

TAUNTON'S

Fine Woodworking

Teach • Inspire • Connect

Do more with your
smoothing plane, p. 38



17th-century carved chest

Case construction
the Krenov way

Build a
light and lively
side table

Add curves
to your projects
with steam
bending

Make your
own brass
hardware

► Peter Follansbee uses
traditional methods
to build a chest with
timeless beauty, p. 46.





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- Spindle travel: 4 3/4"
- Spindle speeds: 12, from 180-3240 RPM
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- Maximum rabbeting depth: 1/2"
- Minimum stock length: 10"



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- Minimum stock thickness: 1/2"
- Dust port size: 4"
- Footprint: 17" x 23 1/2"
- Approx. shipping weight: 450 lbs.



WARNING! †¹

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14" SUPER HEAVY-DUTY RESAW BANDSAW W/ FOOT BRAKE

- Motor: 2 HP, 110V/220V (prewired 110V), single-phase, 19A/9.5A
- Max. cutting width: 13 1/2"
- Max. cutting depth: 14"
- Table size: 21 3/4" L x 16 5/8" W
- Table tilt: 5° L, 45° R
- Floor-to-table height: 37"
- Blade size: 120" (1/8" to 3/4")
- Blade speed: 2820 FPM
- Overall size: 29" W x 32 1/2" D x 76" H
- Footprint: 24" L x 18" W
- Approx. shipping weight: 388 lbs.



14" RESAW
HEIGHT!

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15" PLANER W/ CABINET STAND

- Motor: 3 HP, 230V, single-phase, 12A
- Max. cutting width: 15"
- Max. cutting height: 6"
- Max. cutting depth: 1/8"
- Min. stock length: 6"
- Min. stock thickness: 3/16"
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- Approx. shipping weight: 552 lbs.



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- Motor: 1 HP, 110V, single-phase, 10A
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- Cast-iron 17 3/4" x 10" disc sander table tilts to 45°
- Four spindle sizes: 1/4", 5/8", 1 1/2" and 2"
- Spindle speed: 1725 RPM
- Spindle oscillations: 60 SPM
- Stroke length: 1"
- Footprint: 21 1/4" L x 16 1/2" W
- Overall height: 47"
- Approx. shipping weight: 181 lbs.



WARNING! †¹

G0529 ONLY \$695⁰⁰



10" HYBRID TABLE SAW W/ RIVING KNIFE

- Motor: 2 HP, 115V/230V (prewired for 115V), single-phase, 16A/8A
- Rip capacity: 31 1/2" right, 11 3/8" left of blade
- Max. depth of cut @ 90°: 3 3/8"
- Max. depth of cut @ 45°: 2 1/8"
- Table size with extension wings: 40 1/2" W x 27" D
- Distance from front of table to center of blade: 16 1/4"
- Floor-to-table height: 34 1/4"
- Dust port size: 4"
- Footprint: 20 1/2" L x 19 1/2" W
- Overall dimensions: 63" W x 40" D x 48" H
- Approx. shipping weight: 449 lbs.



WARNING! †¹

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- Sliding table size: 12 1/4" x 63"
- Main blade arbor: 5/8"
- Main blade speed: 4000 RPM
- Scoring blade size: 3/8"
- Scoring blade arbor: 22mm
- Depth of cut: 3/8" @ 90°, 2 1/4" @ 45°
- Approx. shipping weight: 688 lbs. (G0623X), 670 lbs (G0623X3)

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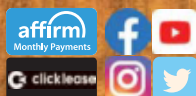
WARNING! †¹

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For members



VIDEO

In hot water

Russ Filbeck shows how he uses boiling water to get his chair parts up to bending temperature.



VIDEO

A jig-free dowel joint

Tim Rousseau demonstrates how to transfer points for dowel joints using brad nails.

Online extras

Free content at finewoodworking.com/287



VIDEO

When spring comes around

Bob Van Dyke (p. 38) demonstrates how he creates a spring joint, making it easier to glue up a flush panel or tabletop that requires only light handplaning or scraping.



VIDEO

Nice day for a scroll

Watch and listen as Peter Follansbee (pp. 46, 74) carves a panel of S-scrolls in this mesmerizing video.



VIDEO

7 questions with Clark Kellogg

Step inside Clark Kellogg's brain (p. 20) as we hit him with seven top secret questions. You're going to enjoy this journey.

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contributors

Like so many of us, **Peter Follansbee** (“Simple, Handsome 17th-Century Box” and Master Class) is adapting to these trying times. For him, that involves two returns to his roots. The first is his recently revived interest in building Windsor chairs, which were among his first greenwood projects. To rehone his skills, he’s taking online classes with Elia Bizzarri and Curtis Buchanan. The second venture brings him a little further back, to his days as an illustrator. On his blog, pfollansbee.wordpress.com, Peter has begun selling full-size drawings of several carving patterns from 17th-century England and New England. Turn to Master Class to follow along step by step as he carves the box in this issue.



Brian Boggs (“Bend Wood to Your Will”) took one shop class in junior high school, and “absolutely hated it.” His passion at that point was fine art painting, and he went to Paris to pursue it. When that dream fell away in his early 20s he found woodworking through *Fine Woodworking*, James Krenov’s books, and Jennie Alexander’s book *Make a Chair from a Tree*, and began to teach himself the craft. Thousands of chairs later, he works with a team of eight or so in a large shop in Asheville, N.C., building chairs but also tables and cabinets.



Mike Korsak (“Light and Lively Side Table”) and his wife, Jen, have their hands full with Ted, their 1½-year-old, 130-lb. Newfoundland who’s full of energy and slobber, and isn’t done growing. Luckily, Ted’s full of affection and kindness too. In between dog walks, Mike’s working on a commission for a dining table and matching side chairs. Last time we were there, Mike was refining the mockup of the chair. It sat fantastically, proving to be a nice perch after wrangling Ted.

The lifelong woodworking journey of **David Welter** (“The Dowel Joint”) began on his family farm in Iowa. After a number of woodworking jobs, he studied with James Krenov for two years at College of the Redwoods. Afterward he joined the staff as shop manager. For 30 years (1986 to 2016), he kept the school’s heartbeat strong and steady—tending to the machines, keeping the materials and wood supplies stocked, providing extra instruction and moral support, and so much more. Now retired, David is able to focus on his own projects and can usually be found in his cozy shop.



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From the Editor



Finding sanctuary in the shop

I switched jobs recently, and with the expanded duties and a little more stress added to my life, my first thought was that I may need to cut down on my shop time. Instead, I found that woodworking began to play a more important role in allowing me to take a break from everything else that was going on. When my kids were younger, shop time was tough to come by, and striking a balance between woodworking and family time was always a challenge. With the house a little quieter now, it's easier to get out in the shop, and pursuing tasks like writing articles or prepping for teaching have given me even more reasons to be out there.

What got lost in the mix was the reason why getting into the shop was so important in the first place. Not just for me, but for a lot of us pursuing this craft, woodworking allows the chance to change gears and change focus—to slow down a bit, and quiet the noise (or at least replace it temporarily with that of a router or tablesaw, or better yet, the swish of a handplane). While not always enjoyable in the strictest terms, putting our hands to work making things—a notion that has become something of a spectator sport these days—always brings a tremendous sense of satisfaction.

I began reading *Fine Woodworking* as a furniture-making student in college not only because it afforded me the information I sorely needed in my attempts to gain a foothold in the craft, but also because it spoke to who I aspired to be as a woodworker. Its writers seemed to understand and share my passions in pursuing the craft. It was for the same reason that 24 years ago, while I was working as a graphic designer and starting a family, we moved from California to Connecticut so I could take a job at the magazine. And it's for the same reason that today I'm still here working to hone my craft and working to make the path a little easier for readers.

During my tenure as art director, and then creative director, my aim has been to help shine a light on the amazingly talented makers in the craft and to share their knowledge in a clear and inspiring way. Now that “editor” has been added to my title, my aim is still the same, and my hope is that my recent reconnection to the important role woodworking can play in our everyday lives will help to guide my efforts.

—Michael Pekovich, editor and creative director

From the Bench struck a chord

As one who has subscribed to every issue of *FWW* and still gets excited when one appears in my mailbox, I am writing you for the first time in response to Adam Godet's article “The tortured cycle of a woodworking project” (From the Bench, *FWW* #285). After nearly 60 years of experience, moving from basic to fine furniture making, I found myself identifying completely with his sequence of emotions and appraisals during his project build and was laughing inside given the almost infinite number of times I have shared those feelings. That was an enjoyable piece, written from a unique perspective. Thank you for making that part of the December 2020 issue.

—DARYL KRESS, Anderson, S.C.

Adam really nailed it in his article. I laughed and even cried thinking it fit so perfectly every project I attempt. Yes, I am mostly a turner now and hope someday to make a piece that will make David Ellsworth, John Jordan, or Betty Scarpino jealous, but then reality sets in. I go to club meetings with my work and of course point out every flaw. So I'm headed to the shop to create another Platonic form.

—JOHN LUCAS, Cookeville, Tenn.

Loved Dave Fisher's drawings

Thanks for the article on adze work from Dave Fisher (Greenwood, *FWW* #285). I enjoyed it thoroughly. However the thing that struck me most about it was those wonderful old-fashioned-looking graphics. They reminded me of the books on early American life and craft by Eric Sloane: *A Reverence for Wood*, *Diary of an Early American Boy*, and others. Black-and-white drawings of this same type are used throughout his books. His books make very clear how dependent on wood those pioneers were, and any woodworker serious about the craft will find them enlightening and educating. Hope to see more new old-fashioned stuff in the future.

—JERRY BLACKBURN, Sea Cliff, N.Y.

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workshop tips

Modular storage system adjusts to fit cargo

Like most woodworkers, I have a place for every machine but no good home for my large stash of power tools: sanders, routers, saws, drills, and so on. After years of tripping over stacks of cases, I got frustrated enough to do something about it.

I wanted everything in one central, easy-to-access location. I also wanted my storage system to be adjustable, since it's almost impossible to know what tools I may add or subtract down the road. These quick-to-make cabinets fill the bill perfectly.

The modular system is made up of simple plywood cabinet boxes that can be of any size, screwed together in any array. Rows of $\frac{1}{4}$ -in. dadoes inside each box let you slip in $\frac{1}{4}$ -in.-thick plywood panels that act as adjustable shelves. I drilled a finger-pull hole at the front of each shelf to make it easy to move.

While cabinets like these can be as tall as your plywood is long, it's more helpful to build them in two stacked banks, letting you alter the depth and width of the bays to suit the contents. In my case, there's an upper, 60-in.-tall bank of five units, sized to fit my large collection of Festool Systainers and similar aftermarket cases for other tools; and a lower, 40-in.-tall bank of four wider units that holds everything else.

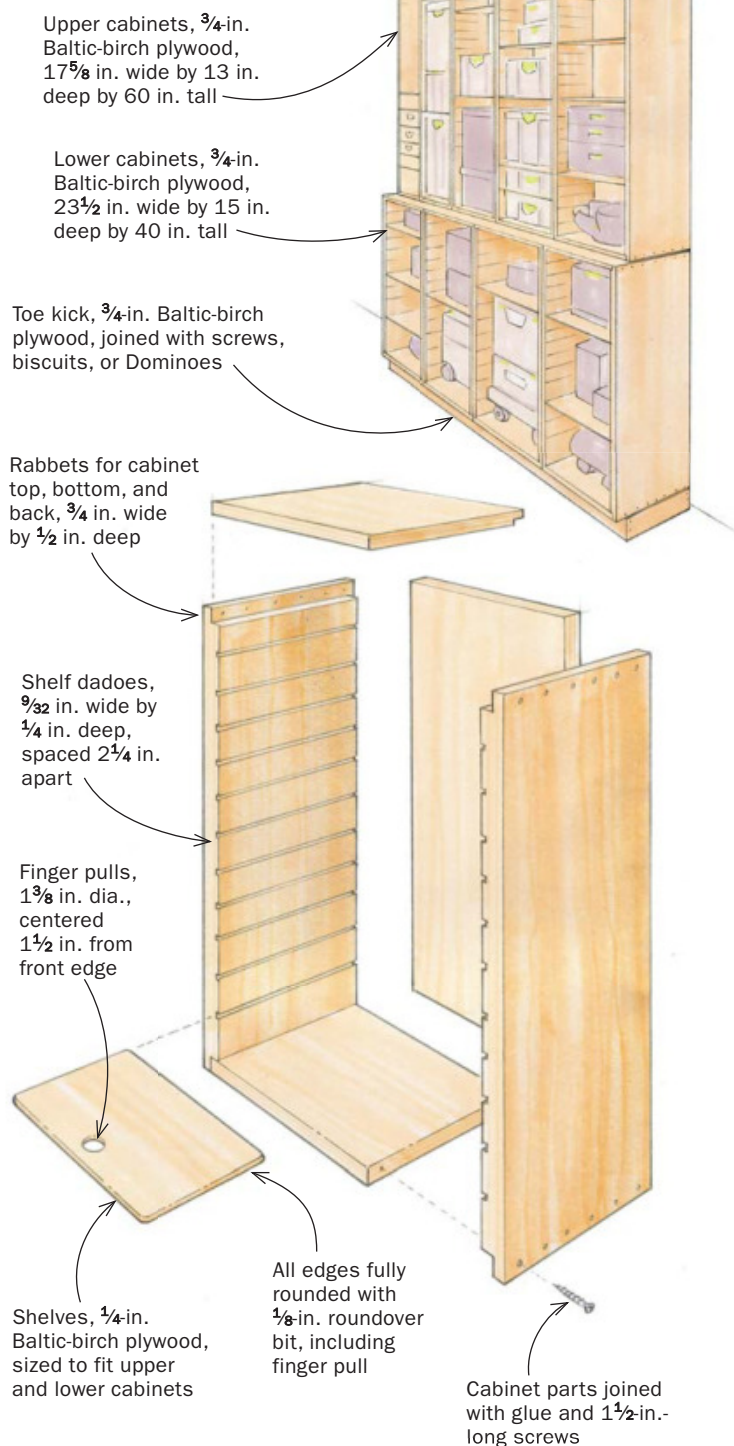
The cabinet sides and backs are $\frac{3}{4}$ -in. (18mm) Baltic-birch plywood joined with glued-and-screwed rabbets, and the shelf dadoes are slightly oversize for easy sliding. I cut all the rabbets with one setup on the tablesaw using a stacked dado head, and I cut the shelf dadoes on my crosscut sled. Before screwing the boxes to each other, make a simple toe-kick base from plywood strips, level it with shims, and screw it to the wall and/or floor. Then set the cabinet boxes on top, join them with $1\frac{1}{4}$ -in.-long screws, and anchor them to the wall.

To make the shelves better looking and easier to adjust, I gave all of the edges a $\frac{1}{8}$ -in. roundover—including the $1\frac{3}{8}$ -in.-dia. finger pull—running them over the router table in all directions to create fully rounded edges.

The system has worked well, and can be expanded as far as your wall space will allow.

—CLARK KELLOGG, Houston, Texas

Author's dimensions given; adapt to fit storage needs of your shop.



Best Tip



Clark Kellogg is a professional woodworker in Texas and a contributor to FWW, with a handful of articles to his credit, including the recent "Hexagonal Boxes Are Little Gems," in FWW #285. He's as smart at organizing his shop as he is at building fine furniture. This adjustable storage system demonstrates Kellogg's knack for efficient problem-solving.

A Reward for the Best Tip

Send your original tips to fwtips@taunton.com. We pay \$100 for a published tip with illustration; \$50 for one without. The prize for this issue's best tip was a Veritas Medium Shoulder Plane.



Quick Tip

Unlock tight joints in the freezer

While test-fitting a frame-and-panel assembly on a humid day, I forced the parts together and couldn't find a way to get them apart again. Just as I was thinking, "The only way to get this apart without breaking it is to wait until winter!" I got an idea. I put the assembly in my chest freezer for an hour or two and it came apart easily.

—GREG SULLIVAN, Farmville, Va.

Use push pins to align your track saw

Whenever I try to align my long track saw with two pencil marks, there's an annoying back-and-forth as I get one end of the track aligned and the other pivots slightly off the mark. This push-pin trick lets me align both ends in one quick step. Just push or hammer the pins firmly into your layout marks, push the track against them, and pull the pins. You get perfect alignment every time, and the sawkerf removes the pin holes.

—BRIAN GAMBERG, Los Angeles

Stick push pins firmly into the pencil marks.

Push the track against the pins for perfect alignment in seconds.

Remove the pins and make the cut (the sawblade removes the pin holes).

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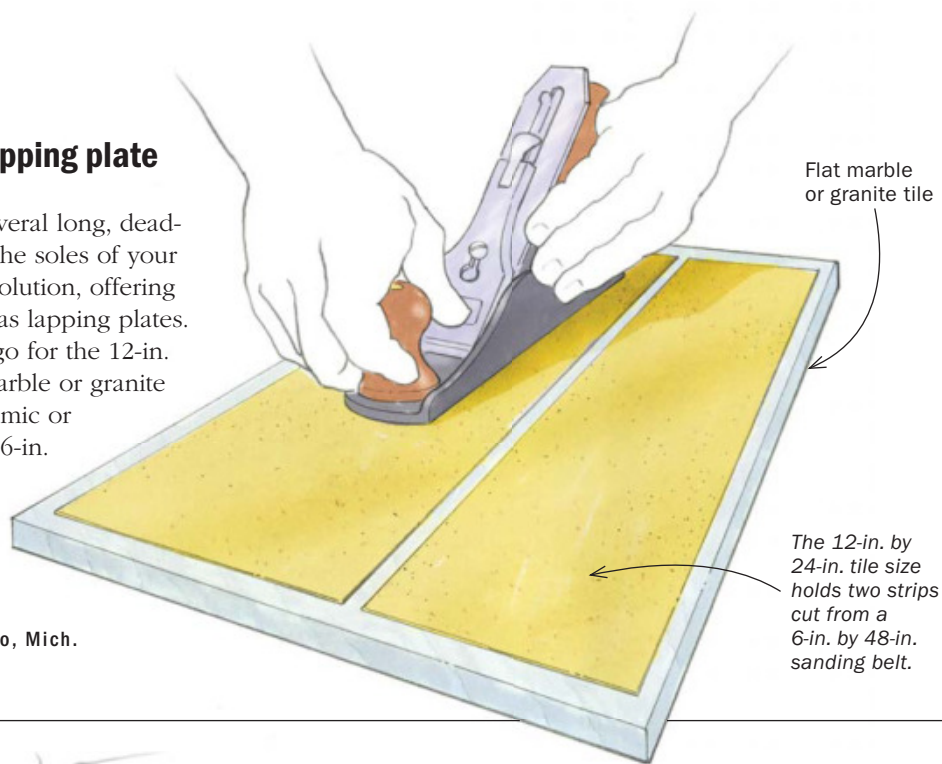
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Marble or granite tile is a low-cost lapping plate

If you love hand tools like I do, you'll need several long, dead-flat surfaces for flattening blades, chisels, and the soles of your planes. Floor tiles are an affordable, effective solution, offering a longer surface than heavy granite slabs sold as lapping plates. Look for stores that sell tile by the piece, and go for the 12-in. by 24-in. size. But beware, not all tile is flat. Marble or granite tiles are very good for this purpose, while ceramic or porcelain tiles are not. For the abrasives, I use 6-in. by 48-in. sanding belts—cut in half to create 2-ft.-long strips—and I attach them with 3M Super 77 spray adhesive. I like the belts better than sandpaper rolls, which are often less than 3 in. wide.

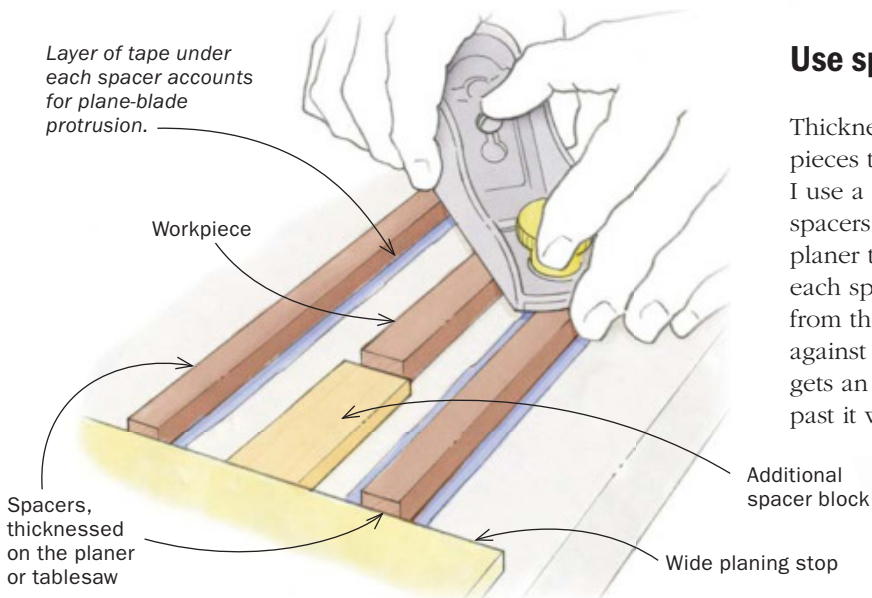
—MICHAEL RICCO, Kalamazoo, Mich.



Use spacers to plane strips to perfect thickness

Thickening small pieces can be tricky. When I need to trim pieces that are too short to be handled safely on a machine, I use a spacer system to guide my handplane. I make the spacers long enough that I can run them safely through the planer to the thickness I'm after. I put a piece of tape under each spacer to account for the protrusion of the plane blade from the sole. The spacers and workpiece get butted up against a wide stop on the workbench, but the workpiece gets an additional block in front of it so the plane will ride past it while still supported by the spacers.

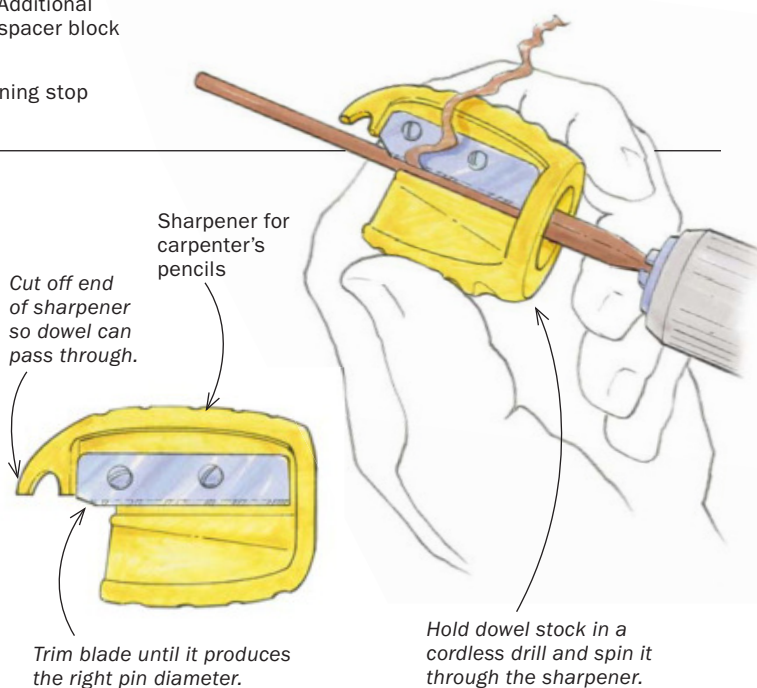
—DAVID JOHNSON, Los Angeles



Adapt a pencil sharpener to make small pins

Thin pins in a contrasting wood are a nice way to lock joinery and add a decorative touch to small projects. But turning a 1/8-in.-dia. pin is difficult. It's possible, though, to adapt a carpenter-pencil sharpener to turn a thin dowel. I used a rotary tool to cut off the end of my sharpener, so the dowel could push through, and trimmed the cutting blade (without removing it from the sharpener) to create the diameter I wanted. To use the improvised dowel jig, I rip square stock about 12 in. long on the tablesaw, whittle the end so I can hold it in my cordless drill, and run it slowly through the sharpener, which I simply hold in my hand. If need be, you can spin the pins against sandpaper to smooth them and dial in the diameter.

—STEPHEN ZERWAS, Summerfield, N.C.



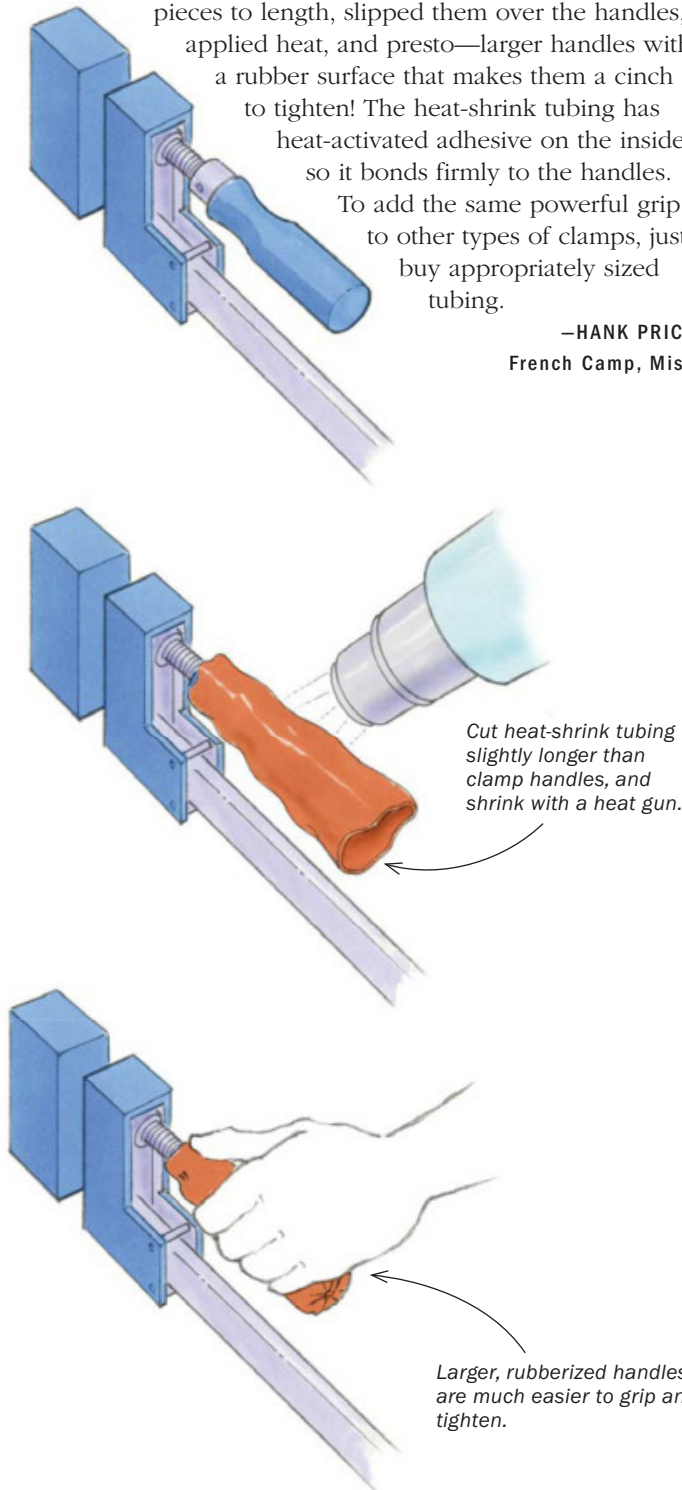
Heat-shrink tubing makes clamp handles easy to grip

While I love my Bessey K-Body parallel-jaw clamps, my hands aren't getting any younger, and I find the narrow wooden handles difficult to grip tightly. When doing some electrical work recently, it occurred to me that heat-shrink tubing might be the perfect solution. I found 1½-in.-dia. tubing in

4-ft. lengths for a little over \$10 on Amazon. I cut pieces to length, slipped them over the handles, applied heat, and presto—larger handles with a rubber surface that makes them a cinch to tighten! The heat-shrink tubing has heat-activated adhesive on the inside, so it bonds firmly to the handles.

To add the same powerful grip to other types of clamps, just buy appropriately sized tubing.

—HANK PRICE,
French Camp, Miss.



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■ MACHINES

Dust collector for a small shop

THE GRIZZLY G0860, a 1½-hp portable cyclone dust collector, packs a serious punch. It's a small unit that can handle two large machines at the same time. It has a super handy 20-gal. collection drum with quick-release handle catches for heavier, bigger material. And its pleated 1-micron filter catches finer dust. The unit proved so good I bought one for myself.

This dust collector is perfect for my small one-person shop. For starters, I was able to assemble it alone, with the exception of the large and heavy motor assembly. I needed five minutes of help from a friend to lift it, set it on the support legs, and secure it in place. The manual says you'll need two others, but we made it work.

My shop is 20 ft. by 24 ft. This machine takes up just under 8½ sq. ft. of floor space and has radically improved the air quality. I move the hose from machine to machine—tablesaw, jointer, planer, bandsaw—and it has worked well on all of them. One of my favorite features is the collection drum. Its bag is easy to carry and dispose of in my weekly trash, but the quick-release and sealing system means the whole process is no longer a dreaded task. It takes about three minutes, two of them to walk to the trash and empty the bag and walk back. The filter portion has a built-in handle that cleans the filter, dropping the dust into a collection bag that is just as easy to empty.

—Anissa Kapsales is an associate editor.

Dust collector
by Grizzly
\$775



A well-sized bag. The 20-gal. drum is a perfect size for a one person to handle quickly and easily.



Never lose the handy remote. Kapsales's favorite feature is the wireless remote, which she keeps attached to her shop apron for quick access.



Castors for easy mobility. The swivel casters move well, making it easy to move the machine around the shop without getting caught up on little debris.

■ ACCESSORIES

DIY power feeder

I'M A BIG FAN of little power feeders. They can turn a router table into a small shaper, take the tedium out of ripping stock on the tablesaw, and allow a bandsaw to resaw without all the irregularities of feeding by hand. They also provide a big safety margin. The Little Proteus delivers all this and works excellently.

I was impressed with how accurately the feeder controlled stock. The tires are soft with lots of traction to keep the feed consistent, and the springs holding the tires to the material are stout. The feeder easily sets up anywhere you can mount a T-track, like at the top of a router or tablesaw fence. The bandsaw setup uses an attachment that clamps to the tabletop. The feeder can be angled too.

You can buy the Little Proteus in several different stages of completion, each requiring different levels of DIY. These start with a very basic kit; then there's a complete hardware set and plans (you make the wooden parts). The final kit, the one I tested, includes everything except the motor, a brushless hand drill. Believe it or not, the drill works wonderfully.

—Roland Johnson is a contributing editor.



A drill drives the feeder. Instead of coming with a motor, the Little Proteus has you supply your own, a simple cordless, brushless hand drill, allowing for infinitely variable speed.

Some assembly required. The power feeder comes in different kits, from just the plans to all the parts needed to assemble the complete feeder.

Power Feeder from Al Ladd
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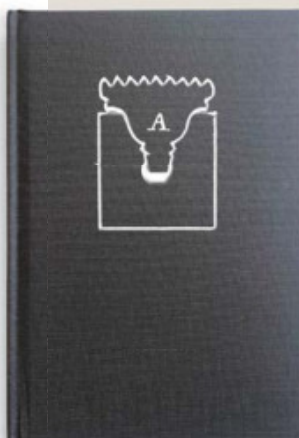
■ TOOL NEWS

New tools to look out for



Sanding guide for angles

Festool's new edge-sanding guide promises to bring some balance to sanding. The pivoting cradle attaches to the company's 5-in. ETS 125 REQ and the ETSC 125 random-orbit sanders. It works on different edges, angles, or curves.



New workbench book

If one thing unites woodworkers, it's our love of workbenches. Christopher Schwarz's latest book with Lost Art Press, *The Anarchist's Workbench*, combines the author's decades of research into the form and function of benches, as well as a detailed plan for a bench that can be made using basic tools and standard construction lumber.



Drawknife with tougher steel

For those looking for a small drawknife in modern steel, Veritas's 4-in. Carver's model is now available in PM-V11 tool steel. It comes with a blade guard.

—Barry NM Dima is an associate editor.



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Make custom hardware with basic tools

BY CLARK KELLOGG

Although I like to think of myself as a woodworker, almost every project I build tends to involve at least a few metal components, if not by design then by necessity. Commercial hardware is generic in both style and function, and therefore often poorly suited to the task. If I'm going to spend months designing and building something intended to outlast me by 100 years, why settle for hardware that looks store-bought or mediocre?

The good news is that you already own many of the tools needed to make your own hardware, and it will only take another handful to start making beautiful, useful parts out of metal. To keep you from getting lost in a machinist's catalog that's the size of a phone book, I'll give you an essential list of tools and materials to get you up and running, along with a starter project—brass tabletop fasteners—that will let you develop many key skills.

Start with brass bar stock

Brass is the perfect material for furniture hardware. It's affordable, readily available, easy to work, and it ages to a warm patina that goes great with almost any wood. And like most metals brass comes in various sizes of flat and round bar stock, which you can simply cut to length for almost any hardware component, leaving you minimal shaping to do.

But you probably won't find what you need—such as $\frac{1}{8}$ -in.-thick brass bar stock—at a local hardware or art-supply store. Those tend to carry flat stock that's $\frac{1}{16}$ in. or thinner. If you're in a city with an industrial base, you might be able to find a local dealer specializing in the “red” metals: brass, bronze, and copper. I've had good luck with Morris Metals here in Houston, as well as Metal Supermarkets, a nationwide chain. Online there are several very good sources that specialize in small orders, such as McMaster-Carr and onlinemetals.com. Be sure to order

TABLETOP TABS TEACH THE BASICS



Handmade from every angle. Custom brass tabletop tabs make the underside of these tables look as handcrafted as the top.



Match the look to the piece. Kellogg uses simple polishing and shaping techniques to adapt the look of the tabs to the style of the furniture he's building. Note how age and oxidation have given the installed tab at center a warm, matte look.

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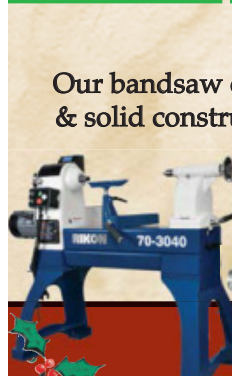
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#360 “ultra-machinable” brass. While brass can be milled with most woodworking machines, it is imperative that pieces be held securely. Brass tends to grab sawblades and drill bits, and there is a very real risk of your workpiece instantly becoming a propeller or projectile.

Wide range of easy finishes

You have a few finishing options. The simplest is just to sand everything to 400 grit, for a “brushed” finish. The best way to sand metal is to adhere the paper to a flat surface and rub the part on it. The other option is polishing brass to a bright finish: Start with 220-grit, follow with 400- and 600-grit wet-or-dry paper—all stuck to something flat—and then scrub with 0000 steel wool. Or buy a Scotch-Brite deburring wheel for your bench grinder. Then you can stop sanding at 400 grit, and polish the brass in a tiny fraction of the time. I use the wheel to soften hard corners, too.

To add final polish and protection, whether the finish is brushed or shiny, I follow with Nevrr-Dull polishing compound, applied with wadding (it’s in the can).

Wear gloves and a mask while sanding and polishing, since brass dust can contain lead.

Darken brass for a gunmetal look—One of my favorite finishes for brass is patination, which involves coloring the surface of the metal with a chemical reaction. For a dark, gunmetal finish on brass, I use “Brown-Black Darkener” for brass, bronze, and copper, by JAX Chemical.

To use any patination chemical, the first step is to remove all traces of dirt, oil, or other contaminants from the surface. Even a fingerprint can keep chemicals from bonding properly, so be sure to wear gloves throughout the process. After sanding and polishing, I scrub the hardware with acetone and a blue shop towel, followed by “No Name Patina Prep,” a mildly abrasive powder made by Reactive Metals Studio (riogrande.com).

After that, rinse the parts with cold water and immediately submerge them in the patination solution. You’ll see them start to change instantly. Give them a minute or two in the solution, remove them, and rinse again. Don’t leave them in too long: After 5 or 10 minutes, the patinated surface will start flaking off. Finally, buff the parts gently with Renaissance Wax. Don’t use Nevrr-Dull, which reacts with the chemicals.

A few metalworking tools go a long way

Just as with woodworking tools, you get what you pay for in metalworking. Try to buy your tools from a local machinist supply house, or a reputable online retailer such as McMaster-Carr or Rex Supply. Most catalogs will offer a range of seemingly identical tools—usually relatively expensive “domestic” versions followed by one or two more affordable “import” tools.

A few new tools and supplies

You can do beautiful work in metal by adding just a few specialty items to the woodworking tools you already have.

3-IN. DRILL PRESS VISE

McMaster-Carr #52855A21

When doing any sort of machining, it is essential that the work be held firmly in place, both for safety and accuracy. While an ultra-precise machinist’s vise can run to thousands of dollars, Kellogg has had great luck with this little drill-press vise.

NUMBERED DRILL BITS

#1-#60 gauge, McMaster-Carr #31055A62

A halfway decent set of numbered drills is crucial for drilling precise holes in metal. They are sized in thousandths of an inch instead of the usual $\frac{1}{16}$ -in. or $\frac{1}{8}$ -in. increments, and they’re an order of magnitude nicer to use than wood/metal combination bits from the hardware store.

Online Extra

For an expanded list of Kellogg’s suggested metalworking tools, go to FineWoodworking.com/287.

ADHESIVE-BACKED SANDPAPER

3M Gold, 220-grit

Works great for flattening the edges and faces of brass stock, which comes with rolled edges and mill marks.

FREUD LU89M THICK NON-FERROUS TABLESAW BLADE

Rockler.com #22521

This blade has a negative rake angle designed for cutting through metal. Avoid using a regular tablesaw blade, as the forward-rake angle used for cutting wood is far too grabby and potentially dangerous for metal.

POLISHING WHEEL

3M Scotch-Brite Grade 8S "Fine Grit" EXL Deburring Wheel, amazon.com
It takes a little bit of practice, but this wheel turns an hour of polishing with steel wool and Nev-Dull compound into a job of a minute or less.

LAYOUT FLUID

Dykem Steel Blue (or Red) Layout Fluid, Bass Tool

Makes layout marks clear and obvious, and wipes away with acetone.

SCRIBER

General Tools 85 Single-Point Scriber, amazon.com

Used in conjunction with layout fluid (see above), a scriber works like a marking knife for metal, offering a way to quickly and precisely lay out measurements on your workpieces.

6-IN. DIAL CALIPER

Metal (not plastic), with 0.001-in. graduations

Working with metal, you generally have very little room for error, particularly when it comes to machining small parts. Calipers allow you to measure and lay out distances in the thousandths of an inch—impossible to do with an adjustable square.

CENTER PUNCH

Stanley 58120 1/8 in., amazon.com

Because metal drill bits don't have a spur center like brad-point bits, they can skate across the surface of your workpiece. A center punch leaves a tiny divot, which keeps the drill bit right on the mark as it engages.

MEDIUM FILES

Nicholson Flat-Smooth, 6-in., Amazon.com

Fresh, high-quality files cut brass smoothly and efficiently. Like a freshly sharpened plane blade, they are a joy to use. Pretty soon, you'll want to add fine files, including a needle file.

3/8 X 82° 6-FLUTE HSS COUNTERSINK BIT

McMaster-Carr #27885A35

A lot of countersinks vibrate and leave chatter marks in metal, but this one doesn't, especially if you slow its speed.

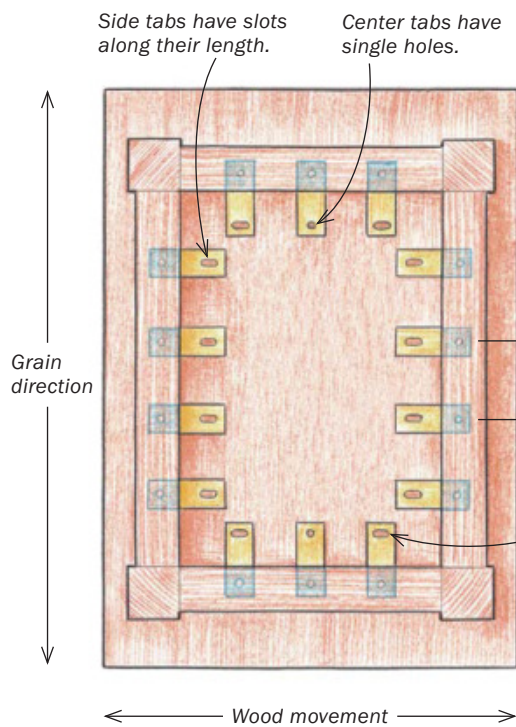
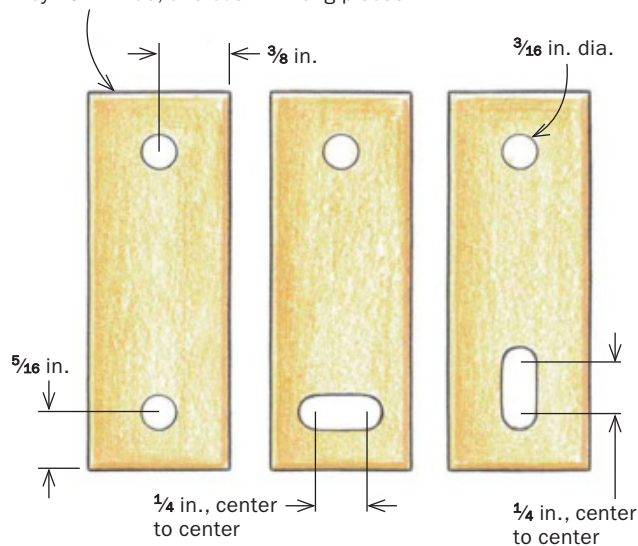
Making tabletop tabs

Custom table-attachment tabs, made from standard brass bar stock, will teach you many of the skills you'll need for more ambitious projects.

THREE VARIATIONS

Kellogg makes the tabs in three variations, to lock the tabletop in place or allow wood movement in two directions.

Choose brass bar stock that's $\frac{1}{8}$ in. thick by $\frac{3}{4}$ in. wide, and cut 2-in.-long pieces.



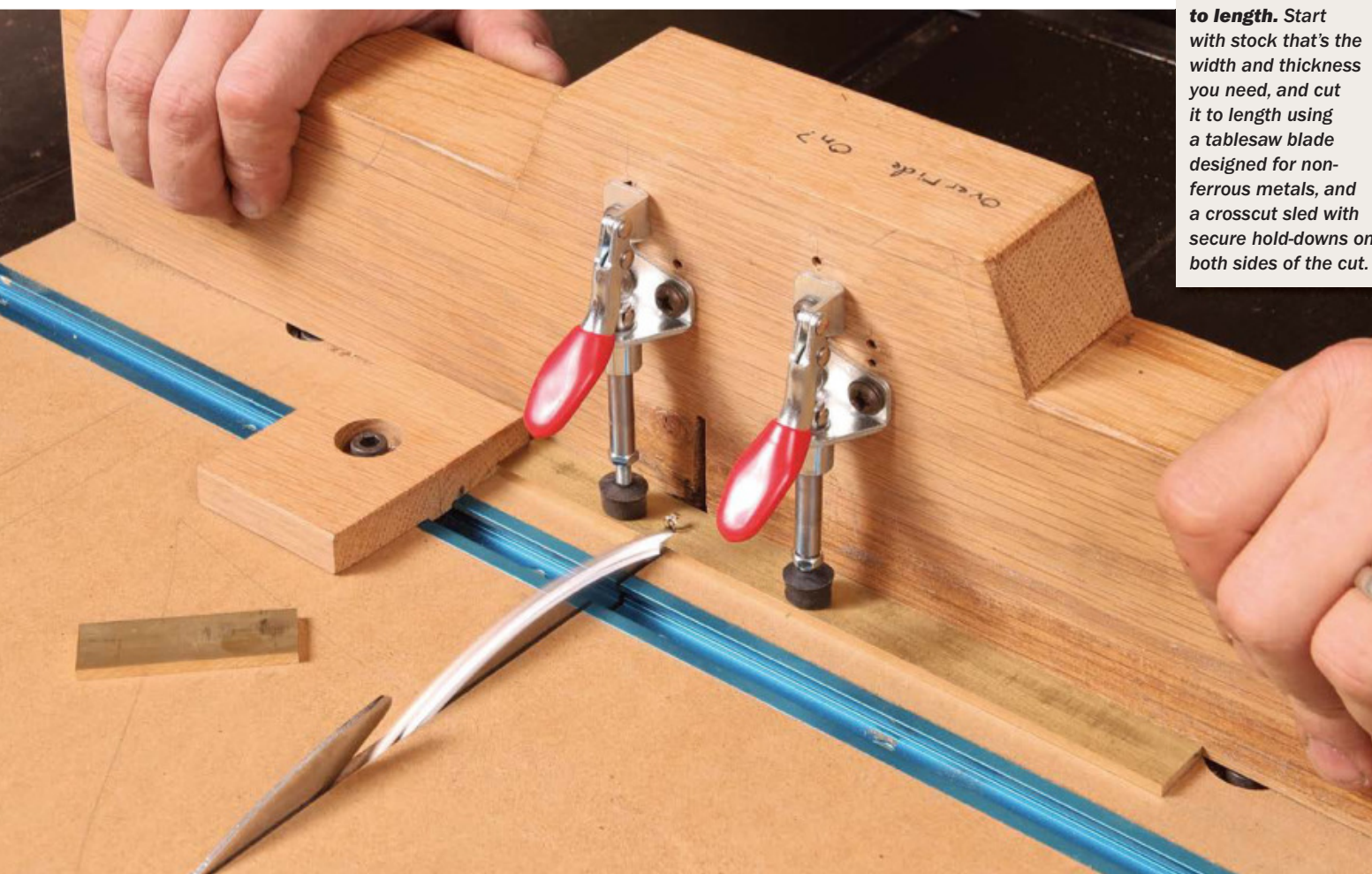
SLOTS ALLOW MOVEMENT

A single hole is used in the two center tabs while the other tabs are slotted to allow seasonal movement across solid-wood tops.

Space tabs 12 to 18 in. apart around table base.

Outer tabs at ends of table have slots across their width.

Cut brass bar stock to length. Start with stock that's the width and thickness you need, and cut it to length using a tablesaw blade designed for non-ferrous metals, and a crosscut sled with secure hold-downs on both sides of the cut.



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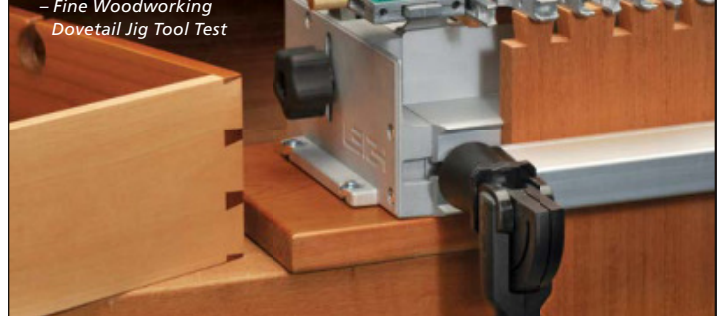
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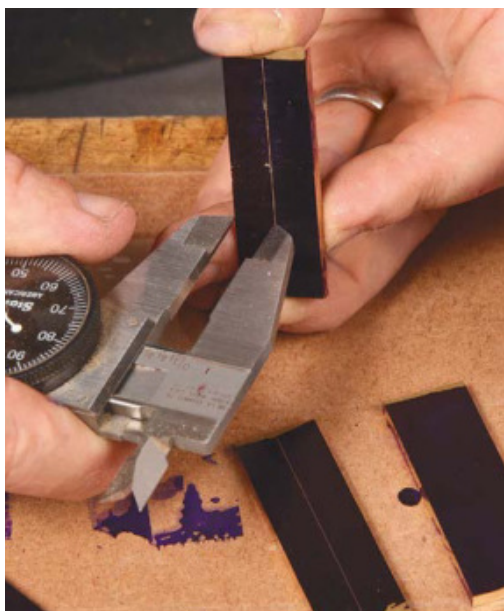


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LAY OUT THE HOLES AND SLOTS

Layout tricks. For accurate, visible layout on metal, start with a quick coat of layout fluid. After that a dial caliper can be used like a marking gauge (right), and a metal scriber like a marking knife (below).



Accurate holes start with a dimple. A center punch leaves a small dent, which keeps the drill bit from wandering.

Beyond the price, I haven't found much difference between the two. That said, be careful about buying metalworking tools from a hardware store or home center: These are usually of inferior quality, with all the attendant headaches. Finally, if you are willing to wait, Craigslist, estate sales, and flea markets can all be great sources for used tools, but *caveat emptor*, as they say.

Great first project for new metalworkers

I try to finish my pieces so the inside looks as good as the outside. To that end, when I build a table, I use shopmade brass tabs to attach the top to the base. Their design is based on plates James Krenov made for some of his cabinets, adapted to account for the seasonal movement of a solid top.

To accommodate movement in the top, I make a few variations of the tabs, two for small tables and three for large ones. Each has either a simple through-hole to accommodate

a #8 or #10 screw, or a slotted hole running lengthwise or crosswise, with a brass round-head screw.

Cut bar stock to size—For tabletop tabs I use brass bar stock that is $\frac{3}{4}$ in. wide by $\frac{1}{8}$ in. thick. I start by cutting it into 2-in. lengths, using the specialty blade on the tablesaw, in conjunction with a purpose-made crosscut sled with a built-in stop and—most importantly—integrated hold-down clamps.

Note to SawStop owners: Be sure to activate the brake override. I've been reminded of this the hard way.

Lay out the holes and slots—Start by applying a thin coat of blue or red layout fluid to one face of each tab. Don't worry about being neat here; the fluid is easily removed with acetone. Once it dries, scribe a centerline along each tab (above).

Drill holes and cut slots—Clamp or bolt a small metalworking vise onto the drill-press table. If you don't have one, a wood hand-screw clamp will do. You can also make a plywood fixture with a fence, stop, and hold-down clamp.

DRILL HOLES AND CUT SLOTS



Two ways to hold work for drilling. Metal parts must be held securely for all cutting activities, including drilling. If you don't yet have a drill-press vise (left), a hand screw will work (right). Use a very slow speed for drilling brass.



Clean countersinks. To avoid chatter in brass, keep the speed very slow and use a 6-flute bit like the one listed on p. 23.



Turn holes into slots. To make a slot, drill a hole at both ends, saw out the waste with a coping saw or jeweler's saw—threading a metal-cutting blade through the holes—and then use a flat or half-round needle file to flatten the sawcuts.

TIP

SLOT MORTISERS CAN MILL BRASS



These days, Kellogg cuts slots in one step—no pre-drilling required—on his Multi-Router, using a special hold-down and an all-carbide, up-spiral bit in a series of shallow passes.

Bring one of the punched center points in line with the drill chuck and slowly drill through the brass. Just as with wood tools, you should see chips or shavings rising, not dust. Drill all the holes.

Next, set up a countersink bit in the drill press and slowly feed the bit into the piece until it will accommodate a #8 or #10 screw head.

Cut out the slots with a coping saw and smooth them with a thin “needle” file. Be sure to use a metal-cutting (preferably non-ferrous) blade in your coping saw. Or buy a small jeweler's saw, which takes a range of thin metal-cutting blades and also works great for curvy cuts in thin brass, which you can finish smoothing and shaping with files.

For even faster slots, a slot mortiser will do the job in a single step, with no pre-drilling. I use my Multi-Router, set up with a 1/8-in.-dia. end mill bit, clamping the tabs down in a dedicated fixture and milling the slots in slow, shallow passes.

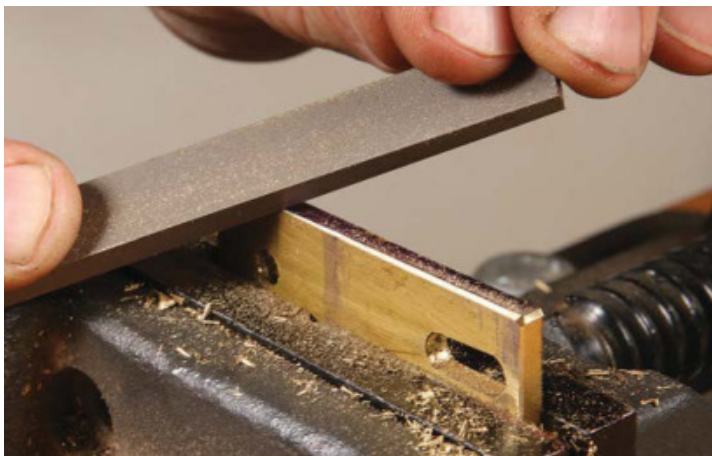
Clean up, polish, and install—Before the tabs are installed, get everything cleaned up and polished. Flatten each tab on 220- and 400-grit paper stuck to a flat surface. I usually detail the visible side of the pieces by breaking the sharp corners and filing a chamfer around the edges. Finally, I polish the tabs using the methods described above.

Installing the tabs is like mortising hinges. Lay out the finished tabs around your table base, with the countersunk holes centered on the thickness of each apron. Then attach each tab temporarily with a #8 or #10 flathead screw, and scribe around each one.

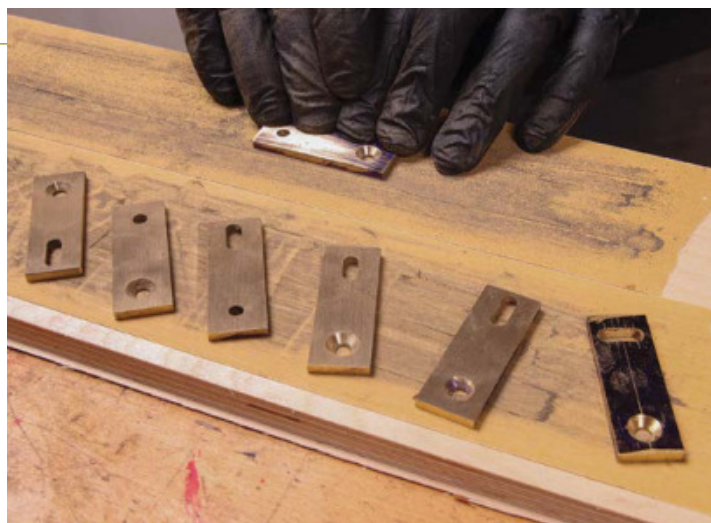
I use a trim router with a straight bit to cut the mortises, clean up the edges and corners with chisels, and install the tabs with flathead screws. Last, I flip the base onto the underside of the top, and install it with brass roundhead screws.

Clark Kellogg is a furniture maker in Houston, Texas.

CLEAN UP, POLISH, AND INSTALL



Break the edges. Soften edges and remove sharp burrs with a flat, medium file. Kellogg often adds a distinct chamfer on the edges.



Sand first. Brass bar stock has slightly rounded surfaces. Flatten it on 200-grit sandpaper, stuck to a flat surface, and continue polishing on 400-grit paper. For a brushed finish, stop there.



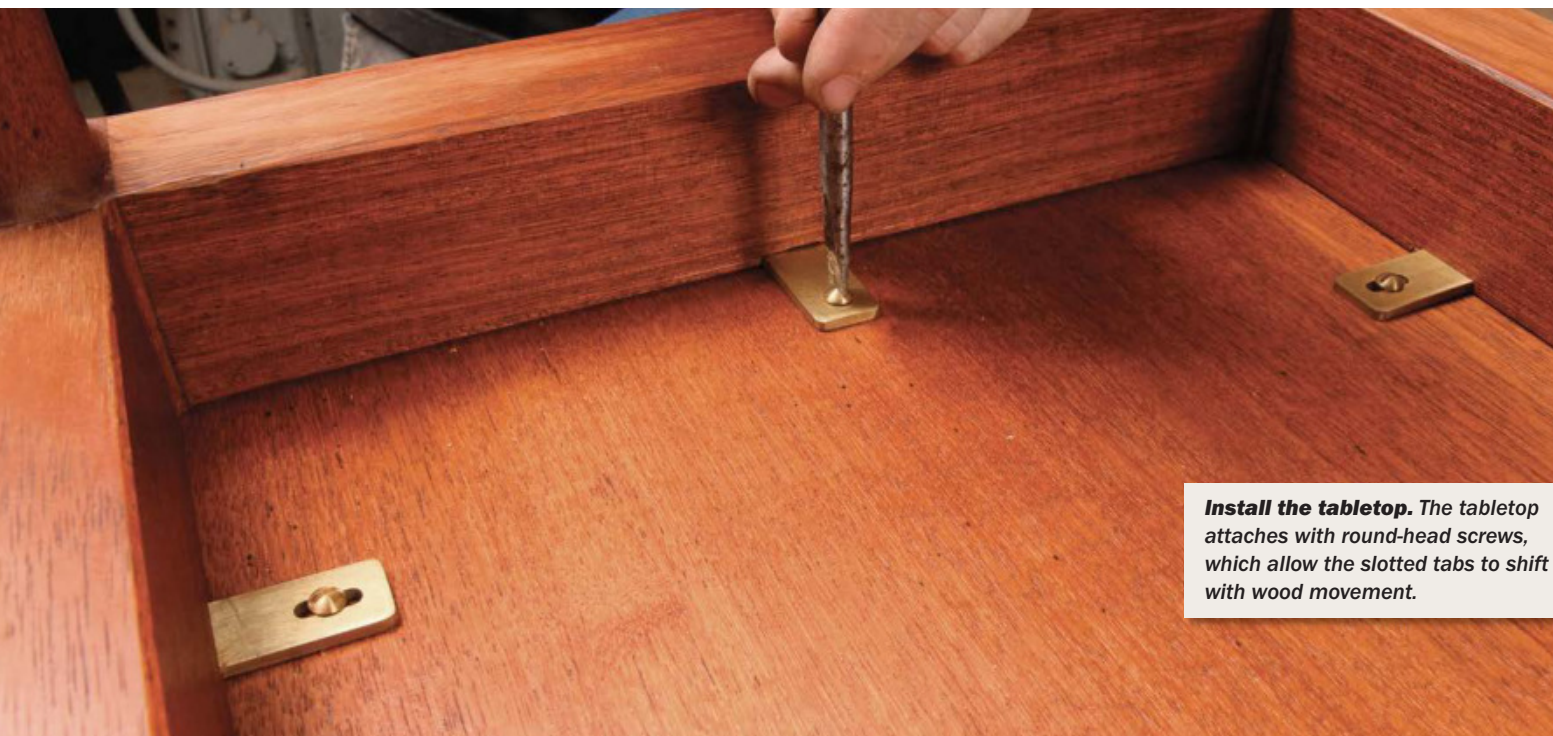
Polish second. For a quick, bright polish and softened edges, buy a Scotch-Brite wheel for your bench grinder. If not all of the part will be visible, polish only as needed.



Quick, accurate mortises. Screw the tabs temporarily into position and scribe around them with a marking knife. Rout away most of the waste freehand and chisel to the lines.



Install the tabs. The tabs drop snugly into their mortises in the apron, held in place with flathead screws.



Install the tabletop. The tabletop attaches with round-head screws, which allow the slotted tabs to shift with wood movement.



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Light and Lively Side Table



I'm a huge fan of using continuous grain in my furniture. I think it clearly shows intention, which is something that I strive for. I want people to understand that the details in my work do not happen by chance. One common way that people use continuous grain is with drawers, where they'll use a single board for a row of drawer fronts, making sure to cut and sequence the fronts so that the grain appears to flow from one drawer to the next, interrupted only by the vertical

Behind the front's
flowing grain lie
simple and smart
building strategies

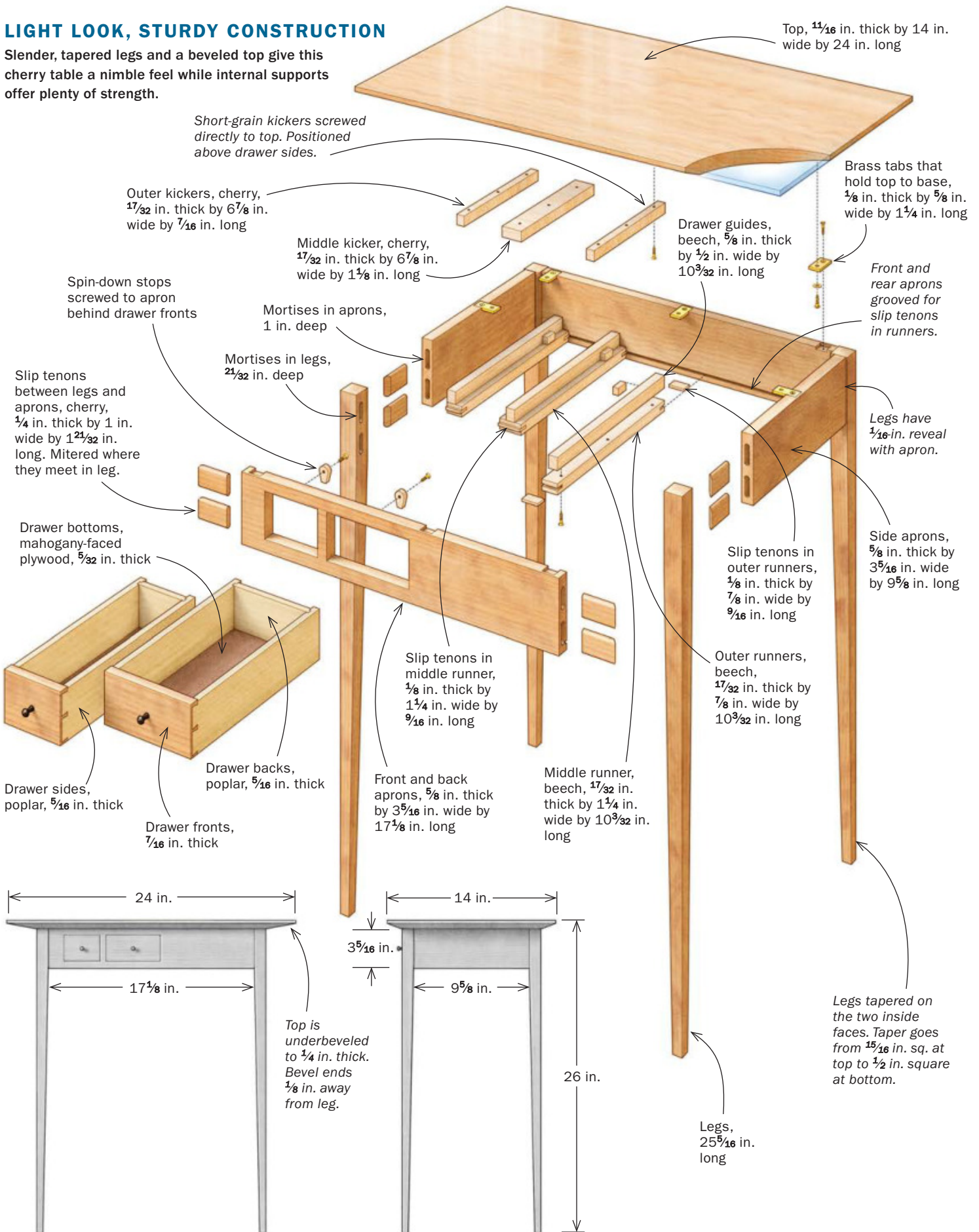
BY MIKE KORSAK

dividers that separate the drawers.

When I can, like on this table, I take this approach a step further and cut out virtually all interruption, wrapping the grain across the apron as well as the drawer fronts. My method for achieving this is to rip the apron blank into three strips, cross-cut the middle strip to separate the drawer fronts from the rest of the apron, then reassemble the parts (minus the drawer fronts) back into a single apron. Done methodically, this technique produces an apron

LIGHT LOOK, STURDY CONSTRUCTION

Slender, tapered legs and a beveled top give this cherry table a nimble feel while internal supports offer plenty of strength.



Apron and drawer fronts

The table's entire front apron comes from a single board.

Top apron strip, $\frac{5}{8}$ in. thick by $17\frac{7}{32}$ in. wide by $17\frac{1}{8}$ in. long

Middle segment (vertical divider), middle apron strip, $\frac{5}{8}$ in. thick by $2\frac{3}{16}$ in. wide by $\frac{1}{2}$ in. long

Right segment, middle apron strip, $\frac{5}{8}$ in. thick by $2\frac{3}{16}$ in. wide by $7\frac{13}{16}$ in. long

Left segment, middle apron strip, $\frac{5}{8}$ in. thick by $2\frac{3}{16}$ in. wide by $1\frac{5}{16}$ in. long

Left drawer front, $\frac{7}{16}$ in. thick by $2\frac{3}{16}$ in. wide by 3 in. long

Right drawer front, $\frac{7}{16}$ in. thick by $2\frac{3}{16}$ in. wide by $4\frac{1}{2}$ in. long

Bottom apron strip, $\frac{5}{8}$ in. thick by $19\frac{9}{32}$ in. wide by $17\frac{1}{8}$ in. long

SAWING



Bandsaw the first long apron strip. A bandsaw's narrow kerf removes less material, which better maintains the continuity of the grain. The workpiece should be extra wide and long to account for the kerfs.



Joint the bandsawn edge. The piece is still wide enough to let you use a jointer. Take a very light pass to remove sawmarks and true up your reference edge.



Second rip separates the middle from the second long apron strip. Keep the freshly jointed reference edge against the fence and use a steady feed rate to reduce sawmarks and cleanup.

and drawer fronts that have consistent, closely matched grain that appears to flow from one part to the next.

Less apparent, but equally interesting—at least for us woodworkers—is the way I construct the table's internals. I have an uncommon way of building the kickers, runners, and guides that reduces my headaches when fitting the drawers.

Sliced and diced apron

I've made a few tables with this method, and I've streamlined the process. Because the vertical dividers between the drawers are short grain, I used to add long-grain splines to reinforce them. But then I realized this table and its drawers are small, and unlikely to be under much load. The splines started to look like a belt-and-suspenders step, so I omit them now.

Once I select the board for the front apron, I want to remove as little material as possible when cutting it up. This is important



Crosscut the middle apron strip into the drawer parts. Using a crosscut sled, Korsak separates the wide middle strip into the two drawer fronts, the narrow vertical divider between the drawer fronts, and the two pieces of apron flanking the drawers.

GLUING



Use the drawer fronts as assembly spacers. Take five or six plane shavings from the same edge on each drawer front and wax around their perimeters. You'll glue up the front apron with the drawer fronts in place, and you don't want them interfering with the assembly or getting glued in.

because the more material that is removed, the harder it becomes to maintain the continuity of the grain pattern. So I used the bandsaw, with its thin kerf, instead of the tablesaw to rip out the three apron strips, and took only light passes with my jointer and handplane when jointing edges afterward.

To cut up the apron's middle section, I used the tablesaw and a crosscut sled.

With the front apron sliced and diced, it was time to start putting it back together. To begin the reassembly, I started by planing a few shavings off the top edges of the two drawer fronts. This ensured that the drawer fronts were ever-so-slightly narrower than the three other middle apron parts. I also applied a light coat of paste wax to the edges and ends of the drawer fronts. This way, I could use them as spacers when gluing up the other parts without inadvertently gluing them in place.

While the glue dried on the apron, I tapered the legs at the bandsaw and cleaned them up by hand. I also thinned the drawer fronts to $\frac{7}{16}$ in. so they visually worked better with the thin drawer sides.

Double slip tenons are stronger

Next up was the joinery for connecting the aprons to the legs and the runners. I almost never use integral tenons; I much prefer slip tenons. I find they are easier to make and yield a more consistent result.

I thought the aprons were too wide to use a single wide slip tenon for each leg.

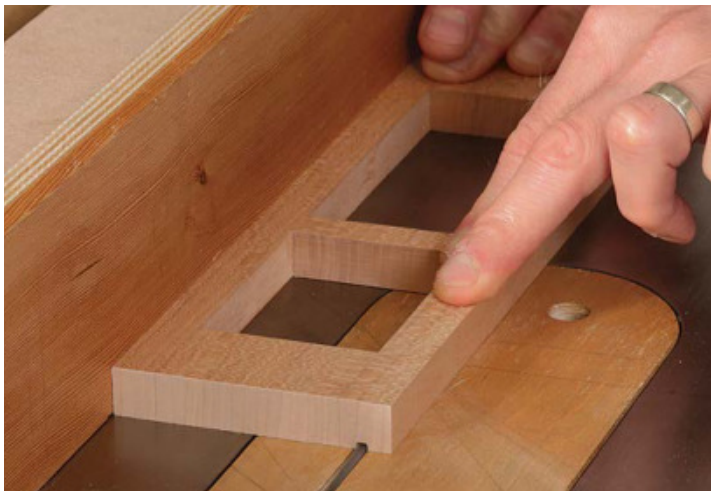


Glue up the front apron one part at a time. There are a lot of parts in play, so Korsak glues up the apron piece by piece instead of all at once. Blue tape keeps the unglued parts aligned and in place while the other parts get glued.

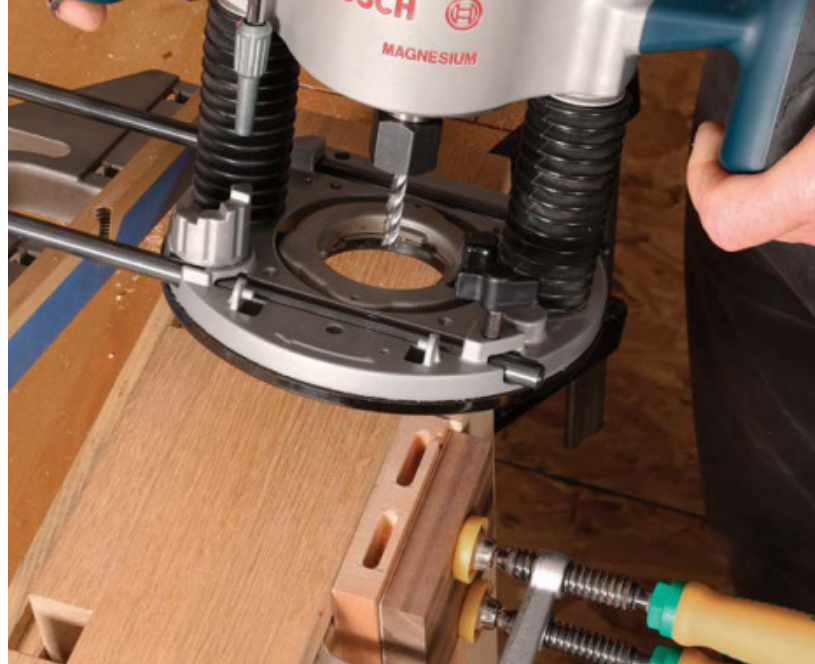


Wide plywood cauls even out clamping pressure. The top and bottom apron strips are long and narrow, so to help distribute clamping pressure across the whole assembly, Korsak uses wide cauls.

Slip-tenon joinery



Groove the front and back aprons for the runners. After cutting the aprons to final length, Korsak runs a groove their entire lengths, making it easy to slide the runners into the correct position. He uses a flat-top rip blade.



Legs and aprons connect with slip tenons. Korsak uses a plunge router with a $\frac{1}{4}$ -in. end mill to cut the mortises. He mills the slip tenons from stock of the same species and similar grain as the aprons, in this case quartersawn cherry.

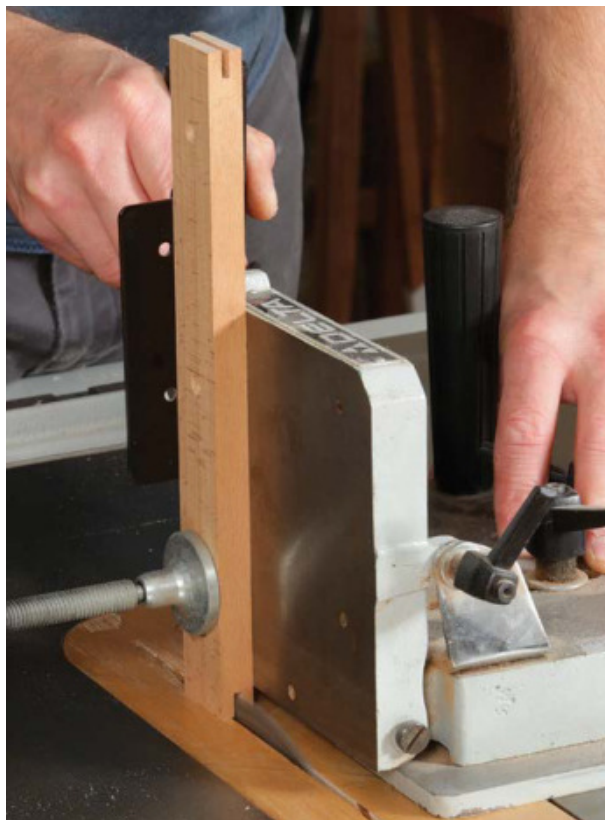
So instead of a single tenon at each joint, I used two.

When laying out the mortises, I reference off the top of the legs and aprons. The mortises are centered in the apron's thickness, but be sure to adjust your setup to account for the $\frac{1}{16}$ -in. inset. I find a spacer handy for this.

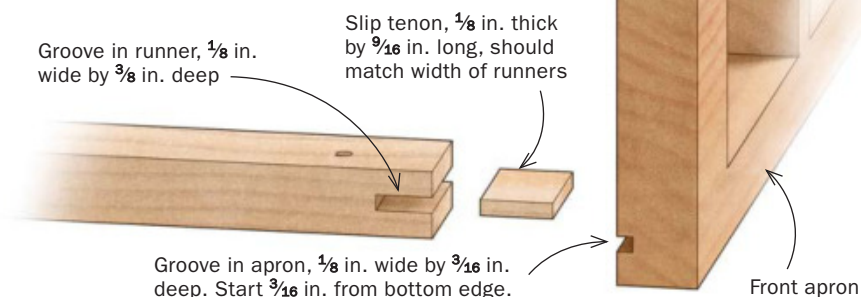
When selecting stock for slip tenons, I believe it's best to use the same material and same cut (quartersawn, riftsawn, etc.) as the parts the tenons will be mortised into. In the case of the table's apron, that meant quartersawn cherry. This is easy to do since there's always some waste that can be used for slip-tenon stock.

My normal practice with slip tenons is to fit each tenon to its respective mortise rather than just milling tenon stock to a certain thickness and hoping that all the tenons will fit their mortises. By fitting individual slip tenons, I can fine-tune the fit of each, ensuring nice tight joints all around. I use a block plane for the fitting and calipers to check my progress. This may sound like a lot of work, but it doesn't take that much time. To me, the extra time is offset by the benefits of having tight-fitting joints. As I fitted the slip tenons, I marked each tenon and its respective mortise, so that I knew which slip tenon went with which mortise.

Slip tenons also connect the runners to the aprons. The drawers in this table are small, and most likely won't carry loads of any real significance. So I felt comfortable



Runners get an open mortise for a slip tenon. Cut these slots using the same blade you used to groove the aprons. Position the slots so the tops of the drawer runners are flush with the bottom of the drawer openings.



using thin slip tenons to join the runners to the front and back aprons. Because the table and drawers aren't large, I run a groove the length of the apron rather than making stopped cuts for individual mortises. I used a flat-bottom rip blade to cut the grooves in the aprons and the slots in the ends of the runners. Groove the apron first, then position the slot on the runners so the runners' top face will be flush to the drawer opening. Before cutting the slots, dry-fit the table to get the length of the runners.

The last step in preparing the drawer runners was to drill and countersink them to accept the screws that will attach the drawer guides.

Keep assembly methodical



Glue the rear legs to the rear apron. With the slip tenons glued in the legs, attach the apron to the legs. Korsak uses leather cauls to protect the legs from the clamps. Glue the front apron to its legs now too.



Attach the side aprons and runners to the rear assembly. After gluing the side aprons to each rear leg, attach the runners. Dry-fit the front apron and use it as a caul and to keep parts aligned. The runners are predrilled for the screws that will secure the drawer guides.

Assemble in an afternoon

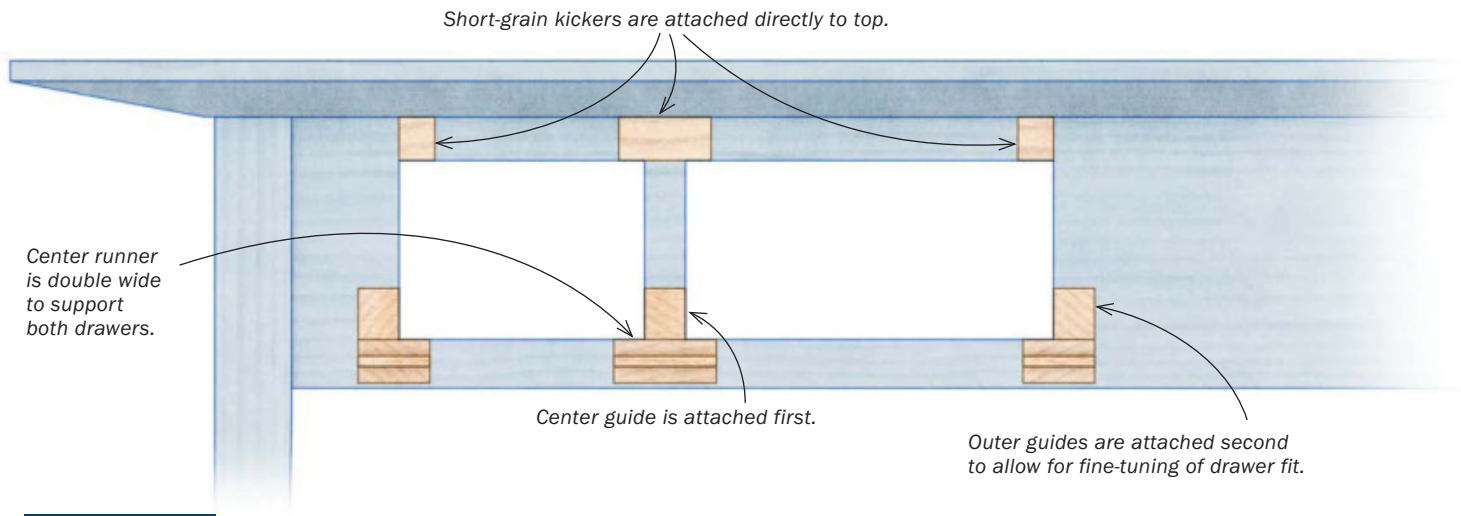
With the parts made and joinery cut, it was time for assembly. But first, I did final surface preparation on all of the visible surfaces of the legs and aprons. I used a smoothing plane before sanding to 320 grit. After cleaning the surfaces with a shop vacuum, I used a block plane to chamfer the corners of the bottom edges of all the aprons, as well as the corners of the legs.

When I embark on a complex glue-up, I always prefer to break it down into smaller units, as opposed to trying to assemble multiple parts at one time. Yes, it takes longer, but I much prefer taking my time and focusing on getting a single joint as close to perfect as I can. I have been party to enough "I'll just wing it" glue-ups to know that the results can be suboptimal.



Glue the front assembly to the rest of the table. Like before, have the tenons already glued in the legs. Then glue this assembly to the side aprons and runners.

Novel solution for kickers and guides



KICKERS



Short-grain kickers move with the top. Korsak makes kickers with their grain running the short dimension so he can attach them directly to the tabletop, knowing they'll expand and contract in concert with the top.



Screw the top to the base. Because attaching the top could realign things, Korsak attaches it to the rest of the table before installing and adjusting the guides. He drills the tab holes oversize to allow for seasonal movement.

Following that line of thinking, my first step was to glue the slip tenons into their respective leg mortises, letting me focus on good glue coverage and good contact where the mitered tenons meet. From there, I glued the front and back aprons to their respective legs, one leg at a time. Next was attaching the side aprons and runners to the rear assembly before finally bringing in the front apron. If you glued one part at a time until this point, this last glue-up will go as smoothly as possible.

After underbeveling the top to lighten its appearance, there's a special step: screwing the short-grain kickers to the underside of the tabletop. Instead of building these into the base, the traditional method, I attach them directly to the top. The short-grain strips will expand and contract with the top.

Before installing the guides and stops, I attach the top to the base. Screwing it on now makes installing the guides and stops a little trickier, but I think it's still smarter. If I waited until after, the top could rack the base, messing up the travel of the drawers.

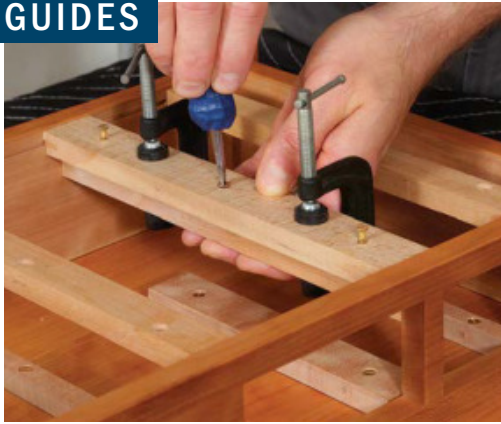
Guides, stops installed around drawers

My drawers are pretty traditional affairs: half-blind dovetails at the front, a lock rabbet at the back. The sides and back are quartersawn poplar, a stable wood that's easy to dovetail. The kickers are cherry, and the runners and guides are beech, more durable woods. And like the runners and kickers, the guides follow a nontraditional approach.

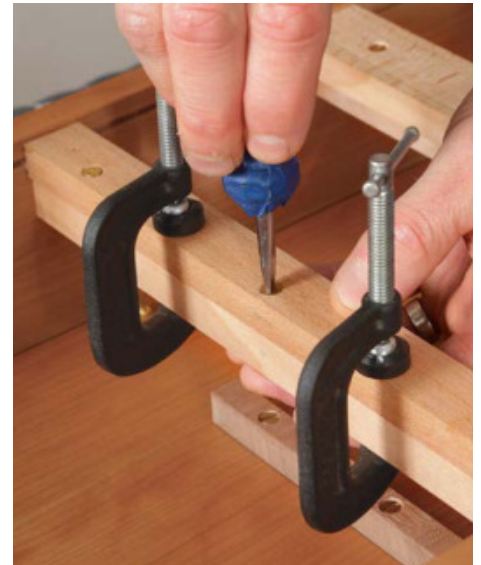
With the finished drawers in hand, I tailor-fit each drawer pocket by shifting the outer guides. To begin, with the table

GUIDES

Begin by attaching the center guide. Glue and screw this in place. Position it so each drawer travels well, and the drawer fronts are parallel with the front apron.



Loosely clamp an outer guide in place. You want to be able to move the guides without them slipping too much. Position the clamps so they don't interfere with the drawer.



Check the fit of the drawer and adjust the outer guide as necessary. By leaving the outer guide loosely clamped, you can tailor-fit each drawer pocket to its respective drawer. Glue and screw the guide in place once the drawer slides true.

upside down, glue and screw the middle guide in place. Next, gently clamp an outer guide in place. You want firm pressure, but not so firm that you can't wiggle the guide if necessary.

Next, test the fit of the drawer. Do this with the table right side up to see how the drawer will move in real life, not upside down on your bench. When you're happy with the drawer's travel, tighten the clamps and screw the guide in place. Then you can add the stops, which I glue to both the runner and the guide. Have the drawers in place when figuring out where to place the stops. □

Mike Korsak is a furniture maker in Pittsburgh, Pa.

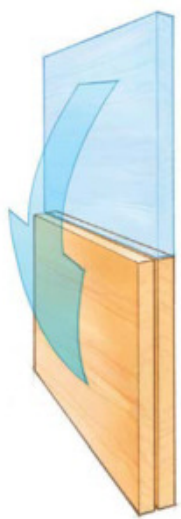
STOPS



Install the drawer stops. To keep the drawers from pushing in too far, Korsak adds small stops at the back of the drawer pocket. Glue these to the runner and guide.

PERFECT GLUE JOINTS

Fold the boards for a flat glue-up. After figuring out their orientation in the final panel, close the boards like a book with the glue joint at the spine. This way, when you plane their edges, you'll guarantee the edges meet at supplementary angles even if they aren't exactly 90°. Clamp them near the joint before planing.



By folding the boards together and planing both edges at once, you'll end up with a flat panel even if the angle of the edges is out of square.



Planing

Use your smoothing plane for more than just smoothing

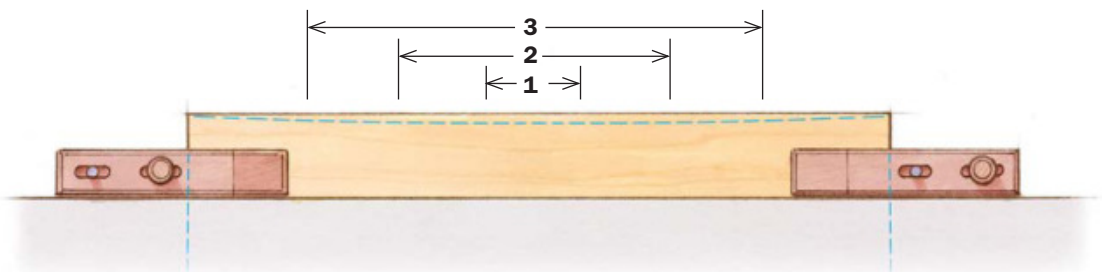
BY BOB VAN DYKE

It was not until I started working with Will Neptune years ago that I began to appreciate the value of a systematic approach to working with a handplane. Until then, I had used one for smoothing and making pretty shavings, and completely missed the level of precision possible. By approaching planing tasks, including joinery, systematically, I've been able to work more accurately using just a single plane, my No. 4, whose small size lets me target specific areas effectively.

The key is to plan and count your strokes. Most plane shavings are around 1–3 thousandths of an inch thick—the average piece of paper is 3 thousandths of an inch thick—making the handplane an incredibly precise tool for adjustment. By mapping out and counting the strokes, you can predict and control your results. This means precision doesn't come from taking a heavier or lighter cut,



Add a slight hollow along the joint. Start in the middle and work your way out with progressively longer, overlapping strokes. Take as many passes as you need, with the second to last shaving starting and stopping about ¼ in. from the ends.



with Precision

but by keeping track of how many passes you have made—and where you've made them.

Better edge joints

One of the most useful and rewarding tasks with a handplane is creating spring joints. This traditional technique is used to edge-glue two boards together, and it allows you to easily align boards that are at their final thickness. Thus, the technique is extremely useful when gluing up tabletops or panels that will be wider than the capacity of your thickness planer. The idea of the spring joint

is to create a small hollow in the middle of the joint that gradually tapers to nothing at the ends. This is done with overlapping cuts, beginning in the middle and working outward. I find the technique easiest on boards shorter than 4 ft.

Orient the boards as they'll go together in the final panel and close them like a book. Clamp them together near the edges you'll glue. Plane both boards along their full length until they are flush. Then visually divide the edges into four or five sections.

Begin with one full-width shaving over the middle section. Now take a full-width shaving across the second section as well as the



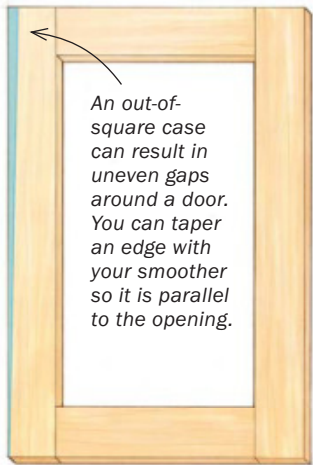
Final pass is full-length. A continuous shaving side to side and end to end ensures a quality surface for the strongest joint.



End with a flat panel. Stack the boards and check for flatness with a straightedge. Because of the spring joint, the boards should touch at the ends with a very small gap at the center. When clamped here, the joint will close and pressure will transfer to the ends. As you begin to tighten the clamp, push any bow into alignment if the boards aren't flush along the joint.

FIT A DOOR

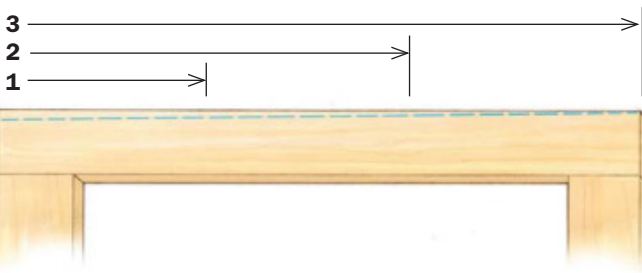
When installing a door, it's common to find uneven gaps around the edges. A tapered cut along an edge can fix the problem quickly.



Put the door in place to check for uneven gaps. After jointing one edge and using the tablesaw to trim the door to fit top and bottom, place the door in its opening and note where the other edge needs trimming.



Work from the "wide" end. Starting at the end of the edge that needs trimming, take one short shaving (left). Then take a longer one, beginning from the same point. Continue the overlapping cuts until you've planed along the whole stile. By ending with a full-length shaving, you ensure the edge of the stile remains straight. If the door still needs more taper, repeat the process.



first. Repeat along the length of the board. The short sole on the No. 4 allows the plane to follow the diving cut as you form the hollow. The last pass should be twin continuous shavings the length of both boards.

Planing technique is critical here. To begin the stroke, apply extra downward pressure over the plane's front knob and only a little over the tote. Transition the pressure to the tote and release it off the knob as you reach the end of the stroke.

Test the joint by setting one board in a vise, planed edge up. Place the second board, planed edge down, on top of the first. You should be able to fit a dollar bill between the two at the

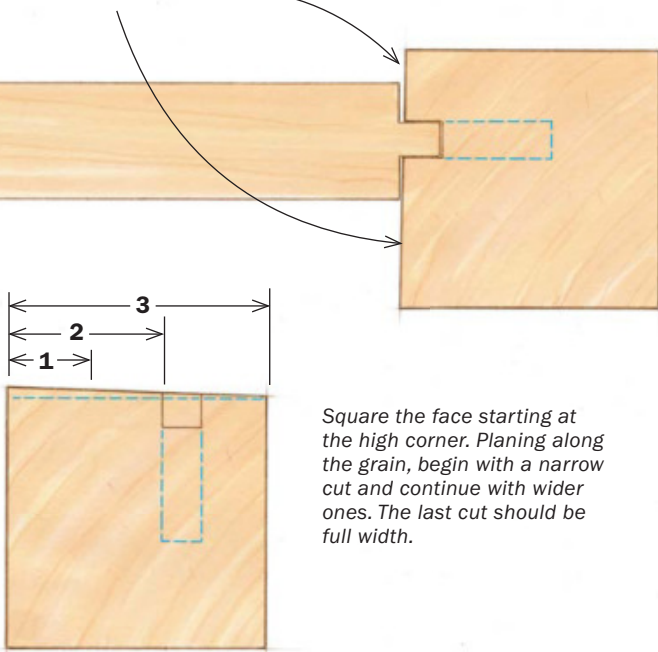
center, but not much more. When you clamp across the middle, the pressure on the ends increases dramatically while the center of the joint closes.

If the joint's not flush along its length, you get to use the most important benefit of this technique. Because the boards' ends are tight while the center is not completely closed as you begin clamping, you can push the center of one board perfectly flush with the mating board while tightening the clamp. Properly glued up, the boards will be aligned well enough that any discrepancy is easy to remove with a final handplaning or card scraping when the joint is dry, eliminating the need for further thickness planing.

FINE-TUNE JOINERY

Overlapping shavings can work to close up gaps in joinery.

Gap at joint created by an out-of-square leg.



Square the face starting at the high corner. Planing along the grain, begin with a narrow cut and continue with wider ones. The last cut should be full width.



This shoulder won't close. If the square shoulder of a tenon seats on an out-of-square leg, you'll see a gap. Rather than adjust the end-grain shoulder, you can easily fix the long-grain area around the mortise.



Start at the high corner and work across. The first shaving should be narrow. From there, advance across the face until you end with a shaving the width of the leg. These overlapping shavings progressively lower the high side while blending it into the low side, thereby closing the gap.

Joinery: Sneak up on a perfect fit

When it comes to furniture, precise fit is important. If an inset door looks out of square in its opening or a tenon shoulder does not close up, it can be easily fixed by counting strokes and taking successively longer or wider cuts.

Fitting a door—Frequently, a furniture part like a door or drawer front needs to be tapered to fit in its opening. Both are handled the same way. After jointing one edge, I'll hold it in the opening tight against the carcase to determine how much the bottom and top of the workpiece need to be trimmed to make it square to the opening. These cuts are usually done on the tablesaw with a sled and a shim to match the angle needed. After dialing in the top and bottom, you usually have to correct the other edge using tapering cuts.

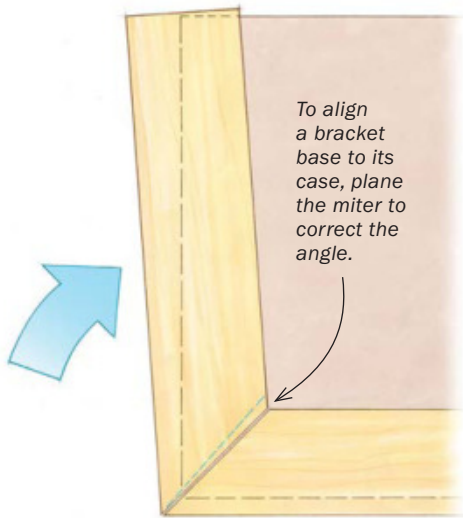
First determine which end needs the most material removed to create an even gap. Then, to map out your cuts, visually divide the workpiece into several sections of equal length. For reference, I'd break a 24-in.-long door into five sections.

Starting at the "widest" part of the workpiece, take a shaving the length of the first section. Then take a shaving over the first and second sections. The next shaving will include the third section. Continue until you have taken a continuous shaving over all five sections, or the entire length of the stile. The first section will have had five sets of thin shavings, while the last section will only have had one. But because you end with a full-length shaving, the edge stays straight. Need more of a taper? Do another set of shavings.

Squaring a leg—For seamless joinery, parts need to meet perfectly. This usually means parts coming together at 90°. Take a

ADJUST A MITER

Use overlapping plane strokes to dial in the angle of a miter joint.



Begin with short cuts that lengthen as you plane across the joint. Be careful. It's surprising how much a set of light overlapping cuts on a miter will affect the fit. Three overlapping cuts totaling a few thousandths of an inch can move the back end of a 20-in. side as much as $\frac{1}{8}$ in.



table, for example. If the square shoulder of an apron seats on an out-of-square leg, you'll see a gap. Squaring a table leg uses the same high-to-low tapering technique as the door, but across the workpiece's width rather than along its length.

Divide the leg's width into four or five sections. Start by taking one narrow shaving off the highest section. The second shaving should be wider, comprising the first section and the second. Continue until you take a final full-width shaving that includes the last section. If the leg is still out of square, take a second series of cuts.

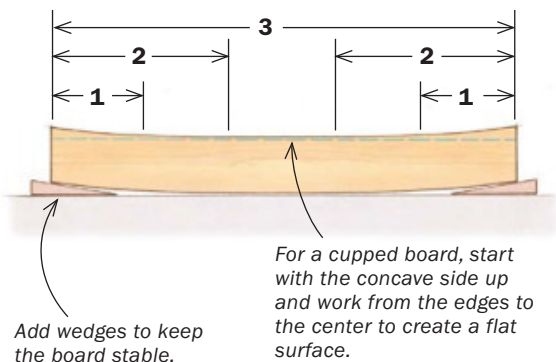
Adjusting a miter—There are a couple of reasons to plane a miter. For one, a hand-planed miter will always close tighter than one off the saw. Plus, a mitered furniture part frequently needs to be adjusted to match another furniture part, like a molded plinth base and its case above. These bases are typically just a little larger than the carcass, and it is critical that the reveal between them is even. To accomplish this, adjust the miters.

Start by planing the miters on the front piece, and then leave them alone. You'll fit the side pieces, which is why I always leave these long. First, determine if the inside or the outside corner of the miter needs to be trimmed to fix the reveal.

Adjust these miters by taking three or four gradually longer overlapping cuts that

FLATTEN A CUP

For boards too wide for a jointer, you can flatten a face with a handplane by paying attention to your passes.



Cup up, wedges down. Van Dyke needs to stabilize the board before he planes it, so he uses wedges and his tail vise.

start at the corner that requires the most material to be removed. End with a full shaving.

Take light cuts and check your progress frequently.

Flattening: Do it all with one plane

When flattening a board by hand, the typical techniques use at least two or three different planes to get the job done. With this method, you can fix bow, cup, and twist all with a No. 4. Again, you'll plan your strokes while using the plane's short sole to your advantage by targeting specific areas. If you think of the surface of the board as a series of mountains and plains, this method of overlapping cuts lowers the mountains to the level of the plains.

Your goal is to create a fully flat reference face, whether on a roughsawn board or a previously milled board that moved afterward, before planing the opposite face parallel by machine or by hand. The importance of these techniques is that you are not limited by the width of your electric jointer and you have to remove only enough wood to correct the problem.

In all these flattening techniques, the major planing is all done across the grain. A sharp plane can easily take cross-grain shavings three times as heavy as it can with the grain. The final surfacing can be done with light smoothing cuts along the grain or with a card scraper and fine sandpaper.

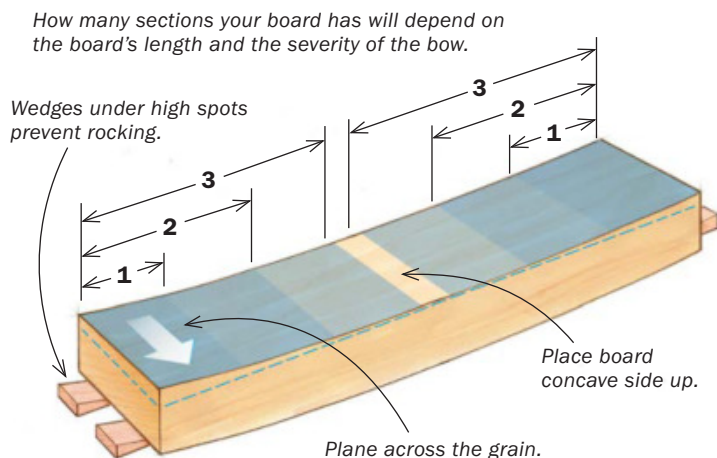
Cup—My method for tackling cup works by making overlapping cuts beginning with the high spots (the edges) until they meet the low spot (the center).



Work toward the middle from the high edges until the face is flat. When lowering each edge, start with short, cross-grain strokes and work down the board's length. Increase the length of the strokes for each trip down the board. Your final set of shavings will be across the board's whole width. Track your progress with a straightedge.

FIX A BOW

With the concave side facing up, add wedges and plane across the grain starting at the ends and working toward the center.



Immobilize the board. After securing it with his tail vise, Van Dyke places wedges under the high spots. He'll be planing cross grain, which generates a lot of force, and he doesn't want the board to shift.



Take overlapping shavings and work from each end toward the middle. Start by taking one full stroke across the grain over the first section at each end. Next take a stroke across sections one and two at each end. Continue working in from both ends until you reach the center. The last set of shavings should march across the whole length of the board.



Start with a series of cross-grain shavings $1\frac{1}{2}$ in. to 2 in. long, planing from the front edge toward the middle of the panel. Work your way from one end of the board to the other. Start a second series of shavings over the first series, but make this set a little longer. Continue until your shavings reach the middle of the panel.

Repeat the process on the far edge with the first set of shavings starting about $1\frac{1}{2}$ in. from the edge. Work along the whole length of the board. With each set of cuts, take progressively longer shavings until you are near the center of the board.

Now plane all the way across the board while moving down its full length. Gauge your progress with a straightedge.

Bow—Hold the board on the bench with the bow up and place wedges underneath to stabilize it. Divide the length of the board into as many sections as seems reasonable. The more bowed the board, the more sections you'll need.

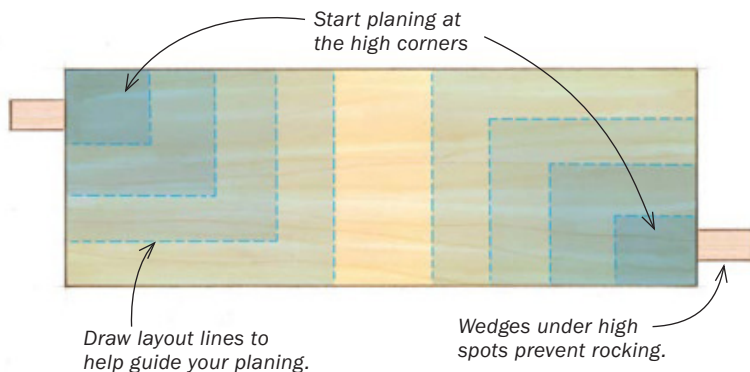
Starting at the ends and working in toward the middle, take full strokes across the grain over the first section. Next, plane both



Check for flat. If the board is still bowed, you may have to repeat the steps. The remaining bow will determine how many sections you should divide the board into this time around.

REMOVE A TWIST

To flatten the face of a twisted board, first determine which are the high corners. Start there and plane progressively larger sections until the face is flat.



Assess the twist with winding sticks. By sighting down the board with winding sticks, Van Dyke checks how much the board is twisted, and how many sections he'll have to divide it into for planing.



Take the time to draw the grid. Because the sections for twist are more complex than those for bow or cup, Van Dyke draws them on the board. Roughly divide the board in half in its width and length and then subdivide each half into equal sections.



sections one and two. Continue working in from both ends until you reach the center. The last set of shavings should march across the whole length of the board.

If there's still bow, measure it and assess how many sections you should divide the board into this time around.

Twist—Correcting twist works the same way, lowering the high corners to the valley in the middle by shaving down overlapping sections. For this example, let's assume that each half of the board has five sections. A larger or more twisted board might have more.

Working across the grain only, plane the first section. The next set of shavings will be longer and will overlap the first section. Continue planing, working along the sections until you reach the far edge of the board. That last set of shavings will go all the way across the width of the board. Repeat on the other half. Check your progress with winding sticks to see if you'll need to repeat the process. □



Plane from high corners inward. After wedging and clamping the board, take overlapping cross-grain shavings to flatten the opposing high corners. Regularly check your progress with winding sticks. If you need to do subsequent sets of shavings, you will probably divide the board into fewer sections to avoid taking off too much material.

Bob Van Dyke runs the Connecticut Valley School of Woodworking in Manchester, Conn.



Carving comes first. It makes sense to carve the box parts before cutting joinery. See *Master Class* (p. 74) to learn how Follansbee lays out and carves these patterns.

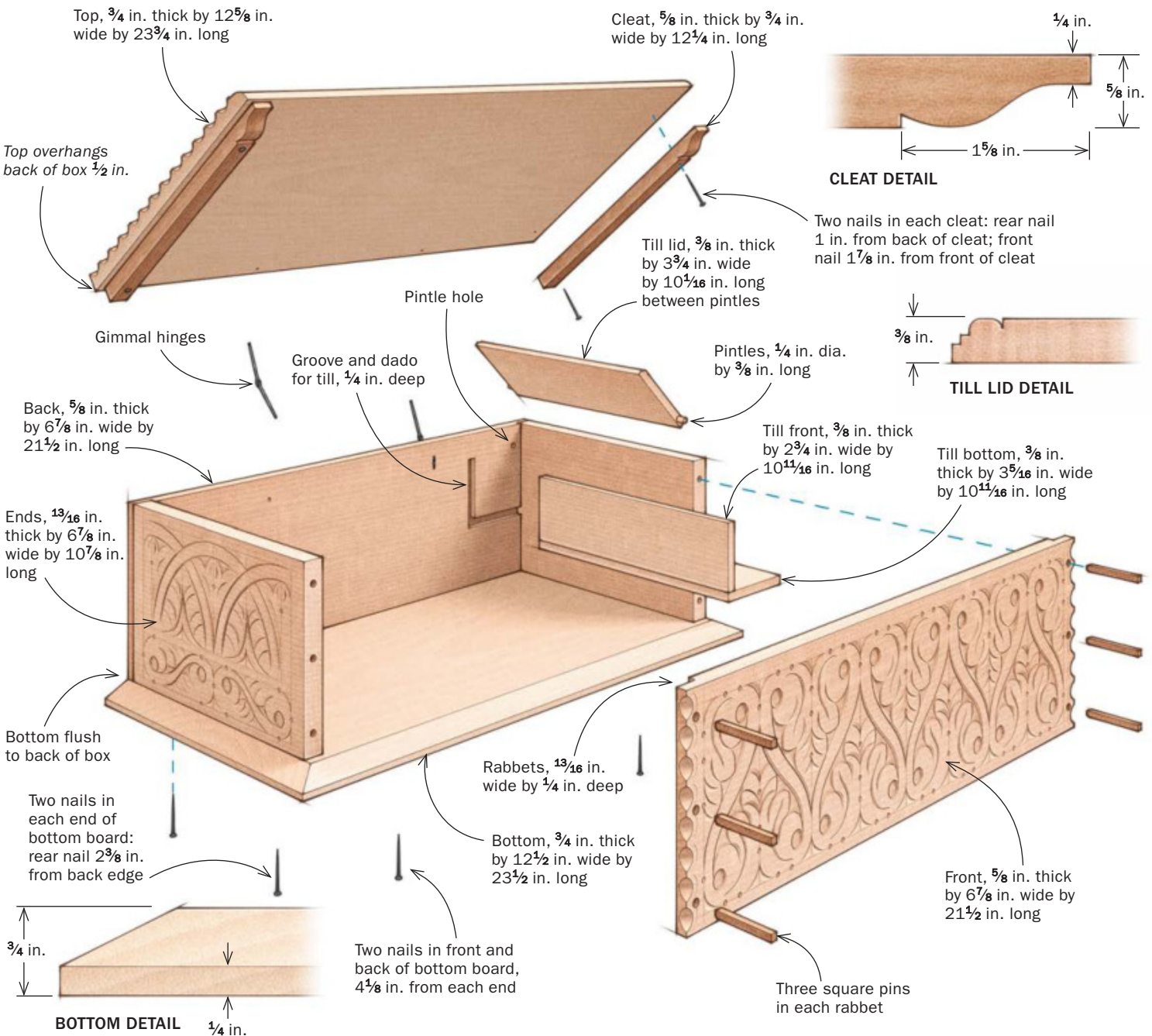
Simple, Handsome 17th-Century Box

Underneath the carving, this traditional form is a great exercise in hand skills

BY PETER FOLLANSBEE

ROUGH MEASUREMENTS, NOT HARD RULES

View these dimensions as general guidelines, not settled law. Even in Follansbee's own box, dimensions vary slightly, reflecting the variability of riven stock worked by hand. Let your carving tools partly determine the size and shape of your patterns—and therefore your box.



Boxes like this one were a common 17th-century form in New England and old England. The construction is no-frills: pinned rabbets at the corners, a nailed-on bottom, a hinged top with cleats to limit cupping. The only real fussy part is the till, but its impact is great. People ooh and ahh over tills.

The other big impact comes from the carving. Don't skip the carving. Among the hundreds of historical examples I've studied, most were left blank on the ends, but all except one had carved fronts. In this issue's Master Class (pp. 74–80), I demonstrate how

to carve the patterns on the front and ends. You'll want to tackle the carving before getting into the joinery.

For material, my preference is riven ring-porous hardwood, like red or white oak. It's not just the traditional option; it's the best one. Workpieces split from straight green logs are more stable and easier to work, and their even grain makes them excellent surfaces for carving. For more on this process, see my article "Greenwood: A Joiner's Tool Kit" (FWW #279). The catch is that for most boxes you need a hefty log. If you can't find a big enough

Corner joinery

SPEEDY RABBETS



Mark each rabbet with its matching box side. If you prep these boards by hand, you likely won't get both ends exactly the same thickness. So mark each rabbet using the part that will join it.



Marking gauge lays out rabbets' depth. Reference off the same surface for each joint. Follansbee uses the outside faces.



Saw and split. After sawing the rabbets' shoulders, Follansbee splits the cheeks. The grain must be straight for this to work well. Stay well shy of your depth layout line.



log, quartersawn boards are a good second choice. In a pinch, I've even used rift- and plainsawn oak.

Rabbets take account of handwork

I make furniture entirely by hand, so I don't rely on all surfaces being perfectly flat, square, and even. Instead, I establish reference edges and faces. For boxes, these are the outside faces and bottom edges. All my layout is done off of these two surfaces. To keep parts oriented—front, back, left, and right—I strike a triangle into the top edges.

The rabbeted joinery also accommodates the handwork. Because I mill and prep these boards by hand, I'm sure I rarely get both end boards the exact same thickness. As a result, the ends are not interchangeable; each has a dedicated position in the box. So I use each end to lay out the width of its respective rabbet. It



Pare to the layout line. Follansbee uses a long paring chisel to flatten the rabbet while bringing it to final depth.

helps to have the rabbets slightly overwide at this point, letting you clean up the joint later. I use a marking gauge to lay out the depth of the rabbets.

I saw the rabbets' shoulders, chop with a chisel to split the waste off the cheeks, and then pare across the grain, working down to the layout lines. If I had a really cantankerous board, I might saw the cheeks, but I can't remember the last time I did so.

To fasten the rabbets, I use wooden pins and glue, spacing the pins by eye. I bore $\frac{1}{4}$ -in. pilot holes, drilling from the inside of the rabbet so I can see where I'm putting them. To avoid blowout, don't put them too near the edges of the board. Once you transfer and bore mating pilot holes in the ends, you'll need to wait to pin them until after you've made the parts for the till.

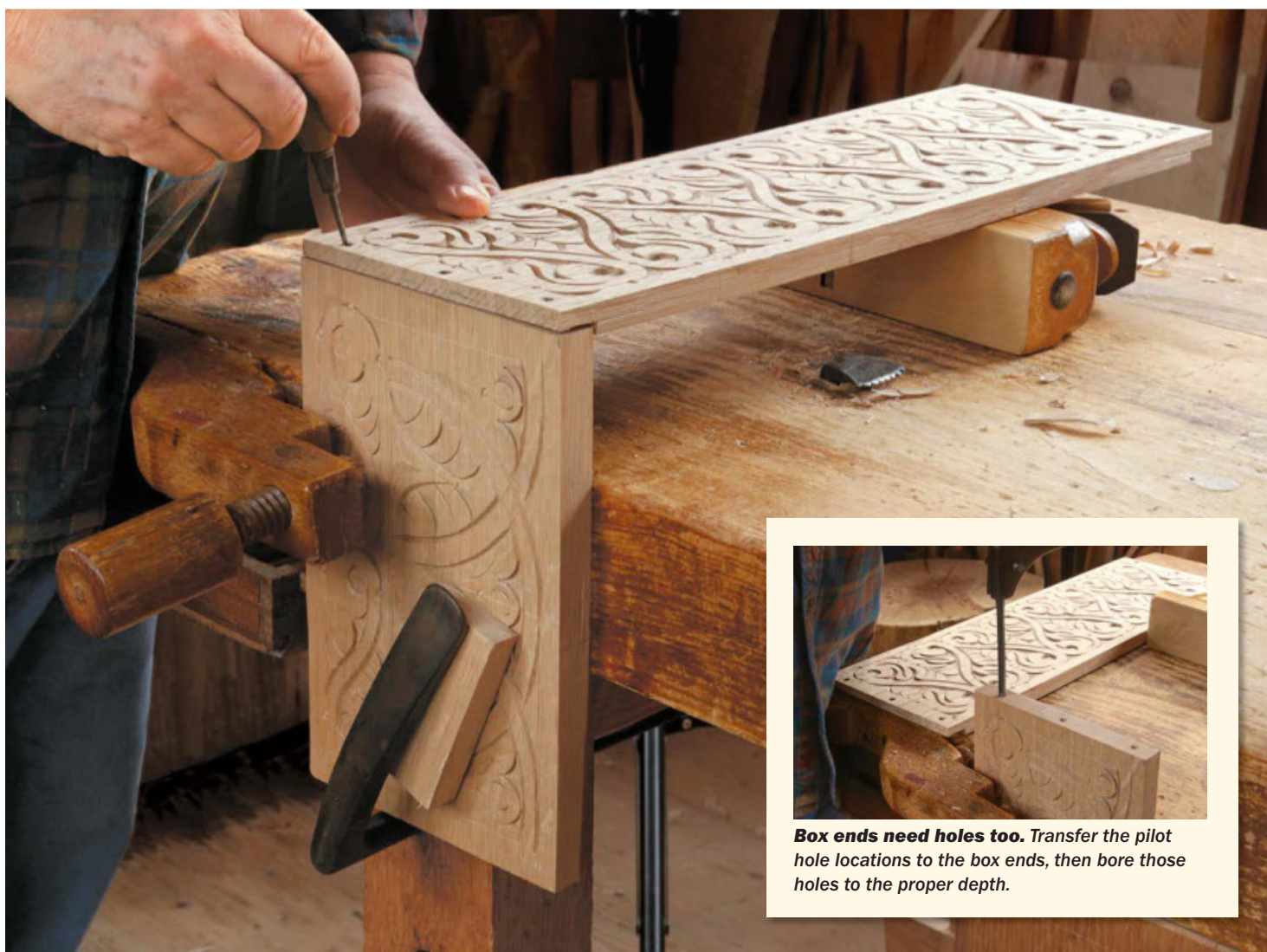
Lidded till

The lidded till is a nice touch that I include in most of my boxes. It runs front to back, and it doesn't matter which end you put it on. But like I said, the till can get fussy. The till parts are captured between the front and back of the box. Come assembly time,

BORE FOR PINS



Holes for pins and pintles. The rabbets get pinned, so bore those holes in the box front and back now. Also bore the clearance hole for the pintles on the till's lid. This hole should not sit too close to the box's upper edge or the rabbet.



Box ends need holes too. Transfer the pilot hole locations to the box ends, then bore those holes to the proper depth.

Add the lidded till

Lay out the till joints. After using a square to lay out the dado for the till's front, Follansbee uses a marking gauge for the bottom's groove (right). Saw most of the groove walls (far right), tilting the backsaw so you don't cut beyond the till side. Watch that you don't cut into the rabbet.



Chisel work. Strike straight down to incise the dado. Then, with a wide chisel used bevel down, bring the dado to near depth (right). Switching to a narrow chisel, split out the waste from the groove (far right), and smooth the bottom of the groove and the dado.



Transfer the till joinery with the box assembled. To lay out the till joints on the back of the box, first extend the dado's layout to the top edge of the front. Then use a large square to scribe those marks on the back side. Lay out the groove with a marking gauge. Then cut the till joints.



Mark till lid's length and pintles. Having the box clamped up to do this lets you mark off the actual piece instead of relying on a drawing.



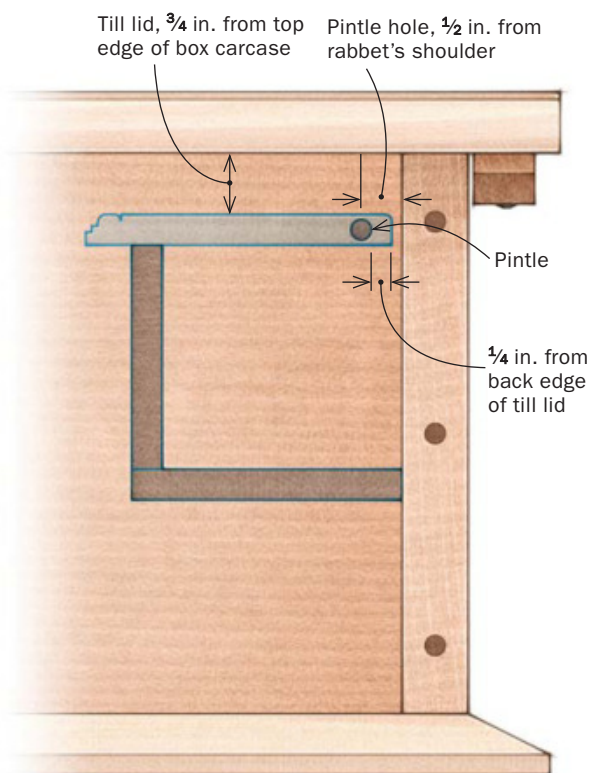
you'll build the box around the till. I've sometimes wished for a third hand at assembly for this reason. So be careful with your layout and joinery to limit the headache.

The till has three parts: the lid, the side, and the bottom. I use hardwood for the lid and whatever I have on hand for the rest. Lay out the dado and groove so the lid overhangs the till side a bit, allowing you to lift the lid from underneath. The lid's pindle hinge should not sit too close to the box's upper edge or rabbet.

Now cut the joints. I begin the groove for the bottom with a saw before chopping and paring with chisels. The dado is all chisel work.

I then test-fit the box carcase to get the proper lengths for the till parts. With the box clamped up, get the length measurements for the till side and bottom. They are often the same, but sometimes not. For the till lid, I hold it in place to scribe its

Cut the lid and pintles to shape. Start by ripping and crosscutting the lid to form the rough pintles. Then, with a knife, shave the pintles until they fit into their respective holes.



Test the lid's action. Now is the time to adjust the lid, not after the box is glued and pinned. Round over the back of the till lid so it doesn't catch as it opens.

Assemble the box with the till inside



Square pins, round holes. Pin the back first. Use straight, square pins slightly larger than your pilot holes. The ideal pin compresses the hole a bit and fills it completely. Trim and pare the pins flush afterward.

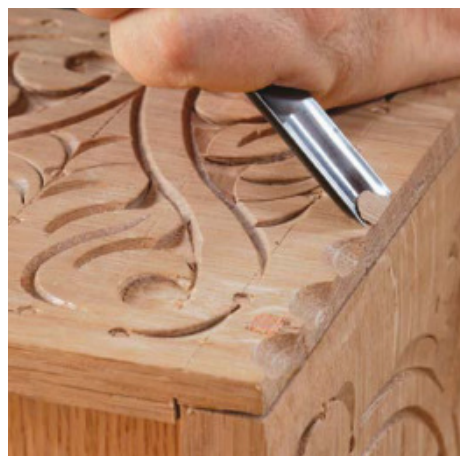
pintle locations and shoulder-to-shoulder length. I then saw and pare the pintles until they fit easily in the holes.

Build around the till

This box has a lot of loose parts, so glue-up can be a bit like juggling. Start by gluing and pegging the rear board to the ends. Trim these pegs flush. Next, lay the rear board on its back with the ends sticking up. Drop in the till parts, with the till lid open. Add glue to the box ends and the rabbets in the front, then put the front in



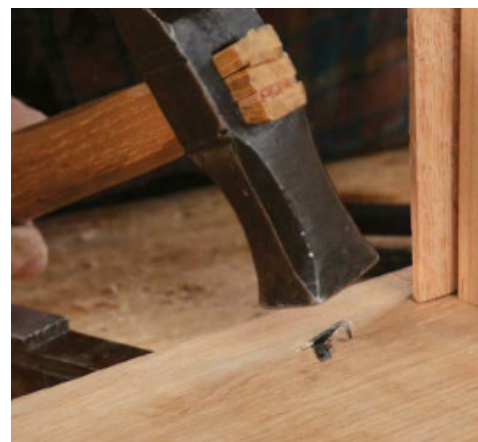
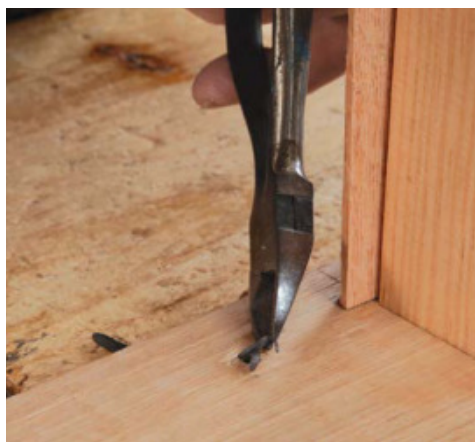
Add the till parts and front. Drop the till parts dry into the back, with the till lid open. Apply glue to the box ends and put the front in place. Patiently fiddle the till parts into position in the front, then drive the pins.



Carve the thumbnails. Use a deeply curved gouge and a mallet to chop thumbnail cuts into each end of the box front. Then use the same gouge to punch an echo cut right behind each thumbnail. Eyeball the spacing.



Hinge the back, nail the bottom



Drive and clinch the hinges into the back. After boring a pilot hole and hammering the hinges in place, fold over their tips with a pair of pliers. Then drive these points, like staples, into the back's inside face to secure the hinges.

place. Fiddle the till parts in position—stay patient—before driving in the pins.

The pins are square pegs. Don't shortchange these. You want dry, straight-grain stock. I split them out oversize and pare them with a very sharp chisel. Aim for squares just larger than the pilot hole and with no taper. It helps to bore a test hole to check your progress. Lightly point the ends. You want to see the corners of the pins shear a bit as you drive them. Leave them long so you can trim them flush at the end.



Simple hinges

I know these hinges as gimmals, although some call them snipe-bills or snipe hinges. They're essentially two linked cotter pins that you clinch in place. One half is driven into the back board; the other half goes into the top. For now, just install the hinges in the back. The pilot hole should be tight enough that you have to drive in the hinge, but not so tight as to split the board or bend the iron. I bore a test hole in scrap to get the right size. Bore the pilot hole $\frac{3}{8}$ in. from the back's top edge and at a downward angle.

Knock the gimmals into the holes, with their loops oriented vertically. Once they're in, spread their tails apart. I use pliers to bend the tips around. Before clinching the tips—driving them back into the box—see that the heads of the gimmals are just under the top edge of the box. Too low is more of a problem than too high. You can knock higher ones down, but you can't bring low ones up.

Bottom board nailed on

Now that the sides are assembled, it's time to make the pine bottom. Because of all the handwork you've done, you want to be

Bottom gets a bevel. After tracing the perimeter of the box onto the bottom, bevel the bottom's overhanging front and ends. Don't plane beyond the layout lines, or you'll create a gap under the box carcass.



Nail the bottom in place. Follansbee hammers two blacksmith-made nails into the front and back and two into each end. Before driving the nails, bore pilot holes and create countersinks for the nail heads.

Embellish the lid



Profile starts with a rabbet, ends with a roundover. The lid's quarter-round has a fillet above it, so the first step is to cut a rabbet. To finish the shape, Follansbee uses a smoothing plane to round over the top corner.



Thumbnails and echoes on the top too. Carve the ends of the lid just like you did the ends of the front. Again, eyeball the spacing.



able to fit the bottom board to the box you made, not the one you planned. Place the box carcass on top of the oversize bottom board with the two flush at the back. Scribe around the box sides, inside and out. Then mark the overhang.

Saw and plane the bottom to length and width. Then, using the layout lines on the bottom board, bore pilot holes for the nails that will fasten it to the box. Then plane the bevel.

I make countersinks for the nail heads using a gouge to carve in a slight divot. Now transfer the hole locations to the bottom edge of the box. Bore the pilot holes in the box with a smaller bit than you used for the bottom. Finally, nail the bottom in place.

Last, the lid

On historical examples of these boxes from New England, the lids are often pine. In old England, they're all oak. Either way, they offer an excellent chance for more decoration. On the ends of the lid, I punch out thumbnail cuts, and just inside those I use



Nail cleats to the top. Because Follansbee uses a wide single board for the lid, he uses cleats to help keep it flat. These have decorative ogees at the front. Drive overlong nails through the cleat and the top.

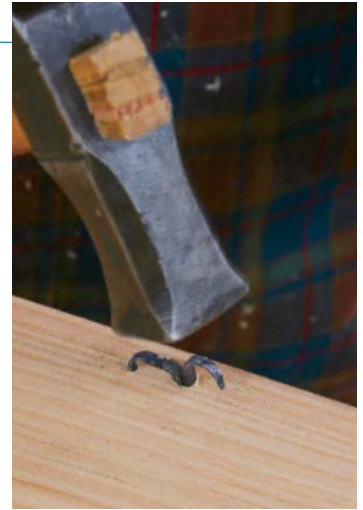


Clinch the nails with a hard backstop. After bending the nail's tip over, hammer it back into the lid. Use a metal stop, like this benchdog, to back up the nail head.

Install the clinched hinges



Mark the hinge location. Pressing down firmly on the lid, Follansbee scribes the back overhang of the lid and the eye of the hinge installed into the back. This guides him when boring the hinge's pilot hole in the lid.



Install the hinge in the lid. It's easiest to press the lid onto the hinge from above. A piece of scrap protects the lid from the hammer blows. When that's done, clinch the hinges in place.

the same gouge to punch an echo. At the front of the lid is a quarter round and fillet.

Because my top is a single board, it needs something to help keep it flat. I nail oak cleats on either end. These cleats have decorative ogees cut into their front ends. Leave $\frac{1}{16}$ in. or more between box sides and the cleats. It's best if the cleats are inset from the ends of the lid, not flush. □

Peter Follansbee wrote Joiner's Work (Lost Art Press, 2019) and regularly posts on his blog, pfollansbee.wordpress.com.



The Dowel Joint

Use a simple shopmade jig
to create cabinets
that stand the test of time

BY DAVID WELTER

The strong and unobtrusive dowel joint has earned its place in woodworking history. For cabinets, the technique can provide a joint as strong as other methods and has the advantage of being accessible to shops of modest means.

Doweling is an excellent technique for both solid wood and veneered carcasses. The key to good doweling is accuracy. I've had success using James Krenov's approach to doweling, which uses a shopmade doweling jig. It is accurate, of negligible expense, and adaptable to many situations.

What kind, how many, and how to get a perfect fit

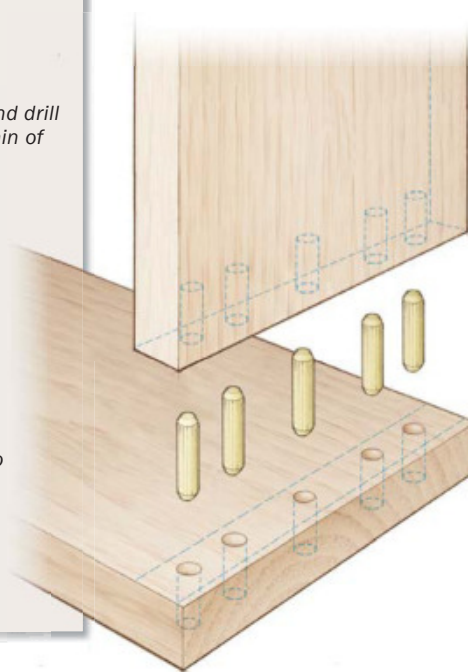
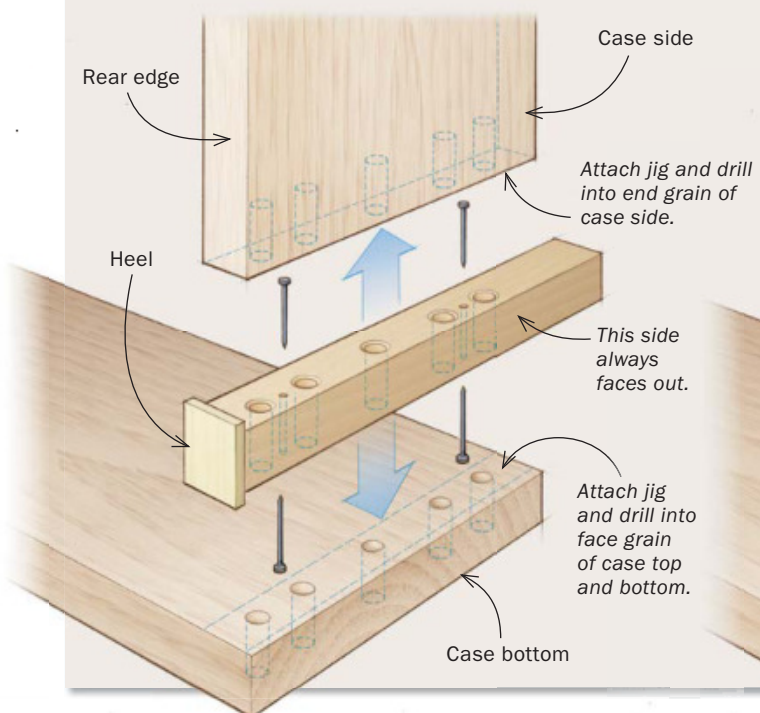
A properly fitting dowel should slide into its hole with a feeling of friction but should not need to be driven into place.

First, choose an appropriate size and number of dowels. The diameter of the dowel should be from one third to half the thickness of the end-grained stock. By locating dowels closer together at the outside edges and spreading them out in the middle you can counter the tendency of a joint to open at the ends. Lay some dowels across the workpiece to get a feel for the number and spacing.

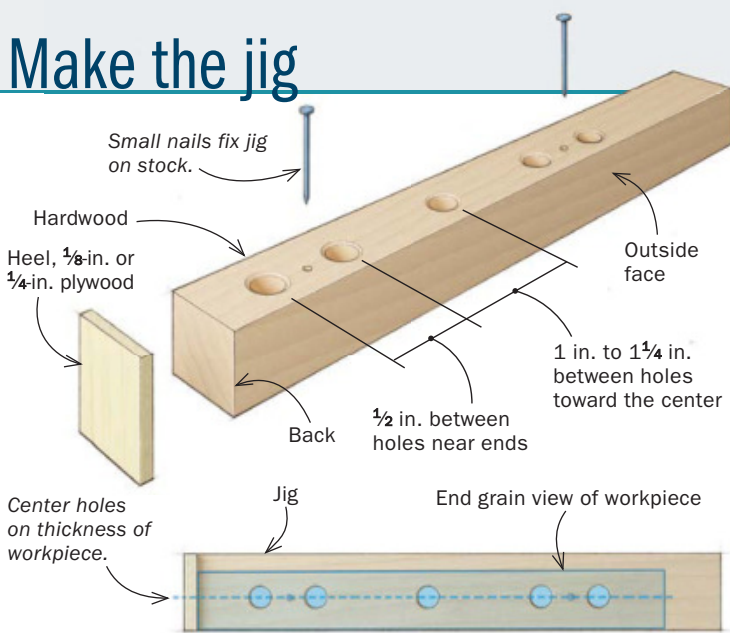
Depending upon the wood being used, the same drill bit may produce different-size holes, especially when drilling into end grain as opposed to face grain. Choose a drill-bit size by experimenting with scrap stock, boring holes in both face and end grain. If there's a variance, make sure the dowels fit well in the larger

ONE JIG DOES IT ALL

A simple stick of scrap with a fence, or heel, at one end and holes cut on the drill press is the only jig you'll need. Always have the jig's outside face turned toward the outside of the workpiece, and hook the jig's heel over the back edge of the workpiece.



Make the jig



Attach the heel. The jig can be made of any hardwood. Add a $\frac{1}{8}$ in. to $\frac{1}{4}$ in. plywood heel to the end of the jig. This will act as a hook to align the jig on the workpiece from the back. Welter chamfers the end of the jig before attaching the heel. This will help keep crumbs from catching in the corner and causing misalignment.



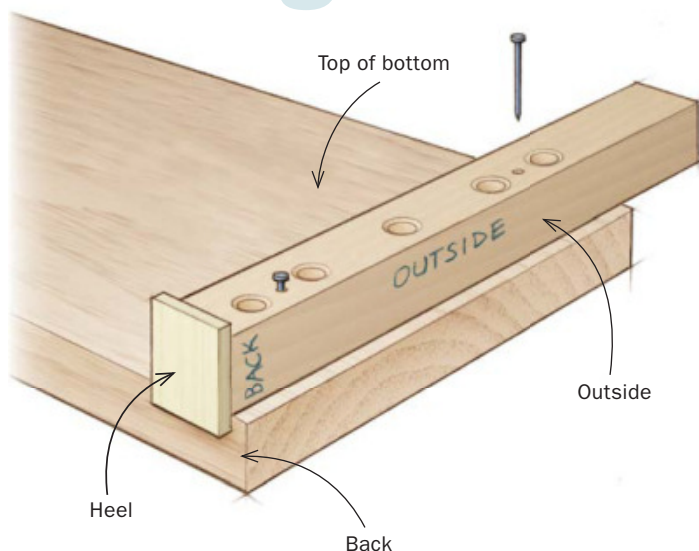
Figure out the spacing. Hook the jig on the workpiece, spread out the dowels, and mark their placement on the jig. Keep the spacing closer at the outside edges, about $\frac{1}{2}$ in. Spread the spacing out to 1 or $1\frac{1}{4}$ in. toward the center. Drill the holes through the jig on the drill press, positioning them so they'll be centered on the thickness of the workpiece. Then chamfer their edges slightly.



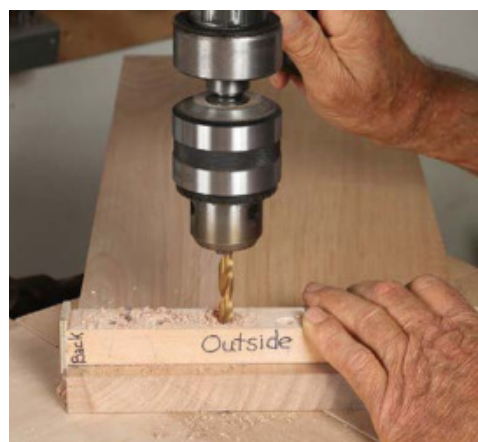
Nails hold the jig in place. You'll affix the jig to the work with two small wire nails or brads. With the jig at the drill press, drill clearance holes for the nails sized to create a little friction, but allow no play.

Drill the dowel holes

Face grain



Attaching the jig. Because the case sides are inset, Welter registers the outside of the jig to a layout line, not the end of the workpiece. He hooks the heel over the back and tacks the jig to the workpiece, leaving the nails proud so they're easy to remove.



Drill and chamfer. Make sure to set the depth stop so you do not drill through the opposite face. For accuracy, drill slowly. Afterward, chamfer the holes to remove crumbs, which may interfere with the joint.



of the holes. The dowels can be sized with a file to fit into the tighter holes. Letter drill bits have sizes slightly larger and smaller than fractional sizes, affording better fits. In a pinch, I have reduced the size of stock bits with an oilstone while running the bit on the drill press.

The doweling jig itself

A doweling jig is a drill guide that is used to repeat the same hole pattern in joining parts. One end and one side of the jig serve as reference points. Understanding the relationship of the jig to each side of the joint can be confusing at first. Think of the jig as being sandwiched between the two parts of a joint. Dowel holes will be drilled from each direction through the jig to create one joint. The nails that locate the jig will be driven through one side of the jig for half of each joint and through the other side for the other half.

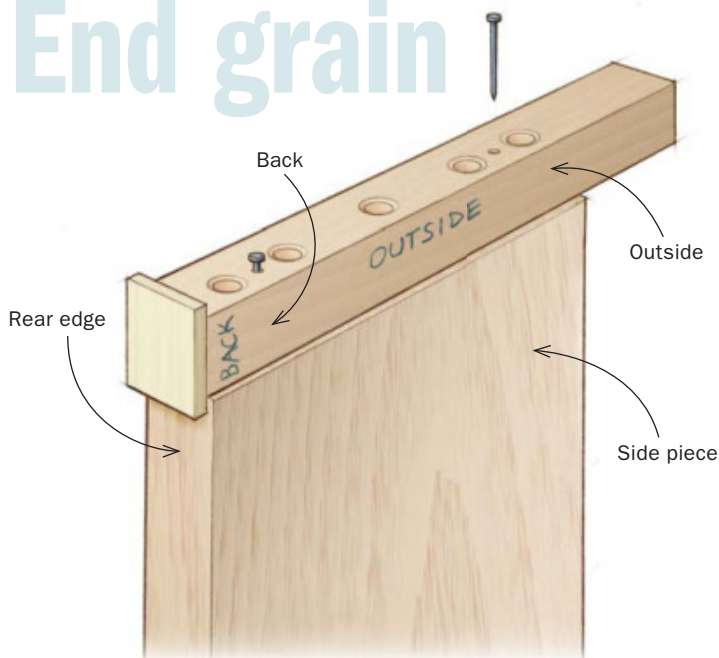
When making the jig, choose a width that is greater than the thickness of the carcass stock. That makes the jig's reference edge readily evident because the holes will be closer to one edge than the other. Visual clues such as this can go a long way in avoiding confusion. A bandsawn non-reference edge serves the same purpose.

Glue a plywood heel on one end of the jig. It will serve as a fence to align the back edges of the two workpieces being joined. Keep the heel short, protruding no more than $\frac{1}{4}$ in. beyond the face of the jig. A heel that's too long may amplify a small variance.

Drill the holes in the jig

Mark the hole spacing on the jig based on a visual layout. The spacing can be casual; precise measurement is of no consequence because the layout, whatever it is, will be duplicated with the jig. On a drill press, drill the holes in the jig that will keep the jig

End grain



Use a depth stop. A wooden block with a through-hole is the perfect way to mark the depth of the dowel hole. Place it on the drill bit, taped to the chuck. The stop is more reliable than a piece of tape on the bit, which can be bumped upward when it contacts the doweling jig. A few such bumps can make the difference between success and disaster.



in place on the workpiece. The through-holes in the jig may be drilled at the same time as the first set of face-grain holes. That will keep the jig in place on the workpiece.

Attach the jig to the workpiece with the two small wire nails. While the heel of the jig aligns the back edges, one long edge of the jig establishes the relationship of the faces of the stock to be joined. I typically reference to the outside, so the jig is always referencing off the back and to the outside of each workpiece.

Drill the dowel holes

Generally, the depth of a dowel hole drilled into face grain should be $\frac{1}{8}$ in. less than the thickness of the stock. Working any closer creates the possibility of evidence of the hole being telegraphed, and, at worst, poses the risk of exposing the holes in the show side when finish surfacing the stock. If you are using a brad-point drill bit, be sure to consider the point as the bottom of the hole.



Drill into the end grain. When drilling into the end-grain elements, hook the jig on the back edge with the jig's reference face toward the outside (above left). While drilling, keep the bit plumb (above).

Assembling a doweled case

Gluing up dowel joints is a low-stress job if you prepare well. Test the fit and adjust and dry-fit again before you even look at the glue bottle.



The first step. Glue the dowels into both ends of the side pieces.



Measure depth and transfer. Measure the depth of the holes in the top and bottom pieces, and transfer that depth minus $\frac{1}{16}$ in. to the dowels in the side pieces.



Cut dowels to length. With the dowels glued into the workpiece, crosscut them to length using a miter gauge. Then file a slight chamfer around the tips, making them easier to fit. Confirm that the dowel holes in the face-grain parts are about $\frac{1}{16}$ in. deeper than the exposed dowel length. Welter uses fluted dowels, which will expand when glue is applied, ensuring a tight joint.

The hole in the end-grain part should be deep enough to firmly locate the dowel, about 1 in. deep.

The sides of this cabinet are inset, so when drilling the dowel holes in the carcass top and bottom, instead of referencing the jig to the ends of those parts, I used lines on them representing the outside face of the sides. I made marks on one piece, squaring from the back, then transferred them to its mate by aligning the two along their back edges with the interior faces up. In more advanced work, the reference lines may not be square, but the principle is the same if the sides of a cabinet are angled. In this case, the reference end of the jig would be angled to match. Hook the heel of the jig onto the back edge of the face-grain stock, aligning the reference edge of the jig with the established reference lines. Drive the nails through the jig into the workpiece just far enough to hold firmly, leaving the heads free so the nails can be pulled out easily. I drill the face-grain holes on the drill press, using the stop to carefully

set the depth. Remember to roll the doweling jig over when drilling the other end of the same part.

Drill the end-grain holes by hand

I drill the end-grain holes with a hand drill and a wooden drill stop that positively limits drill depth. When drilling into the end-grain piece, hook the jig again on the back edge with the jig's reference face flush with the stock's outside face.

Once all the dowel holes are cut, you'll assemble and take apart the carcass several times before the final glue-up. To avoid enlarging the dowel holes through repeated fittings, temporarily place slip-fit dowels in the second hole from each end until glue-up time approaches.

Get ready for glue-up

After the doweling and any other machining is completed, start preparing for glue-up. Plane, sand if necessary, and finish all of the in-

Test the fit first.

Before gluing up, Welter pre-finishes interior surfaces as well as the exterior of the sides. The exterior surfaces of the top and bottom will still be accessible after glue-up. He does a dry-fit to make sure all the joints are coming together perfectly, and then glues and clamps the case together.



terior surfaces and the exterior of at least the long-grain parts.

A clean joint looks good from every side. To help ensure that no gap appears at the end of the joint, plane a slight, long hollow into the butt ends. The hollow should be only a hair ($\frac{1}{64}$ in. or so), enough to ensure that the ends of the butted cut contact the surface of its mate before the center does.

Glue the dowels into the long-grain parts first. Because the holes are deep here, the dowels will be well seated. Apply a healthy drop of glue to the holes only, spreading the glue with a bamboo skewer.

Before applying any more glue, do a dry run of the final glue-up. The fewer the surprises, the greater the likelihood of success. Padded clamping blocks will disperse clamp pressure. Check for squareness with diagonal sticks or measurement. Remove the clamps when the glue has cured, admire your project, and get busy on the next step. □

Retired after 30 years at
The Krenov School, David Welter
builds furniture in Fort Bragg, Calif.

www.finewoodworking.com



Bend Wood to Your Will

Use steam to create strong, curved parts with continuous grain

BY BRIAN BOGGS



I've been steam-bending wood for nearly 40 years and still I don't know of any process in our shop that is more mysterious or more fascinating. Or more powerful—with steam you can create curved parts with perfectly continuous grain that couldn't be improved on for strength, resilience, or appearance.

In hopes of making steam-bending a little less mysterious, I'll explain something about selecting and preparing wood for bending, building a steambox, building bending forms, and putting them all to use. Along the way I'll demonstrate three different ways to bend: formless bending, which is done freehand and requires no bending form; free bending, which uses a bending form and a drying rack; and compression bending, which uses a metal compression strap as well as a bending form and a drying rack.

Wood selection and preparation

Selecting the right wood makes all the difference in steam-bending. No matter how skilled you are at bending, trying to bend the wrong wood makes for frustrating work. Finding the right wood is not just a matter of picking the right species. While some species are, on average, more flexible than others, most hardwoods vary as much within their species as they differ from other species. While I don't know of any rule or set of rules that guarantees a particular board or log will yield good bending wood, there are a few guidelines that will put the odds more in your favor.

Heavy wood—Look for wood that is heavy for its species. It's generally stronger and more flexible.

Less porous—With maple and cherry it's hard to tell much about porosity, but woods like oak, hickory, walnut, and ash are easy to survey for this. Compare the ratio of pores in several boards and you will likely find a significant disparity. Pick the denser wood.

Straight grain—This won't impact flexibility, but if the wood fibers follow the sides of the board, the parts will be less likely to break.

If you find the right specimen, most American hardwoods can bend quite well, especially in compression bending. Cherry, for example, is generally a poor choice for bending without a strap, but with a compression strap it bends about as well as any wood.

Should the wood be air-dried, kiln-dried, or green?

Ideally, wood for steam-bending should be between 15% and 20% moisture content. If you don't have a moisture meter, get one. Knowing the moisture content of the wood you are working with is critical.

I most prefer air-dried wood for bending. But if you don't have access to air-dried or green lumber you can still play the steam-bending game. Kiln-dried wood can be steam-bent if you pre-treat the wood. I put kiln-dried workpieces in the steambox for at least an hour and leave them there overnight. Then I pull them out and soak them in water for three days. Now I'm ready to put them back in the steamer and get

Best woods for steam-bending?

Boggs has steam-bent dozens of different woods over the years. This chart lists some of his favorites, with comments on each. He cautions that although species do differ in terms of their suitability for steam-bending, he finds as much range within particular species as between them. He prefers to bend air-dried wood, but you can steam-bend most any kiln-dried wood if you pre-soak it.

SPECIES	CHARACTERISTICS
Red oak	There's hardly a better wood to start steaming with. It's easy to find stock with really straight grain free of defects. Red oak is often abused in the kiln, so if you use kiln-dried stock for steaming, inspect it carefully.
White oak	Generally fabulous for steam-bending. Some people report trouble with cracking, but I suspect that's due to improper drying.
White ash	This dream wood was sent from the steam-bending gods and destroyed by a beetle. A superb stand-in for oak if the parts are to be stained.
Sweet gum	I've played with it, and it's incredibly flexible—it seems to be made of rubber. But it warps, so proceed with caution.
Red maple	In the second tier of good bending woods. It's generally more elastic than cherry, but a bit weaker.
Cherry	Very good for steam-bending, but only if you use a compression strap. It's extremely compressible, so it bends well even though it's not particularly elastic.
Walnut	Of those I've used extensively, it's the species with the widest range of elasticity, weight, and strength. Depending on the tree, walnut can be very good for steam-bending, or it can be very challenging.
Hickory	This is another species that is all over the place when it comes to steam-bending. There are more than a dozen sub-species that are sold interchangeably, so it's hard to pin down. Some hickory is enormously elastic and great for bending, some is impossible. It's very stiff, and so requires a lot of force to bend.



Meter the moisture. Wood that will be steam-bent should ideally be between 15% and 20% moisture content. Boggs highly recommends using air-dried wood and monitoring it with a meter.



Kiln-dried wood gets a bath before bending. Boggs prepares kiln-dried parts by steaming them for an hour, then soaking them in water for three days before steaming and bending them. The bathtub is a bag in a box.

RUGGED, RELIABLE STEAMBOX

Bern Chandley's steambox is a high-pressure plastic pipe inside a plywood box. Wallpaper steamers provide the steam. He's a chairmaker, and his box is sized for chair parts. Build yours to suit the parts you intend to bend.

Short section of garden hose drains water from pipe.

Steamer hoses wrapped in carpet underlayment, then insulation tape.

Box and stand made from $\frac{3}{4}$ -in. MDO forming plywood; typically used for concrete forms, it deals well with moisture and adds some insulation.

Fixed casters at the back

Two wallpaper steamers used alternately; one takes over when the other loses steam.

Solid wood

Swivel casters with brake at front

Front support higher than rear one so box tilts 2° to drain at rear.

Holes for power cords

SOURCES OF SUPPLY

EARLEX STEAM GENERATOR
leevalley.com

GALVANIZED STAMPED STEEL GRATE
standartpark-usa.com

HIGH DENSITY POLYETHYLENE PIPE, 8 IN. DIA.
hdpesupply.com

bending. It's an easy process, but it means starting your project four days sooner.

Bending green wood works too, but it will have to dry a lot longer on the form, and the risk of cracking during that time is greater. You'll also get more deformation in the drying process with green wood. Having said that, there is an advantage to bending green vs. air dried: It takes less force. With some parts (the bow of a Windsor chair, for example) the distortion during drying doesn't impact the part much. But I love precision, so I rarely bend green wood.

The steambox

The simplest steamer I ever made was a stove-pipe set into a saucepan on the kitchen stove. I balanced chair legs in the pipe and stuck a rag in the top to keep steam from escaping. If you have only a bit of steaming to do, or want to experiment before investing in a proper steambox, stovetop steaming will get you by.

The key thing in setting up a steamer, no matter how robust or economical the system, is getting enough steam in the box. So what is enough? While I can't give you a number of BTUs or tell you how much water is sufficient, the wood can. After 15 to 20 minutes of steaming, the wood should be dripping when you pull it from the chamber. If it isn't, you will likely need to deliver more steam or build a smaller chamber. In a smaller chamber, the same amount of steam can more fully saturate the space and better plasticize the wood. I use a thermometer mounted in the door of my steambox to see that I'm getting 200° in the chamber.

Earlex steam generators (or similar steamers, like those for

CHAMBER DETAIL

Shopmade stopper fashioned from dense water-resistant hardwood

High-pressure polyethylene pipe, 8 in. dia. by $\frac{1}{2}$ in. thick

Pipe wrapped in moving blanket for insulation

Galvanized steel grate with most crossbars cut out slides into pipe and serves as tray for workpieces. Avoid untreated steel for this application, as it will react with water and tannins to stain the wood.

Formless bending

Useful for developing ideas and building prototypes or one-of-a-kind pieces, formless bending is a little like freehand drawing. It works only with thin stock and when the precise final shape of the piece isn't critical.



Steam is friend and foe. When pulling parts from the steambox, wear long insulated gloves. Reach into the opening from the bottom instead of the top, where the steam flows out. Keep the rack close to the door so you don't have to reach deep into the chamber.



Hot from the oven. When the workpiece is cooked, Boggs removes it and starts bending by hand, using his thigh as a bending form.



Doing a back bend. With thin stock the bending goes quickly and easily. After making a first bend and then glancing at the target curve he'd drawn on a piece of plywood, Boggs flips the workpiece to bend a reverse curve.



Bending to the master. In a matter of a minute or two, after tweaking the initial bends with further pressure against his leg and making other corrections in midair, Boggs has a workpiece that matches the reverse curve he was aiming for.

removing wallpaper) can do the job on a small scale, but you might need two of these to fully saturate a steambox like the one drawn here. You can use a CPVC pipe alone as a quick steambox. It can handle the heat and contain the steam. But it may get soft and lose its form unless you support it well while steaming.

Bending forms and drying racks

I typically make my bending forms with a tighter curve than the finished part. I overbend the part on the form, hold or clamp it in place for a while, then remove it, let it relax slightly, and put it on a drying rack that holds it in the desired final shape. Why the two-step process? Like most materials, wood has a "memory" and

will spring back somewhat when bent. So we need to deform the wood to the extent that it "forgets" what it was like before. I do this for all my bends and get remarkably consistent results once I discover the requirements for the part I'm bending. How much to overbend the part and how long to hold it on the bending form depends on the species and thickness of the wood, and on the curve you're generating. There are no hard and fast rules. I experiment with each part, and it may take several rounds to get it right.

Releasing the parts from the bending form late does not hurt them, but releasing them too early, before they have cooled and set enough, can mean they spring back too much as you release them and can break when you bend them onto the drying rack.

Free bending

Free bending involves a bending form and a drying rack. The part is bent over the form without using compression and is held in place temporarily by hand or with clamps. Then it is transferred to a drying rack.



Overbending is good. Boggs presses the thin workpiece to a form with a tighter radius than the final curve he's after. He holds the part in place or clamps it to the form for a minute or two. He uses a steel strap here to help make a smooth bend, but without end blocks that would add compression.

Into the drying rack. After taking it off the bending form, Boggs slips the part into a drying rack whose end stops hold the workpiece to the desired radius of the finished part.



Building bending forms

Bending forms need accurately cut curves and a smooth bending surface. Any bump or dip in the form's face can cause one area to over-stress and can lead to part failure. Typically, making a form is a matter of laminating several pieces of sheet material cut to the same curves. I strongly advise against freehand sawing your form curves and trying to smooth them by hand. You won't likely get an accurate form. Routing to a template is an excellent way to create good form curves. I recommend sawing the template out of $\frac{1}{4}$ -in. MDF and perfecting your curve on that. The thin stock is quick and easy to smooth by sanding. When you rout to this pattern, the curved surface stays square to the sides from end to end.

Sometimes it makes sense to bend parts by anchoring the center of the workpiece and pulling both ends to the form. But I prefer to bend from one end to the other for most of what I make. The leverage advantage is significant when you anchor one end. Plus, you only have to bend half as much wood at once when you are pulling one end rather than both ends. I orient my forms so I am pulling down to the table rather than working



Rack of another order. A special device with three serpentine vertical ribs serves as a drying rack for the slats on a Boggs rocker. Though all the slats were bent over the same form, they dry to different radii, which graduate from one to the next.



Bending form with a built-in clamp. With a slot at the lower end that pinches the workpiece in place, this form makes for an easy bend without a metal strap. Boggs clamps the upper end of the part to the form to let it set.

horizontally. I have not found a project yet that requires more than my body weight and maybe a lever bar to get enough force to bend the parts.

Steaming and bending the parts

A long-held basic rule states that you should steam the wood for 1 hour per inch of thickness before bending. In general this works, but the wood doesn't know about this rule yet and, like all natural materials, behaves however it wants. I add to that rule that the drier the wood and the denser the wood, the longer it needs to cook. Much like with baking bread, there is a feel to knowing when the wood is ready. You get that feel by breaking parts that aren't cooked enough. So it is a good idea to start with cheap wood.

The broken parts can teach you what went wrong. If there are tension failures on the outside of the bend, it means the outer fibers were stretched too much. If this happens on a free bend, you will likely have to add a compression strap to the form. If this happens in a compression bending form, you need to tighten the foot of the compression strap to get more compression than you had. If you are getting failures on the inside of the bend (which only happens in compression bending) then you need to back off the compression pressure on the next effort.

Once you have bent your parts, you'll need to heat-set and dry them. These two changes to the wood are not the same thing. The wood will dry in your shop environment just fine. But if you heat the material, the bends will be more stable. I achieve both by hanging the parts—still in their drying racks—in a room heated

TIP

BENDS ARE TWEAKABLE

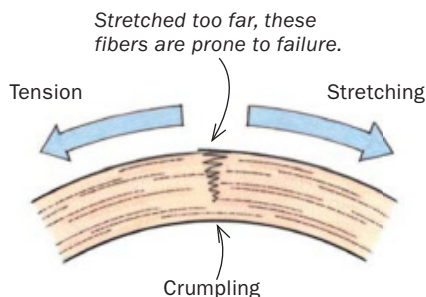


Before they are fully set, steam-bent parts can be coaxed into tighter or flatter curves. With three slats in a drying rack, Boggs uses hand pressure to get them all to conform to the same curve (left). Even thicker parts with bends that are fully set can be reshaped somewhat with the help of a heat gun and clamping pressure (right).

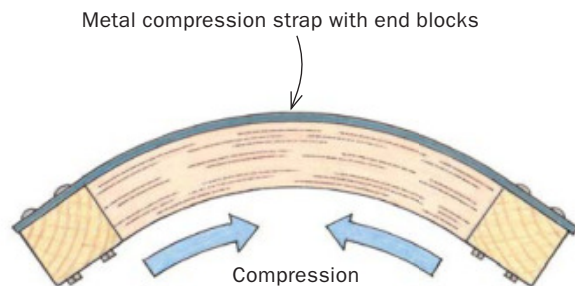
Compression bending

In compression bending, a metal strap with stops on both ends helps bend the workpiece. It compresses the fibers on the inside of the curved part, and restricts the stretching of the outer fibers, reducing breakage.

HERE'S HOW THE WOOD BENDS

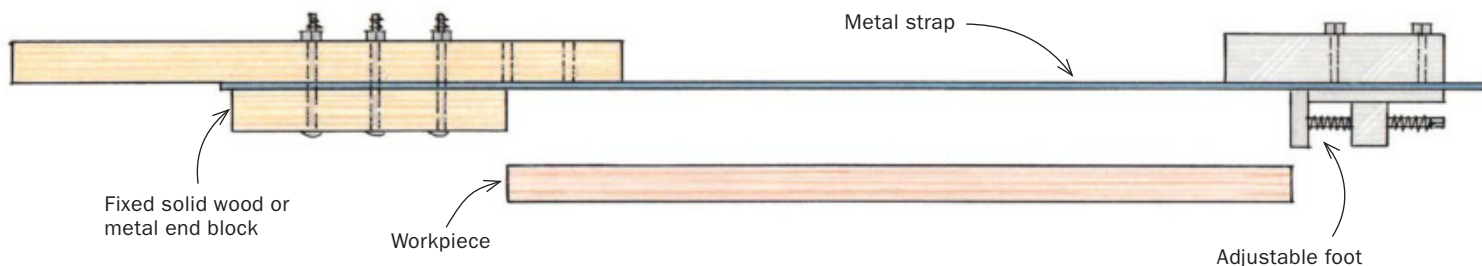


When a piece of wood is steam-bent, the fibers on the outside of the curve are stretched and those on the inside are compressed. Failures typically occur on the outside of the curve.



When you steam-bend using a compression strap, the end blocks force the inside fibers to compress and prevent the outside fibers from stretching.

ANATOMY OF A COMPRESSION STRAP



Thick parts call for compression.

After steaming the workpiece and inserting one end in the closed end of the form, Boggs makes the bend by pulling down on the handle of his shopmade compression strap. With the part nearly home, he adds a clamp to clinch the deal.



TIP

STOPGAP DRYING RACK



In a pinch, Boggs sometimes uses a bar clamp as a drying rack after removing the part from the form. A bevel gauge monitors the angle of the bend. If the angle needs adjusting, he tightens or loosens the clamp.

Reverse curves



Commercial compression. To bend these chair posts, Boggs uses a compression strap from Lee Valley. After inserting the workpiece he tightens the adjustable foot, snugging it up to the end of the part.



Clamp the first curve. Before pulling the part down onto the form, Boggs clamps the section that gets a concave curve.



Time for some serious leverage. After re-tightening the adjustable foot and fully tightening the C-clamp, Boggs pulls down with the compression strap, inserting a cheater bar for extra leverage.



Wedge and clamp. To keep the workpiece close to the form, Boggs uses a pin and wedge system. Then he applies pressure with a second C-clamp to pull the part to the form.

to 115° and dehumidified to 15% relative humidity. I leave them there until their moisture content is 6% to 8% before removing them for final shaping and joinery. If you do a fair amount of steam-bending, it's a worthwhile effort to set up some kind of drying space in your shop. In some workshops I have used a closet with a space heater in it. For just a couple of bends, you can set the bends with a heat lamp placed to heat the bent portion. Just use good judgment with regard to fire hazards.

I made a study many years ago of how to steam-bend parts consistently. I wanted to find out where all the variables were coming from with each species and type of part I was using. It took a good bit of time, and lots of note taking, but I found all the variables that were making the parts come out differently. They were all coming from the same place: me. Once I started managing the wood's moisture content to between 15% and 20%, and tracking how long I spent bending the part onto the form and how long I kept it there, parts started coming out with remarkable consistency. Applying a much more disciplined approach to steam-bending has made the whole process more successful and more enjoyable. □

Brian Boggs does his steam-bending in Asheville, N.C.



One more wedge. With the second C-clamp tight, Boggs adds a wedge to bring the part all the way home to the form. After 10 minutes on the bending form he'll move the part to a drying rack.

gallery

Inspiration for our readers, from our readers



KELLEN CARR

Fallbrook, Calif.

This cabinet-on-stand was Kellen's first and only project at The Krenov School before school was cut short by the Covid-19 pandemic. The goal was a cabinet with curves that didn't have to be placed against a wall, but looked interesting viewed from all sides. "This was my first time experimenting with tambours, and the Cuban mahogany was a lovely choice for straight, stable sticks," Kellen says.

MAHOGANY AND MAKORE, 13D X 21W X 40H

Photo: Todd Sorenson



JAY SIEGELAUB

Ossining, N.Y.

Though inspired by George Nakashima, Jay devised his own twist on the slab-top table. The big-leaf maple burl top started off as a single piece, but he said, "I decided that I didn't want to just work with the natural cracks in the wood, so I created my own 'splits' in a manner that highlighted aspects of the wood." He made butterflies in purpleheart, yellowheart, bubinga, and redheart to add contrast.

BIG-LEAF MAPLE BURL (TOP), WALNUT (LEGS), 13W X 27½L X 18H



WILLIAM CRAWFORD

Clearwater, Fla.

This chair and footstool combo reflects the Mid-Century Modern "Kenya" style, which was originally modeled after the armchairs carried on African safaris. William's versions, unlike the originals, were not made to be folded and packed in a truck. The seats and back are leather.

RED OAK, 26D X 25W X 29H

Photo: Lori Ballard





JOEL MARK

Hillsdale, N.Y.

This vanity is part of a six-piece bedroom set Joel designed and made. The influences, he says, are Émile-Jacques Ruhlman and James Krenov. “Krenov influenced the sides and Ruhlman the inlays,” he says. More pieces from the set can be seen on his website, Joelmark.net.

QUILTED MAPLE AND WALNUT, 18D X 56W X 29½H



ABRAHAM TESSER

Athens, Ga.

Abraham made this table as a gift for a friend, and it features work by the friend's favorite quilter, Olena Nebuchadnezzar. Abraham used a technique called “inside out turning” to create an incised detail on the walnut legs. The legs are oriented at 45° to make the detail more easily visible.

WALNUT, OAK, AND MAPLE, 12D X 17½W X 24H

Photo: Louis and Lilia Tesser



ROBERT K. BONNETT

Shelton, Wash.

Robert built this coat rack during a class at the Port Townsend School of Woodworking taught by Seth Rolland. The class was called “Out of Square” and Robert says the overall form, which is his favorite part of the piece, was inspired by the old-growth fir trees of the Pacific Northwest.

DOUGLAS FIR, 30D X 27W X 78H

Photo: Cooper Studios

DEAN M. VANDE GRIEND

Story City, Iowa

"I designed this floating-top table and wasn't sure I would ever build it," Dean says. But then he was given some thick slabs of soft maple that were ideal for the 2½-in.-square legs and frame. "I came up with a three-way corner joint to keep the overall design clean, but add interest when you take a closer look," he says. When the corner joint is assembled, the short rails lock the legs and long rails in place. Six cherry supports float the top and join to the frame with asymmetrical double tenons.

MAPLE AND CHERRY, 32D X 56W X 30H

Photo: George Ensly



DAVID COSTA

Niwot, Colo.

While studying woodworking at Red Rocks Community College in Lakewood, Colo., David designed this chair and purposely didn't think about how he'd build it. "Only after I arrived at a design did I say 'oh shoot ... how am I supposed to actually make this thing!'" he says. His solution was to use bent-lamination. As a bonus, he also taught himself how to upholster the seat and backrest.

PURPLEHEART, 32D X 23W X 35H

Photo: Leane Mahanke



TIM HEIL

Gem Lake, Minn.

Tim turned 30 candlesticks of this design for the American Association of Woodturners' 30th anniversary a few years ago. He's turned more than 600 of these candlesticks in all. They are based on a famous design by Rude Osolnik, but differ in that Tim uses a brass insert to support the candle. The sticks taper to ¾ in. dia. at their thinnest part.

MAHOGANY, COCOBOLO, VERA WOOD, MYRTLE WOOD, 2½ DIA. (BASE), 2 DIA. (TOP), RANGING FROM 6H TO 11H

Photo: Jordan Schroeder

ERIN IRBER

Nevada City, Calif.

Erin designed this tabletop display cabinet as an homage to Greg Smith, her mentor at The Krenov School. When he was a student at the school himself, he made an intricate glass cabinet in pear that inspired her work. The design allowed her to explore how glass lets light into the interior. The top of the cabinet is glass, letting in more light and letting you see into the bank of drawers from above.

GRANADILLO AND SWISS PEAR, 11½D X 13¾W X 10½H

Photo: Todd Sorenson



KEVIN ALMEYDA

New City, N.Y.

This piece combines the basic design of Mike Pekovich's low chest of drawers in *FWW* #248 with the butler's desk by Chris Becksvoort in #243. "It gave my son much-needed storage space, a desk to do his schoolwork, and, thanks to a couple of secret drawers I added, a place to hide secrets from his sister," Kevin says.

CHERRY AND POPLAR, 20D X 42W X 40H

CRAIG KOSONEN

Toronto, Ont., Canada



Craig made this jewelry cabinet as an anniversary gift for his wife. "I wanted there to be a surprise upon opening the door, so I did a marquetry Japanese maple branch with a couple of birds to greet you." He says he learned the inlay and veneering

techniques from Craig Thibodeau's book and *FWW* articles.

WALNUT BURL, BLACKWOOD, MAPLE BURL, AND VARIOUS MARQUETRY WOODS, 5D X 18W X 18H



17th-century relief carving

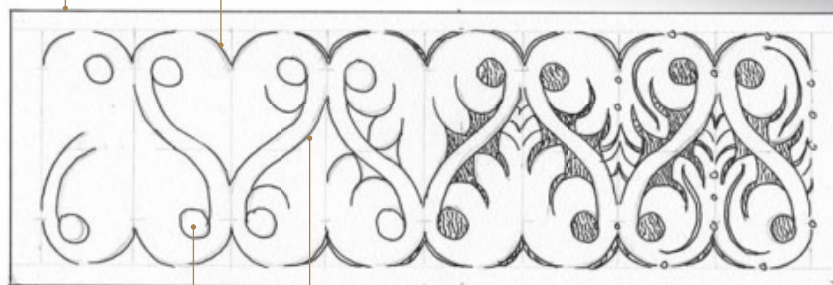
BY PETER FOLLANSBEE

I specialize in 17th-century English and New England furniture, much of which is carved, like my box (see pp. 46–55). In this Master Class, I'll show you how to carve that box's two patterns, S-scrolls on the front and lunettes on the sides. The examples included here I learned from studying surviving oak furniture from Devon, England; and Ipswich, Mass. These are common motifs, and from layout to the execution they contain lessons that help with many other patterns.



1. Scribe margins.

2. Incise rounded corners.



3. Form circles.

4. Carve S-shapes.

S-scrolls



Step off the spacing. Once you've scribed the perimeter margins, use a pair of dividers to lay out the spacing for each S. Then square those divider points across the board with an awl. You'll be left with a series of rectangles.



Gouge outlines each scroll's corners. Strike a wide #7 or so gouge vertically at the intersection of each horizontal and vertical layout line, rounding off the corners of each rectangle (top). Next, tilt the same gouge back 45° to pop out the chip behind each incision.



Two circles for each rectangle. Using a narrower and more deeply curved gouge, incise a series of small circles in opposite corners of the rectangles. Leave space between these circles and the arcs at the corners.



The tools: gouges and a V-tool

Before I get to the patterns, it's helpful to discuss the carving tools. I recommend practicing with them before diving right into the patterns. This style of carving is quite approachable, but beginners still benefit from a few test cuts in scrap.

Gouges for controlled cuts—Much of this style of carving, these two patterns included, is formed by making incised cuts with gouges. These are simple: Strike the gouge vertically into the wood and then remove the chip behind it with the same gouge tipped to about 45°. The shape of the gouge thereby defines the shape of the chip. Easy, repeatable, and effective.

By organizing these gouge cuts in different ways, you can quickly and reliably duplicate motifs and elements. For example, by systematically staggering and flipping the cuts, you can create the mirrored leaf carving around the S-scrolls, as well as some of the leaf's veins. They also help when carving curves, like at the corners of the S-curves and leaves under the lunettes.

With these gouge cuts, you're both drawing the pattern and incising it at the same time. There's no layout to speak of; it's all struck. So you get one shot at it, but it's completely manageable.

V-tool for more freedom—While the gouges will get you partway there, you'll need the V-tool for both patterns. Because it's steerable, you'll use it to outline both the free-flowing sweep of the S-scrolls and the curved arches of the lunettes.

This freedom can be daunting, and the tool does come with challenges. You need to learn how to steer it. One key is to take deep cuts; this sounds counterintuitive, but these are easier

And I do recommend trying other designs. You shouldn't let the word *carving* intimidate you here. You don't

need an artistic background to handle these. A V-tool, a handful of gouges, a round mallet, and a compass get the job done. Plus, any mistakes are likely to be hidden by the detailed, highly geometric patterns. The result is a relief carving that light and shadow play off of dramatically.



4

V-tool outlines each S. The V-tool lines travel from the circle to the rectangle's vertical margin, or from the margin to the circle. It's not circle-to-circle or margin-to-margin. Cut all the lines in one direction, then the mirror images heading the other way.

S-scrolls continued

5

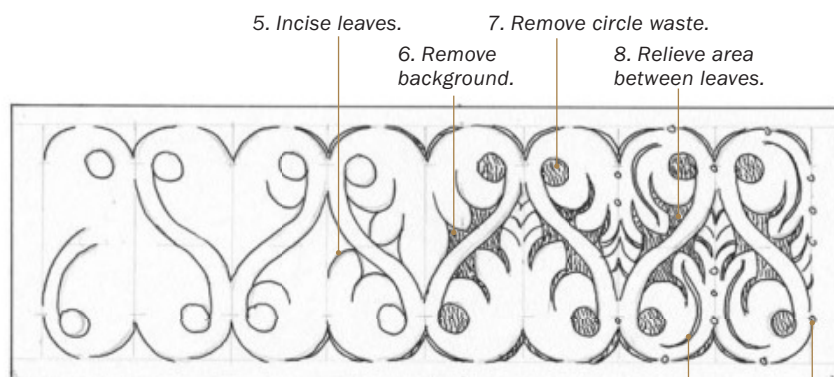


Begin incising the leaves. With a wide, deeply curved gouge, strike the outline of the leaf around the circles. For the remaining leaves, which angle toward the V-tool trough, use a gouge with less sweep but similar width. The last cuts form the middle leaf. These cuts don't meet in the vertical centerline, but rather go into the V-tool line.

6



Remove the background behind the leaves. Hand pressure with a shallow gouge is usually enough, but be careful. It's easier to slip with hand pressure than with mallet work. Hold the tool near the cutting edge while bracing your fingers on the board.



5. Incise leaves.

7. Remove circle waste.

6. Remove background.

8. Relieve area between leaves.

9. Add veins.

10. Punch circular accents.

to control than shallow ones. Deeper cuts also create a wider, more pronounced line, revealing more light and shadow. So cut as deep as you can, within reason, while still maintaining control. This means heavier strikes with your mallet, too. I keep my stance wide to maintain balance during these hits. Take practice cuts of varying depths and widths to find which gives you the lines you want.

My V-tool is 6mm wide with an approximately 50° angle.

Lay out and carve the S-scrolls

After scribing your margins, use dividers to lay out the scrolls' spacing and scribe these divisions with a square and awl. You'll be left with a series of rectangles. From there, use a wide gouge with a moderate sweep to round the corners of each rectangle. This creates the rounded corners of each S.

The next step, incising circles at diagonally opposite corners of each rectangle, is a little trickier. These circles and the rectangle layout lines are the waypoints for your V-tool, so their placement is critical. I start on the right-most rectangle, striking circles in its top left and bottom right corners. The rectangle to the left gets a circle in its top right and bottom left. This alternating pattern continues across the grid. Think this through carefully. Once you hit the gouge, there's no eraser other than a plane. Leave some space between the circle and the outer rounded corner of the rectangle. The gouge I use for this is ½ in. wide with a slightly tighter sweep than the previous one.

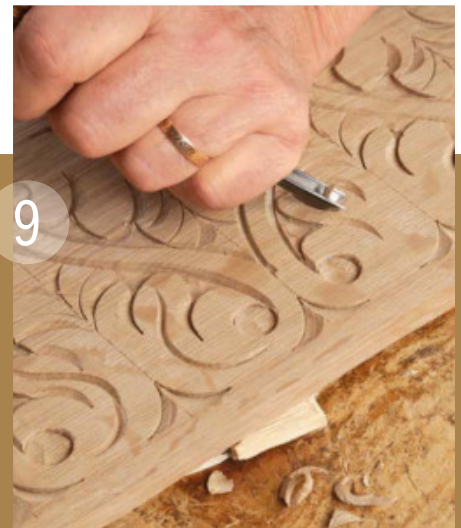
Now use the V-tool to outline the curves of the S, which go from corner to corner. The V-tool line connects the rectangle's margin to the circle, then the circle to the margin. It's not circle to circle and margin to margin. If you need to draw pattern



Pop out the circle. This is more fun than you'd think. Just tuck the corner of your shallow gouge in there and give it a whack. Then pivot this way and that with hand pressure to clean out the cut.



Add depth to the leaves. Now back to the larger gouge. Pop a chip out behind those initial incised cuts within the leaves. This is much like what you did behind each corner chip.



Gouge cuts and V-tool for veins. The middle leaves' veins are incised cuts. For the leaves directly beneath those, a V-tool handles the job.



Nail set for finishing details. To accent some more of the foreground, Follansbee uses a $\frac{5}{32}$ -in. nail set to punch circles around the pattern.

lines, use chalk; it's easy to remove. I often have students draw a mark at the midpoint of the rectangle too, where the S bends.

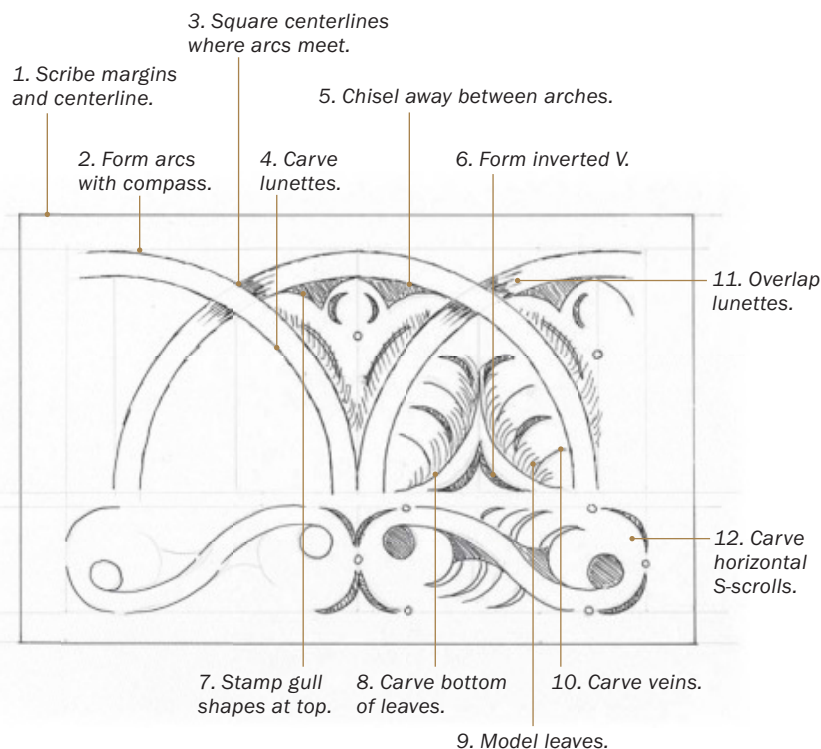
Leaves fill in the space between the S shapes. Begin with the leaf around the circles and work your way up to where the V-tool lines meet.

The next step is to remove the background with a shallow gouge about $\frac{1}{2}$ in. wide. Do this behind the leaves, within the circles, and at the rounded corners. You don't want a dead-flat background. Facets show shadows better. Make clean cuts. Hand pressure is usually enough for this task, but be careful not to slip.

Finish with the detailing that fills in the blank spaces, namely the veins in the leaves and punched circles.

Use a compass to lay out intersecting lunettes

The box sides have a short run of intersecting lunettes, an art history term for these half-circles. This pattern



Lunettes



Mark the margins and a vertical centerline. Use a marking gauge to scribe the horizontal lines, and a square and awl for the vertical ones.



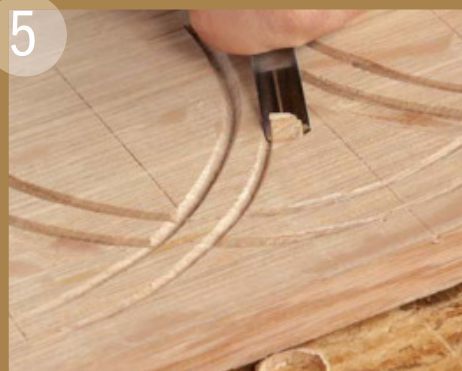
Scribe lunettes. The pivot point of the half-circles is on the centerline. Make the quarter-circles by pivoting on the half-circles' ends. Close the compass $\frac{3}{8}$ in. for the concentric circles.



Square lines down from where the lunettes meet. Doing it now instead of before you scribe the arcs lets you mark using the actual layout lines.



V-tool carves the lunettes. Follansbee cuts all the halves heading from 12-o'clock down to the margin, then turns and carves the others coming up from the bottom margin.



Relieve around the middle of the lunettes. Use a shallow gouge bevel up. With one corner of the tool in the V-tool line, tilt the edge so the other corner doesn't contact the board.



Incise inverted Vs under the arches. Connect the vertical layout line with the bottom margin. Use a wide, medium-sweep gouge.

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involves a lot more V-tool work, but it's not freehand, like the S-scrolls. Instead, it's laid out with a compass.

No matter how many of these I'm cutting, I cut all the arcs heading in one direction, from the top down, then turn and carve the others coming up. It helps with flow. Since I'm a righty, it's always counterclockwise, too.

Cutting across the board is easier than cutting with it, where your tool can follow the grain. Be extra aware at the top of each lunette for this reason.

The rest of the detailing is predominantly gouge cuts, with some V-tool work to help outline the bottoms of the leaves within the intersecting lunettes. Familiar territory. You don't level the background, so to give the pattern more punch, use the gouge bevel down around the lunettes in the middle of the pattern and bevel up to model the bottoms of the leaves. □

Peter Follansbee specializes in 17th-century oak furniture from England and New England.

For more carving ideas, Follansbee sells full-size step-by-step drawings at his blog, <https://pfollansbee.wordpress.com/>



Lunettes continued



7 **Form abbreviated leaf shapes at the top.** Some people visualize these as gull shapes. Use the same gouge as in the last step. Then remove the chips behind the strikes.



8 **V-tool cuts the bottoms of middle leaves.** Mirror the curve of the incised gull shape below when making this curve. Stop these lines short of the lunette's crossing.



9 **Shallow gouge models the bottoms of leaves.** Use the tool with its bevel up and its handle near level. Pare away the edge of the almond-shaped leaves you just made.



10 **Cut veins in the leaves with a wide, moderately curved gouge.** These cuts should flow with the leaf. Strike four on each side before removing a chip behind every other one.



11 **Shallow gouge creates overlap.** Where two lunettes intersect, use a gouge with a mild sweep to remove chips on either side of the V-tool lines.



12 **Opposing S-scrolls at the bottom.** These scrolls are the same as the first pattern, just lying down instead of standing up. Make sure the left and right are mirror images.

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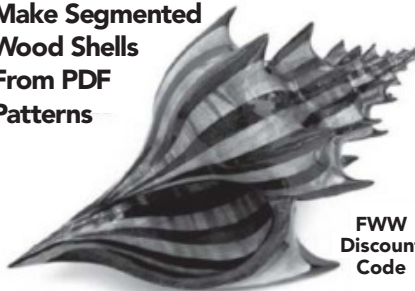
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Resilience runs in the family

BY TONY O'MALLEY

I've been thinking about retirement lately, though my wife has other thoughts on the matter. In addition to wondering how much longer I want to keep making custom cabinets and furniture as a full-time business, I sometimes ruminate on how I ended up as a woodworker in the first place, starting 35-plus years ago. Like many, my story involved a turn from another line of work. Few of us follow our fathers (let alone our mothers) into this trade. And anyway, since I grew up without a father in the house, I've had to look for other influences.

My mother's father, though I never met him, was one strong candidate. I was named after him. As the stories go, Anthony Farrell lost his right arm in some kind of big machine at the Budd Locomotive Company in Philadelphia around 1928. A curious silver lining to the tragedy was that the company kept him employed all through the Depression that followed soon after. (This was before the advent of workers' compensation programs.) He reportedly adjusted well, doing all manner of tasks around the plant and was, literally, a one-armed paperhanger and carpenter in his spare time. I'll come back to grand-pop Farrell (shown above) in a minute. By the way, I became a grand-pop myself a few years ago, and now have two grandchildren.

My career path took its sharp turn shortly after I graduated from college. I worked for a couple of years in hospital administration, and hated the pressure and suit-wearing aspects. I had dabbled a little in self-taught woodworking during college. My growing interest was amplified by the burgeoning of custom furniture work in Philadelphia at the time, the fruits of which were offered every year to the public at The Philadelphia Furniture Show, starting in the mid 1990s. That was also when I found and subscribed to *Fine Woodworking* and caught the woodworking bug. But how and why was the fever strong enough to lead me to quit a decent-paying, career-track job for a minimum wage position (\$4.25 an hour!) in a line of work where I had no experience? Having a supportive spouse was a key factor.



Not long into my first year working full-time in a woodworking shop, I had a serious accident on a big old tablesaw with a 16-in. blade. I had minimal training, the saw lacked any kind of safety guard, and I did something really stupid—a terrible combination of ingredients! The blade badly cut a couple of fingers on my left hand and completely severed my pinky. Fortunately, an intrepid co-worker was able to retrieve the digit from the sawdust and bring it to the hospital. Also luckily, this was during the advent of microsurgery, and my finger was successfully re-attached, though a good bit shorter. (There went my fall-back career as a guitarist!)

When I went back to work, I was terrified to use that same tablesaw. Maybe that's when I channeled my one-armed grandfather. I felt somehow initiated into a select club, one of highly dubious distinction, that compelled me to stay the course and prove my mettle. Over the next five years at that shop I learned a lot—about furniture making, residential cabinetry and its installation, as well as commercial millwork. I learned how to fix mistakes, and avoid them in the future. This wide range of exposure helped me stay employed over the years, self-employed for the last 20 years. Early in my self-employment I even exhibited at the Philadelphia Furniture Show, where I learned the harsh truth that selling custom furniture is an exceedingly hard way to earn a living. That's partly how I found my niche making built-in cabinetry, though that market is only slightly bigger.

While I may be a moderately competent cabinetmaker, I often marvel at how many aspects of the trade I simply have not become adept at, like turning, carving, veneering, even finishing. Of course I've tried my hand at all these and still do, but self-employment requires wearing so many other hats (selling, designing, purchasing, book-keeping, managing, to name a few) that being resourceful is really the overriding skill required to earn even a modest living in this trade. That and resilience, which my grandfather exhibited far beyond me, working with one arm through the Depression and beyond. □

Tony O'Malley makes furniture and cabinetry in Emmaus, Pa.

A close-up, top-down view of a light-colored wooden workbench. In the upper left, there are wood shavings and a piece of wood. In the upper right, a portion of a white laptop is visible, showing the 'cmd' key and a trackpad. The main text is centered on the workbench.

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Ted Lott braids together art and craft, furniture and architecture, found objects and fantasy houses. He's fascinated by the connections between buildings and furniture: their shared stylistic motifs, their common catering to the human form, and their mutual reliance on wood. He points out that in the past, "the cabinetmaker and the house builder were often the same person—a joiner who built cabinets in the winter and framed houses in the summer." If Lott is infatuated with habitation, perhaps it's because he's been so much on the move, having lived, worked, and studied everywhere from Hawaii to Maine, with dozens of stops in between, as he explored woodworking, cabinet-making, house building, black-



The Hepplewhite House



smithing, and sculpture. When he built this piece, he was working as a restoration carpenter on historic houses in Cooperstown, N.Y., and came across a reproduction Hepplewhite settee in poor condition at a garage sale. After some contemplation, he cut off its legs ("quite a disconcerting moment") and used them as the foundation for a miniature platform-framed house, building it floor by floor with tiny studs, joists, and planking bandsawn

from white pine boards and left rough like vintage building timbers. The facade of the house, with its two curved doors, conforms to the shape of the settee's seat and echoes historic window design. He thinks of the piece as sculpture, but also as a display cabinet, one he hopes "will resonate with the history of furniture and architecture and art."

To see more of his work, go to tedlott.com.

—Jonathan Binzen

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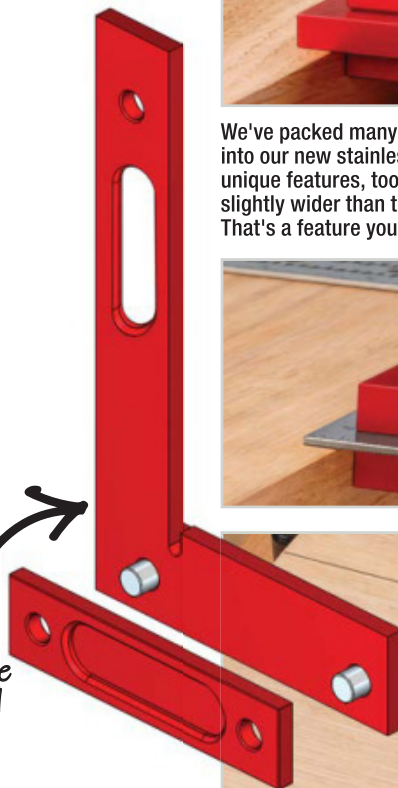
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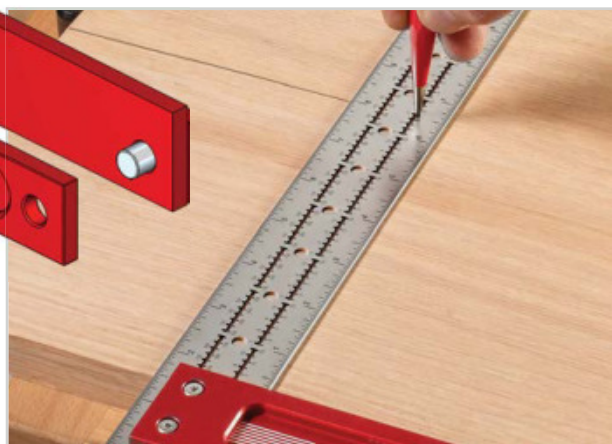


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To make accurate layout even easier, there are scribing guides milled every eighth-inch along the blade. Just drop the tip of your pencil in the right hole and slide the base along the edge of your stock for perfectly parallel lines at the precise measurement you choose.

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Beveled edges and high contrast. When you need the scale, you'll never find ones easier to read. We beveled the edges 30° to put the graduations right down on top of your work, and the bright white laser-engraved scale is easy to read against the red anodized surface. Prefer metric? We make the same tools with the pencil guides on a 1mm grid and metric scales on the edges.

While the Saddle T's and Pocket T's are very similar tools, there are some differences, too. The Saddle T-Squares have a deeper reference edge and the ends of the reference edge are in line with the scale edge. The deeper lip works nicely with material that has already been shaped. Having the end in line with the edge means you can mark the face and edge of your stock at the same time.

The Pocket T-Square is more compact but just as accurate. The reference edge is exactly the same length as the Saddle T-Square, but not as deep. That's handy when you work with thinner stock. The narrower blade feels comfortable in your hand when you're laying out joinery on small casework and jewelry boxes.

Both the Saddle T-Square and Pocket T-Square are available individually or as a complete set. The complete sets come with a wall-mountable Rack-It to keep your T-Squares always in sight and ready for work.



Mark the face and edge of your stock in one motion with the Saddle T-Square.



The Pocket T-Squares are perfect for joinery layout and thinner stock.

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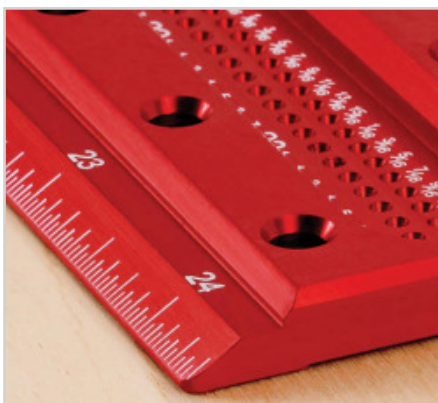


them. The scales are laser engraved to a tolerance of $\pm .004"$. The white engraving on our famous "Woodpeckers Red" anodized finish delivers a very readable contrast, even for older eyes or poor lighting conditions.

We offer four versions of our T-Square: 12", 24", 32" and 600mm. Each delivered with a wall-mountable Rack-It™ to keep your Precision T-square safe and always in plain sight.



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The 30° beveled edges puts the scale markings right next to your work, reducing parallax error.



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When you need vertical measurement, slide the stop off the end and insert it into the cut-out on the blade. Now your rule has a perfect stand to keep it upright while you use both hands to dial in the height of a router bit, saw blade or dado stack, matching it to the easy-to-read scale engraved on the end of the rule.

Two material choices and three calibration options.

The bright white laser engraved scales on the "Woodpecker Red" anodized surface make the original aluminum Paolini Pocket Rule one of the easiest-to-read rules on the market, as well as one of the lightest. If you prefer a thinner rule, go for the stainless steel version. Both are milled to a precise 1-inch width. The anodized aluminum rule is 1/8" thick and the stainless model is 1/16" thick. Both are available with your choice of inch-only, metric-only or inch-metric combo calibrations. Regardless of the material or calibration choice you make, you'll love the clean, precise look of our state-of-the-art laser engraving, as will generations of woodworkers to come.



Above: Stop used to hold rule vertical, leaving your hands free for adjusting.
Below: Paolini Rule used as a marking gauge. Notch keeps pencil centered.



Keep your rules handy with a PPR Rack-It.



PAOLINI POCKET RULES

PAOLINI POCKET RULE - ANODIZED ALUMINUM

PPR-6-19 6" PPR	\$34.99
PPR-8-19 8" PPR	\$39.99
PPR-12-19 12" PPR	\$44.99
PPR-SET-I19 PPR Set	\$114.99
PPRRI-AI PPR Set & Rack-It™	\$124.99

metric
available

combo
available

PAOLINI POCKET RULE - STAINLESS STEEL

PPRSS-6-19 6" PPR SS Inch Only	\$42.99
PPRSS-8-19 8" PPR SS Inch Only	\$47.99
PPRSS-12-19 12" PPR SS Inch Only	\$52.99
PPRSS-SET-I19 PPR SS Inch Set	\$139.99
PPRRI-SI PPR SS Inch Set & PPR Rack-It™	\$149.99

Wraps Around the Corner of Your Stock for Perfect Alignment and Dual-Edge Marking



Edge Rule wraps around your stock insuring parallel alignment & simplifying simultaneous edge and face marking.

Patent Pending



Woodpeckers Woodworkers Edge Rule wraps around the edge of your stock and gives you an accurate scale on both sides. The short side is 3/8" wide. The long side is 3/4". A slightly acute angle between the two planes (89°) keeps the edges right in contact with your stock.

Here are just a few of applications for this nifty new rule:

Measurements from Inside Corners...like the intersection of rails and stiles in a cabinet face frame. The Edge Rule keeps your scale square to your stock and starts you out perfectly flush at the corner. Just flip the tool over to come in from either right or left.

Marking Edge & Face By placing the desired dimension at the end of your board, you can mark both the face and edge at the same time. As mentioned above, this works just as easily and accurately from right to left as it does from left to right.

Finding Center of 3/4" Nominal Stock We all know 3/4" plywood isn't 3/4" anymore, and even if you're careful with your planer, solid stock can be a hair under or a hair over. Using the short side of the Edge Rule, you can scribe a line from both sides and the center of the board is between the two lines...it doesn't matter whether your stock is slightly under or slightly over, the center will always be between the lines.

Mid-Field Measurements Even when you're not working on the edge of your stock, you'll still find the Edge Rule handy. The profiled shape makes it easy to move around on a large flat panel and the beveled edges get the scale right next to your stock where you need it.

Both edges are beveled, putting the scale right next to your work, which minimizes parallax error. The Edge Rules are anodized for surface protection and to give them our familiar "Woodpeckers Red" color. The scale is laser engraved with 1/32" graduations to a tolerance of $\pm .004$ ".

Woodworkers Edge Rules are available in 6", 12", 24" and 36" lengths. The small size and unique profile make the 6" Edge Rule an ideal pocket rule. Your choice in the longer Edge Rules depends on the scale of your work.

Repetitive marking is easier and more accurate when you add an Edge Rule Stop. If you need a place to keep your Edge Rules organized, the Edge Rule Rack-It keeps them handy and safe (*requires an Edge Rule Stop for each stored Edge Rule*).

Edge Rule Stops available individually. Edge Rule Rack-It™ includes 4 Stops.



Rule indexed from inside corner & parallel to stock being measured.



Edge Rule Stops ensure accuracy on repetitive marking.

WOODWORKERS EDGE RULE metric available

ERULE-6	6" Woodworkers Edge Rule.....	\$12.99
ERULE-12	12" Woodworkers Edge Rule.....	\$22.99
ERULE-24	24" Woodworkers Edge Rule	\$29.99
ERULE-36	36" Woodworkers Edge Rule.....	\$34.99
ERULE-I	Woodworkers Edge Rule Set of 4 - Inch.....	\$89.99
ERULE-I-KIT	Edge Rule Set of 4 - with Rack-It™ & 4 Stops.....	\$109.99
ERRIKIT	Edge Rule Rack-It™ & 4 Stops.....	\$29.99
ERSTOP	Edge Rule Stop (ea)	\$4.99

Woodpeckers®, LLC • 1-800-752-0725 • woodpeck.com



Adjust fixed block to stock thickness.



Hand-held mode.



Table top mode.

Square & Secure Your Smaller Projects With Our Versatile Box Clamps

Woodpeckers Box Clamps hold your box and case good projects perfectly square while you check joinery, do layout work, or install fasteners. They're better than an extra pair of hands in the shop, because extra hands can't guarantee your stock is being held square! The clever low-profile wedge system forces the corner square, even if the two sides are of different thicknesses (up to 1/4" difference). The outside of the corner has no obstructions. That means box joints and dovetails with pins that overlap are no problem. Neither are T-joints; and there's nothing in your way if you are installing screws or other fasteners.

You get hardware to use the Box Clamps two different ways. You can rest it flat on a table (or even mount it) or change the clamping bolt, add a knob and use it as a hand-held clamp on the upper sections of your project. The change from one mode to the other takes just seconds.

JUST A FEW OF THE FEATURES OF WOODPECKERS BOX CLAMPS:

- Tough, fiberglass-reinforced polycarbonate construction
- Complete access to corner for fastener installation
- Accommodates dovetails and box joints that extend past corner
- Adjoining sides can vary in thickness by up to 1/4"
- Can be screwed to a benchtop for repeat production
- Works equally well hand-held



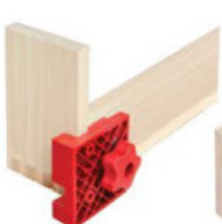
BOX CLAMPS

BC4-M2X2 Box Clamps (2pk)\$39.99
BD-0710.474 3/16" Ball Wrench\$6.99

BUY MORE & SAVE! Buy 2 Box Clamp 2-Packs at **\$38.99** each
 Buy 4 Box Clamp 2-Packs at **\$37.99** each
 Buy 6 Box Clamp 2-Packs at **\$36.99** each



Our ball-end Allen wrench makes tightening Box Clamps simple, even in deep assemblies.



Box Joint



Butt Joint



Corner Joint



Dado Joint



Miter Joint



T-Joint

Steel Clamping Squares... Reinforced Strength at a Competitive Price

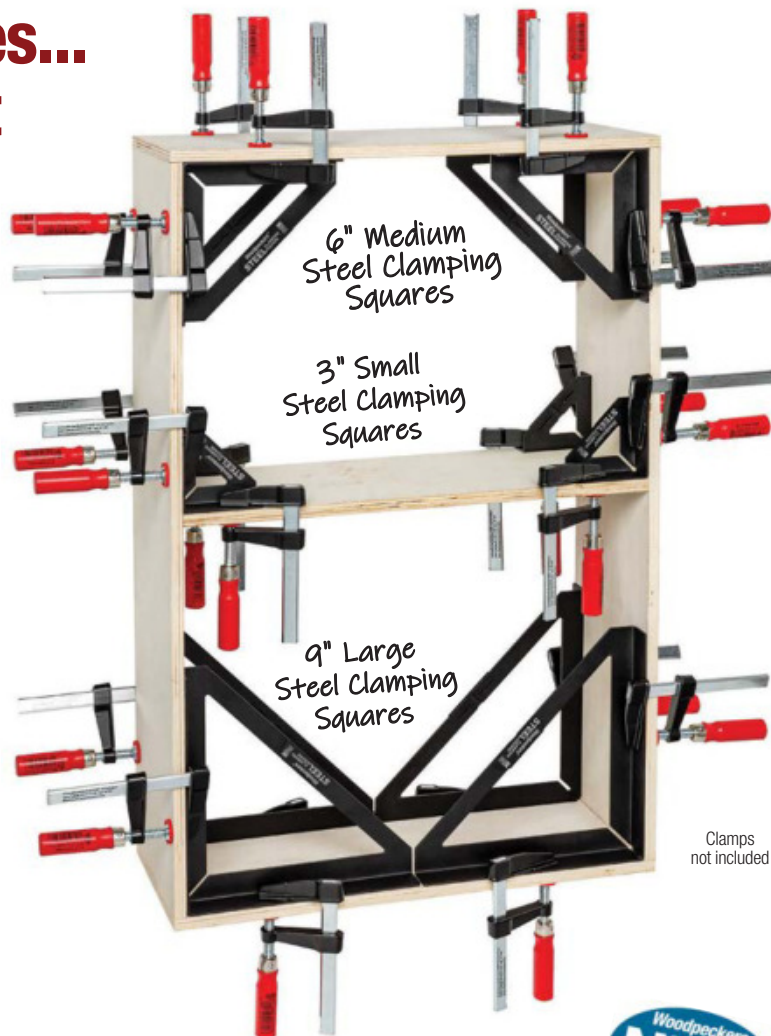
Simplify your project assembly process with Woodpeckers new Steel Clamping Squares. What makes our Steel Clamping Squares different from the rest is the reinforcing brace running between the two legs. Our computerized welding system holds the squares perfectly perpendicular while permanently welding the brace. And these clamping squares are formed from steel, not plastic.

Once we had the fabrication and welding process figured out on the 6" Steel Clamping Square, we realized we could take this design somewhere no other assembly square has gone before...bigger. The 9" Steel Clamping Square is the largest, strongest clamping square on the market. It's perfect for built-in cabinets and other large casework.

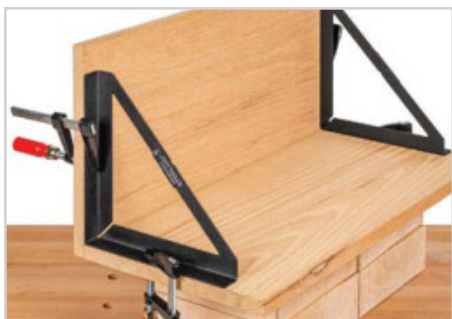
Bigger is better...some of the time. But, what about your smaller projects? When you're working on jewelry boxes and other small projects, don't give up on the idea of using a clamping square to control your results. We make our Steel Clamping Square in a 3" version perfect for those small projects.

What we didn't give our Steel Clamping Squares was a hefty price tag. Despite all-steel construction, the unique reinforcing brace, and a tough powder-coat finish, these squares are very competitively priced, and they're compatible with most "F", "C" and spring clamps.

Woodpeckers Steel Clamping Squares are available in 3", 6" and 9" sizes and come in sets of four with a wall-mountable Rack-It. We also offer a Master Set with four each of all three sizes and three Rack-Its.



Woodpeckers
NEW
PRODUCT



9" Steel Clamping Squares: Great for Panel Projects.



General purpose 6" Steel Clamping Squares.



3" Steel Clamping Squares for small projects.



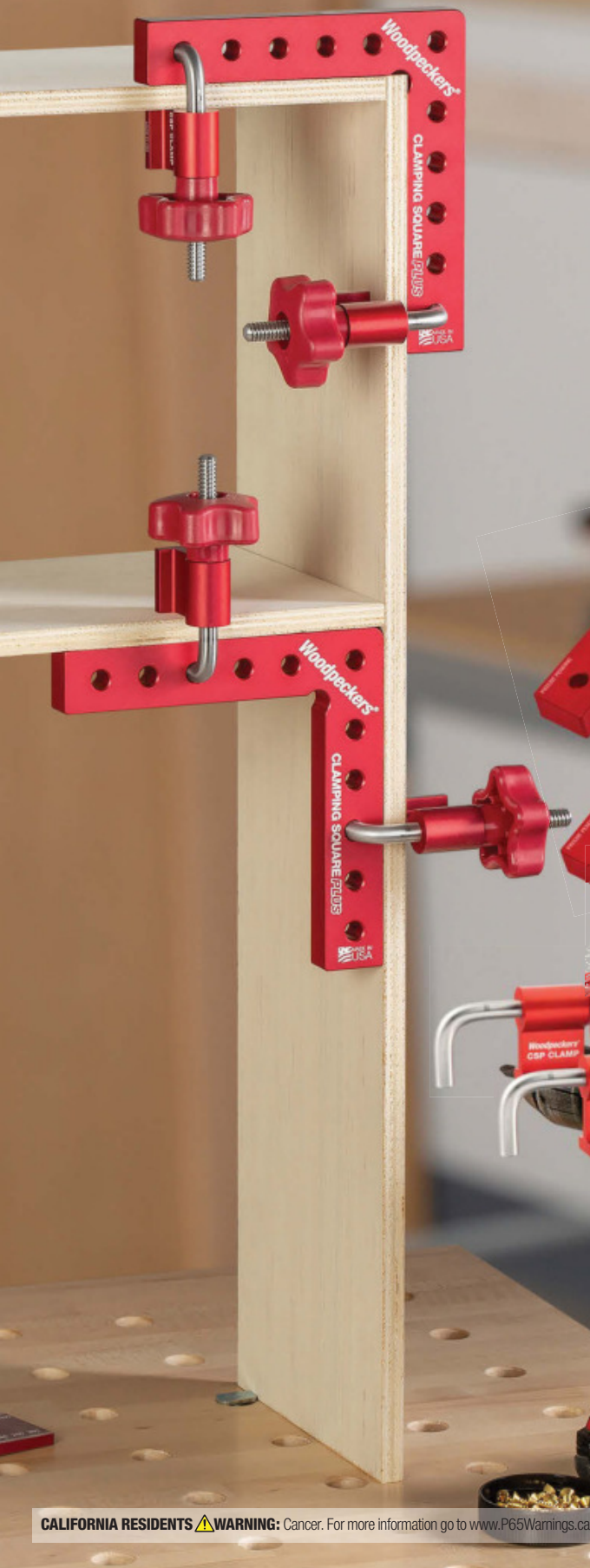
Each set of four Steel Clamping Squares includes a wall-mountable Rack-It.



STEEL CLAMPING SQUARES

SCS3	3" Steel Clamping Squares (4pk) & Rack-It™	\$59.99
SCS6	6" Steel Clamping Squares (4pk) & Rack-It™	\$69.99
SCS9	9" Steel Clamping Squares (4pk) & Rack-It™	\$79.99
SCSSET	Steel Clamping Squares Complete Set & Rack-Its™	\$199.99

CLAMPING SQUARES PLUS & CSP CLAMPS



Never Again Shout... “Honey...Can You Come Hold This for a Minute?”

Clamping Squares Plus make assembly a simple process. Instead of struggling to keep corners lined up while trying to install fasteners, just locate a Clamping Square Plus on the corner, throw a clamp on both legs, align your panels and secure the clamps. Now you have both hands free to fasten your project. We sold thousands of our original Clamping Squares over the years, then in 2018, we redesigned it bigger and stronger than before. The new Clamping Square Plus is a full 3/4" thick, with legs 1-1/4" wide and 6-3/4" long.

While you can use any kind of clamp on the Clamping Square Plus, we've designed one just for the job. It's convenient, fast and strong. The stainless steel L-bolts fit in any hole in the CSP and give you a gripping range of 1/8" to 2". Since they're made just for this job, there's not a bunch of stuff sticking out in your way.

Get our CSP Clamp Rack-It to keep your Clamping Squares Plus and CSP Clamps organized. It mounts to any wall and holds 4 Clamping Squares Plus and 8 CSP Clamps.



Clamping Squares Plus hold your projects square while you work on joinery or install fasteners.

Designed specifically to secure Clamping Squares Plus, the CSP Clamps are compact & efficient.



CSP Clamp Rack-It holds 4 Clamping Squares Plus & 8 CSP Clamps. Available in a set or individually.

CLAMPING SQUARE PLUS & CSP CLAMPS

CSP Clamping Square Plus (2pk).....	\$49.99
CSPX4 Clamping Square Plus (4pk).....	\$97.98
CSPX8 Clamping Square Plus (8pk).....	\$195.96
CSPC2 CSP Clamp (4pk)	\$59.99
CSPCK-4 Clamping Square Plus (4pk) & CSP Clamp (8pk).....	\$209.99
CSPRIK1 Clamping Square Plus (4pk), CSP Clamp (8pk) & Rack-It™.....	\$239.99
CSPRI CSP Clamp Rack-It™	\$34.99



Patent Pending

CLAMP RACK-IT™

If your clamp storage needs are more localized, with one set of clamps needed here and a different set there, the original Clamp Rack-It is for you. The assembled rack is just over 1-1/2" wide and 12" deep, giving you plenty of room for six heavy duty parallel jaw clamps. Anywhere you can attach to a stud, you can hang clamps. Drill two holes, screw the lag bolts in almost all the way, hang the Clamp Rack-It halves on the lags, and lock them down through the convenient access ports. Heavy gauge steel racks provide strength. Powder coated finish stands up to wear and tear.

CLAMP RACK-IT™

CRI	Clamp Rack-It™ Single.....	\$29.99
CRIX2	Clamp Rack-It™ (2pk)	\$59.98
CRIX4	Clamp Rack-It™ (4pk).....	\$119.96



Kit includes (2) small floating wedges, (2) large floating wedges, (2) fixed wedges, (2) fixed stops, (4 each of) 2", 0.7" and .375" dogs (8) .125" dogs (drilled and tapped for the adjustable dogs) and (4) adjustable dogs.



Get the Most Out of Your Gridwork Workbenches

If you agree that the simplest solution is usually the correct solution, you'll love Woodpeckers 2096 Workholding Kit. Few things are simpler than two opposing wedges, and that's one of the principles behind this kit. With one wedge fixed, the opposing wedge can apply amazing gripping strength with the tiniest application of pressure. When you're done and ready for the next piece, a simple tap on the narrow end of the floating wedge and it's free.

Another simple approach is a bench stop or "dog" with a fixed height...no springs, no clamps, just a shoulder that keeps it in place. The kit has a gaggle of them, in a range of heights where you'll always find one just a little shorter than your typical stock dimensions.

When you need to work on material that has been rabbetted, grab a couple of the Adjustable Dogs. The threaded stem fits into any of the 1/8" dogs and adjusts up or down to completely support a ledge from below.

"2096" refers to the spacing on Festool's MFT table...20mm holes on 96mm centers. This kit works perfectly with an MFT or with any table you make with our Hole Boring Jig (see next page).

Any of the dogs will lock the fixed wedges and fixed stops to your workbench to set up a quick clamping system like no other.

2096 WORKHOLDING KIT

WHK2096SB-19	2096 Workholding Kit (No Case).....	\$299.99
WHK2096S-19	2096 Workholding Kit in Systainer Case	\$359.99

NOTE: The Festool brand name is the registered trademark of the respective companies and are not associated with Woodpeckers, LLC.



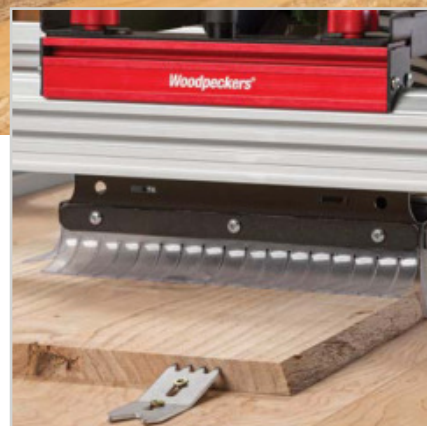
Rails can be moved closer together when not using the full 48-1/2" width.

Smooth & Flatten Large Live Edge Slabs Right In Your Own Shop!

Imagine being able to mill a flat face on a live edge slab over 4' wide and up to 3-3/8" thick. Or go the other way and imagine milling something just as wide, but only a fraction of an inch thick. Imagine milling slabs with virtually all the shavings being captured by your dust collector. It's time to stop imagining and start milling with Woodpeckers Slab Flattening Mill-PRO. This second generation Slab Flattening Mill features a router carriage with a greater thickness range and integrated dust capture right at the source. The "PRO" details don't stop with the feature-packed new carriage. We also extended the rails, increasing the standard width capacity to a massive 48-1/2" wide (using a 2" cutter...even more with a larger bit).

Woodpeckers Slab Flattening Mill-PRO guides your router over your slab in a controlled plane. Since you're using a router instead of a planer-style cutterhead, tear-out is minimal. And thanks to our uniquely engineered rails and enhanced solid steel carriage, the surface will only need light sanding afterwards.

Don't beat yourself up if you bought the original and now love the features of the PRO...the Conversion Kit puts the new router carriage on your existing rails. You can get the Slab Flattening Mill-PRO in either Basic or Extended Capacity. The Extension Kit can also be added at any time in the future.



Lower carriage for thin slabs or rough lumber.



Raise carriage for thick, heavy slabs.

SLAB FLATTENING MILL-PRO

SLBFPRO-BAS Basic Slab Flattening Mill-PRO \$899.99

SLBFPRO-XL Extended Slab Flattening Mill-PRO \$1149.99

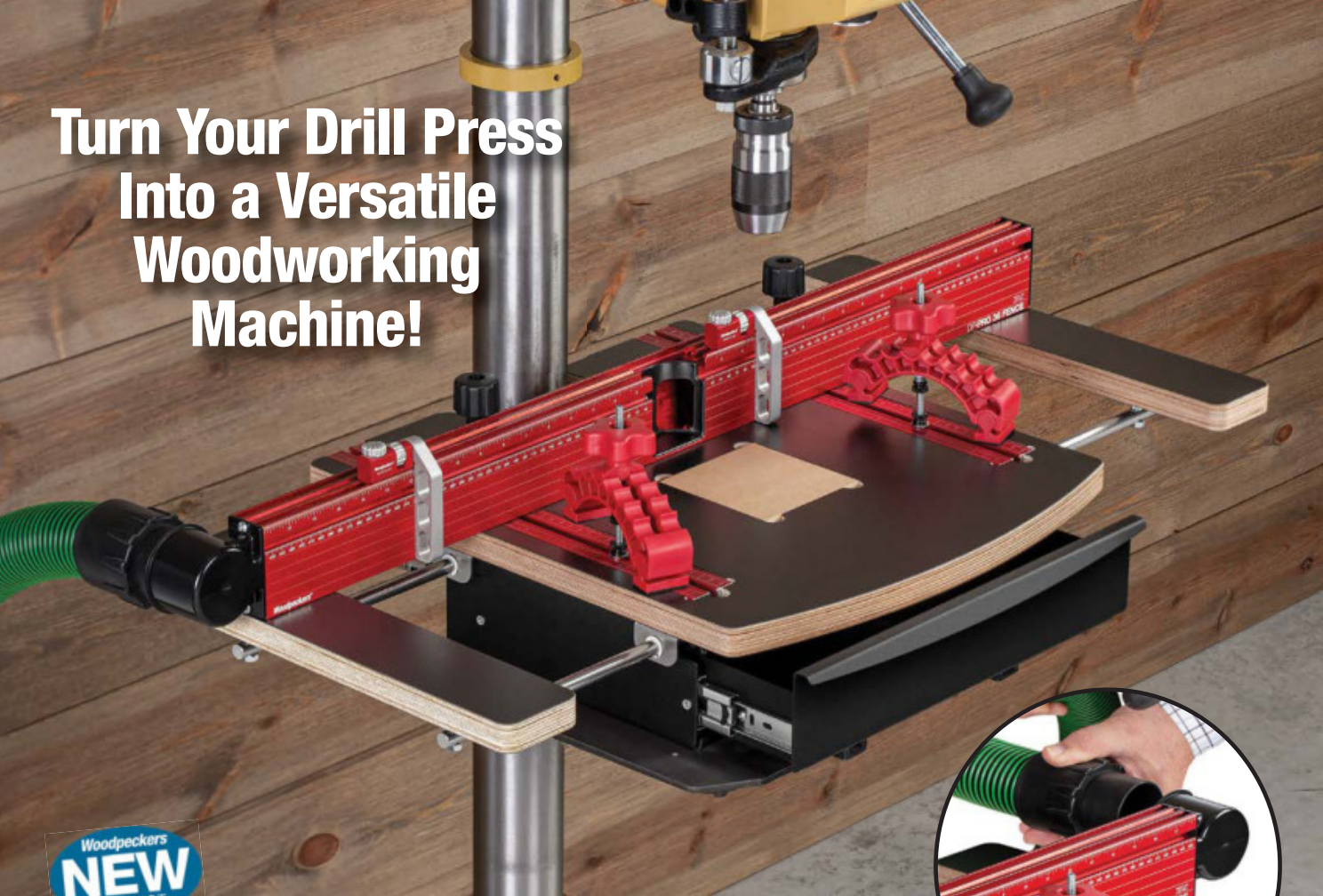
SLBFPRO-EXT 76" Extension Kit Slab Flattening Mill-PRO..... \$269.99

SLBFPRO-CONV Carriage Conversion for Slab Flattening Mill..\$399.99

SLBFLT-CD4 Replacement Slab Clamping Dogs (4pk)..... \$14.99

DON'T FORGET THE ROUTER BITS! Check out Woodpeck.com for a full line of Whiteside and Amana Tool Bits to complete your project.

Turn Your Drill Press Into a Versatile Woodworking Machine!



Woodpeckers has been transforming drill presses into woodworking-oriented machines since 1994, and now we're introducing our newest, most innovative model yet. Woodpeckers new DP-PRO Drill Press Table System is the first system to effectively integrate dust collection right at the source. It expands to support longer work, installs in minutes on virtually every drill press on the market and doesn't interfere with drill press adjustments.

The heart of the system is the all new DP-PRO Fence. We made it tall enough to support work vertically as well as horizontally. Then we made that taller fence an integrated dust collection duct, picking up the chips right where they're created. Just attach a vacuum or dust collector to the port at the end of the fence and virtually all the chips and dust are sucked up instantly. The dust port can be assembled on either end of the fence to best suit your shop layout.

The DP-PRO Tables have extension wings that slide out for extra support when you need it and tuck back in tight to the central table when you don't. We offer two table sizes, 36" (24" closed) and 48" (36" closed). The table and extensions are made from full 1" thick Baltic Birch plywood with black Micro-Dot laminate on both sides. Graduated DP-Tracks provide mounting for both the fence and hold-down clamps.

Our newly designed DP-PRO Drawer Base is the foundation of the system. Looking at the hundreds of different drill press sizes and models out there, we designed a base that attaches to just about all of them in just minutes. The base elevates the table by four inches, which provides clearance for the table elevation crank and makes space for a convenient drawer, too.

We've bundled the new DP-PRO System into turn-key packages, you only have to decide if you want the fence to match the table when the wings are out or when they're in.

Dust Port attaches to either end!



Since every table fits every fence, and you may have specific needs in your shop, we also offer "Basic" models, which include the DP-PRO Drawer Base and DP-PRO Table (*without fence*). You can customize your system just the way you want it.



Dust collecting DP-PRO Fence captures dust and chips at the source.

Included with All DP·PRO Master Systems...



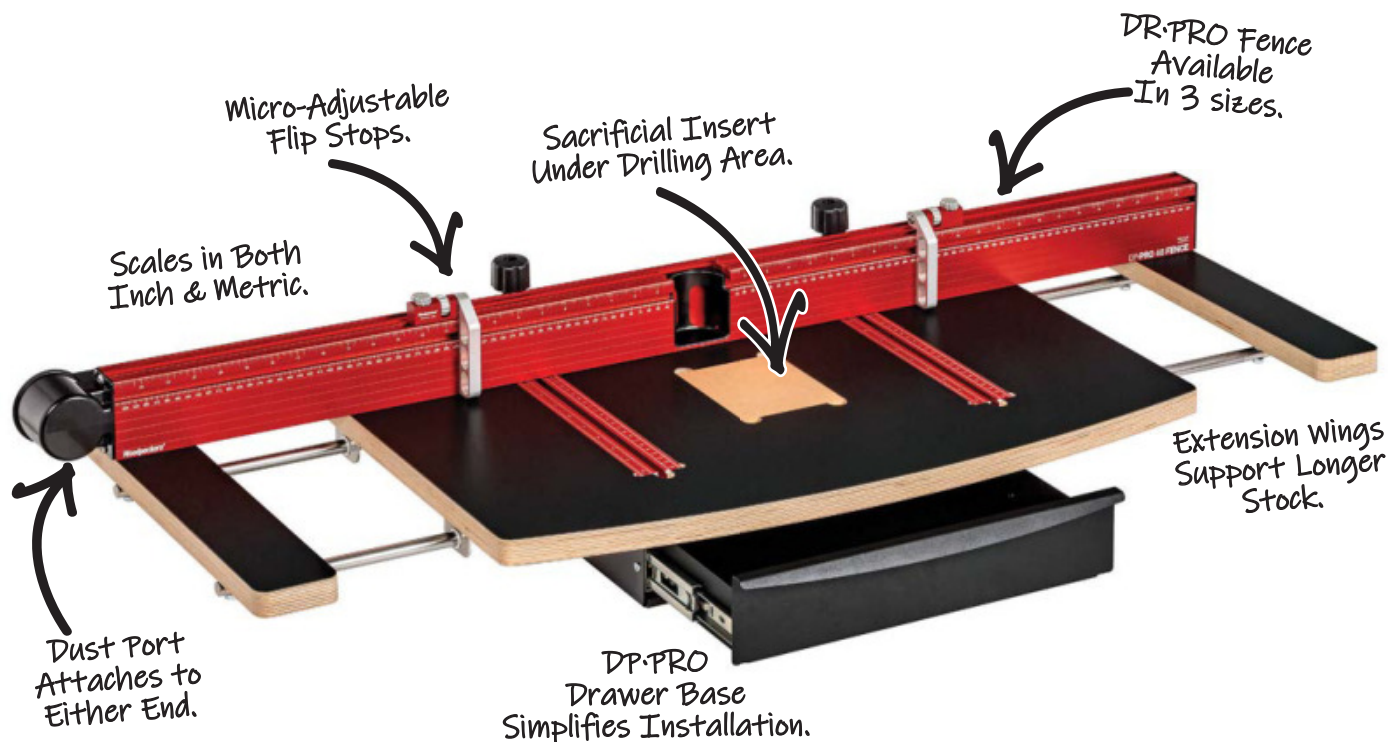
DP·PRO Drawer Base simplifies installation. Included in all DP·PRO Systems (Master & Basic).



New Micro-Adjustable Flip Stops aid repetitive work. Two included in DP·PRO Master Systems.



Versatile Knuckle Clamps hold stock securely. Two included in DP·PRO Master Systems.



DP·PRO DRILL PRESS TABLE SYSTEM

DPPRO-B-36	DP·PRO Basic 36 (36" Table, Drawer Base, No Fence, Stops or Clamps)	\$259.99
DPPRO-B-48	DP·PRO Basic 48 (48" Table, Drawer Base, No Fence, Stops or Clamps)	\$289.99
DPPROM-3624	DP·PRO Master System 36/24 (36" Table, 24" Fence, Drawer Base, 2 Flip Stops & 2 Knuckle Clamps)	\$369.99
DPPROM-3636	DP·PRO Master System 36/36 (36" Table, 36" Fence, Drawer Base, 2 Flip Stops & 2 Knuckle Clamps)	\$389.99
DPPROM-4836	DP·PRO Master System 48/36 (48" Table, 36" Fence, Drawer Base, 2 Flip Stops & 2 Knuckle Clamps)	\$419.99
DPPROM-4848	DP·PRO Master System 48/48 (48" Table, 48" Fence, Drawer Base, 2 Flip Stops & 2 Knuckle Clamps)	\$439.99
DPPRO-FN-24	DP·PRO Fence 24	\$69.99
DPPRO-FN-36	DP·PRO Fence 36	\$89.99
DPPRO-BASE	DP·PRO Drawer Base	\$109.99
DPPRO-FN-48	DP·PRO Fence 48	\$109.99
DPPRO-FSTP	DP·PRO Flip Stop (ea)	\$29.99
KNCLAMP	Knuckle Clamp (ea)	\$17.99
DPFILLER	Replacement Fillers (1/2" x 4" x 4" MDF) (3pk)	\$4.99

Fast Adjustment, Fine Tuning and Top-of-Table Bit Changing Are Just the Best Features...There's More!

Take on the most challenging router table projects confidently with the PRL-V2 Precision Router Lift. Truly exceptional power-tool accessories save time while also increasing precision and enhancing safety. The PRL-V2 delivers on all fronts.

For starters, the PRL-V2 provides all of the industry-leading features built into our Cast Aluminum Router Plate: leveling screws accessible from the top of the plate, adjustable plungers to eliminate side play, multiple starting pin locations and quick-change Twist Lock Rings to provide close clearances around router bits with different diameters.

The PRL-V2 augments these basic router plate capabilities with a bulletproof lift mechanism and an impressive array of time saving, precision-enhancing features that are all accessible from the top of the plate. Precise bit-height adjustments are quick and easy, thanks to the thumb wheel micro-adjuster and an easy-reading scale we built into the top. Don't worry, we designed the scale so it can be zeroed out at any bit height. When it's time to change bits, the PRL-V2 won't slow you down. Our patented quick-lift wrench allows you to bypass the micro-adjustment mechanism and elevate the router collet so you can use your wrenches above the table.

With its one-piece motor carriage and long linear bearings, the PRL-V2 is built to deliver years of trouble-free performance. Designed to improve precision, convenience and efficiency, this revolutionary router lift puts the most complex profiling and joinery operations right at your fingertips.



UNIQUE FEATURES

- Instant quick lift with spring-assisted wrench
- Micro-adjust with thumb wheel
- One-piece motor carriage for maximum rigidity
- Extra long sleeve bearings for effortless travel
- Includes three self-leveling twist lock rings and spanner wrench



Above-the-table router bit changes with many router models.



Includes three twist lock rings & a spanner wrench.



Tool-less micro-adjustment.



Solid-steel starting pin.

PRL-V2 PRECISION ROUTER LIFT

PRL-V2 PRL-V2 Precision Router Lift\$399.99

Visit woodpeck.com for details on ordering the correct model Lift to fit your router.

Patents Pending. U.S. Patent #6,505,659; #6,948,892; #7,108,463; #7,559,347; #8,282,323; #7,481,253

Woodpeckers®, LLC • 1-800-752-0725 • woodpeck.com

Get a Grip on Tricky End-Grain Cuts

Woodpeckers Coping Sled handles the most challenging coping cuts with ultimate precision and safety. We've built this rock-solid sled using the best materials available and a true "belt and suspenders" approach, eliminating the problems we found in lesser sleds.

The design starts with a rigid 3/8" phenolic base that slides smoothly on the table surface. On top of this foundation, the workpiece is effectively trapped between a fixed fence and a slotted top plate that adjusts to handle stock up to 5-1/2" wide. Maximum workpiece thickness is 1-1/2". To lock the stock down, a rigid clamp beam with two hold-downs slides into place directly over the workpiece.

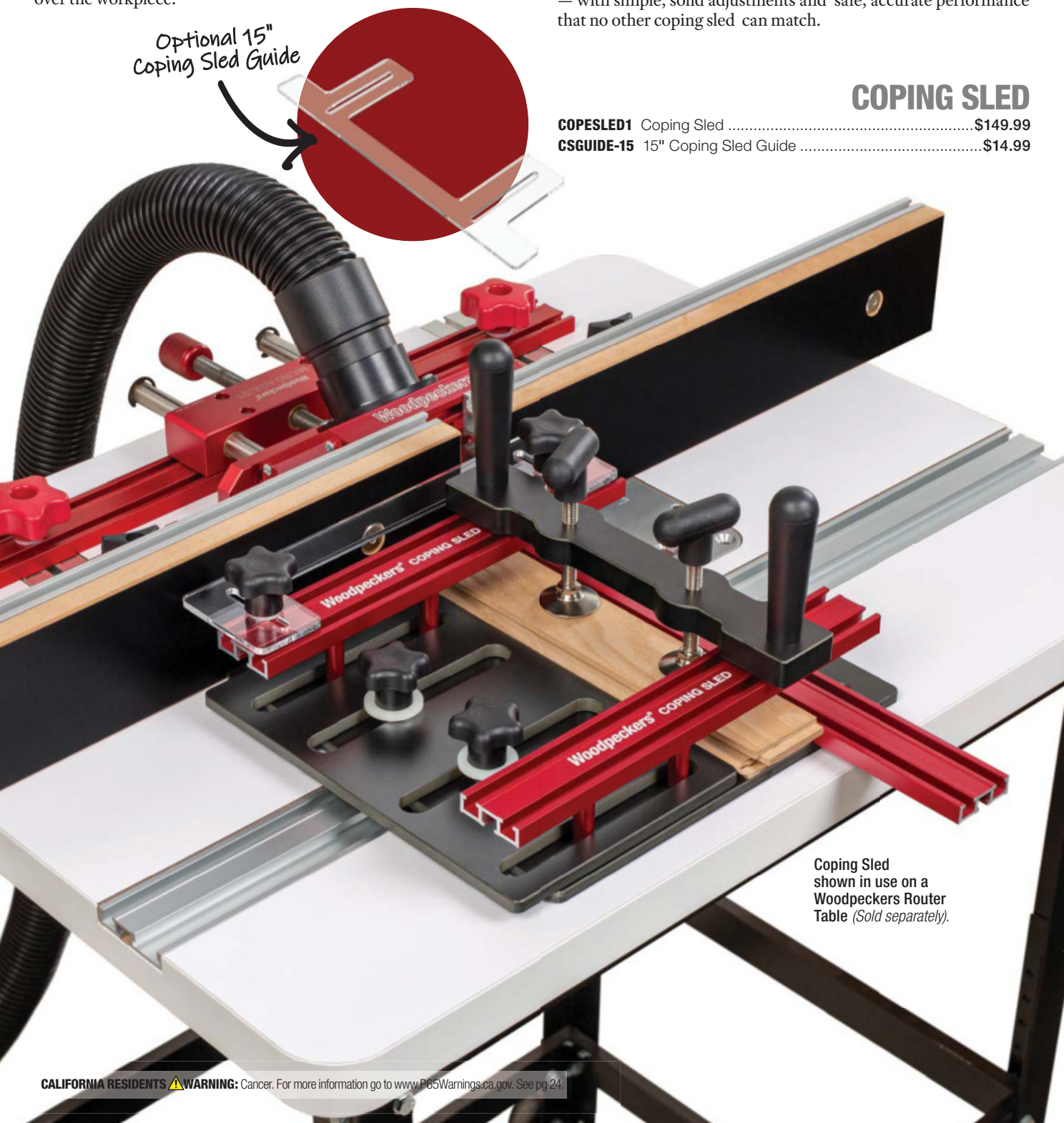
Unlike coping sleds that ride in the miter slot, Woodpeckers Coping Sled uses a guide that rides against the router fence. This allows you to concentrate your feed pressure where it counts the most - toward the bit and fence. The clear fence guide provides a good view of the cut and doubles as a chip deflector and bit guard. If you need more depth of cut, the optional 15" Guide gives you a longer guide and up to 3" of depth.

Woodpeckers Coping Sled has no sacrificial parts. Just use a piece of scrap as a backer board to prevent tear-out. Woodpeckers Coping Sled sets you up for success with any end grain cutting challenge — with simple, solid adjustments and safe, accurate performance that no other coping sled can match.

Optional 15"
Coping Sled Guide

COPING SLED

COPELED1	Coping Sled	\$149.99
CSGUIDE-15	15" Coping Sled Guide	\$14.99



Coping Sled
shown in use on a
Woodpeckers Router
Table (Sold separately).

Complete Router Table Packages for Every Budget

We make some really great router table equipment. In fact, we make so much of it, it's pretty easy to get confused and a little lost. To help you out with that, we've put together five Router Table Packages. While there are still other accessories you might want to add, these packages put a world-class router table in your shop. Here's a chart that shows you which components are included with each package.

Once you decide which Package you want, the next step is to determine what router you're going to install. We have versions of the PRL-V2 Lift and the Router Plate that will fit most popular routers on the market...you'll just need to know which one you have before you go online or call Customer Service.

	A		B		C	D	E	F	G	
Package	24x32 MDF	27x43 MDF	24x32 Phenolic	27x43 Phenolic	Aluminum Plate	PRL-V2	Super Fence	Adjustable Router Stand	Wheel Kit	Price
PRP BASIC	✓				✓		✓	✓		\$659.99
PRP 1	✓					✓	✓	✓	✓	\$989.99
PRP 2			✓			✓	✓	✓	✓	\$1159.99
PRP 3		✓				✓	✓	✓	✓	\$1069.99
PRP 4				✓		✓	✓	✓	✓	\$1289.99

HERE ARE THE HIGHLIGHTS OF EACH COMPONENT OF THE PACKAGE:

A. MDF Table Tops

- Micro-dot laminate reduces friction and stays clean
- Laminated under pressure for stability
- Same laminate on both sides for long-term balance

B. Phenolic Table Tops

- Impervious to moisture, chemicals, impact or abrasion
- Unmatched for flatness, strength and durability
- Surface under leveling screws will not wear

C. Cast Aluminum Router Plate

- Twist lock rings to accommodate different bit diameters
- Models drilled for many popular routers or un-drilled
- Adjustable tension side plungers (also on PRL-V2)

D. PRL-V2

- Rapid adjustment for bit changes and coarse positioning
- Above-the-table, thumbwheel fine adjustment of router bit
- Twist lock rings to accommodate different bit diameters
- Leveling screws accessed from above the table
- Indexable height indicator built into top of router lift

E. Super Fence

- Dust port compatible with both 2-1/4" and 2-1/2" vacuum hose
- Offset module keeps outfeed and infeed fences parallel
- Sacrificial sub-fences included and easily replaced

F. Adjustable Router Stand

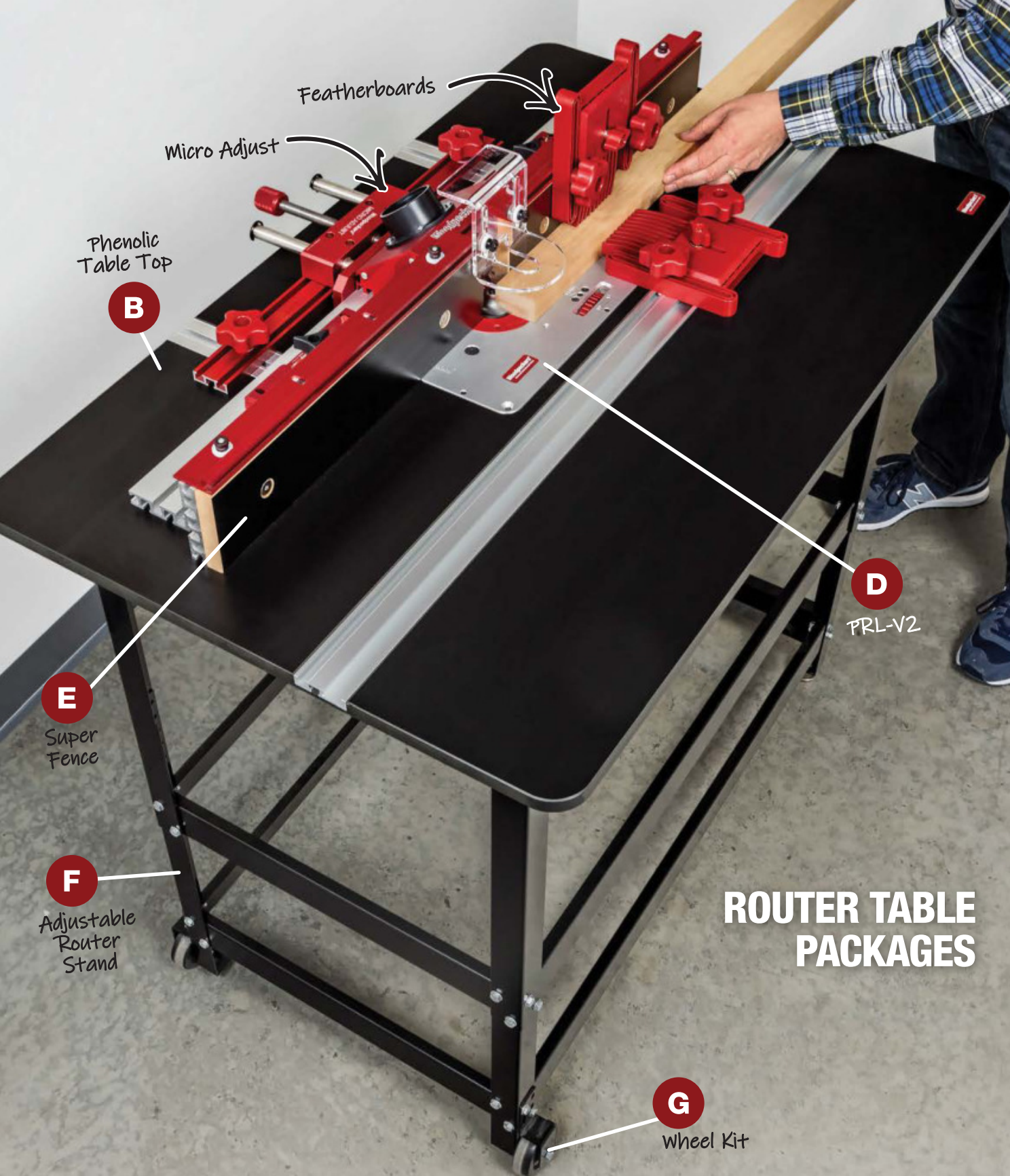
- Height adjusts from 36" to 42" for operator comfort
- Pre-drilled for easy attachment to Woodpeckers Router Tables
- Powder-coat finish stands up to heavy shop use

G. Wheel Kit

- Step on pedal to lower swivel wheel and move table
- Kick pedal up to drop table back onto leveling feet
- Can be added to any Woodpeckers Router Table anytime



PRP-Basic - Our most economical router table.



Featherboards

Micro Adjust

Phenolic
Table Top

B

E

Super
Fence

F

Adjustable
Router
Stand

D

PRL-V2

G

Wheel Kit

ROUTER TABLE PACKAGES

What Else Do I Want?

- **Coping Sled** If you're going to do raised panel doors.
- **Featherboards** Hold stock against the fence and down to the table.
- **Micro Adjust** Simplifies fine adjustment of the fence position.
- **Downdraft Dust Cabinet** Collects dust and from under the table.
- **Twist Lock Ring Set** Closely match opening to router bit size.
- **Router Motors** Check out woodpeck.com for top quality routers.

UNIVERSAL CROSS DOWEL JIG



Drill once for the cross dowel & once more for the bolt clearance. Cross dowel joinery is simple & strong.

Universal Cross Dowel Jig: Knock Out Great Knock-Down Designs

Design and build quality furniture that assembles in minutes. Woodpeckers new Universal Cross Dowel Jig does most of the work for you! A "cross dowel" is a handy piece of hardware with standard threads cut across a standard dimension steel dowel. Drill two intersecting holes in one piece of stock and a matching hole in its mating piece and you have a joint with mechanical strength equal to or greater than the most complicated traditional joinery. But, unlike traditional joinery, cross dowel joints can come apart and go back together over and over without losing strength.

The trick in cross dowel joinery is getting the hole for the cross dowel exactly centered with the bolt hole. That's where Woodpeckers Universal Cross Dowel Jig comes in. By wrapping around your workpiece, you have stainless steel guide bushings on the end and the side at the same time and they're on exactly the same centerline. The end guide bushing directs your drill bit perfectly straight for the bolt hole and the side guide bushing does the same for the cross dowel insertion hole.

The Deluxe Kit comes with guide bushings for #10 (3/16"), 1/4", 5/16" and 3/8" bolts and the matching cross dowels. The Basic Kit only includes guide bushings for #10 and 1/4" bolts and matching cross dowels. We sell the remaining bushings separately if you choose to upgrade your system later.

Visit our web site to shop our wide selection of cross dowels and connector bolts to complete your knock-down furniture designs.

UNIVERSAL CROSS DOWEL JIG

UCDJ14 Basic Kit in Woodpeckers Case\$109.99
UCDJ Deluxe Kit in Woodpeckers Case.....\$179.99

EXACT WIDTH DADO JIG



Matches your dado width precisely to the material going into the dado.

No Math, No Measuring... Just Perfect Fitting Dados

Blame it on imports, blame it on the metric system...blame it on whatever you want, but there's no denying that plywood and other sheet goods don't match their "nominal" dimensions these days. Woodpeckers new Exact Width Dado Jig delivers perfect fitting dados by avoiding measuring altogether...it uses the actual material you're fitting into the dado as the gauge to set up the cut.

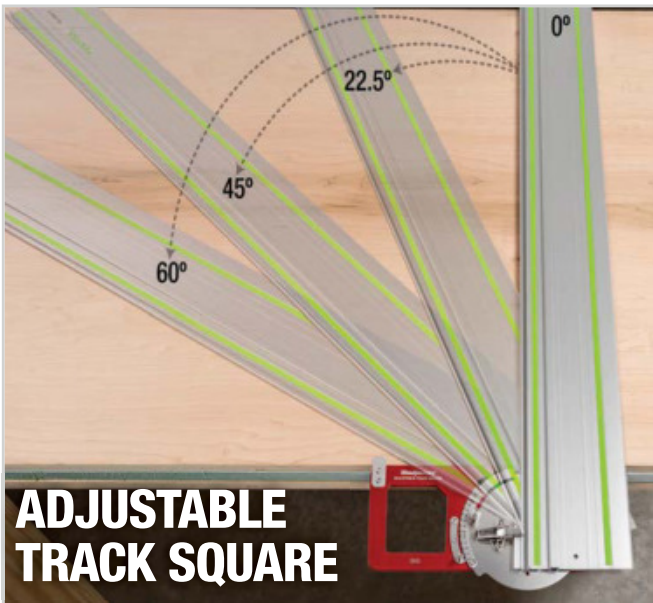
All you have to do is fit your stock snugly between the edge guides. Your router guide bushing follows the jig's rails while the router bit cuts a dado perfectly matching the thickness of your stock. It's that simple. No measuring, no test cuts, no scrap. If you've ever used a track saw and guide rail, this jig works similarly...except double...the edge guides are on the exact cutting lines of both sides of the dado.

In its original OneTIME Tool release, the Exact Width Dado Jig had a maximum capacity of 24-1/2". That size is still available, but now we've added 14-1/2" and 32-1/2" models. If you cut dados mostly for upper cabinets and bookcases the new 14-1/2" model is perfectly sized and easy to work with. If you need something much bigger, the new 32-1/2" model is just the ticket. All three sizes can close down to cut a dado just 5" long.

The jig comes with a precision-machined 1/2" diameter template guide bushing and a matching spacer (you'll need it to trim edge guides). If your router doesn't use Porter-Cable style guide bushings, any 1/2" guide bushing and 3/8" router bit will work. This is a bulletproof, lifetime tool that will keep your dados fitting perfectly for years, no matter what the plywood manufacturers do in the future.

EXACT WIDTH DADO JIG

EWDJ-14-20 Exact Width Dado Jig 14-1/2" \$339.99
EWDJ-24-20 Exact Width Dado Jig 24-1/2" \$369.99
EWDJ-32-20 Exact Width Dado Jig 32-1/2" \$399.99
EWDJ-ZCB-20 Exact Width Dado Jig Clearance Blocks (3pr)\$19.99
EWDJ-EG-20 Exact Width Dado Jig Edge Guides (3pr).....\$19.99



ADJUSTABLE TRACK SQUARE

Positive stops every 5° from square to 60° plus 22-1/2°. Works with Festool, Makita and Triton tracks and track saws.

Get the Right Angle on Track Saw Cross Cuts

The modern track saw has taken the market by storm. It puts industrial table saw accuracy in the field for remodelers and trim carpenters. For the hobbyist, it cuts the shop space required to handle sheet goods in half (compared to a table saw). The concept is simple...drop the track saw on the guide rail and a straight cut is guaranteed. But, "straight" isn't enough. When you need a cut square to an edge just add Woodpeckers Adjustable Track Square to your guide rail and use it to align the guide rail perpendicular to the stock edge. It works with Festool, Makita and Triton guide rail. Once it's mounted you have locked-in accuracy.

Need something other than square? Just rotate the protractor to your desired angle. There are detents every 5° and at 22-1/2°. For angles between the detents, the scale is laser engraved in crisp one-degree increments. The scale is calibrated at the factory and can be easily re-calibrated anytime and anywhere.

Works equally well with or without track clamps. The choice is yours. You can hold the Adjustable Track Square by hand or clamp it down with your standard track clamps. You'll also find the area right under the edge of your workpiece has been shaped so the track clamp you use will stay put in the Track Square when you reposition it.

The main frame is machined from the same incredibly stable cast and ground aluminum plate we use in our famous precision woodworking squares. The stainless-steel protractor base rotates on a bronze bushing and glides on low-friction wear-resistant pads. Even the cam buckle is stainless steel. In short, whether you use the Adjustable Track Square every day, all day or just on the weekends it's designed to keep producing perfect accuracy for decades.

ADJUSTABLE TRACK SQUARE

ADTKSQ-NC Adjustable Track Square (No Case) \$269.99
ADTKSQ-WSYS Adjustable Track Square in Systainer Case \$349.99

NOTE: The Festool, Makita and Triton brand names are the registered trademark of the respective companies and are not associated with Woodpeckers, LLC.

CALIFORNIA RESIDENTS ⚠️ **WARNING:** Cancer. For more information go to www.P65Warnings.ca.gov. See pg 24.



PARALLEL GUIDE SYSTEM

Parallel Guide System reliably positions guide rail a fixed distance from the material edge.

Table Saw Precision From Your Track Saw

Everyone who has wrangled a full sheet of plywood around a table saw immediately recognizes the advantages of track saws for breaking down sheet goods. Keeping the unwieldy sheet stationary and moving the saw down a precision-made rail makes a lot of sense, but how do you get two (or more) pieces to come out exactly the same width? Woodpeckers new Parallel Guide System takes measuring and marking out of the equation and uses a physical reference to ensure your last cut is exactly the same as your first. The Parallel Guide System locks onto your Festool, Makita or Triton guide rail and instantly aligns the cutting line parallel to, and a specific distance from, the edge of your stock.

The Parallel Guide System shines when working on large cabinet or furniture panels, but what about smaller pieces? We've got that under control, too. Add the Narrow Stock Guides, use the scale on the edge instead of the top, and now you can rip stock from 10-1/2" down to just a fraction of an inch. This feature is really great when you're on a job site without a table saw and need to make some frame stock immediately, or if your shop space is so limited a table saw is out of the question.

The T-tracks come in sections. Use all of them or just the ones you need. Fully assembled, you can rip up to 52" – well beyond the center of a sheet of plywood. But, when working normal cabinet components, you'll only need a couple sections assembled, while the rest is tucked securely in its Systainer. The ends are precisely cut to ensure the connected sections are perfectly straight and the scale calibrations are accurate.

PARALLEL GUIDE SYSTEM for Track Saws

metric available

PGSI-NC-19 Parallel Guide System (No Case) \$369.99
PGSI-WSYS-19 Parallel Guide System in Systainer Case \$429.99
PGS-STOPS-19 Parallel Guide System Flip Stops (2pk) \$54.99
PGS-CONN-19 Parallel Guide System Track Connectors (6pc) .. \$54.99
PGS-ITRK-19 Parallel Guide System Track Set (8pc) \$74.99



VARIABLE ROUTER JIG

Create any rectangular template by just sliding the tracks into position.

Configure Square & Rectangular Templates

The Variable Router Jig configures in minutes to any square or rectangular shape you want. Rout mortises for joinery. Mortise in hardware like hinges and locks. Rout dados for inlay work, adding visually stunning details to your projects. Once you see how easy it is to set up and use, you'll start inventing ways to use it to make your projects go faster and smoother.

You can assemble the jig in minutes. Both metric and fractional scales are laser engraved on tracks. Put the scale you prefer on the inside, slide the lockbars into the edges, adjust to dimension, tighten the clamps and you're ready to rout. When you need to reconfigure for the next step, just slide the tracks to the new dimensions, lock it back up and get back to work.

In the kit you'll find four clever hold-down brackets that slip into the edge of the track and allow you to clamp your work securely and quickly. If you're working on a perforated table like Festool's MFT, you can clamp your project without anything sticking above the level of the VRJ. The same thing can be done on almost any workbench surface with the proper clamps and a little planning.

The tracks for the Variable Router Jig are clear anodized to create a tough, abrasion-resistant surface. The lockbars are a special polycarbonate that slides easily and locks solidly in the track. We offer two complete kits, one with four 18" tracks and one with two 18" tracks and two 32" tracks. Both come with all the lockbars and hold-down brackets you need. If you buy the smaller kit and later need more capacity, we sell the 32" tracks separately.

VARIABLE ROUTER JIG

VRJ-19 Variable Router Jig 18" x 18"	\$219.99
VRJ-191832 Variable Router Jig 18" x 32"	\$269.99
VRJ-19-LBK Variable Router Jig Lockbar Kit	\$13.99
VRJ-19-BC Variable Router Jig Clamp Brackets (2pk)	\$13.99
VRJ19-SPT48 Variable Router Jig 48" Accessory Track (2pk)...	\$89.99
VRJ19-SPT60 Variable Router Jig 60" Accessory Track (2pk)...	\$109.99
VRJ-19-TR32 Variable Router Jig 32" Accessory Track (2pk)...	\$119.99

NOTE: The Festool and Veritas brand names are the registered trademark of the respective companies and are not associated with Woodpeckers, LLC.



OFFSET BASE SYSTEM

Offset Base & Outriggers on Domino DF-500.

Added Stability & Improved Spacing for Your Domino

Woodpeckers Offset Base gives Festool's two Domino joinery tools a much larger and more robust indexing platform. The system starts with a perfectly flat plate that fastens securely to the base of either Domino. The reference surface for your stock connects to the attachment plate with 3/4" diameter stainless steel spacers. By simply changing the spacers between the attachment plate and the reference plate, you can center your mortises precisely in five different material thicknesses. There are shims to tweak the mortise position to even tighter tolerance. There's also an optional expanded spacer set that gives you more options for thicker material.

The heavy-duty extruded aluminum outriggers extend up to 54" either right or left of the Domino cutter. By using the flip-stops, you can precisely locate mortises over a 9-foot span in a dependably repeatable pattern. The outrigger comes in five sections, you only need to assemble what you're using for that particular project.

The complete "System" includes the Offset Base, five outrigger bars with connectors, five sets of spacers and four flip stops. You can also order the Offset Base without the outrigger set up. The "Base" includes the attachment plate, reference plate and five sets of spacers. For either configuration, add the optional 5mm spacers if you're using a Domino XL. Both configurations are available with inch or metric scales, and both come in a Systainer, compatible with your Festool cases.

For table aprons where an offset is desired, the Table Apron Spacers make it simple to create an offset of 1/8", 3/16" or 1/4". Just add them in for the legs and take them out for the aprons.

OFFSET BASE SYSTEM metric available for Festool Domino

DF500-OBSI-18 Offset Base System in Systainer Case.....	\$429.99
DF500-OB1-18 Offset Base in Systainer Case	\$259.99
DF500-OB01-18 Offset Base Outrigger.....	\$199.99
DF500-OBES-18 Offset Expanded Spacer Set	\$79.99
DF500-OBTA-18 Offset Base Table Apron Spacers	\$34.99
DF500-OB5A-18 Offset Base XL700 5mm Adapters	\$14.99

HOLE BORING JIG



Index pins used for starting at the first corner. After that, red mid-field pins use previously milled holes to position the next group.

Machine Your Own MFT Style Bench Tops

Woodworkers around the world have embraced the idea of a work surface milled with a gridwork of holes. Dozens of companies (large and small) produce devices that fit into the grid to hold your work. The milled work surface itself is available from several companies, often as part of a workbench or work table. Now, with Woodpeckers Hole Boring Jig, you can make your own gridwork top, right in your shop, for a fraction of the cost of a ready-made top. Whether you're building a custom work table or replacing the top on something like a Festool MFT, you can mill the top with near-CNC accuracy with nothing fancier than a good router and a sharp bit.

Woodpeckers Hole Boring Jig is a 3/8" thick solid phenolic, CNC-machined template. Index pins placed against the corner of your table position the template for the first group of holes. Then, you'll use the already-milled holes to index across the rest of the table surface. All you need is a router that accepts Porter-Cable style guide bushings and a 1/2" straight router bit (up-cut spiral bits are best).

Two standards have developed for these table tops. Festool and several other European-based companies use 20mm holes. Veritas and several others use 3/4" holes. Woodpeckers has you covered no matter which standard you use. You can get the Hole Boring Jig with the right guide bushings and index pins to cut either 20mm or 3/4" holes. Or, if you're like most American woodworkers and have "some of this and some of that," get the complete kit which has the guide bushings and index pins for both sizes.

For less than the price of one replacement top for a Festool MFT, you can get the jig, make your own replacement top and then start adding gridwork tops for the other work surfaces in your shop. With an array of clamps and end-stops there's no limit to the workholding arrangements you can set up on a gridwork table.

HOLE BORING JIG metric available

HBJ-19 Hole Boring Jig 3/4" & 20mm in Woodpeckers Case..... **\$199.99**
HBJI-NC-19 Hole Boring Jig 3/4" Inch Only **\$139.99**



MFT LAYOUT & ASSEMBLY SQUARE

Square you fence and guide rail quickly and precisely with this 3/4" thick solid phenolic square.

Accurate Set Up of your MFT Guide Rail System

Woodpeckers MFT Layout & Assembly Square makes quick work of the tedious task of aligning your track saw guide rail. At 3/4" thick, this solid phenolic square can rest flat on the table and intersect with both the fence and the rail at the same time. No more trying to hold a framing square along the guide rail and hoping you've got it aligned. If that was this tool's only trick, it would be a great addition your shop, but there's more.

Great for Assembly Work, Too. Slots are milled into the square along both edges. This lets you clamp the square to your workbench, creating a vertical reference allowing you to clamp work perpendicular. You can also use it as a giant clamping square while joining large panels.

Keep Your MFT Square Technically, your fence and guide rail don't have to be square to the holes in your MFT top to give you square cuts. But anyone who has used the system knows that it can be reassuring when everything lines up and you can use your stops and hold downs in conjunction with the fence. The MFT Layout and Assembly Square comes with two 20mm location dogs. Drop them in any two holes in an MFT table top and your square is correctly aligned with all the holes. Now set your guide rail and fence to the square and everyone is on the same page of the playbook.

Woodpeckers Precision and Quality. We meticulously machine the MFT Layout & Assembly Square from a nearly indestructible solid phenolic. It's the same material we use for our top-of-the-line router tables. It won't warp or twist and it is completely impervious to moisture.

MFT LAYOUT & ASSEMBLY SQUARE

MFTLASQR-19 MFT Square & 2 Positioning Dogs **\$79.99**
MFTPOSDOG2-19 Replacement MFT Positioning Dogs (2pk) **\$16.99**

Woodpeckers® Home of the *OneTIME Tool*®

Designing and manufacturing tools for that small, but very particular, group of people known as “woodworkers” is our passion at Woodpeckers. We love coming up with new and innovative tools that make woodworking easier, more accurate and more enjoyable. Acknowledging that our products aren’t for everyone, we’ve geared our factory toward making a few thousand of lots of different things, rather than making millions of just a few things. That approach has made our *OneTIME Tool*® program possible.

When we come up with a clever idea or an improvement on an existing product, we’ll work out all the details on both the design and the manufacturing process. Then we offer it to our E-CLUB

members as a *OneTIME Tool* and keep it available for 3 weeks. After the ordering window closes, we know exactly how many to build.

The complete history of *OneTIME Tool* offers can be found on woodpeck.com. If you take a look, you might notice that certain *OneTIME Tools* come out of the vault on a pretty consistent basis (the inside joke is these are Once-In-A-While Tools). If you see something that you really like, be sure to let us know by voting... that is a very important part of how we decide which tools are re-released.

Don’t be left out of the next great *OneTIME Tool* offer. Sign up for our E-CLUB today at woodpeck.com.

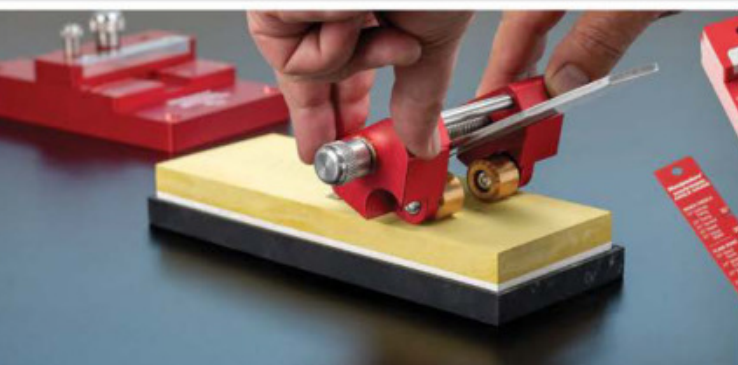


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To order via phone, call a Customer Service Representative toll free at 800-752-0725 Monday - Friday 8:30 am to 4:00pm (EDT).

Woodpeckers accepts the following forms of payment.



Woodpeckers, LLC reserves the right to limit quantities.

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