

TAUNTON'S

Fine Woodworking

Teach • Inspire • Connect

Cut covers safely
on the tablesaw, p. 62

Antique chest made with modern tools

How to make and
use a saw bench

Build an elegant
side table in ash

Four options for
breadboard ends

Layer milk paint
for a classic finish





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The carpenter's son

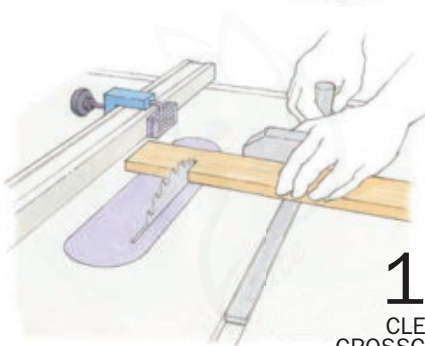
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DOWEL
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VIDEO

A gem of a technique

Chairmaker Russ Filbeck demonstrates how he gets his drawknives and carving gouges sharp in short order using abrasive belts and a rubber lapidary wheel on his grinder.



VIDEO

Shop tour: Patrick Edwards

Cartouche award winner Patrick Edwards gives us a tour of his San Diego shop, which is home to a gigantic workbench, hundreds of handplanes, and an enviable stash of veneer.

Online extras

Free content at finewoodworking.com/281



VIDEO

One-of-a-kind sanders

Known for his intricate puzzle furniture, Craig Thibodeau (p. 42) produces work that obviously comes from the mind of a mechanical master. It's no wonder that when commercial sanders come up short, he modifies them or makes new ones himself.

VIDEO

Spring fling

Using a spring joint, Bob Van Dyke demonstrates just how strong a panel glue-up can be after only half an hour in clamps.

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Unlimited includes two digital book collections: *The Complete Illustrated Guide to Woodworking* and *Methods of Work*.

VIDEO WORKSHOP

Hanging Wall Cabinet with Mike Pekovich

FWW creative director Michael Pekovich builds a small cabinet that packs in a lot of techniques. It has dovetailed case construction, through-mortise-and-tenon joinery, a dovetailed drawer, a frame-and-panel door, and a decorative kumiko panel. In this series, while demonstrating how to build the cabinet, he teaches woodworking techniques that can be applied to building any piece of furniture.



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contributors

Wanting furniture that she couldn't afford to buy led **Nancy Hiller** ("Arts and Crafts Chest") to complete a basic City & Guilds of London training course in England. After working for furniture and cabinet shops there and in the United States, she started NR Hiller Design in Bloomington, Ind., in 1995. She specializes in custom furniture and built-ins informed by historical research and context-sensitive design. Her latest book, on kitchens, will be published by Lost Art Press this year. After nearly 40 years in woodworking, what keeps Hiller in the game? "Frankly," she says, "the need to make a living." But she also loves helping clients bring their ideas to life. And of course she needs to keep her shop cat, Tony, in the lifestyle to which he has become accustomed.

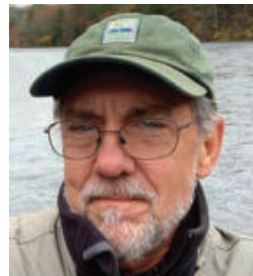


Gary Rogowski ("Breadboard Ends") is a longtime contributor to *FWW*. He runs the Northwest Woodworking Studio in Portland, Ore., where he emphasizes both solid woodworking skills and contemporary design strategies. A tireless writer and teacher, he was the first person to lecture in English at the Ecole Boulle in Paris. His latest book is *Handmade: Creative Focus in the Age of Distraction* (Linden Publishing, 2017) and he hosts the Northwest Woodworking Studio Podcast.



Megan Fitzpatrick (*Handwork*: "A saw bench is a versatile addition to your shop") is founder and editor of Rude Mechanicals Press and has compiled a long list of publishing credits during her career, including as former editor of *Popular Woodworking*. She is renovating a 1905 American foursquare home in Cincinnati, doing her best to use reclaimed materials appropriate to the period. As of this writing she was working on the staircase, installing the spindles and handrail. Fitzpatrick also teaches woodworking classes, builds furniture, and edits books at Lost Art Press.

It's been a few years since **Dan Thornton** took over as illustrator of Workshop Tips. But he's been a longtime contributor; in fact, his first illustration for us was in issue #44. Young Dan was one of those kids who liked taking things apart to see how they worked and then putting them back together. It drove his parents crazy, but this is how he learned what it takes to show others how things are made. His illustrations of everything from simple jigs to grandfather clocks reflect his lifelong love of woodworking. He also loves fly fishing on the rivers of western Connecticut.



We are a reader-written magazine. To learn how to propose an article, go to [FineWoodworking.com/submissions](https://www.finewoodworking.com/submissions).

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Shaper Origin

A Revolution in Woodworking Precision

While woodworkers have endless creativity, many of us are short on space and cash. This makes full-size CNC tempting but unfeasible for a lot of small shops. Enter Shaper Origin, the first-ever handheld CNC router, a game-changing tool that packs digital precision and unlimited potential into a few feet of storage space.

How does Origin work? After you input a cutting path—it's simple and intuitive—and stick a few strips of disposable guide tape onto the work surface, an onboard camera orients the tool to the work and Origin does the rest. As you move the router roughly along its path, following the action on a small screen, Origin's router spindle moves independently to cut only where it needs to. Move too far off the path, and the cutter retracts, waiting for you to get back on track. It's CNC magic.

"I started using it just for putting my logo on pieces," says Justin Nelson, who makes small-batch, custom modern furniture in Bend, Ore. "Since then, I've been amazed at how many jobs it's come in handy on." Today, Nelson uses Origin to add efficiency and precision in his most difficult shaping tasks—eliminating risk and error in the process—and crafts eye-catching joinery that would be nearly impossible otherwise.

"Origin has sped up my process in going from an idea to reality," says Eric Needham, a cabinetmaker based in San Francisco who specializes in bespoke modular synthesizer cabinets. "Having Origin simplify time-consuming tasks, I have more time to focus on custom design."

A quick YouTube or Instagram search of #shapermade posts reveals an army of passionate users exploring the potential of this revolutionary tool. Origin's versatility means that it fits seamlessly into a wide variety of workflows: everything from precise profile curves on furniture to onsite hardware mortising to complex custom inlays, and much more!

For a deeper dive into this game-changing tool, go to ShaperTools.com, where you can check out their videos, tutorials, and free downloadable digital templates for projects of all ability levels.



What's in the box. Shaper Origin includes a 720-watt (1-hp) motor with a 1/4-in.-dia. collet, two straight bits, a 60° engraving bit, and two 150-ft. rolls of ShaperTape.



Setup is quick and easy. After you input a cutting path and apply ShaperTape to the nearby surface, Origin is ready to go. Just keep the router bit close to the toolpath, and the spindle makes automatic adjustments on-the-fly to keep your cuts precise. Origin accepts all 1/4-in.-shank bits, and the depth of cut is set digitally, up to 1.7 in.

ShaperTools.com



From the Editor

Celebrate success, learn from mistakes

To me, one of the inspiring aspects of woodworking is that every experience is a learning moment. Sometimes that moment results from a positive experience: Perhaps your machine setup was a success, or your design came to life just as you'd imagined. Other times, you learn from a mistake.

I had a bandsaw incident back in December. I won't call it an accident because I was not injured. I was making a few trivets as gifts for the holidays. I had some contrasting offcuts from an end-grain trivet that I had made, and I didn't want them to go to waste. My plan was to glue them up to create a block with a decorative pattern that I'd resaw to make inlay pieces for other projects.

The thick assembly was about 6 in. long and shaped like a figure 8—imagine two squares connected at a corner—and it would ride the bandsaw table on edge on two wide points. I was concerned about that, so I rehearsed the cut with the power off to figure out the best way to keep the small piece against the fence and on the table while I pushed it. I set the fence to take a thin slice and used a push stick with a bird's mouth to guide the work through the blade and a long offcut to keep it against the fence. The first pass went swimmingly.

The second pass, however, went bad quickly. About 1 in. into the cut, the leading edge got hung up for a brief moment. That hiccup caused the blade to grab the work at the front and tilt it down, pulling it away from the push stick and driving the back end up and into the blade and guide assembly. I've been woodworking for a long time, and I understand the forces at work when it comes to machines. However, in this instance I underestimated the power of those forces—rookie mistake.

The incident did not stop me from trying again. The blade was a goner, but the workpiece was salvageable. So I took what I learned and altered my method. I made a zero-clearance base to cover the table, which eliminated any bumps. And I custom-crafted a more secure push stick to support the corner at the back of the workpiece and again used a long offcut to keep the piece against the fence.

It was a success. The slices came off the block clean and uniform in thickness—without incident. The whole process was truly a learning moment, and I'm a better woodworker for it. But it also was a reminder that there's a risk involved with any machine maneuver. Be sure to take care in your setup and technique to avoid mishaps. Try to see pitfalls before they happen. Be confident but mindful of the power of the machine. I want everyone to enjoy their time in the shop—safely.

—Tom McKenna, editorial director



Caveats about drying your own lumber

Your *Tools & Shops* annual issue had a great article titled "Turn Your Logs into Lumber." It is a good way to get large wild-edge slabs and lumber at reasonable cost.

Two issues I would warn readers about. First, avoid using green stickers. You will end up with "sticker shadow," a stain that may not be removable without a lot of planing. Use fluted, kiln-dried stickers. I buy broken ones from large sawmills, cut them to useable length, then double up the stickers.

Second, with white sapwoods, especially ash, maple, and birches, there is great potential for powder post beetle infections. This usually occurs within the



first year the lumber was sawn. Powder post beetles can create a lot of unusable wood. It is best to get these species into a dry kiln as soon as possible. There are small mills with small dehumidifier dry kilns that do an excellent job.

—FRED HATHAWAY, Oneonta, N.Y.

Note: Writer is a certified arborist.

Jason Stephens replies: Good points. I use what are called lath sticks, available at home centers. They come in bundles of six, and are about 60 in. long each. Lath sticks are pretty cheap, and they're dry.

Get a white pencil for dark woods

I want to add one item to Tom McLaughlin's fine list of basic layout tools (*Fundamentals*, *FWW* #280). If you work with walnut or similar dark woods, take a trip to your local art-supply store and buy some white drawing pencils. They are soft and get dull quickly, but they can leave a line as fine as a pen.

—BILL CHRISTIE, Brevard, N.C.

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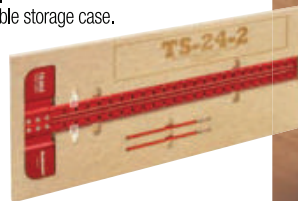


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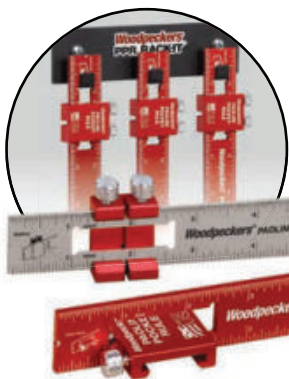
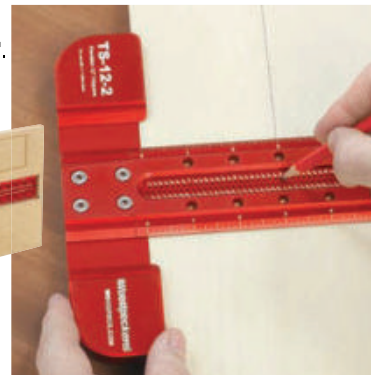
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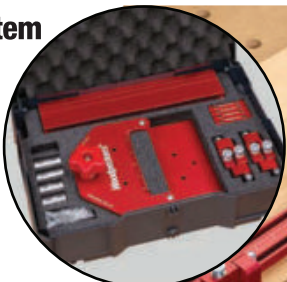
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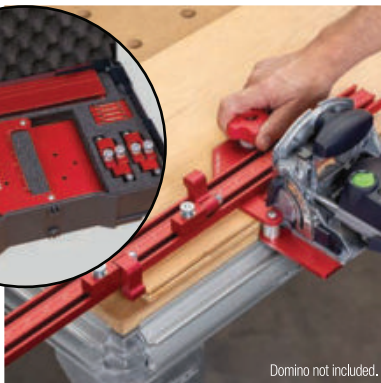
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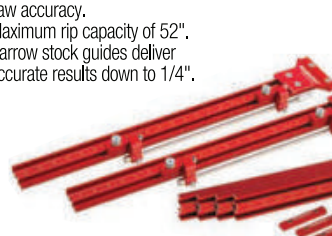


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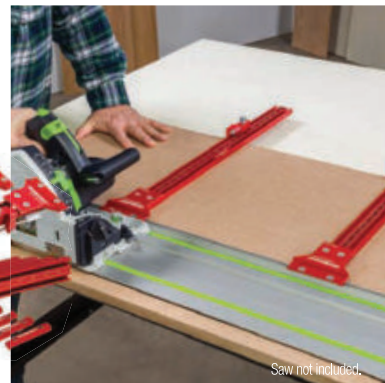
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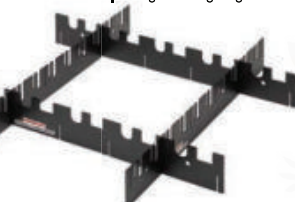
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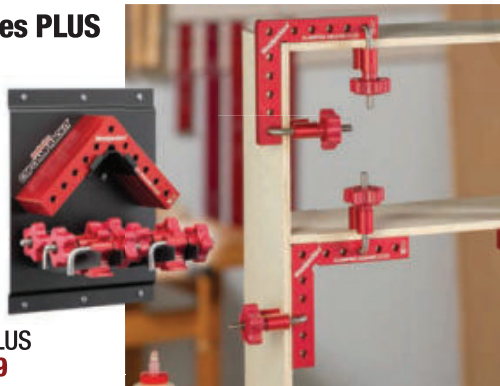
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workshop tips

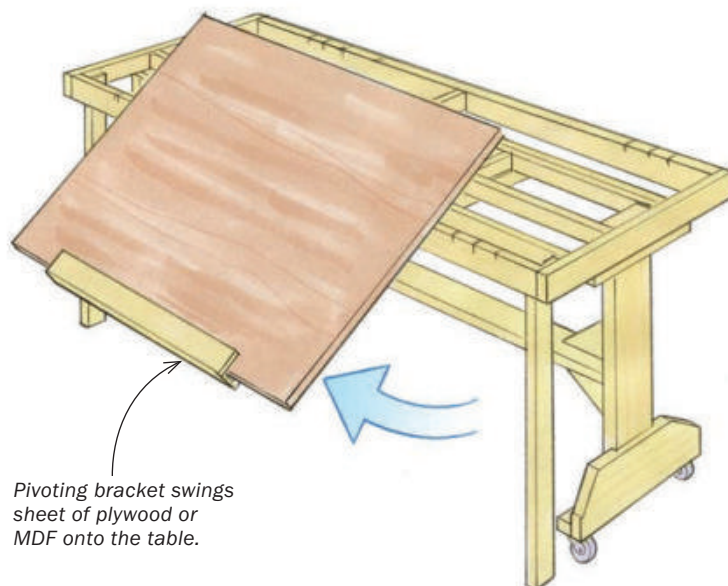
Sheet goods table has built-in panel lifter

I built this big, lightweight, rolling table for my track saw, which I use to break down sheet goods for easier handling on the tablesaw. The whole table is made from construction lumber, so you can let the blade cut into it. I sometimes add a sheet of MDF to turn it into an assembly table.

The pivoting lift bracket is a big bonus. I need only hoist the bottom edge of a heavy sheet onto the bracket and then it easily flips up on the table. To be sure that side of the table doesn't tip, I added folding legs that reach the floor and stow on simple clips.

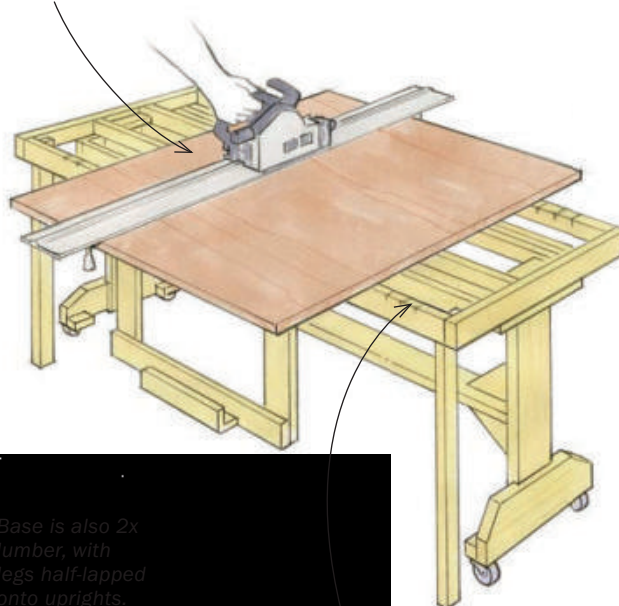
Heavy-duty, locking casters let me wheel the table close to my truck or sheet-goods rack, and move it out of the way just as easily.

—THOM LIPICZKY, West Stockbridge, Mass.



Pivoting bracket swings sheet of plywood or MDF onto the table.

Use table with a track saw or circular saw, cutting slightly into the top frame.



Table, 36 in. tall

Upper frame, 42 in. wide by 84 in. long, made from 5/4 pine or 2x6 studs ripped in half

Locking swivel casters

Folding legs prevent table from tipping under unbalanced loads.

Base is also 2x lumber, with legs half-lapped onto uprights.

Add a sheet of MDF and it becomes an assembly table.

Best Tip

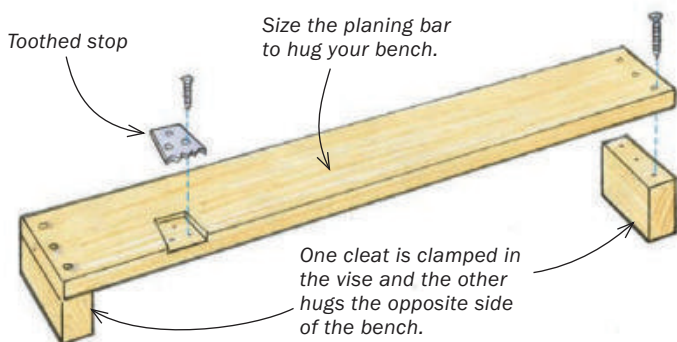


After 15 years teaching music at the college level, Thom Lipiczky jumped ship to become a design/build contractor, a job he's held for 35 years now. A skilled woodworker, he builds custom cabinets into many of his remodeling jobs and additions, and crafts guitars and dulcimers in his spare time, as well as making furniture from recycled lumber. He also built his own large woodshop, "with a house on top of it to keep the rain out."

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 Veritas crosscut and dovetail saw set.

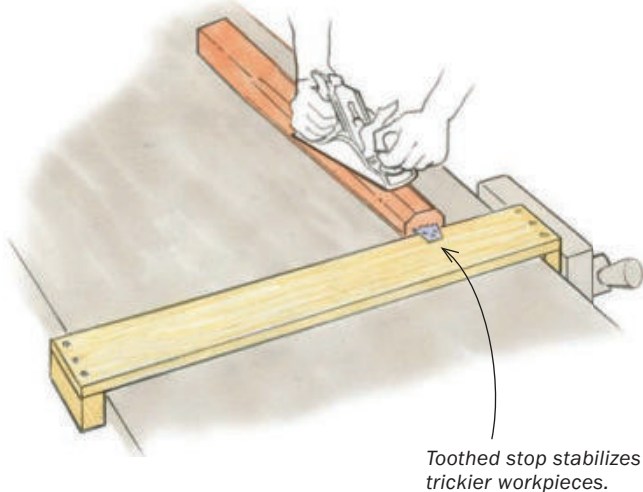
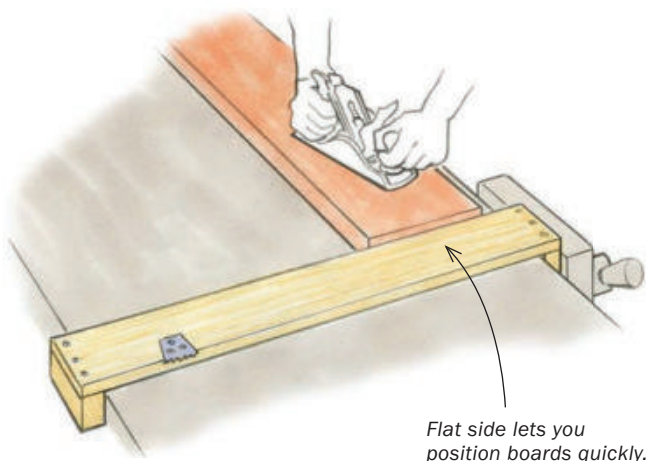




Reversible planing bar works two ways

My planing bar includes a toothed stop (BT&C Planing Stop from toolsforworkingwood.com) on one side and a flat edge on the other. Cleats at the ends hug the workbench and clamp quickly in the vise to secure the stop in either position. The toothed stop stabilizes the end of awkward work, but requires a tap on the end of the workpiece to engage it. The flat side of the bar lets you change and reposition boards quickly.

—JOSH SALOMON, Palo Alto, Calif.





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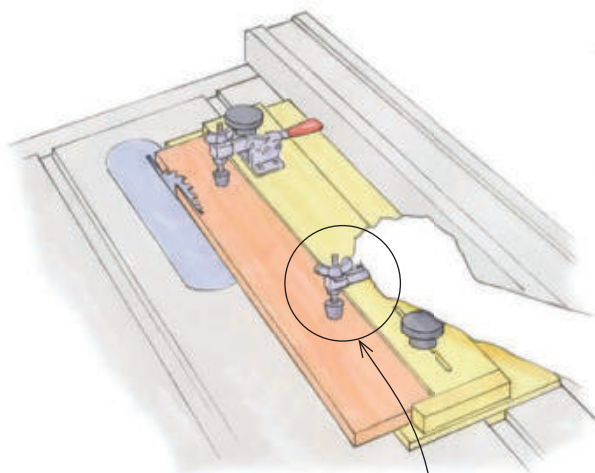
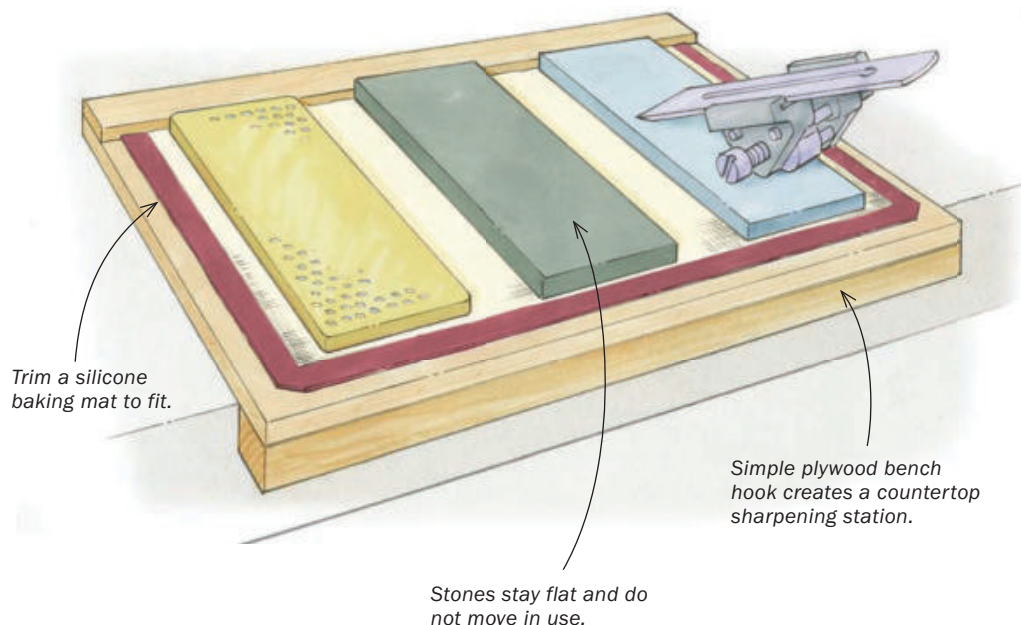
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SINCE 1993



Silicone baking mat secures waterstones

I use a silicone baking mat (available on Amazon for under \$10) as a waterproof, nonslip surface under my diamond plates and waterstones. I trimmed the mat and laid it on top of a plywood bench hook to create a simple but effective sharpening station, which I set up on the counter near my sink. It can also be clamped in a vise. The mat and the stones remain very stable throughout the sharpening process.

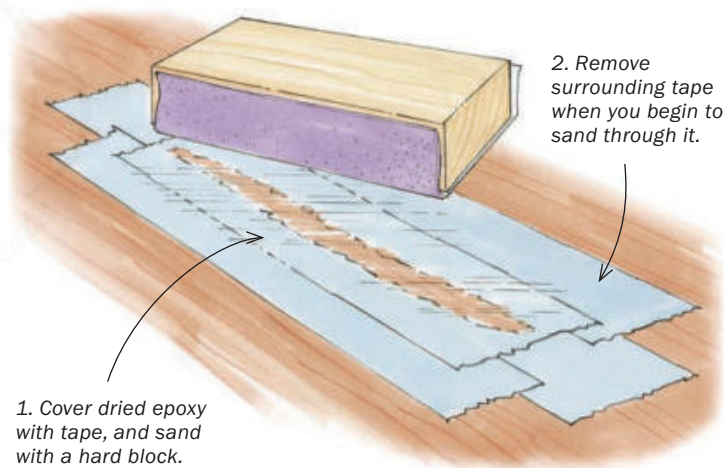
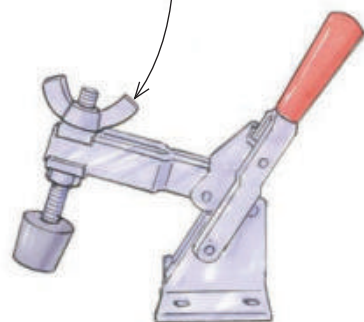
—JOHN BARFIELD, Toledo, Ohio



A simple wingnut improves any toggle clamp

Toggle clamps have two nuts for adjusting the height of their pressure tips, requiring two wrenches and some frustrating fiddling. If you replace the top nut with a wingnut or clamp knob, height adjustments become quick and easy, with no wrenches needed.

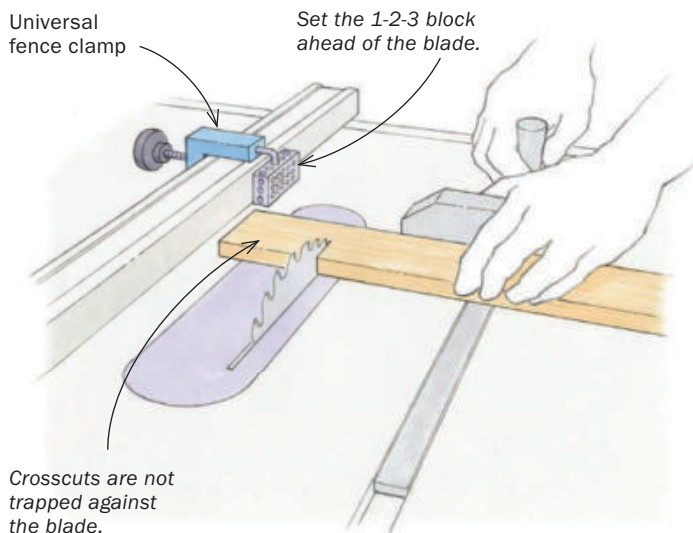
—JEFF BREMER, Los Angeles



Cover epoxy repairs with tape for safe leveling

When you use epoxy to fill a defect or make a repair in a finished surface, the trick is leveling it without sanding a hollow into the adjacent surface. My simple trick is to apply blue painter's tape over the hardened glue mound and surrounding area, and then use a small, hardwood block to sand through the tape. As you sand through the tape in the center and level the excess epoxy, the surrounding tape protects the wood surface. Once the dark blue of the nearby tape becomes pale and abraded, you know that the epoxy is nearly level. At this point I remove the remaining tape and carefully finish sanding the repair level with the wood. It works beautifully.

—PETER KEMPTHORNE, Christchurch, New Zealand

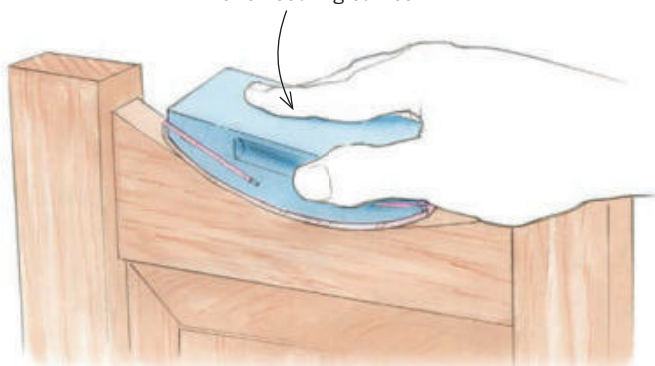


1-2-3 block for crosscuts and more

I use a cheap machinist's 1-2-3 block as a crosscut stop for my table saw. It keeps the offcuts from getting jammed between the fence and blade, and the precise dimension lets me use the rip fence's built-in scale (subtracting 1 in.). You can get a pair of these precise steel blocks online for as little as \$16. I combine the block with a universal fence clamp, which secures it quickly and tightly in place. The convenient 1-2-3-in. dimensions and precise right angles of the blocks are useful for setup and clamping elsewhere in the shop as well.

—GEOFF BURTNER, Reno, Nev.

Stretch sandpaper across the back of a standard rubber block for smoothing curves.



Reverse your rubber sanding block for curves

I've found that putting a piece of sandpaper across the curved back of a standard rubber sanding block provides the needed support for smoothing concave surfaces. The little brads inside the block hold the paper just as well in this position.

—TOM IGIELSKI, Woodbury, Minn.

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■ MACHINES

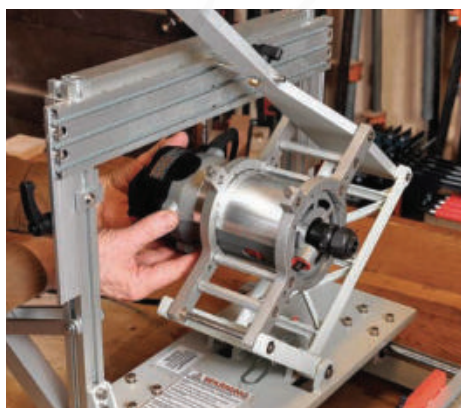
Powerful tool for perfect joinery

THE PANTOROUTER IS A NEW, highly capable machine that performs like a souped-up slot mortiser. At its heart is a router mounted to an articulating arm that moves on the X, Y, and Z axes. This makes it great for joinery, whether it's traditional or has a little more flair. Mortise-and-tenon joints, box joints, and dovetails can be created with available patterns, or you can design your own patterns. It can be purchased with or without a router.

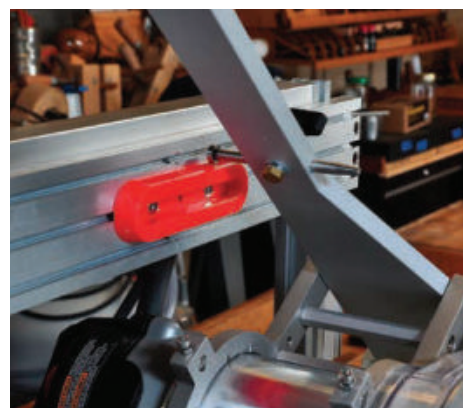
Assembly, setup, and fine-tuning were straightforward, and the learning curve was short. I started by creating simple mortise-and-tenons, and by my third try the fit of the joint was right on the money.

The PantoRouter's carriage moves precisely along the X and Y axes. To direct this movement, the arm has a bearing-guided stylus that rides around templates mounted to an adjustable fence. By following the inside or outside perimeter of the template, you can cut the positive or negative halves of a joint. To travel in and out—the Z-axis—the carriage rides on steel rods. There's a fence to align the cut, and it moves easily, clamps securely, and has a great indexing feature, making it easy to find center on odd-sized workpieces. To top it all off, the machine's dust collection is very effective.

—Roland Johnson is a contributing editor.



Router rides in a carriage attached to an articulating arm. The tool operates much like a horizontal mortiser, except that the router can travel along the X, Y, and Z axes.



Templates guide the arm. The arm has a bearing-guided stylus that rides around templates mounted to an adjustable fence.



This versatile tool handles both sides of a joint. Riding along the inside and outside of a template will yield each half of a joint. Angled tenons are just as easy as straight ones.

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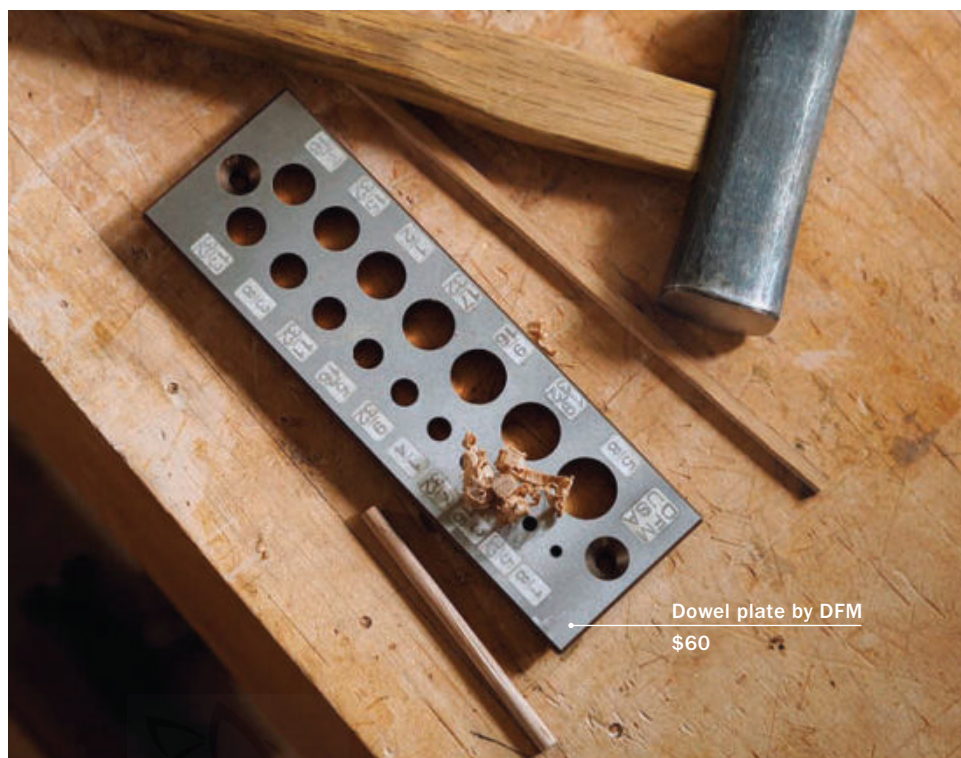
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■ ACCESSORIES

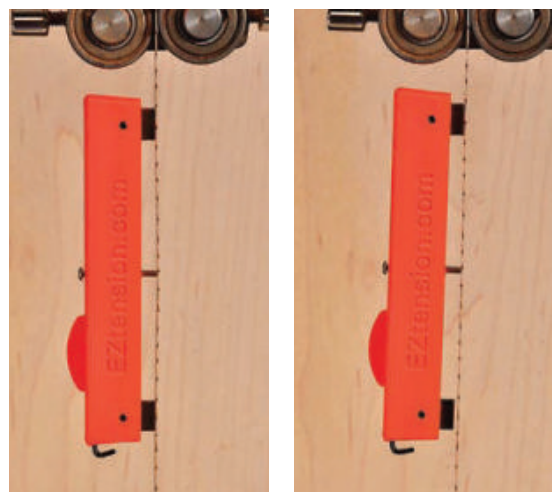
Great dowel plate at a good price

A **DOWEL PLATE'S** job is to turn square sticks into round dowels, and the new offering from DFM fits the bill nicely. Made from A-2 steel, the plate's best feature is the number of holes at your disposal. With a range of sizes in $\frac{1}{32}$ -in. increments between $\frac{1}{8}$ in. and $\frac{5}{8}$ in., the chances are you'll find just the dowel size for the job. The plate works well, but as with other dowel plates, it pays to chamfer the corners of the stick before driving it through the plate. The plate can be mounted in a wood block, though I find centering it over a dog hole in my bench works fine. At \$60, the DFM dowel plate is a great value.

—Michael Pekovich is FWW's creative director.



Dowel plate by DFM
\$60



Untensioned, tensioned. A pair of magnets tells you when the blade is tensioned properly. The control fulcrum deflects the blade the right amount. When both magnets touch the blade, it's still loose. When one pops off, it's set correctly.

Bandsaw tension gauge by EZtension

\$40



■ ACCESSORIES

Clever bandsaw tension gauge

THE **EZTENSION GAUGE** is a clever little tool that solves the recurring problem of setting the tension on a bandsaw blade. The gauge is simple. It has a plastic beam that has an adjustable screw in the middle of one edge and magnets toward either end. There is also a slot to hold a plastic setup gauge and a holder for a hex key used to adjust the screw.

To use the tool, adjust the screw to the setting appropriate for your blade's width, then place the EZtension on the side of a bandsaw blade that is tracked and ready to tension. Increase tension on the blade until one of the magnets releases from the blade. It's that simple.

The magnets are slightly loose in their sockets, so a bit of rotation is possible to allow the magnets to sit flat on the blade as the screw slightly bows the blade. The small, comb-like setup gauges provide screw settings for $\frac{1}{4}$ -in., $\frac{3}{8}$ -in., $\frac{1}{2}$ -in., $\frac{5}{8}$ -in., and $\frac{3}{4}$ -in. blades.

I found the EZtension to be repeatably accurate. My only complaint is that there are two gauges for setting the screw extension but only one pocket on the tool. A little gauge, although brightly colored, can easily disappear in a cluttered shop; a second pocket would be helpful.

—R.J.



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■ CLAMPS

New one-handed clamps

I'VE HAD SOME OF BESSEY'S new EHK XL one-handed trigger clamps in the shop for the last few weeks. I prefer not to have vises on my bench, so I use a variety of clamps to hold anything and everything together and to the bench. These clamps worked like a charm, with enough force to hold almost anything securely and quickly. The composite handle was sturdy and easy to grip. It did not take a lot of force to obtain good clamping pressure, which is rated at 600 lb. The removable pads were non-marring with a non-slip surface, and were easy to take off and put back on. The clamps have a $3\frac{5}{8}$ -in.-deep throat and come in 6-, 12-, 18-, 24-, 36- and 50-in. lengths. The jaws closed evenly and smoothly when squeezing the handle. The clamps were easily converted to a spreader, which came in

handy in taking apart some chair joints.

I found that the metal release lever was sometimes hard to operate with the clamp locked down. That said, I reached for them all day for a variety of tasks.

—David Douyard builds chairs and teaches chairmaking in Connecticut.



EHK XL Trigger clamps by Bessey
\$27-\$45

■ HAND TOOLS

Improved hook knives

THANKS TO SMALL BUT IMPORTANT CHANGES in blade profile, blade width, and edge geometry, Morakniv's updated 162 and 164 hook knives are a serious improvement to the company's older versions. And these updated models have earned a permanent spot in my tool roll.

The 164 is a nice general-purpose hook knife that can be used with a variety of grips. The 162 is double-edged, meaning it takes extra caution to use, but I find it perfect for excavating deep hollows in scoops, ladles, and cups. The new 162 can reach just a little deeper than its predecessor, and turns a tighter radius. The new knives also come with their own leather sheaths, a very welcome addition.

I recently tuned up 13 of these hook knives for spoon-carving courses. All but one made acceptable cuts right out of the box, and were improved to a polished edge in just a couple of minutes of stropping with honing compound. The one questionable edge had a small nick that sharpened out quickly. Most importantly, many of my students were able to intuitively carve nice hollows right away with these.

—Dawson Moore works green wood in Harbor Springs, Mich.



Hook knives by Morakniv
Models 162 and 164
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A stunning black-over-red milk paint finish

BY ELIA BIZZARRI

Milk paint is an ancient finish concocted from milk curds, lime, and pigments. By the time Windsor chairs had their heyday back in the 18th century, thicker and more efficient paints had long since replaced it. But in the last few decades there's been a revival of milk paint, and it's now often seen on Windsors and other furniture. Why?

If most paints are a wool coat, milk paint is a silk dress. Exceptionally thin, milk paint showcases every pore of the wood. It also allows various layering effects, like the black-over-red treatment I'll describe here. The red glows through the black, adding depth and warmth. Milk paint is completely non-toxic.

Beware of imitations. Paint companies have jumped on the milk paint bandwagon, producing premixed "milk paints" that are merely flat acrylic paint, lacking milk paint's thinness. True milk paints come in powder form and once mixed with water they last only a week (and in the fridge, at that). The brand I use is Old Fashioned Milk Paint (milkpaint.com).

How to mix the milk paint

When mixing milk paint, getting the right viscosity is critical, and each color and brand of milk paint requires a different ratio of water to powder. A good starting place is equal parts powder and hot water; you can add more water later if needed. Powder particles will dissolve more completely if you mix the paint thoroughly, let it sit for an hour, and mix it again. Strain the paint through a conical strainer to remove clumps and foam.

To measure the paint's viscosity, you can use a viscosity cup, or you can make one from a plastic soda bottle. First cut the bottle in two at the waist. Then drill a $\frac{5}{32}$ -in.-dia. hole in the cap and remove any resulting burrs. With the cap pointing down and a gloved finger over the hole, pour in half a cup of paint. Remove your finger and count the time it takes for the paint to flow out in a steady stream (don't count the dribbles). Nine to 11 seconds is about right.

For the first coat of red, I mix in some adhesion additive (Milk Paint Extra-Bond), available from milk paint companies, which helps the first coat bond to the wood. The resulting coat looks like plastic, so only use Extra-Bond in the first coat.



MIXING UP MILK PAINT



Pour in the powder. Add water until the mix seems about right. The exact ratio will differ by color and by the brand of milk paint.



Strain the mixture. After stirring well, pour the paint through a conical paper strainer to keep lumps and foam out of the mixture.



High-tech viscosity gauge. To make a device to measure viscosity, cut a plastic soda bottle in half at the waist, then drill a $\frac{5}{32}$ -in.-dia. hole in the lid.



The gauge in use. Cover the hole and pour in $\frac{1}{2}$ cup of paint. Uncover the hole and see how long it takes the paint to flow out. Nine to 11 seconds is about right.



Make the first coat stickier. You can increase milk paint's adhesion to bare wood by using an additive like Extra Bond. Mix in one part additive to two parts milk paint.

Brushing tools and techniques

After raising the grain with a moist rag, I lightly sand with fine sandpaper, then begin to paint. I use a $1\frac{1}{2}$ -in. Purdy sash brush. The amount of paint on the brush directly affects the quality of the paint job. Too much paint causes drips that then dry into a flaky, crusty layer. A drier brush is a safer (if slower) option. In addition, the smaller the surface being painted, the drier your brush should be. A good starting place is to dip the bristles $\frac{1}{2}$ in. into the paint, wiping one side off on the edge of the can. Make sure you have good light; when possible I prefer to paint outdoors.

Start the first coat by painting an obscure portion of the piece, practicing your brushwork technique there before moving to

more prominent areas. The brush will leave a puddle where it first touches the work, so put the puddle somewhere easy to access, away from corners. Apply the paint in any direction that is efficient. Work the paint out over more and more of the surface until your brush is dry, then go back over the initial puddle. The more you work the paint, the smoother the surface will be. Your last strokes should all be in the same direction, usually parallel with the grain.

Wash your brush, and let the paint dry three hours between coats. The paint exaggerates any surface defects. After the first coat, sand any raised grain and scrape down nicks and steam dents. Cutting completely through the paint to bare

LAY ON THE UNDERCOATS



First raise the grain. Dip a rag in water and moisten all the surfaces you'll be painting.



Then knock it down. Lightly sand all the surfaces of the piece with fine sandpaper to smooth back the raised grain.

wood is common. It usually takes two to three coats of red to completely cover the wood surface.

Black follows red

The black milk paint is mixed just like the red. Application is the same, too, but with one added factor: Too much brushing can soften the red undercoats, mixing them with the black and causing a loathsome brown mess. Getting a good amount of paint on your brush (but not too much) and landing just the tips of the bristles onto the work will prevent this problem. If you do get mixing of the red and black, you can sometimes fix it by dipping your brush in the black paint again and gently applying more paint over the area. While you are learning the technique, it may be useful to lay down a thin coat of shellac between the red and black paint layers to prevent them from blending.

A final streaking coat of black paint comes next, covering roughly two-thirds of the surface and producing an effect like graining. This creates visual depth and covers any spots missed during the first black coat. The goal is to land just the tips of the bristles so that only half of them touch the wood, leaving

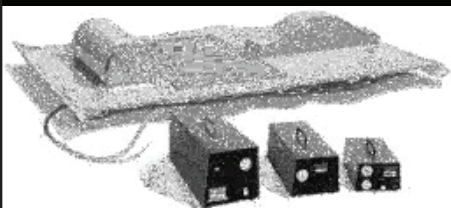


Now the fun part. Making sure you have good light to paint by, apply the first red coat. For the legs, Bizzarri uses a flipping motion perpendicular to their length. For flat surfaces like the tabletop, make the final strokes along the grain.



Post-paint touchup. When the first coat of red is dry, examine the piece for flaws in the wood's surface. Scrape or sand them, then apply another coat of red.

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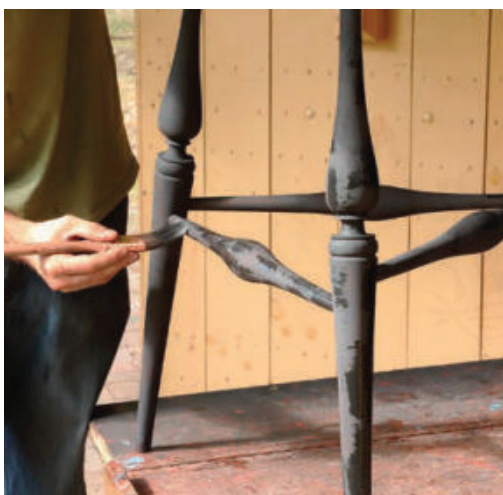
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BRING ON THE BLACK

First a full coat of black. Brush on the first black coat as you did the red coats, but be careful not to overbrush, which can soften the undercoats and muddy the color.



Now for a partial coat. The second coat of black is intentionally mottled, which lets more of the red show through in places, producing the somewhat uneven appearance you're after.



streaks. This may sound tricky, but in fact the streaking coat hides irregularities in the first black coat, gracefully covering any mistakes. To ease the learning curve, a graining brush can be made: cut back $\frac{1}{4}$ -in.-wide sections of an old brush's bristles so they alternate with $\frac{1}{4}$ -in.-wide sections of full-length bristles.

Once dried, the paint looks like chalk and feels like fine sandpaper. Burnishing it with abrasive smooths the finish, adding sheen and visual depth. I start with a maroon Scotch-Brite pad and end with 000 steel wool, rubbing every surface hard with the steel wool until it gets shiny. It is not my goal to create a "worn" surface, but any red, or even wood, that shows through at the edges and high points only adds visual interest.

Milk paint oxidizes over a matter of years and becomes rock hard, but the finish is rather soft in the interim and needs some protection. Any topcoat can be applied over the paint. Wiping varnish is lovely, but I brush or pad on shellac, then rub the shellac down with steel wool dipped in carnauba wax. Instead of finishing up with paste wax, which leaves white spots in the wood pores, I use a liquid wax made by Bioshield. □

Elia Bizzarri builds Windsor chairs and tables in Hillsborough, N.C.



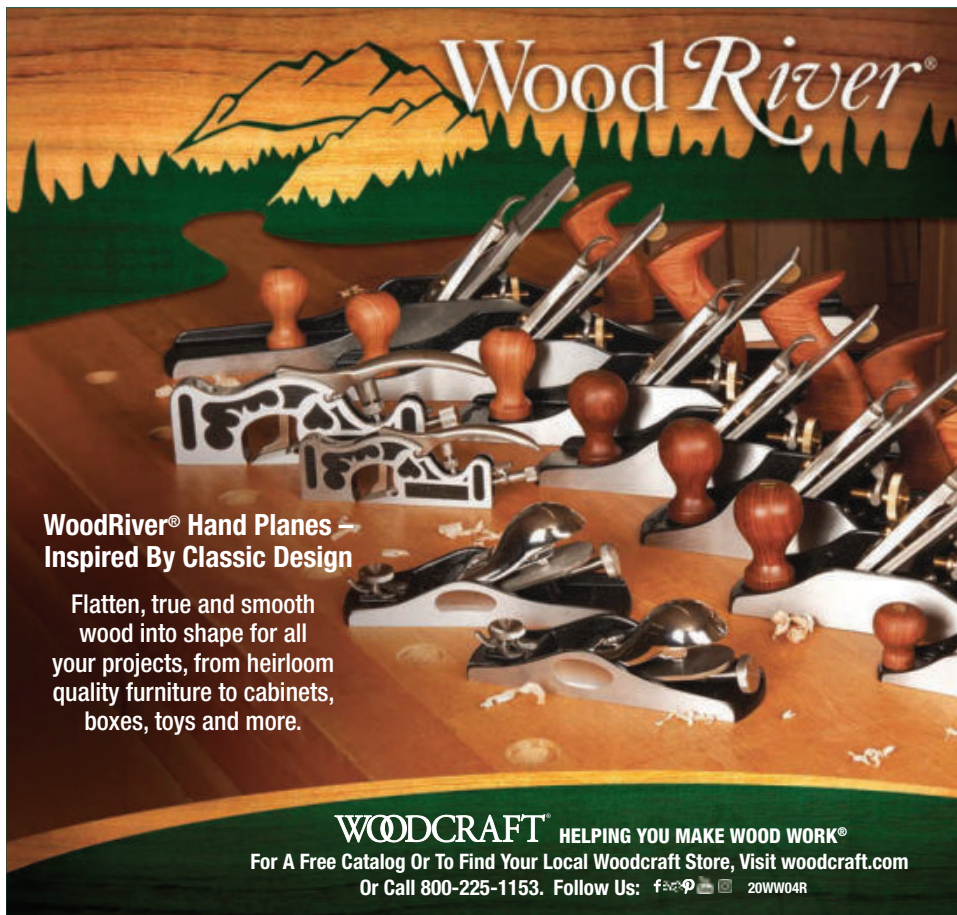
Burnish the surface. After letting the final coat of black paint dry at least overnight, give it a thorough burnishing. First use a fine Scotch-Brite pad, then switch to 000 steel wool wielded with very firm pressure.



Shield the paint with shellac. Brush on a coat of shellac to create a barrier to protect the paint in the months before it cures to its full hardness.



Wipe on wax. Paste wax would leave white spots in the pores, so liquid wax is a better choice.



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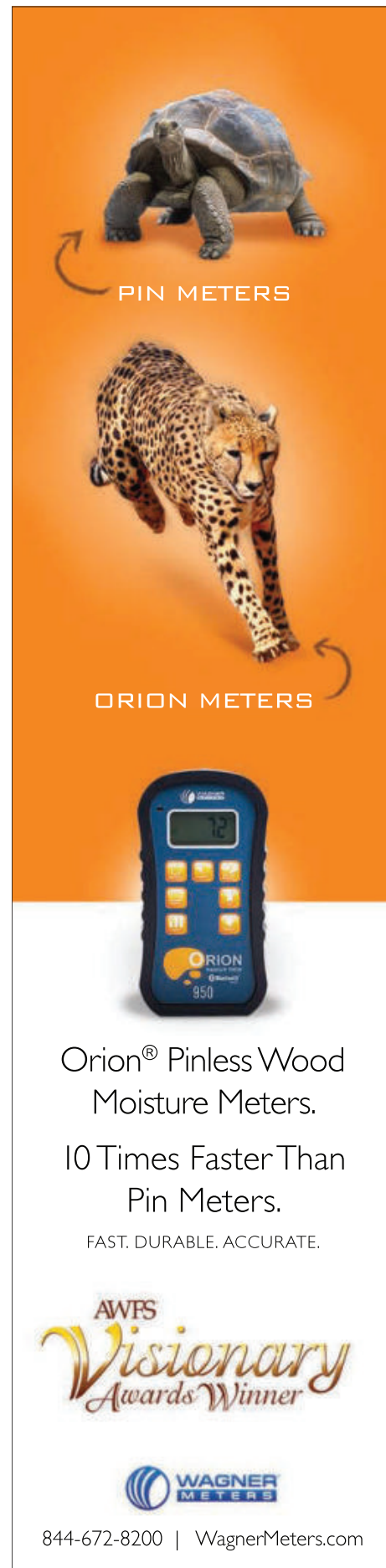


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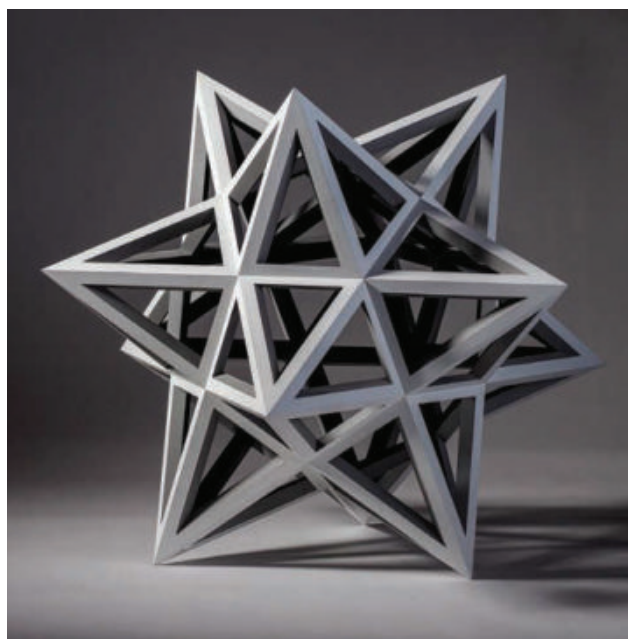
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Playing with angles

BY JAMIE HERMAN



Jamie Herman is a designer, artist, and furniture maker based in Midcoast Maine. In his work, he looks to find a balance between traditional woodworking techniques and bold, modern forms. Brought up in Kentucky and Ohio, Herman first came to value craft while participating as a student in archaeological digs at Mississippian and Mayan sites. After college, he developed an interest in carpentry that eventually led him to pursue a full-time furniture making program at the Vermont Woodworking School and a fellowship at the Center for Furniture Craftsmanship.



The craft of furniture making is a constant push and pull between form and function. As woodworkers and designers, we make objects that are a balance of these two ideas, taking a familiar form like a chair and inserting it somewhere on the spectrum between pure sculpture and total practicality. Between these extremes an object can be both a joy to interact with and a joy to behold. We know these pieces when we see them, and there usually isn't some big secret as to why they sing—they're just well designed. Design is a skill that takes time to develop, just like learning to use a chisel or a saw. It takes repetition, practice, failure, and thought to improve. It's a skill that is constantly evolving within each of us, and something we never really finish learning.

My design process usually starts with a sketch. Sketching is a fantastic way to get an idea out of your head and to give it form. For me, sketches are more of a mental placeholder than anything else—I just want to have enough drawn so I can remember what I was thinking when the concept came to me. My best ideas almost never happen when I've been sitting down with my sketchbook actively trying to design furniture; instead, they usually come when I give my brain a little distance from the shop. When inspiration strikes, get that idea sketched! I don't bother being overly analytical at this point; the important part is just getting the ideas out of my head and onto a page.

After I've refined my sketches a bit and have an idea that seems promising, I find a way to make it three-dimensional. It can be through a scale model or a full-sized mockup, or by modeling the design in a CAD program. However it's done, you want to be

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able to look at your idea from every angle. Once you have a three-dimensional representation you can start to get critical. What are the most interesting views of the piece? Why? More importantly: What are the least interesting views? Why don't they work?

I tend to use compound angles to add interest and three-dimensionality to my pieces. I like to use forms that interact with each other at complex angles to make my furniture more dynamic, and to add a sense of balance and motion. I always try to design my pieces as if they will be sitting in the middle of a room; I want to make sure my work invites exploration from every viewpoint. I'd say half of the reason for me using these tilted forms stems from my desire to make interesting furniture that I've never seen before. The other half is me trying to push myself technically, setting up complicated builds as challenges to test my skills.

Introducing angularity doesn't make a piece inherently more difficult than square work. Every cut you make on a tablesaw is a balance of two angles, usually the right angle of the fence or sled and the right angle of the blade. It's just as hard to get two perfect 90° angles as it is to set those cuts up to, say, 77° and 125°. The only big difference lies in the planning. This is easily the most important step in my build process. I use 3-D modeling software while I design so that I know exactly

what I'm doing when I start making cuts. I want to know what every angle will be, what every dimension is, and how it'll look when put together. There are lots of great programs that can accomplish this for you, from SketchUp to Fusion 360 to Solidworks. They take a lot of practice to master, but have become invaluable tools for me.

Construction-wise, working with a tilt often leads me down the road of complex veneering projects. I may be in the minority saying this, but I absolutely love veneering and the versatility it allows me as a designer. With solid wood, so much revolves around controlling wood movement that our techniques can sometimes dictate our designs instead of the other way around. I'm a firm believer that one should design first and let the build process develop accordingly.

Furniture making is often a slow and time-consuming process, so it's worth it to make sure you're happy with your design before you begin a big build. Try to think in three dimensions during the design process, and take the time to give your ideas some critical thought. Ask yourself not only what you like and don't like, but also why you feel that way. Design is just as important to the making of a successful piece as technical precision. Design with purpose, explore, take risks, and challenge yourself to find what makes your own voice unique. □



Arts and Crafts Chest

Time-tested and versatile project, with beauty in the details

BY NANCY R. HILLER

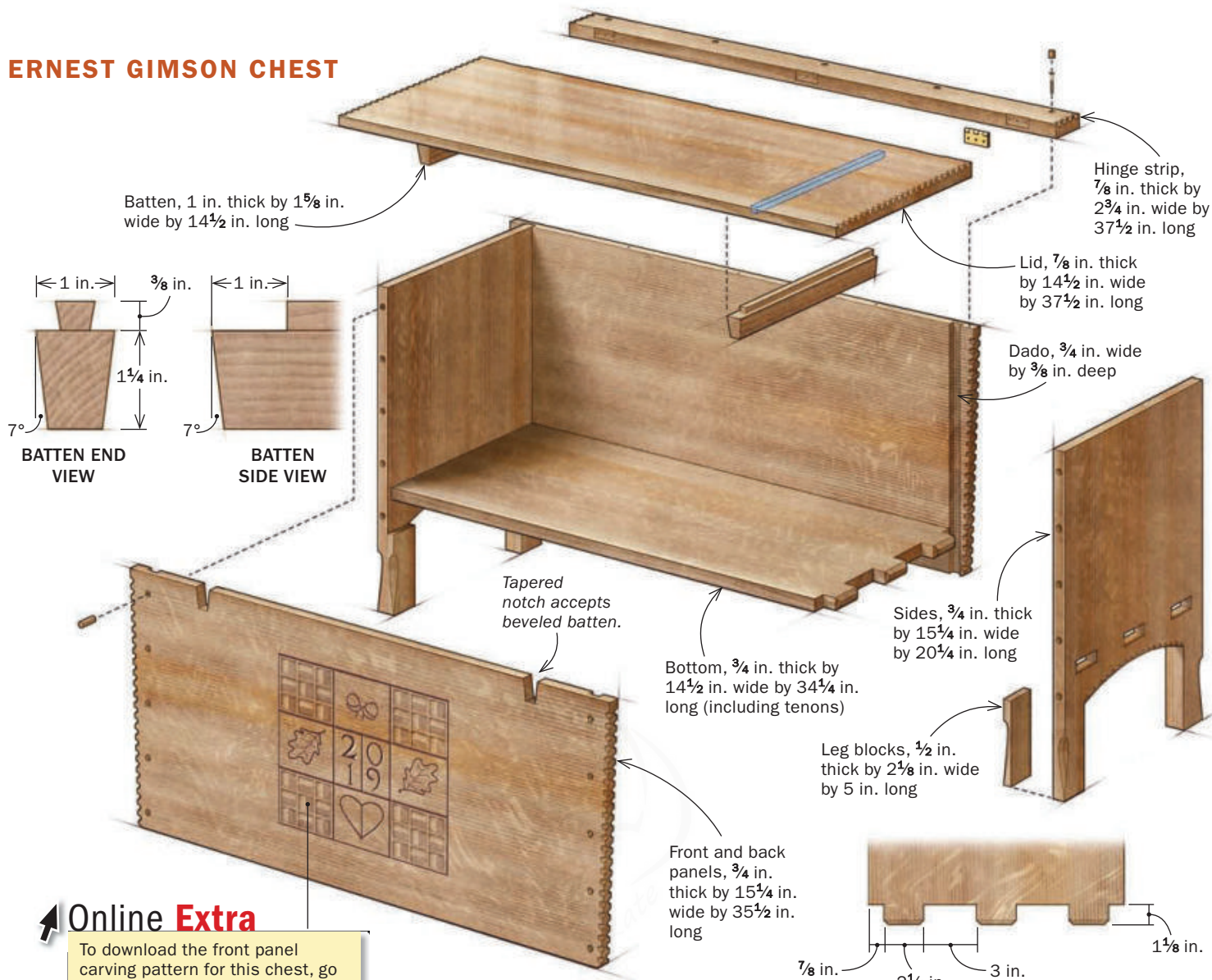
I've long been a fan of English designer Ernest Gimson (1864–1919), who moved from London to the rural Cotswolds region with Sidney and Ernest Barnsley in 1893. Collectively their influential work, which is characterized by sturdy lines, exposed joinery, simple decorative carving, and motifs drawn from rural forms, is the heart of the Cotswold School of Arts and Crafts design.

This chest, or coffer, is a good example of the style. Built of quartersawn oak, it has straightforward lines, through-tenons, and artful lettering, along with decorative chamfers and gouging. It's a versatile piece that would be equally at home storing towels in a bathroom or blankets at the foot of a bed.

Unconventional construction has lasted over a century

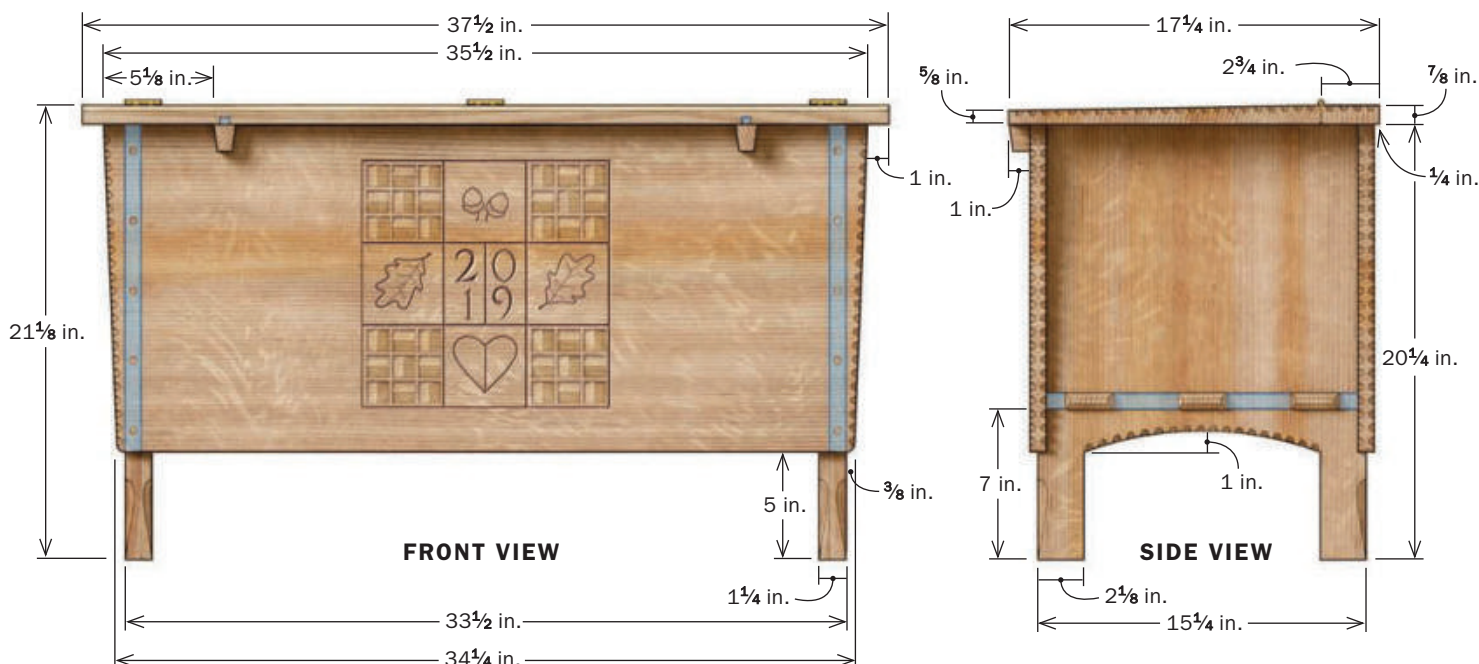
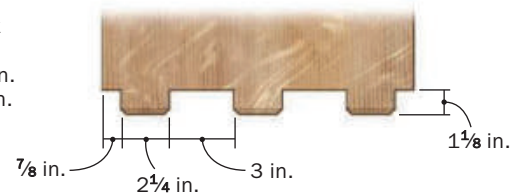
I was skeptical about the joinery. So I consulted Christopher Vickers, an English furniture maker who specializes in Arts and Crafts designs and has inspected the original chest at auction. Vertical-grain sides fit into dadoes in the horizontal grain front and back and are reinforced with pegs—rule breaking at its most blatant. But as Vickers points out, despite the opposing grain orientation, the front and back panels of the original coffer have not split. The quartersawn lumber no doubt helps; and though there are examples of other furniture forms made in quartersawn oak that have split where the joinery has not allowed for movement,

ERNEST GIMSON CHEST



Online Extra

To download the front panel carving pattern for this chest, go to FineWoodworking.com/281.



Join the sides to the bottom

It's unusual, but this project begins by joining the bottom to the sides with through-mortise-and-tenons.

MORTISE-AND-TENONS MOSTLY BY HAND



Mortises first. After scoring the outlines of the mortises, use a Forstner bit in a drill to waste out the insides of the mortise. To avoid tearout, drill halfway through on one side, flip the piece, and go the rest of the way through from the other side. Clean up the walls with a chisel.



Tenons follow suit. Using the mortises in the side pieces, transfer the tenon locations onto the bottom piece. Score them, hand saw the sides of the tenons, use a coping saw to remove most of the waste, and then clean it all to the line with a chisel.



Refine the tenons. Hiller uses a handplane to create a pyramid shape on the ends of the through-tenons.

splitting seems to be more likely in thinner stock. Because this cross-grain joinery is authentic to the original coffer, I've thrown caution to the wind and am using it here. The prototype chest I made a few years ago has made it through Indiana's seasonal changes in temperature and humidity and is doing just fine.

Start with the sides and bottom

I begin the chest by cutting the sides to shape. Then I turn to the joinery that will attach the sides to the bottom. Through-tenons in the bottom fit into mortises in the sides. Lay out the mortises and score across the grain with a knife to avoid tearout. Remove the bulk of the waste with a drill, then chop out the rest and pare the edges with a chisel. Take care to avoid chopping or paring too vigorously and breaking out the grain on either face.

Transfer the mortise locations to the bottom for the tenons. Use a cutting gauge to mark the shoulders, and then cut the tenons with a backsaw, coping saw, and chisels.

The legs of the original chest appear to be thicker than $\frac{3}{4}$ in. To create this look without the significant added weight of using thicker stock for the whole side, I laminate a block to each leg. Rip the leg blocks to the same width as the legs, glue them on, then cut them to length. They will go from the bottom of the leg to the bottom edge of the front and back panels. After the glue has dried, chamfer the legs with a gouge and spokeshave.

Create the front and back panels

I begin the front and back panels with the dados. Keeping both panels square for now, cut the dados on the tablesaw. I use a Forrest finger-joint blade with a $\frac{1}{8}$ -in. kerf and start with the fence set at 1 in. After cutting the first grooves for the left and right sides of both the front and back panels, I move the fence out by $\frac{1}{8}$ -in. increments until the sides fit snugly.

The front and back panels are wedge-shaped with decorative gouging on the front and back of both ends. The front panel also has a central field of carved numbers, Arts and Crafts motifs, and geometric shapes.

First, cut the ends of the front and back panels to a taper, removing $\frac{5}{8}$ in. at the bottom of each end. Then clean up the

Thicken up the legs

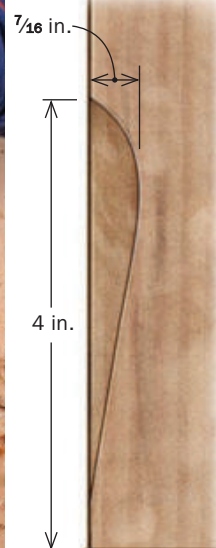
The legs of the original chest appear to be thicker than $\frac{3}{4}$ in., but Hiller didn't want to make the whole side thicker. To emulate the beefier look, she added $\frac{1}{2}$ -in.-thick blocks to the legs.



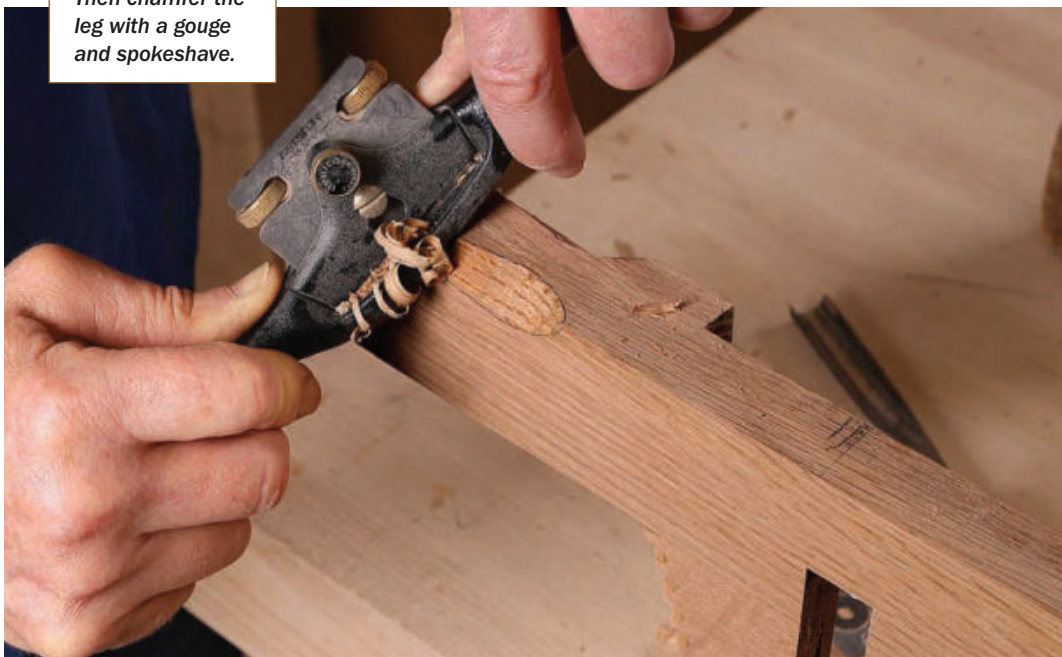
Add blocks to the legs. Cut these out of the same stock as the sides so that the grain will match, and then glue and clamp them to the legs.



Shape the legs. After trimming the added blocks to length, use a template to draw the shape on both sides of the leg. Then chamfer the leg with a gouge and spokeshave.



CARVING PROFILE



Flare the front and back pieces

Angled front and back panels overhang the sides and get thumbnail carving on both faces at the ends. In keeping with the joinery on the original chest, the side pieces fit into dadoes in the front and back, and are reinforced with pegs.



Start with the dadoes. Before tapering the ends of the front and back pieces, cut the dadoes. Hiller uses a Forrest finger-joint blade, adjusting the fence and creeping up on the fit in multiple passes. She keeps the board firmly against the fence while using a nonslip push pad.



Angle both ends of the front and back pieces. Bandsaw close to your taper line, and then clean up the cut with a handplane or a straightedge and a handheld router with a bearing-guided bit.

Add a simple yet elegant carving. Using dividers, mark the center point of each thumbnail. Clamp the workpiece to the bench and then cut the pattern with a #9-15mm gouge and mallet.



end grain with a block plane or a router and pattern-cutting bit with a straightedge.

Mark a line parallel to the taper to guide the thumbnail carving at each side. Use dividers to lay out the center point of each thumbnail. Clamp the workpiece to the bench and cut the pattern with a #9-15mm gouge and a mallet.

While you're at it with the gouging, lay out the smaller thumbnail pattern along the arch on each of the sides and cut them the same way using a #9-7mm or #9-8mm gouge and mallet.

Lay out your pattern for the carved field on the front panel with care and carve the letters, numerals, and other motifs with gouges and chisels. (For more on this technique, see "The ABCs of Letter Carving" by Clark Kellogg, *FWW* #275.)

The lid and the batten

The two-part lid is hinged together, with one smaller section that is secured to the case and a larger section that lifts to open the chest. Cut the lid parts to size and place them on the chest. Lay out the

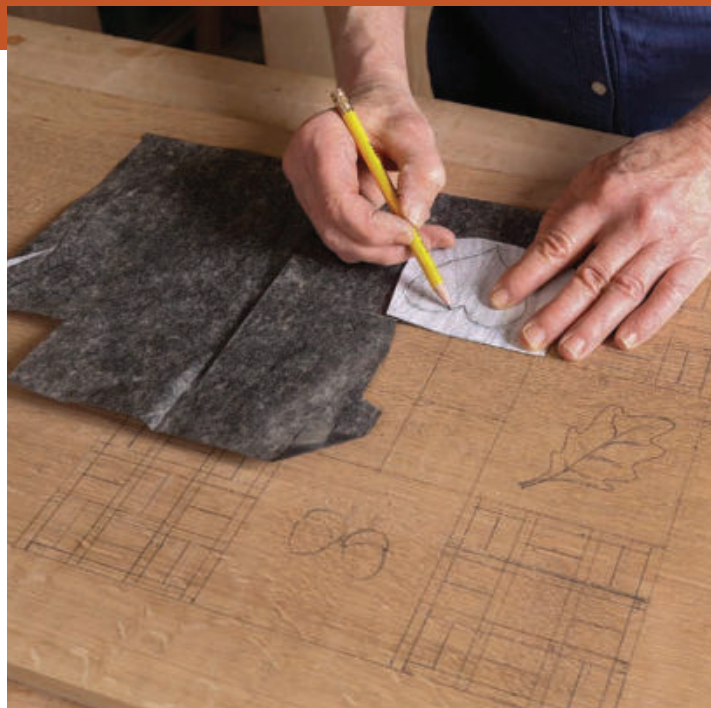


Add the carved field

Gimson used simple, decorative carving and motifs drawn from rural forms in much of his work. Just a handful of layout and carving tools will get you a beautiful result.



Lay out the design. Carefully draw the design directly on the front panel. Hiller uses dividers and a square to mark out and then draw the straight lines. She uses carbon paper to trace her drawings onto the wood.



Cut the repeating peak shapes. First use a knife and straightedge to mark the sides parallel to the peaks. Then use a chisel to slowly approach the depth you want, leaving the apex of the peak sharp and crisp.



Carve the letters, numbers, and designs. Take special care with the outlines that are parallel to the grain; these are especially challenging because your V-chisel will want to follow the grain instead of your line.

mortises for butt hinges and cut them. I cut them by hand, making a series of chops with a chisel and then paring out the waste with a chisel held flat.

The larger portion of the lid is thinner at the front than at the back. Taper its top face from $\frac{7}{8}$ in. to $\frac{5}{8}$ in. thick. I do this by securing a $\frac{1}{4}$ -in.-thick shim to the underside at the front with double-sided tape, then taking a few light cuts with my planer.

The lid is held flat with wedge-shaped battens fastened by sliding dovetails that allow the wood to move. Start by routing the slots at your bench, using a guide. The slots will come through the hinged back edge of the lid but will be stopped about 1 in. short of the front. Next cut the dovetails on the battens at the router table, then trim the dovetails back to the stopped slot with a tenon saw. Cut a 7° angle on

the front end of each batten, then rip a 7° bevel along the length of each side.

Sand the battens and the underside of the lid, avoiding the shoulder areas to preserve a clean fit. Then affix the battens, gluing just the section at the front.

Assemble the chest

To prepare for assembly, clean up the parts with a scraper or sandpaper. Avoid

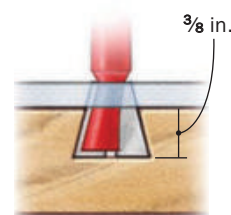
Focus on the top

A subtly tapered lid has sliding dovetailed battens that keep it flat.



THE LID

Cut the dovetail slots. After cutting the hinge mortises in the lid, use a straightedge and a dovetail bit in a handheld router to cut the dovetail slots. Hiller registers the router on the straightedge, careful not to cut all the way through the front edge, and then backs the router out while maintaining the same registration.



Create the taper. Tape a shim to the underside of the front edge of the lid. Feed the lid into the planer, top side up. The taper goes from $\frac{5}{8}$ in. thick at the front of the lid to the full $\frac{7}{8}$ -in. thickness at the back where it is hinged. You also could use a drum sander to do the tapering, or bust out your jack plane, roll up your sleeves, and get to work.

removing material around the joints where doing so could affect their fit. Tap the sides onto the bottom. I don't use glue here. It isn't necessary. The bottom is trapped between the sides, and I cut tight-fitting joints.

For the rest of the assembly, I use a slow-setting adhesive such as Titebond Extend or a slow-curing epoxy. Set the back panel on your workbench, brush glue into the dadoes, and set each side into its dado.

Next, apply glue to the dadoes in the front panel, then lay the front on top of the sides and tap it in place with a rubber mallet. Lift the assembly carefully into upright position, then clamp. Check for square and twist, and make adjustments as needed. Clean up the joints and the top edge of the case.

Hinge and install the lid

With the two lid parts hinged together, glue and clamp the small part in place.

Counterbore with a $\frac{3}{8}$ -in. Forstner bit, then drill for screws and screw it in place. Plug the holes with oak pegs.

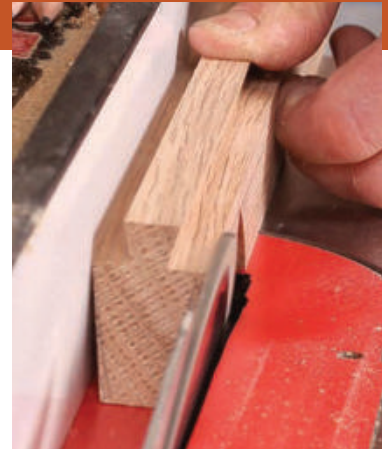
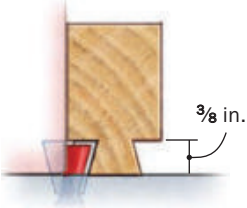
Clean up the lid by scraping or sanding, then lay out the decorative gouging pattern for the smaller thumbnails along each end, and cut those.

Cutouts for beveled battens

The front panel is notched at the top to accept the lid battens. Lay out the notches

THE BATTEN

Cut the dovetails. On a router table with a dovetail bit, cut both sides of the batten, creeping up on and testing the fit of the dovetail in its slot.



Bevel it. Rip a 7° angle along each side of the batten. When cutting the first side (left) you have a flat surface to ride the fence. For the second side (right), with the first bevel against the fence, maintain good downward pressure and make sure the pressure against the fence is at the top of the stock. Be sure to finish both cuts using a push stick.



Trim the dovetails back. Because the dovetail slot stops 1 in. before the front, notch out the dovetail with two cuts with a handsaw.



Affix the battens. Gluing just the front section, where you trimmed back the dovetail, slide the battens across the underside of the lid.

Assemble the case

Putting the chest together is as stress-free as a glue-up can get. Assemble the bottom to the two sides, add the front and back, and then install the two-part lid.



Attach the bottom to the sides. Hiller doesn't always use glue on the mortise-and-tenons that attach the sides to the bottom. The bottom is trapped and not going anywhere. She makes sure the joinery fits tightly, and she doesn't have to worry about squeeze-out.



Add the front and back panels. Spread glue in the dadoes, set the sides-to-bottom assembly on top of the back, add the front, turn the assembly upright, and clamp it all in place to dry.



Add the lid



Install the hinges. To cut the hinge mortises, Hiller makes a series of chop cuts with a chisel and then cleans them up with paring cuts. Then she hinges the two lid pieces together.



Attach the lid. Set the lid in place with equal overhang on each side. Then counterbore with a $\frac{3}{8}$ -in. Forstner bit and drill for screws. Screw the lid to the back panel and plug the holes with oak pegs.



Tapered notch for the beveled battens. Transfer the beveled battens' wide and narrow points onto the top front edge of the chest using a square. Extend these lines down the front and back. Cut the tapered notches with a backsaw and chisel, and then pare to fit.

carefully; the battens are beveled, so the notches must be tapered to match. Cut the tapered notches with a backsaw and chisel, then pare to fit.

I finished the piece with TransTint dye in Honey Amber followed by Minwax oil stain in Golden Oak, a thinly brushed coat of Zinsser amber shellac applied at full strength, and black wax. □

Nancy Hiller, the owner of NR Hiller Design Inc., is a custom furniture and cabinet maker in Bloomington, Ind.



Waterfall Edging

Master this hallmark of Art Deco furniture

BY CRAIG THIBODEAU

If you love Art Deco furniture as much as I do, you've noticed the way the grain seems to flow over the edges of certain veneered panels like water. This is done with a combination of crossbanding around the top face and matched banding on the edges.

The key to the effect is lining up the grain on the face and edges. It requires a little more effort and precision than other edge-banding methods, but it is not as complex as you might think.

I'll show how to apply waterfall veneer on all four edges of a tabletop or door. On doors, I often veneer the back with a contrasting wood that matches the interior of the cabinet.

It's difficult to pull off large veneered panels like these without a vacuum bag or press, but a basic pump and bag system is relatively affordable, and useful not only for veneering but also bent laminations.

Prep the panel

The classic waterfall starts with a cross-banded border on the face of the panel, with the banding's grain direction flowing outward, away from the center. With this type of a border, the substrate has to be

cut to final size up front. That's because trimming the edges after veneering would alter the widths of the border pieces, making them uneven at their mitered corners.

For the substrate of this small tabletop, I used two pieces of $\frac{3}{4}$ -in.-thick Baltic-birch plywood, laminated in the vacuum bag. The layers in the plywood edges would telegraph through a single piece of edge-banding, so after trimming the panel to $\frac{1}{8}$ in. under the final size, I edged it with $\frac{1}{16}$ -in.-thick solid mahogany. Any fine-grained wood between $\frac{1}{32}$ in. and $\frac{1}{8}$ in. thick will work.

Cut the crossbanding strips

To make the edge banding a perfect continuation of the face banding, all of the parts are cut from the same sheet of veneer. Quartersawn veneer works best, because the straight grain is easier to line up.

To get all the crossbanding strips I needed for my 20-in.-square tabletop, I cut a stack of four sheets of quartersawn walnut veneer, each a little over 5 in. wide

by about 24 in. long, and stacked them. I taped the stack together at its ends and trimmed its sides straight (and parallel with the grain) using a sharp veneer saw with a wood block as a guide. Sandpaper glued to the bottom of the guide block kept it from shifting during the cut.

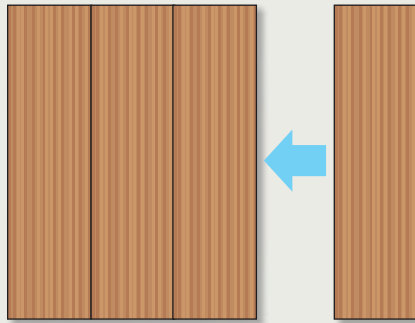
Then I taped the four sheets edge to edge and crosscut them to create the strips of crossgrain banding. With straight-grained veneer, I could cut the crossbanding strips $\frac{1}{4}$ in. wider than necessary and trim them flush with the tabletop afterward, without interrupting the grain match. Be sure to mark the parts to keep track of their orientation.

Join the banding and central veneer

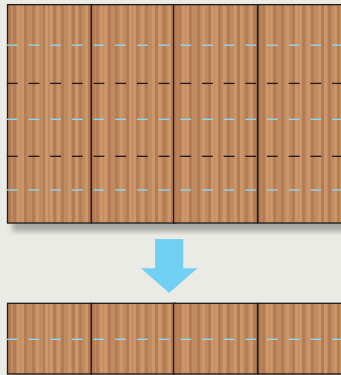
One of my favorite things about veneering is how easy it is to create clean, beautiful patterns, like this central field of maple with a cross-grain walnut border. Unlike

CREATE CROSSGRAIN BANDING

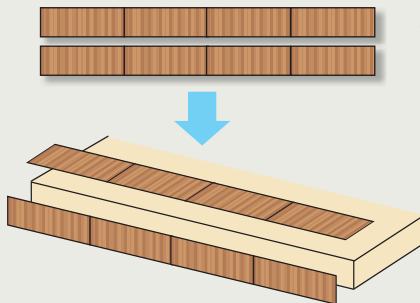
1. Using blue tape, edge-join squared-up sheets of veneer to create a panel wider than one side of the table, and long enough to provide all the crossgrain strips needed.



2. Crosscut the veneer panel into four cross-grain strips, each long enough to span the table and wide enough to yield a matched pair of face and edge bandings.



3. Slice each strip into two pieces, keeping track of their orientation to create a continuous grain match from the top of the table to the edge.



PREP THE CROSSBANDING

The waterfall effect depends on continuous grain in the border and edging, so these strips must be cut from the same sections of veneer.



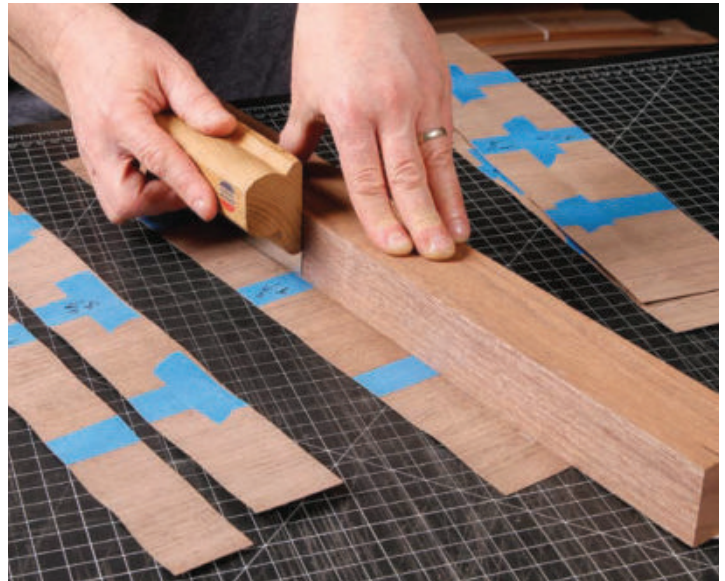
Trim the stack. Figure out how much crossgrain veneer you need, tape it into a stack, and trim the edges parallel to the grain. Use light pressure and multiple passes to cut cleanly through the four plies.



Tape them edge to edge. Flipping every other piece for a bookmatched look, pull the edges together and stretch painter's blue tape across them. Then run a piece of tape down the seam.



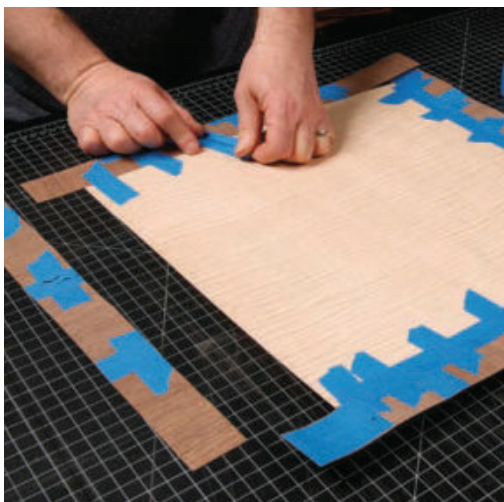
One pair at a time. Using a cutting mat's grid lines to ensure square cuts, Thibodeau cuts a 3½-in.-wide strip of crossgrain veneer, enough for two matched 1¾-in.-wide strips, which will overlap the edges of the panel before being trimmed flush. Mark each strip to keep track of orientation and cut down the middle to separate the border from the edge banding.



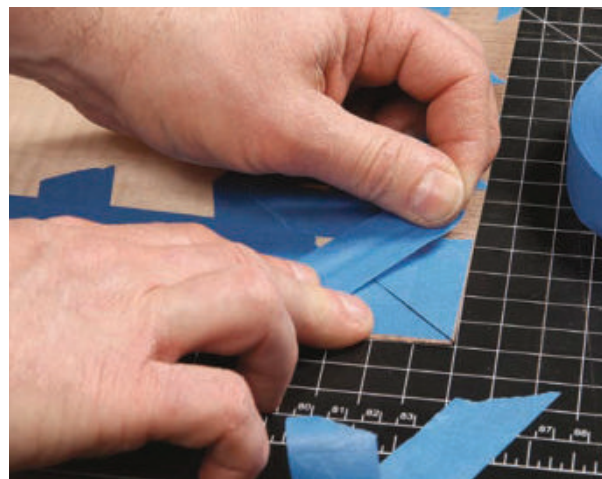
TAPE AND GLUE THE FACE VENEER

Veneer patterns are much easier to execute than solid inlay. All you need are clean cuts and a few strips of tape.

Add the border. Attach one strip of the crossbanded border at a time, aligning its center joint with center marks on the panel and letting the ends overlap their neighbors.



Miter the corners. Flip over the sheet, align a metal ruler with the overlapping corners, and make a series of passes with a sharp scalpel, light at first. Then flip the panel back over to the show face, and stretch tape across each joint.



Clean up the overhang. After gluing the veneer to the substrate, use a flush-cutting bit to trim the overhang (left). Then attach 120-grit paper to a long, hard block and sand away any remaining glue or veneer (above). Note that the plywood substrate was pre-edged with mahogany veneer to keep the layers from telegraphing through the show veneer.

APPLY THE WATERFALL EDGE BANDING

The waterfall edge banding goes on last, one strip at a time, with conventional clamps this time.



One strip at a time. After applying glue, align the edge strip carefully and tape it in position. Its extra width makes it easy to align the grain perfectly. A thick cork-lined caul distributes the clamping pressure evenly, and a second caul protects the opposite edge of the panel. Wait a couple hours, trim the overhang, and move on to the next strip.

you look closely at the mitered veneer joints at each corner and align them perfectly with the panel. Also, make sure the grain direction of the center veneer runs opposite the direction of the Baltic-birch plywood; that will help keep the panel flat.

Let the vacuum pump run and the glue dry overnight, and then trim the overhang flush around the perimeter with a trim router, using a climb-cut to prevent chipping. Now give the edges a quick sanding with a hard block (no cork) to clean up whatever the router bit left behind: glue drips, a bit of overhanging veneer, etc.

I glue on the edge crossbanding strips one at a time using F-clamps and cork-lined clamping cauls. I wrap packing tape over the cork to make sure glue won't stick.

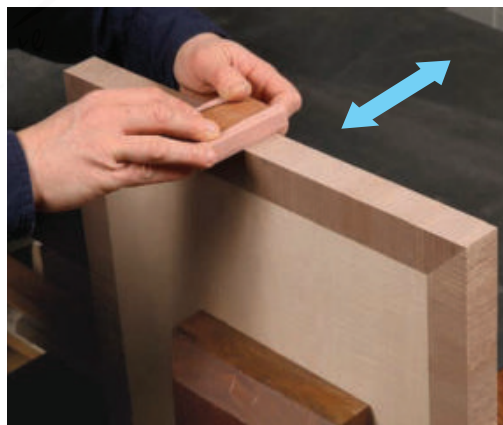
Pay close attention to the grain alignment between the edge banding and the face banding. Let each strip set up for a couple of hours before trimming it flush with the router and sanding block and moving on to the next one.

Sanding waterfall veneer for finishing

The grain on the face of this panel runs in every direction, requiring special care when sanding. I do an initial flat-sanding with a long cork-lined block and 150-grit paper, to level the surface and remove leftover glue, and then follow with a random-orbit sander at 180, 220, and 320 grit. Sand the edge banding with the grain, making lots of short strokes with a smaller block (no cork this time). Be careful to keep the block flat against the edge.

These fundamental veneering techniques are great to learn, and they're all you'll need to make world-class waterfall veneer. □

Craig Thibodeau is a furniture maker in San Diego, Calif., and the author of The Craft of Veneering (The Taunton Press, 2018).



Final surface prep. Make short strokes across the edge, using a small, hard sanding block. Then apply a very fine roundover to the corners, hand sanding with folded 320-grit paper, and the joint disappears.



Breadboard Ends

Four methods for keeping panels flat

BY GARY ROGOWSKI



It was more than a few years back that I made a sewing table for my sweetie and, wanting to test my fledgling woodworking skills, decided to use breadboard ends across the tabletop. While they turned out fine, I nearly pulled out my hair doing them. In the time since, I've refined my processes, using breadboards on numerous projects both for their structural benefits and design opportunities.

Breadboard ends are narrow boards attached to a solid panel across the grain to help hold it flat. In this article, I go into four ways to attach them. They're all effective. But it's important to pick the right option for the scale of your project, so I outline when to use which and why. The different options involve different machine and hand-tool strategies. Regardless of the type, though, I always refine the joint by hand for a tight fit that will stay closed for years to come.

As for decorative elements, like contrasting woods and shapely plugs, I leave that up to you. For a little inspiration, though, I recommend looking at this article's Online Extra. It's a feature on a Greene and Greene side table I made, and its breadboard ends pull out all the stops.

Gary Rogowski hosts the podcast Splinters at northwestwoodworking.com.

Online Extra

To see how to build a Greene-and-Greene side table with striking breadboard ends, go to **FineWoodworking.com/281**.

1. Tongue-and-groove

LIGHT-DUTY JOINT FOR SMALLER PROJECTS

This option is great for small projects like lids for boxes, but its small tongue won't work well for bigger, thicker panels without reinforcement.

Cut the groove first. Set the tablesaw fence so the blade is just about centered in the workpiece. After taking the first pass, flip the board face for face for the second, centering the groove. Move the fence slightly farther from the blade and make pairs of passes until the groove is the desired width. The tongue is also centered, so when cutting it, flip the panel face for face between passes as you dial in the thickness. I aim for it to end up a little fat off the saw, letting me clean up the tongue with a shoulder plane for a great fit. Just don't make it too tight because with stock this thin, you can crack the face of the groove.

After the tongue fits, plane a spring joint. With a plane set for a very light cut, take two light swipes across the middle of the end's inside edge. This forms a slight concavity—about $\frac{1}{32}$ in., enough to barely see—that will close under clamping pressure. Glue the center 2 in. or 3 in. of the tongue and clamp it in the middle. The spring joint will hold the breadboard ends closed along the rest of the joint.



For a small panel on $\frac{1}{2}$ -in. stock, use a $\frac{3}{16}$ -in.-long by $\frac{3}{16}$ -in.-thick tongue.



Groove the breadboard end. Flip the workpiece face for face between passes, centering the groove. Use a rip blade for flat-bottom cuts.



Set the blade height for the tongue. Raise the blade to just shy of the bottom of the groove. This leaves the tongue thick, letting you sneak up on the fit by hand later.



Cut the tongue. With the blade partly buried in a sacrificial fence, make cuts on both faces. Then move the fence over to complete the tongue.



Spring time. Take two light passes along the middle of the breadboard end's inside edge. This forms a spring joint, a slight concavity that will keep the joint tight. Add glue to only the middle of the tongue to allow for seasonal movement of the panel.



2. Tongue-and-groove for bigger panels

REINFORCE THE JOINT BY ADDING SCREWS

#8 x 3-in.-long
trim-head screws



Tables with breadboard ends need more strength because people will inevitably lift a table by the ends. I often use screws in these cases. They sit in elongated holes and are hidden with plugs.

I still use a centered tongue and groove, except this time, after cutting the groove at the tablesaw, I cut the tongue with a plunge router and straight bit. With large

panels, I find this method safer than using the tablesaw.

I cut the tongues about a third as thick as the panel, but typically not under $\frac{1}{4}$ in. or over $\frac{1}{2}$ in. Clamp the panel to the bench and put an extralong fence on your router to make locating the cut easier. When necessary, such as when making a smooth entry cut, hold the

router with one hand and use your other hand to guide the fence along the panel's end. After the first cut, flip the panel and cut from the other face. I get the tongue close with the router. Final fitting comes with a few passes of my shoulder plane.

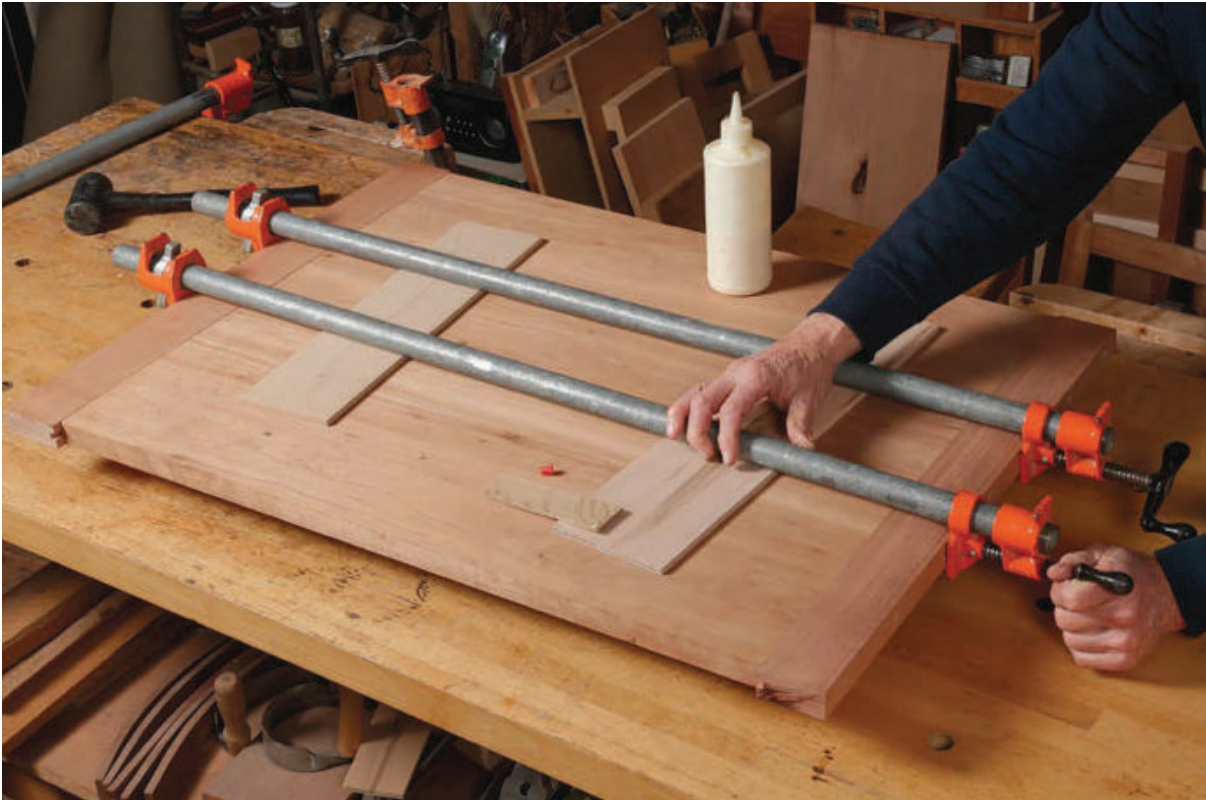
Once the breadboard end fits, I spring the joint (opposite page) before drilling for screws that run through the breadboard

Use a plunge router for the tongue. On long panels, Rogowski cuts the tongue with a plunge router equipped with an extralong fence. After getting the fit close with the router, he refines it with a shoulder plane. To counter any cup in the panel, clamp it between a pair of jointed battens (far right).



Drill holes for screws in the breadboard end. After planing the spring joint, drill the holes and counterbores. Then ream out all but the center hole to allow for wood movement. This lets the panel move seasonally within the breadboard ends. To ream the holes, Rogowski chucks a chainsaw file (handle end out) into a drill, pivoting it back and forth in the holes on the grooved edge (far right).





Glue and clamp the middle of the joint. The spring joint will help extend the pressure outward, keeping the joint tight end to end. Rogowski elevates the clamps with thin plywood spacers, letting him center the clamping force in the thickness of the breadboard end. They also prevent the pipe clamps from marring the workpiece.



Drill and drive screws into the panel. You'll likely need an extralong drill bit for this. Rogowski uses tape as a depth marker when drilling into the panel (far left) before driving the screws.

end and into the tongue. The screws sit in slotted clearance holes in the breadboard ends, and plugs cover them up. I have a simple method for elongating my screw holes. I drill a clearance hole first and then chuck a $\frac{1}{4}$ -in. chainsaw file backward in my cordless drill. Then I use the file's hardened handle to ream the hole by angling the drill back and forth.

Apply glue to the breadboard ends only in the middle 3 in. Clamp the ends in place and let the glue dry before adding the screws and plugs.



Cover with plugs. You can either make these a decorative element with contrasting wood or use the same species to make them more inconspicuous.

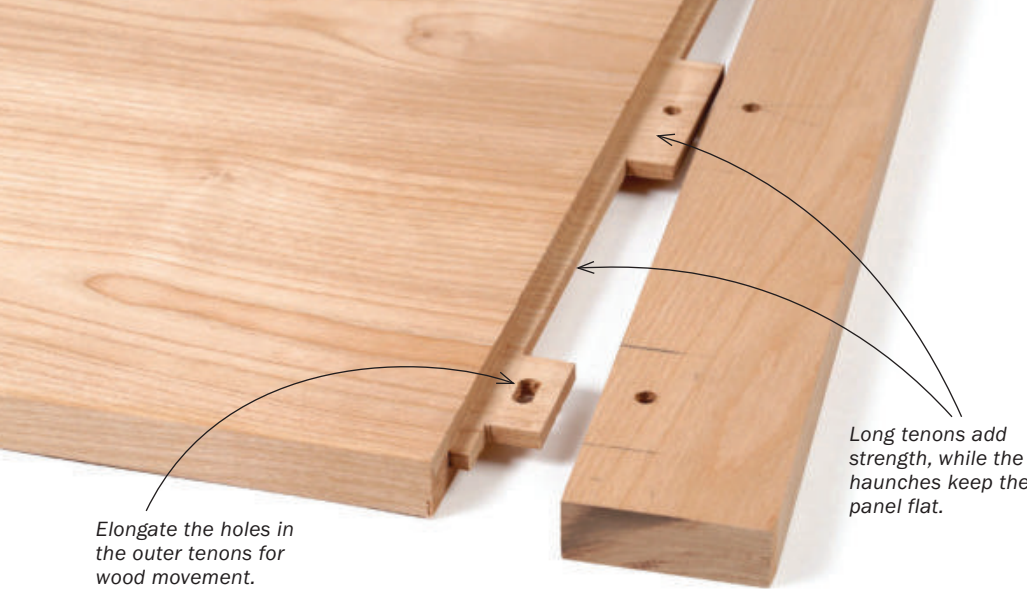
3. Tenons

A TRADITIONAL OPTION WITH PLENTY OF STRENGTH

When I want an option that's nearly bombproof, I use a series of pinned mortise-and-tenon joints connected by haunches between the tenons. It takes more time, but these ends are on to last.

The tenons, spaced across the width of the panel, provide great strength and allow you to pin the joint. The stub tenon fits in a groove, maintaining the integrity of the breadboard end by reducing how much material is removed. Here the groove is blind to conceal the joint and simplify fitting, but these types of breadboard ends work just as well with a through-groove.

The outer tenons should be narrower than their mortises so there's room for the panel's expansion. For a tabletop 24 in. wide or more, I cut mortises 2½ in. wide and tenons 2 in. wide. That gives plenty of space. To cut the groove and mortises, I use my router table with a



Elongate the holes in the outer tenons for wood movement.

Long tenons add strength, while the haunches keep the panel flat.

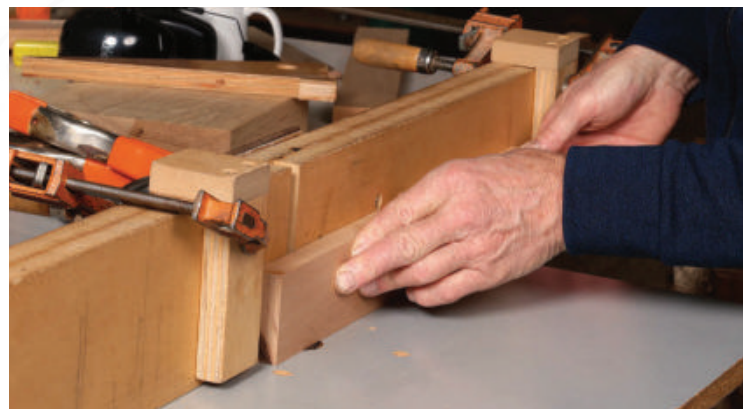
Groove between stops. With stops secured to the fence to control the groove length, Rogowski pivots into and out of the cut. Plywood shims clamped to the table let him take a light pass to cut the groove while keeping the bit at final height for the mortises.



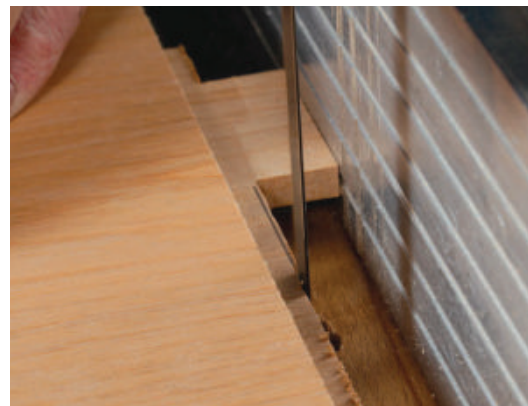
Reset the stops. To rout the mortises, leave the fence setting but remove the table shims and reset the stops. To set the stops, use the mortise layout lines, lining up the ends of each mortise with the sides of the bit.

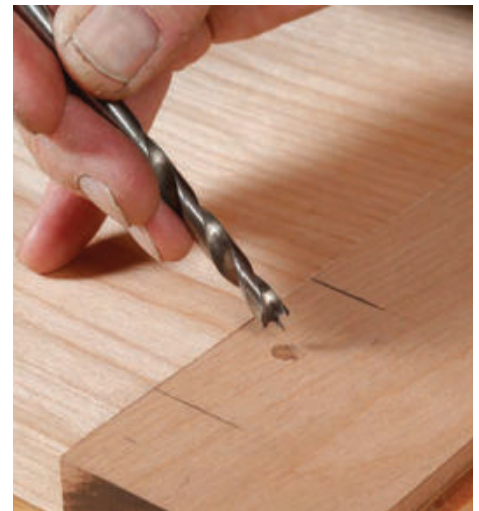


Drill for the pins in the breadboard ends. Keep these centered in the mortises. The holes can be either through or stopped.



Turn one tenon into several. Rogowski begins by plunge-routing one long tenon that runs the width of the panel. He then bandsaws it into individual tenons, trimming them slightly narrow to leave space for wood movement.





Dry-fit and transfer the hole locations to the panel. With the assembly clamped together, use the same bit you drilled the holes with to transfer those locations to the tenons.

fence and stops. The fence stays at the same setting, but the stops move for each cut. The mortises should be symmetrical along the length of the breadboard end, but don't flip the breadboard end face for face. If you're not mortising dead on in the middle of the thickness of the workpiece, you'll end up having to tweak the joint, and that's more trouble than the time saved flipping the piece. I mortise $\frac{3}{4}$ in. to 1 in. deep depending on whether the piece might get lifted at the breadboard ends. Deeper mortises make stronger joints.

To create the full and stub tenons, I start by routing one continuous long tenon across the panel's ends with a plunge router. I rout it slightly over thickness and then refine it with a shoulder plane. Then at the bandsaw, I cut the full tenons to width and crosscut between them to create the stub tenon. Once the mortises are cut and tenons fitted, I add the spring joint.

A great benefit of this method is that you can pin the joints for extra strength. After drilling through the mortises, dry-fit the panel and both ends, transfer the hole locations, and drill through the tenons. Elongate all but the middle hole into a slot so the pin doesn't prevent the tenon from moving in the mortise as the seasons change.

Glue the middle of the joint, clamp it tight, and add the pins.



Outside holes need elongating. After drilling the holes in the tenons, widen the holes in all but the middle tenon to allow for wood movement.



Pin the joints. While the glue on the breadboard ends cures and the assembly's still clamped up, add glue to the pins and drive them into place.



Orient the grain of the spline parallel to that of the panel for greater strength.

Both parts are grooved for the spline.

4. Loose spline

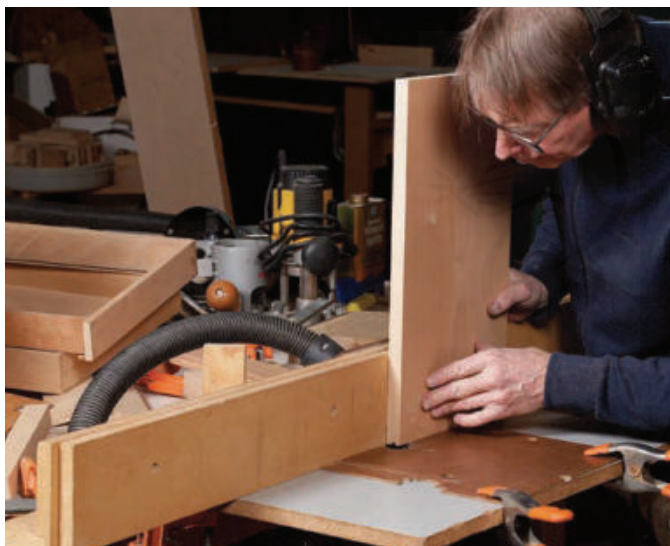
SIMPLER METHOD WITH DECORATIVE POSSIBILITIES

An easier and potentially more decorative alternative to the tongue and groove is two grooves with a spline between them. The spline can be made of a contrasting wood, but its grain has to run in the same direction as the panel's for strength and so the two will expand and contract together. This method is good for littler projects and small tabletops. To make life simple, mill the panel and ends to the same thickness. Make the spline out of a board wider than your panel, or use multiple pieces. If your panel is pretty wide, say over 12 in. or so, then using two or even three splines is a much easier way of working because the splines, all short grain, will be less likely to break. No one will know there's more than one spline in there.

Glue the splines into the panel. Trim them to length. Like before, use a spring joint on the breadboard ends and glue only the middle 2 in. or 3 in. of the joint.

Two grooves.

The panel and breadboard both get grooved. Set the bit to final depth, and temporarily clamp a piece of masonite to the tabletop for the first pass to avoid taking too deep a cut.



Cut the spline.

To make the spline stock, first crosscut a piece a bit over length. Next, cut it to thickness at the tablesaw (far right).

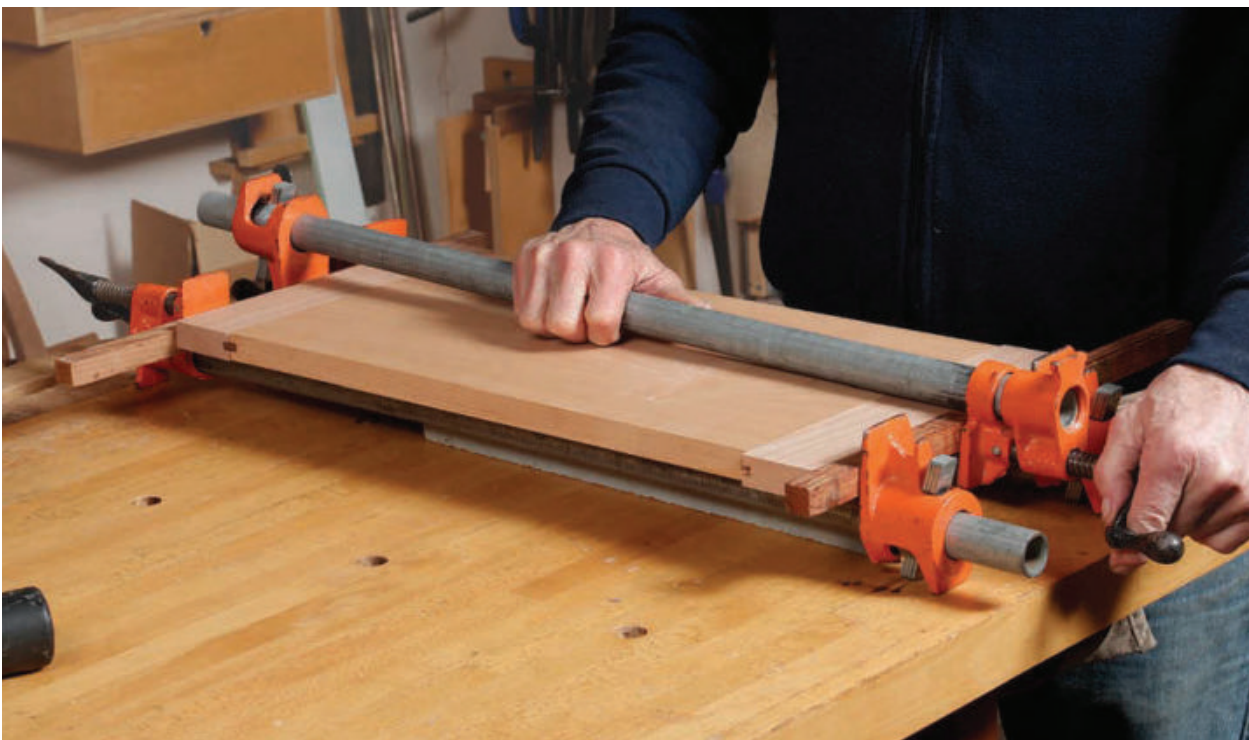




Cut the spline to length. Dry-fit the assembly so you can measure the gap between the panel and the breadboard end (far left). Trim this much from the spline stock.



Glue splines to the panel. Because the splines' grain runs in the same direction as the panel's, you can glue it in the whole length of the groove. For wider panels, use multiple shorter splines, which are less likely to break as you handle them. Lightly chamfer the corners afterward.



Glue up. As usual, Rogowski adds a spring joint to the breadboard end, glues the middle of the workpiece, and makes sure clamping pressure is straight across the joint.

Elegant Side Table



Tasteful project celebrates
ash's signature linear grain

BY MASON M c B R I E N

The primary motivation behind this table was to make a simple piece that celebrated the beautiful grain of American white ash—a tree doomed to extinction because of the invasive emerald ash borer. In keeping with the elegance of ash's linear grain, the table's construction is fairly straightforward—straight-tapered legs, split aprons connecting them, and a top profiled underneath.

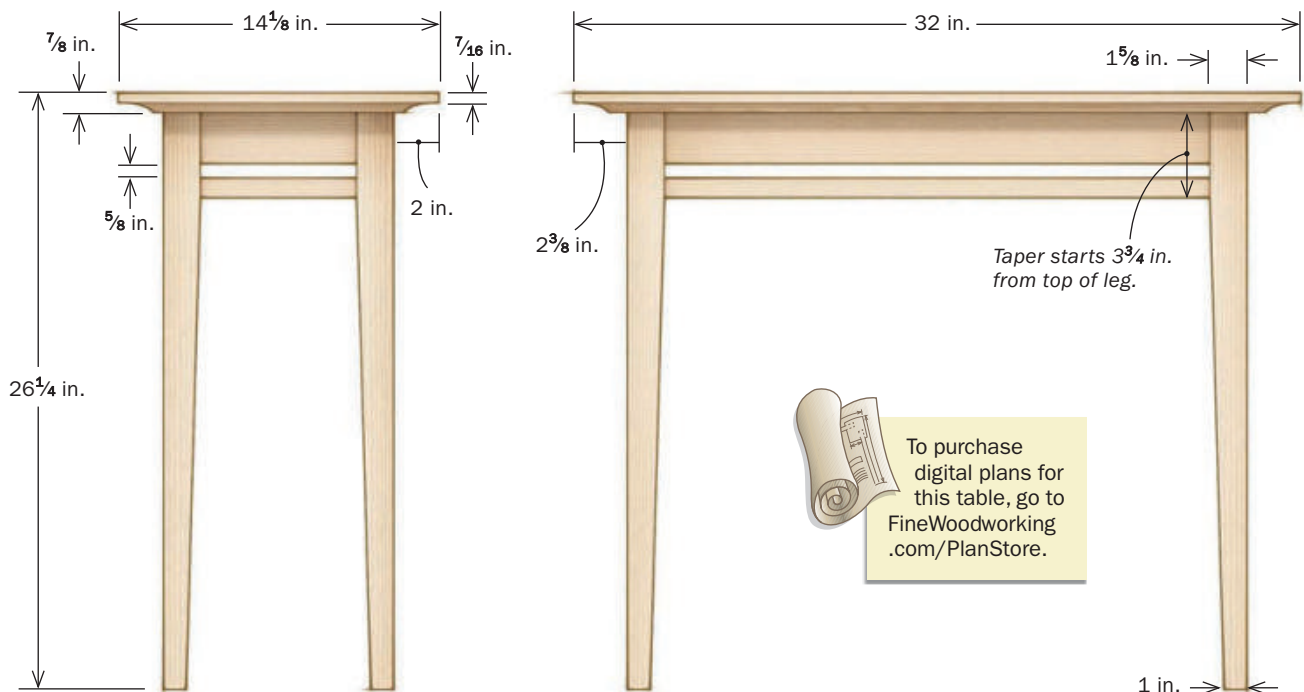
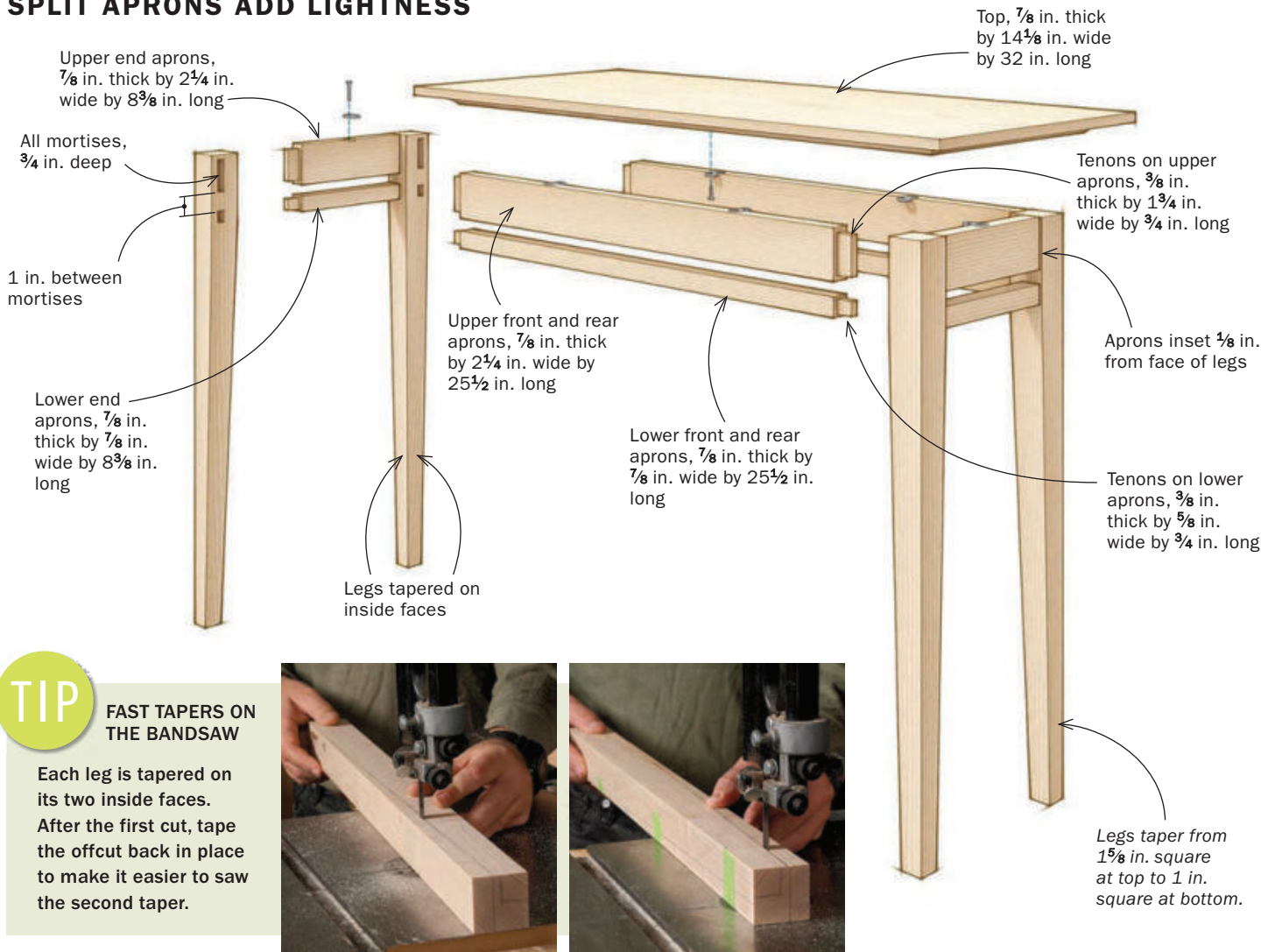
The double apron has a double benefit. Whereas a single wider apron would provide the necessary anti-racking strength, its size would have clashed with the lightness of the design. This dual apron keeps things light while acting

mechanically like a single wide apron. Don't let the table's simplicity and clean lines persuade you to take building it lightly, however. Its stripped-down aesthetic, meant to display the beauty of ash's grain and the lightness of its color, also lays bare any miscues.

Consider the grain

For me, the great fun of this project is finding the beautiful straight grain for all the parts. It requires patience and an observant eye not only to ferret out good boards but also to obtain linear grain from boards that might not look like

SPLIT APRONS ADD LIGHTNESS



How to break down a board for best grain

APRONS

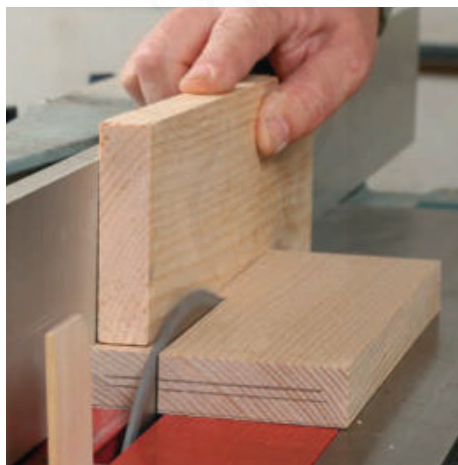
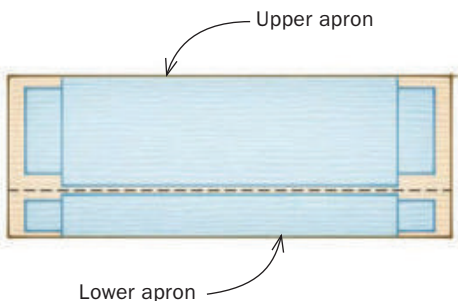
See the grain.

When breaking down a board, McBrien likes to use a clear template a little bigger than the part he's laying out. This way, he makes sure the grain is exactly what he wants.



Clear plastic template

Rip wide and narrow aprons from a single board. This keeps the grain matching between the two, bolstering the table's harmonious linear grain. Mark the end grain so you can easily identify the pairs later.



Straight rips at the bandsaw. Because laying out for grain often means running at an angle to the board's edge, use the bandsaw for rips. A jigsaw can handle the crosscuts.

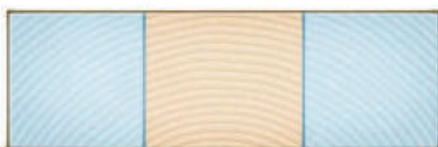
good candidates. When you succeed, the result is harmony.

A little time at the lumberyard will yield a few boards with enough straight grain at the edges for the legs and dual aprons, as well as suitable stock for the top. Although quartersawn works well, I usually find enough stock in the rift portions of flatsawn boards. I use the leftover crown portions as setup or practice parts. The top and aprons are made out of 4/4 boards. The legs are out of 8/4.

When choosing the leg material, look for straight grain on the edge of the board as well as 2 in. of straight grain on the face. An even-grained 6-ft. flatsawn board should yield four legs.

LEGS

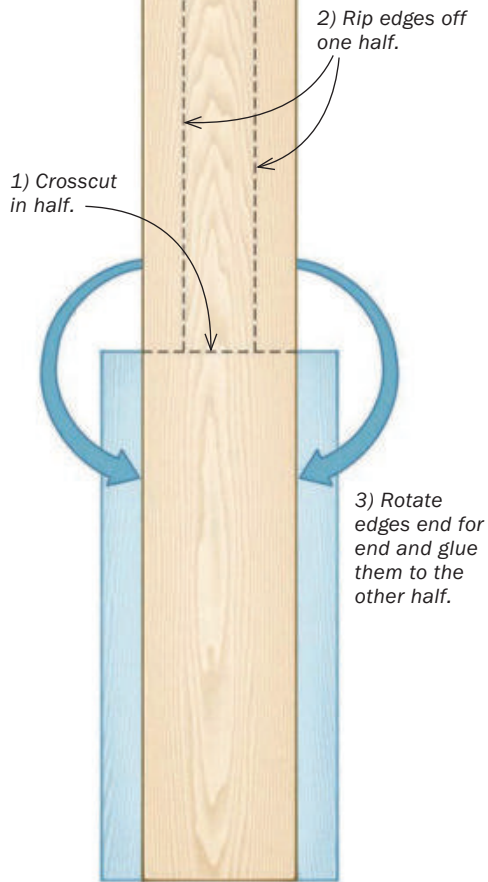
Legs need rift grain. Look for straight grain on the edge of an 8/4 board as well as 2 in. of straight grain on the face (right). Ideally, you want growth rings that are evenly spaced on all faces and run 45° across the ends (far right).



Rip out the legs so their end grain runs 45° to the faces.



TOP



Try to keep the grain harmonious on the aprons, too. If possible, choose sections of boards that have $3\frac{1}{2}$ in. of linear grain. This way, you can rip each pair of aprons out of the same section, letting the grain flow between the two. Start by laying out the front apron, then the sides, and finally the back. Mark their ends to keep them together through milling and glue-up.

The top requires a 10-in.-wide, 6-ft.-long board with centered cathedrals and $2\frac{1}{4}$ in. of straight rift grain on the edges.

On any piece in which the grain doesn't run parallel to the roughsawn edge, straighten things out before milling by bandsawing parallel to the grain.

Base gets mortise-and-tenons

The table joinery is fairly simple. Still, I like to mark my parts to ensure I don't cut a mortise where it doesn't belong. For the legs, this means bundling them with



Make the top from a single board. This ensures grain and color match. Crosscut the board and use one half as the middle of the glued-up top; the second half gives you straight, riftsawn edges.



Glueline disappears in the rift. Rotate the riftsawn edges end for end and glue them onto the first half of the board you crosscut, and the glueline vanishes in the straight grain. The tighter and straighter the grain, the better the effect.

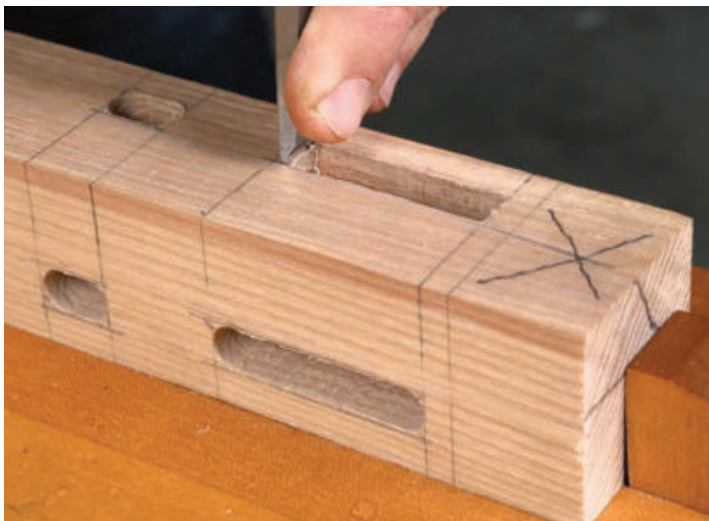
A simple approach to joinery

MORTISES

Lay out the mortises. McBrien lays out one leg's mortises before transferring the end lines across the other three. He leaves the legs 1 in. overlong at the top to avoid blowing out the end grain when chiseling the mortises square.



Drill out the mortises in several passes. After drilling out the ends of the mortise and clearing in between, McBrien makes a series of passes to clean up the scalloped ridges, leaving nearly flat mortise walls that need little paring.



Square up the mortises. Use a sharp chisel to lightly chop and pare to your layout lines.



Trim the legs to length. For an accurate cut, McBrien lines up his layout line with the zero-clearance kerf in his crosscut sled.

the best faces out before drawing a bold reference triangle atop all four. These legs will be tapered, so you'll have a chance to remove surface imperfections.

Next, I draw light lines where the mortises will go. The mortises are placed so the aprons are inset about $\frac{1}{8}$ in. from the front of the leg to give a nice shadow line. I usually leave the legs a little extralong at the top to avoid blowing out the short grain when paring the top of the upper mortise. I trim them to length afterward.

I cut the $\frac{3}{8}$ -in. mortises on the drill press and then clean and square them up with chisels. With the mortises cut, you can taper the legs. I cut them at the bandsaw and clean up with a jointer plane.

For efficiency, I mill the two-part aprons as one unit before ripping them apart. For the upper aprons, I cut the tenon shoulders at the tablesaw and the face cheeks at the bandsaw. After scribing the tenon's width directly from its mating mortise, I cut the tenons to width with a backsaw.

I use slightly more handwork for the tenons on the narrower lower aprons. I cut only their front and back shoulders at the tablesaw and cheeks at the bandsaw. To cut the tenon to width, I use the backsaw for both the shoulder and cheek cuts.

Wide, seamless top

The tabletop is more than 14 in. wide—not an easy dimension to find in a single

TENONS



Tablesawn shoulders. Using a stop for repeatability, cut all the $\frac{1}{4}$ -in. shoulders on the upper and lower aprons.



Bandsawn cheeks. Cut the aprons' front and back cheeks using the bandsaw. Set a stop to keep from cutting into the shoulder.



Scribe and saw tenon's width. Because McBrien cleaned up the end of each mortise by hand, he may have introduced some variation. So he uses each mortise to mark the width on its mating tenon (far left). Then he saws the tenons to width by hand (left).

board. Here is my way of making it from narrower stock: Find a 10-in. board with a little over 2 in. of straight rift grain on both sides and a centered crown. The top is about 32 in. long, so cut two sequential 32-in. pieces. From one board, rip off the rift sides, swing them onto the other board, and glue them to the edges. The gluelines become nearly impossible to find in the straight grain.

To form the coved profile under the top, I use a vertical panel-raising bit. These are much less taxing on your router table than horizontal panel-raising bits.

At this stage, you can chamfer the edges on the legs, aprons, and top.



TIP

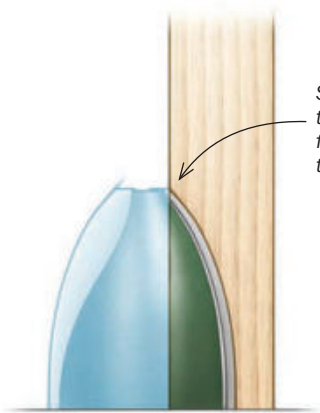
SPACER HELPS LAY OUT NARROW APRON'S TENON

The narrow apron's upper and lower shoulders are only $\frac{1}{8}$ in., so McBrien cuts these entirely by hand. To ensure the gap between the aprons is uniform, he uses a spacer between the narrow apron and a dry-fitted wide apron.

Cove the top



Rout the cove under the tabletop. McBrien uses a vertical panel-raising bit because it's less taxing on his router table than horizontal bits. He leaves about $\frac{7}{16}$ in. at the table's edge.



Stop at apex of the cutter to avoid fillet at the end of the cove.

NOTE: Take multiple light passes to reach final depth.

Glue-up and finish

Glue up the shorter ends before the longer front and back. This way, you can more easily use spacers to hold the lower aprons in place. Because of all the joints involved, I prefer to use a glue with a longer open time.

One of the reasons I love ash so much is its light color. To preserve this as much as possible, I use a water-based varnish, Behlen's Rockhard Waterborne Brushing Varnish in semigloss. After two to four coats of that, I apply Liberon neutral wax, which doesn't color the wood. □

Mason McBrien is a furniture maker in Union, Maine.



Rout the ends before the edges. McBrien coves both ends before the edges to avoid blowout in the finished top. Rout in stages, taking a series of light cuts.

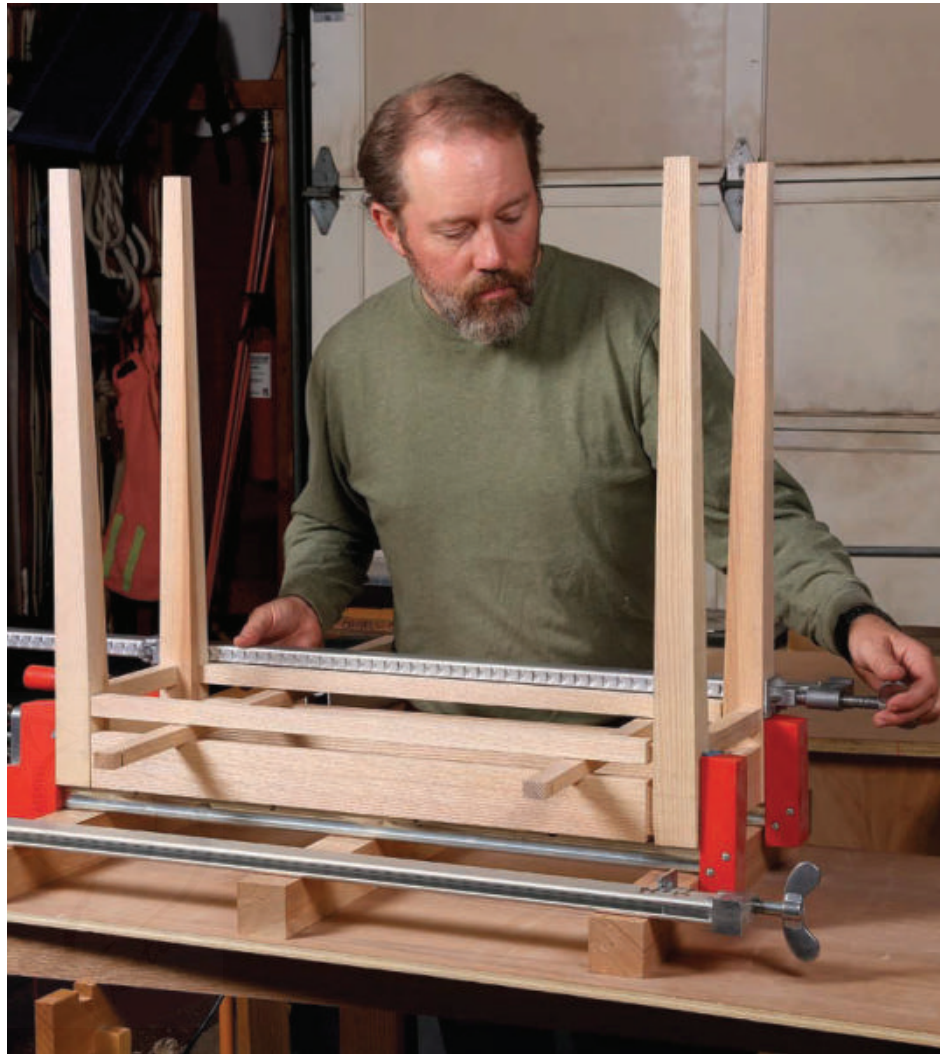
Take a calm approach to the glue-up



Start with the ends. Glue the end assemblies together first. The short aprons make them easier to manage, and assembling these first will make gluing in the longer aprons easier.



Spacer keeps front and rear narrow aprons in place. Because of their length, the narrow aprons can be unwieldy during glue-up. A pair of spacers fixes this headache (above), making clamping the end assemblies to the long aprons much easier (right).



Top attaches with figure-8 fasteners. McBrien uses one fastener on each short apron and two on each long apron. Use a Forstner bit so they sit flush with the top of the aprons (above). After adjusting the top's overhang, predrill and screw the figure-8s to the top (right).



Cutting Coves on the Tablesaw

HOW IT WORKS

A pair of fences are clamped to the tablesaw and outfeed table.

By feeding stock at an angle to the sawblade and cutting incrementally, you can create a wide range of coves.

TOP VIEW

Take an angled approach to create curves for molding and much more

BY WILL NEPTUNE

While bigger shops can easily produce a wide range of concave surfaces using a shaper or molder, smaller shops often need to get creative to make coves. A router can go only so far. That's where cove cutting on the tablesaw comes in. By feeding stock at an angle on the tablesaw, you can create a wide range of curves, from narrow to wide, flat to steep. Things get even more interesting when you tilt the blade as well, as this angles the cove. If you follow the steps and precautions in this article, you'll be able to comfortably and safely produce curves that are deeper, wider, and more varied than those you can make with a router table.

Two types of coves, plenty of variety

Tablesaws can produce two kinds of coves: standard and angled. Standard coves are simpler and are symmetrical along their vertical axes. They're formed by setting the blade 90° to the table. Angled coves, on the other hand, are the result of tilting the blade. Angled coves are sometimes referred to as asymmetrical coves, but this makes the curve sound overly mysterious. Tilting the blade simply tilts the line of symmetry.

Arbor angle isn't the only thing that determines a cove's shape. Three other factors also come into play. First, there's the height of the blade, which affects the cove's depth. Second is the feed angle. The higher the feed angle—meaning the farther away it is from parallel with the blade—the wider the cove. The last factor is blade diameter, as

Standard coves, cut with the blade vertical, are the bread and butter of this method.

By varying your techniques and setups, **partial coves** and **coved panels** are possible, too.

Angled coves, cut with the blade tilted, add further variety and energy to the array of shapes available.

SETTING UP

Draw the desired curve. Draw the cove you want on the end of the workpiece to help set up the cut. Be sure to leave enough wood above the cove so the stock doesn't get too thin and weak as you cut it. And leave enough on either side of the cove to ensure solid contact with the saw table.



Online Extra

If you feel more comfortable setting up with a cove angle calculator, go to FineWoodworking.com/281.

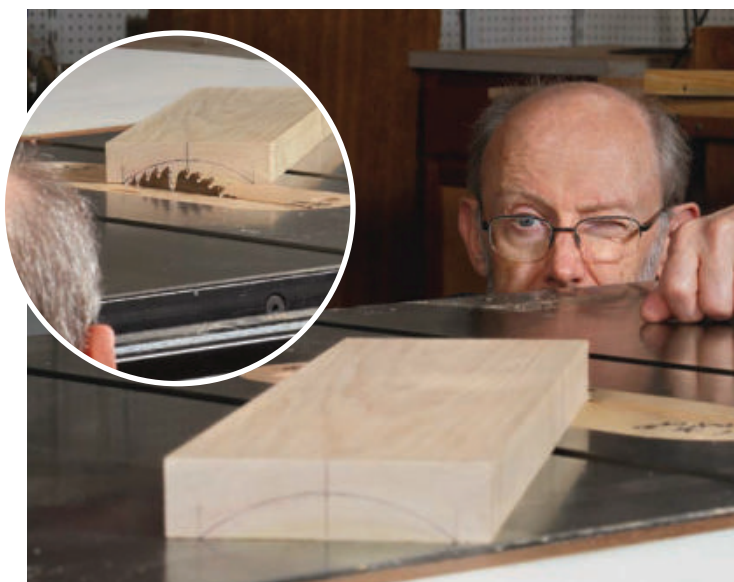
smaller blades can produce tighter coves. Use a rough rip blade if possible, although a combination blade will do.

Straightforward setup ensures safety

While some people use jigs or even computer programs to help figure out their coving setups, I try to keep things simple. After drawing the cove on the stock, I set the height of the blade to the deepest point of the arc. To figure out my feed angle, I put the workpiece behind the blade and sight the blade's arc against the drawn cove, angling the board until the width of the cove matches the width of the blade's silhouette. That's all you need to do for straight coves. If you're doing an angled cove, match the width first, then tilt the



Raise the blade to the depth of the cove. When coving, you raise the blade incrementally between passes, but start by lifting the sawblade to the highest point in the cove (above). Then mark the extent of its cut on the throat plate, using a left-angled tooth at the back and a right-angled tooth at the front (right). This will guide you when setting up the two fences.



Find your feed angle by sighting the blade against the stock. Move the stock until the outline of the blade fits within the cove.



Draw the feed angle on the throat plate. You'll use these lines to align your fences. If you can't directly trace the edges of the stock, use a straightedge to extend the line.

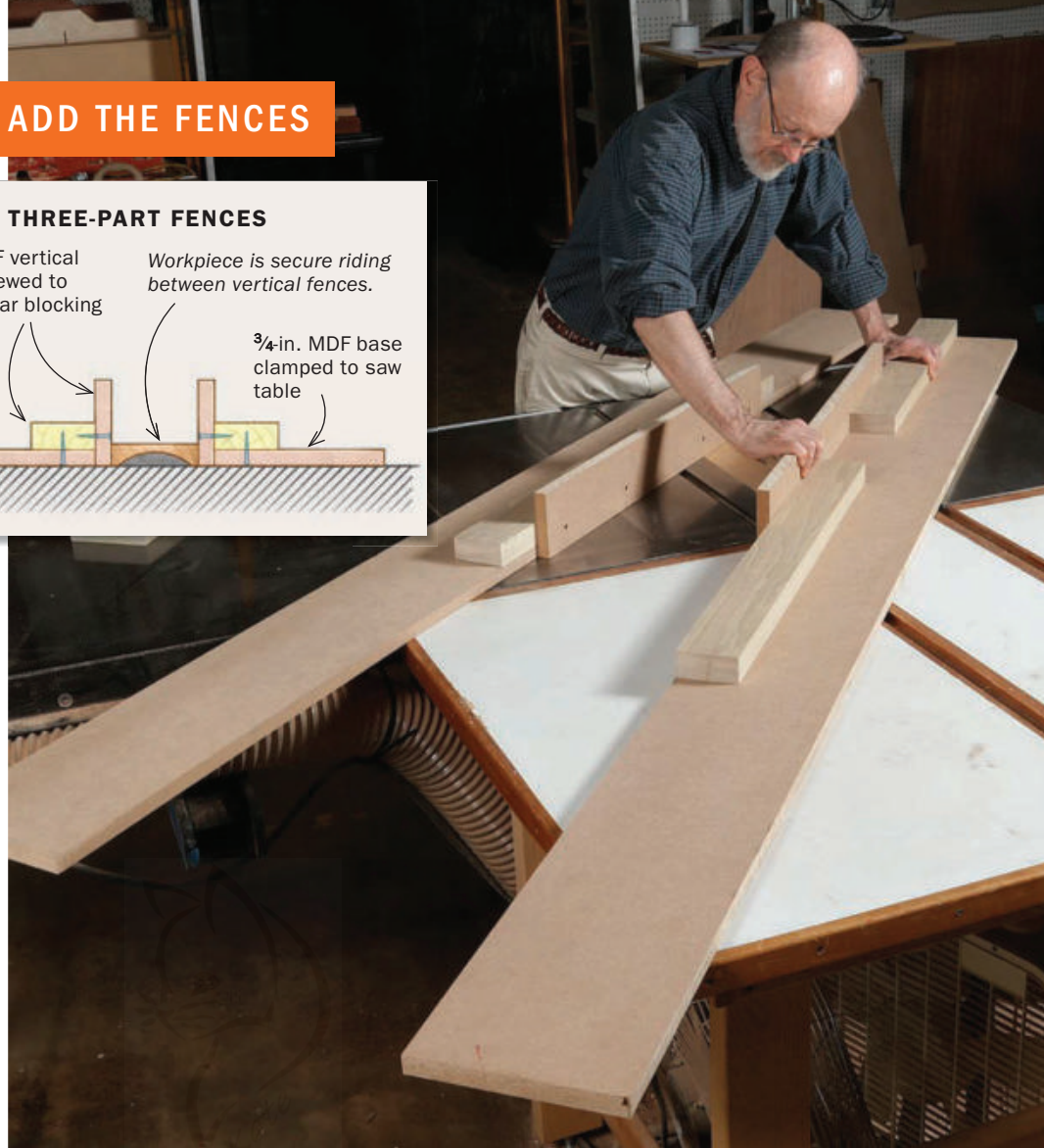
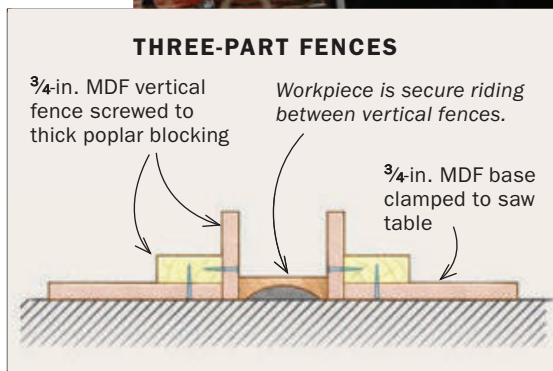
blade. You will then need to readjust the height of the blade.

The angle of the board is your feed angle, so transfer the board's edges onto the throat plate with a pencil and you'll know where to clamp the fences. Just be aware that no matter how much you fiddle with the setup, though, you're unlikely to hit your layout lines spot on. The blade gives you what it gives you, so take test cuts and accept when they're good enough.

Use two fences and hold-downs—The safety goal here is to control the path of the workpiece. Coving on the tablesaw means cutting with the sides of the teeth, so I take extra precautions to make sure my stock travels straight and tight to the table. Because I am using two fences and hold-downs, the workpiece can only travel straight and stay tight to the table.

The two fences flank the sawblade, one in front and the other behind. The front fence resists the force of the blade pushing the wood toward the front of the saw. The back fence keeps the wood tight against the front fence. During the cut, the wood pushes against the sides of the teeth, which cut slowly. Without this rear fence, the wood could rub against the saw plate and slide away from the operator—possibly leading to kickback.

ADD THE FENCES



It takes two. The front fence resists the force of the blade pushing the wood toward the front of the saw. The rear fence keeps the wood tight to the front fence. Making both overlong and fairly wide leaves room for clamping them down at different feed angles.

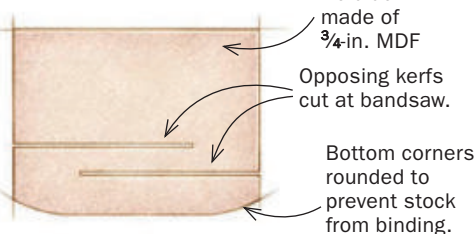


Clamping may require creativity. These fences need to be locked down securely, and you will likely have to use shims in spots where there's otherwise not enough bearing surface. Place the workpiece between the fences as you clamp to ensure accurate spacing.



Hold-downs add security. Attaching hold-downs to the fences keeps stock held firmly against the saw table. Without them, the wood can lose contact with the table, possibly leading to kickback.

SHOPMADE HOLD-DOWNS



CUT A STANDARD COVE

Never try to cut the cove all at once. Instead, for a safe, clean cut, take multiple passes, raising the blade $\frac{1}{32}$ in. to $\frac{1}{16}$ in. each time. Examine the early passes and adjust your feed angle in case the cove is off. Feed slowly, and use a push stick to keep your hand away from the blade.



Slow down on final pass for a cleaner surface. On the last cut, back off on your feed rate even more. The tablesaw can leave rough coves, and the slower rate lessens the cleanup you'll have to do.



The fences are simple affairs. Each has a long, horizontal base that's clamped to the saw table. I screw poplar blocking to the base to bolster vertical fences, which press against and direct the workpiece. The vertical fences are also screwed to the poplar.

The vertical fences should have room to attach hold-downs, which ensure the workpiece stays solidly against the table. With tall pieces, such as panels, I use taller vertical fences and hold-downs. As an added bonus, these rigid setups also limit vibration, producing a cleaner cut.

Feed direction—Feed direction matters too, although much more so on angled coves than standard ones. For standard coves, you can safely feed from the left or right. But I prefer feeding from the left, which gives me a lot more access around the side of the saw, letting me push the board through the cut much more comfortably.

The feed direction on tipped coves is much more important, and there's only one option. That's because a tilted blade is essentially a ramp, so you want to feed into it, not up it. As a result, the feed direction is based on which way your saw's arbor tilts. For left-tilt blades, you feed left to right; for right-tilt, it's the opposite. If you push the wood toward a blade that angles away from you—up the ramp—the stock is more likely to ride up off the table.

Cut slowly, steadily, and in stages

Coving on the tablesaw is inherently inefficient. You're cutting with the sides of



Clean up the cove. To smooth coves, Neptune rolls up cloth-backed sandpaper made for belt sanders because it's firm but can still bend. Contoured sanding blocks and curved scrapers also work.



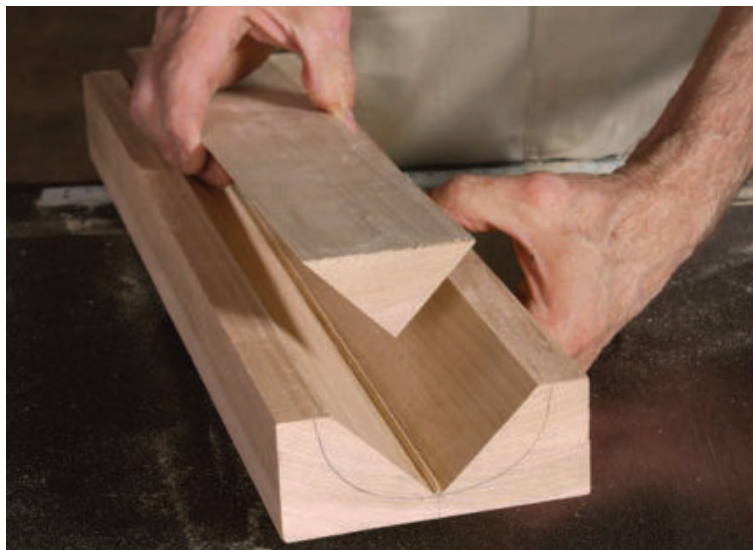
TIP

Label offcuts for reference.

Build up a library of shapes by writing the arbor angle, feed angle, and blade diameter on coved offcuts. Even if you don't want to duplicate an exact profile, the offcuts still work as references when dialing in a setup.

SPEEDING UP DEEP COVES

Cove cutting on the tablesaw can be slow and dusty, especially with deeper curves. For these, it pays to remove most of the waste beforehand.



Pair of angled rips removes triangle of waste. Neptune laid out these lines at 45°, and fed the stock from opposite ends to complete the triangle.

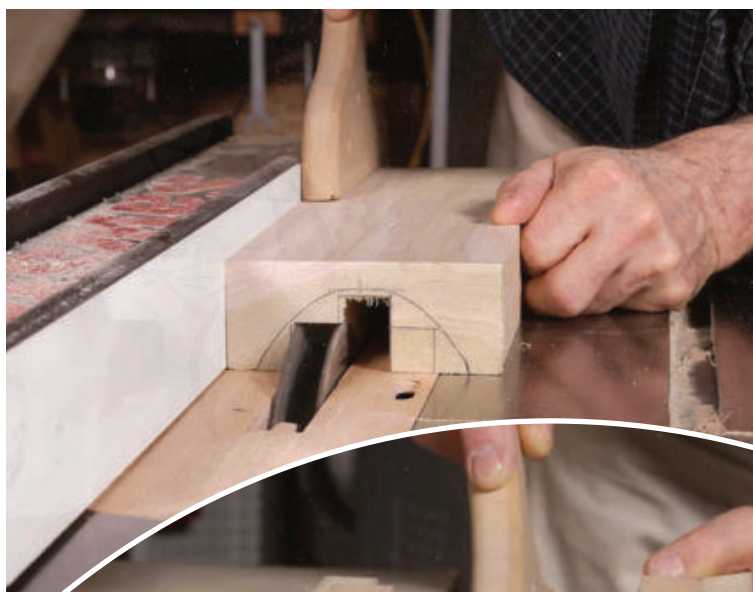
the saw teeth, which can tax the saw and raise safety concerns. To lessen the workload and make the cut safe, you need to slow the feed rate and take multiple passes, removing small amounts of waste and raising the blade a little bit each time. Consider the width of the cove and the stock's density when choosing your feed rate and depth of cut. If you try to go too fast or take off too much, you risk kick-back—another reason I use hold-downs. On deeper coves, you can speed things up by removing the bulk of the waste beforehand with a pair of angled ripcuts or stepped cuts with a dado stack.

Partial coves are possible

Until now, we've just focused on full coves. But if you get a little creative and plan ahead, you can end up with partial coves via one of two methods.

The method I pick often comes down to my stock. With thick pieces, I cove the face of a board as normal before ripping it down the middle, yielding a pair of quarter coves. Just be sure to account for the kerf of the saw when laying out the initial full cove.

With thinner stock, I use a method that's a bit more involved, but it's more versatile too. Prepare the



Dado stack also removes stock rapidly. Make stepped grooves as wide as you can to remove the bulk of the waste (left). This lets you make the cove more quickly and efficiently (below).



Two methods for partial coves



1 THICK STOCK

Rip a full cove in half for matching quarter coves. This produces two symmetrical coves if the original cove was cut with the blade at 90°.



2 THINNER STOCK

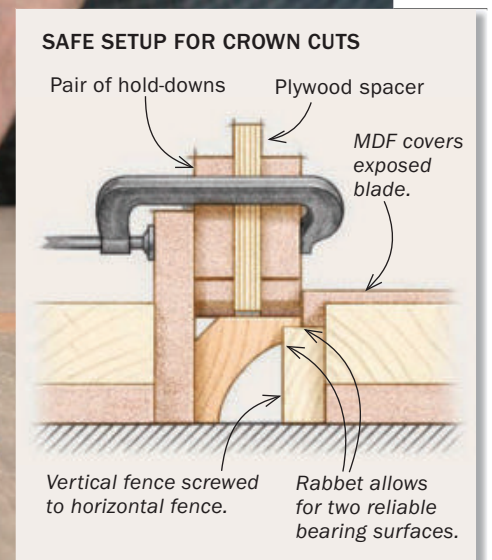
Rip at 45° for a pair of crown molding blanks. Lay out the pattern on the end of the board. A template of the shape helps. Leave room for the kerf.



Temporary rabbet helps with registration. With the blade still at 45°, cut a rabbet just past the end of the cove. This rabbet will ride on a vertical fence to provide a secure point of contact.



Two points of contact. The vertical fence creates a stable bearing surface for the rabbeted workpiece. Like always, cut the cove in multiple passes. Adjust the feed angle or arbor angle—or both—as you go to create the desired cove.



RAISED PANELS



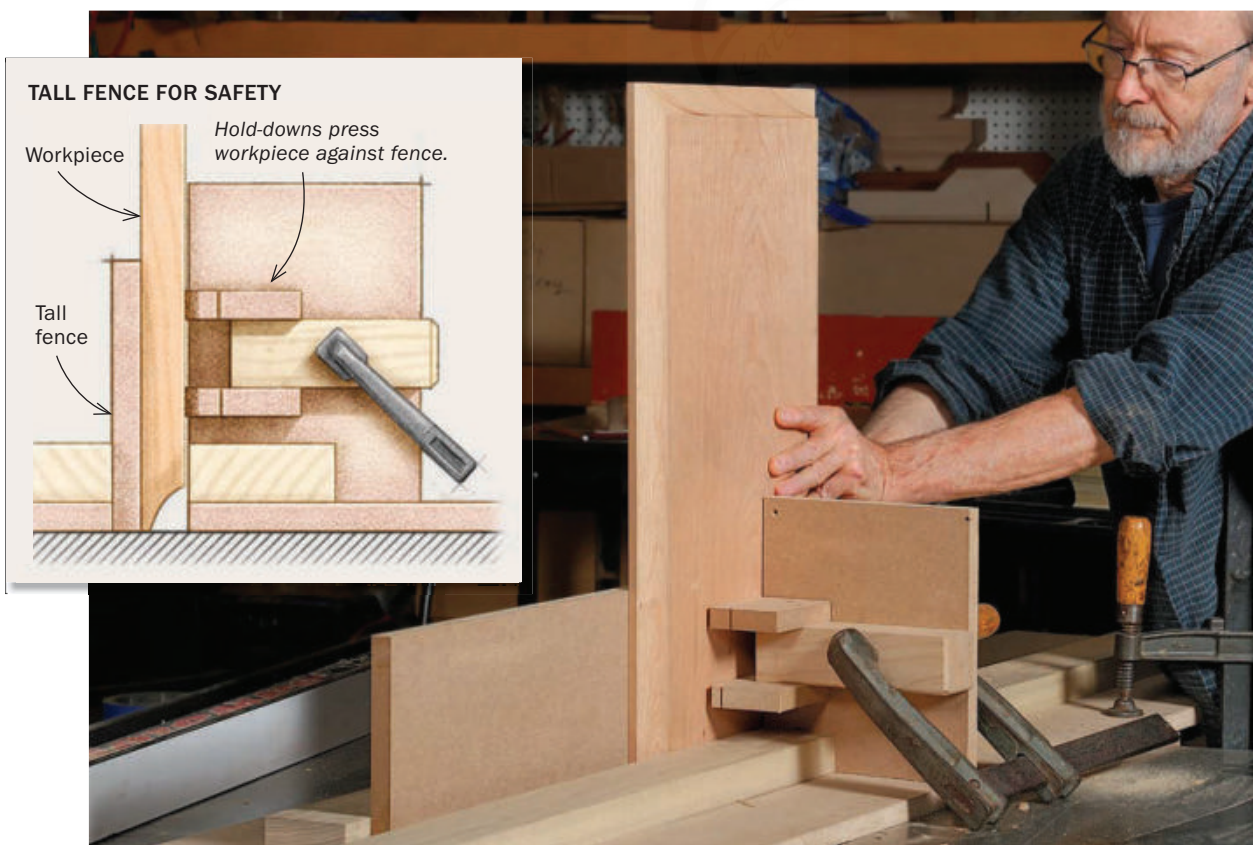
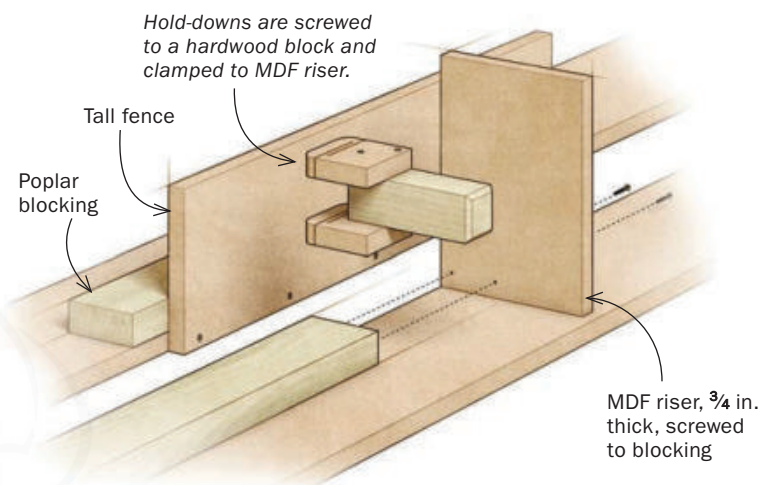
Panels need a tall fence. To keep oversize parts from tipping, screw a tall fence to the poplar blocking.

workpiece slightly overwide and cut a temporary rabbet into an edge. This rabbet will ride on the edge of a short vertical fence, letting you cut with only a portion of the blade. I recommend using hold-downs here. Once the cove is cut, you'll cut off the rabbet.

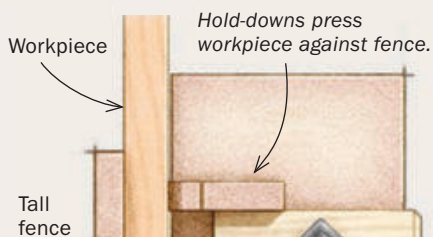
The rabbet method has a further benefit: It can be used to cut any partial cove, not just quarters of one. Since I'm cutting with part of the blade (the rest is buried in the rear fence), I can, for example, match the shape from ripping a thick, coved workpiece down the middle—meaning I can get the same curve from thick and thin stock. More importantly, I can also angle the arbor to sneak up on



Hold stock against the fence. For safety, secure high and low hold-downs (see p. 65) to an MDF riser. To ensure the proper pressure, have the panel in place when setting the hold-downs.



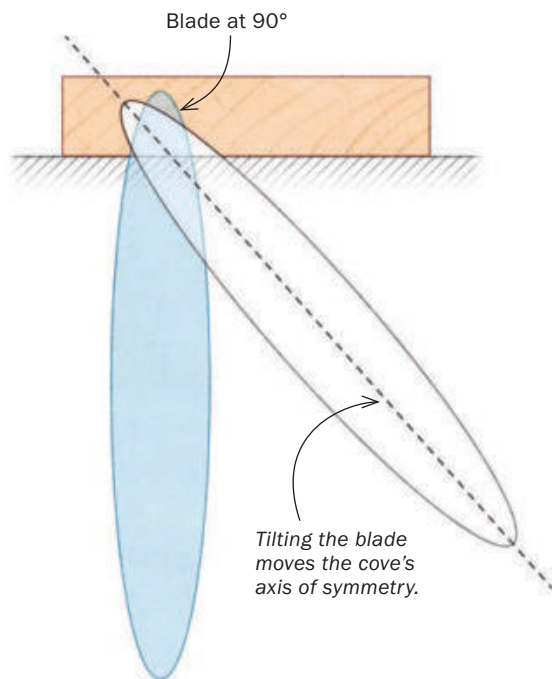
TALL FENCE FOR SAFETY



Cove around the panel. Again, work in stages, raising the blade slightly between each pass. Cut the end grain first, then the long grain; that way you'll clean up any blowout. Keep the panel down against the saw table. For safety, don't attempt this on panels less than 12 in. wide.

ANGLED COVES

Tilting the blade leads to swooping ellipses and additional sculptural possibilities.



TIP

Black cardboard blade helps visualize cove. Cutting out a circle of cardboard the size of your blade, coloring it black, and mounting it on the arbor makes it easier to sight the cove of any given setup.

desired curves, like when I miss my layout line but really want that shape.

Expect cleanup

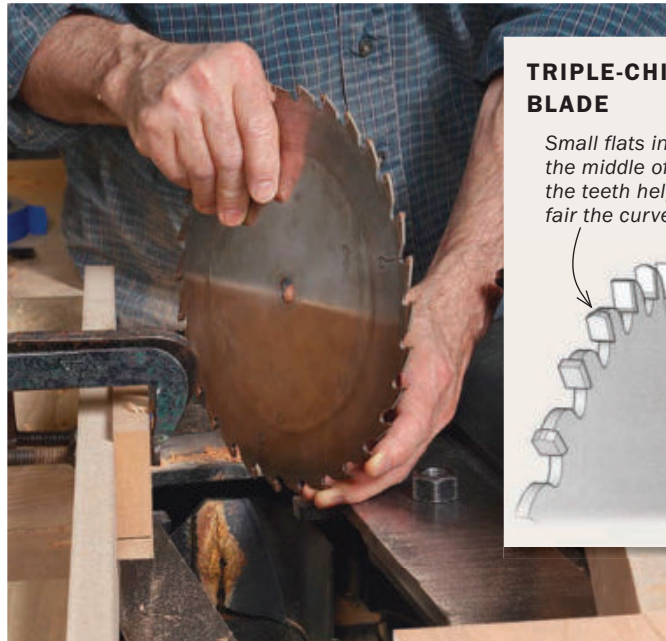
When cutting coves, tablesaws typically leave a fuzzy, scratchy surface that needs to be sanded or scraped. It helps to back off on your feed rate and take lighter cuts on the final passes, since these reduce vibration, thereby yielding a cleaner cut.

You may have to contend with a little bump in the middle of the cove. This is due to the thickness of the blade, as the left-angled teeth are producing one curve and the right-angled teeth a second, identical curve—but in a different plane. The effect can be especially pronounced on angled coves. While the ridge can be scraped and sanded fair, in extreme cases, I switch to a triple-chip blade for plywood on my final passes because the blade's grind eliminates the ridge. Changing the blade means temporarily removing the fences, so mark where they go first. □

Will Neptune is a woodworker and instructor in Acton, Mass.

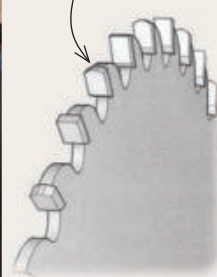


Tilted arbor, angled cove. Coving with a tilted arbor involves the same fence setup but opens up much more energetic, sculptural curves. Here, Neptune is making a finger pull for a drawer.



TRIPLE-CHIP BLADE

Small flats in the middle of the teeth help to fair the curve.



Special blade for the last pass. Combination blades can leave a little bump, especially in angled coves. If you want, take a final pass or two with a triple-chip blade, although this means temporarily removing and resetting the fences.



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Inspiration for our readers, from our readers



SAYER HOUSEAL

Rockport, Maine

When Houseal first started sketching the design of this piece, it was intended as a spice cabinet. It ended up a drinks cabinet as this woodworking student incorporated a variety of joinery and design techniques learned at the Center for Furniture Craftsmanship in Maine. "This was the first solid-wood cabinet I have built and I enjoyed the mortise-and-tenon joinery as well as creating the coopered door," Houseal says.

WHITE OAK AND SPALTED SYCAMORE, 11D X 19W X 48H

Photo: Mark Juliana



DAN STROUT

Milton, Mass.

The inspiration for this chest of drawers came from a chest attributed to Martin Pfening (1775-1782). The case is mahogany and the drawers are book-matched crotch mahogany veneer over poplar. Strout says the overall design, inlay, and sand shading are the aspects of this piece that gave him the most pleasure.

MAHOGANY, MAHOGANY VENEER, HOLLY AND EBONY INLAY, 25D X 41W X 48H

LESLIE WEBB

Georgetown, Texas

Webb built two versions of this coffee table, one from walnut (shown) and one from curly maple with cherry legs. She says she developed the design by asking herself, "How do you support a tabletop without having legs at the four corners?"

CURLY WALNUT, WALNUT

23½D X 51¼W X 16½H



PAUL FLESSNER

Bainbridge Island, Wash.

A natural stone arch in Canyonlands National Park in Utah gave Flessner the eureka moment he needed to complete the design for this table. "I had been thinking about and sketching various wall table designs for a couple of years," he says, "I could see the arched legs but was stuck on how to attach the tabletop without cluttering the design. It all became clear in a single moment when I saw the arch."

MACAWOOD AND WENGE, 11D X 45W X 30H



LAYNE SHERIDAN

Bracebridge, Ont., Canada

Two different design influences came together as plans for this dresser took shape. Sheridan blended Shaker and Japanese tansu influences in the piece, which includes hand-cut dovetails and drawers hidden within the sides of the base.

CHERRY, EBONY, AND MAPLE, 18D X 67W X 61H



MARIO RODRIGUEZ

Philadelphia, Pa.

Rodriguez built this corner chair with only a lathe and hand tools. It is a copy of a period chair brought in by a client for repair. "This is a very successful transitional piece," he said, "combining elements of both the William and Mary and Queen Anne periods." It has a natural rush seat and shellac finish.

WALNUT, 25½D X 38W X 30H



PETE MICHELINIE

South Pomfret, Vt.

"I started a tradition of making settees as wedding gifts for good friends. This is the most recent one," says Michelinie, who added that he has always loved the Windsor because the building process is so much fun. The finish is milk paint and shellac.

PINE, ASH, AND MAPLE,
20D X 46W X 28H



MICHAEL FORTUNE

Douro-Dummer, Ont., Canada

Fortune made the inlaid leaf forms on this curly maple tabletop using a male and female router jig that allows him to make leaves in an infinite number of sizes. The edging is steam-bent curly maple. The top is a torsion box, making it dead flat and extremely light. Next up, Fortune plans to design chairs to go with the table.

CURLY MAPLE AND WALNUT, 42W X 80L X 29H



ALAN CHARNEY

Scottsdale, Ariz.

Charney designed this small breakfast table so that the table and chairs present a single profile to the viewer. "I decided to design and build it with hidden chairs that become part of the table and disappear when pushed in," he says. The curved pieces, including the chair seat backs, are all bent laminations.

MAPLE, CHERRY, AND WALNUT,
32½D X 25¾W X 30H





LI CHEN

Kunming, Yunnan Province, China

Li Chen often gets inspiration for his furniture from Chinese gate tower and Japanese torii construction. His latest piece is this bench for two. "I appreciate my inspiration's squareness and simplicity, but I'd like to also celebrate the vitality brought by angles."

RED OAK AND WALNUT, 15 $\frac{3}{4}$ D X 33 $\frac{1}{2}$ W X 15 $\frac{3}{4}$ H

Photo: Jaifu



NICHOLAS MARALDO

Pelham, N.H.

Eight years in the Navy and time spent in the seafaring town of Beverly, Mass., as a student at The Furniture Institute inspired the motifs in this table. "On the compass rose I cut the walnut burl to include the sapwood with the intention of it looking like an old nautical chart, with coastlines and islands."

MAHOGANY WITH EBONY, HOLLY, AND WALNUT INLAY, 15 $\frac{1}{4}$ D X 39W X 30H



SARAH WATLINGTON

Los Angeles, Calif.

Inspiration for this cabinet-on-stand came from many places, says this graduate of The Krenov School. "I wanted it to be my own take on a cabinet on a stand that is emblematic of my alma mater. It was a practice in humility."

BAY LAUREL, POPLAR, CAMPHOR, AND EBONY, 11D X 27W X 30H

Photo: Todd Sorenson

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A saw bench is a versatile addition to your shop

BY MEGAN FITZPATRICK

A saw bench is not simply a low sawhorse; it's a completely different animal. A pair of benches makes the use of panel saws and full-size handsaws efficient and comfortable when crosscutting and ripping boards. I also use them for drilling, finishing, helping brace workpieces, sitting and standing on, and much more.

I'll show you how to build one saw bench using hand tools and home center material, but for many operations, two—and sometimes a small herd—of saw benches are required. When I make multiples I prep the stock at the same time (at least the parts I use machinery to prep), but I build them separately. There aren't any tricky setups to replicate, so I don't see an advantage to building them simultaneously.

These benches are built to fit the maker. After you have your saw bench

together, you'll trim the legs to make the top of the bench hit just below your kneecap. I'm just shy of 5 ft., 6 in.; my saw bench is 17½ in. high. If you're remarkably tall (more than about 6 ft., 5 in.), make your bench legs' rough length a little longer than shown in the drawing; if you're petite, you might want to raise the height of the braces so they remain a bit above the floor when you trim the legs to length.

Find, cut, and prep your stock

At your local home center, pick through the 2x6 white pine to find the straightest, clearest 10-ft. board available.

Typically, I recommend cutting each part as you need it, referencing off



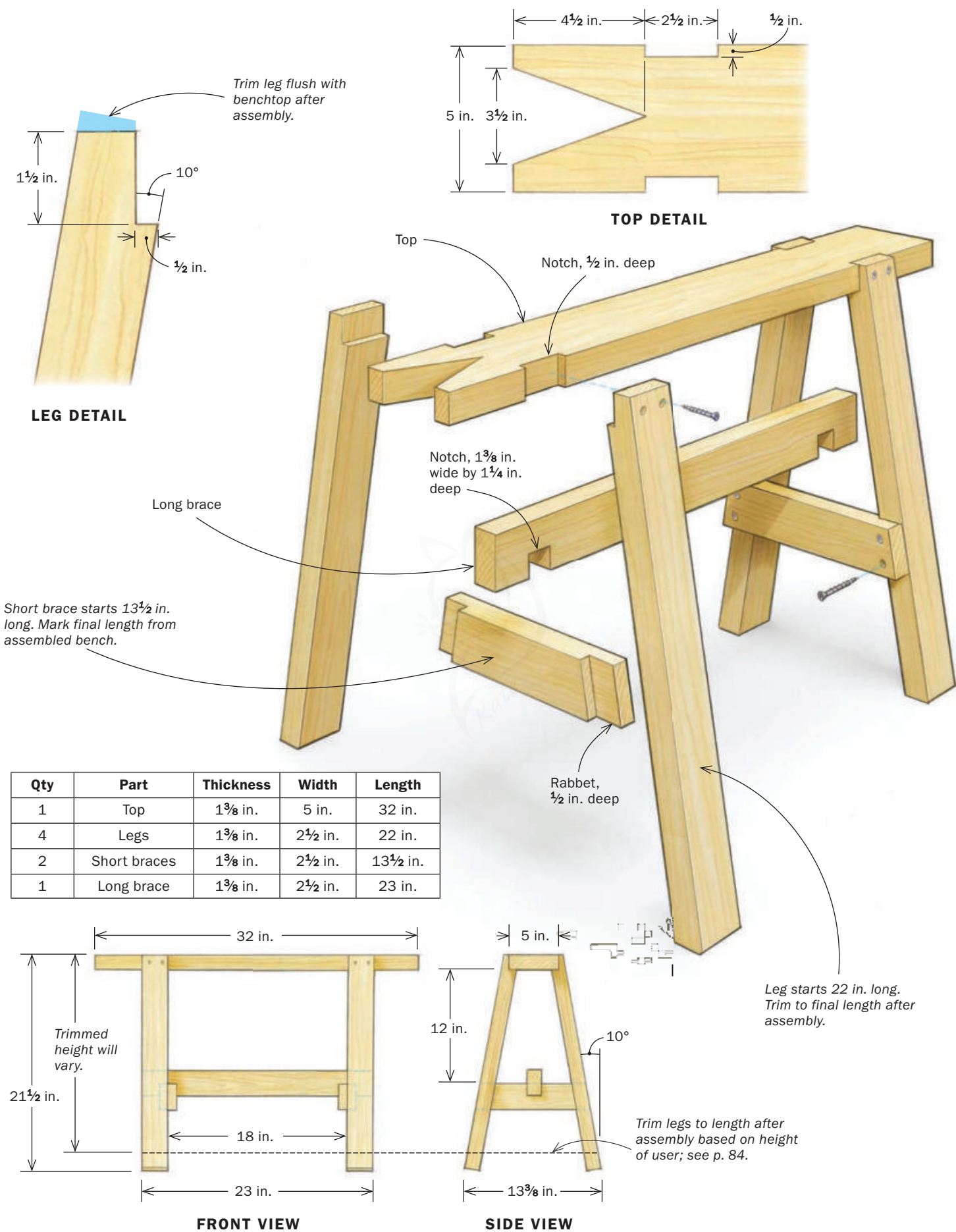
HOW TO USE IT

RIPPING With one knee on top of the board to keep it in place, begin the ripcut on the end overhanging the front of the bench. As you approach the V-notch in the top, shift the work forward to continue ripping. For longer boards, use two benches to support the work. To maintain support of the entire workpiece later in the cut, shift it back and continue cutting between the benches. If the workpiece is wide enough, saw to the side of the bench.

CROSSCUTTING The foot of your dominant leg should be on the floor with the board butted against the top of your shin (far left). Keep your other knee atop the work to hold it. As you approach the end of the cut, reach around with your free hand to grasp the offcut so that it doesn't break off.

WORK SUPPORT A saw bench makes an excellent surface for finishing (especially large pieces, left). You can also clamp work to a saw bench for boring or mortising; the low height makes it possible to get your body right over the work.





Notch the legs

An angled half lap in the legs creates the splay when the legs are attached to the top.



Mark the cheek and shoulder cuts. With a bevel gauge set to 10°, mark a line to establish the cheek. With the gauge still set to 10°, mark a line to establish the shoulder.



Cut the shoulder. Deepen the shoulder line slightly with a chisel. This small trench helps to position the saw when starting the cut.



Clean up the joint. With the leg in a hand-screw clamp, align the cheek flush to the top of the jaws. Then use the jaws to guide a wide chisel as you clean up the cheek cuts. Because the cheek and shoulder are at a 90° angle, you can use a shoulder plane to clean up the inside corner.



Cut the cheek. Cut a shallow kerf into the end grain, then tilt the tenon saw to follow the vertical cheek line. This will help you to follow the two lines accurately as you saw.



your work. However, this project is a rare instance in which you should mark out and cut all the pieces to match the cut list before starting the joinery. That's because no one part relies on another for its finished size, and because you need the parts cut and ready for direct transfer of measurements for the joints.

Leg joinery

Flatten the least attractive side of each leg with a jointer plane, then mark it as the true face. Now plane the edges, using a square to check that they are perfectly square to the true face, and shoot the top ends to ensure that they, too, are square to the true face. The show face can be cleaned up later if you wish. All the joinery layout will be on the true face and on the square end and edges; the show face of the legs doesn't affect the joinery.

The legs get angled half laps that fit into notches in the top. To lay out the half laps, set a marking gauge to ½ in. and scribe a line off the true face onto the top of each leg. Now set the gauge to 1½ in., and scribe the shoulder line on each leg, registering off the top.

Both the cheeks and shoulders are angled at 10°. Set a bevel gauge to 10° and use a pencil to mark the angles. Now saw the cheeks. Use a chisel, bevel toward the waste, to make a small V-shaped notch on the corner. Set a fine-toothed rip saw into the notch, then saw down your layout line.

Next, cut the shoulders. Drop a chisel into your marking gauge line and cut a small V-shaped trench along the joint line. Secure the leg against a bench hook on your bench, then use the trench to guide a fine crosscut saw as you saw down to the cheek. Save the offcuts to use later as clamping cauls, and clean up the cheeks.

Top joinery

Just as with the legs, with the top the true face is the side that won't show. So true up the less attractive face, mark it as true, then square the long edges to that face.



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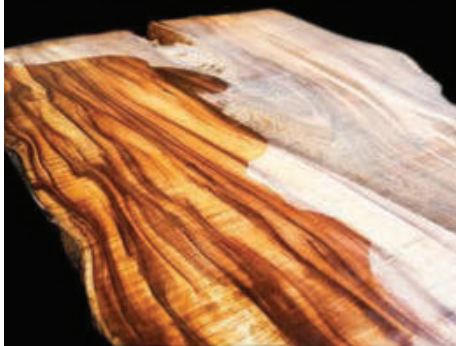
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Shape the top

Ripping notch.

Use a panel saw or full-size handsaw to cut the V of the ripping notch. Because the cuts are at an angle, either a crosscut or rip saw will work.



Mark the leg

notches. Align the leg to a knifed line $4\frac{1}{2}$ in. from the end of the top, then scribe along the other side of the leg with a knife. Finish by marking the depth of the notch on each face of the top.



Next, lay out the V-shaped ripping notch on both faces at the front end of the top. Use a pencil to mark a centerline, then measure 5 in. from the front edge and make a tick mark. Measure and mark $\frac{3}{4}$ in. from both edges at the end. Connect the dots with a straightedge. Use a rip saw or crosscut saw to cut the notch, then clean up the cuts with a rasp as necessary.

Now lay out and cut the notches for the legs. On both long edges, measure $4\frac{1}{2}$ in. from each end, then register a marking knife against a square to knife in the outside shoulder of each notch. Use the leg to locate the other shoulder of the notch. Use a cutting gauge to lay out the notch bottoms, $\frac{1}{2}$ in. from the edge. Saw the shoulders of each notch, then remove most of the waste with a coping saw, or pop it out with a chisel. Use a large router plane to clean up the bottoms.

Remember those offcuts you saved? Tape them to the top of the legs, narrow side down. Brush glue in the notches and on the cheeks of the legs, then clamp the legs in place, making sure the top is firmly seated on the shoulders. Thanks to those offcuts, the clamps should close squarely. Because the assembly is upside down, you can leave it in clamps and move on to the next few steps while the glue dries.

Add the short braces

The two short braces get lapped onto the inside of the legs, but the legs don't get a corresponding notch. True up the two short braces, and mark the true face (this time, it is the show face). The top edge of each short brace is located 12 in. from the underside of the top, so cut a 12-in. spacer block from scrap, and use that to position each brace on the inside of the legs, with the true face against the legs. Clamp the braces to the legs, and mark the braces for length with a pencil.

Register a knife against the inside face of the legs to mark out the shoulders on the braces. After unclamping and crosscutting the braces to length, set a cutting gauge to $\frac{1}{2}$ in. and mark the cheeks. Cut the cheeks and shoulders, then clean up the cheeks



Cut the notches. Use a crosscut saw to cut both shoulders of the notch. Use a coping saw and chisel to remove the waste. Then use a router plane to clean up the bottom, working into the center from each face so as not to blow out the back.



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Add the braces



Glue the legs to the top. Use the tapered offcuts from the leg half-laps as clamping cauls. Clamp the assembly upside down with the top shimmed up so the clamps will apply pressure to the center of the joint.

with a router plane and the shoulders with a shoulder plane. Glue the short braces to the legs, and clamp them in place while you cut the joinery for the long brace.

Long brace joinery

On the long brace, the true surface is not a face, but the bottom edge. So true up the least-attractive edge, then true both faces 90° to that edge.

Center the long brace end-to-end, then clamp it in position on the short braces. Use a marking knife to scribe the location of the short braces on the true edge of the long brace. Then remove the long brace to lay out the notches that join it to the short braces. Remove most of the waste with a coping saw or chisel; clean up the bottoms with a router plane.

If you want to be fancy, plane chamfers on the top edge of the long brace, cut ogees on the end, or whatever you choose. You can also do nothing here.

Nail, clean, and level

Nail in the same order that you glued and clamped; legs to top first, short braces to legs, and finally long brace to



Mark the short and long braces. With the short braces clamped in place, mark the inside edge with a knife. Use a pencil to mark the outside edges. Saw them to length, then cut the half-laps. Glue and clamp them in place, and mark and cut the notches in the long brace. Then glue that in place.

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Nail and trim the bench

Drill for the nails.

Without pilot holes, the wedge shape of cut nails or square-shanked nails could split the work. Fitzpatrick uses diamond-head forged nails from Clouterie Rivierre, available from leevalley.com, lienielsen.com, or directly at forgednails.com.



Flush the legs to the top. A cheap pull saw works great as a flush-cutting saw on large work. Just be sure to take it to your sharpening stones to remove the set from both sides before using it for this purpose.

short braces. Then, use a flush-cutting saw to trim the legs flush to the top.

Now measure from the floor to the bottom of your kneecap and note that number. Shim the saw bench level on a flat surface, then measure down from the top of the bench to the level surface. Subtract your leg-measurement number from the current saw bench height number, and cut a scrap the length of the result. Use a scrap and a pencil to mark each leg.

You don't need a finish on the saw bench. It will acquire its own with age and while finishing other projects.

Now go build that second saw bench. □

Megan Fitzpatrick is a writer, teacher, and furniture maker in Cincinnati, Ohio.

The right height for you.

Measure from the floor to the bottom of your kneecap. Level the saw bench on a flat surface, shimming the legs as necessary. Use a scrap and half-pencil to mark around all four sides of each leg, then cut them to length.



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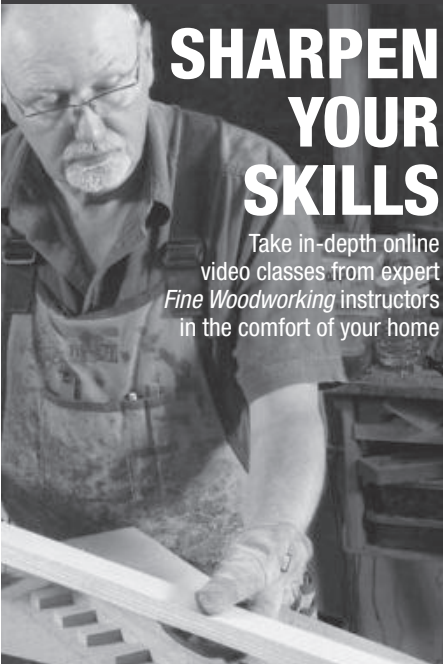
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The carpenter's son

BY VALERIAN WELICKA

"Those shingles belong on that roof. If you get too tired to carry a full bundle, then bring them up one by one if you have to."

"You will keep this work area clean. The homeowner of this kitchen remodel needs to prepare supper for their family. We don't want sawdust in their food."

When I think of my youth, my memories ring with statements like these, spoken in my father's voice. You see, I am a carpenter's son.

On projects from boat building to house framing, I grew up helping my father with his work. I learned mostly by observation; he didn't give a lot of verbal instruction. I remember one particular visit to a mill. Before we arrived, Dad told me to take a look at the workers' hands. I don't think anyone there had a full set of fingers. After we left, he told me to take care of myself, as replacement parts were not as good as what God had given me. Lesson learned.

Another lesson I learned early was the joy of working in the shop by myself. I never raised Dad's ire for using the tools or material in his shop, but I did pay the price when I failed to return a tool to its proper spot. I was also lucky because my dad was friends with the high school woodshop teacher, so I had free rein in the school shop all four years of high school and built many pieces there, including a solid bird's-eye maple rocker and a steam-bent toboggan. While I was there I did Dad's turning projects, as he did not own a lathe.

After high school, I embarked on a 30-year career as a Coast Guard aviator.

I loved my career, raised my own family, and slowly pieced together a shop of my own. As my children grew, I introduced them to woodworking and, like me, they enjoyed full use of their father's shop.

When Dad retired, he upgraded his shop and mine as well, since I was the beneficiary of his castoffs. Since then,



Dad has been quite prolific, designing and building many beautiful pieces, from small boxes to hutches. Together we have felled trees, milled lumber, and made projects from the wood. My woodworking has improved through the years, yet my abilities still lag well

behind his. Often Dad will scrutinize one of my finished projects, find a flaw, and ask, "What happened here?" When that happens, his final thought is always the same: "A wise man won't say anything, and a dumb man won't notice."

We regularly discuss projects and share our ideas about various elements. Dad has always been quite set in his ways. Of course I'm just a kid in my late 50s, and he's in his mid-80s; what could I possibly teach him? But every once in a while my persistence pays off.

For decades, his go-to finish was wiping varnish. No matter how I tried to get him to consider the plethora of finishes available, he resisted. Thankfully, we both have been *FWW* subscribers for years and have had many great discussions about what we've read. Greg Arceneaux's article "Easiest Finish? Danish Oil" in *FWW* #238 opened his eyes to the benefits and use of that finish, which he now uses with great success.

When I retired several years ago, my parents gave me a lathe, which rekindled my interest in turning. When I upgraded my lathe recently, I returned the original to my dad and gave him the first turning lesson he's had since he was in high school. I also recently rebuilt one of my dad's first contractor saws. It will soon find a home in one of my sons' shops.

Many woodworkers say they were inspired in this craft by a design, book, or piece by one of woodworking's "greats." But I believe far more woodworking passion, insight, and inspiration has been shared among family. My dad became a woodworker because an uncle encouraged him. Dad passed his love on to me. I shared it with my sons and daughter. It is a bond that has drawn me closer to my children, and continues to bring me closer to my dad.

Valerian Welicka is a woodworker in Carlisle, Pa. To share your thoughts from the bench, email us at bench@taunton.com.



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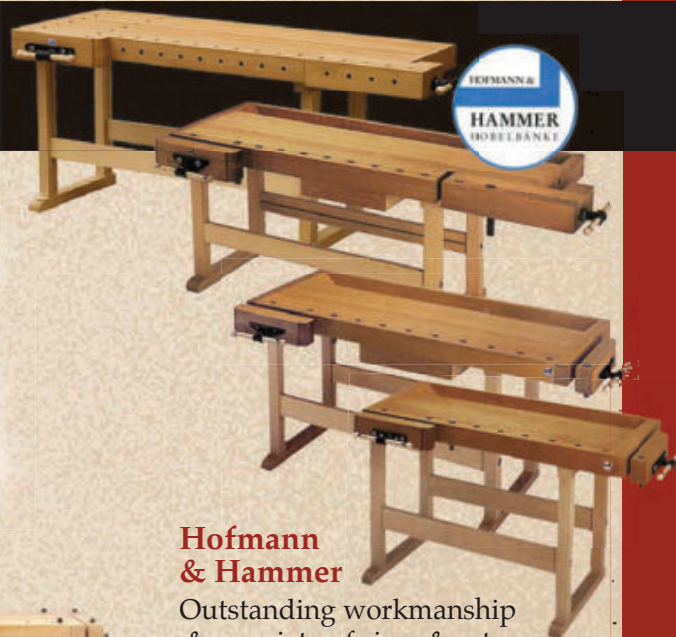
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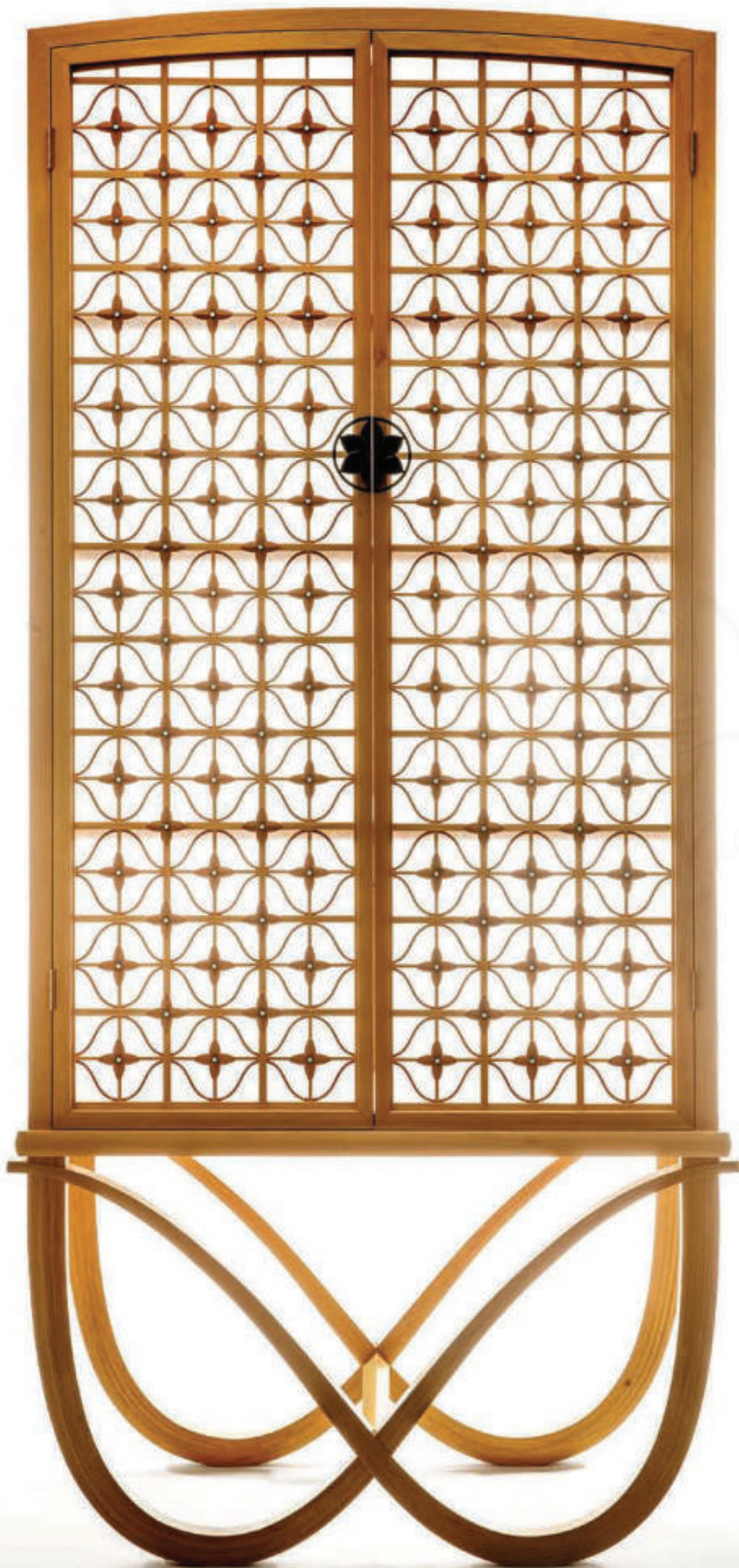
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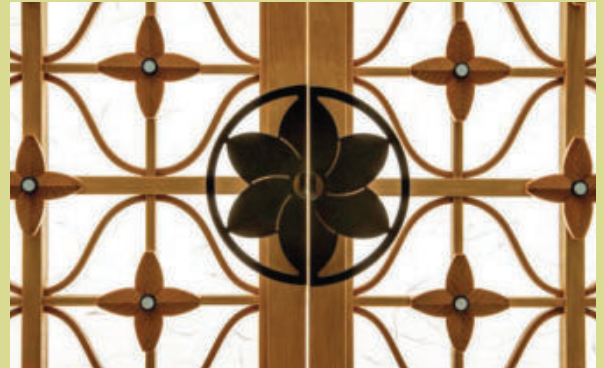
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The Lantern Cabinet



Several years ago, Michael Hurwitz drew a small pen-and-ink sketch and hung it on the wall of his Philadelphia studio. It was a tall cabinet with solid plank doors on an open base whose looping lines were inspired by arms folded in repose. “Someday I’ll build that,” he thought. Hurwitz, who has been immersed in making furniture for 40 years, almost never repeats a piece, not wanting to miss out on the adventure of designing and



Latticework. Based on an old Chinese pattern, the lattice is made with bent-laminated bars and end-grain flower petals with turquoise and oxydized silver stamens. The pull was water-jet cut from sheet steel.

building a new one. Design for him happens mostly in mockups. When he built a mockup for this yellowheart cabinet, using MDF for the base and cardboard for the case, he saw instantly that the base would work but that a solid closed-in case made the piece look top-heavy. He needed the case to be “as transparent as possible—something that looked like a lantern.” That led him to latticework, and with woodworking help from Lesley Gold, he made latticed yellowheart door panels backed with handmade Japanese paper adhered to acrylic sheet. Refining the curves and tapers of the bent-laminated base was another challenge, and overall building the cabinet, he said, “felt like a culmination; it seemed to draw from all my experiences making furniture.” But once the cabinet was finished, Hurwitz had an unusual sensation. The regrets he typically feels when shipping a piece were absent. “There’s nothing I would change about this one. I’m happy with it.”

—Jonathan Binzen