

5 PROJECTS IN

GUILD ♦ EDITION

EVERY ISSUE!

Woodsmith®

Woodsmith.com

Vol. 44 / No. 261

A person wearing a plaid shirt and tan leather apron is using a router table. The table has a light-colored wooden frame and a blue cabinet with two doors and a black handle. The person's hands are on the table, guiding a piece of wood through the router bit. The background is a wooden wall.

RIGHT-SIZED ROUTER TABLE

Also:

All-New Plans:

- Walnut Cabinet
- Valet Chair
- Bathroom Vanity
- Wood-Gear Clock

Mastering the Table Saw
Bridle Joinery

Great Gear
New Tools & Accessories

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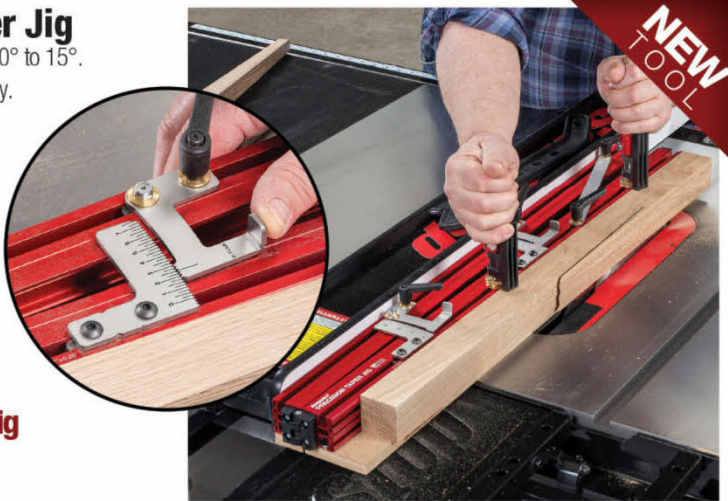
TS-24 24"....\$124.99

TS-32 32"....\$154.99



Precision Taper Jig

- Repeatable tapers from 0° to 15°.
- Clamps material securely.
- Standard 32" capacity.
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Precision Taper Jig

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48"....\$399.99

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- Combination & Double Squares in two sizes.

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Double 6"....\$129.99

Double XL 12"....\$169.99

Combination 12"....\$169.99

Combination XL 18"....\$199.99

Metric Available on Woodpeck.com



EZ Edge Corner Plane

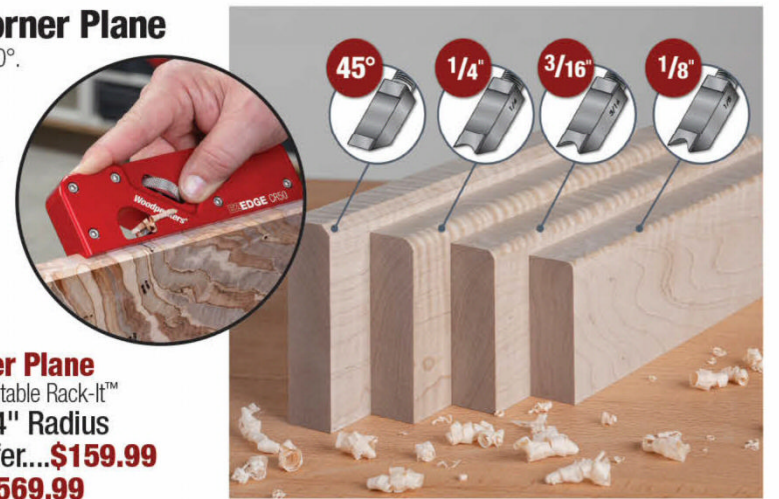
- Sole is a perfect 90°.
- 3 radius profiles.
- 45° chamfer.
- Resharpens easily.

EZ Edge Corner Plane

Includes a wall-mountable Rack-It™

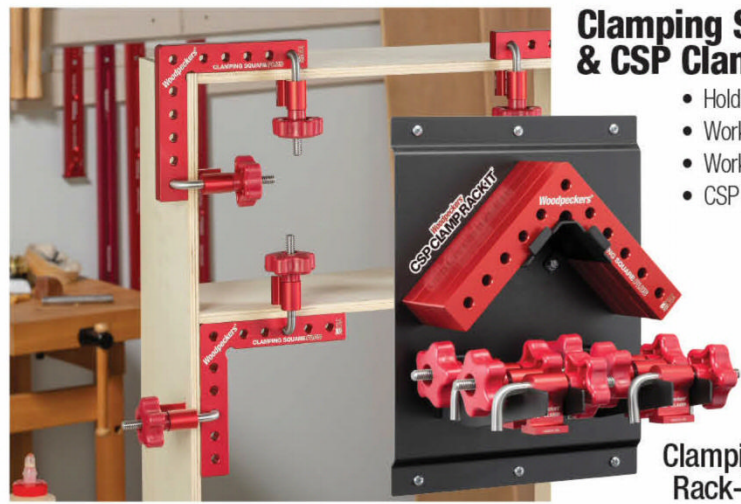
1/8", 3/16", 1/4" Radius
-or- 45° Chamfer....\$159.99

Deluxe Set....\$569.99

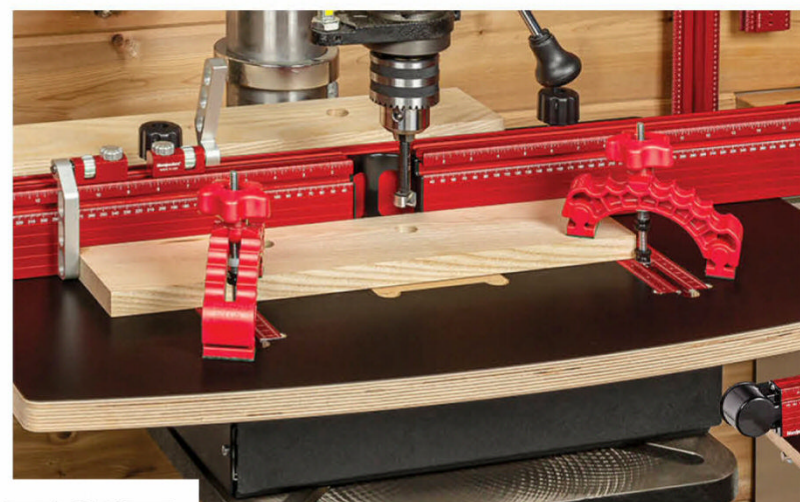


Clamping Squares PLUS & CSP Clamps

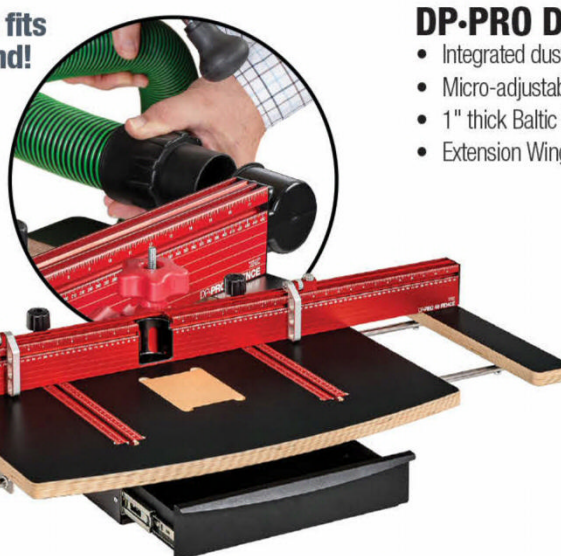
- Holds stock at right angles.
- Works inside or outside.
- Works with any clamp.
- CSP Clamps speed the job.



Clamping Squares PLUS
Rack-It™ Kit....\$259.99



Dust Port fits
either end!



DP-PRO Drill Press Table System

- Integrated dust collection.
- Micro-adjustable Flip Stops.
- 1" thick Baltic Birch with laminate both sides.
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DP-PRO Drill Press Table Master System

36" Table, 24" Fence....\$399.99

36" Table, 36" Fence....\$419.99

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48" Table, 48" Fence....\$469.99

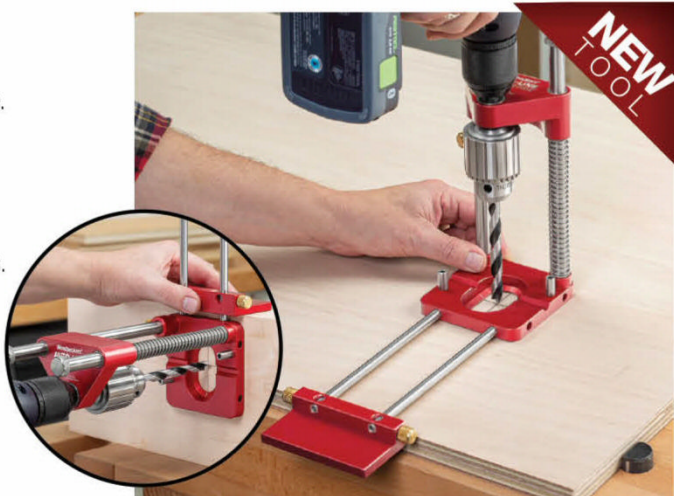


Drill Press & Hose not included.

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- Perpendicular holes anywhere.
- Fence fits on all 4 sides.
- Works with most drills.
- 1" inside frame.
- 2" capacity outboard.
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Auto-Line Drill Guide
Drill Guide....\$259.99
Deluxe Kit....\$369.99



Drill not included.

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- Square cuts every time.
- Miter bar self-adjusts 3/4" slots.
- Micro-adjust flip stop & 45" extension.
- 24" cross-cut capacity on most saws.
- Miter Bar available separately.

Exact-90
Miter Gauge....\$329.99
25.5" Miter Bar....\$69.99



Table Saw not included.

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Rods....\$239.99



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Duax Angle Drilling Table
Duax....\$299.99
Deluxe Kit....\$339.99



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Biesemeyer
& SawStop



Table Saw not included.

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RIP-FLIP Fence Stop System
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- Micro-adjust provides precise control.
- Installs flat or as a vertical fence.
- Include track, stops, brackets & rule.

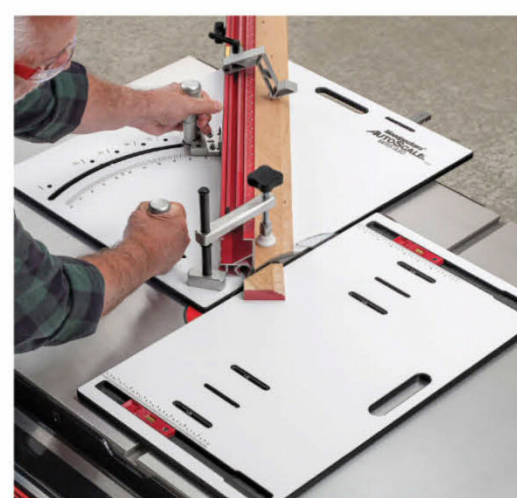
StealthStop
Left -or- Right
4' Fence....\$129.99
4' Combination....\$199.99



AUTO SCALE™ Miter Sled

- Scale accurate at any angle.
- Miter bar fits any 3/8" x 3/4" slot.
- Flip stop with micro-adjust.
- Stop extends to 50".
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AutoScale Miter Sled
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Left-or-Right Miter Sled....\$529.99
Drop Zone....\$129.99



CLAMPZILLA 4-Way Panel Clamp

- Applies pressure both directions.
- Works with material from 5/8" to 4".
- Improved vertical pressure.
- Flatter panels faster.

ClampZILLA 4-Way Panel Clamp
18" Capacity....\$139.99
38" Capacity....\$169.99
50" Capacity....\$199.99



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CONTRIBUTING PHOTOGRAPHERS Chris Hennessey,
 Jack Coyier



Woodsmith® (USPS 465-410) (ISSN 0164-4114) is published bimonthly by the Home Group of Active Interest Media Holdco, Inc. The known office of publication is located at 2143 Grand Ave, Des Moines, IA 50312. Periodicals Postage Paid at Des Moines, IA, and additional mailing offices. Postmaster: Send address changes to Woodsmith, Box 37274, Boone, IA 50037-0274.

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 Subscriptions: \$29/year, Single copy: \$7.99
 Canadian Subscriptions: Canada Post Agreement No. 40038201. Send change of address information to PO Box 881, Station Main, Markham, ON L3P 8M6.
 Canada BN 82564 2911

Printed in U.S.A.

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EDITORIAL

Woodsmith Magazine
 2143 Grand Avenue
 Des Moines, IA 50312
 woodsmith@woodsmith.com



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from the editor Sawdust



Some of my favorite toys as a kid were Legos and Transformers. The first for the process of creative building and the second for the way robots could be turned into cars and planes with a few simple moves. Both toys invited a level of exploration and tinkering. It's in that vein that we present the clock featured on page 56. The movement of gears, the swinging pendulum, and the gentle tick tock are a delight to experience. The design flows from the mind of Chris Fitch. In past issues, he's come up with a whirligig and weathervane — two other projects that incorporate a sense of motion and transformation. He calls it "kinetic sculpture." I'll allow it and look forward to the next one.

Chris made the clock parts using a CNC router. In the course of designing the

Woodsmith shop-made CNC, he's learned a lot about how this machine can do all kinds of things. Recently, he started a web-based show *CNC Basecamp*. Check it out if you're interested in what CNCs can do — whether you plan to get one for your shop or not, Woodsmith.com/cnc-basecamp.



FRD



MARC HOPKINS, SHOP CRAFTSMAN

◀ Originally from Coventry, UK, he completed his Carpentry and Joinery training with the City and Guilds of London Institute. He worked as a self-employed carpenter and for a remodeling company before transitioning to the finer side when joining *Woodsmith* as a Shop Craftsman.

To date: his favorite projects include a modern chess set turned on the lathe and a 14' plywood boat, which he later acquired — perk of the job! If he can escape the honey-do list and home remodeling projects, he coaches his son's soccer team and gets out on the boat with the family.

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My woodshop is rather small, so I'm always looking for ways to save storage space. One such way is this compact holder, made for two diamond sharpening plates. Now I have four sharpening surfaces in a single block. This holder makes it quick and easy to switch sharpening surfaces for whatever I need, and the holder itself has the same footprint as just one plate.

I used a 1" core box bit to create notches for finger grips in the side. I also routed a recess in the top and bottom of each end cap, as well as on the side of the base (detail 'b'). The recess on the base makes for an easy grip while the recess on the caps add some visual interest.

END CAP
(3" x 2 3/4")

BASE
(3" x 8 1/4")

1/2" rare-earth magnet

1/2"-dia.
1/8" deep

1 3/4"

1 1/16"

1 1/8"

3/16"

#8 x 1" Fh woodscrew

1/2" x 3/4" x 1/16" aluminium channel

Base

1 1/2"

c.

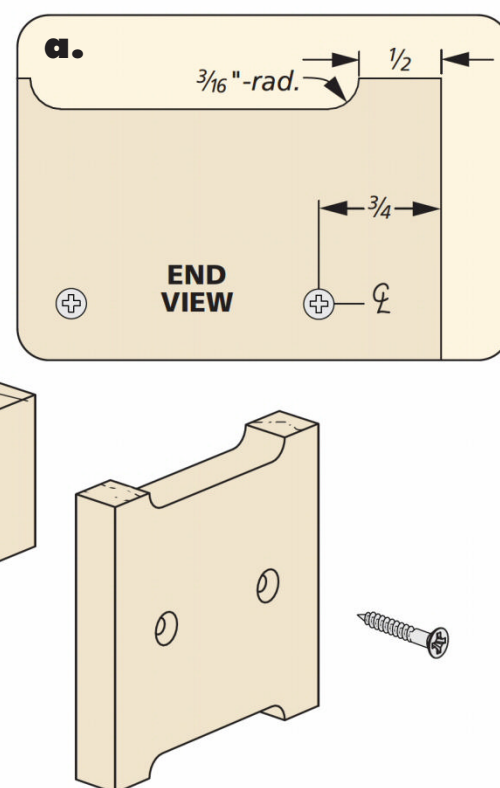
SIDE VIEW

1/16"

9/16"

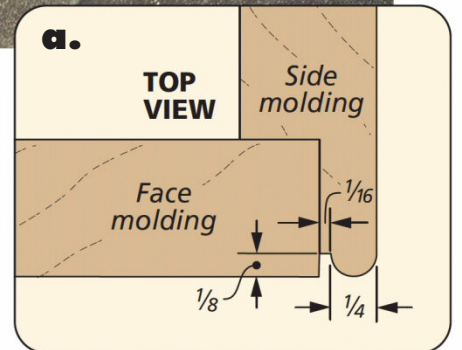
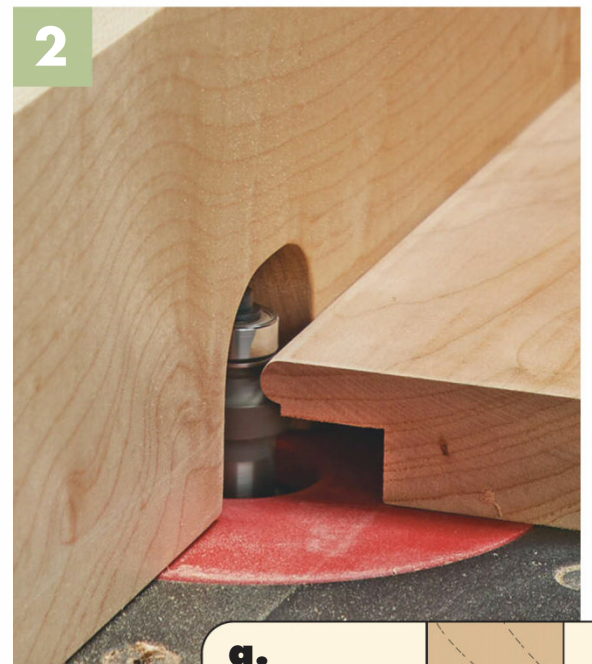
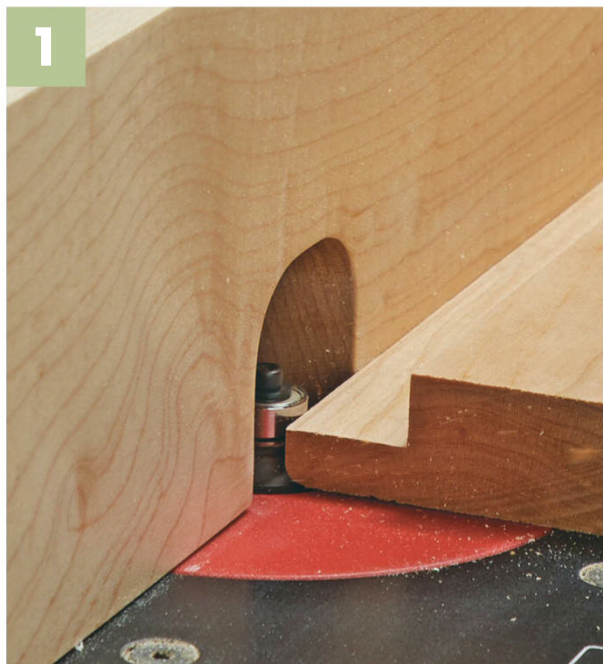
7/16"

NOTE: End caps are 1/2" thick and base is 1 1/2" thick





Bead moulding is a great way to add style to a project



Beads Without a Beading Bit

I don't own an $\frac{1}{8}$ " beading bit, which posed a particular challenge when I was working on the Oak Nightstand from issue 208. However, I did have an $\frac{1}{8}$ " roundover bit, and with a little ingenuity I that'd be enough to do the job.

I started by cutting a rabbet, sizing it to accept the face molding and leaving a $\frac{5}{16}$ " tongue to accommodate the bead and quirk.

Next, I headed to the router table to form the bead, rounding over the outside edge, as you can see in Photo 1 above. Then I flipped the piece over once again to finish the other side. It took me a number of passes to form the bead, slowly raising the bit with each pass until I was happy with the shape, which you can see in Photo 2 and detail 'a' to the right.

This method let me get a bead without a specialized bit, plus the seam between the face molding and the side molding is now buried in the bottom of the quirk rather than exposed on the side of the cabinet.

Bruce Vincent
St. Louis Missouri



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Multi-Router shown with optional Stand.

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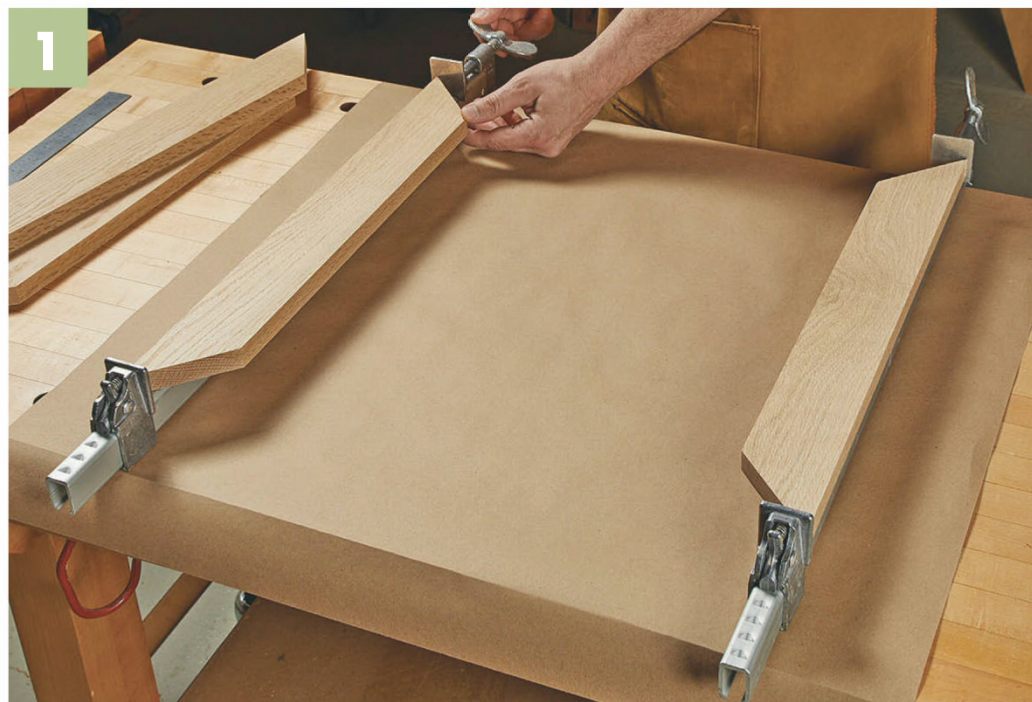
Mitered Frame Clamping

Mitered joints are one of the cleanest ways to assemble a frame, but with glue's slippery consistency, they're not the easiest to clamp up. However, this simple process ensures your frame stays aligned.

Begin by placing a pair of frame pieces in a clamp, as shown in Step 1. The idea here is that the heads of the clamps register the parts to keep them flush.

Once the first pieces are held, apply glue to the miters and slip the remaining frame pieces in place, adding additional clamps along the top and bottom (Step 2). Finally, adjust the clamps to align the miter joints. Tighten the clamps down slowly to finish the glueup, making sure the miters keep aligned.

*Andrew Peterson
Sioux City, Iowa*



Start at the Side. Begin by lightly clamping two same-length sides of the frame parallel to each other, just enough to hold them in place.



Placing the Frame. Once the sides are held, put the remaining pieces of the frame in place, then apply glue and lightly clamp.



Final Adjustment. Lastly, adjust the clamps to align the miter joints as needed before tightening them down.

SUBMIT A TIP TO WIN



GO ONLINE

If you have an original shop tip, we would like to hear from you and consider publishing your tip in one or more of our publications. So jump online and go to:

SubmitWoodsmithTips.com

You'll be able to tell us all about your tip and upload your photos and drawings. You can also mail your tips to "Woodsmith Tips" at the editorial address shown on page 2. We will pay up to \$200 if we publish your tip.



▲ This handy tip isn't limited to just the wash bottle you see at left. Empty ketchup and mustard bottles work just as well!

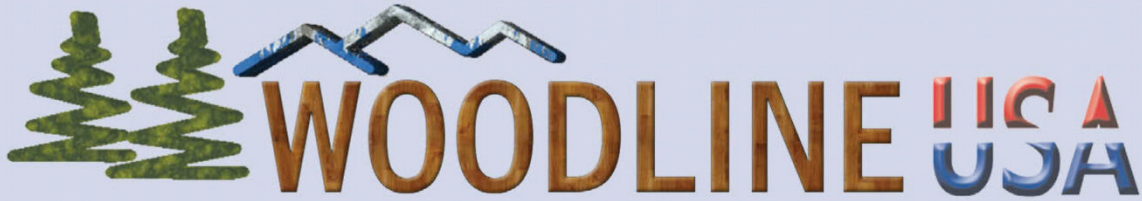
Mess-Free Finishing

To make it easier to apply a wipe-on finish, I purchased a wash bottle from a nearby *Walmart*. When it comes time to finish a piece, just dispense a small amount

of your finish into the bottle. A squeeze bottle like this makes it easy to control the amount of finish, applying just enough without making a mess. A cotton rag helps

apply the finish to your workpiece, and nitrile gloves keep your hands clean as well.

*Alex Whitten
Kansas City, Kansas*



WOODLINE USA

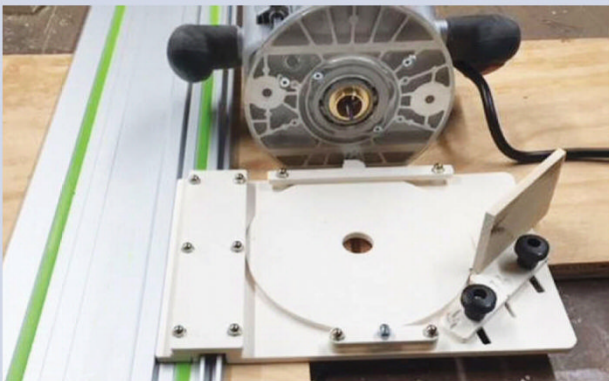
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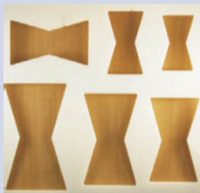
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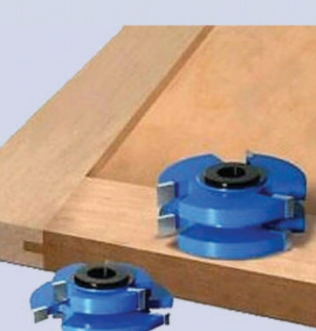


Get precise dados with your router & our Dadoright™ Jig. Versions available for ProGrip™ style clamps, Festool™, Makita™, TrueTrac™ and more.







What can we help you make today?

Installing Threaded Inserts into Plywood

Installing threaded inserts into the edge of plywood presents a challenge. First, you have to make sure you're drilling a straight hole. Second, there's always a chance that the edges of the plywood will split as you install the insert. Luckily, there are a few easy solutions to these problems.

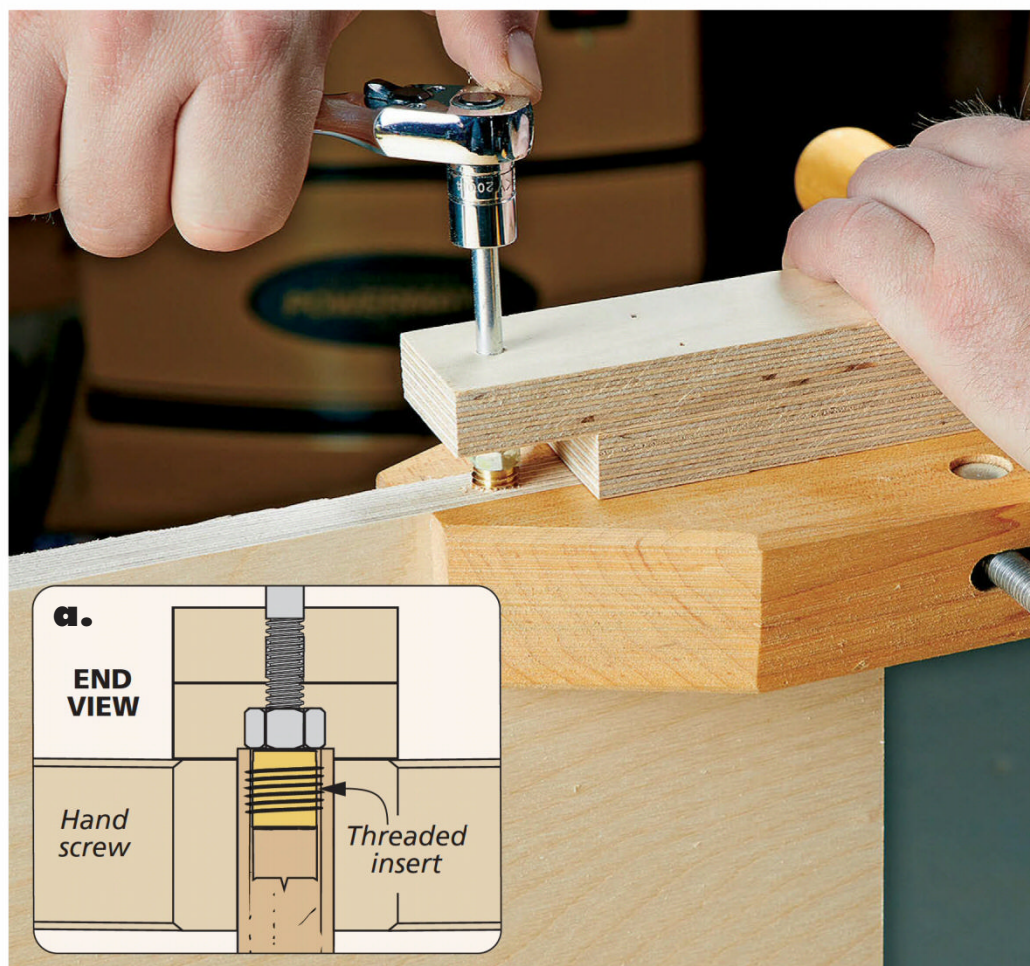
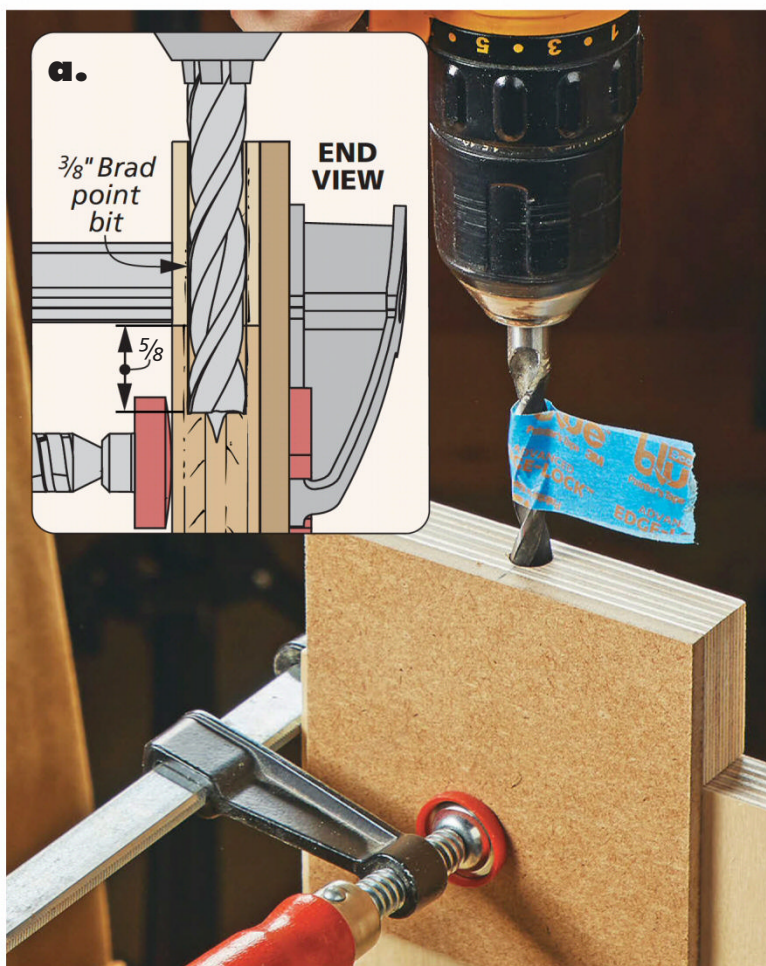
The first step is to use a drill guide. You can see what I mean

in the lower left photo and drawing. It's a plywood cleat with a through hole glued to a hard-board fence. To ensure the hole is at 90°, I drilled it out on the drill press. Then I simply clamped this to the edge of the plywood and drilled the hole for my insert, using tape to gauge the depth.

I used a handscrew (a clamp works as well) to support the ply-

wood edges as I drove the insert home. The photo at lower right shows this. To install the insert, I used a bolt, a nut, and an insert guide. The insert guide is just two pieces of plywood with a hole to fit the bolt to keep the insert straight. From there, a socket wrench makes it easy.

*Nathan Heemstra
Primghar, IA*



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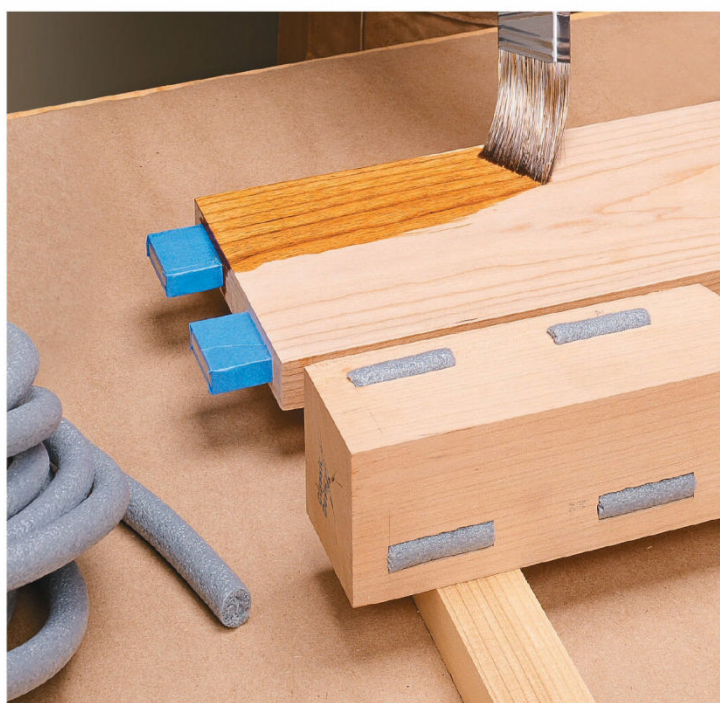
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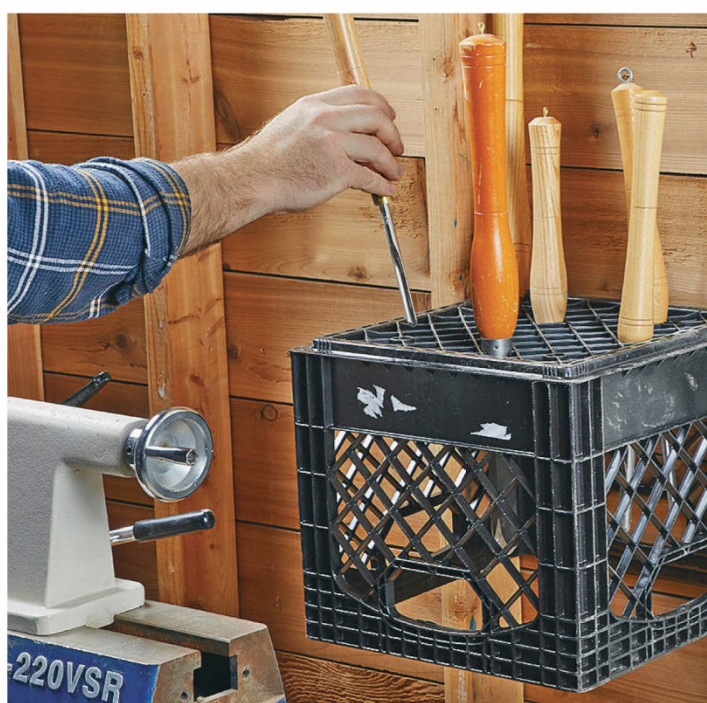
You'll receive one of our favorite tips by email each and every week.



QUICK TIPS



Prefinishing Protection. Don Filson of Lima, OH used masking tape and some foam backer rod to protect glue surfaces (like the mortises and tenons you see above) when he was prefinishing parts. This gives you a better finish and strong joints.



Quick Lathe Tool Holder. Jack Sarcone of West Des Moines, IA likes to keep his most used tools at the ready when turning. To make sure they're holstered nearby, he found a spare milk crate and attached it to the wall with a few screws and some big washers.

Woodpeckers® Slab Flattening Mill•PRO

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- Flatten stock as thin as 3/4" & up to 3-7/16" without shimming.
- Straight-line edges on stock up to 2" thick.

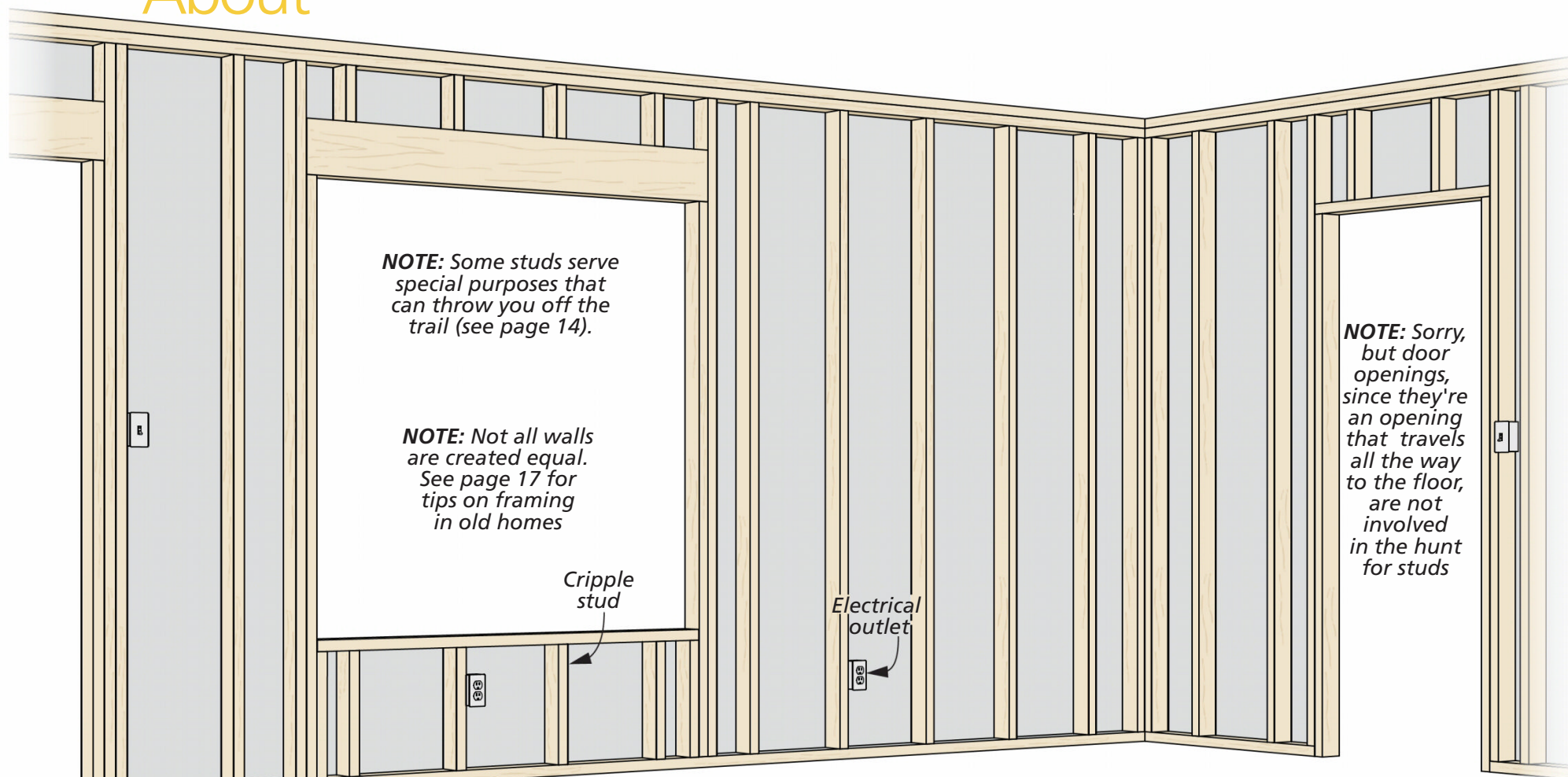
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Router not included.



NOTE: Outlets are your ally when you're on the hunt for wall framing

NOTE: Door openings unlike windows, do not have cripple studs at floor level that are in the framing schedule

Low-Tech Stud Finding Tricks



Basic Tools. A hammer, #6 finish nail, tape measure, and a pencil are all the tools you need to find wall framing.

It's time for a face lift in your home. It could be re-trimming the interior with a new, more fashionable material. Maybe you want to hang some floating shelves (known as torsion boxes) or install built-in bookcases that need to be anchored to the framing of the house.

All of these projects require you to attach something to an object hidden in your wall — the infamous stud. A stud is the infantry member of the framing of your house. Framing is the underlying skeleton of your house. Understanding the logic behind the placement of these bones will give you the confidence to hunt down the location of studs without having to lay out a lot of cash for tools such as stud finders and density meters.

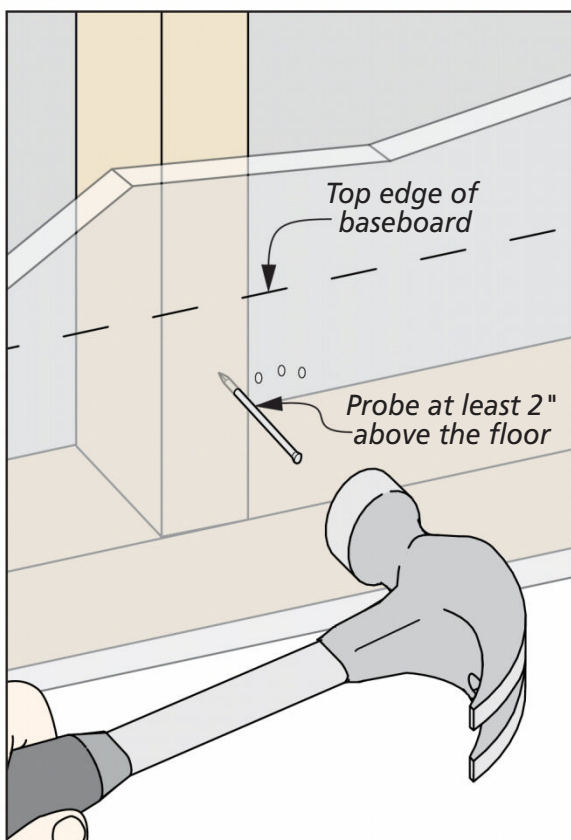
FINDING A STUD. Yes, let the dad jokes ensue, it can be hard to find a stud if you don't know where to start. As you can see in the drawing above, when trimming a door or window the framing underneath both accounts for the fastening needs of the cosmetic items.

But out in the field, away from doors and windows it's a different story. You know there's a forest of two-bys under the drywall, but how to pin them down? Not to despair, there is a method to the madness that is framing. The next page has some tried and true tactics for tracking down the notorious stud.

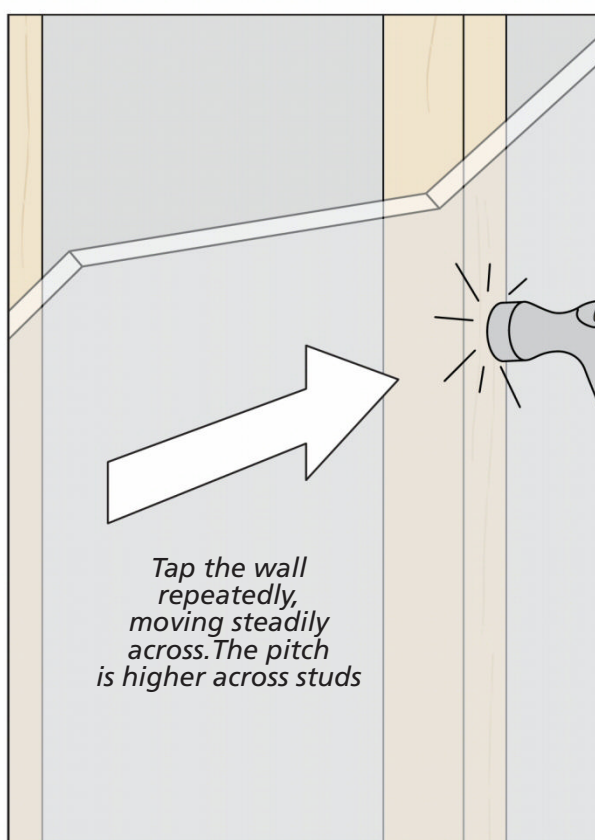
DETECTIVE WORK

The left drawing on the top of the next page shows the base board removed and using a hammer along with a #6 finish

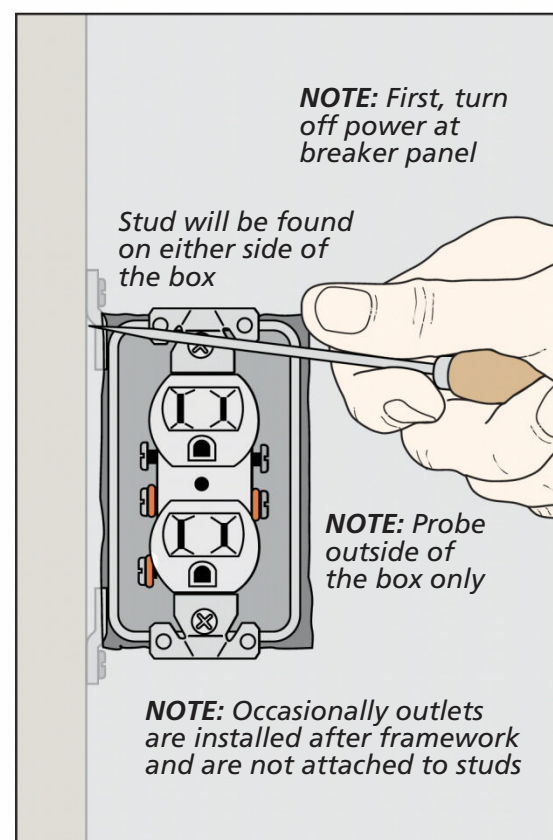
START WITH SIMPLE SOLUTIONS



Behind the Baseboard. You can start your search in the space between the upper edge of the baseboard and the top of the bottom plate .



Sorta Sonar. The sound of a hammer tapping on the wall surface will reveal what's behind the wall. When you're close to a stud, the pitch is the highest.



Electrical Clues. All outlets are nailed to studs. When you've determined which side the framing is on, you can begin the search for other studs.

nail to locate studs. Drive the nail at least 2" above the floor so you're not hitting the bottom plate of the wall. Searching in this space means you won't have any wall repairs to worry about.

SOUNDING THE WALL. The middle drawing shows using of a hammer to tap across the surface of the wall. The sound is lower in the cavity between the studs and the pitch will rise as you pass over the stud.

ELECTRICAL CLUES. Electrical outlets are attached to the framing members of your house. To find out which side the outlet is attached, first, turn off the power at the breaker panel. Then remove the plate cover and use an awl to probe either side of the box. Now that you've located one stud, you need to confirm that it's a stud that falls within the 16" on center schedule, or if it's a stud that serves a secondary purpose.



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6"

5"

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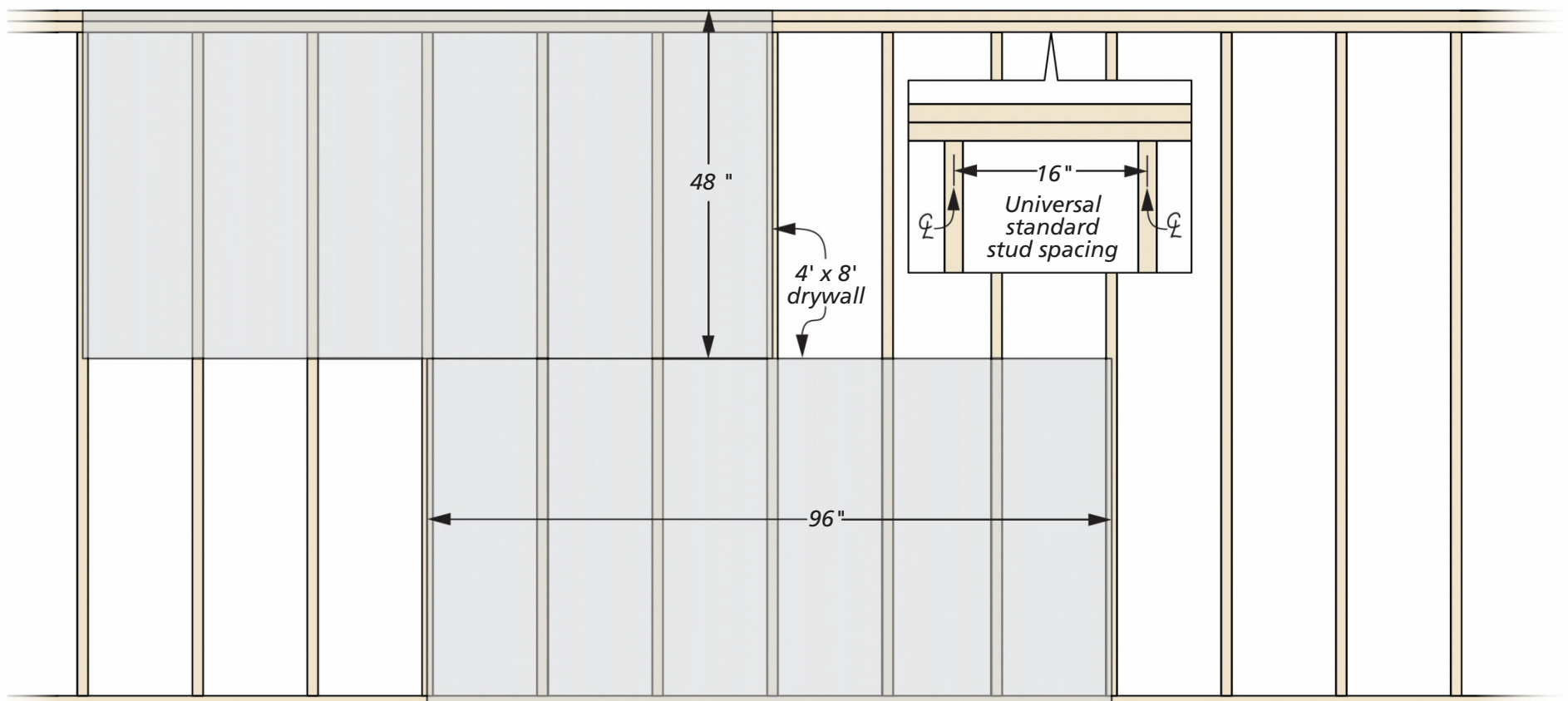


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ON CENTER, ON SCHEDULE

The examples of finding studs on the previous page are all fine and good if you happen to hit a stud that's in the 16" on center standard spacing. The problem is that there are studs in your wall that don't conform to that pattern. More on that in a moment. First, let's look at the basics.

SIXTEEN INCHES. Sixteen inches on center is the standard for framing walls in the United States. The system is designed

for optimal strength, and material use. The spacing pattern is aligned to the standard sizes of sheet good materials (4' increments). The wall that you see above is a perfect example of a wall that's uninterrupted by windows, doors, or other walls.

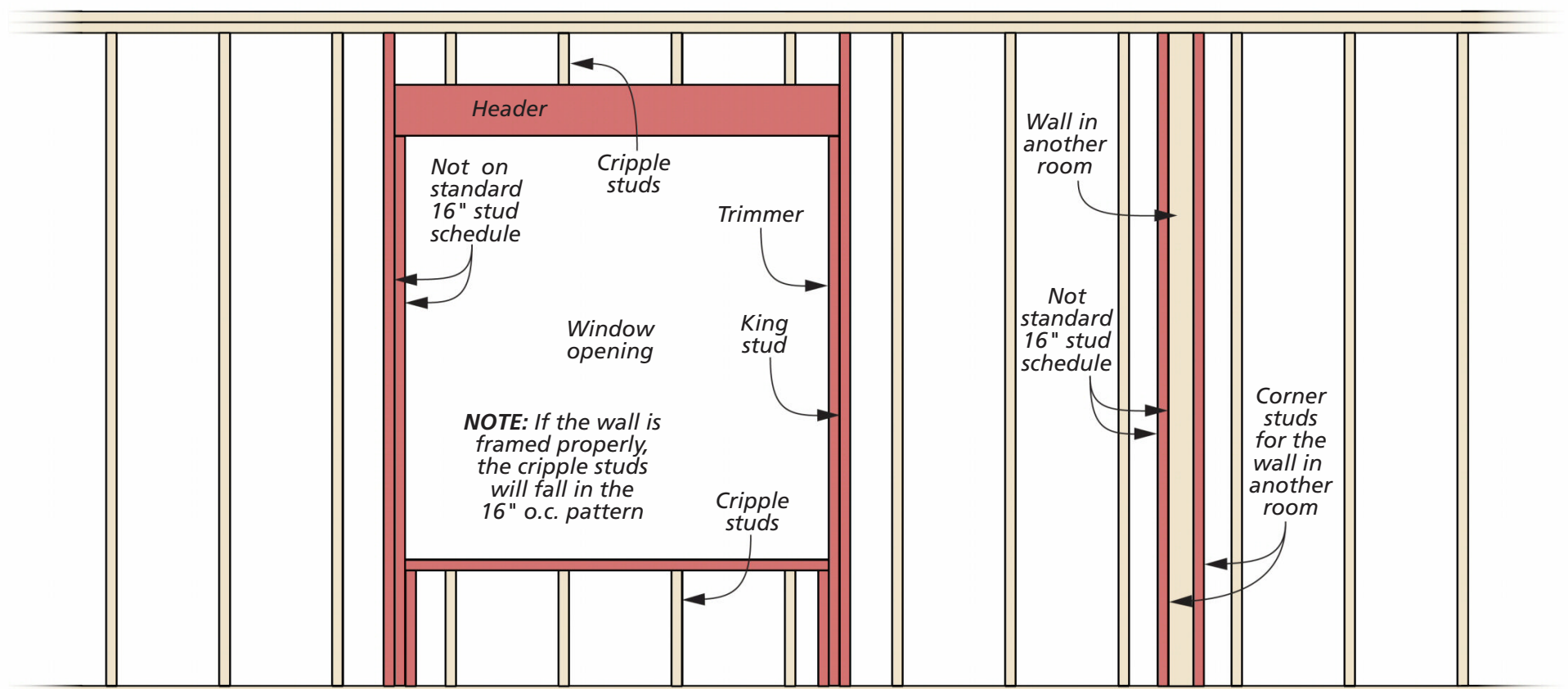
OUTLIERS

The drawing below shows the framing required for a window, and the supporting material for an adjacent wall that's in a room

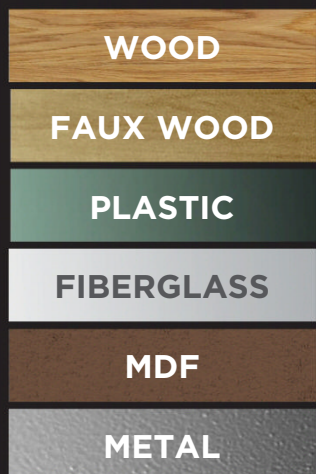
behind the wall we're looking at. These outliers are highlighted in red for clarity.

STUDS GONE WILD. The framing for the window is self-evident. The trimmer and king studs carry the load from above and provide a nailing surface for the window trim.

The devil to look out for is the corner studs you see below. If you find one of these and assume you've found the greater stud pattern, you'll be frustrated.



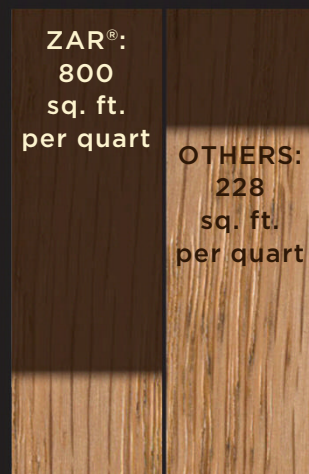
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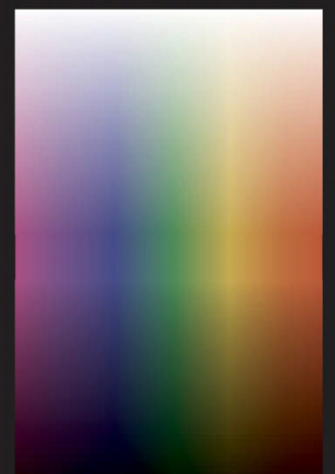
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HANGING HEAVY STUFF

Now that you have a better understanding of the framework behind the drywall, let's look at a sound method of securely attaching items that float above the floor.

If you're attaching things to your wall that are also supported by the floor, such as a bookcase or cabinet, you don't have to be as exacting as the process that is shown here.

To avoid later wall repairs, you can draw a level line at the shelf height and do all your stud-finding research below this line (Figure 3 shows this in action).

FIND THE STUD PROFILE. Figure 1 shows a nail being used to find the complete 1½" profile of the stud. Now that you've nailed down the center of the stud (sorry, couldn't resist that) you can start the search for the other studs required to hang the shelf.

MARK THE LAYOUT. A nail firmly driven in the center of your stud is what you hook the end of your tape on (Figure 2). Simply make a reference mark every 16" across the length of the shelf (or cabinet).

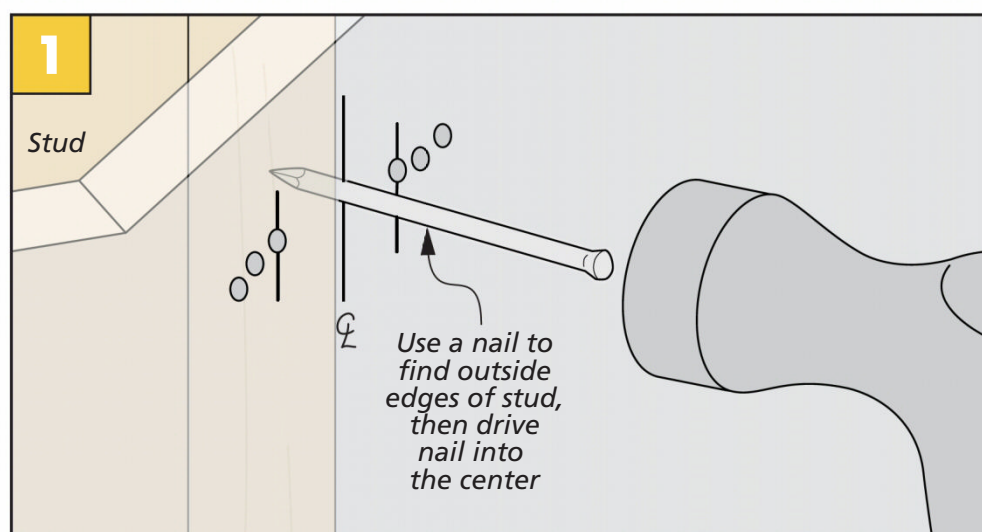
CONFIRMATION. In the words of a famous politician, "Trust, but verify." You need to confirm that your marks are dead center on each stud. It's a repeat of what you did at the start, Figure 3 shows this in action. And since you've done all this behind the shelf, you'll have no wall repairs on your to-do list.

ECCENTRIC FRAMING

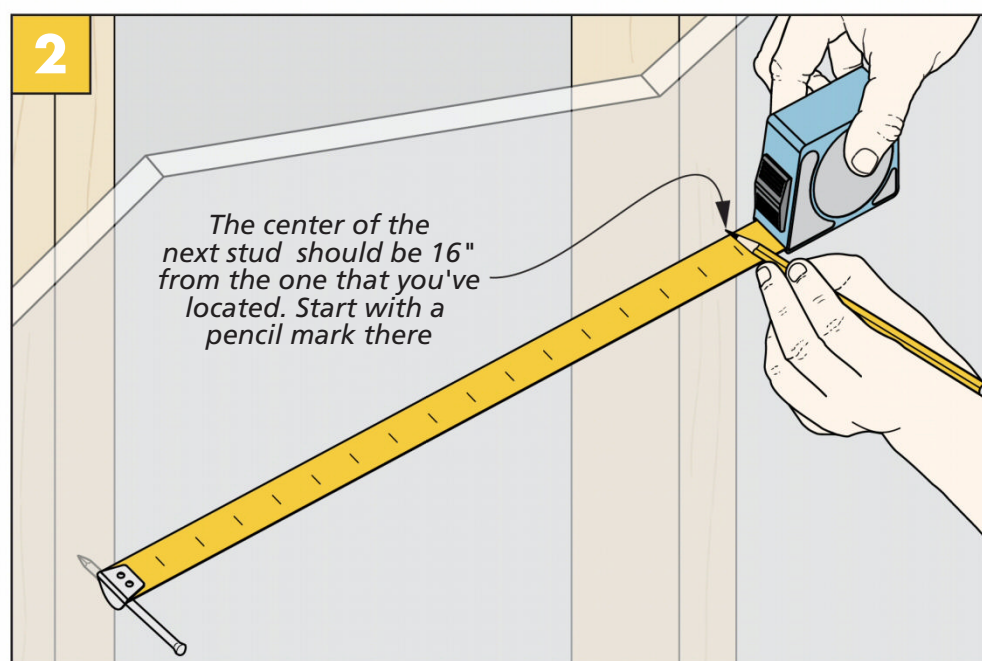
"They sure don't build them like they used to." In the case of framing that's a good thing. Scheduled framing has been around quite a while, but came into full force at the end of WWII.

The world of framing from before that time is often a real head scratcher. The most commonly know method of framing

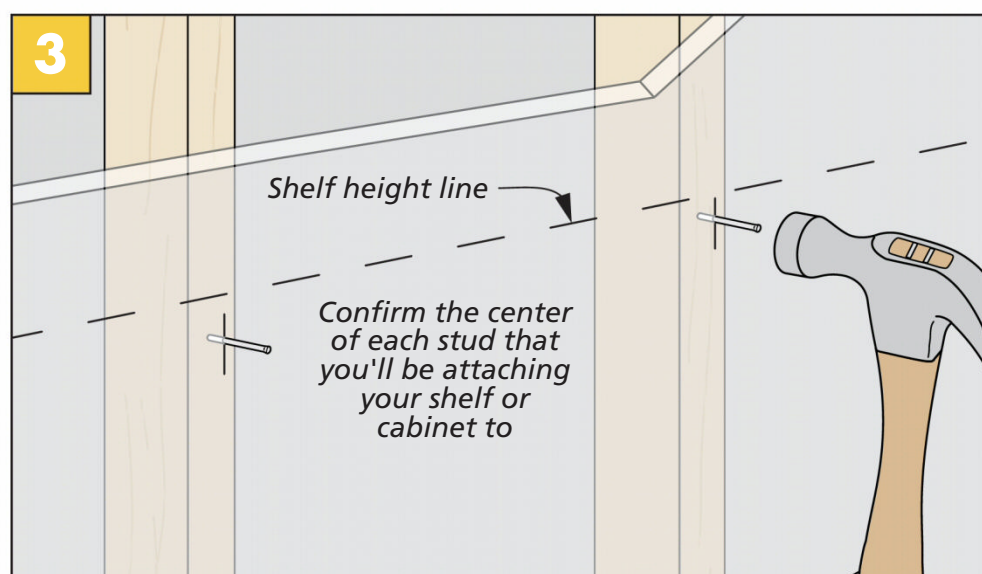
FINDING MULTIPLE STUDS



Find Dead Center. A #6 nail is ideal for making the multiple holes required to find the edges of the stud. Then drive the nail into the center of the stud firmly enough to hold the end of the tape.



The Rest of the Story. Hook the end of your tape on the nail that's embedded in the stud. Then make a light pencil mark at the location of the rest of the studs you need to locate in the wall.



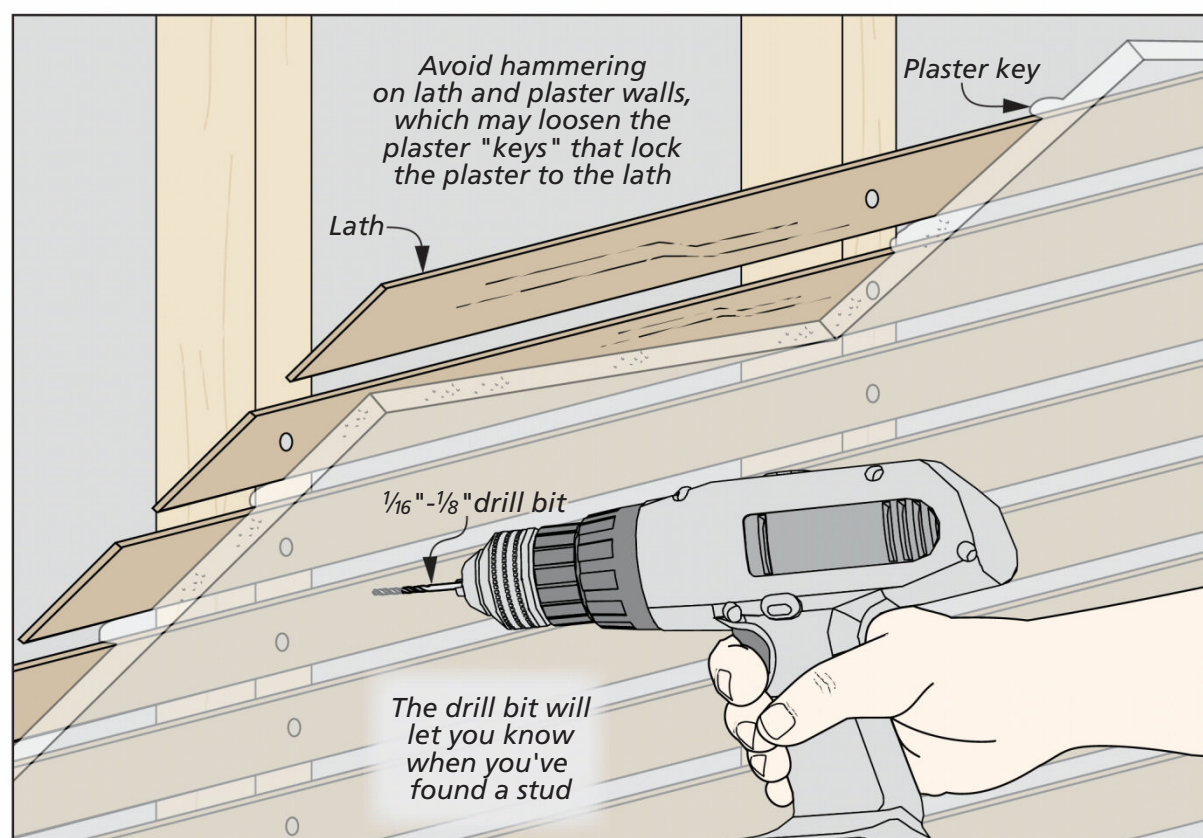
Confirm the Centers. You'll want the peace of mind that comes with knowing you've found the centers of each stud. You don't want a screw or bolt blowing out the side of the lumber.

was called “balloon framing,” this is where the studs ran from the sill plate at the base to the rafters at the top. They followed a schedule, sometimes 16" o.c., sometimes 24" o.c. It often depended on the lumber supply and the carpenter’s mood.

Most of the walls in the homes of that era have lath and plaster walls. The box to the right shows how to tackle finding studs there.

PLASTER ANATOMY. Although plaster is rock hard, it does have a weak point — keys. Keys are formed when the first coat of plaster squeezes between the lath and, when dry, is the base that holds the other coats on the wall. If you treat the wall roughly and those keys break off, the wall surface is no longer attached to the framing and can fall free. If that happens, you’ll have found all of the studs you want, but have a whole new headache on your hands. 

OLD-HOME CHALLENGES



Slow & Steady. A drill with a bit is the best way to go hunting for the framework behind a lath and plaster wall. When the resistance on the drill bit never lets up, you’ve most likely found your first stud.



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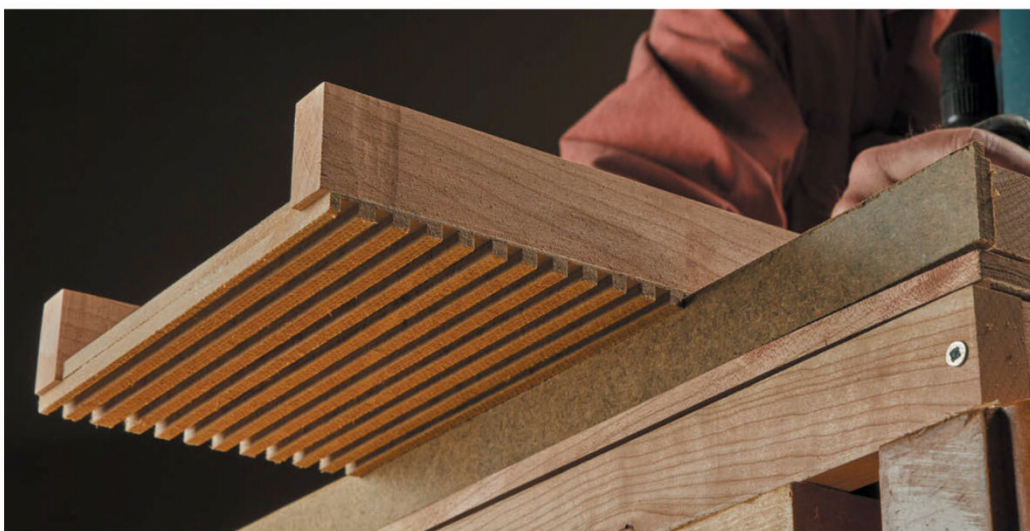


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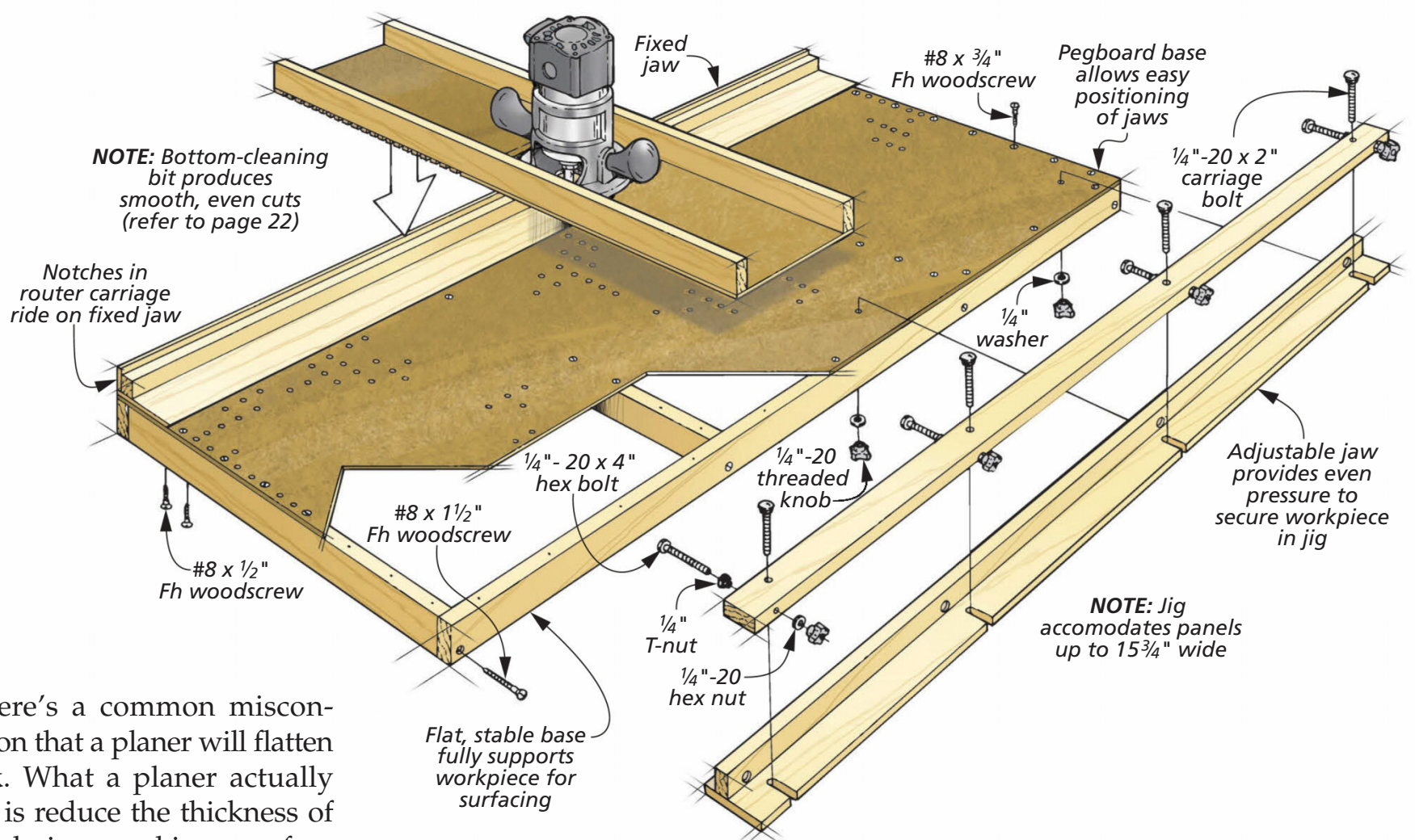


Planing Rough Stock



▲ Grooves in the bottom of the router carriage index on the hardboard carriage guide attached to the fixed jaw. This allows you to plane in a straight line and move across the board in even increments.

I was working on a project recently when I got the opportunity to use some air-dried lumber straight from a mill. I started with a couple eight-foot-long slabs of rough-sawn hickory, and I was excited to work with them. Air-dried lumber has a rich color, and I find it's far less prone to chipping and tearing out than kiln-dried wood. I had one issue though, and those familiar with rough-sawn lumber will likely see where I'm going. I enjoy working with rough-sawn wood, but those planks will almost always dry unevenly, warping, bowing, and twisting. That's what I was working with, and no planer or jointer I had around was going to be able to deal with it.



There's a common misconception that a planer will flatten stock. What a planer actually does is reduce the thickness of a workpiece, making one face parallel to the other. Naturally, this means that to get a flat workpiece, you've got to start with one flat face. And with the size of workpieces I wanted to use,

the jointer wasn't going to be an option. I could've broken out the hand planes, but that would've made for one long day. Instead, I chose to tackle this problem

with a router and a shop-made jig. Not only did the jig save me time on this project, but it'll be great for any rough-sawn stuff I get my hands on down the road.



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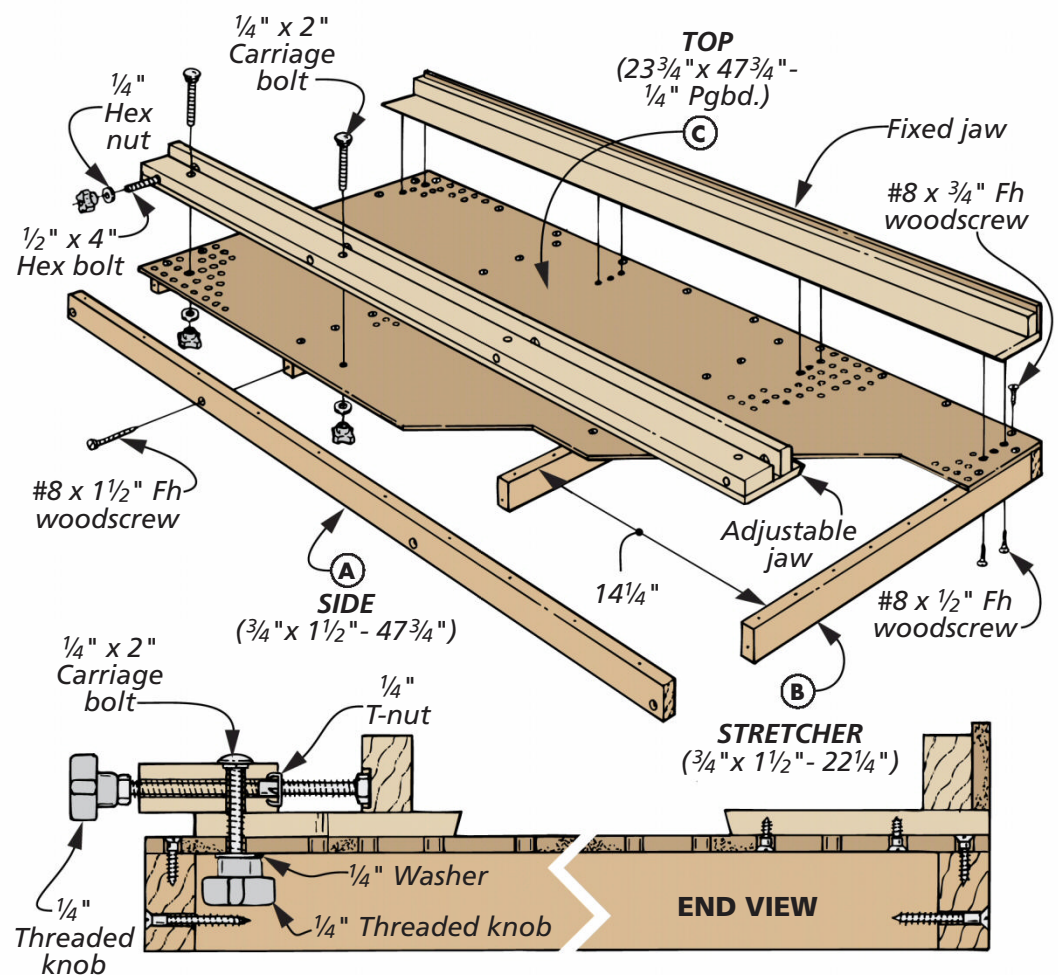
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Not only is this jig good for rough lumber, but even glued up panels or end grain cutting boards. After one face is flat, just flip the workpiece over and rout the board to whatever thickness you need, or stick it in the planer if it fits. The jig uses a router riding on a carriage. Grooves in the bottom of the carriage allow you to rout in even increments, sliding along a guide and a couple of rails. The workpiece rests between the rails, below the router. The router is simply moved across the piece, and because it stays at a fixed height, it removes the high spots and flattens the surface.

This jig is a great option for any woodworkers without a planer in their shop, and it can also be used on glued-up panels and boards that are too wide for most thickness planers or jointers. The jig here works on pieces up to $15\frac{3}{4}$ " wide – but you could go even further by extending the width of the base and the length of the carriage.

This jig is designed to handle stock up to $1\frac{1}{2}$ " thick, and to plane stock to as thin as $\frac{1}{4}$ " using shims, as long as your plunge



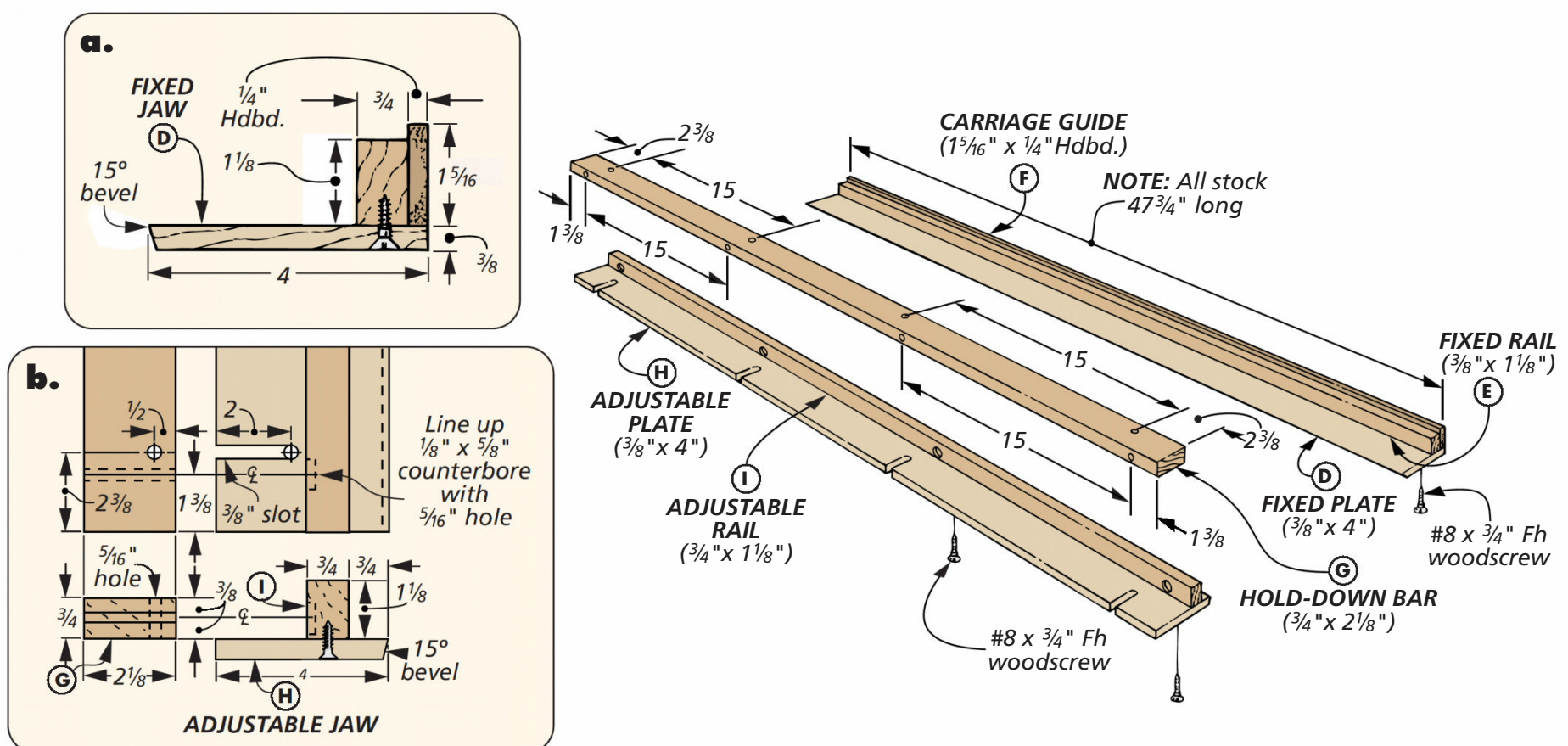
router reaches that far. Alternatively, by increasing the width of the rails and carriage guide, the jig could be used to plane down even thicker pieces.

MAKING THE JIG

The base of the jig is just a hardwood frame consisting of two sides screwed to four stretchers (drawing above). For the

surface, I used $\frac{1}{4}$ " pegboard. This lets me adjust the position of the jaws for narrower pieces. Instead of drilling extra holes to attach the pegboard, I cut the pegboard so the existing holes were centered over the frame.

JAWS. Next up is the fixed jaw. As you can see below, there are three parts: a plate, a rail, and a carriage guide.



The plate is beveled (detail 'a,' previous page) for a better grip. The rail is screwed to the plate to form an L-shaped support for the carriage. Lastly, the carriage guide is made from $\frac{1}{4}$ " hardboard and glued to the rail. Once the fixed jaw is made, mount it to the base.

The adjustable jaw has three parts as well, but there are a few differences at play. First, the plate on the adjustable jaw isn't screwed to the base. Instead, it's held by a hold-down bar, allowing the adjustable jaw to move and press against the workpiece.

The hold-down bar sits atop the adjustable plate. Bolts pass down through it and into the pegboard. Again, when making the hold-down bar and adjustable rail, align the holes and slots respectively with the holes of the pegboard. Plastic knobs or wing nuts easily secure the bar and plate to the base.

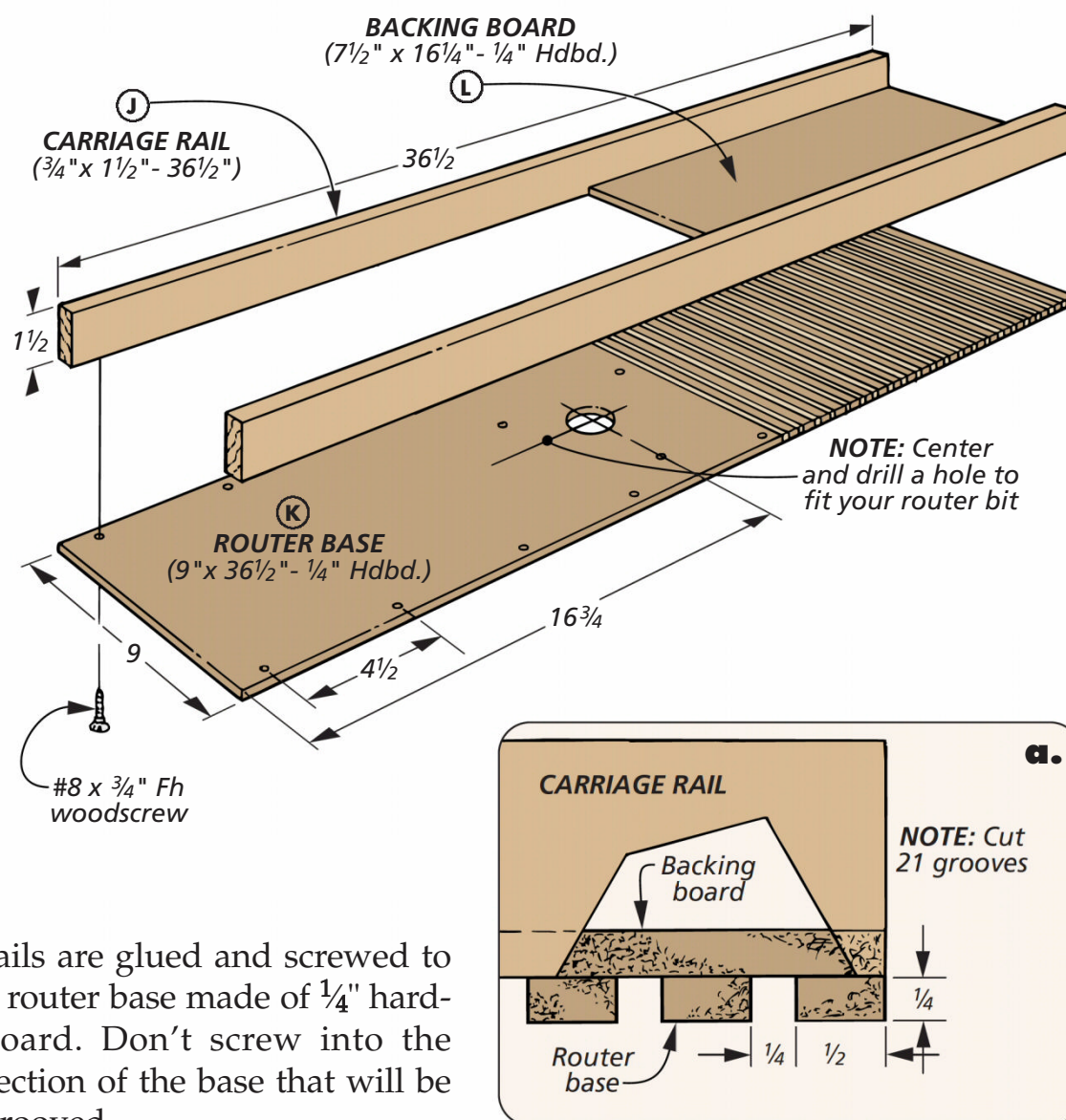
To allow more minor adjustments to the plate, a second set of longer bolts runs horizontally through the hold-down bar and a T-nut, pressing against the back face of the adjustable rail. Counterbores in the adjustable rail accept the heads of the bolts, keeping the jaw from sliding when pressure is applied (detail 'b,' opposite page). The pressure comes from threaded knobs and jam nuts threaded onto the end of each bolt. Once complete, attach the adjustable jaw to the base as well.

CARRIAGE. The carriage shown in the drawing above supports the router above the workpiece as it rides across the jaws. It consists of its own pair of rails with a base for the router. Grooves in the bottom allow you to index the router above the workpiece in even increments as you plane.

Let's start on the rails. These pieces are cut extra long so the carriage spans both jaws no matter where it's indexed. The

rails are glued and screwed to a router base made of $\frac{1}{4}$ " hardboard. Don't screw into the section of the base that will be grooved.

To support the grooves, a backing board is cut to fit between the rails and glued to the top of the base. Once the glue dries, the indexing grooves can be made. These are cut on the bottom of the base and sized to fit the thickness of the carriage guide, as shown in detail 'a' on the previous page and in the drawing above. I spaced the grooves $\frac{1}{2}$ " apart from each other, but at minimum the space between them should be $\frac{1}{4}$ " less than your bit diameter to allow for an overlap on each pass. After the grooves are in, cut a hole in the base for your chosen bit and mount your router to the carriage.



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PLANING WITH A ROUTER

Now that the jig is built, it's time to dive into how to use it. Planing a workpiece is fairly straightforward, as most of the work goes into the setup. Once that's done, it's all a matter of learning the routing technique and getting to work.

THE BIT. Before we get too far, I should talk about which bit you'll want to use. This jig works well enough with a straight bit, but after using it the first couple

of times, I was a little disappointed with the results. When I was done, a series of swirls had been left on the workpiece. I could've sanded or scraped the surface clean, but I figured there had to be a better way.

The issue here was the straight bit I used. Specifically, the points on the bottom of the cutters. After a little reading, I found that a bottom-cleaning bit might be the answer to my problems. It operates much like a straight bit, but it has an additional set of cutters on the bottom to "plane" the surface smooth and flat. This left me with a surface that barely needed smoothed or sanded.

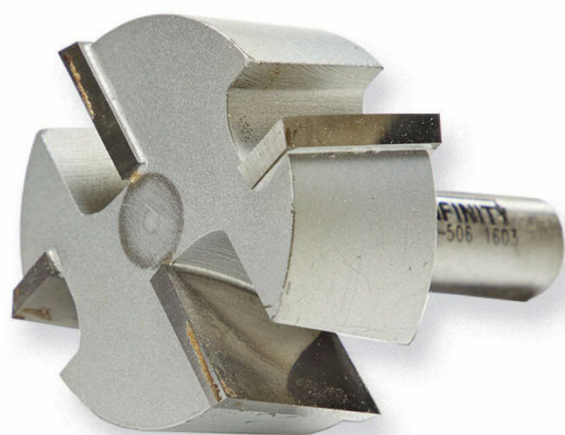
And I was almost satisfied with just that. Luckily, I have coworkers. I was using a 1" bottom-cleaning bit when I was introduced to the bit you see at the left: a spoilboard bit. This bit had a lot in common with my bottom-cleaning bit, and as it turns out, it's typically used to flatten the spoil board of a CNC machine. The big advantage here

is that the one pictured (and the one I now prefer for this jig) has a 2" diameter. As a result, this bit cut my work time in half. Now I can plane down a workpiece with this jig in minutes.

USING THE JIG. No matter which bit you've decided to use, the technique is the same, as you can see in the box below.

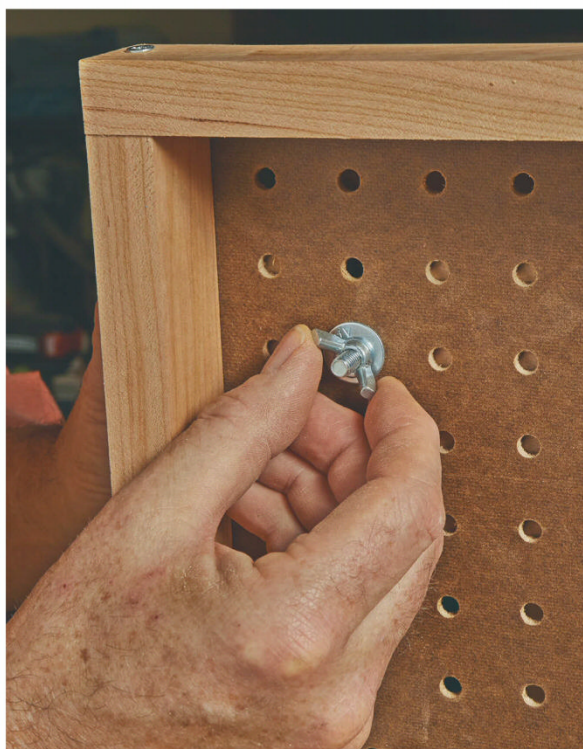
First, secure the workpiece in the jig. Position the adjustable jaw on the platform. This is more of a broad-stroke positioning, so locate it as close to the workpiece as you can now, but leave the hold-down bar a little loose. Now use the knobs to tighten the hex bolts, moving the adjustable rail and plate. When the adjustable plate is firm against the workpiece, tighten the hold-down bar fully to lock it in place. For heavier workpieces, you'll want to have the jig hanging over the edge of your bench while you get the adjustable jaw assembly in place.

When you place the workpiece in the jig, pay attention to the



▲ Spoilboard bits are designed to leave a smooth, flat surface, and they make planing a wide piece quick work. You can find our source for this bit on page 66.

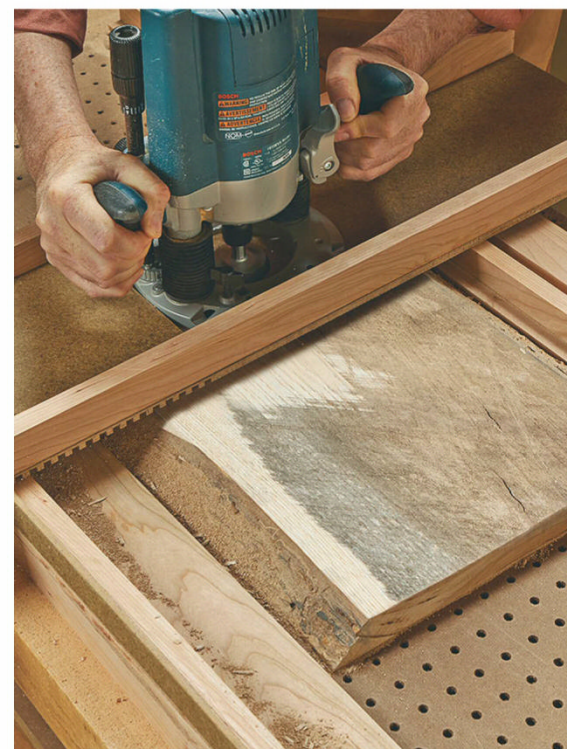
USING THE JIG



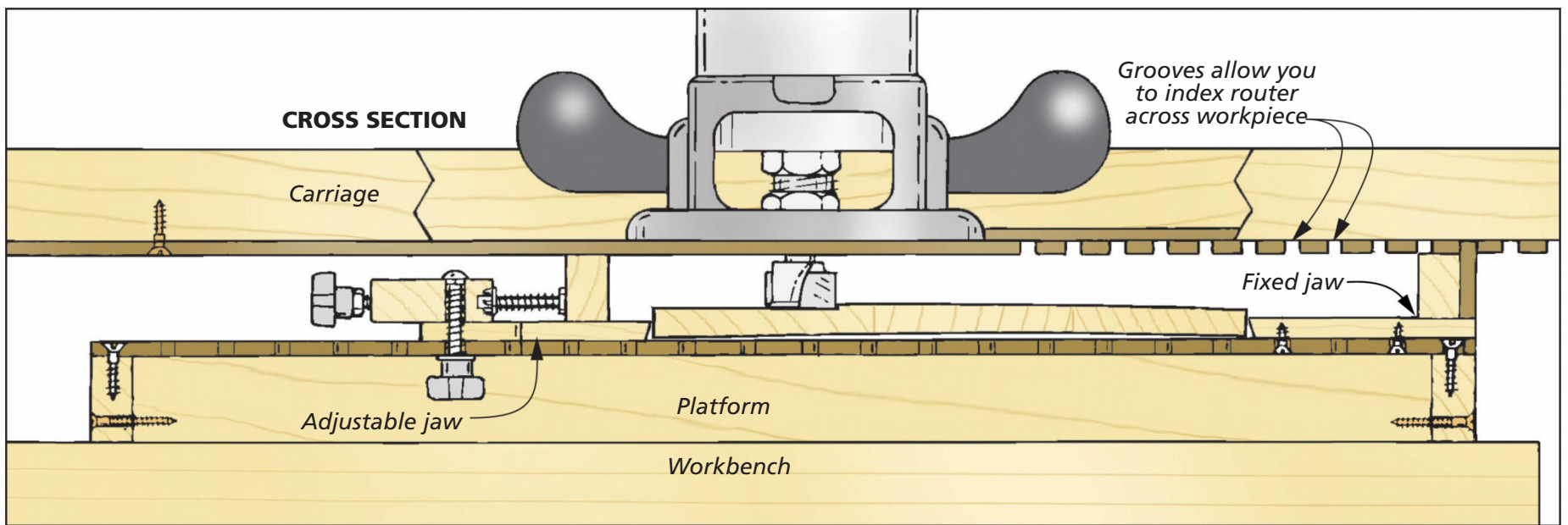
Position the Jaw. Begin by positioning the adjustable jaw assembly as close to the workpiece as possible.



Secure the Workpiece. Tighten the hex nuts until the adjustable plate firmly grips the workpiece.



Flatten Away. Index the carriage and run the router across the workpiece to plane. Then re-index and rout again.



initial shape. Is it cupped, or is it twisted? If you're surfacing a twisted piece, you can put either side up first, so long as you make sure to remove all the high spots before flipping it. When working on a cupped piece, start with the concave side facing down (as shown in the art above) to prevent the workpiece from rocking.

If the jig does end up rocking, you may notice that one stretch has a slightly different depth than the one beside it after you've routed, leaving a ridge. You may need to shim up the areas not touching the platform to stop it from moving.

If you keep finding a ridge, check under the hold-down bar to make sure it locks in place. A lot of material gets removed this with this jig, so sawdust will eventually end up everywhere.

If you're surfacing a warped board instead of a rough one, keeping track of progress during your planing can be difficult without some kind of reference. Covering the surface with pencil marks is an easy way to do this, planing until they're gone.

While you rout, try to apply a steady amount of force throughout, and keep the force consistent between passes. Several passes may be needed to flatten the surface. This is easy to do with most plunge routers by simply adjusting the turret on the depth stop. I like to limit the depth of the cut

to around $\frac{1}{8}$ " per pass to prevent tearout and keep the stress on my router motor to a minimum, especially with a larger bit like I was using.

THE OTHER SIDE. Once you've flattened one side, you can run the opposite face through the planer, so long as your planer is wide enough. As I mentioned earlier, since you're starting with one flat face, this will leave you with a flat, parallel-faced workpiece. If you chose to stick with a standard straight bit, you can run the routed face through afterward to remove the router marks. The marks will be small enough that it won't make a difference when planing the workpiece down to thickness.

Alternatively, this jig can be used to bring a workpiece to thickness in place of a planer. In this case, all you need to do once you've surfaced one side of your piece is flip it over and surface the opposite side.

IN PLACE OF A PLANER. This jig has become my go-to for planing rough-sawn lumber. For anyone who has yet to buy a planer, or who's looking to work with pieces too wide for the one they

have now, this jig is an excellent choice. Keep in mind, you can also build the jig longer or wider than the dimensions shown here to accommodate larger pieces, and because the jaws can be easily removed, multiple sets of jaws can be made to handle a wide range of thicknesses. So whether you're working with a cupped panel or some rough-sawn lumber, this jig is bound to be handy. **W**

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Top picks for a better Shop Life

We always look forward to buying new tools for the shop — the bigger they are the more exhilarating the process is. Here we're going to look at some smaller items that may not have the thrill of a new table saw but nonetheless make life better in the shop.

SHELF PIN JIGS

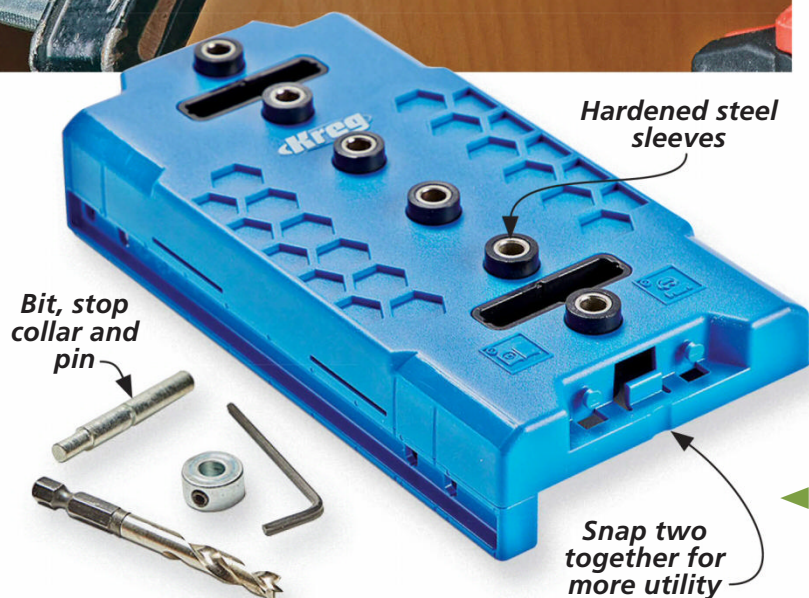
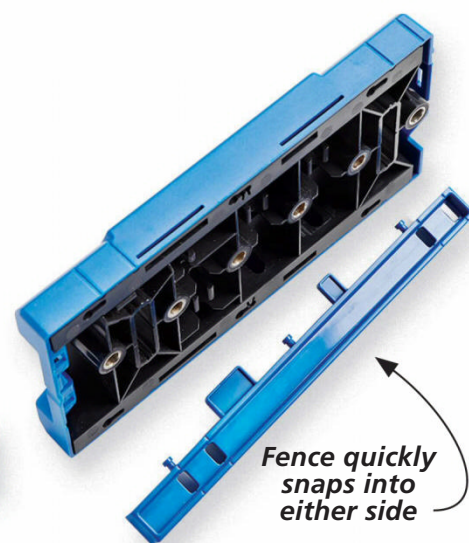
In the pursuit of wanting shelf pin holes to be dead accurate every time, the jig you see here from *Kreg Tools* is up to the task. It comes in two pin sizes: $\frac{1}{4}$ " and 5mm. Each section has six holes that are lined with hardened

steel sleeves (photo, below left). The jig comes with a removable fence that lets you flip the jig. Also, there's a bit to drill the holes, and a guide pin that lets you leap frog the jig for long runs of precisely placed holes. You can buy multiple jigs and daisy chain them together as well. The underside is molded to store the drill bit and guide pin, I like that feature the most. The jig (and shelf pins with generously sized paddle supports) can be bought at Kregtool.com.

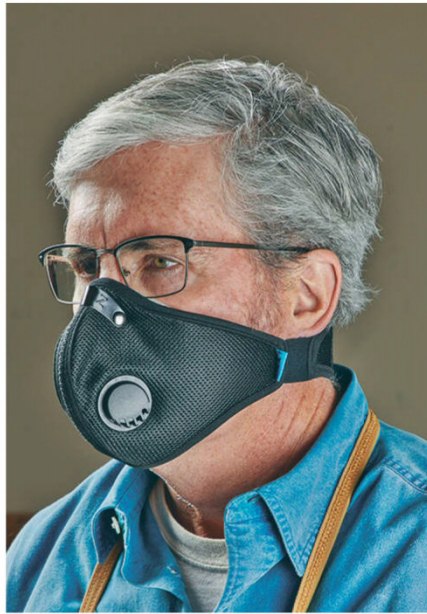
RZ INDUSTRIES

Here's a mask the we can talk about without the heat of politics involved. *RZ Industries* makes the mask you see in the photos at the top of the next page. As you see, the kit consists of the mask, two valves, and a filter that's held in place by the valves. The package includes a carrying bag and two filters.

OPTIONS. The masks come in a variety of solid colors and some unique printed patterns as well. If you buy one of the creative shells, you'll have to harvest the valves and filters from your mask, or buy separate parts that are available at their website.



◀ The Kreg Shelf-Pin Jig is a well thought out jig that stows all the parts you need in the underside of the jig.



▲ The standard mask from RZ Industries was tested by our shop rats and received a thumbs up for comfort. The only downside was the sizing suggestions from the online chart. So order one size up from the chart.

Both the M1 (the original neoprene mask) and the M2 nylon masks that are featured here have a large strap that joins comfortably with hook and loop. The metal nose bridge conforms around your unique schnozz.

PARTS. There are two grades of filters to choose from. The F1 is the standard everyday filter.

The F3, according to RZ Industries is more breathable and preferred by pros in the field of woodworking, construction and landscaping. Also, there are valve options that will expand your masks performance. The masks and all the other accessories can be purchased at their online store rzmask.com.

MAKE A STATEMENT!



Bold Printed Masks. Doing the right thing by your lungs doesn't have to be boring. Shown here is just a sampling of the creative shells that RZ Industries offers to pair with your mask.

DREAM IT.

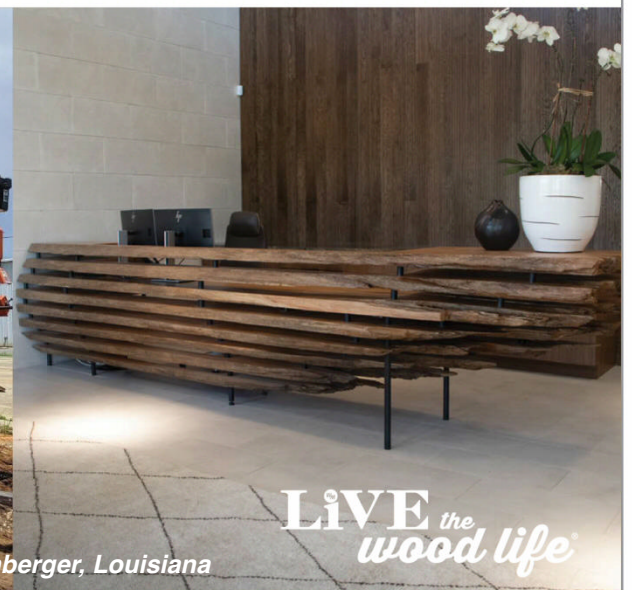
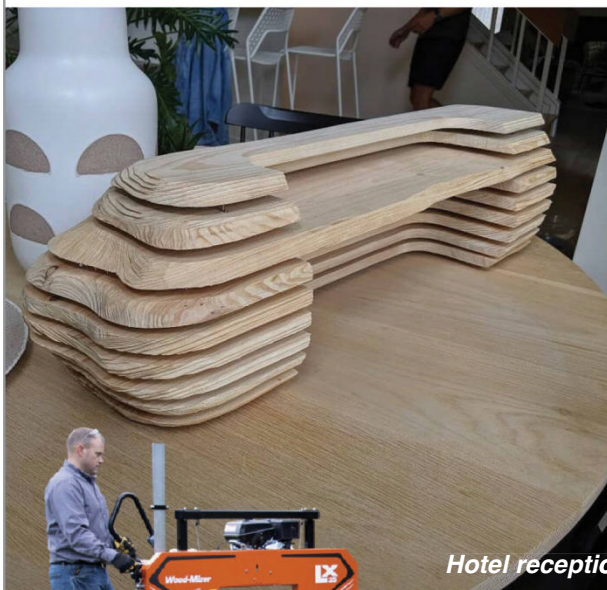
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▲ Kreg's drill guide block works like a champ on the edges of material. But the hole centering marks that let you dial in a hole location on any surface are what makes this tool worthy of a place in your apron or tool belt.

DRILL GUIDE BLOCK

Whenever I needed to drill a hole in the edge of a piece of wood I would drag out my trusty doweling jig. Not any more. The Drilling Guide from Kreg has put my doweling jig in semi-retirement.

This little guy has a lot going for it. Like most Kreg tools, the guide holes are lined with hardened steel sleeves. And the GripMaxx material on the

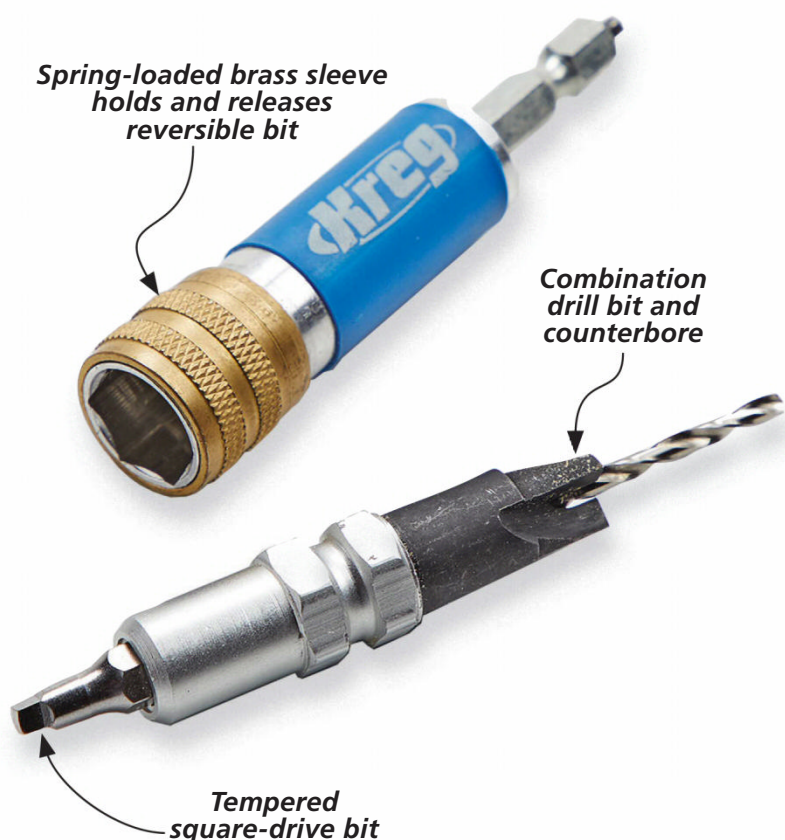
underside holds it in place while you drill holes. The jig cradles the edge of $\frac{1}{2}$ " or $\frac{3}{4}$ " lumber or plywood. But what sold me on the tool (photo above, left), is the hole centering marks on all sides of the block. This feature lets you align to marks and accurately drill square holes in any surface.

QUICK-FLIP

Fastening case parts together is one of those tasks that is

somewhere between boring and annoying — but it's got to be done. The *Quick-Flip* you see below delivers you from the drudgery of having two drills set up for screw installation.

The bit side lets you drill counterbored holes. Then flip the insert and use the square head driver to set the screw (Kreg pocket screws, of course). Conveniently, there's a hex head on the end of the driver that lets



▲ First drill all of the counterbores to the desired depth. Then you can flip the bit to the driver side.



▲ The square bit works perfectly with any Kreg pocket screws. You can plug the hole with a $\frac{3}{8}$ " dowel.



▲ All 90° drill attachments get high marks for their snake-like flexibility. This version from Kreg is a slimmer, well-made version of this specialty attachment.

you change or adjust the bit and driver on the insert.

90° DRIVER

Admittedly, I don't have the need for a right-angle driver very often, so I certainly would never lay out the cash for a dedicated drill with this feature. Especially since this 90° driver attachment for your drill is so much more flexible — in operation and cost.

Installing pocket screws in tight places is a task that's been made a lot easier with the 90° *Pocket Hole Driver* you see above. It comes with a square drive bit that locks into the driver.

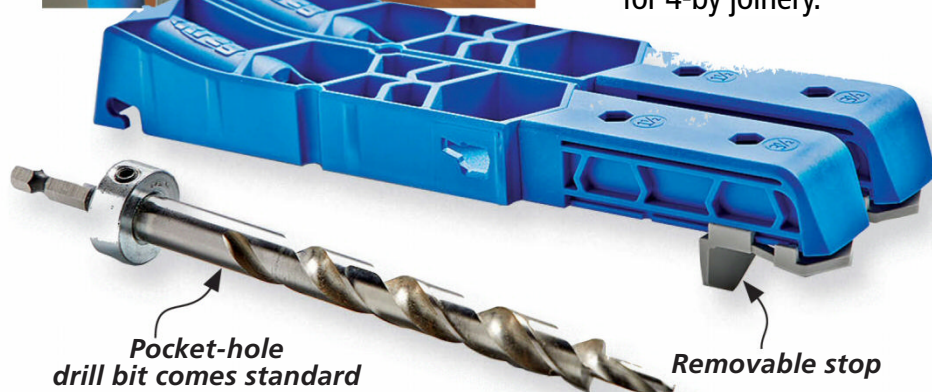
You could also use this bit with any hex shanked bits.

XL POCKET HOLE JIG

The pocket hole jig you see below is designed to maximize the bond between dimensional lumber up to 3½" thick. The guide holes are lined with hardened steel to guide the bit accurately. The tails of the jig adjust to drill for either 1½" to 3½" thick boards. *Grip Maxx* on the underside prevents the jig from sliding around.

The jig is comprised of two halves that can be uncoupled for use on smaller boards. The stops can be removed as well. It comes with a bit

▲ This beefy pocket hole jig and the included hardware are designed for 4-by joinery.



and stop collar that's custom made for the two settings. All this would be pointless without a screw that brings the lumber together tightly. The big #12 x 4" XL screw completes the task of pocket hole joinery on this larger scale. All these tools are found at homecenters, hardware stores, and online at Kregtool.com. **W**

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Valet Chair





◀ Bridle joints are used to connect the chair's framework and add a graphic punch to the overall appearance. The seat is hollowed for a comfortable and subtle detail.



▲ Under the seat, you'll find a leather-lined tray for stashing your everyday carry. Leather strips on the seat rails dampen the sound of closing the seat. Customize the look of the leather with a wood stain of your choice.



▲ Straight-grained ash in the chair's structure plays well with the red tones of the mahogany used to make the seat and back.

More than just a place to sit, this attractive chair pulls double duty as an all-in-one launching pad for your day.

I've been looking forward to this project for a long time. You can be forgiven if you've never heard of a valet chair before — especially if you work outside the suit and tie world. The idea is to provide a place to stage your next day's clothes and safeguard the items you carry around in your pockets. Sort of a combination coat rack and night stand.

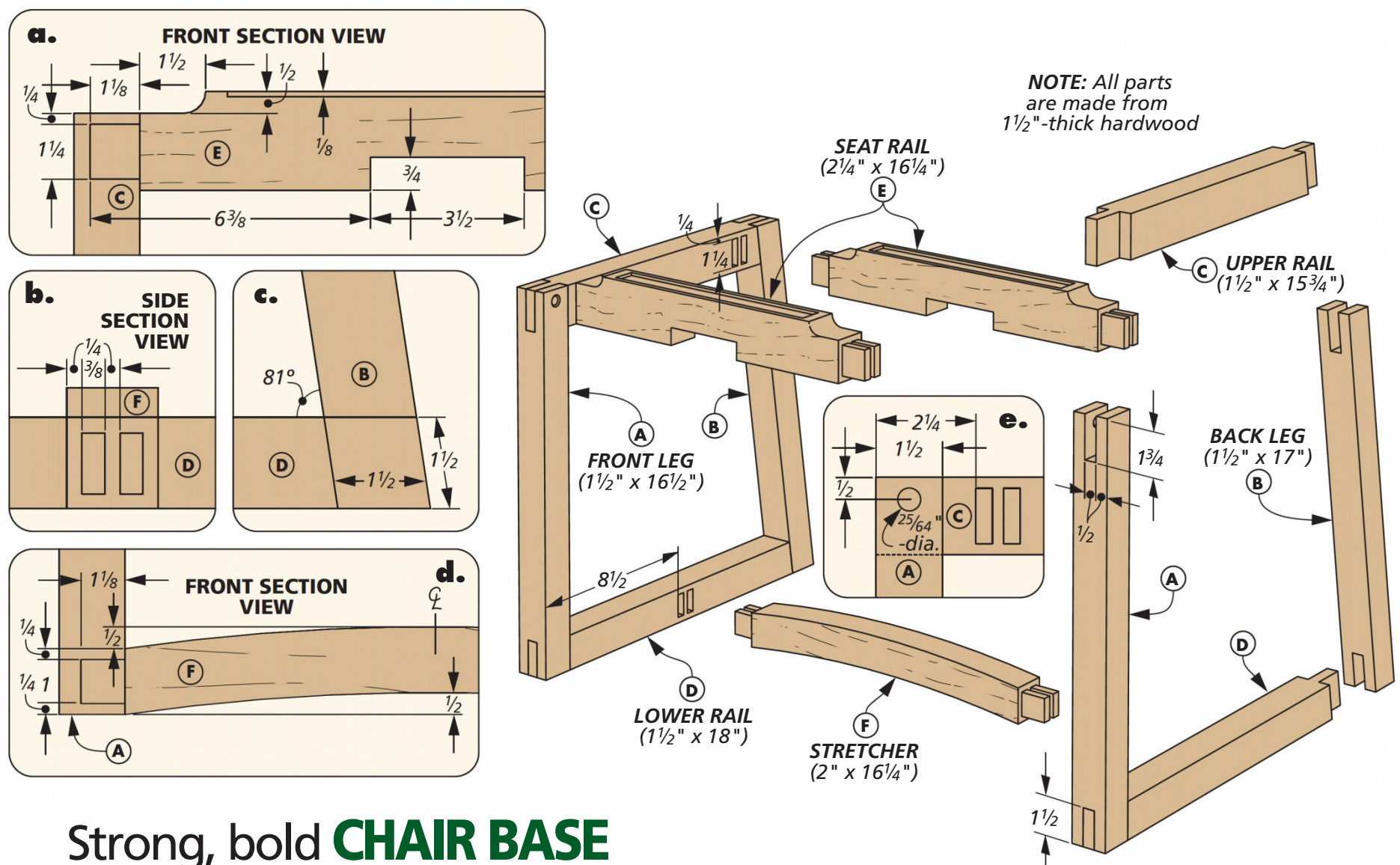
A number of years back, I came across a (the) valet chair designed by Hans Wegner. It oozes Danish modern cool. And I really wanted to build one.

What sets Wegner's design apart (along with our version) is its transforming nature. At first glance you see an ordinary chair. However, the back is shaped to cradle a shirt, jacket, or suit coat. The seat flips up to be a pants hanger. It also reveals a storage tray for essentials.

Photos showing the chair draped with dressy clothing came across as out of place in an "office-casual" world — even more so now when a lot of folk work from anywhere. So the idea got shot down in previous design meetings. Personally, I feel the idea works for just about anyone who could use a little help on a busy morning.

Persistence pays off. Dillon took up the idea and ran with it. I'm happy to present his design here.

In addition to its practicality, this project offers some solid woodworking fun in creating joinery that's strong and adds a great look to the completed piece. Many chairs feature angles for comfort and stability, and this one is no exception. The angles here give you an opportunity to improve your skills without making your head spin. It's time to build.



Strong, bold **CHAIR BASE**

A stable structure is a necessity for any chair. So that's the starting point for this project. The drawing above is your road map for the journey. The main parts are joined with bridle joints. These offer both high strength and a visual punctuation with the ends of the rails visible. The effect is almost like box joints.

The article on page 62 takes a deeper dive into forming the joints on the table saw.

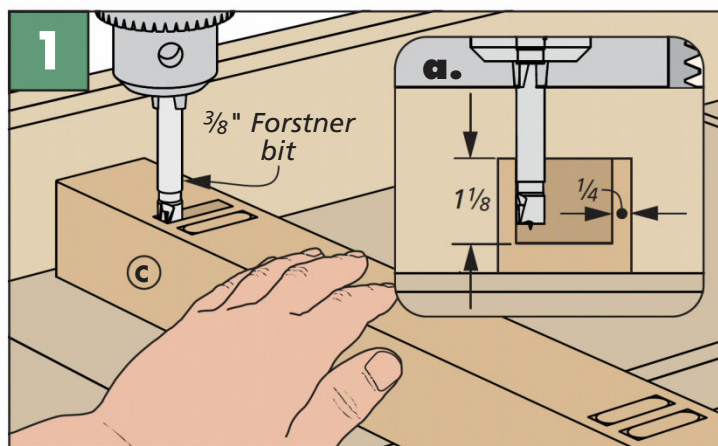
MATERIAL CONSIDERATIONS. The design of the chair opens up a lot of freedom for choosing materials. This version uses ash for the structural components. The parts are cut from boards with the straightest grain on all

the faces. To find this, the end grain of the boards should run around 45°.

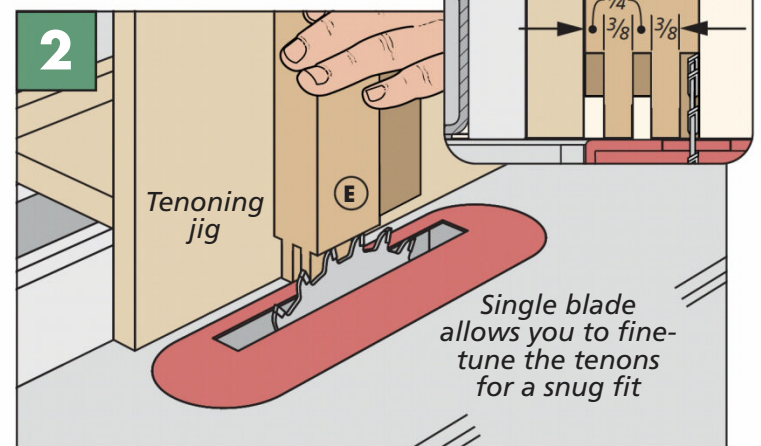
The seat and back are made from mahogany. The darker color and grain patterns offer a good counterpoint to the ash.

LEGS. Begin the construction by cutting the legs to size. Take note that the back legs are mitered

DOUBLE TENONS



Mortises. Careful layout and a Forstner bit get the mortises off on a good foot. Square up the ends and smooth the sides with chisels.



Upright Tenons. You need to support the rails vertically in order to cut between the tenons. A shop-made tenon jig does the job.

on the ends to lean towards the front, as in detail 'c.' These four parts have an open mortise centered on each end.

RAILS. An upper and lower rail joins each pair of legs together. The back edges of these pieces are mitered to complement the tilt of the back leg.

In addition to the tenon formed on the end, you'll add some mortises to accept the seat rails and stretcher that run cross-wise on the chair's structure. Refer to the drawings on the previous page for the locations and sizes of these mortise pairs.

SIDE ASSEMBLY. Hit pause on the joinery for a moment to glue up the leg/rail components. Then drill a hole on the inside face of each to house a threaded insert for the tilting seat (detail 'e').

DOUBLE TENONS. It's back to the table saw to cut double tenons on the two seat rails and stretcher. Figure 2 on the previous page shows the setup using a tenoning jig.

These parts also have some shaping, but do that after the joinery is cut. Otherwise you lose the reference surfaces that are necessary for accurate work.

Detail 'a' shows one other item you need to address. A centered notch on the bottom side of the seat rails holds the support system for the seat back you'll make later. Wrap up the work by routing a recess in the seat rails.

These shallow depressions hold strips of leather used to cushion the hinged seat.

With joinery checked off the list, you can turn the stretcher into an arch and form the curves on the seat rails. Then use these pieces to bring the side assemblies into a single structure.

SEAT SUPPORT & TRAY

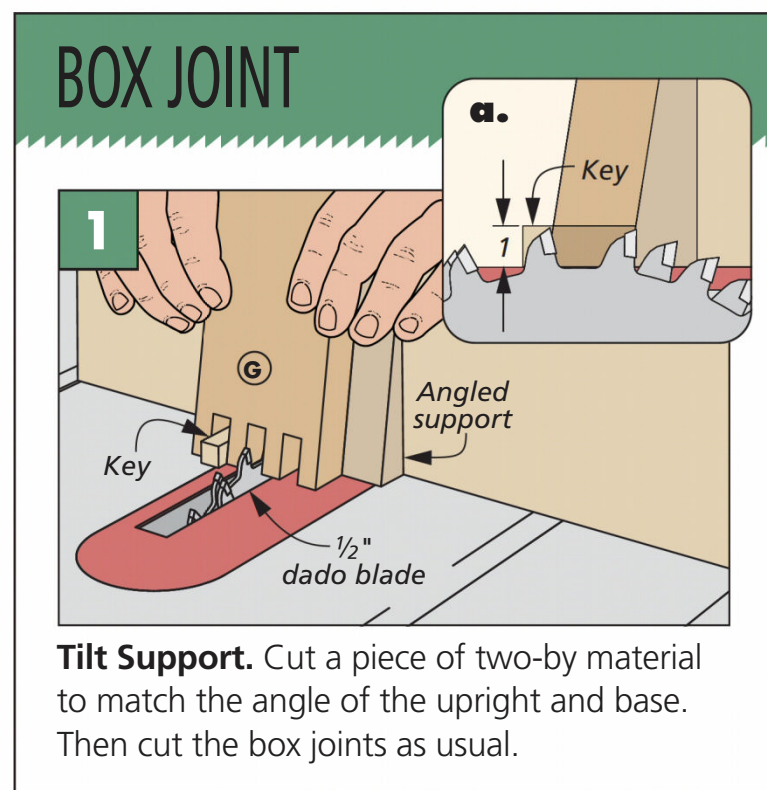
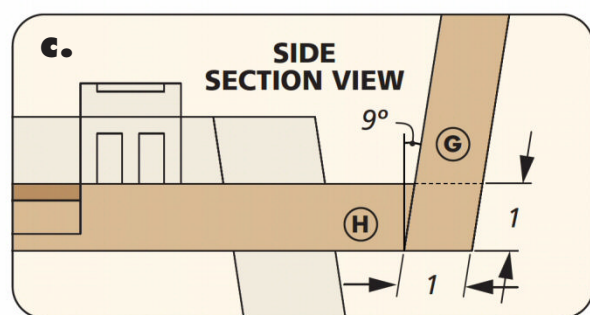
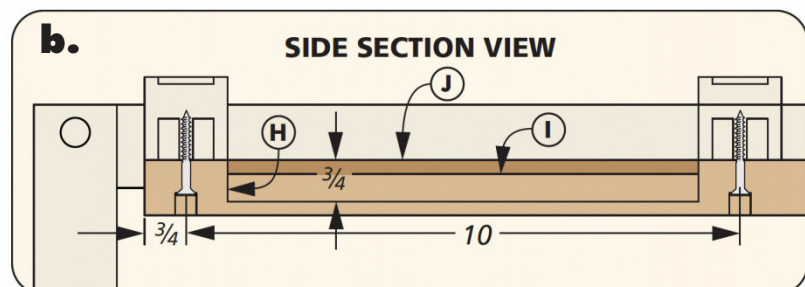
Moving along up the chair, it's time to work on the a two-part system that supports the seat back. You can see what's going on in the drawing below.

Box joints connect the upright and base. Detail 'c' shows the slight angle cut on the ends that makes the upright lean back. Don't get spooked, this angle doesn't effect cutting the box joints. All you need to is add an angled support to a box joint jig, as shown in the upper right box.

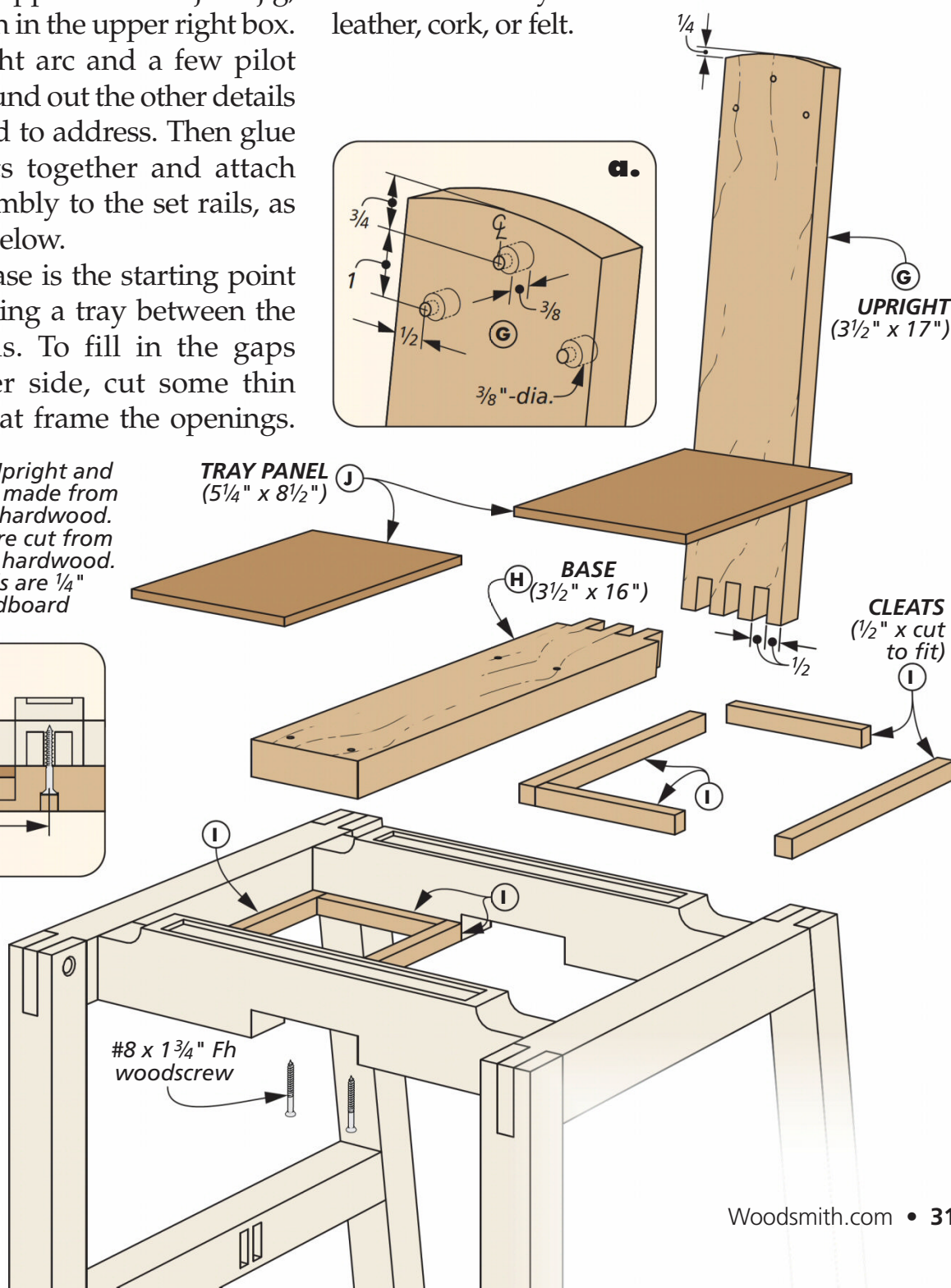
A slight arc and a few pilot holes round out the other details you need to address. Then glue the parts together and attach the assembly to the set rails, as shown below.

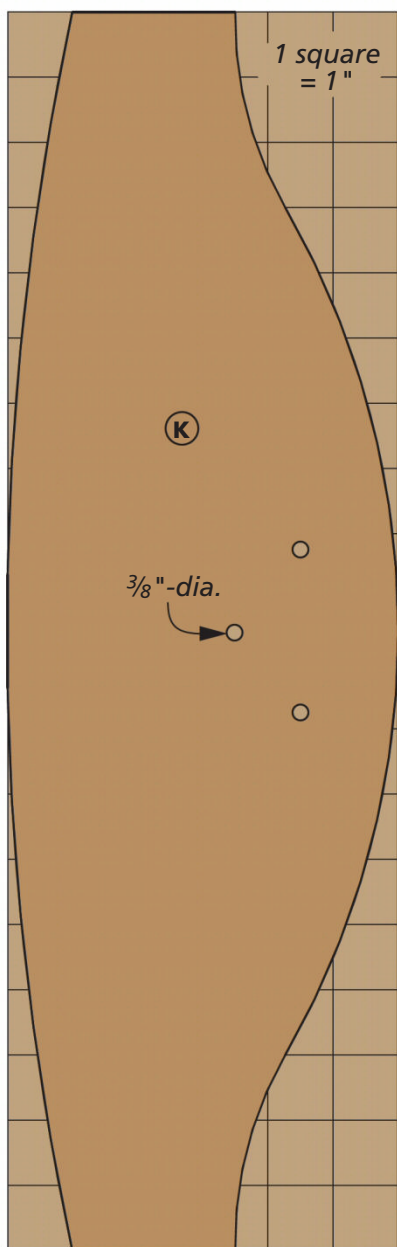
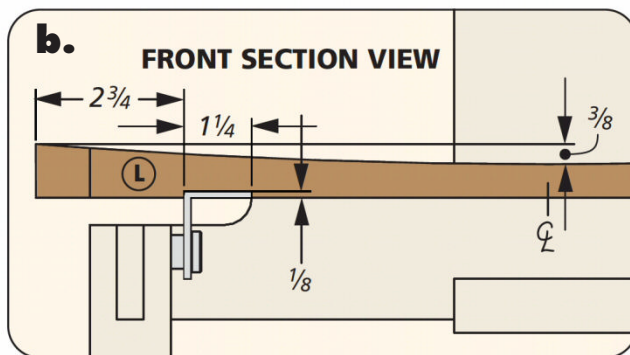
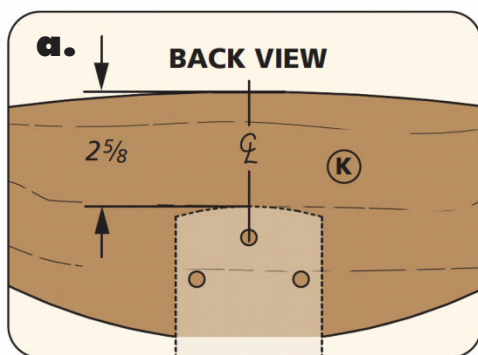
The base is the starting point for creating a tray between the seat rails. To fill in the gaps on either side, cut some thin cleats that frame the openings.

NOTE: Upright and base are made from 1"-thick hardwood. Cleats are cut from 1/2"-thick hardwood. Panels are 1/4" hardboard

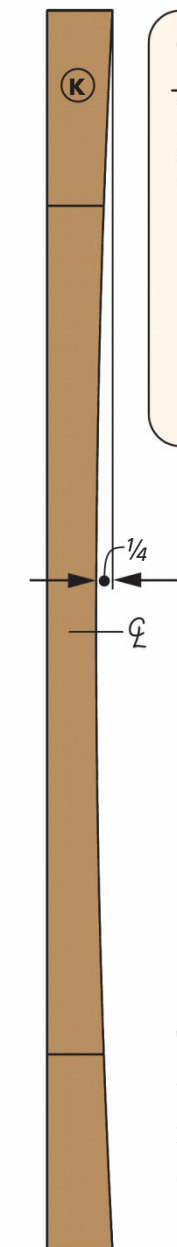


Install the cleats so that a couple of small hardboard panels will end up flush with the base, as you can see in detail 'b.' Later on, you can line the tray with leather, cork, or felt.

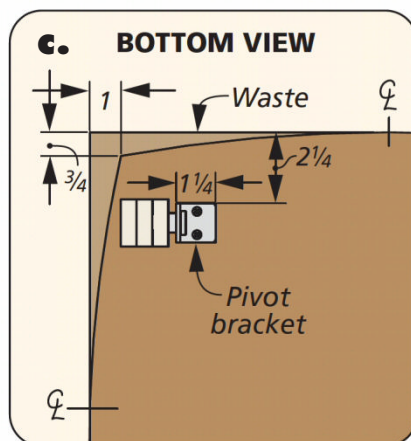




PATTERN 25%



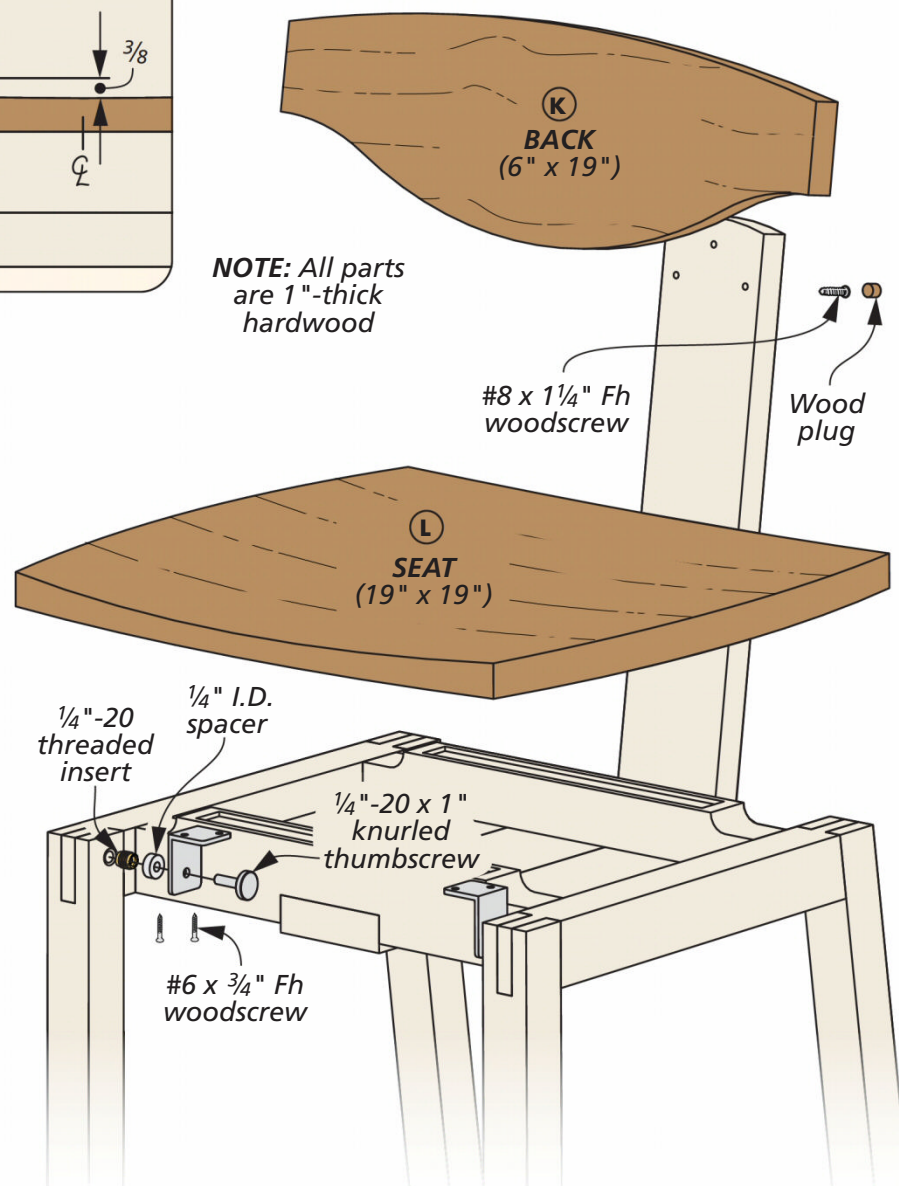
END VIEW



To find full-size patterns for the back, go to:

Woodsmith.com/261

NOTE: All parts are 1"-thick hardwood



Comfortable BACK & SEAT

To be fair, this isn't the kind of chair that's meant for kicking back and relaxing. However, I still wanted it to be comfortable. The remaining two parts of the chair share that task. Due to the transforming nature of this chair, these parts also have a second job. The back works as a coat hanger, while the seat offers a place to hang your pants.

COMPLIMENTARY MATERIALS. Here's a good place to add another material in to complement the wood species used in the base assembly. I chose mahogany for its warm reddish color and more uniform grain patterns. I think it plays nicely with the straight lines of the ash.

GLUED UP PANELS. The two parts shown in the drawing above are the most visible pieces of the project. That's code for take your time in selecting the boards for grain and color when gluing up the panels. You may be able to get the seat back from a single piece.

BACK REST. The pattern at left will guide you for cutting the back to shape at the

band saw. Besides the appearance, the curve along the upper edge mimics the shape of a hanger for gentle support of coats and sweaters.

DISHING. But that's not the only shaping you'll do. The forward face of the back is curved (dished) for comfort. It's possible to do this with a band saw — and a lot of sanding.

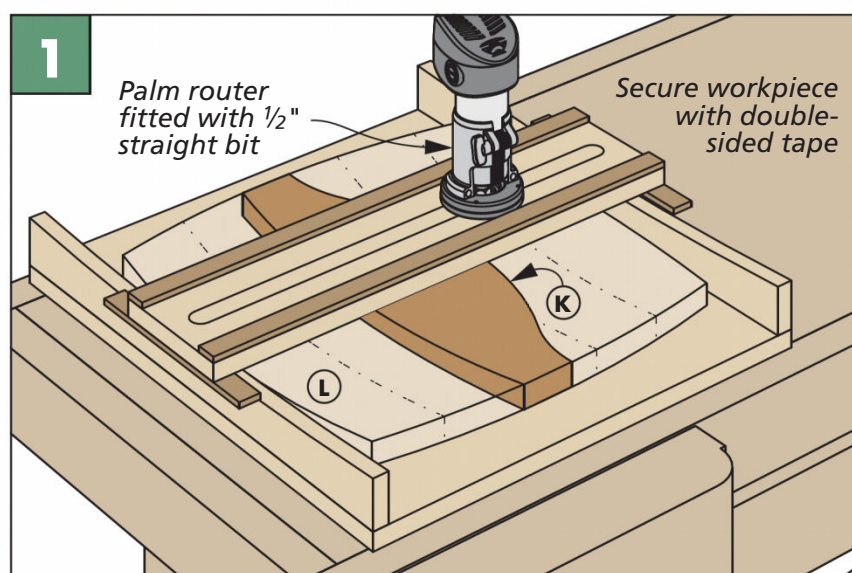
Another option is to use the router jig shown at the top of the next page. A router runs back and forth in a carriage across the workpiece. The carriage moves along a pair of curved guides that form the hollow. Even though the back and seat are slightly dished, I did this with light passes to prevent the router from bogging down or burning. The result is an even curve on the workpiece.

The router bit leaves only minor bit marks to scrape and sand away. From there, you can soften the edges and attach the back to the upright, as shown in detail 'a' above. I covered the screws with mahogany plugs.

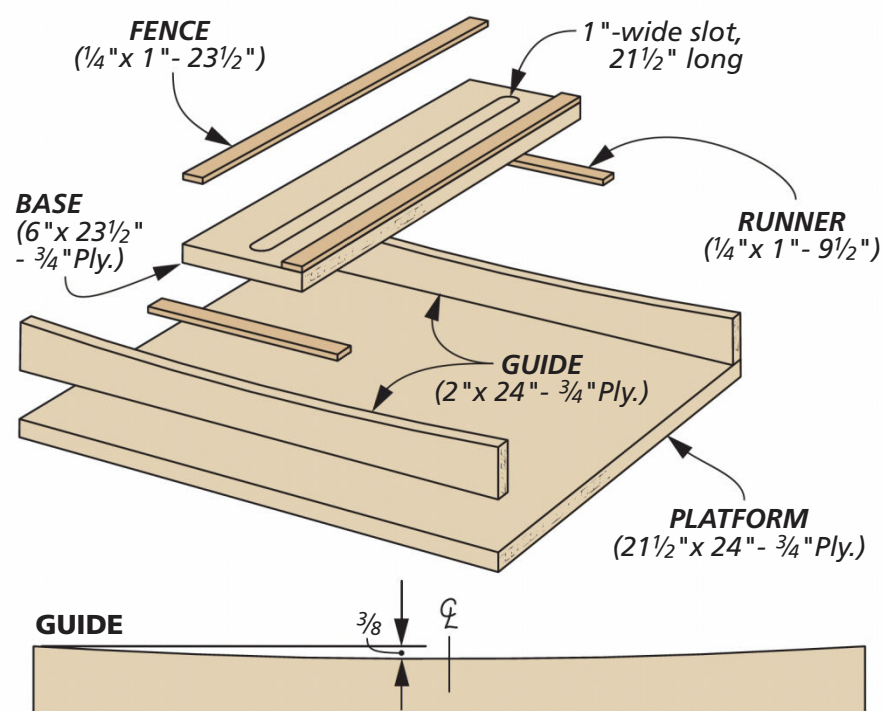


▲ The seat rotates on a custom-made L-shaped mechanism that consists of a bracket, a thumbscrew, and a threaded insert installed in the leg.

DISHING OUT THE BACK & SEAT



Carriage for Curves. Similar to a router slab-flattening jig, this setup is used to create a smooth curve on the back as well as the seat.



TAKE A SEAT. Making the seat takes a similar route as making the back. Start with the blank cut to its overall size. The next step is to cut two shallow mortises in the bottom face to accept the pivoting mechanism. You can see this in the photo and details 'b' and 'c' on the previous page. Measuring and cutting this mortise is easier to do with the seat in its straight, flat, and square shape. Test fit the hardware to make sure the pivoting mechanism works the way you like. (Make adjustments as necessary.)

Then cut the seat to shape by curving the edges, as shown in detail 'c' on the previous page. The seat can take its turn in the dishing jig (Figure 1 above).

Oil-based finish brings out the color of the mahogany and warms up the look of the ash. Then I sprayed a couple coats of lacquer for protection.

The final steps are to glue in the leather in the seat rails and cut another piece to line the tray (photo at right). Then this valet chair can take its place as a quiet sentinel of sartorial service. **W**

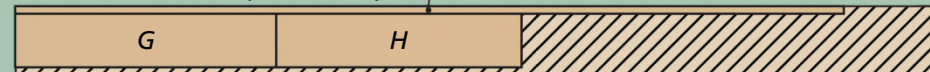


▲ Leather strips cushion the seat for a softer-sounding close. Leather also lines the tray.

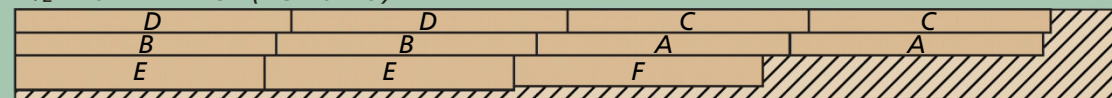
Materials, Supplies & Cutting Diagram

A Front Legs (2)	1 1/2 x 1 1/2 - 16 1/2	H Base (1)	1 x 3 1/2 - 16	• (2) 5/8" O.D. x 1/4" I.D. Spacers
B Back Legs (2)	1 1/2 x 1 1/2 - 17	I Cleats (1)	1/2 x 1/2 - 54 rgh.	• (2) 1/4"-20 Threaded Inserts
C Upper Rails (2)	1 1/2 x 1 1/2 - 15 3/4	J Tray Panels (2)	1/4 ply. - 5 1/4 x 8 1/2	• (2) 1/4"-20 x 1" Knurled Thumbscrews
D Lower Rails (2)	1 1/2 x 1 1/2 - 18	K Back (1)	1 x 6 - 19	• (4) #6 x 3/4" Fh Woodscrews
E Seat Rails (2)	1 1/2 x 2 1/4 - 16 1/4	L Seat (1)	1 x 19 - 19	• (4) #8 x 2" Fh Woodscrews
F Stretcher (1)	1 1/2 x 2 - 16 1/4			• (3) #8 x 1 1/4" Fh Woodscrews
G Upright (1)	1 x 3 1/2 - 17	• (2) 1 1/4" x 1 1/4" Pivot Brackets		• (1) 12" x 24" 12oz. Leather

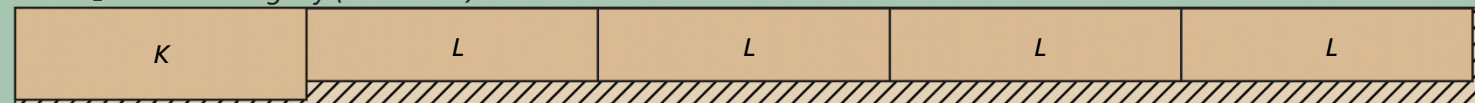
1" x 4 1/2" - 60" Ash (1.9 Bd. Ft.)



1 1/2" x 6" - 72" Ash (4.5 Bd. Ft.)



1" x 6 1/2" - 96" Mahogany (4.3 Bd. Ft.)



Router Table

This project makes the case that shop machines should work hard and look great, too.

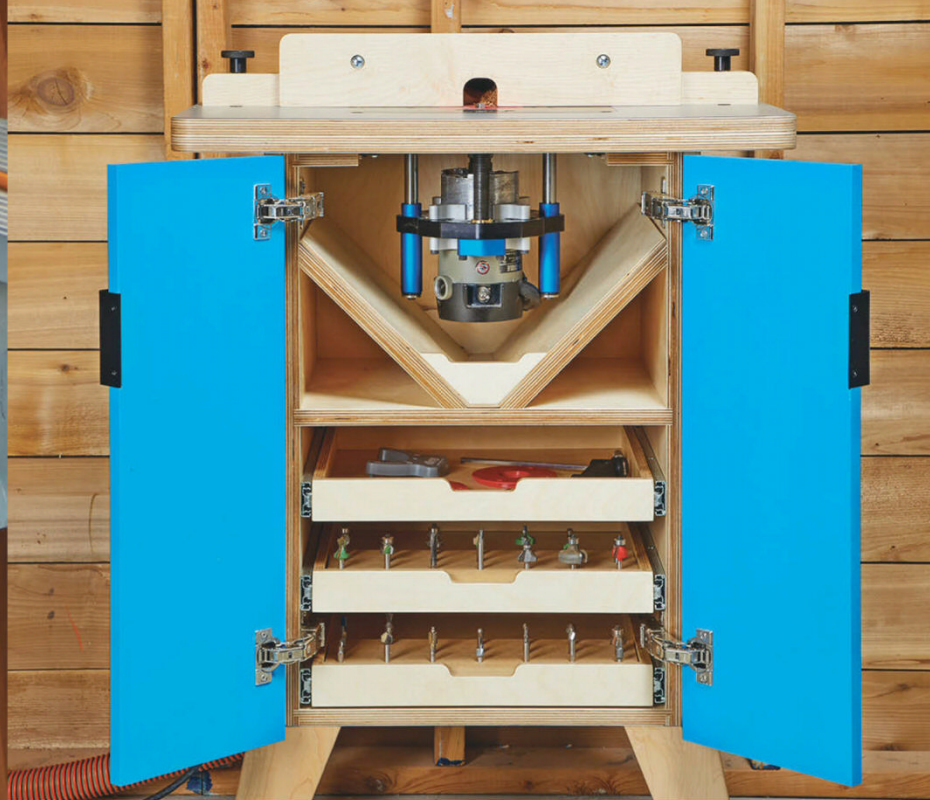
The siren call of professional-grade gear is tough to block out for home wood-working. Router tables offer a good example. In the past few years, the trend has followed the “bigger is better” line. Even with mobile bases, these continent-sized tools take up significant space in a small shop.

My build-it-yourself approach has several payoffs. In the case of this router table it’s to nestle into a sweet spot for size. The 18" x 26" top is sized for the kind of projects you’re likely to encounter in *Woodsmith*.

The Baltic birch plywood and plastic laminate that make up the top provide high performance. We used a Kreg plate and lift system that makes bit changes and adjustments easy and accurate.

CABINET BASE. Down below, the cabinet is a triple threat. Enclosing the router dampens the sound. It also contains dust and chips. Finally, the case offers storage for all the things that go with routing: wrenches, insert rings, bits, bearings, set-up gauges ... the list goes on.

GOOD LOOKS. Shop projects, whether commercially made or shop-built, feature a pragmatic, utilitarian design aesthetic (read boxy and boring). I want my workshop to exhibit the same creativity that I like to express in my other projects. The flared legs amp up the visual appeal without clogging the construction process.



▲ The cabinet houses a slide-out hopper that collects dust and chips for easy disposal. Three drawers on full-extension slides corral all your router-related gear, keeping it dust free.

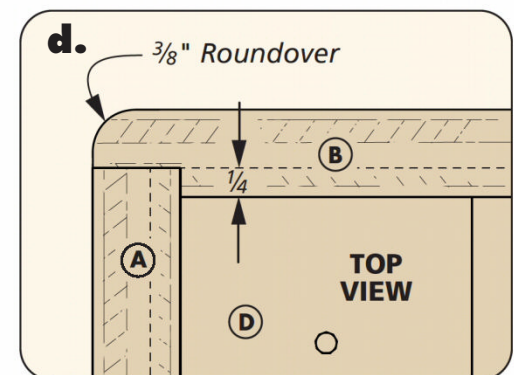
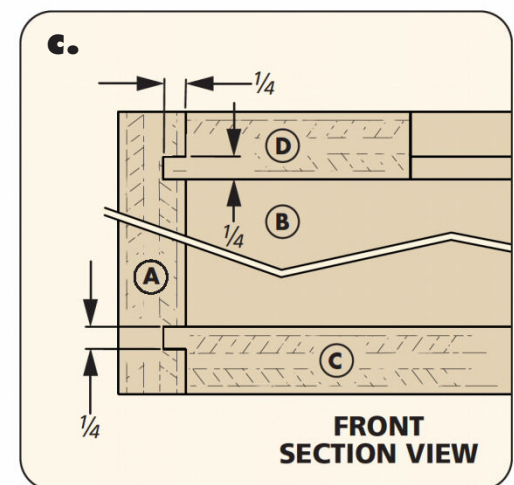
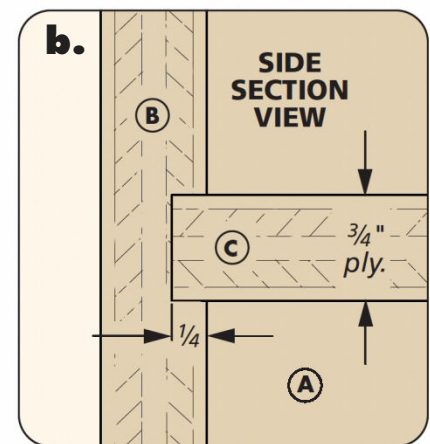
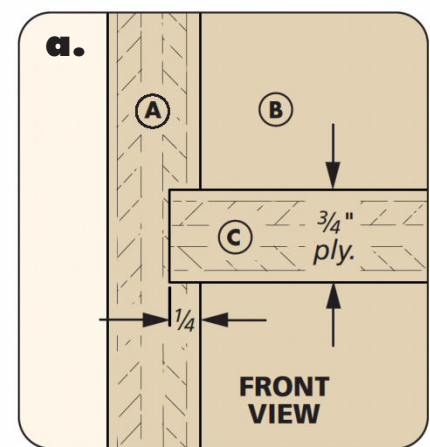
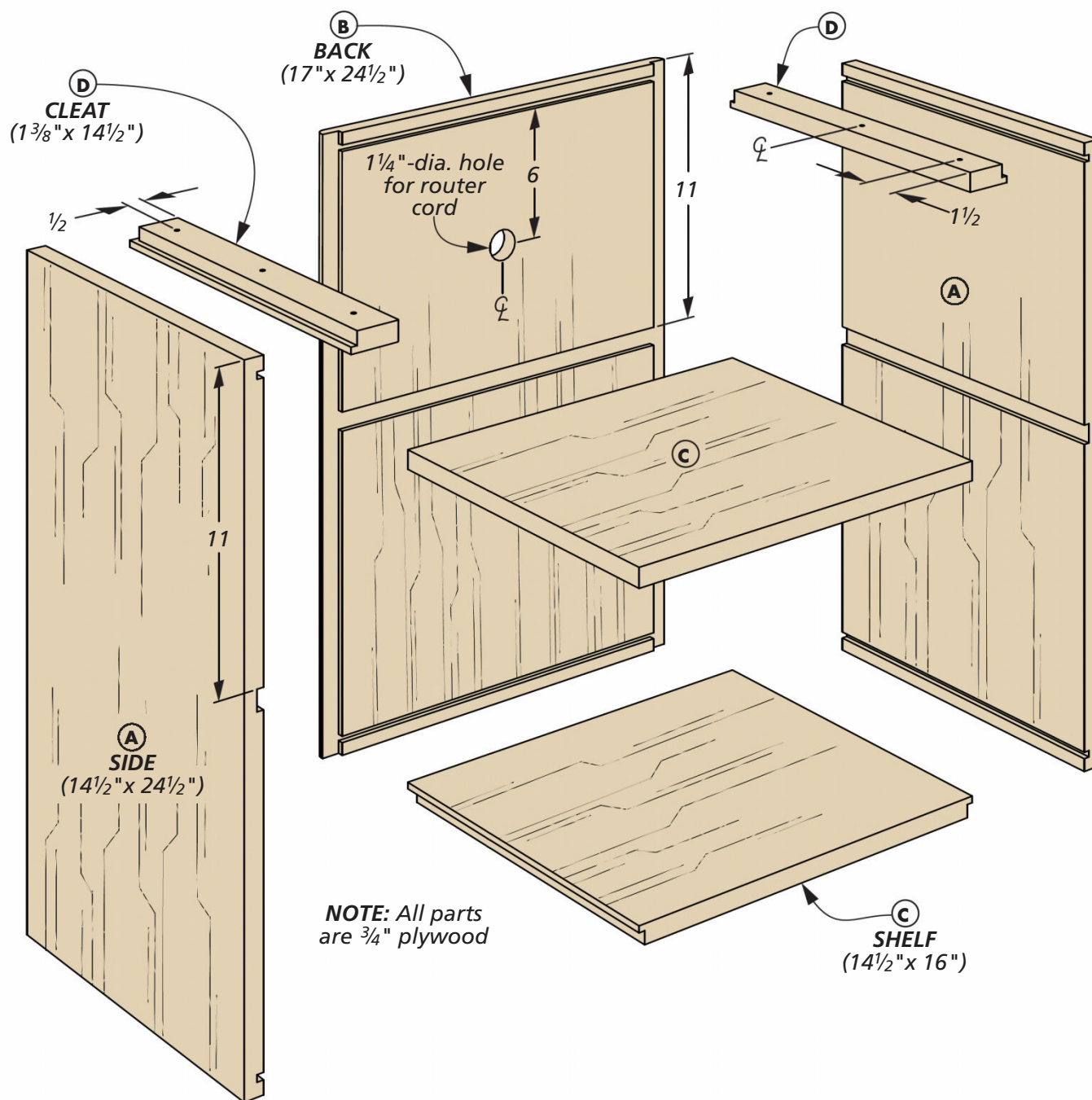


▲ European-style, soft-close hinges open wide for full access to the dust bin and the drawers. While not strictly necessary, a paint job elevates the look of the project and your shop space.



▲ Often overlooked, a solid fence is a critical part of a router table. A stout hardwood beam adjusts easily and has dust collection built in. The front face can be customized to suit the task at hand.





Cabinet comes **FIRST**

The center of gravity on this project is the plywood case. It supports the top and is the structure the legs are attached to. The “normal” approach to casework like this is to use thick plywood on the sides and a thin back panel. The drawing above shows a more robust method.

The sides and back are all ¾" plywood. Using a thick back panel allows you to cut joinery into the three pieces for a stronger connection, with the two shelves and the cleats up top.

JOINERY. Let's take a closer look at the joinery. With plywood, simple solutions works best. At each end of the sides and back, a narrow dado holds the bottom shelf and the cleats. This is shown in detail 'c.' The location

of the far end of the dados on the sides and back matches the thickness of the mating plywood pieces. So why narrow dados and not rabbets? Dados allow the shelf and cleats to lock into position positively.

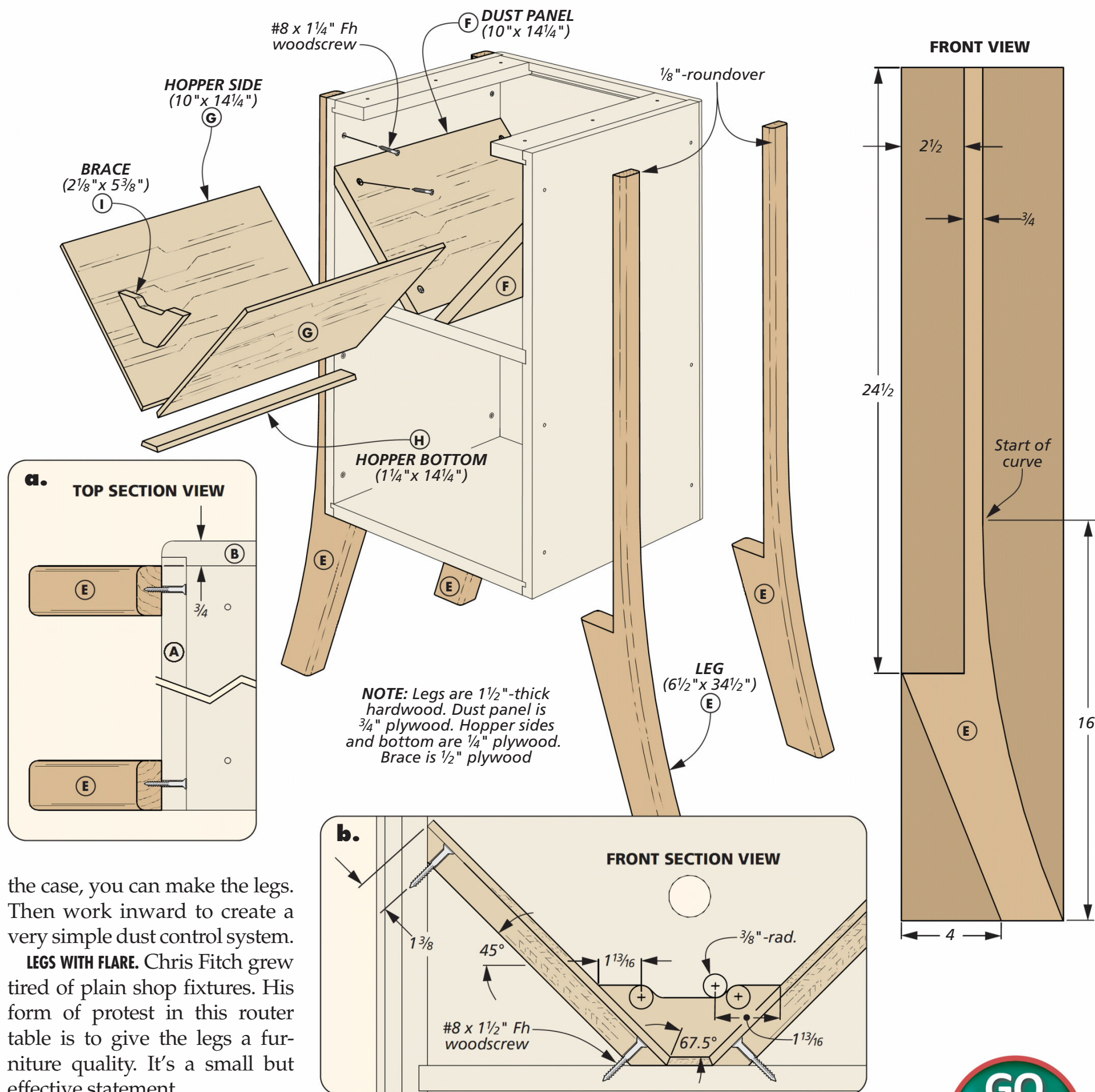
The middle shelf is held in a dado that's sized to match its thickness exactly, as in details 'a' and 'b.' The final bit of joinery is to cut a rabbet along each edge of the back to index the case sides. You can see that in detail 'd.' Then drill a hole for the router's power cord.

ASSEMBLY. Take a moment here to glue up the case. The back, sides, and two shelves are best glued up in one go. The smaller cleats can be slipped into place once the clamps are on.

ROUNDROVER. Detail 'd' above shows the final step to take care of on the case. A sprinkling of roundovers on this project adds a little style, as well as softens the harsh edges. If you'll be painting the case, as we did, now is a good time to start the priming and painting process.

LEGS & DUST CONTROL

A completed case forms the basis for the remaining parts of the project. Working out from



the case, you can make the legs. Then work inward to create a very simple dust control system.

LEGS WITH FLARE. Chris Fitch grew tired of plain shop fixtures. His form of protest in this router table is to give the legs a furniture quality. It's a small but effective statement.

The upper right drawing shows how the legs are cut from the blank. Shape the long notch that cradles the case first. I cut the bottom of the notch at the table saw. A band saw and rip fence handles the long side.

Stay at the band saw to cut the curves. I cut one leg then used that as a template to form the others. The outer edges of the legs have roundovers and are secured to the case with screws, as you can see in detail 'a.'

DUST HOPPER. A surprising pile of chips end up inside of a router table cabinet. To make cleanup easier, there's a two-part system. The first part consists of a pair of angled panels that are screwed to the inside of the case (detail 'b'). Beveled edges on the panels seat against the case sides and shelf.

On top of these rests a lightweight, removable hopper. The angled sides gather and funnel

the dust and chips so you can dump them out.

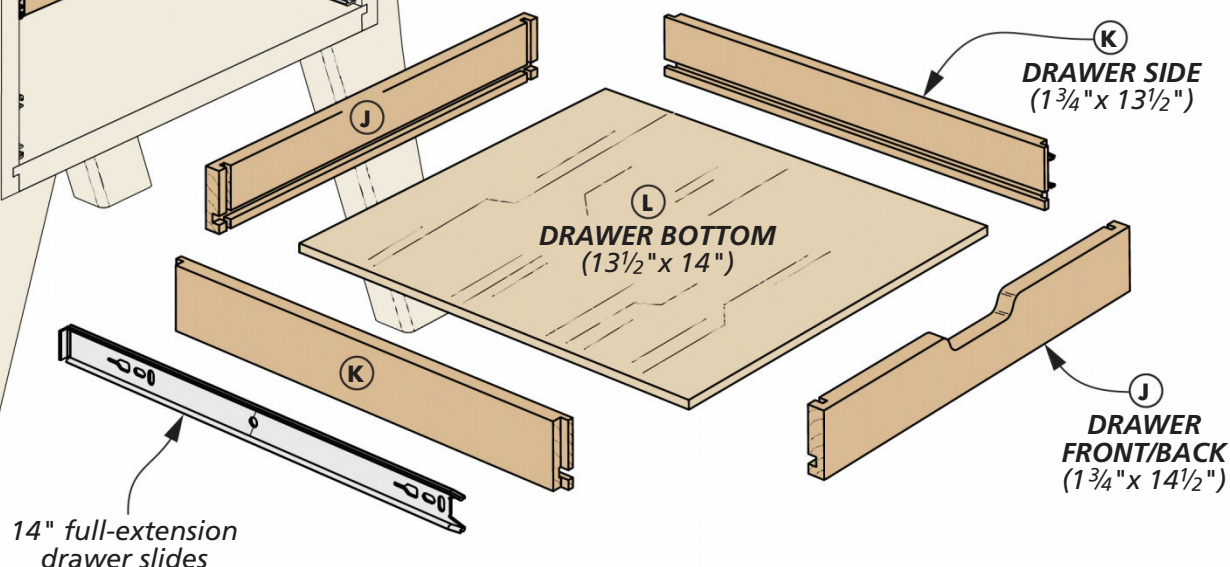
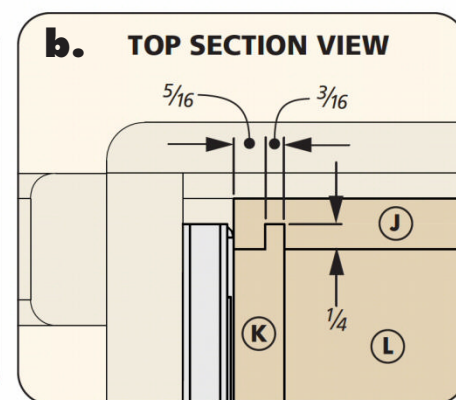
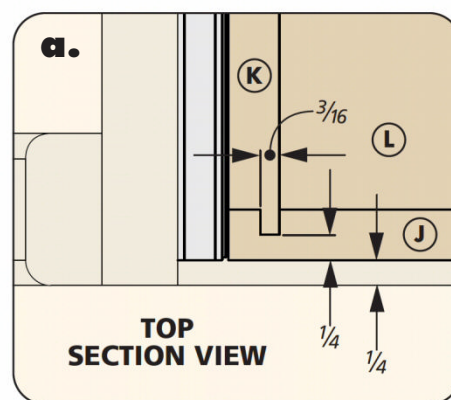
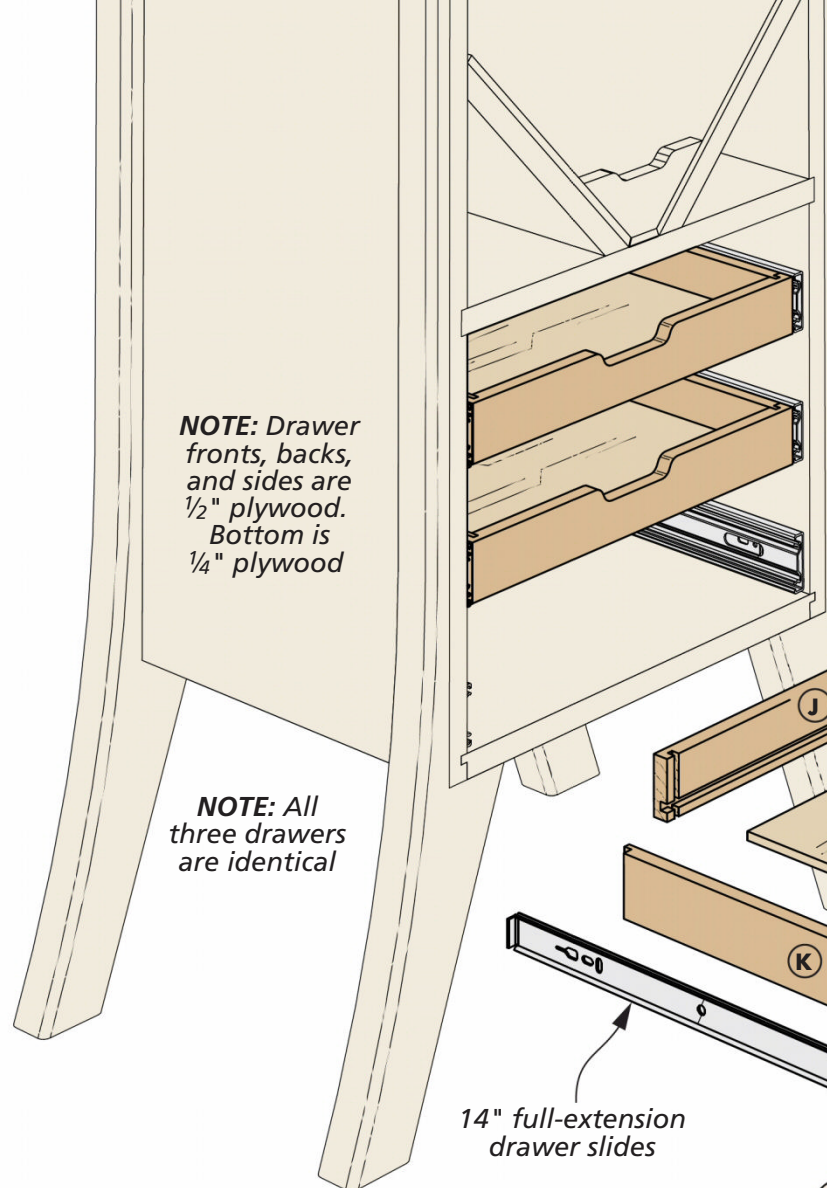
Installing the dust panels allows you to accurately size the components for the hopper. Take a moment to study detail 'b' to pick out the various angles you need to cut along the hopper sides and bottom piece.

A pair of braces create a front and back for the hopper and provide added strength, since the other parts are thin plywood.



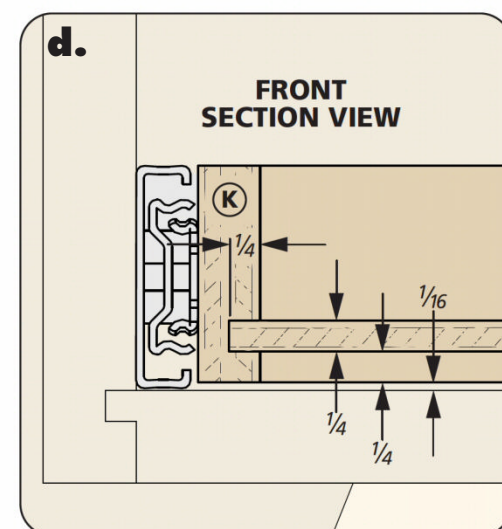
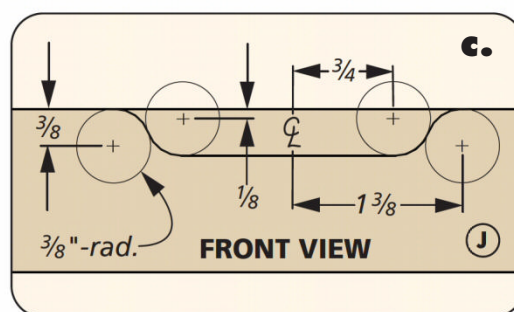
For full-sized leg and brace patterns, go to:

Woodsmith.com/261



Corralling the **GEAR**

The compartment below the dust hopper could easily be left as is. For me, that would be a huge problem. Unorganized space like that is a warehouse, spacious but easily descends into chaos. The drawers shown here transform that same space into a library — organized and serene.



For simplicity, all three drawers are the same size. And I kept them shallow. This eliminates deep, dark recesses where the bit you're looking for likes to hide.

TONGUE & DADO. The drawer box pieces are made from 1/2" plywood. The parts and joinery are sized to leave a 1/2" gap on each side for the drawer slides. Speaking of, the joinery on the drawers is tongue and dado. The details are shown in details 'a' and 'b' above.

A dado is cut on the fronts and backs. An interlocking tongue is then formed to fit on the sides. This is easily done at the table saw. Check out detail 'd' for the location of the groove cut in all the parts that holds the bottom.

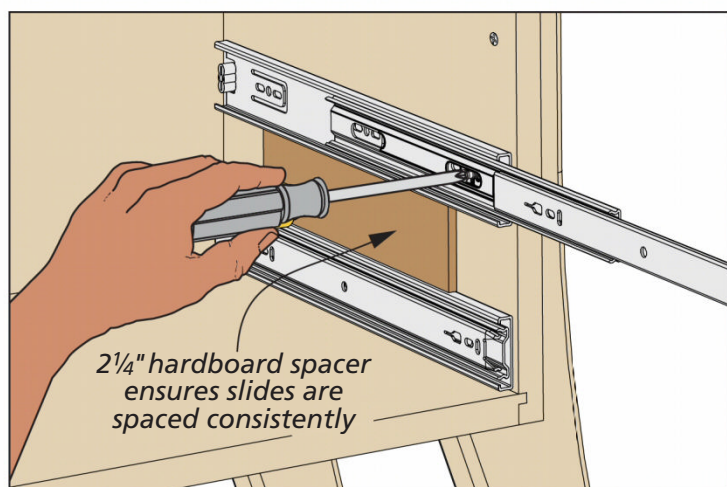
INTEGRATED PULL. The drawers are covered by doors we'll get to in a bit. So I didn't want pulls

that protruded from the front. Instead, I opted for the subtle cutout you can see in detail 'c.' I like using a Forstner bit to create the inner radii. The connecting cuts can be taken care of at the band saw.

After assembly, the drawers can be installed using full-extension slides. These come in two parts: a cabinet part and a drawer part. The drawing above shows the drawers evenly spaced in their compartment. But that's only one option. You can create any spacing to suit the items you plan on stashing inside.

The key to successful installation is making sure each side is

DRAWER SLIDE SPACERS



Consistency. One drawer is flush with the bottom of the case. Space the others off it.

level. The box on the bottom of the previous page highlights a trusted solution.

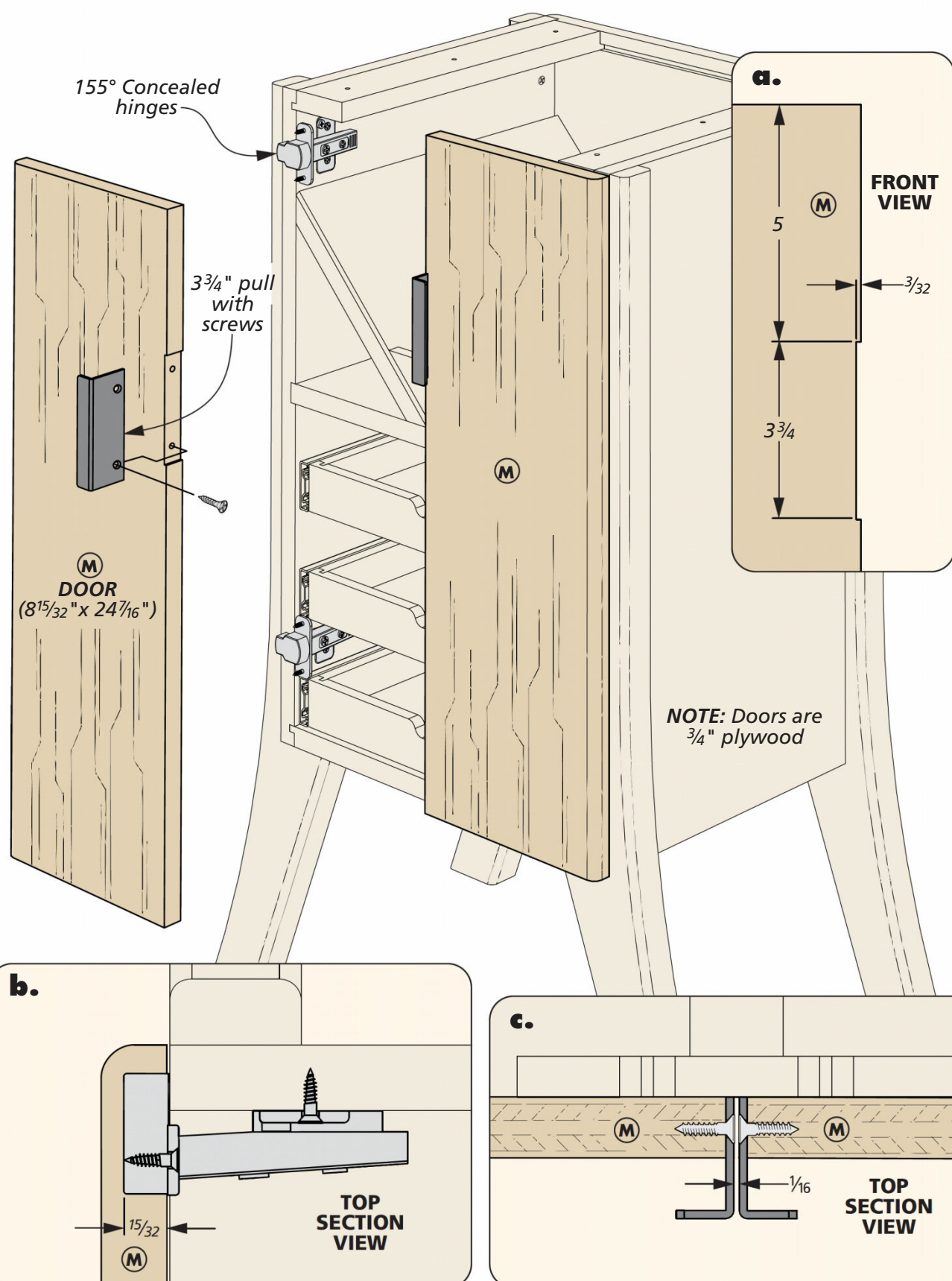
THE EASIEST DOORS

On a lot of projects, the doors can be mini-projects in themselves. But that doesn't have to always be the case. Here, plain plywood slabs do the job nicely and fit in well with the overall design motif of the project.

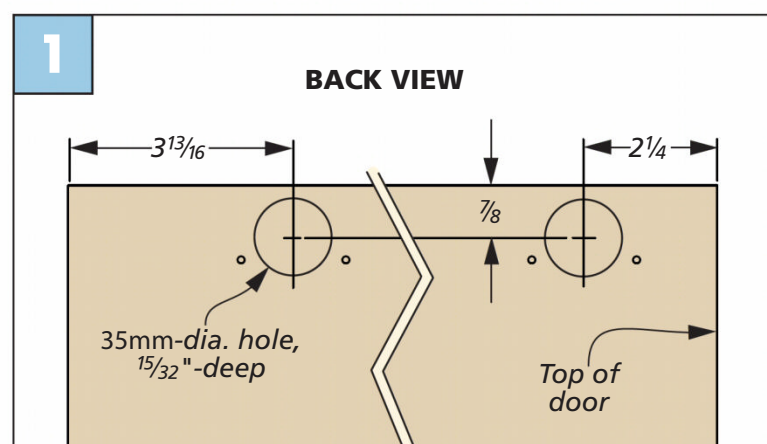
Each door is cut a hair shorter than the overall height of the cabinet. This creates clearance so the door won't bind against the top. Width-wise, size the doors for a small gap in the middle and the doors flush with the edges of the case. Check out details 'b' and 'c' at right.

DETAILS. Now for some finer details. The outside edge of each door gets a roundover to match the one at the back of the case. Along the inside edge, cut out a shallow mortise for a pair of trim edge pulls (detail 'a').

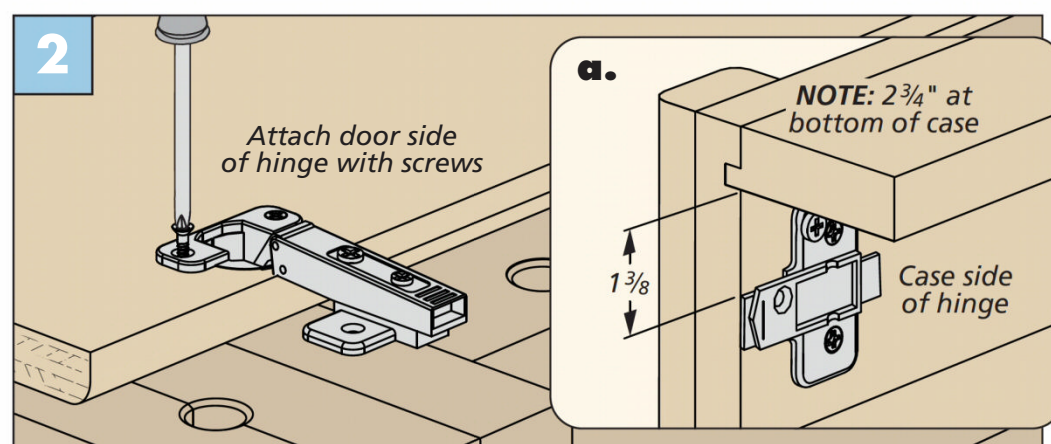
CONCEALED HINGES. The doors hang on concealed hinges that open wide enough to allow the drawer to open without scraping. Detail 'b' at right and the box below show you what you need to know. You'll drill holes in the doors for the hinge cup and attach the case side of the hinge with screws.



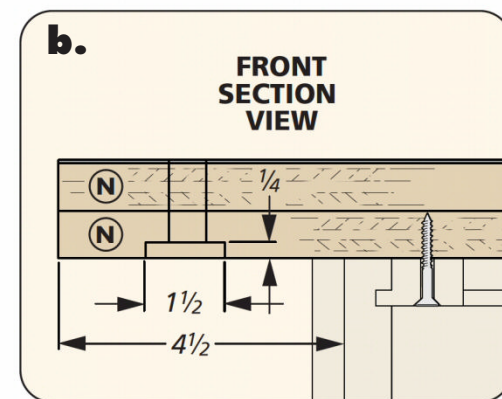
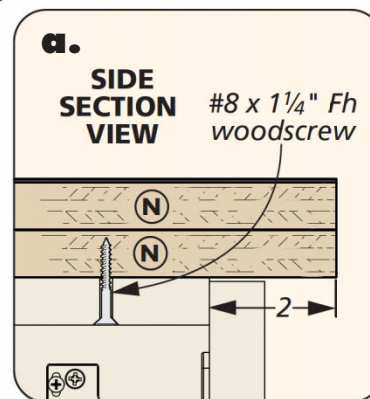
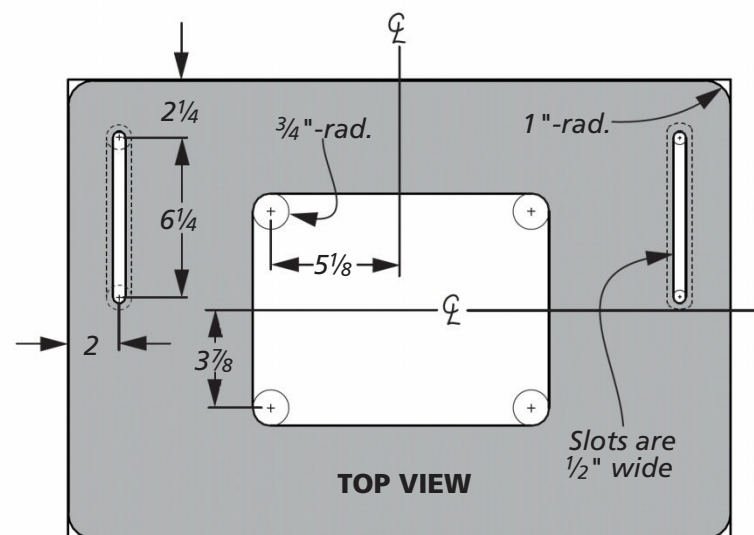
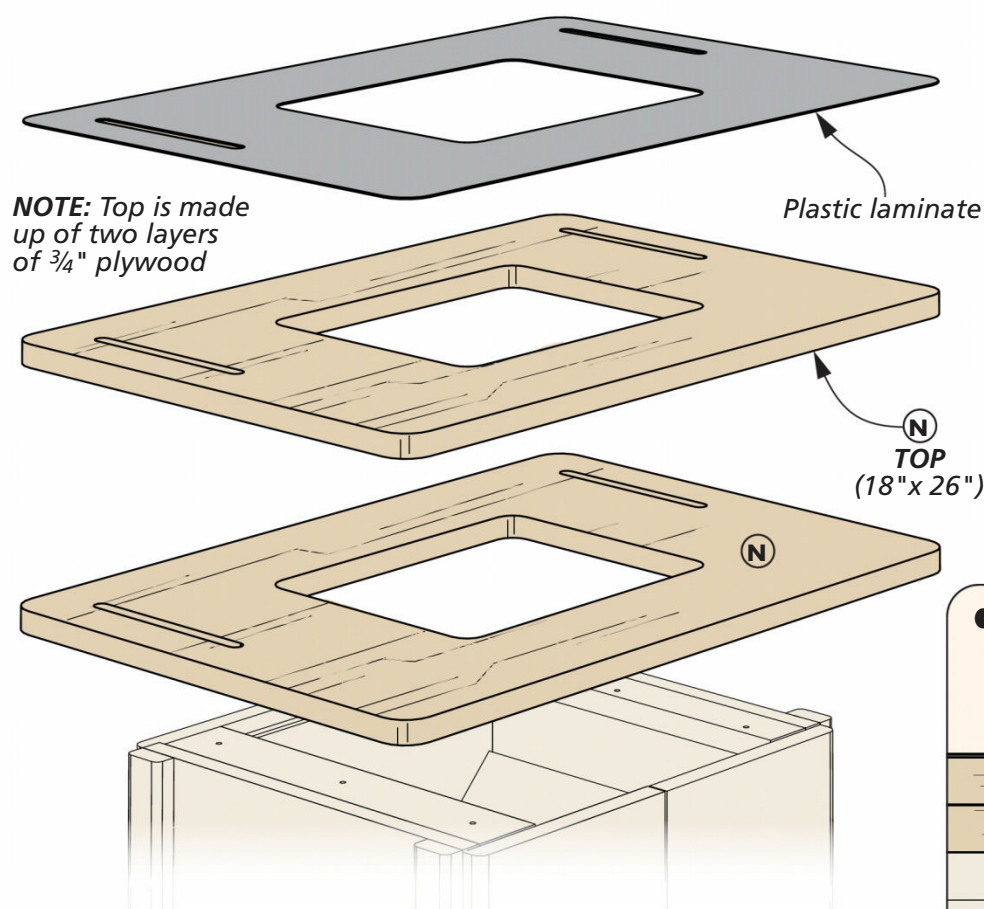
TWO-PART EUROPEAN HINGES



Cup Holes. The door portion of the hinge fits into 35mm holes drilled in the doors.



Easy Installation. Two screws secure the hinge portion. After installing the cabinet part, the two pieces snap together.



Where the **MAGIC HAPPENS**

All that's come before are opening acts. At last we get to the main event — the top. The requirements here are short: big enough, flat, durable.

Let's check some of these items off the list. As I mentioned at the outset, a lot of router tables are too big (personal preference). This one is sized to suit most project parts and get along well with the other tools in my shop.

DOUBLE-STRENGTH. The top is glued up from two layers of plywood and cut to the size shown in the drawing

above. I used Baltic birch plywood here, as it's more reliably flat than other sheet materials as well as offering the strength required for a worksurface.

After rounding the corners, I capped the top with a piece of plastic laminate (pick your favorite color). Laminate is hardwearing and offers a smooth, low-friction surface for moving a workpiece around.

FENCE SLOTS. Cut a slot along each end of the top, as shown in the "Top View" drawing. These slots accept the fence we'll come to shortly. There's a narrow

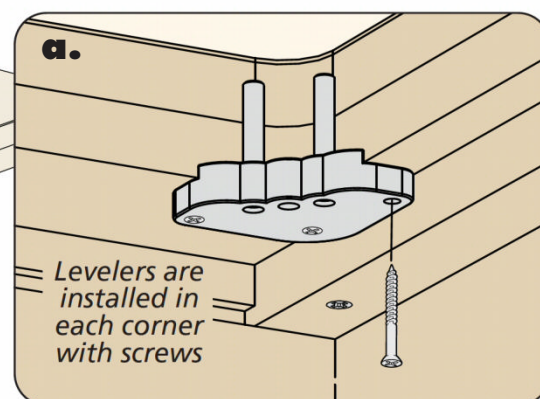
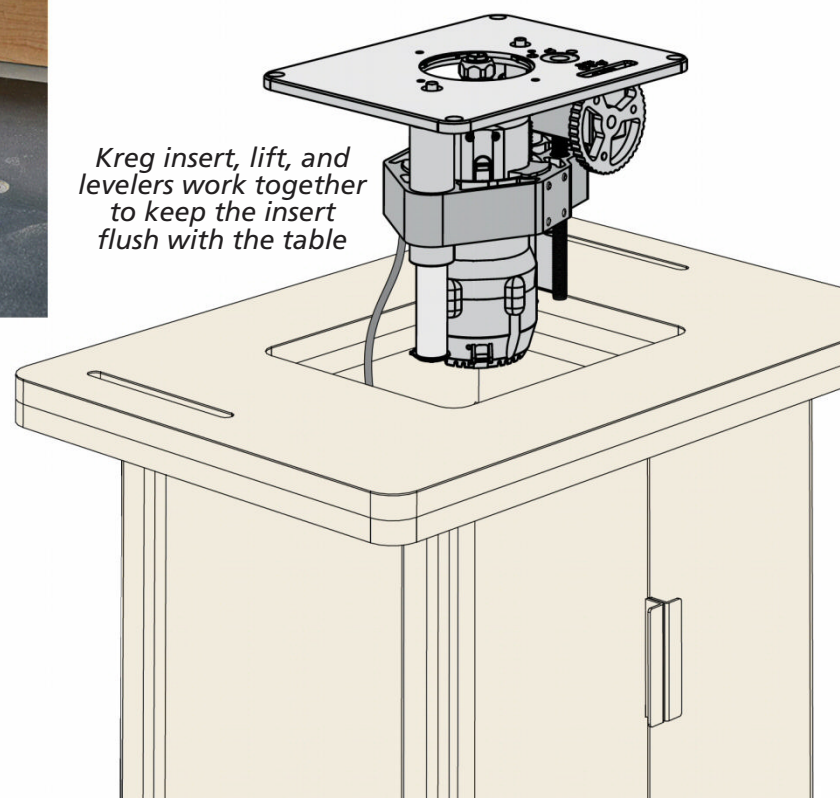
through slot and a stepped portion on the bottom face (detail 'b'). A plunge router with an edge guide is the approach I used to make these.

INSERT PLATE KIT. It's time to add the router part of this router table. I used a kit from *Kreg Tool* that includes an insert plate, router lift, and levelers, as shown in the drawing and photo below.

All you need to do is make an opening in the table top that matches the size of the insert plate. An insert plate leveler is attached in each corner (detail 'a' below). It has two posts to help level the insert plate (which should be pretty obvious based on the name.) But it also has a threaded insert that allows you to secure the plate to the leveler.



Kreg insert, lift, and levelers work together to keep the insert flush with the table



▲ Insert plate levelers offer fine-tuning and a way to secure the plate to the table top.

This cuts down on vibration and noise that can occur on other insert plate setups.

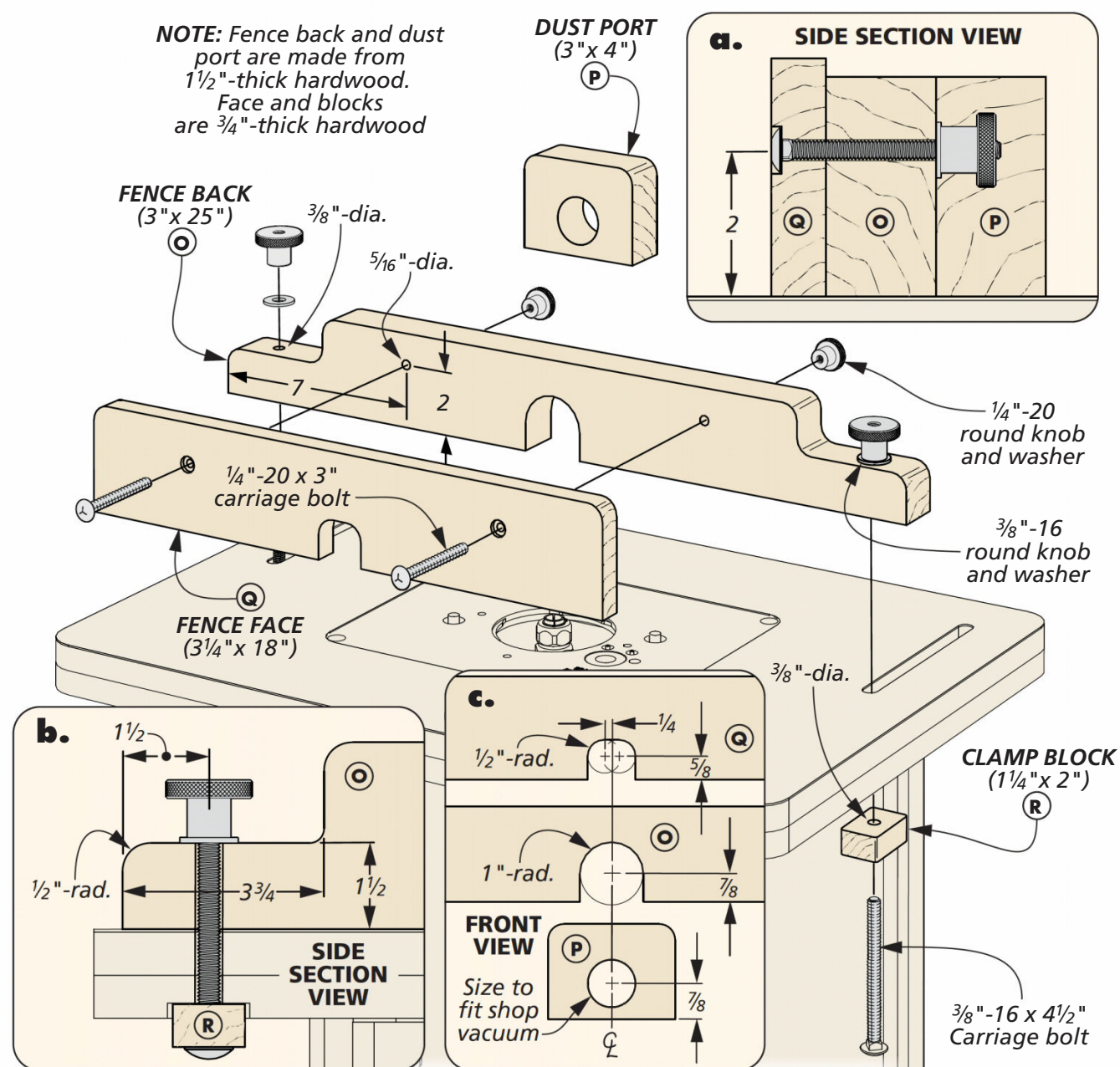
Completing this work means you can attach the top to the case. Drive three screws up through the cleats into the top. Check out details 'a' and 'b' on the previous page for the overhang numbers.

A STEP UP FENCE

For years, Steve Johnson, one of the shop craftsmen at *Woodsmith* used a straight piece of hardwood with a bit cutout as his fence. The fence on this table riffs on that uncomplicated concept with a few convenience upgrades. The back is a thick block with stepped ends for the adjustment knobs. Do you notice the roundover theme in the main drawing and detail 'b'? On the back is another thick block with a hole to connect your shop vacuum (detail 'c').

An interchangeable face is attached to the front. This lets you create a fence with custom openings to suit various bits.

What about a fence with sliding faces? I'm not a fan. The faces too often end up misaligned, resulting in poor cuts.



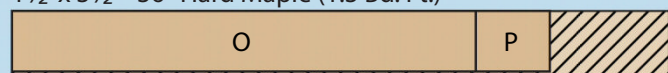
Finally, cut clamp blocks to anchor a pair of carriage bolts. These slide in the slots on the bottom face of the table, as shown in detail 'b,' to adjust the fence.

Once this table takes its place in your shop, you'll find a valuable and versatile member of the team. And one that's easy on the eyes, too. **W**

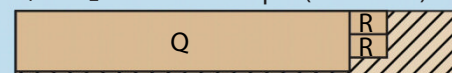
Materials, Supplies & Cutting Diagram

A Sides (2)	$\frac{3}{4}$ ply. - $14\frac{1}{2} \times 24\frac{1}{2}$	L Drawer Bottoms (3)	$\frac{1}{4}$ ply. - $13\frac{1}{2} \times 14$	• (2) $3\frac{3}{4}$ " Edge Pulls w/Screws
B Back (1)	$\frac{3}{4}$ ply. - $17 \times 24\frac{1}{2}$	M Doors (2)	$\frac{3}{4}$ ply. - $8\frac{15}{32} \times 24\frac{7}{16}$	• (2 pr.) 155° Full Overlay Hinges
C Shelves (2)	$\frac{3}{4}$ ply. - $14\frac{1}{2} \times 16$	N Tops (2)	$\frac{3}{4}$ ply. - 18×26	• (1) Router Insert Plate w/Levelers
D Cleats (2)	$\frac{3}{4}$ ply. - $1\frac{3}{8} \times 14\frac{1}{2}$	O Fence Back (1)	$1\frac{1}{2} \times 3 - 25$	• (1) Router Lift
E Legs (4)	$1\frac{1}{2} \times 6\frac{1}{2} - 34\frac{1}{2}$	P Dust Port (1)	$1\frac{1}{2} \times 3 - 4$	• (2) $\frac{3}{8}$ "-16 x $4\frac{1}{2}$ " Carriage Bolts
F Dust Panels (2)	$\frac{3}{4}$ ply. - $10 \times 14\frac{1}{4}$	Q Fence Face (1)	$\frac{3}{4} \times 3\frac{1}{4} - 18$	• (2) $\frac{3}{8}$ " Flat Washers
G Hopper Sides (2)	$\frac{1}{4}$ ply. - $10 \times 14\frac{1}{4}$	R Clamp Blocks (2)	$\frac{3}{4} \times 1\frac{1}{4} - 2$	• (2) $\frac{3}{8}$ "-16 Steel Knurled Knobs
H Hopper Bottom (1)	$\frac{1}{4}$ ply. - $1\frac{1}{4} \times 14\frac{1}{4}$			• (2) $\frac{1}{4}$ "-20 x 3" Carriage Bolts
I Braces (2)	$\frac{1}{2}$ ply. - $2\frac{1}{8} \times 5\frac{3}{8}$			• (2) $\frac{1}{4}$ " Flat Washers
J Drawer Frts./Backs (6)	$\frac{1}{2}$ ply. - $1\frac{3}{4} \times 14\frac{1}{2}$			• (2) $\frac{1}{4}$ "-20 Steel Knurled Knobs
K Drawer Sides (6)	$\frac{1}{2}$ ply. - $1\frac{3}{4} \times 13\frac{1}{2}$			

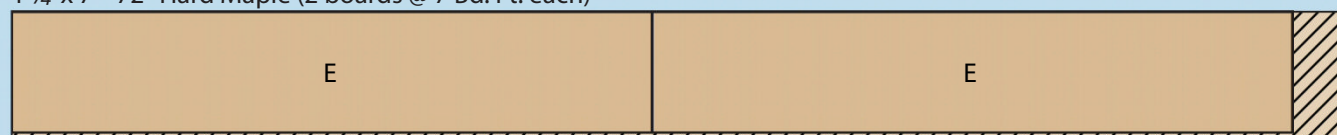
$1\frac{1}{2} \times 3\frac{1}{2}$ " - 36" Hard Maple (1.3 Bd. Ft.)



$\frac{3}{4} \times 3\frac{1}{2}$ " - 24" Hard Maple (0.6 Bd. Ft.)



$1\frac{3}{4} \times 7$ " - 72" Hard Maple (2 boards @ 7 Bd. Ft. each)



ALSO NEEDED: One 48" x 96" sheet of $\frac{3}{4}$ " Baltic birch plywood. One 48" x 48" sheet of $\frac{1}{2}$ " Baltic birch plywood. One 48" x 48" sheet of $\frac{1}{4}$ " birch plywood



Bahut Cabinet

Top to bottom, front to back, and side to side, this cabinet is a beauty. It's a workout in the shop — but the results will provide a lifetime of joy.

If you've never heard of George Nakashima or built any of his objects (he doesn't call them projects) you're in for a two-fisted, heavy-duty, deceptively simple, ruggedly delicate woodworking journey. All the paradoxes described here are fitting when it comes to the designs and life work of Mr. Nakashima. He was passionate about building, beauty, woodworking, and trees.

He treated trees as sacred objects, and many of his thoughts on trees were captured in the book he released in 1983 *"The Soul of a Tree."* Here's a quote from his website that gives you a feel for the reverence that he has for trees. *"In Japanese, kodama, the 'spirit of a tree,' refers to a feeling of kinship with the heart of a tree. It is our deepest respect for the tree...that we may offer the tree a second life."*

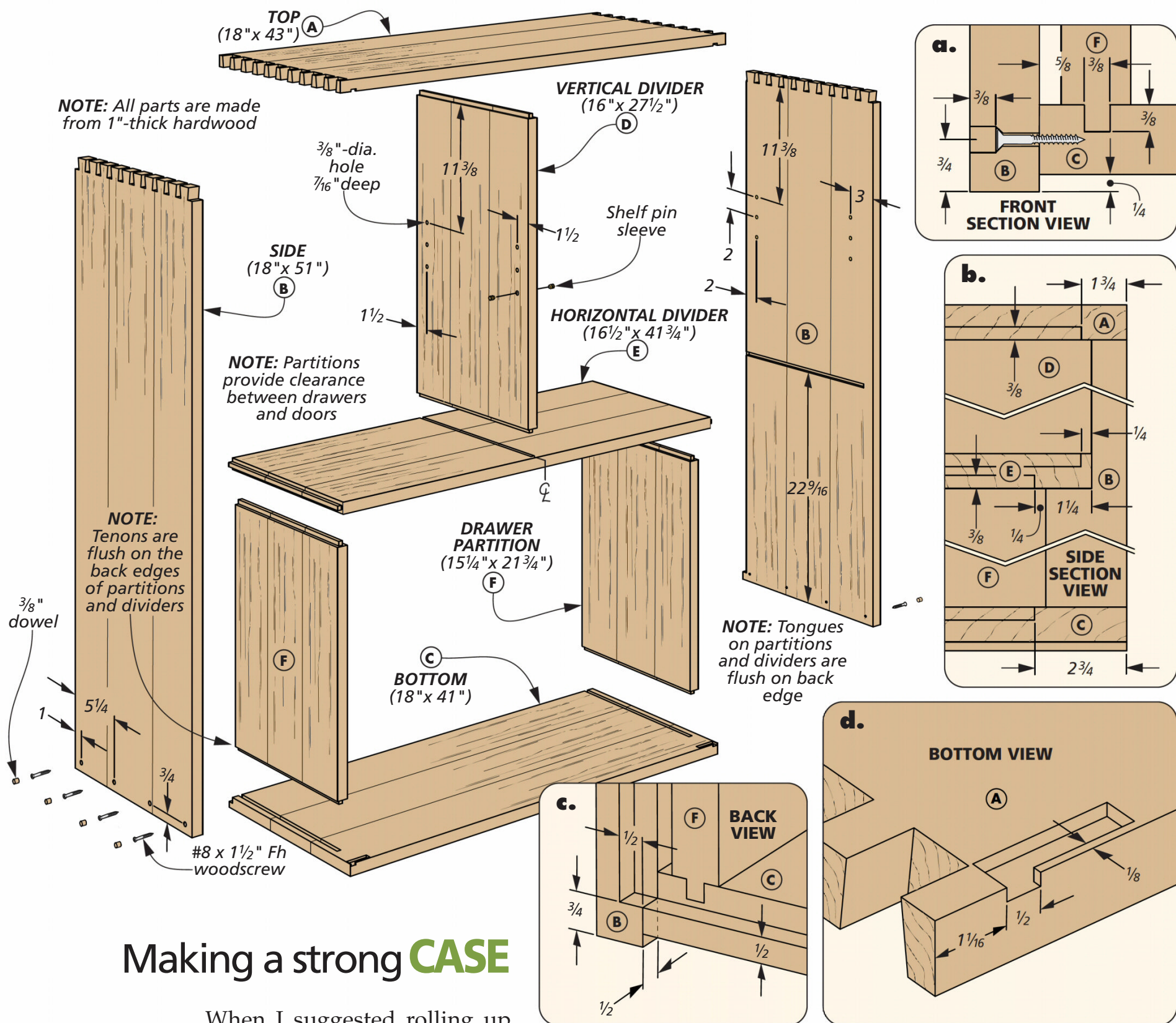
Now that you're aware of the broader background of this woodworker, let's hone in on Dillon Baker's interpretation of the *Bahut* cabinet. As you see in the pictures here, the cabinet is mainly made of thick walnut. Not only is walnut used in the drawer fronts, but the sides and back of the drawers also. The back of the cabinet is good looking as well; it's ship-lapped walnut slats — giving you the option of using the cabinet as a room divider if you so choose. The only plywood here is used for the drawer bottoms and as substrate for the walnut burl veneered door panels. Clearly it's time to roll up your sleeves and head to the shop.

◀ A large burl block (like this one) was a signature pull on Mr. Nakashima's *Bahut* cabinets. Dillon found this one on eBay. Mount it to the left door for an authentic look.



▲ Dovetail joinery that joins the top to the sides provides visual relief and interesting punctuation to the large panels. The pivot hinges are a strong but discrete way to operate the doors.

▼ Inside the cabinet you'll find ample room to store whatever particulars could be needed in the room the cabinet occupies. The solid walnut drawers add abundant storage options.



Making a strong CASE

When I suggested rolling up your sleeves, I meant it. This cabinet is a beast. All of the parts you see here are made of glued-up 1" thick material.

Sorting, selecting, and prioritizing the material for the case is one of the reasons Mr. Nakashima's objects are so highly prized. You should follow suit and pick the best material for the top, sides, and horizontal divider. When all of the panels have been glued up, cleaned, and trimmed to size, you can focus on the first of your joinery tasks — some big hand cut dovetails.

HAND CUT DOVETAILS. There's a primer for making hand-cut dovetails at Woodsmith.com/261.

The drawing at the top of the next page shows the layout of the pins on the top. The pins are used to locate the tails on the side. You can minimize sawing vibration in these big panels with good clamping strategies at the bench.

Test-fitting the dovetails ensures good-looking joinery, and also lets you get an exact measurement for the length of the bottom. Then you can pull the pieces apart and drill the counterbores and pilot holes in the sides (detail 'a').

INTERNAL PARTS. Start off by cutting the vertical and horizontal

dividers to size, along with the drawer partitions. Figure 1 on the next page shows how to make the tongues on these pieces. Now you can cut the stopped dados (detail 'b' above) in the partitions and dividers, Figure 2 sheds some insight on this. Figure 3 shows how to do the stopped dados in the sides and top. Take a moment and drill the holes for the shelf pin sleeves that you see in the main drawing above.

Cut the mortises in the top (detail 'd' above) and bottom for the pivot hinges. Figure 4 shows the bottom panel's mortise.

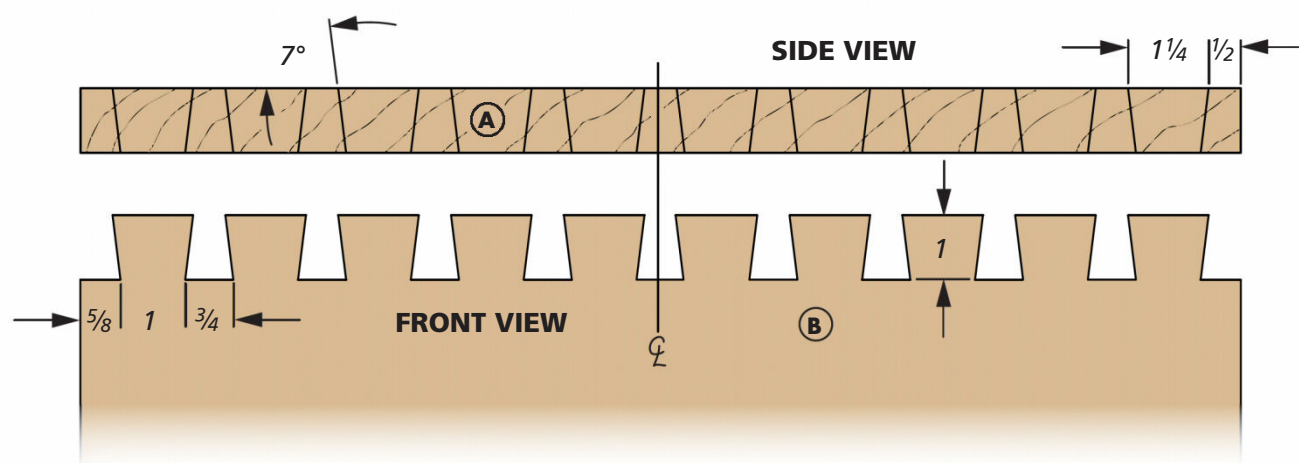


For more on how to make perfect hand cut dovetails, go to:

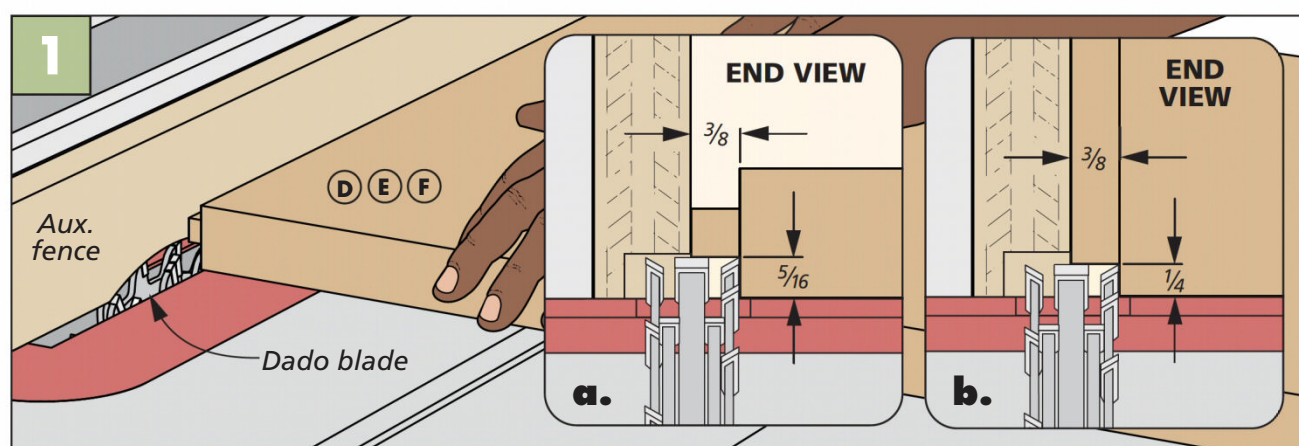
Woodsmith.com/261

ASSEMBLE THE CASE. Slow set glue and extra hands that know what they're doing will help make the case go together smoothly. Assemble the top, sides, horizontal divider, and bottom first. When the clamps are stowed, rout a rabbet along the rear edge of the cabinet for the back that you'll install later.

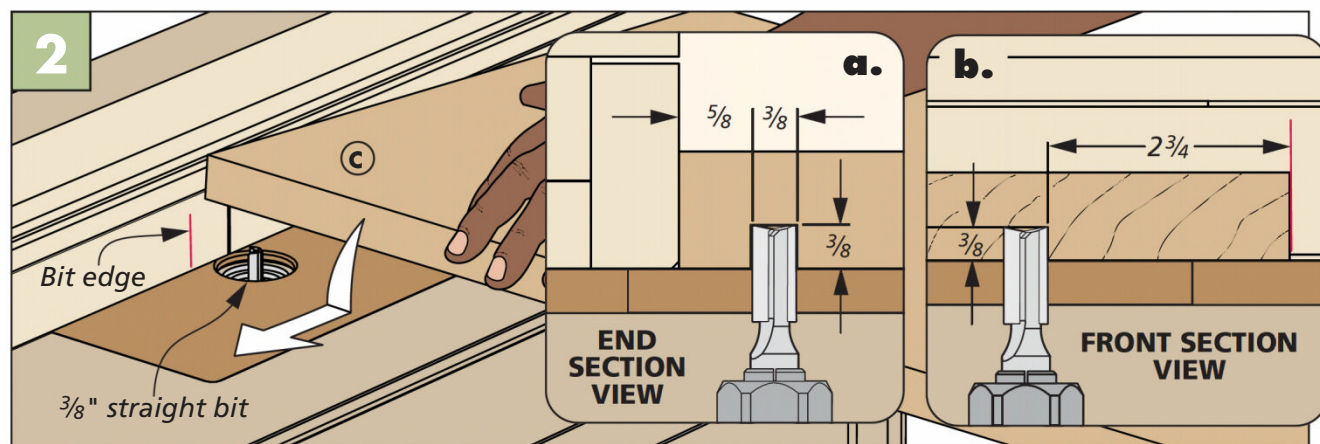
Now you can apply glue and slide the vertical divider and drawer partitions in place.



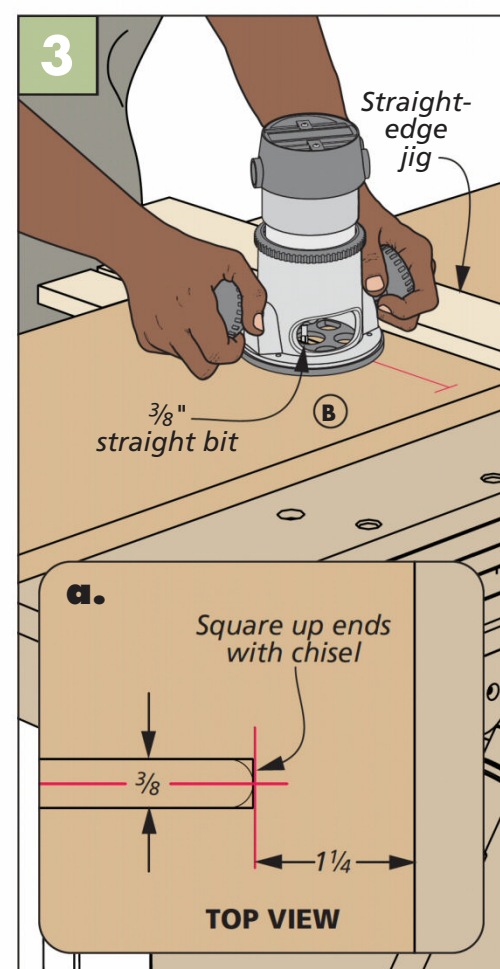
CASE JOINERY DETAILS



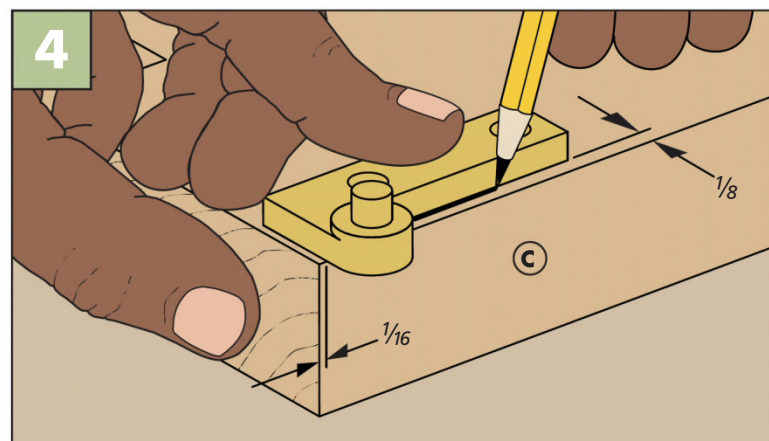
Tongues First. The tongues on the dividers and partitions are made at the table saw. Cut the shoulders with the boards supported by a miter gauge and auxiliary fence (detail 'b').



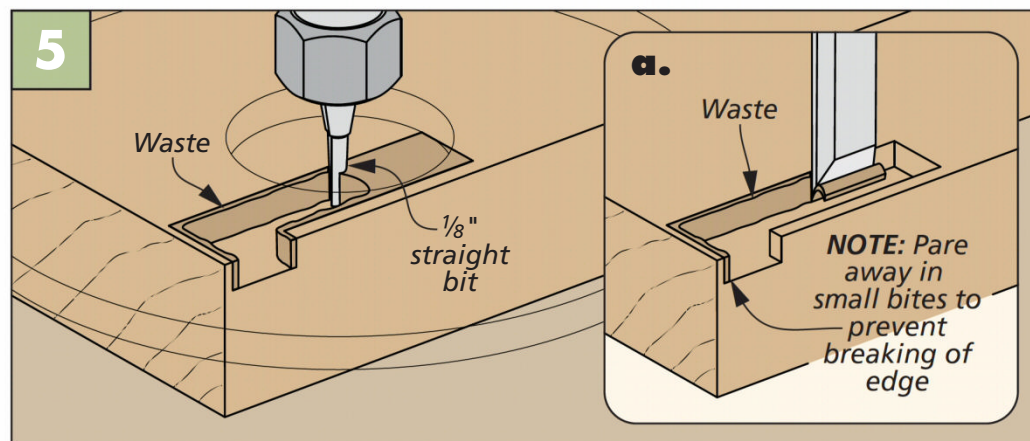
Stopped Dados. The dados for the partitions in the bottom and horizontal divider are stopped dados. To dial in your plunge cut, mark the leading edge of the bit on the fence.



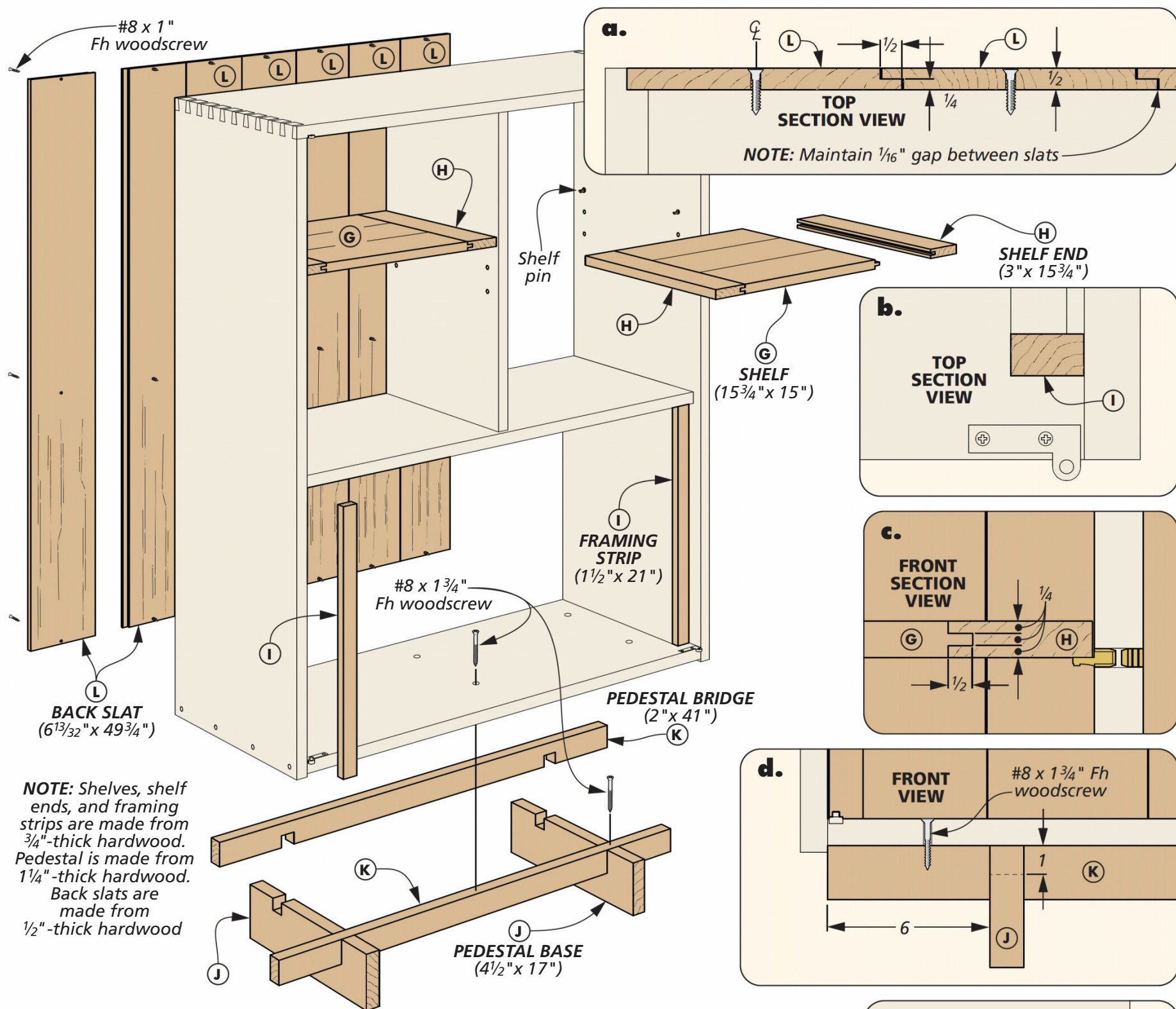
Dadoes for Dividers. A jig guides your router when making the dados for dividers.



Trace the Hinge. Place the hinge on the bottom and trace its outline with a marking knife or pencil.



Remove the Waste. A router and a small straight bit removes most of the waste. A chisel squares the corners and completes the job.



Next, the **BACK, THE DRAWERS, & MORE**

Building the case for this cabinet was definitely a workout. You'll be glad to know that all the heavy lifting you just finished required the most sweat equity — other than moving the cabinet to its final home, the heavy lifting is done. Some lighter fare is next, starting with the shelves.

SHELVES. The two shelves you see in the main drawing above and detail 'c' are panels with breadboard ends. After cutting the centered tongues in the shelves, cut the mating grooves in the ends. Both steps are done

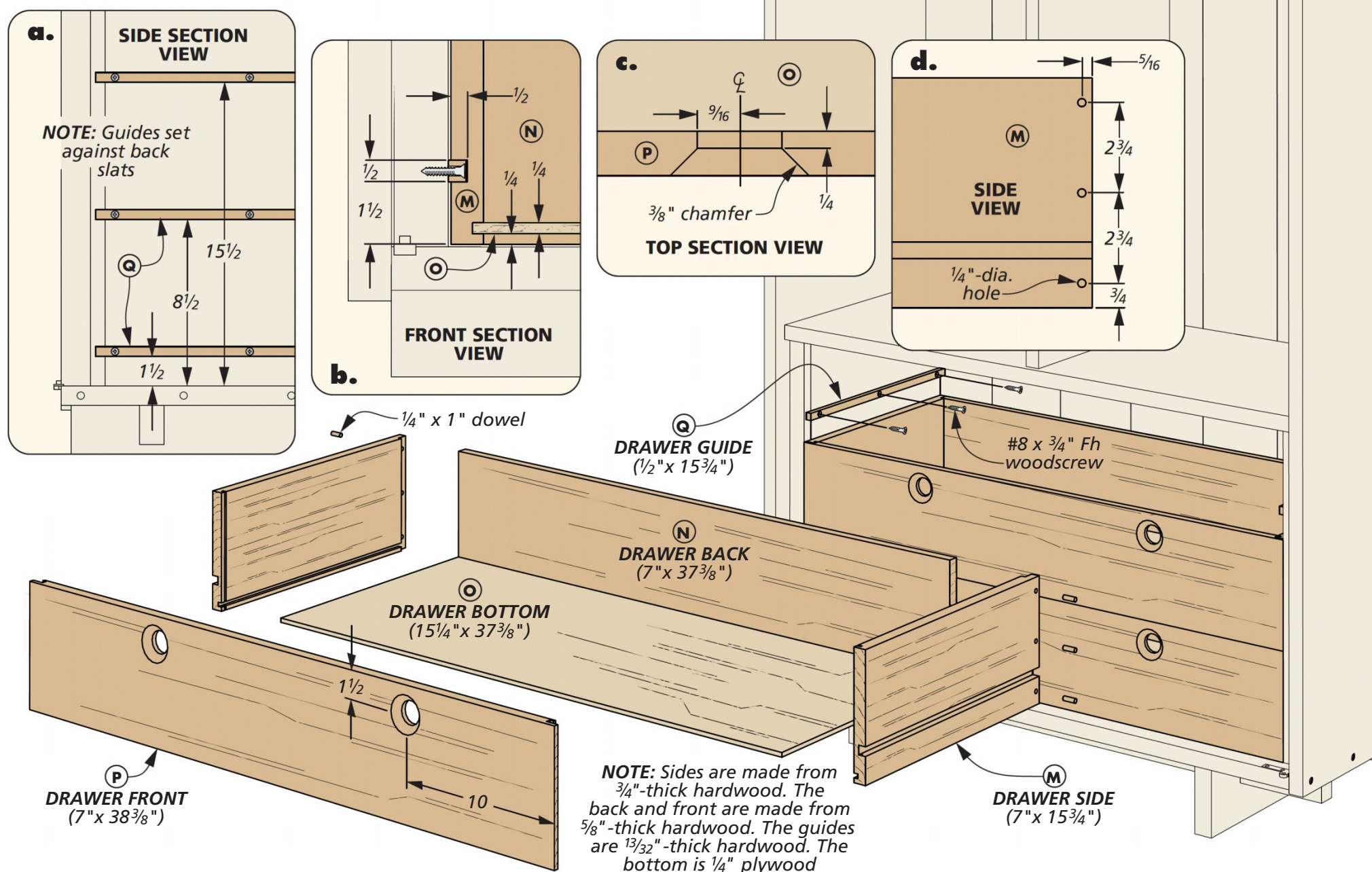
at the table saw. When clamping up the shelves, apply glue only in the center of the grooves to allow for wood movement.

FRAMING STRIPS. The framing strips you see in detail 'b' are glued to the edges of the drawer partitions. They cover the gap between the sides and drawer partitions. Now that you've had some time to recoup doing some light work, let's step back into the heavy material for a moment and focus what the cabinet sits on — the pedestal.

THE PEDESTAL. The pedestal of the cabinet scales nicely to the rest of the object. It lifts the cabinet off the ground for easy cleaning yet provides plenty of support. The wider base parts run from

front to back and are centered on the cabinet. Detail 'e' lays out the notches in the base.

Meanwhile the bridge parts travel side to side and are trapped between the side panels. All four pieces are notched (at the table saw) so they'll set flush to each other. Detail 'd' shows the notch location and how the bridge pieces cantilever beyond the base pieces. Once you've



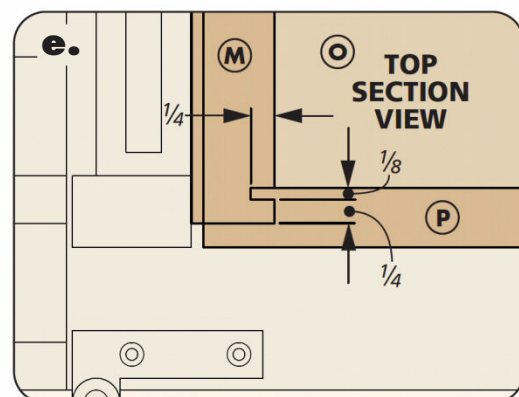
screwed the bridges to the bases, screw the assembly to the bottom of the cabinet (detail 'd').

THE BACK. The back slats have a shiplap joint that allows the boards to expand and contract. First cut double rabbets in all the pieces but the ends (detail 'a' on the previous page). Screw them in the center to the case and horizontal divider. The drawers are next on the agenda.

DRAWERS

It won't come as a shock to you, but as you see above these drawers are generously sized. Note that the sides are thicker than the front and back of the drawer. This adds some rigidity to these large drawers.

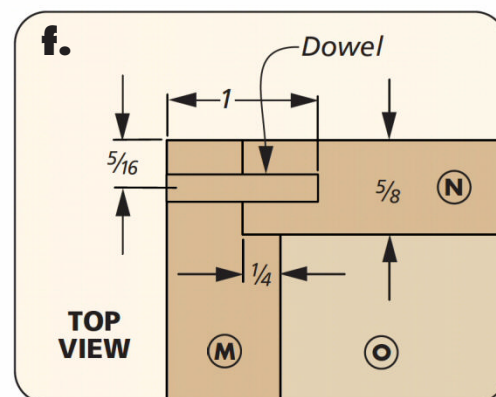
Start by milling all the pieces to size, then install your dado blade in the table saw. I started by making the rabbets in the back of the drawer sides (detail 'f'). Follow that up with changing the dado



setup and cut the grooves in the sides for the guides (detail 'b'). Then change the blade and make all the grooves in the drawer parts for the plywood bottoms.

The last dado setup is used to make the initial cut for the locking rabbet on the drawer front that you see in detail 'e.' Then trim the narrow lip on the back to make a tongue for the dado you'll cut next in the side.

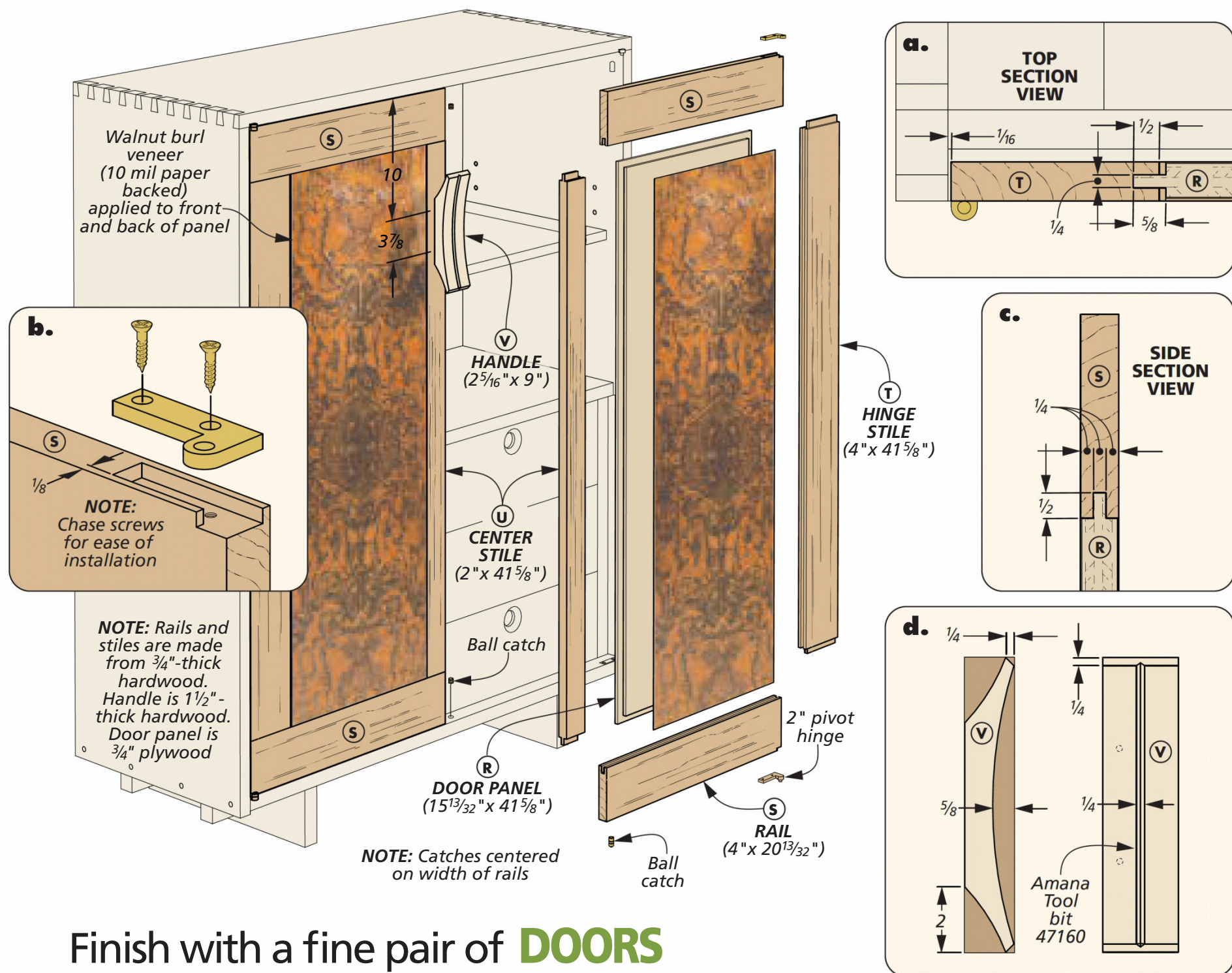
DRAWER PULLS. There are no drawer pulls. As shown in the main drawing above, there are two finger holes in the front. After you've drilled the holes,



use a chamfer bit to flare out the opening (detail 'c').

Now you can glue up the drawer. When the clamps come off, drill the holes for the dowels that pin the sides to the back (details 'd' and 'f'). To add a little more strength to the drawer they're held in place with epoxy. You can sand the dowels flush after the epoxy cures.

INSTALL THE DRAWERS. Cut the drawer guides to length and drill holes for the mounting screws. Detail 'a' shows their location in the cabinet. Now it's time to make some doors.



Finish with a fine pair of **DOORS**

You're at the final chapter of the *Bahut* cabinet, all that's left to do is make and hang these good looking doors. As you see in the drawing above, the panels are made of Baltic birch plywood with a walnut veneer. Let's start by making these panels.

DOOR PANELS. First, cut to size the Baltic birch panels. To apply the burl veneer (10 mil paper backed) our shop craftsman Steve Johnson used a vacuum press. He said it could be done with contact cement instead since it's paper backed. Either way, afterwards you'll need to cut a centered tongue on all the edges of the panels.

TONGUES. Notice in detail 'c' that the tongues for the rails are narrower than the tongues for the

stiles (detail 'a'). This creates the vertical shadow line between the panel and the stiles that I mentioned in the beginning. Before assembly, you'll need to paint the reveal of the vertical tongues black. Now it's time to make the rails and stiles.

RAILS & STILES. Notice that the stiles are trapped between the rails. To me, this detail makes the doors appear a little wider.

After you've cut the centered grooves in the rails and stiles at the table saw, you can glue up the two doors.

FITTING THE DOORS. Detail 'a' shows the ideal reveal that you want to create between the doors and the cabinet. Use thin shims to test fit the doors in the opening and plane the edges as needed.

Detail 'b' shows the mortises in the top and bottom rails for



For more on making an alternative burl handle, go to:

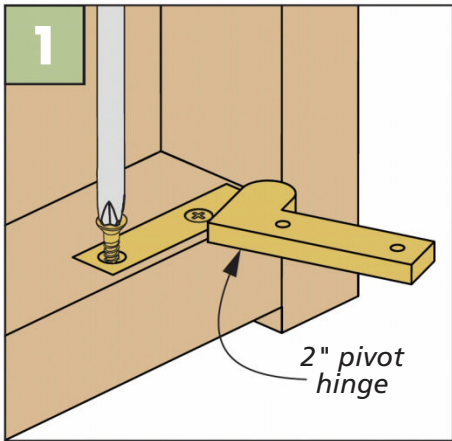
Woodsmith.com/261

the pivot hinges. Detail 'b' also shows the trick of drilling the pilot holes and installing the screws temporarily. This will make following the directions in Figure 2 in the box to the right much easier.

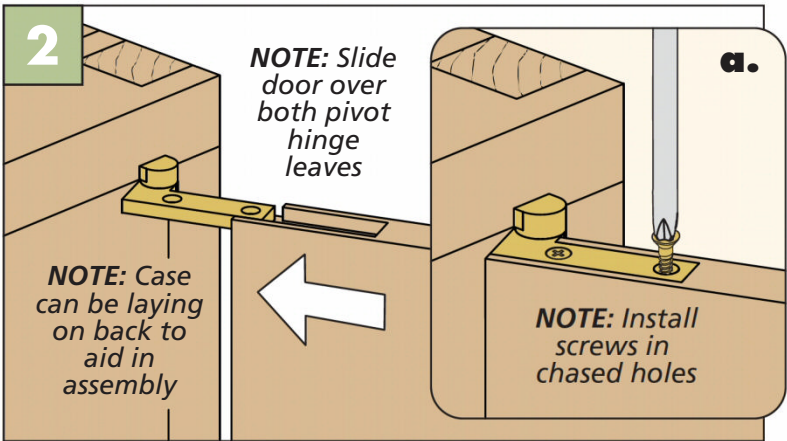
There are a couple of things left to do. Install the ball catches (detail 'f'). Make the handle that screws to the door on the left side of the cabinet (detail 'd' and 'e').

Now you can apply the finish. *Seal-A-Cell* and two coats of lacquer is all you need to protect this beautiful object — you'll want to let that walnut glow. **W**

HINGE MOUNTING



The Hinge. Screw the hinges into the mortises on the case.



Attach the Doors. With the help of a friend, slide the doors on to the hinges and screw them in place.

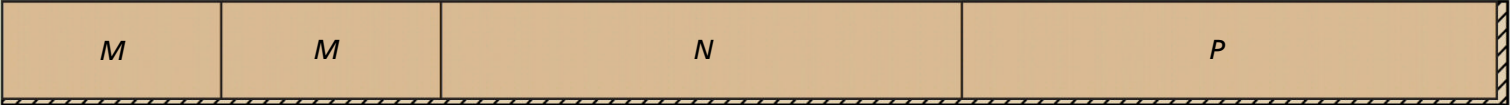
Materials, Supplies & Cutting Diagram

A Top (1)	1 x 18 - 43	L Back Slats (7)	$\frac{1}{2}$ x $6\frac{13}{32}$ - $49\frac{3}{4}$	• (10) #8 x $1\frac{1}{2}$ " Fh Woodscrews
B Sides (2)	1 x 18 - 51	M Drawer Sides (6)	$\frac{3}{4}$ x 7 - $15\frac{3}{4}$	• (1) $\frac{3}{8}$ " x 8" Walnut Dowel
C Bottom (1)	1 x 18 - 41	N Drawer Backs (3)	$\frac{5}{8}$ x 7 - $37\frac{3}{8}$	• (24) Shelf Pin Sleeves
D Vertical Divider (1)	1 x 16 - $27\frac{1}{2}$	O Drawer Bottoms (3) $\frac{1}{4}$ ply. - $15\frac{1}{4}$ x $37\frac{3}{8}$		• (8) Shelf Pins
E Horizontal Divider (1)	1 x $16\frac{1}{2}$ - $41\frac{3}{4}$	P Drawer Fronts (3)	$\frac{5}{8}$ x 7 - $38\frac{3}{8}$	• (10) #8 x $1\frac{3}{4}$ " Fh Woodscrews
F Drawer Partitions (2)	1 x $15\frac{1}{4}$ - $21\frac{3}{4}$	Q Drawer Guides (6)	$\frac{13}{32}$ x $\frac{1}{2}$ - $15\frac{3}{4}$	• (18) #8 x $\frac{3}{4}$ " Fh Woodscrews
G Shelves (2)	$\frac{3}{4}$ x $15\frac{3}{4}$ - 15	R Door Panels (2) $\frac{3}{4}$ ply. - $15\frac{13}{32}$ x $41\frac{5}{8}$		• (21) #8 x 1" Fh Woodscrews
H Shelf Ends (4)	$\frac{3}{4}$ x 3 - $15\frac{3}{4}$	S Rails (4)	$\frac{3}{4}$ x 4 - $20\frac{13}{32}$	• (1) $\frac{1}{4}$ " x 18" Walnut Dowel
I Framing Strips (2)	$\frac{3}{4}$ x $1\frac{1}{4}$ - 21	T Hinge Stiles (2)	$\frac{3}{4}$ x 4 - $41\frac{5}{8}$	• (4) 2" Pivot Hinges
J Pedestal Base (2)	$1\frac{1}{4}$ x $4\frac{1}{2}$ - 17	U Center Stiles (2)	$\frac{3}{4}$ x 2 - $41\frac{5}{8}$	• (4) $1\frac{1}{32}$ " dia. Ball Catch
K Pedestal Bridge (2)	$1\frac{1}{4}$ x 2 - 41	V Handle (1)	$1\frac{1}{2}$ x $2\frac{5}{16}$ - 9	

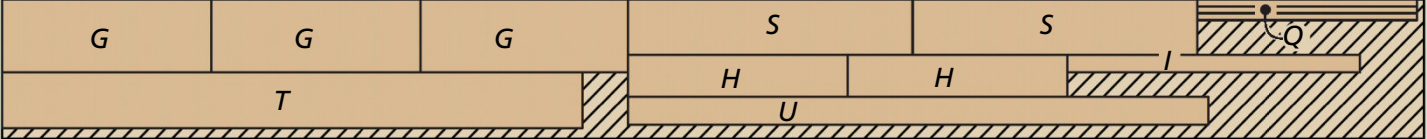
1" x 6" - 114" Walnut (Three boards @ 5.9 Bd. Ft. each)



$\frac{3}{4}$ " x $7\frac{1}{4}$ " - 108" Walnut (Three Boards @ 5.4 Bd. Ft. Each)



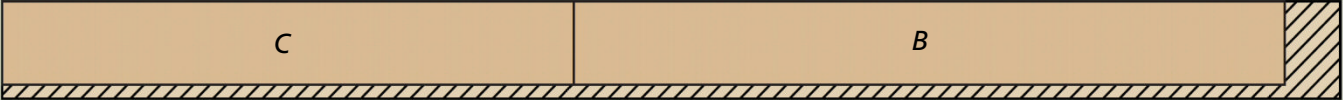
$\frac{3}{4}$ " x 10" - 102" Walnut (Two Boards @ 7.1 Bd. Ft. Each)



1" x 7" - 96" Walnut (Three boards @ 5.8 Bd. Ft. each)



1" x 7" - 96" Walnut (Three boards @ 5.8 Bd. Ft. each)



$1\frac{1}{4}$ " x $9\frac{1}{2}$ " - 60" Walnut (5.9 Bd. Ft.)

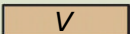


$\frac{1}{2}$ " x 7" - 54" Walnut (Seven Boards @ 2.6 Sq. Ft. Each)



ALSO NEEDED: One 48"x 48" Sheet of $\frac{1}{4}$ " Walnut Plywood, One 48"x 48" Sheet of $\frac{3}{4}$ " Baltic birch Plywood, One Sheet of 48"x 96" Walnut burl veneer (10 mil paper backed)

$1\frac{1}{2}$ " x $2\frac{5}{16}$ " - 9" Maple block





Bathroom Vanity

This vanity combines Mission sensibility with a cheerful, modern style to brighten up any bathroom and expand an otherwise small space.

In my opinion, a vanity is the centerpiece of a bathroom. Of course, this could just be me—wood will always draw my eye more than tile or porcelain. Regardless, a bathroom vanity is a great chance to add style and color to an often less-than-glamorous room.

The vanity here clearly takes inspiration from the classic Mission aesthetic: thick legs, strong vertical and horizontal lines, and paneled sides for a simple sense of depth. Yet the sturdy design is offset by the bright, carefree color and the open, airy design of the bottom shelf.

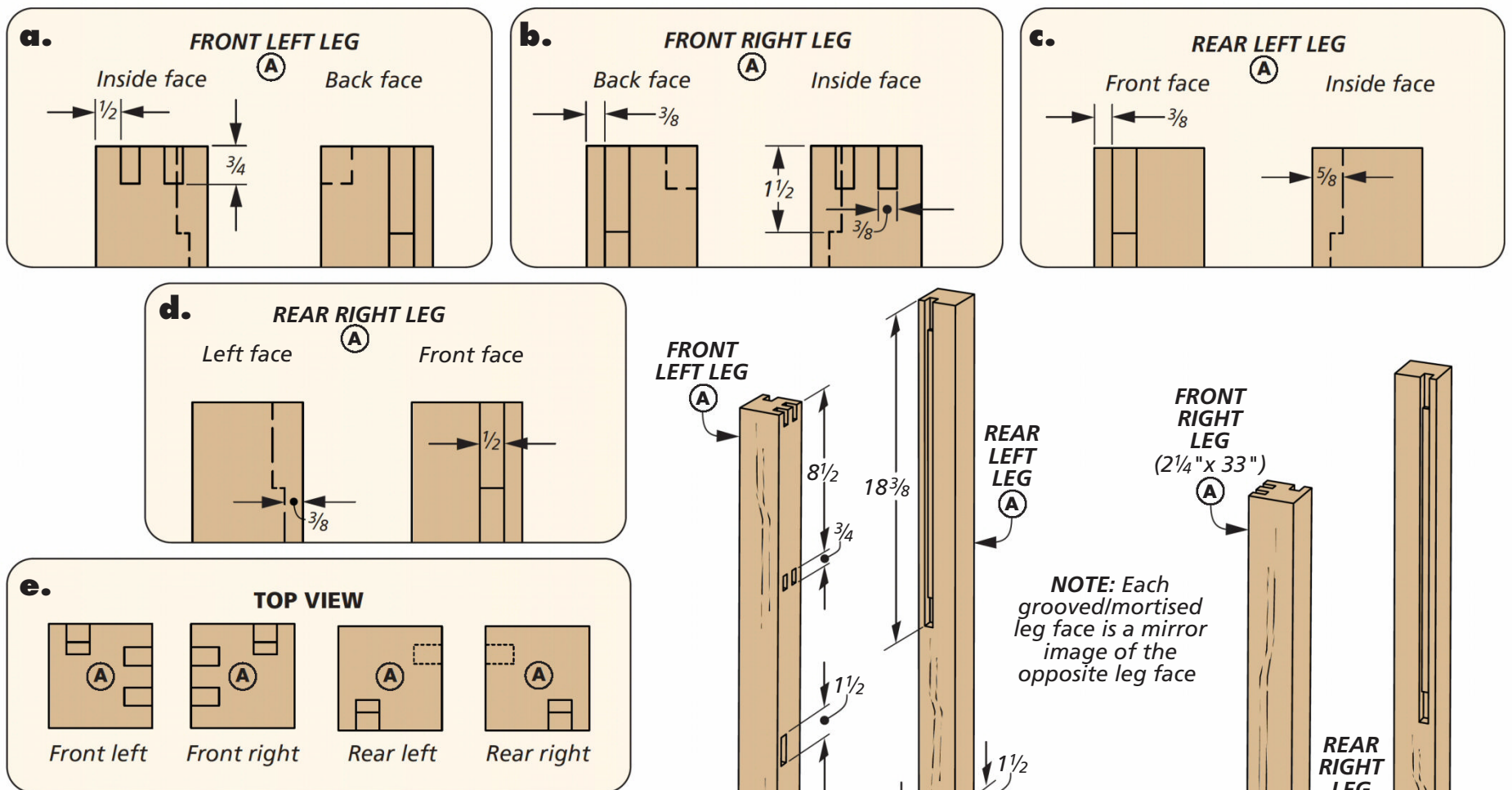
This project was designed with smaller bathrooms in mind, to light up the room and provide the feeling of a larger vanity without taking up all the space. That said, this colorful piece can be

a great addition to any lavatory of your choice, from an expansive washroom to a tucked-away water closet.

True to its inspiration, you'll find this project full of sturdy joints. Mortise and tenons provide most of the structure here, with a few grooves to hold in those side panels of course. Of particular note, you'll find a couple instances of twin tenons here as well. This is an easy method of adding strength to a joint when you think a little extra brawn might be needed (like when it'll be holding up a porcelain sink basin). A finish of milk paint and lacquer adds a fresh look and protects the vanity from moisture, even through the most indulgent of showers. All in all, this simple-yet-sturdy piece is a great candidate for your next project.

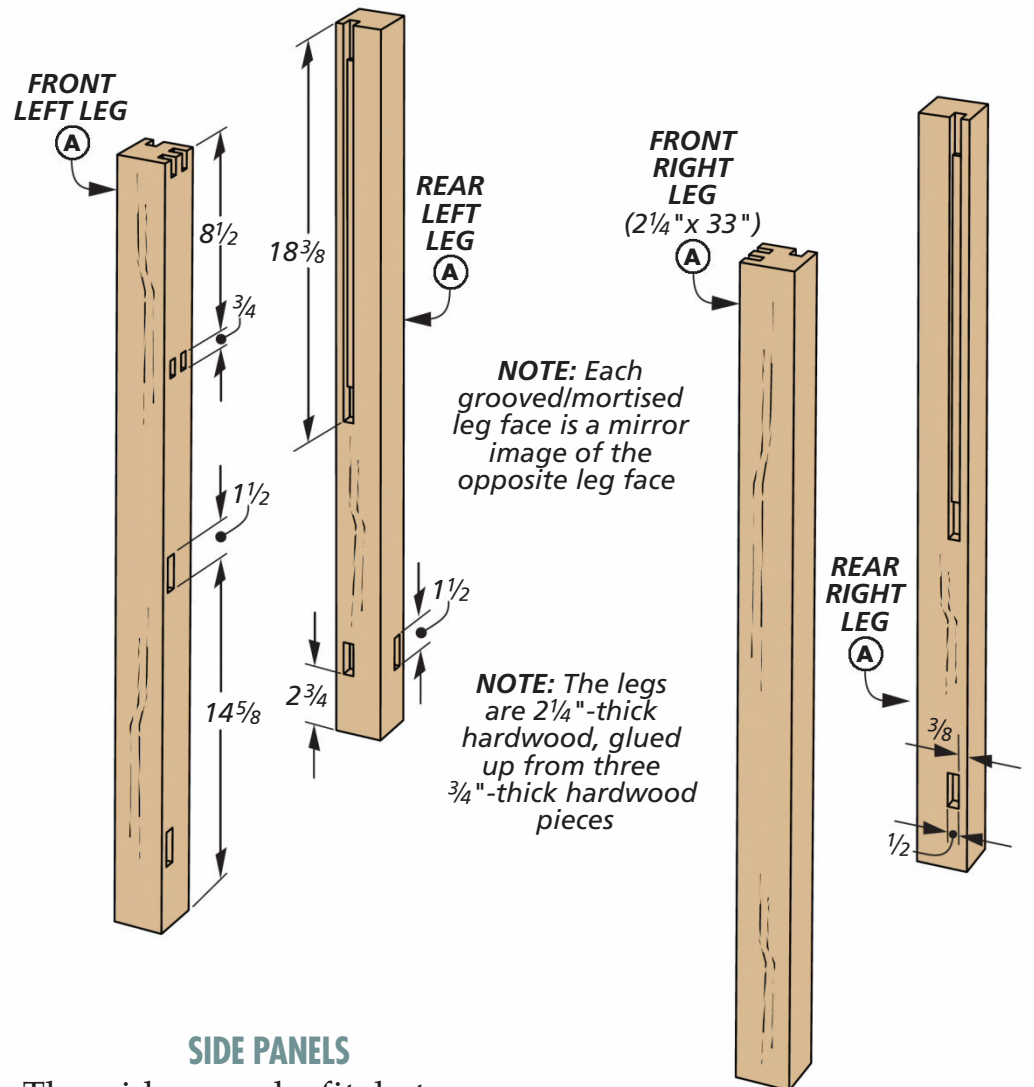


◀ This U-shaped drawer offers significant storage while still accommodating space for plumbing within. The false drawer front above balances the vanity and conceals the sink's inner workings. A slatted shelf below gives a light feeling to the piece as a whole.



A Strong Set of LEGS

The legs are the foundation of this vanity, so they make an excellent place to start. First, lay out the mortises and stopped grooves on each leg according to the drawings above. With those in place, cut the grooves as you see in the box below. Once you've taken care of the grooves, head back to the drill press and bore out most of the waste for the mortises. Use a chisel to finish the mortises, squaring them up and paring the sides smooth.



SIDE PANELS

The side panels fit between the legs and rails (drawings on opposite page). After gluing up and sizing the panels, cut a rabbet around the back face of each.

STRETCHERS & RAILS. Cut the stretchers and rails to size, then head to the table saw to make the

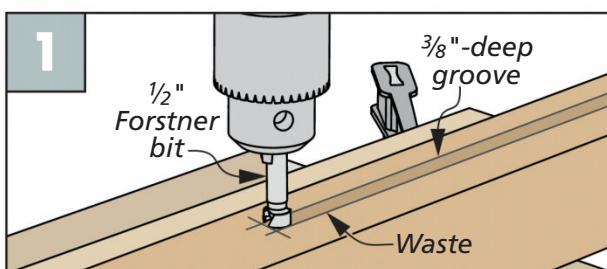
tenons. The upper and middle stretchers have a double tenon on each end, and the tenons of the top stretchers and rails are flush with the top faces (details 'a,' 'd,' and 'e,' opposite page). Once the tenons are in place, cut the grooves you see in details 'a' and 'b' on the next page.

The nailer board gives you a place to screw the vanity into your wall. It'll be pocket screwed in place during assembly, but set it aside for now.

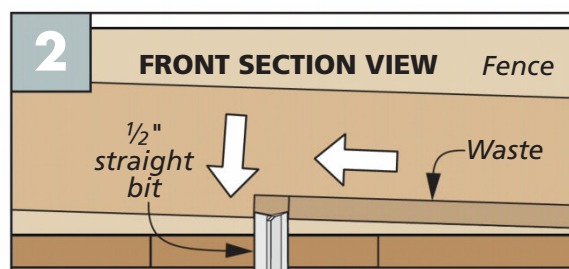
FRAME ASSEMBLY. It's time to bring these pieces together. Start by making two side assemblies. Use the rails to join the legs, gluing them up but leaving the side panels unglued within.

Once dry, the two side assemblies can be joined using the

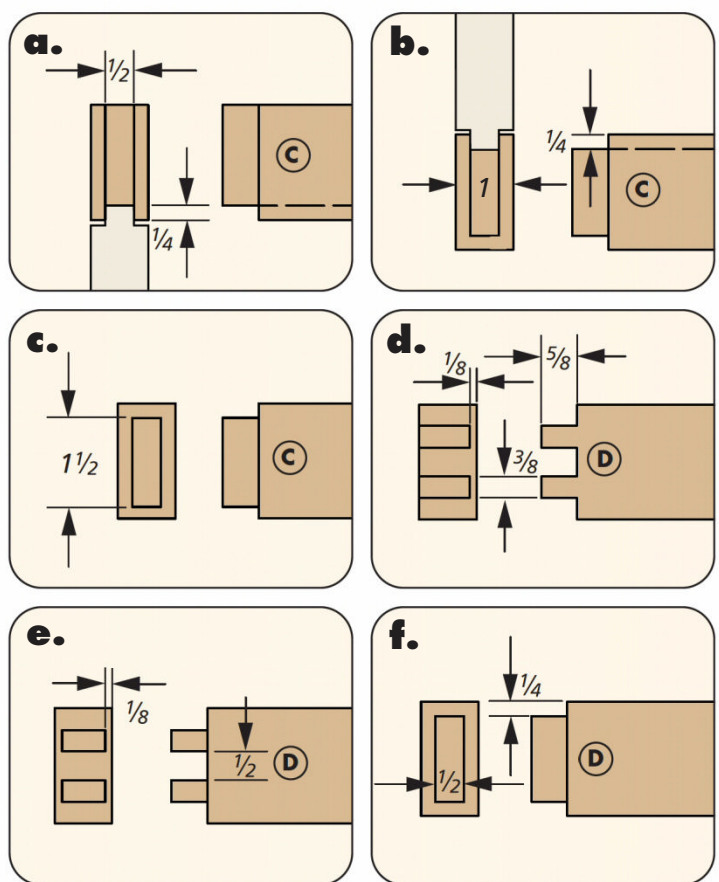
MAKING STOPPED GROOVES



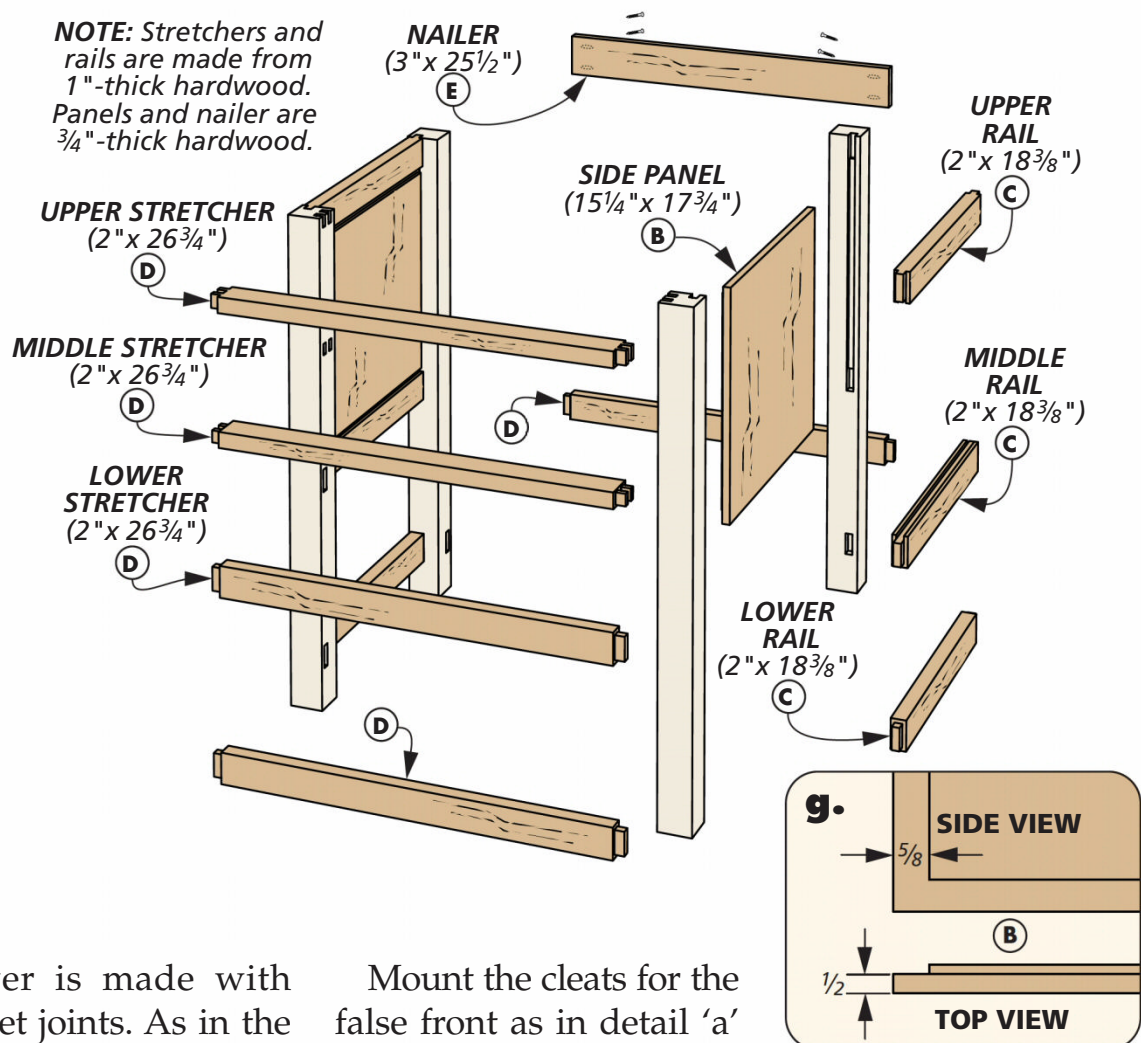
Drill the Ends. Lay out the grooves on the leg pieces. Drill out the end of each groove with a Forstner bit.



Rout the Groove. Lower the piece over the spinning bit and cut to the other end, then square with a chisel.



NOTE: Stretchers and rails are made from 1"-thick hardwood. Panels and nailer are 3/4"-thick hardwood.

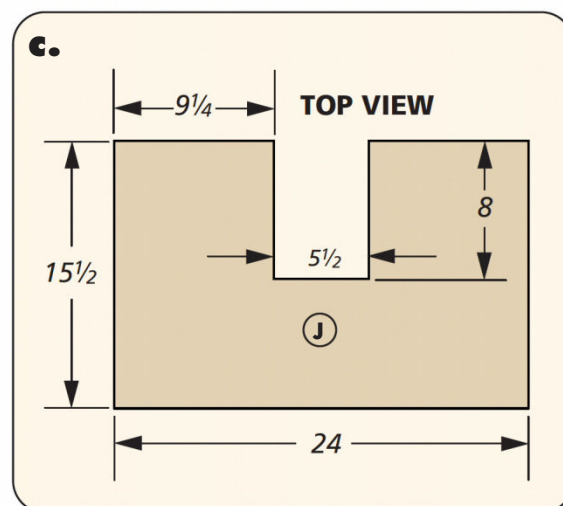
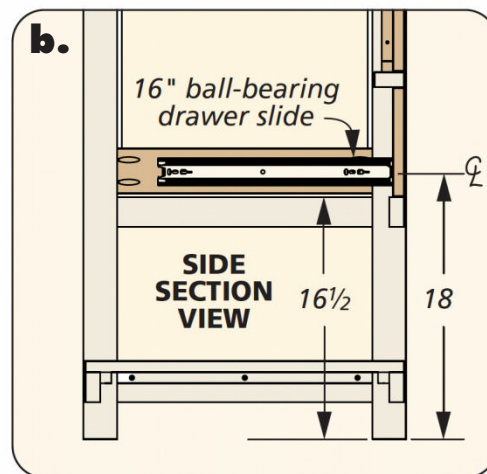
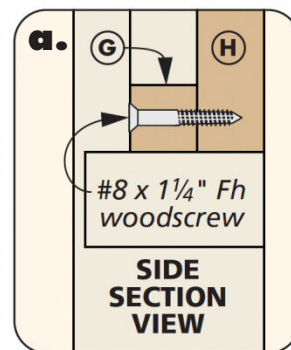
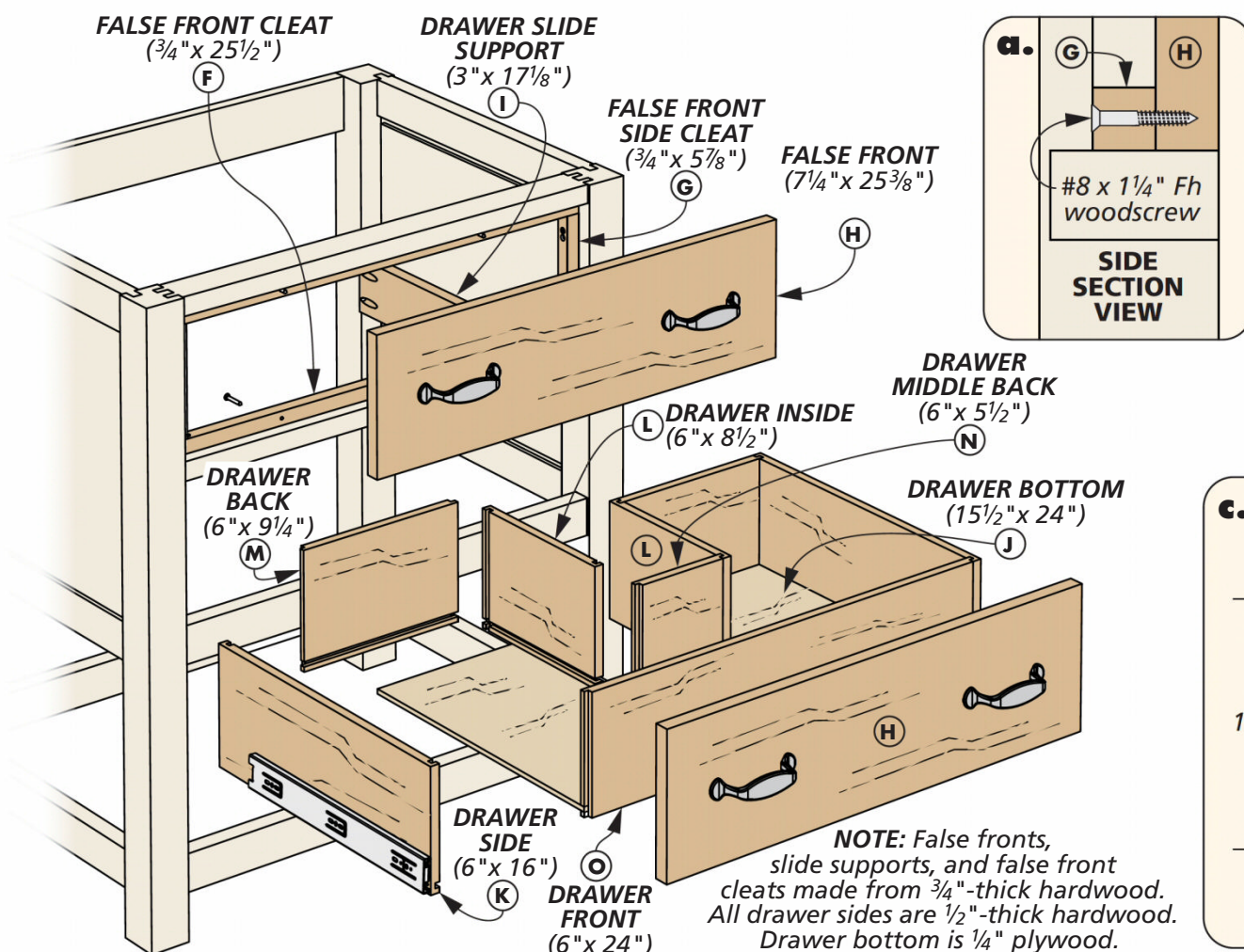


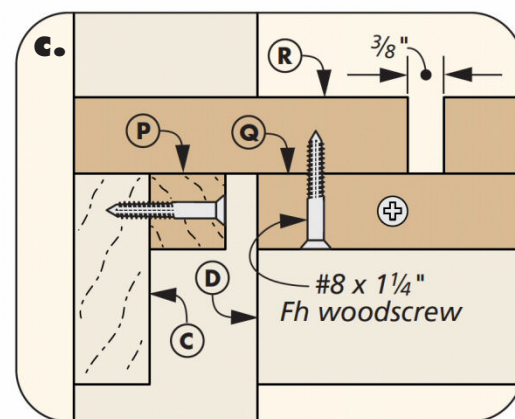
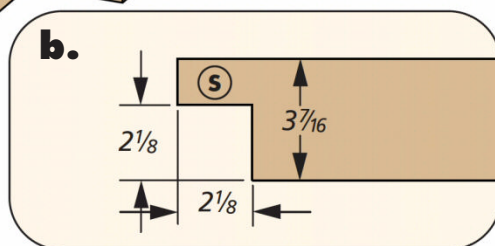
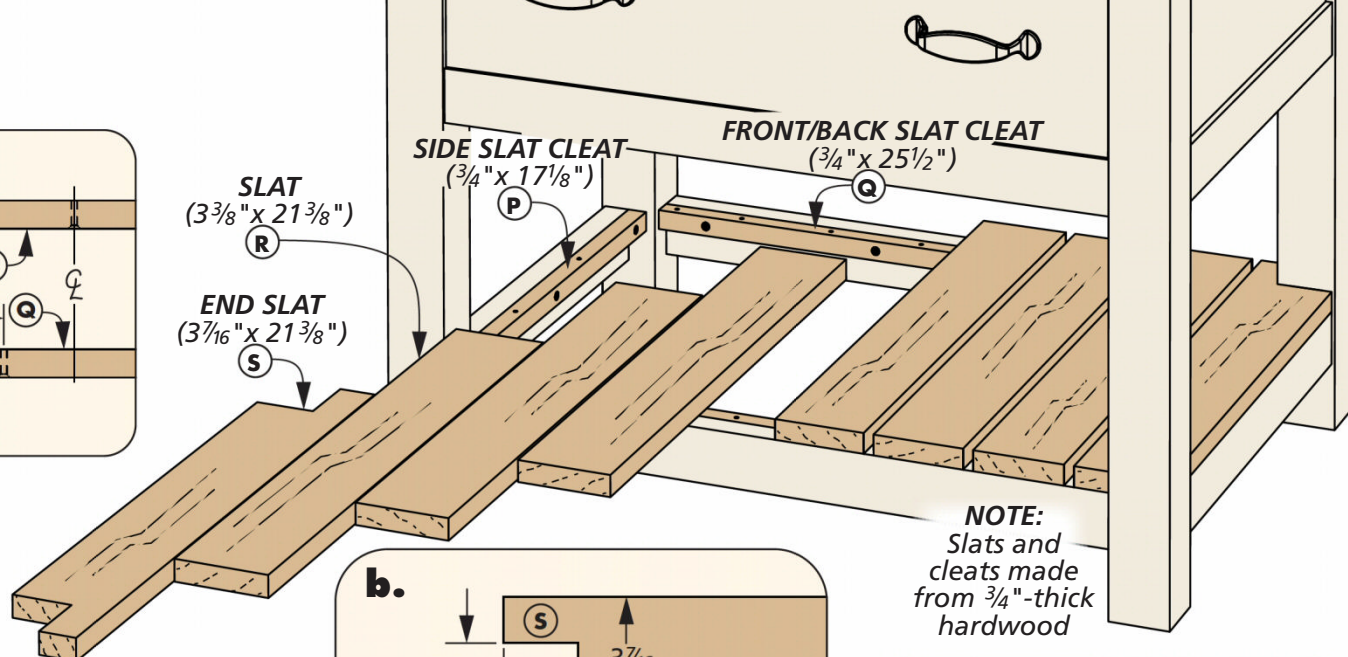
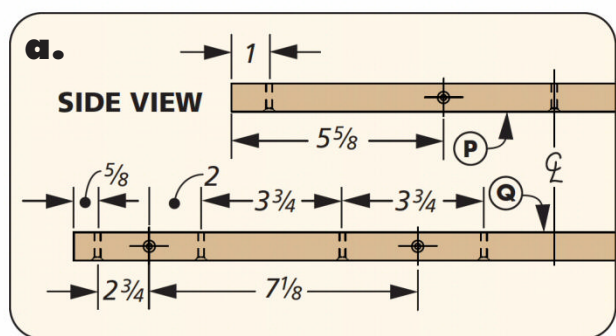
stretchers. After the whole assembly has been glued up, the nailer can be pocket screwed into the rear legs, flush to their tops.

FALSE FRONT & DRAWER. Now for the false front and drawer. The false front is screwed on with cleats, while the drawer will be held in by full-extension slides (and each requires 1/2" of clearance).

The drawer is made with locking rabbet joints. As in the drawing below, cut rabbets in the back, middle back, and front pieces. Next, cut mating dados in the sides and insides. Finally, cut grooves into the inner face of each drawer piece to accept the plywood drawer bottom, then glue up the drawer assembly.

Mount the cleats for the false front as in detail 'a' below, then screw on the false front. Screw the other false front to the drawer. Attach the supports for the drawer guides to the frame with pocket screws. Mount the slides, then install the drawer. Lastly, attach two handles to each front.





An Open & AIRY SHELF

Below the drawer lies a shelf. Rather than one solid panel however, this shelf is a series of slats. There are eight in total: six middle slats and two end slats, all screwed into hidden cleats.

Begin by screwing the cleats in place behind the lower rails and stretchers, as in the drawing above. Now mark out the centerline on the front and back cleats to give you a starting place for screwing on the slats.

The end slats are wider than the middle ones, and I recommend cutting them extra wide

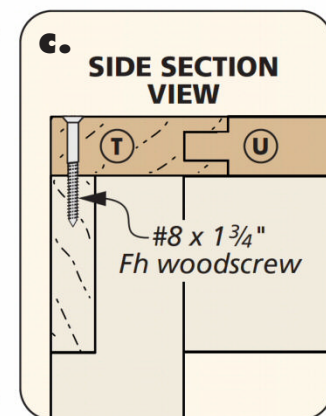
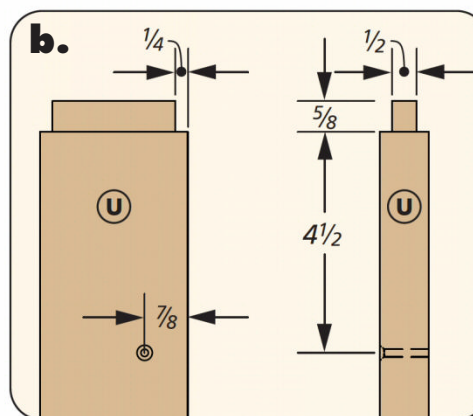
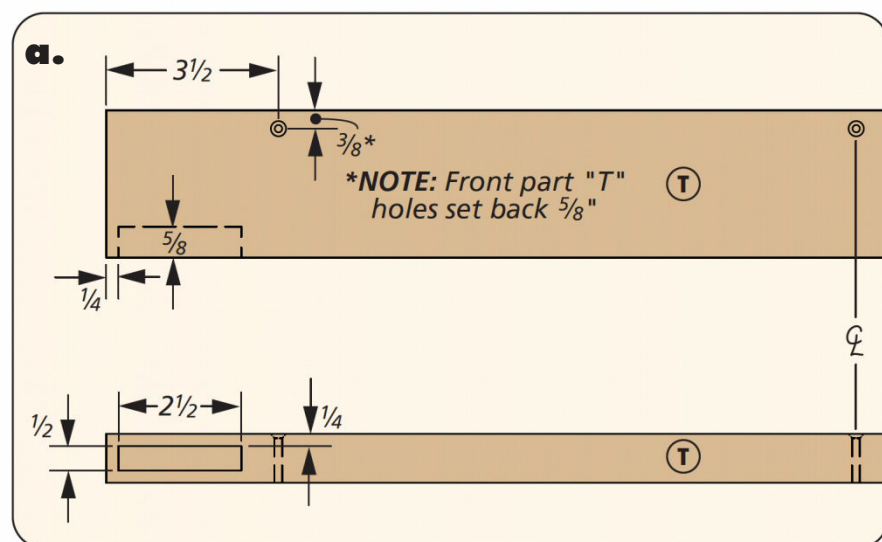
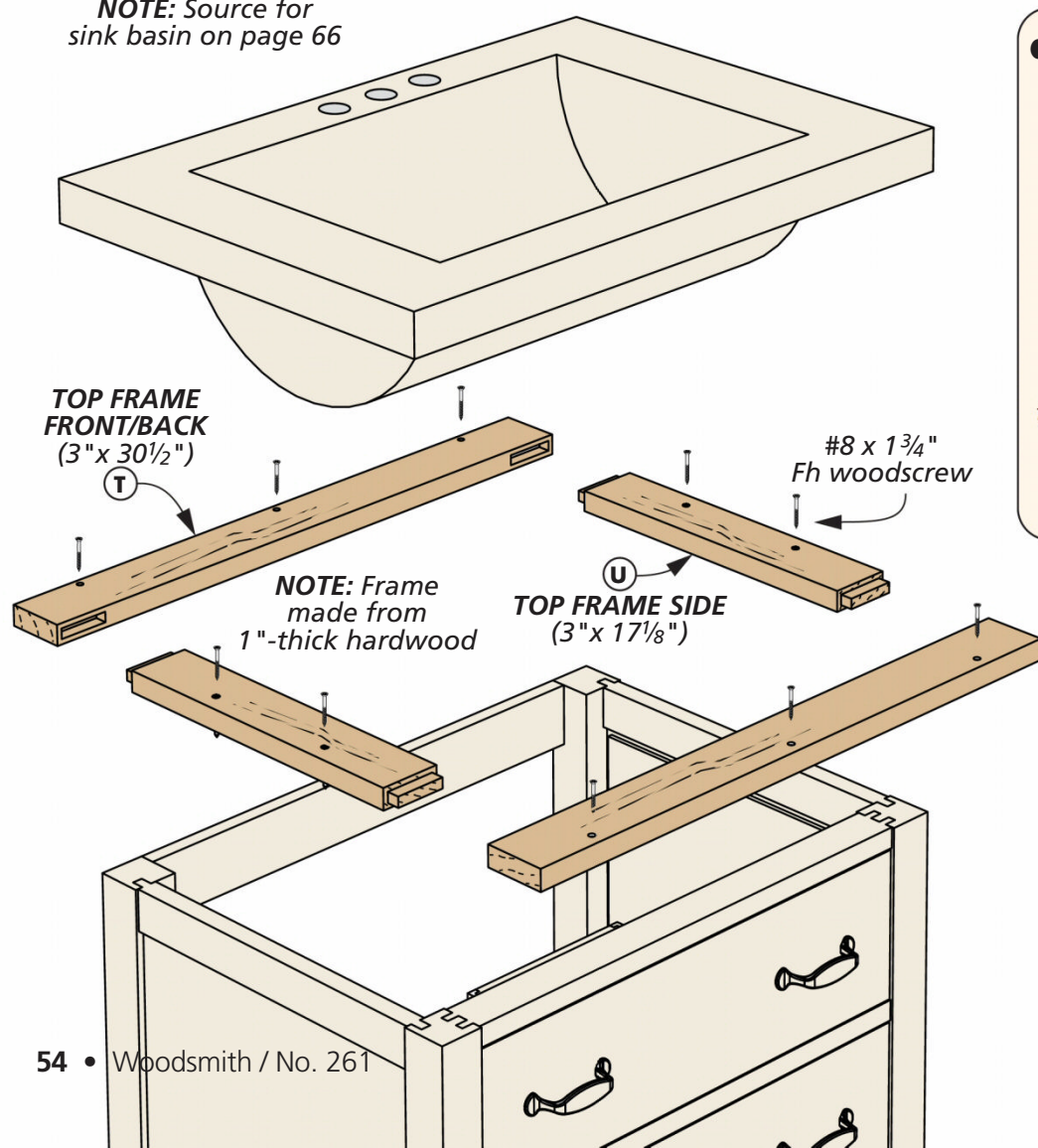
to start off with so they can be cut to fit exactly later on. Start with the middle two, then work out toward the ends, driving the screws up from below and keeping consistent spacing (detail 'c').

As shown in detail 'b,' the end slats are notched to fit the legs. Fit the workpieces against the legs to mark these cuts. Then rip both end slats to final width. Either use the dimensions shown in detail 'b' above, or set your slats in place and mark where they'll sit flush with the rails. Lastly, screw them in place.

FRAME & SINK

Much like you've seen in this project so far, mortise and tenons do the heavy lifting in the frame. After sizing the frame pieces, cut tenons into the ends of the two sides, as in detail 'b' below. For the front and back pieces, make the mortises just as you did on

NOTE: Source for sink basin on page 66



the legs (detail 'a'). Fit the joints together and glue up the frame.

Once dry, position the frame over the vanity, centered side to side and flush with the back. Clamp the frame in place, drill the pilot holes, and screw the frame on top of the vanity.

FINISHING. It's a good idea to finish the vanity before installing it. We began by painting the vanity with *General Finishes*' "Persian Blue" milk paint, then applied lacquer over the top.

MOUNTING. Before mounting the vanity, be sure to turn the water lines off. Now move the vanity into place. If you're lucky, it may fit with no noticeable gaps around it, but the walls and floors of most homes aren't flat and square. If the vanity needs to be levelled, trim a leg with a saw, or shim beneath a leg so the vanity sits level. Secure the vanity by driving long screws through the nailer piece and into the studs of your wall.

Install the faucet in the sink basin before attaching them to the vanity (sources for both on page 66). A thin bead of caulking between the basin and the frame should be enough to secure the sink. Once your sink is in place, reattach the drain trap and water lines. Removing the drawer and false front will make this process much easier. After the sink is in working order, you're finished! Enjoy the new splash of color and style in your bathroom. [W](#)

Materials, Supplies & Cutting Diagram

A Legs (4)	2 1/4 x 2 1/4 - 33	L Drawer Insides (2)	1/2 x 6 - 8 1/2	• (4) Brushed Nickel Andante Pull • (1 pr) 16" Full-Ext. Drawer Slide • (1) 31" W x 22" D Sink Basin • (1) 4" Center Set Faucet • (12) #8 x 1 1/4" Pocket screws • (48) #8 x 1 1/4" Fh Woodscrews • (10) #8 x 1 3/4" Fh Woodscrews
B Side Panels (2)	3/4 x 15 1/4 - 17 3/4	M Drawer Backs (2)	1/2 x 6 - 9 1/4	
C Rails (6)	1 x 2 - 18 3/8	N Drawer Middle Back (1)	1/2 x 6 - 5 1/2	
D Stretchers (5)	1 x 2 - 26 3/4	O Drawer Front (1)	1/2 x 6 - 24	
E Nailer (1)	3/4 x 3 - 25 1/2	P Side Slat Cleats (2)	3/4 x 3/4 - 17 1/8	
F False Front Cleats (2)	3/4 x 3/4 - 25 1/2	Q Front/Back Slat Cleats (2)	3/4 x 3/4 - 25 1/2	
G False Front Side Cleats (2)	3/4 x 3/4 - 5 7/8	R Slats (6)	3/4 x 3 3/8 - 21 3/8	
H False Fronts (2)	3/4 x 7 1/4 - 25 3/8	S End Slats (2)	3/4 x 3 7/16 - 21 3/8	
I Drawer Slide Supports (2)	3/4 x 3 - 17 1/8	T Top Frame Front/Back (2)	1 x 3 - 30 1/2	
J Drawer Bottoms (1)	1/4 ply. - 15 1/2 x 24	U Top Frame Sides (2)	1 x 3 - 17 1/8	
K Drawer Sides (2)	1/2 x 6 - 16			

1/2" x 6 1/2" - 36" Hard Maple (1.6 Sq. Ft.)



ALSO NEEDED: One 24" x 24" sheet of 1/4" maple plywood

1/2" x 6 1/2" - 72" Hard Maple (3.3 Sq. Ft.)



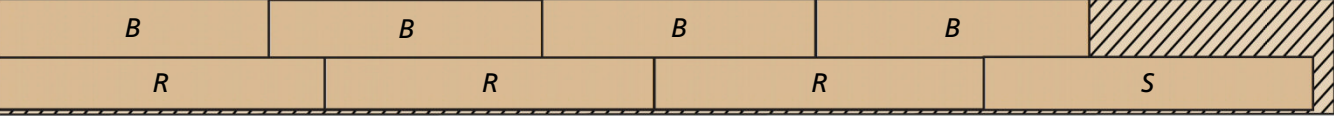
3/4" x 2" - 84" Poplar (1.2 Bd. Ft.)



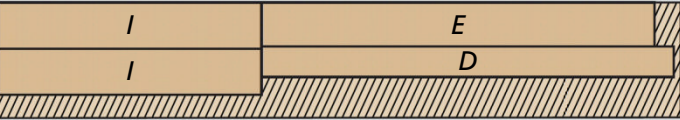
3/4" x 7 1/2" - 96" Poplar (5.0 Bd. Ft.) (Need two)



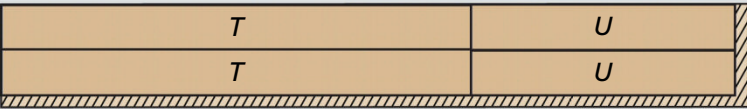
3/4" x 7 1/2" - 86" Poplar (5.0 Bd. Ft.)



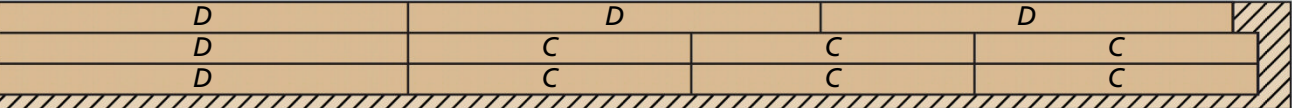
3/4" x 7 1/2" - 45" Poplar (2.1 Bd. Ft.)



1" x 6 1/2" - 48" Poplar (2.6 Bd. Ft.)



1" x 7" - 84" Poplar (4.1 Bd. Ft.)



Whimsical Clock

Time stops for a moment for everyone who beholds this project. And then they want to know how it's done — it all starts with your CNC machine.

This clock is one of the more unique projects that have graced the pages of *Woodsmith*. There are several reasons for this. First, obviously, it's a working clock made out of wood. Second, you have two options in how to build it: download the CNC files, or the full-size patterns for your scroll saw. Both items are found at Woodsmith.com/261.

The next thing that stands out about this clock is — holy moly, all them gears and wheels. Not to worry, you don't have to be a horologist to make this clock. It's more like a fancy puzzle that moves and makes a charming sound once you've put it together.

CLOCK GLOSSARY. We can't go into all the nuances of clock making in these few pages. So I heartily recommend an informative set of videos on *YouTube* from the *National Watch & Clock Museum* that go into great detail about the hows and whys a clock ticks. Also online at

The moving wheels of a wood clock, combined with its calm tick-tock, is a mesmerizing thing to witness. Each time you wind the clock you have 12 hours of enjoyment.



▼ This project will keep your CNC machine humming and happy for the workout. MDF core plywood is the best option for the making the precise parts of the clock.



our site is a primer and glossary to help you navigate the nomenclature. So let's jump in.

The wood parts of the clock are made of three materials: 1/4" MDF core plywood, 1/8" veneer core plywood, and 1/4" dowels.

PLAN OF ATTACK

There are four steps you need to take to successfully complete the clock. These steps will make working on the clock a lot easier.

1 - DRY RUN. Start with a complete dry assembly of the movements. First, sand all the cut out parts and follow the steps shown here and in the rest of this article. This ensures the parts of the clock interact smoothly.

2 - APPLY FINISH. After taking the movements apart, apply your stain and finish to the parts. No finish or stain on the working teeth or leaves though.

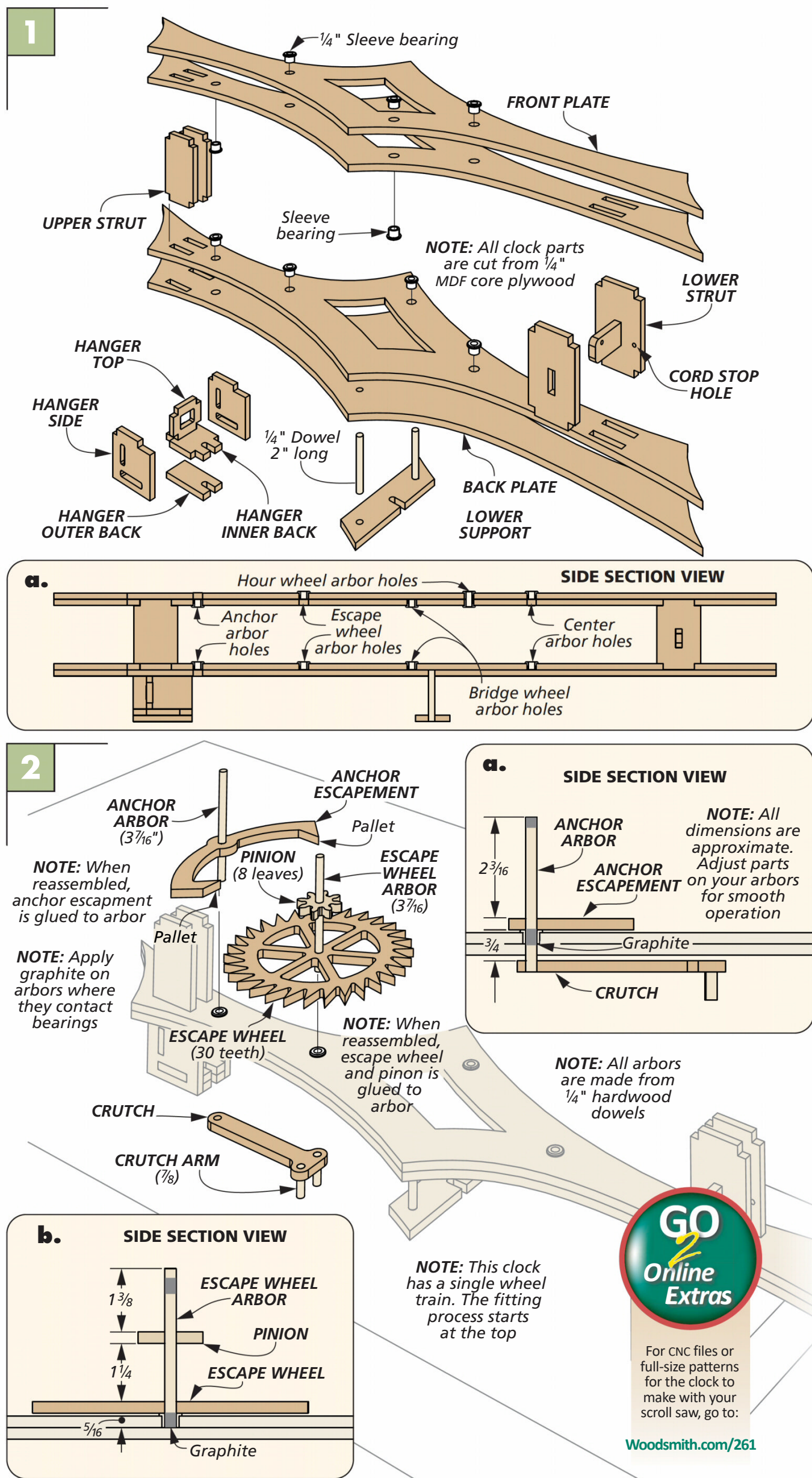
3 - REASSEMBLE. Add the winding cord to the ratchet assembly and the shot to the weight shell as you reassemble the clock.

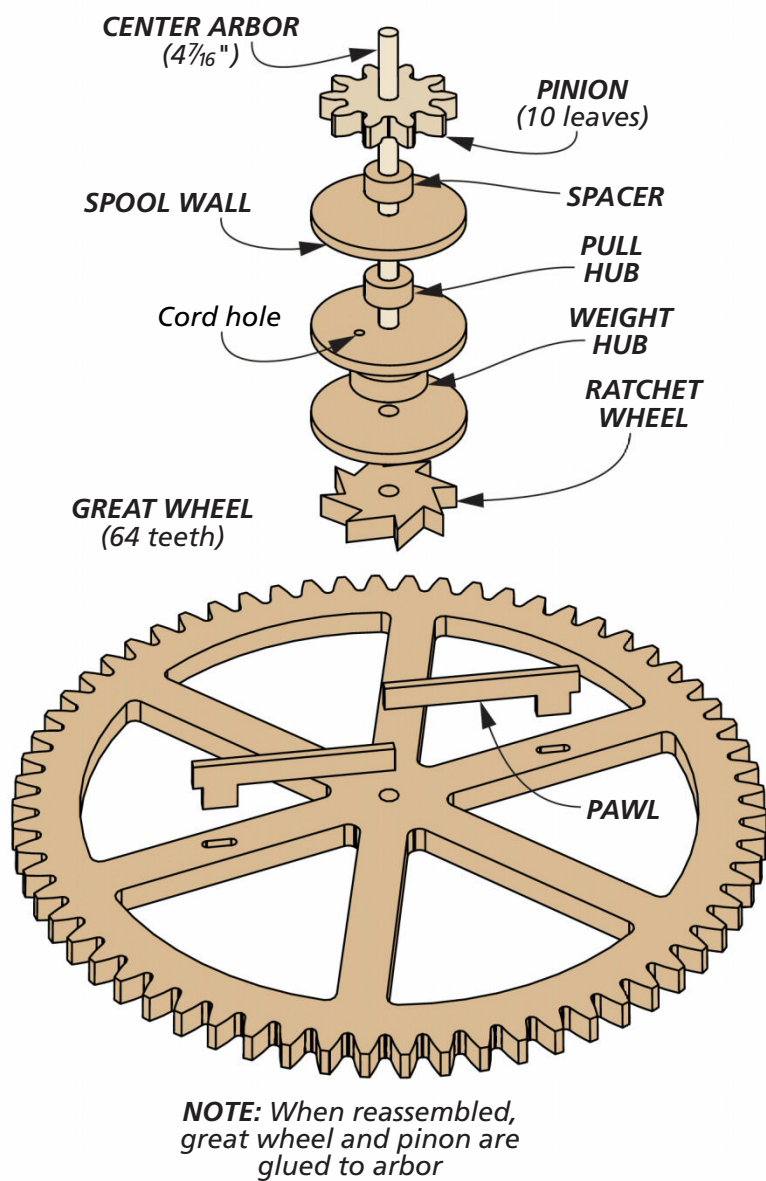
4 - CALIBRATE. This involves putting the clock in beat and setting the rate. Then you can glue the parts together.

PLATES FIRST. Figure 1 shows how to get the ball rolling. The clock movements are anchored on two plates. Each plate is made of two pieces glued together. The struts, hanger assembly, and lower support are glued to the back plate. If the bearings don't fit snugly, you can glue them in place

The profile of the front plate is identical to the back but there are added bushings to install. When it's done, set it aside until later.

START THE WHEEL TRAIN. The first moving parts that are fit to the bottom plate are the anchor assembly and the escape wheel assembly (Figure 2). The crutch attaches to the anchor arbor that feeds through the plate (detail 'a'). The escape wheel sits in a bearing in the plate (detail 'b').

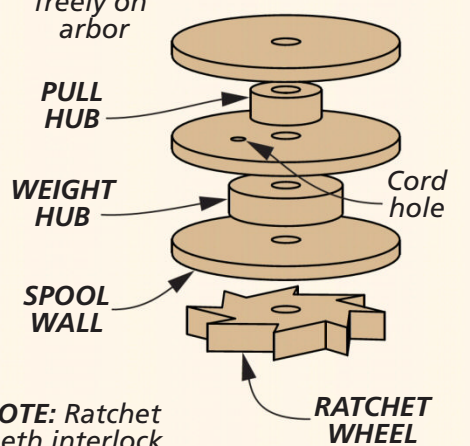




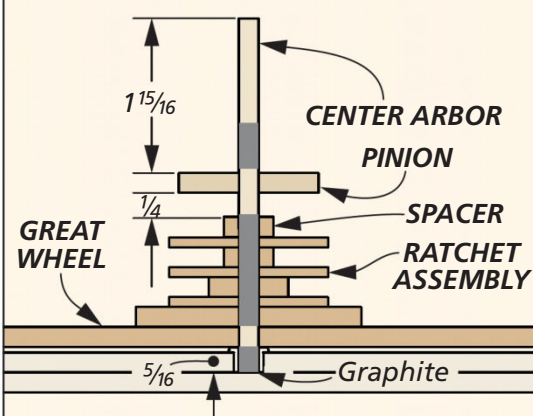
a.

RATCHET ASSEMBLY

NOTE: Assembly must turn freely on arbor

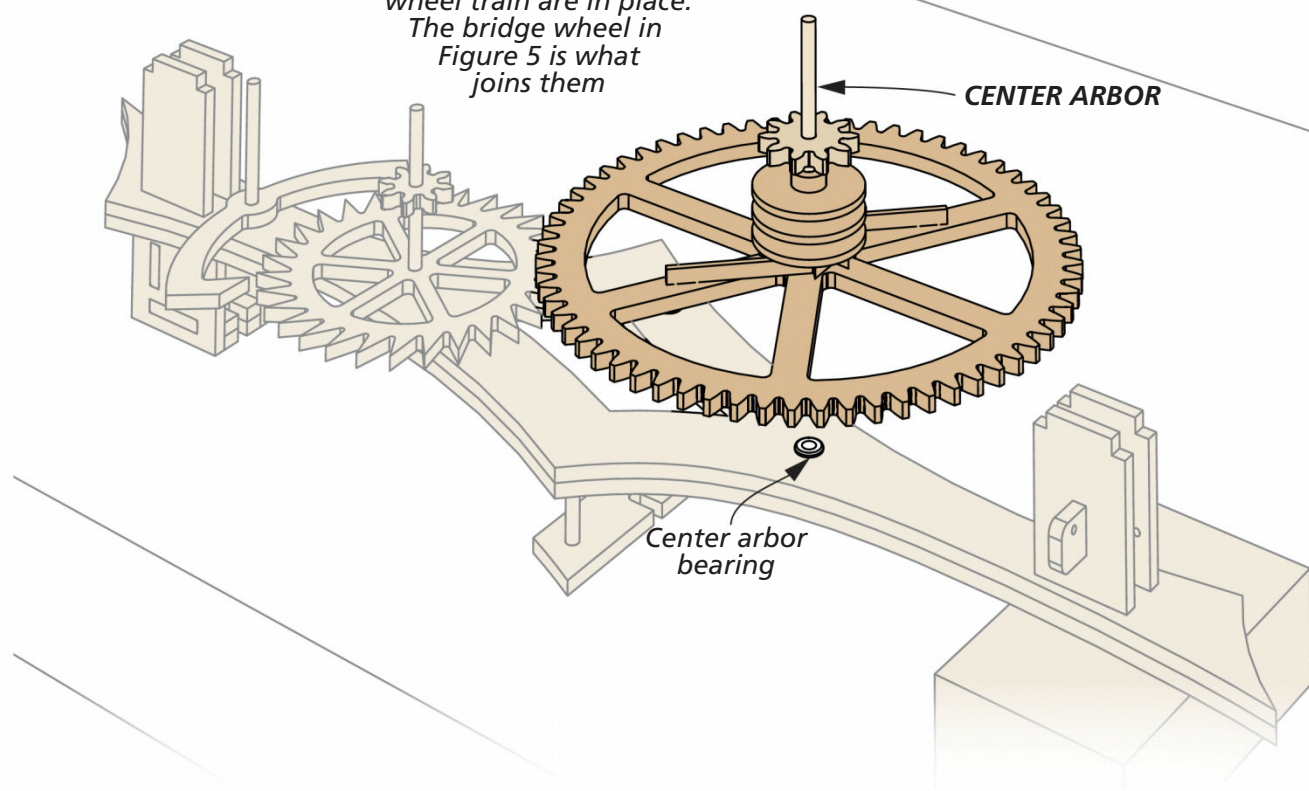


b.

SIDE SECTION VIEW

NOTE: All dimensions are approximate. Adjust parts on your arbors for smooth operation

NOTE: The two ends of the wheel train are in place. The bridge wheel in Figure 5 is what joins them



Adding more WHEELS

The next layer of the clock starts with the great wheel. This is the foundation of an assembly that's the heart of any clock. It absorbs the energy of the power source (provided by a weight in this case) and passes it along to the rest of the clock movements. Great wheel assemblies are as varied as there are types of clocks. This one, like the clock, is elegantly simple.

RATCHET ASSEMBLY. Our great wheel, the one you see in Figure 3, holds the ratchet assembly shown in detail 'a,' and a pinion that turns a wheel that drives the hour hand, I'll talk more about that later.

The spools on the ratchet hold the cord that's tied to the weight and pull. (The direction of the teeth on the ratchet wheel must match what you see in the drawing). The ratchet assembly needs to turn freely on the center arbor for the clock to work properly.

PAWLS. The pawls that you see just above the great wheel corral the energy from the ratchet assembly and pass it along to the rest of the clock. After you glue the pawls in place on the great wheel, you can bring the parts together.

Detail 'b' shows how to space the great wheel, ratchet assembly, and pinion on the center arbor. You want the pinion and great wheel to fit snugly on the arbor. Make sure the great wheel turns smoothly in the bearing (Figure 4). As I mentioned in the details on the previous page, coat the portion of the arbor that contacts the bearing with graphite.

THE BRIDGE WHEEL. Next comes the bridge wheel. The pinion that's below the bridge wheel takes power from the great wheel and delivers it to the pinion on the

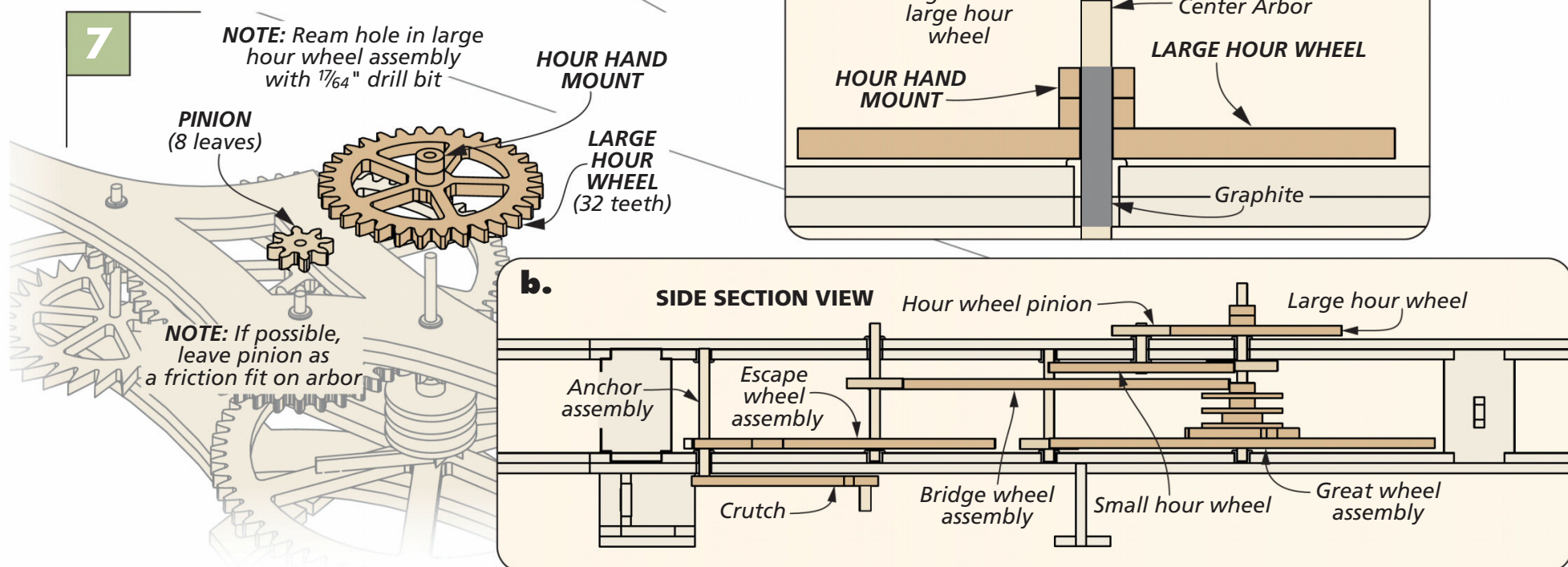
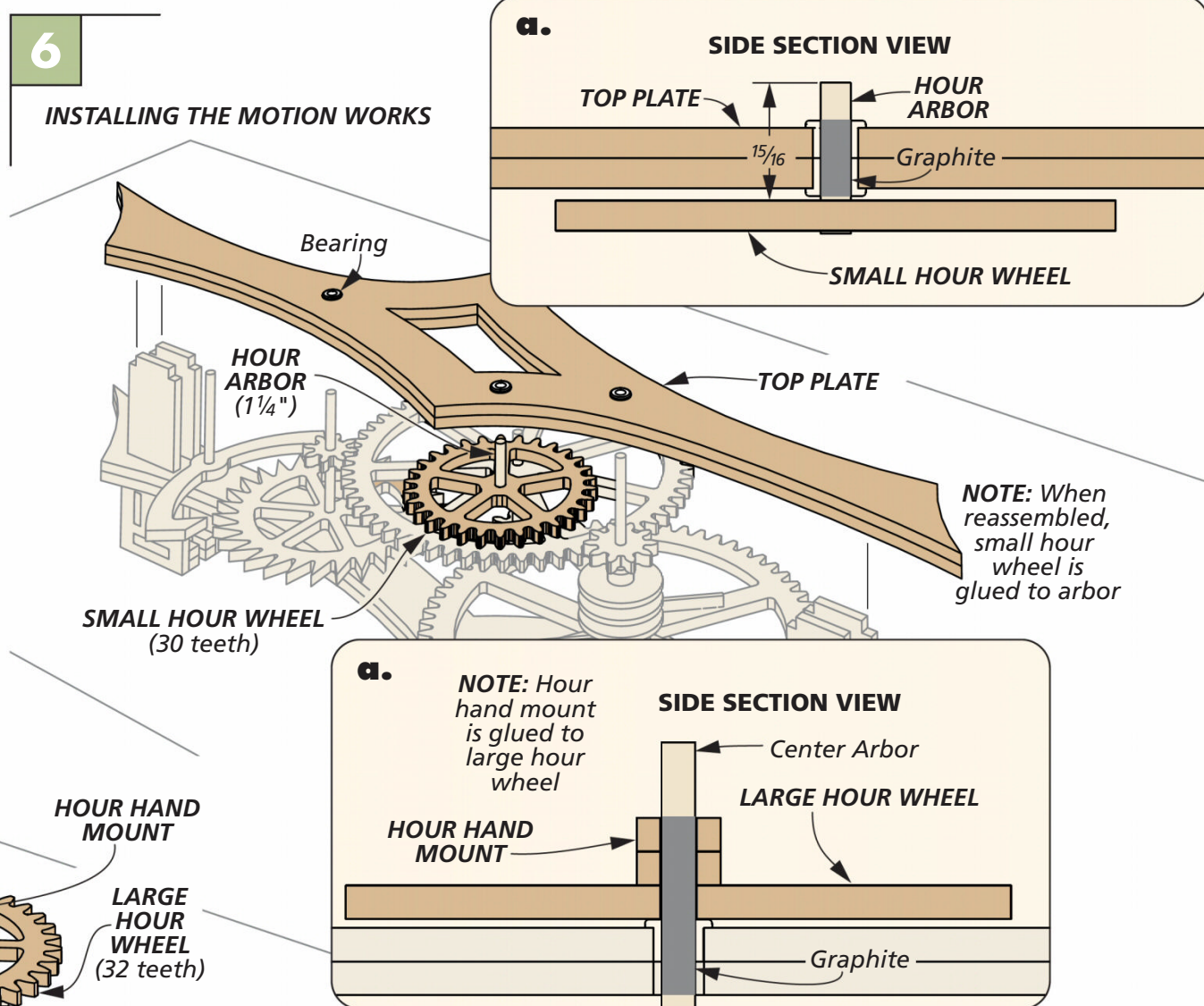
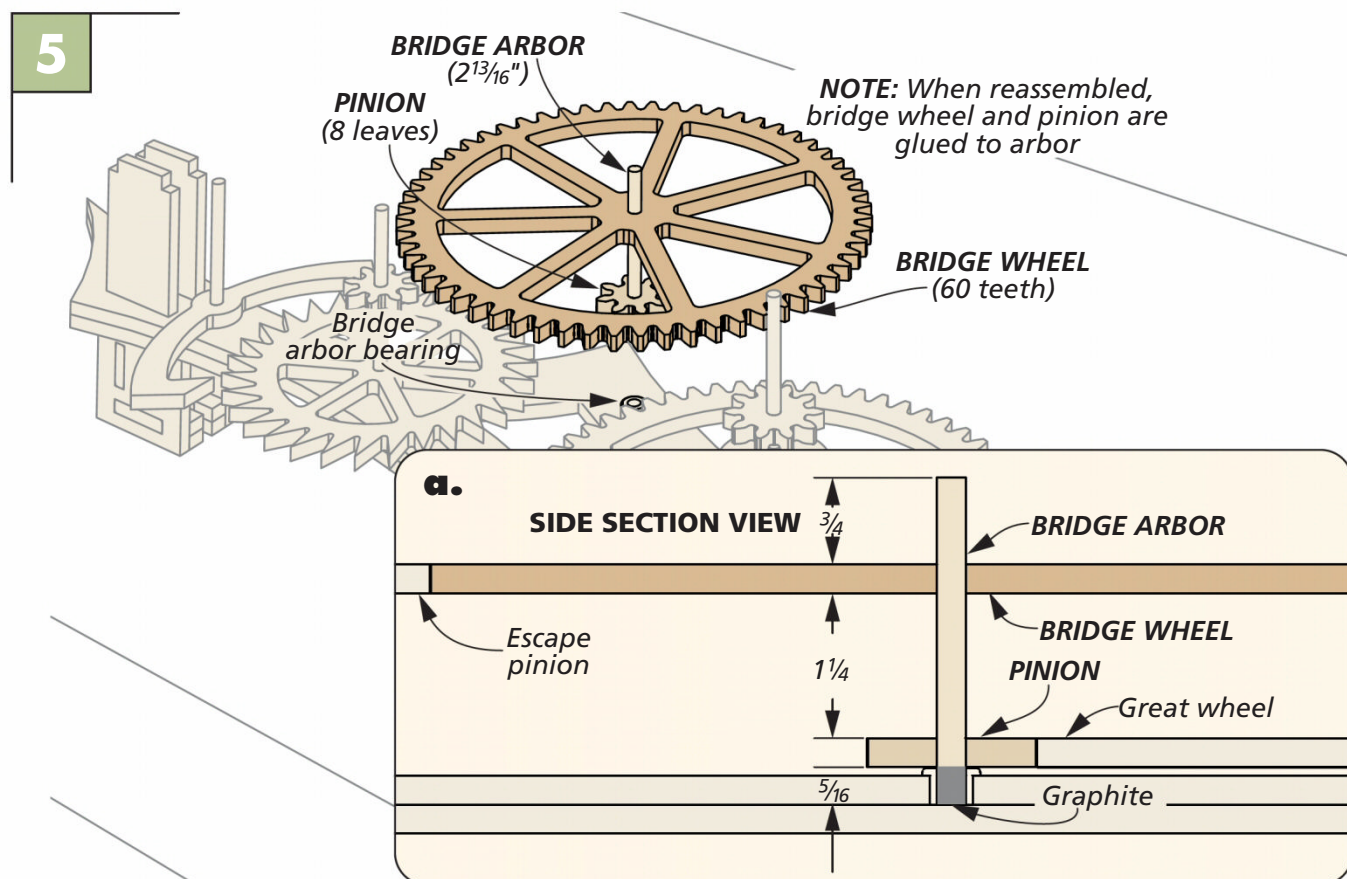
escapement assembly. Figure 5a shows the location of the wheel and pinion on the bridge arbor.

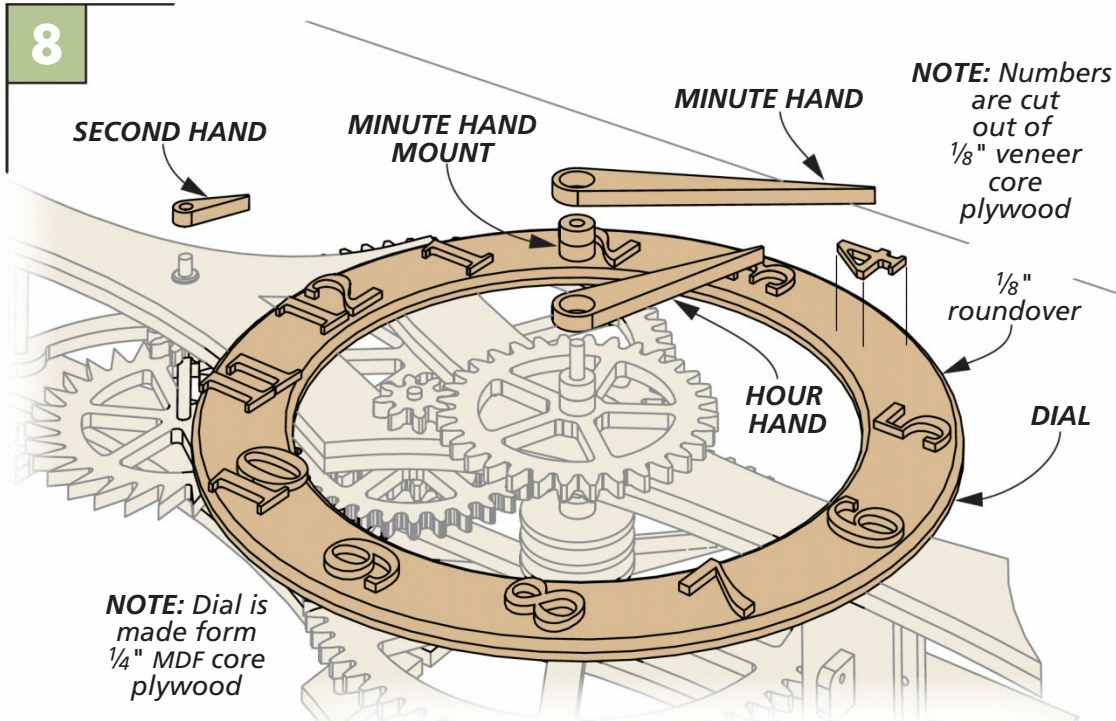
MOTION WORKS

That completes the power source portion of the clock. But there's more to do on the front of the clock before we can work on the timing source that's on the back-side. The motion works takes power from the great wheel and shares it between the hour and minute hand. Figure 6 shows sliding the arbor for small hour wheel into the bearing on the back side of the top plate. This involves adding a the small hour wheel that transfers power through the front plate to the hour hand pinion on the outside of the top plate.

There are also bearings in the top plate for the escapement arbor, which serves as the driver for the second hand. Farther down are bearings for the center arbor's minute hand.

When the top plate is in place on the struts you can add the large hour wheel and pinion that are shown in Figure 7 below. The large hour wheel has a mount glued to it. This will hold the friction-fit hour hand and let it track separately from the minute hand. Once again, make sure this wheel doesn't hang up on the center arbor.





Working towards a MOMENT IN TIME

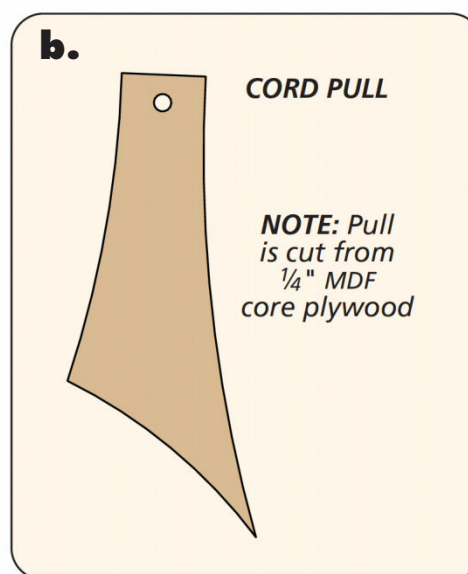
To finish the dry run of the clock puzzle, you need to add the hands, dial ring, make the weight and pull, and add the timing source. The timing source is the pendulum and bob that will get your clock tick-tocking.

THE HOUR HAND. This all starts with fitting the hands. Detail 'a' shows what is going on close up. The hour hand fits tightly on the mount you glued to the large hour wheel. The enlarged hole on the large hour wheel lets it operate independently of the center arbor that it's housed on. (It's controlled by the pinion of the small hour wheel.)

THE MINUTE HAND. Meanwhile the minute hand is friction fit on its mount, that is driven by the center arbor. Confusing? Not really. As you bring these parts together how they interact becomes much clearer.

When you're comfortable with the fit, remove the minute hand and glue the dial to the top plate. That is — after you glue the numbers on the dial face.

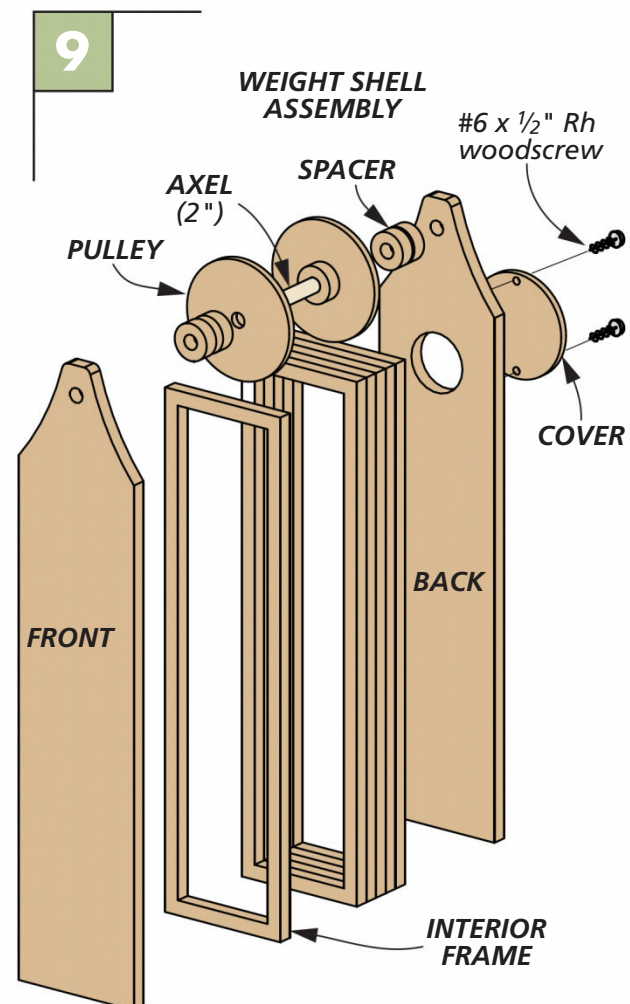
That completes the dry run and test fitting stage — almost. You need to add the timing source of



the clock. To do that, you'll need to hang the clock temporarily on the wall, and turn your focus to the pendulum.

LINKING UP

All this power that you'll shortly have needs to be harnessed and released in a timely fashion (sorry, couldn't resist that one). To do that, you're going to link the power source (the weight) to the timing source (the pendulum). That link is the anchor arbor and escapement you see in Figure 10a on the next page. The arms of the crutch hold and direct the shaft of the pendulum. You mounted the crutch to the anchor arbor way back at the beginning of our journey. Also on the arbor, on the other side of the bottom plate is the anchor escapement. The escapement is the gatekeeper that not



only controls the power flow, it creates the tick and the tock we love about clocks. Now back to the pendulum.

THE PENDULUM. Figure 10 shows the pendulum hanger glued to the end of the pendulum shaft. The screws in the hanger sit in the divots in the hanger top, allowing the pendulum shaft to swing freely back and forth. How fast it swings back and forth is dictated by how far up the shaft the bob at the other end is positioned. For now, just make sure the pendulum swings freely and the crutch moves smoothly.

THE POWER. Finally, let's talk about the power source. The weight is strung to the clock through the winding cord that loops through the pulley. The shell itself is not that heavy, that's why you fill it with shot through the opening in the back. Wait to fill the shell until the next step is done.

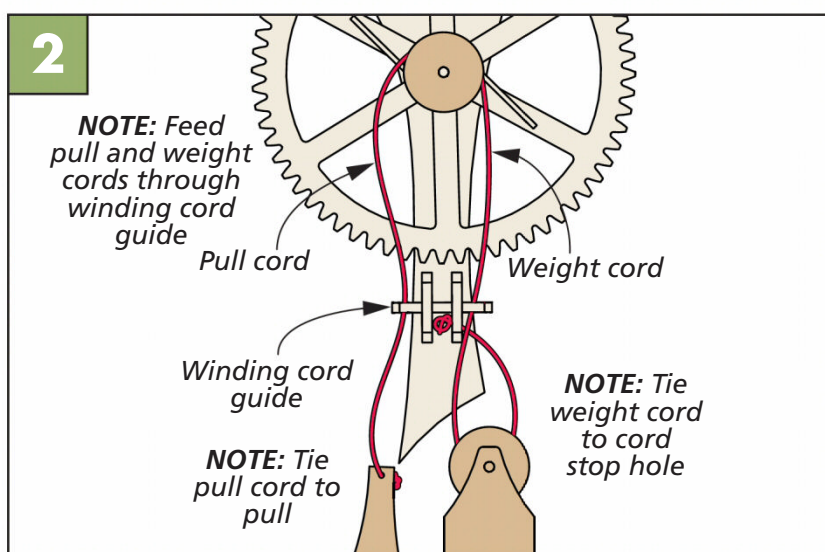
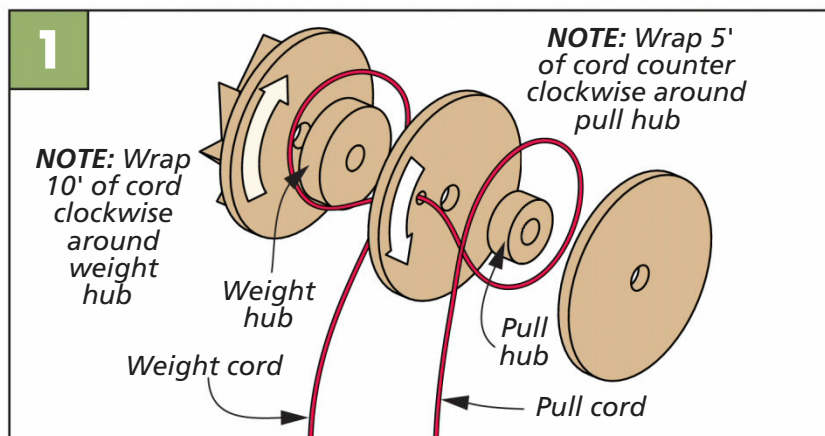
DO IT AGAIN. With all the parts together and interacting smoothly, your reward is to take it all apart. It's time to disassemble the clock and apply the finish you prefer (everywhere but the teeth and leaves of the wheels and pinions).

This time as you reassemble the clock, you'll need to add the winding cord. This starts with loading the cord on the spool of the ratchet assembly as you put the great wheel back together. As the box below shows, one end goes to the pull. The other end loops through the weight and is tied off in the hole on the lower strut.

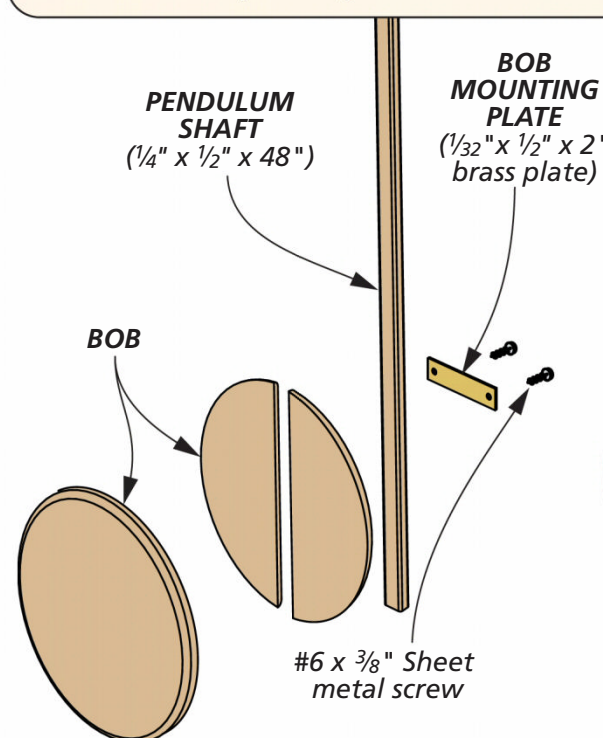
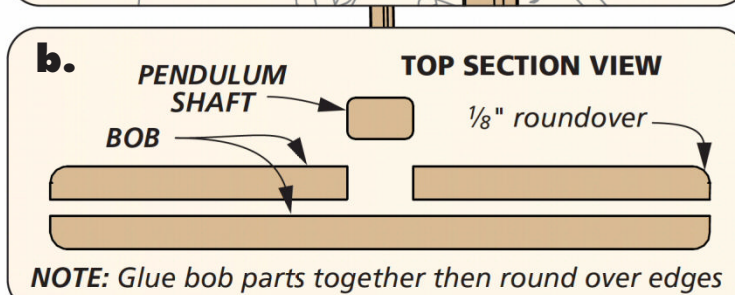
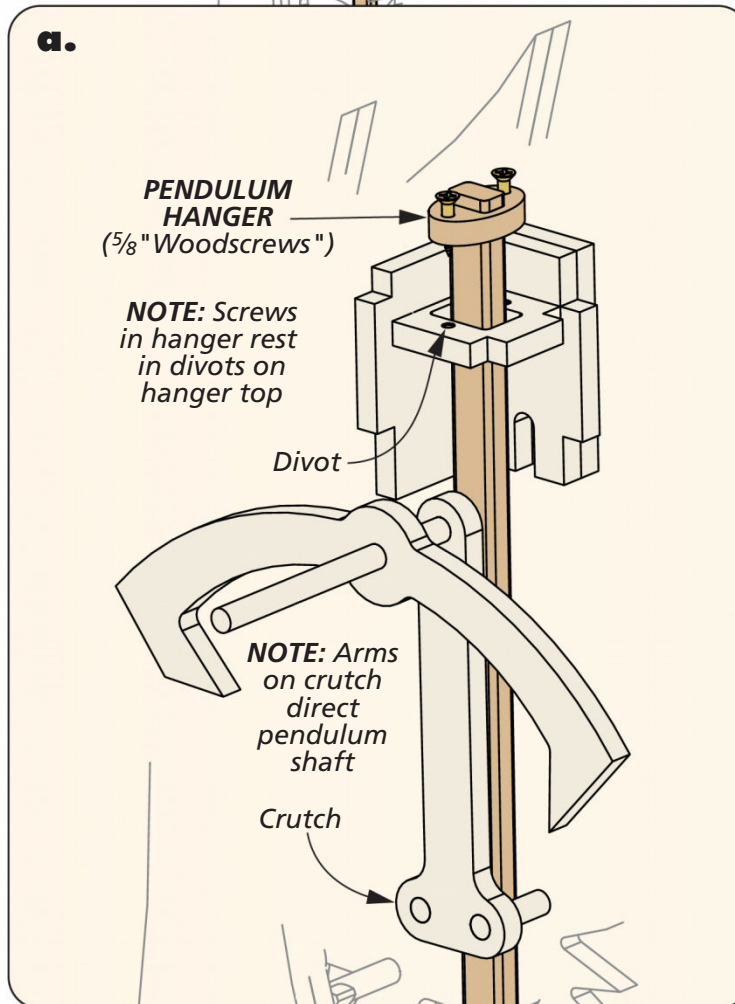
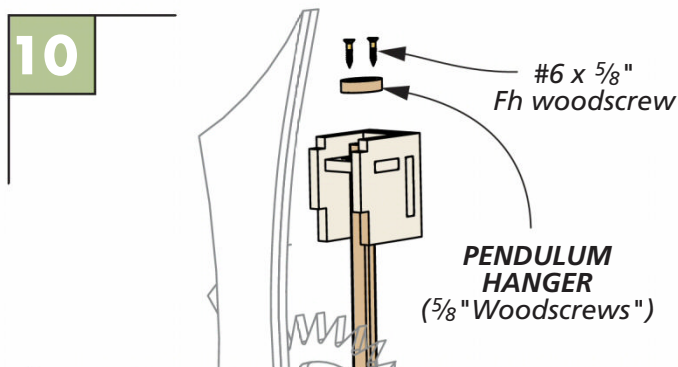
When the clock is back together and the parts are interacting smoothly, you can spot-glue all of the wheels and pinions to their arbors. Be careful to avoid gluing the moving parts.

CALIBRATION. Your beautiful clock will dazzle and charm people as it is now. But you still need to go online at Woodsmith.com/261 to learn how to put the clock in beat and set the rate. Unless you actually are a horologist — then you're way ahead of the game. **W**

ADD THE WINDING CORD



Start by feeding the cord through the hole in the middle spool wall. Figure 1 shows the amount of cord and direction the for each side. Then tie the cord to the pull, and loop the weight as you see in Figure 2.



To learn how to get your clock running perfectly, go to:

Woodsmith.com/261



Bridle Joints on the Table Saw

With all the options available, choosing the joinery for a project can feel overwhelming. To be honest, it's something a lot of woodworkers (myself included) obsess about a little too much.

An easy way to narrow your choices is by dividing joinery into two broad categories: case joinery and frame joinery. Case joints have flat, relatively wide parts. Think cabinets or boxes.

Frame assemblies cover such territory as picture frames, doors, even table bases and chairs. It's the realm ruled by the mortise and tenon. So when design editor Dillon Baker went looking for the right joinery for his valet chair (page 28), the mortise and tenon was waiting. This joinery option has plenty of

strength, but is out of sight once it's assembled.

Instead Dillon chose a showier version called a bridle joint. You can see it in the leg and rail assemblies of the valet chair in the photos below. It works just as well in frame and panel settings, too in case you're interested.

There are a couple of things I like about bridle joints. First, You get all the strength of a mortise and tenon. Along with it, the exposed joinery provides visual punctuation to the overall project. It's almost like inlay — super strong inlay.

ANATOMY. The drawing above shows how the components work together. You can clearly see the family resemblance to regular mortise and tenon work.

Let's start with the mortise. It extends all

the way through the width of the workpiece. It's also exposed on the end, looking like a large slot.

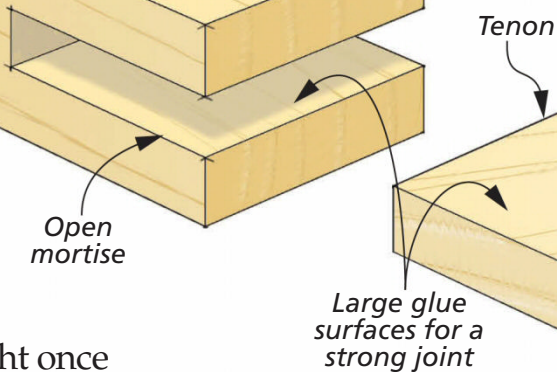
A through mortise allows the mating tenon to be longer (and stronger). You'll also notice that there are no end shoulders on the tenon, either. Adding these up means there is a lot of face grain glue surface to go with the good looks. Come assembly time, the wide shoulders help register the parts. They also resist racking (diagonal) forces during the life of the project.

On a side note, this joint looks a lot like a super-sized finger joint. Take a quick glance at the valet chair again and you can see how the bridle joints on the legs and the finger joints in the back support are complementary.

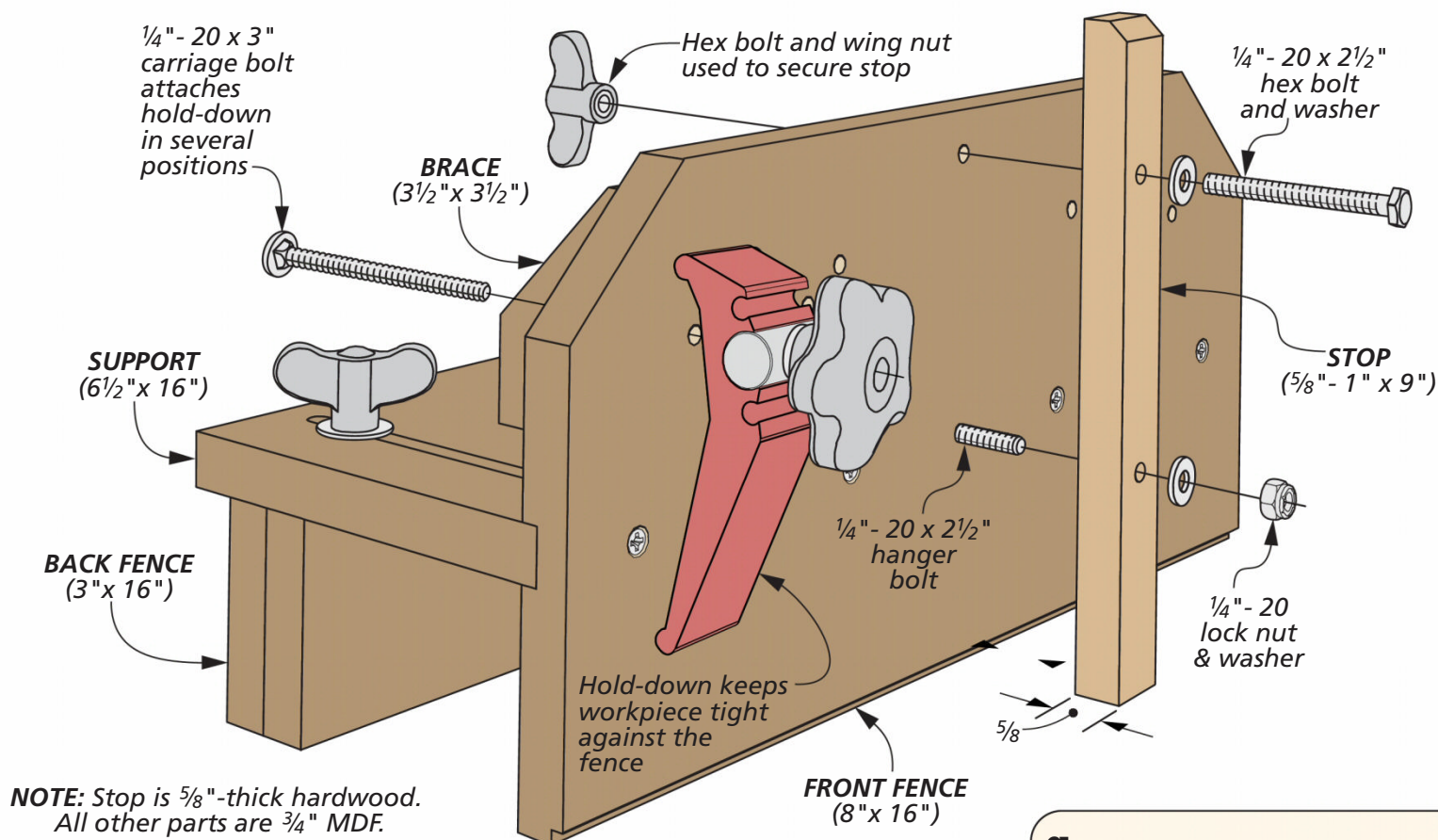
SIMPLIFICATION. Using bridle joinery has other benefits, too. Sizing parts is simplified. The parts run the full length so there's no depth of mortise/length of tenon ciphering that has to take place. This really comes in handy when making frame and panel doors.

Another benefit is more process related. Cutting the mortise and forming the tenon are similar steps with this joint. This can reduce the number of tools needed and eases the setup when getting started.

For this article, I show how the joint is made at the table saw. All it takes is a simple jig.



▲ Bridle joints connecting the legs and rails of this chair draw your attention and add visual appeal to the look of the whole piece.



START WITH A TENONING JIG

The key to cutting a bridge joint is to use a tenoning jig. This kind of jig holds the workpiece vertically to the saw table. This allows you to create a deep mortise on the end of a workpiece, as well as the tenon for the mating part. I also find that this cutting action results in a smoother glue surface than a typical dado blade tenon-making operation.

OLD-SCHOOL OR DIY. Tenoning jigs take two forms: cast iron jigs, or shop-made versions. Either type of jig will work for this method. Cast iron tenoning jigs go in and out of fashion. And we're definitely in an ebb-tide situation right now.

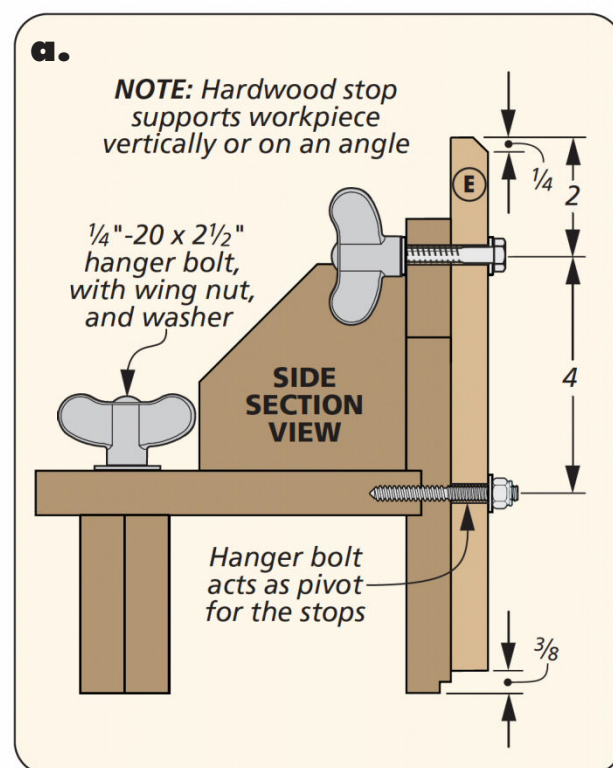
SIMPLE & SHOP-MADE. I don't want the lack of a jig to slow you down from learning how to do this. The drawing above shows my favorite shop-made tenoning jig. It rides on your table saw's rip fence. And it's easily adjustable. The body can be adjusted to suit your rip fence. The stop handles square and angled joints with ease. Both plywood or MDF are solid material choices.

CUTTING THE JOINT

When cutting joinery with power tools, consistently sized parts make a huge difference. Spend some time planing and sizing the parts so that they're the same thickness and width. Hitting a specific dimension isn't as big of a deal as consistency among parts. Otherwise, you'll end up fiddling with every joint.

MORTISES, FIRST. The order of operations on a bridge joint is the same as with a regular mortise and tenon. Form the mortises then use them to gauge the size of the tenons. The tenon faces are easier to adjust than the inner recesses of the mortise — even an open mortise.

Figure 1 on the next page shows you the setup for cutting the mortise. It shows a regular blade installed in the table saw. But if you have mortises that will be wider than 1/4", you can use a dado blade. Just be aware that a dado blade limits the length of the mortise.



Most of the time, the mortise is centered. I make one pass with the workpiece set just off-center to the blade. Then I flip the workpiece around and make a second pass.

Take a moment to measure the width of the mortise. If necessary, bump the fence away from the blade to make it wider. Then fire up to cut a mortise on each end of all the relevant parts.

SHIFT FOR TENONS. The tenon-making step in Figure 2 looks nearly identical to how the mortises were formed. The big difference is that the workpiece is shifted so that the blade is cutting on

the outside, leaving the tenon in the middle.

Just as with the mortise, the tenon is formed by making pairs of passes. You make a pass along one side of the workpiece, then flip it around for a second pass. This is detailed in Figure 2

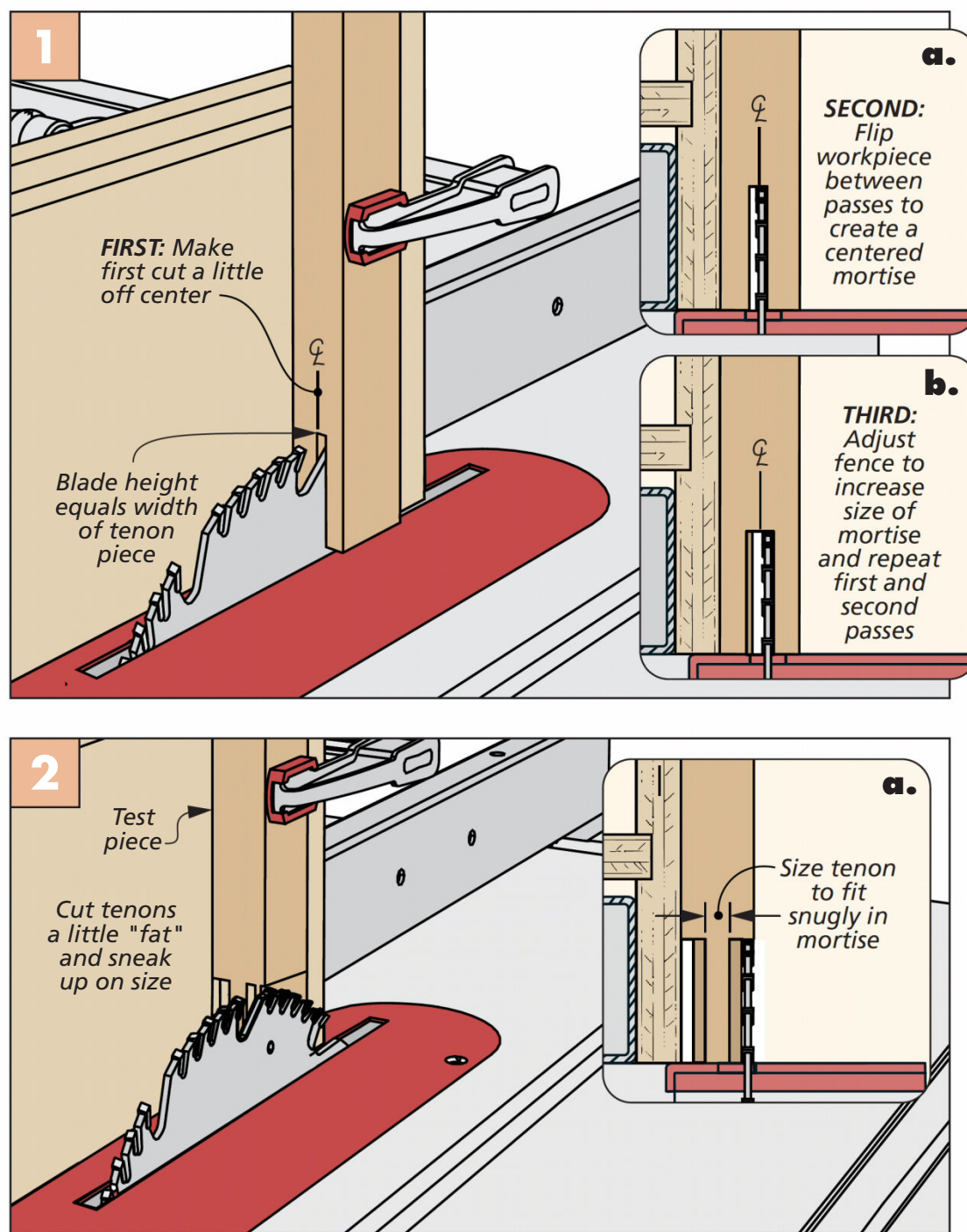
If you're using a standard blade, may need to make a series of passes (on all your parts) to work your way down to a tenon that's close to fitting.

That's not a bad thing. I prefer to cut the tenon thick, then make small adjustments to dial in the fit. Trying to get an acceptable fit in one go is asking for trouble.

I'm aiming for a tenon to slide into the mortise with moderate resistance. Easy enough to do with my hands, without having to resort to clamps or heavy mallet blows. At this point, complete the remaining tenons on all the rest of your parts.

PAUSE FOR GROOVES. If your project is a chair or table, you can skip ahead to assembly advice below. For frame and panel work, you need to make the panel grooves at this point in the process. Just be sure to stop the groove short of the tenons. If you don't, you'll end up with gaps and misaligned parts.

ASSEMBLY. If there's a downside to bridle joinery, you'll encounter it at glueup. The open-ended mortise means you have to apply



clamps from both directions to ensure that the parts are fully seated. In addition, the mortise sides could flare away from the tenon requiring another clamp right on the joint. This is what you see in the photo below.

Bridle joinery and the table saw were made for each other. The skills are easily mastered. The payoff is a joinery option that not only stands the test of time, but also packs a visual punch. That's a lesson worth learning. **W**



◀ Assembling a bridle joint often requires an array of clamps to keep the parts aligned.

Sources

Most of the materials and supplies you'll need to build the projects are available at hardware stores or home centers. For specific products or hard-to-find items, take a look at the sources listed here. You'll find each part number listed by the company name. See the left margin for contact information.

MAIL ORDER SOURCES

Project supplies may be ordered from the following companies:

Woodsmith Store
800-444-7527
store.woodsmith.com

Rockler
800-279-4441
rockler.com

amazon.com

Benjamin Moore
855-724-6802
benjaminmoore.com

Brusso Products LLC
212-337-8510
brusso.com

General Finishes
800-783-6050
generalfinishes.com

Home Depot
800-466-3337
homedepot.com

Infinity Cutting Tools
877-872-2487
infinitytools.com

Kreg Tool
800-447-8638
kregtool.com

McMaster-Carr
630-833-0300
mcmaster.com

Menards
menards.com

ROUTER WORKSHOP (p.18)

- **Infinity Cutting Tools**
2" Dado Planing Bit 52-506

VALET CHAIR (p.28)

- **McMaster-Carr**
Pivot Bracket 8993K61
1/4" Spacers 92320A662
Thumbscrew 91746A414
Threaded Insert 95807A300

The mahogany and straight-grained ash need no further embellishment, so I sprayed two coats of satin lacquer and let the wood shine.

ROUTER TABLE (p.34)

- **Rockler**
Blum 155° Hinges 67052
14" Drawer Slides 63114
- **McMaster-Carr**
Edge Pulls 1471A22
3/8" Knobs 6121K611

1/4" Knobs 6121K311

- **Kreg Tool**
Router Lift PRS5000
Insert Plate Levelers . . PRS3040
- The case of the router table was painted with Benjamin Moore's "Clearest Ocean Blue" paint in their Regal line. Then everything was topped with a couple of coats of satin lacquer.

BAHUT CABINET (p.42)

- **Brusso**
Shelf Sleeves K-2
Shelf Supports K-10
Pivot Hinge L-87
Ball Catch BC-265

The cabinet is finished with General Finishes "Seal-A-Cell" and two coats of lacquer that allow the walnut to glow.

BATHROOM VANITY (p.50)

The vanity was painted with General Finishes' "Persian Blue" milk paint, then finished with two coats of lacquer.

- **Home Depot**
Sink 207058614
- **Menards**
Faucet 6735026
- **Rockler**
Drawer Slides 48469
Andante Pulls 1005734

CNC CLOCK (p.56)

- **McMaster-Carr**
Sleeve Bearings 6389K231
Polyester Twine 8936T61
- The clock is finished with your choice of stain and rub-on lacquer, after the first fitting. No stain or finish should be applied to wheel teeth or pinion leaves.

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DRfieldbrush.com

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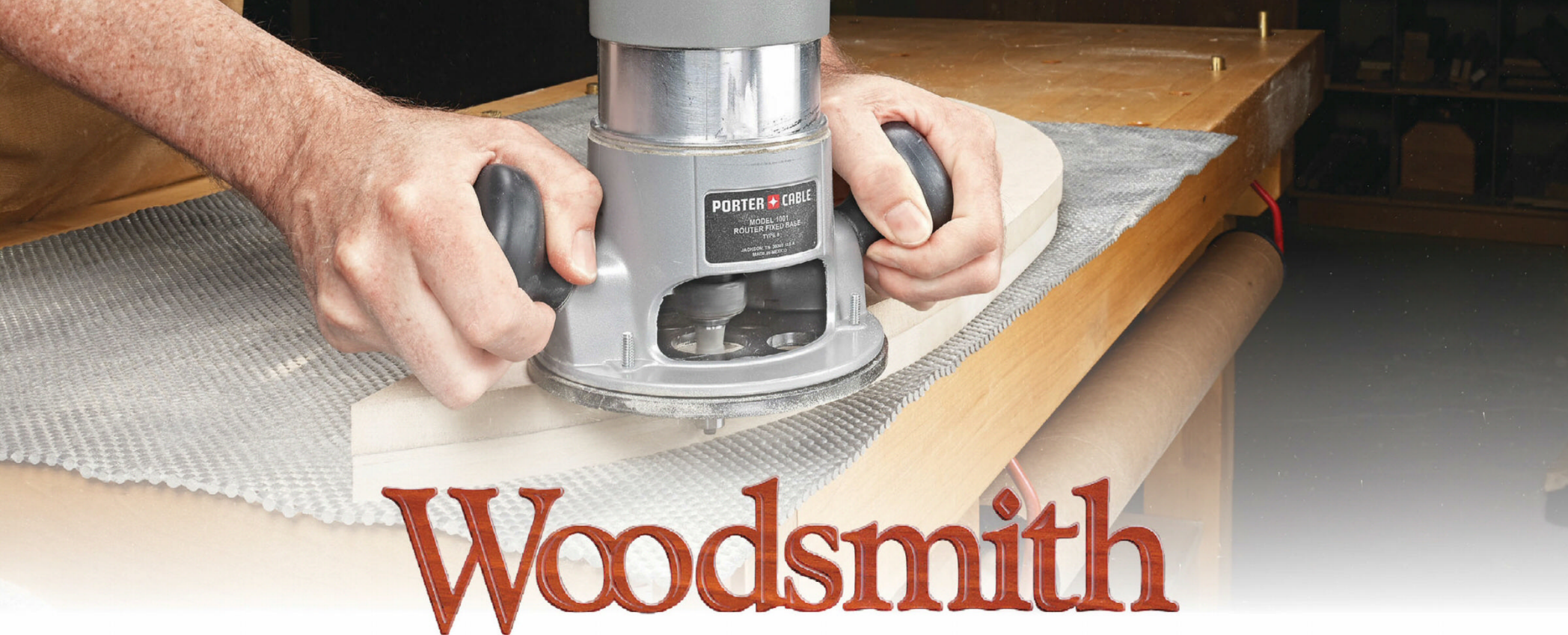


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