get to decide the width of the strips. I try to keep the first around 1½ in. to 2 in. depending on the size of the pieces and what scale pattern I want. I change the width of the strips with each new angle cut, going down in thickness about ¼ in. each time.

Once I have the strips cut, I line them up in order, and then I flip every other strip long end over long end until a zigzag or herringbone pattern appears. Then I adjust the strips if I don't like what I'm seeing. Once I'm satisfied with the look, I glue and



Establish the angle. Set a miter gauge equipped with a backer board to 2° off 90. Make a crosscut that skims off the end of the assembly and establishes that angle.



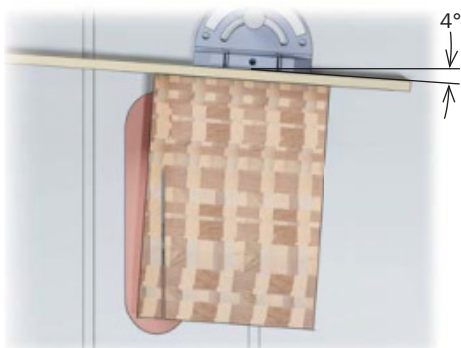
Rip angled strips. Now that the 2° angle has been cut, set the rip fence to the thickness you want and rip the rest of the assembly into strips, always riding the angled end against the fence.



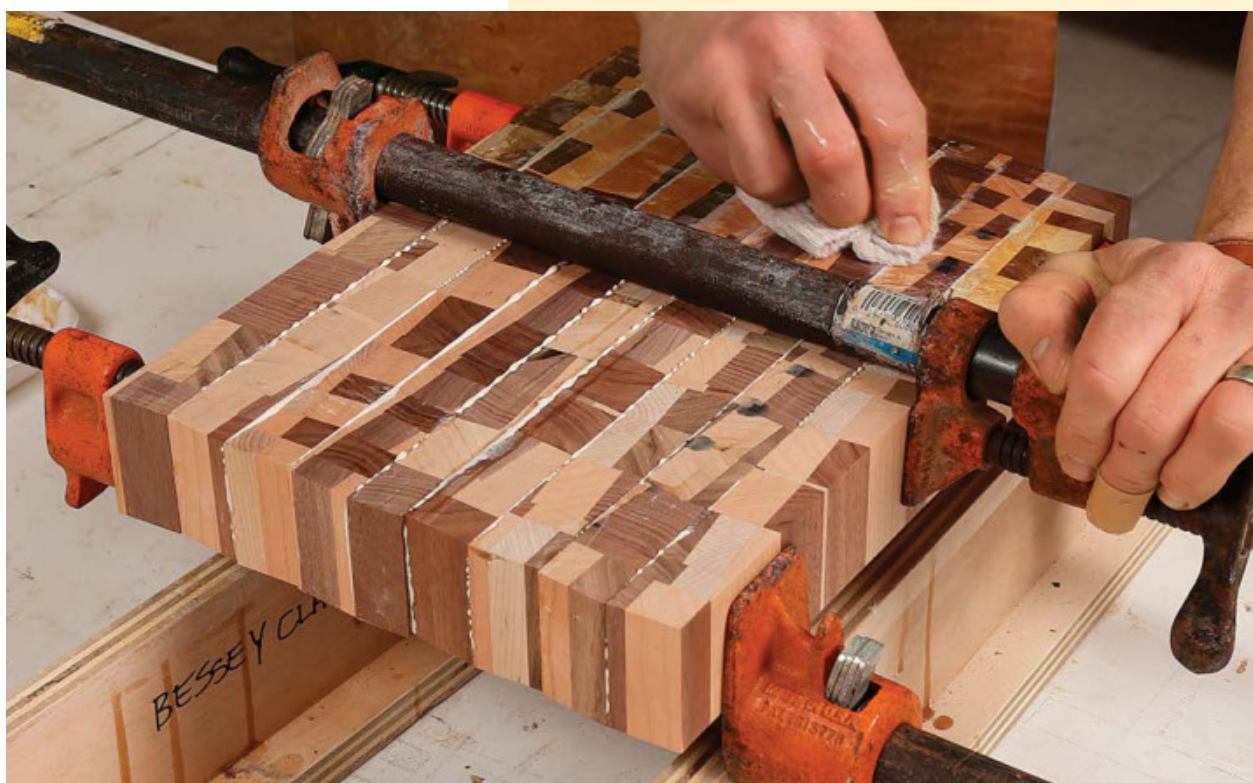
Mix them up. Line up your 2° strips in order. Then flip every other strip long end over long end and you'll see a zigzag or herringbone pattern appear. When flipping, balance the angles so they counteract each other, and you'll end up with a rectangular assembly. Glue and clamp that assembly.

Two more angles

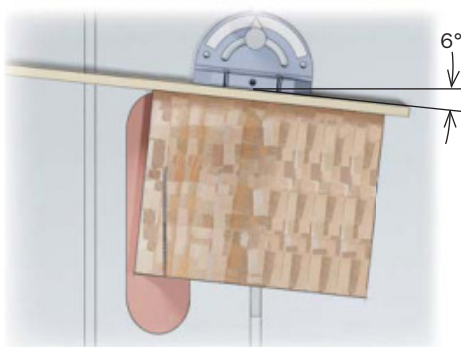
After gluing up the first angled assembly, crosscut it at 4°. But before cutting, turn the board 90° so the cut is roughly perpendicular to the previous gluelines.



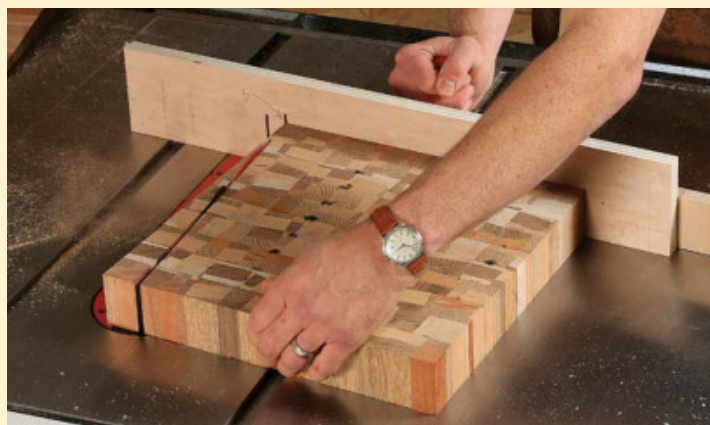
4 degrees. With the miter gauge set to 4°, rotate the board 90° and make the initial crosscut. Once you establish the angle across the assembly, move to the rip fence and cut the rest of the assembly into strips, always riding the angled end against the fence.



Clean the squeeze-out. While the glue is still wet, use a damp rag to wipe away any glue on the surface. Once the glue is dry and the clamps are off, you can run the assembly through the planer to skim off any residual glue and flatten it. Yes, even end grain up.



When the 4° strips are cut and glued up, again rotate the board 90° to make the final cuts at 6°.



The final angle. Trim the end of the assembly to 6°, then move to the rip fence. Brower varies the thickness of the strips, moving the fence closer to the blade for each assembly.



Finishing touches

Add a subtle profile, sand, finish the board, and add feet.

Round over the edges. Use a $\frac{1}{8}$ -in. bearing-guided roundover bit on your handheld router to ease the edges of the board, top and bottom.

clamp the strips into one assembly, clean up the squeeze-out, and let the glue cure.

Move on to 4° and then 6°

Because these cutting boards get a lot of machining, I let each glue-up remain in the clamps overnight. Years ago I retrofitted my 13-in. planer with a helical, carbide-tipped cutterhead. This was not only quieter, but also allowed me to run end grain through it, taking light passes without much issue. After unclamping, again plane the surface to a working flatness and then crosscut the rough edges off the piece so it is ready for the next angled crosscut. This time, change the angle to 4°, and rotate the glued-up panel 90° so your crosscut is roughly perpendicular to the previous gluelines. Then rip the board into strips.

Once you have the new strips cut, it's the same song and dance with arranging the pieces. Feel free to move pieces around; I eyeball the pattern until I like what I see, then I glue up and clamp.

Now move on to the third angled glue-up, with a 6° angle this time. After this round, there won't be many parallel pieces left. You can keep going, but this is where I typically stop.

Finishing touches

After the last glue-up has gone through the planer and is flat, I take the board to the tablesaw for final sizing. Then I use a drum sander to flatten the surfaces, remove planing marks, and bring it to 150 grit. You also can use a belt sander, an orbital sander with low grit to start, or a super sharp handplane with a low angle setting. I rout a $\frac{1}{8}$ -in. roundover along the edges and sand the surfaces up to 220 grit. The finish is a cocktail of four parts mineral oil and one part beeswax. After that, I use a little mineral oil when the board dries a bit to keep up the appearance. □

Jonathan Brower makes cutting boards and furniture at his business, Mosaic Woodworks in Newport, R.I.

www.finewoodworking.com



Work the grits. Sand the top and bottom surfaces of the board. Work from 150 grit up to 220 grit.



Finish coat and feet. Brower uses an oil/wax cocktail made from four parts mineral oil and one part beeswax. He applies the finish on the bottom of the board, and then screws the rubber feet in place. Then he flips the board and applies the rest of the finish.



Developing a Furniture Style

One maker's path to powerful, personal designs

BY GARRETT HACK



Every aspect of building furniture involves design, from first sketches to choosing materials, proportioning the parts, fashioning details, even deciding on the right finish. It will always be a challenge. As I have evolved as a designer I've developed a personal style, a visual vocabulary of design ideas that I am constantly exploring, refining, and adding to.

Educate your eye

Design is about looking—really looking—and making sense of what you see. Why does one thing appeal to you strongly and something else less so? Stimulating ideas can come from nature, architecture, a painting, anything that attracts your attention. I have always been a strongly visual person, no doubt influenced by



Look, then leap. For Garrett Hack, observation is the root of furniture design. The catalyst for a new piece might be found anywhere: buildings, bridges, period furniture, or natural forms, like the shells that inspired the rippled top and apron on the pear and rosewood desk above.

a mother who believed that every museum was worth visiting, and travel was always a rich source of new ideas. My visual curiosity nurtured at an early age is even greater today, as I more easily connect ideas and see patterns that inspire future work. This deep well is my strongest asset as a designer.

I remember one instance many years ago of really looking at and trying to understand a complex Philadelphia highboy at the Museum of Fine Arts, Boston. I was studying furniture at Boston University's Program in Artistry and, through museums and reading, I was learning about the foundational styles of our craft. This highboy was not that appealing to me, but as I forced myself to study it I began to appreciate its shapes, proportions, the organization of its many elements and



Shaker study

Building on a Shaker foundation. Early in his career, Hack closely studied the forms of Shaker furniture, like the chest above, attracted to their directness, simplicity, and clarity. His own pieces, like the cherry and maple table at left, clearly reflect their Shaker roots but have a crispness and lightness of their own. In his Lil Shaker table (below), he used some brilliant curly birch and an asymmetrical arrangement of drawers, pushing the design to a more distinctly personal place.



details. It was considered to be a sophisticated masterpiece by many; what could it teach me about design? That I can still reconstruct that piece in my mind says that some design influence lasted, but maybe just as important was the lesson that there are useful ideas everywhere if you look for them.

Trust your ear

My design sense and furniture making skills were really propelled by my years at Program in Artistry—far further and faster than if I had been working alone. It was a small shop with a group of dynamic makers with different experiences, where design and technique was a daily discussion and a huge amount of cross-pollination went on. I was challenged to design



Sequential demilunes

Exploring a Federal form.

If Shaker was Hack's first love in furniture, Federal was his second. He was drawn to its lightness, its formal lines, and its often exuberant detailing. He has designed variations on the Federal demilune table form repeatedly over the years, each time exploring new details. His cherry and bird's-eye maple Demi Demi table, above, features a small demilune box fixed to the top. In X-Ray, below, the form is familiar but the vibrant curly birch primary wood and the central panel in rosewood, with an inlaid abalone accent, give the piece an almost electric effect. Hack flipped the script altogether with *Takin a Shine*, at right, whose shape is a demilune in reverse. The Macassar ebony case, amboyna burl top, bird's-eye maple drawers, and rosewood legs with silver feet elevate the piece to a rarefied realm.



and build piece after piece, with immensely useful critiques of each by my teacher Jere Osgood and peers.

Critical feedback is key to moving forward and developing a style, especially working alone as I do. Which ideas are worth exploring, and which ones should be rejected or reworked? The confidence to be self-critical is a good start. For the 20-plus years I have been a member of the New Hampshire Furniture Masters, I have gotten valuable criticism from my peers. But there has been no more humbling or honest feedback than our annual auction, where for many years I have presented my best work to an educated marketplace. Finally, I am lucky to be married to an artist whose judgment can be keen.

I followed the Shakers

My path into designing and making furniture was through Shaker work, simply because it was so clear and accessible. Their use of beautiful native woods, pleasing proportions, small but significant details, and occasional asymmetry have been lasting influences.

Understanding how every wood has different qualities and an optimal use is essential to building furniture. Shaker work taught me about maple for strong chair legs, tough oak for thin spindles, butternut for



large door panels, stable pine for drawer bottoms and case backs, and cherry or bird's-eye maple for beautiful drawer faces. Shaker chests of drawers, and built-in cases of drawers and doors, were lessons in proportion and occasionally asymmetry, a design idea new to me. I could see how the few but lively details they favored contributed to the whole—case tops with rounded molded edges, table aprons outlined with beads, and drawers with delicate “thumbnail” edges. Attention was paid to every surface, edge, and joint.

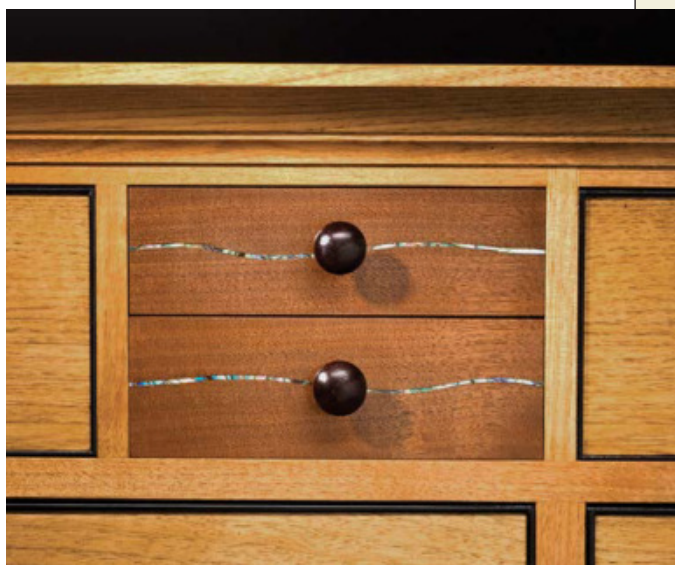
Federal furniture offered a second pathway

Another leap for me was discovering the Federal style, with its exuberant inlays and sensuous shapes, rich imported woods, and complex design ideas. I reimagined classic demilune tables and serpentine chests in my own voice and taught myself how to fashion the details. I even went into the woods in search of wildly figured crotch or other woods for panel and oval inlays. Once I understood the basic techniques—fine

Design from a distance



Levels of attraction. Hack wants his furniture to be visually striking from across the room, but also engaging from a few paces away, and still more fascinating when you are close enough to touch it. He makes sure that at each level there is much to explore.



Put delight in the details. The main drawers in Hack's butternut chest are outlined with ebony cock beads; the two small, stacked walnut drawers at the center feature wavy lines of abalone inlay. Another pair of Lilliputian drawers awaiting examination has migrated toward the back of the chest.

line inlays, for example—it was natural to try lines of black and white dots and dashes signing my name in Morse code, or rippling lines of silver or shell.

Diving into details

Through studying and making Federal-inspired work I developed a love and appreciation for the importance of details to my furniture. I want to make pieces rich with visual interest, with details sometimes visually bold and other times far more subtle and only discovered by living with my work for a long time. As my furniture has evolved, my favorite details have become more complex. Today they are easily the most fun part of designing and building furniture, where each new detail spawns many others.

You can almost trace my evolution as a designer by how I've used beads. Initially I copied the Shakers



Serpentinism



Find a vein of ore and mine it. Hack was attracted to the serpentine forms he saw in some period furniture, and employed them in this early chest of drawers in cherry as well as in a Federal-inspired hall table. Building these pieces, he learned techniques he would later use to make more distinctly personal designs.



Riding the wave. As Hack continued to explore curved casework using bent lamination, more traditionally inspired work gave way to innovative pieces like his Wavy Cabinet in butternut and walnut (left), built to hold violins, and Weikewa Shimmering in ebony and curly birch.

Beadwork



A chronology of beading. In his early chests, following the lead of the Shakers, Hack often gave drawer fronts incised beads like those from a cherry huntboard (far left). Later, as he began favoring more emphatic details, he began applying cock beads to drawer fronts in contrasting woods, as with the ebony beads on a butternut chest (left). Later still, he started experimenting with applied beads that ripple, like the ebony one along the bottom edge of the apron on the pear and cherry demilune table below.

and cut them along an edge, to round and protect it. Besides being practical, I liked that the bead catches your eye as it outlines a part. Federal craftsmen made the bead a separate applied piece of wood, a cock bead, so I started making mine of strongly contrasting woods or from alternating pieces of black ebony and white holly. Sometimes they were not beaded at all, but just fun accents to an edge. Lately I have been adding sections of turquoise or recycled ivory, but it could be silver or brass next week. Sometimes the profile is round, sometimes oval, or two beads of different sizes. My latest cock beads are even more fun as they ripple along an edge. Why not?

Design for distance—and intimacy

Really I want to build furniture that will attract your attention on many levels, not just in the details. I want the form and colors and shapes of the piece to attract your attention from across a room, and curiosity to draw you closer. At some distance more comes into focus—the proportions, the grain of the wood, the larger details, shapes of moldings, range of colors. But I still want you to come much closer, to have an intimate connection with my furniture by feeling a finely chamfered edge, the polished surfaces left by my planes, the shape of a fine ebony bead outlining



Playing with inlay

Pure pleasure in the details.

As soon as Hack learned the basics of string inlay, he began exploring and experimenting. Never content to make anything twice, he is constantly looking for new ways to provide pleasure and surprise—for the maker as well as the viewer.



a drawer. Some I want you to take much longer to discover, if you ever do.

A synergistic trio

What pushes what I design and build today is a strong aesthetic sense—knowing what appeals to me and why—filtered through my greater knowledge of materials and effective building techniques. The three have a synergistic relationship, where slight changes in one can have a dramatic effect on the others, leading to a visually stronger piece that's easier to build.

This can be as simple as

knowing that by choosing to work with curly birch instead of curly maple—though the two look very similar—I'm in for a far more difficult time shaping and smoothing each part.

My technical knowledge is broader and more useful. On my first demilune table, the elliptical shape of the front apron where it joined the rear leg made for a tricky joint, an angled mortise and angled tenon that required careful paring to fit. By turning the back leg slightly to meet the apron more head on—a shift that actually looks better—only an angled tenon is needed and I can use a shoulder plane to fit the joint perfectly.

Progress is still additive. Once I understood how to laminate curved parts, I saw how much stronger they were (so parts could be thinner and more elegant) and more efficient, since I could get a nearly finished part off the bending form by polishing the inner and outer surfaces before bending. The next logical step was making tapered laminations for the back legs of chairs, or today, laminations that ripple. After making some large coopered water tubs, it wasn't much of a leap to making coopered curved furniture forms, and then highlighting the joint between the staves with those same beads I've loved since my Shaker days. Tapering the staves led to more interesting curved forms with changing shape. Curved coopered forms will keep me engaged for a long time.

Design and construction challenges have never gone away. When I am up against a new challenge, thinking about it can only help so much; a solution often comes more quickly from leaping in and trying something. Experience gives me a general direction. Working through each problem always opens up other paths worth exploring. And if I have learned anything, it's that there are always new paths to wander. □



The broken string. After developing a segmented straight line inlay in contrasting colors, Hack began using it on curves, such as those outlining the oval panel of curly birch veneer and running down the edge of a curved leg. He'll often inlay abalone (as above right), stone, or metals, and his inlaid lines sometimes drift off into dots. Innovation keeps things fresh.

Garrett Hack builds furniture in Thetford Center, Vt.

Cooperage



Barrel staves spark a style. After enjoying the process of building a couple of large water barrels for use on his farm, Hack began experimenting with stave-constructed casework. His Port and Starboard cabinets (above), built in Douglas fir and cherry, have rosewood beads between the Douglas fir staves. To keep things exciting, Hack later built Pleated (below), whose laminated curly birch staves are tapered and curved.





Make and Fit a Dovetailed Drawer

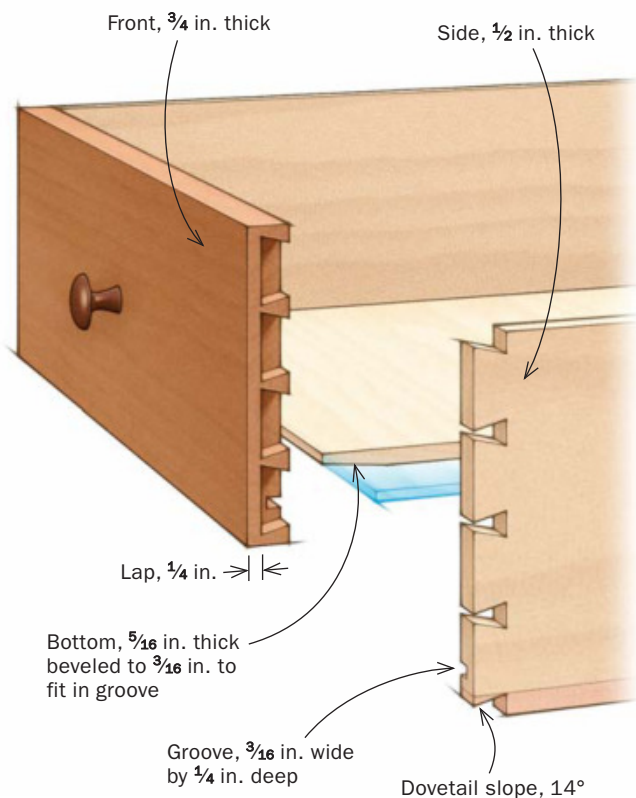
A recipe for drawers that look great and work flawlessly

BY TOM McLAUGHLIN

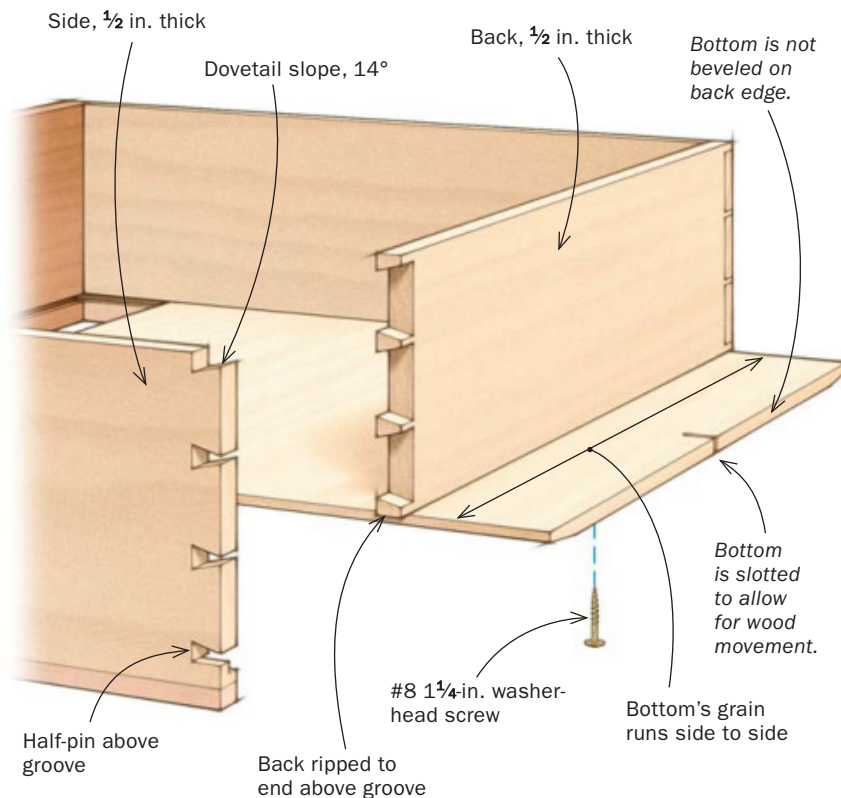
Drawers will add flavor to any project. On top of the design opportunities they open up, they add a large degree of function. The last bit of spice comes in building and fitting them. A drawer that operates poorly or looks sloppy will leave a bitter taste in your mouth, whereas an attractive, smooth operator is satisfying.

Dovetailed drawers with solid-wood components are the traditional option, and the one I typically turn to for furniture. From cutting the dovetails to planing the sides to installing the bottom, I'll take you through the steps necessary to make drawers that look and work just right.

HALF-BLIND DOVETAILS IN THE FRONT



THROUGH-DOVETAILS IN THE BACK

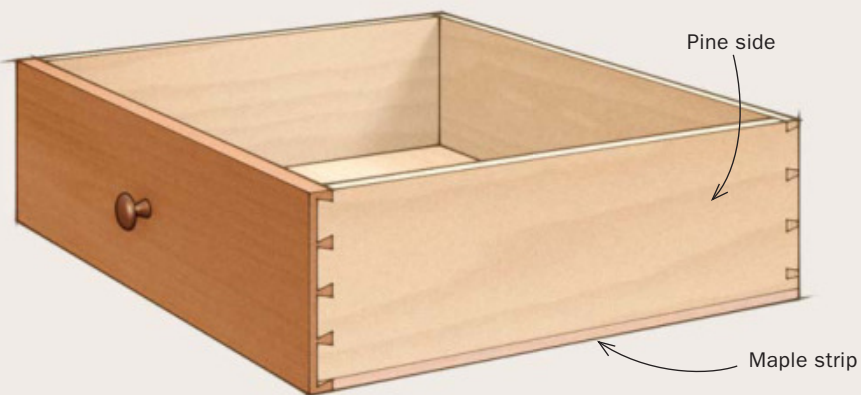


TIP



LAMINATE SIDES WITH HARD-WEARING WOOD

Because McLaughlin has repaired drawers with softwood sides that have dished out from use, he laminates maple onto the bottom of his (and pairs them with maple runners). To simplify the process, he glues an overwide maple strip to the bottom of two drawer sides at once. He then saws the two apart and joints their maple bottoms.



Fit the front to the case



SIZE THE PARTS

Drawer fronts should have a small gap top and bottom, but be snug side to side. When ripping the drawer fronts to width, size them so they leave a $\frac{1}{32}$ -in. gap to the case. Conversely, their ends should have a snug press-fit, which will be addressed after building the drawer.

HALF-BLINDS

The drawers get half-blinds in the front.

After cutting the tails on the sides, scribe their shapes to the drawer front. McLaughlin uses a flat-backed marking knife because he can easily keep it tight to the tails for accurate marking.



GROOVE FOR THE BOTTOM

Strategic sizing

The goals for a drawer are to have even reveals around the front and a smooth ride in and out of the case all year long. This result starts when sizing the front, back, and sides.

I start by ripping the drawer front and sides to width so that there's a gap of approximately $\frac{1}{32}$ in. Later, you'll plane this as necessary to account for seasonal movement. The back's width is determined after you run the grooves for the drawer bottom.

The sides are mostly pine, a traditional secondary wood because of its light weight and stability. But, it's also quite soft. So before ripping the sides to width I laminate on a strip of maple, a hard-wearing wood. These two woods give me the best of both worlds. I use maple runners as well.

The length of the front and back should be sized for a gentle friction fit in the drawer opening. This fit leaves you room for cleanup and refinement after dovetailing, since I recommend cutting the joints so that the pins are a little proud. It's easier to level them to the sides than vice versa.

Dovetails and grooves

To keep the drawer front uninterrupted, I use half-blind dovetails to join the front to the sides. At the back, I prefer through-dovetails because they're easier to cut, although there I need to be mindful of the drawer bottom.

Start by cutting the half-blinds, locating the bottom tail so it will hide the groove for the drawer bottom. Then run the grooves.

Now you can determine the back's width. The drawer back needs to be narrower than the sides; its bottom edge should align with the top of the groove, allowing the drawer bottom to be slid in just beneath it. This width is easily

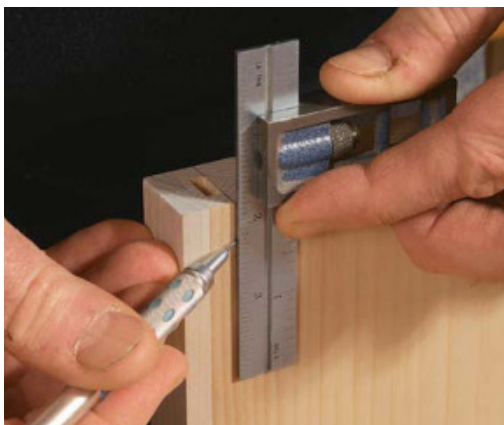


Front and sides get the same groove. The grooves in the front and sides need to line up, so run these parts at the same time. Because the front joint is a half-blind, this through-groove will be hidden in front.

Clearance for the drawer bottom

Spacer helps lay out width of back.

To allow the drawer bottom to slide in, the back sits above the groove. To size the back, McLaughlin places a spacer in the groove, abuts the back blank to it, and marks the width so it ends up flush with the top of the drawer. He then rips it.

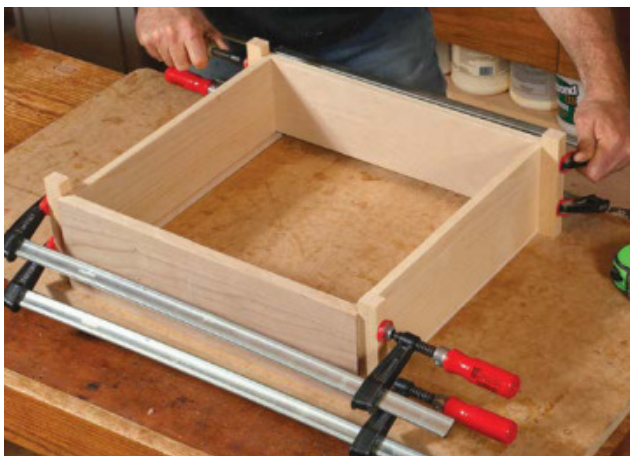


The half-pin above the groove means a 90° cut. The back of the drawer is through-dovetailed. To accommodate the groove, McLaughlin needs a half-pin that ends where the groove starts. He uses a square to lay out this cut on the sides before laying out the rest of the tails.



Spacer aligns parts when transferring the joinery. The spacer indexes the drawer back precisely at the top of the drawer bottom groove, streamlining the process when you knife the tail board to the pin board. After cutting the joint, you should be left with a half pin that rests just above the groove.

Glue and fit



Seat the joints, then check for square. Gently clamp the drawer after applying glue. Before the glue sets, remove the clamps. The dovetails will hold the drawer together and removing the clamps lets you make minor tweaks if you're not square.



Level the pins to the sides.

McLaughlin cuts his pins so they sit just a hair proud of the sides. This is because it's easier to level the pins to the sides than vice versa, and it begins the process of fine-tuning the side-to-side fit of the drawer.



determined by placing a spacer in the groove, registering the back on it, and marking the back's width so it will be flush with the top of the sides. After that, it's just a matter of ripping the back to width.

Now I tackle the through-dovetails in back. Because their layout needs to account for the drawer bottom, I hold off on them until after I have ripped the back. To allow for the bottom, I use a half pin just above the groove. I space the rest of the joint from there.

Cut the tails and pins and glue up the drawer box. To limit headaches in the next step, fitting it, check and double-check it for square.



Plane the sides until the drawer slides well. The drawer should slide smoothly and not bind. Sneak up on this by repeatedly checking the drawer in the opening as you carefully plane down the sides.



Flush the front



Install the drawer stops first. For this case piece, McLaughlin places the stops behind the drawer fronts. To locate the stops, he sets a combination square to a hair over the thickness of the drawer front, and uses that setting to place his stops. The stops are lined with leather for a softer sound when the drawer closes.

Fine-tuning the fit

With the drawer pretty much made, now's the time to adjust its fit, namely how it looks in the opening and how well it rides on the runners.

Begin by lightly hand-planing the pins, which were left slightly proud, flush with the drawer sides. Because the front and back started out as a press-fit end to end and you glued up the drawer square, flushing these pins should leave you with a drawer that travels well. Still, you may have to plane the sides too to get it moving as smoothly as possible in its opening.

Next, skim-plane the bottom edges of the drawer front and drawer sides smooth, and then add a slight ski-tip shape on the back of the sides' bottom edge. This ski tip lets you slide the drawers in place easily without catching a hard back corner.

Third, make sure the drawer fronts are flush with the case. Start by installing the drawer stops, since this will determine where the drawers actually stop. Then, with a drawer in place, feel around the front and mark where it sits proud of the case. Carefully plane down these areas until the front is flush.

The location of the stops depends on the kind of piece you've built. In a piece like the one pictured, where the case sides' grain runs vertically--perpendicular to the grain in the drawer sides--install the stops right behind the drawer front. Putting the stop there lets the case move seasonally while keeping the front flush with the opening. (Additionally, cut the drawer sides $\frac{1}{4}$ in. short of the back to leave room for the case's seasonal movement.)



Feel for high spots, then plane them down. Run your hand around the drawer front to feel where it sits. Mark the high spots with a pencil and carefully use a handplane to knock them down.



Install the bottom

Bevel the bottom on the front and ends. McLaughlin does this on the tablesaw with a tilted blade and a tenoning jig that slides along the fence. He then hand planes the bevels to fit and to remove sawmarks. Leave the back edge square.



Slide the bottom in place. After slotting the back edge for a screw, install the drawer bottom in the grooves. The bottom's grain should run side to side.



A glue block secures the front. To keep the bottom panel in the front groove, McLaughlin uses a short glue block beveled to the same angle as the panel. He uses hide glue, which is reversible, in case repairs are needed later on.

If the drawer is in a table, where the aprons' grain typically runs horizontally, you can put the stops at the back of the drawer since the piece's grain runs the same direction as that of the drawer sides.

The last step is to plane around the top of the drawer sides and front to create space for seasonal movement and a parallel reveal when the drawer is closed. Then true up the ends of the drawer front, making them parallel with the case sides and their reveals even.

Add the bottom

To continue the traditional look, I often make drawer bottoms from white pine for its lighter weight and dimensional stability. They're also beveled underneath to fit into the groove without thinning the panel too much. The grain should run side to side. Otherwise, seasonal expansion will push the bottom against the drawer sides.

Secure the bottom's front edge in place with a glue block, beveled to match the bottom. I like hide glue here because it's reversible. The back of the drawer is held with one or more washer-head screws running through a slot in the bottom's back edge and into the drawer back. This arrangement keeps the bottom tight to the drawer front while directing seasonal movement to the back, where it won't affect the drawer's look or operation. □

Tom McLaughlin teaches at epicwoodworking.com.



Washer-head screw secures the back. The glue block locks the bottom's front edge in place, directing the seasonal movement toward the back. To accommodate the movement, screw—don't glue—the bottom to the drawer back and cut a slot around the screw.

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Inspiration for our readers, from our readers



GREG MAZUR

Philadelphia, Pa.

Greg built his Camden Cabinet while studying at the Center for Furniture Craftsmanship in Maine. The door panels are hand-carved and ebonized with a combination of steel wool/vinegar solution and quebracho bark tea.

WHITE OAK CABINET, WALNUT STAND
12D X 20W X 42H

Photo: Mark Juliana



WILLIAM HARMSEN

Wabash, Ind.

This live-edge table started with a request from a woodworking friend for help machining large slabs for the top. Eventually the project evolved to where William also designed the base, with its half-lap and mortise-and-tenon construction.

WALNUT, 49W X 96L X 30H

Photo: Nichole Howard



PERRY WALLACE

Dallas, Texas

This French-style easel was made for Perry's daughter, who runs an art business. They decided on the style together, and a SketchUp model helped Perry work out the details. Inlaid brass plate reinforces the wear points where the legs lock into place, and a custom drawer pull and other custom wood hardware add a special touch from Dad.

WALNUT AND MAPLE
24D X 18W X 6½H (WHEN CLOSED)

PAUL LITCHY

Franklin, Tenn.

Paul got the construction details of this blockfront kneehole desk from *Construction of American Furniture Treasures* by Lester Morgan (Dover Publications, 1975). Among the many details that challenged him during the build were the hand-cut drawer dovetails, the connection of top to base with parallel sliding dovetails, and the stile-and-rail construction of the mahogany back.

HONDURAN MAHOGANY, 21D X 40W X 30H

Photo: Skip Jackson



TODD BRADLEE

Bishop, Calif.

Todd makes these cube stools in both ash and walnut, with woven leather seats. His goal was to design a comfortable stool that would be lightweight, strong, and stable, and that he could upholster himself. "Once in a while I come up with a design where I am super happy with the outcome and this piece is one of them," he said.

ASH/WALNUT, 17D X 17W X 17H

Photo: Benjamin Ditto



JIM TUTTLE

Pine Mountain Valley, Ga.

A move from the Atlanta area to an 8-acre farm in the Georgia countryside prompted Jim to fulfill a longtime ambition to build a dovetailed blanket chest. "I wanted to maintain the simplicity of the traditional dovetailed box design, but add a set of unique characteristics to it while not overdoing it," he said. The curved drawer fronts, feet, and aprons softened the shape, while the wenge leg inlay and lid backstop, and the rosewood pulls, added some contrast.

CHERRY, CURLY CHERRY VENEER, CEDAR, WENGE, BRAZILIAN ROSEWOOD, AND MAPLE
23D X 48W X 23H



ALBERT KLEINE

Laurel, Md.

This tea caddy gave Albert the chance to explore different wood textures in a single piece. The open grain of the wenge, the smooth rosewood handle, and the charred red oak liner all give a different experience when felt with the hands. It's inspired by the work of Peter Spaulding and Michael Cullen.

WENGE, RED OAK, EAST INDIAN ROSEWOOD, 4W X 13L X 6H



ISRAEL MARTIN

Cantabria, Spain

Simple wood, good proportions, and the use of the wood grain to enhance the design are the hallmarks of Israel's Shaker-style cabinet.

SOUTHERN YELLOW PINE, RED CEDAR, AND AMERICAN WALNUT
11 $\frac{3}{4}$ D X 17 $\frac{3}{4}$ W X 70 $\frac{3}{4}$ H

NOLAN WELLS

Providence, R.I.

The main idea in designing these shelves, Nolan says, was to keep them modular and to allow for multiple configurations that are easy to switch. The vertical supports lock onto a header board via a French cleat.

CHERRY AND MAPLE, 12D X 84W X 96H





DARREN ALMEIDA
South Dartmouth, Mass.

This desk was based on traditional tambour desks from the Federal period, but Darren updated the design. The two drawer fronts on the lower section are actually a single hinged false front that opens to reveal shelves for audio equipment. Steve Latta's Federal reproductions were an inspiration.

SIPO, CURLY MAPLE, HOLLY, GUM
21½D X 34½W X 48H



GEORGE CALLAGHAN
Queenstown, Tas., Australia

To make the parts for these birds, George glued layers of veneer with their grain at 90° and used an iron to shape the pieces over curved surfaces. He says he "set" the curves with a bag of frozen peas.

VARIOUS AUSTRALIAN WOODS, 8D X 10W X 24H



MICHAEL CULLEN
Kent, Conn.

Michael made this entry table for clients who lost their home in the 2017 Tubbs Fire in California. Also lost in the fire was a small table Michael had made that was fairly close in design to this one. This new piece is called "The Lilies" and was inspired by lily pads. "The clients were so happy to see the piece in place since everything they owned was lost to flames," Michael said. "At one point I said, 'Now you can begin. This piece will set the tone for creating your new home.'"

CLARO WALNUT, 24D X 120W X 42H



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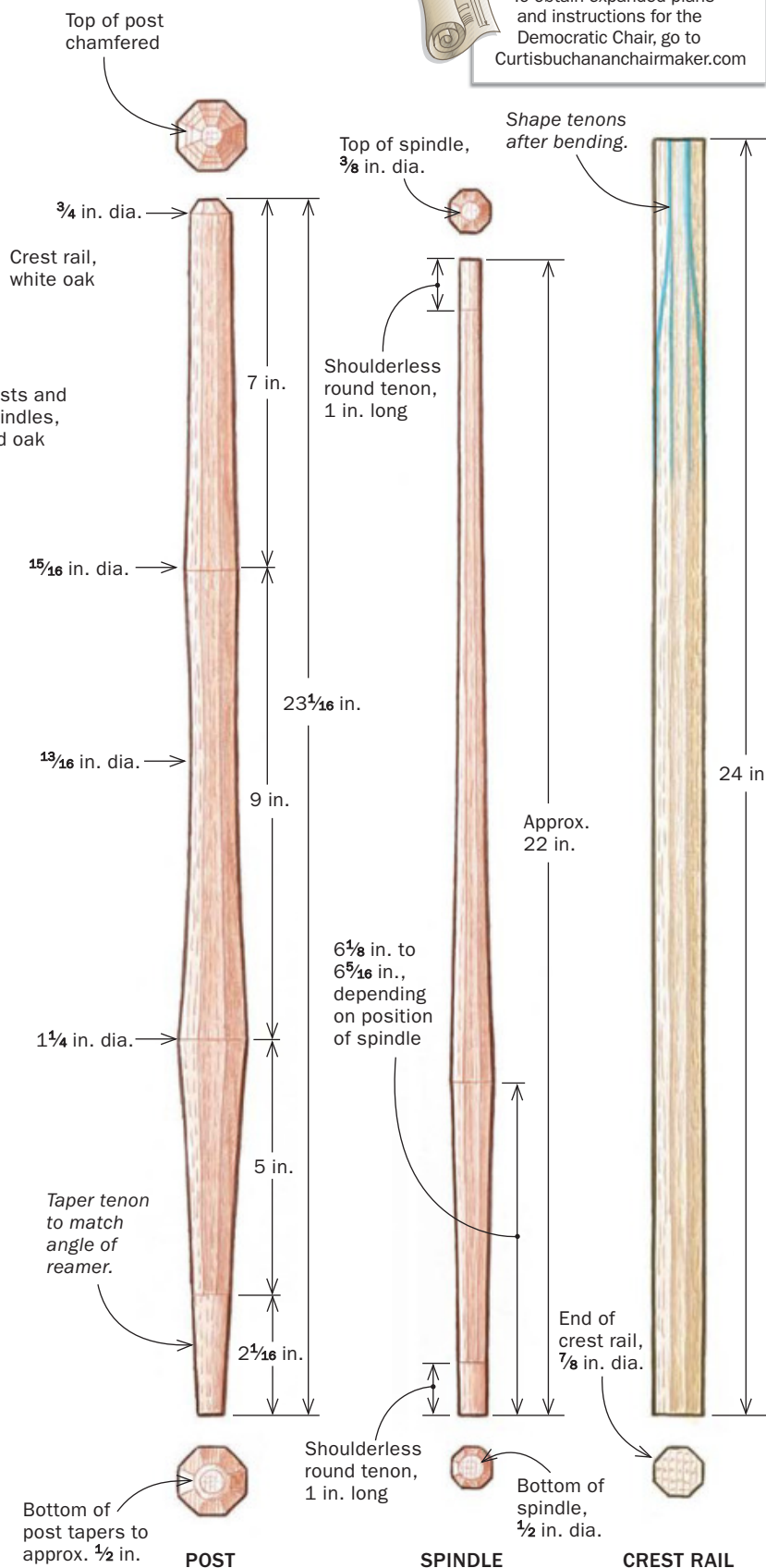
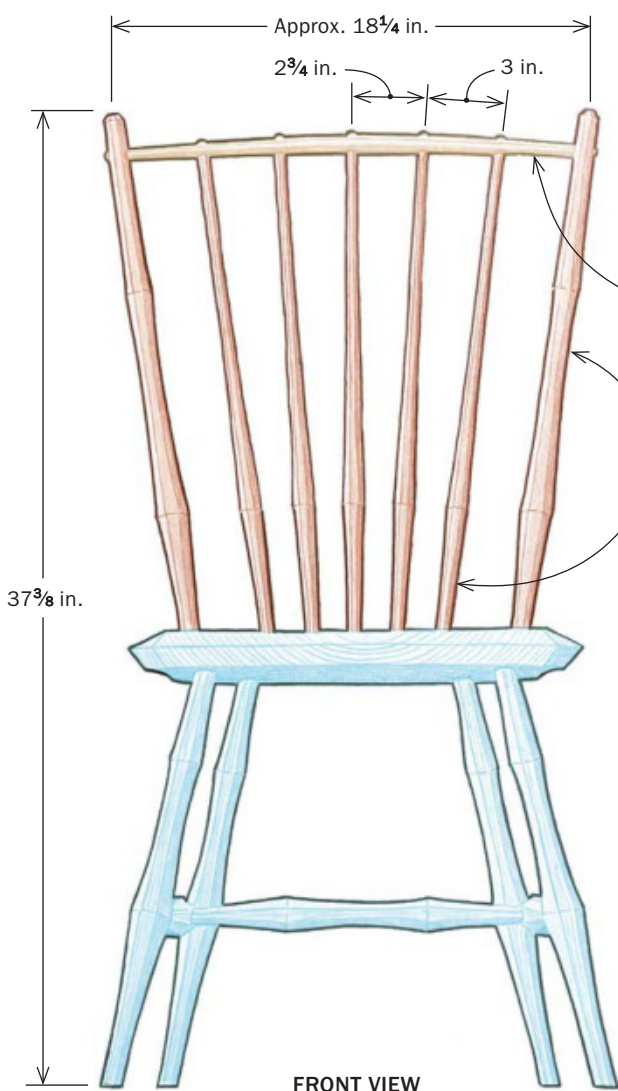
BY CURTIS BUCHANAN

PART 2: POSTS, SPINDLES, AND CREST RAIL



UPPER STRUCTURE

All parts except seat split from green wood and shaped with a drawknife.



This chair, which I call the small-d “democratic chair” because I designed it to be widely accessible, made with as few tools and as small an investment as possible, is also one of my favorite chairs to build—it’s just fun to make. I described building its undercarriage in *FWW* #292, and here I’ll explain how I make the upper half. Like the legs and stretchers in the first part, the spindles, posts, and crest rail that comprise the upper structure are split from the log of any good hardwood.

Shaping the parts

First split spindle blanks from the log, then shape them with a drawknife. I flatten one radial face and the adjacent tangential face. Once the other two faces are shaped to dimension and the spindles are square, I create the lower and upper tapers. Then, still using

SPINDLES



Split the spindles. With a hatchet and maul, split out blanks for the spindles from a green log. Aim for blanks roughly $1\frac{1}{2}$ in. square. Use wedges and a sledgehammer to do the initial splitting of the log.



Square up your stock. Flatten one radial face of the blank, then flatten an adjacent tangential face. Set a marking gauge to $\frac{7}{8}$ in. to scribe lines parallel to the flat faces, and drawknife the last two faces flat.



Taper the square. Once you've got the spindle square, use the drawknife to taper the four faces from the peak toward both ends.



Turning a square taper octagonal. Having shaped the spindle to a square-sectioned double taper, shave off the corners to make it octagonal. After drying the spindles, form the tenons at each end with a drawknife, fitting them to a test hole. Other options for cutting the tenons: spokeshave, tenon cutter, steel drive plate.

CREST RAIL



Fit the crest rail to the bending bar. After splitting out the crest rail blank, squaring it up with the drawknife, and then taking it octagonal, Buchanan shaves one end round to fit into a cheater bar that will help him bend it.

the drawknife, I shape the spindles to an octagon and set them aside to air-dry. I finish the drying by placing them in a light-bulb kiln or near a woodstove. Once the spindles are dry, I cut the upper and lower tenons to size with a drawknife.

I make the posts in much the same way I shaped the legs in Part 1. They get shaved square first, then tapered toward the ends and shaved to a slight saddle between the peaks. After carving off the corners to give the posts an octagonal cross-section, I shape the tapered tenon at the bottom slightly oversize. I let the posts sit out for a week or so, and then superdry the tapered tenons and size them to fit my reamer. I then bore and ream the post mortises in the seat.

Shape the crest rail by first flattening one side with the drawknife, being sure to follow the long wood fibers. I start in the radial plane for easy cutting. Flatten the adjacent tangential plane, then cut the other two faces to a $1\frac{5}{16}$ -in. dimension. Finally, shape the crest rail to an octagon with the drawknife.

If you have access to good bending wood like white oak, you can bend the crest cold. Otherwise, you will have to steam it to get it to bend. After bending, place it to dry in an area with low humidity. You can speed up the process by putting it in a light-bulb kiln or near a woodstove.

Drill and assemble

You are now ready to drill mortises in the posts to accept the crest rail tenons. First place the posts in their respective seat mortises and use spring clamps to hold the crest rail to the back of the posts. Rotate the crest so it crowns upward about $\frac{1}{4}$ in. Next, lining up your drill bit with the extra length of the crest rail, drill the mortises. Measure between the posts at the mortises to determine the length of the crest rail. Then, if you haven't done so already, shape the crest rail tenons. Assemble



Some bend without steam. When bending certain species of green wood—like ash, and the white oak shown here—the crest rail can be bent cold. With other woods, Buchanan will steam the crest rail for 30 minutes before bending.



Rudimentary bending form. Buchanan's adjustable peg-and-wedge bending form is quick to make and easy to use.



Cut tenons on the curved rail. After letting the crest rail cure on the bending form for several days, Buchanan shapes overlong tenons on both ends.

DRILLING AND ASSEMBLY



Crest rail tenons guide the drilling. After setting the back posts in place, Buchanan clamps the crest rail to them from behind. Then, as he drills mortises in the posts, the crest rail's overlong tenons serve as a visual guide to the angle of the mortise.



Follow the dowel. When mortising for the crest rail, Buchanan stopped when the bit's lead screw just emerged. To finish, he takes a few turns of the brace from the other side. To guide this final drilling, he puts the post in a vise and a dowel into the mortise, then aligns his bit with the dowel.

Spindle mortise layout. Once the crest rail tenons are fitted, Buchanan transfers his centerline from the seat to the rail and lays out the spacing for the spindle mortises top and bottom.



the crest rail to the posts and place them as a unit in the seat.

Lay out the position of the spindle mortises in the crest rail and on the seat. Drill $\frac{3}{8}$ -in.-dia. through-mortises in the crest rail, sighting down to the locations of the corresponding layout marks on the seat as you do so. Then switch to a $\frac{1}{2}$ -in.-dia. bit with a drill extension to bore the spindle mortises in the seat. Placing the point of the bit on the layout mark on the seat, lean the extension against the crest rail at the corresponding mortise. Drill all the spindle mortises in the seat using this method.

With all the parts and joints ready, insert the spindles into the seat, then add the crest rail and posts. With a chisel, split the tops of the spindle tenons where they extend through the crest rail, and glue and drive in wedges to lock them in place. After cutting off most of the extra length of those wedged tenons, dome what's left with your drawknife.

Curtis Buchanan makes chairs in Jonesborough, Tenn. Special thanks to Jeff Lefkowitz, whose drawings of the chair provided the foundation for the ones in this article.



The long and short of spindle mortising. After drilling through-mortises for the spindles from above in the crest rail, Buchanan adds an extension to his auger to drill the stopped spindle mortises in the seat.

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DRILLING AND ASSEMBLY CONTINUED



Upper carriage assembly. After drilling the spindle mortises, remove the posts and crest rail, and insert all the spindles into the seat. Then gradually fit the posts and crest rail.



Wedging the crest rail. With the top spindle tenons still overlong, cut the crest rail tenon to length and drive a wedge to lock it in place.



Trim and lock the spindle tenons. Buchanan trims the spindle tenons so they are about $\frac{1}{4}$ in. long, then secures them with glued wedges.

Facets at the finish. Buchanan uses the drawknife to dome the tops of the spindles and to chamfer the top of the post.

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My workbench

BY KAREN M c B R I D E

We woodworkers all need to start somewhere, and my journey began with a workbench. At the time, I was working in IT at a veterinary laboratory and I shared an office with an energetic pathologist from Australia. Since I was new to the lab and there was a shortage of space, Dr. Ian Wilkie and I sat back to back in a tiny office with a fabulous view of the loading dock. Ian was not fond of computers, and I had an equal disdain for Crocodile Dundee, but we bonded over my leather briefcase.

The briefcase, handmade from $\frac{3}{16}$ -in. leather, was brand spankin' new, so much so that the tiny office soon smelled like a tannery. I apologized for the odor and Ian quipped, "If any of that leather goes missing I'll have stolen it for my bench vise." My ears perked up and I turned my chair around. "So what do you make on this bench?" I asked.

The next day Ian appeared for work with snapshots of furniture he had made and a copy of *Fine Woodworking*. It was my first introduction to handmade furniture that looked something like the antiques I had grown up with. Surprise, surprise—Ian was a prolific woodworker who made beautiful reproduction pieces for friends and family. I should probably have been in awe of his pathology credentials, but instead it was his woodworking skills that drew me in.

I had no woodworking experience, but I had apprenticed as an auto mechanic and I loved working with my hands. In one of our many chats I asked Ian if he would help me carve a duck. My father had taken up decoy painting and I was keen to take on Canada's smallest diving duck, a Bufflehead drake. Ian was delighted. He loved birds and had a wonderful collection of books and patterns for reference and the tools and skills to match.

The fun began in his basement workshop where we cut a blank on the bandsaw and taped the pieces back together to restore a reference face to make another cut. Brilliant, I knew I was going to like this. I bought some carving tools but I still needed a vise to hold my duck. I suggested I could buy a portable WorkMate bench that would fit in my apartment's laundry closet, but Ian would have none of it. "I have some scraps here," he offered. "Let me put something together to fit your space." It was clear to me that Ian was taking this very seriously. He even wanted to know how much I weighed and insisted that my small bench needed to be heftier than me so I didn't push it around the room.

I knew less than nothing about woodworking but imagined my new bench would look something like a small chopping block on legs. As a kid I had used the chest freezer in our basement as a workbench, so a wooden working surface would be a big step up for me.

Within weeks my bench was ready and I was eager to see it. Little had I known that Ian loved making benches. His design for mine was based on Frank Klausz's 1985 article, "A Classic Bench" (*FWW* #53). It's a traditional European bench with dovetailed end cleats, square dogs, a tool tray, and a tail vise with a wooden screw that Ian turned and threaded himself.

Ian insisted on weighing the bench on the laboratory's large scale, which normally tallied the poundage of horses and cattle. Word quickly spread and soon my colleagues were gathered around the post mortem room to watch Ian deliver the goods.

We all heaved the bench to the scale and weighed it. Ian hooted in delight. His weight estimate was bang on.

Ian seemed more pleased with his skill of guessing the bench's weight than anything else. A bench like that was old hat to him. But not to me. It was massive and perfect and beautiful all at the same time. There were intricate square holes all down one side. How did he make those so square? The tool tray had slanted blocks on each end so you could sweep shavings out and the large wooden vise screw was newly made but harkened from the old world. The bench was made with an array of woods from Ian's stash: cherry leftovers from his own bench, a few bits of old maple from a demolished mill, Douglas fir, red oak, and even osage orange. In the early years the multi-hued

benchtop served as my wood identification reference.

My bench was impressive in the small laundry room cupboard, but it made me feel a little guilty. I couldn't just carve a duck and let it sit idle. I needed to get woodworking.

Now, some 30 years later, my workshop has grown to over 1,000 square feet and my bench still serves me well. Ian Wilkie has returned to Australia and is still making wonderful benches, infill planes, marking tools, and handsaws in his outdoor shed. I have no idea why he decided to bestow such a fine bench on a total newbie with a few chisels and a partially completed duck, but when people ask me why my bench is so small, I think of Ian and with a smile I say, "let me tell you a story."

Karen McBride makes furniture and sculpture in Dunrobin, Ont., Canada. The log building she restored as her shop was featured in FWW #286.



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Extraordinary Drawers

The dovetails on Garrett Hack's drawers are always impeccable. But cutting dovetails is, for him, the least exciting aspect of drawer making. When designing and building furniture, he constantly seeks the fun and stretches for the surprises. Drawers, he discovered, can provide a bounty of both. Years ago, inspired by a Shaker sewing table whose drawers opened from the ends instead of the front, he added an elfish drawer to the end of his Lil Shaker table. Since then, in piece after piece, he's been creating a menagerie of unexpected drawers: tiny ones in the backs of cabinets; one nested within the front of another, built so they open independently; a pair of them that open through a door, so small items can be retrieved from the cabinet with the door closed; a stack of three curved-front, spinning drawers which, when opened a set amount, release a latch for the door below; and a skinny drawer that curves along its length and slides into a bending drawer pocket like a toy train going around a corner. Why all the effort over drawers? Just for fun. (To read more about how he designs his pieces, turn to p. 54.)

—Jonathan Binzen

