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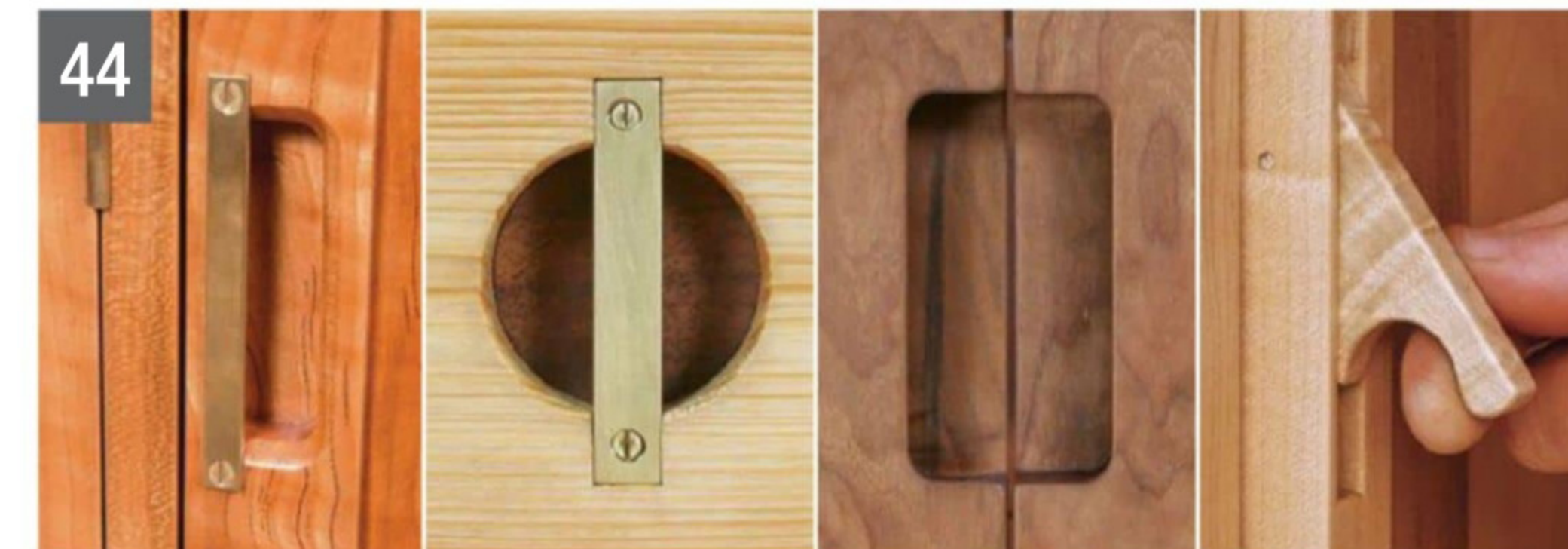
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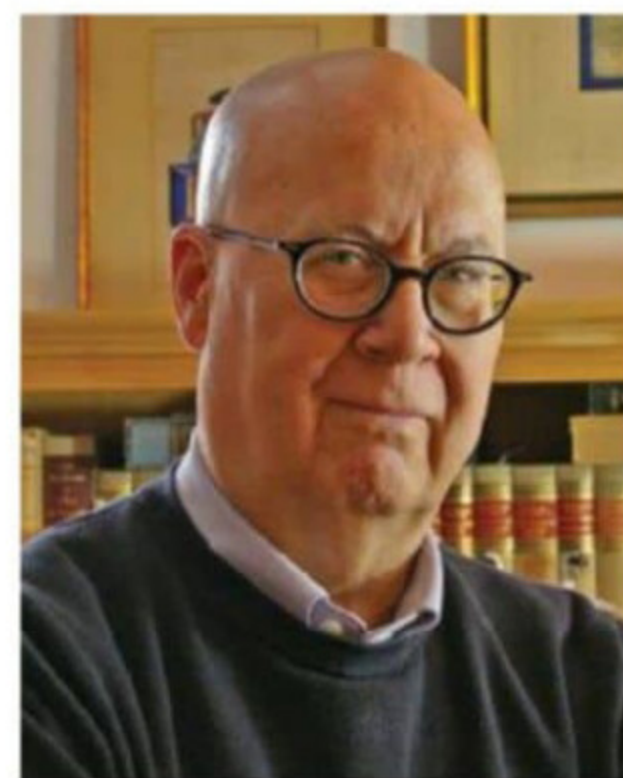
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Contributors



The workbench on page 34 was designed by **Andy Rae**, an instructor at Making Whole (*MakingWhole.com*), an apprenticeship program for men recovering from addiction. Andy (atop bench) supervised the construction of the bench with the crew of Making Whole (shown with shop dog Daenerys) as part of a program built on the idea that the growth opportunity in building objects by hand is the perfect platform for rebuilding lives. The shop makes studio-quality furniture in wood, metal and architectural concrete, not so much for the outcome of the project, but for the process. The men find that as they search for solutions to the problems they encounter during a build, they discover themselves.



"I like watching people work," says **David Heim**, who contributed two articles to this issue (pages 8 and 56). He's been keeping a close eye on talented furniture-makers and woodturners for fifteen years, highlighting their work in magazine articles, books, and how-to videos. David has also written and illustrated two of his own books, *SketchUp Success for Woodworkers* and *Woodturning Patterns*, both published by Spring House Press. An avid woodturner (and a board member for the American Association of Woodturners), David also enjoys making small pieces of furniture.



Matt Kenney just might be the world's most prolific box maker. Not long ago, he designed and built 52 boxes over the course of a year, blogging about the experience on his website (*mekwoodworks.com*). The blog attracted such a large audience that Matt decided to document the adventure in a book, *52 Boxes in 52 Weeks* (published by Taunton Press). When he's not building boxes like the beauty featured in this issue (p. 24), Matt teaches woodworking around the world, writes about the craft, and hosts *The Matt and Joe Woodworking Fun Hour* podcast.

On the Web



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Sharing woodworking's rich history

Woodworking may well be the oldest human craft. Not long after our ancestors climbed down from trees, they began utilizing them to make things. From these primitive beginnings, woodworking and humans evolved together. It's a history rich in crafted objects of all sizes and shapes, for purposes that range from purely practical to total frivolity. But the story of woodworking isn't only about what we make; it's the knowledge we share and the many tools that get passed from one generation to another, accumulating their own special history along the way.

Long after their communities began to decline in the mid-1800s, the Shakers place in woodworking history continues to show its staying power, as evidenced by the candle stand on page 56. The Art of Seating (30) demonstrates how American chair design evolved over time. Each era developed its own brand, and different regions offered their take on how things were made—the style, ornamentation, symbolism, and significance.

As modern woodworkers, we carry on a tradition that never runs out of new ideas, even as we continue to improve basic skills with hand tools that have changed little over

many generations. Today there are so many ways to learn—from a family member or friend, at a woodworking club or Woodcraft store, via online videos, or by reading a magazine like this one. For more positive thoughts on the future of craft, check out Rick Hanish's writing on p. 72.

Every project we take on is an opportunity to make a little history in our shops. Our workbenches are birthing tables for much of what we create. Every ding and dent is a testament to the tales we tell. Building your own workbench is a rite of passage for many woodworkers. In this issue, you'll find a fresh take on this age-old tradition, with guidance provided by professional woodworker Andy Rae and his friends at the Making Whole community shop in Asheville, NC (p. 34).

Get in your shop and make history with techniques for inventive pulls (44) or build a small box (24) for future generations to enjoy. No matter what you craft, if you do it well, you can give a tree another 100 or more years, and your story will be heard, and your lessons learned by the next generation of craftspeople.

Chad McClung

WOODCRAFT
magazine

Aug/Sept 2019 Vol. 15, Issue 90

Chief Editor: Chad McClung
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Circulation: NPS Media Group
Web Support: Jessica Loyer
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Subscriptions: (U.S. and Canada)
One year: \$19.99
Single copy: \$6.99
customer_service@woodcraftmagazine.com
(800) 542-9125

Woodcraft Magazine (ISSN: 1553.2461, USPS 024-953) is published bimonthly (Dec/Jan, Feb/Mar, April/May, June/July, Aug/Sept, Oct/Nov) by Woodcraft Supply, LLC, 4420 Emerson Ave., Suite A, Parkersburg, WV 26104. Tel: (304) 485-2647. Printed in the United States. Periodicals postage paid at Parkersburg, WV, and at additional mailing offices.

POSTMASTER: Send address changes to Woodcraft Magazine, P.O. Box 7020, Parkersburg, WV 26102-7020.

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We love hearing from readers! And there are all kinds of reasons to get in touch with the crew at *Woodcraft Magazine*. Check out the details below.

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Share a slick tip to win cash or a prize.

Here's your chance to help someone become a better woodworker and get rewarded for the effort. The winner of next issue's Top Tip award will receive a Woodcraft Gift Card worth \$250. All others will receive \$125 for a published illustrated tip or \$75 for a non-illustrated tip. Published tips become the property of *Woodcraft Magazine*.

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Have a tough woodworking question?

We'll do our best to find the expert and provide the answer. Email us at editor@woodcraftmagazine.com and put "Expert Answers" in the subject line.

News & Views:

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Gregory PAOLINI

A man with a plan

Beginning in 2007, Gregory Paolini and I worked together on several magazine articles and books. With each collaboration, I came away impressed by Greg's woodworking ingenuity and drive. He has a knack for dreaming up clever router templates, ingenious ways to cut dovetails, and different ways to work more efficiently. When we first met, Greg was building Arts & Crafts furniture out of a small garage. He always seemed to have his sights on better tools, more commissions, and a bigger workspace. These days, he and his staff make custom furniture and cabinetry in a large commercial shop located near Asheville, NC. As if that's not enough, Greg also offers a full schedule of woodworking classes for students who range from beginners to experts. We spoke by phone for this interview.

—David Heim



Homage. Greg modeled this coffee table after a piece by Charles Limbert, one of the greats in the Arts & Crafts movement.



Details make the difference. A master furniture-maker, Greg favors Arts & Crafts and the Greene & Greene styles (above).

WM: What got you started in woodworking?

GP: I grew up in Buffalo, New York. When I was 11 or 12, I inherited a set of woodworking tools from my grandfather. I had no clue how to use them, so I got every woodworking book in the library and started experimenting. I was trying to make the tool in my hand do what the book said it could do.

My first real piece of furniture was a trestle table. I made more things for my family and friends, and before I knew it, I was making things for people I had never met. I kept experimenting and learning techniques. Worst case, I knew, was that I'd make some expensive firewood.

WM: How did you decide to focus on Arts & Crafts furniture?

GP: Buffalo has a huge Arts & Crafts presence, including several houses by Frank Lloyd Wright. Even the house where I grew up, a farmhouse built in about 1893, had quartersawn white oak woodwork.

In the late nineties, I got involved with the Roycrofters At Large Association; it's an organization that recognizes artisans who work in the Arts & Crafts style. But after about seven years I realized that I needed to make a name for myself, and that I didn't want to be known just as a Roycroft artisan.

WM: What brought you to the Asheville area?

GP: My wife Mona's best friend had moved to western North Carolina, and we visited her several times. On one visit, in late October, the weather couldn't have been more perfect. Mona and I looked at each other and said that we could live here. So we put together a three-year plan. Two and a half years later, we were in North Carolina.

WM: Tell me about your first shop in North Carolina.

GP: In Buffalo, the entire lower level of our house was my shop. Our house in North Carolina only had a 1½-car garage, so I went from 1100 square feet to 400 square feet. I spent the next year building a larger garage that I could use for the shop.

WM: How did your business—and your shop—grow?

GP: It took some time, but my work became accepted. Several architects in the area asked if I could bring the level of detail in my furniture into cabinetry. So I shifted the focus of my work away from furniture.

I had opportunities to take on more jobs when I was working alone, but I had to turn most of them down. I was afraid of moving to a level where it was more than just me. Fortunately, I had a student who was the business manager for his wife's dental practice. He became my business mentor. We put together a plan to grow while minimizing risk. Then we landed two big jobs. That gave me the confidence I needed.

WM: So you moved out of the garage into a shop with a crew, then into a bigger shop. What's next?

GP: We're just finishing an addition that will bring the shop to 9000 square feet. And I'm about to take delivery of a CNC machine. The Arts & Crafts guy in me hates that. Deciding to incorporate CNC work into our business was a three-year-long struggle. I finally decided that there's a difference between work that's truly meaningful and work that's merely essential. Is it meaningful for a man to spend time cutting big squares of plywood into little squares? No. It's better to let the robot cut up the plywood and have the artisans make doors or drawers or something that gives their work meaning.

WM: What's it like being a supervisor instead of a furniture-maker?

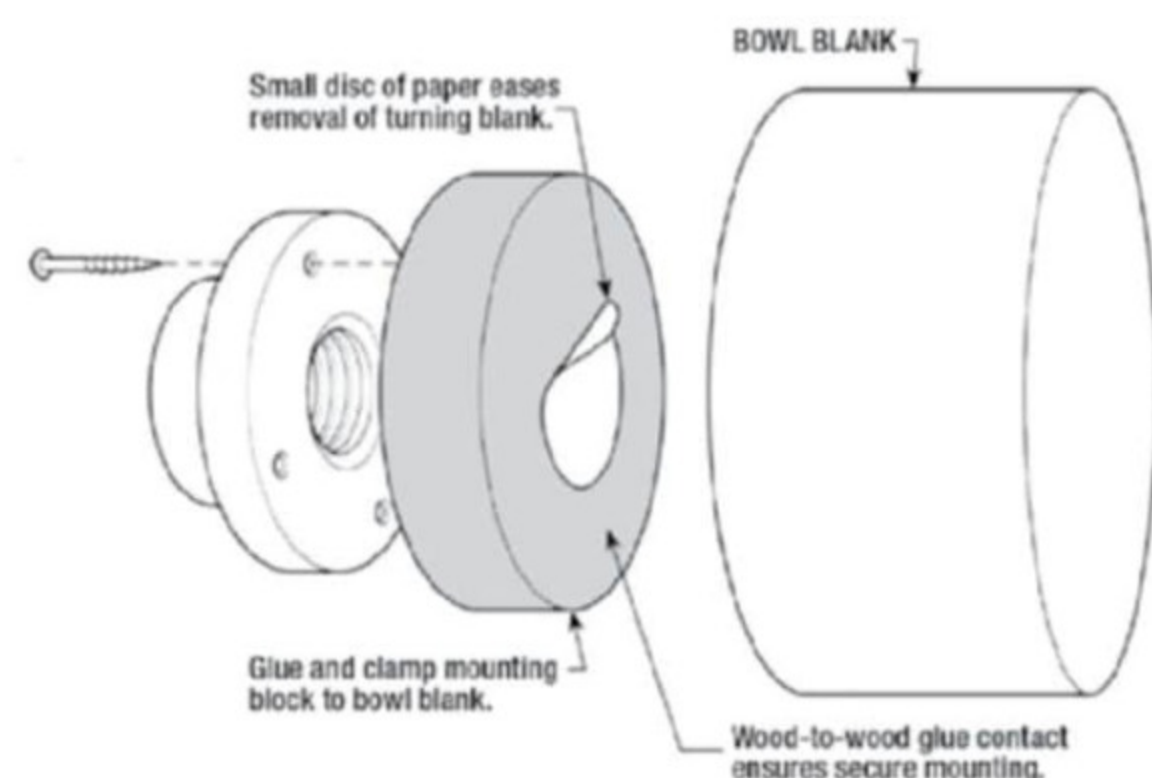
GP: There are days when I miss the solitude of working alone—when no one's calling and it's just me and the board. Being a supervisor has been a learning process for me. My goal is to have a successful woodworking business that I don't have to show up for every day. I want to be sure that if something did happen to me, the guys could continue to pay their mortgages, my wife would be all right, and the business could keep going. Some of the area colleges with woodworking programs send their students here. They always ask what it takes to make it in the woodworking business. I tell them to ask the question again but take out the word "woodworking." There's nothing magical about making it as a woodworker. ■

Faceplate fixes

I liked the Top Tip in the June/July 2019 issue, but have an even better method for faceplate mounting. I use a piece of kraft paper cut to the same size as the mounting block and glue them to the blank using Titebond II. When finished, I wedge a wide chisel between the block and blank. The paper splits, and the blank pops free. —John Crouse, via email

Contributing Editor Ken Burton replies:

I've tried your approach but found that the paper can shear if your tool catches, potentially resulting in catastrophe. This is especially true with beginners. I've taught basic bowl turning for years, and my students see more success with the added security of wood-to-wood contact between the blank and the mounting block. Since I switched to this method, I haven't had any bowls come off the lathe prematurely. But as with so many things in woodworking, there are several solutions to the same problem. You have something that works for you, and I hope it continues to do so.



Shopping list

Thanks for always including the Buyer's Guide in the magazine. The list of tools helps me to tally the cost of materials before starting a project. And I often learn about new tools. —Victoria Louise, Louisville, Kentucky

Buyer's Guide

See page 69 for tools and supplies used in this issue.

Plastics projects

I enjoyed the articles on plastic lumber in your last issue. Since I live in Houston with its wood-destroying climate, my outdoor projects haven't done well, even with no ground contact. It looks like the solid-color HDPE mentioned in the article is just what I need. —Frank Griffin, Houston, Texas



For more info on plastic lumber, see How Good is Plastic Wood?, June/July 2019, Issue 89, p. 32.

A must-see for carvers

The recent editorial about travel with your family reminded me of a neat little carving museum I visited some years ago. The Earnest Warther Museum and Gardens is home to the intricate steam engine creations of the "World's Master Carver" Ernest "Mooney" Warther. Located in Dover, Ohio, the family-run museum welcomes visitors every-day from 9:00 am to 5:00 pm, with the last tour leaving at 4:00 pm. —Evan Pinesworth, Tallahassee, Florida

And the winner is...

Bruce Kuveke is the Grand Prize winner in the "Build It! with Jory and John Sweepstakes" sponsored by

Woodcraft, Jory Brigham Design Studio, and SawStop. Bruce is a retired veteran and postal worker from Boulder City, Nevada. Randomly selected from over 26,000 entrants, Bruce will be awarded the Grand Prize package valued at \$10,000. The prize includes a SawStop Professional Saw and a three-day training class in Paso Robles, California with Jory Brigham and John Malecki. To learn more about Kuveke and the other winners, check out woodcraft.com/pages/blog.



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Reader Showcase



BILL MADER, FOND DU LAC, WI
Cheers. Armed with only a photo from our Dec/Jan 2019 issue and cherry wood harvested from his land, Mader made this liquor cabinet as a wedding gift for his niece. The crotch wood on the drawer face and the lighter sap wood add visual interest.



TIM LAMBERT, BEALETON, VA
Butternut boxes. Using butternut gifted from his uncle's farm, Lambert built this Tansu Box from our Feb/Mar 2009 issue. The drawers pull out to reveal curly maple sides.



DENNIS CAUFIELD, COLLEGE STATION, TX
Cedar slabs. "Happiest when making sawdust," Caufield harvests eastern red cedar logs to build sturdy benches (above) for his friends and family. Caufield is pictured at right with a 2"-thick cedar plank that will soon be a coffee bar in his cabin.



RUSSELL SVENDSEN, OLEAN, NY
Bathtub caddy. For this project, Svendsen combined elements from the Serving Tray (Dec/Jan 2019) and his own Adjustable Trivet (Feb/Mar 2017) as a gift for his daughter. He used engineered flooring for the plank, mahogany for the sides, and curly maple for the handles.

Show off your work!



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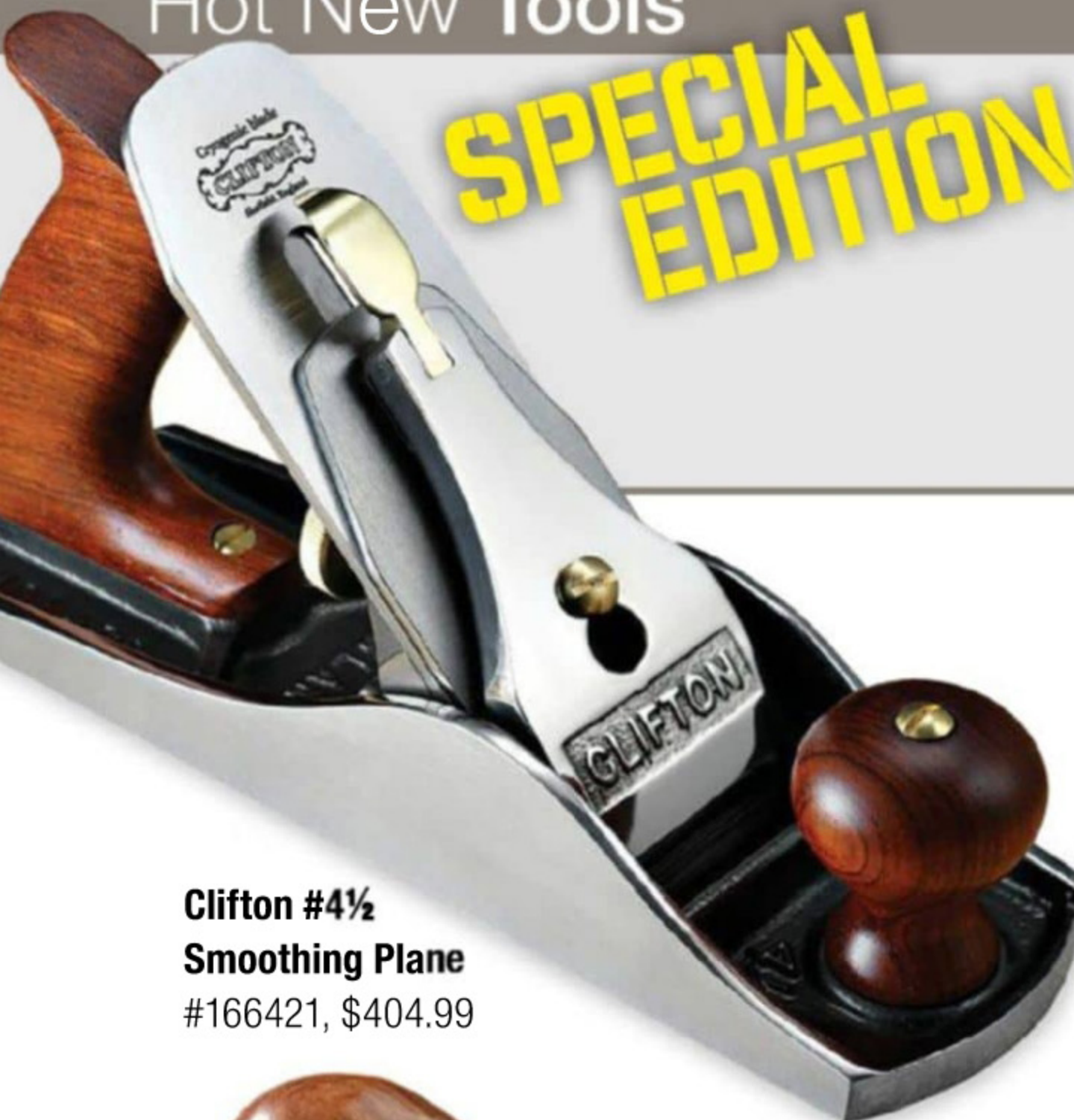


1. How many base alignment blocks do you need to build the plywood workbench?
2. Who invented the circular saw? (Include page number with answer.)
3. From what book/TV series did the shop dog at Making Whole get her name?

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SPECIAL EDITION



Clifton #4 1/2 Smoothing Plane
#166421, \$404.99



Clifton Low Angle Block Plane
#166429, \$374.99

Earlier this summer, nearly 100 manufacturers gathered at the Woodcraft Vendor Trade Show to share their latest offerings in hand tools, machinery, finishes, and accessories. Here are just a few of the items that caught our eye. For more details go to woodcraft.com, or check them out at your local Woodcraft store.

British invasion

A few years back, Thomas Flinn & Co. (a UK-based saw maker since 1923), acquired Clico, the maker of Clifton hand planes. This merger has resulted in a new line of bench planes (3, 4, 4 1/2, 5, 5 1/2, 6, 7) and a block plane to complement their existing offering of shoulder planes and spokeshaves.

These premium planes incorporate the best attributes of both Stanley and Record (many of the employees apprenticed at Record Tools), coupled with exceptional fit and finish. Based on the Stanley Bedrock design, the bench planes sport machined frogs that rest on matching machined pads in the body. The frog can be moved to close or open the mouth of the plane without removing the blade. The soles and sides are ground to the British Standard for bench planes (0.003") for optimum performance for standard planing and for use in a shooting board.

The most noticeable difference between the new Cliftons and vintage planes is the heft. Thicker castings mean more mass; granting greater momentum for gliding through tough grain. The O1 steel irons are 0.125" thick (more than 50% thicker than the industry standard of .080"), and are hardened to HRC 60-62. They are also cryogenically treated to improve edge retention.

If you're serious about hand tools and interested in taking the next step, go to woodcraft.com for more info.



Typical primer

Stain blocker

Super powerful primer

The folks at General Finishes don't hyperbolize, so a description that includes words like "strongest" and "revolutionary" warrants special attention. This water-based interior sealer sticks to almost everything and creates a barrier that prevents stain, dye, and tannin bleed-through.

Having tested the product in my shop, I was impressed by the primer's self-levelling abilities (the brushed-on samples looked almost as good as the sprayed boards). After two coats, the samples looked as if they didn't need a top coat.

Innovation doesn't come cheap, but based on this primer's ability to handle the problems associated with painting over other finishes, it's a reasonably-priced insurance plan for tough paint jobs.

General Finishes Stain Blocker Primer

Quart, #166814, \$41.99



Invisible guardian

Tired of the annual exercise of applying top coat sealers to your outdoor projects? Maybe it's time to step up to 21st Century technology. Made by the folks who also make Anchor-Seal, Seal-Once is a non-toxic, non-film-forming "inner sealer." Based on its track record in the log home and decking market, it might be your best weapon in the fight against Mother Nature's weathering forces.

According to the manufacturer, Seal-Once penetrates the wood's surface and then coats the wood fibers with nano-polymers. The polymers allow water vapor to escape, but restrict water intrusion that leads to mold, mildew, rot, warping, and splitting. Seal-Once can be used under other paints or finishes, or tinted and used as a stand-alone stain. The coating lasts up to ten years on vertical surfaces and six years on horizontal surfaces. ■

Seal-Once Nano Guard Wood Sealer

Quart, #164465, \$26.99



Leigh VRS1200 Vacuum & Router Support
#166417, \$79.00

Perfect partner for PC dovetail jigs

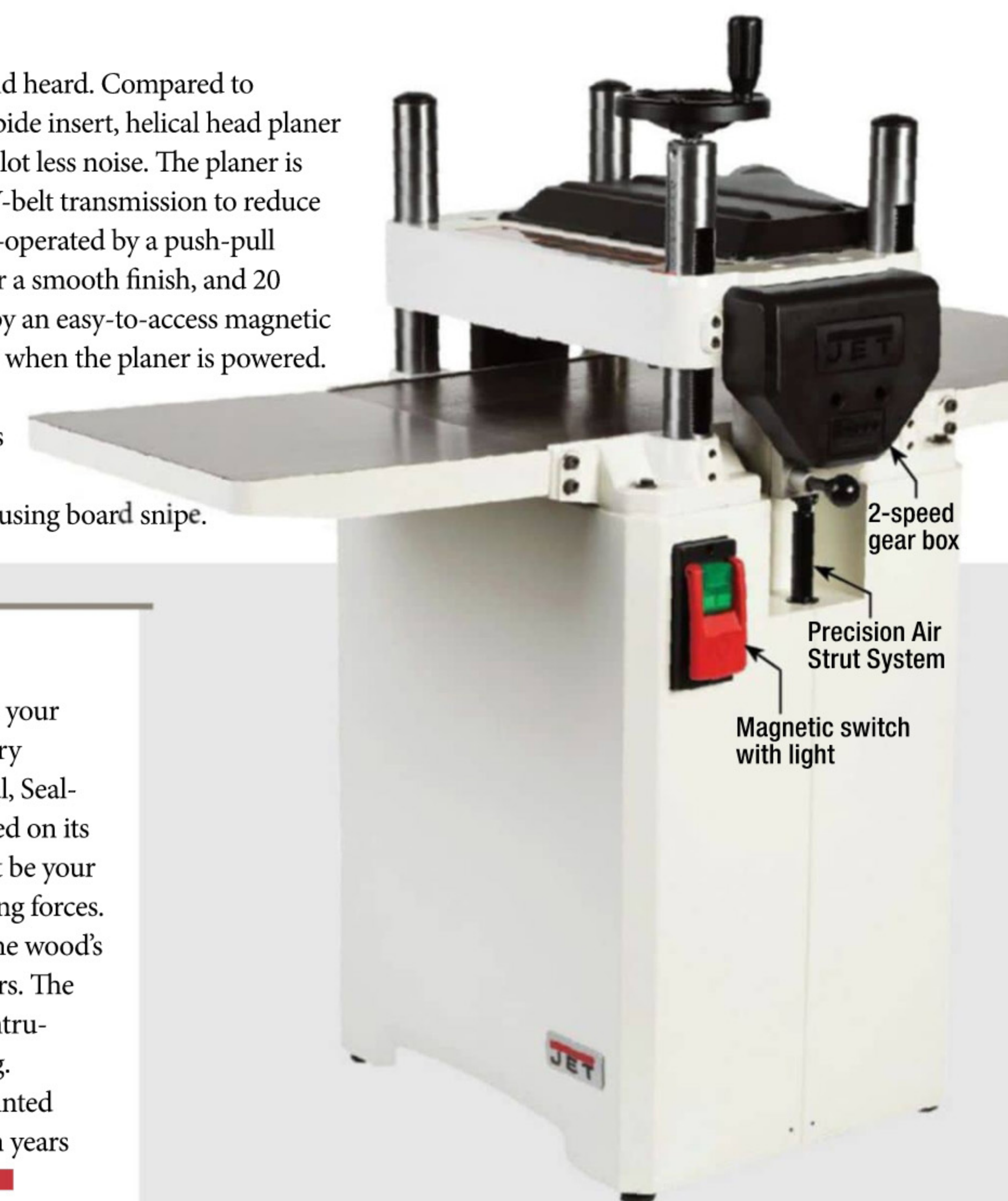
Porter Cable's dovetail jigs may be some of the most popular dovetail jigs on the market, but users discover that routing the parts for a drawer or two produces a prodigious amount of dust and chips. With the Leigh VRS1200 Vacuum & Router Support, PC 4210 and 4212 jig owners can now enjoy almost dust-free dovetails.

The vacuum box is the key to cleanliness. This box clips onto the guide bushing and slides in tandem with the router to collect chips when cutting pins and tails. In addition to supporting the vacuum box, the beam keeps the router from tipping and offers a safe resting spot when making board changes.

Hello, helical. See ya' Snipe.

Jet's newest helical head planer deserves to be seen and heard. Compared to straight-blade machines, the JWP-15B's 48-tooth carbide insert, helical head planer not only delivers a superior finish, but does so with a lot less noise. The planer is powered by a 3-HP, single-phase, 230V motor with V-belt transmission to reduce vibration and running noise. A two-speed gear box—operated by a push-pull knob—provides dual material feed rates of 16 fpm for a smooth finish, and 20 fpm for quick dimensioning. The motor is operated by an easy-to-access magnetic switch, which has a green safety light that illuminates when the planer is powered.

The most interesting innovation is JET's Precision Air Strut System (PASS™). This pair of heavy-duty gas struts exerts upward pressure on the cutterhead with upward pressure, preventing it from dropping and causing board snipe.

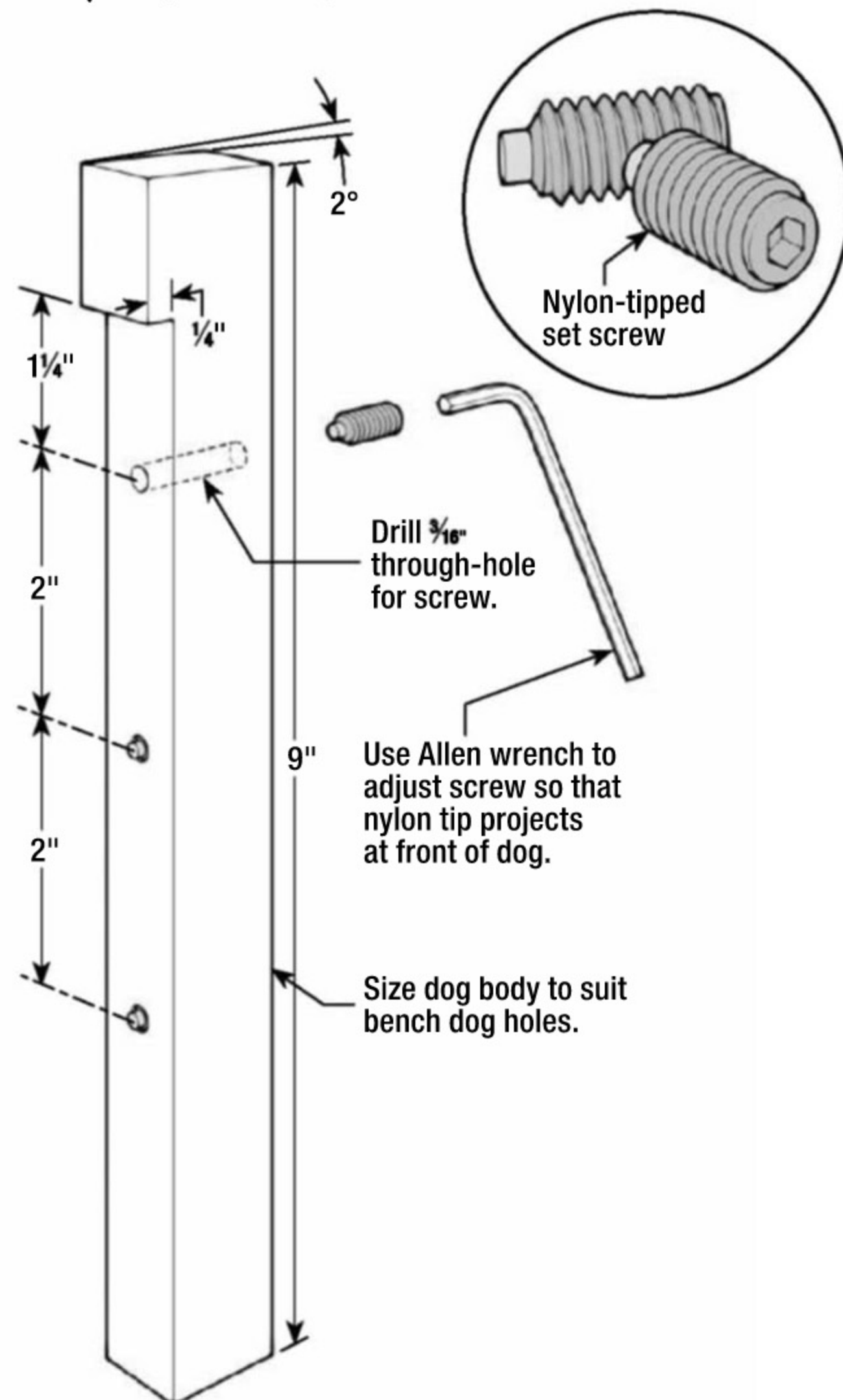


Jet JWP-15B 15" Helical Head Planer

#722155, \$2,599.99

Conventional bench dogs are usually outfitted with sprung metal or wood strips to hold them in place at your desired working height. They work well enough at an inch or so above the benchtop, but lack bite when standing tall to hold higher work. This dog relies on $\frac{1}{4}$ -20 $\times$ $\frac{1}{2}$ " nylon-tipped set screws (available at *McMaster-Carr.com*; item # 94115A537) to keep it precisely where you want it, even when projecting 4" above the work surface. To make a good dog like this, saw your stock from a dense hardwood like maple, sizing its body to suit your benchtop's dog holes. Then drill a series of $\frac{3}{16}$ "-diameter holes through the back of the dog (there's no need to tap them). Drive the screws through until their nylon tips protrude from the opposite face and bear lightly against the inside of the dog hole. It will then sit where you want it to without further commands to "stay!"

—Andy Rae, Asheville, North Carolina



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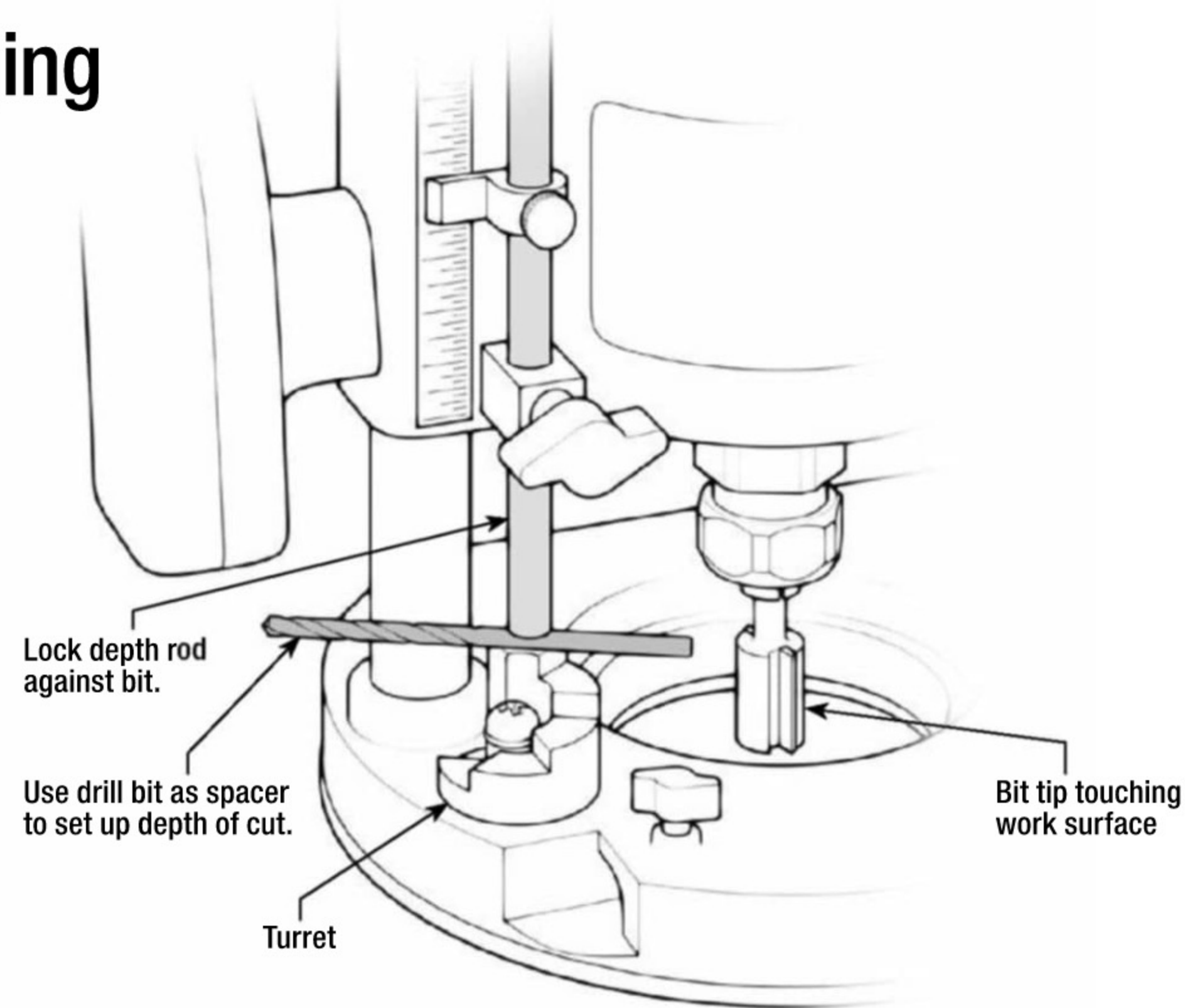
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Web site: www.robert-sorby.co.uk

[illegible]

Precision plunging

I've found that the depth gauges on some plunge routers are tricky to read. For the kind of precision needed when routing inlay recesses, for example, I use as a depth gauge a drill bit whose diameter matches my desired depth of cut. With the router bit zeroed out on the workpiece surface, I trap the drill bit between the router's turret and its adjustable depth rod, and then lock the rod. Remove the drill bit, and go to work, plunging with precision.

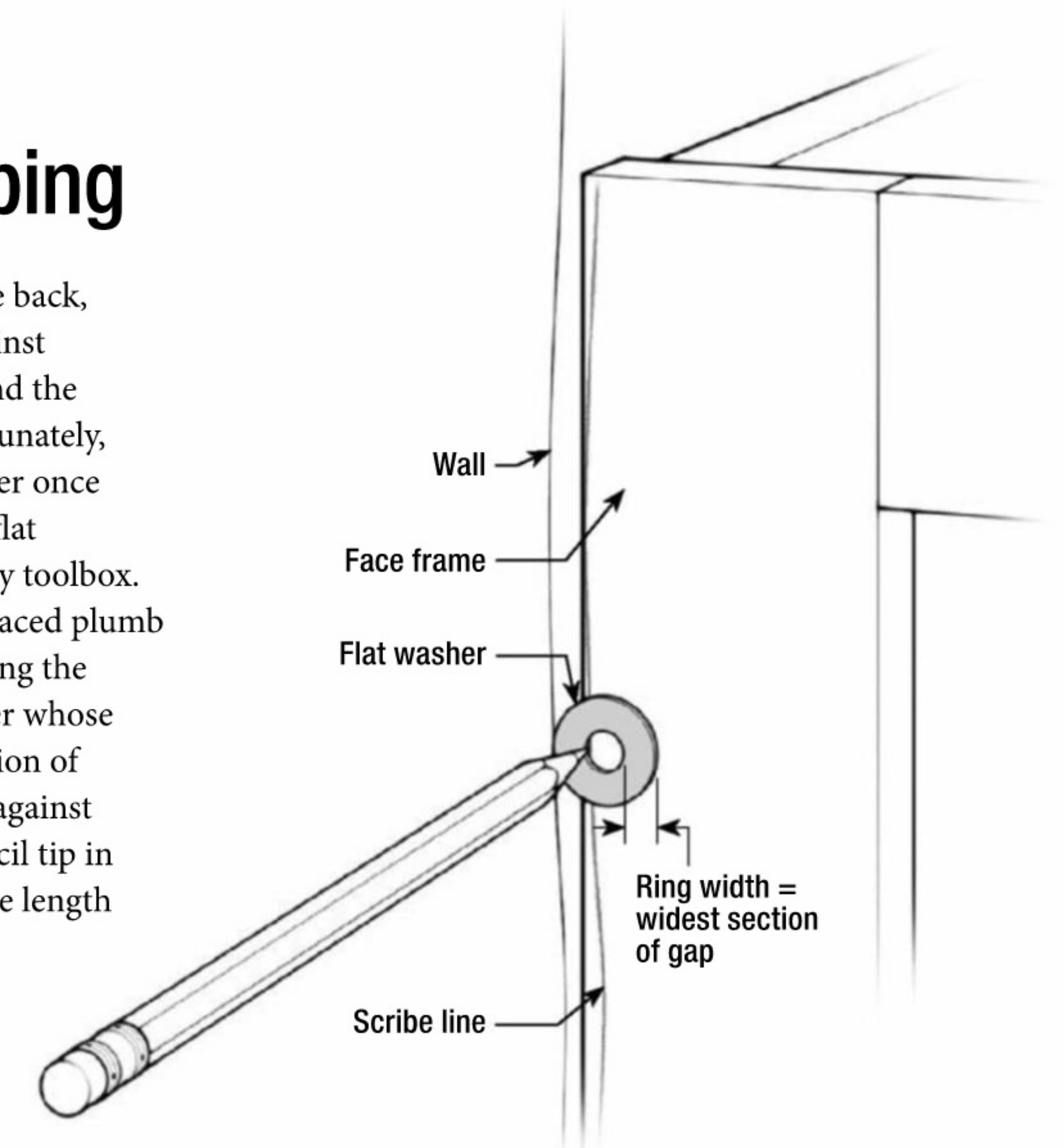
—William Keith,
San Diego, California



Roundabout scribing

When installing wall cabinets some time back, I needed to scribe a face frame to fit against an irregular wall surface, but couldn't find the compass I normally use for the job. Fortunately, I remembered that an old finish carpenter once showed me how to scribe using regular flat washers, which I happened to have in my toolbox. Here's how it works: With the cabinet braced plumb and level, and with the face frame abutting the wall as closely as possible, select a washer whose ring width approximates the widest section of the remaining gap. Pressing the washer against the face frame and the wall, insert a pencil tip in the washer hole as shown, and drag it the length of the area to be trimmed to create your scribe line. Cut to the line, check your fit, and repeat if necessary, using a smaller washer to refine the fit.

—Mark Latimer,
Florissant, Missouri



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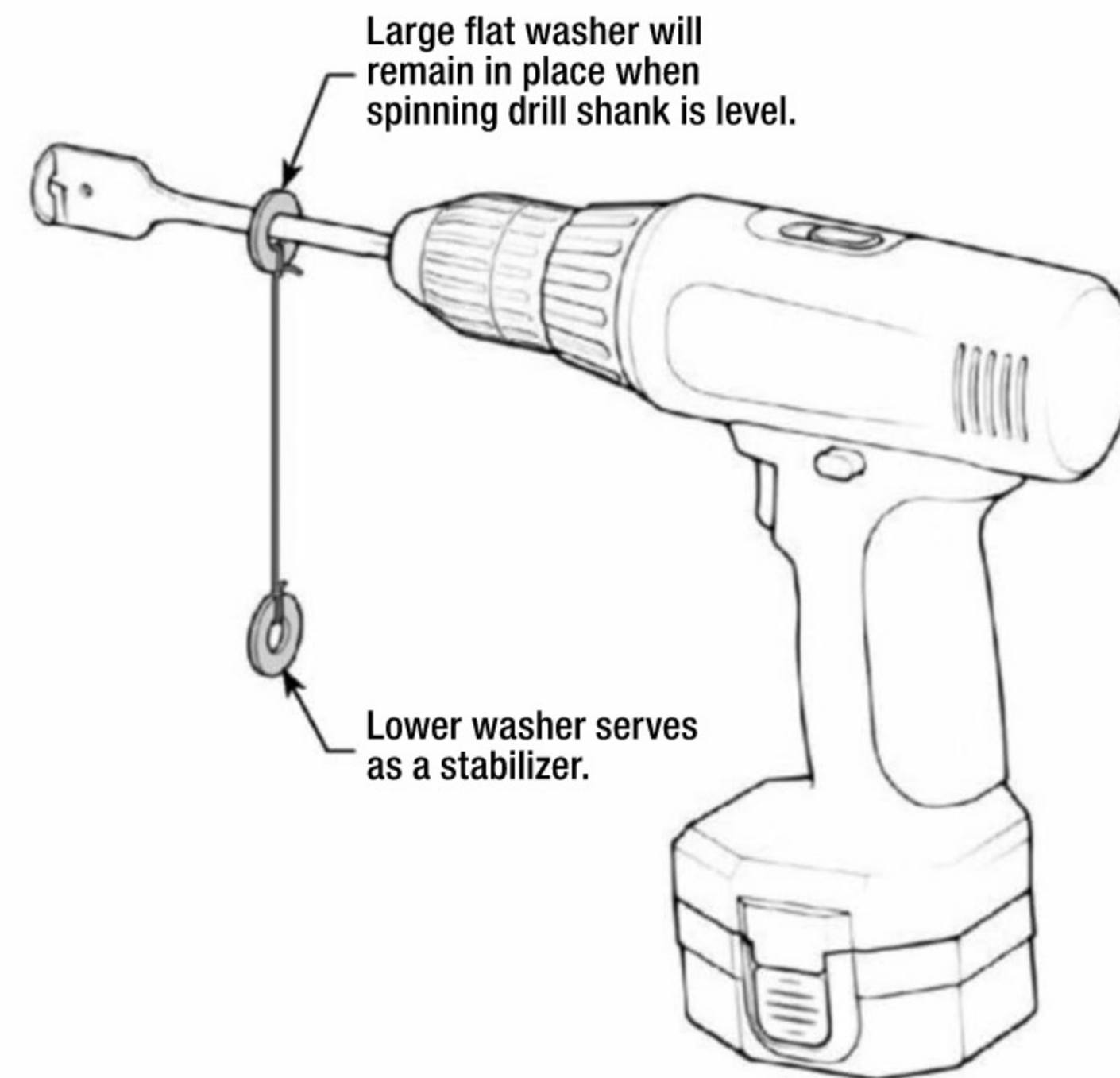
visit woodcraftmagazine.com, and
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Important: Please include your
phone number, as an editor may
need to call you if your trick is
considered for publication.

Drilling on the level

A recent job required drilling a couple of large holes in the walls of an installed cabinet to accept the ends of a large dowel rod. For the rod to span the two holes, they both needed to be horizontal in order to align with each other. Unfortunately, it's hard to gauge level with a spade bit, which is the tool I had for the job. After some head-scratching, I realized that I could employ the same sort of balancing principle used by a toy I had as a child. I strung together a couple of washers, which I then hung from the shank of the bit as shown. When drilling, the shank-hung washer would "walk" as a result of any drill tilt, providing a great leveling gauge. The side-to-side perpendicularity wasn't too difficult to maintain, gauging it by eye with the help of a small square placed nearby.

—Bill Shapwell, Fargo, North Dakota ■



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KING ARTHUR'S TOOLS

Build A Beautiful 3-TOP BOX



A distinctive design combines grain-matched sides, handcrafted handles, and painted accents.

By Matt Kenney

When making small boxes, I usually design a box first, then select the wood I'll use to build it. But this box is different. When a friend gave me some beautiful, vertical-grain Douglas-fir, I worked on a design that would allow the wood to be the most striking feature. My box has mitered corners that allow the grain to run continu-

ously around the square perimeter. The grain display continues at the top of the box, with three different-sized lids that nest in rabbeted sides and dividers. Green paint accents the handle recesses and the edges of each lid. The handles themselves are made from cocobolo. Inside the box, the bottom is lined with a quilting square.

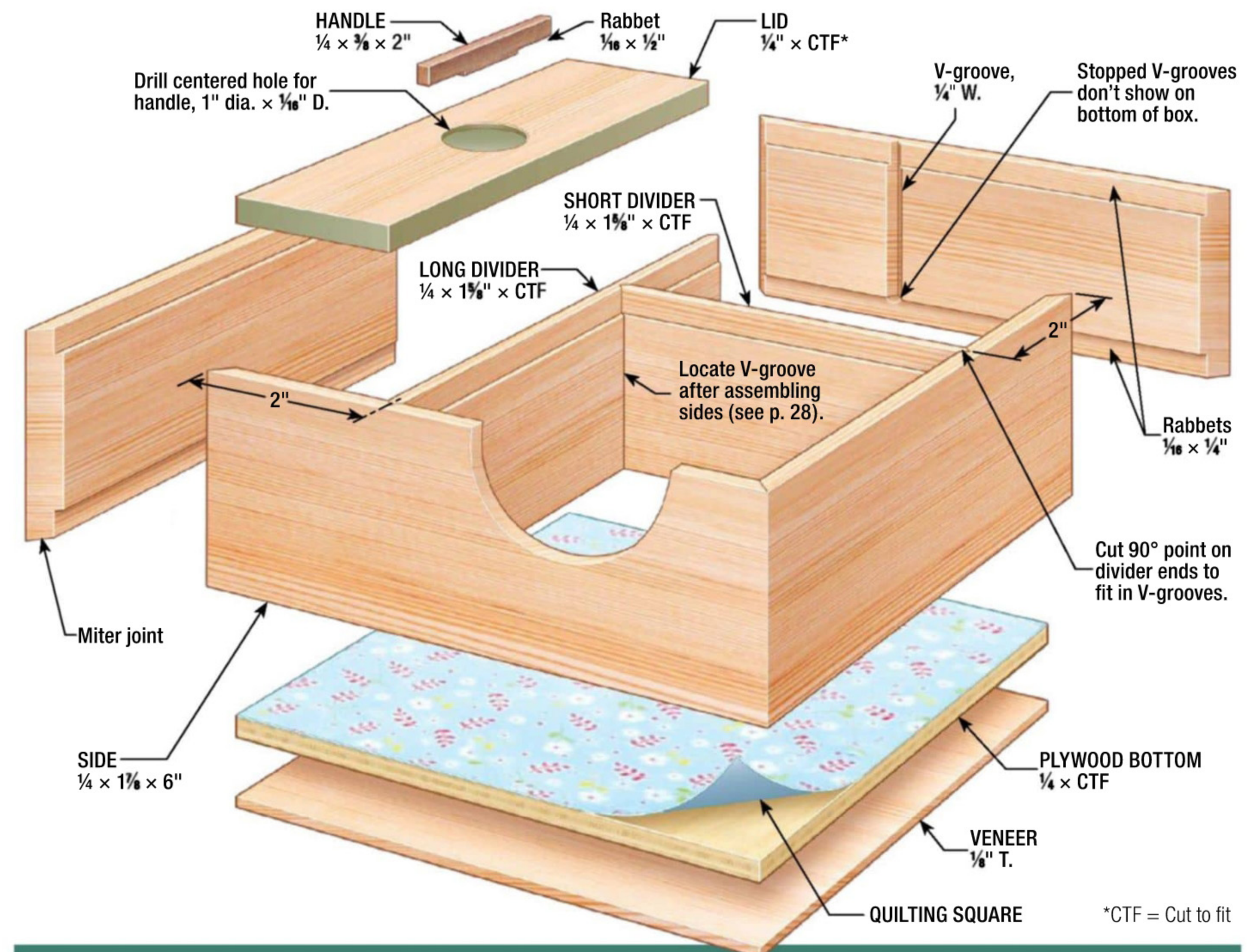
Photos: Randy O' Rourke; Illustrations: Frank Rohrbach III

4 sides, 3 lids, 2 dividers, 1 bottom

All parts except for the bottom and handles are made from clear, vertical-grain Douglas-fir. Cut sides, dividers, lids, and veneer stock from

a single board if possible; that's the best way to achieve uniform grain and wood tone, along with grain-matched sides. Also make sure to

prepare some extra stock (milled to $\frac{1}{4}$ " thickness) to use in setting up your table saw and router table for precisely milled rabbets and V-grooves.

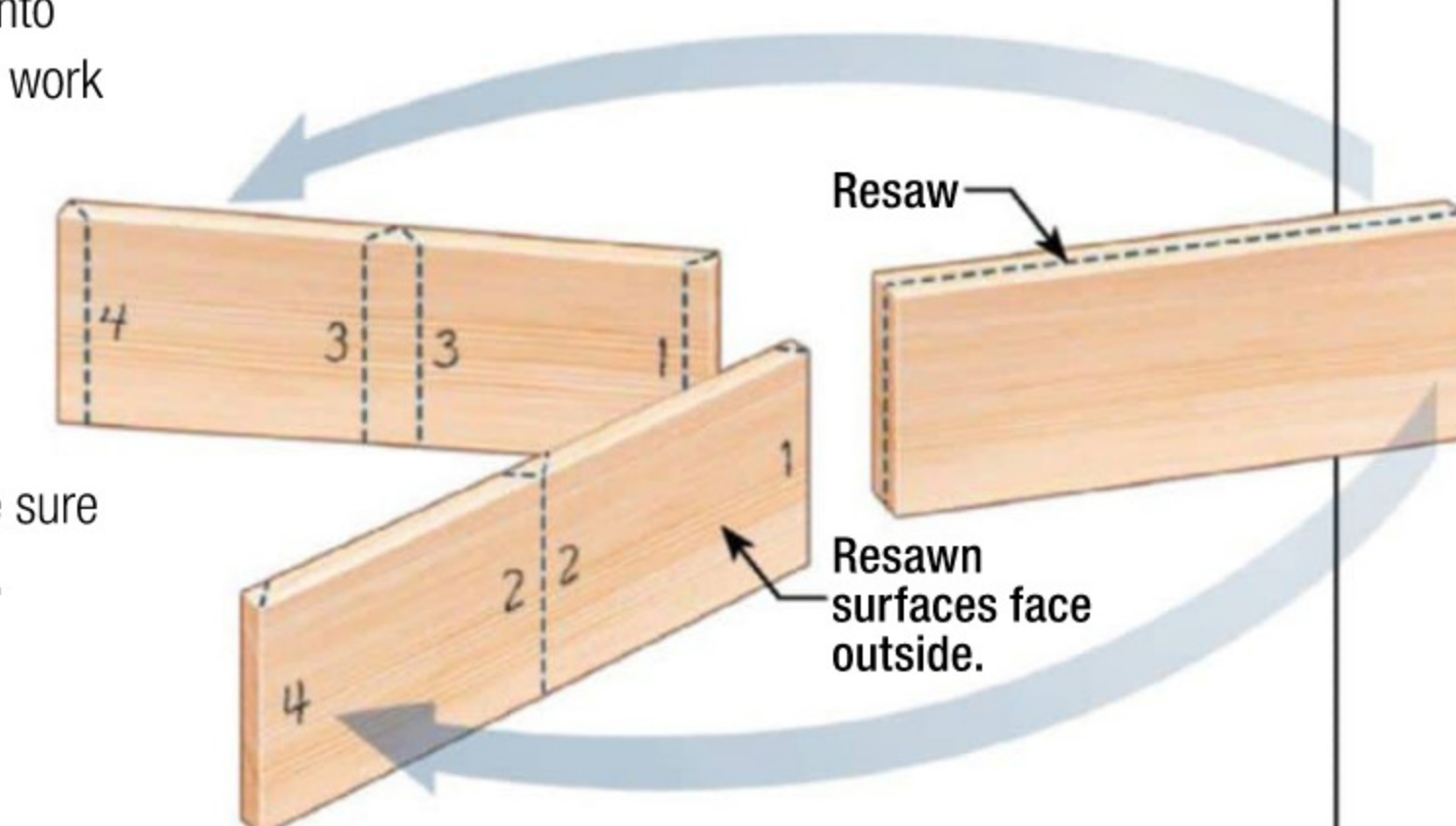


Order of Work

- Mill rabbets in sides and divider stock, then cut sides to finished length.
- Mill stopped V-grooves in sides.
- Miter the sides, then assemble.
- Make the bottom panel.
- Cut dividers to fit, then layout and rout through V-groove in long divider.
- Prefinish dividers and inside faces of sides.
- Glue bottom and dividers in place.
- Make lids and handles.
- Add paint accents to lids, then glue handles in place.
- Apply finish to lids and box exterior.

How to prepare grain-matched sides

1. Prepare a blank that's flat, square, and large enough to be resawn into pairs of adjacent sides, as shown in the drawing. You might need to work with a longer blank (as I did), in order to run it through your planer.
2. Resaw the blank and swing the matching pieces around, so that both freshly sawn surfaces face outside.
3. Mark the miter cuts to divide the two pieces into four sides, then write matching numbers or letters on the joints that need to match up when gluing up the sides, as shown in the drawing. Make sure to transfer your numbers to surfaces or edges that won't be planed.
4. Plane your two boards to finished thickness.
5. Complete joinery work on the sides, then cut their miters and glue up the box.



Building the box frame

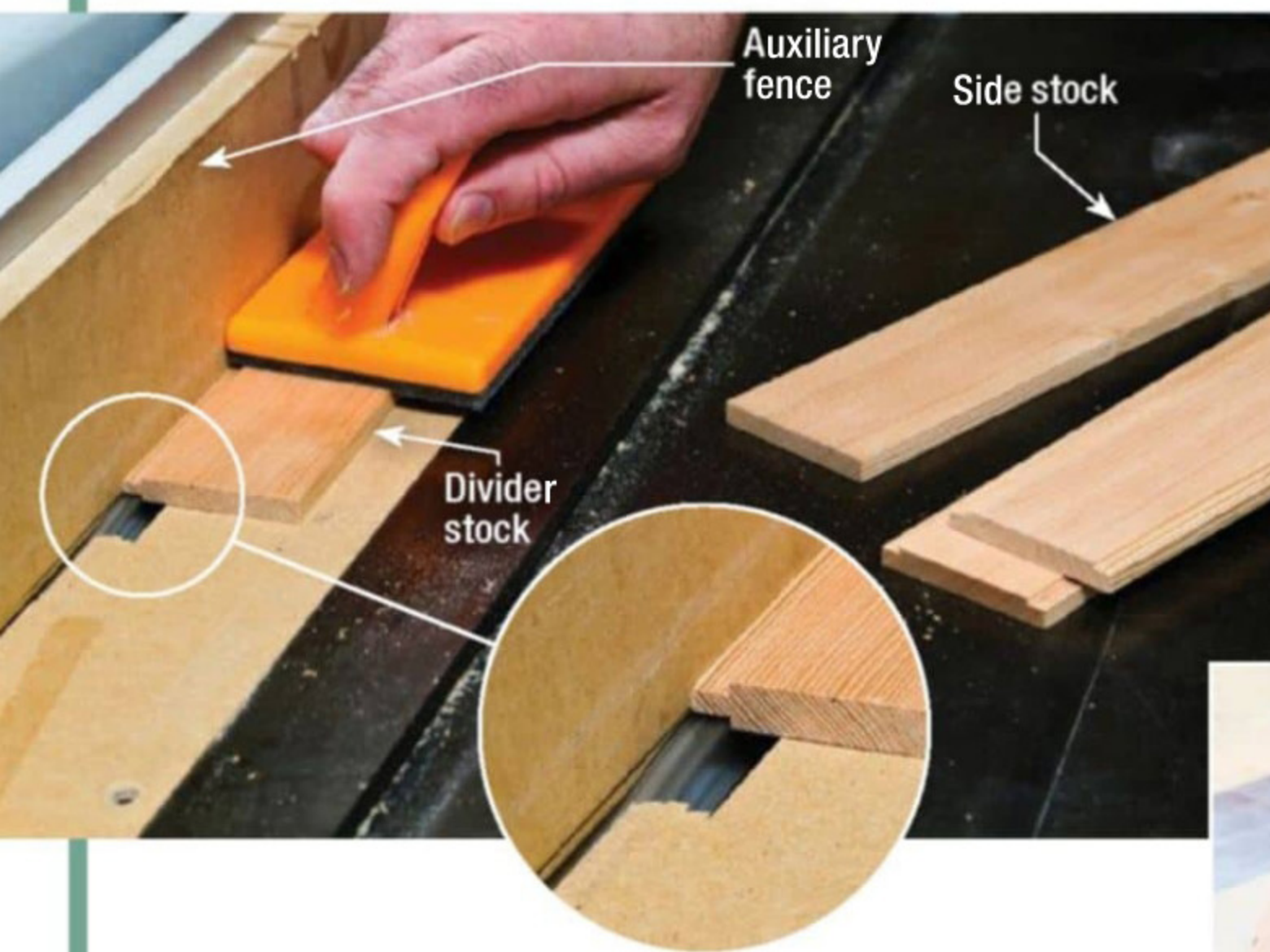
Start with a blank that can be resawn to yield grain-matched sides, dividers, lids, and veneer for the bottom. Also prepare some extra 1/4"-thick stock to check joinery setups. It's better to have longer workpieces when rabbeting edges, because

you get more solid registration against the table saw's fence.

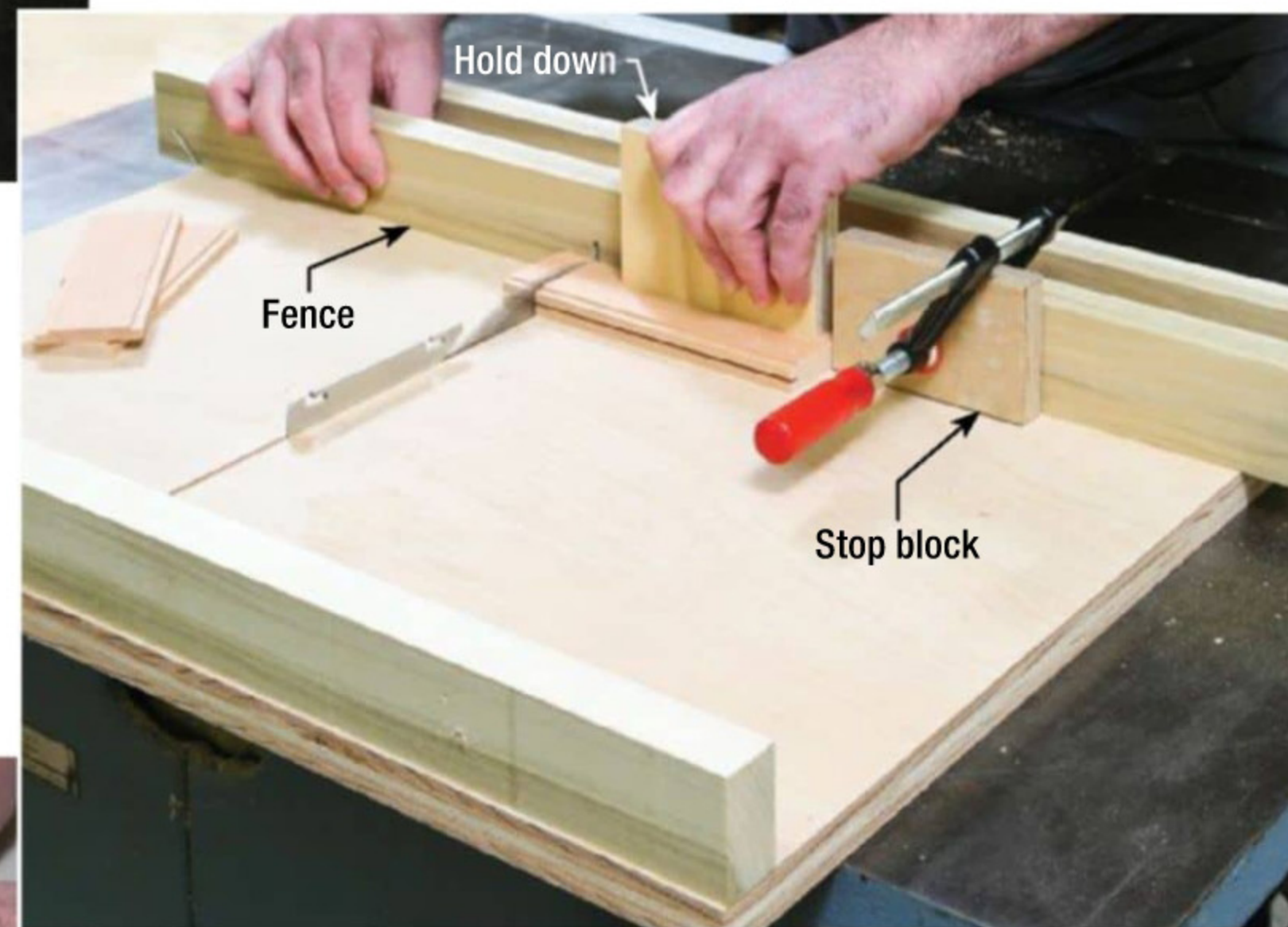
Leave the bit in place on the router table after V-grooving the sides. You'll need it later for V-grooving the long divider.

If you haven't tried my "string-and-

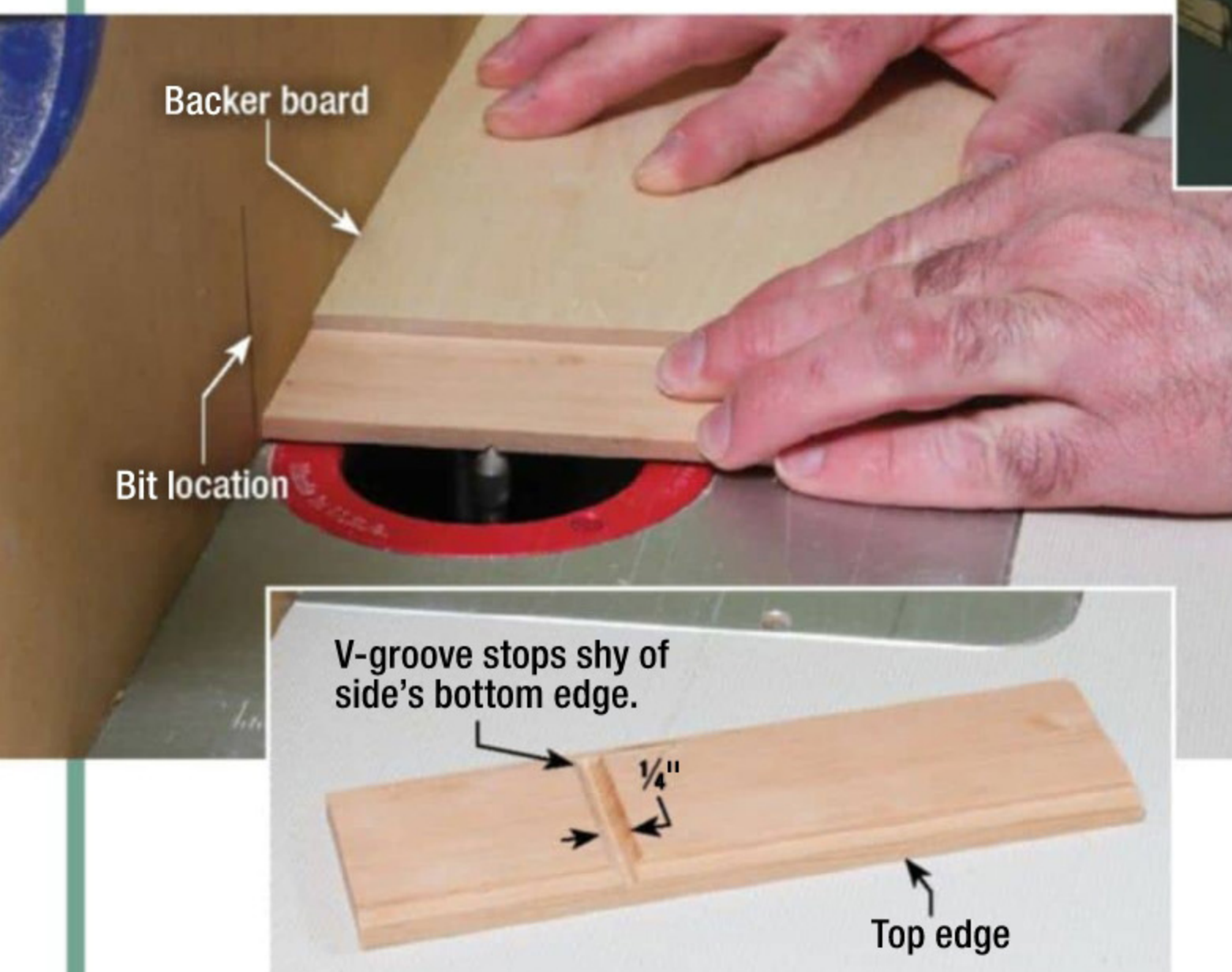
stick" clamping method before, do a dry run of clamping the box frame so you can get a feel for how the technique works. Basically, the tape holds the miter joints together, while the cauls clamp with increasing pressure as you move them toward the corners.



Mill rabbets in dividers and sides. Attach a wood auxiliary fence to the table saw's rip fence, and set up a stack dado to cut at least 3/8" wide. Position the auxiliary fence to expose just 1/4" of the cutter, and set cutting height at 1/16". Test your setup on scrap stock and adjust if necessary. Then mill rabbets, using a push block to protect your fingers.



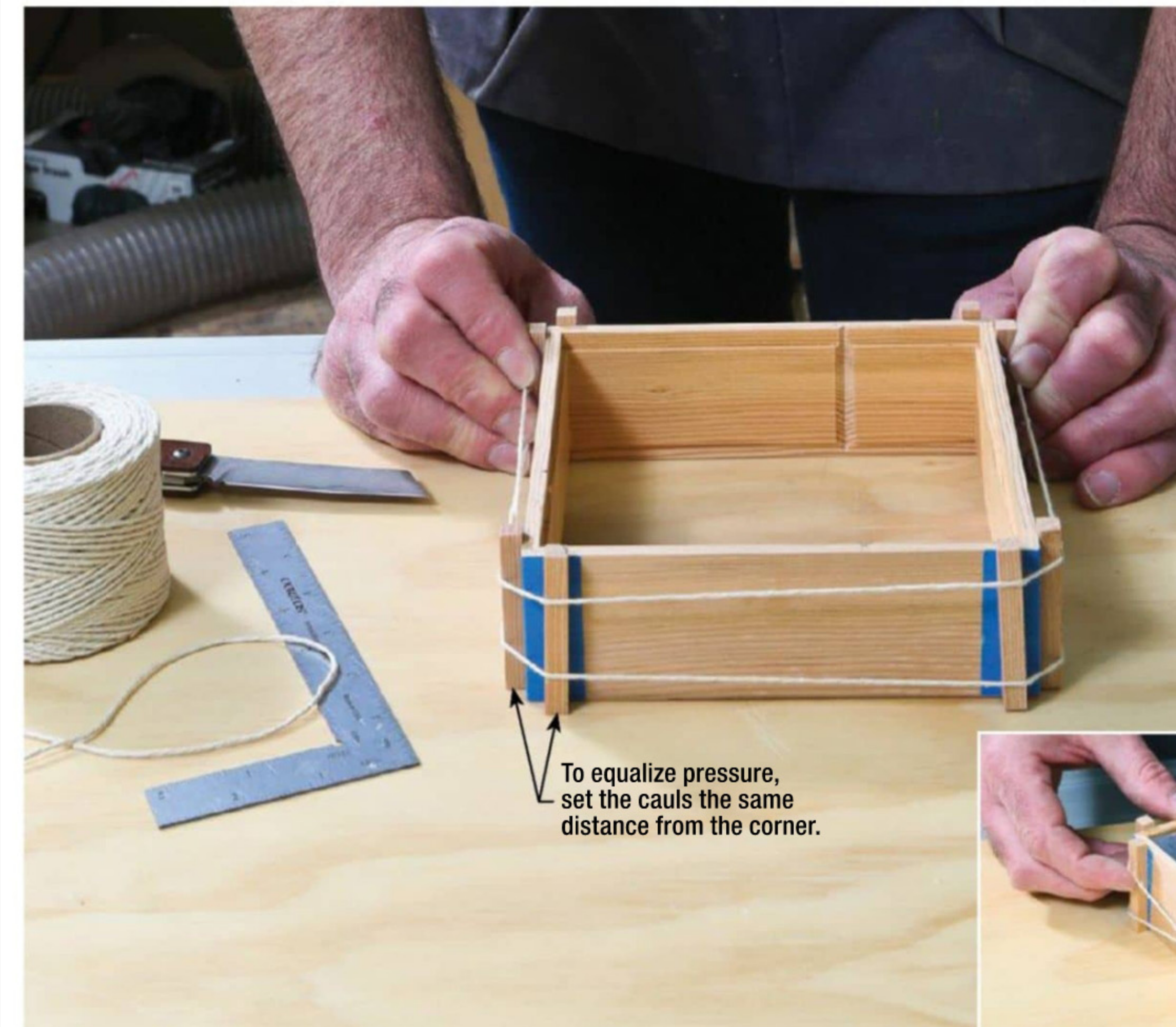
Cut sides to length. Clamp a stop block to the crosscut sled fence, 6" from the blade. Butt a square-cut end of each side against the stop to cut the sides to finished length. The sides still need their ends mitered, but the square-cut ends will provide more solid registration when routing V-grooves—the next step.



Rout V-grooves in sides. Adjust the height of a V-groove bit so that finished grooves will be 1/4" wide, then set the fence 2" from the bit's point. Mark the bit's location on the fence so you can rout a stopped V-groove in three of the four sides (see drawing, p. 26). Use a backer board to guide these cuts, as shown in the photo. For two of the stopped grooves, you'll need to lift the side up before the bit exits the bottom edge. Make the final stopped groove by lowering the side onto the bit and routing through the top edge.



Cut miter joints in sides. Make these cuts with a stop block clamped to the fence. To position the block, align the top corner of a side (already cut to finished length) with the zero-clearance kerf in the jig's fence. The correct cutting set-up will create a sharp miter without shortening the side.



Finishing details

Prefinish the inside faces of the box sides. You can do this before gluing up the sides (keeping finish from mating surfaces), or after the sides have been glued up. Also take the time to prefinish the dividers again, avoiding mating surfaces. I like finishing small boxes with 1 lb. cut shellac. I apply several coats, sanding with 800-grit sandpaper between coats. For painted accents, I use milk paint (see Buyer's Guide, p. 69).

Related Articles

Flip to page 51 to build your own version of the sled shown here. See WoodSense p. 58 for more on Douglas-fir.

Clamp with tape, string, and sticks. Working on a flat surface, apply glue on the miter joints, and tape the box frame together by applying painter's tape at the corners. Tie some common household string to loop twice around the frame, with just enough slack to insert a pair of rectangular cauls near the center of each side. Carefully move the cauls toward the corners, aiming for symmetrical placement on all sides. Don't force it; stop when the string is taut and joints are tight.



Add the bottom and dividers

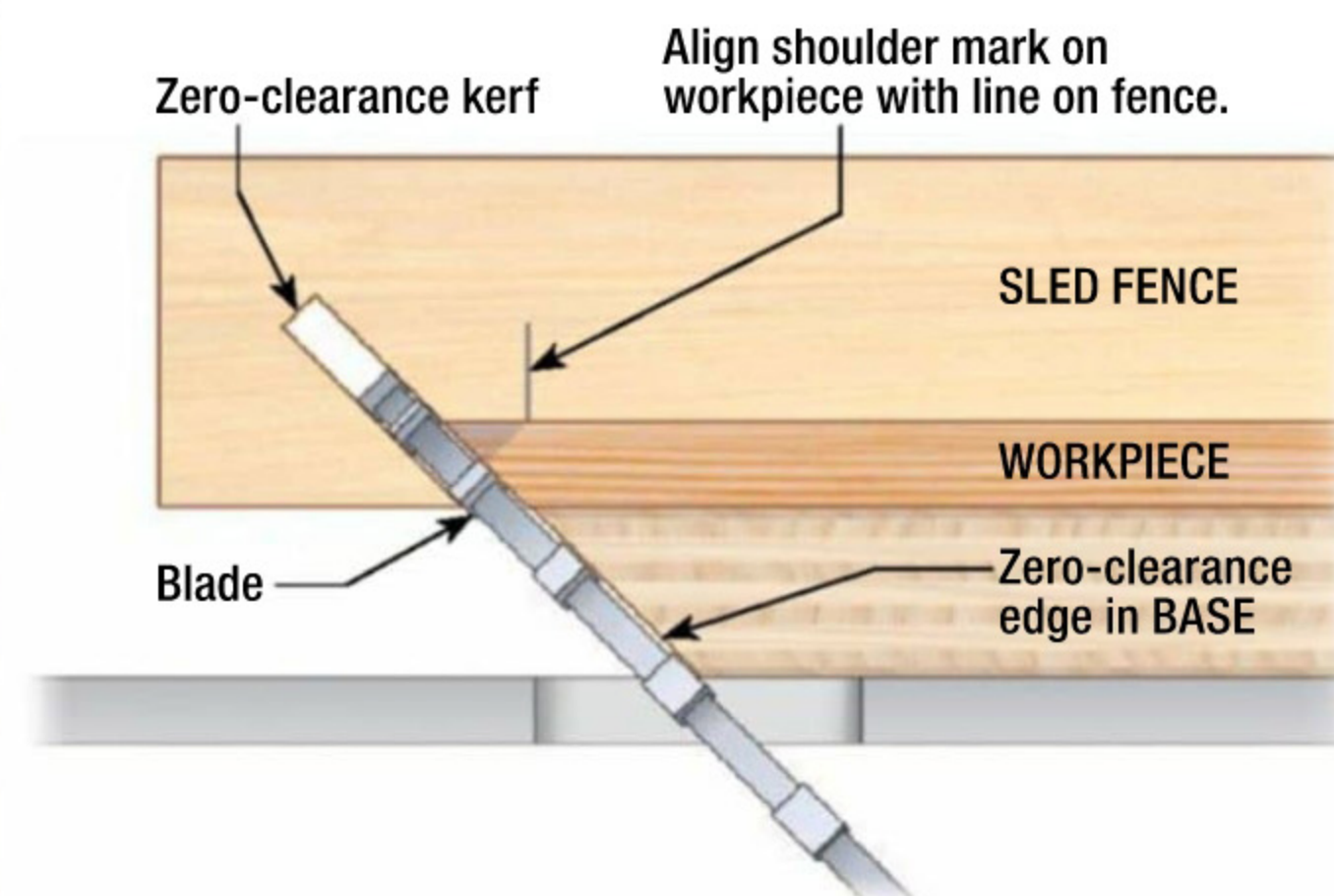
Cut the plywood bottom panel slightly oversize, glue veneer to one side, then cut the bottom to final size before gluing on the fabric. The finished thickness of the bottom allows it to sit slightly proud of the sides. This elevates the sides, creating a delicate shadow line that gives the box a floating appearance.

Use your mitering sled to cut the pointed ends on the dividers. For the long divider, point one end by making two symmetrical miter cuts with the opposite end butted against a stop block. Before removing the workpiece, make a vertical mark on the fence, upward from the miter shoulder, as shown in the drawing. Then mark the piece to fit, as shown in the photo below. To set up to point the remaining end of the long divider, align your mark on the workpiece with the mark on the fence, and clamp a stop block to the fence against the previously cut end of the divider. Make the two remaining miter cuts, then use the same technique to complete the short divider.



Fabric goes on fast. Adhere the cloth by spritzing the plywood with spray contact adhesive, then pressing an oversize quilting square in place. After the adhesive dries, trim the excess with a craft knife or rotary cutter.

Cutting pointed ends on dividers



Mark to fit. After cutting the point on one end of the long divider, tuck it in one of its V-grooves, and mark the shoulder of the point at the opposite end. Align this shoulder mark with the vertical mark you've made on the sled's fence, then set up a stop block to make a pair of symmetrical cuts.



Mark and rout the last V. Set the center divider upside down in the box and use a square to lay out the location of the final V-groove. After routing, reinsert (right-side up) and trim the short divider to fit.



A perfect fit. To complete the short divider, repeat the same cut-to-fit technique used on the long divider.

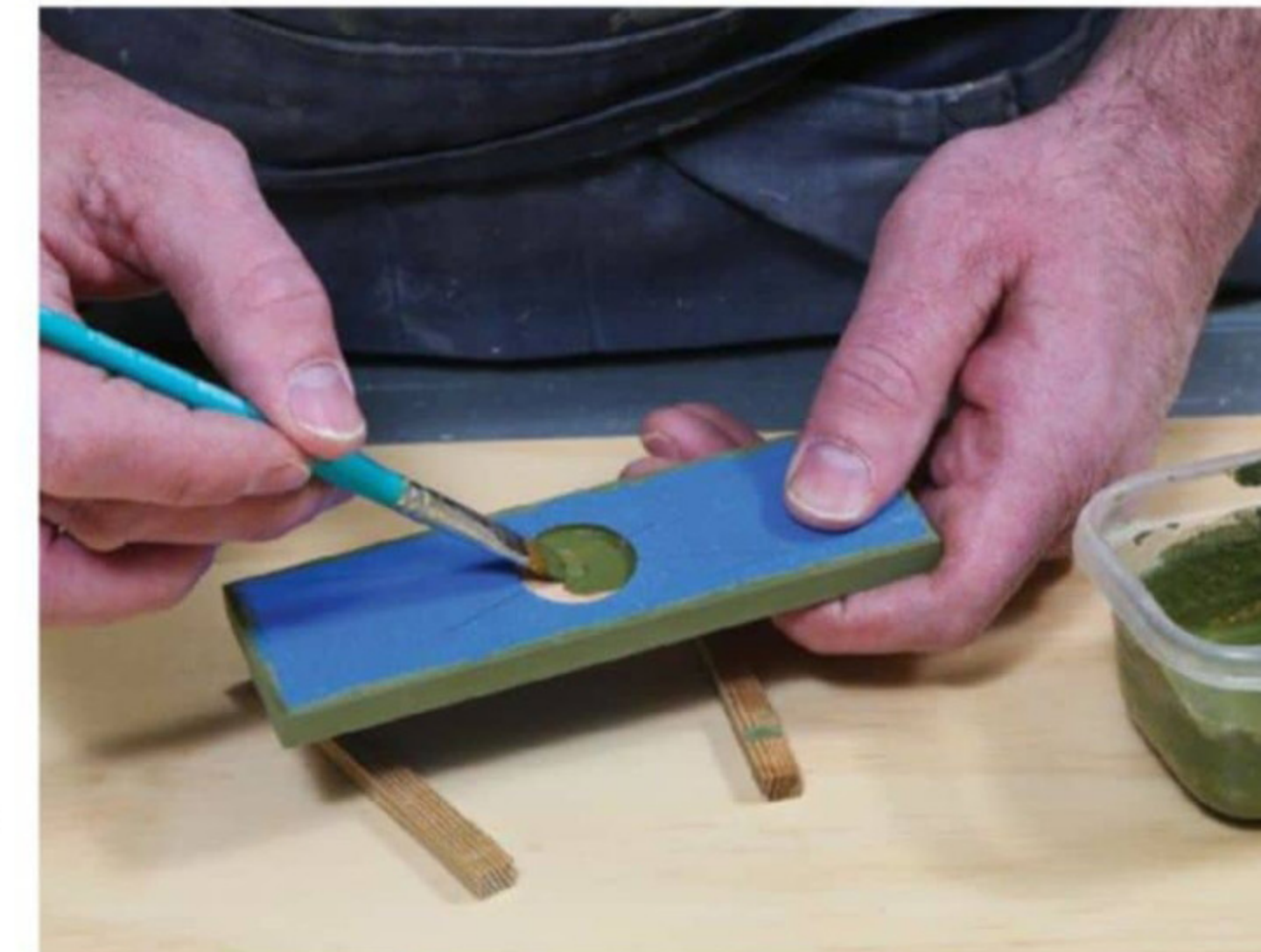
Finish up with lids and pulls

After cutting the lids to fit in their rabbeted openings, mask both faces of each lid with painter's tape. Then lay out a centerpoint for drilling a 1"-dia., 1/16"-deep handle hole in the top of each lid. Use a sharp Forstner bit, and clamp each lid firmly in place before you start to drill. Remove the tape when the paint dries, and lightly sand lid edges to soften corners.

I use my crosscut sled to make the cocobolo handles. After cutting three handle blanks to finished dimensions, set the blade height to 1/16" above the sled, and clamp a stop block 1/2" from the far edge of the blade. With the bulk of the blank on the opposite side of the blade, set an end against the stop to cut the shoulder, then shift the piece away from the stop to nibble away the rest. Be sure to use a hold down. Repeat on the other end, then clean up the notches with a chisel. ■



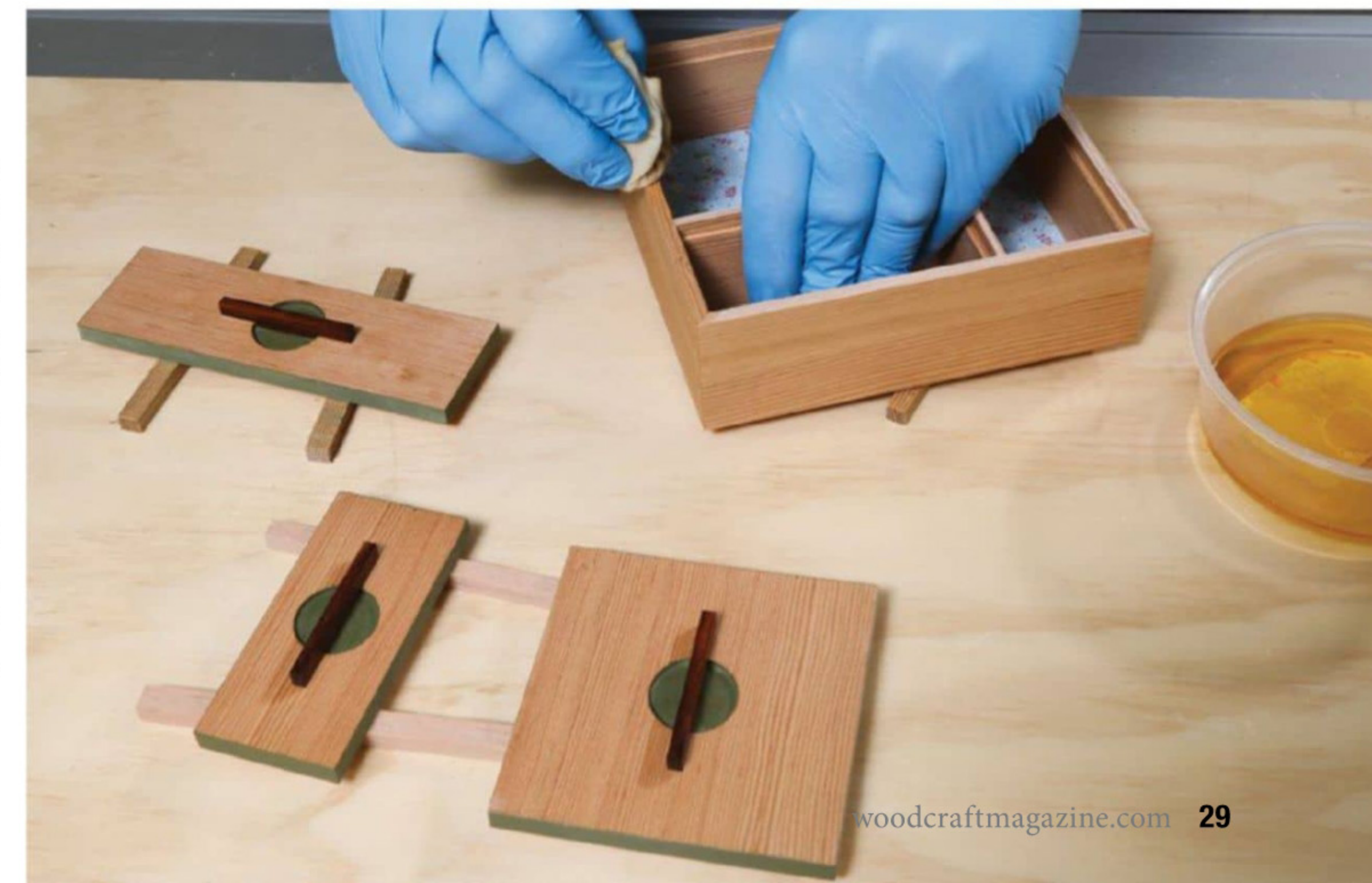
Tiny, T-shaped handles. These handles are cocobolo, but other dark hardwood is equally suitable. Cut notches for a snug fit, mark a centerline on the lid to align your installation, and attach each handle with CA adhesive.



Touches of color. Coat all handle holes and lid edges with milk paint. Painter's tape masks the unpainted sections and reduces the chance of tearout when drilling the stopped holes for the handles.



The finishing touch. The dividers and the inside faces of the sides have already been finished with several coats of 1# shellac. Once the box is assembled and the lids are complete, I apply several coats of shellac to all remaining surfaces, sanding with 800 grit between coats. As a final step, I buff on some paste wax.



The art of SEATING

200 Years of American Design

By John Blackford

As in biology, chair design has undergone its share of evolutionary twists and turns, with any particular design carrying stylistic DNA from its forbears while adapting to its specific regional environment. A traveling exhibit titled *The Art of Seating: 200 Years of American Design* presents a fascinating look at the evolution of chairs in our own country over the course of the last couple of centuries.

The exhibit's 42 chairs are presented chronologically in four groupings. The first reflects the invention and technological development spanning the 1820s to the 1880s. This is followed by the Arts and Crafts movement that continued into the 1930s. The third group represents a period of advanced materials and production that extended through the 1960s. Finally, the show wraps up by exploring the adoption of alternative materials used in various present-day chairs.

The following bit of chair design history, which features a few of my favorites, is only a taste of what the show has to offer. I caught the exhibition just before it closed at The Michener Art Museum in Doylestown, PA. If you get a chance to see it at a future venue, don't miss it. It's likely you'll never look at chairs the same again.

Fancy Chair

Philadelphia, PA; unknown maker

One of the earliest chairs in the exhibit, the Fancy Chair could easily be mistaken for a more modern piece—an indication of how far chair design had already progressed by the time American chair makers got to work. The chair was intended to meet the demand of an emerging middle class by imitating costly inlay and carving techniques used in Europe. By painting on wood, American designers created a trompe l'oeil that was more affordable than it appeared. In fact, 200 years ago, the word "fancy" meant something closer to "fantasy," referring to things born of illusion.

1820

Designers as
ILLUSIONISTS



Shaker Ladderback Rocking Chair

New Lebanon, NY; unknown maker

By the mid-1800s, furniture designers in the Shaker religious community were producing simple but elegant chairs that are still prized today. The Shaker design philosophy is one of prioritization, and the main priority is to be necessary and useful. It is thus not surprising to find that Shakers invented such modern tools as the circular saw, the washing machine, and the flat broom. The underlying principles of Shaker design inspired some of the finest makers of modern furniture, and the Shaker ladderback chairs influenced a generation of modern designers.

1840
Elegance
in simplicity



1857

The official arm chair of
THE HOUSE



House of Representatives Chamber Arm Chair

Philadelphia, PA; designed by Thomas Ustick Walter

Like later chair designers Frank Lloyd Wright and Frank Gehry, the designer of the chairs used by the U.S. House of Representatives was also an architect. In fact, Thomas Ustick Walter is recognized for the construction of the U.S. Capitol in its present form. He designed this Classical Style chair for the House of Representatives in 1857, with two manufacturers producing the 262 chairs needed. The federal shield on each chair features carved oak and olive boughs, representing strength and peace, and the legs have deeply carved laurel leaves. President Lincoln was photographed in one of the chairs by the Mathew Brady Studio in 1863.

McKinley Arm Chair

Grand Rapids, MI; designed by David Wolcott Kendall

Anxiety about industrialization may seem a modern concern, but it stretches back to the 1890s. That worry gave rise to the Arts and Crafts movement, which represented not so much a particular style or location, but a preference for hand-crafted items made of natural materials. One adherent, David Wolcott Kendall, helped popularize making furniture of oak, a wood that was plentiful but considered coarse. Kendall's most popular armchair became known as the "McKinley Chair," after it was presented to President William McKinley. It became so popular that numerous copies flooded the market, forcing manufacturer Phoenix Furniture Company to secure a patent in 1887.

1894

A backlash to
INDUSTRIALIZATION





1938 Furniture reflecting ARCHITECTURE

Johnson Wax Chair

Grand Rapids, MI; designed by Frank Lloyd Wright

In 1936, S.C. Johnson Wax company asked 69-year-old Frank Lloyd Wright to design its corporate headquarters. At the time, Wright was among the most renowned architects of the 20th century. Johnson Wax asked him to design not only the buildings and grounds, but all furniture to be used by employees. Wright's building design incorporated open space, tapering columns and circular patterns to suggest a cathedral-like effect, and incorporated some of the architectural elements into the design of the office chairs. They were originally to have three legs, with two in front to encourage good posture. However, after Wright himself fell over in one, the design was altered to include four legs, perhaps underscoring the old furniture making axiom "form follows function."



1945 MOLDED PLYWOOD MEETS MASS PRODUCTION

Eames Chair

Grand Rapids, MI; designed by Charles and Ray Eames

The Eames Chair, one of the most famous chair designs of the 20th century, was the culmination of over a hundred years of development in using molded plywood for chair design, starting in Germany in 1830. Research during the war years advanced ways to use resin bonding and to form bent and laminated wood. Then, in 1945, husband and wife team Charles and Ray Eames developed a process to bend three-dimensional plywood, named LCW (Lounge Chair Wood). The separate seat and back were cushioned by rubber grommets. Until the Eames separated the main parts, bent plywood furniture tended to split.



1971 Cardboard takes a seat

High Stool

Los Angeles, CA; designed by Frank Gehry

Starting in the 1960s, alternative materials began to appear in chair design. Frank Gehry's minimalistic high stool from 1971 is made from corrugated cardboard, Masonite, and wood. Gehry moved on to a minimalistic "Superlight" chair with brushed aluminum surfaces attached to a simple aluminum frame designed to carry 750 pounds.

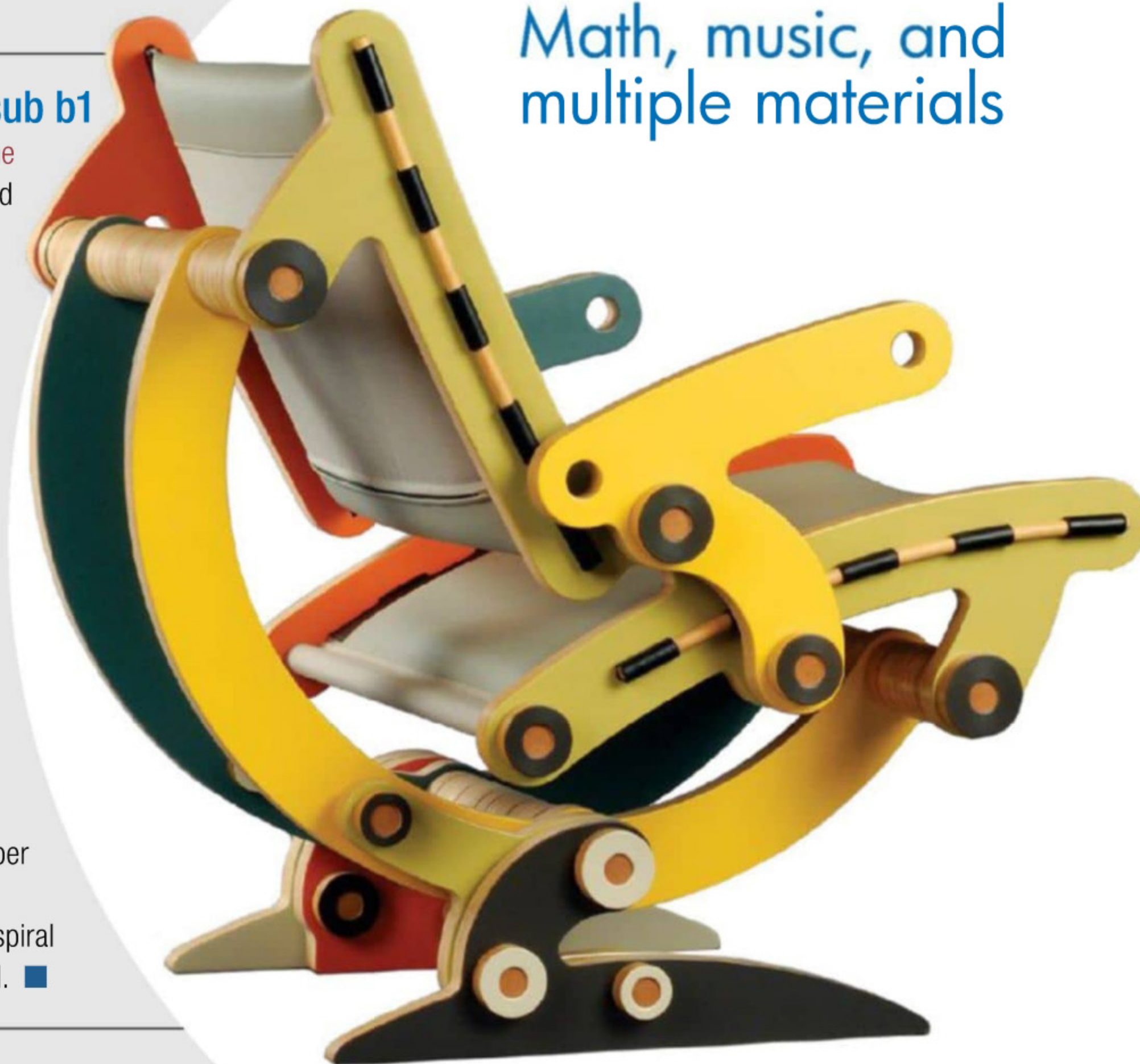
Gehry, an architect, got into chair making almost by accident after becoming inspired by qualities in the cardboard he was using to make land contours for architectural models. He eventually perfected 17 designs and filed a patent for making cross-laminated cardboard into furniture. Though his foray was successful, Gehry eventually gave up designing chairs to focus on his architectural work.

2003 Math, music, and multiple materials

Synergistic Synthesis XVII sub b1

Oakland, CA; designed by Kenneth Smythe

San Francisco-based designer, artist, and scientist Kenneth Smythe went Gehry one better in using exotic materials. His "Synergistic Synthesis XVII sub b1" chair is made from Finn birch laminate, Formica ColorCore®, latigo leather, Sunbrella® acrylic, top grain leather, foam rubber, steel, and maple dowels. Smythe's designs are not only materially extensive, but also often derived from complex evolutionary models of nature. Inspiration for this 2003 chair comes from the mathematician and philosopher Bertrand Russell, the music of Frederick Delius, and the Fibonacci sequence, in which each number is the sum of the two previous numbers. When graphed, the sequence produces spiral shapes, such as that of the nautilus shell. ■



Exhibition Information

The Art of Seating: 200 Years of American Design is organized by the Museum of Contemporary Art, Jacksonville, Florida in collaboration with the Thomas H. and Diane DeMell Jacobsen Ph.D. Foundation. Thanks to The Michener Art Museum in Doylestown, PA for help in putting together this article.

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Modern Plywood WORKBENCH

A simple & super-sturdy bench built from strips

By Andy Rae and the crew at Making Whole

A truly useful woodworking bench serves a lot of needs. It secures all kinds of workpieces for operations ranging from rough stock prep to detailed handwork. It offers a flat planing and assembly surface, and provides a suitable platform for a wide variety of hand and power tool operations.

As an instructor at Making Whole (see page 4), I share space with a bunch of fellow woodworkers, mostly novices, who've become enamoured by my European-style joiner's bench, despite the fact that we have plenty of other benches and work surfaces. To keep what's left of my sanity, it was time to build a similar bench with even better work-holding capabilities. We designed our new bench so that it could be built by budding woodworkers like my junior colleagues. Thus began a collaboration of many student hands to build a bench that would serve their further education.

The most obvious departure from tradition is the choice of building materials. Despite some initial reservations, I discovered that plywood offers several noteworthy advantages here over solid wood. For starters, the material cost for this bench is less than half the price of one made from maple or beech. You'll also save considerable building time. Because most of the components are made from $\frac{3}{4}$ "-thick strips, the intimidating joinery that would be involved in solid-wood construction (big tenons, deep mortises, and 28 dog holes) becomes a simple matter of cutting and stacking to create the joints. Aside from the expedited construction, the biggest benefits reveal themselves when you put this bench to work (see photos, top right).

This strip-built workbench has become the new workshop favorite. As a matter of fact, I'm thinking that I might build another to supplant my old bench in my corner of the shop.

Important: The 5"-thick components ensure a super-sturdy bench, but this thickness exceeds the depth capacity of most saws. Even with a 10"- or 12"- sliding compound miter saw, you'll need to cut in from both faces. If you use $7\frac{1}{4}$ " circular saw, you'll need to complete the cut with a handsaw.



Clever features that lend a hand



The **removable centerboard** enables workpieces to straddle one of the top's twin planks, while providing an additional toehold for clamps when necessary.



A **sliding board jack** works in tandem with the shoulder vise, supporting workpieces for a variety of edge work chores.



A pair of **quick-release, leather-padded end vises** sport wooden dogs for clamping work to the bench top.



With its pivoting jaw, the **shoulder vise** can easily clamp odd-shaped work. Not having a guide bar (like metal vises) makes this vise ideal for holding wide boards.

A strip-built bench

We used seven sheets of $\frac{3}{4}$ " $\times$ 4' $\times$ 8' Blondewood plywood, sold at home centers, but any $\frac{3}{4}$ " hardwood plywood will work. Bear in mind that nominal $\frac{3}{4}$ " plywood isn't exactly $\frac{3}{4}$ " thick, so your assembled parts may not precisely match the final overall dimensions shown. The actual plywood thickness doesn't matter, but take care to obtain all your sheets from the same batch. If the thickness varies from one sheet to the next, the parts might not fit.

The strips are easy to handle, but the subassemblies can get quite heavy. Make arrangements to have a few extra hands on deck when thickening and sizing the components and during assembly. Note also that the adhesive used in plywood dulls bits and blades more quickly than solid wood. Plan on replacing your planer knives (and having your saw blade resharpened) before starting your next project.

Order of Work

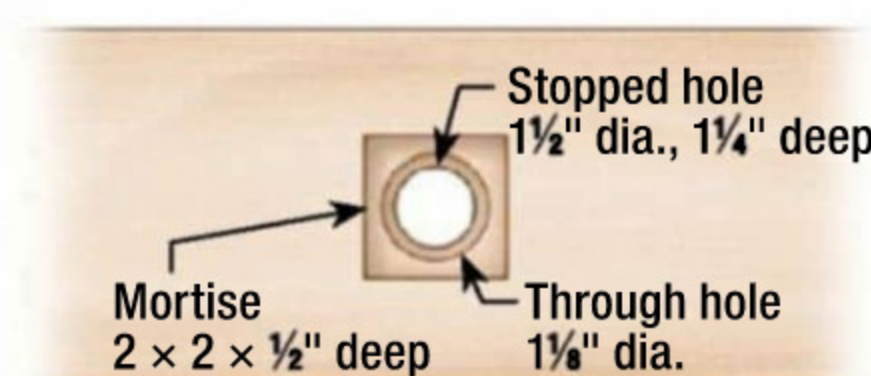
- Rip six sheets of plywood into strips and make dog blocks.
- Build gluing platform.
- Cut strips to make front and rear planks, center blocks, shoulder block, and arm block, and assemble each component.
- Thickness-plane components to 5", finish, and cut to final length.
- Assemble top.
- Cut strips to make legs and rails, and assemble each component.
- Thickness-plane components to 5", cut to length, and assemble base.
- Add vises and end caps.
- Make and install shelf, and set top on base.
- Rout rabbet in top, and make centerboard.
- Make and install board jack.

Notes:

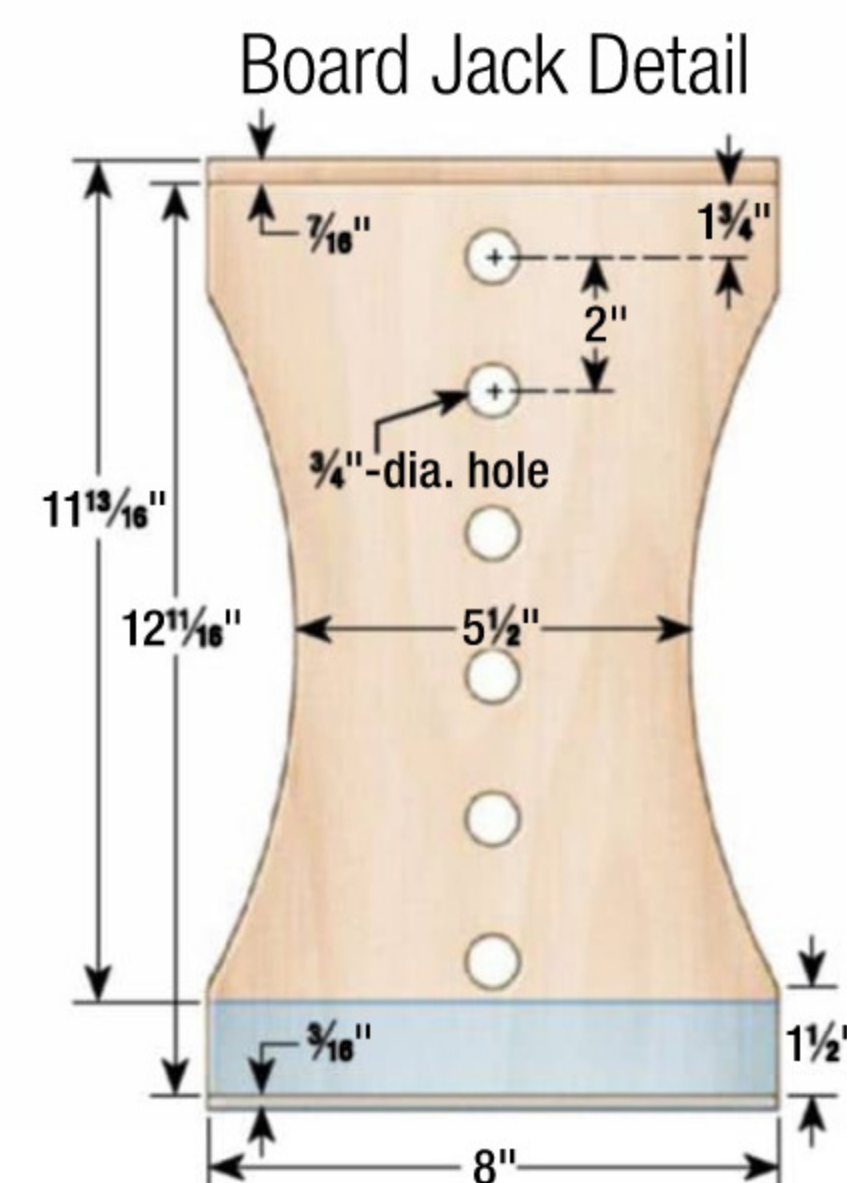
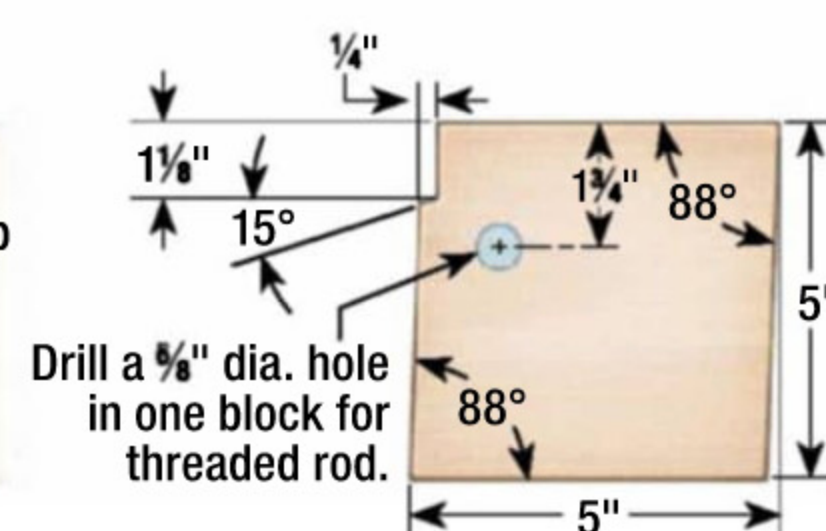
- Assembled Components indicated in **ORANGE**.
- For strip dimensions, refer to the Strip Cutting Guide, available at woodcraftmagazine.com.

Vise Screw Housing Detail

Drill holes 6" in from end of vise arm.



Dog Block Detail

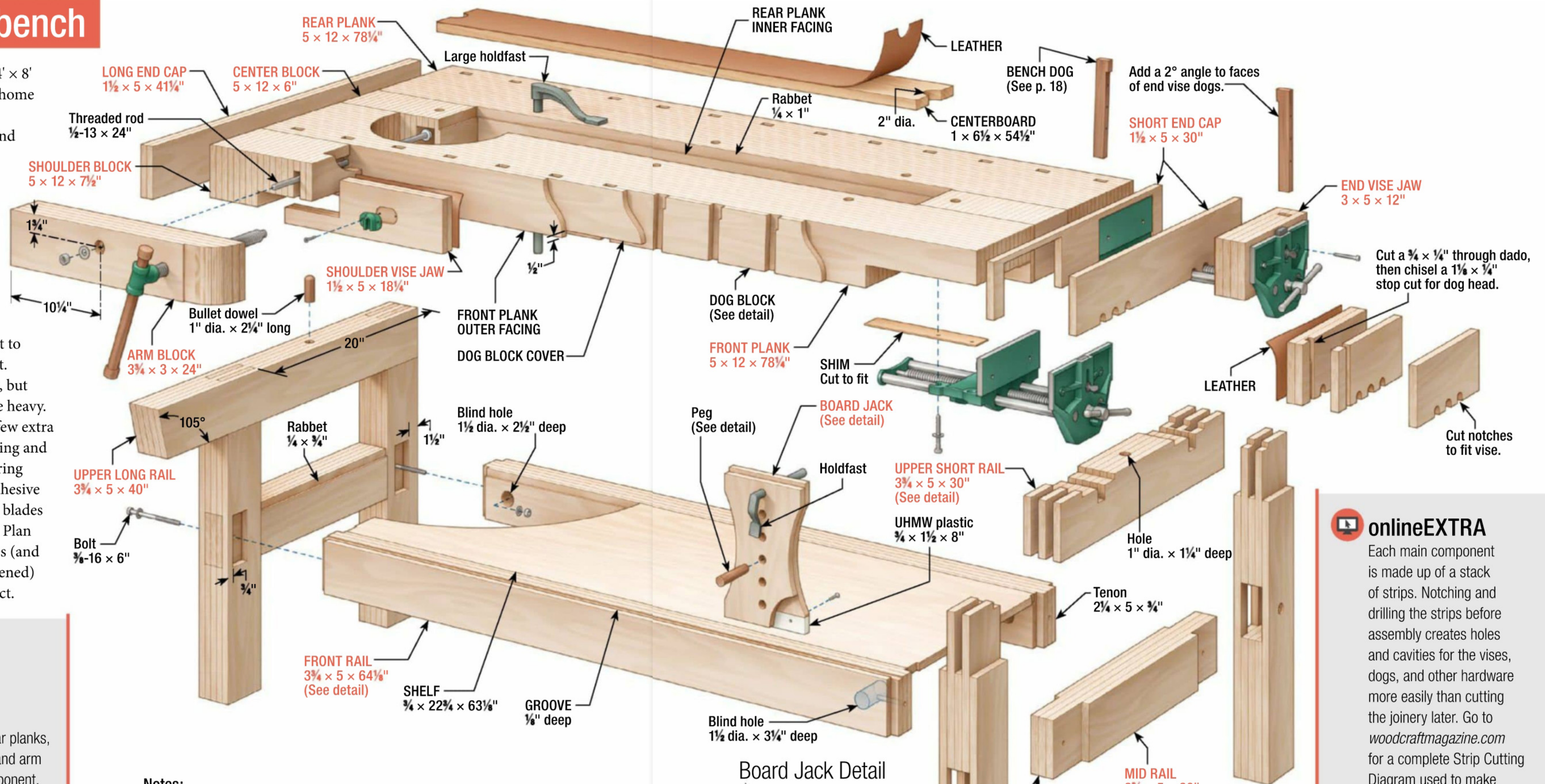
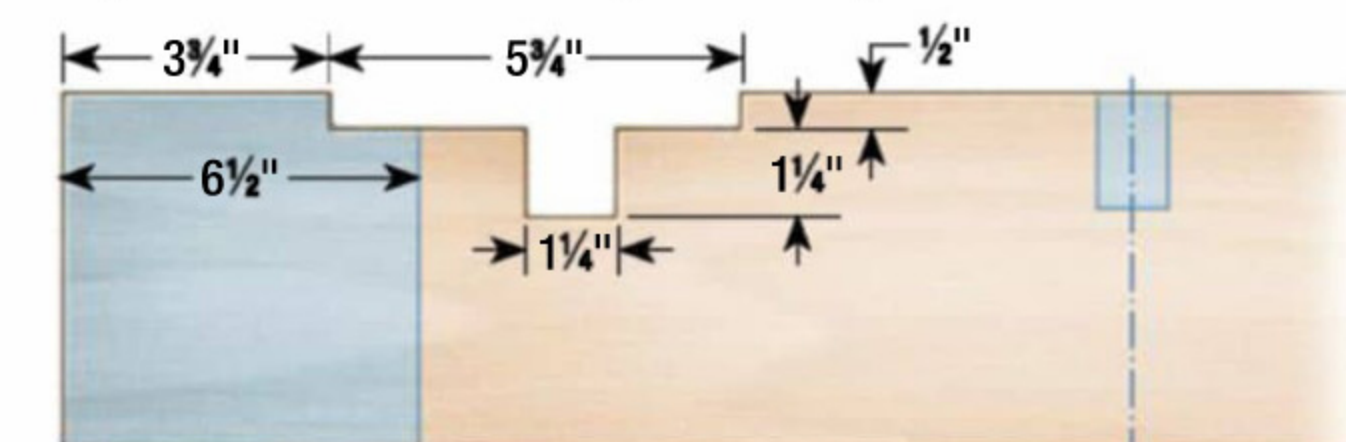


Peg Detail



Upper Short Rail Detail (Front Plank End)

Notch for Rear Plank End Vise starts 5 1/2" in from end of rail. Lay out vise notches after dry-assembling the side.



onlineEXTRA

Each main component is made up of a stack of strips. Notching and drilling the strips before assembly creates holes and cavities for the vises, dogs, and other hardware more easily than cutting the joinery later. Go to woodcraftmagazine.com for a complete Strip Cutting Diagram used to make the top, base, and vises.

Prep the parts

The workbench starts as a stack of strips. Have a shopmate help you rip six sheets of plywood into $5\frac{1}{8}$ "-wide strips. From one of the strips, cut the dog blocks to length, and then saw the dog head notches on the table saw as shown. Referring to the drawing on p. 36 and the Strip Cutting Diagram (see onlineExtras), cut the strips needed to make the twin planks, center blocks, shoulder block, and arm block.

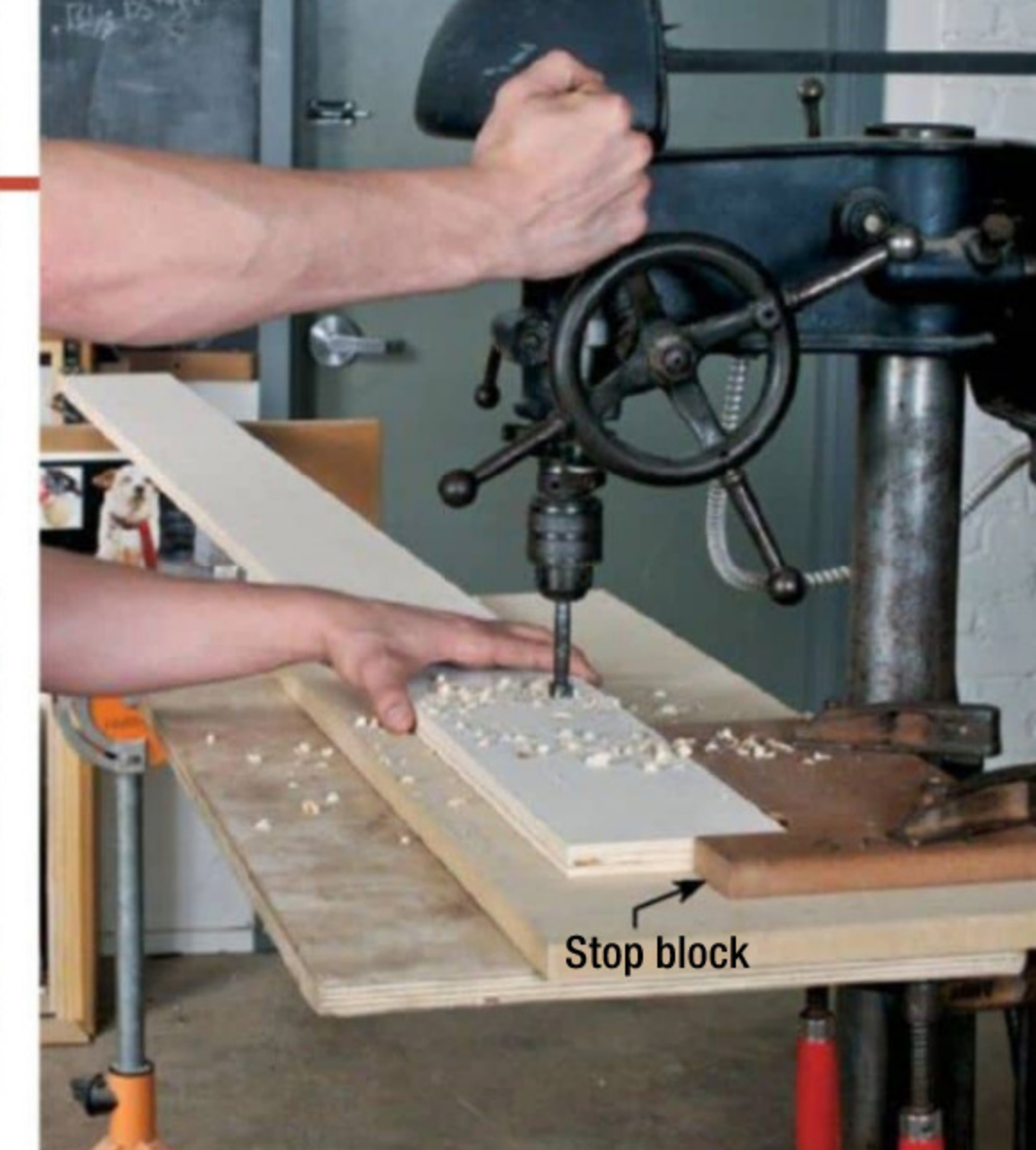
Although glue is strong enough to join most of the main components, the shoulder vise requires additional reinforcement. To prepare the front plank components for the $\frac{1}{2}$ "-dia. threaded rod, drill the holes in its 13 inner strips, two facings, and dog block cover strip, as shown. (Drill the holes in the arm block after assembly.)



Strips from the sheet. You'll get nine strips from a single 4×8 ' sheet of plywood. To ensure clean-edged strips, trim away the factory edge before ripping the strips to width.



Make 26 dog blocks. Set the blade to 15° , stand the dog block with its inner edge against the fence and cut the angle for the notch. Then, flip and rotate the block 90° and make the long notch cut by first removing a saw kerf of material (inset, top) and then butting the block against the fence to complete the cut (inset, bottom).



Ready the top strips for the rod. An L-shaped stop block ensures that the access holes in the strips used to make the front plank line up for the threaded rod. Lay out and drill a hole in one dog block using the same drill bit.

Assemble the top

Gluing the strips together isn't difficult if you have an assembly jig like the one we made for this project. You can assemble each section in stages, and use brads or pins to keep smaller parts in alignment until you apply clamping pressure. To ensure that the clamps exert even pressure, use removable plywood spacers to fill in any cavities, masking or waxing them to resist glue.

Assemble the two planks, shoulder block, and center blocks. For safe machining, make the center blocks from a single, longer glue-up. After planing this workpiece to final thickness, crosscut the assembly in two.

Once the individual top components have been glued together, plane them to 5" thick. If you plan to seal the top with epoxy (see Sidebar, p. 41), do that next, before cutting the components to length.

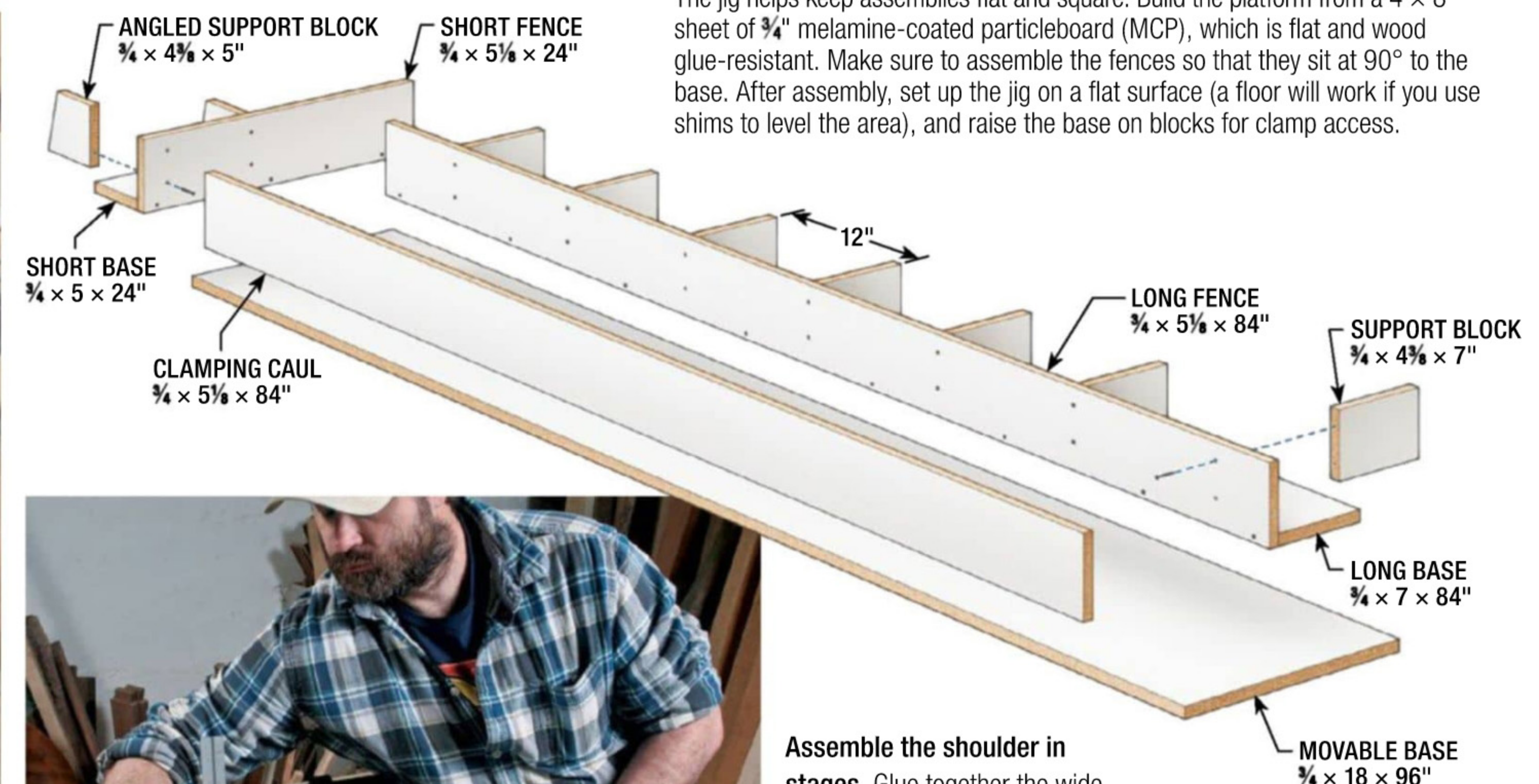
After cutting the parts to final length, glue the planks to the center blocks. Work on a flat surface to keep the sections aligned as you apply the clamps.



Glue up the planks in stages. Stack a half-plank's worth of strips upside down in the assembly jig, with glue-resistant plywood spacers filling any cavities. After rehearsing your assembly procedures, apply adhesive with a thin-nap paint roller to the strips, and clamp them to the jig. Wipe or scrape off the wet excess glue immediately.

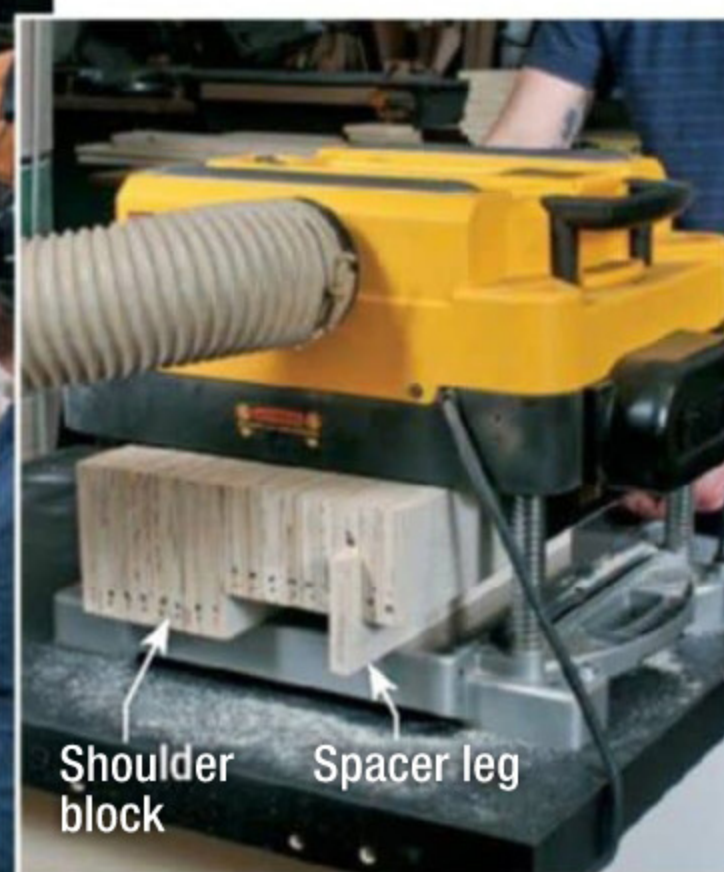
Assembly Jig

The jig helps keep assemblies flat and square. Build the platform from a 4×8 ' sheet of $\frac{3}{4}$ " melamine-coated particleboard (MCP), which is flat and wood glue-resistant. Make sure to assemble the fences so that they sit at 90° to the base. After assembly, set up the jig on a flat surface (a floor will work if you use shims to level the area), and raise the base on blocks for clamp access.



Assemble the shoulder in stages. Glue together the wide and narrow strips (shown) separately, and then join the two halves. Set a waxed plywood spacer in the rod slot to equalize clamping pressure.

Plane the planks, then glue up the top

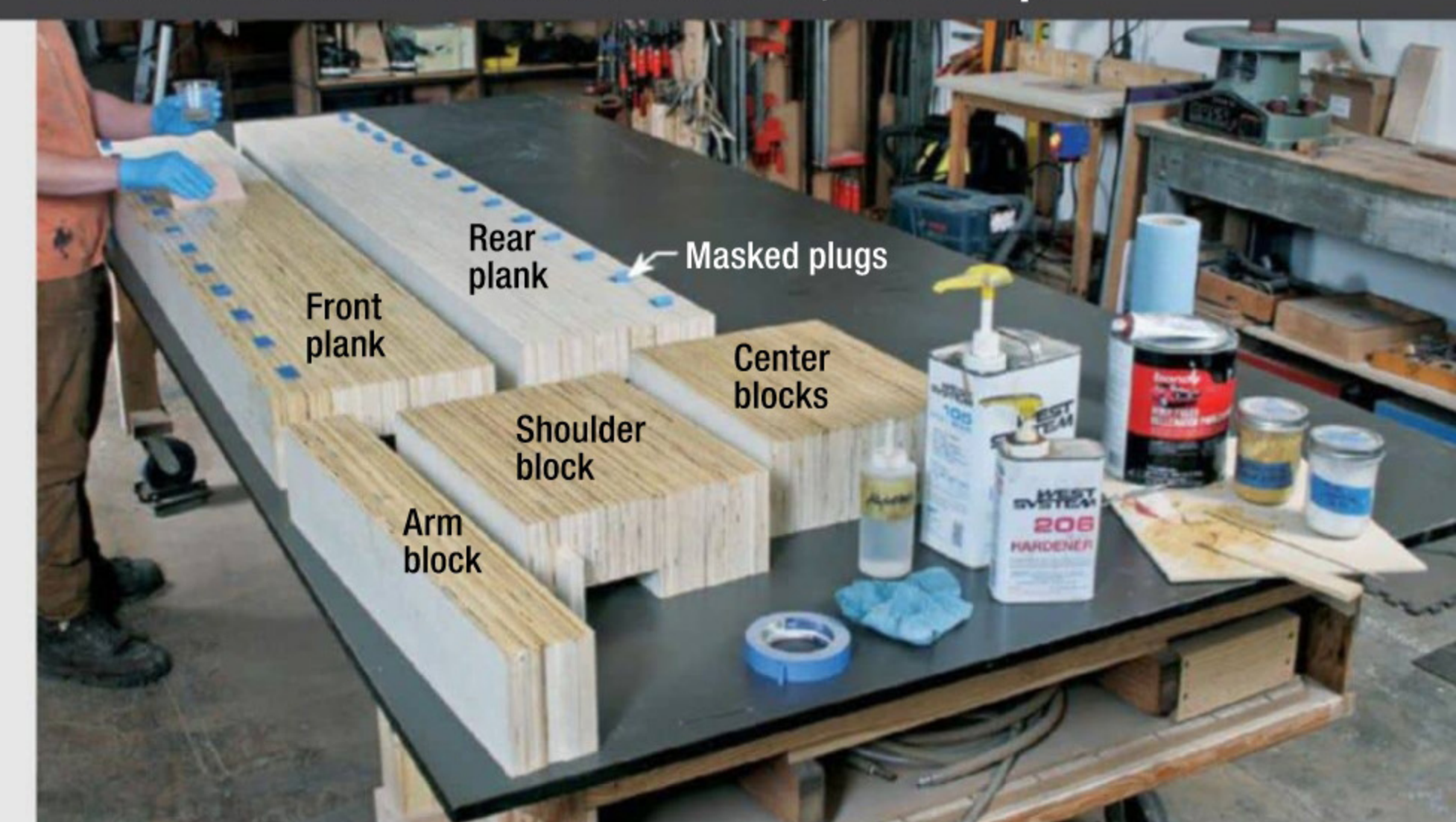


Down to size. When planing the bench top sections, take light, equal cuts from each face in turn to ultimately create 5"-thick sections. Install a spacer 'leg' in the shoulder block slot to stabilize the work for the cut.



Joining the planks. To create the main body of the bench top, glue the fully assembled planks to the center blocks, which you have cleanly cut to length.

A little extra work for a smooth, hard top



Most types of plywood have small voids between the veneer layers. For a solid, seamless work surface, treat the benchtop to polyester body filler (like Bondo) followed by a coat of epoxy. Begin by adding dyes (see page 69) to the filler to match the tone of the plywood, and note your recipe proportions. Then, working with small batches, apply the filler with a wide putty knife. Once the filler sets, plane the parts at the same machine setting as before. Then use a card squeegee to apply a thin coat of epoxy, let it cure overnight, and plane, again at the same setting.

Make the base

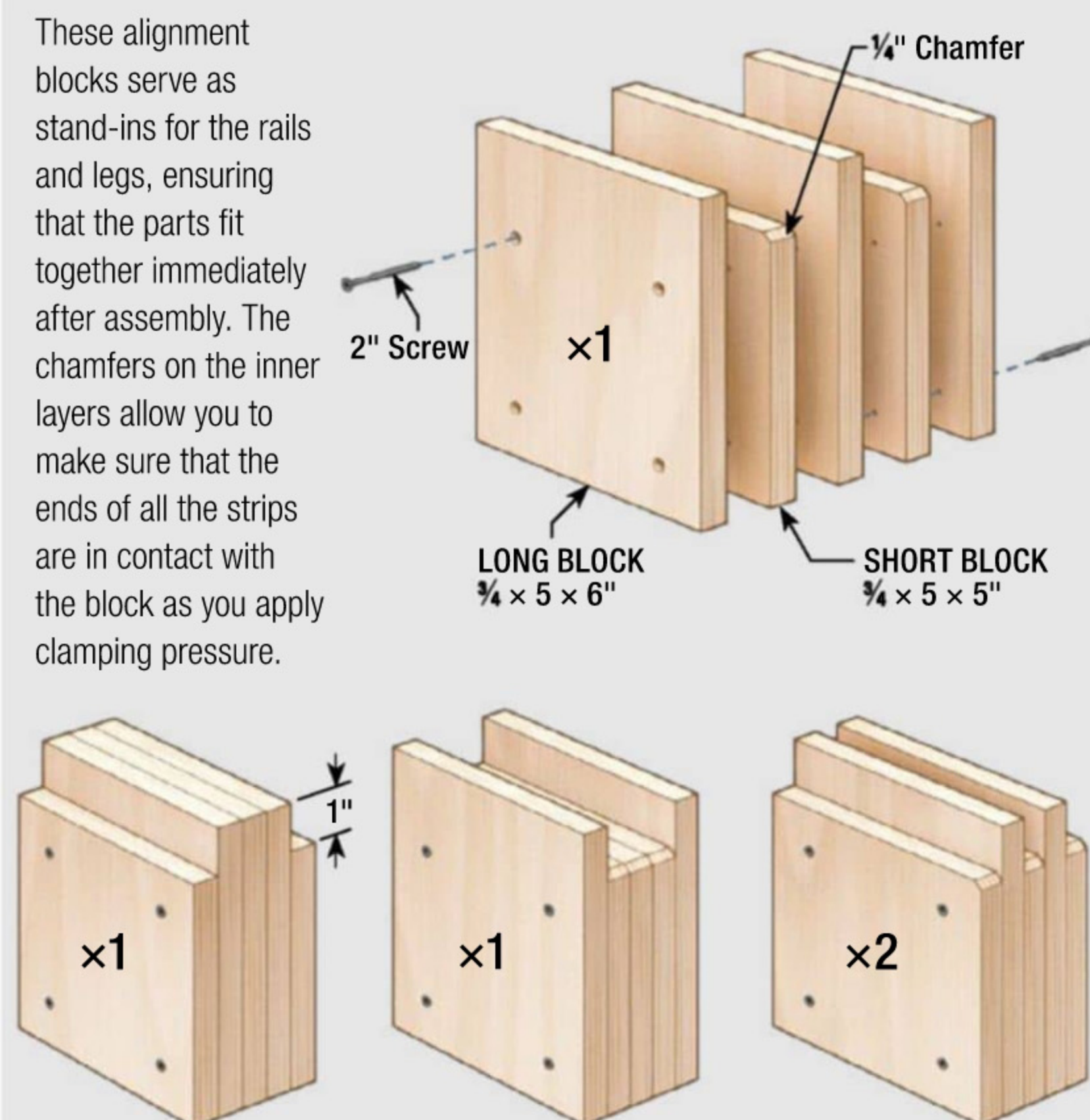
Assembling the legs and rails for the base takes the same "cut, stack, and glue" approach used for the top, but you'll need a way to establish the mortises and tenons. To accomplish this, we made a set of five alignment blocks, as shown at right.

To make the base components, first cut the parts to the sizes shown in the Strip Cutting Diagram, adding a few inches in length. Then arrange the strips on the gluing platform, inserting the appropriate spacer(s). Apply light clamping pressure, tap the ends of the parts to snug them against the blocks, and then tighten the clamps. Remove the blocks and allow the glue to dry.

Once you've assembled the legs and rails, plane and cut to length as before. Then drill the holes in the legs and the blind holes in the front and back rails for the bolts. Next, dry-assemble the mid and upper rails into the legs, and then lay out and cut the notches for the end vises in the upper short rail as shown on page 37. (Note that the notches extend into the legs.) Now, glue up the side assemblies as shown. Finally, insert the front and back rails, and drill the $\frac{7}{8}$ " holes for the bolts.

Base Alignment Blocks

These alignment blocks serve as stand-ins for the rails and legs, ensuring that the parts fit together immediately after assembly. The chamfers on the inner layers allow you to make sure that the ends of all the strips are in contact with the block as you apply clamping pressure.



Block-made mortises. Assemble the legs and rails using alignment blocks at each mortise location before tightening the clamps. Remove the blocks once the clamps are on.



End game. Glue up the end assemblies, using a hefty block to pound the joints home and clamping over the open bridge joints with cauls to spread pressure evenly. Check for square before setting the assembly aside to dry.



Blind bolt-and-nut joint. Dry-fit the long rails into the end assemblies and drill the counterbores. Then drill the clearance holes partway, remove the end assemblies, and continue drilling until the bit reaches the blind hole.

Vises and finishing touches

A bona-fide bench is starting to emerge. Dry-fit the shoulder vise parts and check that the threaded rod has access through to the center block. Next, drill and rout the arm block to accept the vise screw and housing plate, and then glue and clamp the shoulder and arm blocks to the bench. Once the glue has set, add the threaded rod and cinch it tight with nuts and washers.

Next, attach the end vises to the top, and then glue on the short and long end caps. Make the end vise jaws, cutting the two-step groove in each jaw part with a router and straight bit on the router table, or with a stacked dado blade on the table saw. Chisel the angled stops for the dogs at the base of the stepped groove before gluing the parts together.

Now, rout the rabbeted ledge in the center of the bench top, and then make the centerboard to fit. Next, drill holdfast holes in the top, using a shop-made drilling guide.

The heavy top registers onto the base via a pair of short “bullet” dowels. To ensure matching holes, create a drilling guide from a plywood strip. Use the jig to drill mating holes in the upper rails and top, then insert the dowels and set the top on the base. Now make a board jack as shown on p. 37. After turning a board jack peg and vise handle from rosewood or other dense wood and attaching a power strip, the bench is ready to work.



Install the vise screw housing. After drilling a stopped hole for the shoulder vise screw housing and a through hole for the screw, rout a mortise and then square the corners with a chisel.



Keep it flat. Glue and clamp the shoulder and arm blocks to the bench, checking that both components are level with the bench top.



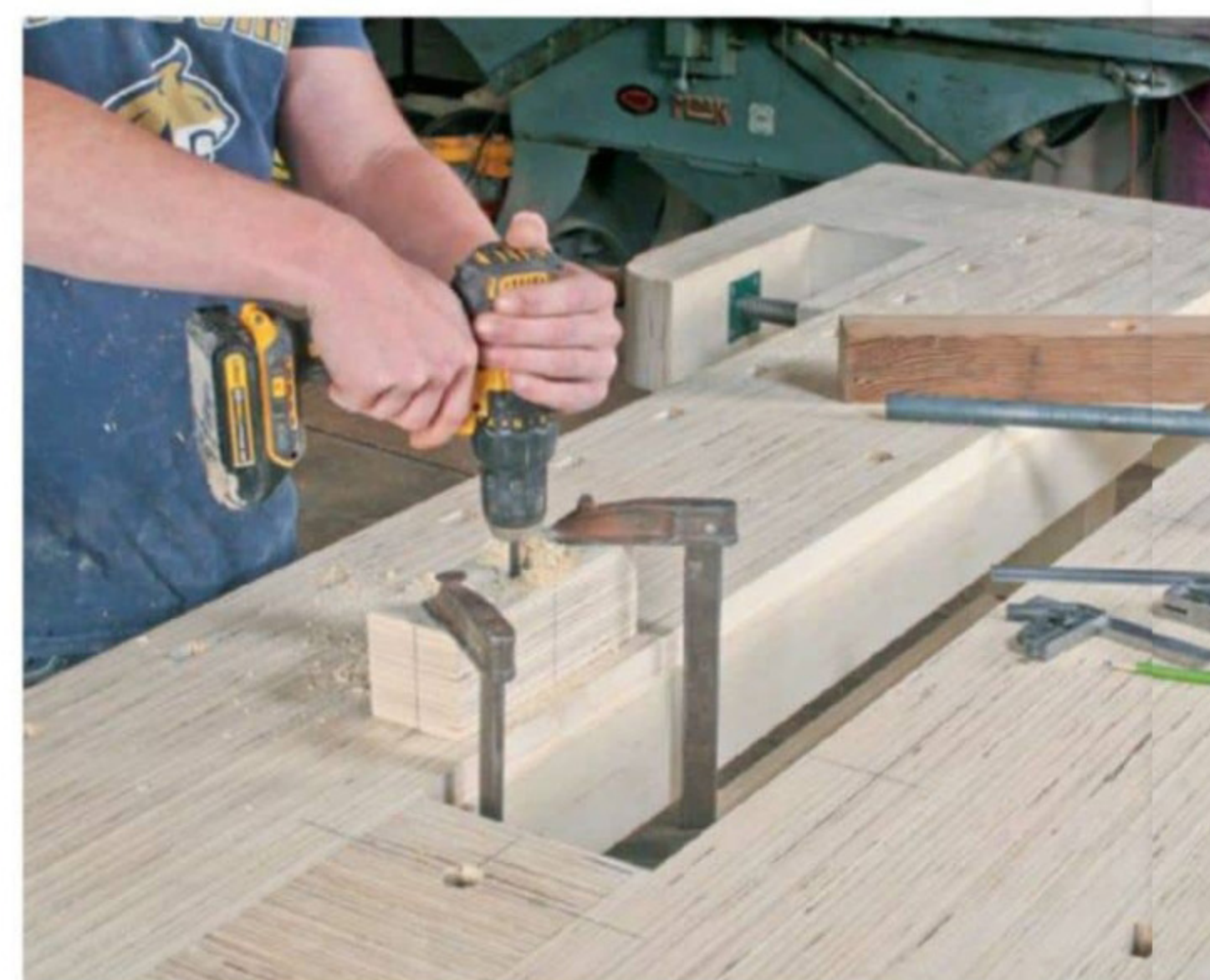
Set the vise height. Install a couple shims under each inverted end vise to locate the fixed jaw about $\frac{9}{16}$ " from the top surface of the bench. Then secure each vise with four lag screws.



Clamp on the cap. Glue the short end cap over the vises' fixed jaws, using a single clamp and the vises themselves fitted with scrap plywood to clamp the cap tight to the end of the bench.



Cut a center ledge. Rout a $\frac{1}{4} \times 1$ "-deep rabbet around the perimeter of the interior for the centerboard using a bearing guided rabbeting bit, taking two or three successively deeper passes. An oversized baseplate steadies the cut.



Guide your holdfast holes. Drill a $\frac{15}{16}$ " hole in a scrap block on the drill press, and then use the block and the same bit to drill perpendicular holes part way through the bench top for a large holdfast. Remove the block and finish drilling through the top by hand, clamping a board to the bench's underside to prevent blowout.



Aiming for a bullet. Make a drilling guide by boring a 1"-dia. hole in a board with a Forstner bit on the drill press. Clamp the guide flush with the front of the end assembly and use the guide and the same bit to drill a $1\frac{1}{4}$ "-deep hole for the bullet dowel. Use the guide again to drill the hole in the other end assembly, and two matching holes in the top's underside. Insert the dowels in the base, and then then lower the top in place. ■



Inset PULLS

Four shop-made handles that lay low

By Andy Rae

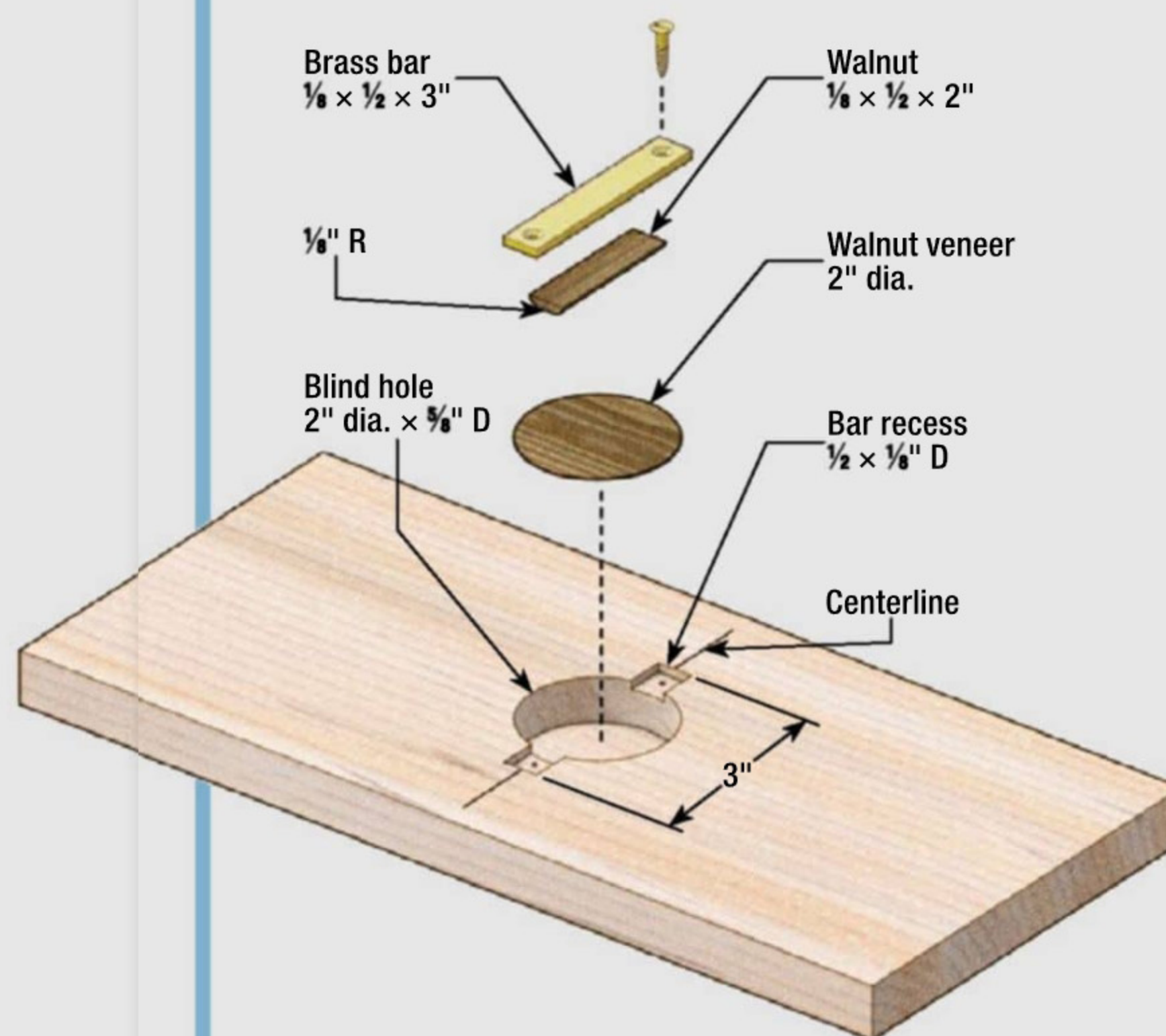


What do you do when a typical cabinet handle or knob doesn't suit an application because, for example, its projection prevents an adjacent door or drawer from opening fully? Another challenge arises when trying to suit pulls to a pocket door or perhaps shoji-style panels that slide past one another. In that case, projecting hardware impedes door travel. But you still need some way to grab the door to pull it sideways. And there are times when you just want a simple unobtrusive look and feel to your hardware. An inset, or flush, pull can solve all these problems.

In this article, I'll share with you four cleverly made inset pulls: two by a couple of fellow furniture makers, and two of my own design. You'll find that they're not hard to make using some smart shop-made jigs to ensure repeatable accuracy. Best yet, they will let you adorn doors and drawers with handmade pulls that whisper "cool."

Bisected pull

Architect and designer Ric Hanisch's brass-and-wood pull offers a pleasing grasp for doors or drawers, and works well along the edge of a sliding or pocket door as long as the surface area is 2½" or wider. Because the Forstner bit used to drill the blind hole leaves a divot, a circle of walnut veneer is glued to the hole bottom, which hides the divot and creates a nice visual contrast. Epoxying a strip of wood to the backside of the brass bar also dresses things up both visually and tactilely.



Brass divide. This bisected pull works equally well on drawer fronts and doors with wide stiles.



Stopped flat. With the work clamped to the drill press table and a 2"-dia. Forstner-style bit located above the center line, bore the 5/8"-deep blind hole.



Line the bottom. Lay out a circle on 1/32"-thick veneer, and cut it out with scissors, removing triangular sections at a time to avoid splintering. Then glue and clamp or weight, using a caul.



Screw, then trace. Center the brass bar over the hole, screw it to the surface, and trace its outline with a knife. Then chisel out the recess so the bar sits flush.



A nice touch. Scuff-sand the back of the brass bar, spread 5-minute epoxy onto it, and clamp a 1/8 x 1/2 x 2" strip of wood to its rear surface.

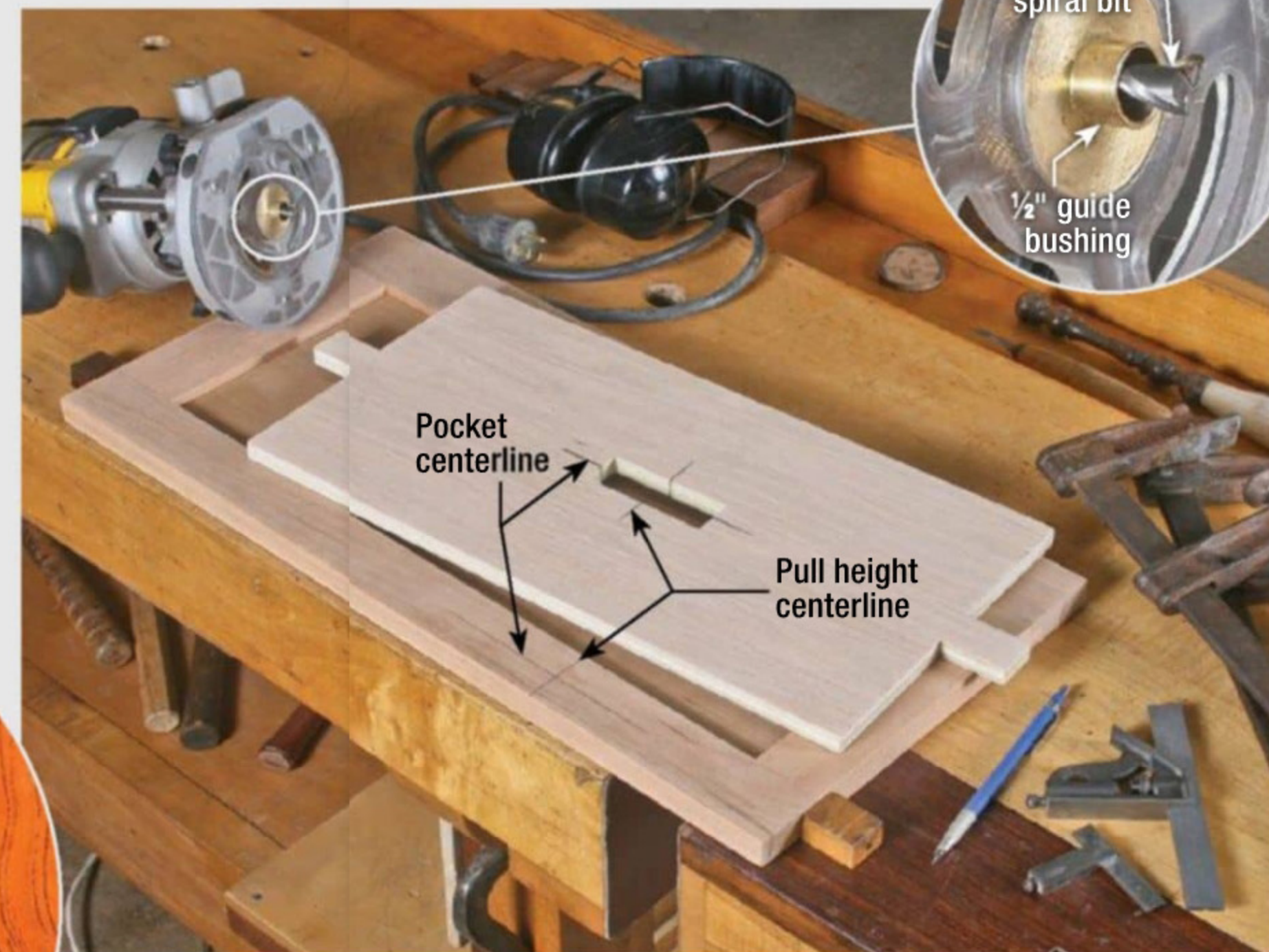
Narrow pull

Paul Anthony's three-door liquor cabinet presented a challenge in that a projecting pull on a side door would prevent the center door from fully folding back against the front of the case. His solution was this sleek, slim, recessed pull that can be used on narrow frames as well as drawer fronts.

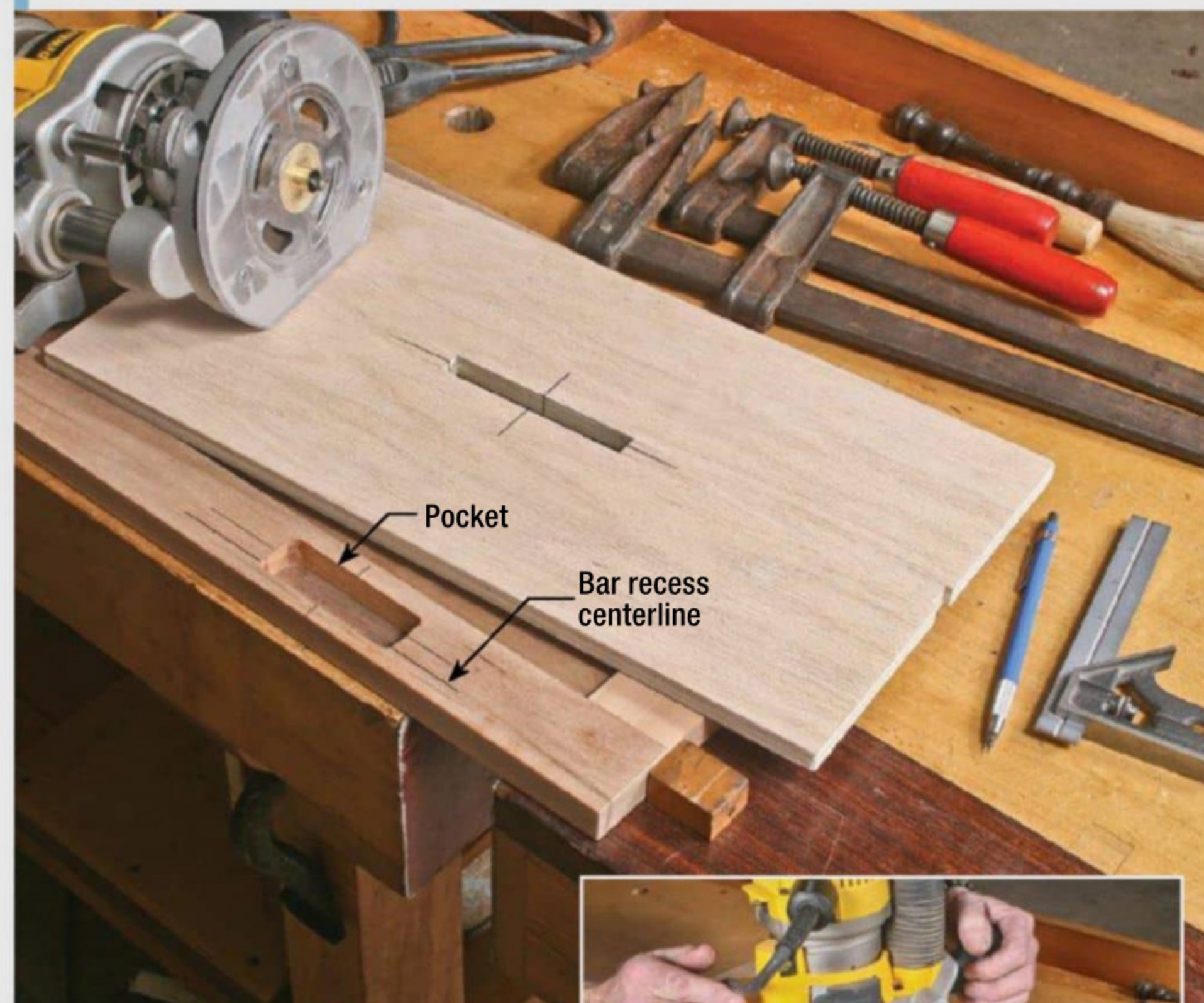
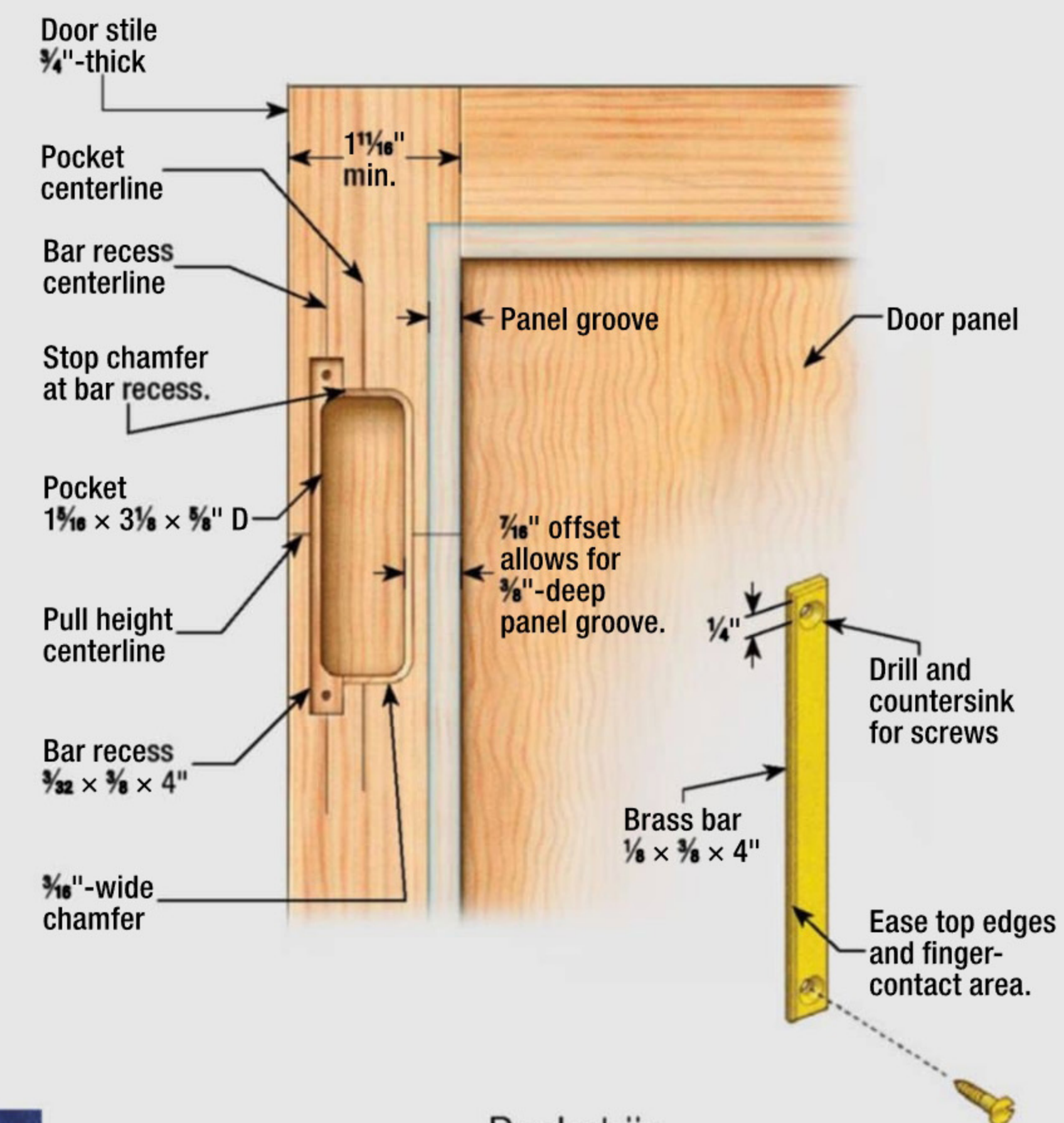
A shallow pocket cut in the face of the stile leaves space for fingers, while a $\frac{1}{8}$ "-thick brass bar (see Buyer's Guide, p. 69) inset atop the pocket provides grip for pulling the door outward. Construction is straightforward, but careful layout of the centerlines is key. Two shop-made jigs guide a plunge router outfitted with a guide bushing and a straight bit to cut the pocket and bar recess.



Slim design. This pull fits narrow frames while offering a brass touch of class.



Pocket-cutting setup. With centerlines laid out on both the template and door stile, set your router bit depth to $\frac{5}{16}$ " plus the jig thickness. Then clamp the jig atop the door with the centerlines aligned, and rout the pocket.



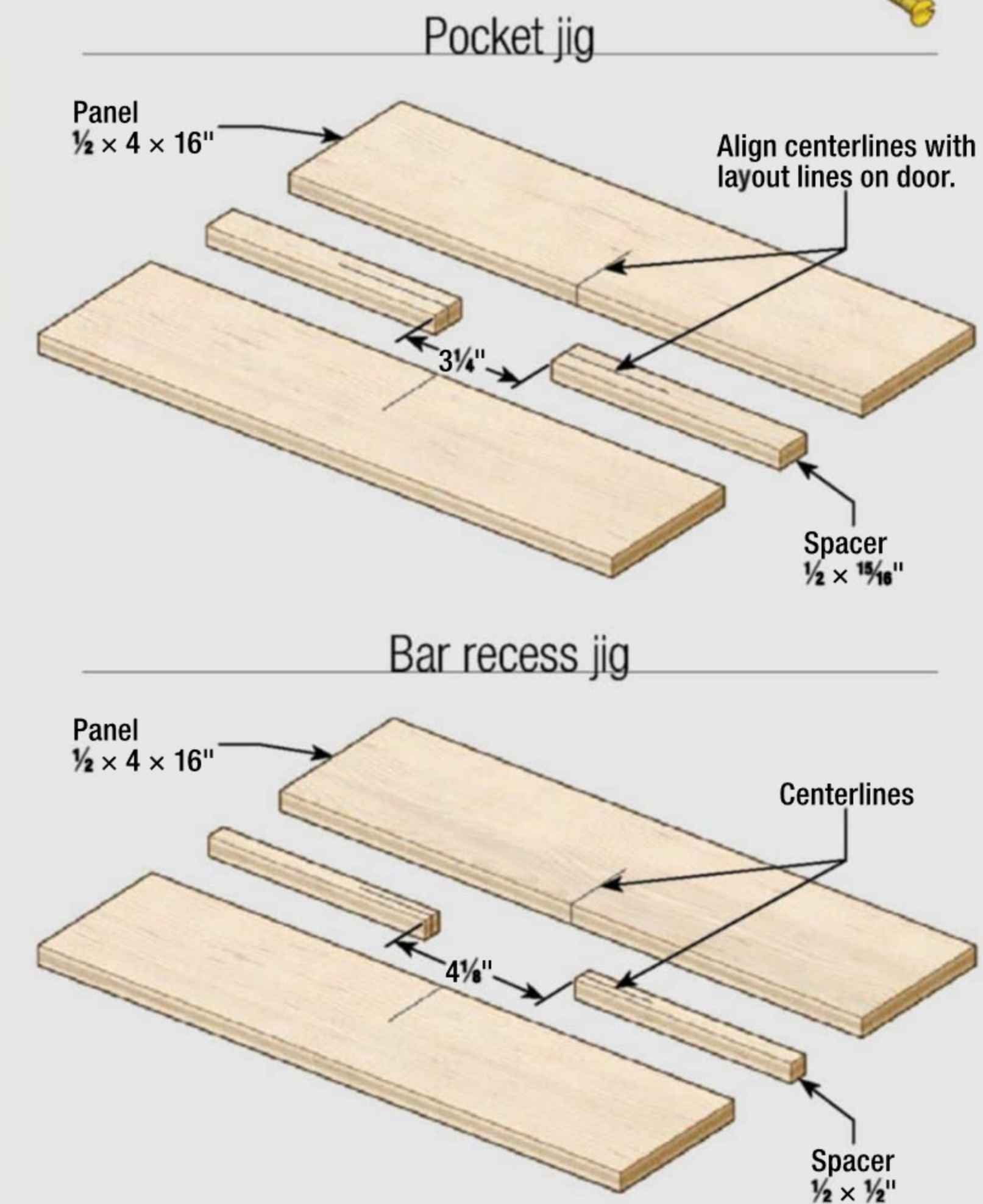
Rout the bar recess. Align the bar recess jig with the layout lines on the stile, reset the bit, and rout the $\frac{3}{32}$ "-deep recess for the brass bar. Chisel the ends square afterward.



Stop that chamfer. Set a bearing-guided chamfer bit for a $\frac{3}{16}$ "-wide cut, and then rout a bevel around the three walls of the pocket, being careful to stop at each edge of the bar recess to avoid beveling this area.



Slightly proud. Lightly ease the upper edges of the brass bar using 400- and then 600-grit carborundum paper before screwing the bar into its recess. It should project about $\frac{1}{32}$ " above the surface of the door.

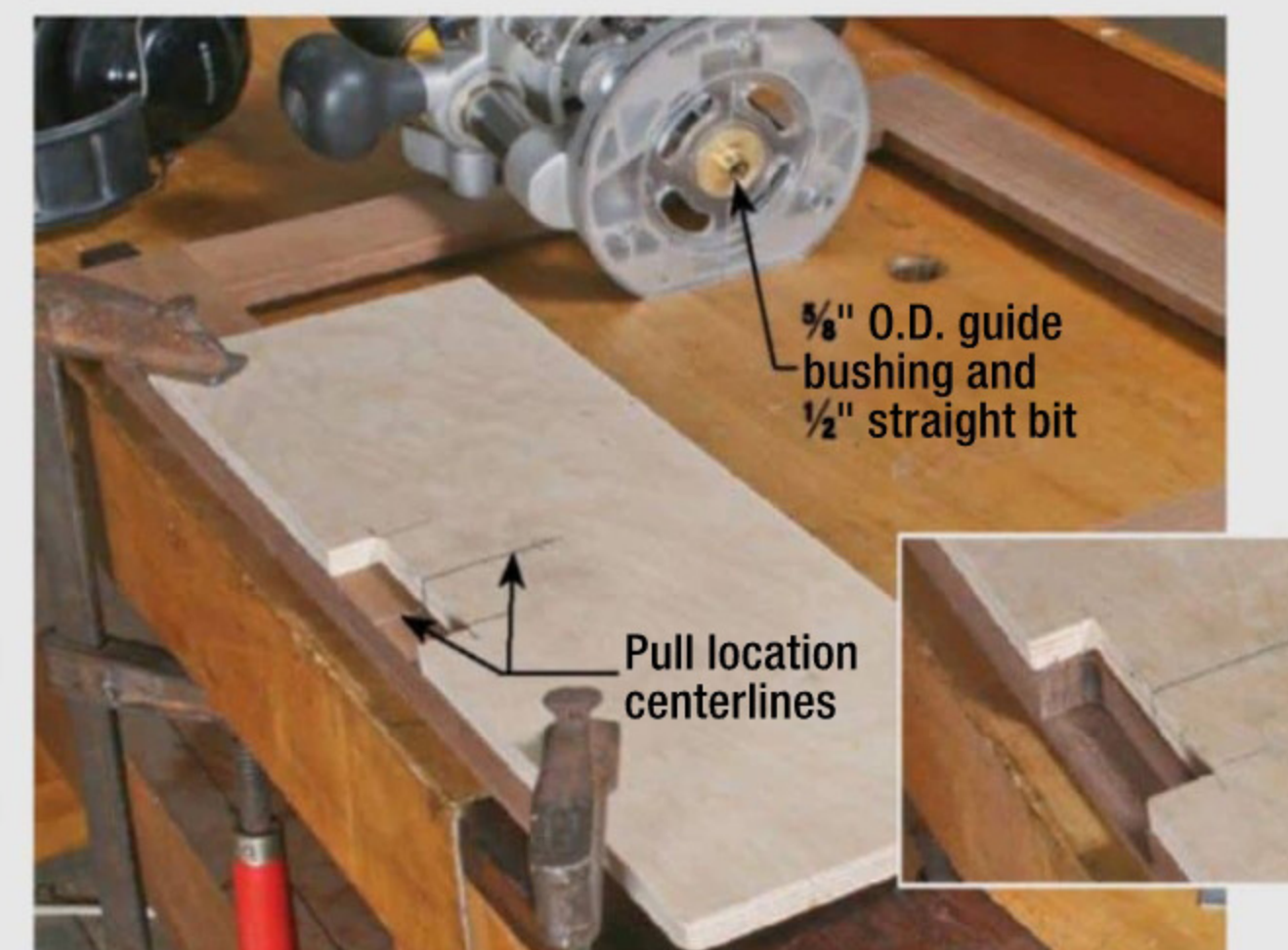
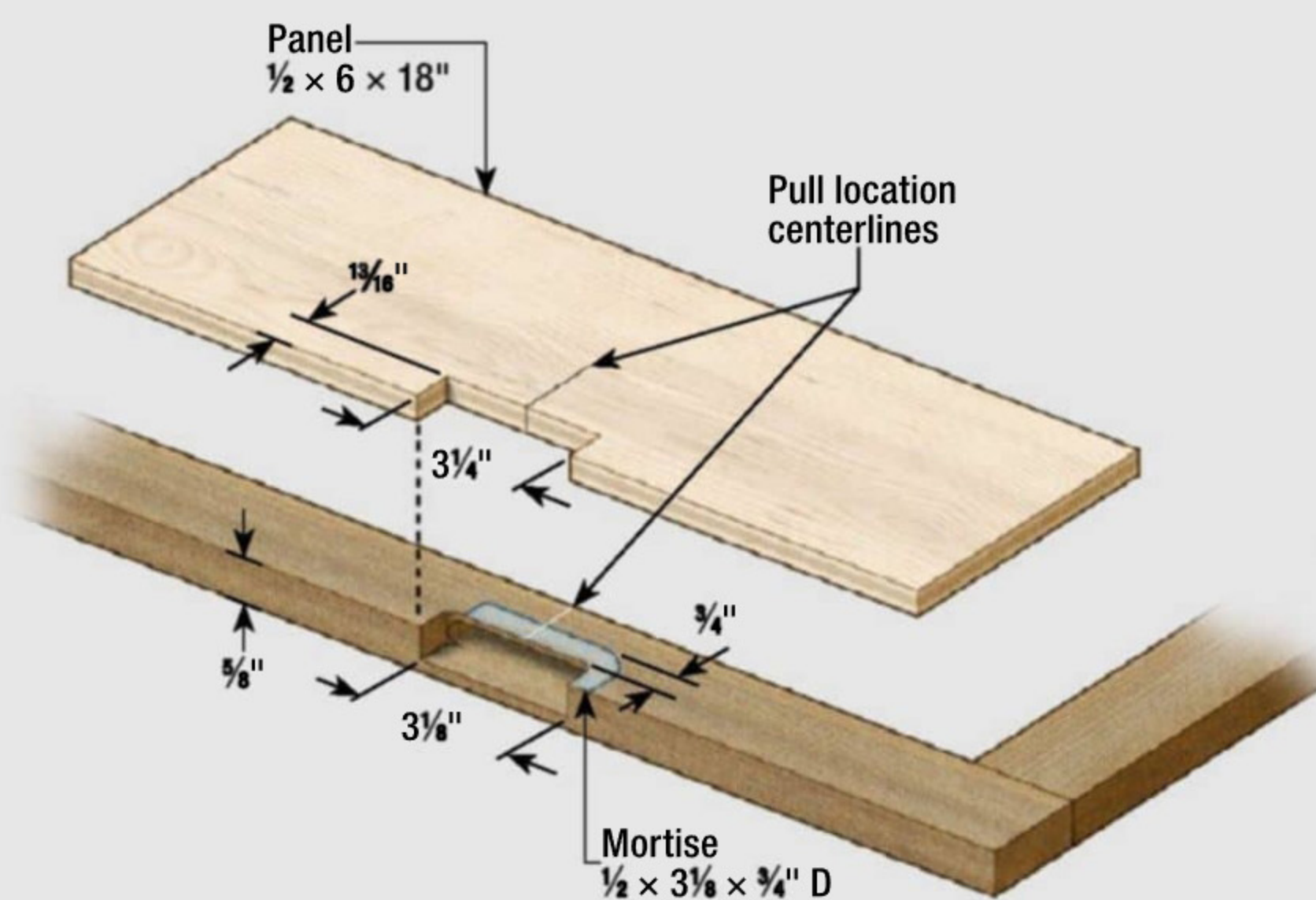


Notched pull

My own version of an inset pull works well whenever you want to locate a pull on the edge of a door or drawer. When made in pairs to suit the juncture of two doors or drawers, the effect can be strikingly reminiscent of mid-century modern design. The pull is essentially an L-shaped recess that includes a mortised cavity that allows fingertip access for pulling the door outward.



On the edge. This notched pull offers easy finger access from the edge of the door. Paired pulls display a rectangular design motif (above).



Notch first. To set up for the cut, outfit a plunge router as shown, and clamp the jig to the workpiece with the centerlines aligned. Then rout the 5/8"-deep notch (inset).

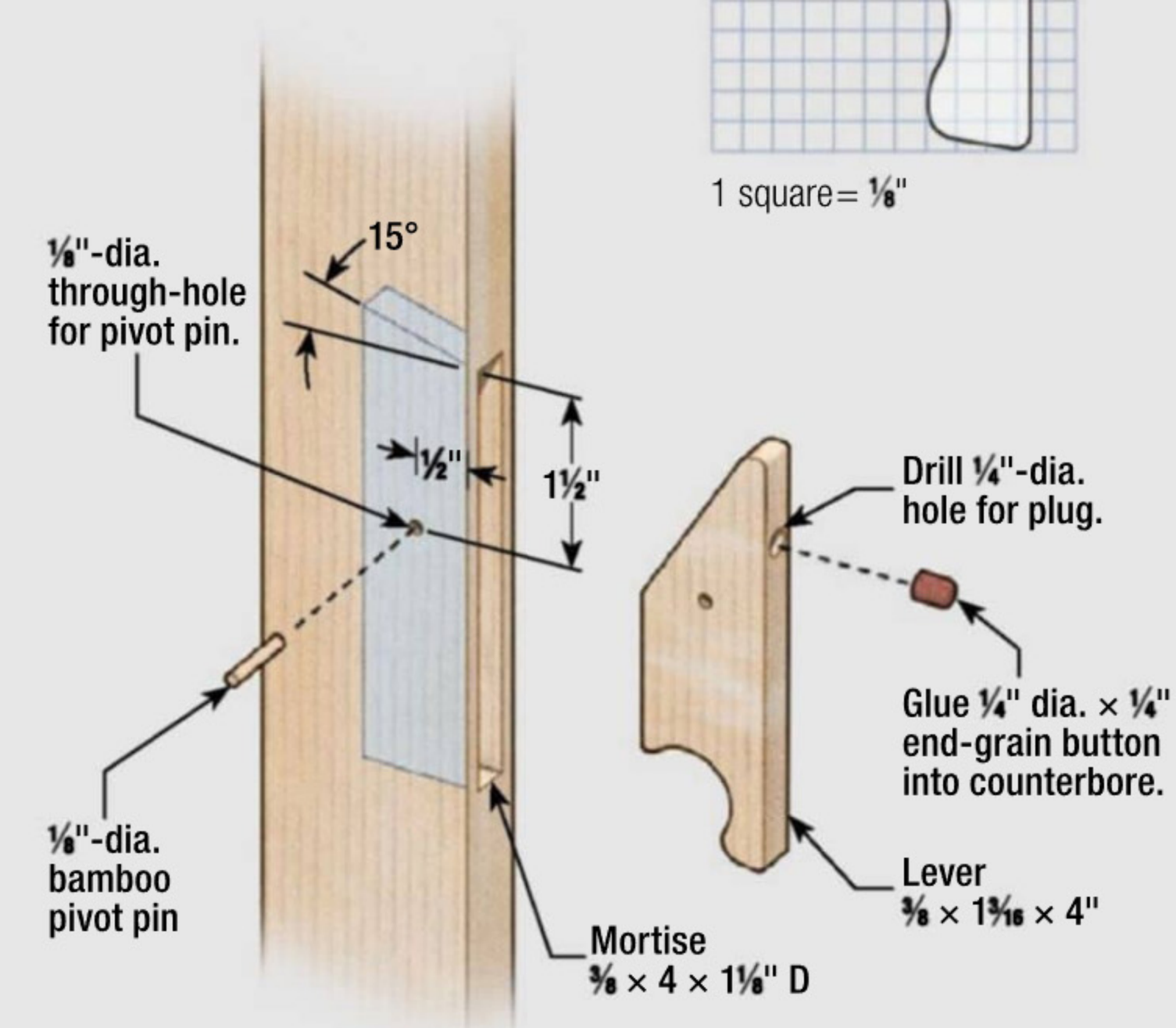
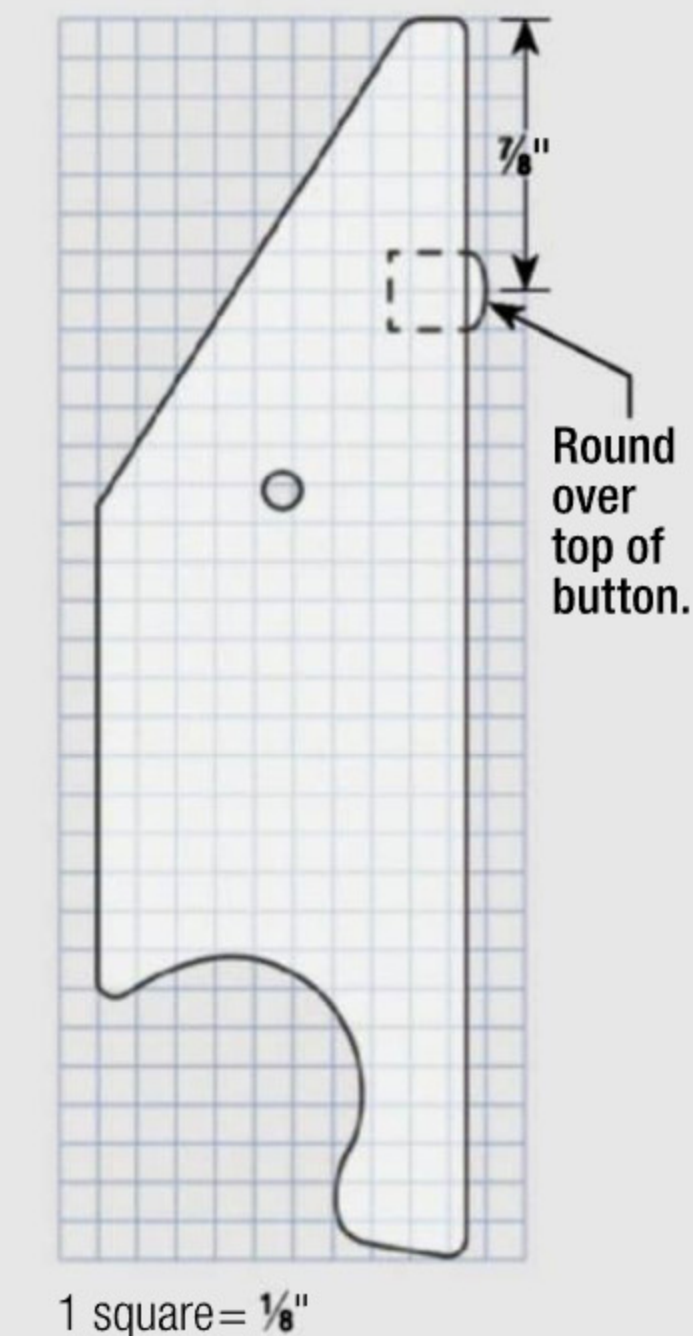


Mortise second. Adjust a router edge guide to locate the bit perimeter flush to the bottom of the notch, and then rout the 3/4"-deep mortise in 1/4" increments.

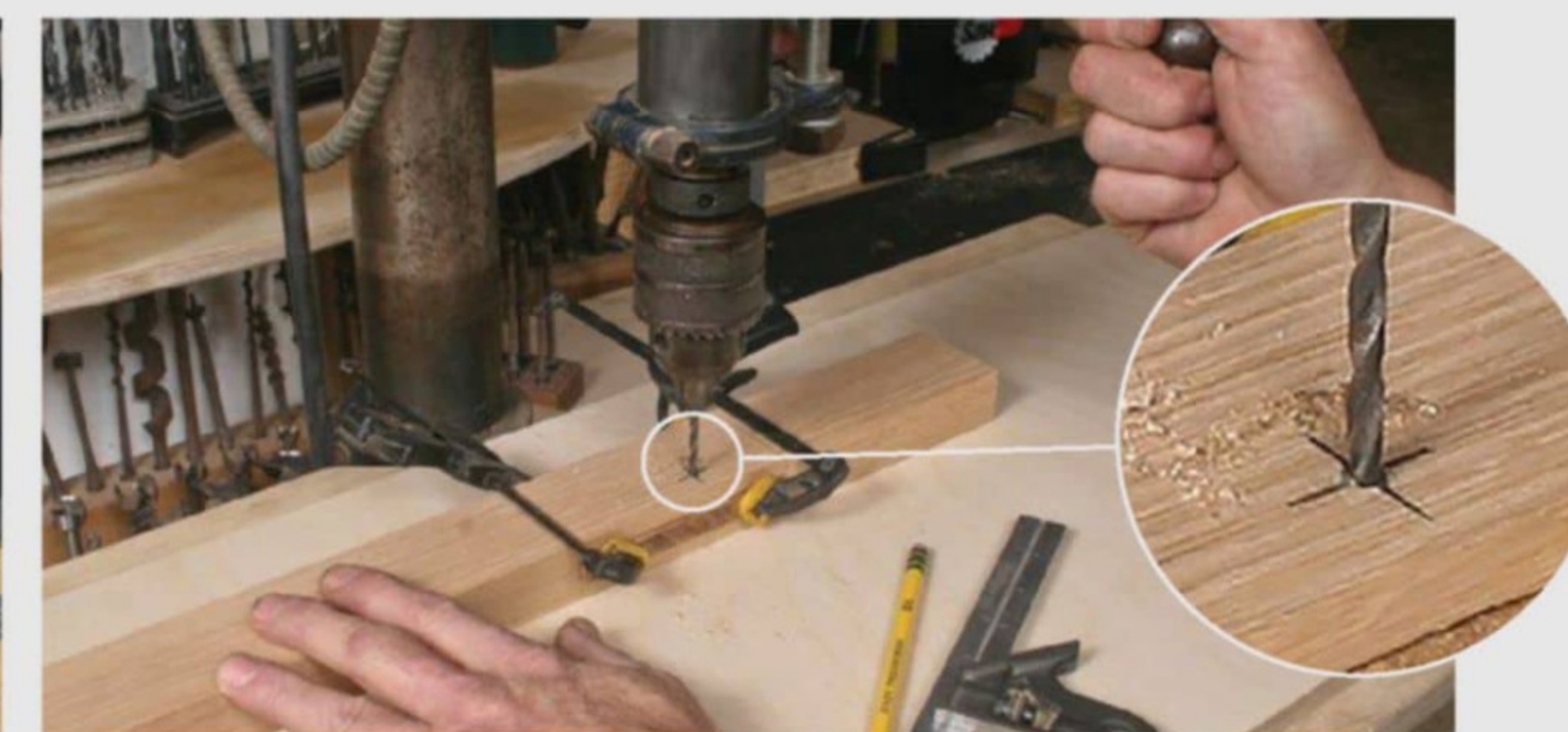
Smooth for the hand. Use a chisel and fine sandpaper to smooth any irregularities left by routing and to soften all sharp edges for a nice touch.

Pivot pull

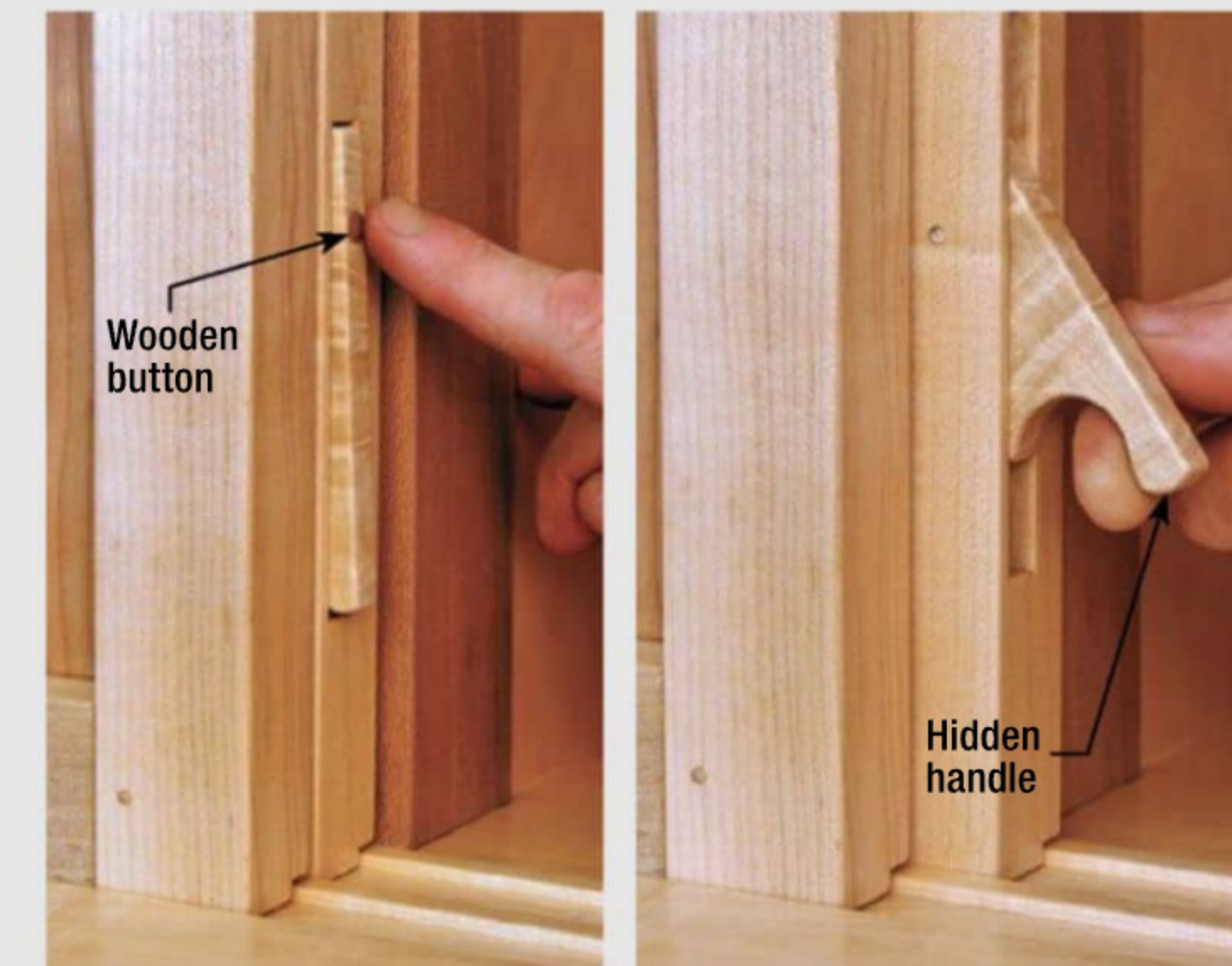
Here's a cool pull for sliding doors or a pocket door. Essentially a wooden lever recessed into the edge of the door, it sits demurely in waiting until a gentle push of the finger pivots it outward for grabbing. I make the lever from figured wood for a "wow" factor, and inlay a raised button of contrasting wood to serve as a fingertip target. A bamboo skewer from the supermarket serves as a pivot pin.



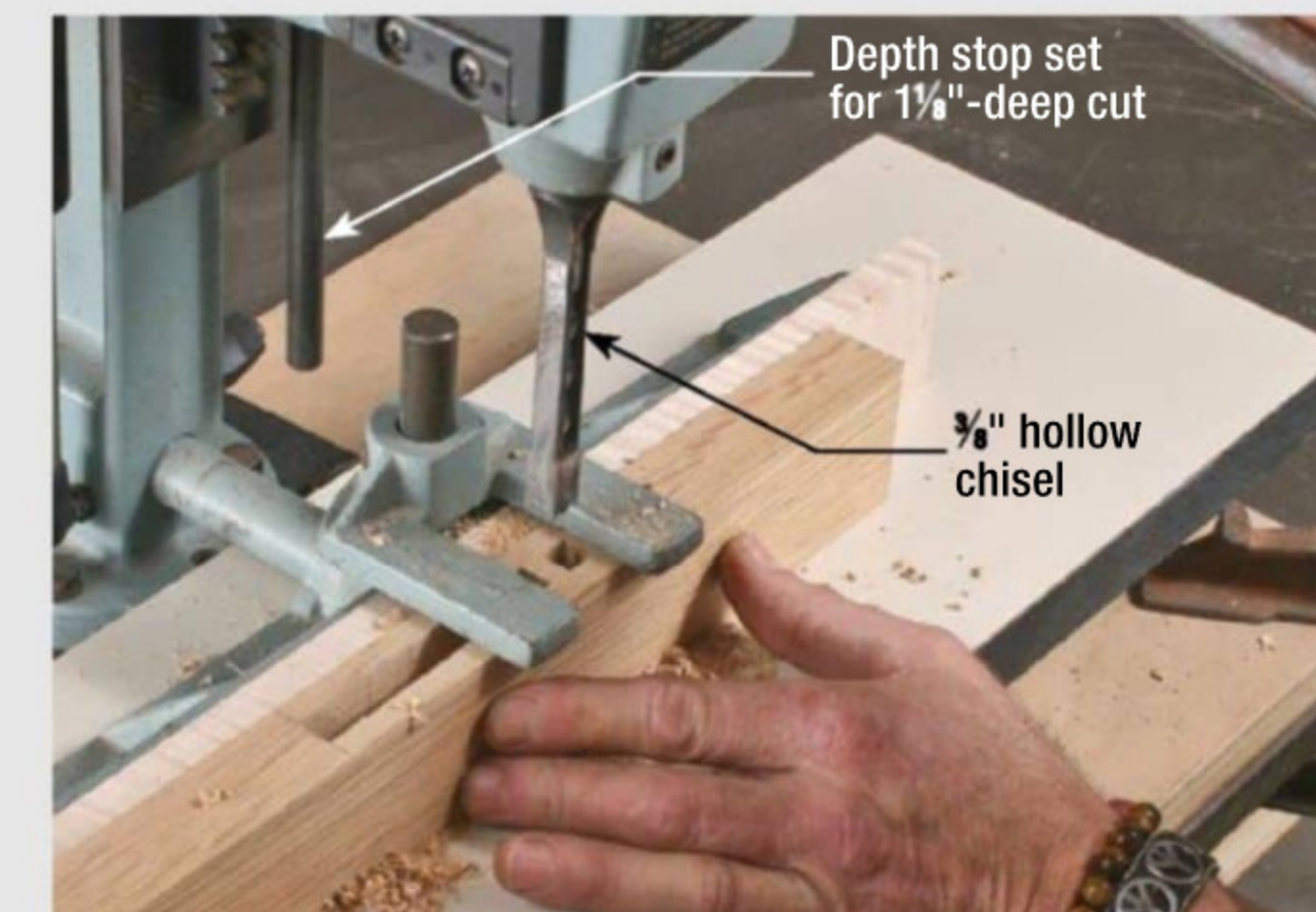
Angle one end. Set a bevel gauge to 15° as a visual aid, and use a stout chisel to chop an angle in the top end of the mortise.



Pin drilling. Clamp the shaped, sanded lever in its mortise with its edge 1/8" proud and parallel to the stile edge. Drill a 1/8"-dia. hole through both, insert the pin, and test the fit. Fix any binding by increasing the mortise angle or easing the top of the lever.



Push n' pull. This pivoting pull consists of a wooden lever fitted inside a mortise and hinged on a bamboo pin. Push the "button" with a finger, and out pops the pull.



Drill and chisel. Using a hollow-chisel mortiser, plunge the ends first, then remove the remaining material with a series of overlapping cuts.

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A Box-Maker's SLED

Precise crosscut and mitering capability make this table saw jig twice as nice

By Matt Kenney



I enjoy making small boxes. Coming up with different designs is just as challenging as the actual construction work. One thing that doesn't change is the requirement for precise cuts. A tiny gap may not be an issue in a large project, but it can be painfully noticeable in a small box. I rely on this table saw sled for making perfectly square and mitered cuts in small parts. The sled has a single runner that can be used in both table grooves. In one groove, you're cutting at 90°. In the other, you make 45° bevel cuts. In both applications, the jig's base and fence provide zero clearance with the saw blade. In addition to reducing tearout, this feature makes it easier to align precise cuts.

My table saw has a right-tilting blade. If your saw's blade tilts left, you'll need to relocate the runner to slide in the saw's left groove when making the first cut. Be sure to make the initial 90° and 45° cuts in your jig with the same sharp, finish-cutting blade you'll have in the saw when putting the jig to use.



Two cuts, done right. With its runner in my saw's right-hand table groove, the jig makes an exact 90° crosscut. Repositioning the jig so the runner slides in the left-hand groove sets me up for a 45° bevel cut (inset).

Start with a base, then add rails, runner, and fence

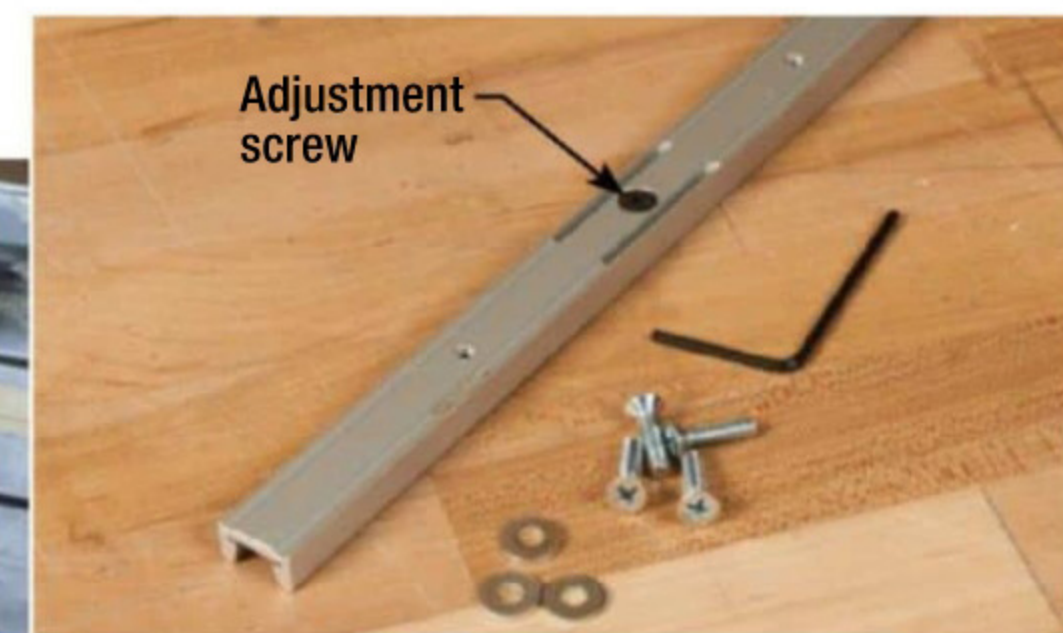
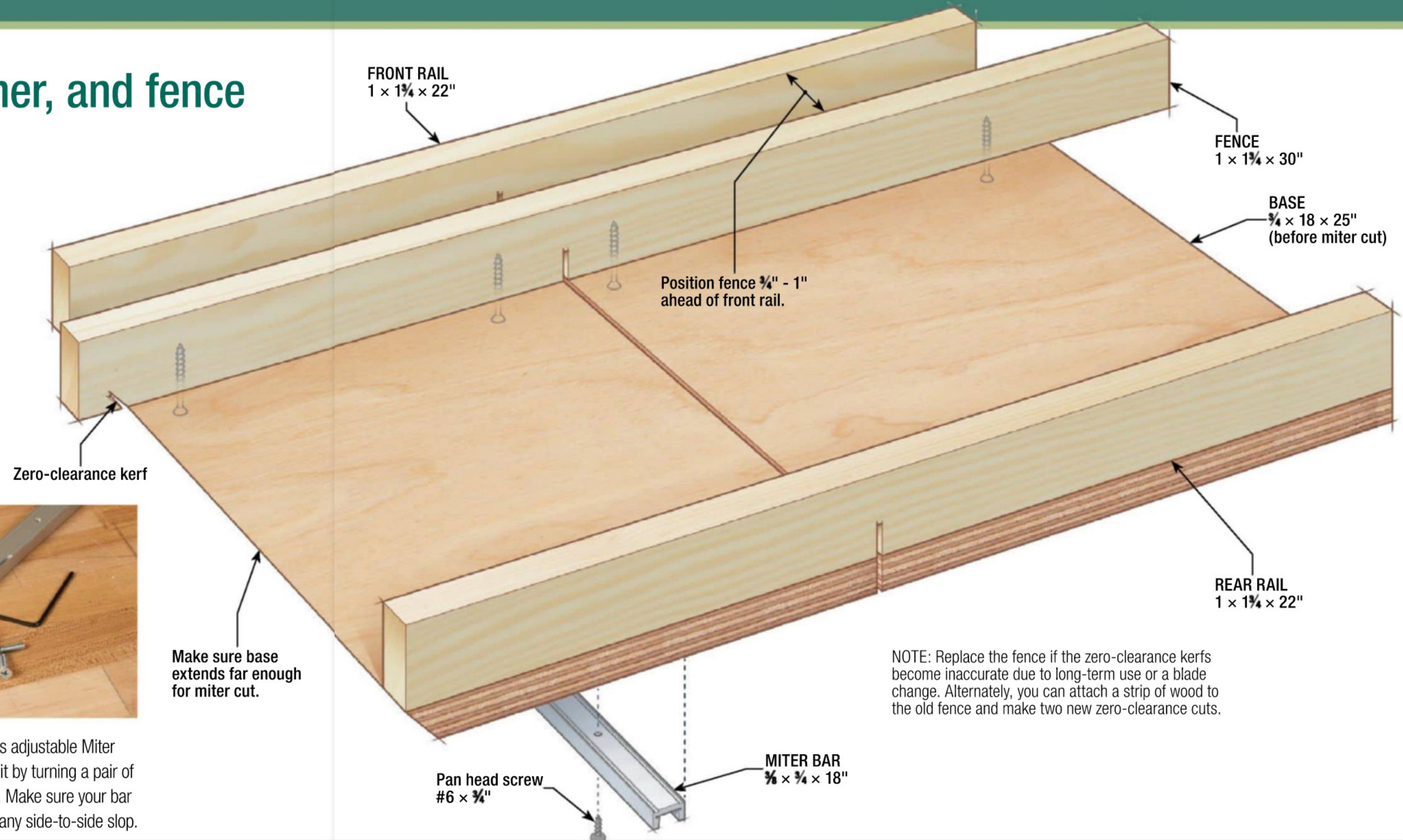
When making your jig, use dead-flat plywood, and make sure to mill your rail and fence stock straight and square. This jig will work just as well if made smaller, but a larger size might put too much torque on the single runner.

The fence that I'm using here is quite a bit longer than you need for cutting small parts. The extra length makes the sled more versatile by enabling me to cut longer parts to uniform length.

The runner for this jig is an 18"-long Miter Slider from Incra (see Buyer's Guide, p. 69). Like other aftermarket runners, this one can be adjusted to slide easily but without slop in the table groove.

The runner's location on the underside of the base depends on the distance between your saw table grooves and the blade. Position it to extend the base an inch or so beyond the blade for your first 45° miter cut (see bottom photo, facing page).

You're supposed to attach the Miter Slider with machine screws that are installed through the top of the base. But I've found that it's easier and no less effective to mount the bar by driving pan-head screws through the mounting holes and into the underside of the base.

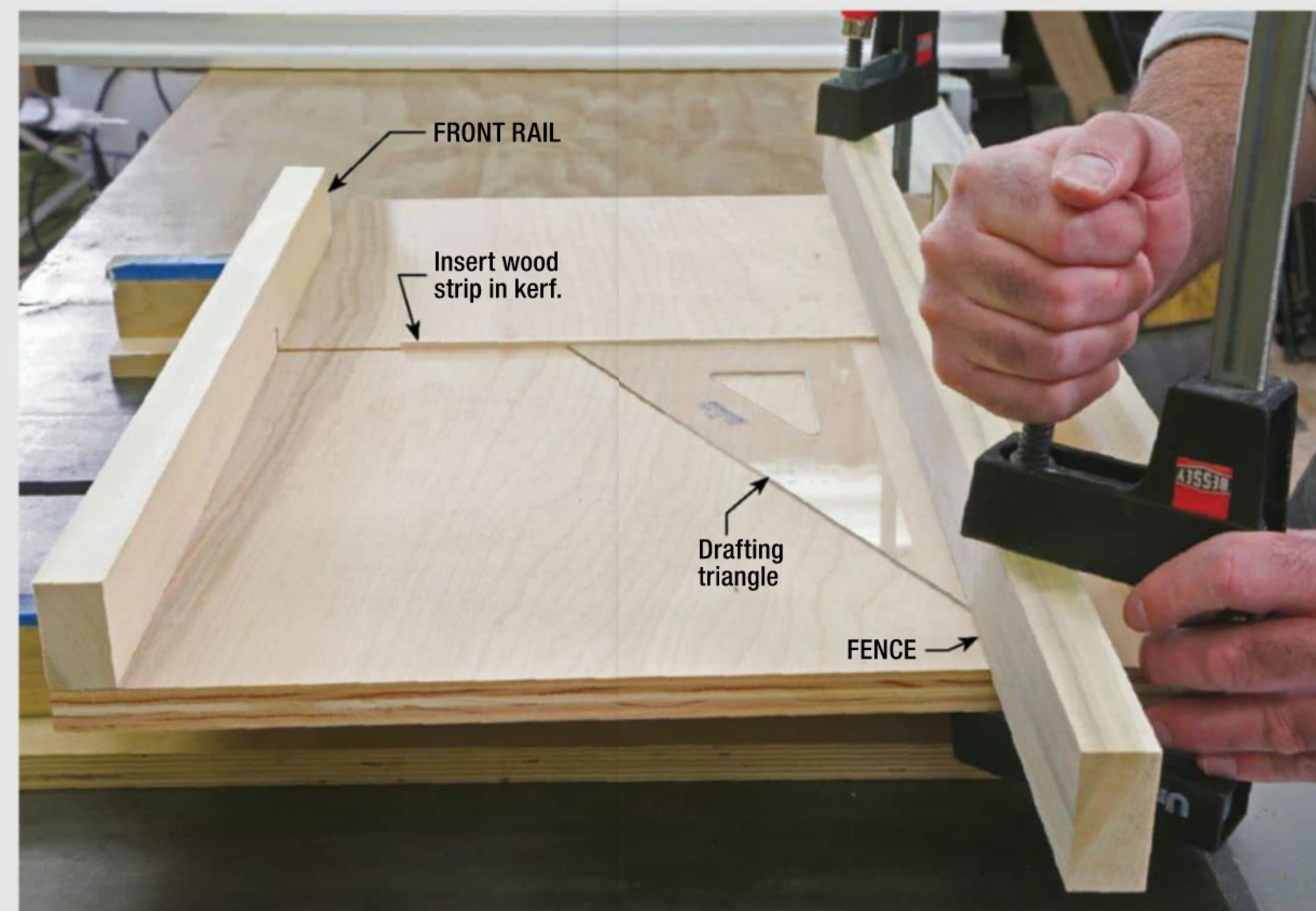


Begin with the bar. With this adjustable Miter Slider bar, you fine-tune the fit by turning a pair of screws with an Allen wrench. Make sure your bar slides smoothly, and without any side-to-side slop.

Attach the runner. Glue the front and rear rails to the plywood base, then attach the bar with #6 x 3/4" pan screws. Position the bar with enough material on one side so that the saw blade can create the mitered edge.



Make the first cut. Raise the blade no more than 1 1/2" above the table for this initial cut. (With a right-tilting blade, the sled's runner should be in the right-hand groove.)



Install the fence. Insert a snug-fitting strip of wood in the kerf, then register a drafting triangle against the strip and the fence while clamping the fence in place. Here I've clamped both ends of the fence to the base. Once the fence is clamped, flip the jig over, and secure the fence with a screw near each end. Make a test cut in some straight-edged stock to confirm that the fence is square to the blade, and fine-tune the fence angle if necessary. When you've got it right, anchor the fence by driving two screws on each side of the kerf.



Make the miter cut. Raise the blade about 1 1/2" above the table and tilt it to exactly 45° to make this cut. When you're done, you'll have a zero-clearance edge in the base, and a zero-clearance kerf in the fence. It's time to make some boxes (See p. 24).

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Build a Classic **SPICE BOX** Part 1

Master challenging joinery details to create a masterpiece

By Chris Hodges

Today you could easily use a spice box to store many things besides spices. But to appreciate the importance that this classic creation has for woodworkers, you have to go back several centuries, when spice boxes were true to their name. Back then, spices were a luxury that only the wealthy could afford. A family in Colonial America with financial means to purchase spices from around the world could also afford to have an exquisite storage cabinet designed and built by the best woodworker in the community.

Just as the spice box became a symbol of affluence for wealthy colonists, it also became a crowning achievement for a woodworker. Its easy to understand why. With its dovetailed case, molding details and intricately divided interior, this piece showcases challenging joinery as well as beautiful wood grain.

This article is the first in a two-part series that explains how I build a classic spice box from start to finish. Associated articles are also part of this ambitious project—to cover special jigs and techniques.

Building the spice box from start to finish—a big project with 6 major construction steps

Covered in this issue (Spice Box, Part 1):

1. Make the case (sides, top, bottom)
2. Make and install interior dividers
3. Make and install the cornice and base

Covered in April/May issue (Spice Box, Part 2):

4. Build and install the drawers
5. Make the door, install lockset, and then hang the door
6. Make and install the back, then sand and finish



Excellent elements. From bottom to top, this small case makes a big statement about fine design and quality construction.



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Photos: Larry Harrel-Lambert; Illustrations: Christopher Mills

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Shaker CANDLE STAND

By David Heim

The Shakers have been a presence in the U.S. since 1774, when the first nine Believers in this religious sect emigrated from England. Industrious and always striving for perfection, the Shakers believed that work was a form of worship. They made things that were practical, efficient, and beautiful.

By the 1850s, in their so-called Classic Period, Shaker woodworkers had attained high levels of skill and perfected their unique designs. Christian Becksvoort,

piece of furniture illustrates the Shaker union of grace and form better" than the round stand shown here. It's Becksvoort's faithful reproduction of an original made in about 1850, most likely at the Shaker community of Mount Lebanon, New York. Similar stands can be seen on display at the Hancock Shaker Village museum, in western Massachusetts.

Today, we'd call a piece like this an occasional table or an end table. At first glance, the stand seems very simple: curved legs

The bottom end of the post is ever so slightly narrower than the curved section, creating a thin shoulder for the legs to rest against. The top edge of the leg follows an S-curve that blends smoothly into the curve of the post. The already-thin top has a bullnose profile that makes it appear even thinner. On the underside of the top, a crosspiece adds stiffness and is drilled at its center to hold a round tenon turned on the top of the post. Typical of the subtle detailing that characterizes many Shaker pieces, the ends

“Simplicity, unity, and functionalism merged to form outright works of art.”

author of *The Shaker Legacy* (Taunton) and *Shaker Inspiration* (Lost Art Press), offers this summary: “The concepts of simplicity, unity, and functionalism merged to form outright works of art.” He adds: “No single

fit into a turned post with a round top attached. But as you look more closely, small but important details emerge. The legs (known as spider legs) are not just cutout shapes; they taper gently along their length.

of the crosspiece are curved, and broad chamfers disguise the piece's thickness.

The candle stand's cleverest feature isn't apparent until you turn the piece upside-down. That's when you'll discover the join-

ery detail that makes this piece as strong as it is beautiful (see drawing).

Each leg has a long dovetail that slides into a matching socket cut in the base of the post. Small flats cut on each side of the socket provide a firm resting place for the dovetail shoulders. These sliding dovetail joints terminate at a shoulder on the post that creates a subtle shadow line while also strengthening the leg-to-post connection. It's impressive joinery work, hidden from view.

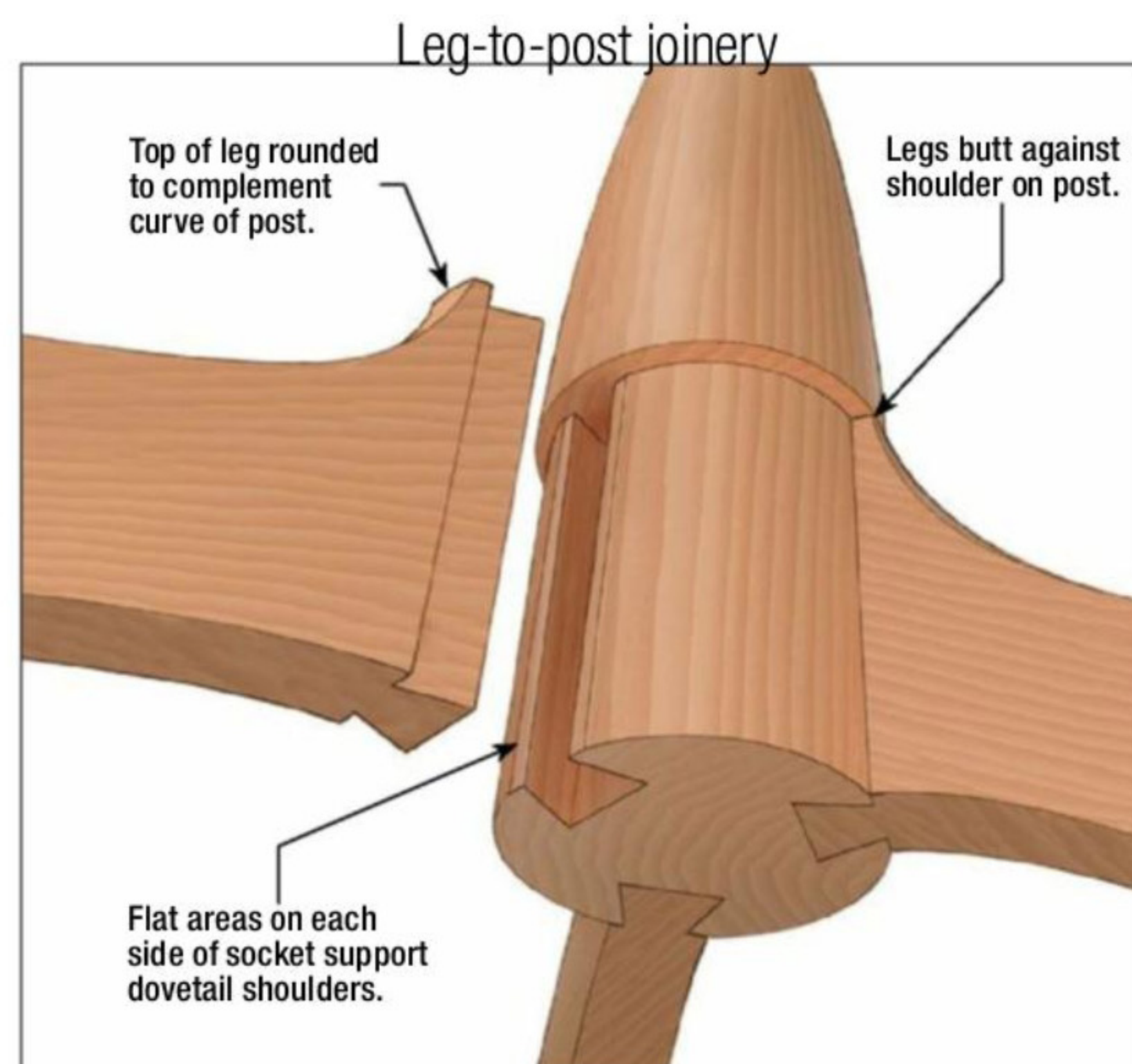
The stand shown here is made from cherry, but the Shakers were happy to use any wood that was readily available and easy to cut and carve. Their favorites included pine, birch, cherry, maple, ash, and walnut. While built-in cabinetry and case pieces were often painted, furniture like this stand was typically finished with varnish or shellac. ■



Faithful reproduction.

This stand is Christian Becksvoort's reproduction of a Shaker original.

You can see similar stands at the Hancock Shaker Village, in Massachusetts. Like the original, this is made of cherry. It's 25" high, 18" in diameter.



fastFACTS

- Shaker artisans were skilled innovators. Among their many enduring inventions: the circular saw, devised in 1810 by Sister Tabitha Babbitt.
- Prior to the Civil War, the Shakers had as many as 4,000 followers. Today, only two remain.
- Decades before architect Louis Sullivan wrote that “form ever follows function,” the Shakers followed a similar rule: “All work done...ought to be faithfully and well done, but plain and without superfluity. All things ought to be made according to their order and use.”
- Today, Shaker life and lore are preserved at eleven different museums, spread out from Maine to Kentucky.

VERTICAL GRAIN DOUGLAS-FIR

Light, strong, and pin-striped

By Ken Burton

Douglas-fir is one of the United States' most plentiful softwoods. Due to its excellent strength-to-weight ratio, it has long been the go-to species for carpentry and construction projects. Construction 2×4s designated as SPF (spruce, pine, fir)—are often Douglas-fir. But before you dismiss this species as simply fodder for framing walls and floors, take a closer look at the photos and the title of the article. We're talking about CVG (Clear, Vertical Grain) Douglas-fir; boards that are more processed and quarter-sawn—cut so the growth rings are relatively perpendicular to board faces.

Where the wood comes from

In truth, Doug-Fir, *Pseudotsuga menziesii*, isn't a fir, at all. It's genus (*Pseudotsuga*) translates to "false hemlock." Doug-Fir forests grow in the Pacific Northwest and up into British Columbia. Mature trees can be 200 feet tall and 6 feet in diameter. The dense stands in which they grow cause the trees to self-prune, yielding straight-grained logs free of knots. As of this writing, the plentiful Douglas-fir is considered far from endangered.

History in woodworking

Ever since the Oregon Trail opened up the Northwest to settlement, Douglas-fir has been valued as a prime building material. Architects, carpenters, and cabinetmakers have long valued the wood for its stability and uniform appearance, and have used it for doors, window sashes, paneling, trim, and cabinetry.

Selecting the best stock

Unlike many of the exotic species discussed in previous WoodSense columns, CVG Douglas-fir can be found at big box hardware stores, although the sales staff may not know exactly what you're asking for. My local place, stocks what they refer to as "tongue and groove fir flooring" (above, right) in the aisle with the premium quality pine boards. While not all the pieces in the bin are vertical grain, you can usually sort through and find those that are. This material is meant to be used for porch flooring and has a groove on one edge and a tongue on the other, so you'll waste a little of it if you just want square-edged boards. These 1×4 pieces sell for about \$6/board foot. You can also find the wood online. CVG Doug-fir is quite uniform in appearance, so, seeing

Vertical Grain Douglas-Fir Quick Take	
DENSITY	32 lbs./cu. ft.
HARDNESS	Medium (hard as far as softwoods go)
STABILITY	Very Good
ROT/INSECT RESISTANCE	Moderate
TEXTURE	Coarse
TOXICITY	Low. Although rare, skin and nose irritation and nausea have been reported.
USES	Doors, window frames, paneling, flooring, cabinetry, furniture, boxes, plywood

From dawn to dusk.

While pinkish-red when freshly cut, CVG (Clear, Vertical Grain) Douglas-fir ages to a beautiful, warm reddish-brown with darker stripes.



before buying isn't as important as when buying lumber with prominent figure. But do note whether the grain is described as "tight" or "loose." The tighter the grain, the closer together the growth rings are, creating a more uniform texture and making it easier to work. With some old-growth lumber, the ring spacing can be 1/16" or less.

Working CVG Douglas-fir

Doug-fir is one of the harder softwoods on the market and features a distinct difference in the hardness of the earlywood (the lighter colored areas) and the latewood (the darker stripes). You'll feel this distinctly when bandsawing across the grain. The harder areas can also cause small drill bits to drift off course. The wood can splinter easily, and is tough to work with hand tools. Folded sandpaper can slip beneath a splinter, angling it right into your finger. Do yourself a favor and use a sanding block.

The wood machines well, but use very sharp cutters, and employ backer blocks when crosscutting to minimize exit tearout. Climb-cutting when routing profiles greatly reduces splintering. The wood glues without a problem and holds both nails and screws well, but drill pilot holes to prevent splitting.

Finishing

Doug-fir has a warm, reddish-brown hue that deepens with age. It accepts stains readily and can be finished with any number of different top-coats, but soaks up oil.

CVG Douglas-Fir in the shop

My most recent experience with CVG Douglas-fir came in the residential construction class I teach as one of the Technology Education electives available to my high school students. (There are still a few of us teaching "shop" in America's public schools.) As part of a renovation project, our gym was updated with ADA-compliant seating. I convinced the demo crew to save me the lumber from the old bleachers—most of it CVG Doug-fir. Those boards were just as flat, straight, and sturdy as when they were installed over 50 years ago, though with more chewing gum.

With my lumber rack overflowing, I set about designing a project my students could tackle that would teach valuable woodworking lessons and utilize this beautiful reclaimed wood. We built a version of the tool tote (shown here). I also wanted them to have a bit of school history to take home (although I doubt that will matter much to them until they get a little older).

The fir was harder and more prone to splintering than the pine the students were used to working. They also learned the value of drilling pilot holes before nailing through the thin sides and of using a backup board when crosscutting. (Or crosscutting, as they named it).

I was impressed with the wood's stability. When I resawn the pieces for the sides of the tool tote, I expected the pieces to cup and bow, but they stayed flat. Out of curiosity (and to show the



students another use of the bandsaw), I installed a fresh blade and sliced one piece into some veneer. Just like the resawn pieces, the veneers stayed perfectly flat.

The students learned the importance of grain direction when edge jointing. Doug-fir's flatsawn edges tore badly when run against the grain. Given the board's uniform face grain, ascertaining proper orientation for jointer feeding was tricky. It was essentially a coin toss to decide which way to first run the board over the jointer.

I also found using fresh router bits made a big difference in how cleanly the boards cut. While cherry can be routed with a bit that has lost some sharpness (albeit with some burning), Doug-fir splinters badly when using dull cutters.

I'm pleased with the results and look forward to using the rest of my stash with next year's class. And I'm planning a project to use the T&G pieces I picked up from the home center. ■

Joinery finesse

When I first started to get serious about woodworking, one of the first good-quality tools I purchased was a Stanley #92 shoulder plane. Now, more than thirty years later, I still use it almost every time I'm in the shop. The plane offers finesse not easily found in machines; it's indispensable for trimming tenons, tweaking rabbets, and cleaning up dadoses. A few years ago, Stanley updated the design of the tool to make it look more streamlined. I bought one of these new models for the facility where I teach evening classes. I was pleased to discover that the new model works just as well as the original. With a sharp blade, the #92 makes a dramatic difference in how easy it is to make the precise cuts necessary for solid joinery.

—Ken Burton



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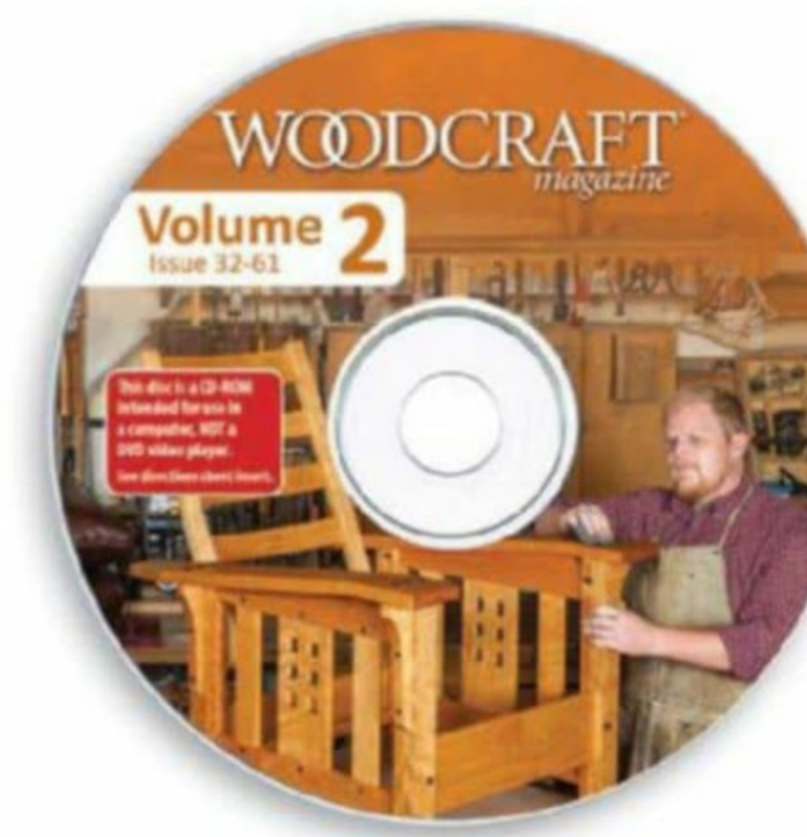
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—Chad McClung ■



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Avoiding splits with wedged tenons

Ken Burton
woodworking teacher
and author



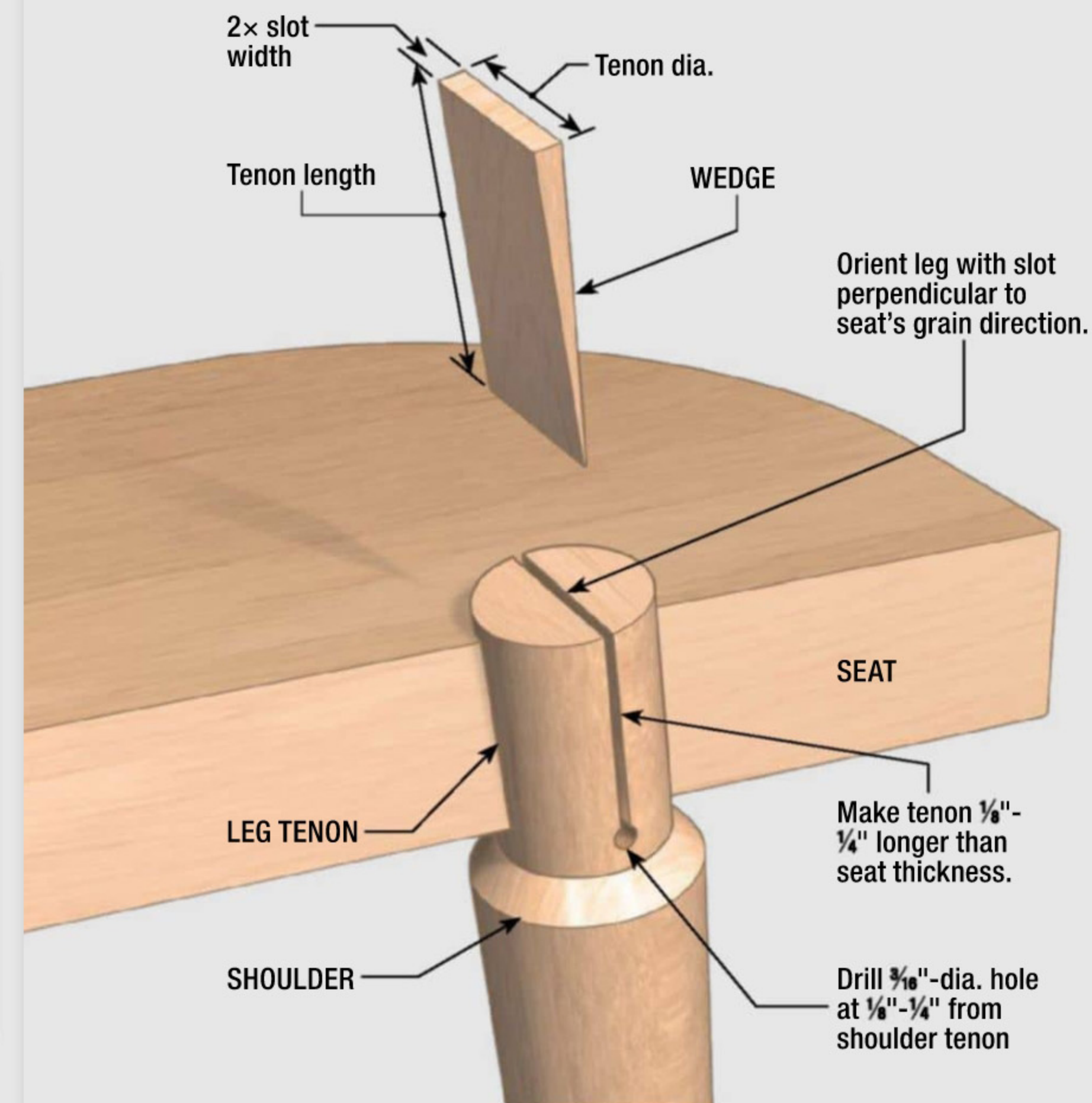
Q: I was making a three-legged stool with round through-tenons attaching the legs to the seat. When I drove a wedge into one of the slotted tenons, the seat split. I was able to repair it, but I don't want to risk more damage. How do I get a tight wedged joint without splitting the seat again?

Carl Benson
Casper, Wyoming

A: It's a good bet that the split in your seat was caused by orienting a leg tenon slot parallel to the seat's grain, rather than perpendicular to the grain. Consider the difference between driving a chisel with the grain in a board, and driving it into the wood at a right angle to the grain. It's a similar principle here; wedging slots in through tenons should always be oriented perpendicular to the grain, as shown in the drawing.

There are a few other details that deserve close attention when installing through-tenons in seats, benches, and stools. For starters, make your tenons $\frac{1}{8}$ " – $\frac{1}{4}$ " longer than the seat thickness. Drill a $\frac{3}{16}$ "-dia. hole through the tenon where the slot will end—usually $\frac{1}{8}$ " – $\frac{1}{4}$ " from the tenon's shoulder. Then cut the slot (I use the band saw) from the tenon end to the drilled hole. The hole helps to dissipate the wedging action and keeps the leg from splitting.

Take care to size your wedges properly. I make all the wedges for a seat from a single strip of wood as wide as the tenon's diameter and long enough for all the wedges you need plus about 6". Resaw the piece so its thickness is about twice the width of the slot (typically a heavy $\frac{1}{8}$ "). Taper both faces on both ends of the strip using your disk sander, going from a near-knife edge to full thickness at a point along the strip equal to the length of the tenon. This will yield two wedges. Cut them off and repeat until you have enough wedges for all your joints. Apply glue to the tenons and slip the legs in place with the slot perpendicular to the grain. Then apply glue to the wedges and tap them home. A wooden mallet is less likely to split wedges than a metal hammer. Drive the wedge until moderate hammer blows no longer advance it. When the glue dries, cut off the protruding tenon and wedge with a flush-cut saw and sand everything smooth. ■



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Looking Ahead

Here's a sneak peek at our next issue.

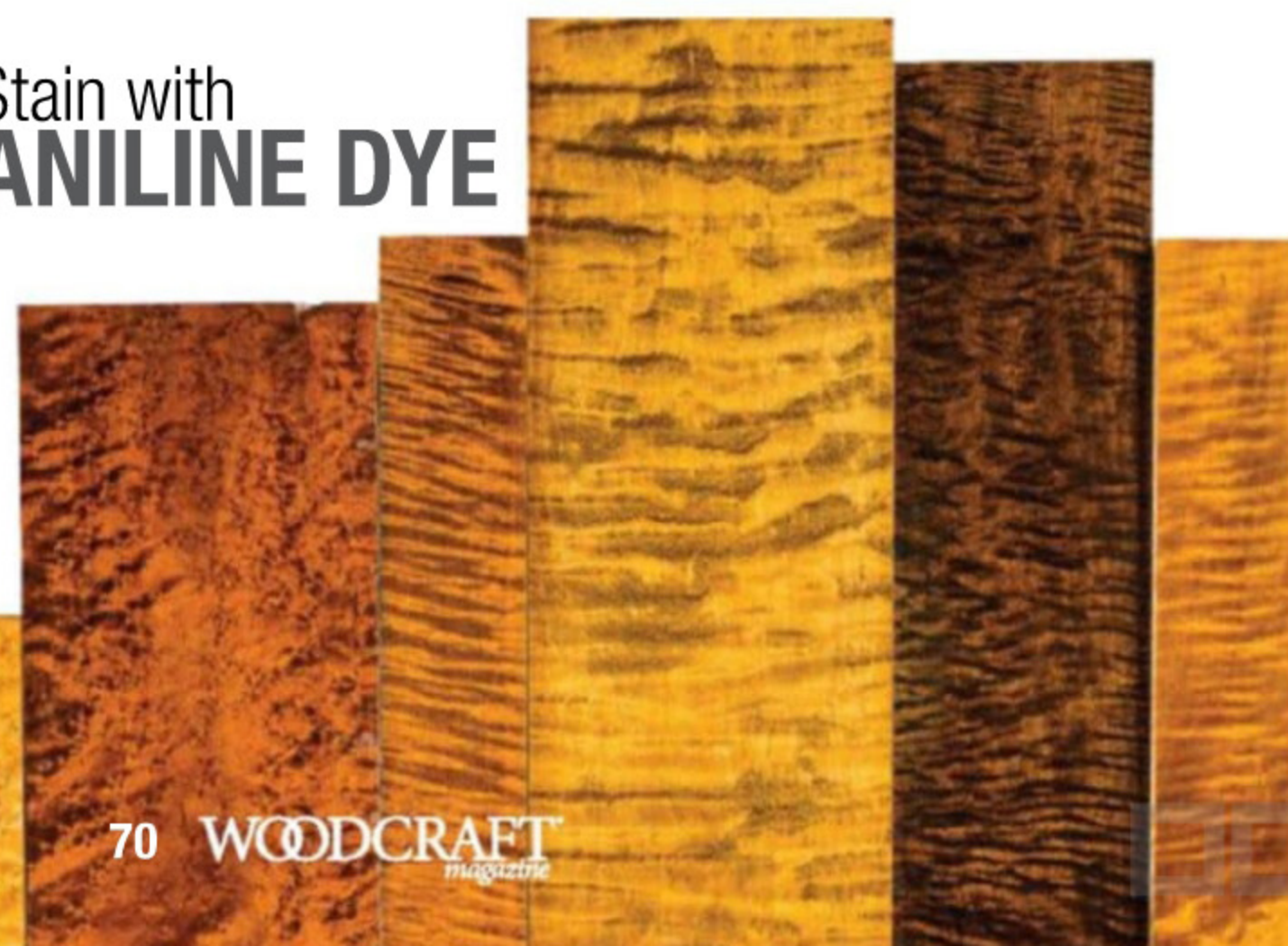


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THE AMERICAN WOODSHOP

Woodcraft is pleased to continue sponsorship of *The American Woodshop* with Scott and Suzy Phillips for Season 26 on PBS.

Season 26 – A history in wood from custom creations produced in independent woodshops. Projects include Live Edge Tall Case Wall Cabinet, Segmented Salad Bowls and Laminated Treenware, Resin and Woodturned Table Lamp, Wright-Inspired Art Glass Free Standing Cabinet and Maloof Inspired Chair.

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www.wbgu.org/americanwoodshop

A CRAFTSMAN'S Legacy

Eric Gorges has been the host of *A Craftsman's Legacy* since it began in 2014. After a health crisis caused him to reevaluate his life, he knew he wanted to work with his hands and he loved motorcycles, so he signed on as an apprentice with one of the best metal shapers in the country. In 1999, he opened a custom motorcycle shop, Voodoo Choppers, in Detroit, Michigan, where he lives today.

Eric's passion for making things by hand led to the idea for his national television series where he showcases men and women who are specialists in their handcrafts. Eric has also written a book, *A Craftsman's Legacy*.

www.craftsmanslegacy.com

THE WOODSHOP

Woodcraft is pleased to partner with woodturner Carl Jacobson of TheWoodshop.TV. Carl started woodworking as a young boy with his grandfather and then developed a love for turning as an adult after seeing a turned project in a friend's shop.

When he couldn't find a how-to video for duck calls in the early days of YouTube, he decided to use his passion to share and instruct the craft in his own video, which led him eventually to start his own YouTube channel and instructional website.

His mobile shop allows him to travel around the country to teach, demonstrate and promote woodturning, while inspiring others to give it a try.

www.thewoodshop.tv

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Kidding in the SHOP

Tooling around with the future

By Ric Hanisch

and a “product” as a goal that awaited on the other side of many botched efforts. A stubborn kid, I guess I was determined to make every mistake myself before I realized that when Dad said “That’s not going to work,” he knew what he was talking about.

Fast-forward about 60 years, during which time two daughters, a couple of their cousins, and sundry other kids found their way to my own bench. And now my grandson Kai has joined their ranks. It’s been fascinating to watch each recent arrival to the world develop tool skills that will help arm them for their future.

It’s not hard to help kids get comfortable with real-world tools. For example, to encourage hand-eye coordination, you might set up a youngster with a ball peen hammer, a can of miscellaneous nails, and a section of log standing on end. Show her how to hold and tap a nail to start it before letting go and pound- ing away into the friendly end grain. To develop dexterity, let a kid have a go at disassembling an old fax machine. Or clamp a 1 × 1” stick in a vise and demonstrate cutting off an inch with a small, stiff back saw. Let a kid try it, and see how quickly that stick disappears into a pile of pieces. Before you know it, he’ll be using a spokeshave!

While you’re at it, teaching shop etiquette is important for every- one’s safety and happiness, so make sure it’s understood which tools are

off-limits, which are up for grabs, and where they all live. And whatever tools are in play, make sure they’re sharp, tuned, and in good shape, or they’ll be useless for skill-building. Don’t forget to keep a close eye on li’l cutter-wielding newbies to gauge their developing motor skills and mental readiness before they advance to the next step.

It’s a beautiful thing, watching kids grow the kind of skills that will help them make the most of a world that can be cut up, put together, reshaped, taken apart, and reassembled to your liking if you know how. Once you slip past the tiger, that is... ■

As a kid, I never let the ankle-biting tiger lurking in the shadows beneath the cellar stairs deter me from getting to my dad’s workbench. With its top of 2 × 10’s and its steel pipe legs, the bench was simply outfitted with a tool pegboard, an old machinist’s vise, and a hand-cranked grinding wheel. Nothing fancy, but it was just the thing when there was work to be done.

Early on, I mostly needed to change the shape of stuff. You know, maybe squash a bottle cap in the vise or grind some nicks in an old file, which made great sparks! I eventually moved on to defunct radios and clocks that begged to be taken apart. While learn- ing to wield pliers and screwdrivers, I also picked up an idea of how these devices worked. As I got older, proj- ects often involved advance planning





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