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December 2018 No. 271

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Wooden pendant pulls • Cove-and-pin drawer joinery



Perfect curves on the bandsaw, p. 26

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NOVEMBER/DECEMBER 2018 ■ ISSUE 271



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VIDEO

Curved scraper perfection

Peter Galbert considers a curved scraper (p. 20) an absolute necessity in his shop. But many woodworkers struggle to use scrapers effectively because they can be difficult to sharpen. Galbert demonstrates how he gets a consistent edge on his scrapers using a simple jig.



VIDEO

Behind the design

Evan Court, whose chair is featured in this issue's gallery (p. 68), shows us all the drawings and mockups he used throughout the design process.

VIDEO

Hot melt how-to

There's more to hot-melt glue than building middle school art projects. Philip Morley (p. 45) uses it in furniture making to hold small parts during shaping. Ben Strano shows you a few other tricks for using this versatile tool.

VIDEO

Ask the teacher

Steve Brown (p. 50) answers seven of life's greatest questions, such as, "What is one tool you wouldn't want to live without?"

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VIDEO WORKSHOP

Router-table fundamentals with Bob Van Dyke

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contributors

Heidi Earnshaw (Back Cover) has been working wood in her native Toronto for more than two decades. She started out specializing in built-ins and millwork, but after attending the furniture program at Sheridan College in 2000, she shifted her focus to furniture making. She has taught at Sheridan and in an evening program called Junction Workshop that she founded with some shopmates. Next year she'll help teach a segment of the 9-month program at the Center for Furniture Craftsmanship in Maine. This fall she is moving north of Toronto, where she'll renovate an 1835 timber-frame and set up shop in a barn.



Louis Kern ("Unlocking the Cove and Pin Joint"), born in Chicago and raised on a farm in Iowa, is now based in Oakland, Calif. As a furniture maker and master stair builder, specializing in grand and storybook spiral staircases, Kern was drawn to the San Francisco area because of all the Victorian homes and their tradition of grand woodwork. He landed in Oakland because prices got too high in San Francisco, a classic artisan's lament. A decorated U.S. Marine, he saw combat in Vietnam as a radio operator and team leader. For more about Kern, read the blog at FineWoodworking.com/271.



Peter Lutz ("Coopered Containers") splits his time between working on yacht interiors and building furniture at Smokestack Studios, a group shop in Fall River, Mass. Originally from Kansas City, he is now a permanent New England transplant. Lutz has been a student and a Fellow at the Center for Furniture Craftsmanship, where he developed the designs for his coopered containers. He was married in July and lives in Providence, R.I.

Phillip Morley ("Make a Wooden Pendant Pull") makes furniture in a one-man shop in Wimberley, Texas, just outside of Austin. His shop sits next to his house and he enjoys having his wife and their four children nearby. Morley originally moved to Wimberley seeking an apprenticeship with master craftsman Michael Colca. He served under Colca's guidance for seven years until he decided to start his own shop, hoping that his children could see him at work and be exposed to the craft of furniture making. He has run his shop for three years now.



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From the Editor

Launching Fine Woodworking into 2019

It's hard to believe that 2018 is coming to an end. I'm sort of sorry to see it go because so many great things have happened over the last 12 months.

We've introduced you to a variety of new faces (Michael Robbins, Heide Martin, Peter Lutz) with fresh points of view and designs. We continue to refine our website to make your experience better. Our social pages are more lively, with conversations happening daily. Plus we rolled out another fantastic batch of video workshops, including an

FineWoodworking
HANDS ON
TAMPA
February 1-3, 2019

inspirational bowl-carving series with Dave Fisher and a deep dive into machines with Matt Wajda and Ellen Kaspern. We partnered with WGBH in Boston to launch *Rough Cut with Fine Woodworking*, with host Tom McLaughlin. On top of all that, Fine Woodworking Live 2018

was a huge success, highlighted by keynote speaker Peter Galbert.

We've done a lot, but there's no time to rest because 2019 promises plenty more new and exciting things for our readers and members.

At the top of the list is our first ever HANDS ON event, launching this February in Tampa, Fla. Unlike Live—which features lecture-style classes and lots of social and shopping time—at HANDS ON you're going to get dusty. Attendees will immerse themselves in a series of intensive hands-on skill-building workshops.

The lineup is top notch. You can learn different ways to shape wood with Michael Fortune. Get design tips from Kelly Parker. Peter Galbert will show how to add turned elements to your furniture, and Mary May and Dixie Biggs will teach traditional and new carving techniques. Jennifer Anderson will help you build and use a wooden handplane. Michael Cullen will inspire you to make your own custom bandsawn box. And finally, enjoy the fun of making a greenwood bowl with Dave Fisher.

Of course, there will be some social time between the days of hard work, but HANDS ON is all about doing. The classes will take place at the Florida School of Woodworking, located in a charming, revitalized section of Tampa. The class sizes are small, so don't wait. Register now at finewoodworking.com/hands-on. I hope to see you there. I have a feeling it's the beginning of something great.



—Tom McKenna, editorial director

Losing sleep over bed project

My question is for Michael Cullen, author of "Contemporary Arts and Crafts Bed" (FWW #268). The panel length required is 61 in. and the article points out the need to rotate the veneer grain 90° to the face of the substrate.

I'm considering building the bed, but the only plywood I have access to locally is a 4x8 sheet, with grain running the 8-ft. length. Obviously, a 61-in. veneer won't fit on a 4-ft. cross-section of plywood, so will the panel remain stable if the veneer and substrate grain orientation is the same? I'd prefer to use a plywood substrate rather than particleboard or MDF.

—LEE ARPIN, Salina, Kan.

Michael Cullen replies: You're going to build the bed—great news! Thank you for reading the article. As far as the ply is concerned, you could use regular 4x8 if you can't get 8x4 sheets.

Start with high-quality ply; something like Baltic-birch that has about twice the plies as the regular stuff. Cut your substrate blanks. At this point you're going to create that "extra layer" of veneer running perpendicular to the length by gluing down an underlayer front and back. I would use commercial veneer for this step. It doesn't have to be anything fancy, but it should have good gluing qualities. Once this is glued down to the substrate, you will have created your ply with the grain running up and down. You're now ready to glue down the top layer. Make sure you give the panels ample time to cure. Longer is always better because it ensures that the panel will stay flat.

Source for leather

We received a number of inquiries on where to source the leather that Michael Robbins used on his desk project (FWW #270). Michael used 10–12 oz. English Bridle Leather purchased from wickett-craig.com.

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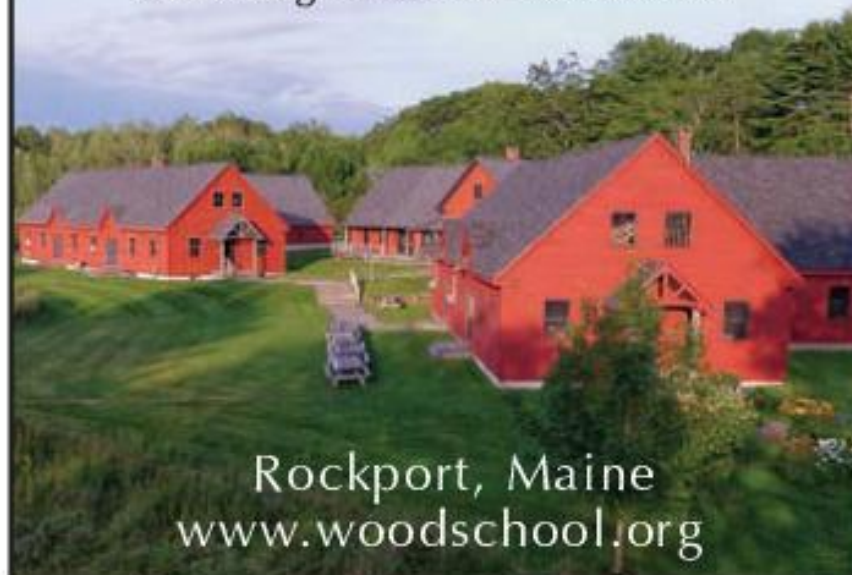
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workshop tips

Best Tip



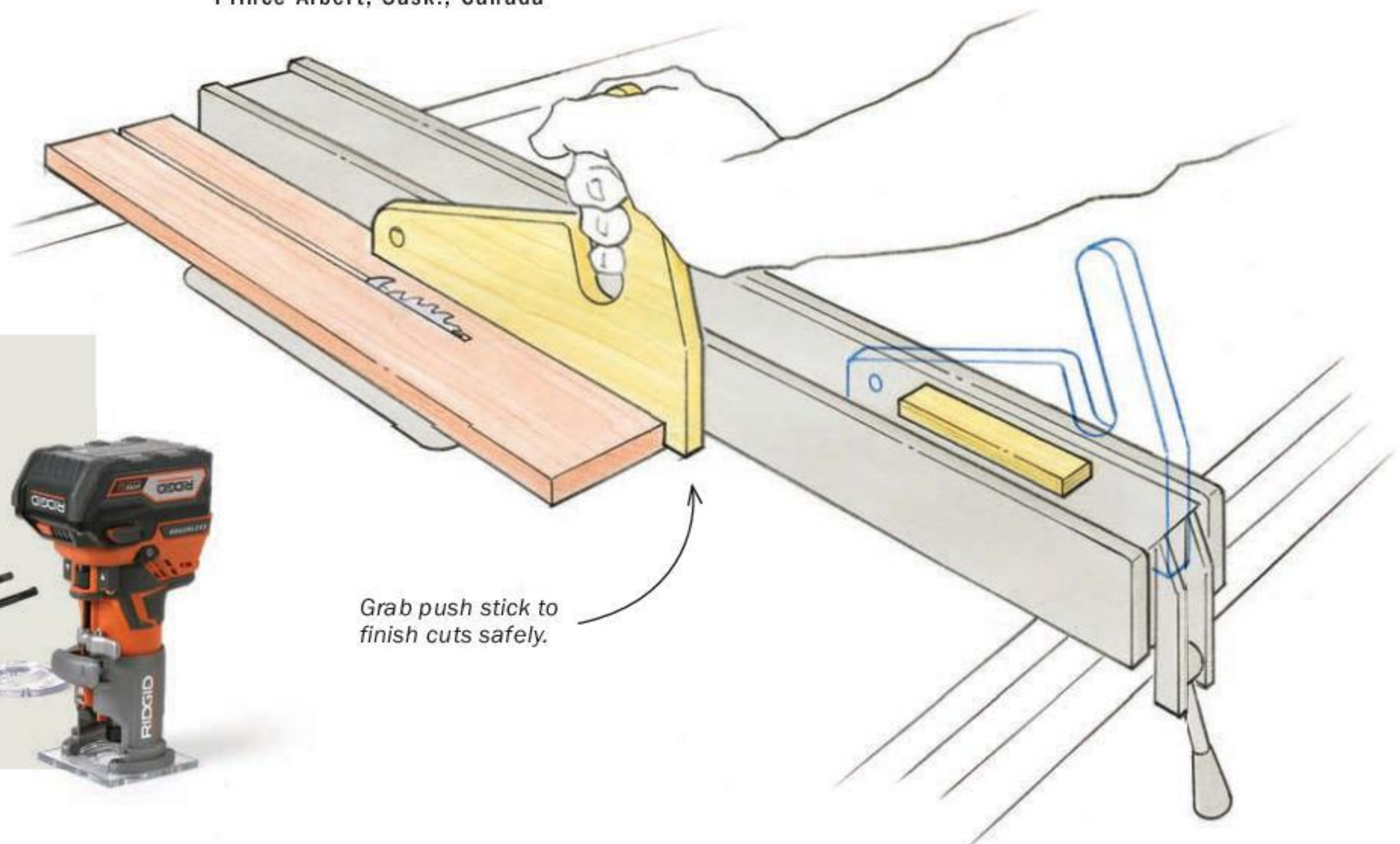
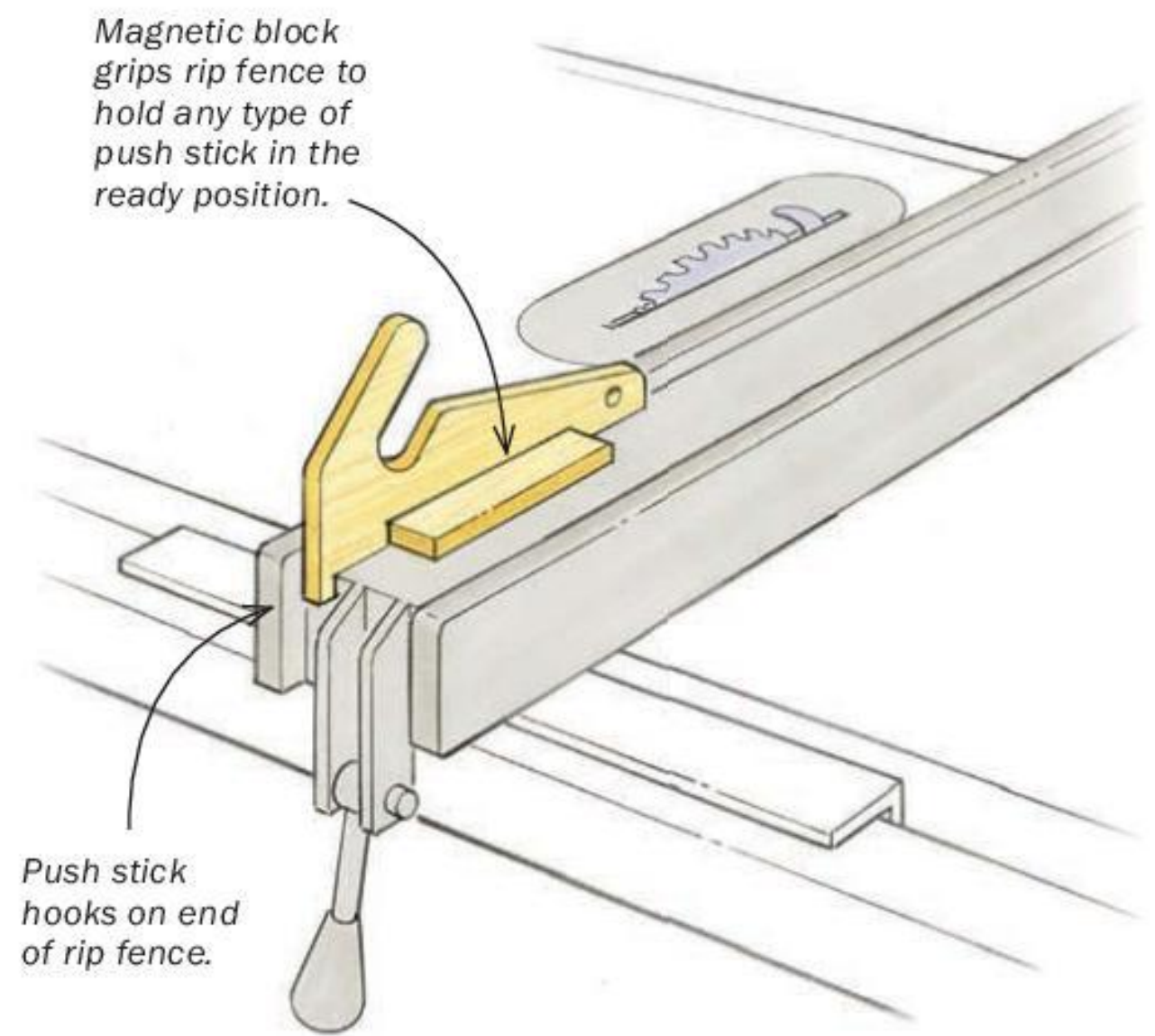
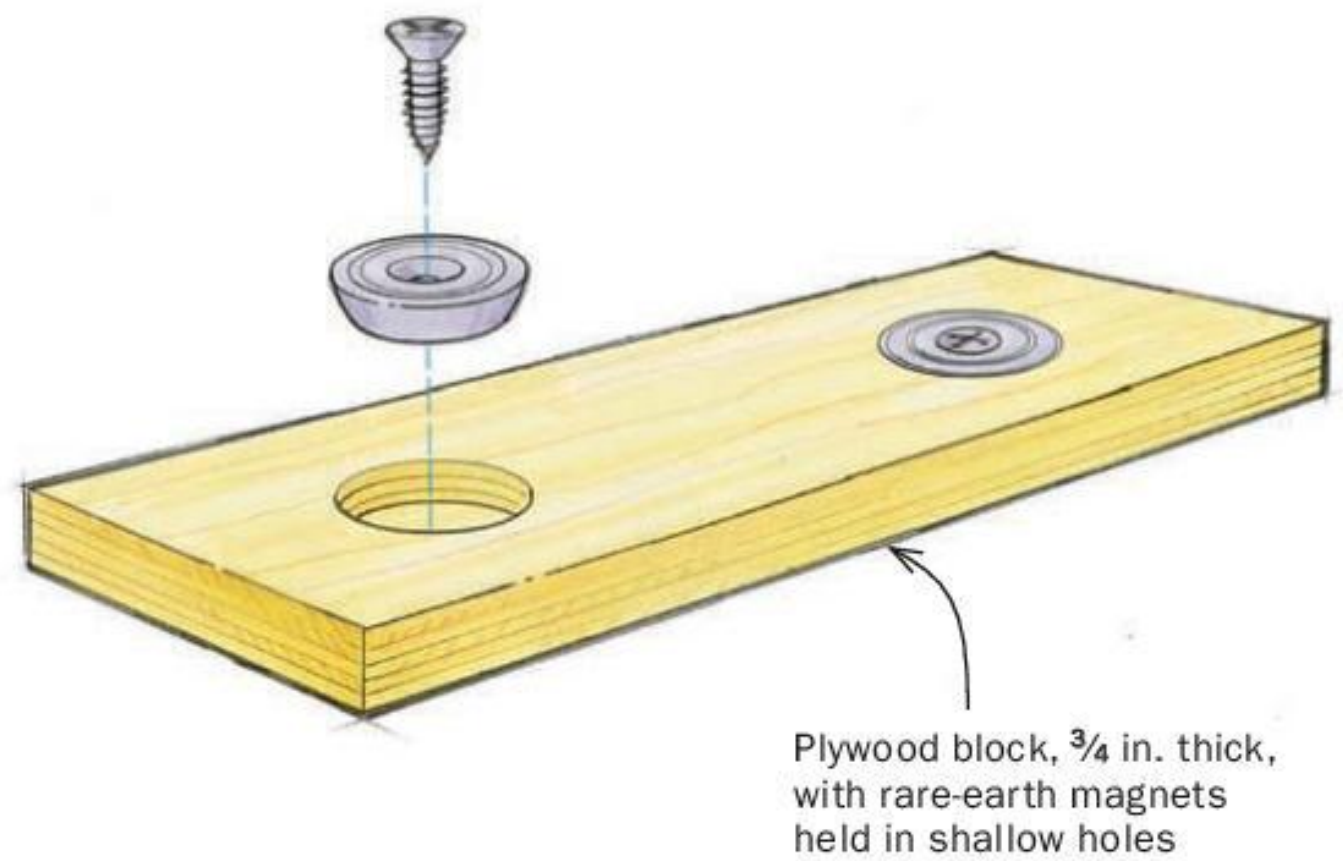
Mirroring his dad's career as an auto mechanics teacher and part-time carpenter, Barry Thalheimer spent 30 years teaching carpentry and construction at a Catholic high school in Prince Albert, Saskatchewan. He retired from teaching in 2013 to start his own company, Thalheimer Woodcraft.

Best push stick is one that's close at hand

Thirty years of teaching woodworking has convinced me that woodworkers will use a push stick consistently—if it's convenient. If not, they'll often go without, finishing cuts by squeezing a few fingers past the blade. To make the tablesaw safer I designed a simple holder that keeps your favorite push stick upright on the rip fence. With the push stick nearby and poised for action, you hold a workpiece securely in both hands as you start a cut, and scoop up the stick as your hand passes by, finishing the cut safely. The small magnetic block lets you pull the push stick off the rip fence at any angle. If the block moves in the process, you can just push it back against the stick when you return it to the ready position.

The holder is a small wood block that attaches to the rip fence with rare-earth magnets, and squeezes almost any type of push stick against the edge of the fence face to keep it vertical. You can epoxy rare-earth magnets into the bottom of the holding block, but I used the type held with a screw (Lee Valley no. 99K39.04).

—BARRY THALHEIMER,
Prince Albert, Sask., Canada



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The prize for this issue's best tip was a cordless trim router by Ridgid.



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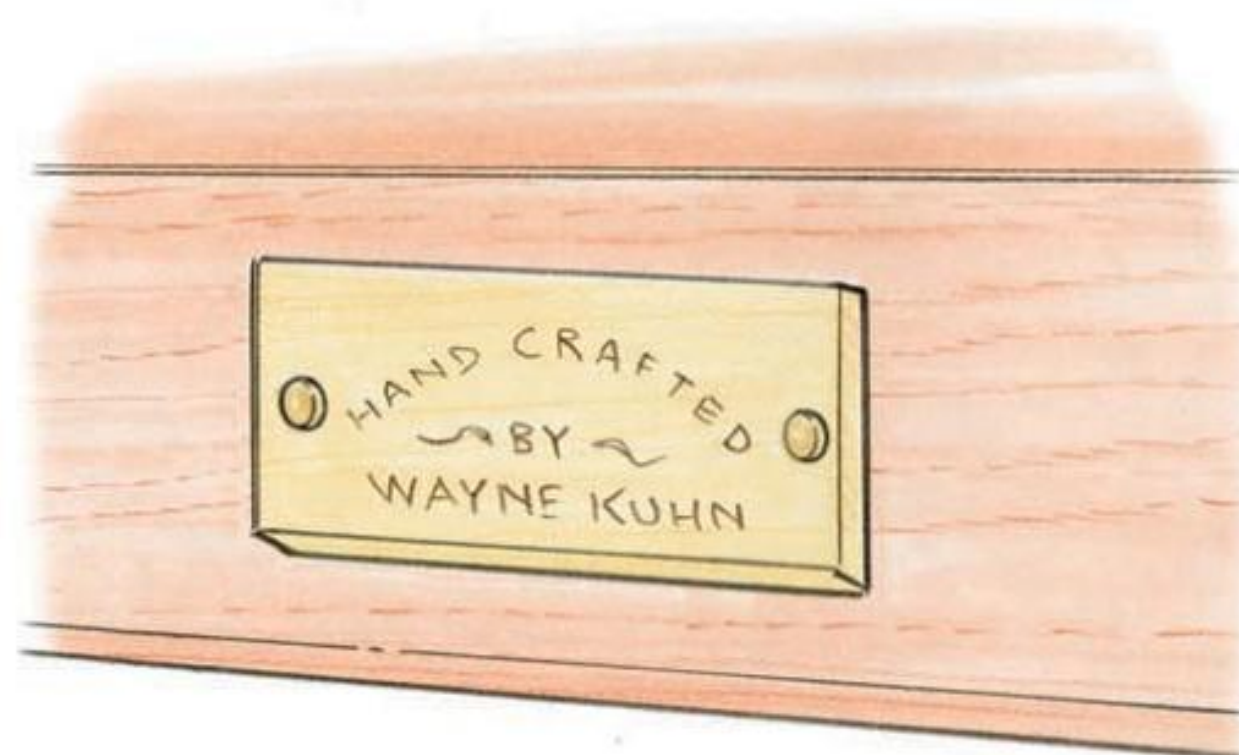
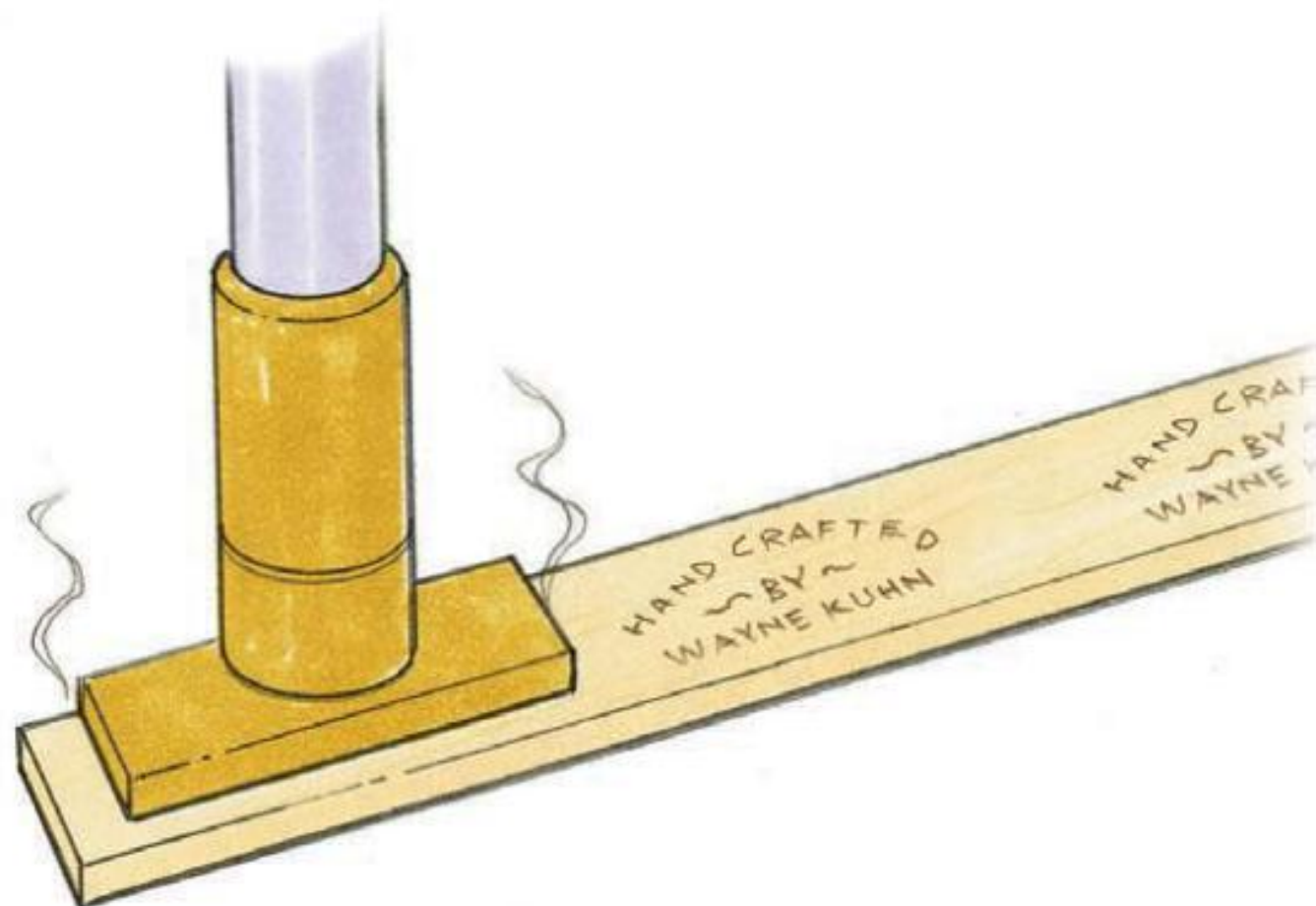
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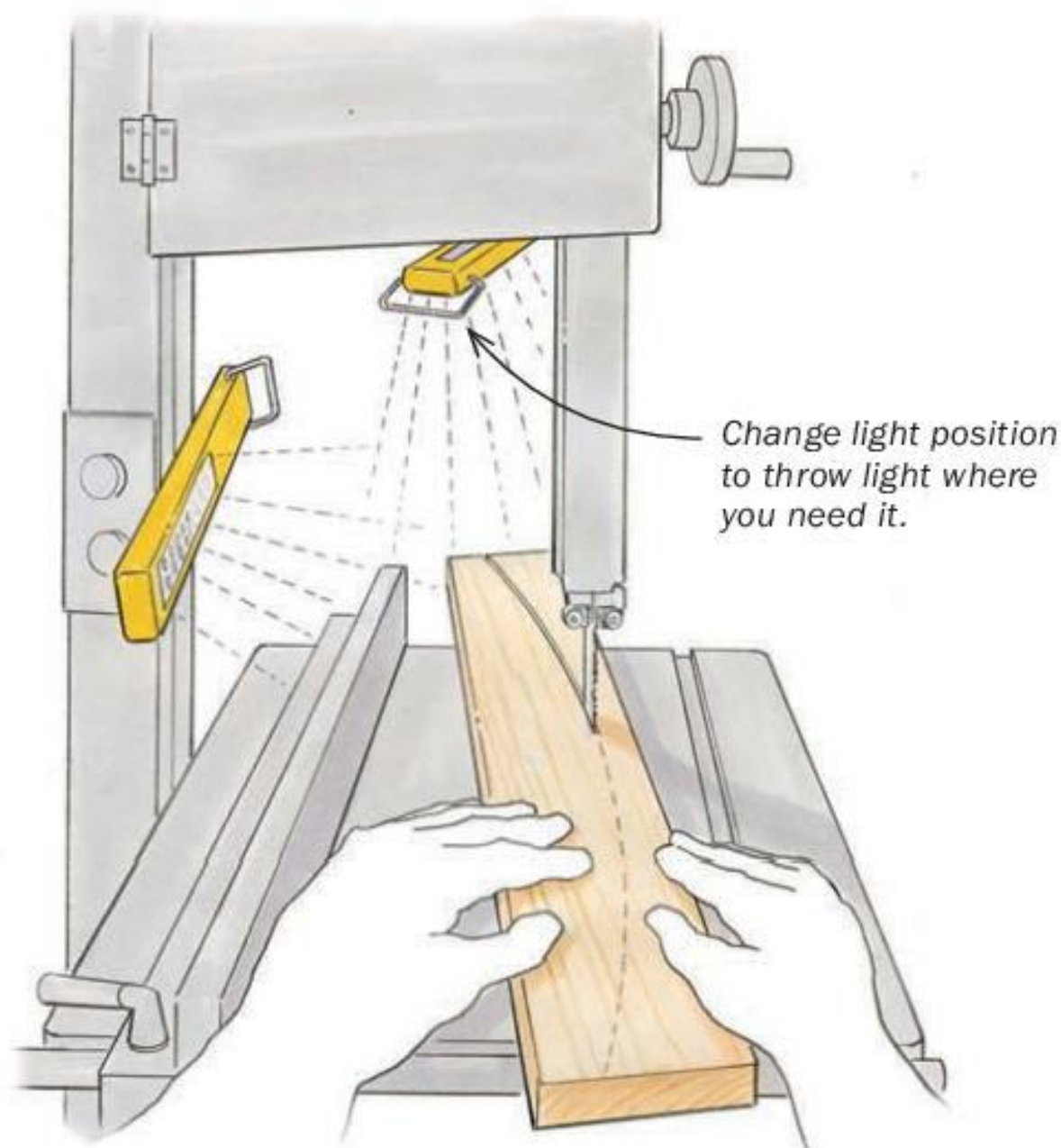
workshop tips continued

Sign your work with branded nameplates

To sign my work in a distinctive, repeatable way, I ordered a custom brand. Available at major online woodworking retailers, these come in electric and torch-heated versions. But it always feels a little risky to apply a hot iron to a finished piece of work. To eliminate the risk and make my maker's mark even more distinctive, I burn a whole row of brands into a strip of thin wood, and then cut it apart to create a stack of custom nameplates. I use hard maple about $\frac{1}{8}$ in. thick, cut just wider than the height of my brand. After burning a row of brands into the strip, I sand the surface a little, cut it apart to create the nameplates, and bevel the edges of each one, storing them in a baggie. When I need one, it's ready to go and I attach it with cyanoacrylate glue or brass brads. No waiting for the iron to heat up, and no risk.

—WAYNE KUHN, Columbia, Md.





Magnetic LEDs attach to many machines

Good lighting is an integral part of any workspace, and it gets even more important as we grow older. When I purchased my bandsaw I was offered an optional plug-in light, but the price was steep. Instead, I went shopping for lights and I found quite an array of LED models, some with flat magnetic backs. I bought two, which I stick on my drill press, bandsaw, and radial-arm saw in various positions as needed.

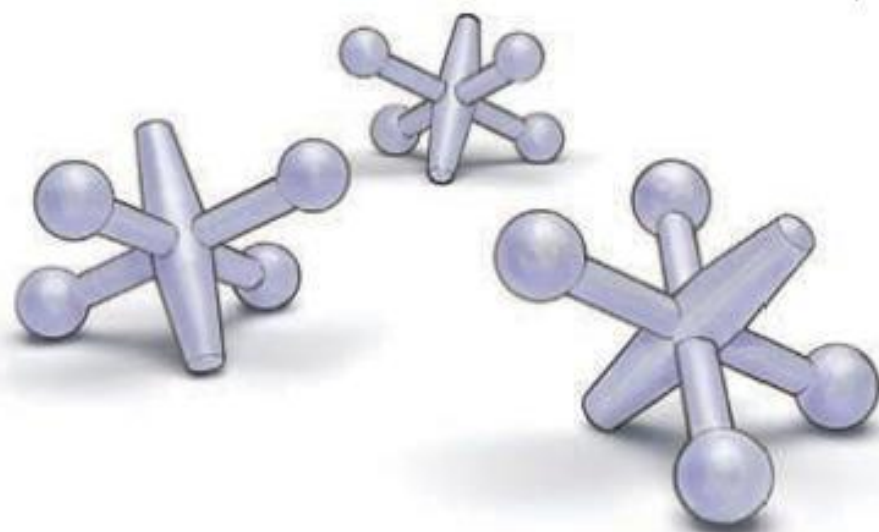
—RANALD MILLAR, Pomona, Queensland, Australia

Quick Tip

Jack up projects for finishing

My favorite way to raise wood projects for finishing or to let a finish dry is a set of jacks (yes, the childhood toy). Throw down a handful on any work surface, and they create a level resting area with great airflow. Better yet, if you throw down more than a few, they won't mar the bottom of your project. I found sets of eight for less than \$1 each at a party-supply store.

—ANTHONY FODERO, Milwaukie, Ore.



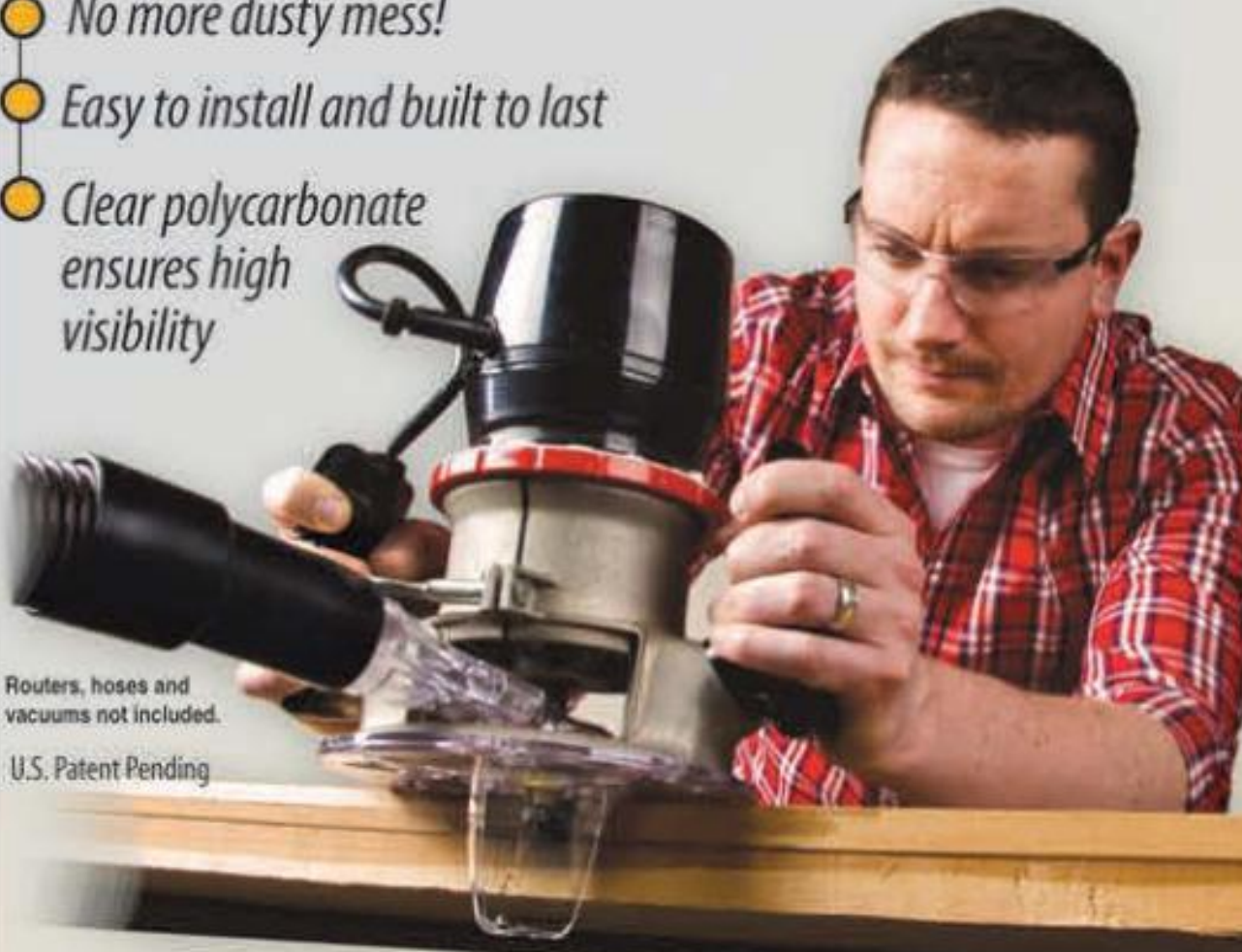
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The base easily slides on and can be finely adjusted by releasing the lock and turning an adjustment wheel. This function works remarkably smoothly. I'm also a big fan of the red spindle lock, which allows the user to tighten or loosen the collet with only one wrench. (Some routers can be knuckle-busters when trying to free a bit after use.) This feature also relieves the struggle of using small bits, which are often hard to tighten and tend to pull out of the collet during use. Not so with the spindle lock.

—Greg Pilotti runs a custom furniture shop in Parkesburg, Pa.



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■ WOOD TURNING

Intuitive thickness gauge for turners

THE GAGE'T BY TOMPKINS excels at quickly and intuitively measuring the wall thickness of traditional bowl forms on the lathe. A spring-loaded pin keeps two spherical, non-scratching measuring points tight against the inner and outer surfaces of the bowl, revealing color-coded stripes on the pin's opposite end that represent the bowl's thickness. It can measure walls up to 1 $\frac{3}{8}$ in. thick, and Tompkins says it will work in bowls up to 20 in. in diameter.

Because of the shape of its body, however, the Gage'T has trouble measuring the walls of steep-sided or narrow-mouthed

forms and large platters that traditional calipers don't have trouble with.

Because the marks on the pin are only $\frac{1}{16}$ in., and the Gage'T must be perfectly perpendicular to the wall's compound curve to get an accurate measurement, I mostly use it for getting quick thickness estimates. Still, accuracy to within $\frac{1}{16}$ in. will be plenty for many turners. Overall, the Tompkins gauge is a welcome addition to the tool kit of any serious bowl turner.

—Amy Costello is a woodworker in Salt Lake City.



Sliding scale. A spring-loaded pin keeps two measuring points tight against the inner and outer surfaces, and the color-coded stripes on the top of the pin indicate the bowl's thickness.



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IF YOU HAVE MACHINERY IN YOUR SHOP, you need a dust collector, and the best type to have is a cyclone, which separates the chips from the airflow before it hits the filter. This minimizes clogging and allows the dust collector to work more efficiently for a longer period of time. I've been testing Harvey Machinery's Gyro Air G700, which is a new twist on the cyclone dust collector. After separating out the large chips from the airflow, the Gyro Air passes the air through two turbine vanes, spinning the air and dust up to 4,000 rpm. This forces the dust out of the airflow, allowing it to fall into a collection bin so that it never reaches the filter.

The Gyro Air was impressive. I used it while testing seven 8-in. jointers, running cherry, curly maple, and white pine through them repeatedly. It kept up without any trouble. Even more impressive than its dust collection performance, however, was how quietly it operated. Standing next to the machine, I measured its loudness at 74 db., which is comparable to a radio playing softly in your house. Standing 15 ft. from the machine,

the noise dropped to 68 db. This is insanely quiet for a dust collector. I had several conversations while the machine was running and never once had to raise my voice. The less noise in the shop, the better. (Of course, you should still wear hearing protection while using woodworking machinery.)

Emptying the collection bins was easy and quick. I also like that the Gyro Air is rectangular (its footprint is 23½ in. by 54¼ in.) and not too tall. At less than 34 in. high, it would fit under a counter. I would love to have the Gyro Air in my shop.

—Matt Kenney is special projects editor.



Gyro Air by Harvey Machinery

G700

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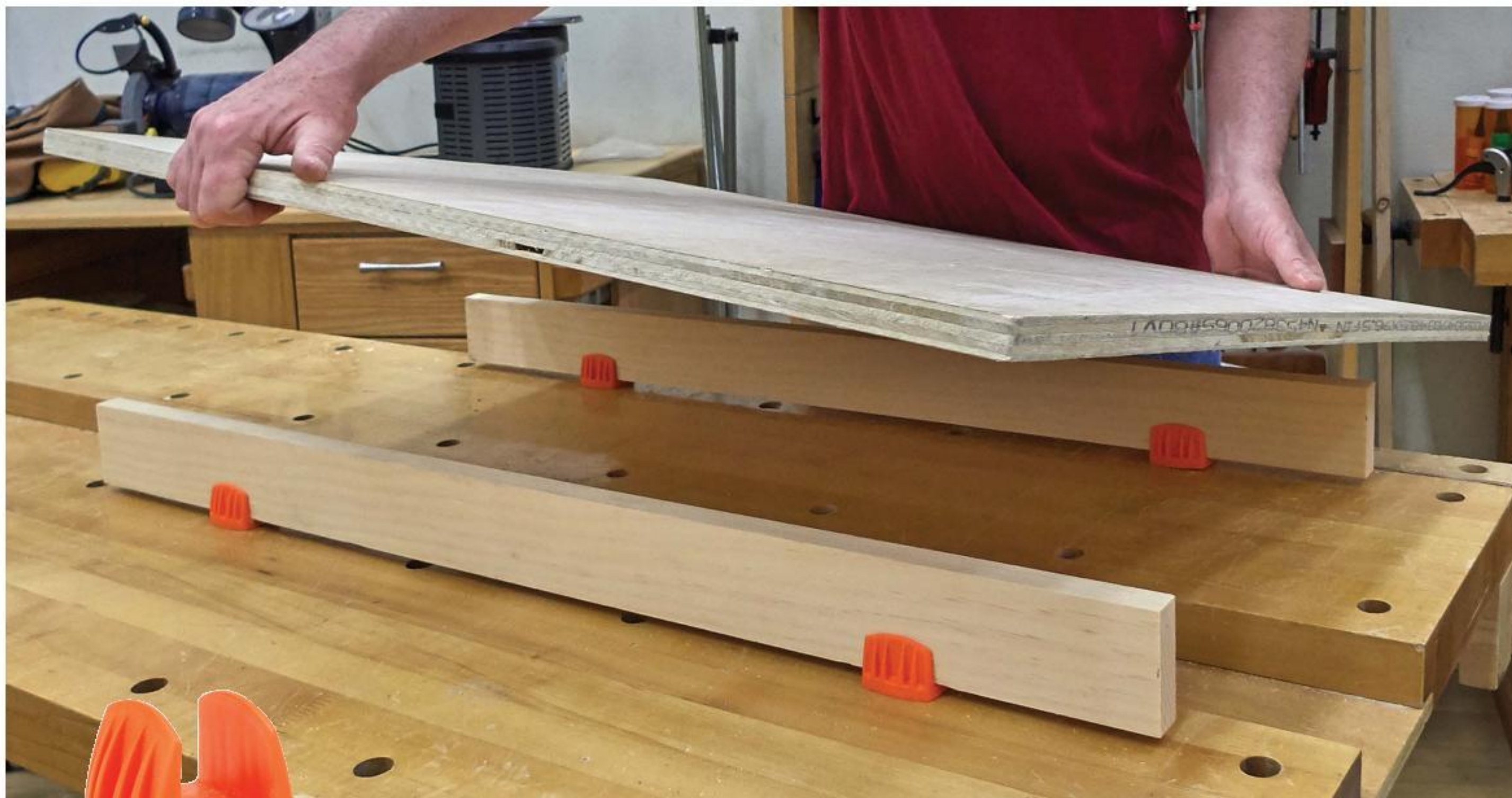
Ready to reduce. Provided with the unit is a split connector with a 4-in. port and a 2-in. port. It fits over the 6-in. inlet port.



Variable speed. In addition to a soft start, the machine has a dial that lets you vary its speed to adjust the suction to the task at hand.



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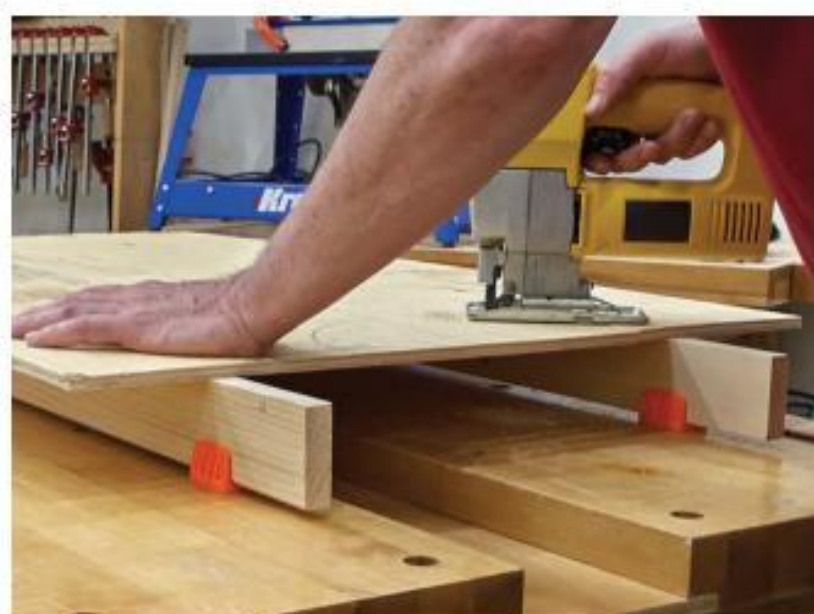


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Sharpen and use a curved scraper

BY PETER GALBERT



Sharpening kit. Used with a file and diamond hone, Galbert's jig quickly prepares the edge of a curved scraper.

The card scraper is an indispensable tool in my shop. I was introduced to it as a tool for refining flat surfaces, but I now use it more as a shaping tool to fair curves and dial in complex shapes on chair seats. The soft metal is easy to grind to a curve, and with a simple shopmade honing jig I can maintain a high level of sharpness across the curved edge with speed and repeatability.

The cutting edge of any scraper, straight or curved, is a slightly deformed 90° meeting of the flat face of the tool and the edge. While much is said about “turning the burr,” the real attention should be paid to establishing a perfect right-angle relationship between the face and the edge. If these surfaces meet at a sharp 90° angle, the scraper will take a good shaving even without a burr. Adding a burr improves the cutting action from good to beautiful. But if there is any rounding of the underlying edge, there will be little hope for success, regardless of your efforts with the burnisher.

Another important factor, besides having a sharp corner where the surfaces meet, is the condition of the surfaces. When you joint the edge with a file, you'll attain the correct geometry, but the edge will have grooves left by the file. This might be acceptable for rough work, but the scraped surface will

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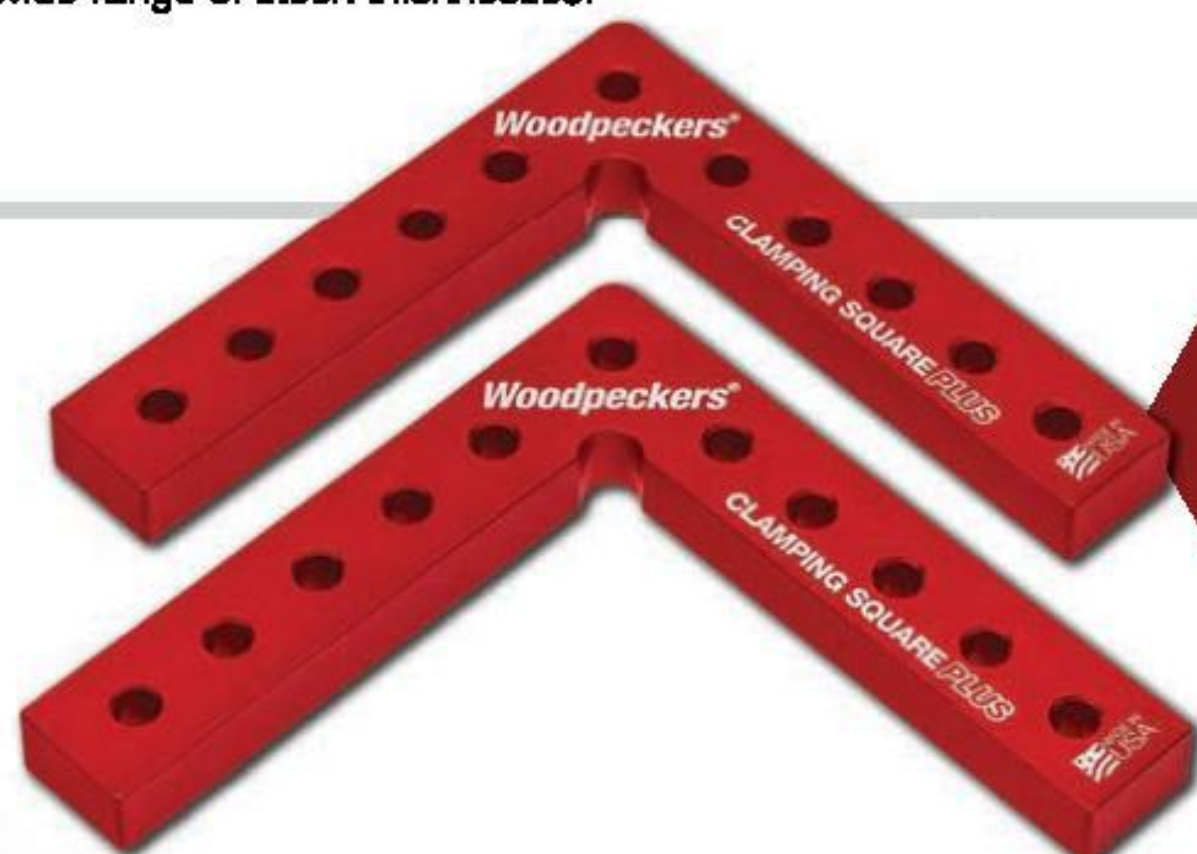
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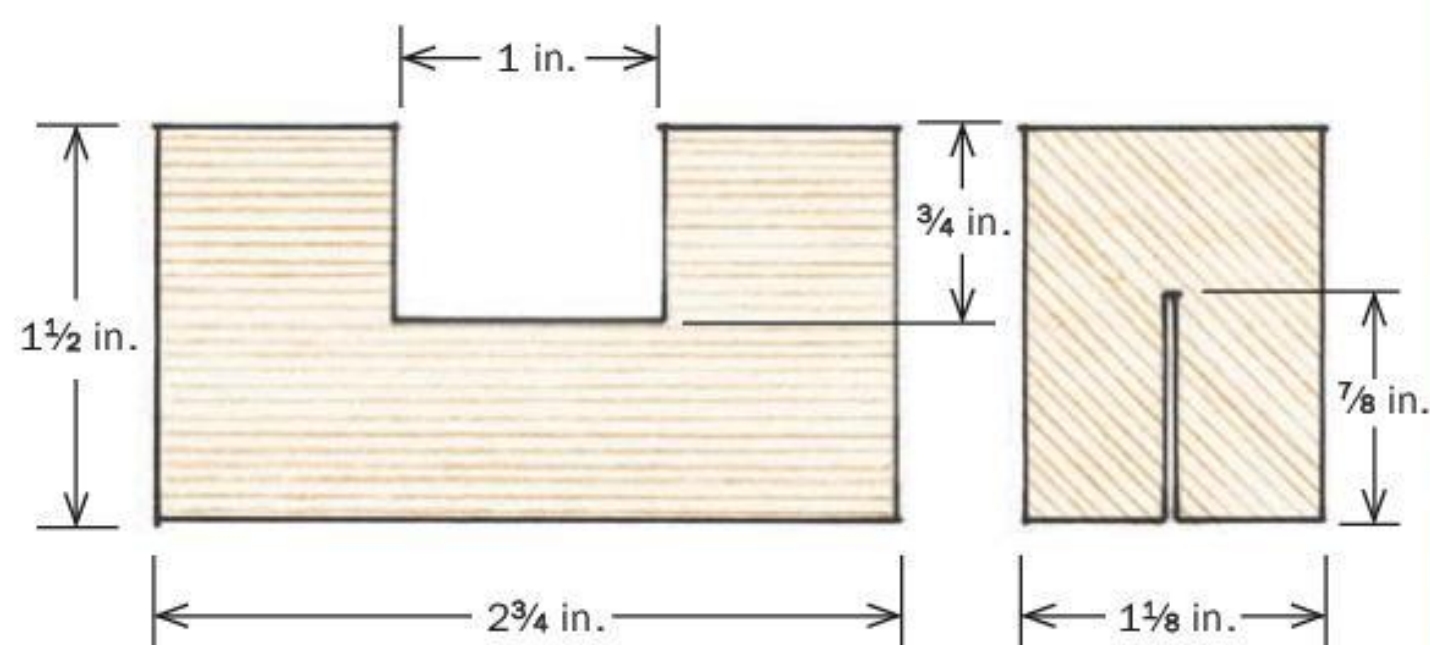
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Make a honing jig



1
Rough out the notch. To create the jig's notch, start by cutting a handful of kerfs, then chisel out the waste.



2
Pare the floor. Use a wide chisel to flatten the bottom of the notch (above). Check with a square to be sure you pare the bottom of the notch 90° to the sides of the jig (right).



have lots of small scratches. Refining the edge with a diamond hone will yield a smoother surface and a cleaner cut.

Making a curved scraper is simple: Draw a curve on the flat face of a scraper and grind to it. Take care not to let the heat build to the point where the edge blues. Overheating will soften the metal and reduce the life of the edge. After grinding, polish the flat faces on a freshly flattened stone or with fine sandpaper on glass. Then it's on to filing.

Once you've made the honing jig (above), put a sharp fine file in the notch and pinch the file against the bottom of the notch. Skew the file so it cuts on the diagonal. Insert the scraper in the slot and draw the jig toward you using very light pressure. If the edge has been burnished previously, the metal will be compressed and hard, and it may take a few strokes to reach the softer metal beneath. Small curly shavings will peel off the edge when you are through the tough stuff.

To refine the edge further, use the jig again, but now with a fine diamond hone. Then, with the scraper laid flat, use



3
One slice for the scraper. Flip the jig upside down and cut a kerf to fit the scraper. The fit should be snug but still allow the jig to slide freely on the scraper.

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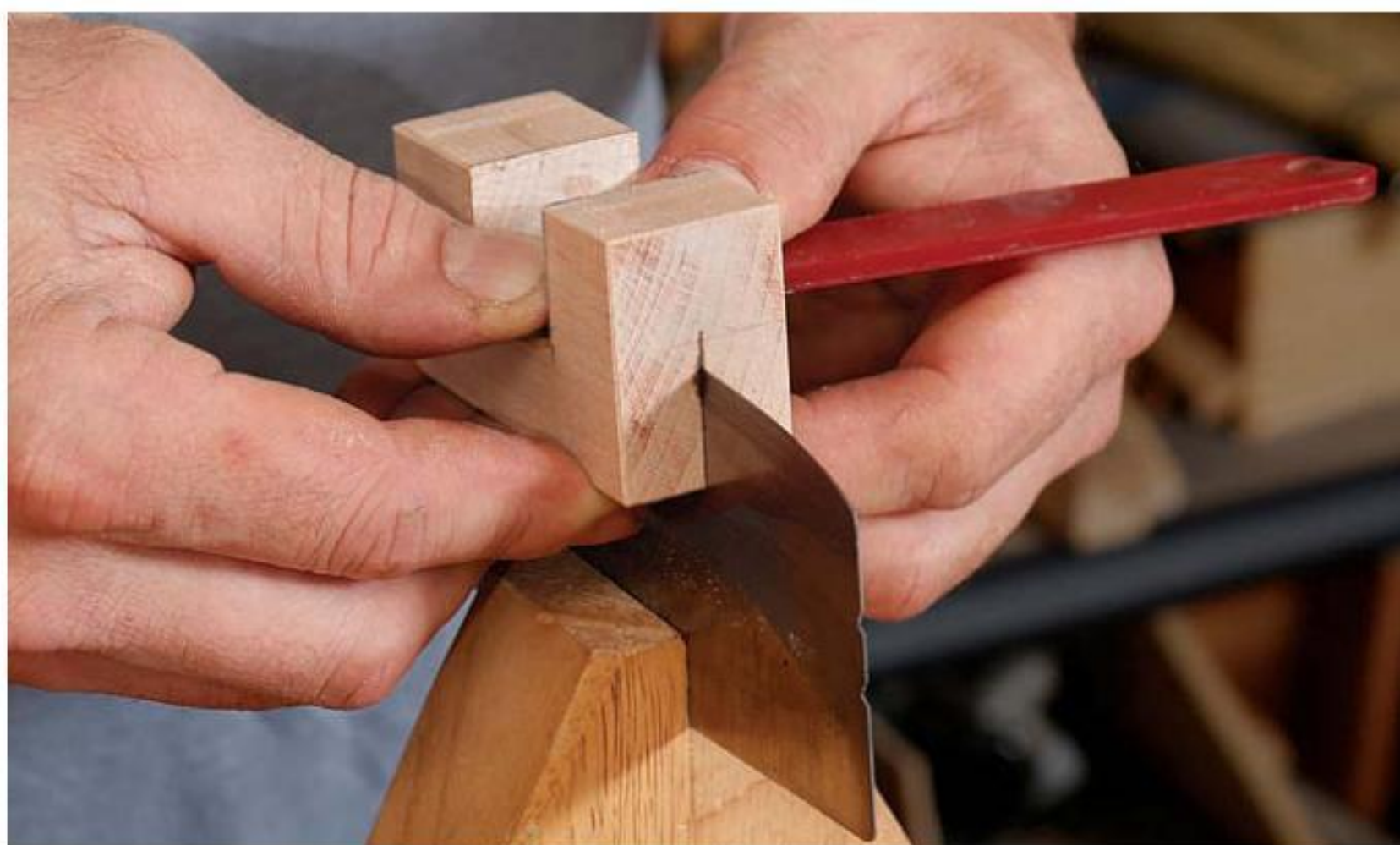
Honing time



File comes first. With a fine file held flat to the bottom of the notch and at a skewed angle, cut by drawing the jig and file toward you (left). Use a light touch. When you've filed into fresh metal you should be creating curly strands of steel (above).



Oil and diamonds. After filing the edge square, Galbert uses a fine diamond hone lubricated with camellia oil to create a super-smooth surface.



Final flattening. Use the fine diamond hone to flatten the face of the scraper, being careful never to tilt the hone. Then hone the edge again.

the diamond hone on both sides, and use it on the edge once more with the jig.

Now turn the burr. Lay the scraper flat on a hard surface, press an oiled burnisher flat on the side, and take several passes. This step points the burr toward the edge. Next hold the scraper with the cutting edge up and position the burnisher 90° to the face. Draw the burnisher down the edge. On the next pass, tilt the burnisher a degree or two toward the side you are sharpening. It's the pressure of the tool, not an extreme angle, that turns the soft metal to a burr. Once you feel a tiny burr along the entire edge, stop and test the tool.

When this burr becomes dull, you can turn a new one. In subsequent burnishings the soft material will get harder, making a burr that lasts longer, but at some point it will get too difficult to distort into a fresh burr and the process must start again with the file to remove the hardened material. □

Peter Galbert is author of *A Chairmaker's Notebook* (Lost Art Press, 2015).

Create the burr



Turn a burr with a burnisher. Using firm pressure and a few drops of oil, press a burnisher across the face of the scraper (above). Then hold the scraper upright and, using moderate pressure, draw the burnisher along the edge to create a burr (right). The burnisher should be tilted just slightly downward toward the side that is getting the burr.



Now put it to use



Stand up straight. Galbert finds the optimal scraping angle by starting at 90° to the work and gradually tilting the scraper into the direction of cut until he gets a shaving. It should still be nearly vertical when you are cutting.



All thumbs. For best control keep your thumbs right at the work surface. Push forward, not down into the work.



Skewed logic. Like other hand tools, the scraper cuts cleanly when the strokes are diagonal to the grain.

 **Online Extra**

To see Peter Galbert's sharpening process, watch the video at FineWoodworking.com/271.

Bandsawn Curves, Precise and Repeatable

Template-guided techniques from a master of the machine

BY BRIAN BOGGS



In 35 years working wood I've gradually acquired many machines, but the bandsaw remains at the heart of my shop, the one machine I couldn't live without. Bandsaws are irreplaceable for cutting all sorts of curves freehand, of course, and I'll say a little here about those. But that's just the beginning. The saw's greatest potential is revealed when you use it for template-guided curve cutting. Set up properly and guided by templates, a bandsaw can deliver repeatable curved cuts in a mind-bending array. With template-guided cuts you don't have to correct rough bandsawn curves with a router, just sand away tooth scratches.

If the techniques I describe here don't work well on your saw, they will if you tune it up. The best article I have read on bandsaw tune-up is Michael Fortune's "Five Tips for Better Bandsawing" (*FWW* #173 or FineWoodworking.com/271). I'd recommend reading that (paying particular attention to

Some tips for sawing freehand

When cutting curves freehand, you'll benefit by watching the side of the blade as well as the pencil line. If the gap beside the blade is uniform, you're cutting well, in line with the blade drift. Drift is the line the blade wants to take while cutting. You can follow a pencil line even if you are not feeding directly with the drift, but the blade will leave a washboard pattern on the cut surface. Ideally, the blade drift should be parallel to the right edge of the table. To check this, place a straightedge on the table and snugged up beside the blade, between two teeth. If the straightedge isn't parallel to the edge of the table, adjust the tracking. If you have to track the blade much off the center of the wheel to correct the drift, it's time to tune up the crown of your wheels to re-center them.



SAWING FLAT

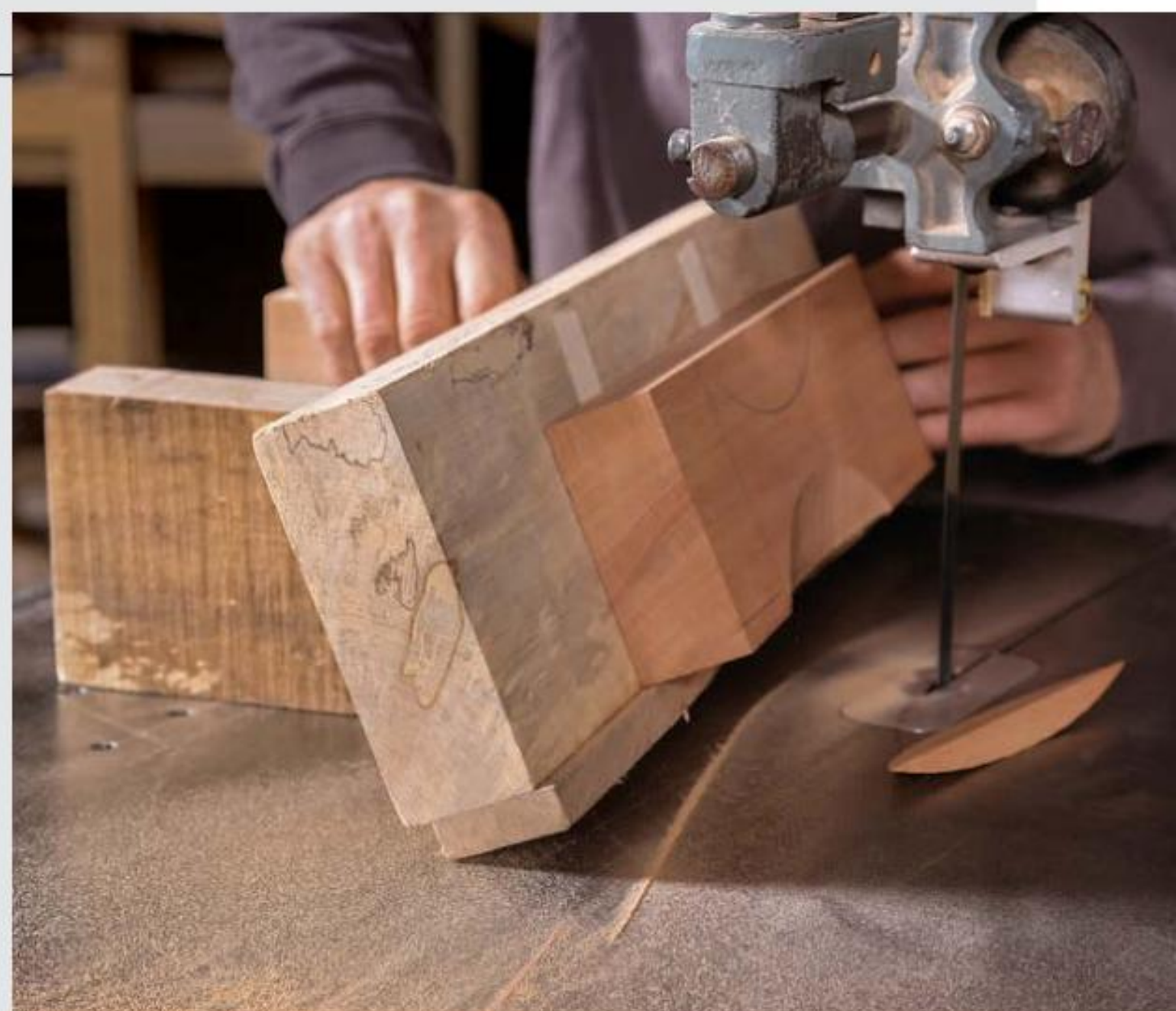
Keep an eye on the gap beside the blade as well as the pencil line. If the saw is cutting properly the gap should be parallel (1). When finishing a low-angle curved cut (2), exert gentle pressure against the side of the blade to keep it from skipping out and leaving a bump. To correct a cut that wavered (3), let the rear of the blade rub the workpiece as you feed the teeth into the waste.



SUPPORT THE WORKPIECE



Use a beefy fence for vertical sawing. When cutting a curve freehand into the face of a board, Boggs steadies the blank with a stout sliding fence. Double-sided tape secures the workpiece.



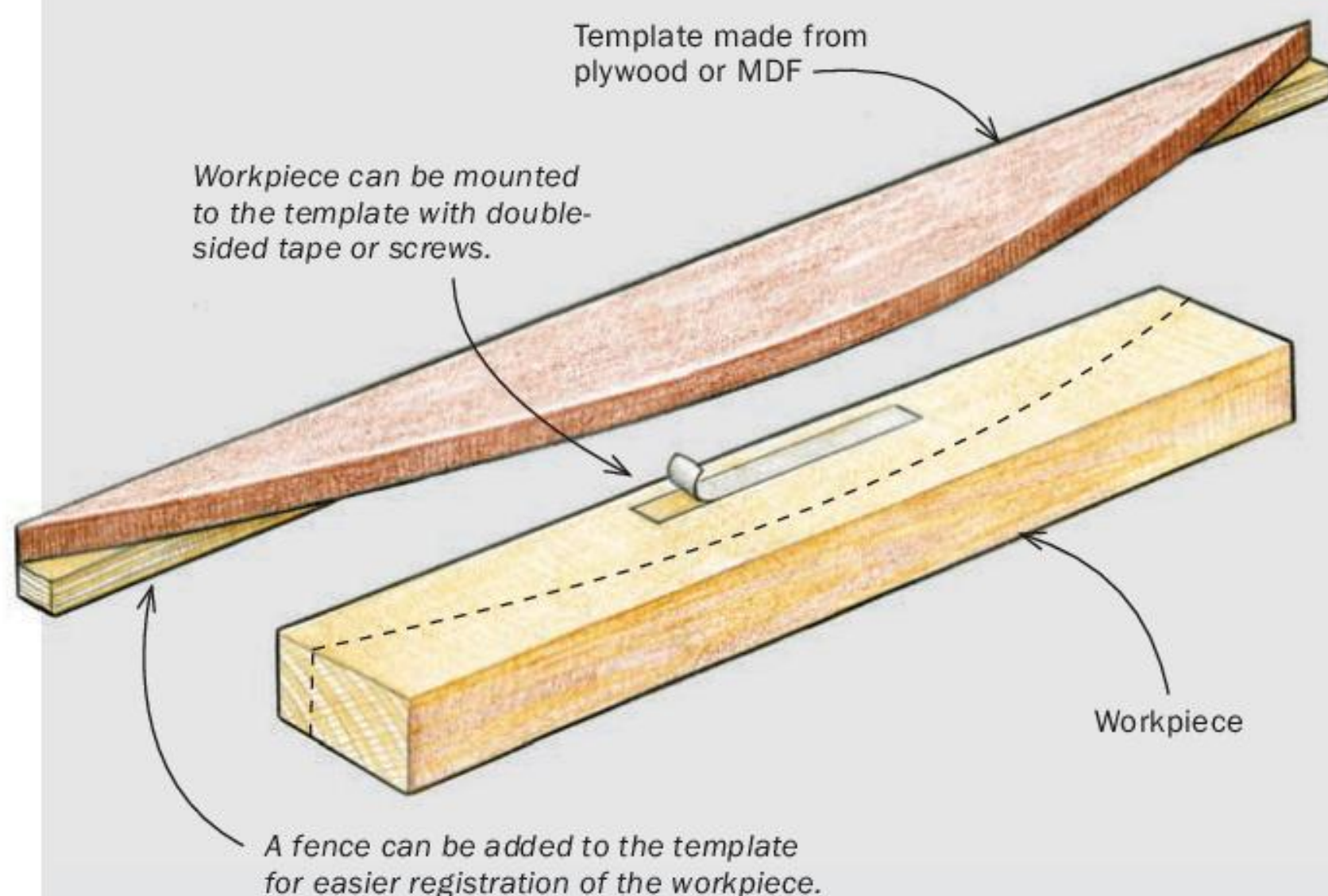
Curved and cocked. A jig with an angled fence and a lip at the bottom makes for easy, safe freehand sawing of angled curves.

Template-guided cutting



MAKING A TEMPLATE

To lay out shallow curves on the MDF template (1), Boggs uses straight-grained solid stock sawn thin. In this case, he glued straight blocks to the ends of the strip to confine the curve to the center section. To fair the sawn edge of the template, Boggs adheres sandpaper to a flexible strip of wood (2). For a long-wearing template in MDF, harden the edge with cyanoacrylate glue (3).



his discussion of blade drift) to get your bandsaw running sweetly before you start cutting with templates.

A few other tips before you begin: I use ½-in., 4-tpi skip-tooth blades almost exclusively for curve cutting, whether I'm sawing with my trusty old 14-in. Delta or my even older, even trustier 30-in. Yates-American. I also keep multiple fresh blades on hand; a dull blade is hard to control, and I don't want to be tempted to continue cutting with one. Be sure the blade tracks to the center of the wheel and that the blade's side is parallel to the right edge of the bandsaw table. Keep your feed rate consistent, as changes in pressure can alter the behavior of the blade. And cut test pieces to make sure

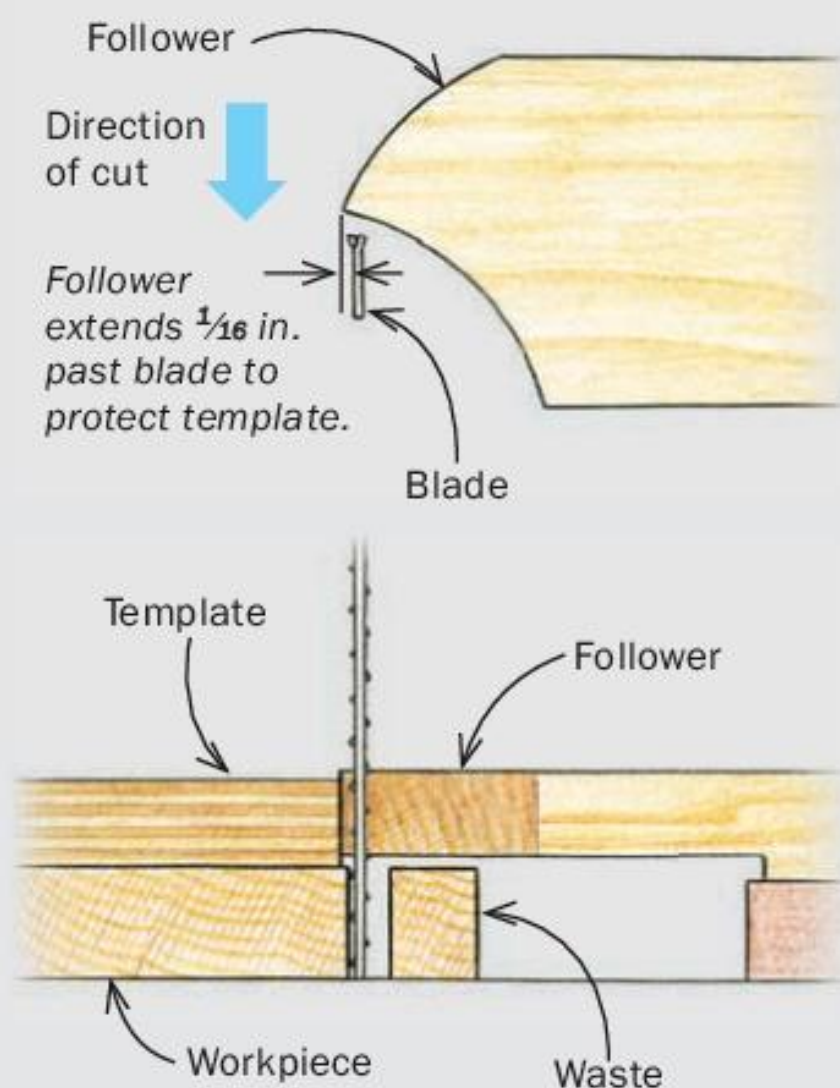
the setup is generating excellent results before you risk your furniture parts.

Template-guided cuts are precise

On the bandsaw, being able to follow a line and get a good cut freehand is an invaluable skill. But no matter what your skill level is with freehand curve cutting, those cuts will not approach the precision you can attain with a template-guided cut. Woodworkers often create curved parts by making a rough cut with the bandsaw and then cleaning up with hand tools or by pattern-routing. But once you get fluent with template-guided bandsawn cuts, you'll be able to create super-smooth curves of virtually any shape that shouldn't need more than a light sanding. And if they are shapes you use often, you'll develop a bank of templates you can access quickly. If you saw a lot of curves, this can be a life changer.

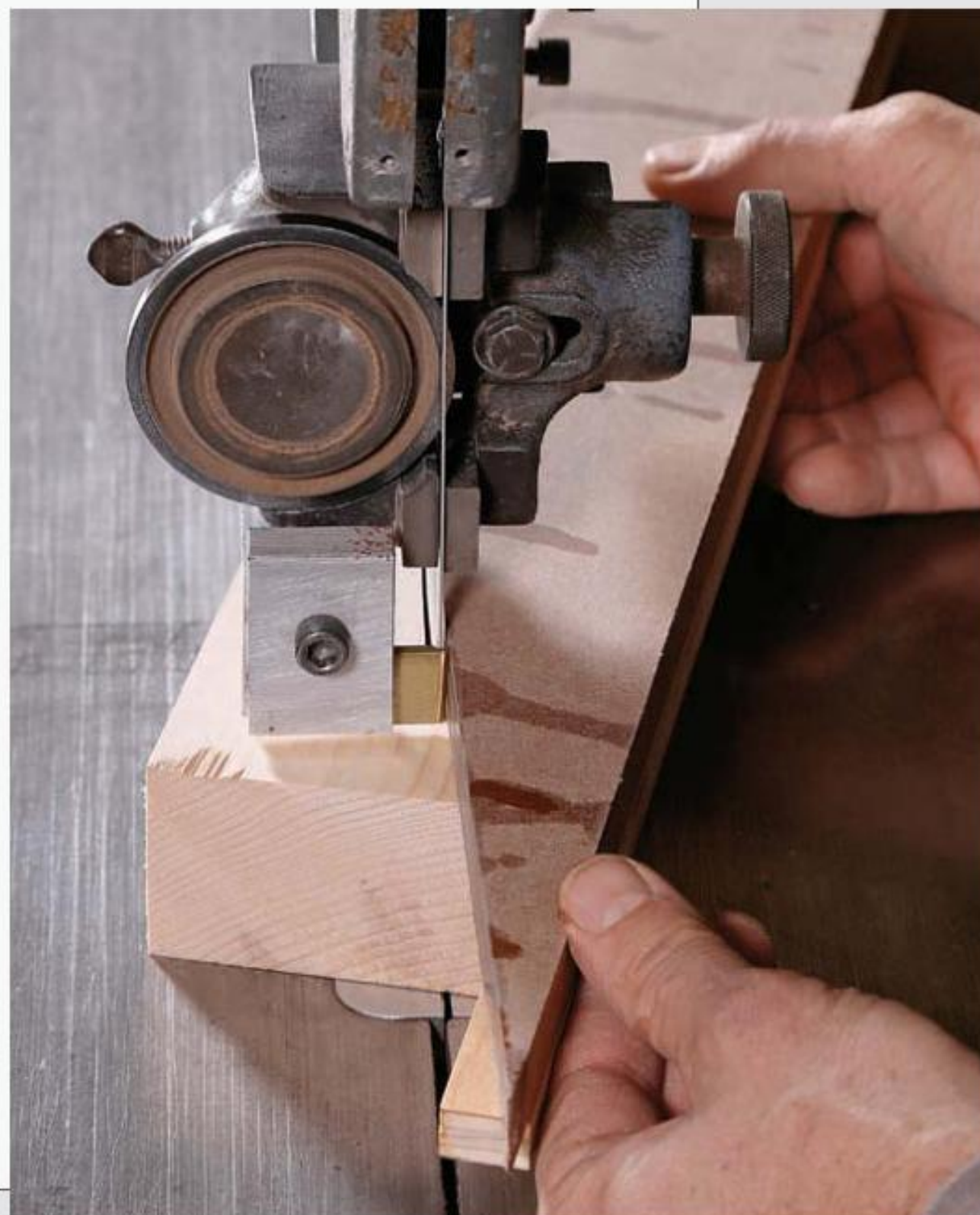
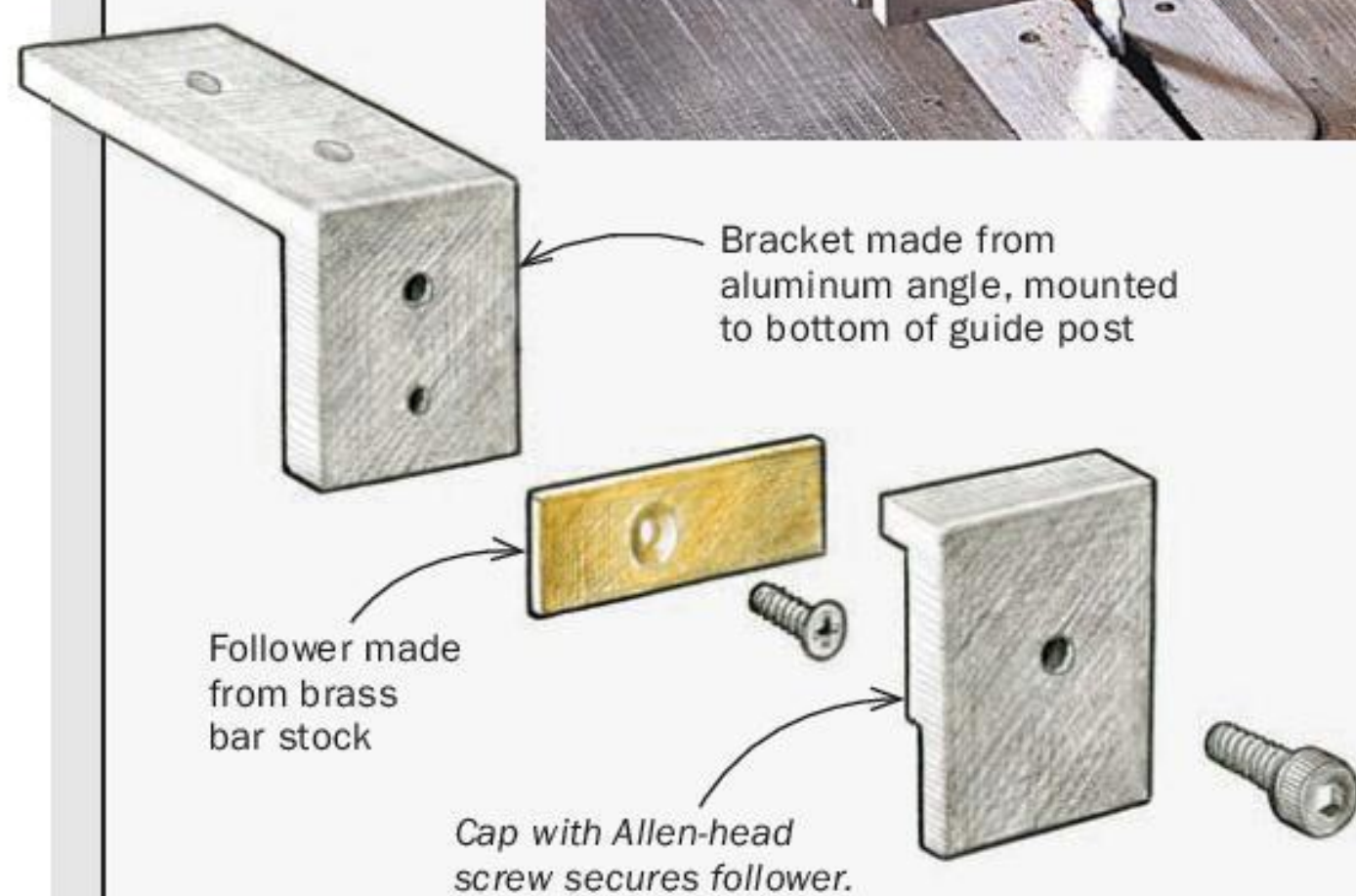
A FOLLOWER STEERS THE CUT

In most guided cuts, the template is attached to the top of the workpiece. A shopmade follower, screwed to a riser block and clamped to the table, rubs the edge of the template to guide the cut.



BOLT-ON FOLLOWER TRAVELS WITH THE GUIDES

Using off-the-shelf aluminum angle and brass bar stock, Boggs made an adjustable follower that bolts to the bottom of his blade-guide assembly.



Template variations



TEMPLATE FOR PRODUCTION WORK

For curved parts that he makes repeatedly, Boggs sometimes creates friction-fit templates. Here the screwed-on end blocks secure and locate the part and also extend the curve of the template, making for smooth entry and exit cuts. Boggs says this system, used here for chair rails, “produces very uniform parts, and they get sawn faster than I can pick up a pencil and draw the curve.”



Follow the finger

To get your saw to follow a curvy template, you'll need to fix a follower, or finger, just in front of the blade. A template attached to the workpiece and pressed against the follower allows for much steadier and faster cutting than freehand. The follower is really just a steady rest. You still have to guide the feed direction manually, but pressing the template against the follower keeps the pattern in the right position and steadies the cut for easier control and much faster feed rates than when bandsawing freehand.

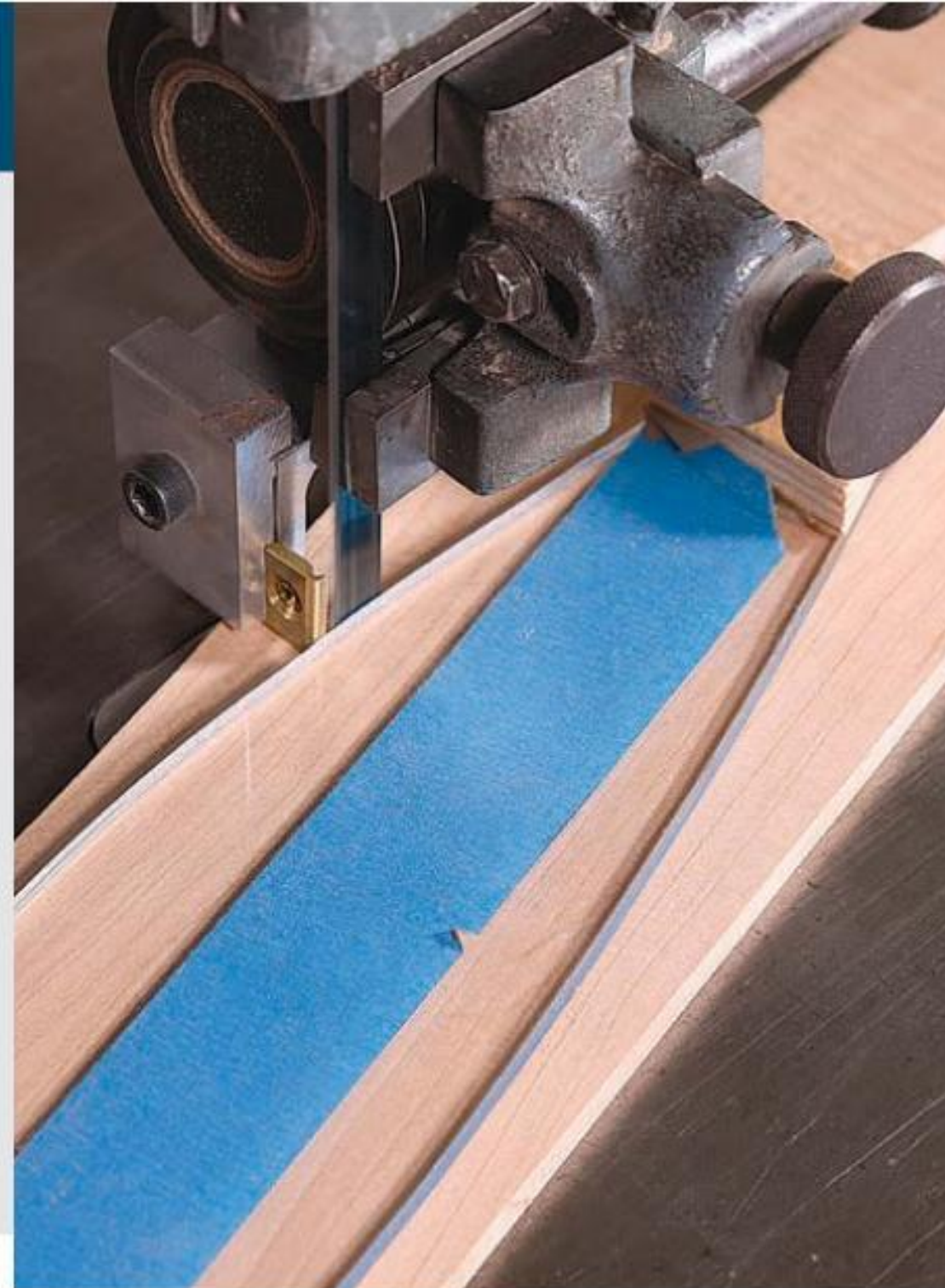
You can create a follower from a piece of solid wood or plywood and clamp it to the bandsaw table. But once you get used to the speed and accuracy of this simple method, you may want

a handier follower to work with. I made one for my 14-in. Delta bandsaw that was screwed to the blade guard. It worked fine, but I had to remove it for every blade change. So on my Yates-American I found a spot below the blade guard where I could bolt a brass follower right in front of the blade. The follower can be adjusted to whatever offset I need. I usually set it at $\frac{1}{16}$ in. That's close enough for accuracy and far enough to save the pattern from getting cut if my focus fails. This follower stays on the saw, always at the ready. It can follow virtually any template, and hardly a day goes by that I don't use it.

Because of the $\frac{1}{16}$ -in. offset between the blade and the follower, the template needs to be made $\frac{1}{16}$ in. smaller than the final part.

TRANSPARENT TEMPLATE

When grain alignment is critical, as on these back slats for his ladderback chairs, Boggs makes Plexiglas templates. He uses screw points, which protrude $\frac{1}{16}$ in., to secure the template to the workpiece.



If you are sawing both sides of a part, the template should be $\frac{1}{8}$ in. narrower than the finished workpiece.

Making templates

To make most templates, I draw the shape I want on a piece of $\frac{1}{2}$ -in.-thick MDF and bandsaw it out very carefully freehand. To smooth the edges, I make a flexible sander by adhering PSA-backed sandpaper to a thin strip of wood. This does not yield a perfect piece, but I don't use the follower system when perfection

is required. After sanding, I soak the edge of the template with thin cyanoacrylate (super) glue and hit it with accelerator, then sand it with 320-grit paper. This gives the template a very hard, smooth, and wear-resistant edge. Without this treatment, MDF is too soft for long-term use as a template.

True arcs require a two-part fence

For cutting large true-radius arcs, or for creating the concave and convex halves of a two-part fence (more about this in a minute),



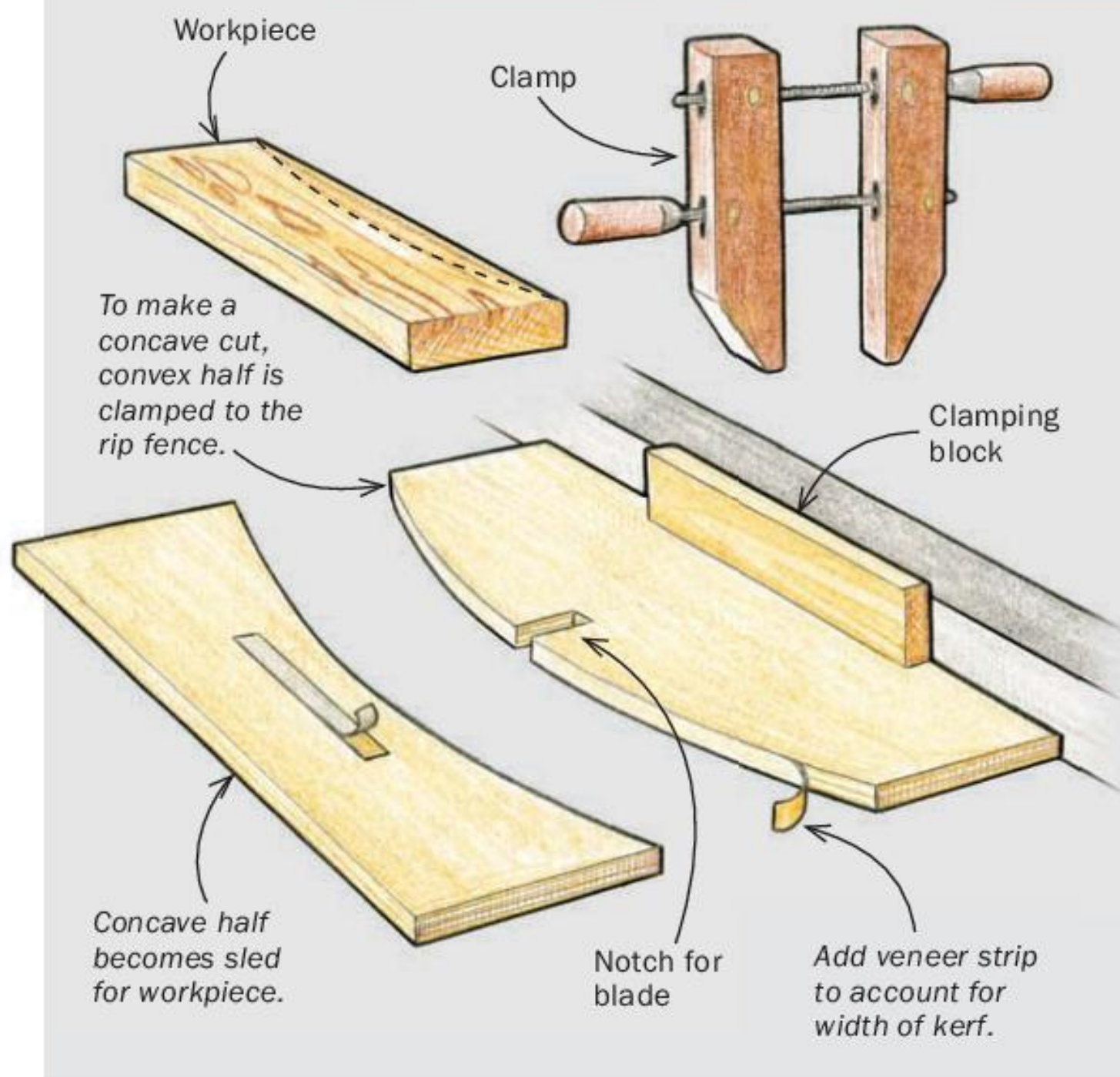
BOTTOM-MOUNTED TEMPLATE

For workpieces that aren't flat, like this stool seat, with its curved top and bottom faces, you can use a bottom-mounted template and a follower clamped directly to the bandsaw table. Add blocks to the template to stabilize the workpiece.

Mating fences for perfect arcs

FIRST MAKE THE FENCES

With one sheet of MDF clamped to the bandsaw table and fitted with a metal pin, another sheet is laid on top and pivots on the pin. This enables Boggs to saw a piece of template stock in half, producing both the convex and concave fences with one cut (below). To make the two fences mate exactly, Boggs creates a strip of veneer the same thickness as the kerf of his bandsaw, then glues the veneer to the edge of one of the fences (right).



THEN PUT THEM TO USE

With one of the mating fences clamped to the saw, the other is used as a sled. Boggs fixes the workpiece in place with double-sided tape. The two-fence system, which works only with true arcs, produces the smoothest possible bandsawn surface.

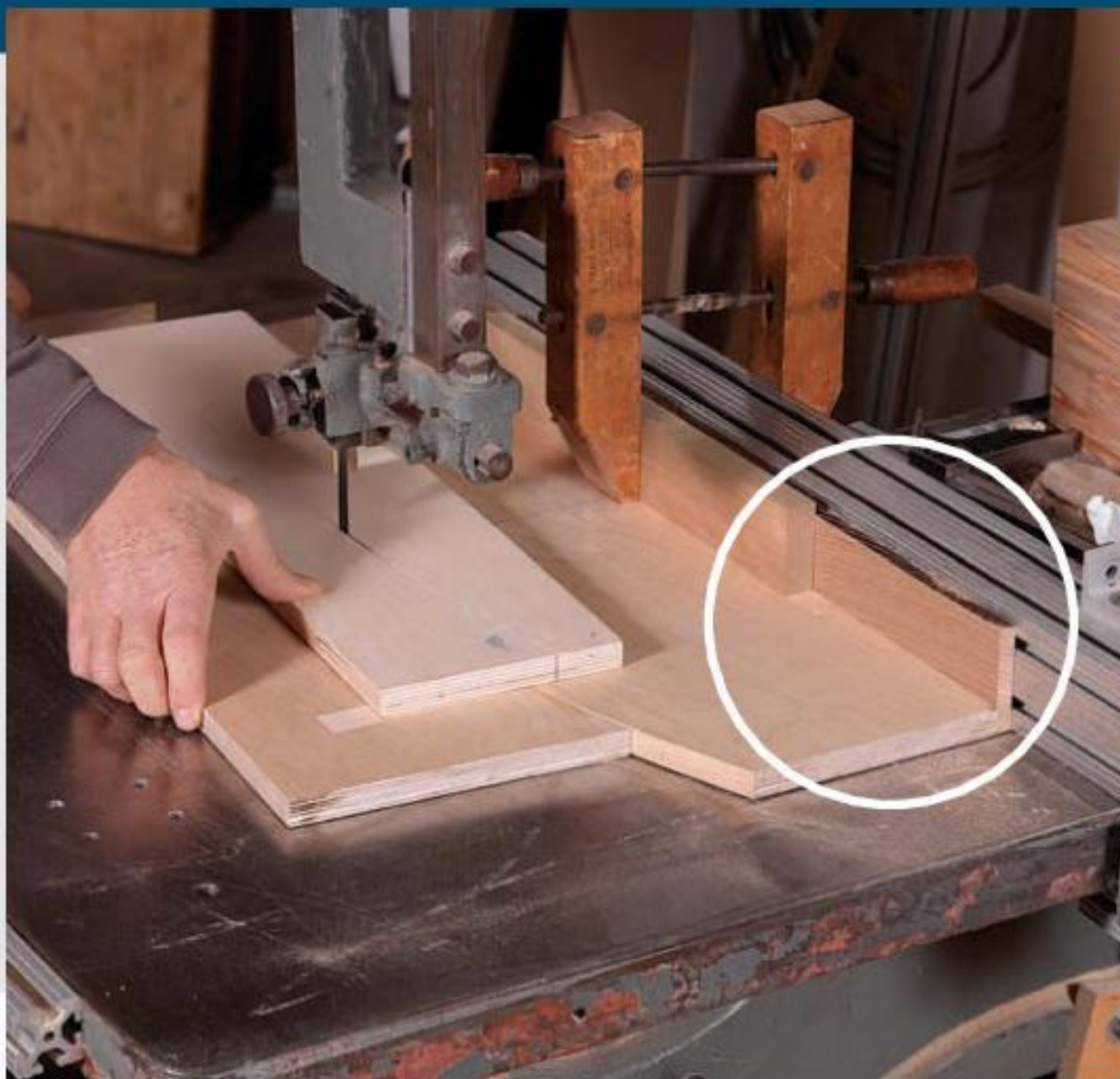


I often use a pivoting jig made from two pieces of MDF. I attach the bottom piece, in which I've drilled a line of holes, to the bandsaw table. The line of holes is centered on the blade and perpendicular to the saw's line of cut. I drill a hole in the top piece of MDF and use a 1/4-in. bolt as a pivot pin. The top sheet acts as a sled to swing the workpiece through the cut. Again, I make a test cut in scrap to check the cut quality before cutting real parts.

When I want to create parts whose curves are true arcs and whose surfaces are glue-joint quality, I often use a two-part fence. This method produces the best possible cut quality and perfect

ADD A SHIM FOR PARALLEL CURVES

You can make a narrow, curved workpiece by inserting a shim between the jig and the rip fence for the first cut (right). Then remove the shim to make the second cut, which will be perfectly concentric with the first (far right).



repeatability. The two parts of the fence must be exactly mated: one fence concave and the other convex. Both these fences can be produced with one cut using the pivot-point technique I just described. After cutting the two pieces apart, make a strip of veneer the same thickness as the bandsaw's kerf. Then glue the strip of veneer to the edge of one of the fences. Now the two fences are perfectly matched, and the veneer also provides a nice low-friction surface.

Next, cut a notch for the blade in whichever fence will be clamped to the saw table. Notch both fences if you want to be able to make both concave and convex arcs. Cut the notch about $\frac{1}{8}$ in.

wider than the blade and at least $\frac{1}{8}$ in. deep; cut it deeper if you want the option to cut varying radii with the same jig. When I'm making a single part, I generally use double-sided tape to attach the workpiece atop the fence. For multiples I'll make a dedicated sled with toggle clamps.

I've used this same two-fence technique to make parts with multiple curves. My RAD bar stool legs ride a template that has two concave cutouts, each of which matches the radius of a convex stationary fence. To create curved chamfers, I make the cuts with the bandsaw table tilted. What's next? I've been doing template bandsawing for decades, but the exploration continues daily. □

Brian Boggs builds furniture in Asheville, N.C.



ARCS ON AN ANGLE

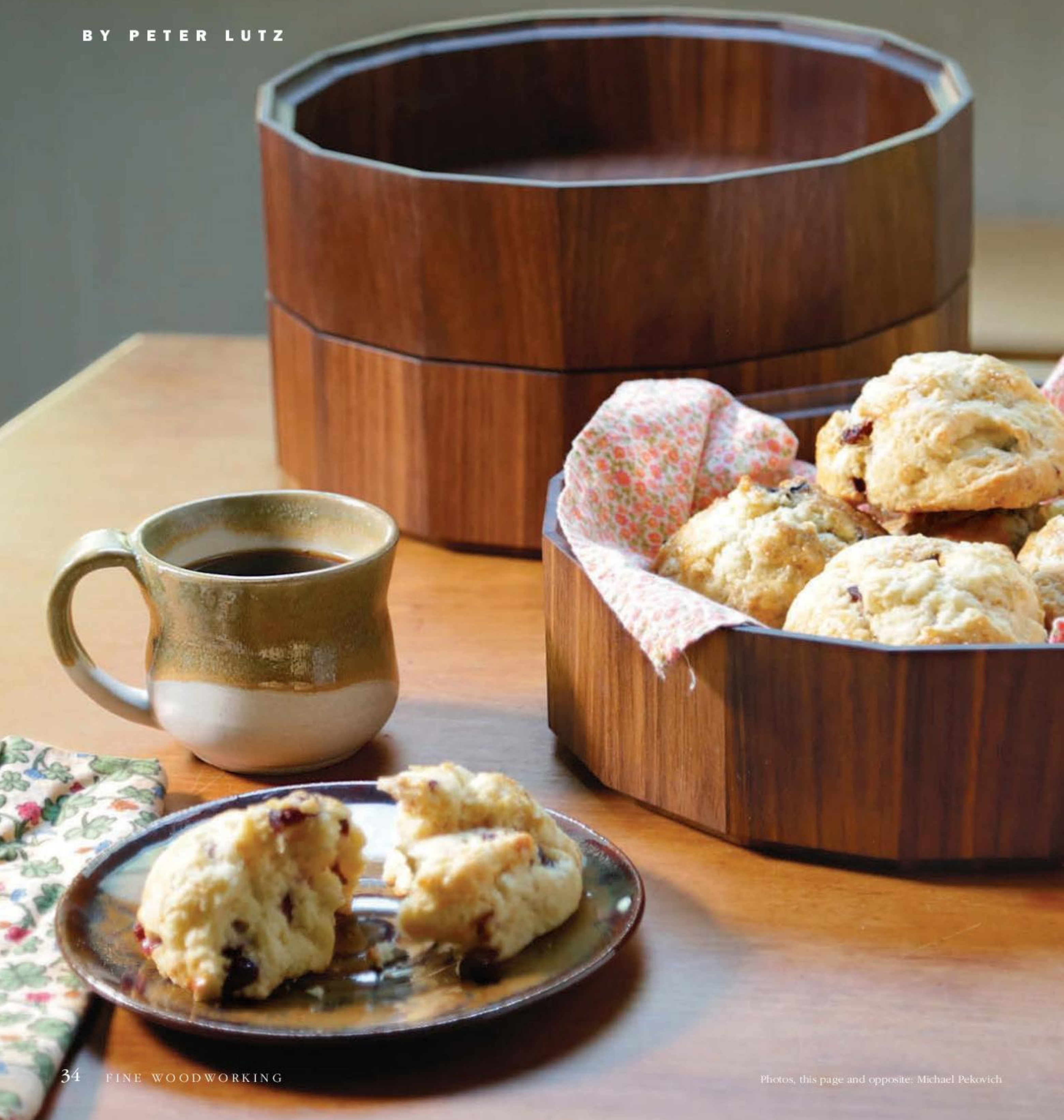
To shape the heavy curved chamfers on his bar stool, Boggs made a bottom-mounted template with two concave scoops on each side that mate with a convex fence clamped to the bandsaw. He cuts with the table at an angle, demonstrating Boggs's contention that nearly all things are possible on a bandsaw.



Coopered Containers

Staved construction makes them handsome, light, and strong

BY PETER LUTZ



Recently I've been exploring coopered forms. I find the shapes elegant, yet the woodworking involved is very approachable. Because all the coopered parts are edge-joined, the whole vessel goes together without mechanical joinery or hardware. And though coopered work is light and graceful, it's quite strong.

In the first half of this article, I'll explain the techniques I use for making coopered trays with vertical sides. You could make a set of three, as I did, or just one. In the second half I'll describe making a coopered basket whose sides are canted outward. There are formulas you can use to ascertain the angle for the appropriate compound

bevel, but the technique I use for creating the splay removes the mathematical hurdle.

A trio of trays

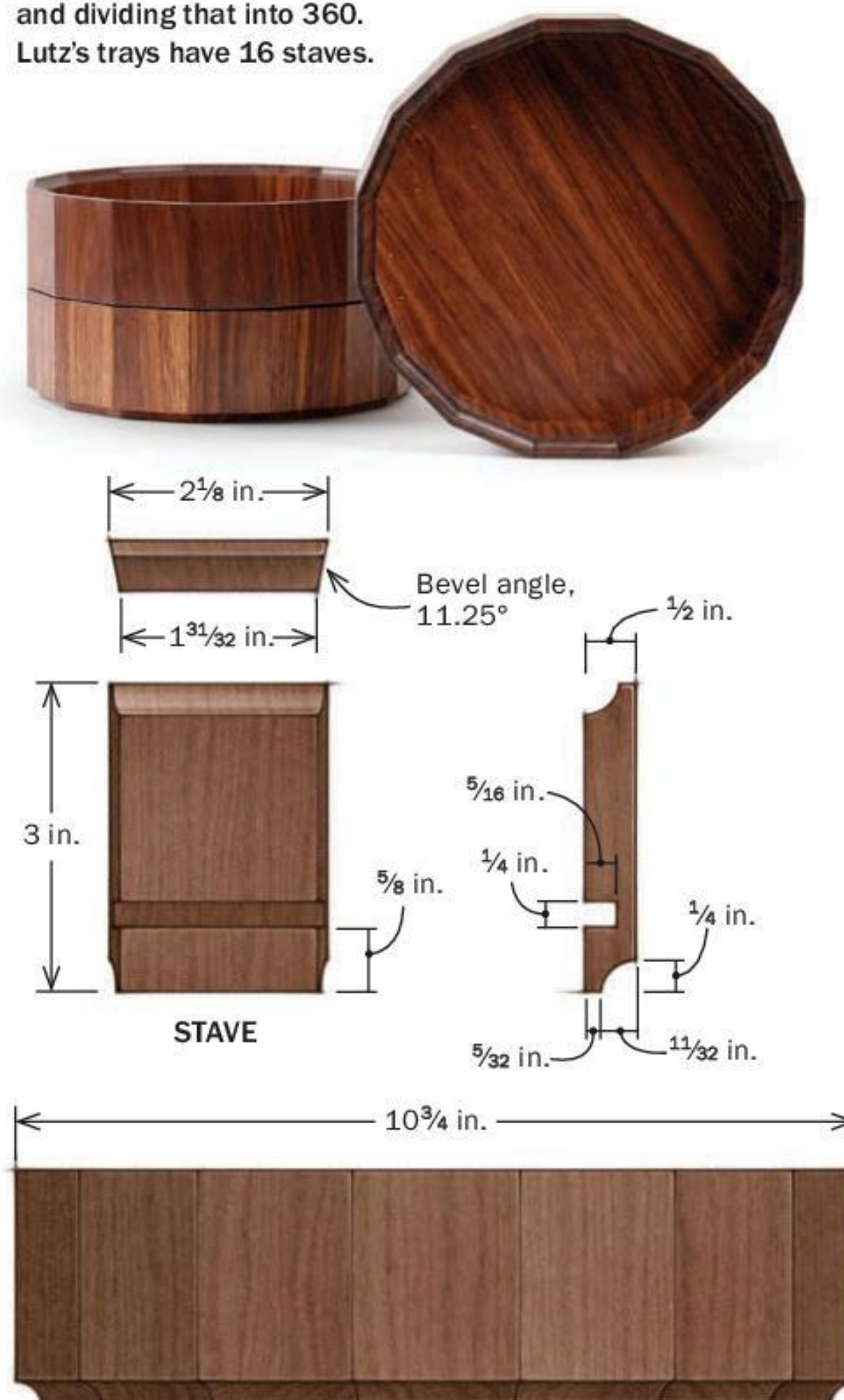
I designed the trays to be made in a batch of three partly because it would be safer and simpler to machine the staves in long blanks, then crosscut them after I had the bevels just right. Since I was going to have multiple trays, I decided to shape the top and bottom edges of the staves with coves—the top one inside, the bottom one outside—so the trays would stack neatly.

Stave making

Coopered containers have far more potential for cross-grain

Stacking trays

For a coopered form with vertical sides, determine the bevel angle by doubling the number of staves you want and dividing that into 360. Lutz's trays have 16 staves.



For safer machining, Lutz made stave blanks 10 in. long, beveled three staves at once, then cut them apart.

Coopered basket. Lutz also makes a coopered basket with sides that splay outward. Go to p. 40 to see how he builds it. He uses a clever approach that you can apply to just about any splayed coopered form.



Stacking trays

MAKE THE STAVES

Quartersaw your staves. To limit seasonal movement, Lutz cuts quartersawn staves, sometimes slicing them from flatsawn 12/4 or 16/4 stock.



seasonal movement than traditional boxes, and this makes quartersawn stock the logical choice for the staves. I often make quartersawn stave blanks by sawing up thick flatsawn planks. Using 12/4 or 16/4 stock and taking 1/2-in. rips, I get very stable blanks, and the straight grain looks attractive in this application.

After milling the blanks, I rip them to about 1/8 in. over their final width. Then I crosscut the blanks to 10 in.—long enough to yield three 3-in. staves—and begin beveling at the tablesaw. To calculate the bevel angle, divide 360° by twice the number of staves you're using.



Digital assistant. With so many staves in a vessel, dialing in the bevel angle is critical. Lutz uses a digital angle gauge at the tablesaw and the jointer. For safer machining, he does the beveling with the staves still in long blanks. Each long blank yields three staves.



A whisker at the jointer. With the fence set to the bevel angle, Lutz takes a very light jointer pass to create perfect glue joints.



Since I wanted 16 staves, I divided 360° by 32 and arrived at a bevel angle of 11.25°.

The bevels have to be spot-on to bring your pieces together without gaps. Accuracy is especially important since any error will be compounded by both sides of each joint, a factor of 32. I find a digital angle gauge very useful. These tools are inexpensive (around \$30 online and at hardware stores) and they're also highly accurate, up to 0.02°. I like the iGaging angle cube. It has magnets on

three sides, which are helpful when setting blade angles.

After cutting the bevels at the tablesaw, I very lightly dress them at the jointer. You could skip the jointing (assuming the surface quality of your table-sawn bevels is excellent), but I do it to ensure the best possible glue joint. Using the digital angle gauge, I set the jointer's fence to the same 11.25° bevel angle and take a whisper-thin pass on each bevel.

Assembling the staves

Next, while keeping my set-up on the jointer unchanged, I dry-fit the stave blanks. I lay all the pieces inside-face



down and side by side, and stretch blue tape across them. I then coax the chain of taped-together pieces into a closed shape. I leave the last piece hinged outward and then try closing it like a door. If the remaining gap is too small to fit the final piece, I need to decrease the angle of the jointer fence. If the gap is bigger than the final piece, then I need to increase the jointer angle.

If necessary, I'll make a slight adjustment on the jointer and run both sides of all the pieces again, taking a pass of less

Fine-tune the staves

Adhesive hinge.

With the triple-length staves lined up, inside-face down, stretch painter's tape across them.



Roll up the barrel.

Flip the taped staves over and then roll them up. Compounded by 32 bevel cuts, a very slight error will result in a misfit. Here the bevel angle needed to be decreased slightly.



Tweak and re-roll.

After Lutz adjusts the jointer fence and lightly rejoins, the staves meet cleanly. He dials in the bevel angles while the staves are triple length so any necessary adjustments can be made simply and safely.



Stacking trays

SHAPE THE STAVES



From triple to single. With the bevels perfected, crosscut the staves to final length, three per blank.

Dado for the bottom. Once cut to length, the staves each get dadoed to receive the bottom.

Cove the staves. Using a jig made for the purpose, Lutz coves both ends of each stave. To prevent tearout, he scores across the grain with a cutting gauge before routing, and he routs in a series of light passes. The mating coves let the trays stack securely.



than $\frac{1}{64}$ in. Usually, I'm close enough that I only need to adjust the angle on the jointer by about a tenth of a degree. I do this until the pieces come together with zero gaps.

Next I crosscut the staves to final length and cut the dado to receive the tray's bottom. Then I cut the coves at the top and bottom of each stave. To rout this profile safely and efficiently on such small parts, I made a jig that clamps the pieces in place and has beveled



Sizing the bottom. With a set of staves dry-assembled and placed on a bottom blank, trace the facets of the inside perimeter.



The cut line gets enlarged. Make a spacer whose thickness is somewhat less than the depth of the dado for the bottom.



GLUE UP THE TRAY

Spread glue between the staves. After pre-finishing, Lutz applies glue to the bevels but not the dado. Then he inserts the bottom and rolls up the staves around it.

backer strips to reduce tearout. I used a $\frac{1}{4}$ -in. radius cove bit and switched out its $\frac{1}{2}$ -in. bearing for a $\frac{3}{8}$ -in. one (Whiteside 1800 bit, B2 bearing).

When you've finished the coves, fit the bottom. Dry-assemble a ring of staves, place it on the bottom, and trace the interior perimeter of the ring. Remove the ring and use a spacer to draw a second line about $\frac{3}{16}$ in. outside the first. The distance between the lines determines how much of the bottom will sit in the dado. I bandsaw to the outer line and smooth the cuts at the disk sander.

Clamp-free glue-up

With all the parts fitted, I sand and prefinish everything, then do the glue-up. I want the bottom to move freely, so I avoid getting glue in the dado. I use blue tape to hold the parts together, then bind the tray with 10 or more layers of stretch wrap until all the seams are pulled tight.

I clean up the squeeze-out, then apply a second coat of finish. Here I used Osmo Polyx-Oil, a nice, all-natural wipe-on finish that is food safe.

Peter Lutz's shop is in Fall River, Mass., at Smokestack Studios.



Stretchy clamping. Blue tape provides the initial hinging and clamping action, but then Lutz circles the tray many times with stretch wrap, which exerts excellent clamping pressure.



Open for cleanup. After the assembly, Lutz removes glue squeeze-out with a chisel.

Add a wedge to make a coopered basket



After making coopered pieces with vertical sides, I began building some with sides that splay. I've used this basket as a centerpiece on the dining table and to bring a dish to a potluck—it definitely makes my contribution look better. Building the basket is similar in most respects to making the coopered trays. The key differences (apart from creating the handle) relate to making the sides splay outward.

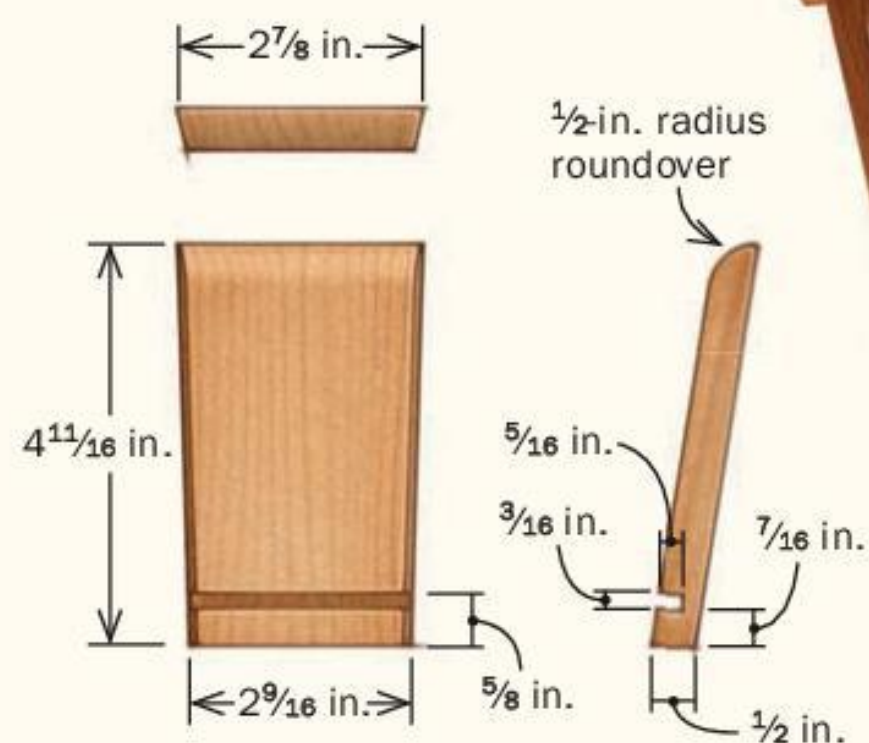
Splayed and coopered

When you make a coopered vessel with vertical sides, the staves are rectangular—their sides are parallel. But in a coopered piece with sides that lean outward, the staves are trapezoidal—wider

at the top than at the bottom. Typically, such parts are made by angling the tablesaw blade to make the bevel, while also angling the miter gauge to create the trapezoidal taper. Because the staves are tapered, the bevel angle isn't the same as for a vertical-sided piece. Divining the correct angles for the taper and bevel settings can be complicated. I found a website that will make calculations for you (pdxtex.com/canoe/compound.htm), and I've done coopering that way, but then I discovered a far simpler and virtually math-free method. By making a wedge to the angle of splay I want (9° in the case of this basket) and using it to support the workpiece during machining, I can cut the bevels using the same angle I'd use if the sides were vertical.

THE WIZARDLY WEDGE

To make a coopered form with sides that splay, you usually have to angle both the tablesaw's miter gauge and its blade. And the blade's bevel angle must be calculated taking the miter angle into account. Lutz's wedge system simplifies the process. If he wants the basket to splay 9° off vertical, he makes a 9° wedge. Then he uses the wedge to support the staves during machining. When using the wedge during beveling, the blade's bevel angle can be set as if for creating a coopered form with vertical sides.

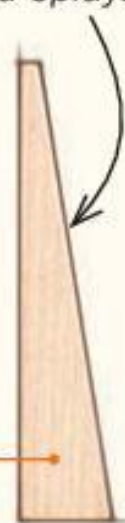


SHORT STAVE



HANDLE

Wedge used in machining determines basket's angle of outward splay.



LONG STAVE

SHAPE THE ENDS



First the foot. Using the wedge to create a 9° angle, crosscut the bottom of the basket's staves. Double-sided tape keeps the wedge in place.



Angle the dado, too. With the dado blade set to 90° , use the wedge to produce the correct angle for the dado.



Route the roundover. With the edges of the staves still square, Lutz uses this jig at the router table to shape the roundover at the top of the staves.

Coopered basket

CREATE THE COMPOUND BEVEL

Compound, yet simple. With the blade angled and the stave resting on a wedge, Lutz's jig cuts the compound bevel angle on the first side of the stave. With 16 staves in the basket, Lutz tilts the blade to 11.25°.



I built this basket with a cutoff from a thick plank of English elm. Once I had ½-in.-thick stock cut and milled, I rough-crosscut the staves to around 5 in. I left two staves longer—12 in. These are the staves that receive the handle.

Unlike with the trays, where I bevel the staves at the start, with the basket I do all the other machining before beveling, while the staves are still rectangular and easier to work with. At the tablesaw, I crosscut the staves at the bottom, using the 9° wedge attached to a crosscut sled with double-sided tape. Then I cut the dado for the bottom. Here again I use a crosscut sled and elevate the workpiece on the wedge. Next, at the router table with a



Slice the second side. After adjusting the screw that acts as a stop and sets the width of cut, spin the stave 180°, place it on the second wedge, and bevel the second side.



Just a smidge off the sides. With the jointer fence set to the same angle as the tablesaw blade and the stave clamped to a wedge, Lutz takes a very light pass to prepare the glue joint.



½-in. roundover bit, I create the rounded profile at the lip of the basket. I hold the staves in the same kind of jig I used to rout the coves for the trays. At every other step, including beveling, the two tall staves are machined just like the short staves, but here they are not—they don't get the roundover.

Beveling

Now the staves are ready to be beveled. I made a jig for the tablesaw with two 9° wedges, one for cutting each side of the stave. Because this basket, like the trays, has 16 staves, I set the blade to the same

11.25° bevel angle. To keep the jig's travel perfectly consistent, I added a raised lip along the left side of its base that tucks under a board clamped to the tablesaw fence.

Once I have all the pieces beveled I take them to the jointer. This is another task where a jig for holding small pieces is essential. Again I tilt the jointer fence to 11.25°. After jointing, I dry-fit the basket to ensure that the joints are tight, then move on to making the handle.

Put a handle on it

I start the handle with the through-mortises in the long staves, drilling them



ADD THE HANDLE

Direct measurement. After dry-assembling the basket, Lutz lays out the shoulders of the handle, marking from the tall staves. He also marks for the tenons by transferring the mortise locations.



More wedge work for cheeks and shoulders. Using a wedge to establish the angle (and a spacer behind it, when needed) on a crosscut sled, make cuts at the tenon's shoulders (above). A similar wedge-and-spacer setup (right) with a tenoning jig works for cutting the cheeks.



No wedge needed. Referencing off the angled end cut, Lutz saws the tenons to width. He then finishes the tenons at the bandsaw.



Curve cuts. With the joinery finished, Lutz bandsaws the handle to shape. He'll fair those sawcuts with a spokeshave.

Coopered basket

BRING THE BASKET TOGETHER



Shape the handle staves. With the handle joinery fitted, bandsaw the handle staves to shape, then clean up the sawn surfaces.



Segmented assembly. To insert the handle tenons, Lutz must assemble the basket staves in two segments.

out with a Forstner bit and cleaning up the corners with a chisel. Then I dry-assemble the basket again and transfer direct measurements from the long staves to the handle blank. Once I've marked the tenon locations, I use a 9° wedge to cut the cheeks and shoulders. For the shoulders I use a crosscut sled, and for the cheeks I use an over-the-fence tenoning jig. I make the final cuts for the tenon on the bandsaw.

Once the tenons are cut, I bandsaw the handle's curve and clean up with a spokeshave. I also bandsaw, file, and sand the upper part of the long staves to shape. Finally, I wrap the handle in rattan or cane, tacking the ends of the rattan on the bottom side of the handle with a small wire nail. After prefinishing all the parts, I glue up with blue tape and stretch wrap.



Dry before wet. At dry assembly, Lutz marks the ends of the through-tenons where they'll be shaped to a curve. He also marks the two tall staves where they meet their shorter neighbors to guide final shaping.



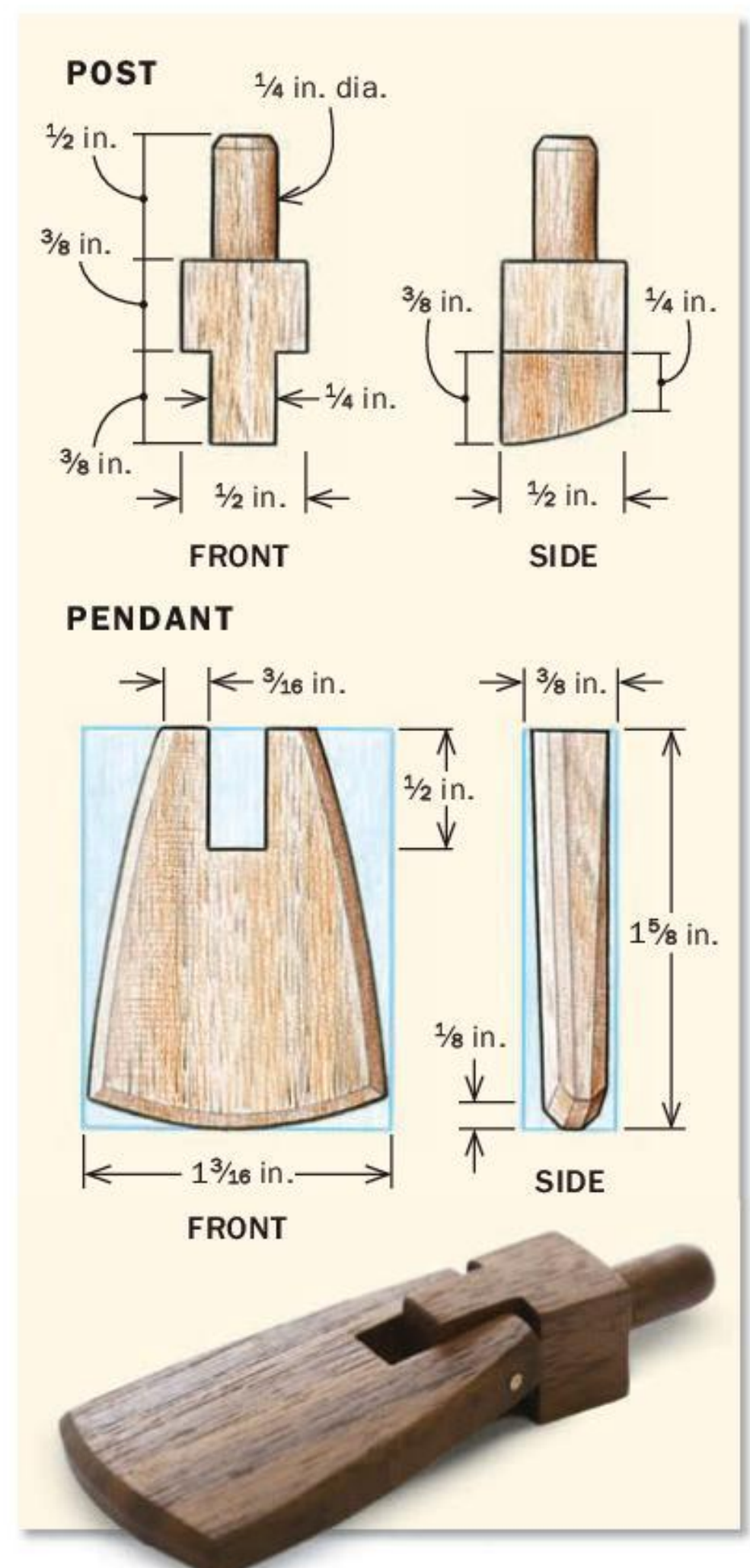
Wrap it up. After pre-finishing the parts and wrapping the handle with rattan, Lutz glues up with blue tape followed by many yards of stretch wrap.

Make a Wooden Pendant Pull

Functional details create an elegant way to open and close drawers and doors

BY PHILIP MORLEY

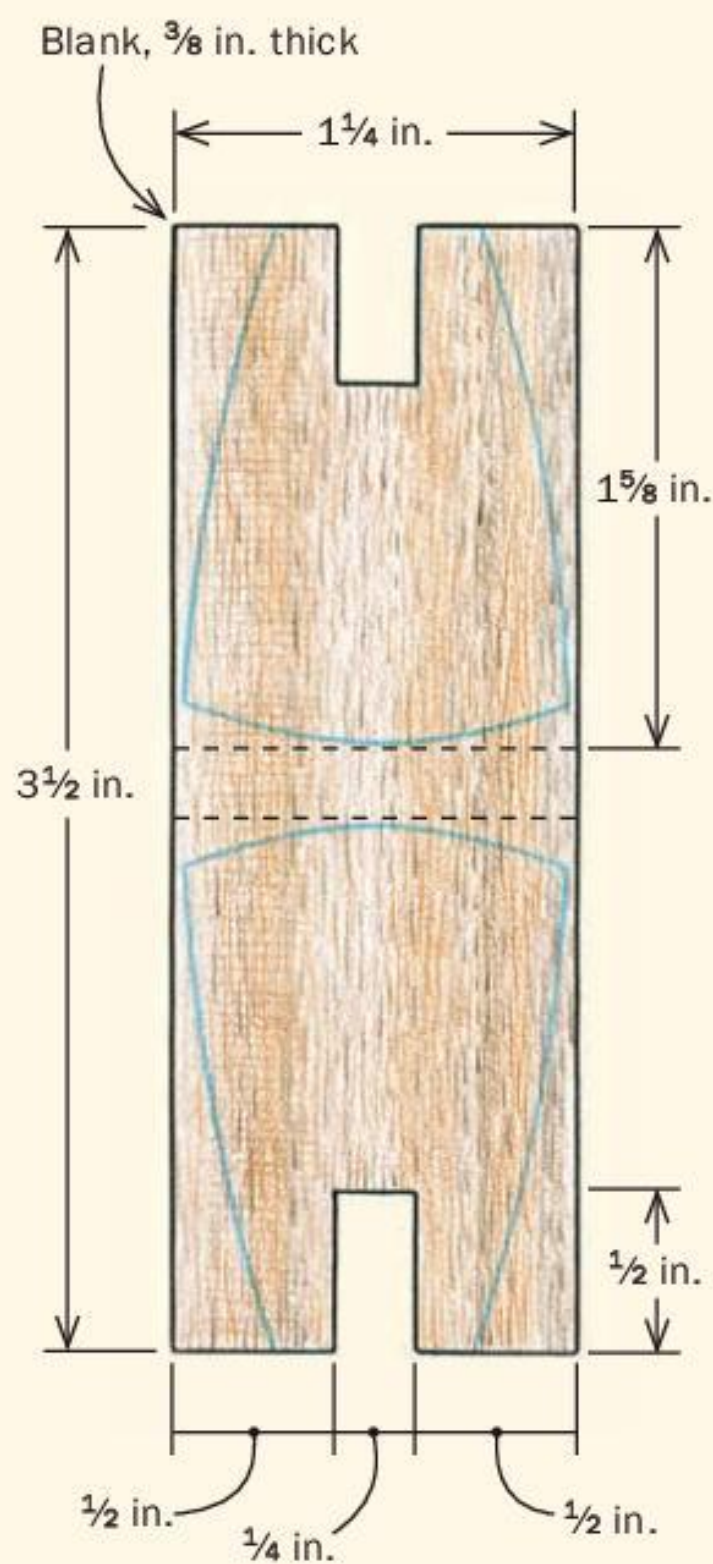
I designed this pull for a cherry credenza I made for some special clients, my in-laws. It's based on a cast brass pull I designed for another piece. My plan was to make these pulls from brass as well, but the artist who cast the first ones for me had moved away so I decided to make them from wood. The challenge was to make them both delicate-looking and strong enough to withstand years of use. As it turns out, I'm very pleased that I was forced to make them from wood. I like



PENDANT SWINGS ON A POST

There are two parts to this pull: a post and a pendant. To make the small parts easier and safer to machine, make two from each overlong blank.

PENDANT BLANK

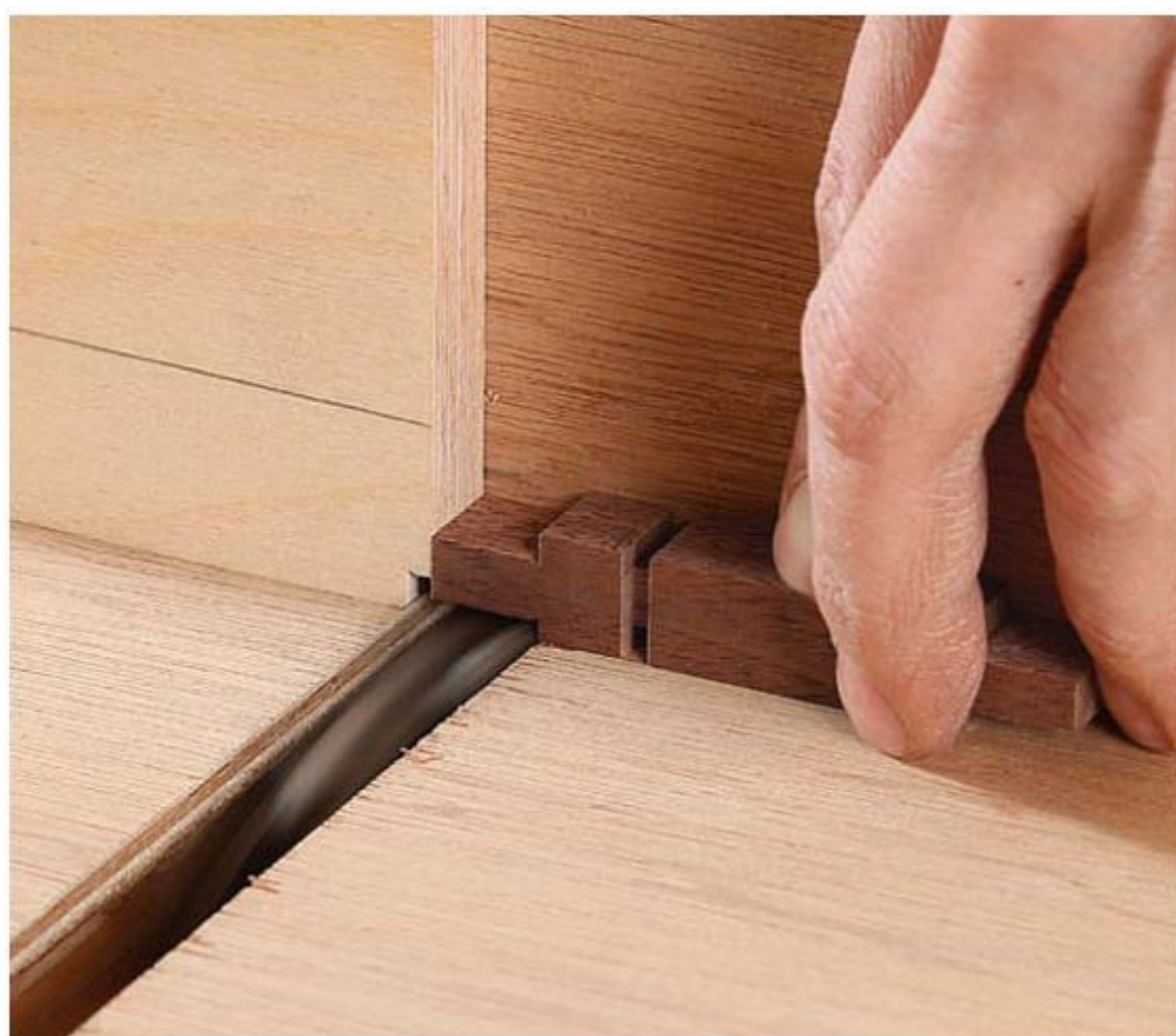
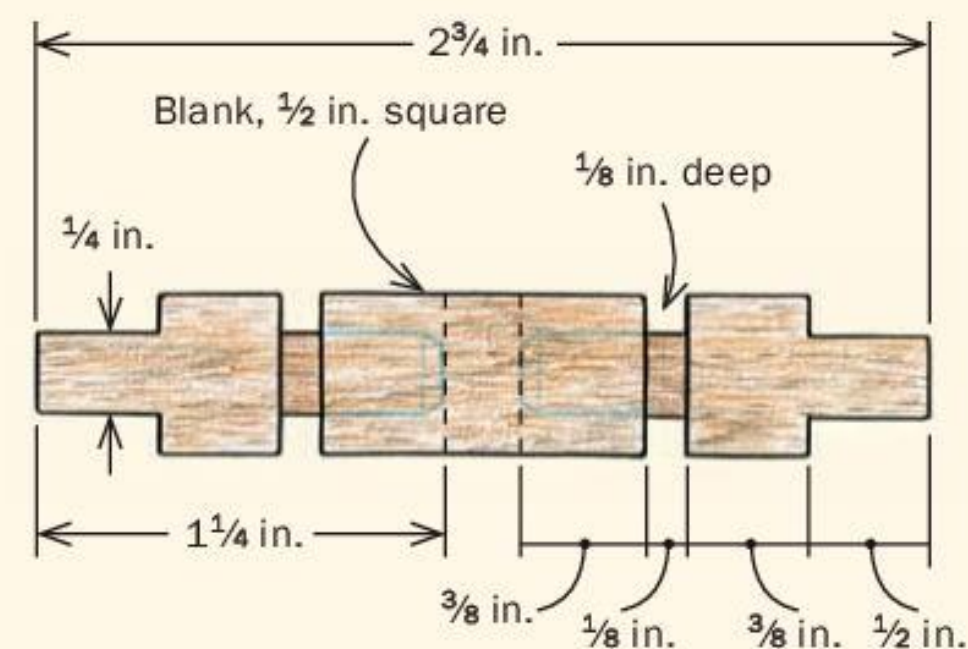


Notch the first blank. Use a tall stop block to center the notch and support the pendant blank during the cut. Morley cuts the notch with a dado set.



Square shoulders for a round tenon. To create a shoulder for the round tenon, cut a $\frac{1}{8}$ -in.-deep kerf around all four faces of the post blank. Flip the blank end for end and repeat.

POST BLANK



Post needs a tongue. A dado set cuts the tongue's full length in one pass (above). Sneak up on the tongue's final thickness, flipping the blank over to cut both faces. The tongue should fit snugly into the notch in the pendant blank (right).



the way they look and feel, and I think they complement the credenza much better than brass pulls would have.

The pull is made from two parts: a post that is glued into the drawer front (or door stile) and a pendant that hangs from the post. The pendant is concave on the back side and convex on the front. The shape fits nicely between your thumb and finger.

Although the pull isn't tiny, the parts are still too small to make one at a time. For safety, and to speed things up when I need multiple pulls for a piece of furniture, I make blanks for the pendant and post that give me two pulls from each set.

Hinge the parts first

The post and pendant are held together with a finger joint that has a thin brass pin running through it as a hinge so the pendant can swing up and down. Start with the pendant blank, cutting a notch into each end with a dado set. Switch out the dado set for a blade that cuts a flat-bottomed kerf and cut a shoulder around the post blank for the round tenon. Put the dado set back in, and cut the finger that fits



Two posts from one blank. Cut both posts to length using a stop.



Simple fixture holds the post. Press the post blank into a grooved piece of plywood until it bottoms out. The stop stabilizes the blank.



Cut the round tenon. A plug-cutter is the perfect tool for the job. Morley sets the stop so that the blank is centered under the cutter.



Drill for the pin. Fit the post and pendant blank together using a $\frac{1}{16}$ -in.-dia. drill bit as a spacer. Push the pendant blank into the groove and against the stop (left). Then drill a $\frac{1}{16}$ -in. hole through the pendant and post (above).

ELEGANT AND FUNCTIONAL

The softly curving faces provide a comfortable grip for your fingers and give the pull a light, graceful beauty.



Cut the pendant blank in two. A stop ensures that all of the individual pendant blanks are the same length.



Rough out the pendant. After tracing a template onto the blank, bandsaw to the line. A spare post blank serves as a push stick.

into the pendant's notch. Aim for a snug fit.

Next, cut the post blank into two separate posts. At the drill press, use a plug-cutter to form a round tenon. To steady the post and keep it plumb during the cut, I put the finger into a groove cut into a piece of plywood, with a stop pressed against the post.

To drill for the pin, put the post into the notch in the pendant blank, using a 1/16-in. drill bit as a spacer between the post and pendant blank (see bottom photos, p. 47).



Online Extra

Hot-melt glue is a great way to safely manage small parts. Watch the video at FineWoodworking.com/271.

Glue on a temporary handle. A small scrap, glued to the front face with hot-melt glue, provides a way to grip the pendant in the next step.



Hollow the back. Morley uses the large end of an edge sander to create a comfortable hollow.

2. Round the front.



1. Hollow the back.

3. Add a small chamfer around the edges.

BOTTOM VIEW



Round the front. After removing the temporary handle from the front of the pendant, hot-glue a handle to the hollow back. Clamp it in a vise, and round the front of the pendant with a spokeshave or a small block plane.

This space is necessary for the pendant to swing on the post. Place the pendant blank into the groove in the plywood, and drill a hole through the joint. Repeat the process at the other end of the pendant blank. After both ends are drilled, cut the pendant blank in two. Set the posts aside, and get to work shaping the pendant.

Function makes for a beautiful form

A pull is easier to grasp and use if it fits the curves of your fingers. The gently concave back

SECURE THE PENDANT TO THE POST

A thin brass pin runs through the pendant and pull, holding them together but allowing the pendant to swing up and down.



Just a bit of glue. Put a few drops of cyanoacrylate glue on the side of the pendant where the pin will exit, and let it drip into the hole.



Add the post to the pull. Slide the tongue into the notch, trying to line up the holes through both.



Tap in the pin. Supporting the post on a block of wood, use a hammer to knock the brass pin through the pendant and post. It should end up a bit proud on both sides.



File it flush. A small triangular file should let you flush off the pin without marking the pull's surface.

and convex front face of this pull fit your fingers nicely, and the shape is graceful. It's a great example of allowing a part's function to dictate its form.

I start by shaping the back of the pendant, using a benchtop belt sander to sand a curve into the surface. Because the pendant by itself would be difficult to hold, I attach a small handle to its front face with hot-melt glue. The bond is more than strong enough for the job, and the handle pops off without trouble after I'm done at the sander.

To shape the convex front face, I use a spokeshave. I glue a handle to the back face this time, clamp it in my vise, and set to work with the spokeshave. I first shave the curved face, and then add a small chamfer around the edges.

Next I finish both parts of the pull with a few coats of shellac. When it's dry, I assemble the complete pull, driving a brass pin through the holes. To ensure that the pin doesn't eventually work itself out, I squeeze a few drops of glue into the pin hole on the side

of the pendant that the pin will exit when I tap it in. If you used glue on the entry side, it could get pushed through the entire hole. The pin would get glued in place, and the pendant wouldn't swing. Tap the pin into place, and then file both of its ends flush to the pendant. All that's left now is to glue the pull into the drawer front or door stile. □

Philip Morley is a professional furniture maker in Wimberley, Texas. To see more of his work, go to philipmorleyfurniture.com.



Hanging beauty. Morley's pendant pull is a superb example of how thoughtful consideration of function can produce an exquisite design.



Assembling the back is key to moving forward

BY STEVE BROWN

Making chairs can be intimidating even to experienced woodworkers, and Chippendale-style chairs are no exception. The chair I'm making here, even without the ornamentation found on so many examples, has a combination of angles and curves that are admittedly complex. But the techniques and joinery needed to build the chair are familiar. The structure is a frame mortise-and-tenoned together. If you can tackle the back assembly, where the legs cant in toward the ground as well as kick back, you can certainly handle the rest of the chair. So building the back is what I will focus on here.



Building

The side seat rail's rear tenon, which attaches to the back assembly, is cut at a compound angle and comes with its own set of challenges. I'll explain those in detail in the Master Class on pp. 74–84.

I recommend working from full-scale drawings and the patterns traced from them. You'll use these from chalking out the parts to laying out joinery. But as you assemble the chair, leave the drawings and patterns aside. When you can, measure off the parts directly. That way, you're building to the actual piece, not your drawing of it.



a Chippendale Chair

Start with the rear legs

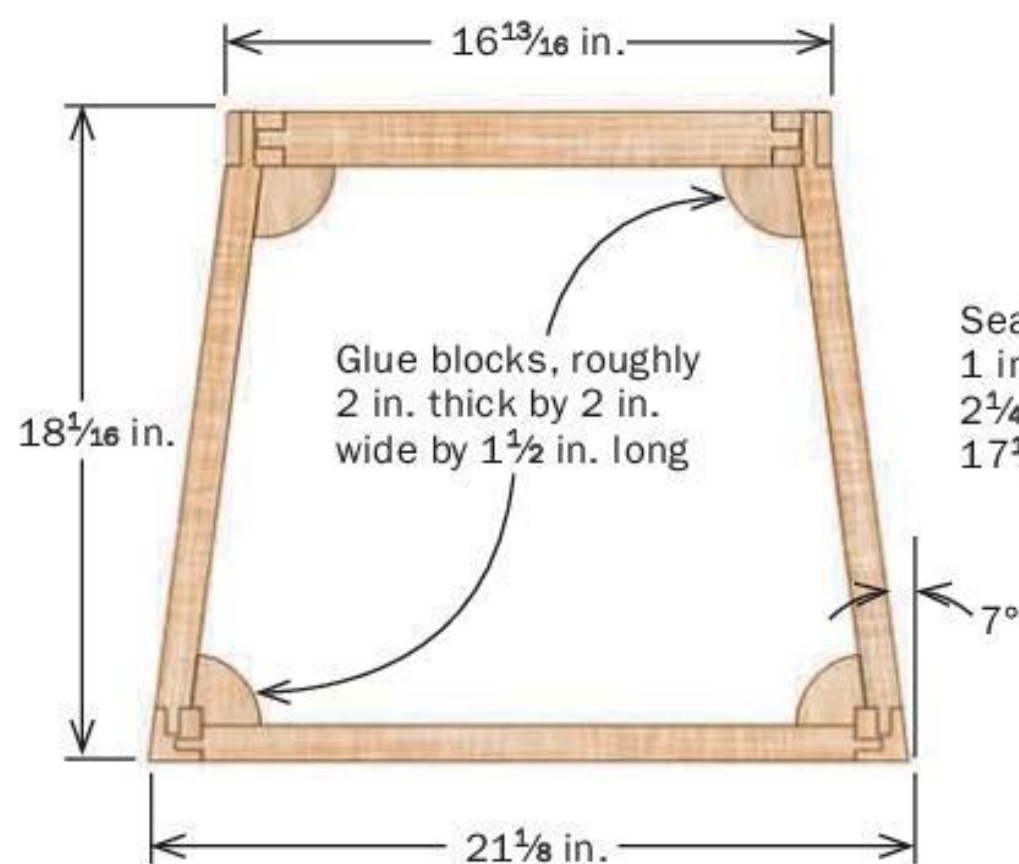
This chair is made of curly maple, though mahogany is another traditional choice. One clear, flatsawn 8/4 board, 10 in. wide by 8 ft. long, should be enough for the whole chair. I start by using my templates to chalk out the parts on the plank. I usually locate the rear legs first because they are large and curved and their grain orientation is a priority. Then I lay out the rest of the parts and rough them all out on the bandsaw.

I begin the joinery by cutting the mortises in the rear legs. Later, after the joinery is complete, these legs will be carved and round-

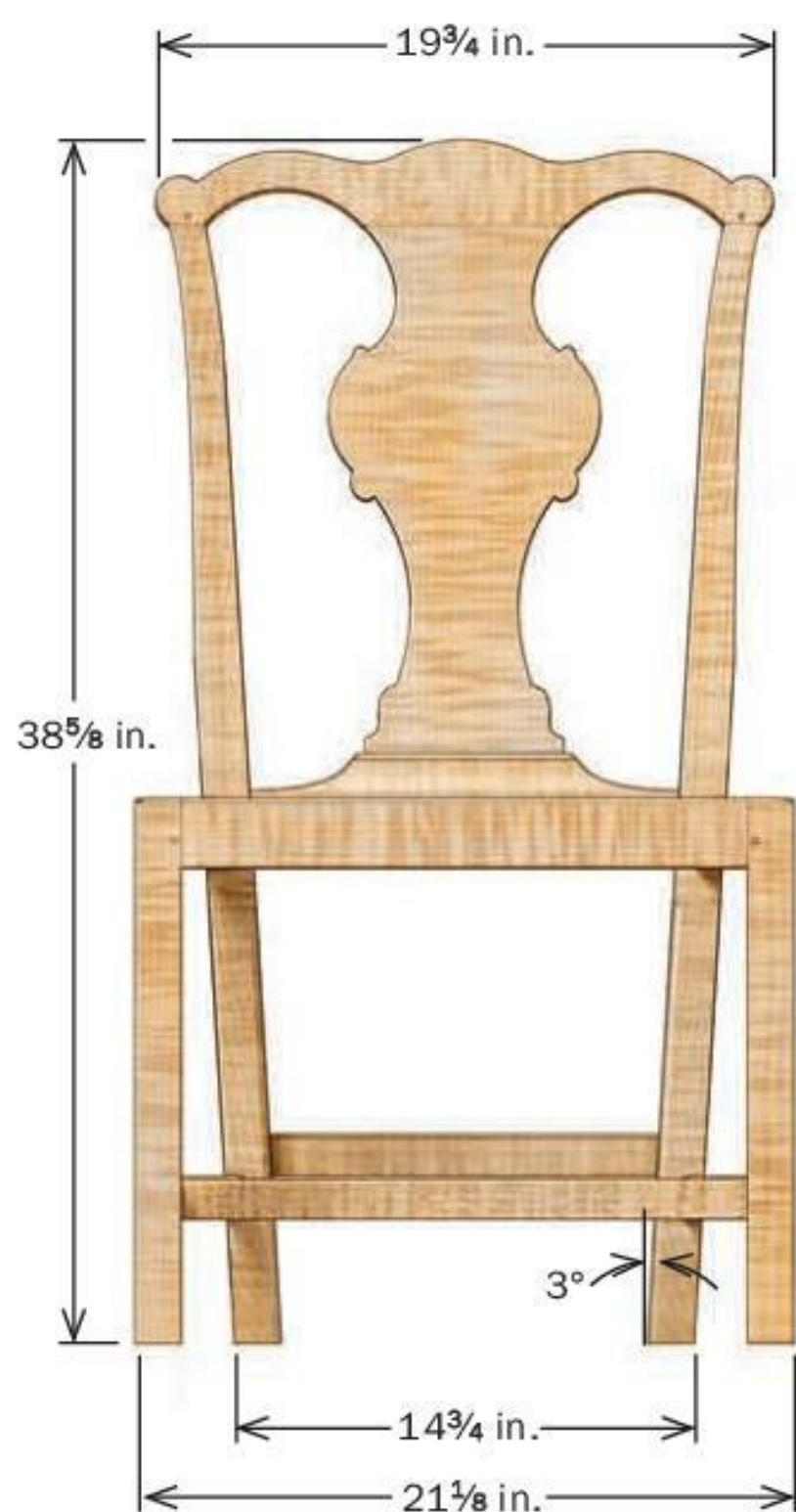
ed, but to simplify cutting the mortises I shape them in distinct stages. First I establish the flat section on the front of the leg where the side rails meet it. This is a vital reference surface, and I create it at the jointer. Then I clamp the two legs side-by-side in a bench vise with their reference flats facing up and the tick marks for the back seat rail mortises aligned. I use a handplane to smooth the bandsawn surfaces on the front of the legs to the layout lines. I then turn the legs so their reference flats are facing down and smooth the bandsawn surfaces on their back faces with a spokeshave. I leave the inside and outside faces of the legs flat for now.

Chippendale side chair

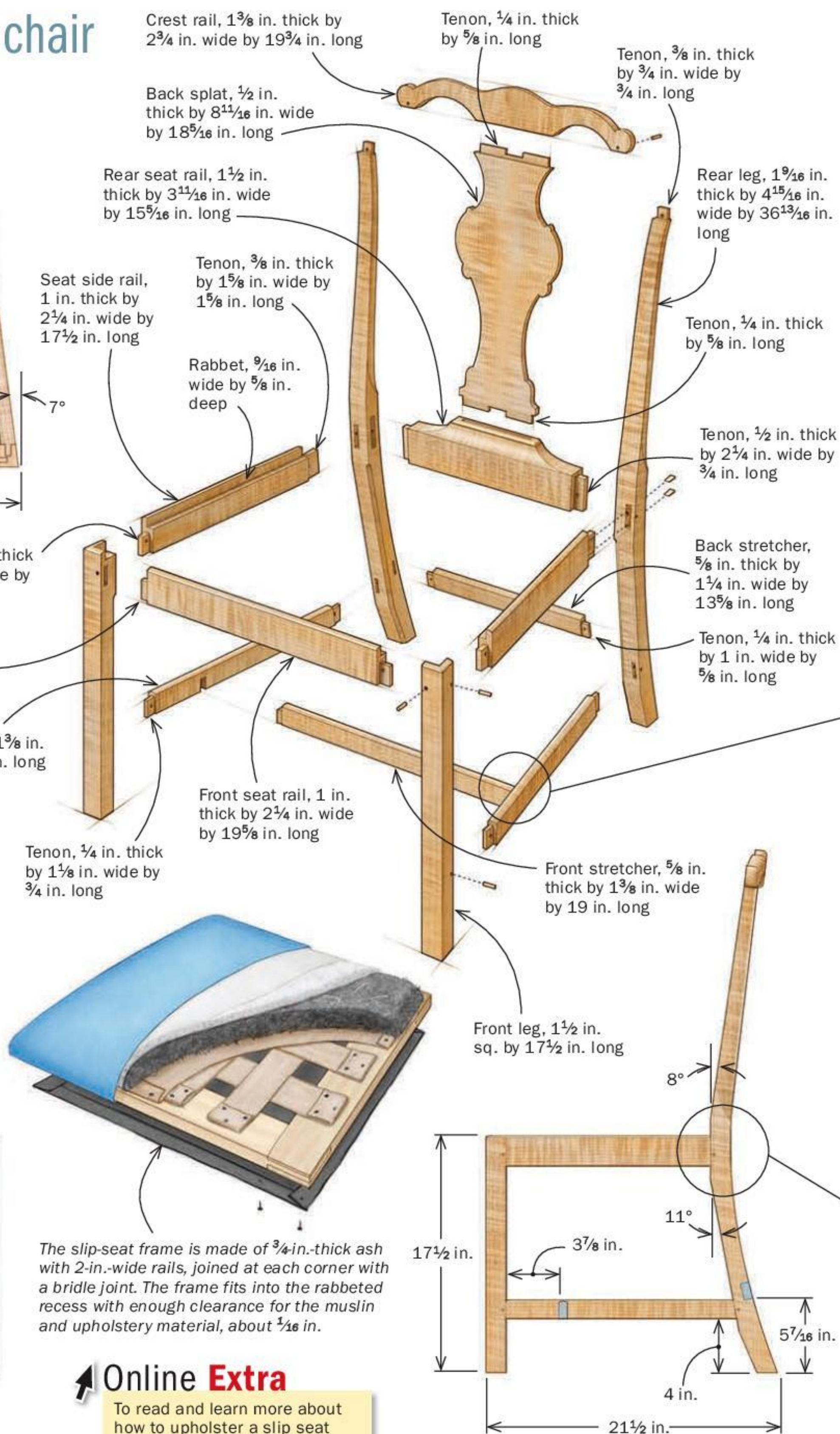
A classic design grounded in angles, curves, and gentle shaping.



SEAT TOP VIEW



FRONT VIEW

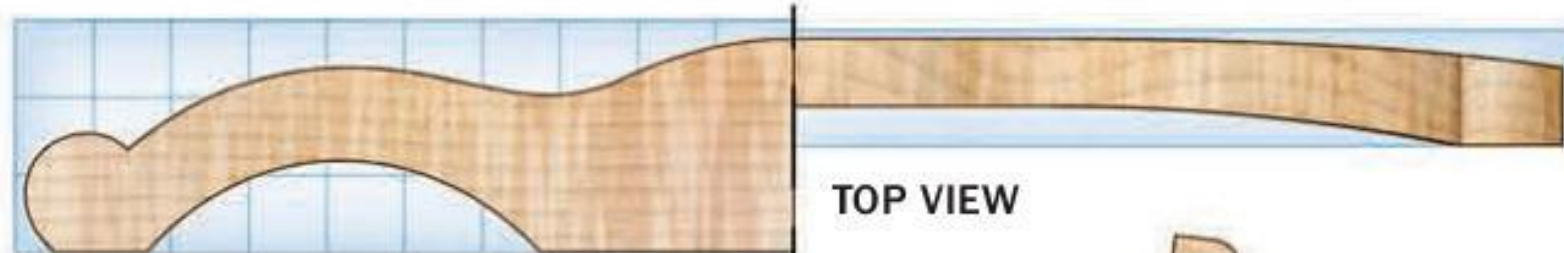


SIDE VIEW

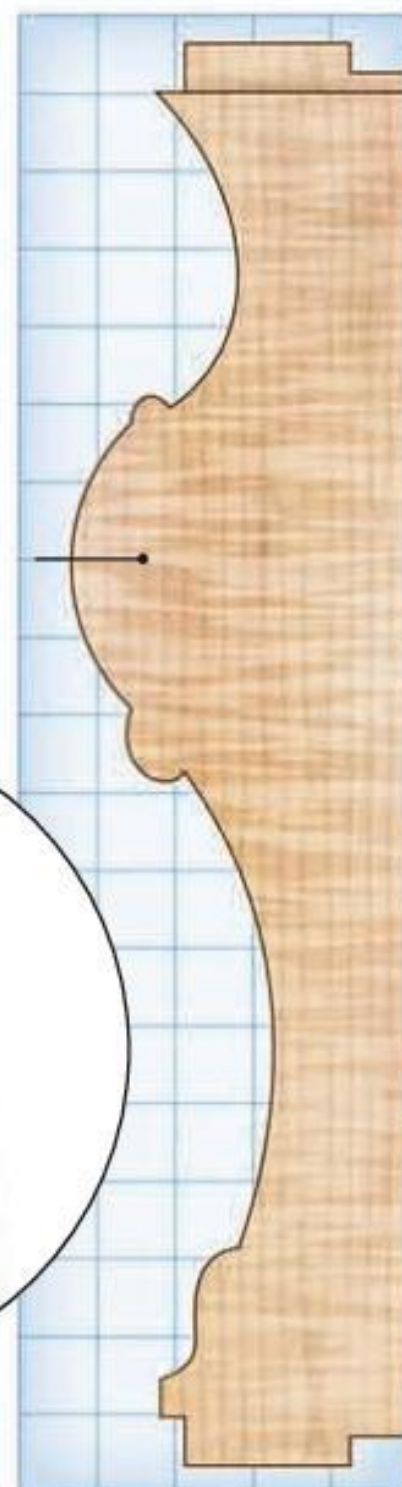
Online Extra

To read and learn more about how to upholster a slip seat the traditional way, go to FineWoodworking.com/271.

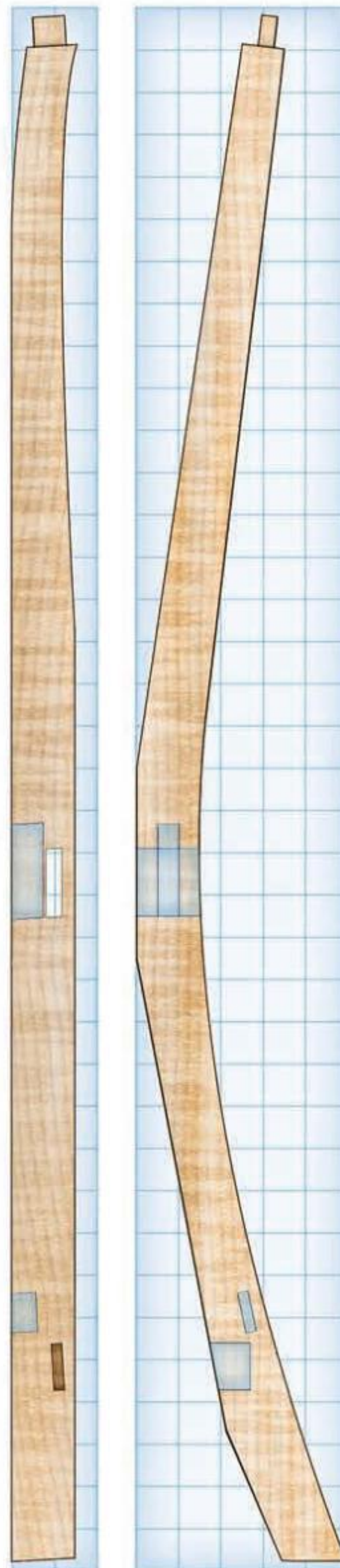
CREST RAIL PATTERN



BACK SPLAT



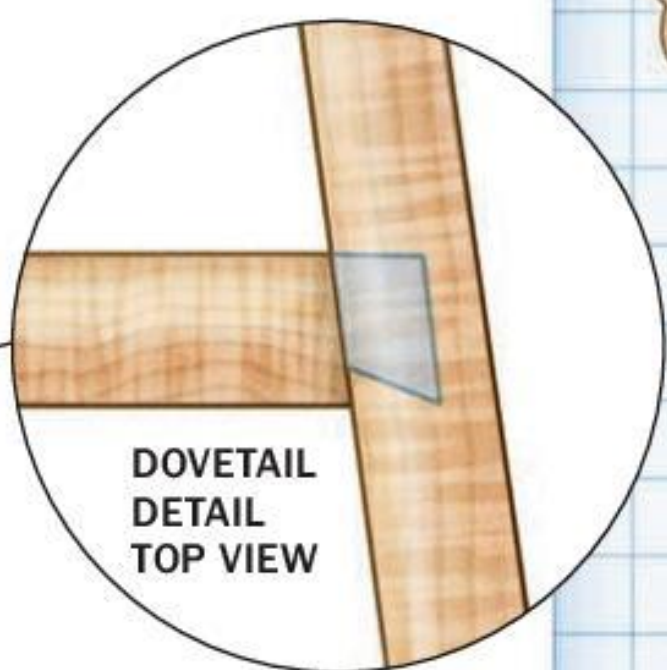
REAR LEG PATTERN



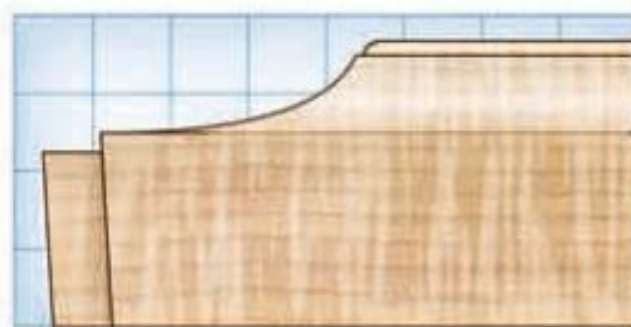
FRONT VIEW

SIDE VIEW

DOVETAIL DETAIL TOP VIEW



REAR SEAT RAIL

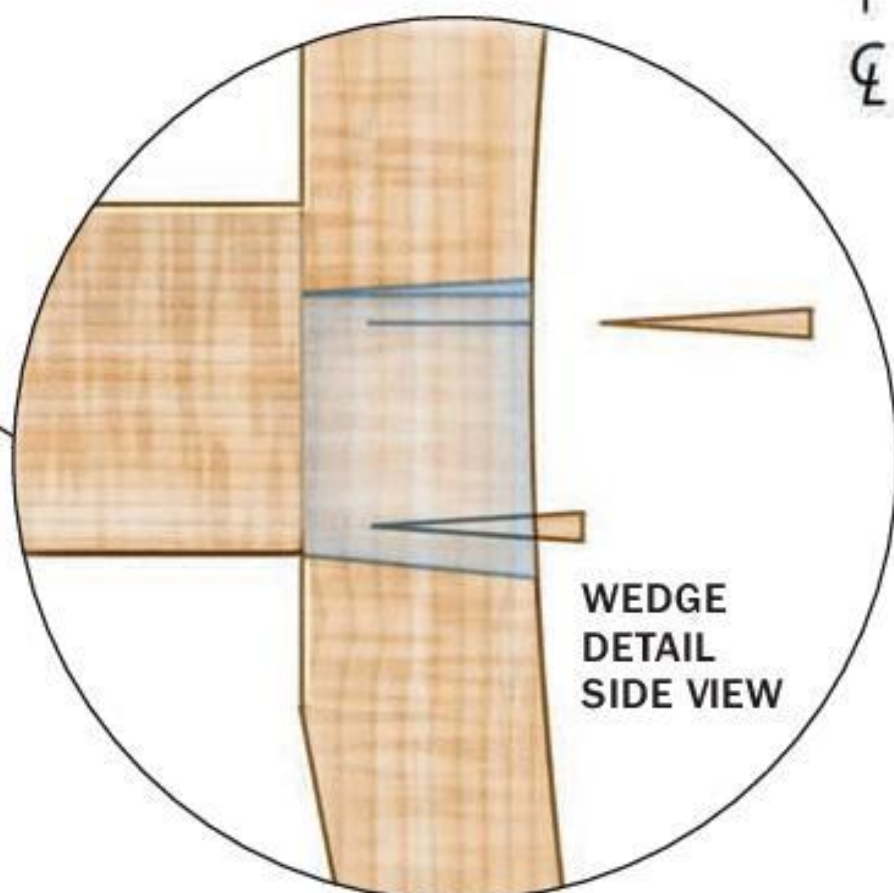


FRONT VIEW



SIDE VIEW

WEDGE DETAIL SIDE VIEW



Grid pattern
shown: Each
square is equal
to 1 in.

Next I lay out the mortises. I locate them along the leg by transferring the tick marks from my template, and I do the layout with a square, a bevel gauge, and a marking gauge. The mortise for the rear seat rail is straightforward, but the others involve some angles. The through-mortise for the side seat rail is normal except that the lines for the top and bottom are slanted to the cant angle of the legs. The mortise for the side stretcher will also need the top and bottom scribed at the cant angle. And the mortises for both the side and back stretchers need to account for the leg's backward slant.

Mortise before shaping

It's helpful to keep a few things in mind when mortising these legs, which I do with a hollow-chisel mortiser. For one, when mortising into the front face of the leg I support it with shaped cauls, which both orient and stabilize it.

Second, I cut the through-mortise for the side seat rail from the back. It's easier to lay the leg on the mortise table with the reference flat down. Also, the back of the mortise will be cut cleanly, and any blowout on the front will be covered by the shoulder of the rail.

Third, if you use a machine to cut these mortises, like I do, be mindful that since the leg angles backward the mortise for the stretcher will be deeper at the top than at the bottom. When setting the mortiser's depth stop, I aim for $\frac{1}{2}$ in. at the shallow end of the mortise.

Last, because of the angles involved, you'll need to use a chisel to pare the ends of the mortises to the layout lines.

Once the mortises are done, trace the front pattern on the leg and bandsaw the inside and outside faces to shape. Then you can begin the hand shaping. To see a clear explanation

Start with the rear legs



Fair the legs. With the front and back profiles cut and the seat rail reference flats jointed, clamp the rear legs together with the reference flats flush and the tick marks for the rear seat rail's mortise aligned. Then plane the sawn surfaces.



Mark the remaining joinery. Use the template to make tick marks for all the rail and stretcher mortises and for the shoulder of the crest-rail tenon. Nick the leg's inside front corner so the marks get chamfered away or covered up later.



Mortise the legs. After cutting the mortise for the back seat rail, chop the through-mortise for the side rail. Working in this sequence helps avoid breaking through the small amount of wood between the mortises. Brown is mortising from the back here to keep the joint's show face clean.



Time to taper the top of the legs. When bandsawing, Brown cuts carefully to the line except at the top of the outside corner, where he veers off approximately $\frac{3}{4}$ in. below the shoulder to avoid leaving too much short grain. He fairs this after gluing on the crest rail.



Shape the back of the legs. After drawing layout lines, Brown knocks off most of the waste by creating a large chamfer with a rasp and spokeshave. Once this chamfer is created, chamfer the resulting arrises into smaller flats until you reach the desired shape.

of the shaping method I use, read Dan Faia's "Porringer-Top Tea Table" (FWW #191).

Bottom of the back

Next you'll fit the rear seat rail and the rear stretcher to the leg. Begin by cutting the rail to length at the cant angle. My method for this is simple: a wedge-shaped block whose slope matches the cant. Pair this with a crosscut sled for accurate, repeatable results. Now you can cut the tenons on the rear seat rail by referencing off its angled ends.

The top edge of the rear seat rail is mortised to receive the splat. Traditionally, a separate part, called a shoe, was mortised for the splat and then attached to the rail. However, my rail and shoe are one solid piece. After cutting the splat mortise, I give the shoe its cove and thumbnail profile. I use a mix of the tablesaw, router table, and hand tools to shape this piece.

Shape the rear seat rail



Cut the rail blank to length, angling the ends. Brown uses a wedge against the fence of his crosscut sled to hold the stock at the cant angle.



Tablesaw tenons. Brown starts with the cheeks, then trims off most of the waste to avoid kickback when cutting the shoulders. He registers the end of the rail against the fence to finish the shoulders.



Give the back rail some character.

After mortising the rail for the splat, Brown cuts a cove on it at the tablesaw (far left) before adding a thumbnail at the router table (left). He cuts the thumbnail's return by hand after bandsawing the side sweeps (below).

Since the chair is now coming together, it is a good time to begin measuring off the chair and its parts instead of the drawing and your templates. For example, at this point, I clamp the legs and back rail together so I can mark, cut, and fit the back stretcher.

With those members fitted, it's time for the first glue-up, comprising the rear legs, rear seat rail, and back stretcher. Use angled cauls to apply even pressure and protect the through-mortises.

It's important to do this glue-up before working on the crest rail blank, because it fixes the legs in space, which will help you more accurately lay out the tenons on the legs and the mortises on the crest rail; it also helps in laying out the crest rail's profile.

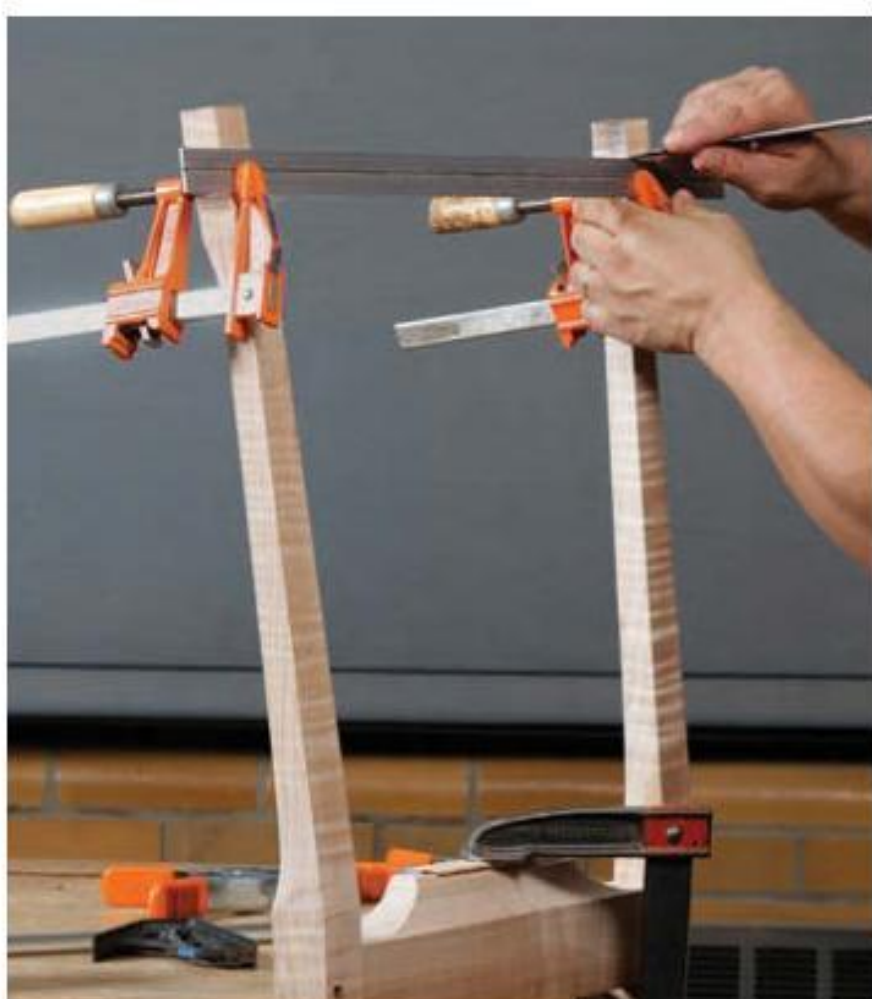
Cutting and fitting the crest rail to leg joints takes a bit of back and forth. I do the tenons by hand and mortises at the hollow-chisel mortiser. Once they have been fitted, you can determine the centerline



Make the rear stretcher and crest rail



Lay out and cut the stretcher tenons. With the legs and rear seat rail dry-clamped, transfer the stretcher mortise locations onto the back of the legs. Set the stretcher in place to mark the tenon shoulder and length. Once the tenons are cut, the lower half of the back can be glued together.



Knife the shoulder for the top tenons. With a straightedge, connect the legs' shoulder nicks from before. Use a square to transfer the lines across the sides.



Mortise the crest rail for the legs. Brown starts by marking the tenon widths on the top of the legs using a cardboard template (inset). Then he sets the crest rail in place to transfer these marks for the mortise locations.



Tenon the legs. Start by cutting the cheeks and shoulders of the tenons. Lay the crest rail in place and transfer the end lines of the crest rail mortises onto the tenons. Then cut the tenons to width.



Mortise the crest rail for the splat. This mortise is stepped, with the outsides deeper than the central section, because a single wide tenon could be weakened by excessive seasonal movement.

Cut out the splat



the cheeks at the tablesaw, I line up the centerline of the splat with that of the shoe and transfer the end points of the mortises. After cutting the bottom tenons, I insert the splat into the shoe to lay out the shoulder of the top tenons directly from the chair. For this, I use a straightedge laid across the shoulders of the leg tenons. When the tenons are cut and fitted, you can bandsaw the profiles of the splats and crest rails.

Time for the second glue-up, which I do in stages to reduce stress. First, I glue and clamp the splat to the crest rail. For this glue-up I have the rear seat rail and posts dry-fitted to the splat. After an hour or so, I glue up the rest of the chair back.

With the hard part done ...

When building the rest of the chair, be sure to keep a few things in mind. First, given the angles in the seat, it's easiest to begin with the side seat rail's rear tenons (covered in Master Class), work forward to the front legs, and fit the front rail to the space between the front legs.

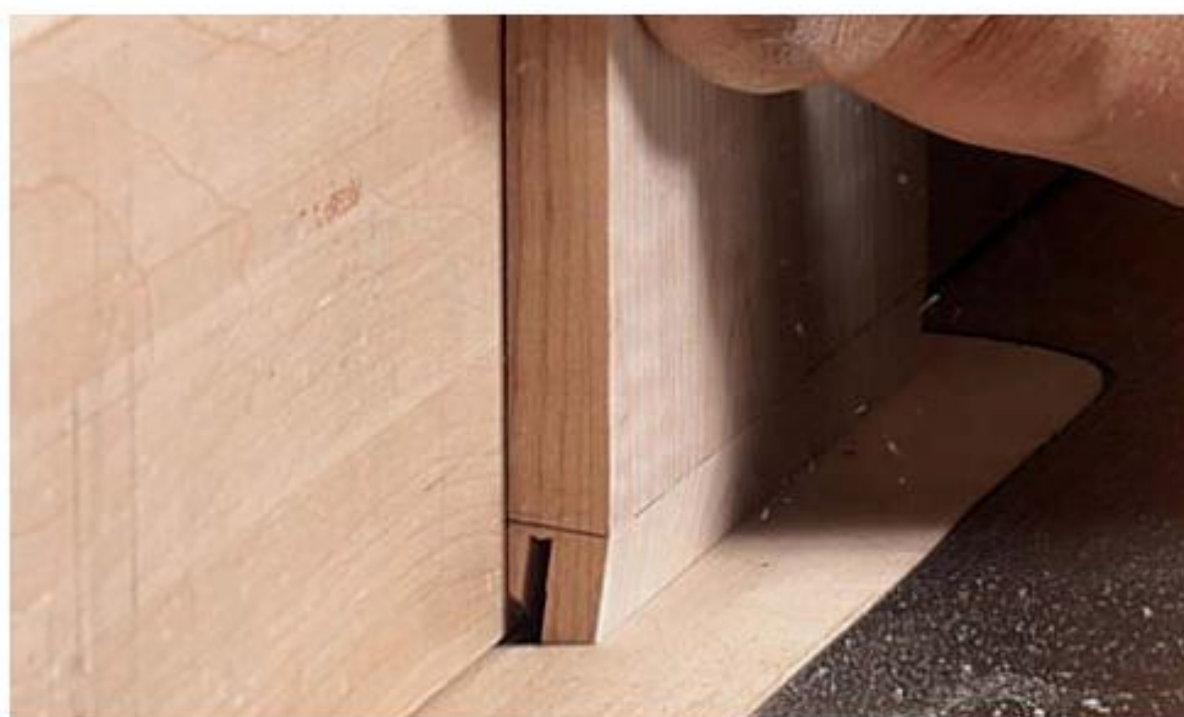
Speaking of the front legs, I recommend mortising them as square blanks. Be mindful that their outside



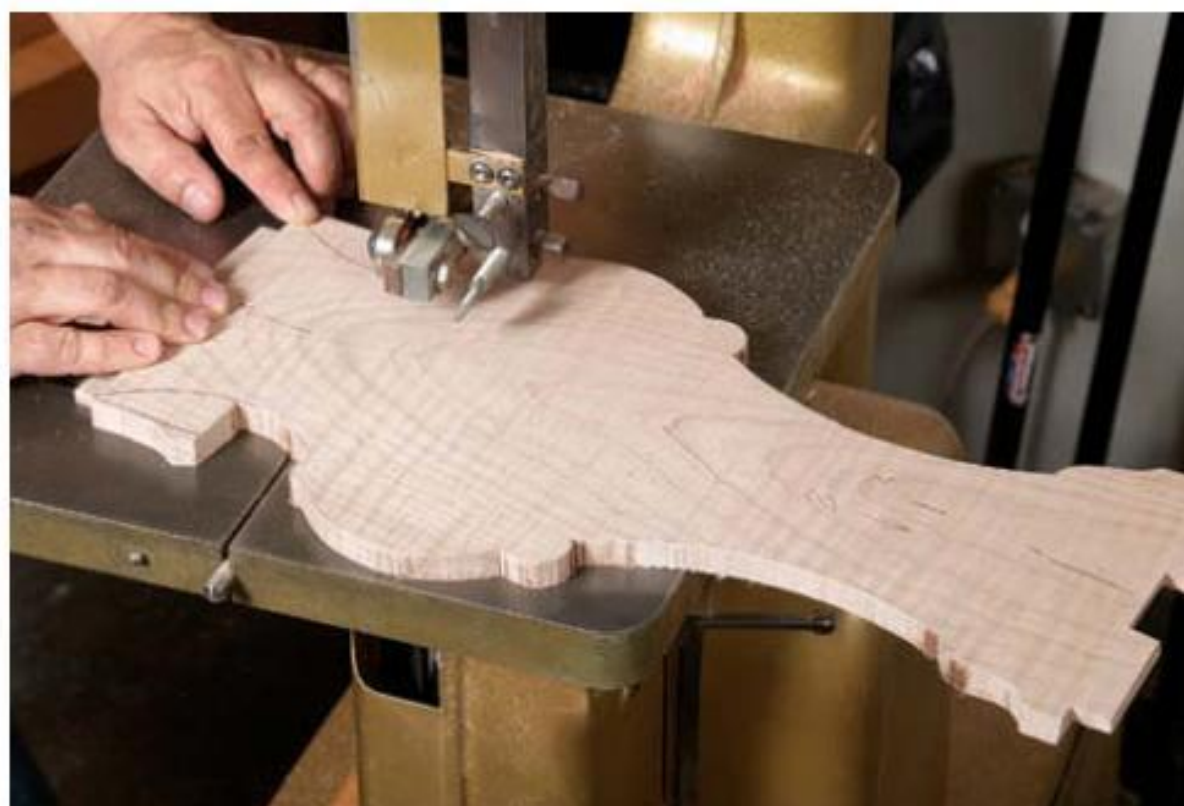
Make a back-splat template. The crest rail and shoe mortises are at an angle to each other. To find it, slip tenoned stock into each mortise (far left). From there, glue and clamp a third piece of scrap between the tenoned pieces (left). Lift off the crest rail to remove the jig.



Transfer the angle. The jig represents the top and bottom of the tenoned splat and indicates both the angle and the distance from one mortise to the other, as well as the tenon shoulders. By lining up its corners with a face of the splat blank, you can trace this information directly onto the splat.



Saw the tenons. Tilt the tablesaw blade to the correct angle and cut the lower tenon. Return the blade to 90° when cutting the upper one, though.



Bandsaw the splat profile. Brown leaves flats toward the top of the workpiece to give the clamps a place to seat. This waste gets sawn off later.

Two-stage glue-up

Start at the top.

For a perfectly shaped caul for this glue-up, Brown uses an offcut from the crest rail. Once he has these parts clamped he dry-fits them to the shoe and legs.



Trim the splat's flats after the glue dries. Because the crest rail is proud of the back of the splat, Brown tapes a scrap to the bottom of the splat, giving him a secure platform at the bandsaw.



Glue the rest. To close the joints where the legs meet the crest rail and the splat meets the shoe, it may be necessary to clamp blocks near the bottom of the splat. The large block here has a cleat to hook it to the bottom of the seat rail.



Curves ahead. After blending and fairing the front surface of the crest rail, legs, and splat, shape the back of the crest rail.

Bevels and sweeps. The shaping makes the chair. The crest rail is gently rounded over in the back, and the splat's edges are beveled, greatly lightening its look.

Moving forward



Dry-fit the rails to measure for the stretchers. When possible, it's best to measure from the chair, not the drawing. So when laying out the three remaining stretchers, dry-assemble the rest of the chair. A big, stout caul at the back will help close up the shoulders.

faces will ultimately be beveled, so account for that when laying out mortises for side rails and stretchers. Also, I fit the side rails to the front legs before cutting the bevels. This way I can mark the leg exactly where it meets the rail.

The slip-seat simply press-fits into a rabbet in the side and front seat rails, bolstered by two-part glue blocks at each corner. I cut this rabbet on the router table, referencing off the outside of the rails. Given all the steps needed to fit these pieces, referencing off the outside keeps the show edge parallel.

The only piece in the chair not joined using a mortise-and-tenon is the front stretcher. It is joined to the side stretchers from below with a lapped dovetail.

When gluing up the rest of the chair, I continue in stages. For the third stage, I glue the front rail to the front legs, with the rest of the frame dry-assembled to the chair back. When that's dry, glue the side rails to the front legs while dry-fitted to the rear legs. Take note that before the final glue-up you'll need to plane off the thin triangle of the side rail that extends beyond the leg. For the final stage, glue in the side stretchers and the dovetailed cross-brace, and glue the seat frame to the back. □

Steve Brown is an instructor at North Bennet Street School in Boston.



Side stretchers have slanted shoulders. With platforms holding the side stretchers at the right height, set a bevel gauge to the backward slant of the leg. Knife this angle down the stretchers' sides. Use a square for the tops and bottoms.



Front stretcher gets a lapped dovetail. Lay out the shoulder by clamping the stretcher against the bottoms of the side stretchers with the chair dry-fitted.



Transfer the dovetail. Use a sharp pencil to mark the dovetail's shape and thickness. Saw, chop, and pare to these lines.

Unlock the Cove-and-Pin Joint

A clever way to re-create a vintage joint

BY LOU KERN

A few years ago I saw an old dresser with a beautiful and unique joint. I was taken with the joint and did some research. Turns out the cove-and-pin joint, also known as the pin-and-scallop joint or the Knapp joint, was commonly used on factory furniture in the late 1800s. In fact, there was a dovetailing machine patented by Charles Knapp and Nathan Clement that was used to make the joint. I'm not sure why, but in the early 1900s the cove-and-pin fell out of favor and the machines along with it.

Finding one of those relics and restoring it wasn't realistic, so I built a sled and two jigs that allow me to create the joint using the router table and a handheld drill. The rounded fingers on the ends of the drawer sides are simple to make using the sled, which is essentially a finger-joint jig for the router table. The trick is cutting the other part of the joint, the line of semi-circular cutouts in the ends of the drawer front. To rout them I need a template, and I make it by taking a casting of the finger side of the joint. It turns out that casting with epoxy is easy to do and remarkably accurate.

My joint differs from the original, in which the pin was integral to the drawer front; I use dowels for that circular detail, adding them after the joint is cut and the drawer box is glued together.

Create a master template

My sled rides in the miter track in my router table, but if you don't have a miter track you can screw a piece of hardwood to the top of the router table so that it stands proud and cut a matching dado in the bottom of your sled. Or you could clamp or screw two straight boards to the table so that the sled exactly slides between them.

Once the sled is built, I use it to create a master template that will establish the pattern and spacing that carries through the process. I set my sled's indexing pin to cut on 1-in. centers because of the

Online Extra

For a members-only article exploring the history of the cove-and-pin joint, go to FineWoodworking.com/271.

START WITH THE MASTER TEMPLATE



Rout the rounded fingers. On the router table, set up a sled in the miter track and begin cutting the rounded fingers, moving over and registering on the indexing pin after each cut. This will create an overall master that you can use to re-create any of the pieces in the future, just in case.



MAKE THE MOLD TEMPLATE FROM THE MASTER



Second one is for the mold. Trace the outline of the master template on a piece of stock. This will be the mold template, used to make a mold to create the mating shape you'll need for the jig to cut the drawer front.



Waste away between the fingers. Use a bandsaw to waste out most of the material before you go to the router table. This will make for cleaner routing and extend the life of your bit, mold, and jigs.



Repeat the router-table process. With the space between the fingers already removed, go back to the router table and use the sled with the indexing pin to cut them. On the first pass, Kern cuts the fingers a hair short, then raises the bit just a little and does another shallow pass for a cleaner final cut.

Cast a template for the drawer fronts

To make a routing template that lets you cut the semi-circular sockets in the drawer fronts, you'll first build a mold and make an epoxy casting.

CREATE A MOLD



Apply a two-part epoxy filler. Mix equal parts of the filler, and apply a coat to the template to create a nonstick surface. Make sure to coat between the fingers.



Spray on shellac and mold release. After the epoxy filler, spray on a thin coat of shellac. Once dry, spray on a dry film mold release.



The simple mold comes together. Cover the base and sides with plastic wrap and screw them in place. The plastic is thin enough that it won't impact the casting. The template should be set perfectly parallel to the long piece that will hold the casting (right). A line of screws in the edge of that piece gives the casting something to grip.

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CASTING IS A SIMPLE PROCESS



MIX



Get the right consistency. Kern found that Smith & Co. Layup and Laminating Epoxy Resin was too thin on its own, and Smith's Fill-it Epoxy Filler was too thick. So he combines them. Once both products are thoroughly mixed on their own, combine and mix until they are a smooth consistency.



POUR

Pour and dry. Pour the liquid into the mold, and poke it down its length to release any air bubbles. Let it dry overnight. Release it from the mold, and then tap the template off the casting.



RELEASE

bit I use (Amana Round Over no. 49704). With the 1-in. finger spacing, your drawer height needs to measure on the $\frac{1}{4}$ in. (for example $5\frac{1}{4}$ in., $6\frac{1}{4}$ in., $7\frac{1}{4}$ in.). Begin cutting the fingers, moving the workpiece over and registering the indexing pin after each cut.

This type of cut often yields tearout. I use a replaceable insert that prevents most tearout on the side that runs against the fence, but there is often still tearout on the front. So I start with my drawer sides slightly thicker than the final dimension and plane them to thickness after the fingers have been cut, removing tearout.

Make the mold template for the drawer-front jig

Now you'll use the master template to create a duplicate, which will become part of the mold. You could skip making the dupli-

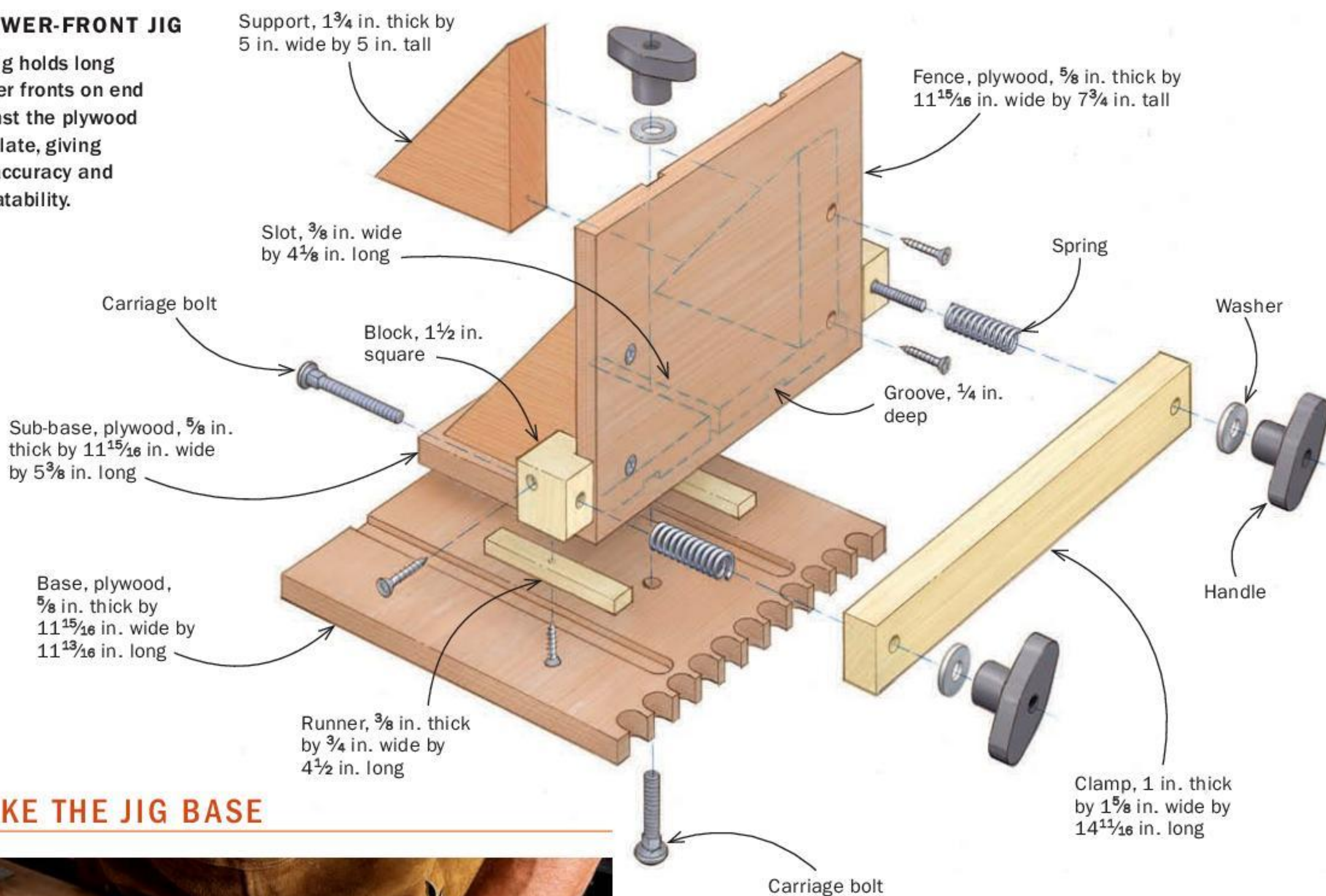
cate and use the master in the mold, but I like to have a perfect master for future use. If anything should go wrong along the way, I can just back up to the master and easily start again. First, trace the master template onto the mold template. Then go to the bandsaw to waste out the space between the fingers. This preserves the router bit and gives a cleaner cut. Sharpening the bit will slightly change its shape and the whole process will have to be redone, so I do anything I can to put that off as long as possible. Buying a pair of bits at the same time helps as well.

Once I finish on the bandsaw, I go back to the router table and cut the finger shapes into the mold template as I did on the master template, using the sled and moving across the board by locating the most recent cut on the indexing pin.

Use casting to make the jig for the drawer fronts

DRAWER-FRONT JIG

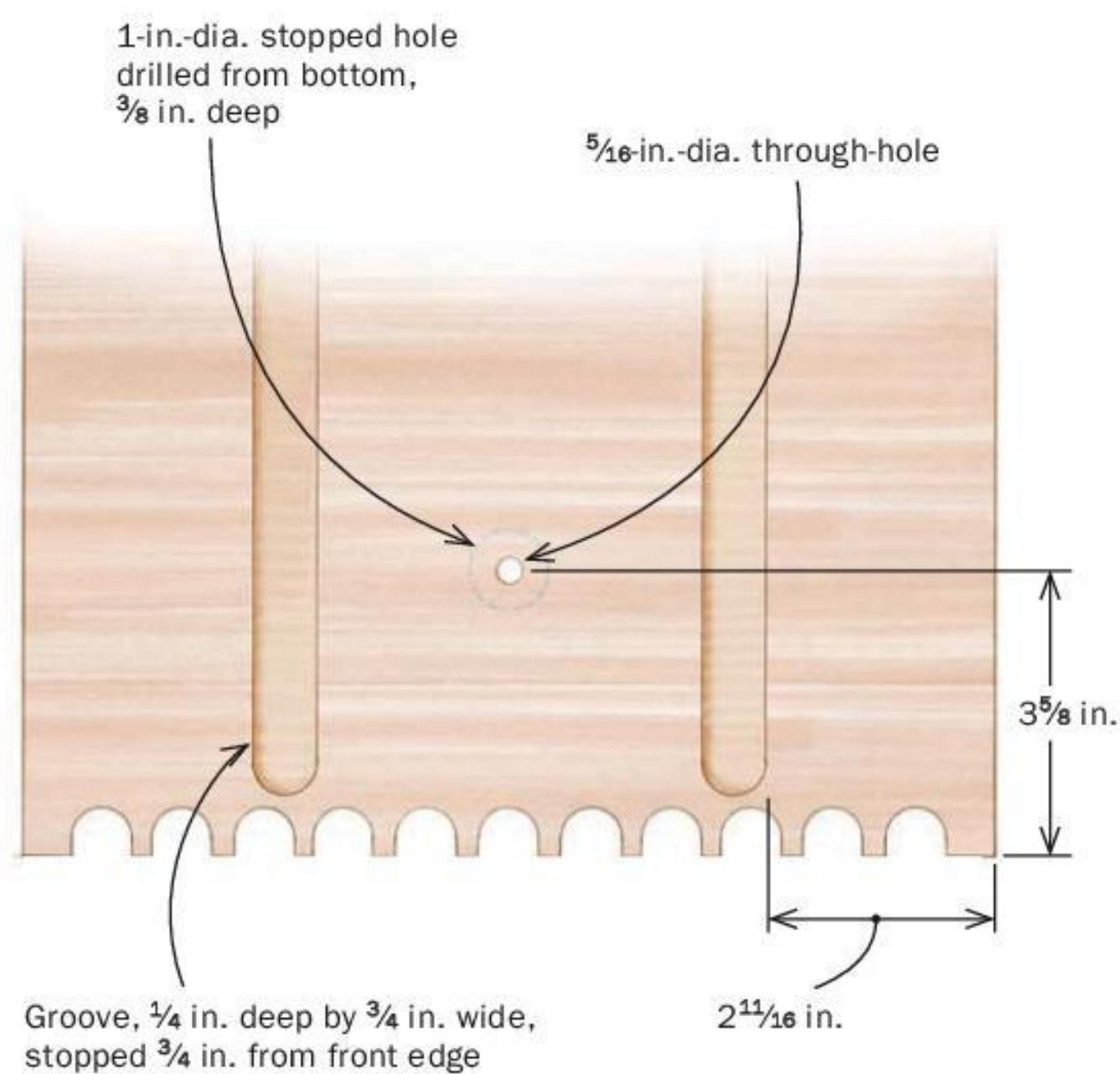
The jig holds long drawer fronts on end against the plywood template, giving you accuracy and repeatability.



MAKE THE JIG BASE



Trace and cut. Trace the casting onto a piece of high-quality plywood. This will become the base of the jig. Use the bandsaw to remove most of the waste. Then go to the router table and use a straight bit with a bearing on top to exactly transfer the casting to the plywood.



BASE TOP VIEW

CUT THE DRAWER-FRONT SOCKETS



The base of the jig. Use the plywood piece you just routed as the base. Technically you don't have to have a jig; you could use the template clumsily clamped to the drawer front. But the jig holds the drawer front upright and is worth the extra effort for the precision it gives.



Position and cut. Tighten the drawer front in the jig, making sure it is positioned so the edges line up at the outside of pins. Using a bottom bearing-guided straight bit, cut the sockets in both ends of the drawer front.

Prepare the mold template for casting

Once the mold template is cut, it's time to create its reverse shape by casting with an epoxy-based mix. First you will build a simple mold. My mold is a plywood base with side pieces screwed in place, the mold template screwed between the side pieces, and a strip of hardwood parallel to the mold template with screws on one edge to grip the casting. Before screwing the mold template down, coat it with a two-part epoxy resin. Once that's dry, spray it with a shellac sealer, and when that dries, spray it with a dry film mold release. I've experimented with a lot of products and product combinations, and I have had great success with this recipe. I mix two different two-part products for the right consistency, pour them into the mold, and let it dry.

Use the casting to make the jig for the drawer front

Once the casting is dry, I pop it out of the mold and use it to template-route the base of the next jig. I make the base from a sheet of plywood—Baltic-birch, marine-grade plywood, or the like. As with the other steps, you'll trace the casting and waste away close to the line on the bandsaw before moving to the router table. I use a straight bit with a top-guided bearing to cut the semi-circular

Move on to the sides



Back to the template. Use the mold template to trace the finger pattern onto the front of each drawer side. Cut out the waste on the bandsaw.

sockets. After completing these cuts, build the jig and use it to cut the sockets in both ends of the drawer front. The depth of cut should equal the thickness of the drawer sides.

Cut the drawer sides

Once the sockets are cut in the drawer front, go back to the mold template and use it to trace the finger pattern onto the front of the drawer sides. Cut out the waste on the bandsaw, and then use the router-table sled to cut the fingers in the front of the drawer sides, indexing on the pin. The drawer back is inserted into dadoes in the sides.

Pinning it all in place

I use what is essentially a doweling jig to drill holes in the center of the fingers and then glue a dowel in each hole and cut them flush with a handsaw. Though this joint isn't as mechanical as a dovetail joint, it is a very tight-fitting joint. The pins add a mechanical element to it, but they are also an aesthetic addition. □

Lou Kern is a stair builder and furniture maker in Oakland, Calif.



Back to the router table and sled. Strike a reference line on the sled for the first shoulder. Position the front of the drawer side on this line, and make the first cut.



Finish the side. Once the first cut is made, begin registering off the indexing pin to make the rest of the cuts.

Assemble and pin

Glue up the drawer box. The front and sides go together the same way a traditional dovetail does. Kern sets the drawer back in a dado and glues and screws it in place.



Match centers. Mark the centers of the fingers, then extend the lines down. Position an L-shaped jig (very similar to a doweling jig) with the same spacing as the finger centers on the drawer box.



Drill and pin. Using a brad-point bit, drill the holes for the pins. Glue the pins in place, and cut them flush with a handsaw.

Inspiration for our readers, from our readers

EVAN COURT

Holderness, N.H.

"I wanted to create a form that allowed the viewer's eye to flow smoothly throughout the entire piece," Court said in describing his chair. He painted the curved arm rail and left the posts natural.

CHERRY, 19D X 24W X 27H

Photo: Bill Truslow

Online Extra

Take a look behind the design of Evan Court's chair in a video at FineWoodworking.com/271.



MICHAEL SARASIN

Mystic, Conn.

Sarasin made this block-front highboy from a photograph he found in the Wallace Nutting *Furniture Treasury*. "One of the challenges was only having a single photograph of the original." Like the original, Sarasin's highboy was built in two pieces.

CHERRY, CURLY AND QUARTERSAWN, 18D X 37W X 84H



ISRAEL MARTIN

Cantabria, Spain

Like most of Martin's work, this sideboard was made using hand tools. The form was inspired by Garrett Hack's huntboard (FWW #187), and the ebony and holly inlay around the doors and drawers was inspired by the work of English Arts and Crafts designer Ernest Gimson.

CHERRY AND SPALTED TIGER MAPLE, WITH COCOBOLO AND AFRICAN BLACKWOOD ACCENTS AND EBONY, ABALONE, AND HOLLY INLAY, 17³/₈D X 45¹/₄W X 33⁴/₅H



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MIKE SELSER

Auburn, Calif.

Two articles helped inspire this table, Selser says. The inspiration for the floating top came from Tim Rousseau's article ("Float the Top," *FWW* #229). The L-tenons used in the mitered drawer box are finger-jointed like those used by Duncan Gowdy in "Add Muscle to Your Miters" (*FWW* #254).

MAHOGANY, ROSEWOOD, AND EBONY
14D X 48W X 32H

ROBIN WILSON

Sonoma, Calif.

The subtle shape of Wilson's chair showcases the grain on the book-matched back panels. He designed it in his second semester at The Krenov School and credits instructors Laura Mays, Jim Budlong, and Ejler Hjorth-Westh with influencing both the design and the execution of the project.

CLARO WALNUT, 24D X 17W X 34H

Photo: Todd Sorenson



DANA SALIHI

Lighthouse Point, Fla.

Modeled after a vintage steel safe, this cabinet has a fully functional combination lock and rack-and-pinion locking mechanism. The gears are oak and each is made up of 18 glued segments, with zebrawood and wenge inlay. The cabinet door, which houses the gears, has three layers of 4/4 walnut to provide the needed depth. He estimates the cabinet weighs 200 lb.

WALNUT, OAK, CHERRY, WITH INLAYS OF OAK, CHERRY, WENGE, AND ZEBRAWOOD, 23D X 39W X 47H

Photo: Jeff Smith



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DESIGN IN WOOD 2018

Each year, the San Diego Fine Woodworkers Association produces its juried exhibition, Design in Wood. This year's show included 26 competitive categories and dozens of interesting pieces. Here is just a thin slice of the many jewels that were found there. For more, go to sdfwa.org.

DAVID O. WADE

Orange, Calif.

Wade's dresser, which won the Fine Woodworking Best in Show award, was inspired by the Greene and Greene chiffonier in the master bedroom at Gamble House in Pasadena. "Instead of the inlay that Greene and Greene used on the doors, I chose a local landmark, Saddleback Mountain. That choice was inspired by its use in a local Greene and Greene style house."

SAPELE WITH EBONY ACCENTS, 18D X 44W X 72H



KEN COWELL

Yorba Linda, Calif.

This bedside table is part of a set. The marquetry on this one shows a mother bird with four babies in the nest waiting for food; the other one (not shown) has the male bird bringing the food. "The design was family inspired," Cowell says, with the four baby birds in the nest depicting his children with their unique personalities. The secondary wood for the project was white oak reclaimed from church pews.

MAHOGANY, EBONY, AND VARIOUS MARQUETRY WOODS, 20D X 25W X 30H



ANDY GOLDMAN

Placentia, Calif.

This open segmented turned bowl is made up of 25 layers (26 if you include the rim) with 72 pieces per layer, for a total of 2,521 pieces including the base. The design is by Tom Lohman. It took Goldman roughly 35 hours to cut the wood into strips and then cut the strips into small pieces. Once the blank was glued up, the turning itself took several hours.

CHERRY, BLOODWOOD, MAPLE, OSAGE ORANGE, PAU FERRO, PAU AMARILLO, WENGE, 12 DIA. X 5½H



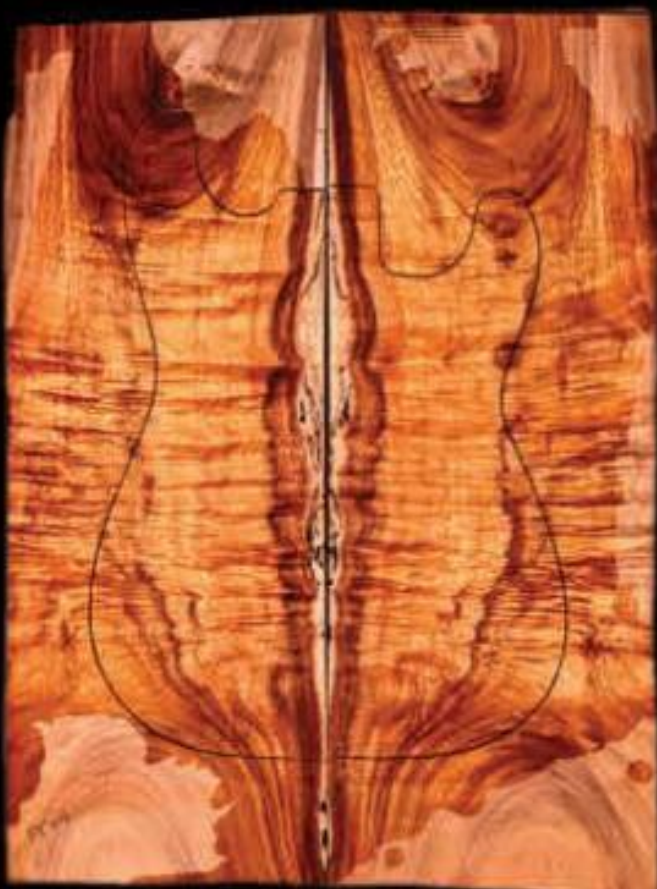
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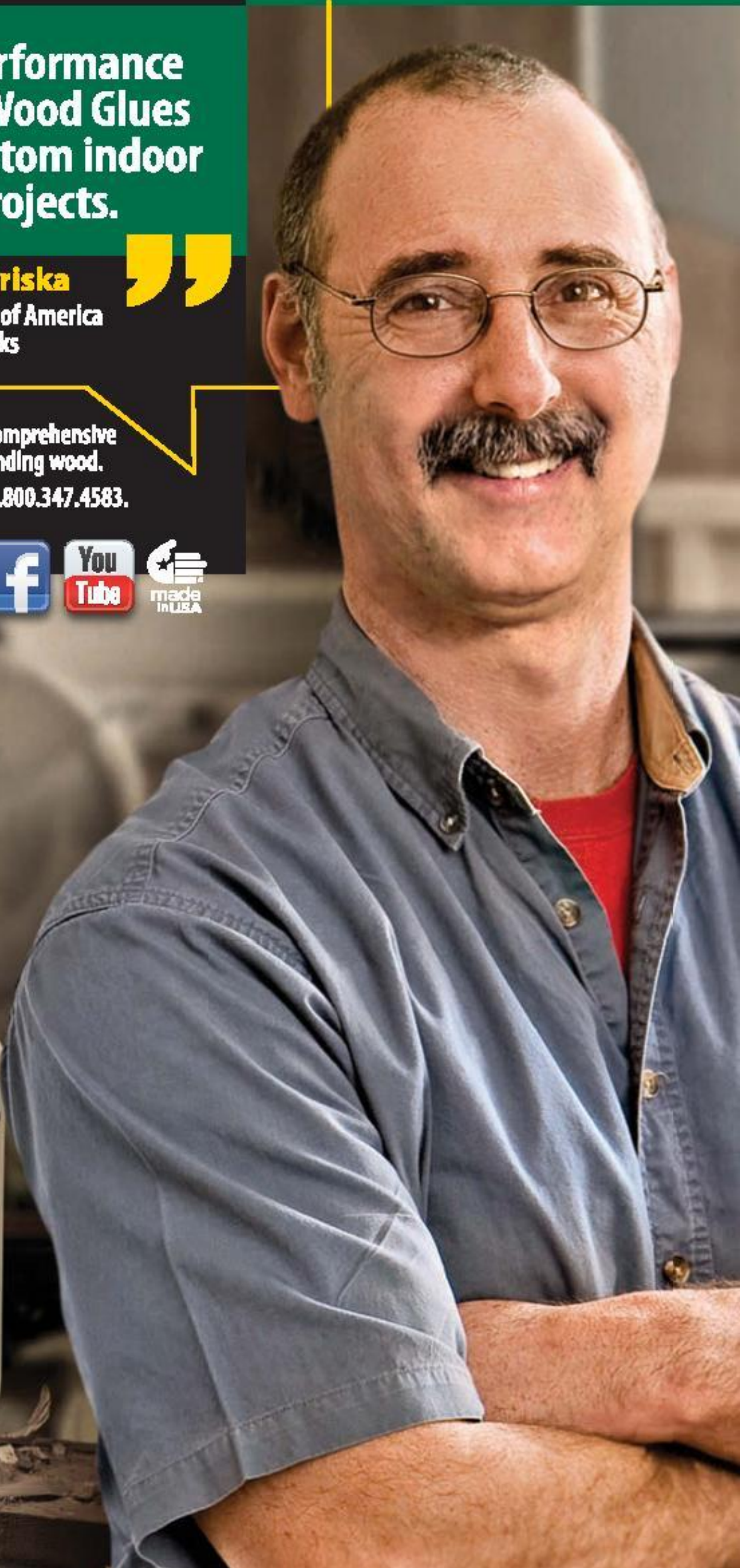
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master class

Even though the back assembly of the Chippendale chair (see pp. 50–59) presents the bulk of the chair's challenges, the compound-angle tenons where the rear legs meet the side seat rails can be a sizable hurdle, too. Don't be intimidated. By using two straightforward, effective jigs—one helping with layout and the other to hold the workpieces properly at the tablesaw—you'll be able to tackle these tenons. All that's left at the end will be a little cleanup by hand.

Compound-angle tenons

TWO INGENUOUS JIGS SIMPLIFY THE PROCESS

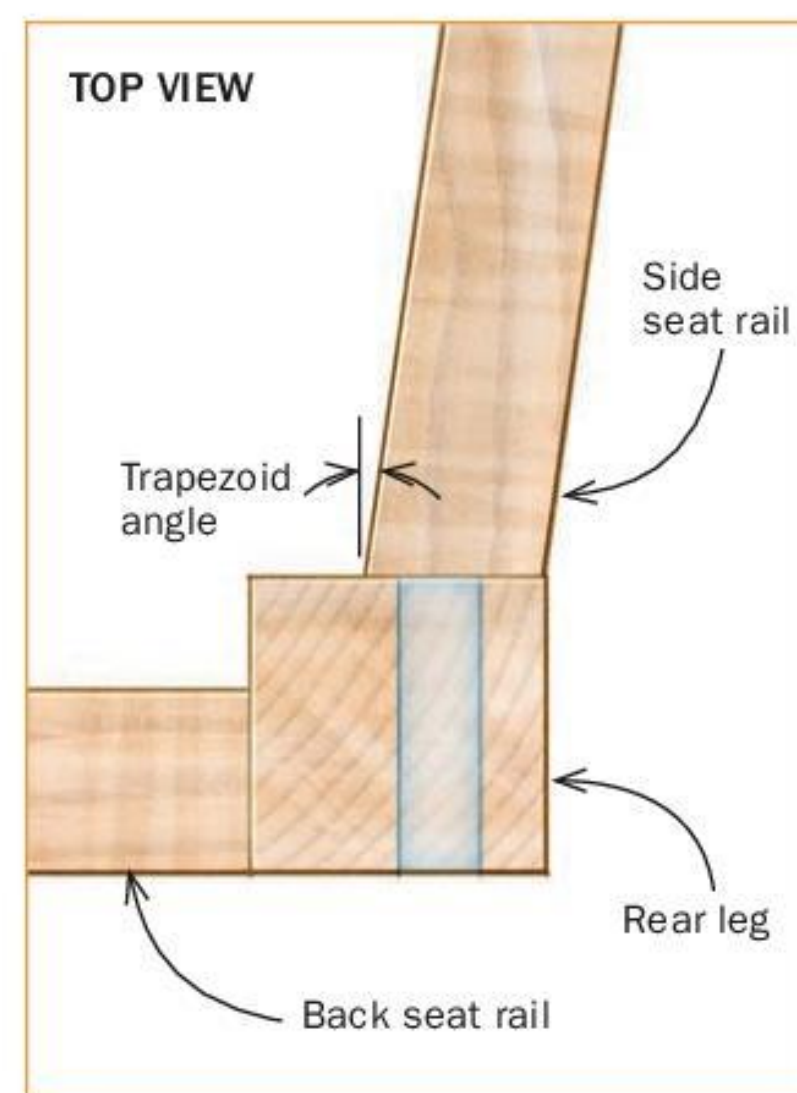
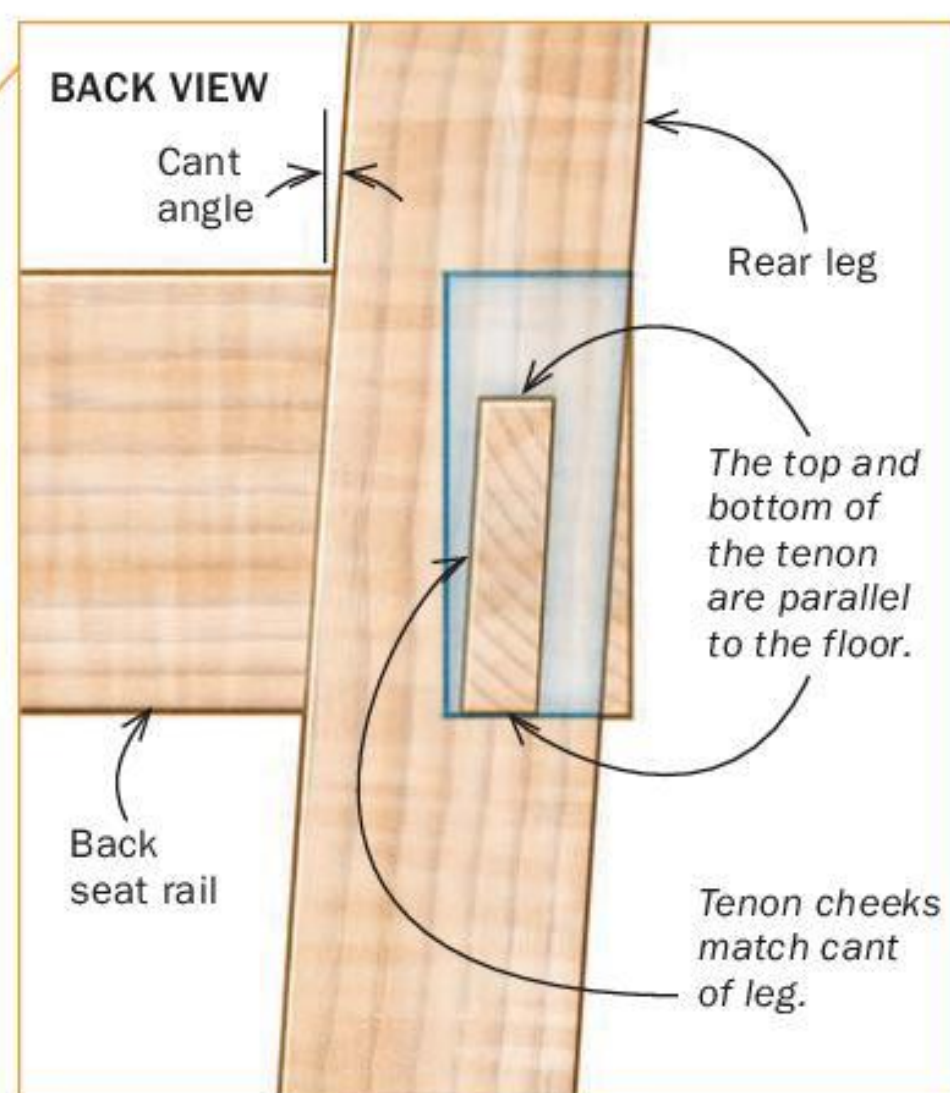
BY STEVE BROWN



Seen from the back, the legs on a Chippendale chair tilt in at the bottom. This is the cant angle.

TWICE-TWISTED TENONS

The side seat rails' rear tenons have two angles at play: the cant angle of the leg and the trapezoid angle of the seat frame. That's a lot to juggle. So even though Brown cuts these by machine, he still takes the time to carefully lay them out on the stock, minimizing the chance of cutting the wrong tenon on the wrong rail.



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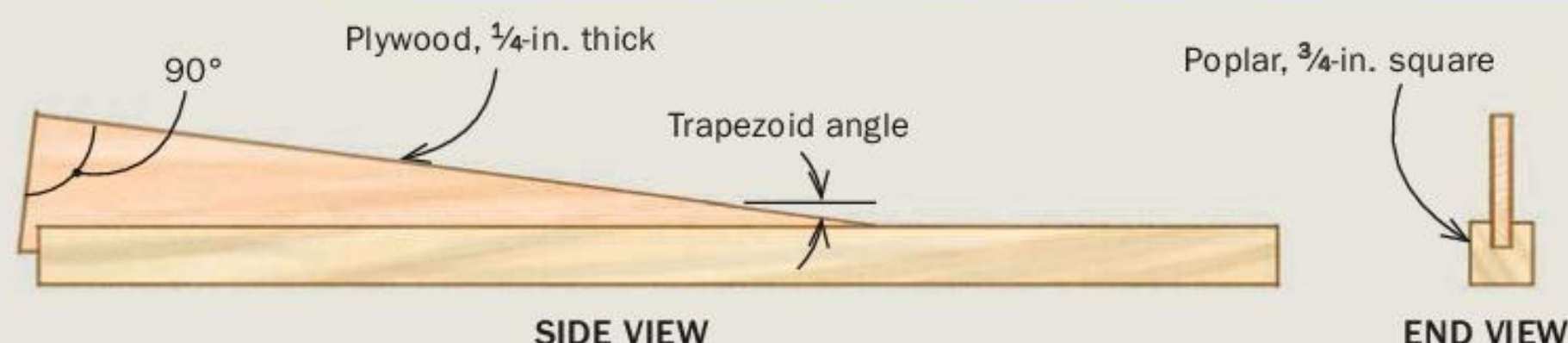
Jig for tenon layout

Scribing the tenons now can spare you a costly mistake at the tablesaw.

Lay out the tenon shoulders. Start by knifing the shoulder on the inside face of the side seat rail. Then, using the end of the layout jig, knife across the rail's top and bottom edges. Complete the shoulder layout by squaring a knife line across the outside face.



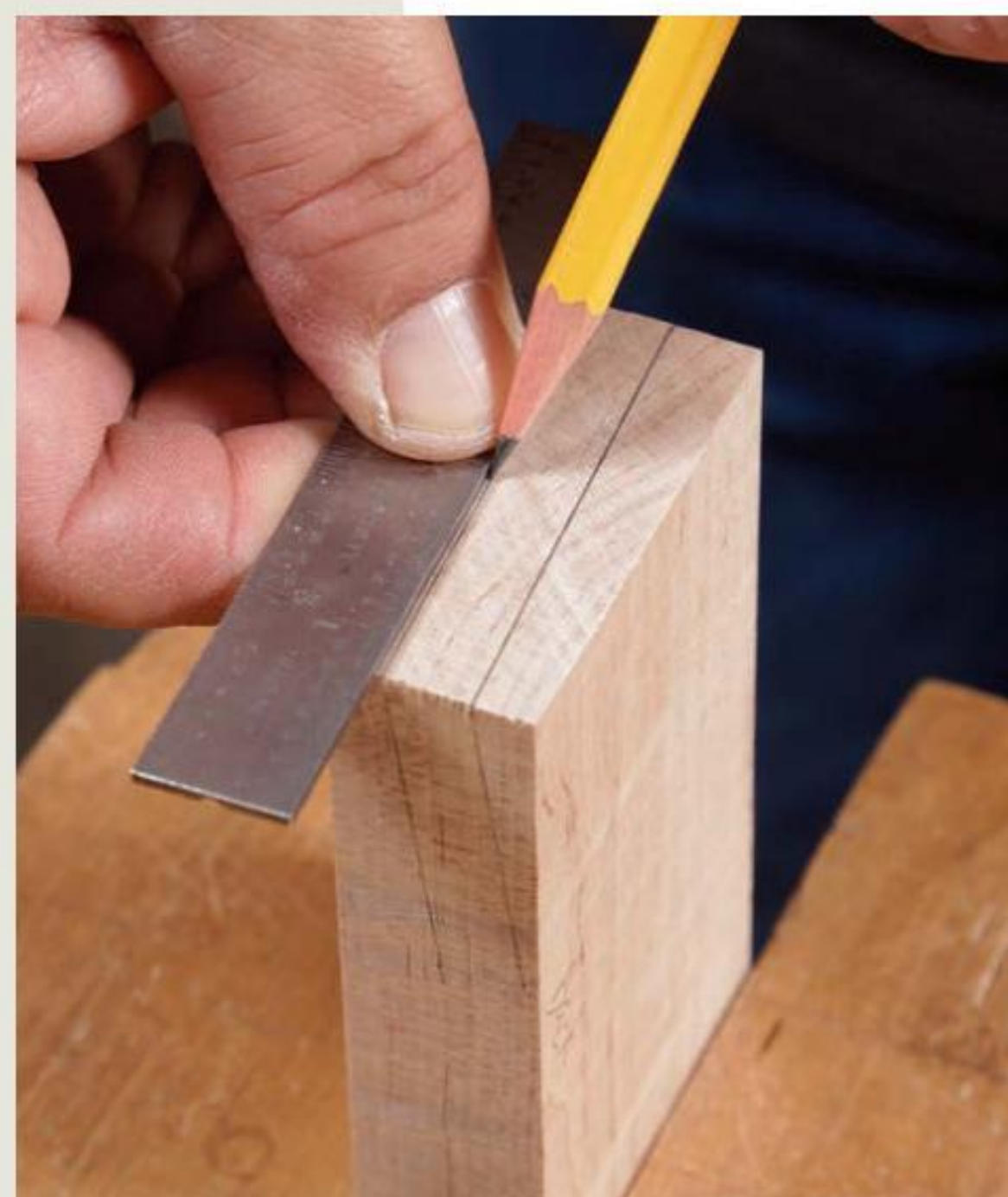
TRAPEZOID ANGLE JIG



To lay out the tenons, I turn to a bare-bones jig, a piece of 1/4-in. plywood cut to the trapezoid angle of the seat frame and glued into a poplar beam. I use the end of the plywood to lay out the shoulders, and its long angled edge to lay out the cheeks. I can lay out both cheeks just by sliding the poplar beam up and down the stock. This jig may sound superfluous, but it isn't. If you've ever laid out angled tenon cheeks with a bevel gauge, you know it can be a balancing act. This jig takes care of that problem. It also comes in handy when making the tenoning jig.

Once you've laid out the tenons, it's time to make the tenoning jig, which you'll use to cut the cheeks. The jig is a wedge sandwiched between two fences and attached to a backer board. Start the wedge by milling a block of solid wood to the same width as the seat rails. Then tilt the tablesaw blade

Mark the cheeks and ends. Use the long angled edge of the jig to lay out the tenon cheeks. Start on the edges of the rail and use the mortises in the chair legs to determine where the cheeks intersect the shoulders. With the cheeks laid out on the edges, use a straightedge to connect those lines and lay out the end of the tenon.



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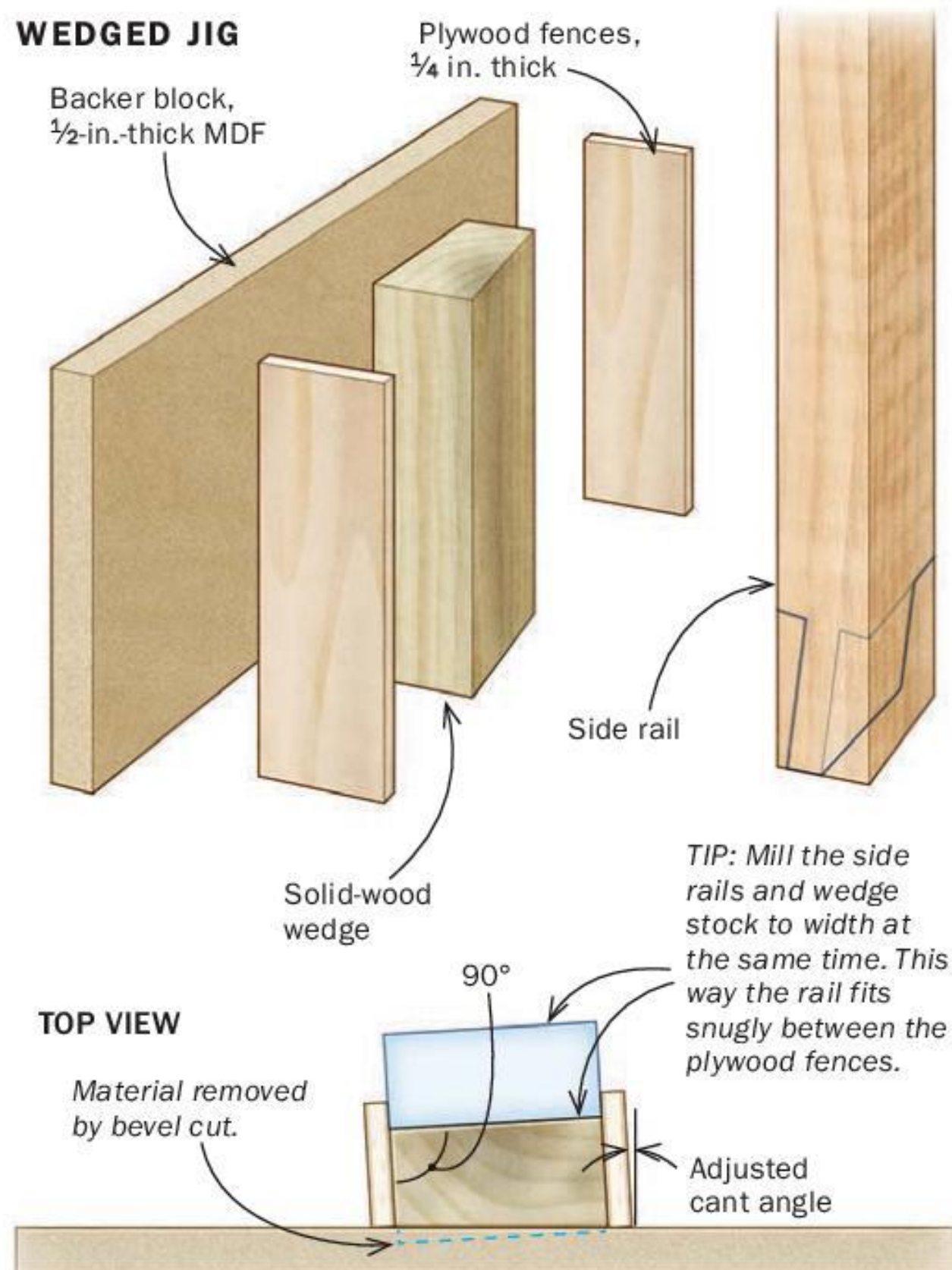
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Jig for compound cutting

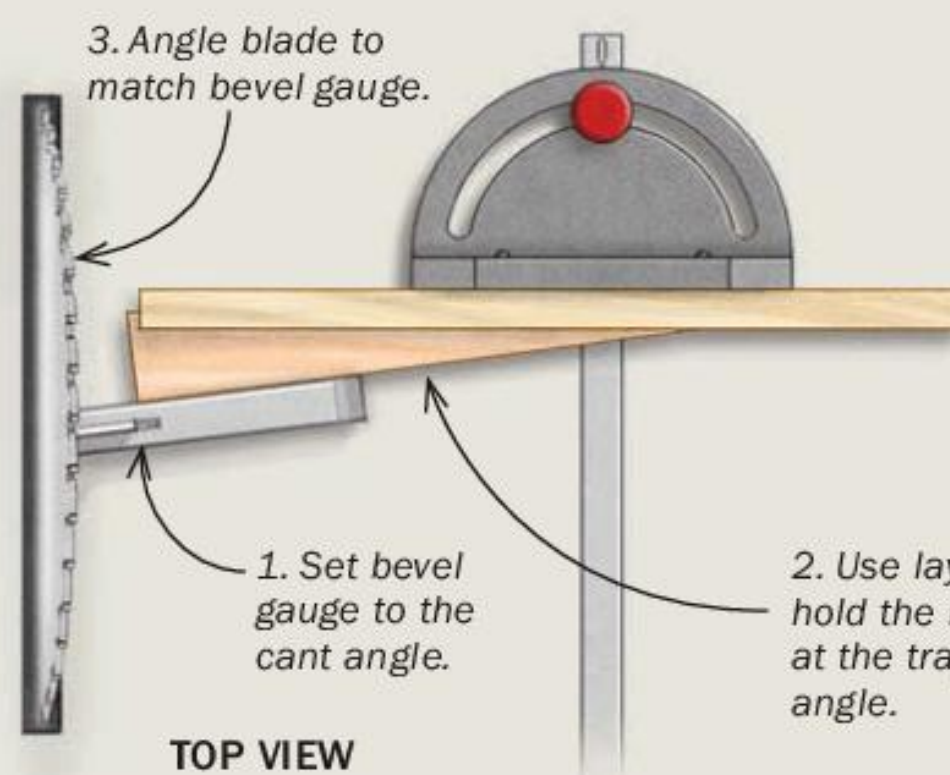


Brown relies on this jig whether he's building one chair or six.

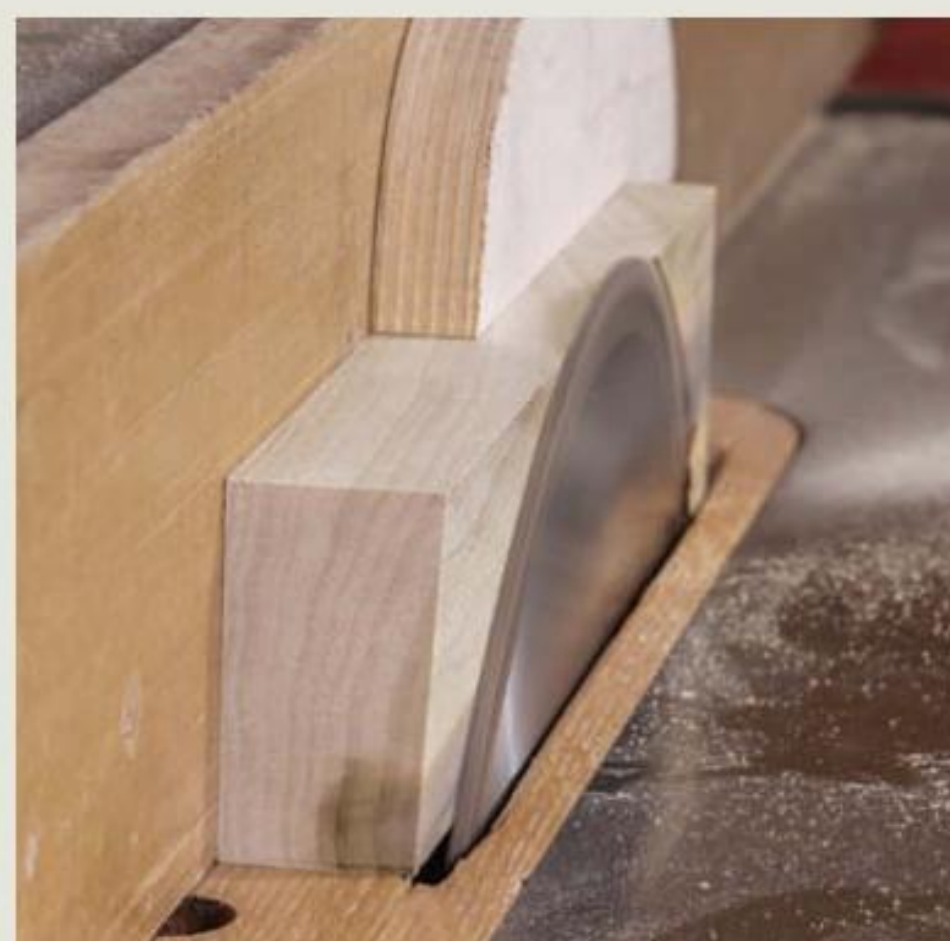
WEDGED JIG



Determine the cant angle. The joint needs to account for the seat's trapezoid angle and the leg's cant angle. Set a bevel gauge to the cant angle, measuring from the chair itself.



Tablesaw setup requires two angles. To cut the wedge to the proper angle, set the blade tilt using both the layout jig and bevel gauge.



Rip your wedge. For safety, Brown bevels the wedge from an overlength blank. He leaves it long until it is fixed to the backer block, ensuring that it and the backer are flush top and bottom.

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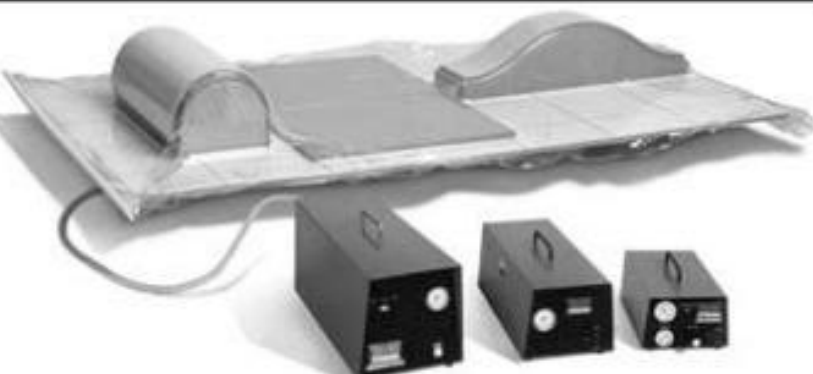
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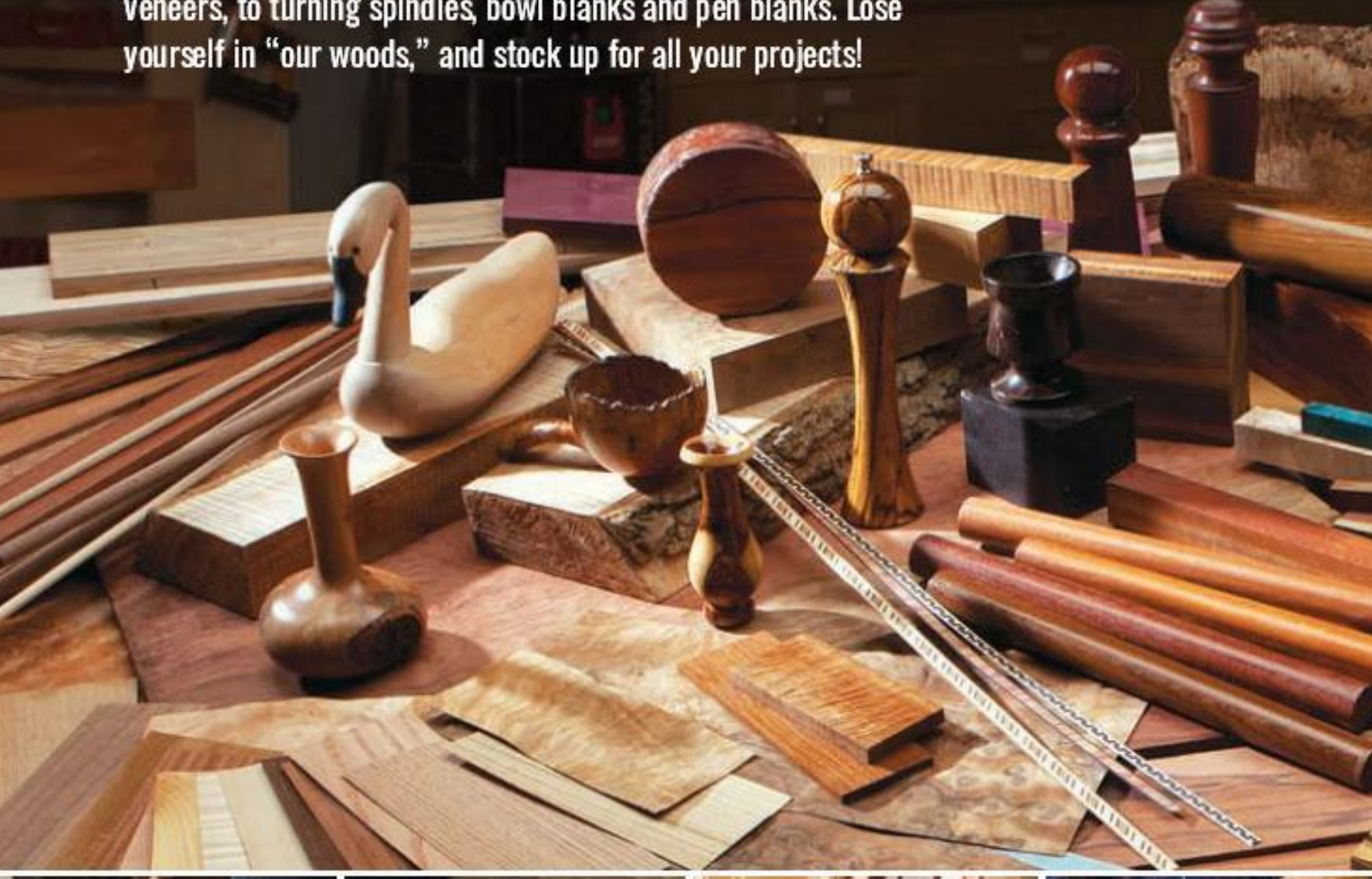
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Attach the wedge to an MDF backer.

The angled side of the wedge goes against the backer, which, for safety, should be about as wide as the height of your tablesaw fence. Brown leaves the wedge overlong at first so he can cut it and the MDF to size later.



Glue on the fences.

Because you milled the wedge with the rails, these 1/4-in. plywood fences will hold the rails with a tight press-fit.



and rip one wide face of the block. To determine the correct blade tilt for the rip, set a bevel gauge to the cant angle. But instead of placing the gauge perpendicular to the blade as normal to set the tilt, skew the body of the gauge to the trapezoid angle. You can use the layout jig to help with this.

Now screw the wedge to the MDF backer, which will ride along the tablesaw fence. Be sure the angled face of the wedge is against the backer. Then glue plywood fences to either side of the wedge.

With the jig complete, it's time to cut the cheeks. To set the blade tilt, adjust a bevel gauge to the trapezoid angle. But again you won't hold the gauge at 90° to the blade. Instead, turn it from perpendicular by the amount of the cant angle. You can do this by holding the body of the gauge against the side of

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Cut the tenons

The jig will help you cut tenons in both rails by simply flipping it over.

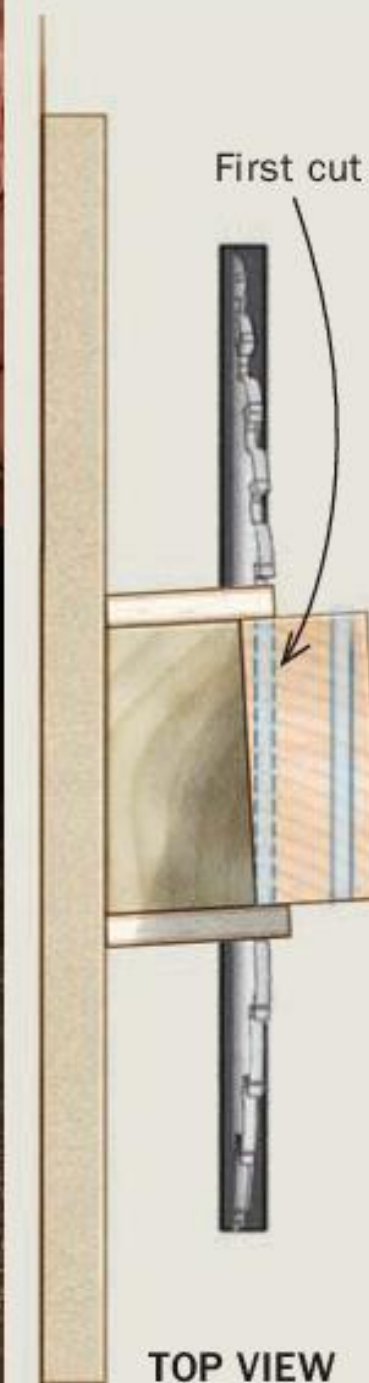


Tilt means two angles again. This time, set the bevel gauge to the trapezoid angle, then place it against the wedged jig so it is presented to the blade at the adjusted cant angle.

FIRST CHEEK



Cut the cheeks. Place the rail in the jig and cut the first cheek (left). Flip the jig upside down to cut the first cheek of the second rail.



SECOND CHEEK

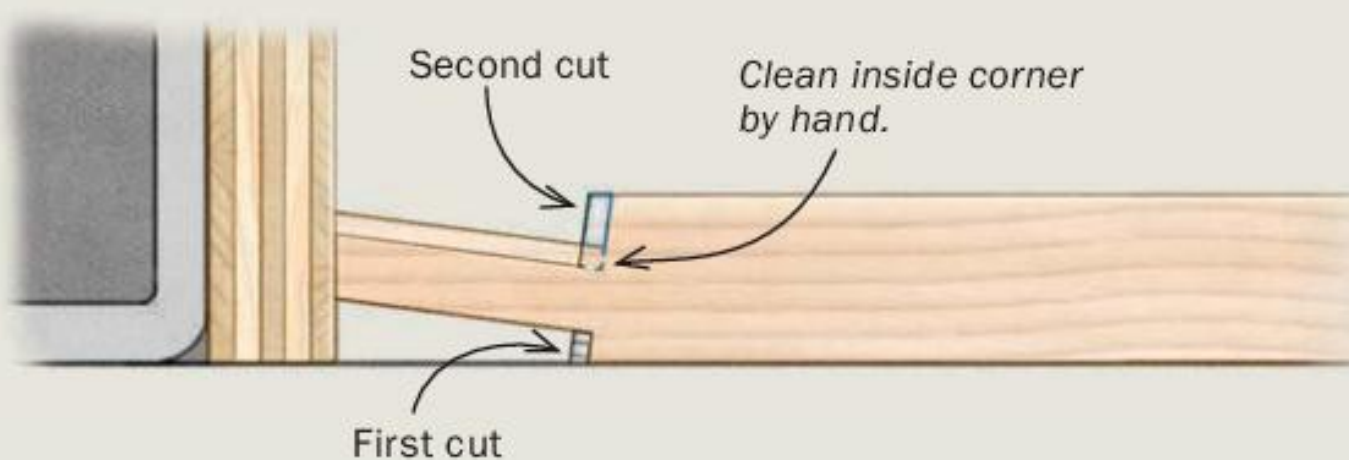


Slide the fence over to cut the second cheek. Lower the blade for the second cut to avoid cutting past the shoulder.

SHOULDERS



Trim the shoulders. Tilt the blade to the trapezoid angle and lower it to cut the shallowest part of the shoulder. Cut one shoulder on both tenons, then shift the fence to the other side of the blade to cut the second ones.



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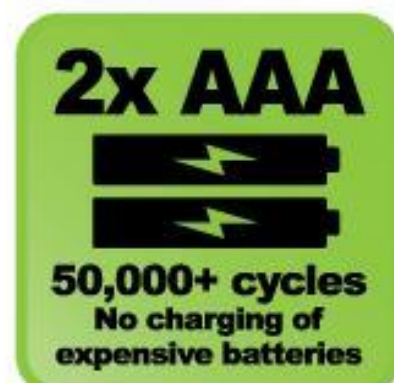
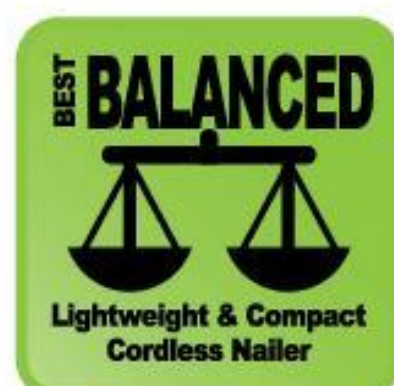
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Cleanup

The chair's compound angles mean you'll need a few more steps to get surfaces neat and flush.

Mark the overhang on the end... Because the leg cants but the side seat rail is plumb, a thin triangle of end grain should be hanging out from the leg.



... and edge. Using a straightedge, pencil a line to mark the overhang from the back end to the front corner of the rail. This will smooth the transition from the plumb front leg to the canted rear leg.



Time to wind. Remove the overhang with a sharp plane and sure strokes. The wind is so subtle that it appears flat.



Area to be planed away



the tenoning jig. Cut the first cheek on one rail, then turn the tenoning jig upside down and cut the first cheek on the other rail. After resetting the fence, cut the second cheeks on both tenons.

For the shoulders, set the tablesaw blade to the trapezoid angle and lower it so it cuts only at the shallowest part of the tenon under each cheek. You'll need to shift the fence to the other side of the blade to cut one shoulder on each tenon. Then finish up with a chisel.

When the tenons have been sawn to width and fitted, a bit of the rail will overhang the leg, since the rail is plumb while the leg is angled. You can fix this after gluing the side and front rails to the front legs. Using a handplane, shape the outside face of the side rail to a gentle wind. The difference is usually so subtle that most people see the rail as flat. □

Steve Brown is an instructor at North Bennet Street School in Boston.

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Portrait of a woodworker

BY GARY ROGOWSKI

If you build things in wood, I know who you are.

First, you love tools. Your hands are drawn to them. You feel magic in their grip, a power that hints at their potential, their capability, their promise. They are old and atavistic, something real with smells from decades ago, these tools that you love.

You adore wood. It's hard not to, because it's so gorgeous and warm and malleable. It feels good in your hand. You can bend it, lay down beautiful, thin veneers of it, or shape it to a sensual form that is inviting and warm. It wears and weathers over time, becoming even more lovely as it is used. It is as essential to your being as the other elements.

You are a problem-solver. You like to figure things out for yourself, find your own solutions. It makes you feel good to come up with your own way of doing things, your own path to the conclusion.

You need to know where everything is in your world. Where is my hammer, my piece of wood, those screws I bought? You need a sense of control in a world that's gone mad. So you create for yourself a shop space to work in, a bench to work on, an atmosphere that makes you feel good when you walk into it. A place where you know, roughly, where everything is.

You love getting to wear many hats—the sheer number and complexity of the tasks required to build a piece of furniture, from designer to lumber buyer to millwright to joiner to assembler to finisher. For each skill there is so much to know, to assimilate, to master.

And finally, you need to talk to yourself. The importance of this cannot be overlooked. You need to be alone so you can converse with yourself throughout the day. It may seem manic to others who see you chatting to yourself at the bench, but it's crucial to your mental health. This is your time spent conversing with your own history or



working out the day's issues, coming up with new designs or plans as you work on a project, working out a new way of being in this world. It might be the best talk of the day, one where the call and response are logical, not insane like the world trying to blow itself up.

There you have it: the portrait of a woodworker. Lover of inanimate objects, puzzler, control-obsessed. Very close to the image of a person you wouldn't sit next to on the bus—but let that go. Because a woodworker is also a stalwart, someone who can be depended upon to build you something beautiful.

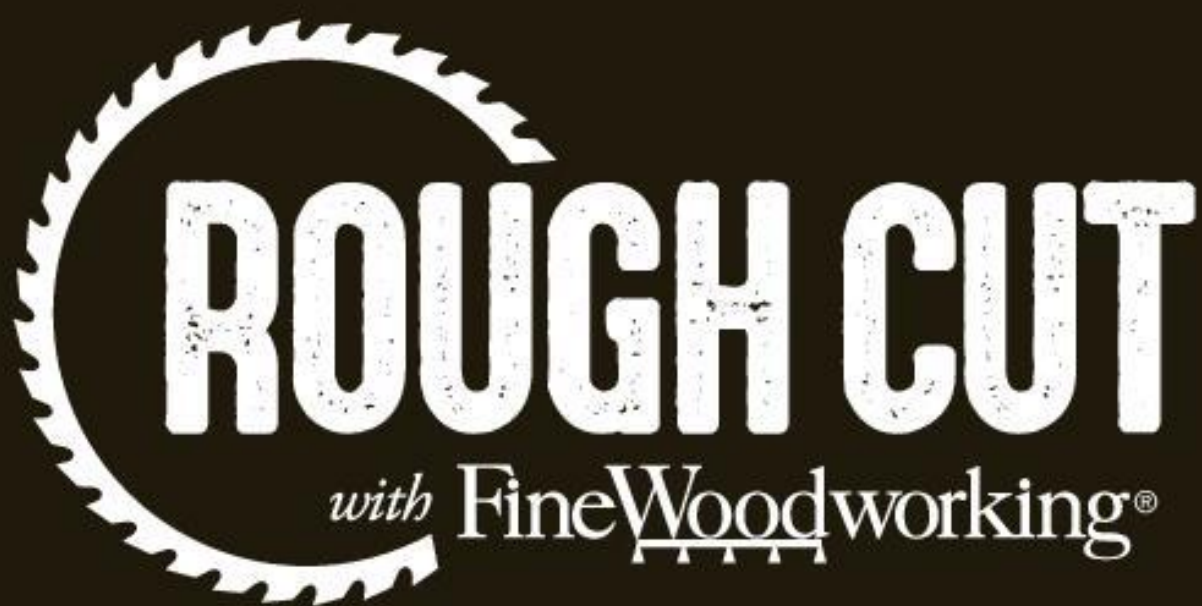
Eventually. Patience is an important quality to have with one.

Gary Rogowski, director of the Northwest Woodworking Studio in Portland, Ore., is the author of Handmade: Creative focus in the age of distraction (Linden, 2017), from which this essay was adapted.



Have you watched yet? The new season is on PBS TV now!

The new season of *Rough Cut with Fine Woodworking* is on the air! Co-produced with *Fine Woodworking*, this new season will feature new projects and techniques from host and expert woodworker Tom McLaughlin. Shot on location in Tom's bright and expansive New Hampshire shop, this season will also feature some special woodworking guests who will share their own tips and skills with Tom and his audience. Watch and learn from every episode and enjoy time spent with the craft you love.



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A Love of the Craft, Exposed



Heidi Earnshaw's white oak seven-drawer dresser is based directly on the 18th-century French *semainier* form, which had one drawer for each day of the week. The resemblance might be elusive if you trace back to the Rococo originals, which were often drenched in curves and carving, *ormolu* and inlay (and would no doubt have had sides and a back). But Earnshaw, a Toronto native whose early education in furniture came through pulling apart curb castoffs to see how they were made, regularly looks to historical furniture for inspiration.

Her own style is decidedly clean and minimalist, but she can see through the decorative skin of period pieces to the forms beneath.

Earnshaw loves the technical aspect of furniture making—one of her favorite parts of this piece is the diagonal brace in the back—and she especially relishes making chests: cutting clean joints and fitting together scores of parts into handsome drawers and a strong, light structure; her dresser exposes all of that. “I feel a huge debt,” she says, “to all the woodworkers who have gone before me, in terms of how things were designed but also how they were made.”

—Jonathan Binzen

