

GUILD ♦ EDITION

1979

Celebrating 40 Years

2019

Woodsmith®

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Vol. 41 / No. 241



A SECRET WEAPON FOR **TAMING TEAROUT**

Inside:

7 Shop-Tested Tips
For Dealing with Snipe

A New Generation of
Coping and Fret Saws

Plus Learn How To:

- Make Stopped Cuts at the Table Saw
- Drill Holes with a Router
- Expand Your Shop Storage Space

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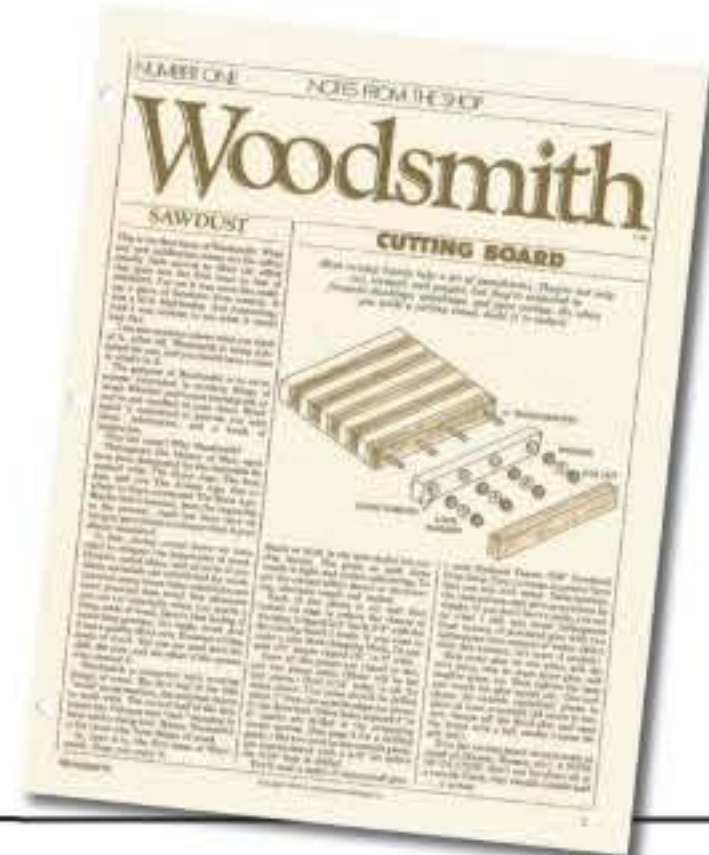
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from the editor Sawdust



This issue of Woodsmith marks our 40th anniversary. Obviously a lot has changed since the magazine started in 1979. The first issue of *Woodsmith* (shown above) was only eight pages long and printed in black and white. Since that time, we've added color photography, expanded the page count several times (currently at 68 pages), and have gone through at least three major redesigns. But a magazine is about more than just words and images on a page.

I know this sounds cheesy, but one of the things that makes *Woodsmith* special is our readers. It's always gratifying to hear from readers who have been with us for a long time. (Although I always find it interesting that people tend to tell us the issue number that they started subscribing, rather than the year.) To me, that kind of loyalty tells us that we're doing something right. And personally, I'm grateful to have had the opportunity to work on this magazine for as long as I have. That wouldn't be possible without the continued support of our readers.

But it's not just our readers who are loyal. Many of the talented people on our staff have also been with us for over 15 or even 20 years. I'd like to point out a few of the people on our team who have been here the longest. **Crayola England** and **Steve Johnson** have both been working for *Woodsmith* for 27 years. During that time, Crayola has shot most of the spectacular photographs you've seen in the magazine. And Steve spent the first 20-plus years of his career here as one of our shop craftsmen, building many of the projects. He now splits his time between building and helping our project designers with shop drawings.

Dirk Ver Steeg and **Jennie Enos** currently hold the record, however, each having been here for 28 years. (Jennie edges Dirk out by about four months.) Dirk is one of the people responsible for creating the wonderful illustrations that accompany our projects. He's been here long enough to remember when all of our artwork was drawn by hand on drawing boards. And Jennie is the head of our customer service department. You may have actually spoken to her if you've ever had to call in with a question about your subscription or order. I'm continually amazed at how gracefully she handles the toughest questions (and the occasional complaint). Thanks to everyone on our staff for their many years of service.

Vince

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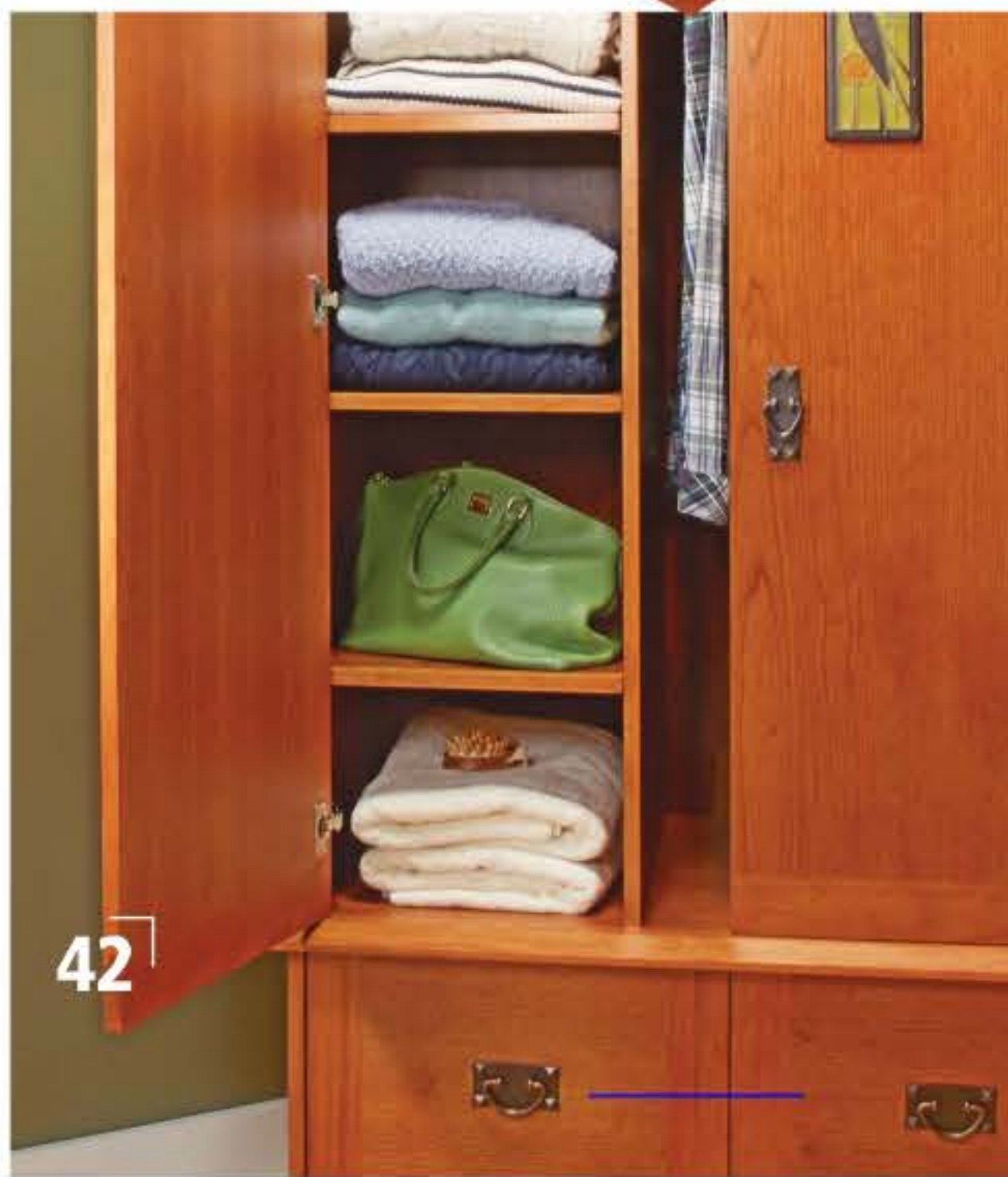
Taking a cue from the Scottish Arts & Crafts tradition, this classic armoire offers plenty of storage space inside. And you'll enjoy the challenge of building it.



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Tips & Techniques

Bench Standoffs

Breaking down sheet goods is something that I see a lot of tips on. I used to cut sheet goods on a piece of foam insulation. And it worked well. However, I was tired of having to store the large sheet of foam. That's when I decided to find my own solution using my workbench. The idea I came up with is the standoffs shown here.

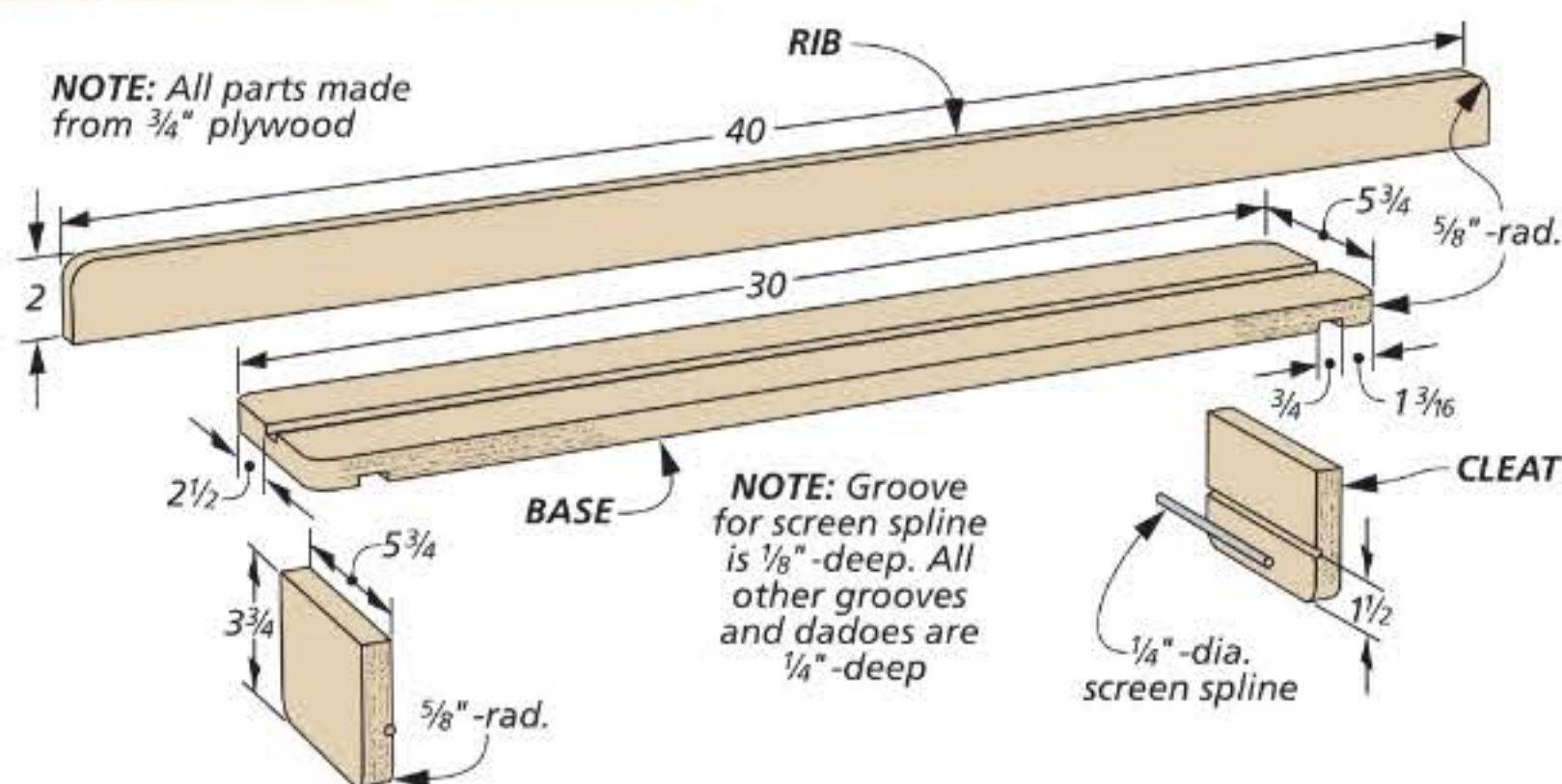
SNUG FIT. The standoffs are designed to fit snugly over my workbench. They hold any sheet goods up off the surface of my workbench and allow me to break them down without cutting into my benchtop. I also sized a few of these to use with a folding table for when my workbench is in use.

The construction starts with a base made of plywood. A groove is cut into the top side to hold a rib. The ribs are glued into the groove. Finally, a pair of cleats are attached to the bottom of the base to straddle the benchtop. I also installed a strip of window screen spline in a groove in the cleats (inset photo). The spline increases friction on the benchtop and keeps the standoffs in place while I'm making cuts.

Craig Turner
Lafayette, Louisiana



◀ A piece of screen spline held in a groove in the cleats keeps the standoffs from moving.



Win This Forrest Blade

Simply send us your favorite shop tips. If your tip or technique is selected as the featured reader's tip, you'll win a *Forrest Woodworker II* blade. To submit your tip or technique, go to SubmitWoodsmithTips.com. There you can upload your tips and photos for consideration.

The Winner!

Congratulations to Craig Turner, the winner of this *Forrest Woodworker II*. To find out how you can win this blade, check out the information at left.



Router Bit Protection

If you're anything like me, you enjoy tackling projects that require a new tool purchase. Often, this is something as simple as a new router bit. And we all know that good router bits can be expensive. After throwing router bits in drawers and hearing them clank together, I decided to upgrade how I was storing my expensive bits.

'LIL OIL. I've started to make cases for my router bits out of PVC pipe and end caps. I've found that $\frac{3}{4}$ " pipe works for most bits and a pair of caps keep the router bit inside to protect the cutting edge. Because it might be awhile before I use a router bit again, I also add a cotton ball saturated with a little oil to keep rust at bay. To quickly find a bit when I need it, I mark the outside of the tube with the type and size of bit.

*Thomas Peter
Clearwater, Florida*

QUICK TIPS



Glueup Mat. *Hermie Tolerba of Sugarland, TX,* discovered that inexpensive plastic drawer liners from discount stores make perfect gluing mats. The slick surface doesn't allow glue to stick to it, and they can be rolled up for storage anywhere in the shop.



Push Stick Scabbard. *Lou LaFrata of Vail, AZ,* was tired of searching for his push sticks. To keep them organized and close at hand, Lou added a scabbard made out of a cardboard tube to the side of his table saw. Now, push sticks are always within reach while he's at the saw.



Blade Cover. *William Aulick of Cincinnati, OH,* was tired of his forearms getting scratched up by the teeth of the table saw blade when changing it. To protect his arm, he now wraps a cord organizer tube over the teeth of the blade before reaching inside to loosen the nut.



Caster Bar. *Dana Myers of Des Moines, IA,* found that using individual casters on each corner of his workbench caused it to twist when raising one corner at a time. To fix this, Dana added a connector bar between the lift levers. Now, both wheels engage at the same time.

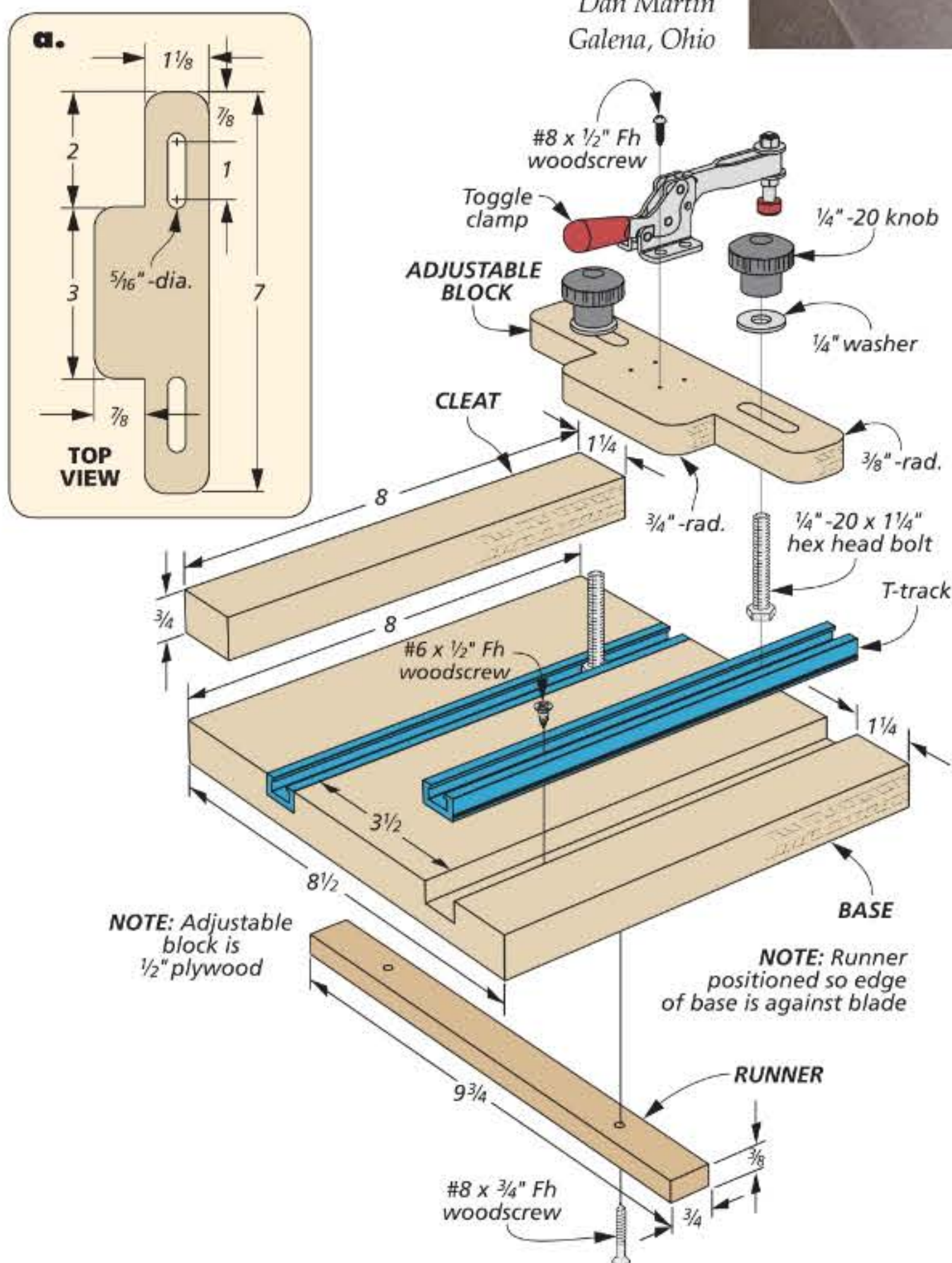
Small Parts Tapering Sled

The table saw is my preferred method to size parts. For the small toys I make, it's perfect to cut a lot of the same part, and quickly too. However, cutting odd angles or tapers safely at the table saw, especially on small parts, can be tricky. At least, until I built the jig that's shown here.

ADJUSTABLE CLAMPING. The taper jig starts off like a small crosscut sled. A runner is connected to a plywood base. A cleat is attached along the back edge to hold workpieces, as well as give you a grip on the sled. The real heart of the jig is an adjustable block that pivots in T-tracks recessed in the base. The block has a toggle clamp to hold down parts and a couple of knobs lock the block in place once it's adjusted.

QUICK & EASY ADJUSTMENT. Using the jig is just like using a full-sized taper sled. I start by laying out the taper or angle on the workpiece and aligning it with the edge of the sled. With the workpiece butted against the cleat, it's a simple matter of bringing the adjustable block tight against the workpiece and locking it in place with the knobs. After the toggle clamp is locked down on the workpiece, I can make my cut. The best thing of all is that the jig stays set at that angle, and I can make a repeatable cut.

Dan Martin
Galena, Ohio



DIGITAL WOODSMITH

SUBMIT TIPS 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. Jump online and go to:

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Cutting Small Parts Safely

I often cut a lot of short pieces, such as spacers. Cutting these pieces without them falling into the blade can be a problem. So, I use the jig you see here to move them away from the blade.

MARCHING ALONG. The jig consists of a piece of stock that's shaped into a wedge, along with a little recess to collect the workpieces. A clamp holds it in place against the fence.

I position the fence so the jig is located just behind the blade. Then, as I make cuts with the miter gauge, the small pieces get pushed along the wedge and collect into the recess. This keeps them from moving into the blade.

*Kevin Martin
Cross Plains, Wisconsin*

Rule Holder

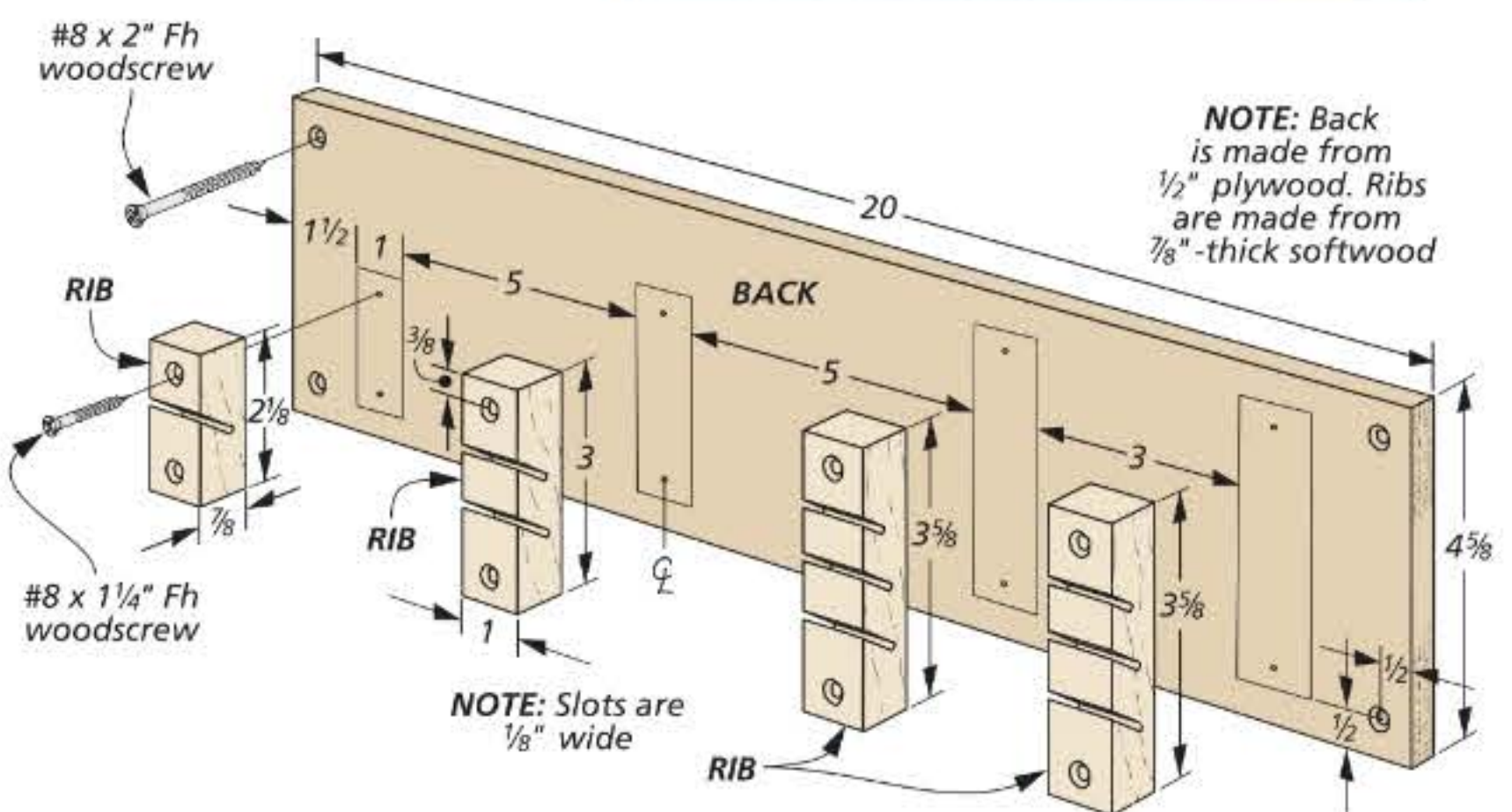
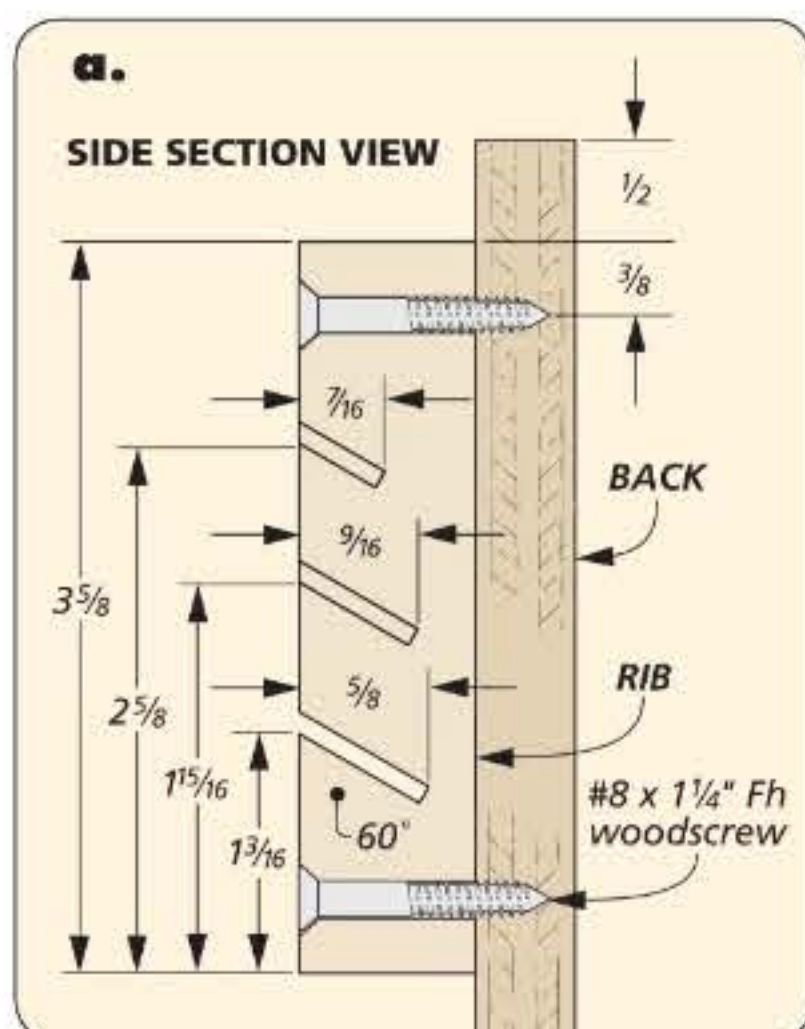
My favorite tools for measuring and laying out parts is a set of three steel rules. I use them all the time at my workbench. However, I have a tendency to leave them lying all over the shop, so I built this simple rule holder to keep track of them.

PEGBOARD HOLDER. The holder consists of a back and four ribs. I simply cut a kerf into each rib to hold the different size rules. Because the rules are different widths, I make each kerf a little different depth, so the rules have a uniform look when they're hung up. The ribs are then screwed to the back, and I attached the holder onto the pegboard above my bench. Now, the rules are always close.

*Dan Gijon
Ontario, Canada*



► The different depth kerfs in the ribs allow plenty of room to remove even the smallest rule.





Drill Press Clamp

Clamping workpieces at the drill press has always given me trouble. With a big auxiliary table, you need long clamps to reach into the center of the table. One day, an idea struck me.

DUAL FENCES. As you can see in the photo, my solution was to build a clamping bar that works with my fence. I made the bar with a few layers of plywood and a hard-board top. On the inside face, sandpaper adds extra grip. The bar slides into the fence T-track and can be tightened down with knobs and T-bolts. This allows the bar to sandwich a workpiece between it and the fence and hold it in place.

*Emanuel Ringel
Fort Washington, Pennsylvania*

Better Measurements

When using my planing sled to thickness thin parts, I use a simple trick to accurately mill and measure my pieces. I use double-sided tape to stick them

down to a backerboard. To get reading of my planing progress, I cut a notch in the backerboard. This way you can slip the nose of a dial caliper into the notch and measure the thickness of

the workpiece, getting an accurate measurement without removing the workpiece from the sled.

*Millicent Doyle
Le Claire, Iowa*



▲ Double-sided tape is applied to the backerboard to hold the workpiece down and allow it to be planed.



▲ The extra thickness of the backerboard carries the stock through the planer and lets you plane it to any thickness.



▲ A notch in the backer is sized to fit the nose of a caliper. You can then check the thickness without removing the workpiece.

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Workshop Respiratory Safety

If you haven't been woodworking for very long, then you may not be aware of one of the biggest dangers present in your shop. And I'm not talking about the obvious stuff, like sharp, spinning blades and errant hammer strikes. While these pose hazards of their own, there's one menace that can cause problems long after the machines are turned off and the tools are put away — fine wood dust particles.

FLOATING DANGERS. If left unchecked, wood dust particles created from cutting and sanding operations can float around in the shop for extended periods — sometimes for as long as 20 to 30 minutes. If you fail to take the proper precautions, some of this dust can end up in your lungs, potentially causing health issues.

That's why every time you walk into the shop, you should be taking steps to

keep these harmful particles out of your respiratory system. Here, I'll take a look at a few ways to keep shop dust to a minimum for maximum safety.

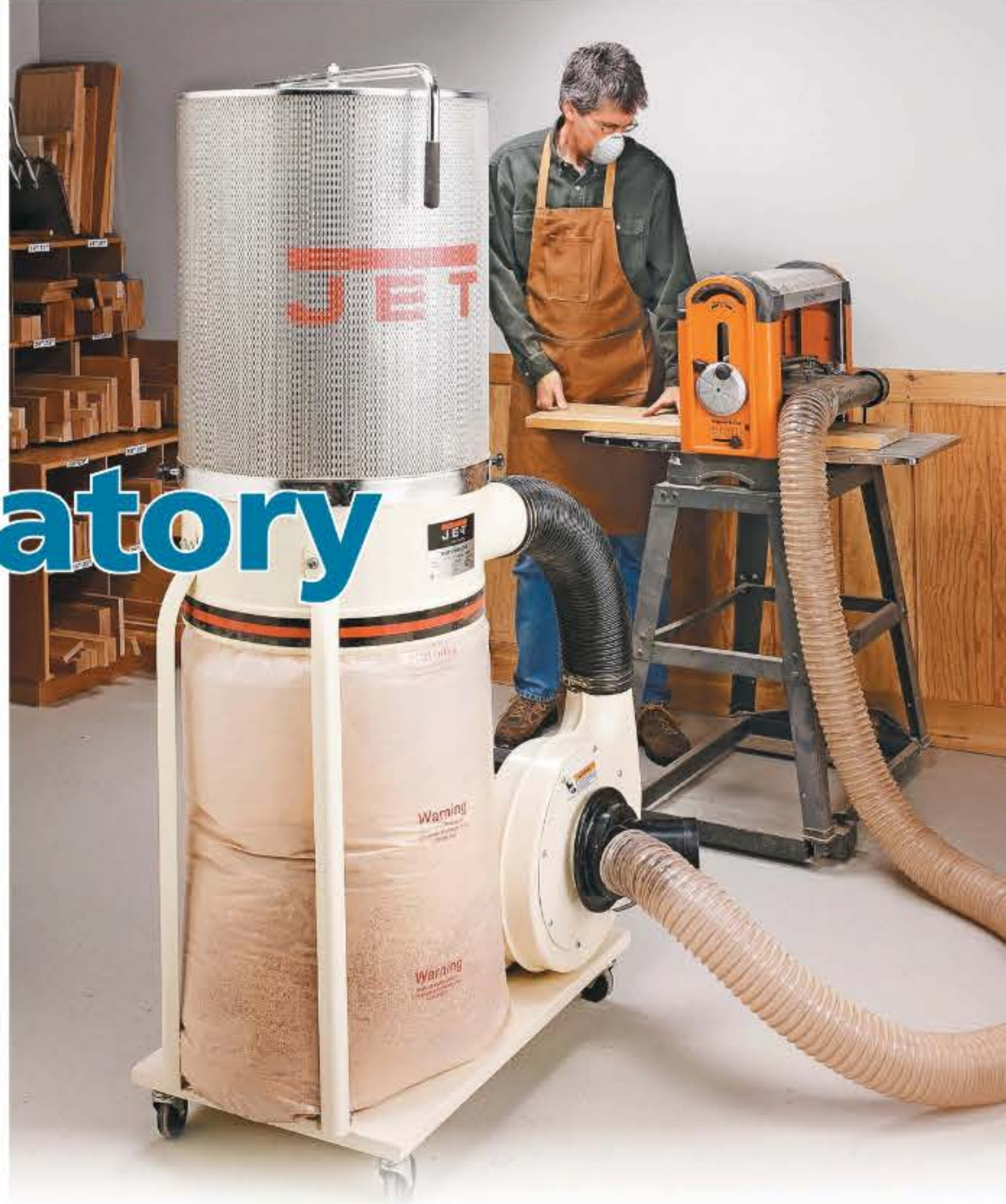
TOXIC DUST. It's worth pointing out that not all wood dust is created equal, so to speak. Some species of wood are much more harmful than others when it

comes to the health problems they can cause. Many exotic hardwoods, such as cocobolo and ebony, and domestic woods, like walnut and cedar, are some of the worst offenders. They can not only be skin and eye irritants, but can also precipitate asthma-like allergic reactions in some people.

This means getting even small amounts of wood dust from these species in your body can cause immediate health complications. But even relatively "benign" species of wood should be blocked, as well, to avoid causing long-term damage.

DUST COLLECTORS

Your first line of defense for capturing airborne contaminants should be the use of a dust collector (main photo).



In the past, most dust collectors were only useful for gathering the large chips and heavy dust created from woodworking. However, most newer models are capable of filtering out around 98% of the dust particles (as small as 1 micron in size) when connected to individual machines. Some even separate the large chips from the dust to make emptying the unit easier.

It's easy to dismiss adding a dust collector to your shop, especially if space is at a premium. But there are numerous models available to accommodate just about every size shop. Some are even designed to hang on the wall or ceiling to preserve floor space.

PERSONAL PROTECTION

Not all of the work in the shop is done using machines connected to a dust collector. So even if your shop has a dust collection system, wearing a dust mask or respirator is still a must. This is not only beneficial for protecting against the small particles that escape being captured by a dust collector, it's also necessary when using tools that aren't connected to the collection system at all.

For instance, you may not notice when using hand tools for some work, but even using a hand saw can kick small dust particles into the air. If you're not wearing a proper dust mask, this dust can easily find its way into your lungs. The bottom photo on



▲ Ceiling-mounted air filtration units (left photo) continuously circulate large volumes of air through the shop. Most come with a remote and timer for easy operation. You'll be surprised at just how much dust a filtration system captures in its filter (right photo).



the previous page shows a few of the options available. And for glasses wearers, (and aren't we all supposed to be wearing eye safety?) there are anti-fog masks available.

AIR FILTRATION

The next line of defense that's often overlooked is the use of an air filtration system. Whether you opt for a benchtop or ceiling-mounted model, as shown above, air filtration units work great for capturing most of the remaining dust that a dust collector misses.

Air filtration works by circulating the air in your shop through a filter to remove the smallest of dust particles. They typically use a replaceable filter (much like on a furnace) to capture

these dust particles (photo above). This small micron dust is the stuff that's the most harmful to your respiratory system. Be sure to note that once the dust particles are in the air, a mask or respirator should continue to be used until the air filtration unit has had ample time to pull most of the dust out of the air.

And don't think that you have to break the bank to get a top-of-the-line air filtration unit, either. It's easy to make a shop-made unit with a couple of inexpensive components. Check out the box at the bottom of the page to learn more.

EXTRA PRECAUTIONS

There are a couple of other measures you can take to help protect your respiratory health. The first is to work in an open area whenever possible when performing dust-intensive tasks. This means opening doors and windows in good weather. If you're in a garage shop, simply opening the door can help clear a lot of the dust out of the shop.

Finally, clean your shop often to keep dust at a minimum. If your shop is constantly dirty, simply picking up a tool from a bench disturbs the dust and kicks it into the air where it can linger.

Making the necessary changes to protect your health is well worth the extra effort. Woodworking should be a fun and fulfilling hobby without creating unnecessary issues down the road. If your current dust protection measures aren't up to the task, take the first step now to remedy that problem. **W**

Simple Solution: BOX FAN AIR FILTER

If your budget doesn't allow for a pricey air filtration unit, try out this shop-made setup that won't break the bank. It works great filtering the air for task-specific operations, like sanding at the workbench, as shown here.

All that's required is a simple box fan and a furnace filter sized to match the fan. Be sure to strap the filter to the intake side of the fan. Now, when you place it close for dusty tasks, the fan pulls the dust from the air and captures it in the filter.



▲ This simple air filter can be made relatively inexpensively, yet works great for removing the dust from a small area.

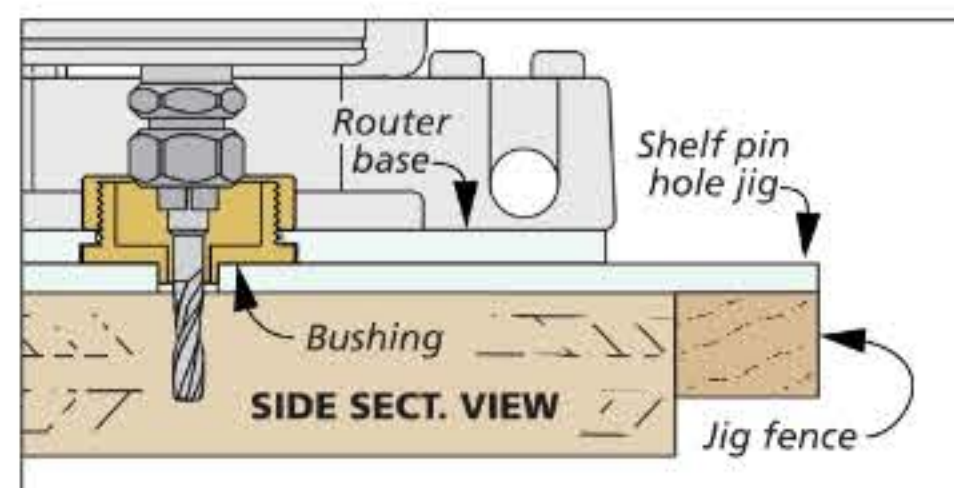
Drilling with a Plunge Router

Sometimes, all it takes to expand the capabilities of a tool is to think of it in a different way. That might sound a bit strange, but bear with me. My fixed-based router has been a key tool in my shop for years. But when I got a plunge router, I found even more uses for it.

Then one day, it occurred to me that the action of a plunge router is pretty similar to how a drill press works. A spinning bit is lowered into a workpiece with a high degree of control. When I

started thinking of my plunge router as a small drill press, several other operations came to mind. Just to be clear, I'm not suggesting you can use drill bits in a router. That's a big safety issue. But you can employ your plunge router and router bits to handle drilling-type tasks.

A drill press offers advantages for three important woodworking attributes: repetition, power, and precision. Most tasks require a combination of all three, but I've found that one usually takes the lead. With that in mind,



I'd like to share three router drilling applications that you may find useful in building your projects.

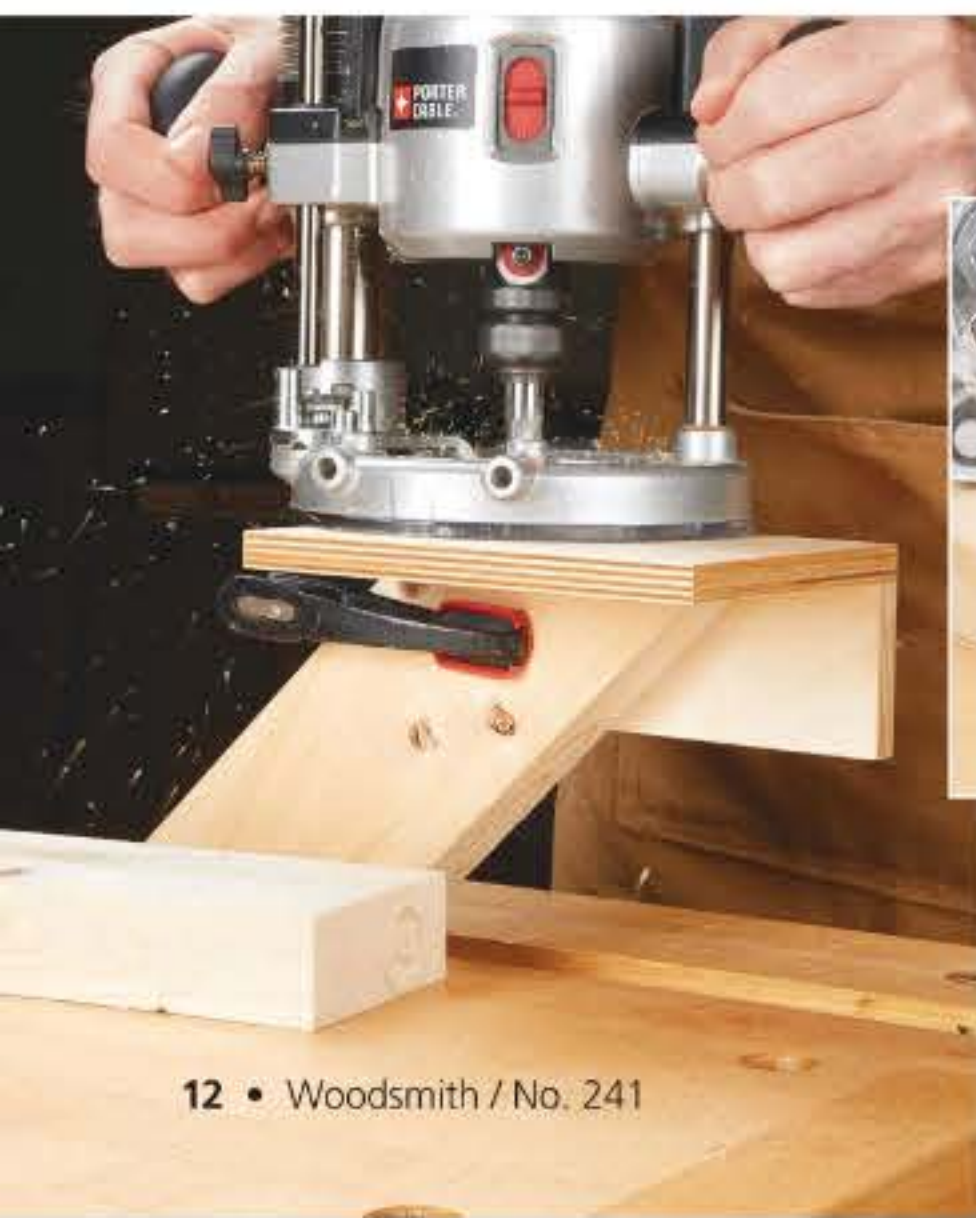
SHELF PIN HOLES

Incorporating adjustable shelves into a project typically involves drilling shelf pin holes — a lot of shelf pin holes. Repetition is the name of the game. I've used both a drill press to do the job, as well as a hand drill and a jig.

The drill press ensures the holes are square and drilled to a consistent depth. But I need to eyeball the spacing.

A jig and drill keeps the spacing on track. But even with a special bit, the holes aren't always square.

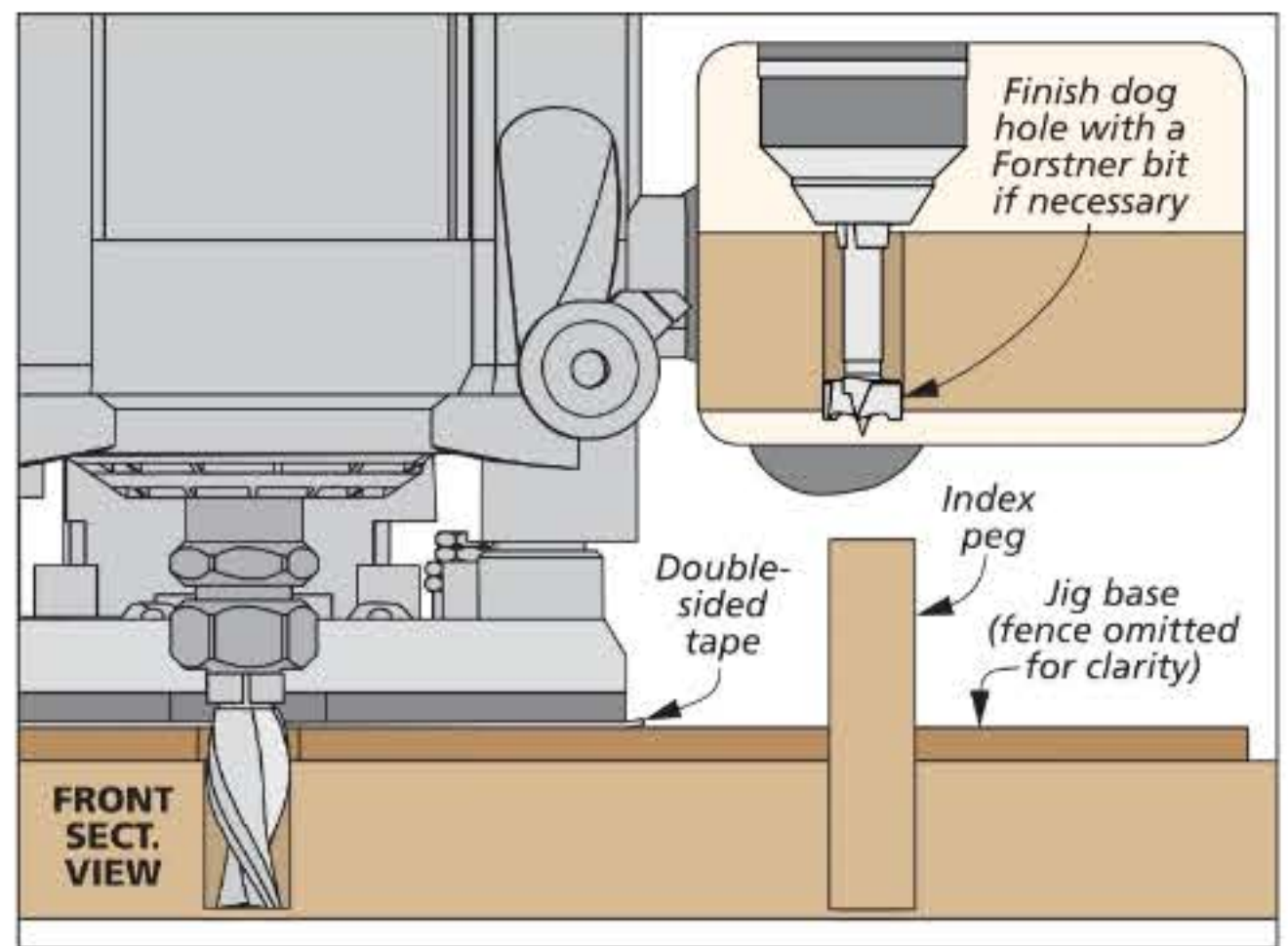
A plunge router, on the other hand, combines the benefits of both. The plunge action and depth stop guarantee



▲ A doweling jig only takes minutes to make. However, with a plunge router and guide bushing, it leads to accurate holes.



▲ The fence on this jig locates the holes a fixed distance from the edge of the bench. After drilling the first hole, slip a dowel into the index hole for equal spacing.



the holes are perfectly square and a consistent depth. It's also portable so you can work on any size workpiece.

To index the router, install a guide bushing that matches the holes in the jig. In the main photo on the previous page, I'm using a Rockler shelf pin jig with a $\frac{3}{8}$ " O.D. bushing with a $\frac{1}{4}$ " spiral upcut bit (drawing on the previous page). Since the bit spins at a high rpm, the hole is very clean. So whether it's the first hole or the 200th, the results will be the same.

DOWEL JOINERY

One of the main reasons I got a plunge base for my router is to make mortises. A plunge router and a spiral bit create

precise mortises that simplify cutting and fitting tenons. Another way to put this precision to work is for dowels.

The two photos on the bottom of the previous page show how I used a plunge router to create dowel joints in some thick lumber for a recent home improvement project. In addition to joining parts, dowels can be used to align parts for easier assembly.

It starts with a simple jig made with a plywood fence and template. The template has holes sized to match a guide bushing. The template holes and fence locate the dowel holes right where you need them. Using the jig means the holes in the two mating pieces are identical.

So I know the dowels will fit into the holes. Just like using a plunge router for shelf pin holes, a spiral bit creates smooth, consistent dowel holes.

I've used a doweling jig and a hand drill to make dowel joints in the past, and I will in the future. But with large dowels and drilling into end grain, a bit can wander, leading to holes that aren't perfectly square and even slightly oversized. Having the plunge router option provides you with another approach.

BENCH DOG HOLES

The third application that I want to talk about is drilling bench dog holes. Here the emphasis is on the muscle. For starters, you're using a fairly large bit — $\frac{3}{4}$ ". Next, you're usually working in thick, hard material. All that can really strain even a corded drill. As for the bit — deep holes quickly clog Forstner bits. Spade bits work quick but aren't really suited for accurate work.

By this point, you know it's time for the plunge router to ride in to the rescue. The photo and drawing above show the details. I attached the router to a jig with double-sided tape. And I included a second hole (and a dowel) to index the jig and keep the hole spacing consistent.

One caveat: Depending on the bit length and plunge capacity, you may not be able to drill completely through the benchtop. If that's the case, you can finish the hole with a drill knowing the critical upper portion is right on.

A router is likely one of your most-used tools in the shop already. Using it for drilling only increases its value. **W**

Big Holes: ROUTING RECESSES

Creating large holes is a job best left to the drill press, usually. But big router bits are difficult to find and expensive to boot. However, a router offers an advantage over a drill press — mobility. Instead of simply going up and down, a plunge router can follow the edge of a template to create a hole or recess much larger than the bit. The photo at right shows making a bowl. For these operations, I turn to a bowl and tray bit since it leaves a smooth bottom.



◀ A bowl and tray bit has rounded flutes to create a recess that transitions smoothly from the sides to the bottom. A bearing allows it to follow a template.

great
gear

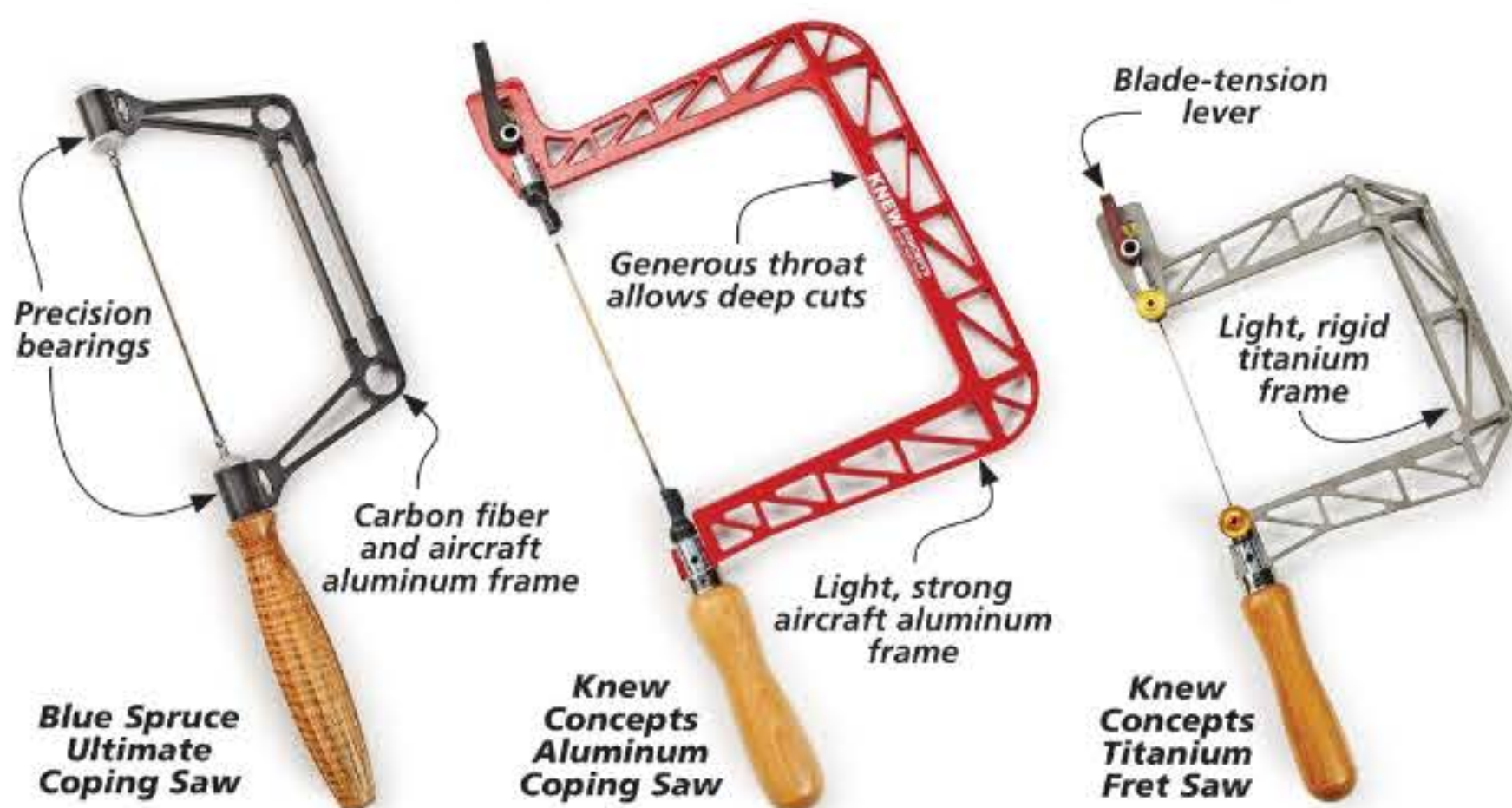
Top-Notch Coping & Fret Saws

There isn't a hand tool better suited to tackle fine, meandering cuts than a coping saw, or its close cousin, the fret saw. In fact, these saws can often be faster than a band saw. Here, I want to take a look at a few saws (photo below) that aren't your dad's old coping saw.

BLUE SPRUCE. If I were to make a list of boutique tool makers, *Blue Spruce Toolworks* would be at the top. While the price of the *Blue Spruce* fleet is up there, they have the quality to back it up. And *Blue Spruce's* new *Ultimate Coping Saw* may be their best tool yet.

HYBRID FRAME. When you look at the main photo above, one of the very first things you notice is the hybrid frame design. The frame is a combination of carbon fiber rods and machined, 6061-T1 aluminum. This mix of materials allows for the perfect amount of blade tension that standard coping saws can't dream of. By twisting the handle, you can dial in the tension to exactly what you need.

FREE-WHEELIN'. While I'm talking about the frame design, I want to mention one thing that really sets this saw apart in my mind. And that's the ball bearings embedded in the frame at either end of the blade. These, combined with precision engineering and milling, allow the blade to freely spin in the frame, even



under full tension. This means you're not only limited to one of the eight blade detents, but you can continually rotate the blade and frame to keep it from contacting the workpiece as you're sawing. Talk about flexibility.

CUSTOMIZABLE. The handle of the *Ultimate Coping Saw* is nice and long. The fluting provides an indexing point and great control of the blade. *Blue Spruce* offers many wood options for the handle and even more options for the hardware and frame colors (11 at last count). In addition, they offer a fret blade adapter so you can turn the coping saw into a fret saw. Overall, it's a great option for someone that is serious about their hand tools.

KNEW CONCEPTS

Another upgrade from hardware store coping saws, *Knew Concepts* has been serving woodworkers and jewelers with their saws for over a decade.

HANDLE UPGRADE

If you really want to increase the control and the sheer pleasure of using a *Knew Concepts* saw, take a look at upgrading the handle with one from *Elk Head Tools*.



- ▲ Mesquite handles from *Elk Head Tools* add balance and provide an ergonomic grip to the *Knew Concept* saws.



- ▲ The deep frame on the *Knew Concepts Coping Saw* allows it to reach into deep cuts. This makes it perfect for larger cuts, such as a curved apron.

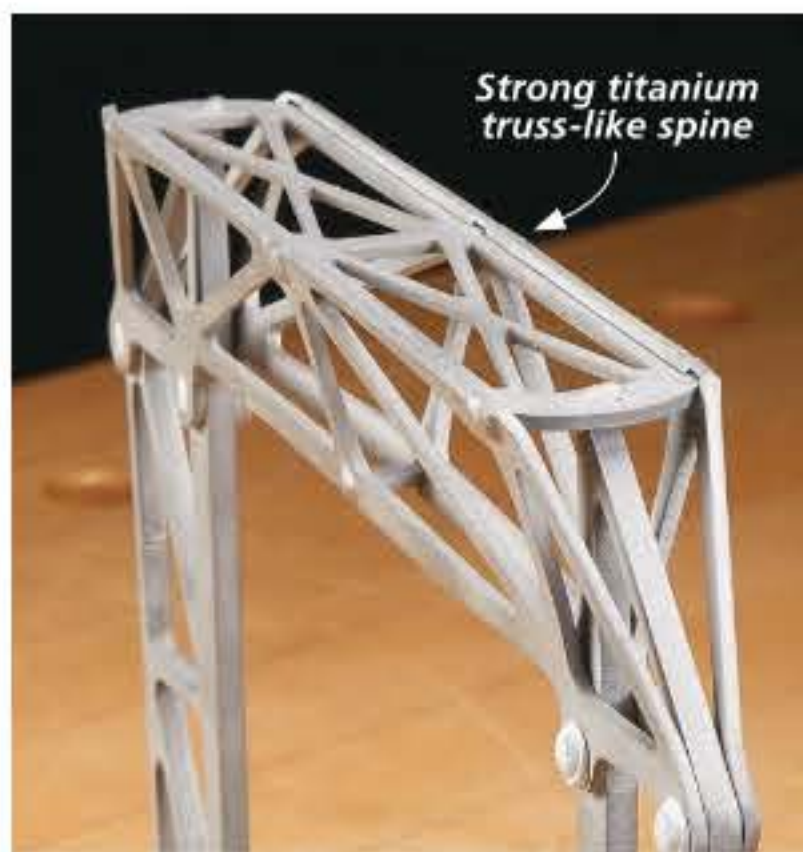


- ▲ All of the *Knew Concepts* saws have a blade lever to quickly engage or release blade tension.

COPING SAW. *Knew Concepts* recently re-introduced their aluminum-frame coping saw, as seen in the photos above, and the lower photo on the previous page. The coping saw rotates a full 360° with eight detents to stop the blade. In addition, its blade holder accepts standard 6.5" pinned coping saw blades.



- ▲ The fret saw makes quick, accurate cuts when working with delicate material like veneers and thin exotics.



- ▲ The *Ti* fret saw features a titanium birdcage design that allows the frame to be featherlight, yet extremely stiff.

The large frame and throat depth make it suited for both large, sweeping shapes and small, delicate work.

TITANIUM FRAME. For a finer cut and more delicate work, a thin-blade, fine-toothed fret saw is what I reach for. And in the world of fret saws, *Knew Concepts* has been the go-to name for years. They still offer their standard fret saw (as of now they're on version four, named the *Mk. IV*), and they've upped the ante by introducing a new *Titanium (Ti) Birdcage* fret saw, shown at left. The titanium "trusses" make the saw extremely rigid and unbelievably lightweight (7 oz). The frame of the *Ti Fret Saw* makes it perfect for delicate marquetry work when using a bird's mouth (as seen in the left photo). All of the *Knew Concept* saws feature a lever to quickly set and release the blade tension. Both the *Ti* and *Mk. IV* have multiple detents to lock the blade at different positions and are available in 3", 5", and 8" throat depths.

HANDLES. The handles on the *Knew Concept* saws are a no-frills varnished hardwood. Unlike the *Blue Spruce* handle, the handles on these saws are smooth. They do get the job done, but they're not much different than a standard coping saw handle. *Knew Concepts* does offer a foam handle sleeve for a little softer grip, but if you really want to upgrade your *Knew Concepts*, take a look at the box to the left.

No matter which saw you choose, you'll be amazed at the quality and ease of use of these saws. They're a stark contrast to the standard coping saws that struggle to hold blade tension and lack control while making a cut. If you're interested in picking up one of these saws, you can find where to purchase them by visiting Sources on page 67. **W**



Melodic Tongue Drum

This whimsical percussion instrument takes your small box building skills to a whole new level.

The tongue drum is one of the world's oldest known instruments. They've been a part of many cultures for thousands of years. The idea behind the tongue drum is simple — a hollow box, or "sound chamber" reverberates when the individual tongues, or soundboard, are struck.

On some tongue drums, the tone the tongues produce is varied by making each one a different length and width. On this design, I opted for form over function and made the

tongues symmetrical in appearance. The tone is varied by removing material from the back face of the toe or heel of each tongue. I'll talk more about that later.

SOUND MATERIAL. One of the fun aspects of a tongue drum is that different wood species can produce distinctly different sounds from one another, based on the wood's density. So it's a good way to experiment with exotic

woods you may have leftover from other projects. I used quilted maple and mahogany for this drum.

A pair of custom-made mallets rounds out this project. Keep reading to get started on this classic musical piece.



▲ There are several different synthetic material options available when it comes to the mallet heads. Each one creates a slight variation in tone.

Making the SOUND BOX

Building a tongue drum is comparable to building a small box. Only here, the "lid" is permanently fastened in place when it's completed. Because of these similarities, it's easy to incorporate much of the same joinery you'd use in a small box, like dovetails, finger joints, and similar features.

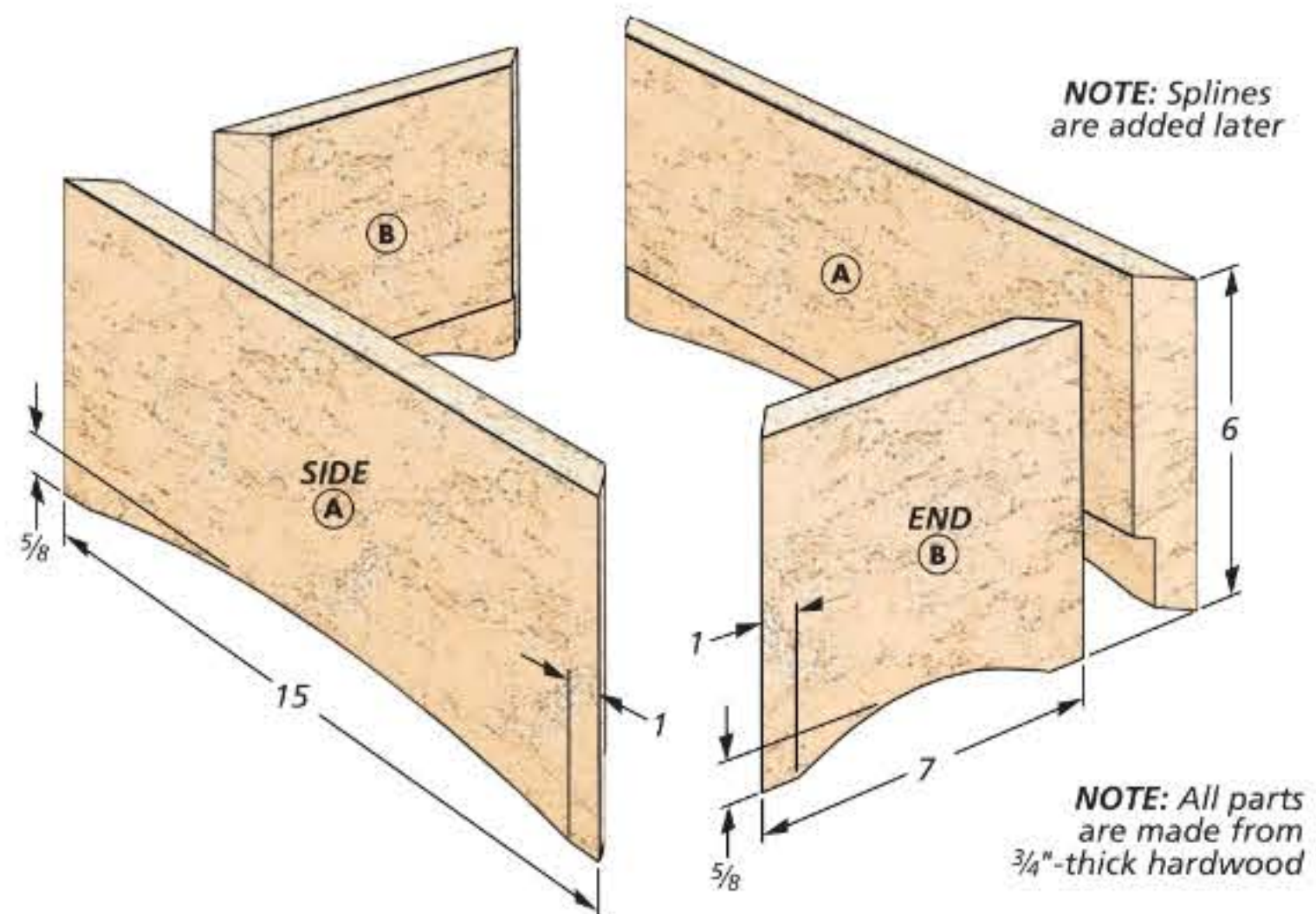
The sound box for this tongue drum has mitered corners with contrasting splines added for strength. The bottom is recessed in a deep rabbet which keeps it hidden from view. The gentle curves along the bottom edges of the box complete the look. But you'll start by squaring up the stock and using the dimensions shown at right to cut the pieces to final size.

MITERED CORNERS. Creating the mitered corners on the side and end pieces is the first order of business. To ensure that I ended up with cuts that were dead on, I began by cutting a miter on one end of each piece. I then attached a stop block to an auxiliary miter gauge fence and cut the miter on the other end of both side pieces (Figure 1). Reset the stop block to do the same thing for the ends.

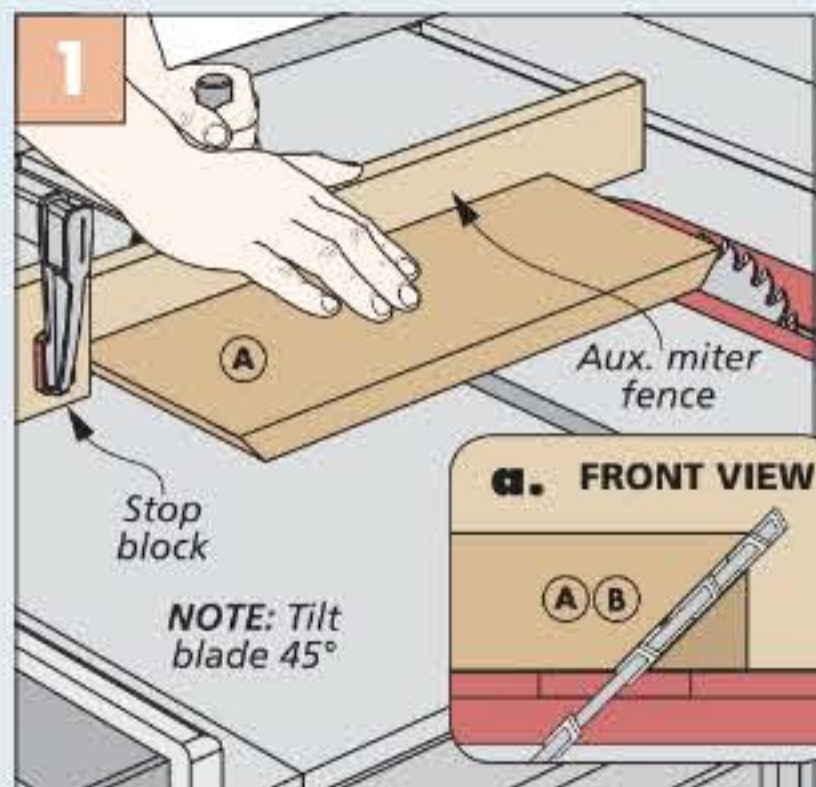
RABBET FOR BOTTOM. As I mentioned earlier, the rabbet that houses the bottom is cut deep enough to completely hide the bottom when it's in place. Cutting this rabbet requires a couple of passes over a dado blade. Make one pass on all four pieces before repositioning the fence for the second pass. Figure 2 shows the process.

CUT CURVES & ASSEMBLE. To draw the curves on the sides and ends, I used a thin strip of posterboard as a guide. Using the layout marks, bend the posterboard strip into position and hold it in place with a piece of masking tape (Figure 3). You can then trace the curve. The curve on the end pieces is done in the same manner.

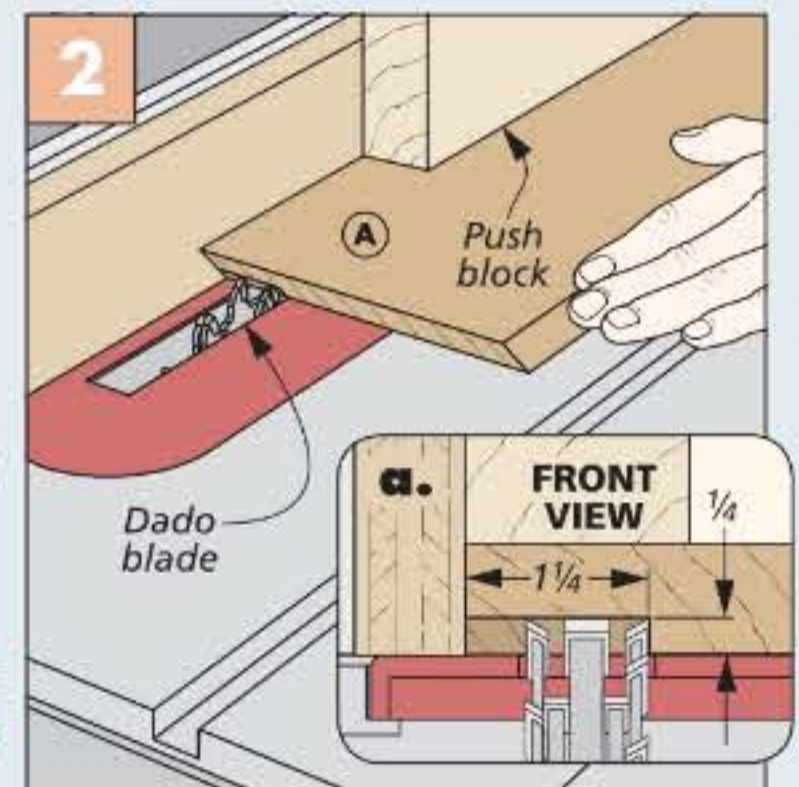
After cutting the curves at the band saw and sanding the parts, you're ready to assemble the box (Figure 4). Be sure to check for square before the glue sets up.



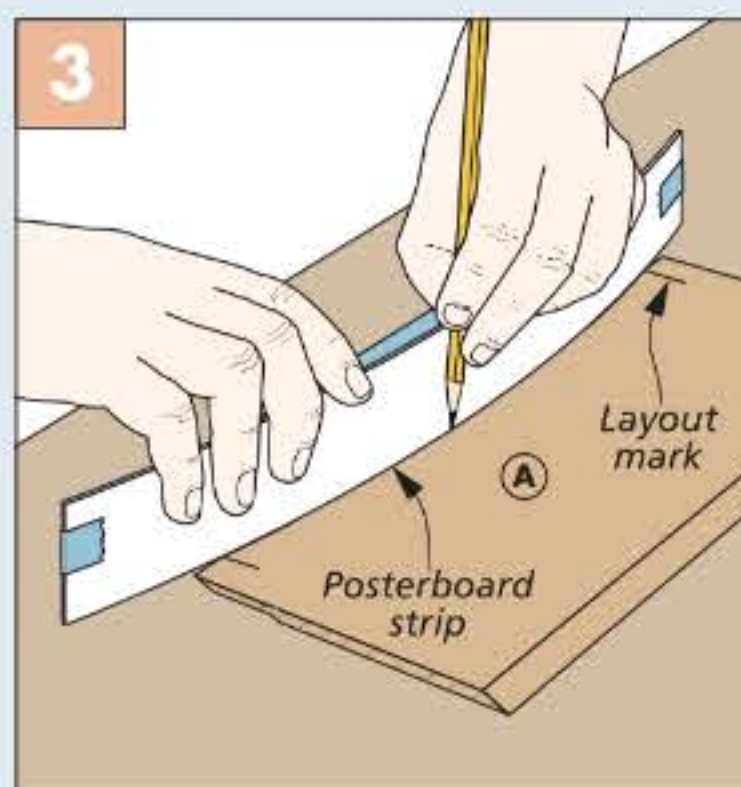
How-To: CUT THE BOX JOINERY



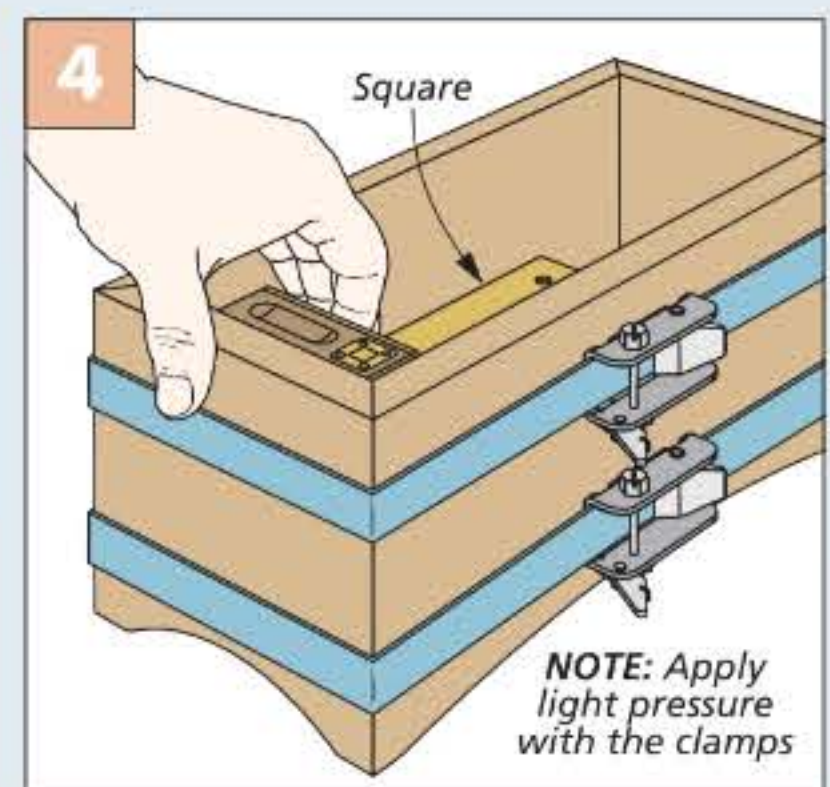
Miter the Ends. Miter one end of each workpiece. Then, use a stop block to miter the other end for consistent results.



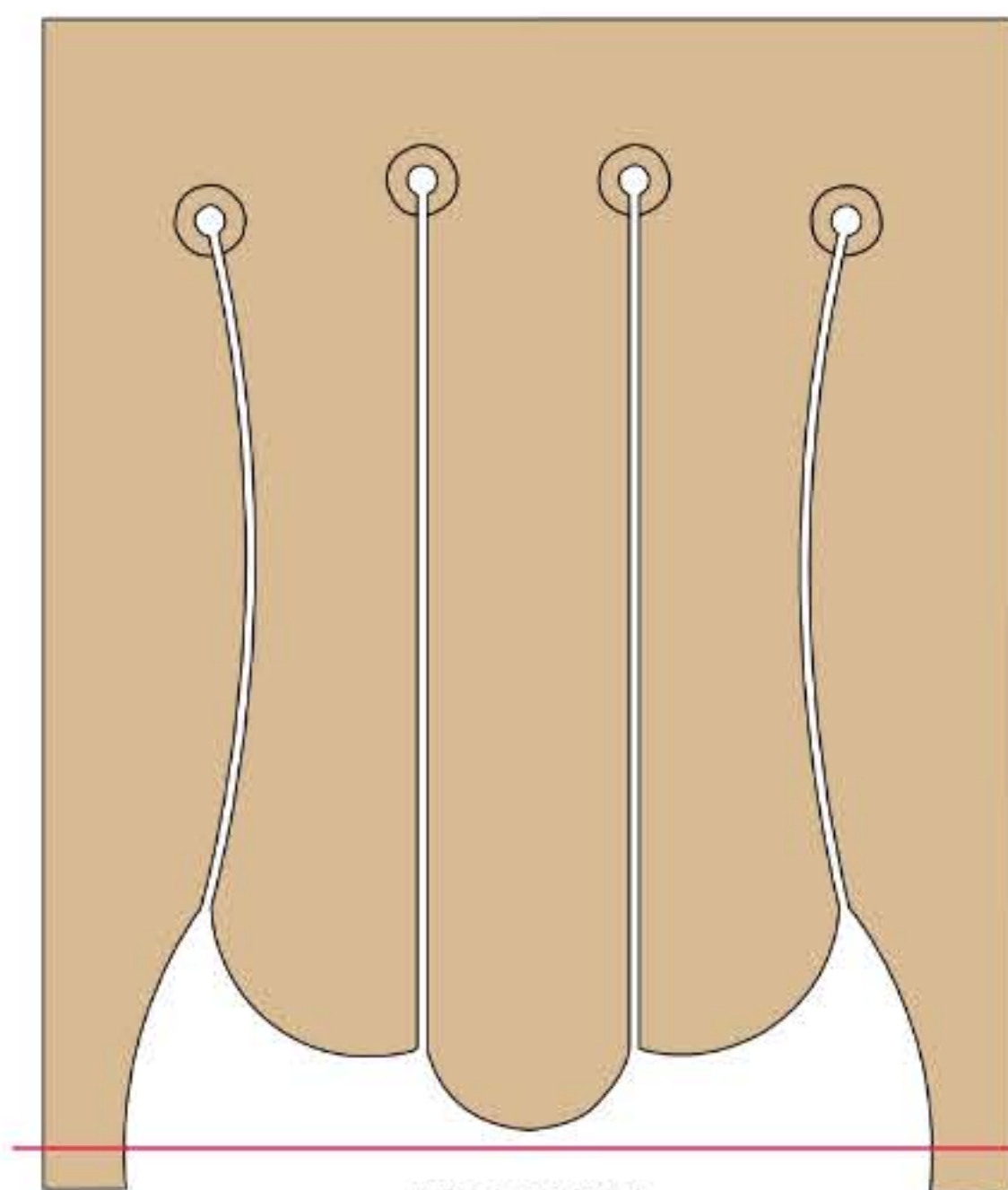
Deep Rabbet. Use a dado blade and an auxiliary rip fence to cut the rabbet along the edge of each piece.



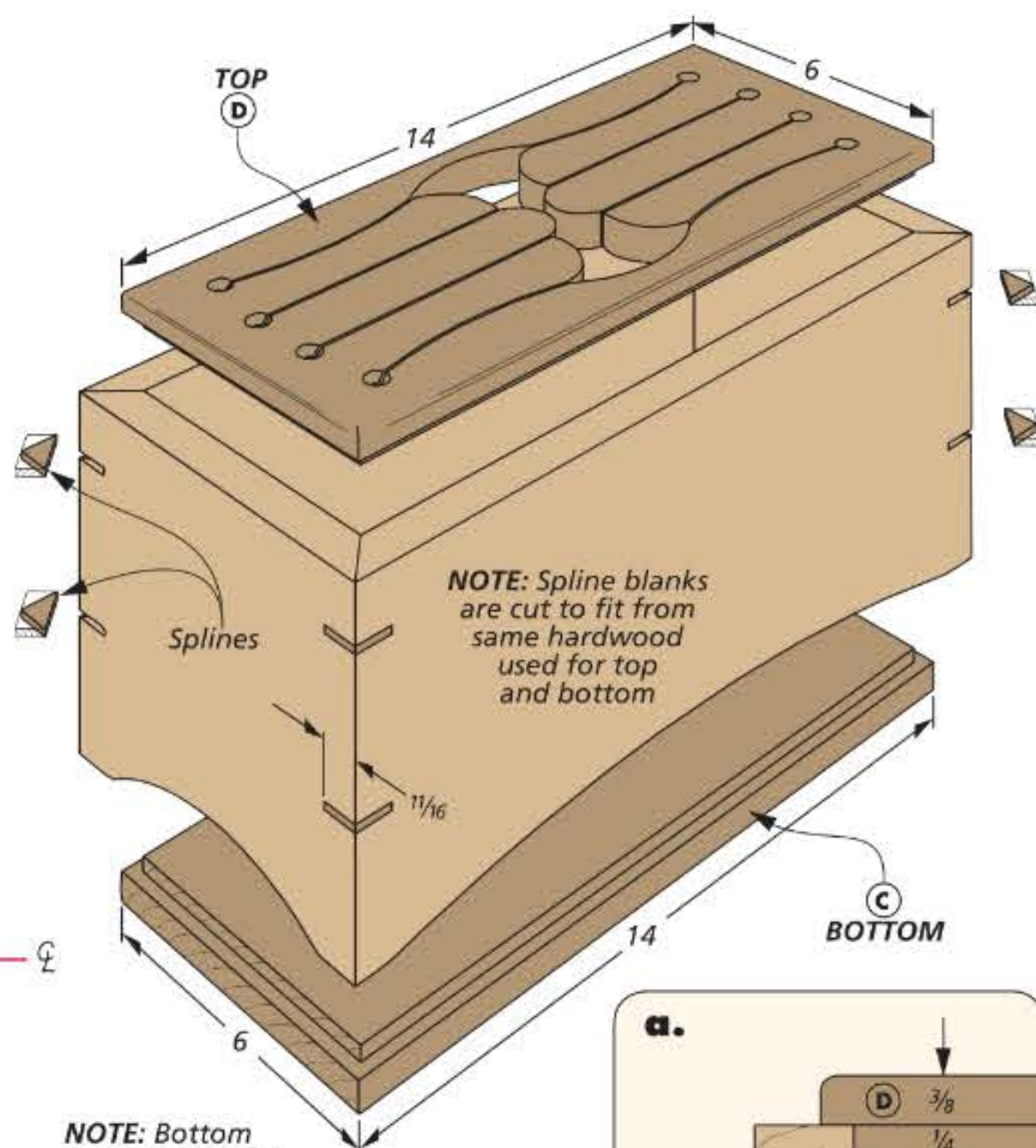
Lay Out Curves. A thin strip of posterboard works well to use as a layout guide for the curves.



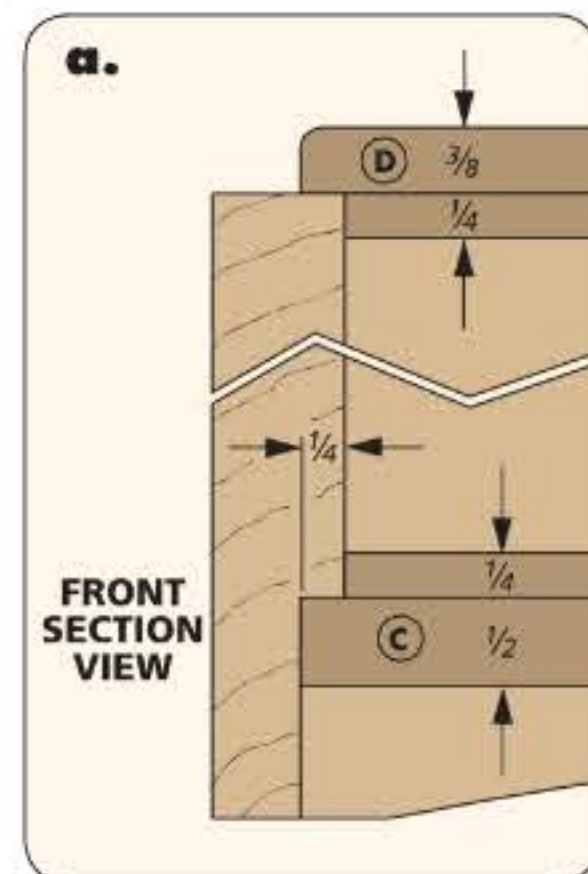
Clamp Time. A couple of band clamps are all it takes to secure the box until the glue dries. Be sure to check for square.



TOP PATTERN
(Print two patterns at 200% and join at the centerlines to get one full-sized pattern)



NOTE: Bottom is made from $\frac{3}{4}$ "-thick hardwood. Top is $\frac{5}{8}$ "-thick hardwood



Completing the CASE

The assembled box still needs a bit of work to finish it up. Hardwood splines at each corner add strength to the miter joints, as well as a decorative detail. From there, you'll head to the router table to soften a few edges.

SPLINE-CUTTING JIG. Cutting slots for splines isn't a complicated process. You do, however, want to ensure that the box is held at

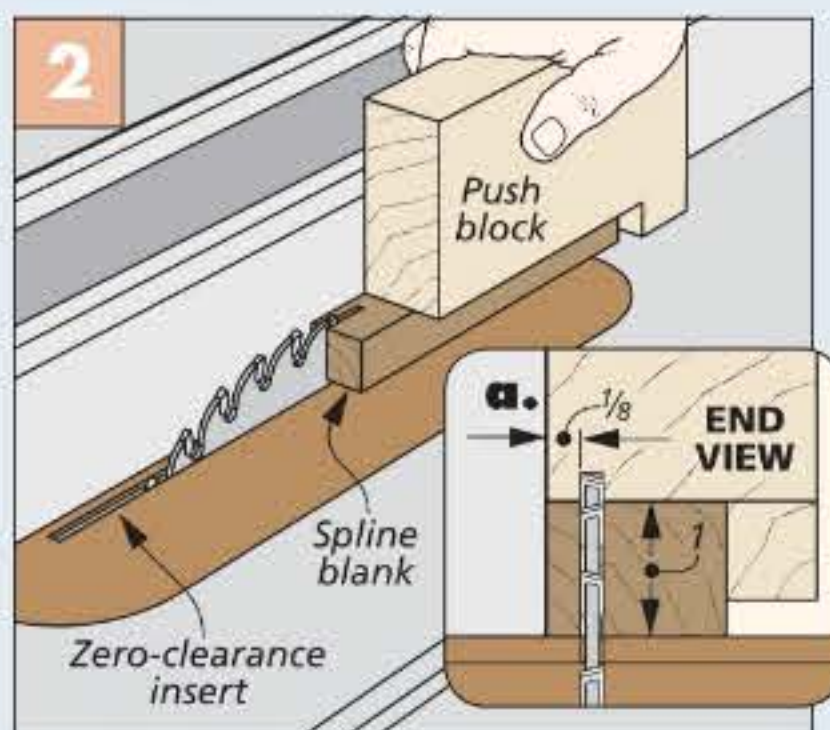
45° to the saw table and that the slots are evenly spaced. For this process, I turned to the simple jig you see in Figure 1, below. It only takes a few minutes to put together and gives precise results. Shop Notes on page 64 provides the jig dimensions and setup.

SPLINE BLANKS. I made my splines from a scrap piece of mahogany (the same

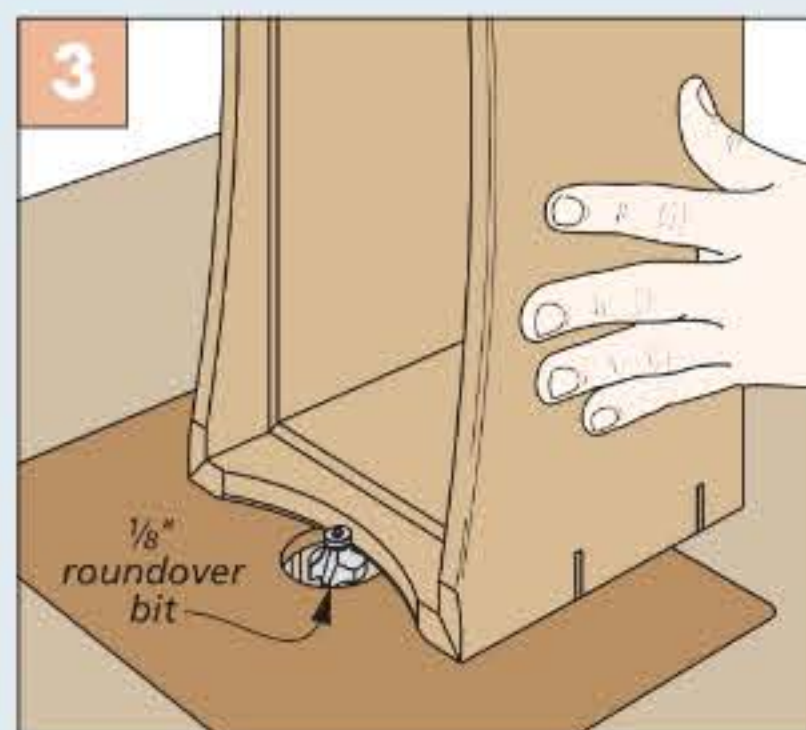
How-To: COMPLETE THE BOX



Slot-Cutting Jig. This simple slot-cutting jig holds the box at the correct angle for cutting the spline slots.



Cut the Spline Blanks. Start with an oversize blank to cut the spline blanks. Use a push block for safety.



Soften Edges. Head to the router table to round over the curved areas only along the bottom edge.

material I used for the bottom and top). Figure 2 on the previous page shows how to safely cut these pieces from a blank. You can then glue the oversized splines into the slots. Trim and sand them flush when the glue is dry. After that, head to the router table to round over the outside edge of the curves (Figure 3).

CLOSE UP THE BOX

With the details on the box completed, you can now work on the parts that seal the box to create the sound chamber — the bottom and the top. The bottom is a pretty straightforward piece. The top, however, requires the detailed cuts that create the tongues.

RABBETS FIRST. After cutting both the bottom and top to size (note they're different thicknesses), head to the table saw to cut the rabbet around the perimeter of each workpiece. Figure 1 at right, along with details 'a' and 'b' provide the dimensions you'll need for both of the cuts.

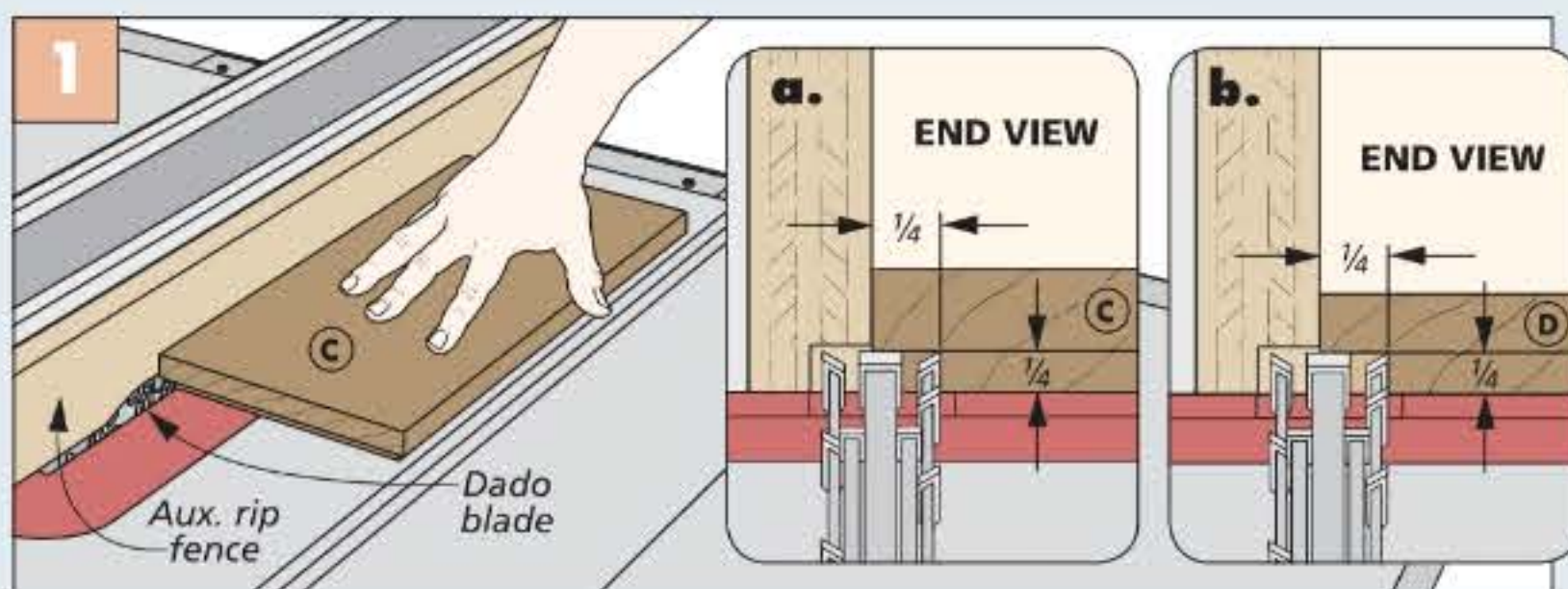
You can do a test fit of the parts at this point and fine-tune them for a snug fit to the box. But don't glue them in place just yet. The top still needs the shaping work done to complete it and you'll need to be able to remove the bottom when it comes time to "tune" the tongues later.

CREATE THE SOUND BOARD. As I mentioned earlier, we opted for a symmetrical pattern for our sound board. The half pattern on the previous page can be enlarged or you can go to Woodsmith.com to print a full-size pattern. Use a light-duty spray adhesive to secure the pattern to the top.

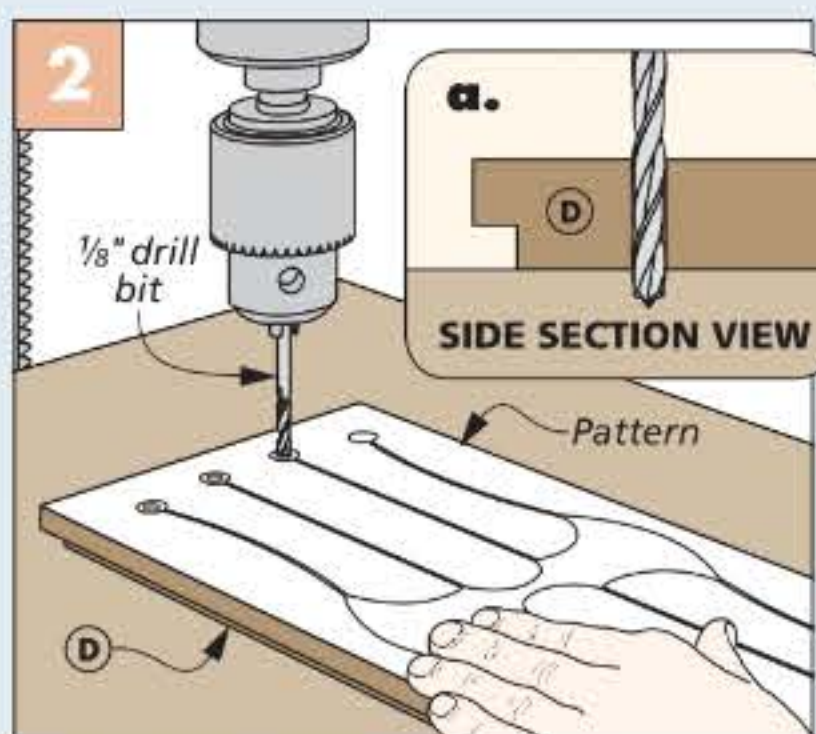
DRILL & COUNTERSINK. With the pattern in place, I headed to the drill press to drill the holes that define the ends of the eight slits (Figure 2). Next, switch to a countersink bit to chamfer these holes, as shown in Figure 3.

SCROLL SAW WORK. While a jig saw would work to cut out the pattern in the top, I decided to use a scroll saw for better control (Figure 4). To avoid a lot of sanding along the narrow openings, take your time making the cuts. And speaking of those narrow slits, they're just wide enough to require two passes

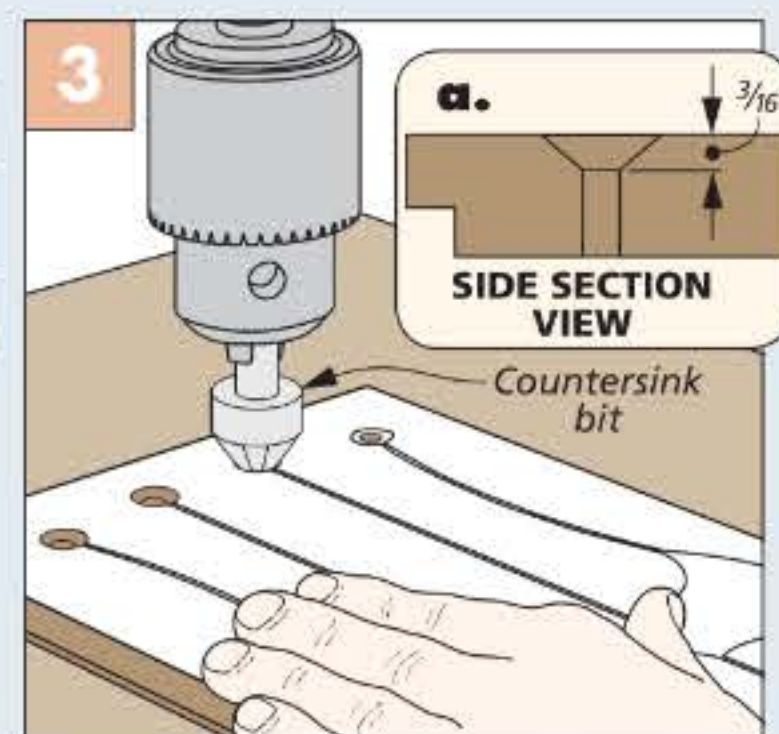
How-To: MAKE THE BOTTOM & TOP



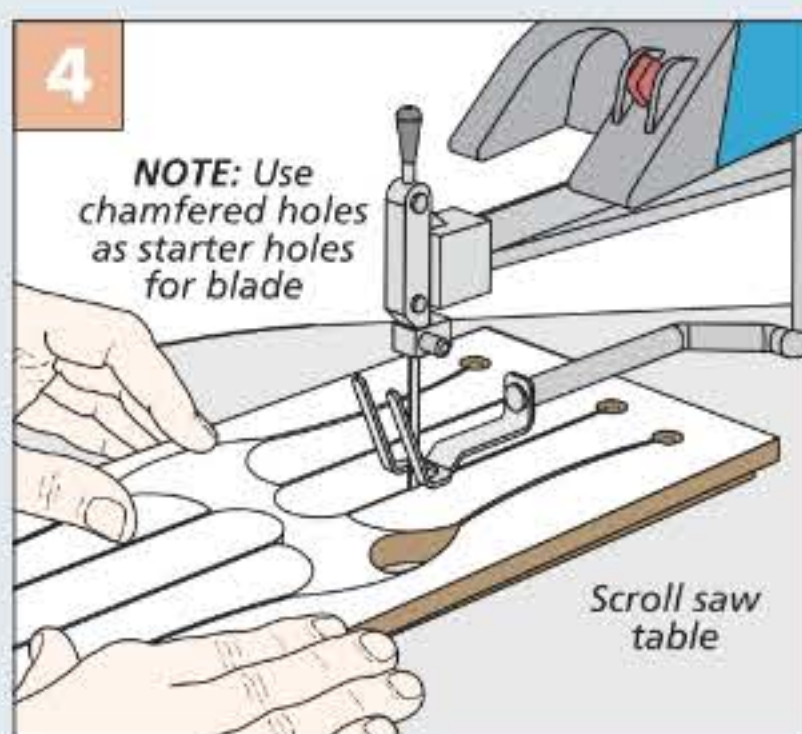
Rabbet Bottom & Top Edges. The bottom and top fit into the box using a snug-fitting rabbet around the edges. The same dado blade setup is used to make these cuts. Be sure to note the difference in material thickness.



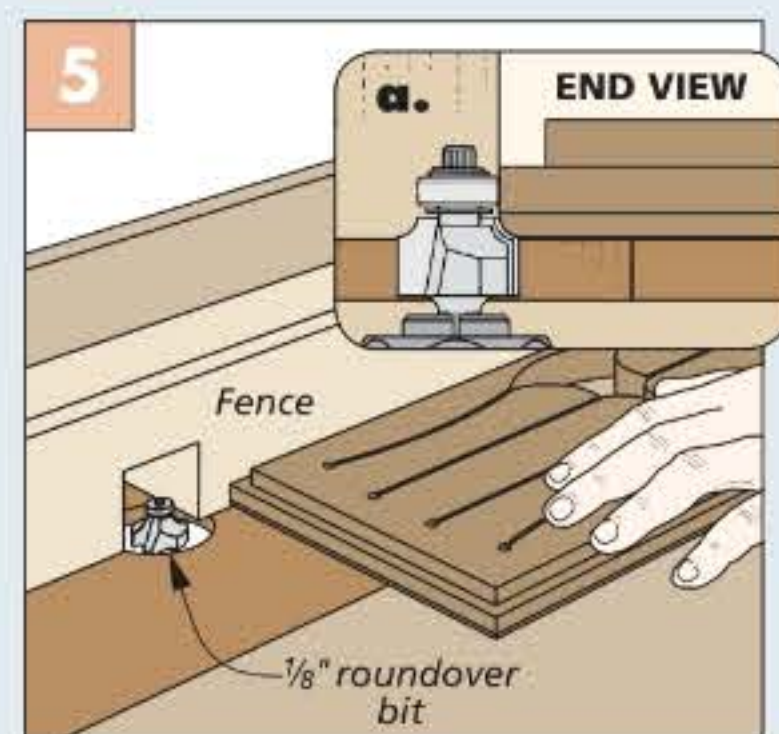
Through Holes. With the pattern in place on the top blank, drill the eight through holes at either end.



Decorative Countersinks. Switch to a large countersink bit to chamfer the edge of each hole.



Finish Cutting Template. A scroll saw makes quick work of removing the waste between the tongues.

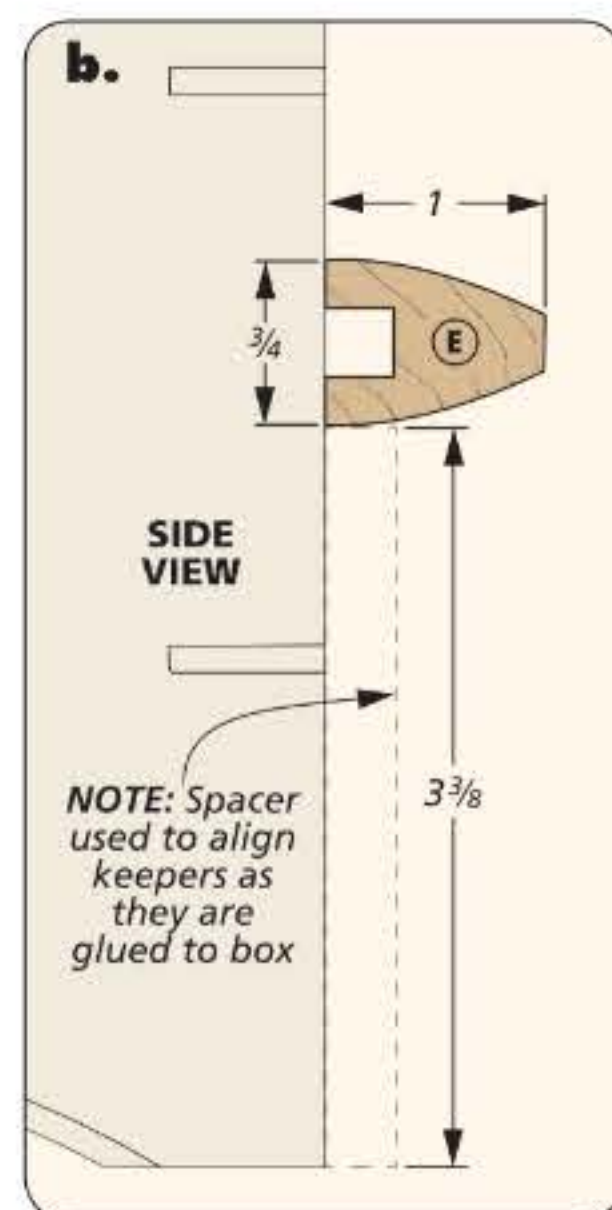
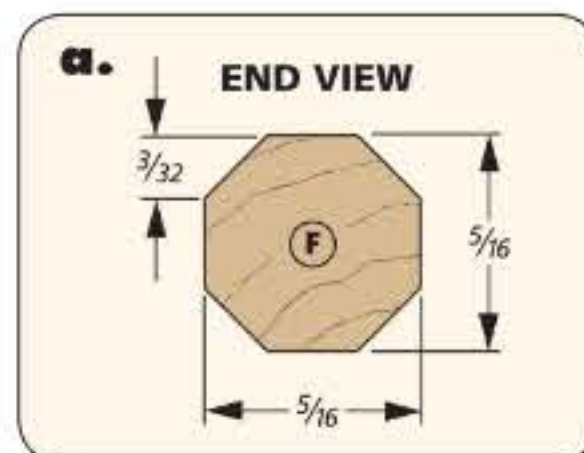
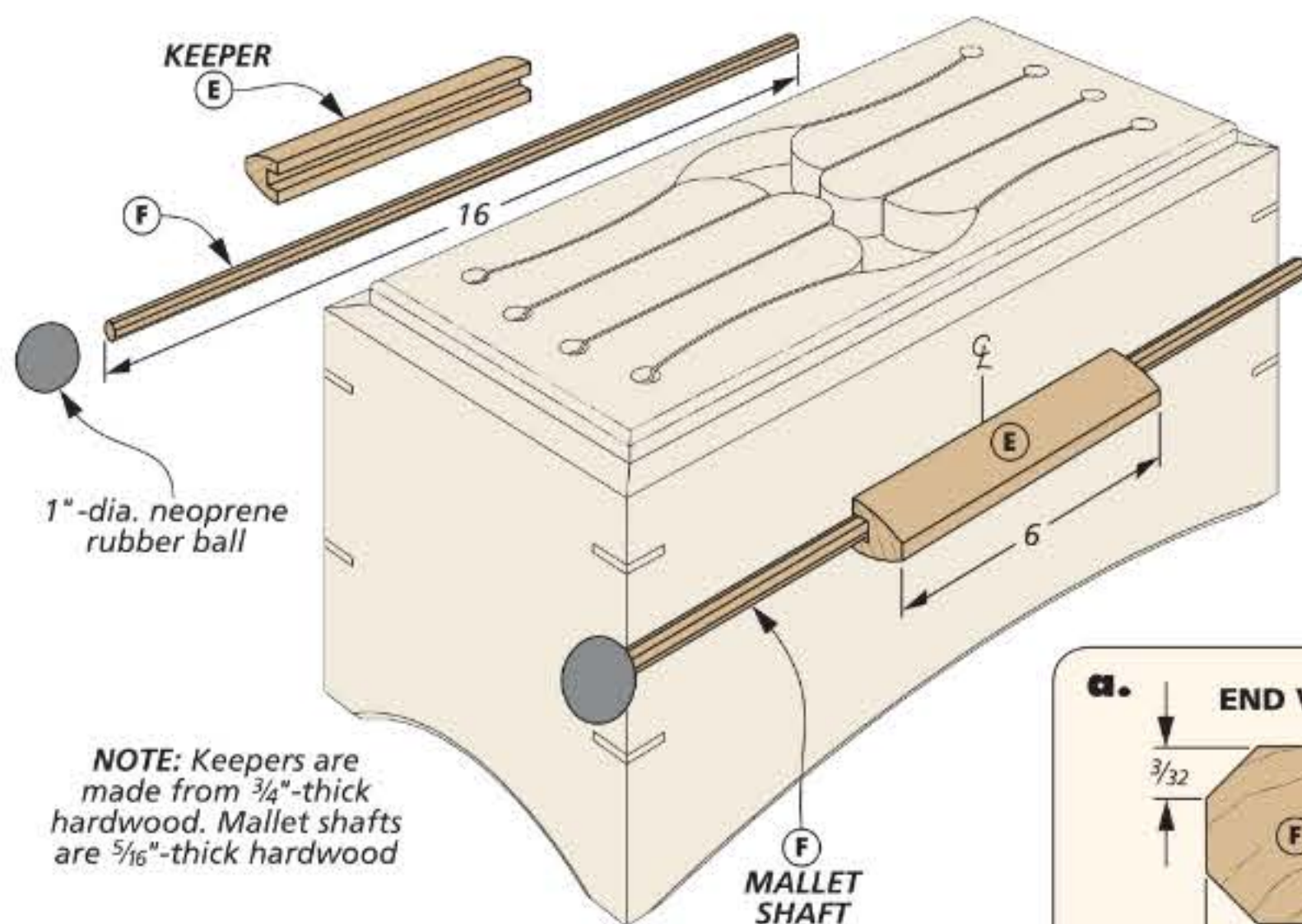


Round Over Top. Head back to the router table one more time to ease the top edge of the top.

with a scroll saw blade to cut along both edges. If any sanding is needed, a piece of sandpaper folded over a putty knife does the trick.

FINAL DETAILS. To wrap up the top, make one more trip back to the router table

to ease the edge around the perimeter, as shown in Figure 5. After a light sanding, the top can be glued in place in the box. Be sure to apply a continuous bead of glue to get a good seal between the top and the box.



Making the KEEPERS & MALLETS

If you've built many small projects, then you know that the devil — and the beauty — is in the details. And our tongue drum is no exception. We could have just used a couple pieces of hardwood dowel for the mallet shafts and called it good. Or simply drilled two holes in one end of the box to house the mallets when not in use. But we opted for adding two keepers to the sides of the box to hold the mallets. And the

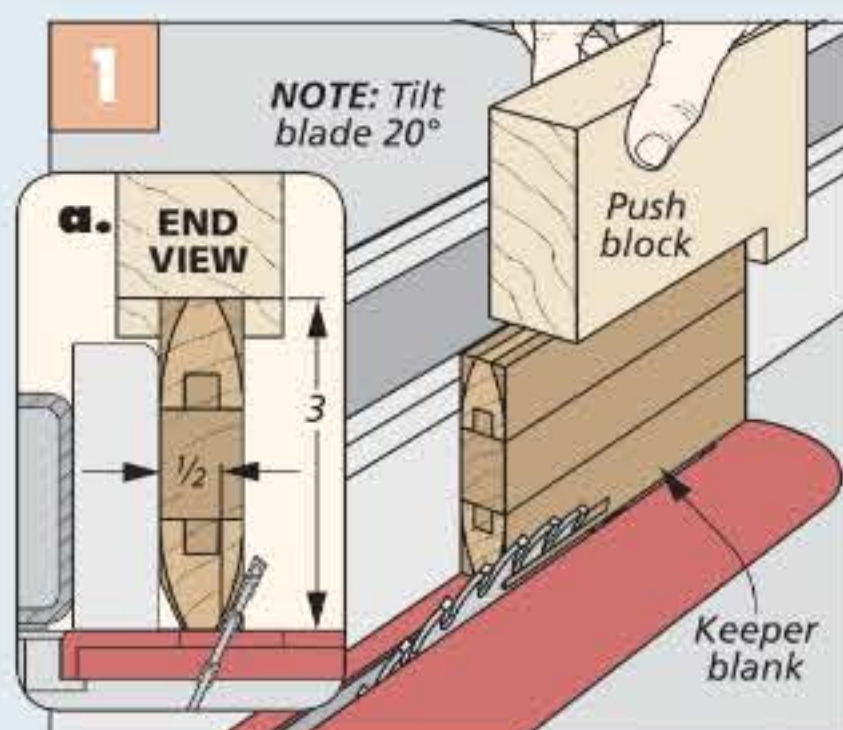
mallet shafts are custom made into a faceted octagon shape. A clever jig helps to make those with a power planer. But first, start with the mallet keepers.

MAKING THE KEEPERS. The final size of the keepers is pretty small. So, in order to make them safely at the table saw, I started with an extra-wide blank that allowed me to do the initial shaping. Figure 1 below shows the proper setup for these angled cuts.

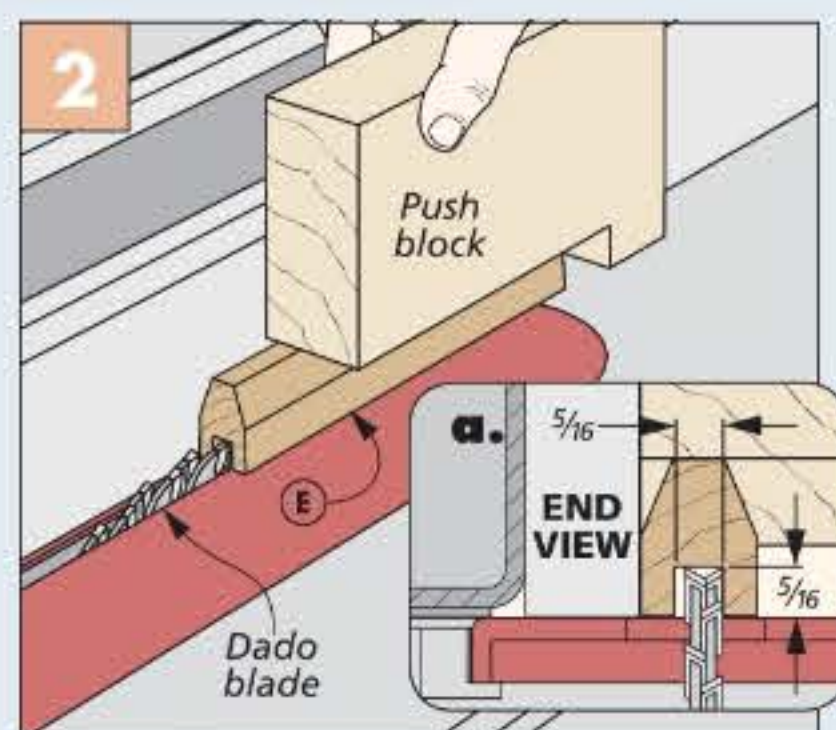
After making the angled cuts along the edges of the blank, rip the two keepers to size. Then, switch to a dado blade to cut the groove in the bottom edge of each workpiece (Figure 2). To complete the shaping, I attached a piece of sandpaper to my benchtop and rounded the faceted edges of each keeper. Figure 3 and detail 'a' below show the shape you're going for.

To glue the keepers to the sides of the box, I made a spacer to position them at the proper height. Detail 'b' above provides the information you need.

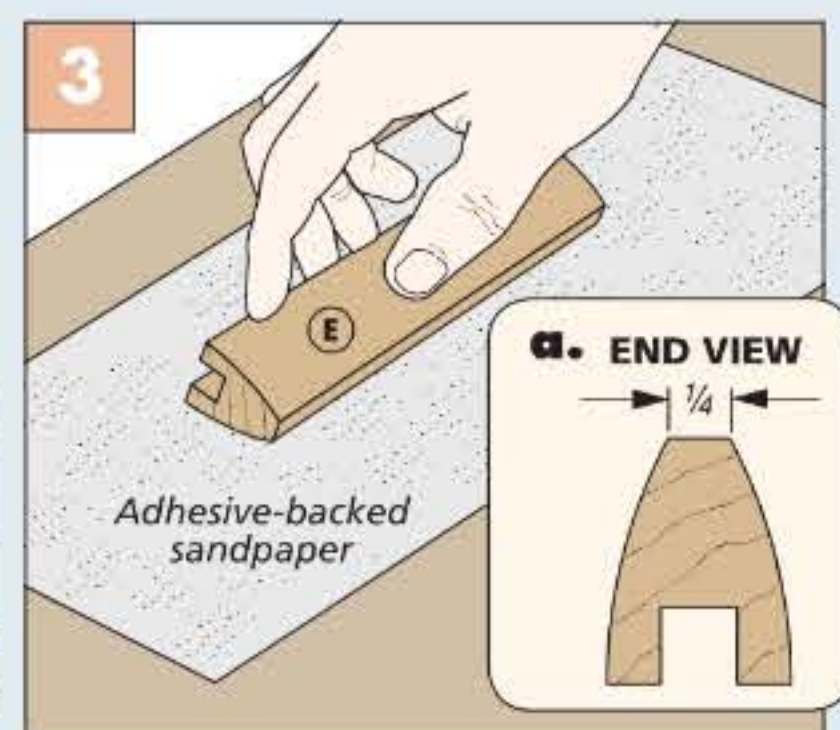
How-To: MAKE THE Mallet KEEPERS



Oversize Keeper Blank. A wide blank keeps your hand away from the blade when shaping the keepers.



Plow a Groove. Make two passes with a narrow dado blade to center the groove in each keeper.



Final Shaping. Fasten a piece of sandpaper to a flat surface to finish the shaping work.

Mallet Heads. Before jumping into the process for making the mallet shafts, let me mention a couple of things about the material used for the heads. There are endless options when it comes to the material you could use here. And many of them will affect the tone when striking the drum.

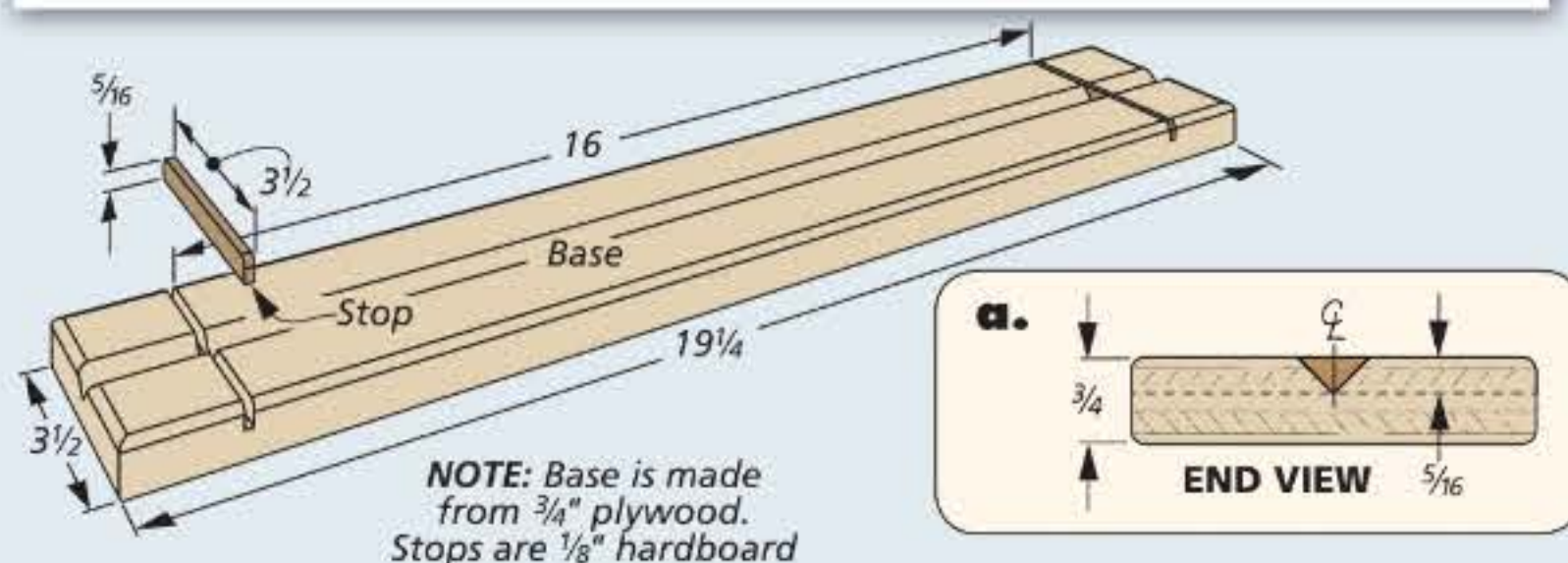
We opted to make two different sets of mallets, both using different types of rubber balls. The main photo on page 16 shows the mallets with neoprene rubber heads, while the inset photo on that page shows the set made with polyurethane rubber heads. Sources on page 67 shows where to find either type of rubber ball, as well as the finishing information for the box.

CUSTOM SHAFTS. As I previously mentioned, the mallet shafts are “planed” into octagons from long, square blanks. This process is quite simple using the jig shown at right. It allows you to position each squared-up shaft blank in the V-groove and pass it through a planer (Figure 1). Simply rotate the blank after each pass to just shave the corner. Four passes result in an octagonal shaft.

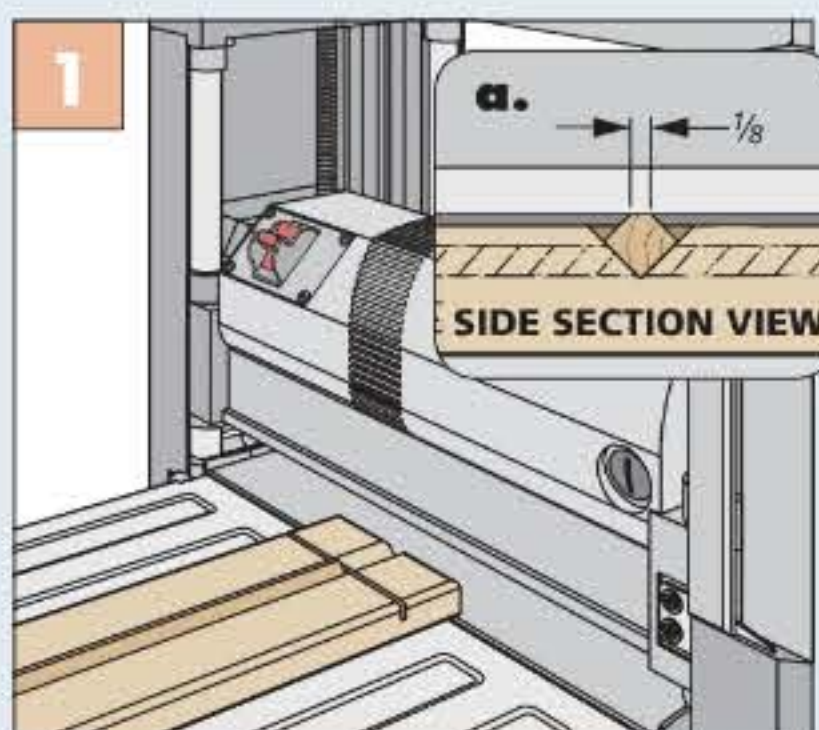
Figure 2 shows the best way to hold the rubber balls while drilling the mounting holes. (Be sure you don’t overtighten the handscrew and distort the shape of the ball.) A dab of epoxy in each hole holds the shafts in place.

TUNING THE DRUM. Now, slip the bottom in place (still no glue) and give the drum a test run by striking the individual tongues. Depending on the wood species you’ve used, you may get some pleasing tones right off the bat.

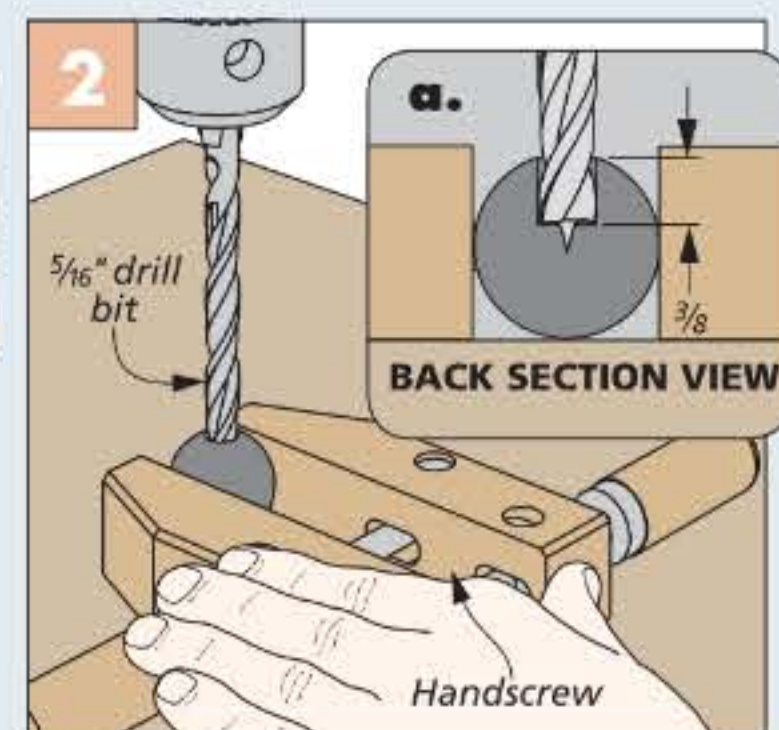
How-To: MAKE & USE THE MALLET SHAFT JIG



Mallet Shaft Jig. The V-groove in the base is made at the table saw with the blade tilted 45°. The stops hold the shaft blanks in place. The distance between the stops is determined by the length of the shaft blanks.



Easy-To-Use. Set the depth of cut so that the planer just skims the corner of the mallet shaft blank (detail ‘a’).



Drill Rubber Ball. Secure the rubber ball in a handscrew to drill the mounting hole for the shaft.

If you’d like to try your hand at tuning the drum to get different sounds, take a look at the lower right photo. It shows how to remove material from the toe or heel (or both) of the individual tongues to change the pitch. You’re simply looking for a continuous change in tone

between the “keys.” Once you’re satisfied with the pitch, glue the bottom in place. If you’re interested in making a fully functioning instrument with more precise tonal scales, check out our online video at Woodsmith.com to perfect this process and learn a new skill. **W**

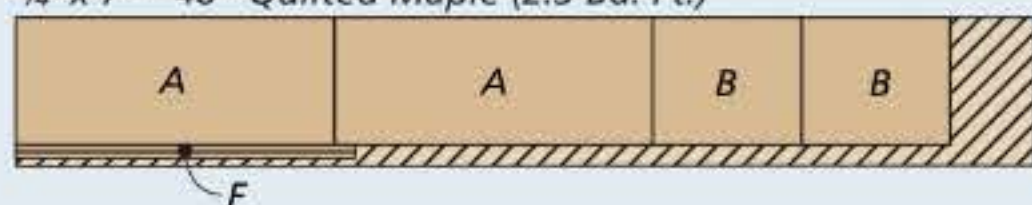
Materials, Supplies & Cutting Diagram

A Sides (2)	$\frac{3}{4}$ x 6 - 15	E Keepers (2)	$\frac{3}{4}$ x 1 - 6
B Ends (2)	$\frac{3}{4}$ x 6 - 7	F Mallet Shafts (2)	$\frac{5}{16}$ x $\frac{5}{16}$ - 16
C Bottom (1)	$\frac{3}{4}$ x 6 - 14	• (8) Hardwood Splines	
D Top (1)	$\frac{5}{8}$ x 6 - 14	• (2) 1"-dia. Rubber Balls	

$\frac{3}{4}$ " x $6\frac{1}{2}$ " - 36" Mahogany (1.6 Bd. Ft.)



$\frac{3}{4}$ " x 7" - 48" Quilted Maple (2.3 Bd. Ft.)



Woodsmith
GO ONLINE
EXTRAS

Full-size top pattern and tongue-tuning video are available at Woodsmith.com



▲ To change the tone of the individual tongues, use various sizes of drill bits to remove material from the underside.

Drill bit Storage Center

You'll never "misplace" a drill bit or accessory again with this combination, wall-mounted storage cabinet and chest.

Most of us strive to get our work done in an efficient manner. Having tools and accessories well organized is critical to meeting that goal. That was the inspiration behind this drill bit storage center. It's big enough to hold all of your drill bit sets and drill press accessories, yet small enough to mount close to your drill press for convenient access.

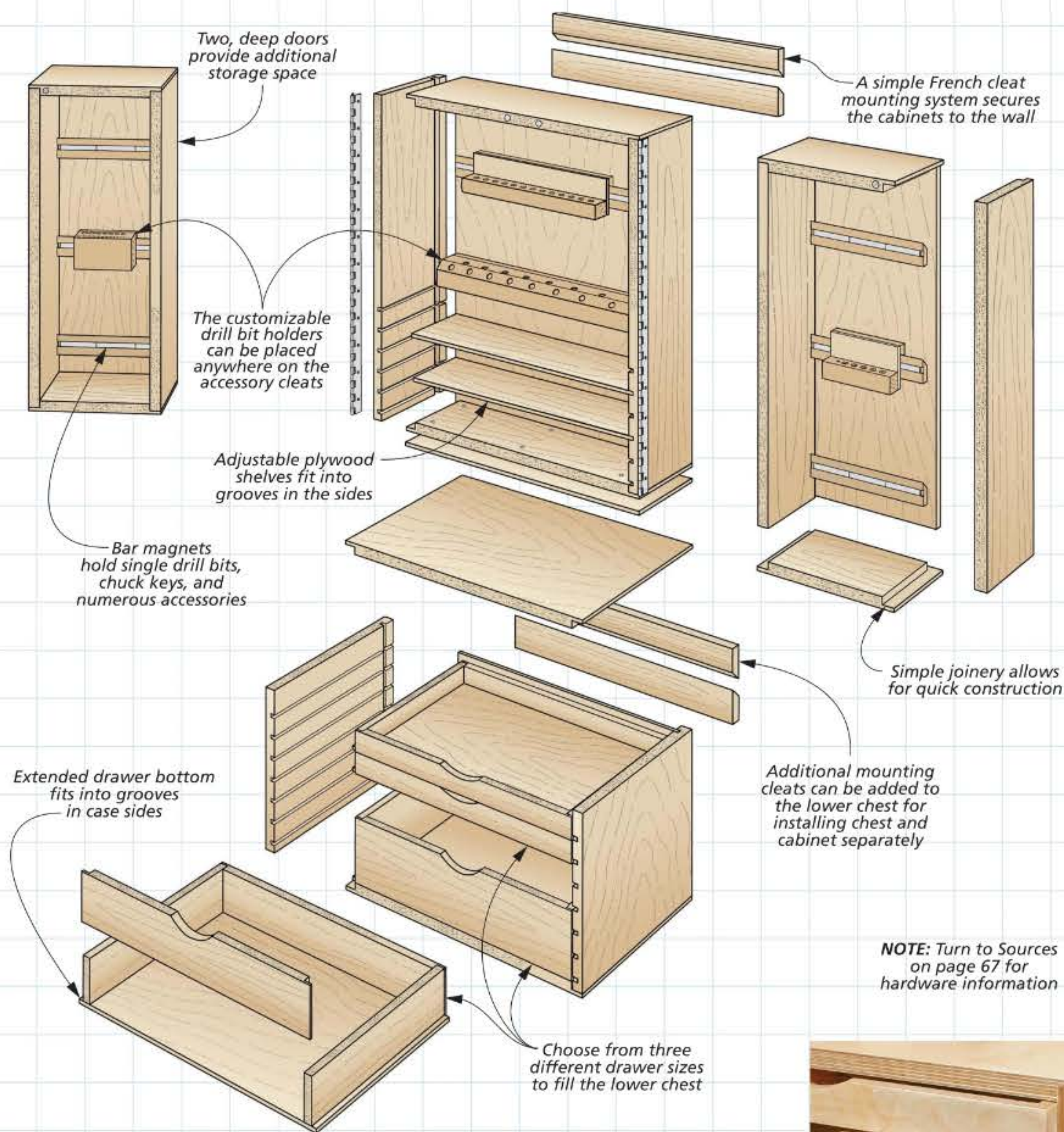
DESIGN OPTIONS. The beauty of this storage center is the multiple ways in which it can be customized to suit your needs. There's a series of drill bit holders that can be made any size you need to hold your drill bits. The holders slip over the cleats in the cabinet and doors. And speaking of those cleats, they have embedded magnets to hold



▲ Individual drill bit holders can be lifted out of the cabinet and brought right to the drill press for easy access.

other metal accessories. The drawers in the chest can be made in three different sizes to catch any miscellaneous items. To top it off, you can build one, or both sections, to fit your needs.

Construction Overview / OVERALL DIMENSIONS: 18"W x 36¹/₄"H x 12"D



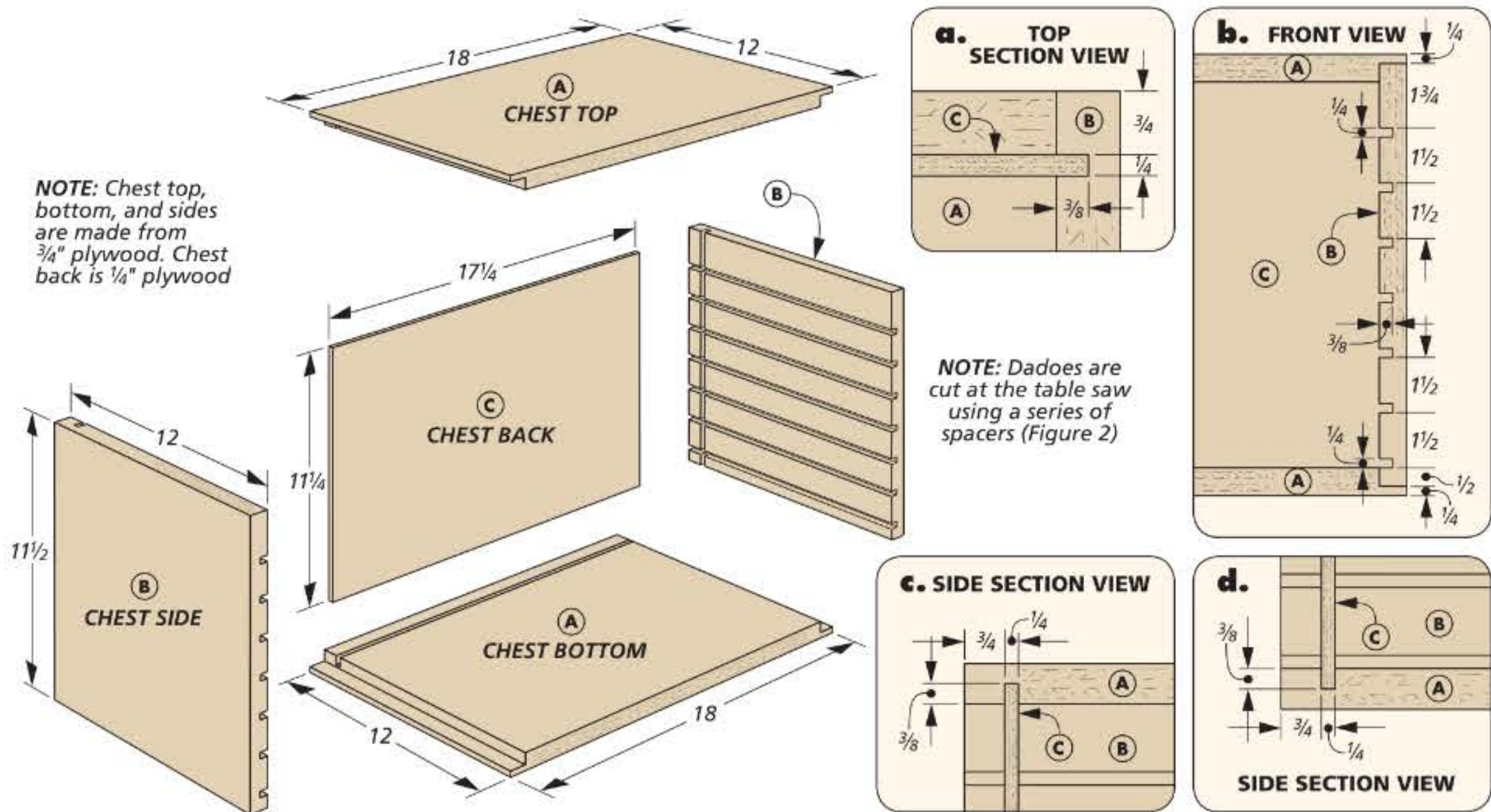
▲ Multiple grooves in the upper cabinet sides provide a spot for a couple of adjustable plywood shelves.



▲ The French cleats make the holders easy to remove from the cabinet and doors.

Narrow dados cut in the sides of the lower chest are spaced to accommodate three different sizes of drawers. You can mix-and-match the drawers by building several different sizes to best meet your storage needs.





Start with the **LOWER CHEST**

As shown on the two previous pages, the storage center actually consists of two different components — the lower chest is filled with drawers and the upper cabinet with two doors that enclose the space. To customize for your individual needs, the lower chest is designed with a series of evenly spaced dadoes in the side pieces that let you mix and match the drawer sizes.

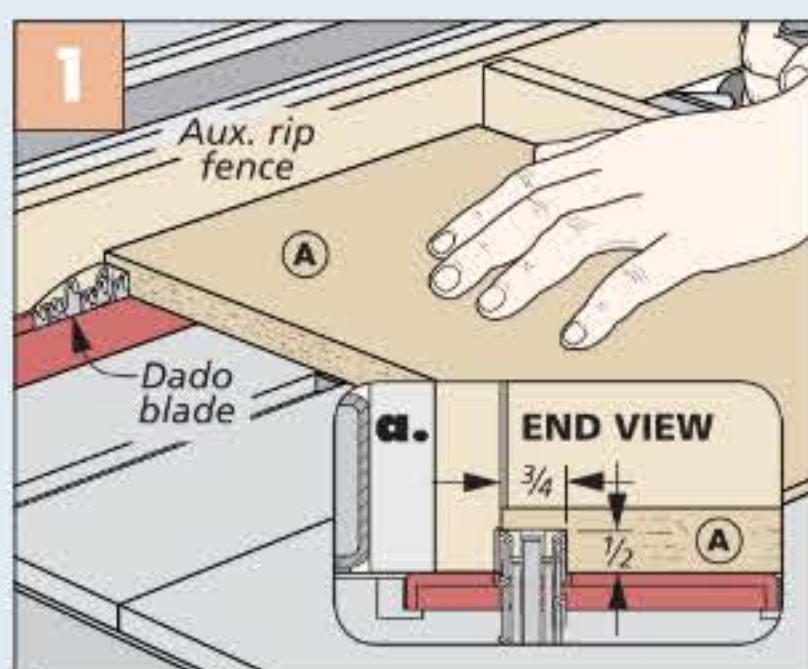
PLYWOOD CASEWORK. The majority of the parts for this project are made from plywood, with just a few hardwood parts here and there. This keeps the cost down and eliminates the need to thickness much material or glue up panels.

Start the lower chest construction by cutting all of the parts to size. The top and bottom pieces both require rabbets along the outer edges to hold the sides.

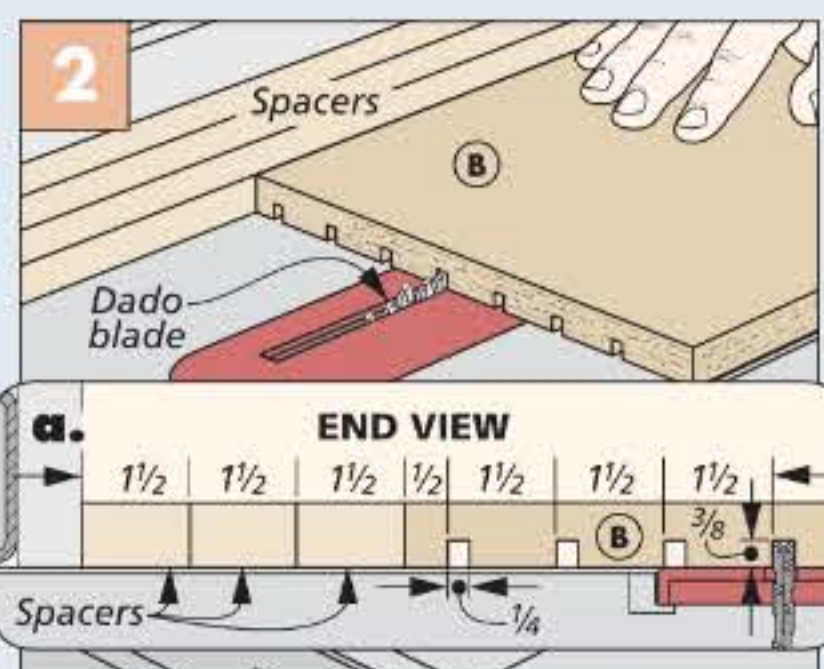
Install a dado blade in the table saw to knock out this joinery (Figure 1, below).

CONSISTENT SPACING. Cutting the dadoes in the sides could be done by simply moving the rip fence the proper distance after each cut. But this doesn't always guarantee the most accurate results. So in order to get consistent spacing between my dadoes (which is critical for the drawers to fit properly), I ripped several $1\frac{1}{2}$ "-wide strips and placed them between my workpiece and the rip fence. After making each pass, just

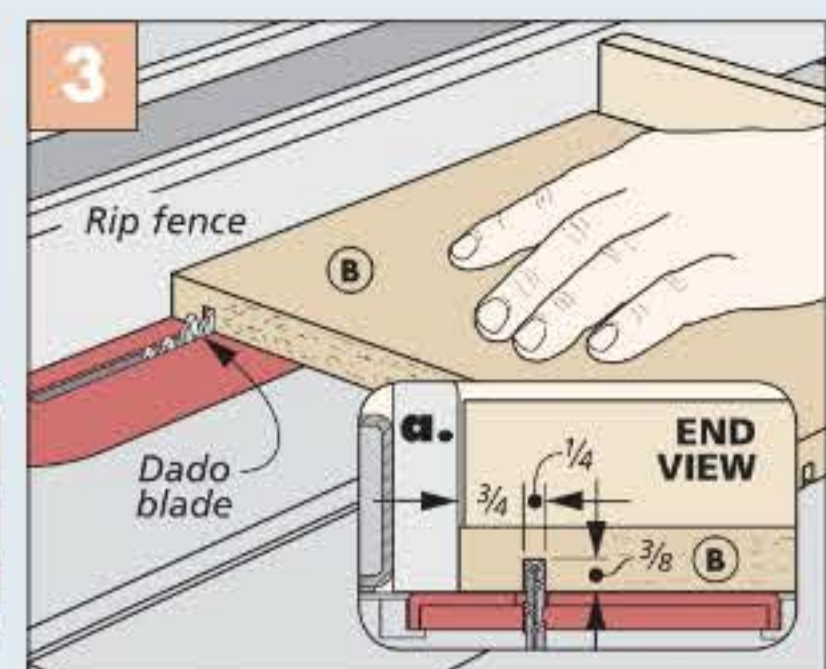
How-To: CUT THE JOINERY FOR THE LOWER CHEST



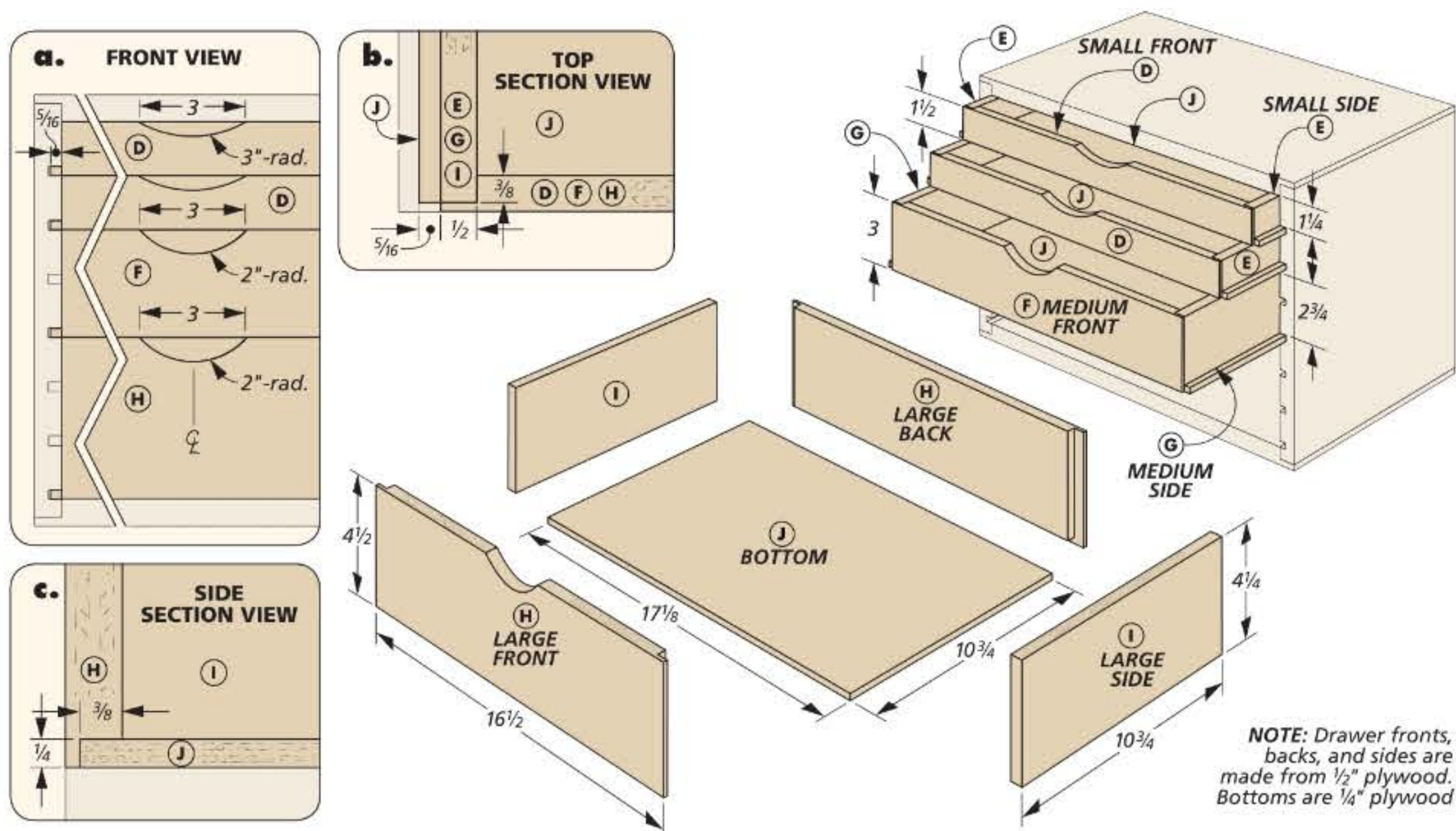
Rabbet Top & Bottom. Using a dado blade and auxiliary rip fence, cut the rabbets in the top and bottom.



Runner Dadoes. Use $1\frac{1}{2}$ "-wide strips to get consistent spacing between the drawer runner dadoes.



Groove for Back. Cut a groove in the top, bottom, and sides to hold the back of the chest in place.



remove one strip and then make the next cut. Figure 2 at the bottom of the previous page shows what I mean.

All that's left before assembly is to cut the grooves in the top, bottom, and sides for the back (Figure 3). The lower chest can now be put together with glue.

CUSTOM DRAWERS

You have a decision to make before beginning work on the drawers. You'll need to choose from the three different depth options — small, medium,

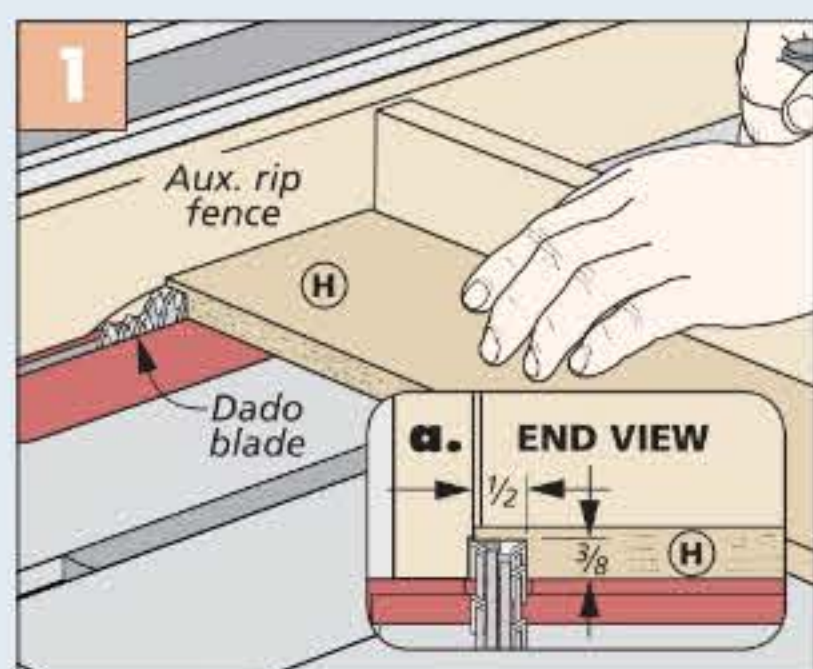
and large. I opted for the four drawer combination shown above. The construction process is the same for each size, so it's easy to build whichever configuration works best for your tools.

SIMPLE JOINERY. The drawers use similar joinery as the chest. The front and back have rabbets along the ends to trap the side pieces (Figure 1). And a shallow groove along the bottom of the front and back workpieces is for the bottom panel to rest in (Figure 2). You'll want to note that the sides are actually 1/4"

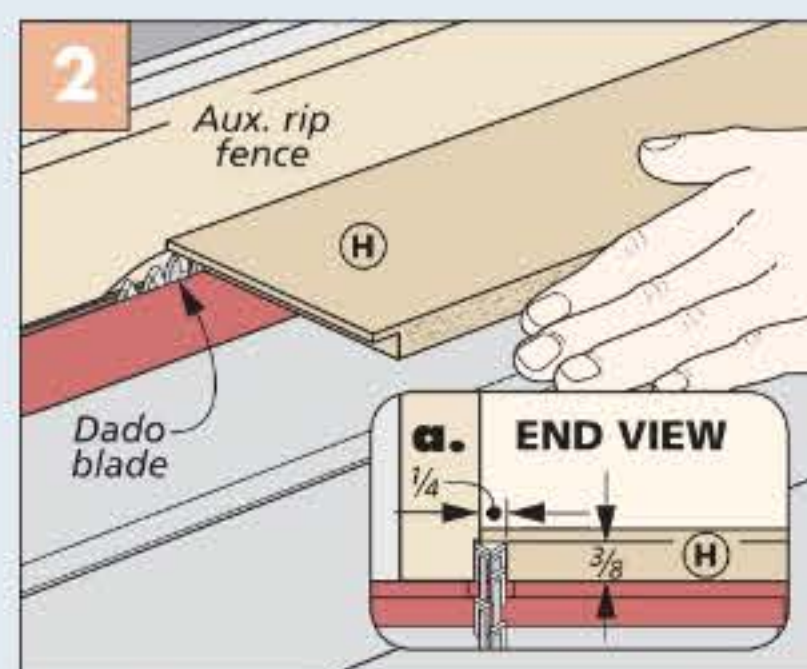
shorter than the front and back. This is because they rest on the bottom, allowing the bottom panels to stick out on the sides to form the drawer runners (detail 'a' above). Once you have all of the joinery complete, you'll once again assemble the drawers with glue.

FINGER PULLS. You could install drawer pulls if you desire, but I opted for a simple cutout along the top edge of each drawer to form a finger pull. Figure 3 shows all the details you'll need to complete this process.

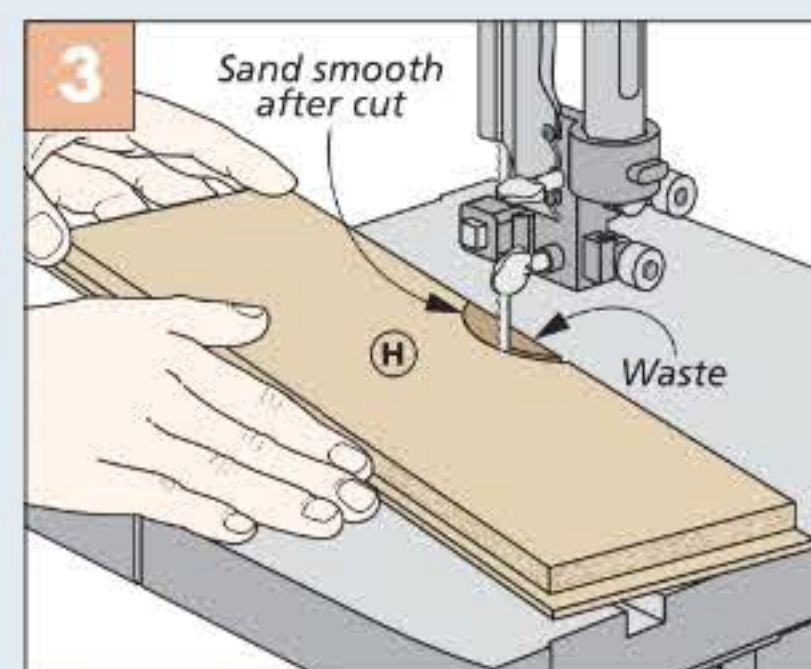
How-To: CUT & SHAPE THE DRAWER PARTS



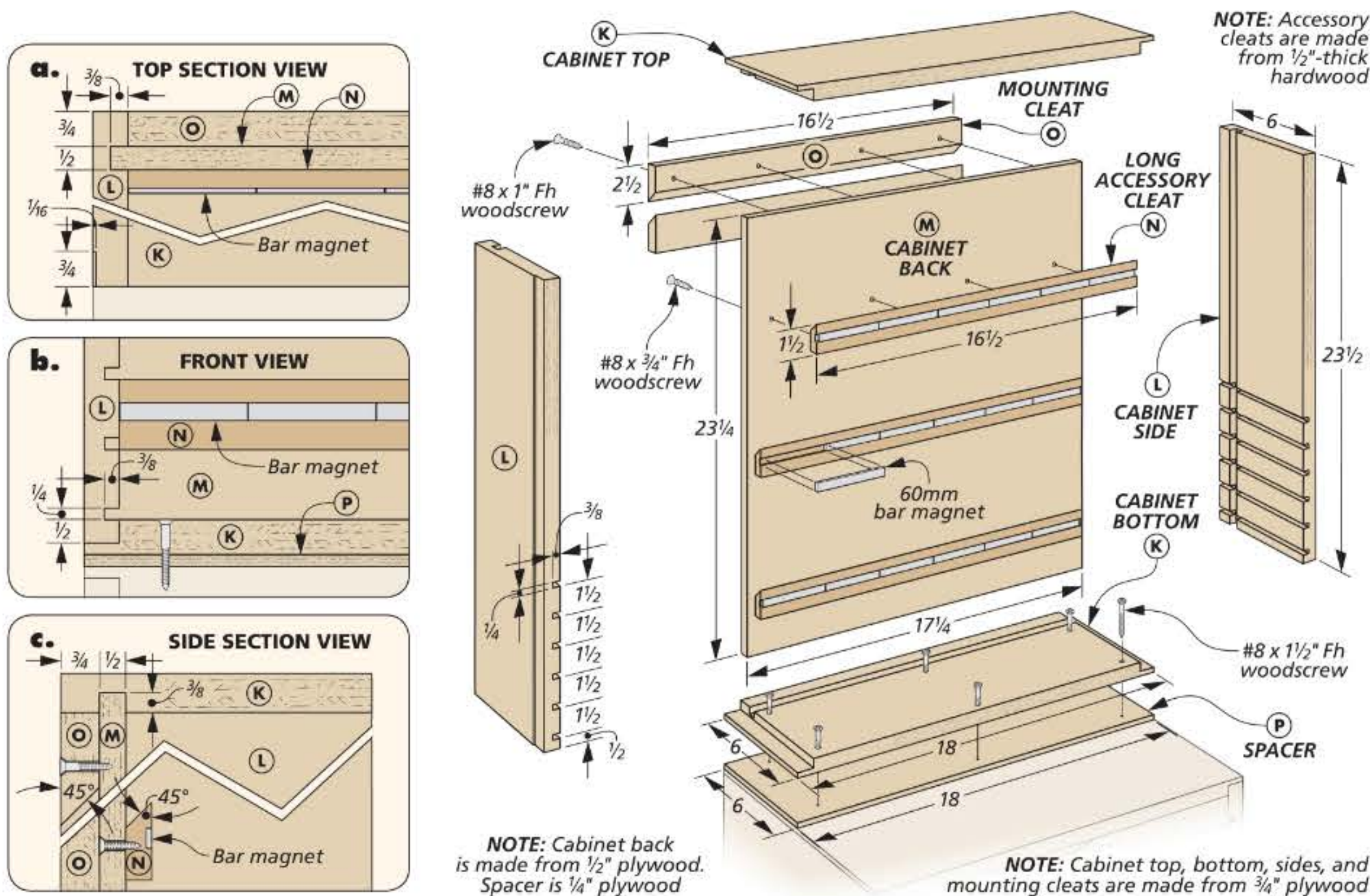
Drawer Rabbets. Rabbets on the ends of the drawer fronts and backs hold the drawer sides in position.



Rabbet for Bottom. A rabbet along the lower edge of the fronts and backs houses the drawer bottom.



Finger Pull Cutout. A simple cutout along the top edge of each drawer front creates a handy pull.



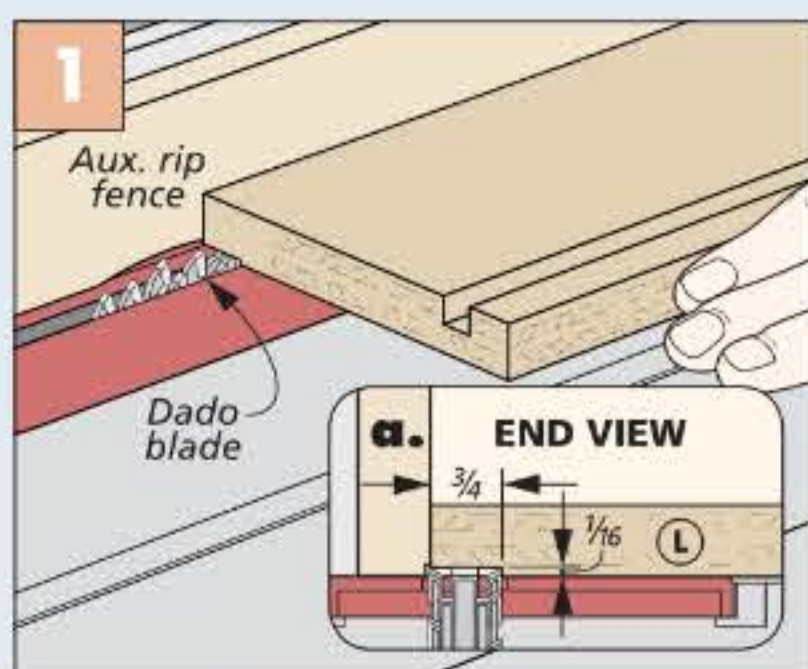
Building the UPPER CABINET

Moving on to the upper cabinet will be somewhat familiar territory. The sides of this cabinet have evenly spaced grooves for a shelf, much like the lower chest. And the grooves are made the same way. The difference with this cabinet, however, is the addition of

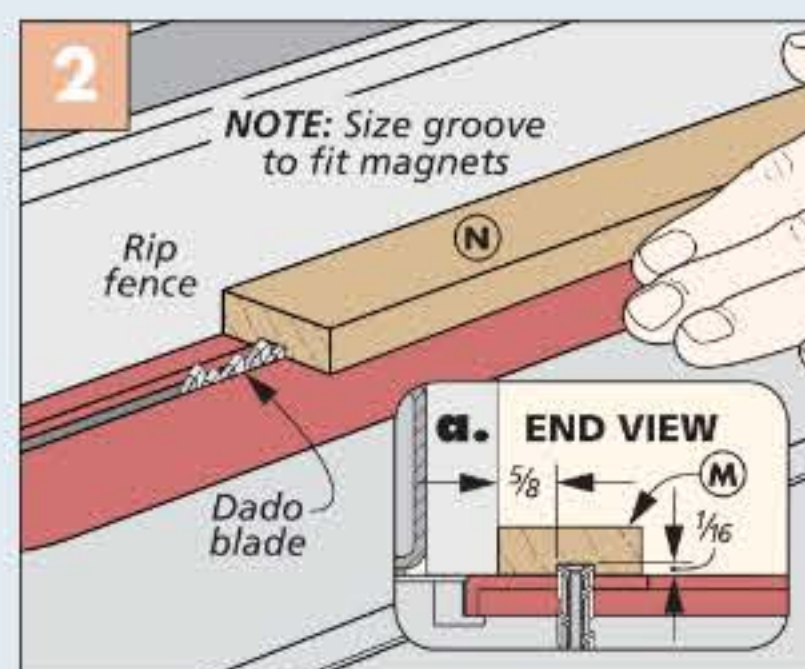
several accessory cleats mounted to the back. These cleats are used to hold customized drill bit holders. The cleats also have a row of rare-earth magnets embedded in a groove that allow you to store other steel odds and ends that don't fit in the customized holders.

SIMILAR CONSTRUCTION. After cutting the parts to size for the upper cabinet, go ahead and cut all of the joinery as before. Then, there's just one more thing that needs to be done before assembling this cabinet. And that's a shallow rabbet along the outside edge of each cabinet side. This rabbet is essentially a hinge mortise that houses a continuous hinge for the doors. Figure 1 on the

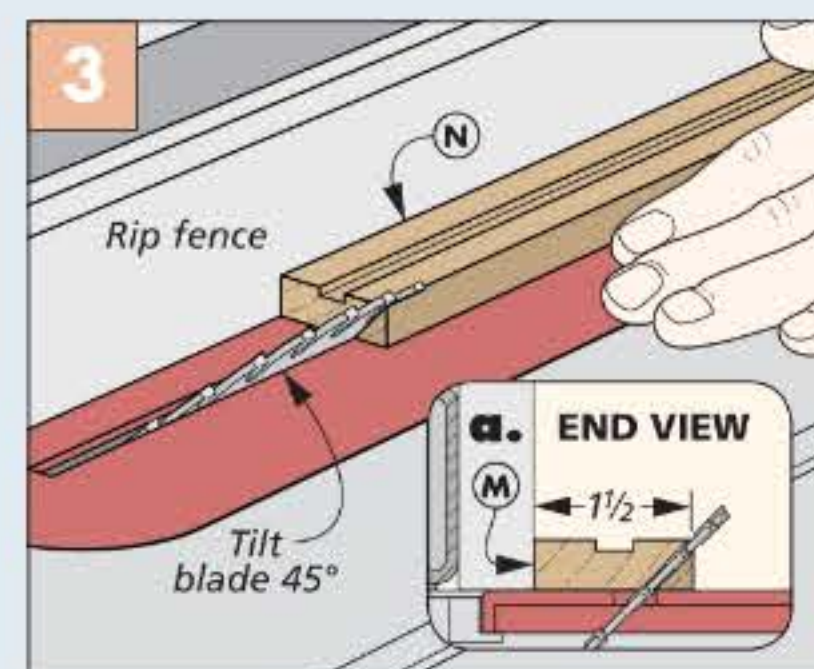
How-To: MAKE THE PARTS FOR THE UPPER CABINET & DOORS



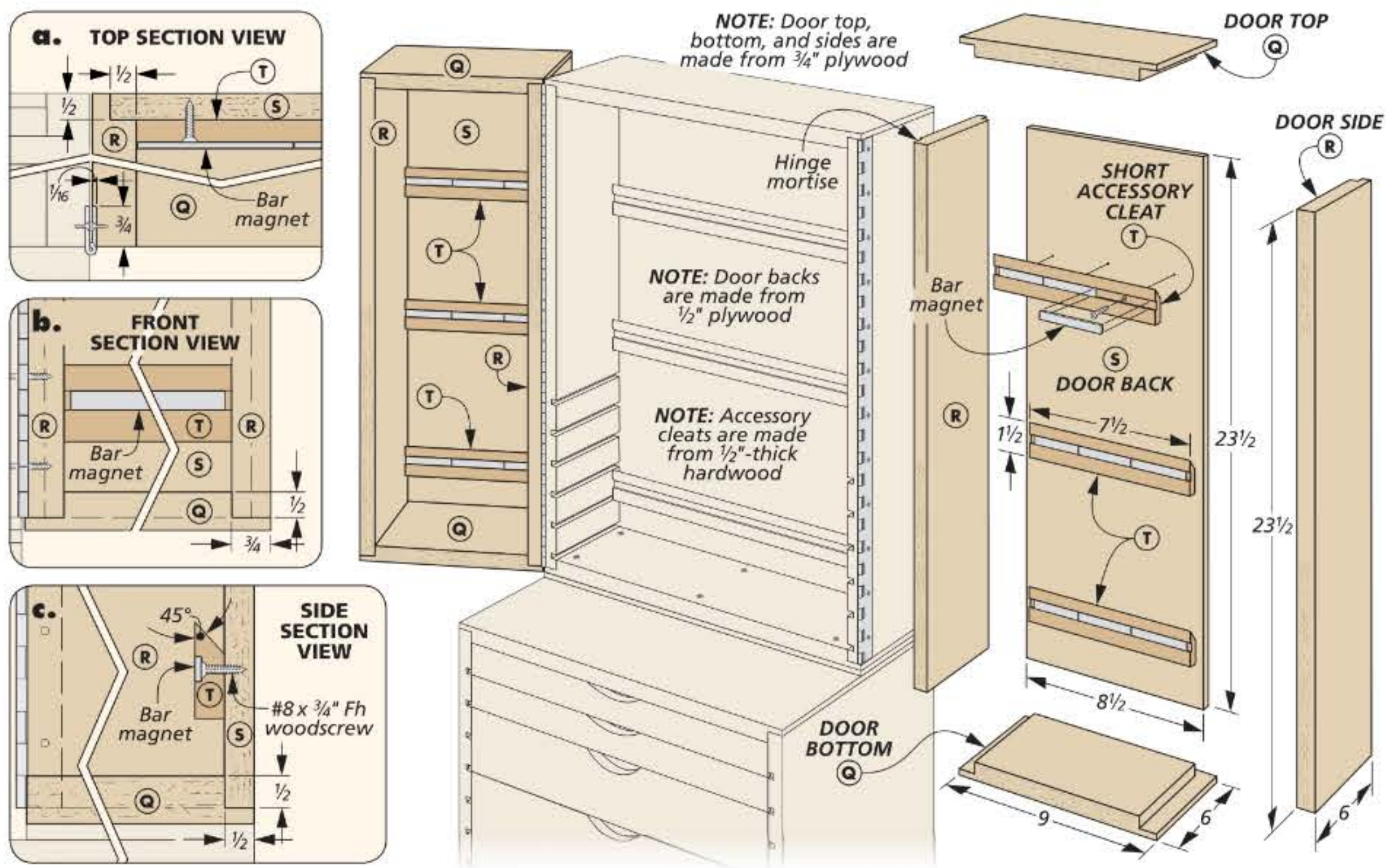
Hinge Rabbet. Each of the upper cabinet sides needs a rabbet along the outside edge for the hinges.



Groove for Magnet Strip. Cut the groove in the accessory cleats using a dado blade at the table saw.



Bevel the Cleats. Rip one edge of the accessory cleats at an angle to secure the drill bit holders.



previous page shows the process for cutting these rabbets. It's a good idea to have the hinges on hand to ensure the rabbet is the correct width and depth.

After assembling the cabinet, I went ahead and made the three accessory cleats and the wall mounting cleats before moving on. Figures 2, 3, & 4 on the previous page hit the highlights for making these parts.

Again, before cutting the groove in the accessory cleats, it's a good idea to purchase the magnets first to ensure a snug fit. A little epoxy can be used to hold the magnets in place if necessary. I used screws driven in from the back to secure the accessory cleats (detail 'c').

The cabinet portion of the wall mounting cleat can be glued in place on the back. The other half of the cleat

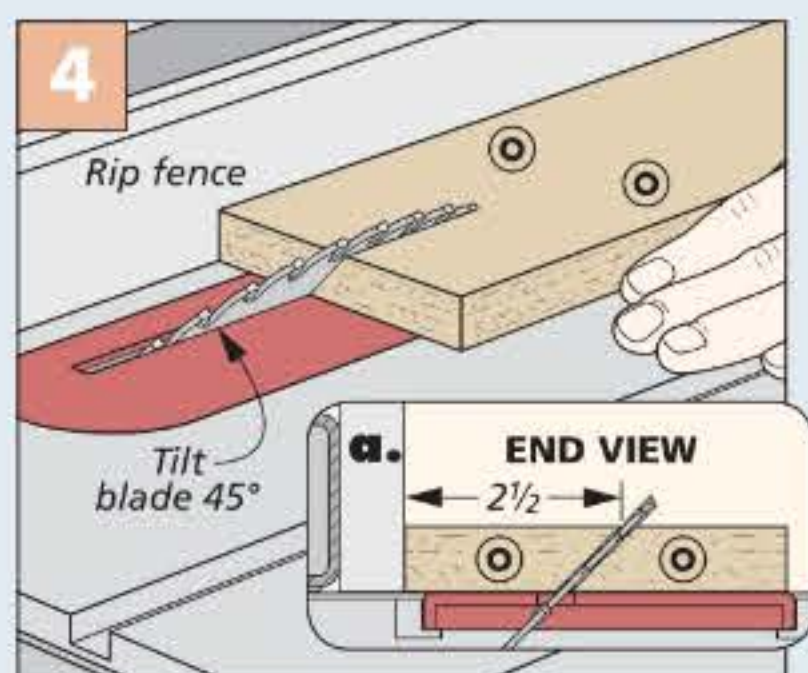
is mounted to the wall when the cabinet is complete. I also made a spacer to fit between the chest and the cabinet. This keeps the doors from rubbing on the top of the chest when opening and closing the doors.

DEEP DOORS

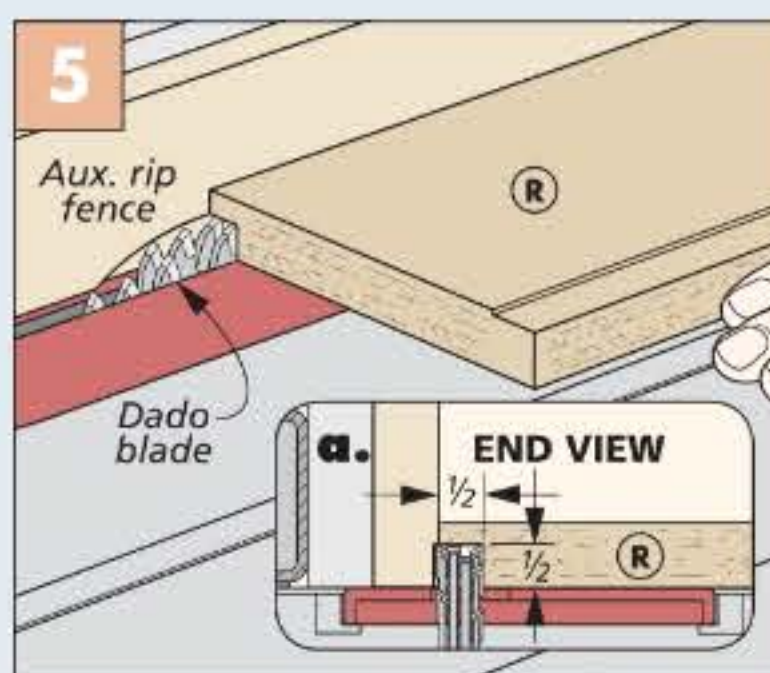
To finish up the upper cabinet, two deep doors help to keep the dust at bay, as well as providing more storage space. There's nothing new to cover here as far as the joinery is concerned. The doors follow the same methods used on the chest and cabinet. This includes making the shallow rabbet on the door edges for the other half of the hinge.

The only exception on the door construction is that the backs are held in rabbets (as opposed to grooves) so they fit flush with the door sides. Figure 5 shows this process. Using rabbets instead of grooves provides a clean look when the doors are closed.

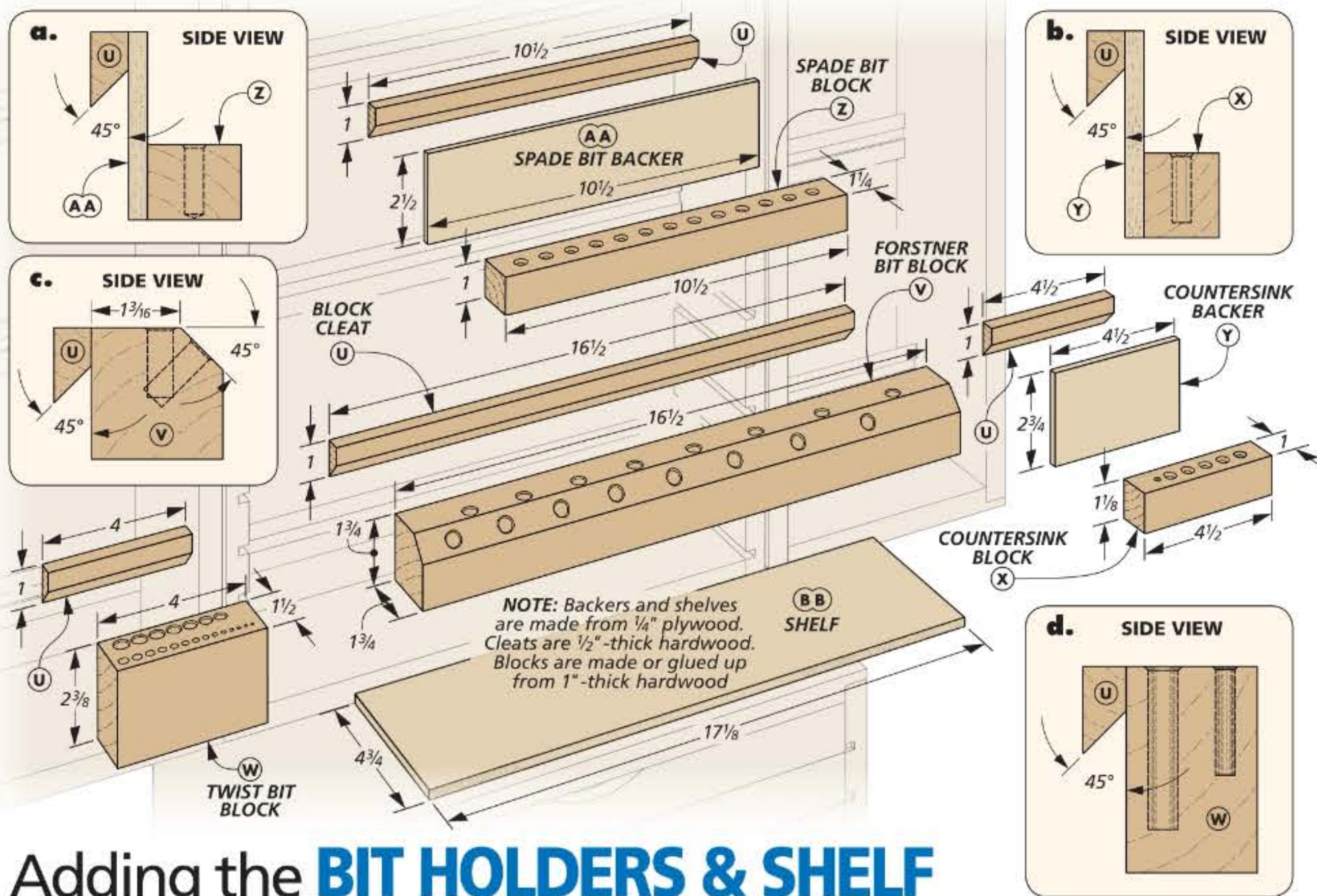
Once the doors are assembled and mounted, the short accessory cleats wrap up this portion of the storage cabinet. Next, the customizable drill bit holders finish things up.



Wall-Mount Cleats. To make the wall-mounting cleats, simply rip the stock at a 45°.



Door Back Rabbets. The rabbets in the door parts hold the back panel flush at the edges.



Adding the **BIT HOLDERS & SHELF**

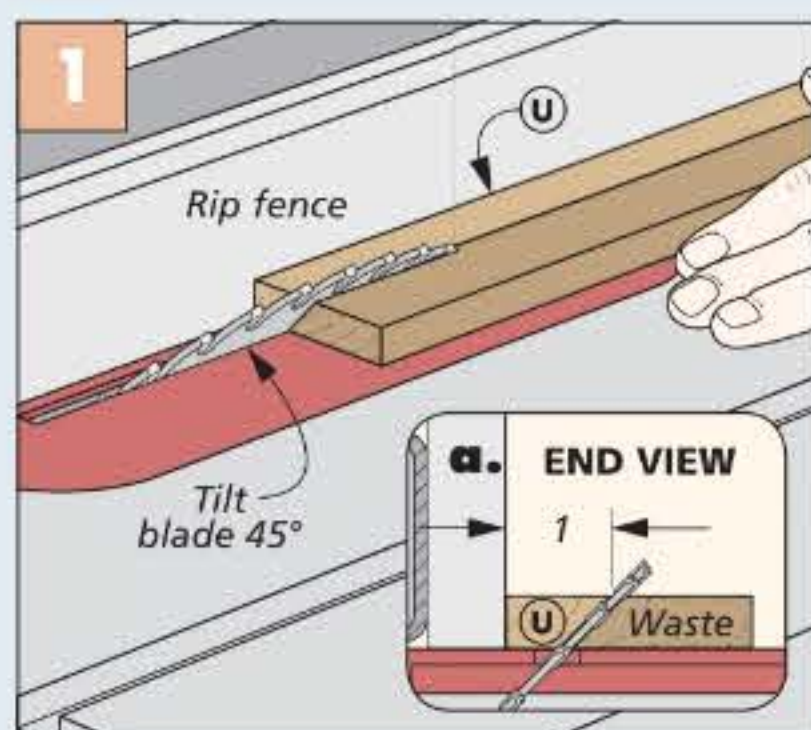
With the upper cabinet complete, it's time to create the drill bit holders and adjustable shelves. The holders are made from a combination of plywood and hardwood blocks, as shown above and in the materials list on the next page.

Now is when you'll want to pull out all of the drill bits and accessories you own to figure out the best way to configure the holders to suit your tools. I fashioned my holders as shown above and on the next page. They consist of a

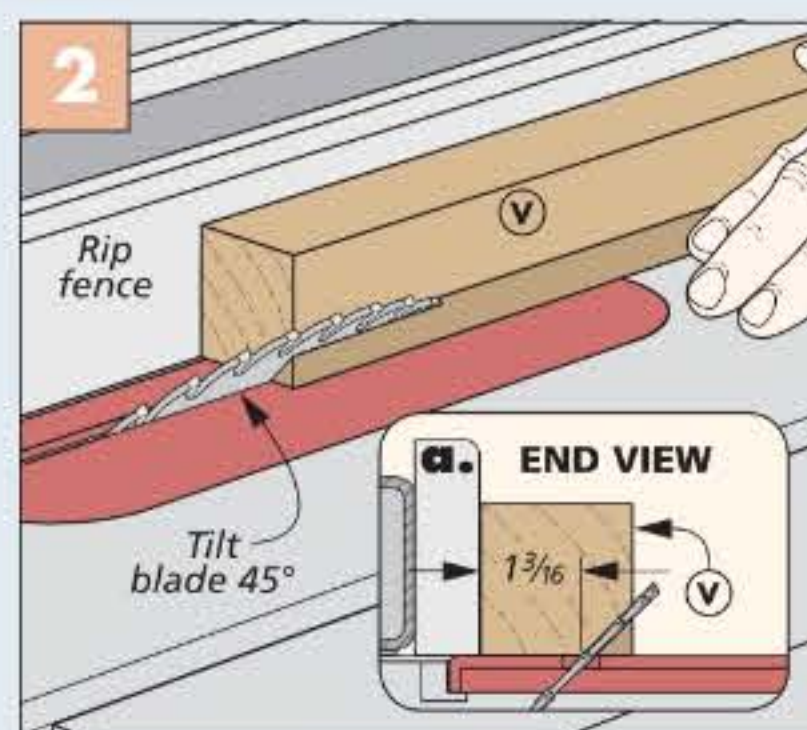
Forstner bit holder, a twist bit and spade bit holder, and even one that holds all of my countersink bits.

CUSTOM CONSTRUCTION. The one common part that's shared by all of the holders is a hardwood cleat secured to the back

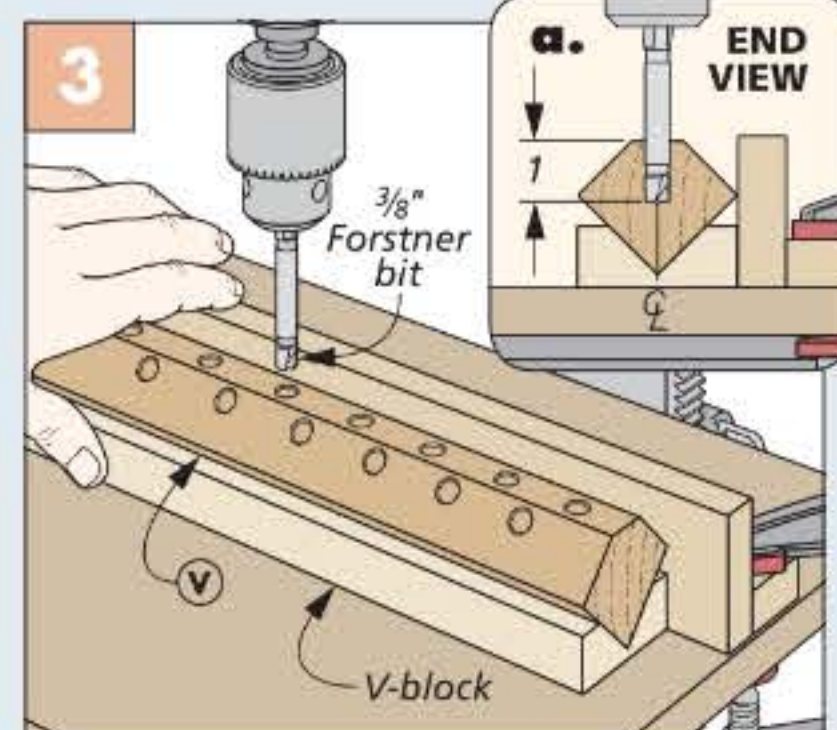
How-To: SHAPE THE BIT HOLDERS



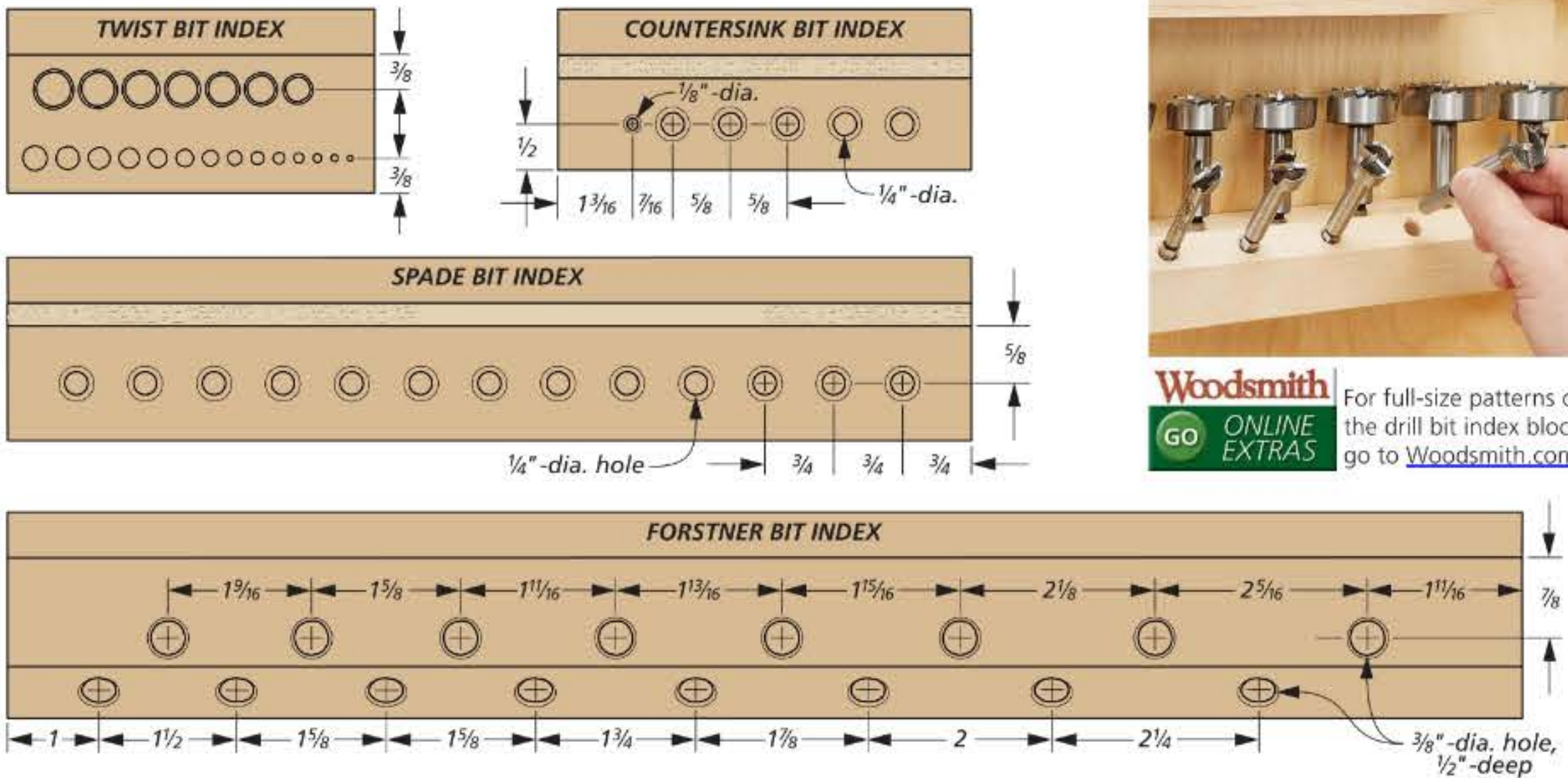
Beveled Block Cleats. The cleats attached to the holders are beveled the same way as the other cleats.



Forstner Bit Block. Chamfering one corner of the Forstner bit block increases the usable storage space.



Angled Bit Holes. A scrap board with a V-notch in one face works well to hold the block in the correct position.



of each one. Figure 1 at the bottom of the previous page shows the process for making the angled rip cut.

Making the blocks for the twist bit and spade bit holders is pretty straightforward. Here, it's just a matter of drilling slightly oversized holes in each one to hold the drill bit shanks. (The oversized holes make it easier to put the drill bits in and take them out.)

FORSTNER BIT HOLDER. The block that holds the Forstner bits is just a little bit trickier

to make. To get maximum storage out of this block, I chamfered one corner of the Forstner bit block to store some of the bits at an angle. Figure 2 shows this cut.

But that means you're left having to drill holes in an angled face. To make that process easier, I cut a V-groove in a scrap board to hold the Forstner block at the proper angle while drilling the holes (Figure 3).

PLYWOOD SHELF. All that's left is to cut a plywood shelf to size. There's room for

two if you'd like. These simply slip into the dadoes in the cabinet sides.

MOUNTING OPTIONS. This storage project was designed to be mounted on the wall as one unit, as shown in the main photo on page 22. But you could make a separate set of wall-mounting cleats and attach them to the wall independently. Whichever choice you make, you're sure to be much better organized the next time you go looking for a particular drill bit. **W**

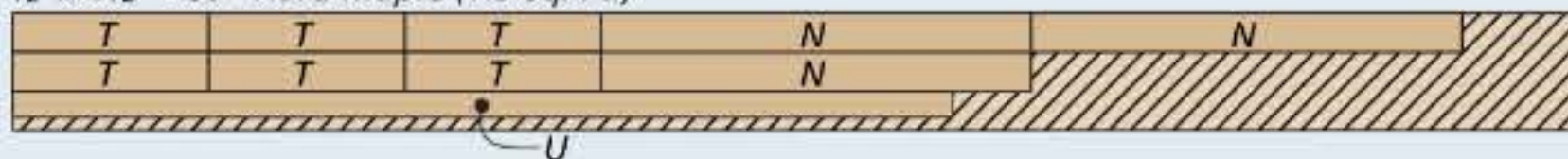
Materials, Supplies & Cutting Diagram

A Chest Top/Bottom (2)	3/4 ply. - 12 x 18
B Chest Sides (2)	3/4 ply. - 12 x 11 1/4
C Chest Back (1)	1/4 ply. - 11 1/4 x 17 1/4
D Small Front/Back (4)	1/2 ply. - 1 1/2 x 16 1/2
E Small Sides (4)	1/2 ply. - 1 1/4 x 10 3/4
F Med. Front/Back (2)	1/2 ply. - 3 x 16 1/2
G Med. Sides (2)	1/2 ply. - 2 3/4 x 10 3/4
H Large Front/Back (2)	1/2 ply. - 4 1/2 x 16 1/2
I Large Sides (2)	1/2 ply. - 4 1/2 x 10 3/4
J Bottoms (4)	1/4 ply. - 10 3/4 x 17 1/8
K Cabinet Top/Bottom (2)	3/4 ply. - 6 x 18

L Cabinet Sides (2)	3/4 ply. - 6 x 23 1/2
M Cabinet Back (1)	1/2 ply. - 17 1/4 x 23 1/4
N Long Acc. Cleats (3)	1/2 x 1 1/2 - 16 1/2
O Wall Cleats (4)	3/4 ply. - 2 1/2 x 16 1/2
P Spacer (1)	1/4 ply. - 6 x 18
Q Door Top/Bottom (4)	3/4 ply. - 6 x 9
R Door Sides (4)	3/4 ply. - 6 x 23 1/2
S Door Backs (2)	1/2 ply. - 8 1/2 x 23 1/2
T Short Acc. Cleats (6)	1/2 x 1 1/2 - 7 1/2
U Block Cleats	1/2 x 1 - 36 rgh.
V Forstner Bit Block (1)	1 3/4 x 1 3/4 - 16 1/2

W Twist Bit Block (1)	1 1/2 x 2 3/8 - 4
X Countersink Block (1)	1 x 1 1/8 - 4 1/2
Y Countersink Backer (1)	1/4 ply. - 2 3/4 x 4 1/2
Z Spade Bit Block (1)	1 x 1 1/4 - 10 1/2
AA Spade Bit Backer (1)	1/4 ply. - 2 1/2 x 10 1/2
BB Shelves (2)	1/4 ply. - 4 3/4 x 17 1/8
• (6) #8 x 1 1/2" Fh Woodscrews • (4) #8 x 1" Fh Woodscrews • (24) #8 x 3/4" Fh Woodscrews • (2) 24" Continuous Hinges • (36) 60mm x 10mm Bar Magnets	

1/2" x 4 1/2" - 60" Hard Maple (1.9 Sq. Ft.)



1" x 3" - 36" Hard Maple (Two boards @ .9 Bd. Ft. each)



ALSO NEEDED: One 48" x 96" sheet of 1/4" Birch plywood. One 48" x 96" sheet of 1/2" Birch plywood. One 48" x 96" sheet of 3/4" Birch plywood

Clear-view Dog Kennel

A combination of a painted finish and hardwood makes this dog kennel a welcome replacement for traditional wire-style crates.

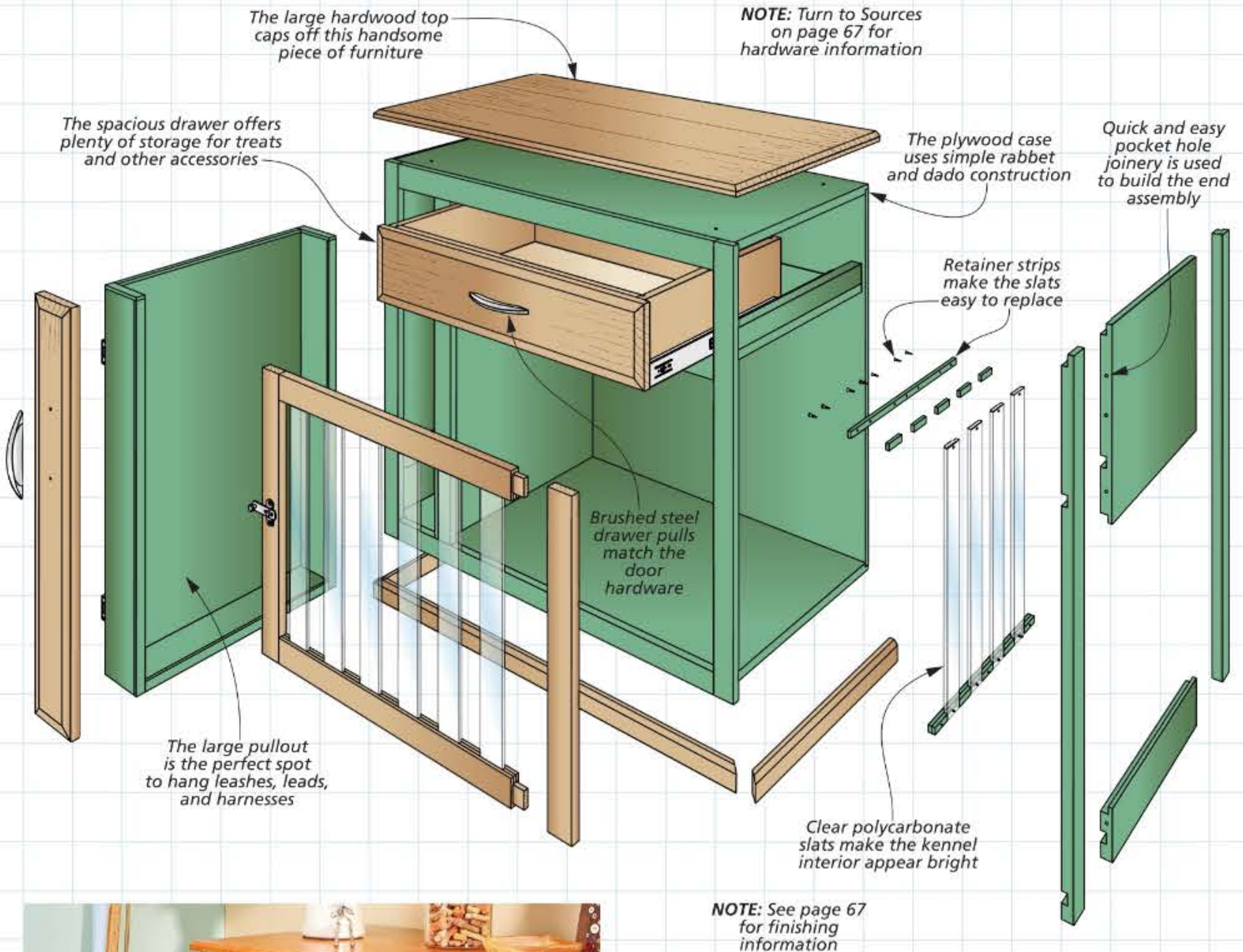
At home, I have a pair of dogs that are very much a part of the family. Most of the time they're well behaved and they're often lying down in their kennels. In the past, these have been a pair of wire kennels from a big box store. These kennels really leave something to be desired in the looks department and were tucked out of sight in a back room. When I saw the initial concepts for this kennel, I was excited because I knew it would be a well-designed

piece of furniture that I would be proud to place in my family room. It's size makes it perfect for most small to medium size dogs.

NOT YOUR AVERAGE KENNEL. Like I mentioned, this kennel is a blend of furniture and a functional dog kennel. The painted case and hardwood accents make it a handsome addition to a room, instead of an unsightly eyesore. A bonus drawer and pullout offer additional storage.

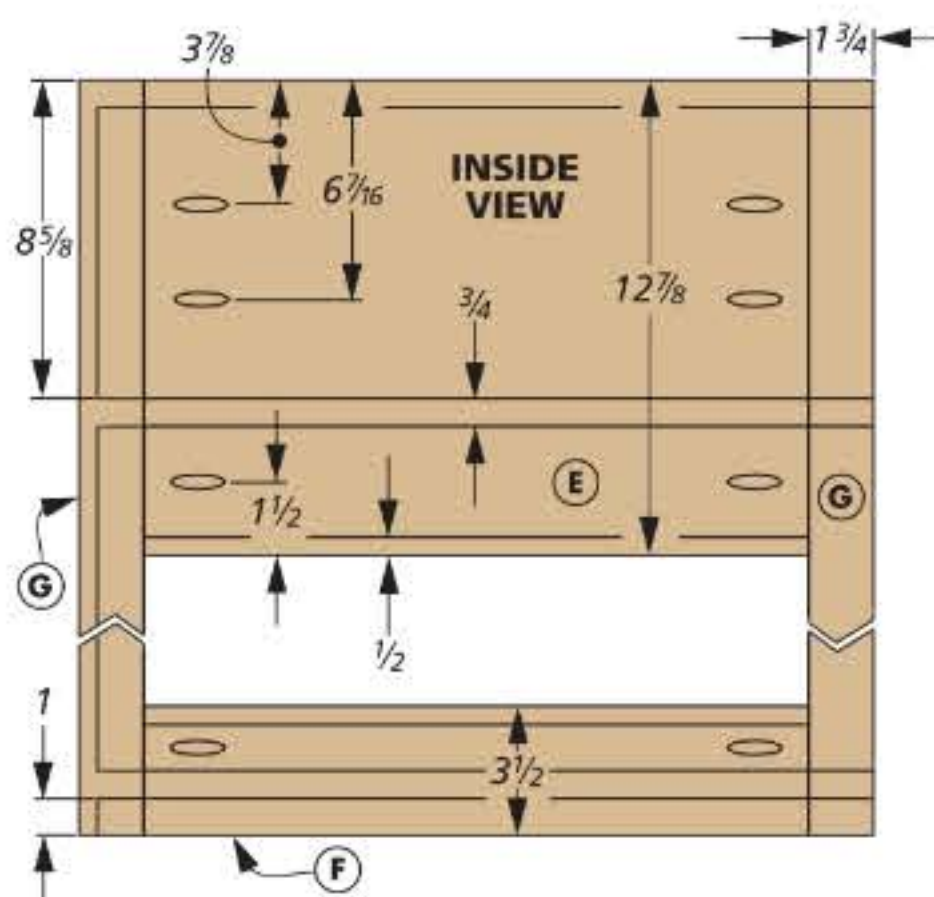
A CLEAR VIEW. Another thing that I really like about this kennel design is the slat system. Instead of using wire or metal bars, this kennel utilizes polycarbonate slats. Not only do they give a light and airy look to the inside of the kennel, but they also allow the dog an unobstructed view of its surroundings. And they're tough too. The kennel is centered around a plywood case that goes together quickly, and that's where I started.

Construction Overview / OVERALL DIMENSIONS: 39³/₄"W x 35¹/₂"H x 23¹/₂"D



▲ From harnesses to leashes, the pullout offers plenty of options to store all of your pet's accessories. A pair of slides ensures the pullout operates smoothly without binding.

▲ The brushed steel hardware adds a contemporary look to the dog kennel. The commercial latch system offers an innovative design that locks in both the open and closed positions.



Building the CASE

The heart of the dog kennel revolves around a stout plywood (mostly) case. The open end of the kennel is made out of hardwood to keep the edges clean. And speaking of edges, a hardwood face frame added to the front covers the exposed plywood edges.

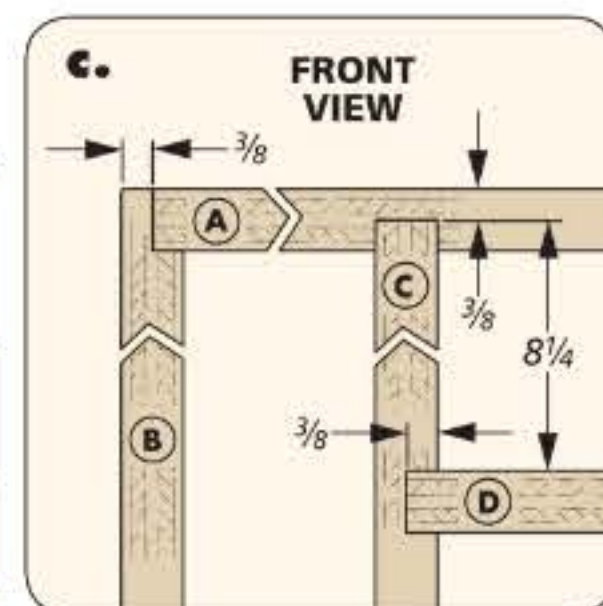
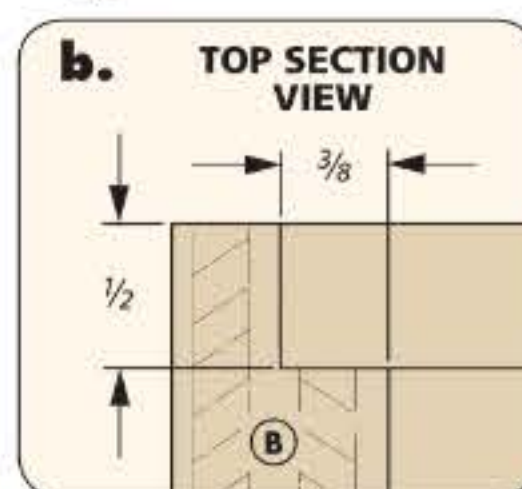
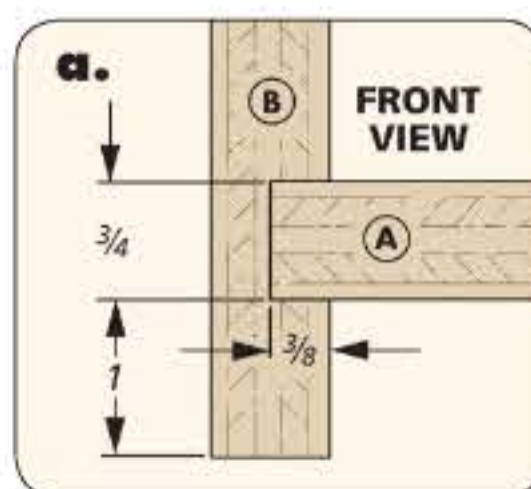
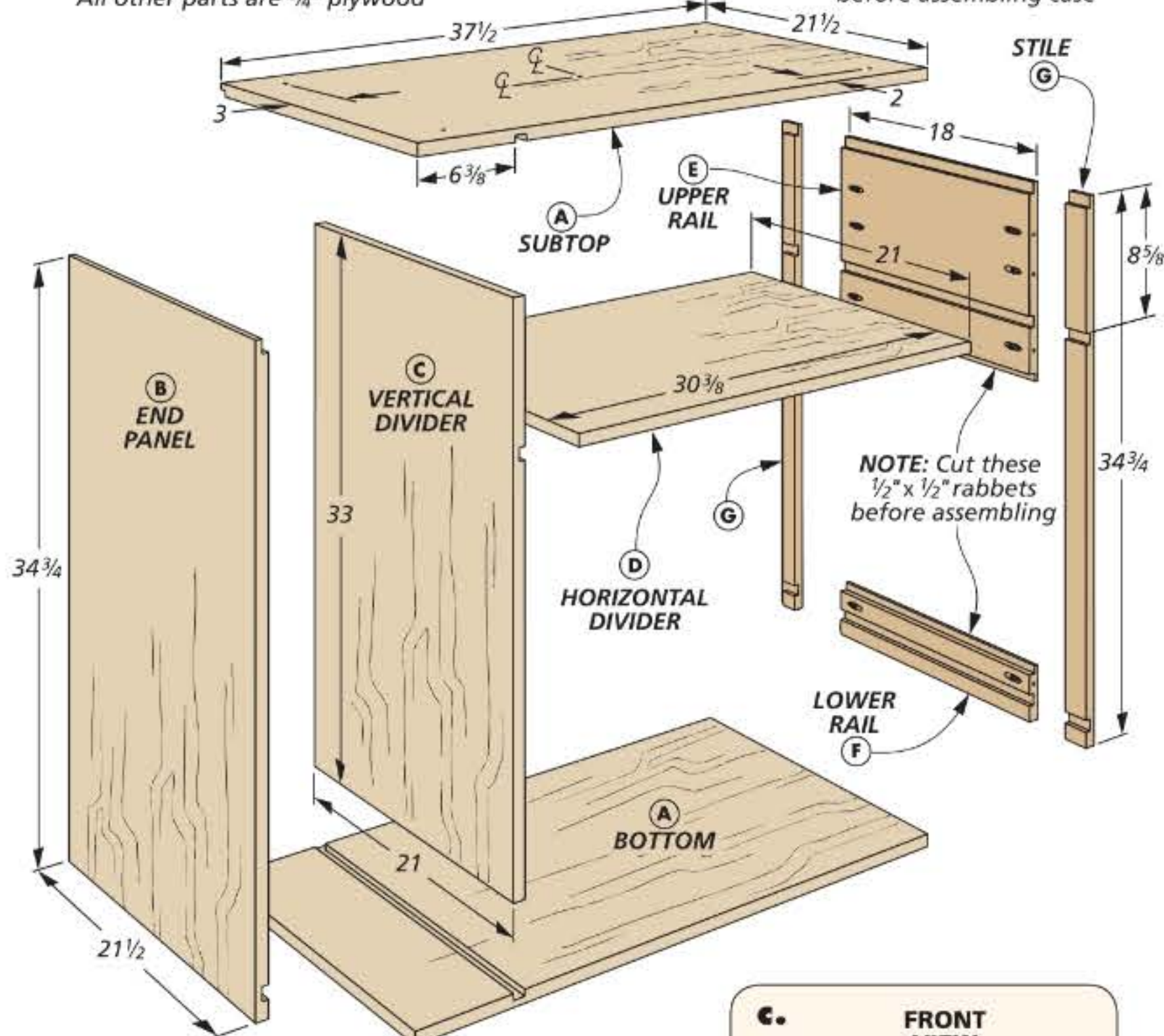
PANELS FIRST. The first thing to do is to break down the plywood into the panels that make up most of the case. These include the bottom, subtop, end panel, and two dividers. These cuts are easy to make at the table saw. After they were made, I set them aside to work on the hardwood end assembly before cutting the joinery.

POCKET SCREW CONSTRUCTION. For the hardwood end assembly, I chose to use pocket screws to hold the parts together. This means that the cuts and joints are straightforward. After cutting the upper and lower rails to size, I cut a rabbet on the inside edge at the table saw (illustration above). Then, I drilled the pocket screw locations and assembled the parts.

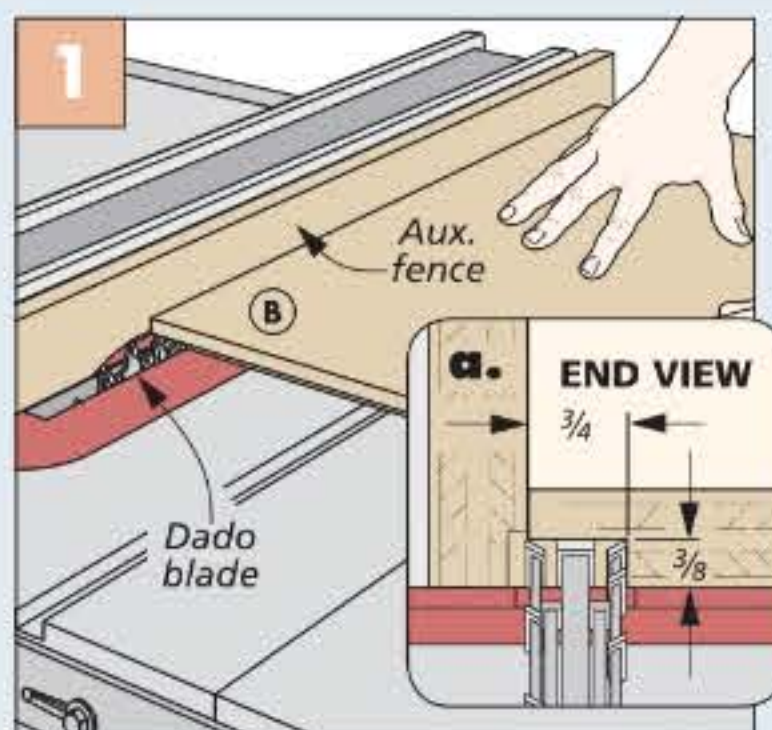
CASE JOINERY. With the end assembly complete, grab the rest of the panels to finish up the joinery. Both the end panel and end assembly receive the same joinery. I cut these first, starting with a rabbet along the top edge to attach the subtop. There is also a narrower rabbet that gets cut along the back edge to capture the back (detail 'b'). In addition, the subtop and bottom have matching rabbets for the back.

NOTE: Stiles, top rail, and bottom rail are made from 3/4"-thick hardwood. All other parts are 3/4" plywood

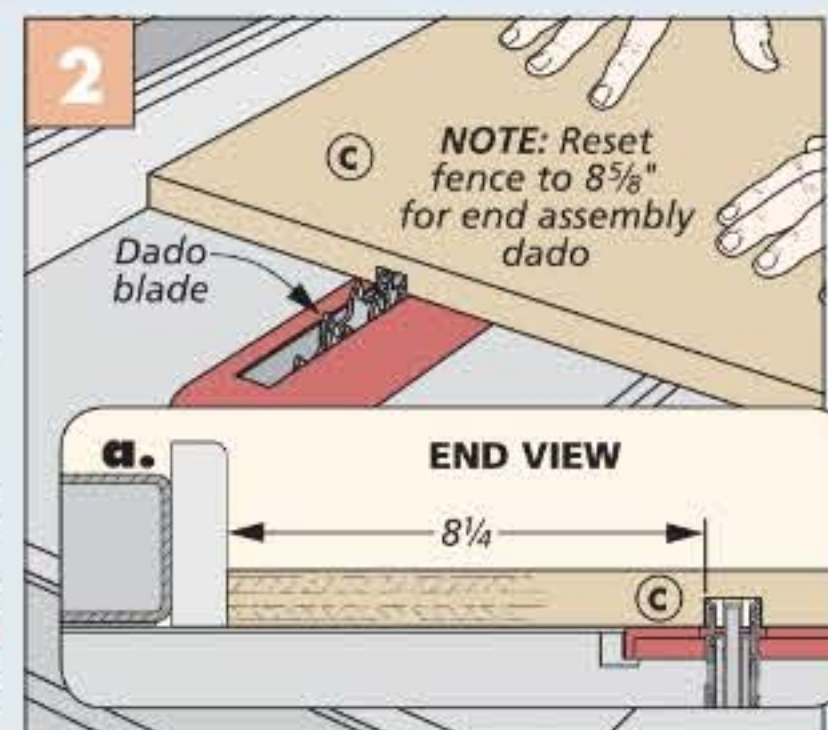
NOTE: Drill holes in subtop before assembling case



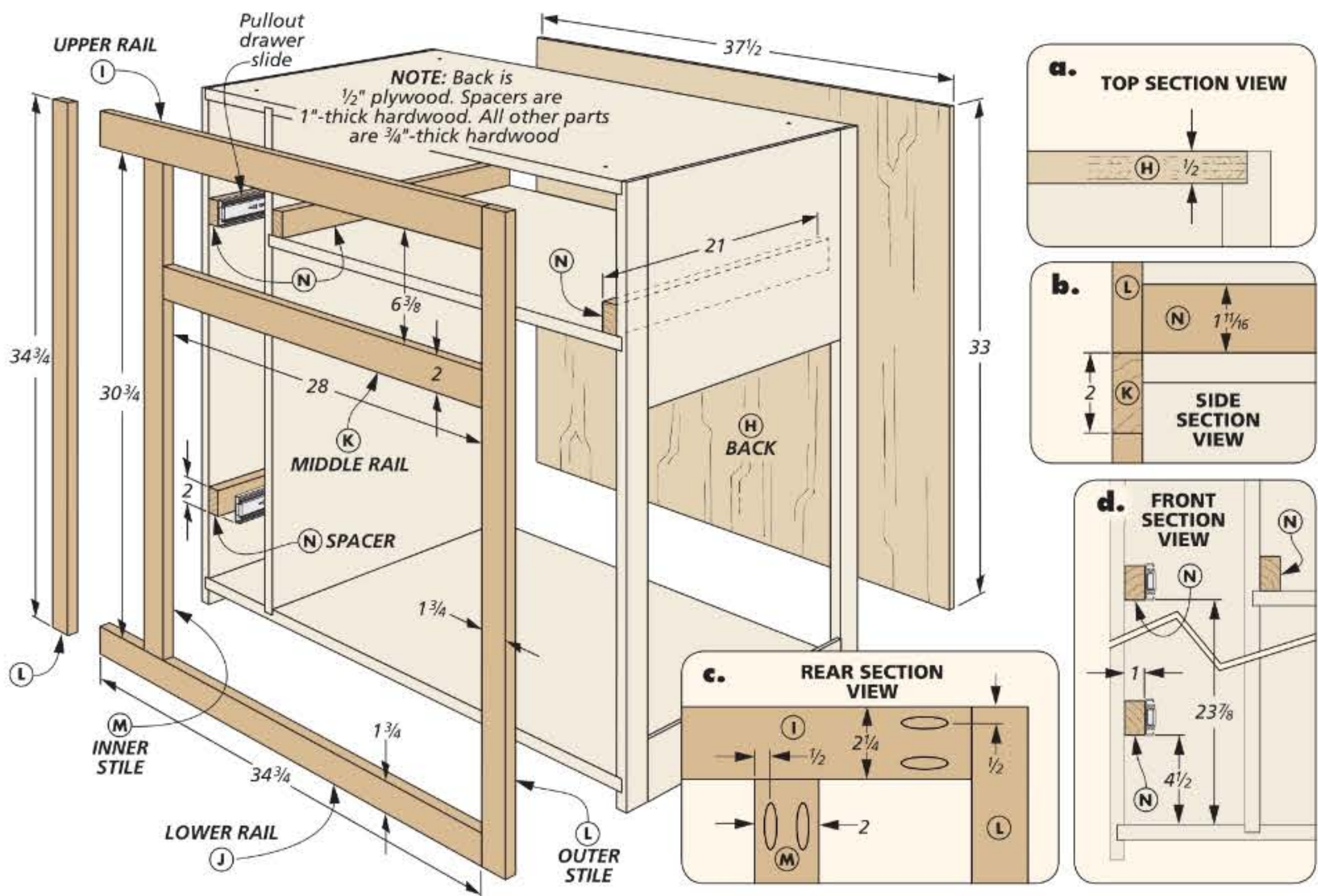
How-To: CUT THE JOINERY & ASSEMBLE THE CASE



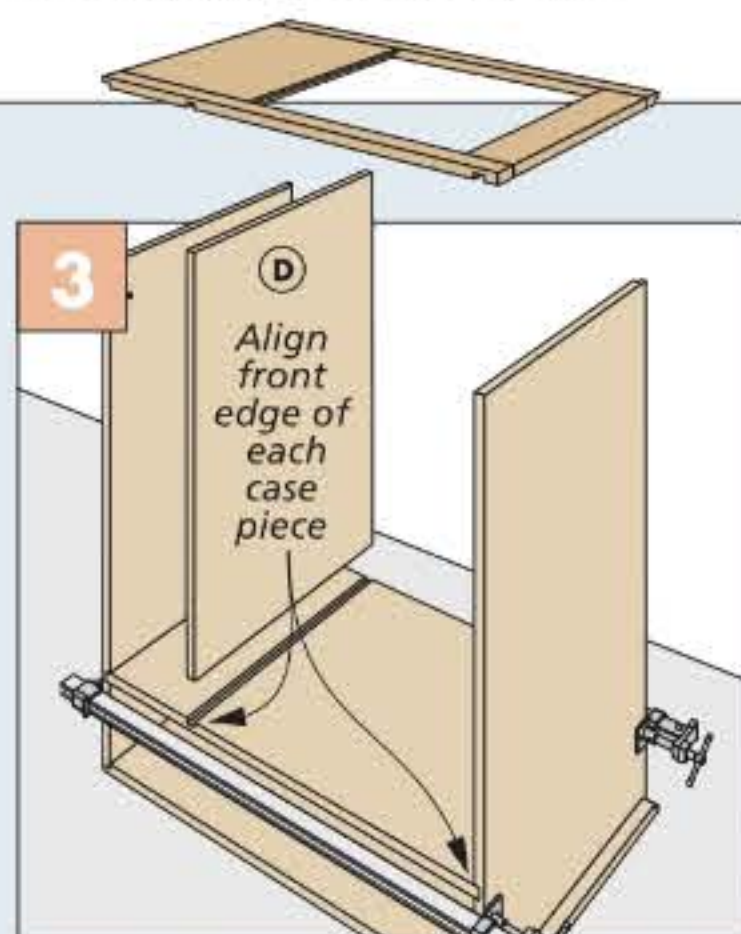
Cut the Rabbets. Bury a dado blade in an auxiliary fence and cut rabbets in the ends that will capture the subtop.



Dadoes Next. Set up a dado blade to match the plywood thickness, then cut the dadoes in the case pieces.



I cut the rabbets first, using a dado blade buried in an auxiliary rip fence (Figure 1). Then, I reset the dado blade to match the plywood thickness and cut the dados in both ends first. After the end dados were cut, I reset the fence to cut the dados in the bottom, subtop, and vertical divider.



Assembly. Assemble the case using glue and clamps. Stand the case on end to fit the end assembly.

ASSEMBLE THE CASE. Now it's time to fit the case together. I started by gluing the vertical divider into the subtop and the bottom. Then, I was able to slip the end panel into place. Finally, you can apply glue to the horizontal divider and fit the other end assembly. You can see the orientation in Figure 3. After loosely applying clamps, I checked the case to make sure everything was square and then tightened the clamps.

FACE FRAME

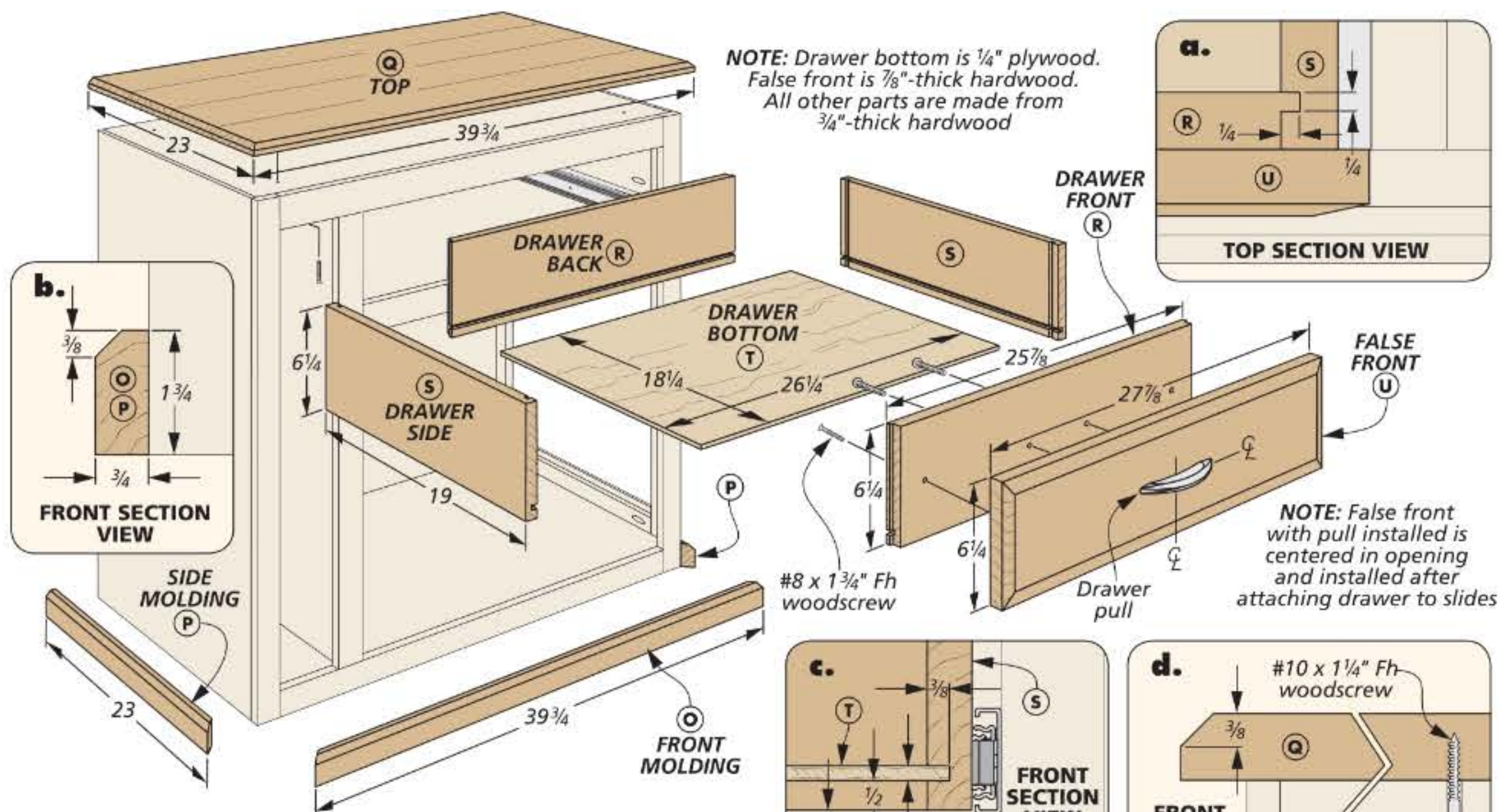
When it comes to dressing up plywood edging, you have a few options. What I chose to use here was a standard face frame. In the past, I've built face frames a few different ways. I've used everything from dowels to mortise and tenons, and I've even face nailed wide edging and called it a face frame. But nothing beats the sheer simplicity of cutting the face frame parts to size and then pocket screwing them together. The pocket screws are hidden, and it adds great rigidity to the finished project.

FACE FRAME CONSTRUCTION. The face frame starts by taking some careful

measurements from the case. I cut the outer stiles and upper and lower rails to size. A pair of pocket screws keep the rails in place, and prevents any twisting. Detail 'c' shows where I located the pocket screws. Then, it's a simple matter of measuring and cutting the middle rail and inner stile. They're attached the same way.

Once the glue on the case is dry, you can remove the clamps and stand the case up. I glued a set of spacers into the case for mounting the drawer slides. In the case of the pullout, I mounted the slides to the spacers before installing them. Detail 'd' shows where these are located. With the spacers in place, the face frame can be installed. A thin bead of glue and some finish nails attach it to the case. The final piece to finish up on the case is to install the back. A couple of clamps hold it in place while the glue dries.

At this point, I chose to paint the case so it could dry as I worked on the remaining parts of the kennel. I started with an even coat of quality primer, and then wrapped it up with a few coats of the color of your choice.



Adding the DETAILS

With the case assembled and the paint drying, you can move on to building the remaining portions of the kennel. First up will be a little trim work. Molding wraps the lower portion of the case for a clean, finished look. Then, the top is added and a drawer and pullout unit offer some storage options.

TRIM IT OUT. Up first on the slate is to trim out the bottom of the case.

I ripped a couple of long blanks to width at the table saw and added a chamfer to the top of the molding to dress it up. This was easy to do at the router table with a 45° chamfer bit, as you can see in Figure 1 below. Then, after mitering the pieces to final length at the table saw, I set them aside until I could apply a finish to all of the hardwood pieces at once. You'll want to stain and finish the

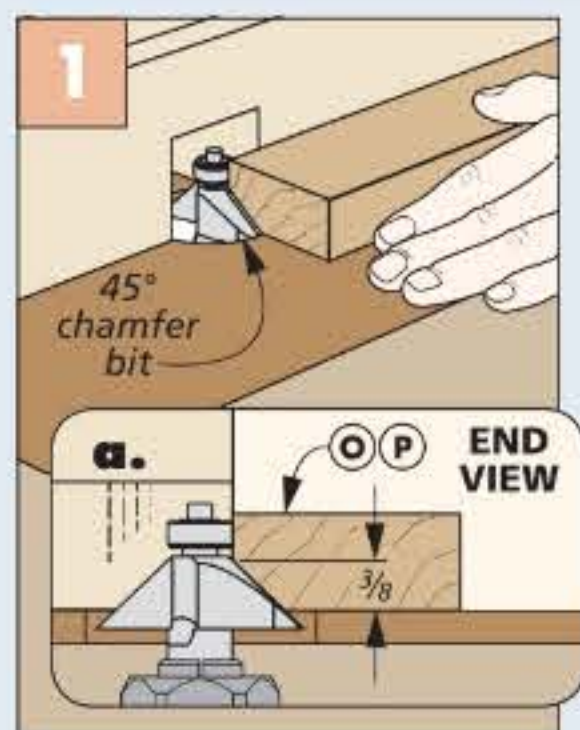
hardwood pieces before attaching them to the kennel. To read more about how I finished the hardwood, see Sources on page 67. But, after you have them finished they get installed with glue.

TOP IT OFF. The top of the dog kennel is a good place to take your time and select nice-looking stock. Choose your boards, glue them up, and let them dry. After smoothing the surfaces with a hand plane and a sander, trim the top to finished size. Finally, I used a hand-held router to make a chamfer around the top that matches the molding (detail 'd').

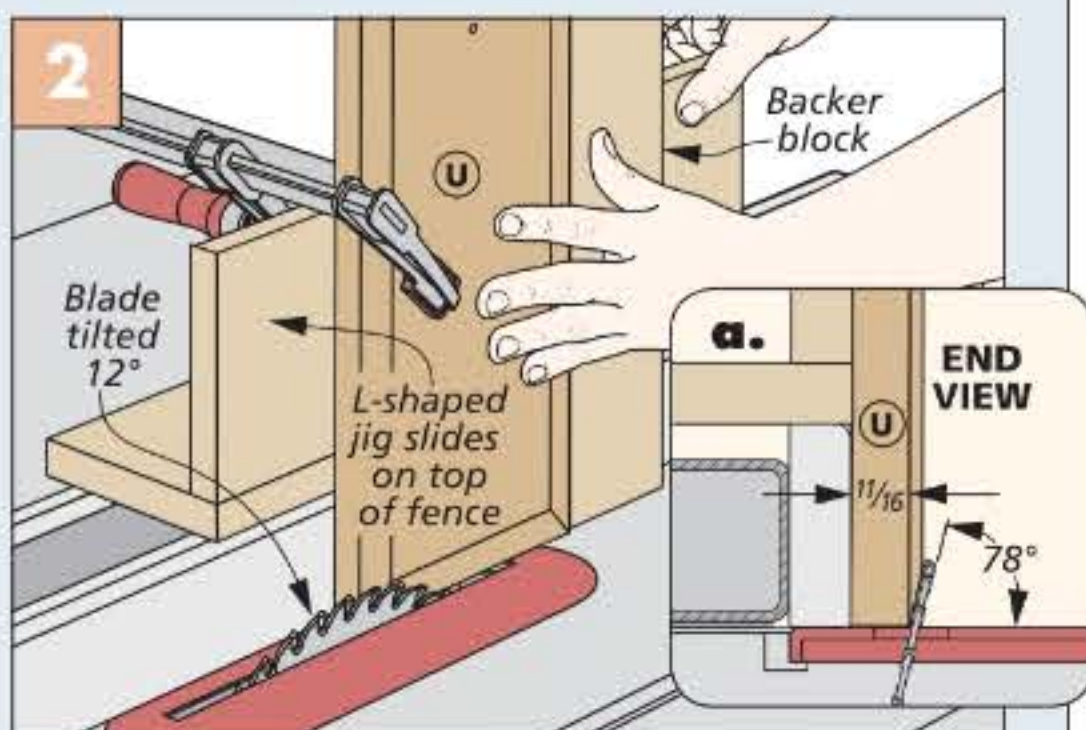
To attach the top to the case, I transferred hole locations from the case to the underside of the top to make pilot holes. A few screws installed with a short screwdriver holds it in place.

ADD DRAWER. Like I mentioned before, the kennel has a drawer and a vertical pullout unit. The drawer construction consists of tongue and dado joinery (detail 'a'). Start by cutting all of the parts to size. At the table saw, I used a dado blade to cut two dados in the drawer sides. A rabbet is cut to create the tongue on the drawer back and front. Finally, a groove is cut along the

How-To: CREATE THE BEVELS



Rout Chamfer. Rout the chamfer profile in several light passes.



Bevel the False Front. Tilt the table saw blade and cut the bevels on the false front. Use a backer block to support the workpiece.

bottom edge of all four pieces to hold the drawer bottom. Now the drawers can be assembled with glue.

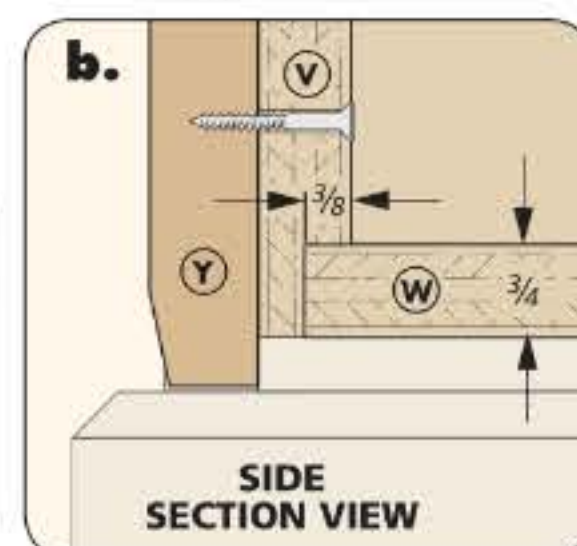
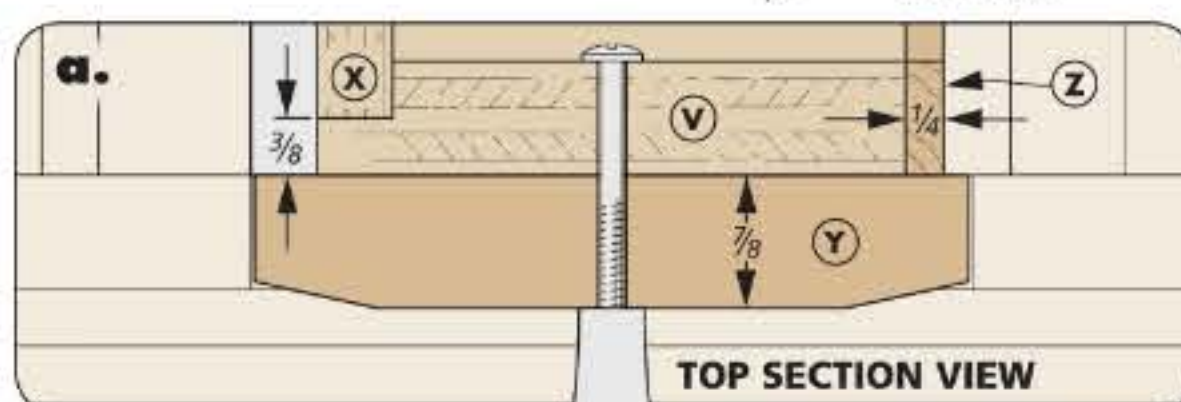
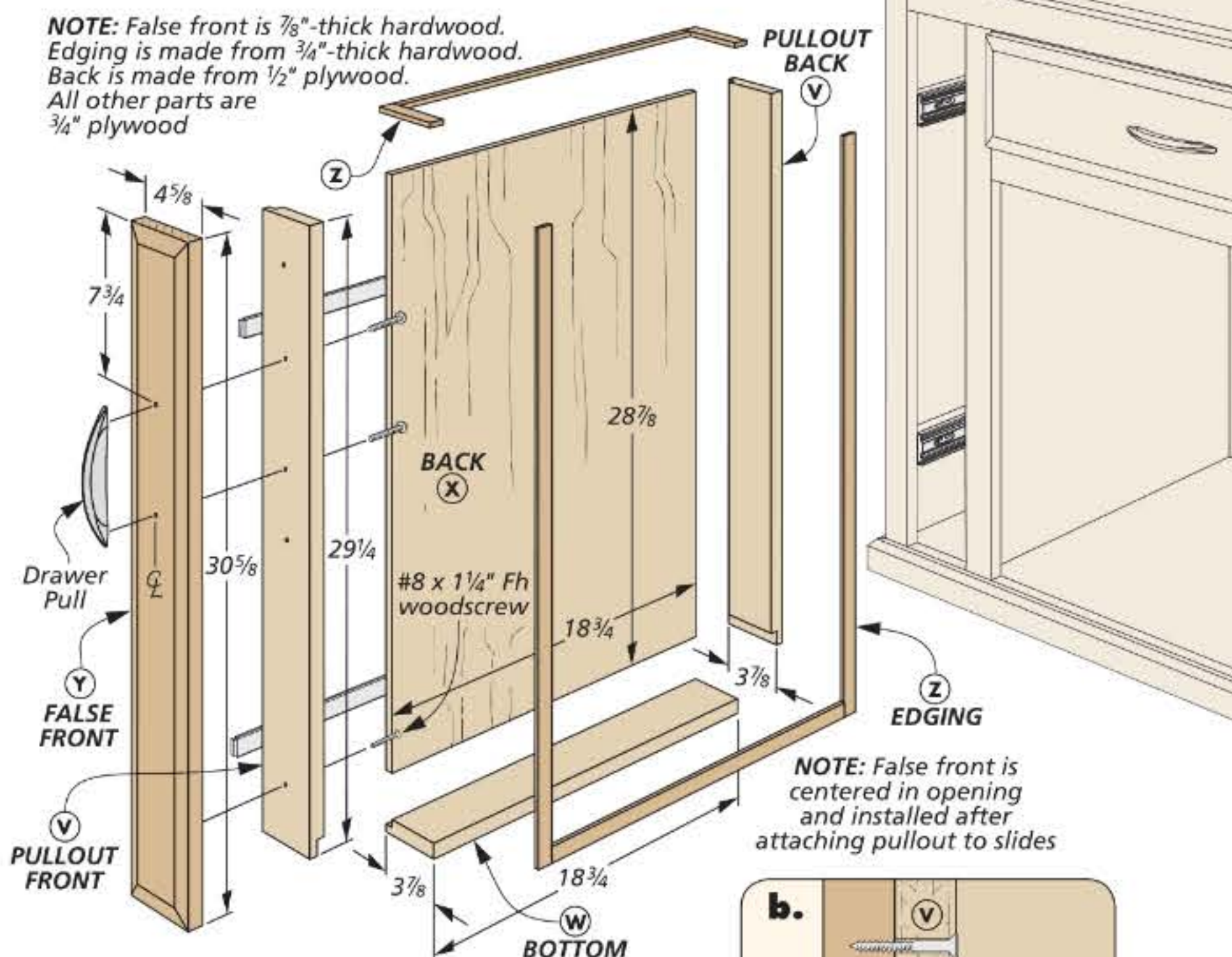
The false front consists of a hardwood face that's beveled around the edges. I cut the bevel at the table saw, as you see in Figure 2 on the previous page. Go ahead and finish the drawer front, but set it aside until the drawer is installed.

Installing the drawer is as simple as attaching the slides to the spacer blocks in the case and installing the drawer box to the slides. Then, position the false front for an even reveal all the way around the case, and stick it in place using double-sided tape. A pair of screws through the box into the false front will fix it in place. Finally, the pulls get installed with counterbored machine screws (detail 'a').

PULLOUT

The vertical pullout on the left side of the kennel is the perfect spot to store all of your leashes and other items that come along with dog ownership.

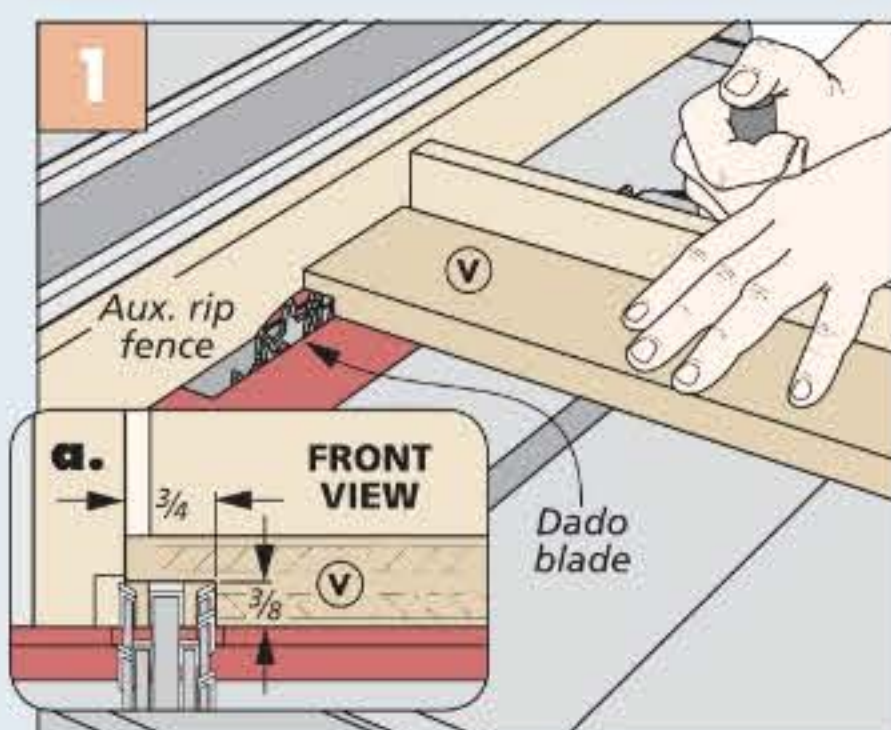
CONSTRUCTION. The main box of the pullout is made of plywood. The front and the back of the box have rabbets cut into the ends to hold the bottom. A dado blade in the table saw makes quick work of this (Figure 1, below). Then, I cut a rabbet along the back edge of the front, back, and bottom to hold the back panel (Figure 2).



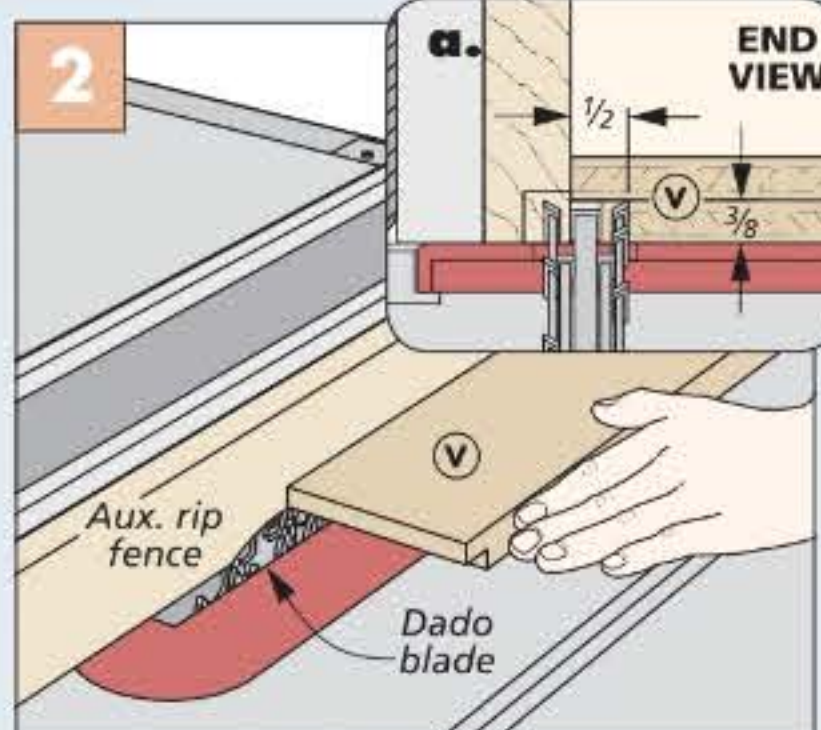
After assembling the pullout with glue and letting it dry, I covered all of the exposed plywood edges with some thin hardwood edging, as seen in Figure 3. I gave it a couple coats of the

same paint that I used on the case, and then the pullout unit can be installed the same way as the drawer. (The pullout front was finished the same way as the rest of the hardwood.)

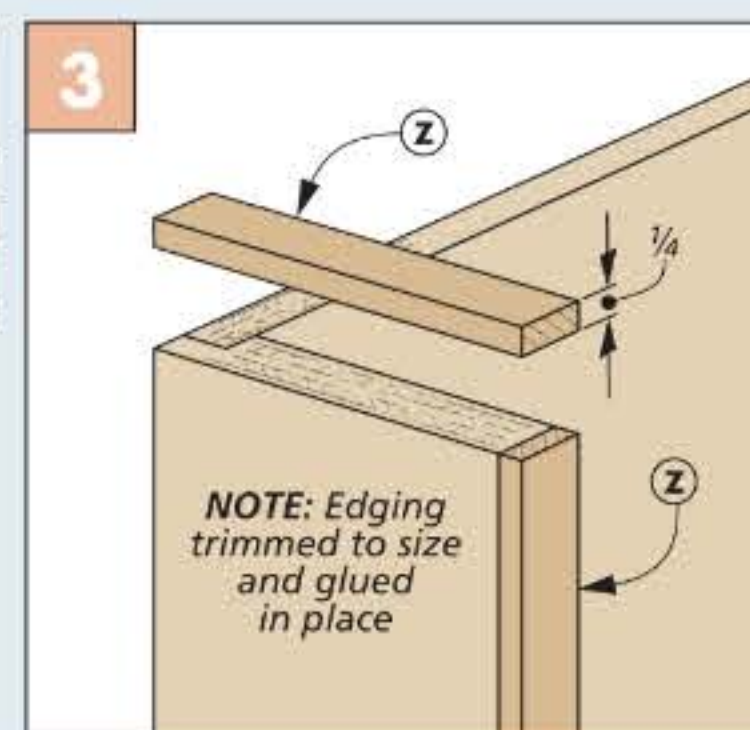
How-To: MAKE THE PULLOUT



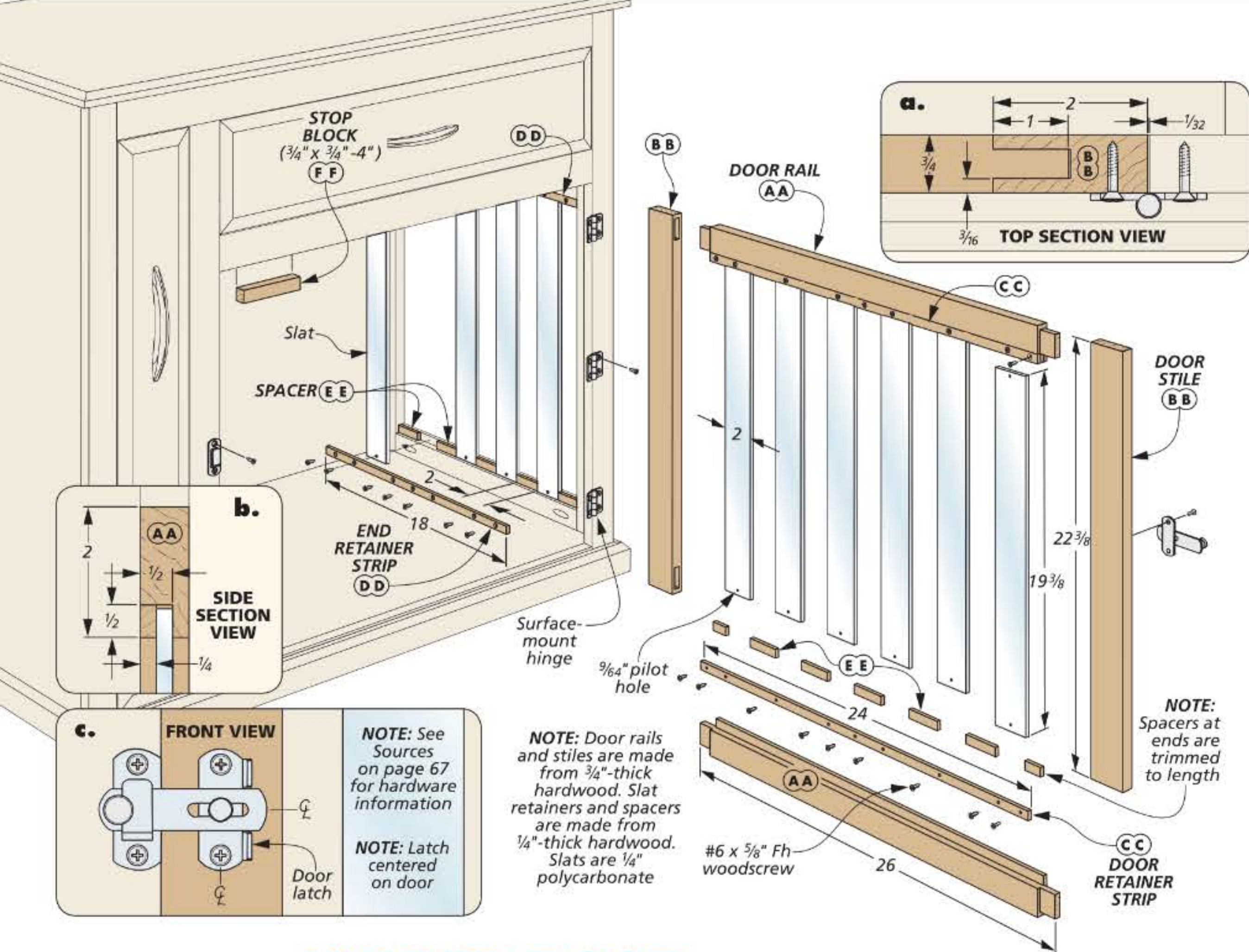
Rabbet the Ends. At the table saw, cut the rabbet in the front and back using a dado blade buried in an auxiliary fence.



A Rabbet for the Back. Reset the fence and cut the rabbet to hold the back panel of the pullout.



Clean It Up. Glue on the hardwood edging to hide all of the exposed plywood edges.



Build the **KENNEL DOOR**

At this point, the kennel is starting to look like a piece of furniture. But, it doesn't serve as much of a kennel with out a door and slats. And that's the final thing to take care of.

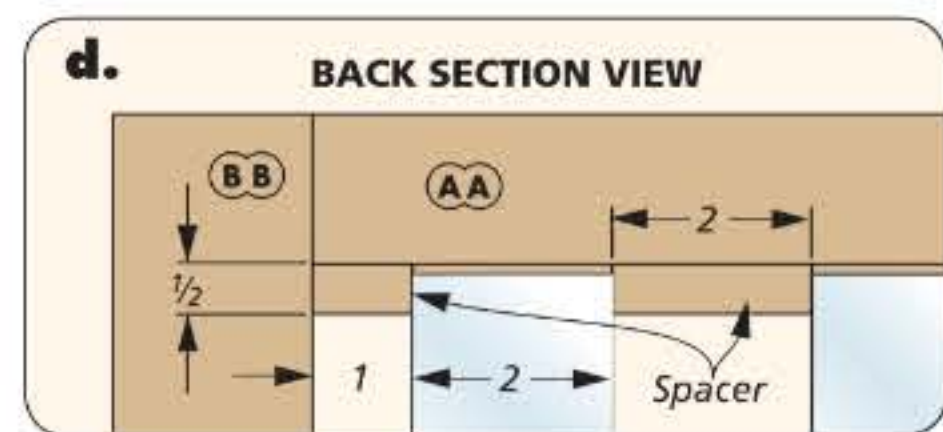
DOOR FRAME. The door of the kennel uses mortise and tenon joinery to create the frame. First, mortises are drilled in the stiles, as seen in Figure 1 at the top of the next page. The sides of the mortise are cleaned up with a chisel. Then, I cut the tenons on the rails (Figure 2). Finally, a rabbet is cut along the inside edge of the rails before assembly. Figure 3 shows the setup for this operation.

CLEAR SLATS. The slats for the kennel are made from polycarbonate. The polycarbonate cuts nicely at the table saw using a fine-toothed blade. Just make sure to leave the protective film on the polycarbonate while working

with it to avoid any scratches. Then, clean up the edge of the slats by making a few passes with a sharp block plane.

To lock the slats into the rabbets in the door and the kennel end, I used a series of spacers and a retaining strip that I cut to size. These are pre-finished to match their respective locations. After laying the door face down, the spacers are installed with glue, alternating slats with spacers (detail d). Then, the retaining strip can be installed. I predrilled through the retaining strip, the slats, and into the rails. Screws lock everything down.

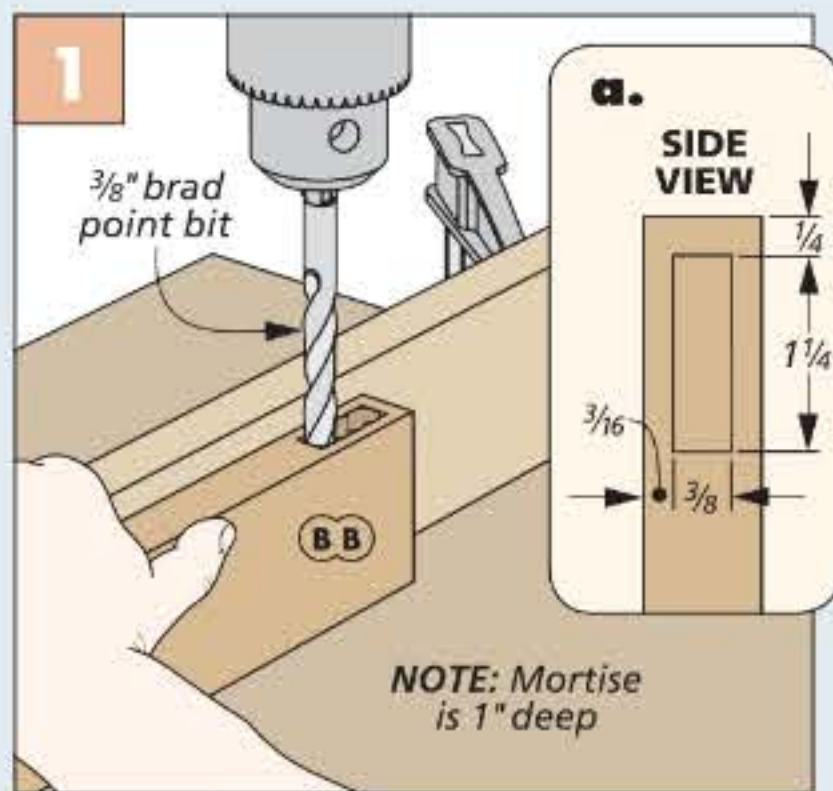
FINALLY, HARDWARE. To wrap up the kennel, I installed the door hardware. I used spacers to get an even reveal all the way around the door and installed it using surface mount hinges. A shutter latch is installed to keep the door closed.



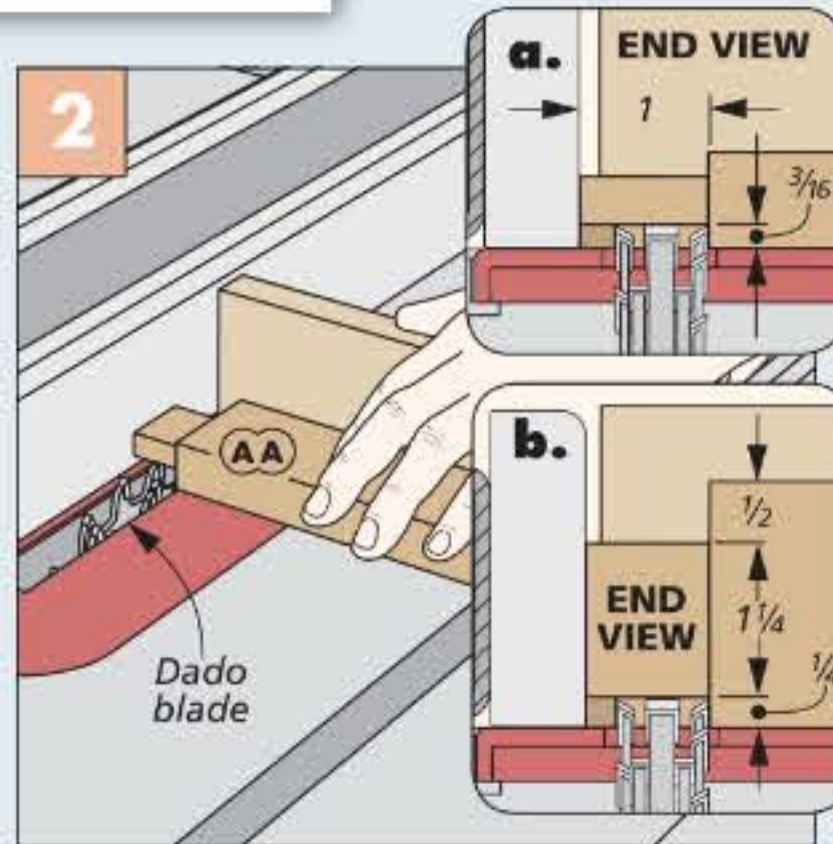
You can see the position of this in detail 'c' above. Finally, I installed a stop block on the inside of the kennel to keep the door from swinging inward.

With the door installed, the kennel is ready to move into your house. As I mentioned before, this kennel is designed for medium-sized dogs (26-40lbs). But, you can easily customize it for larger or smaller dogs. Just ensure they have room to stand up and turn around. No matter what size dog is going to call this kennel home, the light and airy interior is a great upgrade from the cage-like wire kennels. And your dog will thank you. **W**

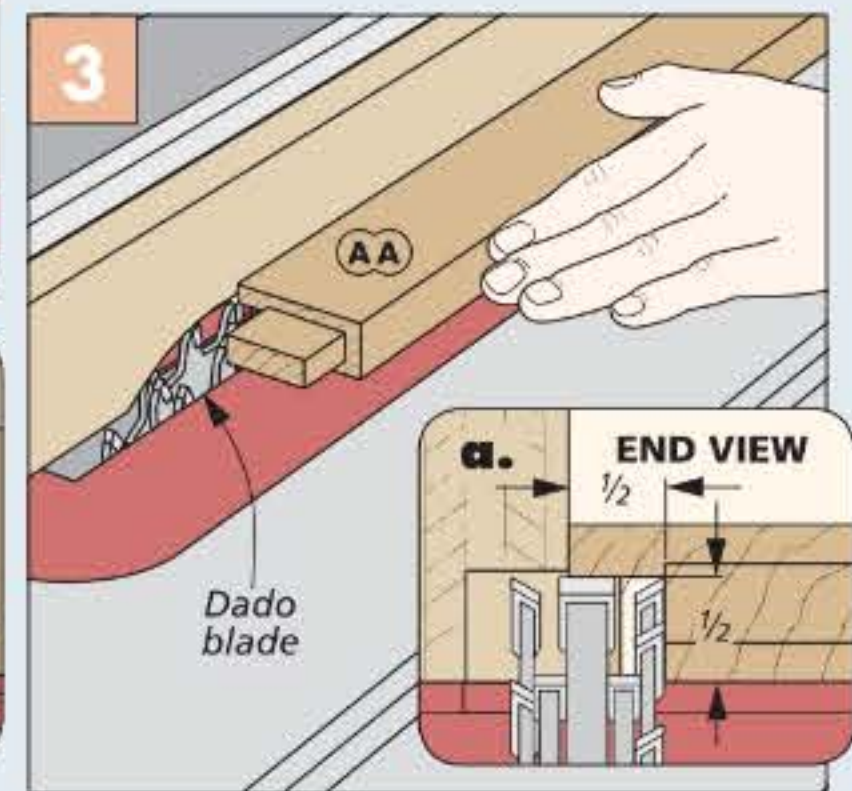
How-To: CUT THE DOOR JOINERY



Mortise the Stiles. Drill out the mortise waste at the drill press, then square up the walls with a chisel.



Cut Tenons. At the table saw, use a dado blade to form the tenons on the rails. Note the different shoulder heights.



Rabbet the Rails. Finally, cut a rabbet on the inside edge of the rails to accept the slats and retainer strips.

Materials, Supplies & Cutting Diagram

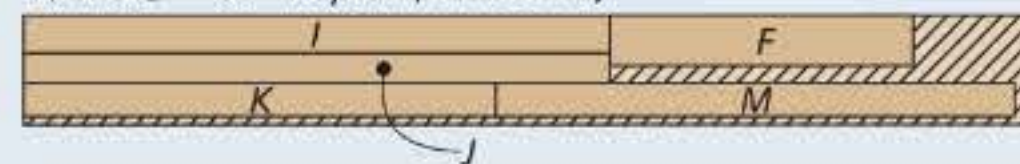
A	Bottom/Subtop (2)	3/4 ply. - 21 1/2 x 37 1/2
B	Side (1)	3/4 ply. - 21 1/2 x 34 3/4
C	Vertical Divider (1)	3/4 ply. - 21 x 33
D	Horizontal Divider (1)	3/4 ply. - 21 x 30 3/8
E	Top Rail (1)	3/4 x 12 7/8 - 18
F	Bottom Rail (1)	3/4 x 3 1/2 - 18
G	Stiles (2)	3/4 x 1 3/4 - 34 3/4
H	Back (1)	1/2 ply. - 37 1/2 x 33
I	Upper Rail (1)	3/4 x 2 1/4 - 34 3/4
J	Lower Rail (1)	3/4 x 1 3/4 - 34 3/4
K	Middle Rail (1)	3/4 x 2 - 28
L	Outer Stiles (2)	3/4 x 1 3/4 - 34 3/4
M	Inner Stile (1)	3/4 x 2 - 30 3/4
N	Slide Spacers (4)	1 x 1 1/16 - 21
O	Front Molding (1)	3/4 x 1 3/4 - 39 3/4
P	Side Moldings (2)	3/4 x 1 3/4 - 23
Q	Top (1)	3/4 x 23 - 39 3/4
R	Drawer Front/Back (2)	3/4 x 6 1/4 - 25 7/8
S	Drawer Sides (2)	3/4 x 6 1/4 - 19
T	Drawer Bottom (1)	1/4 ply. - 18 1/4 x 26 1/4
U	Drawer False Front (1)	7/8 x 6 1/4 - 27 7/8
V	Pullout Frnt./Bck. (2)	3/4 ply. - 37 8 x 29 1/4
W	Pullout Bottom (1)	3/4 ply. - 37 8 x 18 3/4
X	Pullout Back (1)	1/2 ply. - 18 3/4 x 28 7/8
Y	Pullout False Front (1)	7/8 x 4 5/8 - 30 5/8
Z	Edging (1)	1/4 x 3/4 - 110 rgh.
AA	Door Rails (2)	3/4 x 2 - 26
BB	Door Stiles (2)	3/4 x 2 - 22 3/8
CC	Door Retainer Strips (2)	1/4 x 1/2 - 24
DD	End Retainer Strips (2)	1/4 x 1/2 - 18
EE	Spacers (2)	1/4 x 1/2 - 46 rgh.
FF	Stop Block (1)	3/4 x 3/4 - 4

- (1) Door Latch
- (2) 128mm Drawer Pulls
- (4) 18" Full-Extension Drawer Slides
- (26) #8 x 1 1/4" Pocket Screws
- (8) #8 x 1 1/4" Fh Woodscrews

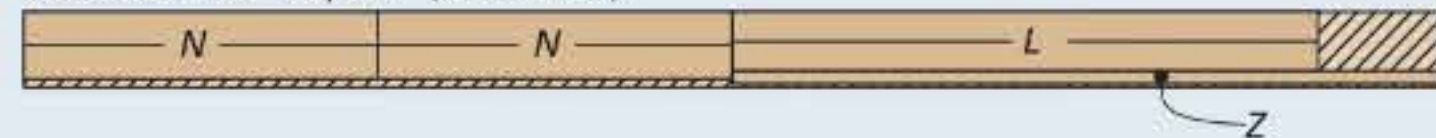
- (10) 1/4" Polycarbonate - 2 x 19 3/8
- (3) Surface-Mount Hinges

ALSO NEEDED: One 48" x 96" sheet of 3/4" Birch plywood, one 48" x 48" sheet of 3/4" Birch plywood, one 48" x 48" sheet of 1/2" Birch plywood, one 24" x 48" sheet of 1/4" Birch plywood

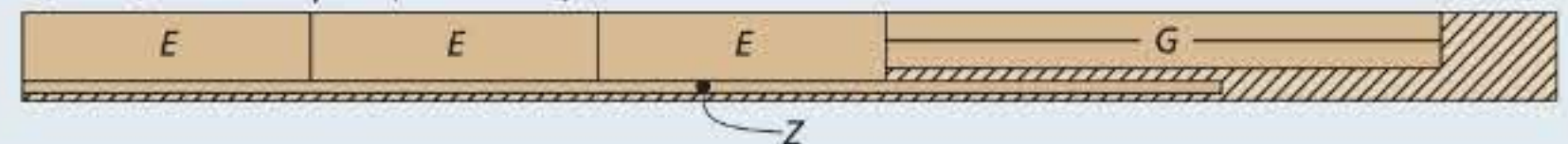
3/4" x 6 1/2" - 60" Poplar (2.7 Bd. Ft.)



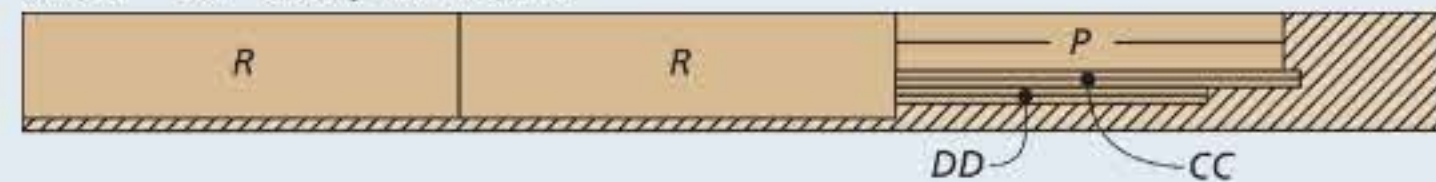
3/4" x 4 1/2" - 84" Poplar (2.6 Bd. Ft.)



3/4" x 5 1/2" - 96" Poplar (3.7 Bd. Ft.)



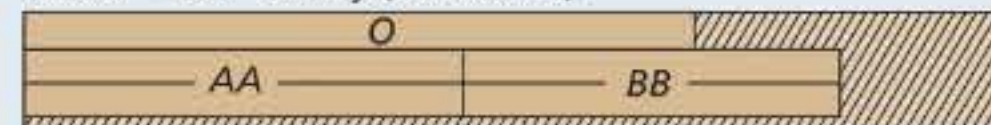
3/4" x 7" - 84" Cherry (4.1 Bd. Ft.)



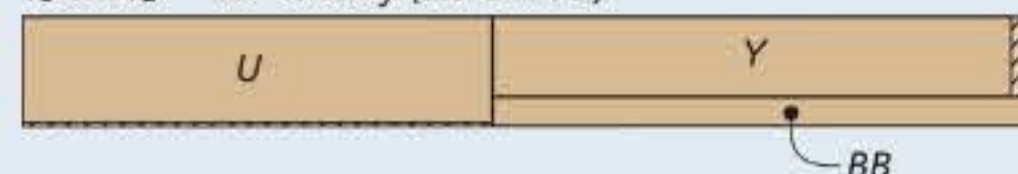
3/4" x 7" - 96" Cherry (Two boards @ 4.7Bd. Ft. each)



3/4" x 7" - 60" Cherry (2.9 Bd. Ft.)



7/8" x 6 1/2" - 60" Cherry (2.7 Bd. Ft.)



Sliding Bevel Gauges

Brass blades paired with wood bodies make these bevel gauges as attractive as they are useful.

There's something about shop-made tools that resonates with me. It may be the nod to a simpler time, where a crafts-person would often make a tool he or she needed. It could be the chance to break out of the production mold and customize your tool set. Or, it may be the opportunity to build a quality tool that future

craftsmen will marvel at and wonder about the person who made it. Whatever it is that calls to you, these bevel gauges are the perfect project to scratch that itch.

TWINS. We designed these gauges to be a set. The larger excels at standard angle-measuring duties, and the smaller version is the perfect size to keep in your

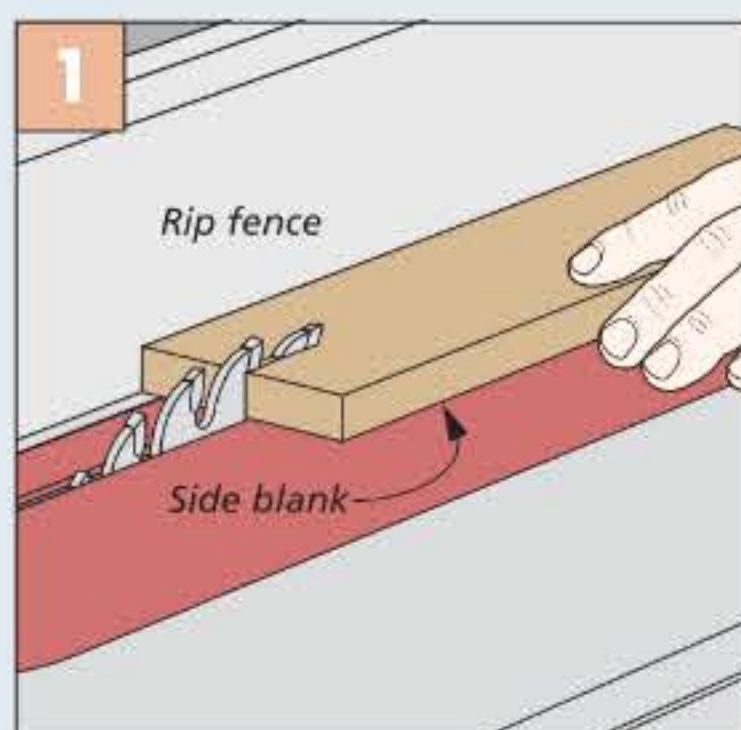
apron for laying out dovetails (inset photo). Both gauges are built with the help of a jig to rout the bodies, which is where I started building.

SIDES

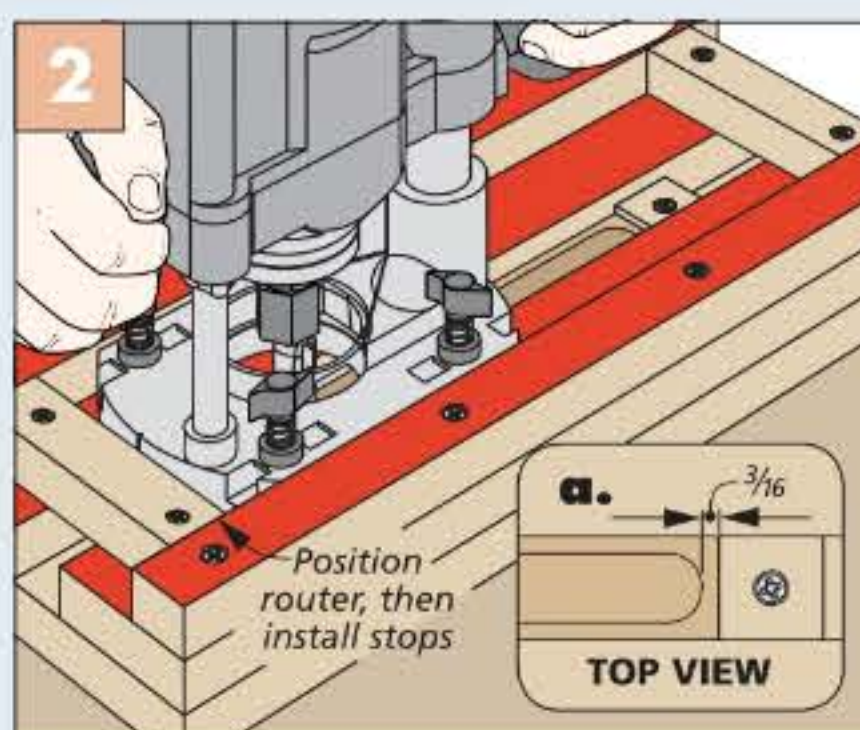
The gauges have two wood parts — leopardwood for the sides and African



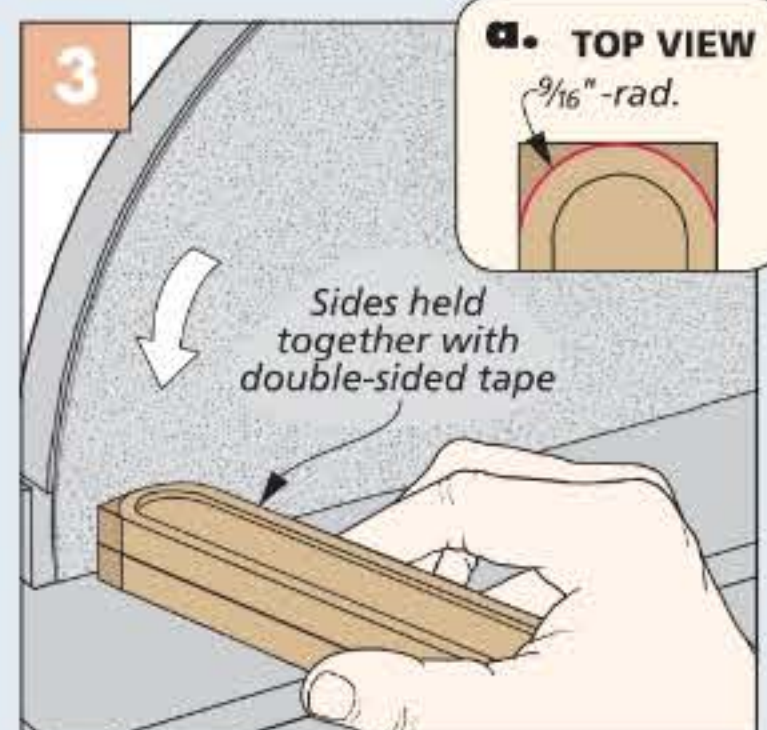
How-To: SHAPE THE SIDES & INSERTS



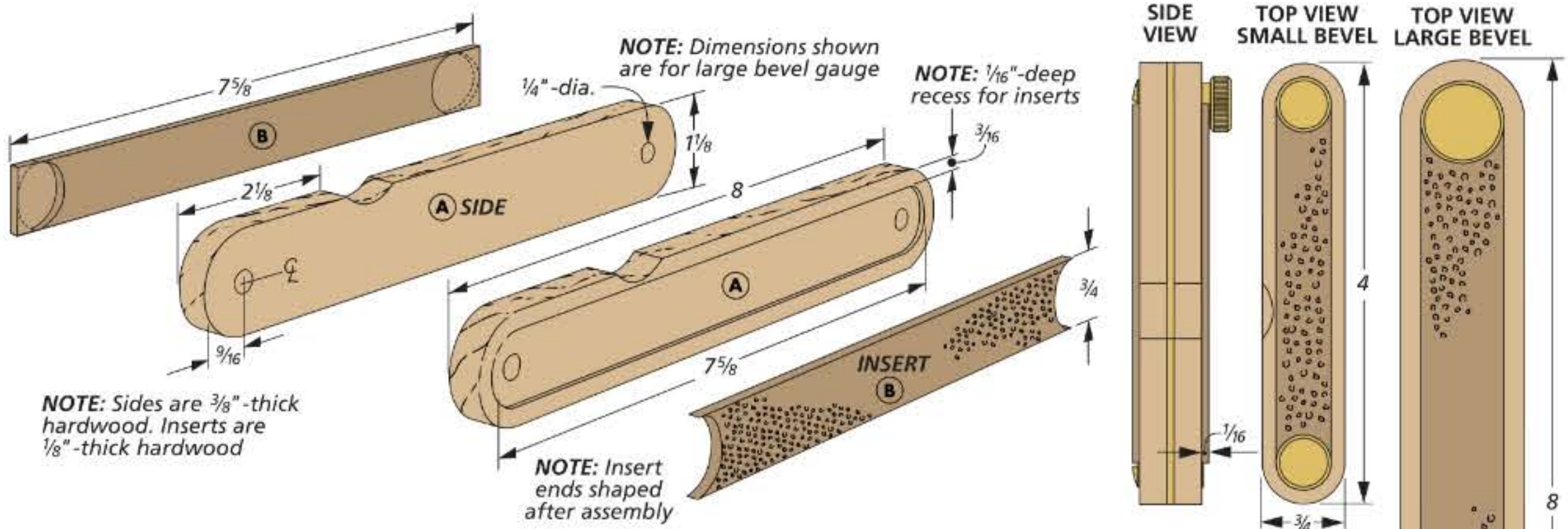
Side Blanks. At the table saw, cut the stock to size for both the side blanks and the inserts.



Rout the Grooves. To rout the grooves in the sides, use a router and the jig shown in Shop Notes on page 64.



Rounding Corners. Use double-sided tape to hold the sides together and round the corners at the disc sander.



mahogany for the raised inserts. The sides have a shallow recess to accept the contrasting inserts. The combination of the two I form the body of the gauge and sandwich the blade that you'll make later. Here, I'm going to be building the larger gauge. For dimensions on the smaller gauge, head over to Woodsmith.com.

The first thing to do is plane the stock for the inserts and sides to thickness. The inserts are thin, so I used a backerboard to support them in the planer. After the thickening was done, I cut them to size, as seen in Figure 1 on the previous page.

ONE JIG TO ROUT THEM ALL. With the blanks in hand, it's time to head over to the bench. To house the inserts, I routed a recess in each side. Milling a precise recess in small parts like this can be tricky. Using a router with the jig shown in Figure 2 makes this task a breeze.

For instructions on building the jig, see Shop Notes on page 64.

After the recesses are routed, set the jig to the side. You'll be using it a little bit later for a few different tasks. Then, you can head over to the disc sander and round the ends of both the sides and the inserts (Figure 3).

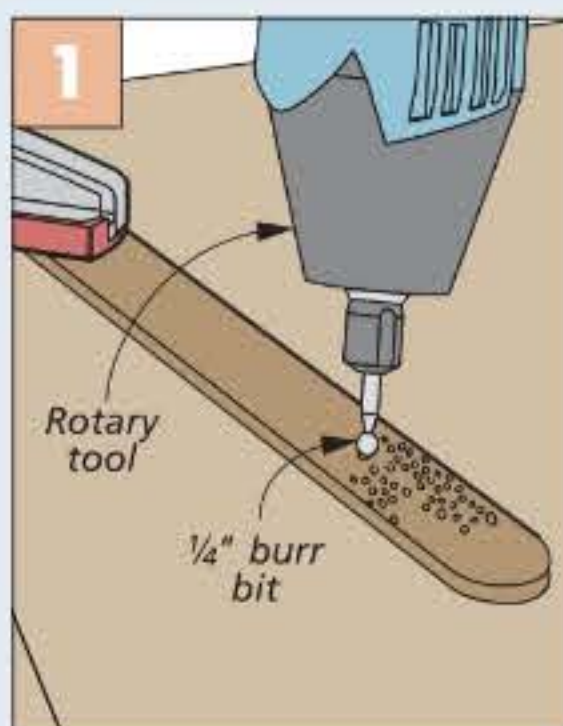
SPICE IT UP. To give a little character to the bevel gauges, I added a stippled texture to the inserts. The texture, combined with the contrasting wood species, makes the inserts really pop on the finished gauge.

To texture the inserts, I turned to a rotary tool equipped with a small burr bit (Figure 1, below). The trick here is to be random with the pattern (more texture is better than not enough). When I was happy with the look of the inserts, I glued them into the sides.

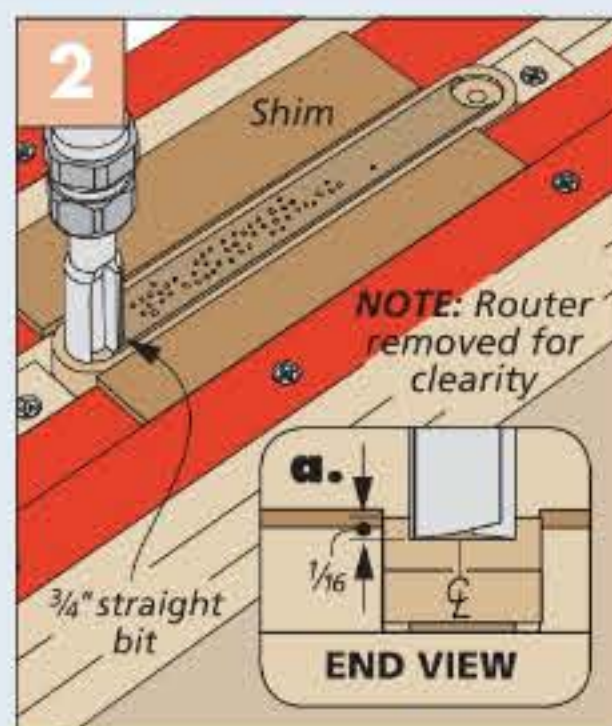
PLUNGE A HOLE. Once the glue is dry, you can remove the clamps and reach for your router jig again to cut holes for the hardware that attach the sides to the blade. Slip one side into the jig and plunge a counterbore on each end (Figure 2). Then, repeat the process on the other side. Finally, you can swap the bit for a smaller straight bit and plunge the through hole (Figure 3).

The final step for the sides is to create a finger notch to push the blade out of the finished bevel. I used double-sided tape to hold the sides together and gently sanded the notch at the spindle sander. After a quick coat of mineral oil, I let the sides dry and turned my attention to the blade.

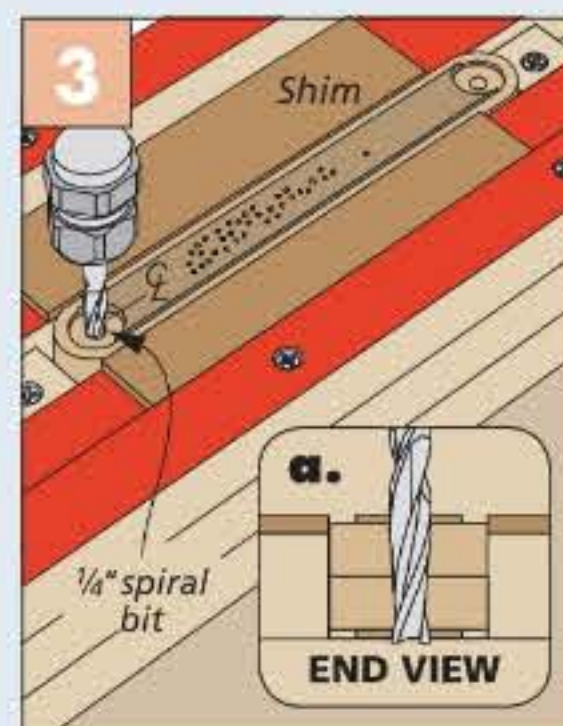
How-To: COMPLETE THE BODY



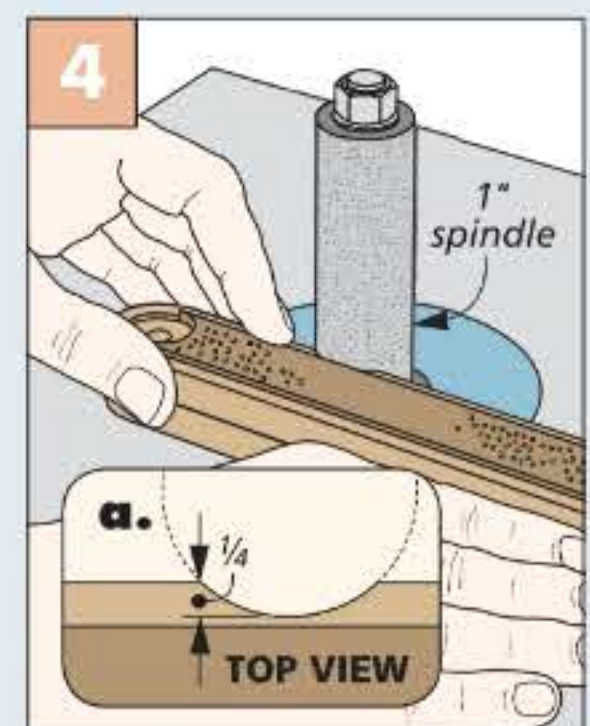
Add Texture. Clamp the inserts to the bench and use a burr bit to add texture.



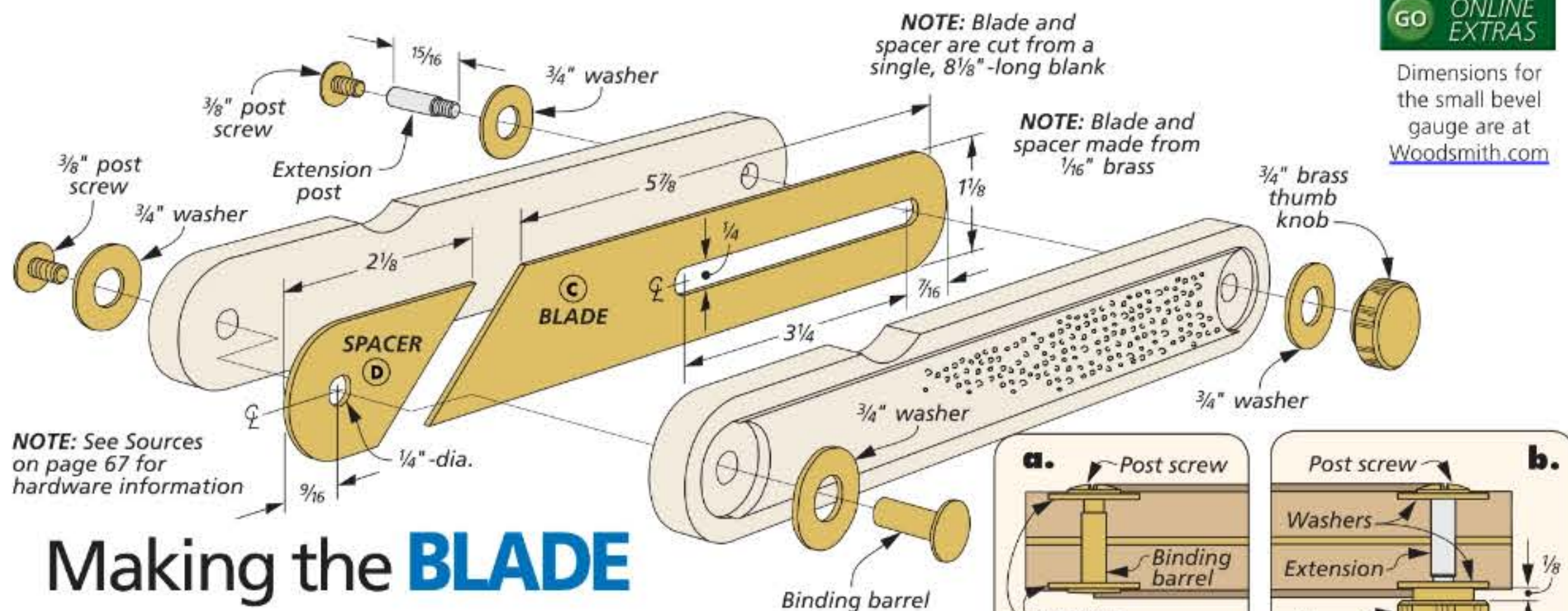
Counterbore. Place the side back in the router jig and plunge the counterbores.



Through Holes. Change bits and plunge a hole through the side ends.



Notching. Use double-sided tape to hold the sides together and sand the notch.



Making the BLADE

The blade of the sliding bevel is held in place with binding posts and washers. A thumb nut provides tension on blade to lock it at the appropriate angle. A matching spacer provides room for the blade to swing. The matching angles of the spacer and blade make the joint nearly invisible when the blade is closed.

BLADE STOCK. For the blade, I chose to use brass. Not only does the brass look nice, but it also cuts like a dream at the table saw using a blade designed for non-ferrous metals. I started by cutting the blade to final width. I left the blank a little long, however. This left me enough material to cut the blade and spacer from the same blank and still account for the blade kerf width.

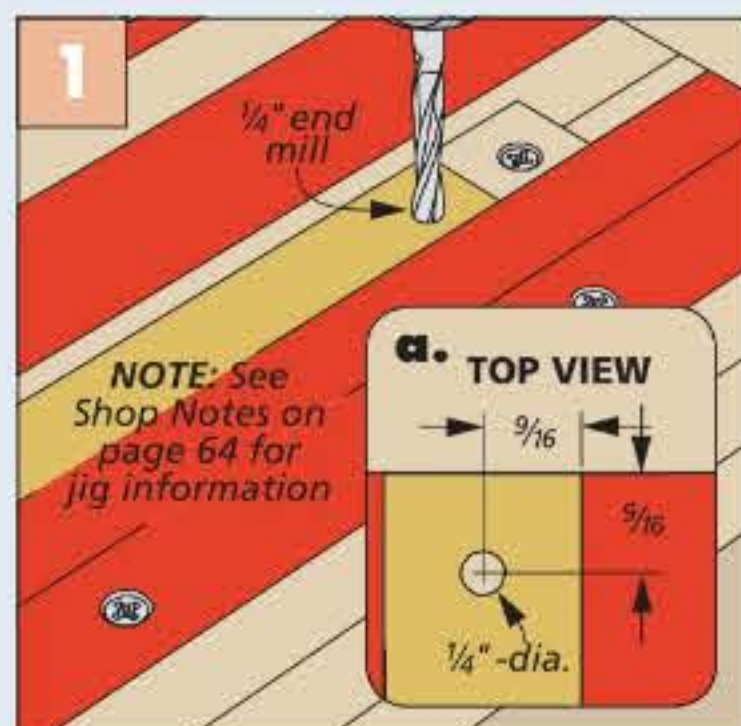
Before cutting the two pieces apart, however, there's a little machining work to do on the brass blank. This starts by using a router with the router jig to drill a hole in the spacer end of the blank (Figure 1, below). Then, I took the blank over to the disc sander and rounded the ends to match the sides. Figure 2 below shows the shape you're going for.

SLOTING THE BLADE. To cut the slot in the blade, I turned to the router jig one last time. The trick in cutting the slot in the blade lies in holding the thin brass securely. To do this, I attached the blade to a spacer block using double-sided tape and routed the slot using an end mill bit. I defined the two

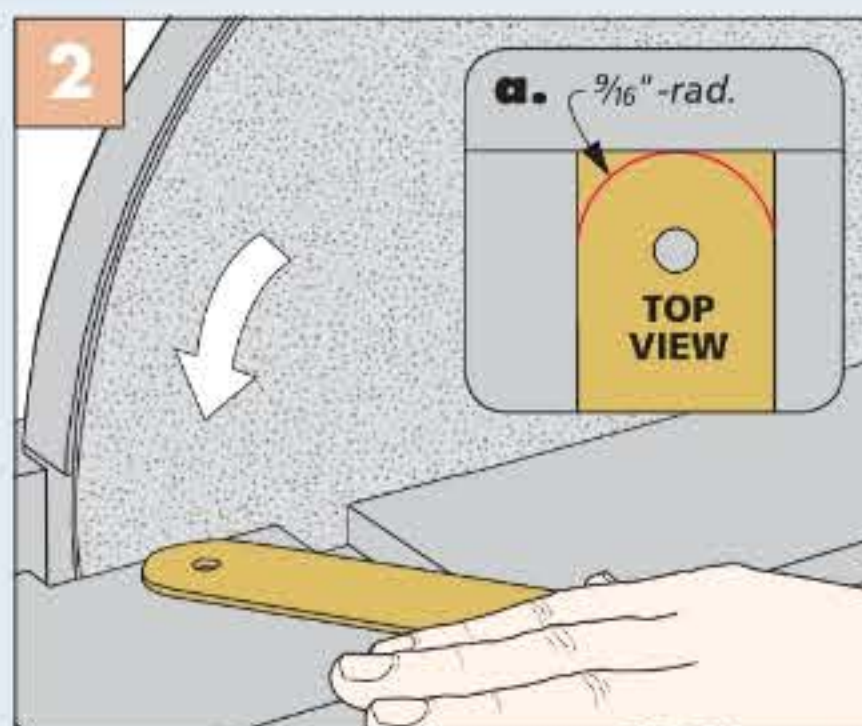
end locations first, plunging through the blade slowly. Finally, I routed the slot in a couple of passes. You can see the setup I used in Figure 3. Now the spacer and blade can be cut apart at the table saw using a non-ferrous blade, as shown in Figure 4 on the next page. You can then set the spacer aside and work on the blade.

I took a few minutes with a sanding block to sand the blade, as shown in the Shop Tip on the next page. Sanding provides a nice satin finish to the brass, as well as makes the blade slightly thinner than the spacer. This helps it swing smoothly without binding.

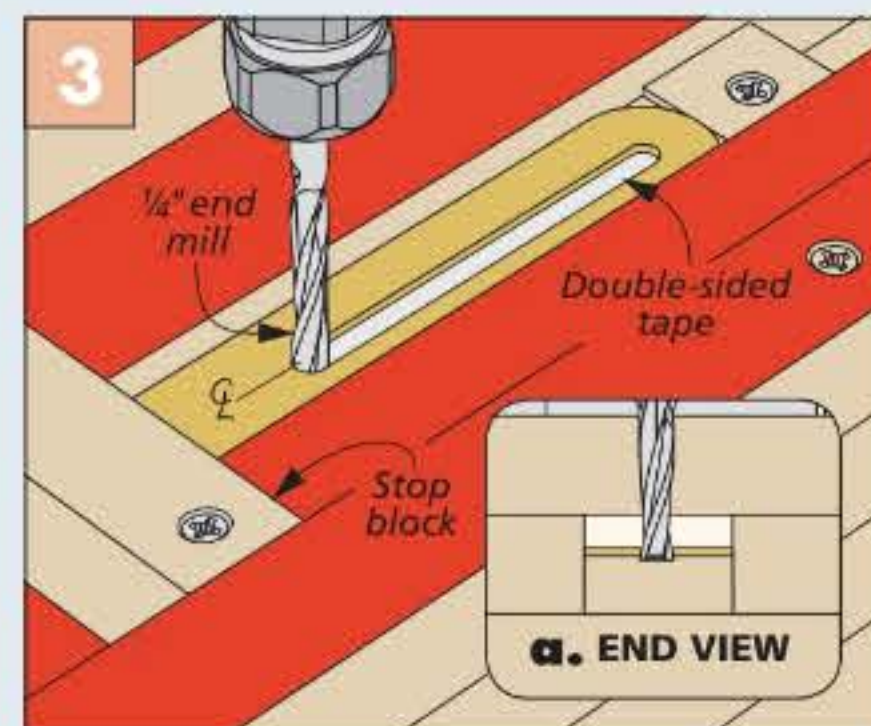
How-To: SHAPE THE BLADE



Hardware Holes. Use the router jig and a router to plunge a hole in the spacer end of the brass blank.



Round Ends. Transfer the shape from the body to the blade and radius the ends to match at the disc sander.



Rout Slot. Tape the blade to a spacer block with double-sided tape and rout the slot in the blade using an end mill.

Shop Tip: SANDING



Satin Smooth. Use double-sided tape to hold the blade on a flat surface and sand to a satin finish.

RETAINING HARDWARE

Both bevel gauges use similar hardware. The sides are held together using a binding post and washers. To lock the blade, a thumb nut is modified to fit the binding posts.

SPACER FIRST. To install the spacer, I first applied epoxy to both faces of the spacer and sandwiched it between the two sides. Make sure that the point of the spacer is on the same side as the finger notch that's cut in the sides. See the main drawing on the previous page. Then, I installed a binding post and washers through the sides and secured them together.

MODIFY THE NUT. With the spacer end taken care of, I turned my attention to the business end of the gauge. To lock the blade in place, I used a customized thumb nut on the binding post.

The thumb nut on the large bevel starts as an untapped brass knob. You can see the steps I took to modify it in the How-To box to the right.

The thumb nut for the small bevel is a little different. The nut I ordered came with a threaded stud. So, I had to cut that stud off first. Then, the process is pretty much the same as the larger nut. You can skip cutting the stem on the smaller nut to length however, as it's a little shorter to begin with.

LOCKING SCREWS. Finally, the pièce de résistance—installing the blade. The blade can be inserted into the body of the bevel. Make sure to align the mitered edge of the blade and the spacer together. Using epoxy, install the binding post as seen in Figure 5. Then, a few twists of the thumb nut and a washer locks the blade in place, and finishes the gauge. The last thing was to apply a finish and I opted to give them a few coats of mineral oil for a natural feel. Looking for a few ideas for using a bevel gauge? Check out the article on page 60. [W](#)

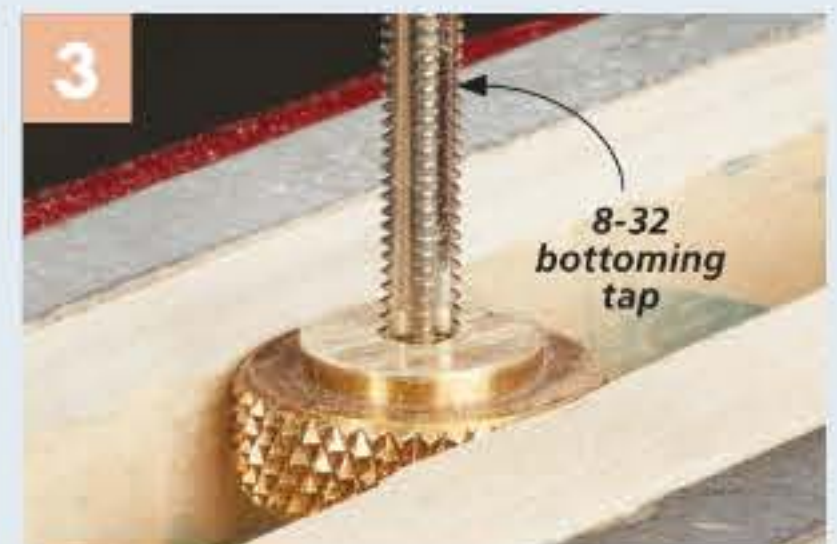
How-To: MODIFY NUT



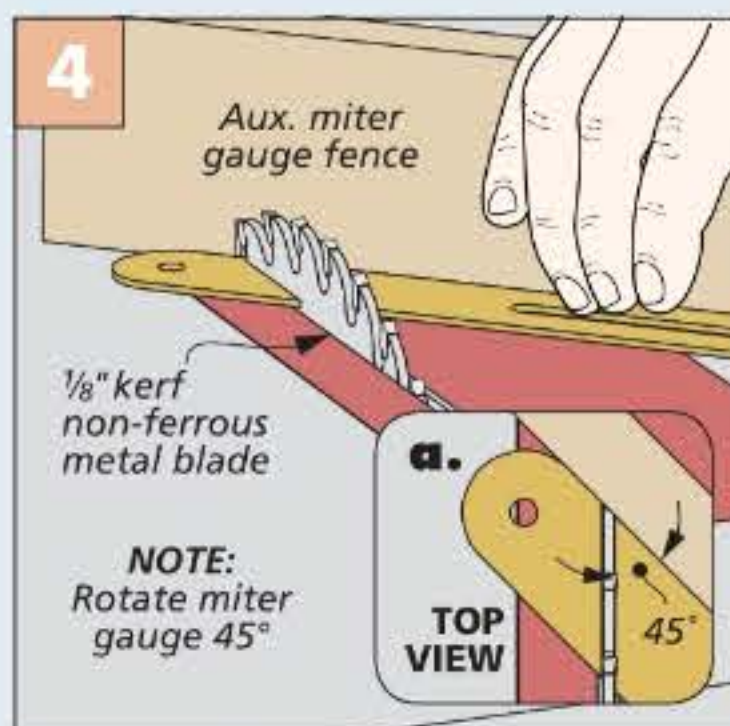
1 Stopped Hole. Drill a stopped hole in the thumb nut, using tape as a depth stop to avoid drilling through the nut.



2 Cut to Length. Use a hacksaw to cut the thumb nut stem down to final size. Take care to keep the cut parallel to the end.



3 Tap Threads. Use a bottoming tap to cut threads in the stopped hole. Occasionally back the tap out to clear chips.



4 Separate Them. Use an auxiliary fence on the miter gauge to cut the spacer free from the blade.



5 Lock the Post. After installing the spacer, install the blade, epoxying the binding post in the side.

Materials & Supplies (for large bevel gauge)

- A** Sides (2) $\frac{3}{4} \times 1\frac{1}{8} - 8$
- B** Inserts (2) $\frac{1}{8} \times \frac{3}{4} - 7\frac{5}{8}$
- C** Blade (1) $\frac{1}{16}$ Brass - $1\frac{1}{8} \times 7$
- D** Spacer (1) $\frac{1}{16}$ Brass - $1\frac{1}{8} \times 2\frac{1}{8}$
- (1) $\frac{3}{8}$ " Post Screw
- (1) $1\frac{5}{16}$ " Extension Post
- (2) $\frac{5}{8}$ " Binding Barrel
- (1) $\frac{3}{4}$ " Brass Thumb Nut
- (4) $\frac{3}{4}$ " Brass Washers

Reviving a Classic Armoire

This gentle giant from the world of Arts & Crafts is a feast for the eyes. Its storage options pay dividends, as well. And those tiles — wow.

Historically speaking, armoires met a need in homes that didn't have closet space built in. Their size, combined with much more modest collections of clothing, made them very popular pieces of pragmatic furniture for a long time.

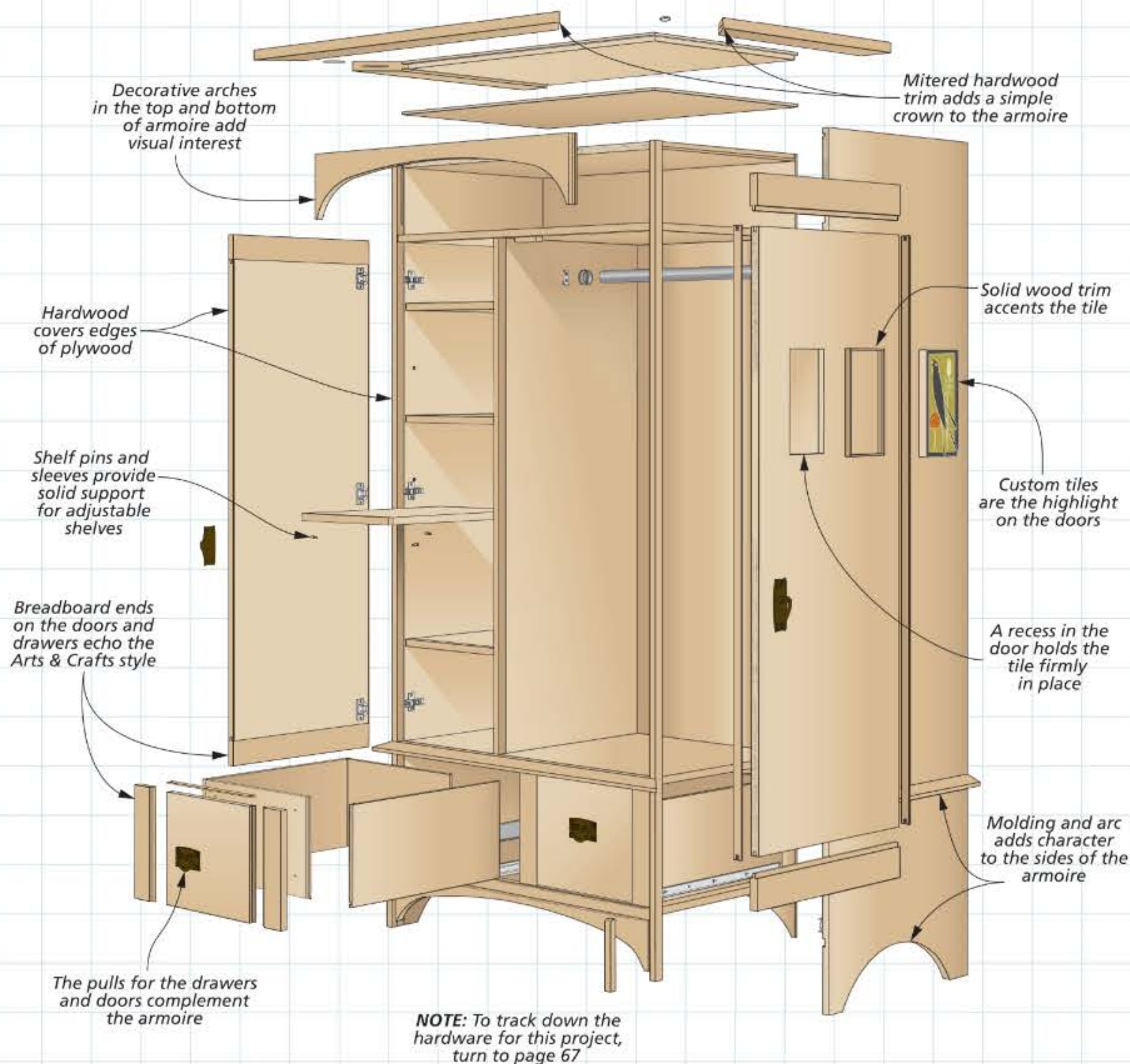
Today, many homes have closets big enough to fit an armoire. While they've mostly been retired from their previous duties, they still can work in other parts of the house like you see here.

GOOD BONES. The case of this armoire is mostly cherry plywood. The solid cherry trim provides a warm field for the inset tiles. Handsome hardware complements the finished piece.

Inside, you'll find shelving and hanging space you can tailor to suit your needs. Below that, there are two generously sized drawers that add to the storage options. Convinced? I thought so — let's get to work.



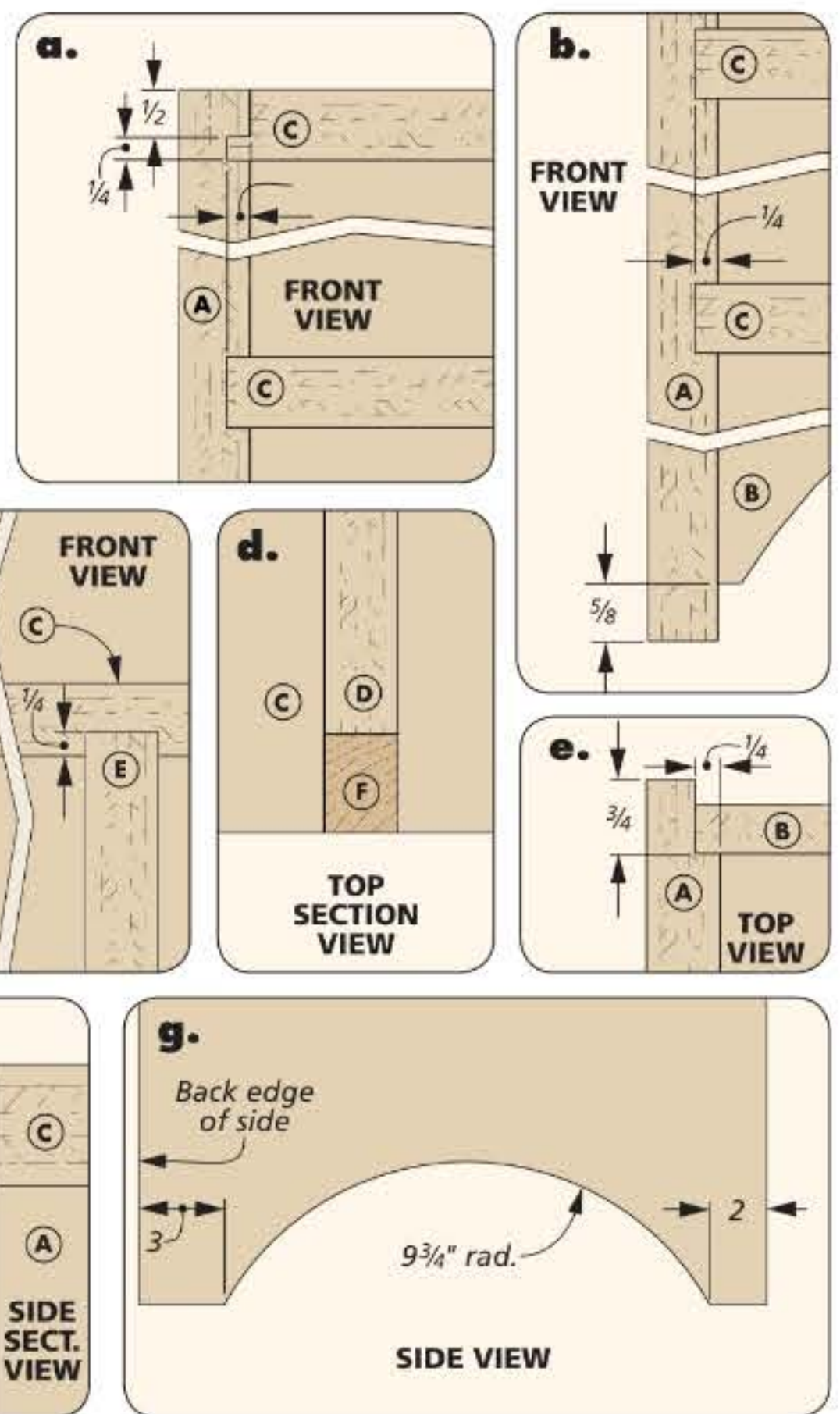
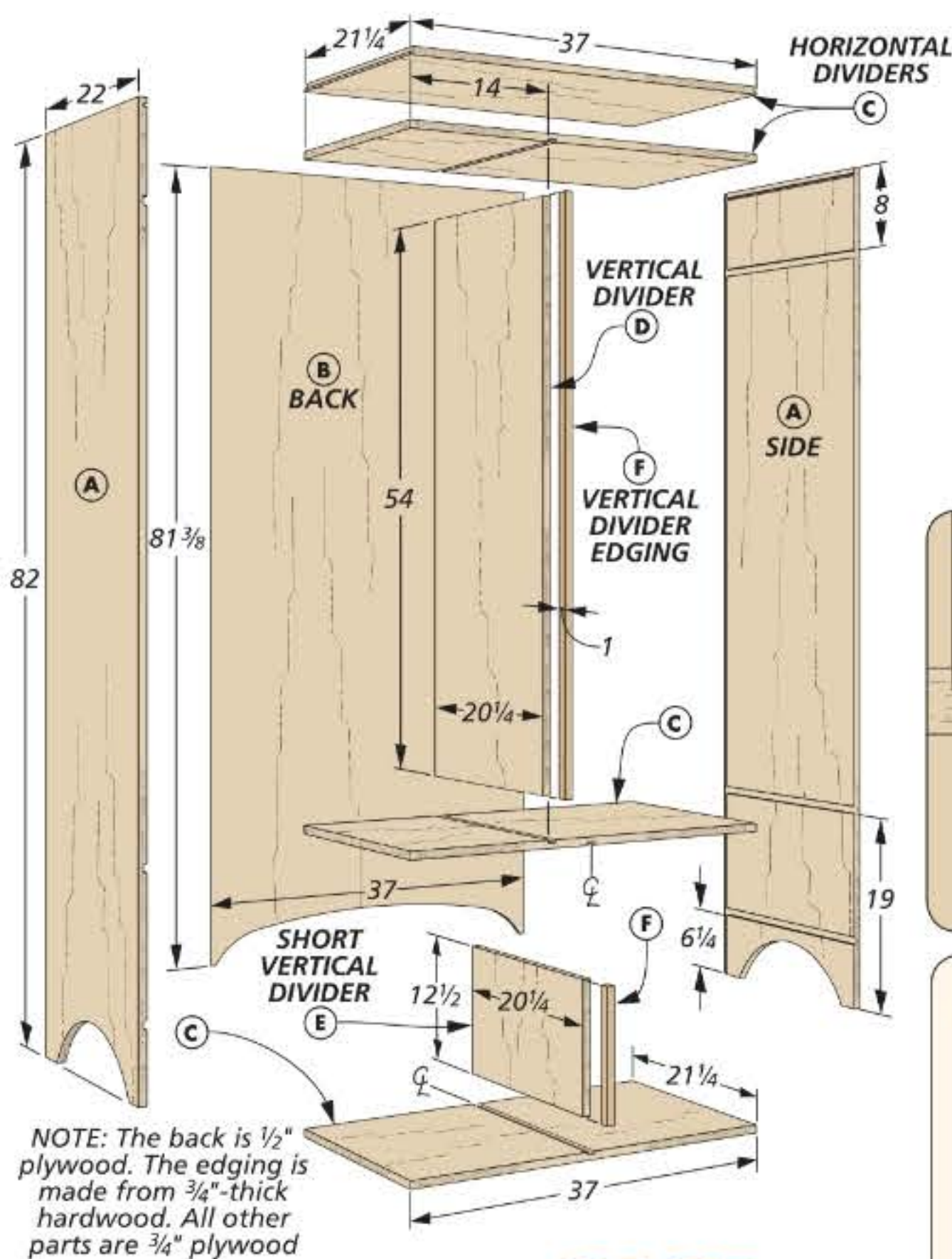
Construction Overview / OVERALL DIMENSIONS: 44"W x 83"H x 26"D



▲ Behind the beautiful doors, there are plenty of storage options. A stack of adjustable shelves lets you customize the space to your needs. And there's a large compartment for all the items you would prefer to hang.

Arches at the top and bottom of the armoire soften the imposing shape gracefully. Just below the top is an alcove that gives you extra storage or an area to display decorations.





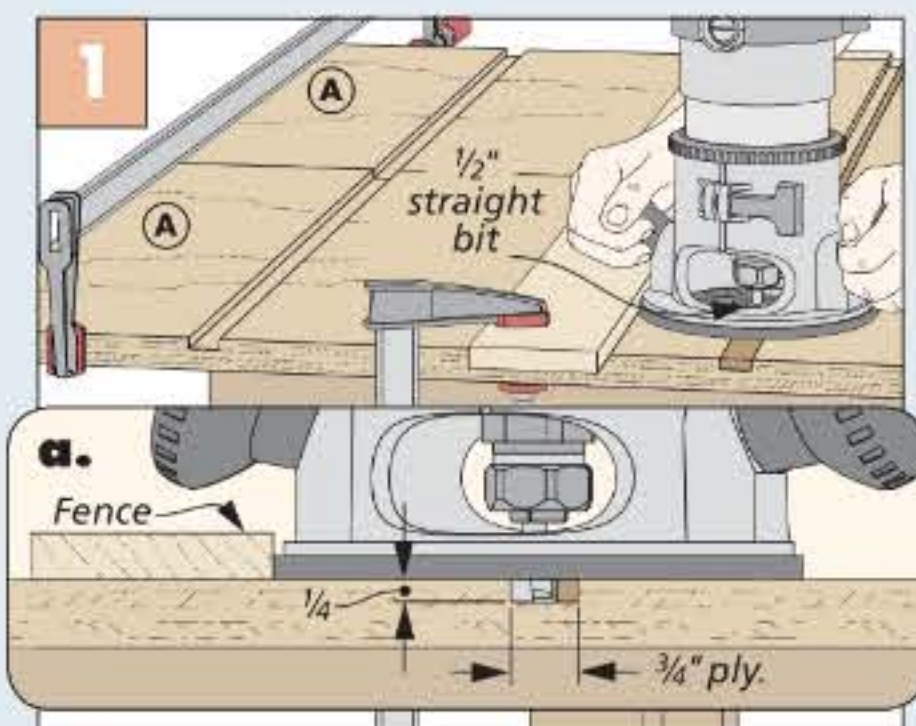
Start with the CASE

This large, free-standing case uses 3/4" plywood for the sides, four horizontal dividers, and two vertical dividers. For added rigidity, the back is 1/2" plywood. To get moving, I started by cutting the sides of the case to size.

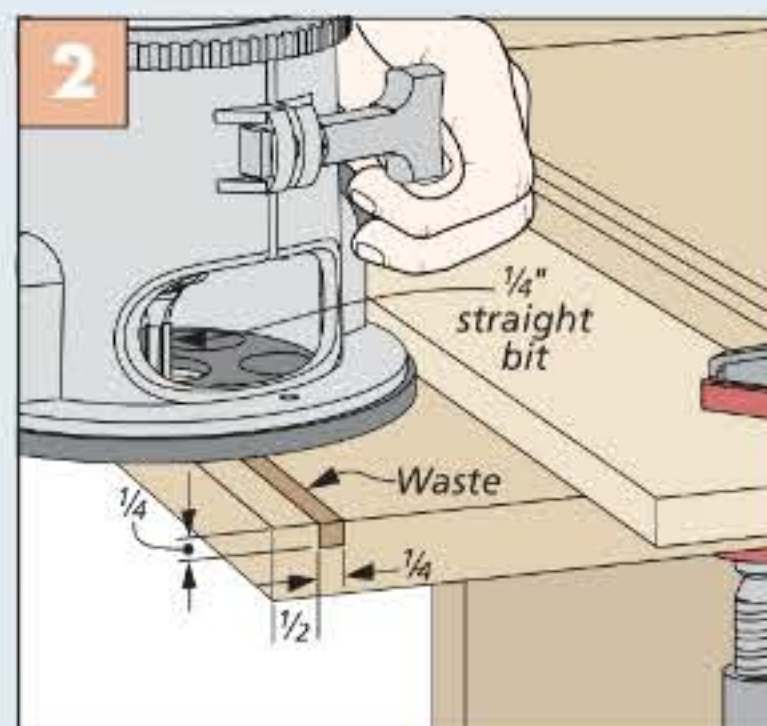
CASE JOINERY. As you see in the drawings and details above, there's some work to do on the sides, starting with the dados you see in Figure 1 below. These are the dados needed for the horizontal dividers. Because of the length of

the case sides, I did this at the bench with a router, straight bit, fence and clamps. Taking multiple passes with a 1/2" bit will give you an exact fit. Figure 2 shows how to make the dado for the uppermost divider. Jumping over to

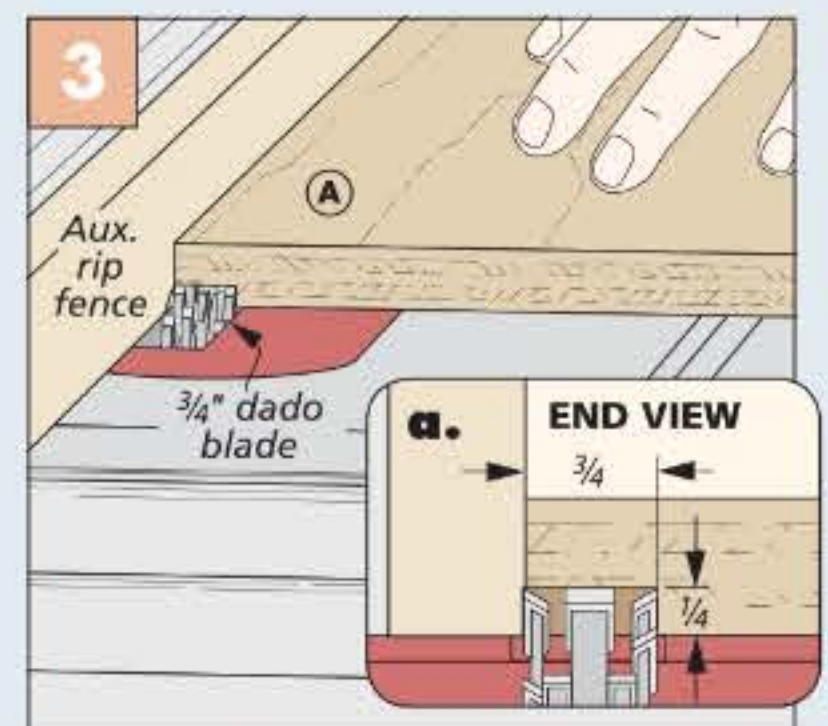
How-To: CUT DADOES & RABBET



Dadoes First. For perfect-fitting joinery, make the dados in the sides in multiple passes with an undersized router bit.



Another Dado. The case sides have a dado at the top that mates with the uppermost divider.



Rabbet for the Back. The rabbet in the back of the sides fully conceals the plywood back once installed.

the table saw, make the rabbet for the back (Figure 3 on the previous page). Next, cut the horizontal dividers to size and take them over to the table saw.

HORIZONTAL DIVIDERS. The four pieces that tie the sides together all start out the same size. After that, there's some unique milling to be done on each piece, starting with the top divider. This divider has a tongue on the ends to mate with the sides. Figure 1 to the right shows the details.

MIDDLE PANELS. The mirrored, inside faces of the two interior horizontal dividers have a dado that holds the vertical divider. Once you've set the saw up for this, you can cut the dados in the opposing faces (Figure 2).

LOWER PANEL & BOTTOM. It's the same scenario for the underside of the lower interior panel and the bottom one, as well. But their mirrored dados are centered to hold the short divider. With all that done, now turn your attention to making the vertical dividers.

VERTICAL DIVIDERS. The two vertical dividers serve different purposes. The long one that you see in the main drawing on the previous page supports the adjustable shelves on one side. On the other side, a wardrobe rail is attached for hanging clothes. The short divider in the lower opening provides a surface to attach the drawer slides.

The edges of both pieces are visible when the doors and drawers are open. So I attached hardwood edging to them. After gluing and clamping the edging in place, use a router and flush-trim bit to trim the edging (Figure 3).

In preparation for the next step, you'll want to dry assemble the case. Then, measure and cut the back panel to size. Now you can add a decorative touch to the back and sides.

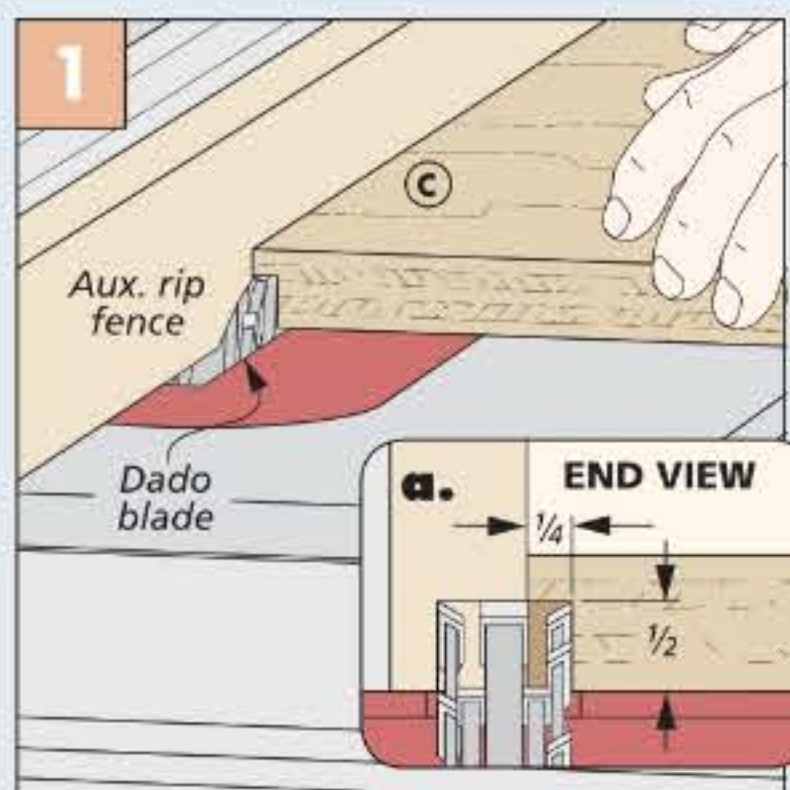
ARCS & CURVES. In the main drawing on the previous page, notice that the bottom of the sides have an arc. You'll also notice in detail 'g' that the arc on the side isn't centered, it's shifted an inch towards the front of the case. (Once the edging is glued to the sides, the arc will be centered.) After drawing the arc on the sides, remove the waste area with a jig saw (Figure 4). Sand the face of the arc smooth and ease the sharp edges

with sandpaper. It's the same process for the back, it's just a different curve that you're cutting. The pattern at the bottom of the page shows the shape needed in this instance.

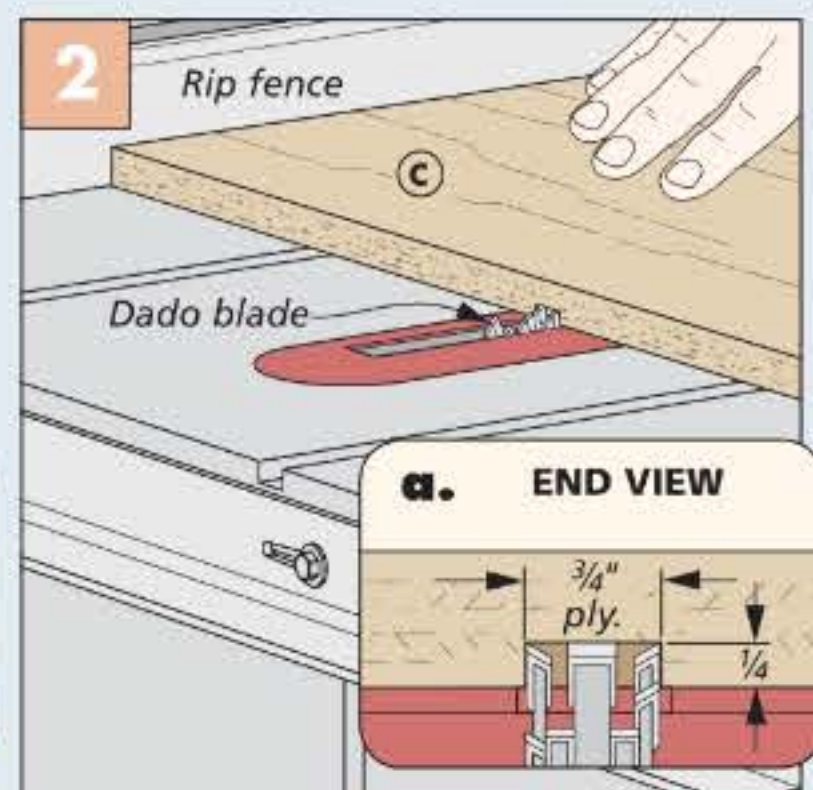
When these two steps are complete, it's time to assemble the case.

While gluing and clamping the case together, use the back to hold everything square. But don't attach it yet. There's more work to do on the case and having full access to the interior will make the process much smoother. That adventure starts on the next page.

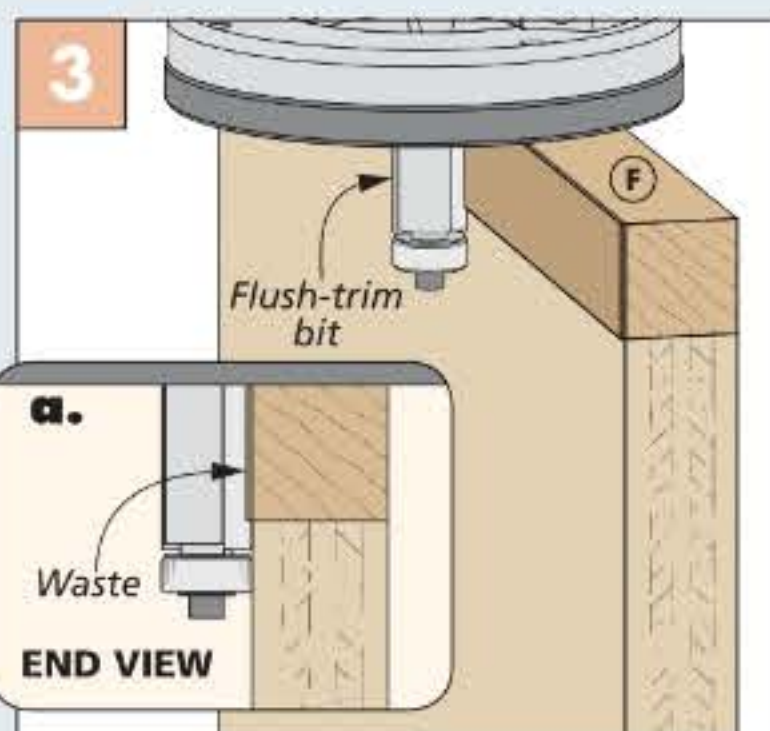
How-To: CUT THE TONGUE, DADOES & CURVES



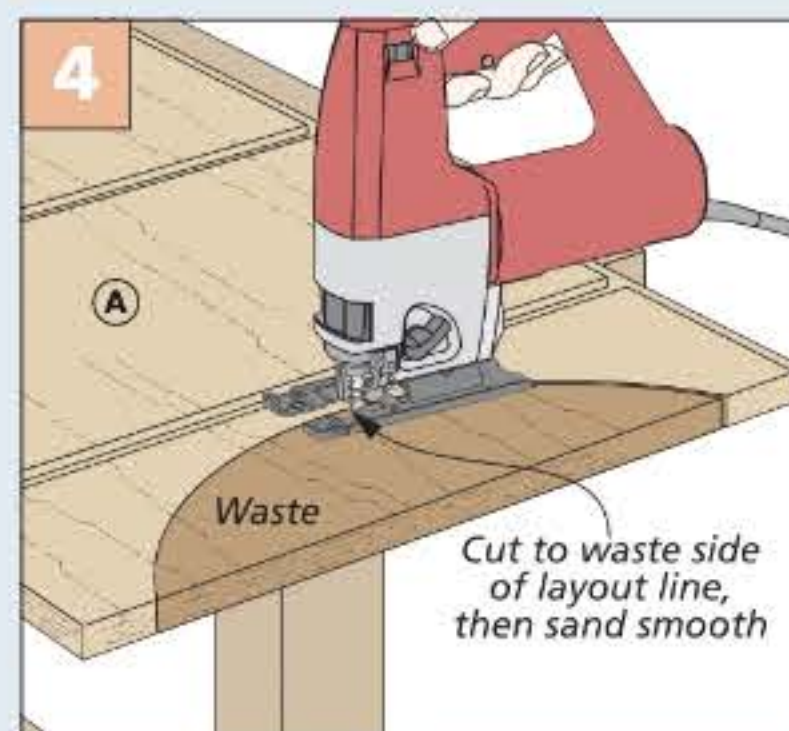
Tongues on the Top. A rabbet in the ends of the top divider forms the tongue that mates with the sides.



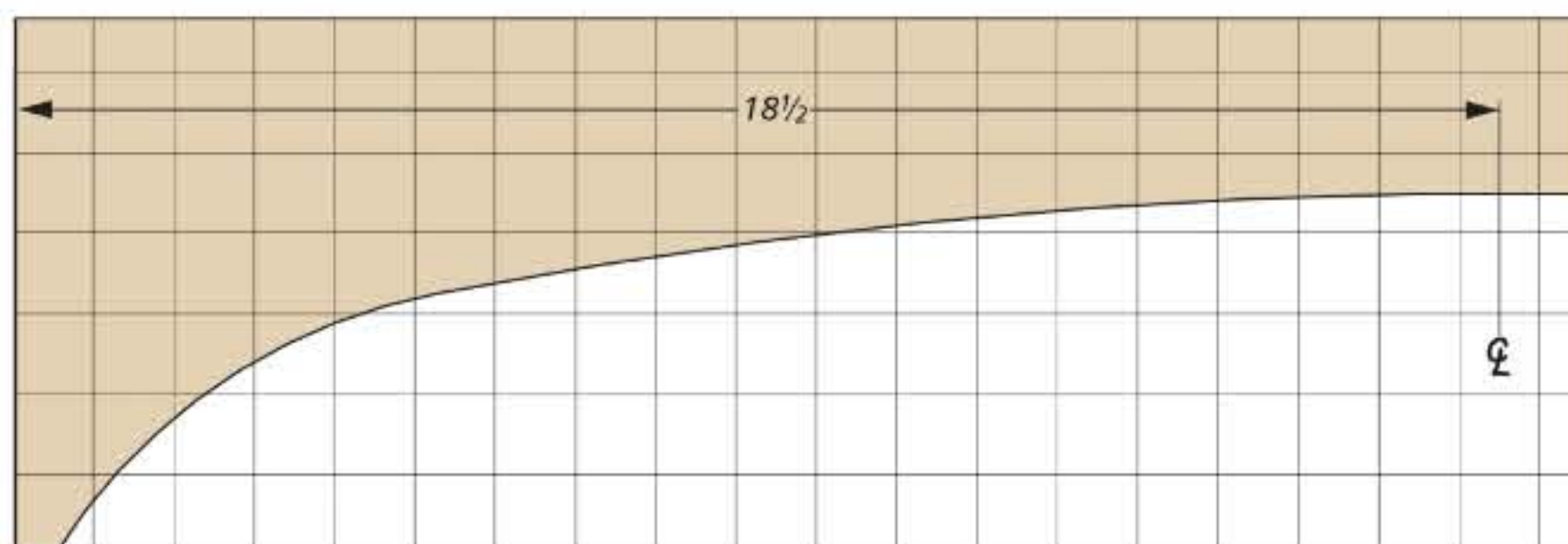
Dadoes in the Dividers. Two of the horizontal dividers have dados that hold the vertical dividers.



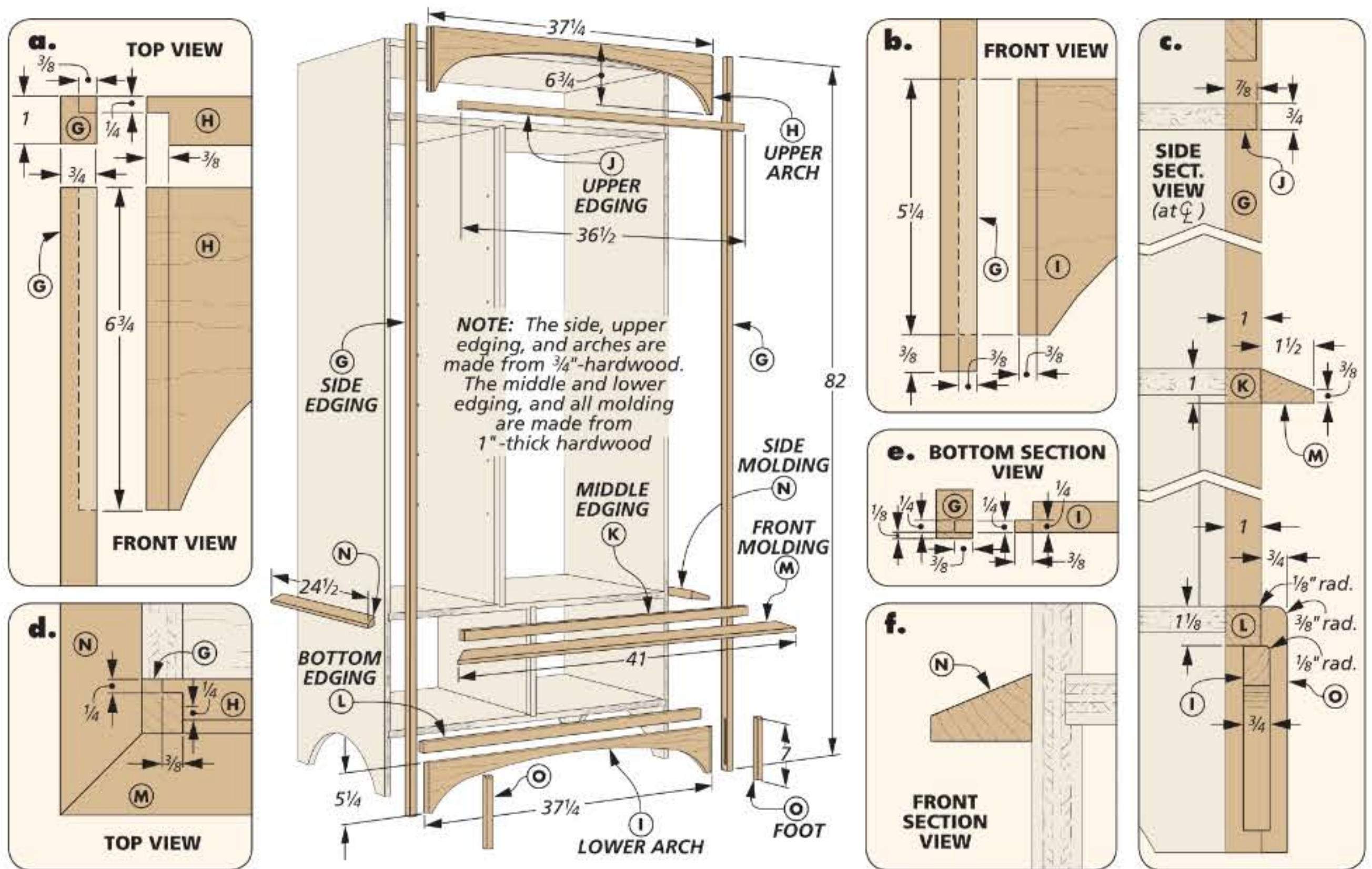
Dress the Edging. Once the glue is dry, rout the hardwood edging flush with the dividers using a flush-trim bit.



Arc in the Side. A jig saw is the tool to use for the arc in the side. Going slowly will make the clean-up easy.



BACK CURVE (scale: 1 square = 1 inch)



More EDGING & TRIM

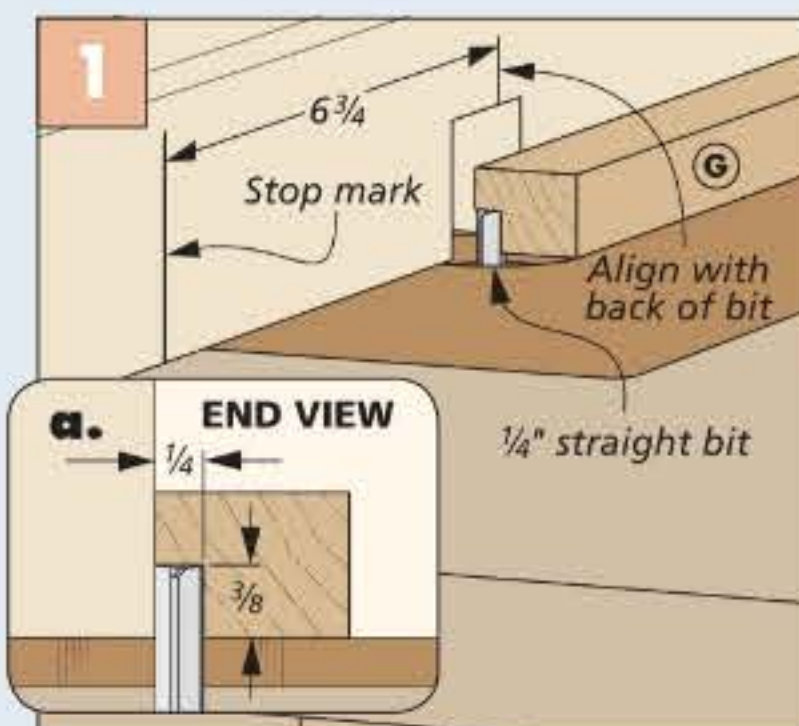
With the basic case assembled, the next step is to trim it out with some edging and molding. Different thicknesses of edging cover the plywood edges. And a pair of arches at the top and bottom mirror the curves in the sides and back

of the case. Finally, a belt molding runs around three sides of the case, tying everything together.

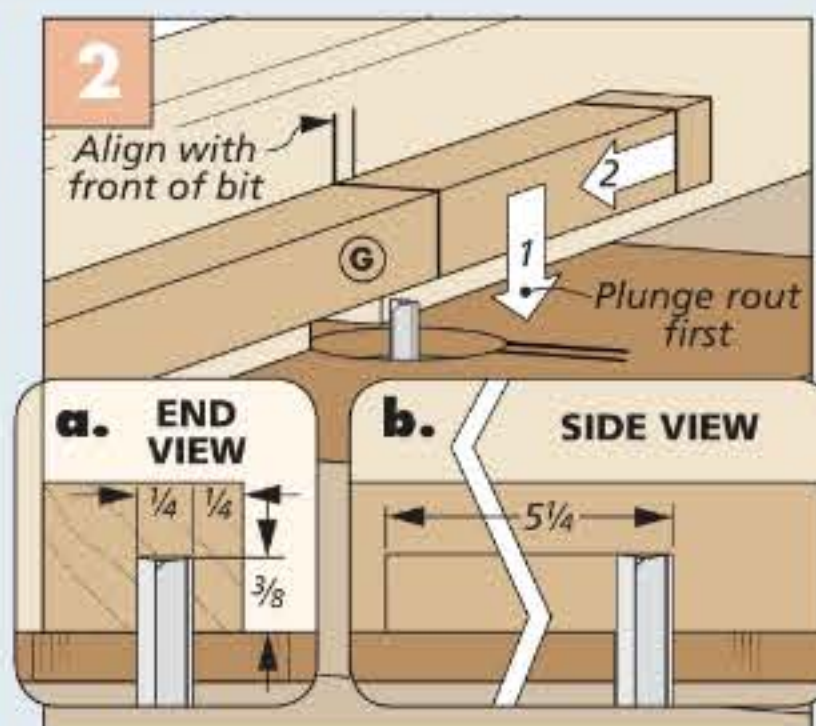
EDGING. The edging for the sides has a stopped rabbet in the top and a mortise in the bottom to hold the arches.

At the router table, use a straight bit to cut the rabbets in the top of the edging for the arch (Figure 1). Then mark the location of the front and back of the bit on the fence and table. Doing this sets you up to plunge the other end of the workpiece for the lower mortise, as seen in Figure 2. Square up the mortises and rabbets with a chisel.

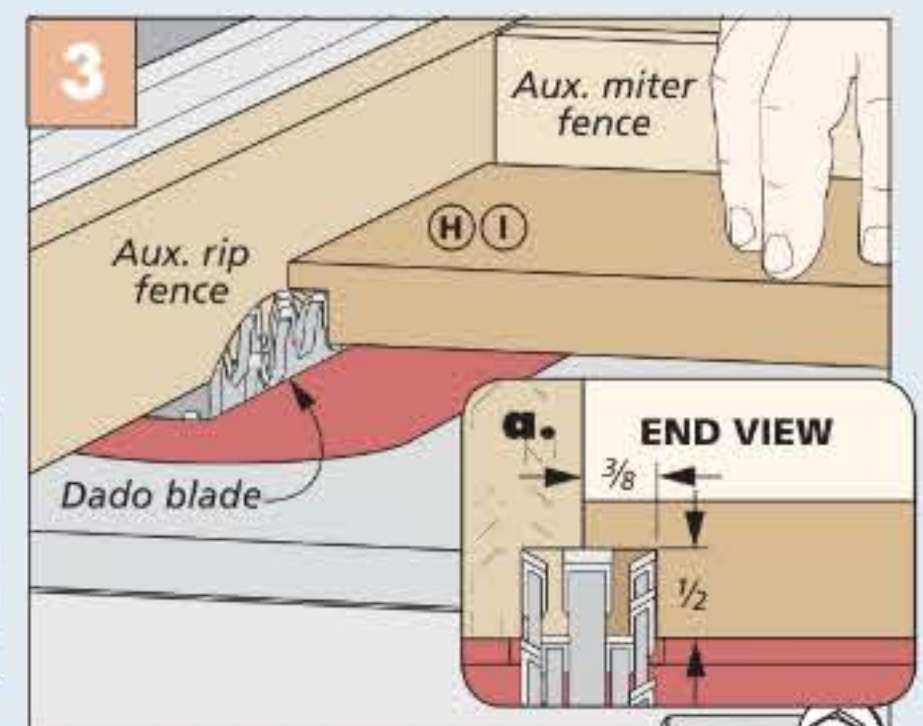
How-To: CUT MORTISES & RABBET



Rabbet for the Top Arch. At the top of the side edging, cut a stopped rabbet to mate with the upper arch.



Mortise for the Bottom Arch. The bottom arch is contained within the side edging, so a mortise is needed.



Rabbets in the Arch. The arches are different widths, but the rabbets in their ends are the same.

ARCH BLANKS. As you can see in the patterns to the right, and the drawings on the previous page, the pieces that make up the arches are the same length and have identical rabbets, but are different widths. Once you've sized the pieces, cut the rabbets (Figure 3 previous page) in the ends of both.

LAY OUT CURVES. Following the details provided in the patterns, lay out the arcs on the appropriate workpieces. Then it's just a matter of cutting away the waste in the same way you did on the sides and the back. Since these edges are visible, it's a good idea to clean up the profile of both workpieces at the drill press using a sanding drum. With that task out of the way, it's time for some assembly work.

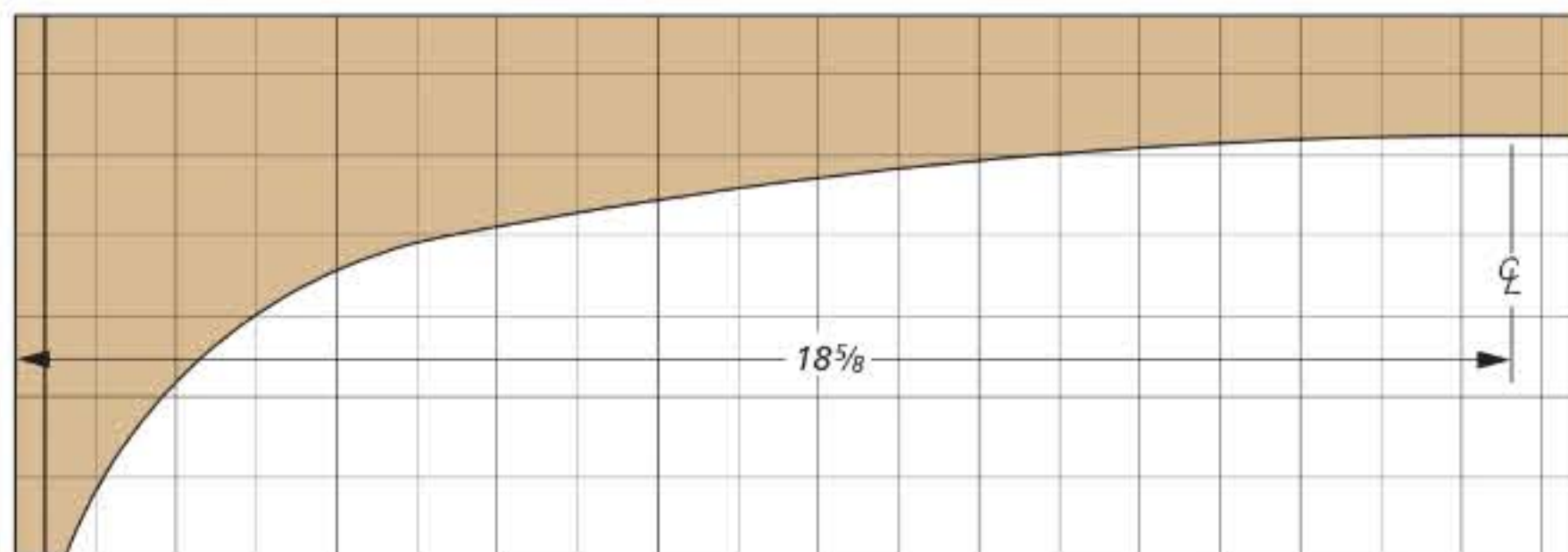
GLUE UP. The edging and arches are front and center on this project so I wanted them to be attached seamlessly to the case. To pull this off, I did the glue-up in two stages. First I glued one edge to its mating case side, making sure everything was flush.

When the glue was dry, I installed the arches, then clamped and glued the other edging in place. All this took a little more time, but the end results were worth the effort. (This is one reason why you're leaving the back off.) After pulling off the clamps, cut and install the remaining edge pieces. Then you can focus on the belt molding.

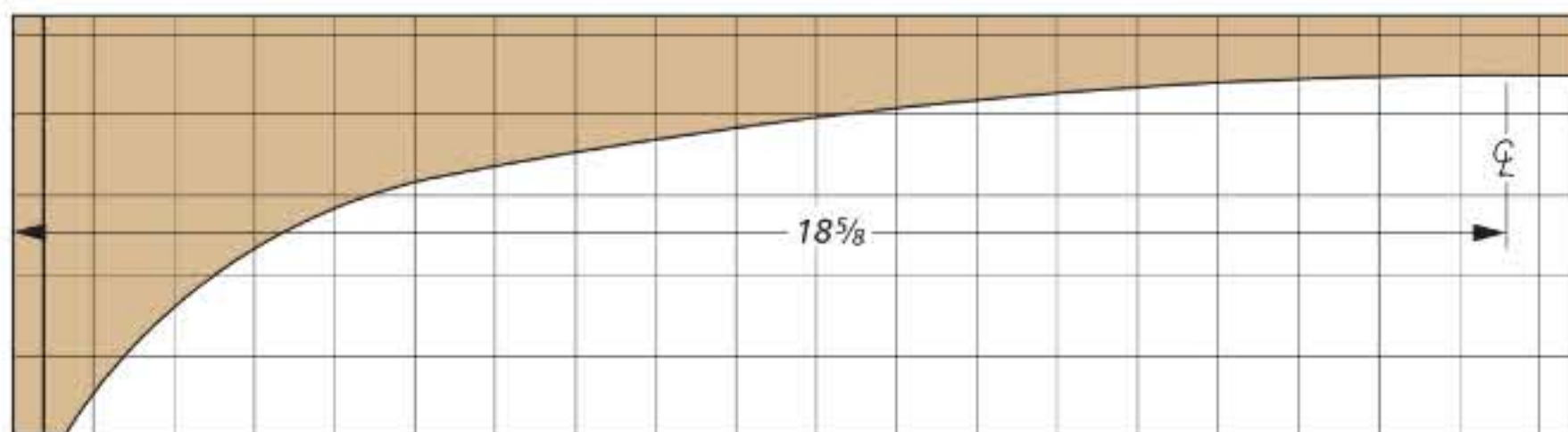
BELT MOLDING. The belt molding that separates the doors and the drawers provides a visual break to the large surfaces of the armoire. They're beveled pieces that reflect light, as well, providing nice contrast. To start, cut the bevel in all the pieces (Figure 1).

FRONT FIRST. Next, cut the miters on the front belt molding (Figure 2). To prevent the piece from shifting while gluing it to the case, drive some brads into the edging and clip the heads. The detail in Figure 3 shows this. Now you can fit the side moldings to the front. Use trimmed brads again and be sure the pieces are square to the case before gluing them.

FEET. The last element to add to the case is a pair of feet. They're glued to the face of the side edging. Making the radius on the top edge is a simple affair (Figure 4). Now it's on to the doors.

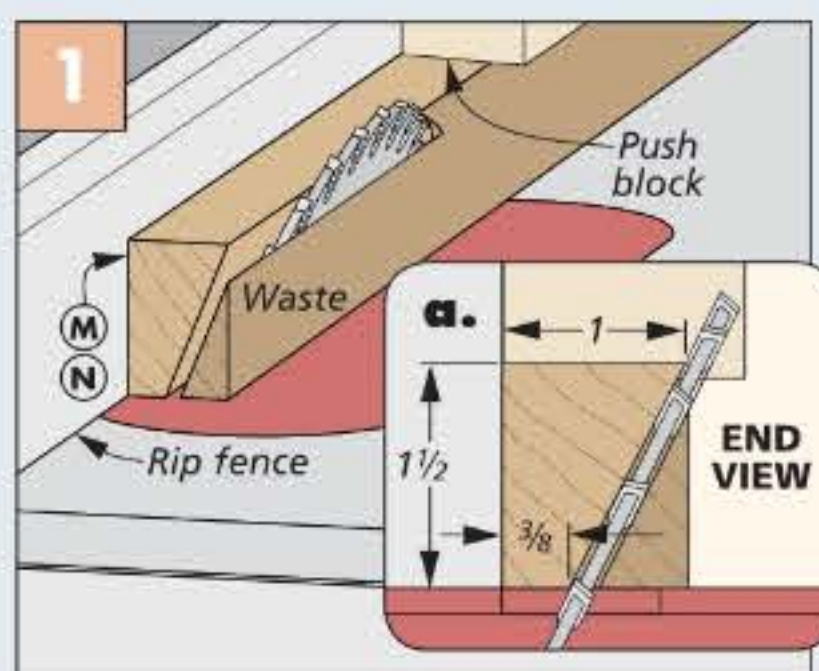


UPPER ARCH CURVE (scale: 1 square = 1 inch)

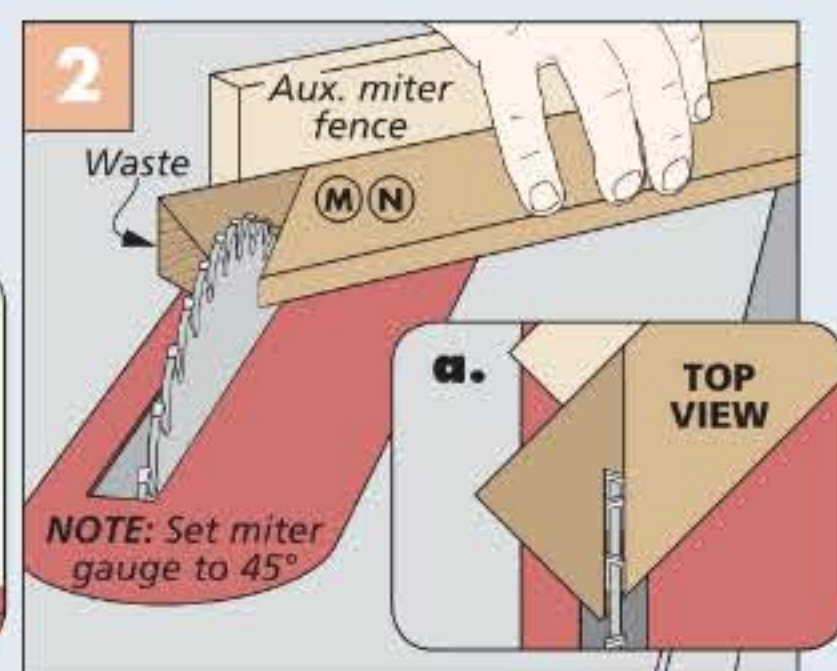


LOWER ARCH CURVE (scale: 1 square = 1 inch)

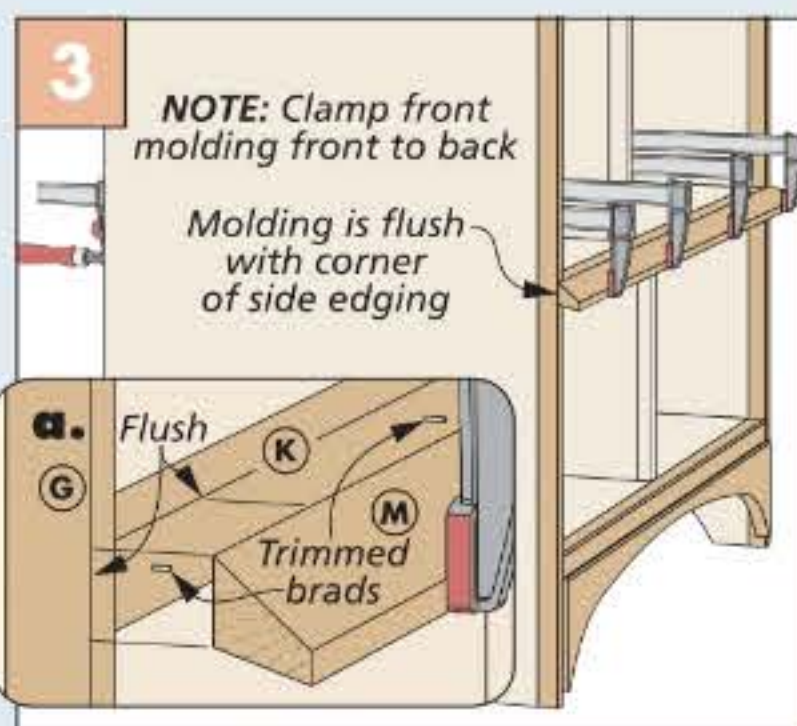
How-To: MAKE THE BELT MOLDING & FOOT



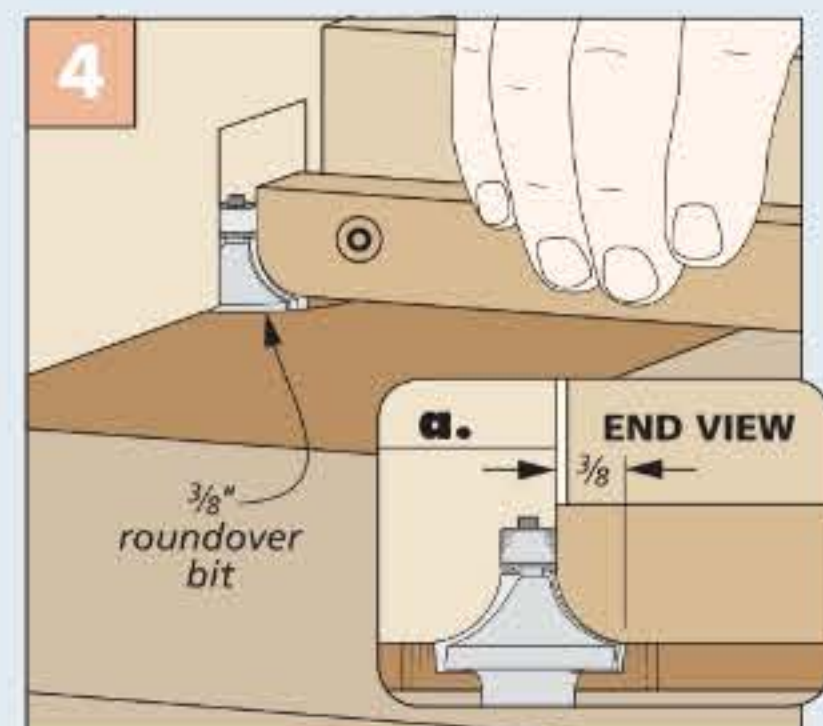
Cutting the Bevel. Cut the bevel in the belt molding first. Sand the face smooth before mitering the corners.



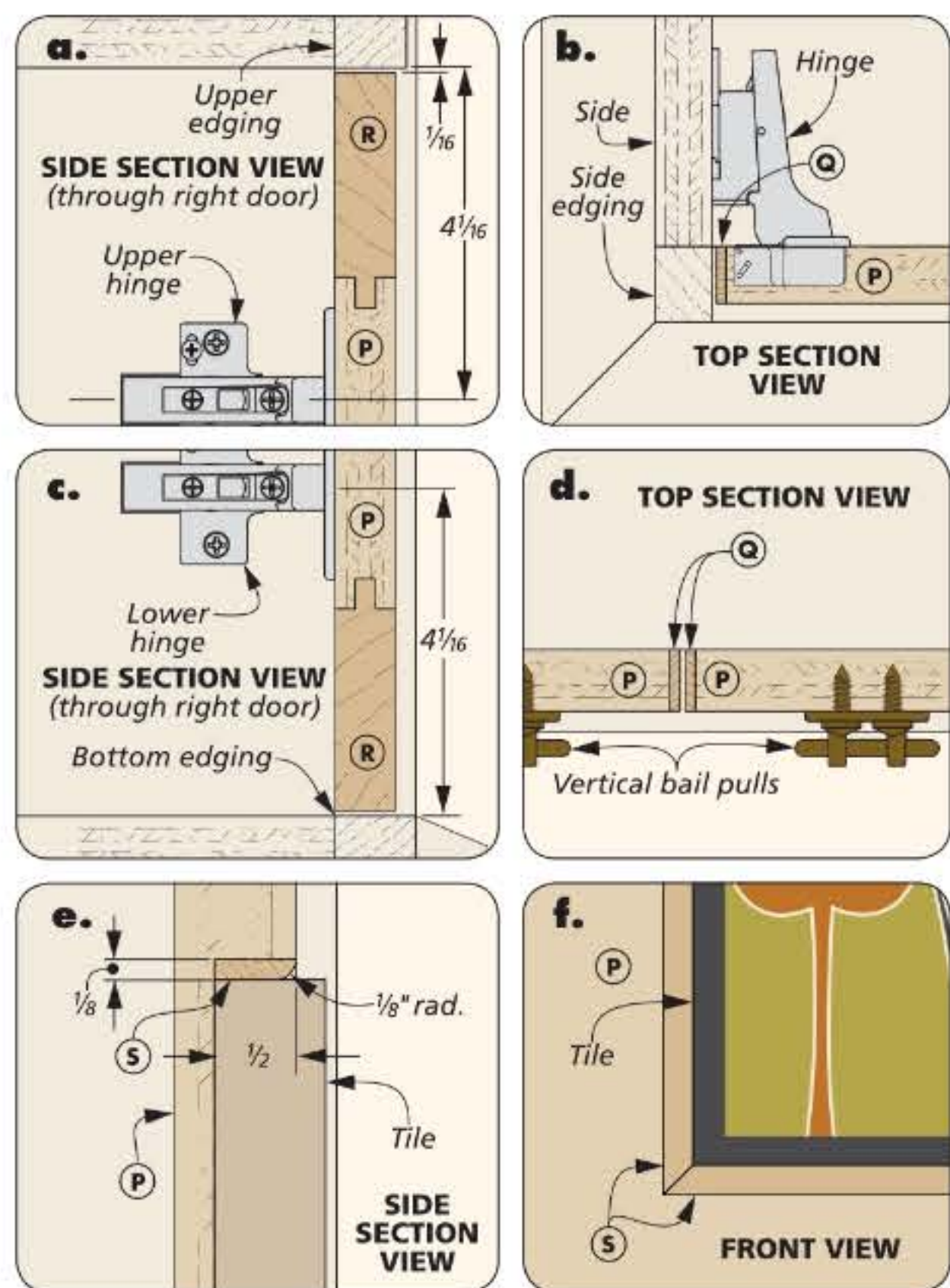
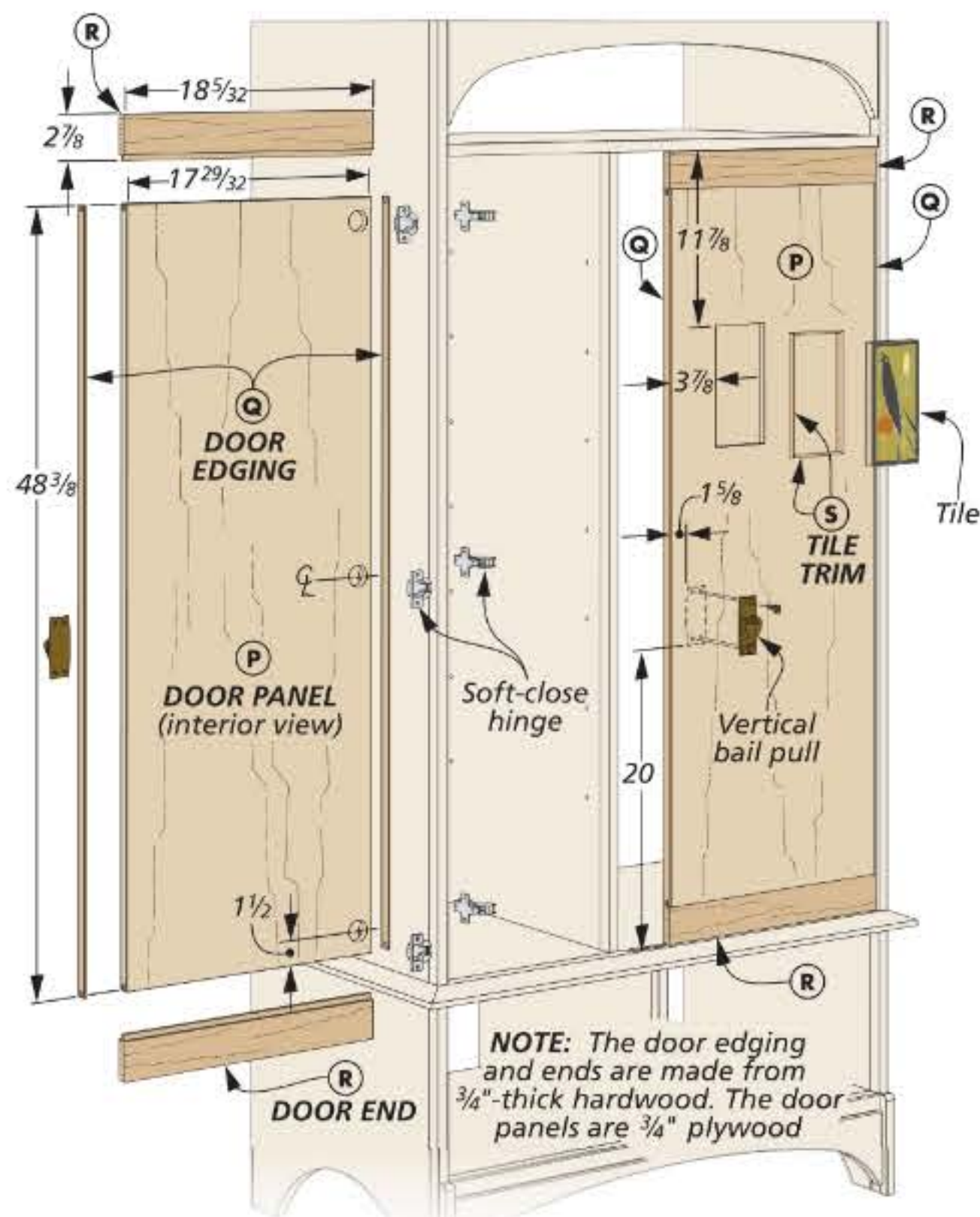
Miter the Molding. Miter one end of the belt molding. Mark the location of the other miter at the case.



Front Molding First. Using clipped brads to hold the molding in place, clamp it to the case through the back.



Rout the Foot. After routing the top of the foot, ease the outer edges before gluing it to the case.



Making the **DOORS**

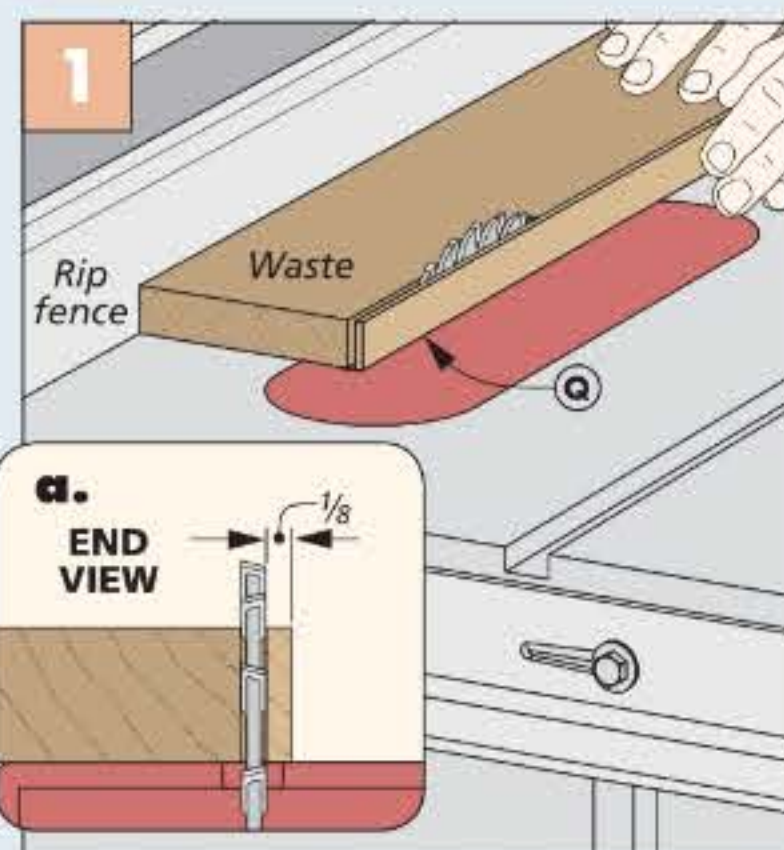
The doors on this project are plywood panels with hardwood edging. The top and bottom of the doors have bread-board ends made of hardwood. Early versions of armoires often had hardwood doors, or sometimes veneer over

wood cores. Using plywood solves a lot of problems with wood movement, labor, and material cost.

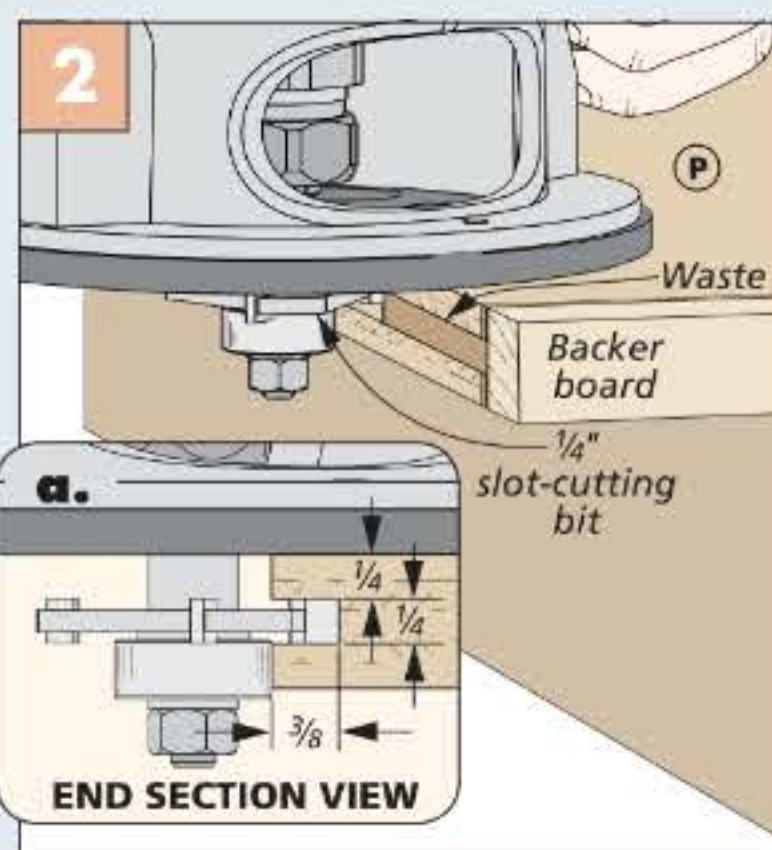
As you see in the drawings above and in the photos at the beginning of the article, artfully located in both doors is

a decorative tile that's been recessed into the plywood. The recess is large enough to accommodate some hardwood trim that hides the plywood edge. That will happen later. For now, let's start by cutting the plywood to size.

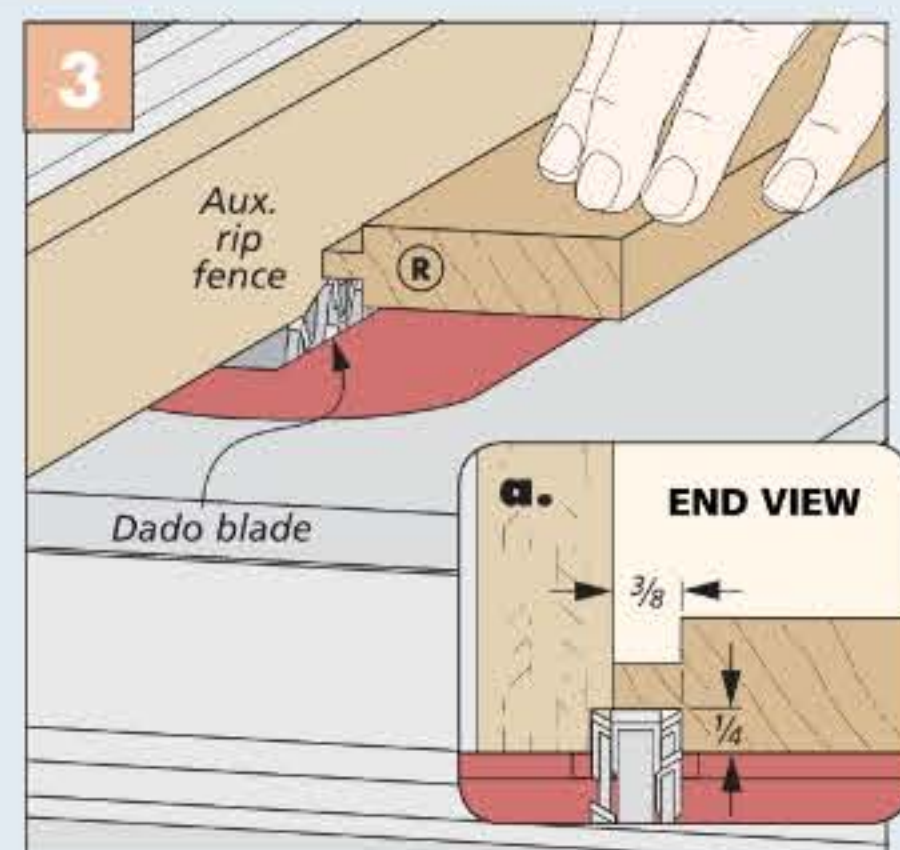
How-To: CUT DOOR EDGING, GROOVES & TONGUES



Strips for Edging. On a long piece of hardwood, rip the strips that make the edging for the door panels.



Groove in Door Panel. Cut a groove in the ends of the door panels to hold the door ends.



Tongues on Door Ends. At the table saw, cut rabbets in the edge of the door ends to form the tongue.

How-To: ADD THE TILE & HARDWARE

PLYWOOD INTO PANELS. Ripping the doors to width at the table saw is easy enough, but when cutting them to length I used my circular saw and a straightedge. When you've finished that task, you'll need to make the thin edging you see in Figure 1 on the previous page.

By the way, the same edging will go on the drawer fronts you'll make later, so rip enough edging for them as well. Back at the bench, you can glue the edging to the doors.

GROOVE IN ENDS. When the glue is dry and the edges are tidied up, it's time to make the grooves in the ends of the door panels that will join with the breadboard ends. Figure 2 shows the best way to do this.

BREADBOARD ENDS. The hardwood ends that fit in the plywood panels aren't hard to make. Figure 3 shows you how. Then you can glue the pieces in place. Just be sure that they stay flush to the plywood panel while the glue dries.

DRESSING OUT THE DOORS

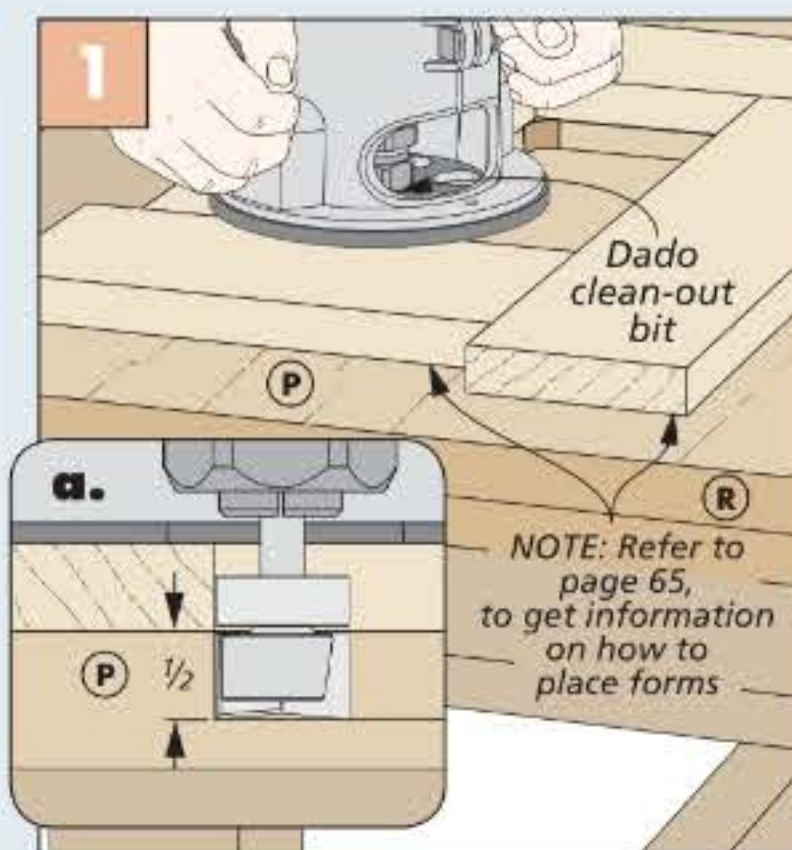
The beautiful tiles that are inset in the doors come from *Motawi Tileworks*. Sources on page 67 has the details for purchasing them. It's best to have the tiles on hand for this next step.

Detail 'e' on the previous page reveals that the tiles, although recessed, stand a little proud of the surface and are framed with thin pieces of hardwood trim. Figure 1 to the right (and Shop Notes on page 65) show how to use forms and some shims to create the tile recess. Then you can clean up the corners (Figure 2).

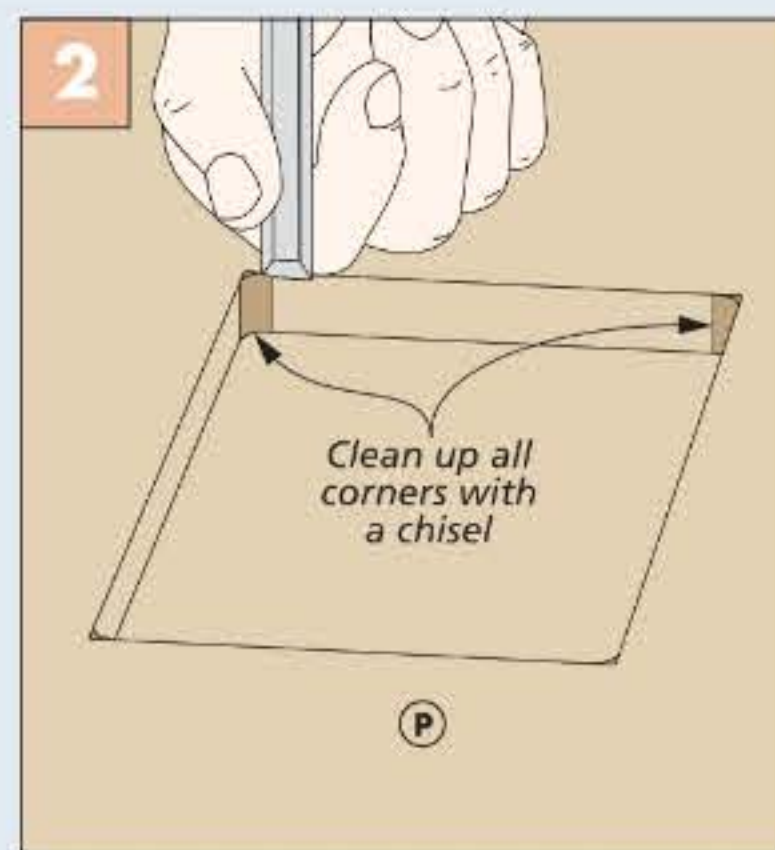
LINERS. Figures 3 and 4 show how to mill the tile trim strips that wrap the sides of the recess. Mitering and fitting each piece takes a little time. But once the openings are trimmed and sanded smooth, they look great.

It's a temptation, but hold off on installing the tiles for now. With the work that's yet to be done on the doors, you don't want to risk damaging them.

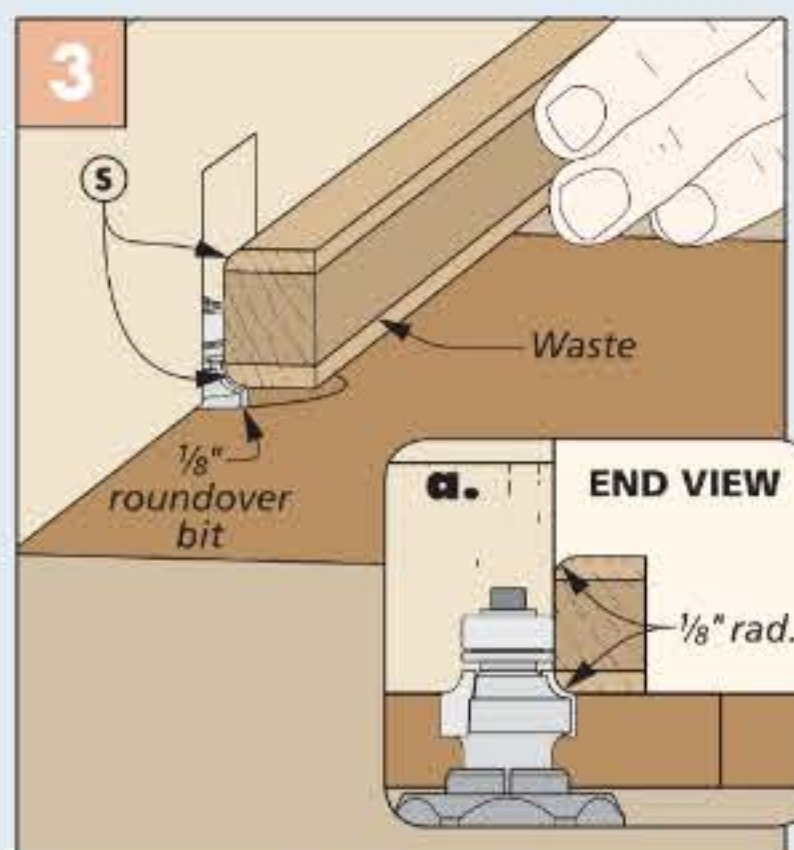
HARDWARE. Drilling the holes for the hinges completes the work on the back of the doors (Figure 5). On the front, install the pulls (Figure 6). I made a wrench out of a wood dowel to install the screws. Next up are the drawers and top of the armoire.



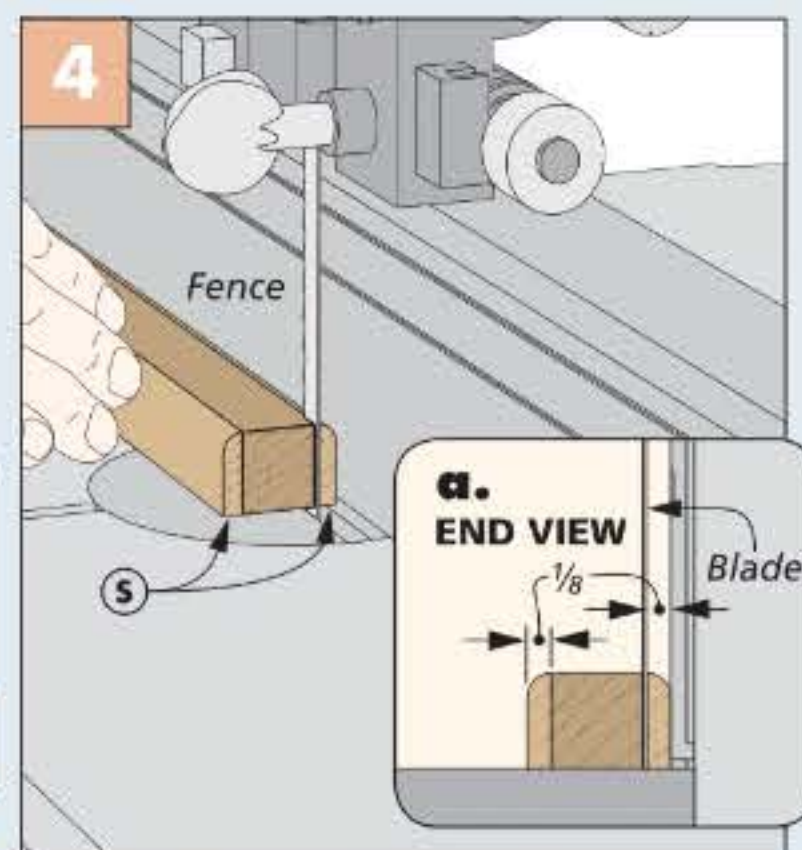
Recess for Tiles. After routing the perimeter, work the router back and forth across the forms.



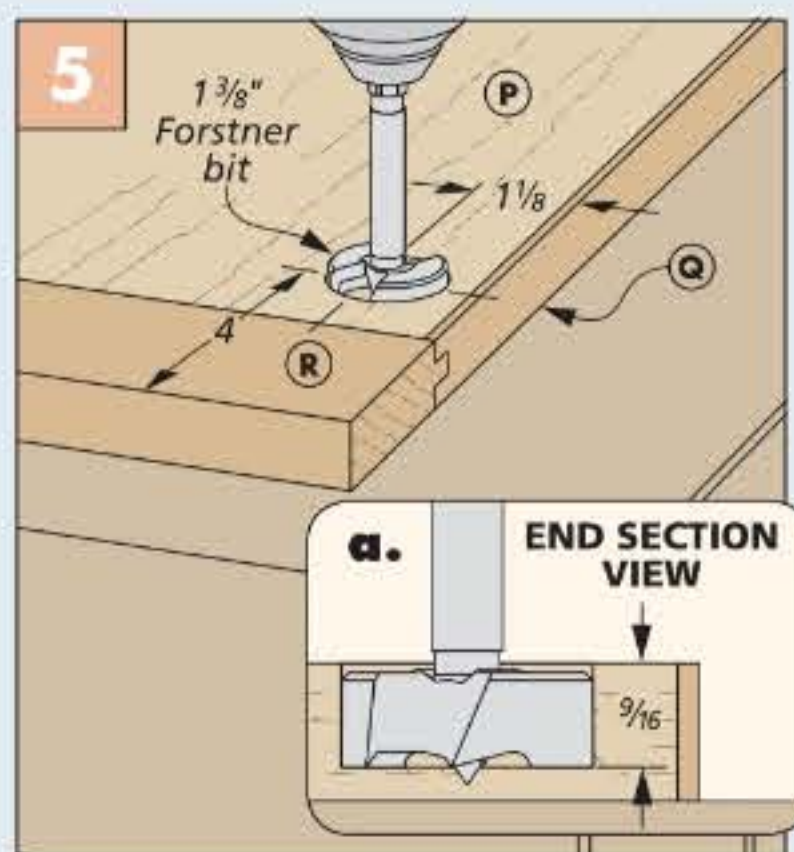
Clean Up Recess. After routing the recess, use a chisel to square the four corners of the tile recess.



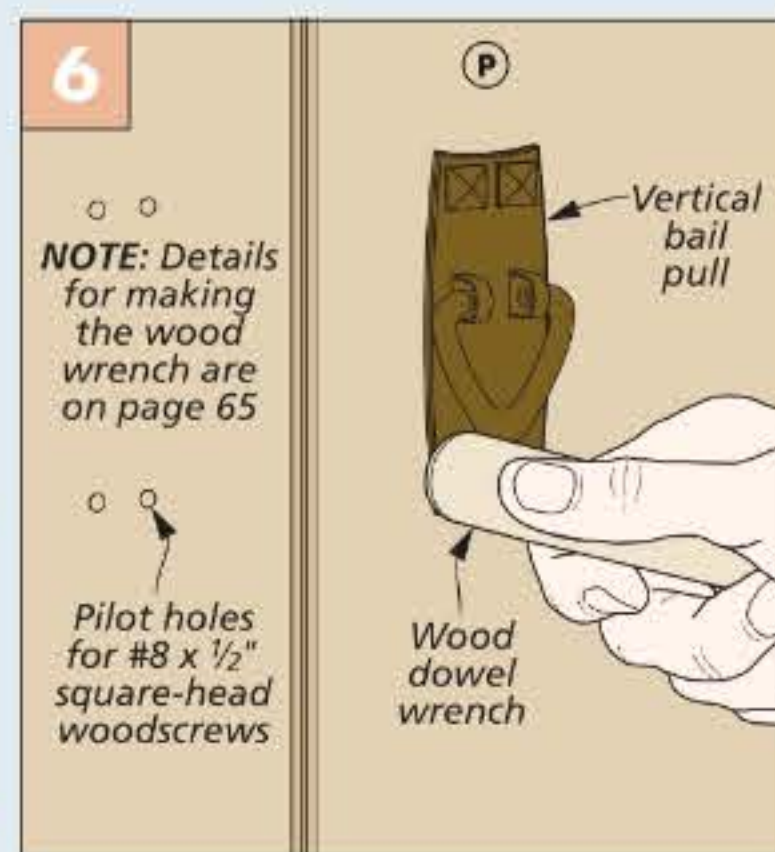
Round Over Tile Trim. On an oversized piece, round over the edges at the router table.



Rip the Trim Free. At the band saw, rip the strips free and sand the blade marks as needed.

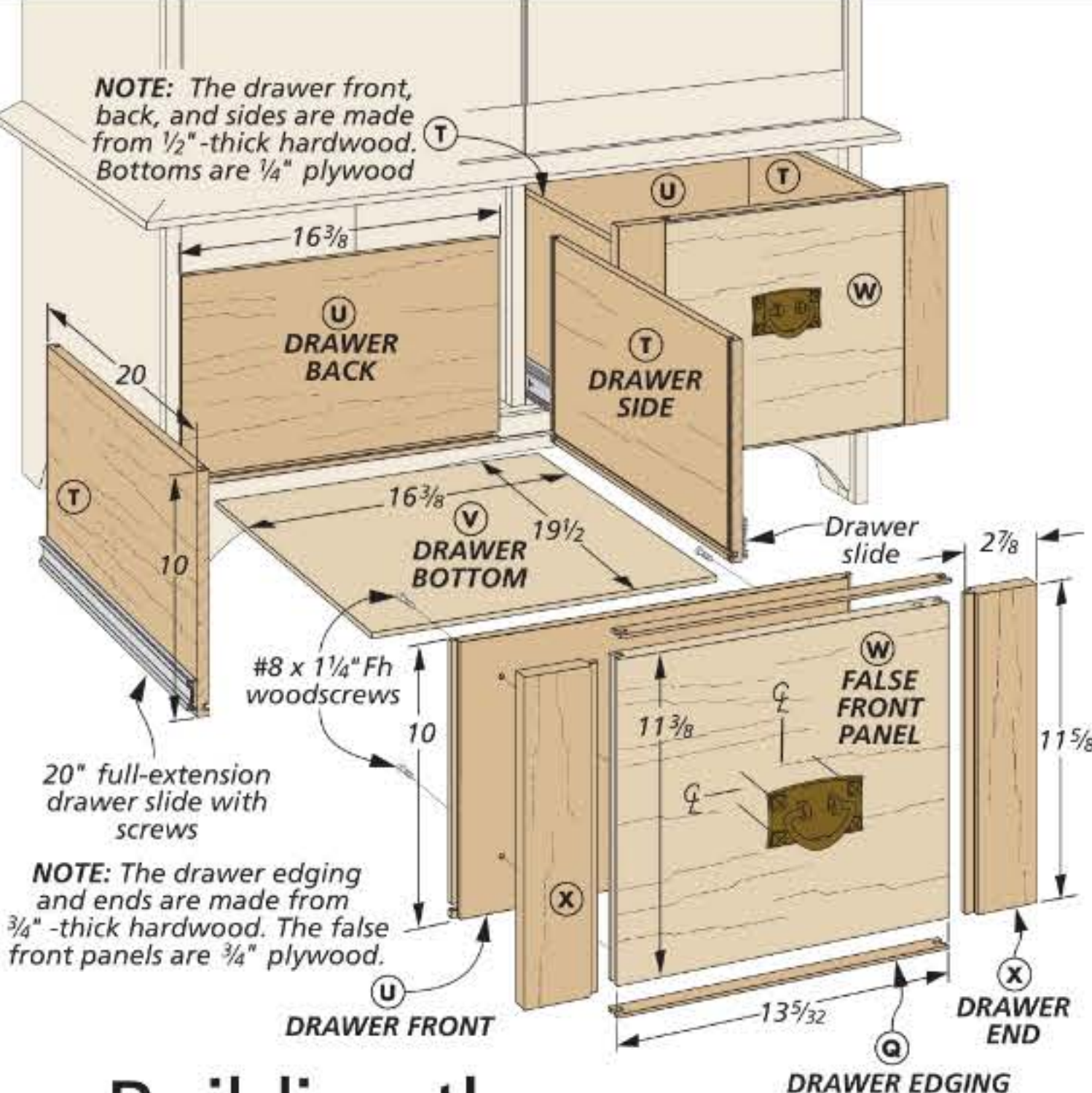


Door Hinge Hole. Use a Forstner bit to drill the holes in the back of the doors for the hinge cup.

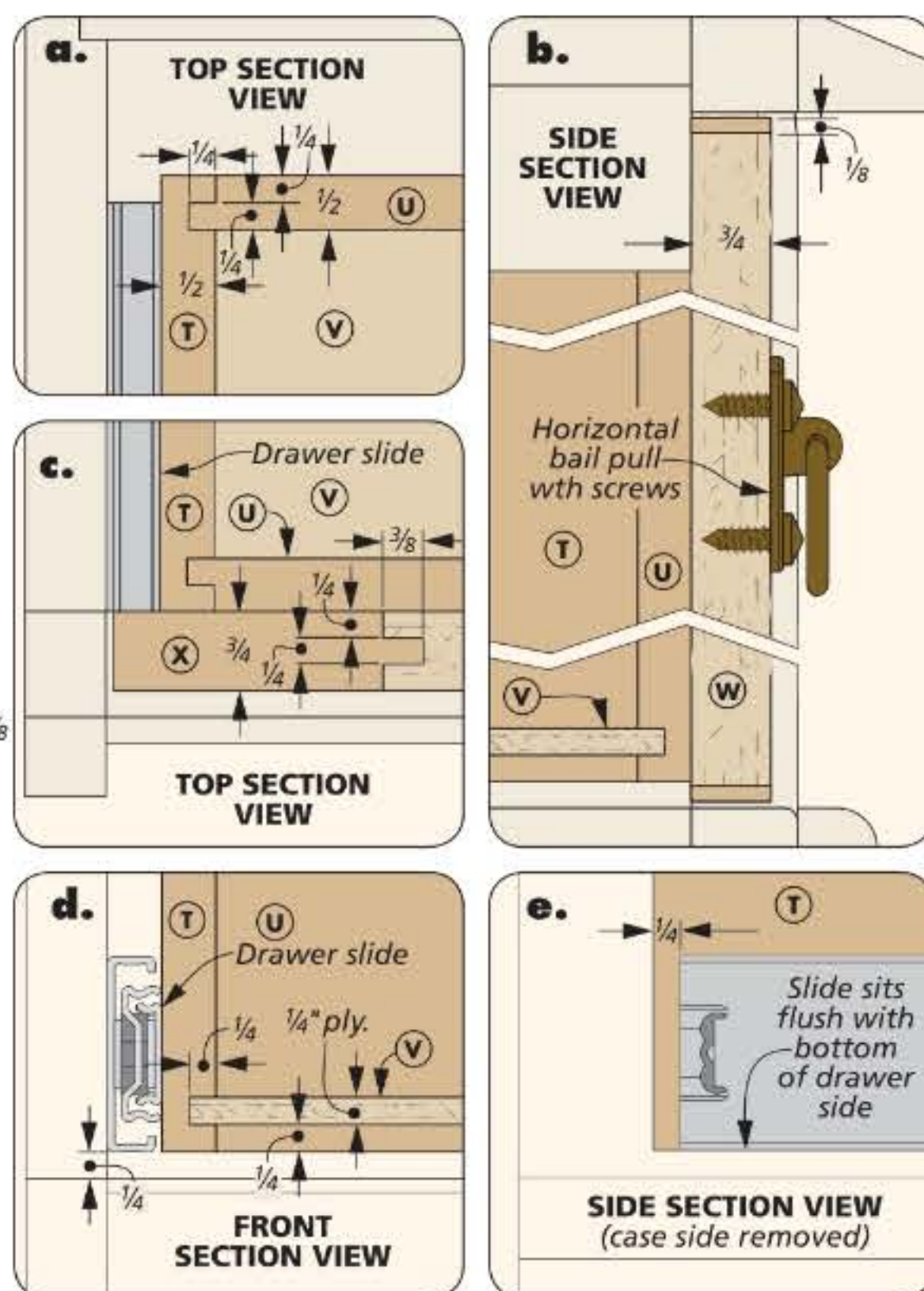


Attach the Pulls. A wrench made from a dowel prevents you from marring the screw heads.

NOTE: The drawer front, back, and sides are made from 1/2"-thick hardwood. Bottoms are 1/4" plywood



NOTE: The drawer edging and ends are made from 3/4"-thick hardwood. The false front panels are 3/4" plywood.



Building the DRAWERS & TOP

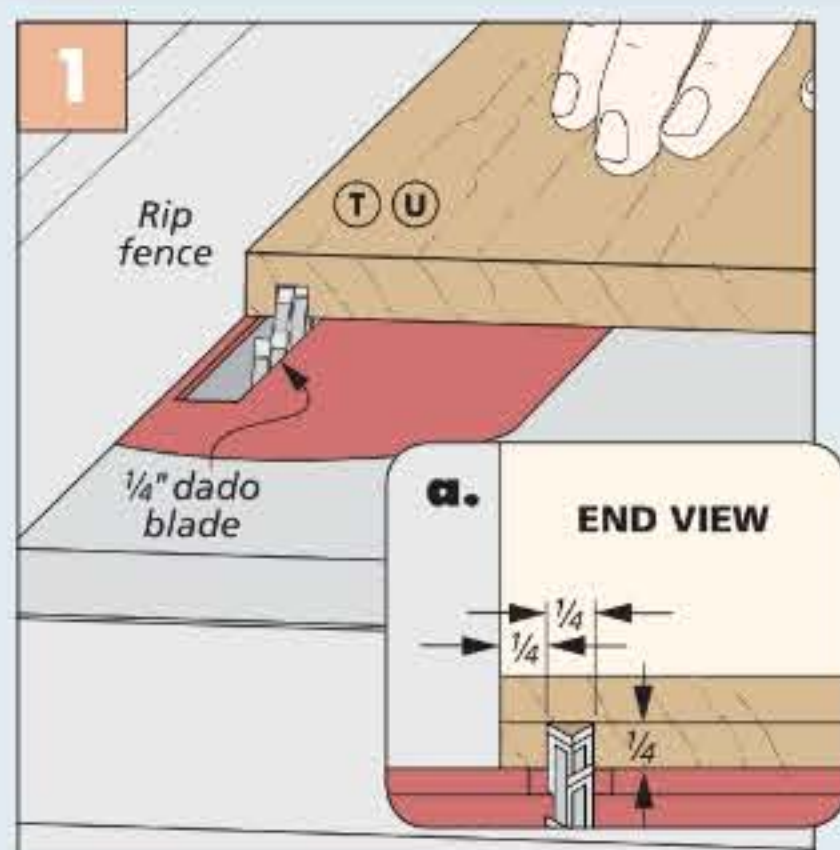
At the base of the armoire there are storage options of a different variety — two large drawers. As you see above, they're hardwood boxes that are joined with tongue and dado joinery and attached to the case with full-extension drawer slides for ease of operation.

The drawer false fronts are fashioned in the same breadboard style as the doors. Here though, the plywood grain direction has been turned 90° (running horizontally). Doing this gives some additional visual interest to the big surface that's the front of the armoire.

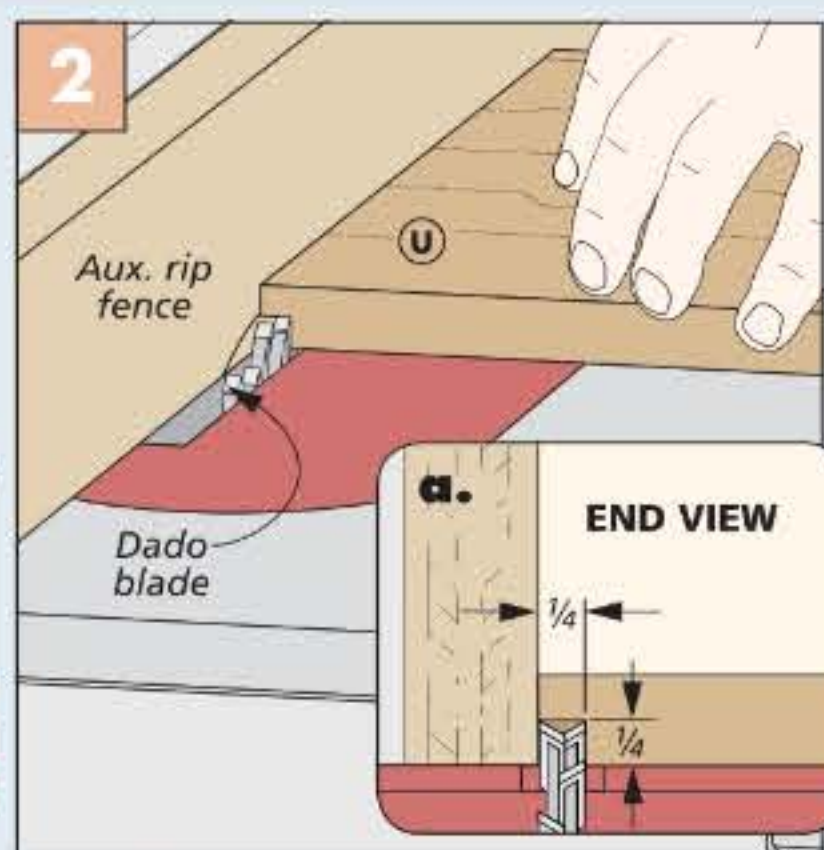
To get going, I headed to the table saw to start on the drawer boxes.

DRAWERS. Employing tongue and dado joinery is a quick way to make drawers that will last a lifetime. Figures 1 through 3 below show you the steps for making this happen.

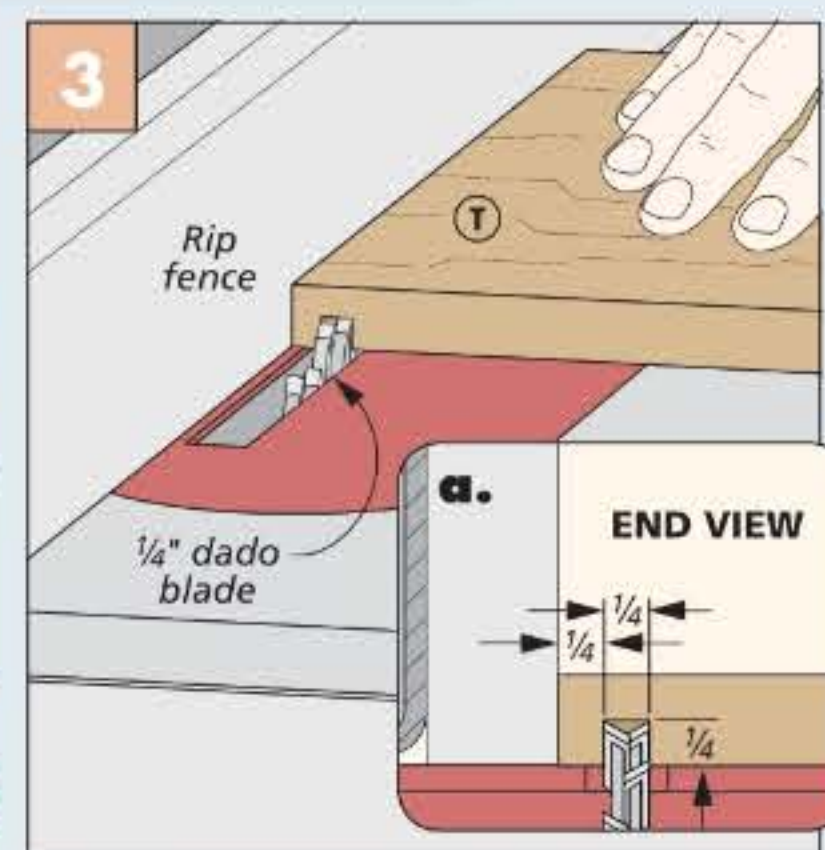
How-To: CUT GROOVES & RABBETS IN THE DRAWERS & TOP CAP



Groove in the Drawer Parts. All four parts of the drawer receive the groove that holds the drawer bottom.



Rabbet the Drawer Front & Back. An auxiliary fence attached to the rip fence lets you dial in the tongue thickness.



Dado in Drawer Sides. Cut dados in the sides to hold the front and back of the drawer firmly in place.

As for the false fronts, they follow the same procedure as the doors. But here, you could easily cut the grooves in the ends of the false fronts at the table saw and skip the router altogether.

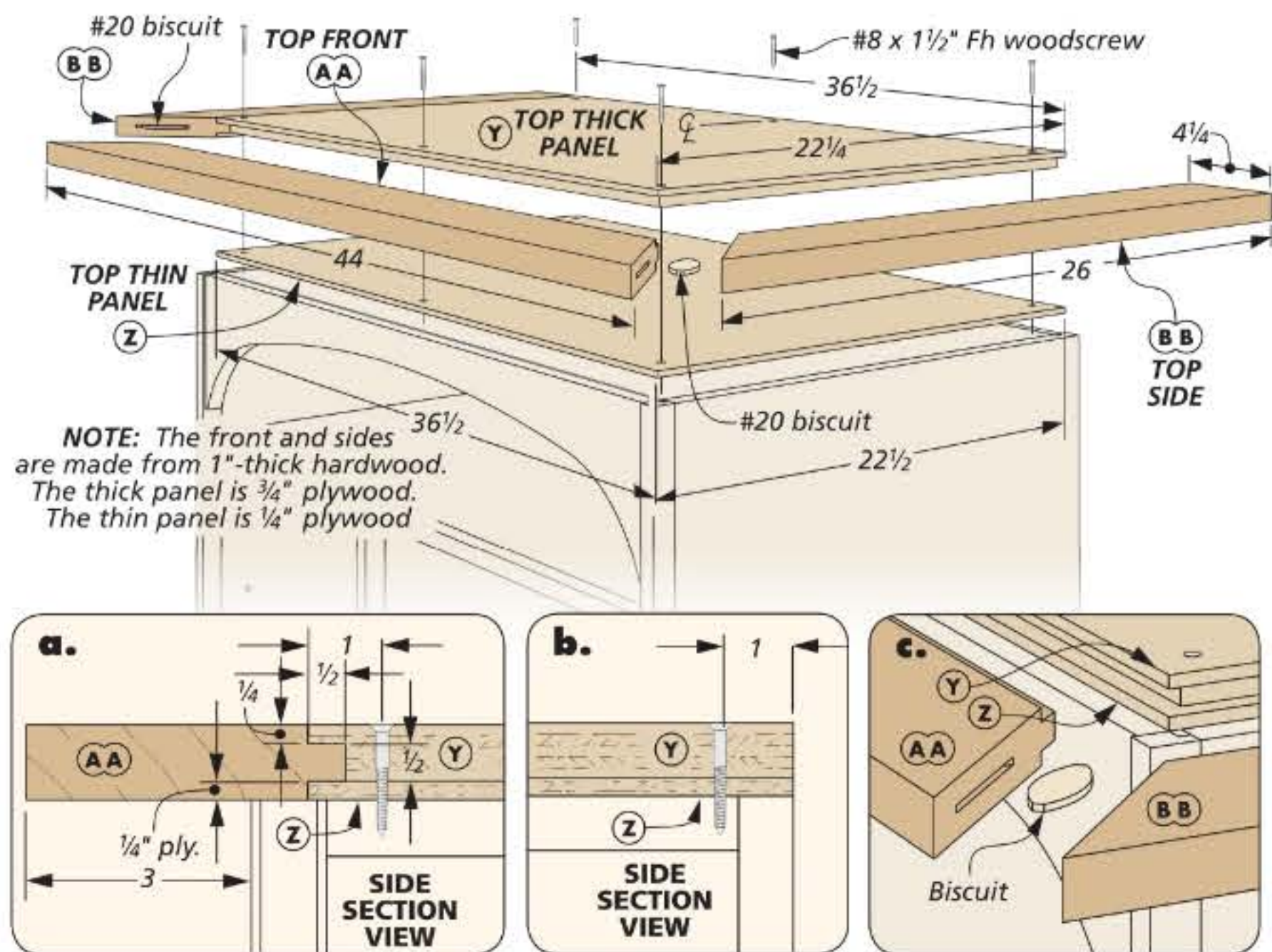
Before installing the drawers in the cabinet, I sprayed them with a couple of coats of lacquer. No stain needed here. For the sake of seeing in a dark drawer, I've always left the inside as light as possible. When they were dry, I attached them to the slides. Now you can focus on attaching the false fronts.

FALSE FRONTS. With the drawers installed in the case, it's time to attach the false fronts. The goal here is to keep an evenly spaced reveal between the case opening and drawer front. Using shims and double-sided tape prior to driving screws makes this task easy. Figure 4 below shows how to pull this off.

To install the drawer pulls, it's just a matter of positioning each one in the center of the drawer. Like before, I used my dowel wrench to install the screws to prevent marring their surfaces.

THE TOP

As the drawing and details above reveal, the top of the armoire is a sandwich of $\frac{1}{4}$ " and $\frac{3}{4}$ " plywood trimmed with a mitered hardwood frame. I used two layers of plywood to create a thicker top. Using $\frac{3}{4}$ " material felt visually thin when compared to the rest of the case.

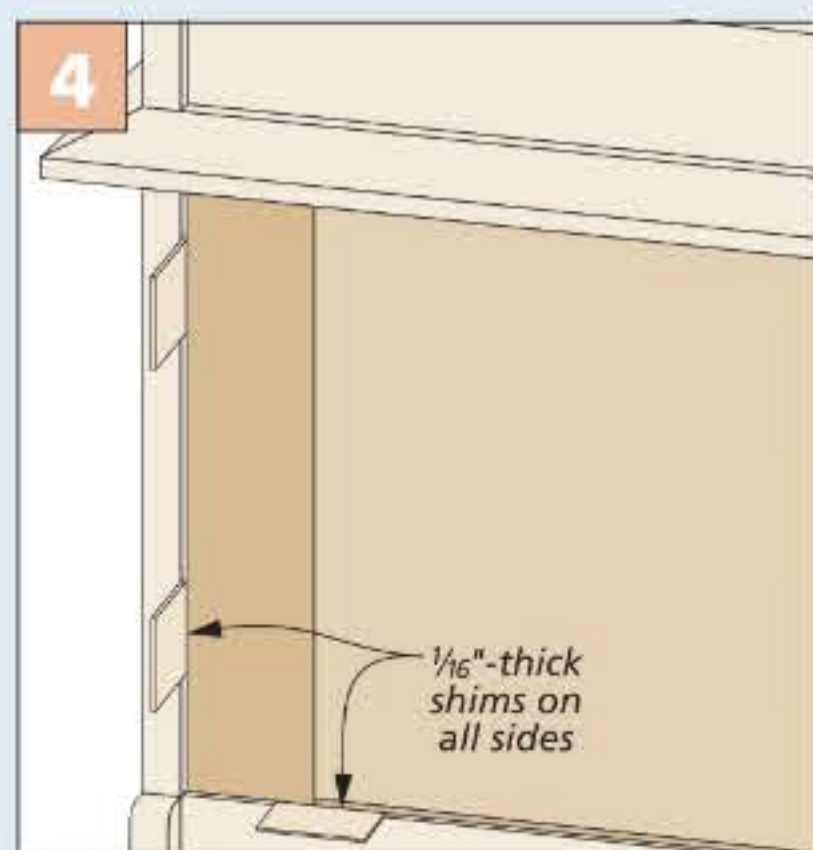


PLYWOOD FIRST. Both pieces that make up the sandwich are the same size so I started by cutting them at the table saw. As detail 'a' above shows, the $\frac{1}{4}$ " piece is simply cut to size, so I set it aside for now. Figure 5 below shows what the other piece of plywood needs.

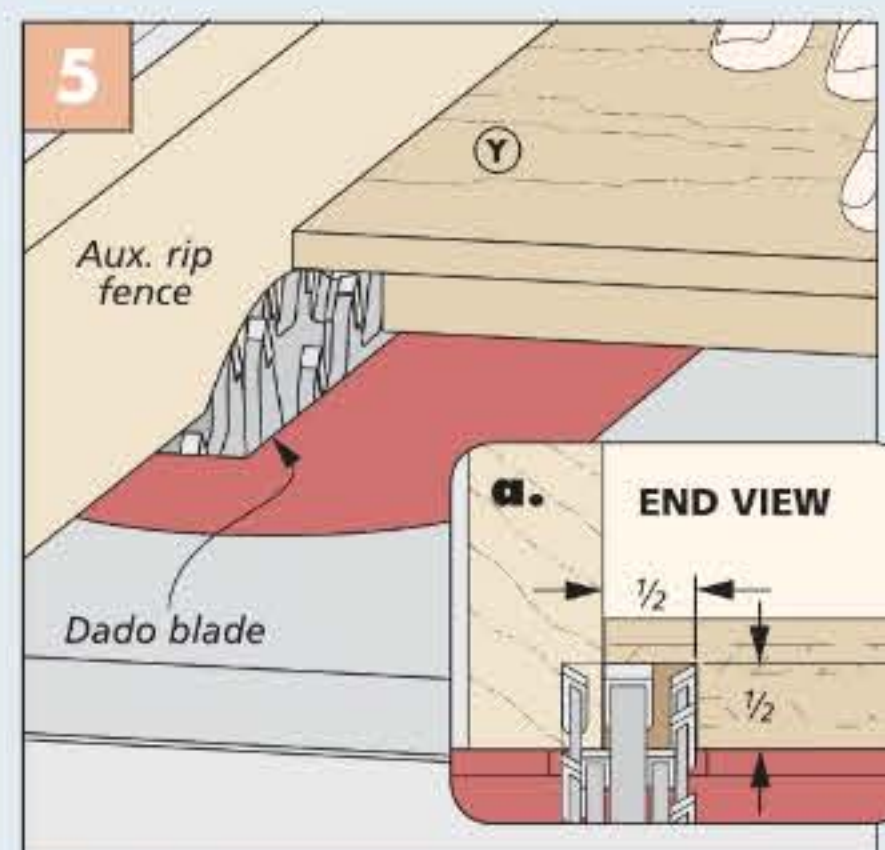
TRIM. With the plywood ready to go, I turned to making the hardwood trim. After ripping enough material to width, I installed a dado blade in the saw and made a tongue along one edge by cutting the rabbets shown in Figure 6.

MITERS. It's best to fit the top trim to the plywood in the same manner that the case molding was installed earlier. Start with the front piece, then fit the sides to it. The width of these pieces are enough of a concern that it's a good idea to join them together with biscuits, like you see in the drawings above.

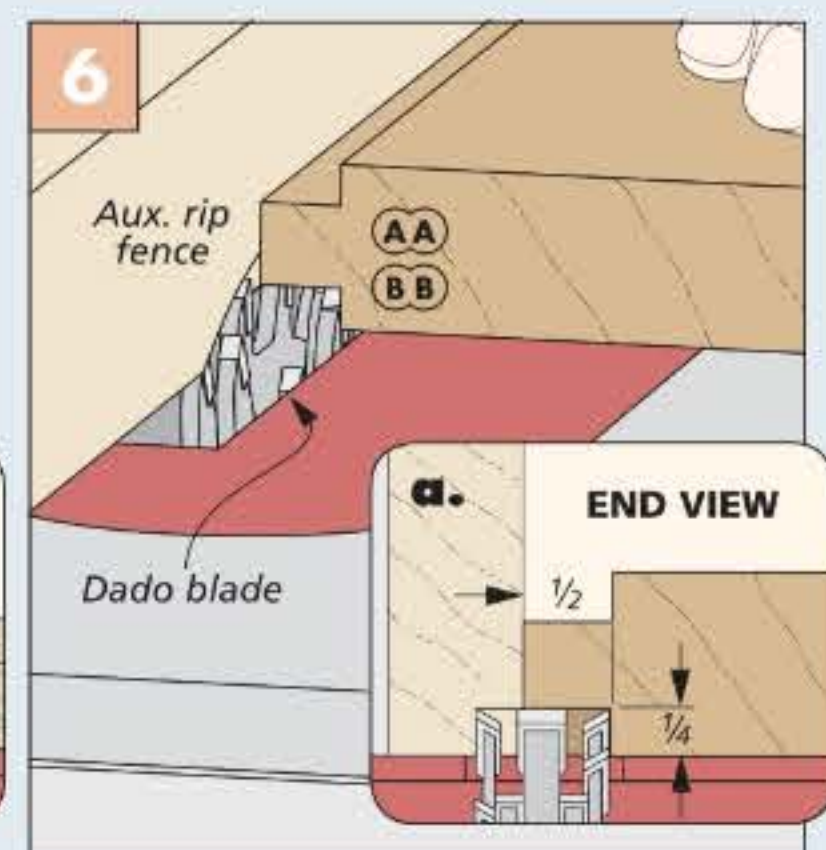
As with the previous parts, I stained and finished the top before screwing it in place. With that, you're in the home stretch and it's time to turn the page for the finishing touches on the armoire.



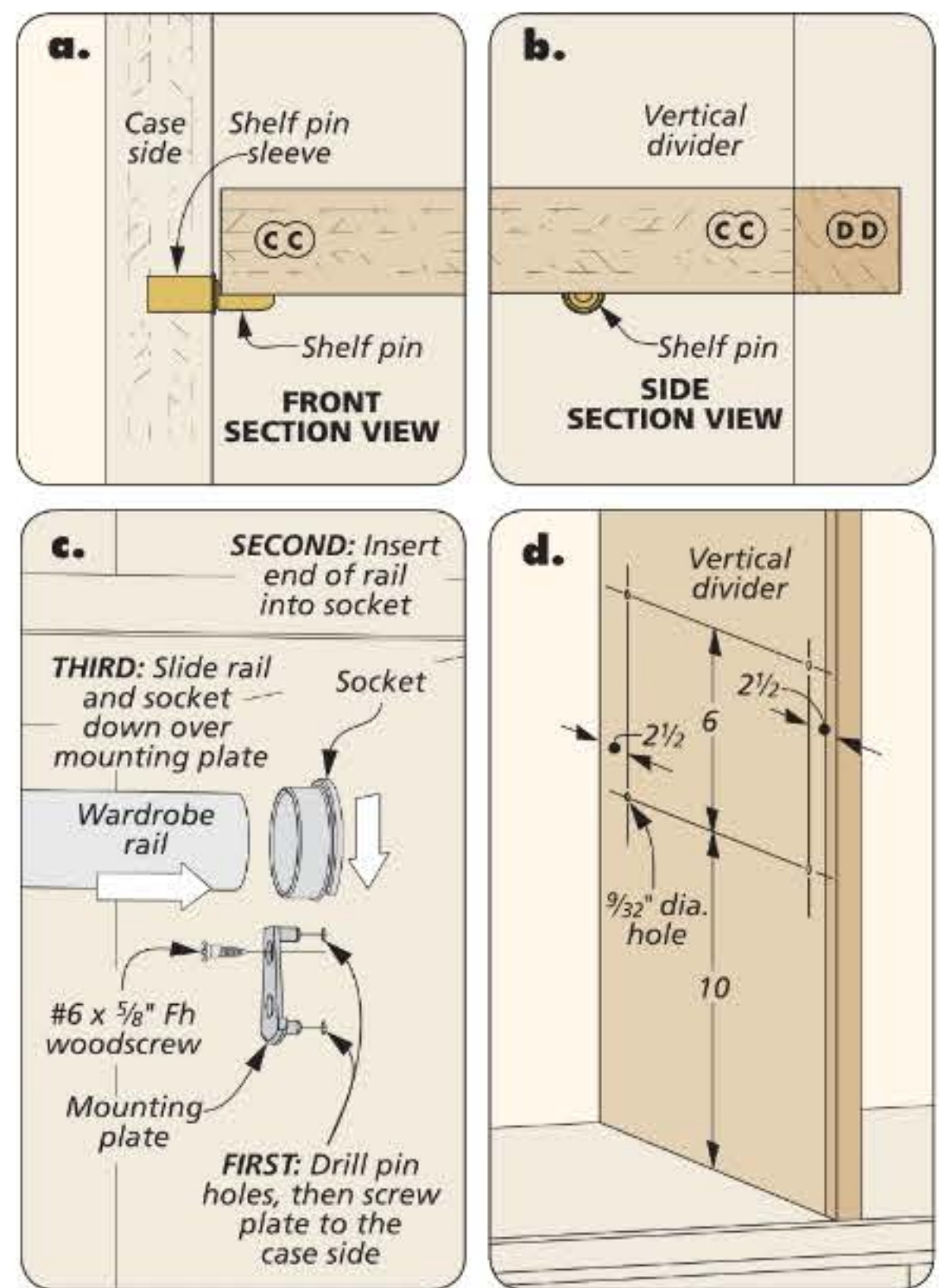
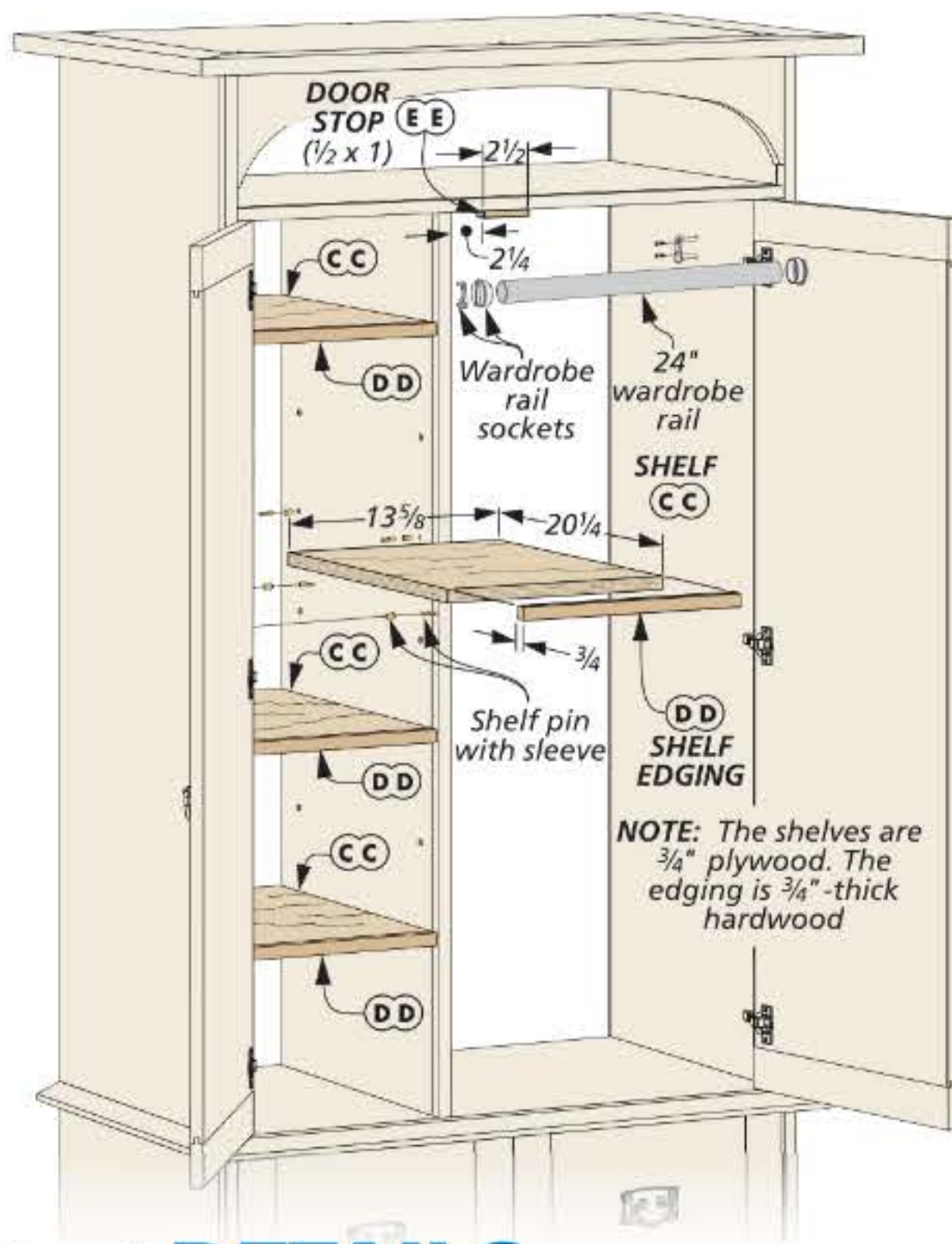
Position False Front. Use shims and double-sided tape applied to the drawer front to evenly space the false front.



Rabbet in Top Panel. The rabbet cut here forms part of the groove that will hold the tongue of the top trim.



Rabbets Form Tongue. Cutting rabbets on both edges of the top trim will create the tongue.



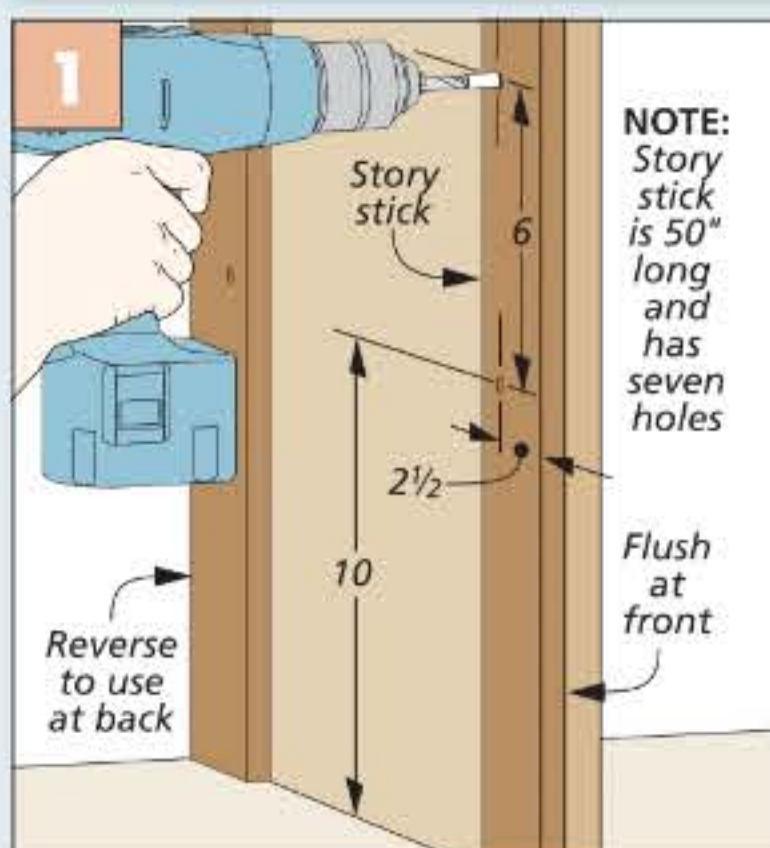
Final DETAILS

The end of this fun project is on the horizon. All the woodworking that's left is to make the adjustable shelves and the door stop. And once the hardware is installed, you'll finish up with screwing the back in place.

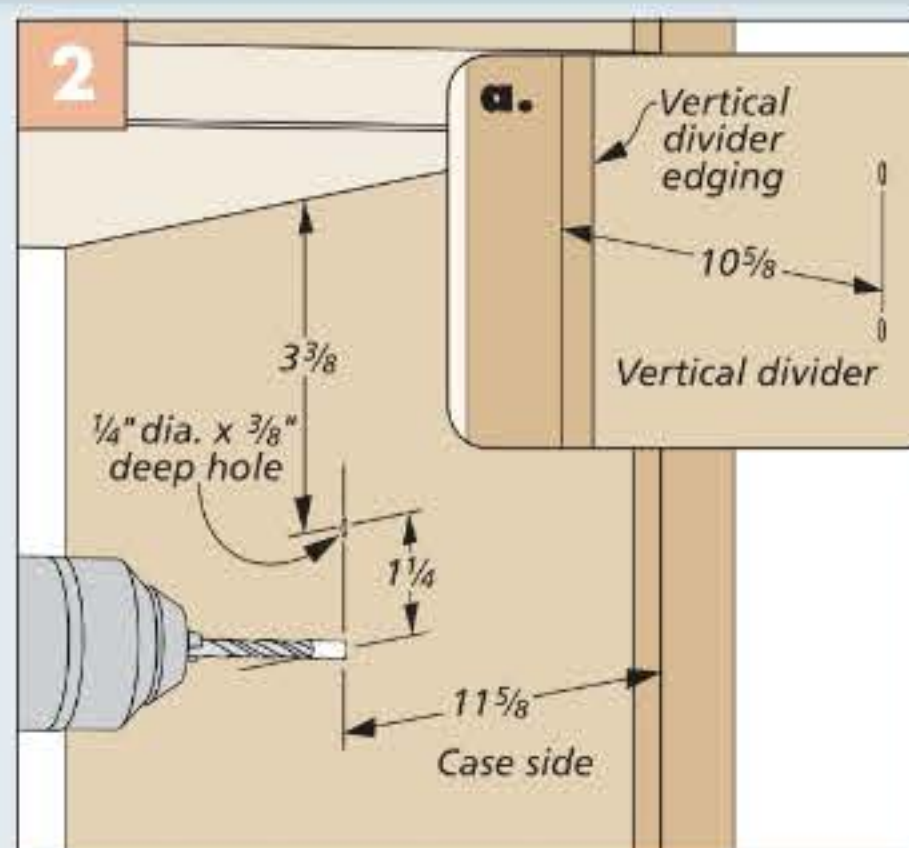
SHELVES. The four shelves that you see in the drawing and details above are made of plywood and have hardwood edging glued to the front. The grain on the plywood will run side to side like the horizontal members of the case.

To support the shelves, I drilled a series of holes in the case for shelf pins. Using a story stick like you see in Figure 1 is an easy way to keep all of the holes level with each other. I chose to use sleeves in combination with the pins.

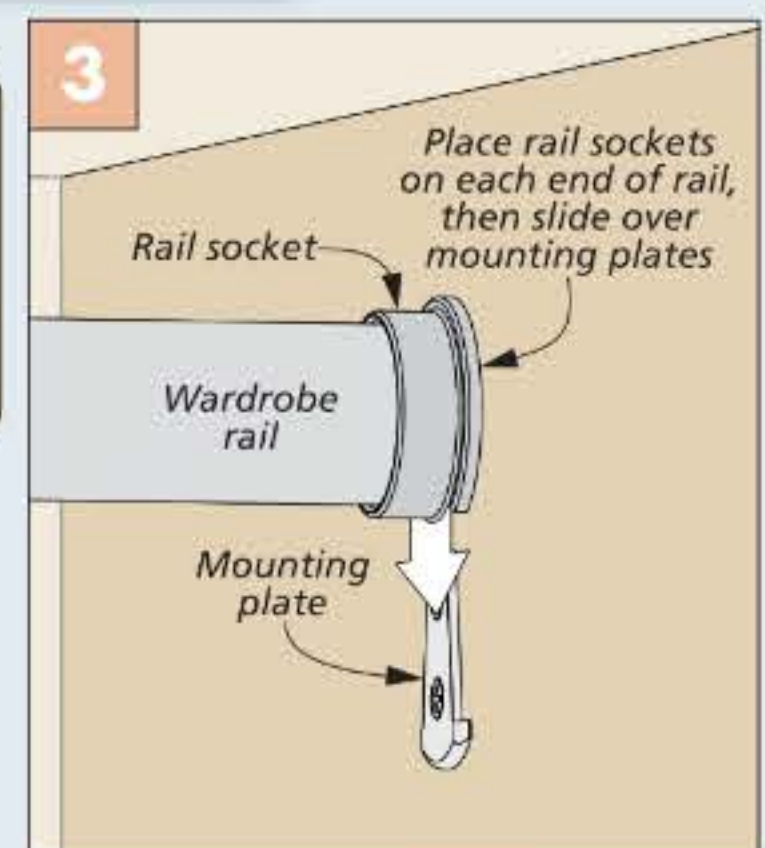
How-To: DRILL SHELF PIN HOLES & INSTALL WARDROBE RAIL



Holes for Sleeves. A story stick aligns the holes for the shelf pin sleeves perfectly in the case sides.



Drill Holes for Mounting Plate. Lay out the mounting plate hole locations on the case sides. Then predrill for the pins.



Installing the Rail. Cut the rail to length and slide the sockets over the ends. The sockets clip to the plates.

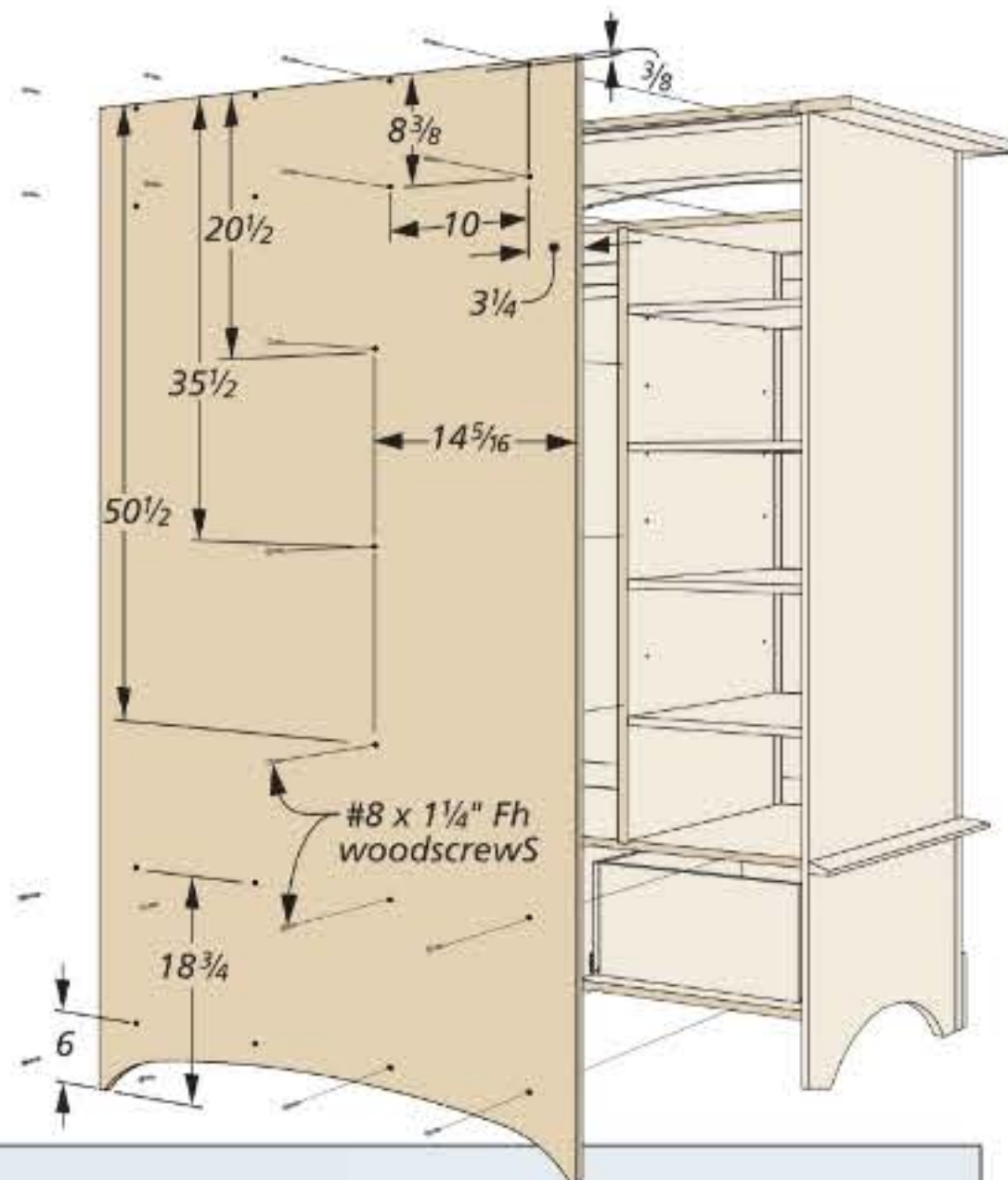
They provide a nice finished look to the case and are a sturdy, smooth support for the pins. Four brad nails are all it takes to install the door stop.

HANG IT UP. The wardrobe rail I used here is a clever, clean-looking way to install a rail for hanging items in a cabinet. The parts needed are available online and can be found (along with the rest of the hardware for this project) in Sources on page 67.

The rail comes with two sockets and mounting plates. The back of the mounting plates have a couple of pins to hold the rail safely in place. Figure 2 shows where to locate the holes for the mounting plate.

THE BACK. After the rail is in place, there are just a couple of things left to do. First, install the plywood back. The drawing to the right shows the screw locations for that step.

Finally, you can install the decorative tiles. I used a high-quality silicone caulk. You don't want to run the risk of the tile falling out over saving a few bucks on caulk. Placing a couple pieces of tape over the tiles until the caulk dries is good insurance. With that task complete, this handsome armoire is ready to take its place in your home. Whether it's the bedroom, living, or family room, it's going to be an instant hit. **W**



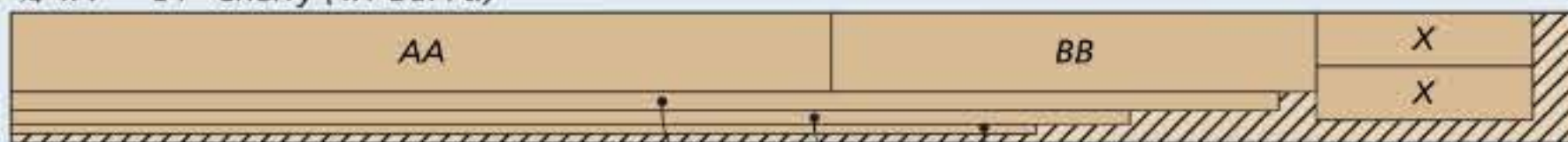
Materials, Supplies & Cutting Diagram

A Sides (2)	$\frac{3}{4}$ ply. - 22 x 82	P Door Panels (2)	$\frac{3}{4}$ ply. - $17\frac{29}{32}$ x $48\frac{3}{8}$	EE Door Stop	$\frac{1}{2}$ x 1 - $2\frac{1}{2}$
B Back (1)	$\frac{3}{4}$ ply. - 37 x $81\frac{3}{8}$	Q Door/Drawer Edging	$\frac{1}{8}$ x $\frac{3}{4}$ - 250 rgh.	• (19) #8 x $1\frac{1}{4}$ " Fh Woodscrews	
C Horizontal Div. (4)	$\frac{3}{4}$ ply. - $21\frac{1}{4}$ x 37	R Door Ends (4)	$\frac{3}{4}$ x $2\frac{7}{8}$ - $18\frac{5}{32}$	• (6) #8 x $1\frac{1}{2}$ " Fh Woodscrews	
D Vertical Div. (1)	$\frac{3}{4}$ ply. - $20\frac{1}{4}$ x 54	S Tile Trim	$\frac{1}{8}$ x $\frac{1}{2}$ - 55 rgh.	• (6) Soft Close Hinges	
E Short Vert. Div. (1)	$\frac{3}{4}$ ply. - $20\frac{1}{4}$ x $12\frac{1}{2}$	T Drawer Sides (4)	$\frac{1}{2}$ x 10 - 20	• (6) 9mm Hinge Mounting Plate	
F Vert. Div Edging	$\frac{3}{4}$ x 1 - 68 rgh.	U Drawer Front/Back (4)	$\frac{1}{2}$ x 10 - $16\frac{3}{8}$	• (2 prs.) 20" Drawer Slides w/screws	
G Side Edging (2)	$\frac{3}{4}$ x 1 - 82	V Drawer Bottoms (2)	$\frac{1}{4}$ ply. - $16\frac{3}{8}$ x $19\frac{1}{2}$	• (1) 24" Wardrobe Rail	
H Upper Arch (1)	$\frac{3}{4}$ x $6\frac{3}{4}$ - $37\frac{1}{4}$	W False Front Panels (2)	$\frac{3}{4}$ ply. - $11\frac{3}{8}$ x $13\frac{5}{32}$	• (16) Shelf Pins and Sleeves	
I Lower Arch (1)	$\frac{3}{4}$ x $5\frac{1}{4}$ - $37\frac{1}{4}$	X Drawer Ends (4)	$\frac{3}{4}$ x $2\frac{7}{8}$ - $11\frac{5}{8}$	• (2) Wardrobe Rail Brackets	
J Upper Edging (1)	$\frac{3}{4}$ x $\frac{7}{8}$ - $36\frac{1}{2}$	Y Top Thick Panel (1)	$\frac{3}{4}$ ply. - $22\frac{1}{4}$ x $36\frac{1}{2}$	• (2) Craftsman Vertical Bail Pulls	
K Middle Edging (1)	1 x 1 - $36\frac{1}{2}$	Z Top Thin Panel (1)	$\frac{1}{4}$ ply. - $22\frac{1}{4}$ x $36\frac{1}{2}$	• (2) Craftsman Horizontal Bail Pulls	
L Bottom Edging (1)	$1\frac{1}{8}$ x 1 - $36\frac{1}{2}$	AA Top Front (1)	$\frac{3}{4}$ x $4\frac{1}{4}$ - 44	• (1) Right Facing Songbird Tile	
M Front Molding (1)	1 x $1\frac{1}{2}$ - 41	BB Top Sides (2)	$\frac{3}{4}$ x $4\frac{1}{4}$ - 26	• (1) Left Facing Songbird Tile	
N Side Moldings (2)	1 x $1\frac{1}{2}$ - $24\frac{1}{2}$	CC Shelves (4)	$\frac{3}{4}$ ply. - $20\frac{1}{4}$ x $13\frac{5}{8}$		
O Feet (2)	$\frac{3}{4}$ x $\frac{3}{4}$ - 7	DD Shelf Edging	$\frac{3}{4}$ x $\frac{3}{4}$ - 60 rgh.		

$\frac{3}{4}$ " x 6" - 72" Cherry (3.0 Bd. Ft.)



$\frac{3}{4}$ " x 7" - 84" Cherry (4.1 Bd. Ft.)



$\frac{3}{4}$ " x 4" - 96" Cherry (2.7 Bd. Ft.)



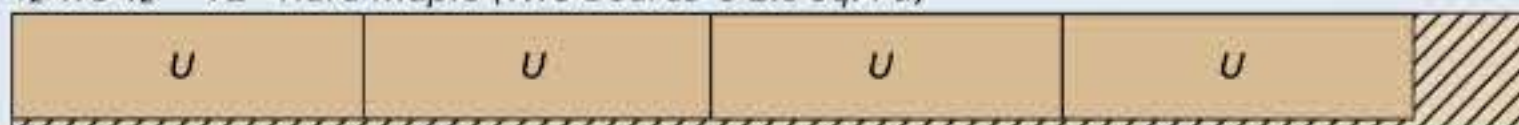
$\frac{3}{4}$ " x 7" - 96" Cherry (4.7 Bd. Ft.)



1" x 7" - 48" Cherry (3.0 Bd. Ft.)



$\frac{1}{2}$ " x $5\frac{1}{2}$ " - 72" Hard Maple (Two Boards @ 2.8 Sq. Ft.)



$\frac{1}{2}$ " x $5\frac{1}{2}$ " - 84" Hard Maple (Two Boards @ 3.2 Sq. Ft.)



ALSO NEEDED: One 24" x 24" sheet of $\frac{1}{4}$ " Maple plywood. One 24" x 24" sheet of $\frac{1}{4}$ " Cherry plywood. One 48" x 96" sheet of $\frac{1}{2}$ " Cherry plywood. Four 48" x 96" sheets of $\frac{3}{4}$ " Cherry plywood.

Tactics for Taming Tearout

Sometimes you run across a board that has a grain pattern that just won't behave. Regardless of how you feed it into your planer, it comes out with those annoying little divots in the surface. The first impulse is to ditch the board for one less unruly. The problem is that the beauty of the board is most likely tied

to that grain and the pattern it reveals. And that's something worth fighting for.

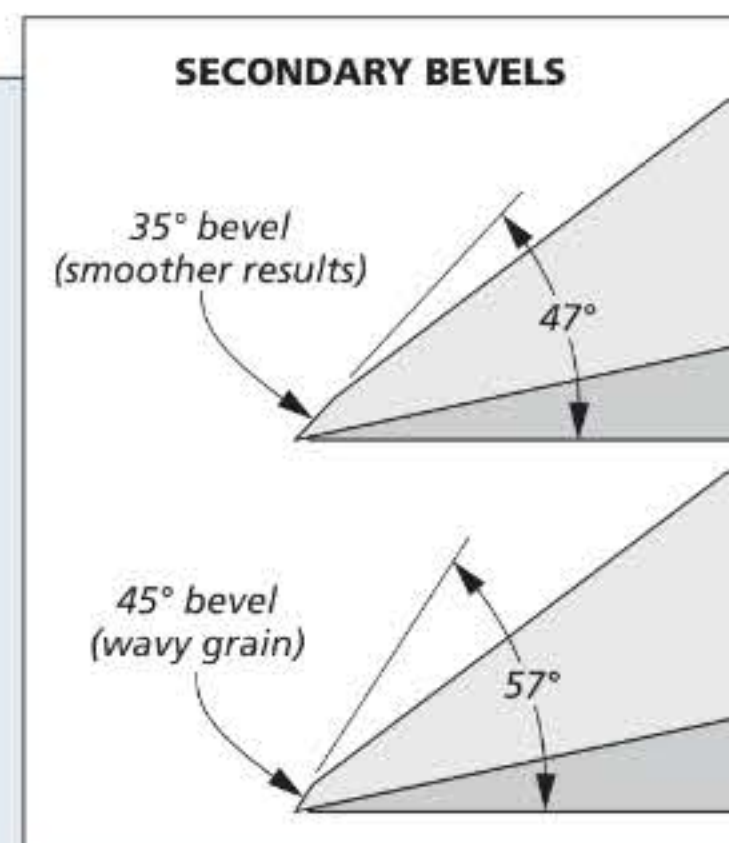
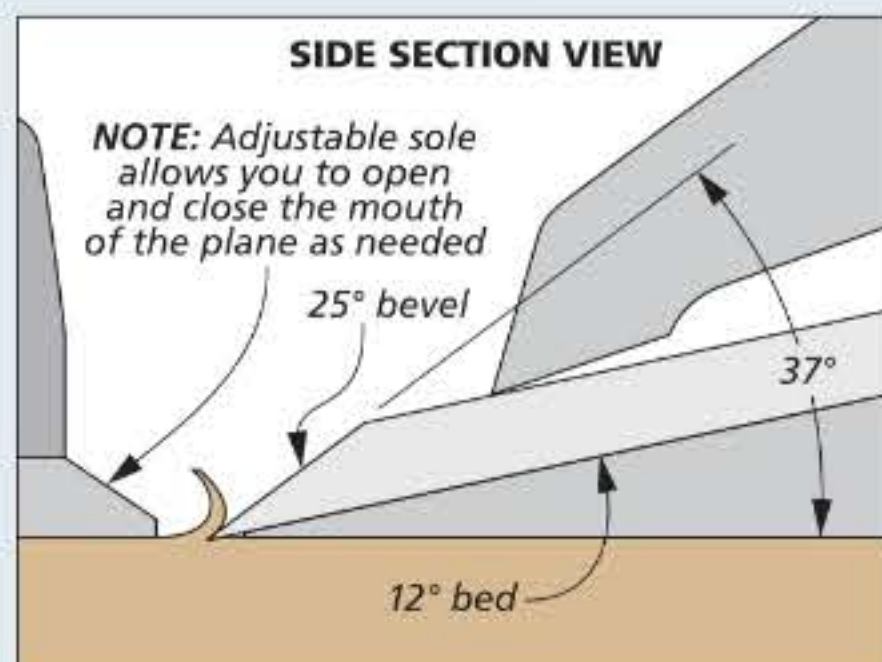
Using a low-angle jack plane (like the *Lie-Nielsen No. 62* you see above) with three different blades makes short work of unruly grain. These blades are standard 25° bevel blade, a toothed blade (also 25° bevel), and a 90° scraper blade.

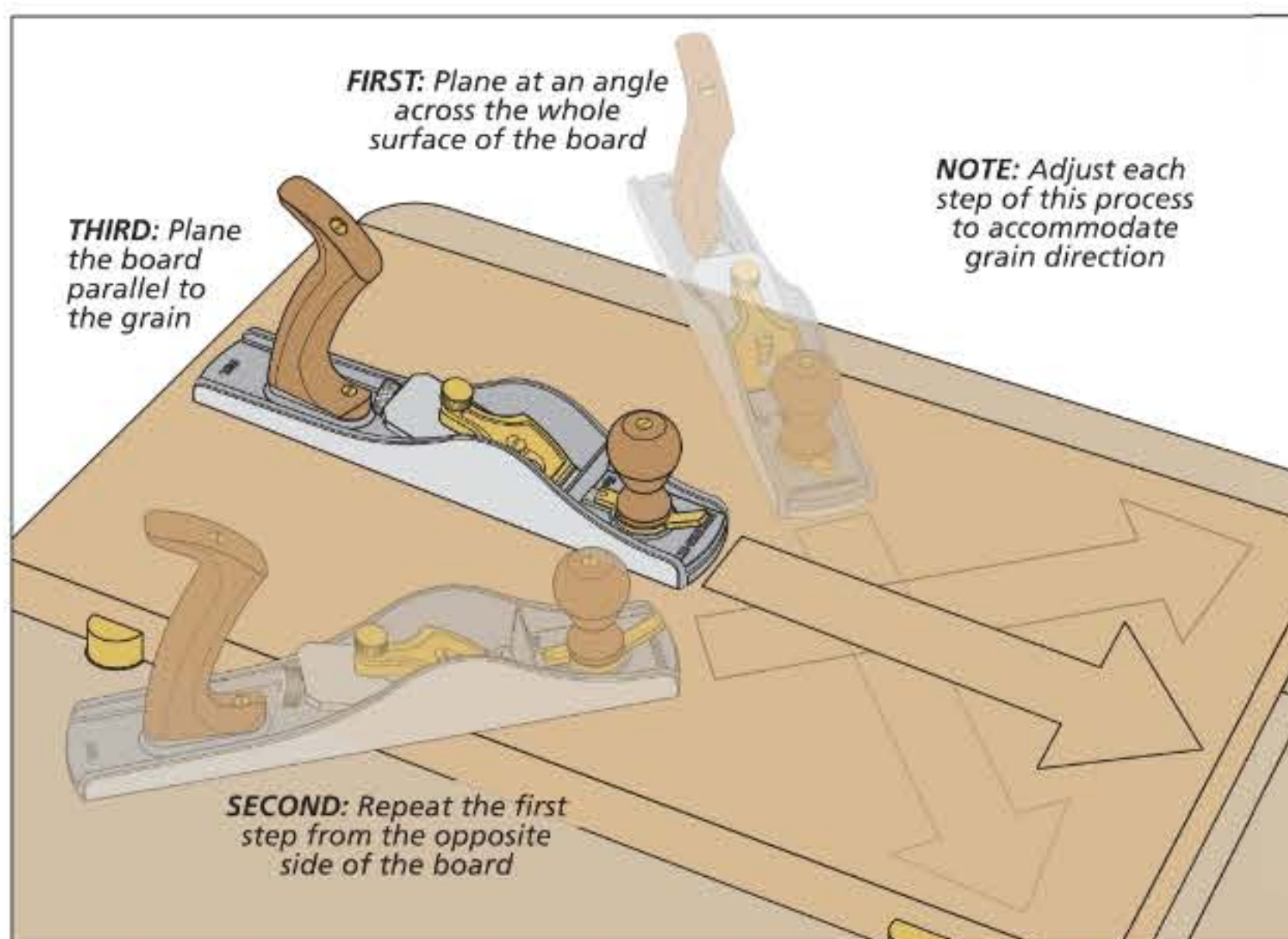
LOW-ANGLE JACK PLANE. The core of a low-angle jack is basically a big block plane. The thick blade sits bevel up on a 12° bed that's machined into the sole, as the box below shows. The plane comes with a blade ground to a razor sharp 25° ready to use out of the box. You can get a lot done with this blade.

How It Works: LOW ANGLE & BEVEL UP

As you can see in the drawing at the right, the plane iron is bedded at 12°. Combined with a 25° bevel on the iron, this results in a 37° cutting angle. This angle works well for end grain and some smoothing operations.

If the standard blade angle doesn't give the results you're after, adding a secondary bevel to the blade (far right drawing) is a good remedy. Honing the tip of the blade is all that's needed.





▲ Used in combination, these three blades can tackle the frustrations of dealing with tearout in an otherwise beautiful board.

Also, in front of the blade, there's an adjustable mouth plate that lets you dial in how aggressive the blade will cut. If the grain is still tearing out, I'll add a secondary bevel that can have a calming effect on stubborn grain.

SINK YOUR TEETH INTO IT. If the board is still giving me fits, I'll move on to rough planing the board with a toothed blade. This is a specialty blade shown at the top of the photo above. The chisel-like teeth of this blade slice fine grooves in the surface, creating a series of furrows.

There's a method to this that's shown in the drawing above. It involves planing the board at an angle to start. Slicing across the board with a toothed blade will reveal any trouble spots in the

surface with the benefit of not tearing out any more of the board. Move carefully around any knots when using this blade. The teeth are strong but small, and they can break.

One thing you'll notice with the toothed blade is that it creates a lot of shavings fast. So to prevent clogging, start with the mouth opened up a little more than normal. After the board is flat and the tearout gone, you can move onto removing the ridges.

SMOOTH OPERATOR. To do this, install the smoothing blade in the plane (photo below, left) and repeat the process as done with the toothed blade. Again, adjust the mouth and add a steeper secondary bevel if necessary.

MORE THAN SCRAPING BY. A recent addition for me is the scraper blade that Lie-Nielsen makes for this plane (bottom blade in above photo). This blade comes with a perfect 90° nose that is the cutting edge. The blade in effect turns the plane into a scraper plane. Since this blade is held in the span of the plane it's harder to create low spots in the surface like can be done with a card scraper.

To start, I set the plane on the workpiece and zero out the blade. Then slowly dial it forward and make test passes along the way.

So that's the recipe: A great plane, three blades, the ability to tweak bevels and openings — all the ingredients you need to achieve a tearout-free surface. **W**



▲ Removing the furrows formed by the toothed blade is done in short order with the smoothing blade. This is the blade that comes standard with the Lie-Nielsen No. 62.



▲ With the scraper blade honed to a perfect 90° and set for paper-thin shavings, it's easy to clean up any marks left from the previous blade.



7 strategies for Dealing with Snipe

My woodworking world changed the day I bought my thickness planer. With my new planer, I could plane lumber to whatever thickness I desired to suit the needs of the project I was building.

But there was a tradeoff. Nearly every piece of lumber would end up with snipe. Snipe is that tell-tale divoting of the wood at the front and back end of the board (photo below) after passing it through the planer. Over the years, I've learned a few handy tips and tricks for dealing with it.

Before getting started, make sure your planer is set up correctly. The key is to align the infeed and outfeed tables

with the bed of the planer (or slightly elevated for some planers). And when planing long workpieces, use auxiliary infeed and outfeed supports in addition to what is built into the table (main photo above).

[1] Start Extra-Long

With everything set up correctly, you may notice less snipe on your workpieces. But if snipe is still present, the simplest solution for dealing with it is to make sure you start with an extra-long workpiece.

After planing the workpiece to the desired thickness, you simply cut it to

final length. The key is to trim off the snipe at each end in the process, as in the lower photo.

[2] Provide Some Lift

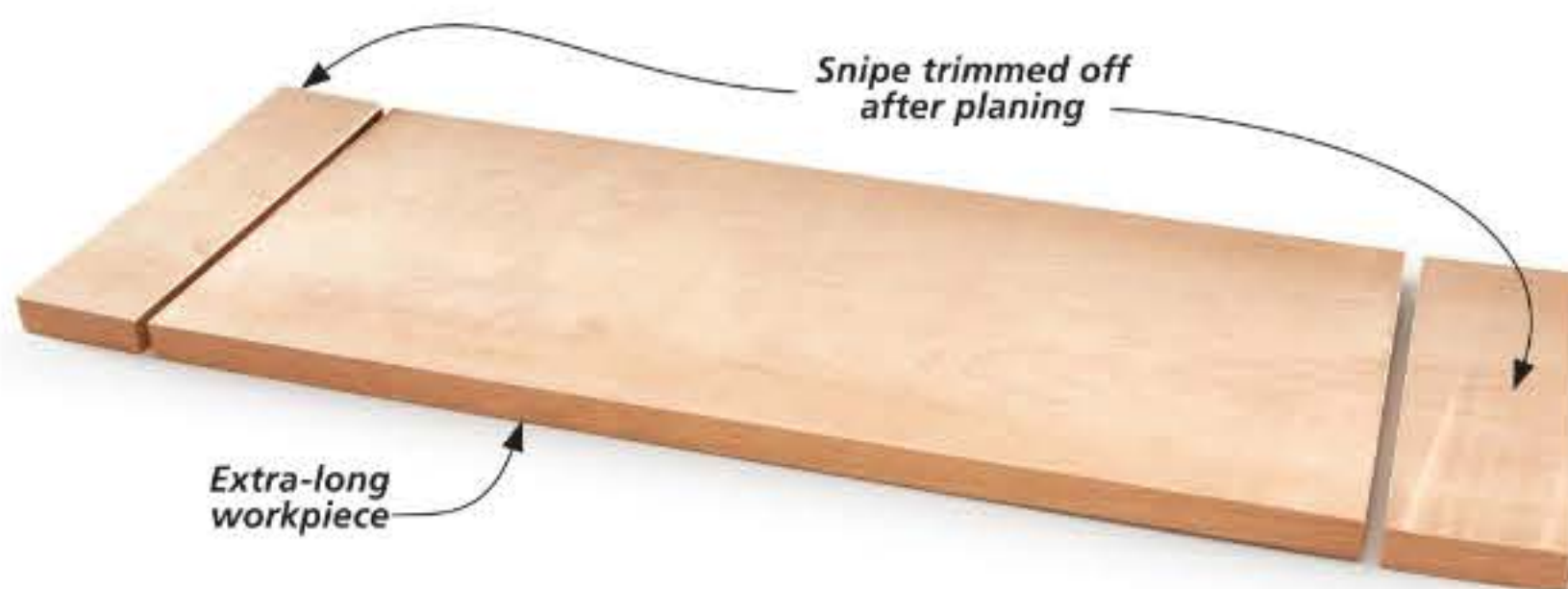
One "classic" tip some woodworkers use for dealing with snipe is to slightly lift the end of the workpiece as it's fed into the planer (about $\frac{1}{8}$ " to $\frac{1}{4}$ "). Then as it exits, you lift the leading edge of the workpiece.

The thought is that this helps offset the shifting of the cutterhead or any dropping or sagging of the workpiece. The challenge with this technique is timing things correctly and lifting just the right amount, something I've found to be a hit-or-miss process at best.

[3] Give It Some Angle

A tip that we recently received from a reader suggested feeding the workpiece into the planer at an angle. You can see

▶ An easy way to eliminate snipe is to start with an extra-long workpiece and simply trim off each end after planing.



how this technique works in the lower left photo below.

This places more of the workpiece on the infeed (and eventually the out-feed table) providing more support. Of course, with wider (and longer) workpieces, you won't have as much of an angle. But for narrow workpieces, it's an option you may want to try.

[4] All in Sequence

I've used all of the previous tips to some degree of success. But it still bothered me that at times I had to trim the snipe away, tossing perfectly good lumber into the scrap pile in the process.

To alleviate the problem, I turned to a different solution. The trick here starts with a pair of scrap pieces. You begin by feeding the first scrap piece into the planer and then continue by butting your workpieces end to end, like a train of railroad cars, as you feed them through the planer, as in the main photo on the previous page.

As you feed your last workpiece in, butt the second scrap against it to end the process. Doing this results in snipe on the leading edge of the first scrap and the trailing edge of the last one.

All the workpieces in between won't have any snipe. Not only does this save material, it saves time, since you don't have to do any trimming. This solution works just as well with a single workpiece between the two scraps.



▲ For narrow workpieces, try angling the workpiece to create more support and minimize the chance of snipe.



▲ Adding extra-long outriggers to a workpiece is a great way to avoid snipe at the ends. The outriggers provide solid support for the cutterhead so any snipe that may occur happens on the outriggers, not on the ends of the workpiece.

[5] Adding Outriggers

Sometimes I have a piece of material I need to plane down and can't afford any chance of snipe at all. It may be a special board I've been saving, a workpiece I've already cut to final length, or most often, a piece that's too short to safely feed through the planer by itself.

The solution here is to use some sacrificial outriggers. You make them extra-long and glue them to the edges of the workpiece so they extend well past each end of the workpiece.

As you feed the assembly through the planer, any snipe occurs on the outriggers, with the workpiece itself planed to a consistent thickness without any snipe at all, as detailed in the photo above. All you need to do is trim the outriggers off once the planing is done.

[6] Use Every Advantage

Buy a better planer. Okay, that may be a little extreme, but I wanted to point



▲ The cutterhead lock on this planer prevents movement to virtually eliminate snipe on a workpiece.

out something key to some of the newer planers available today. And that's a cutterhead lock (lower right photo). Most older planers don't have this feature and even if they do, many woodworkers don't take advantage of it.

Why, you may ask? Well, locking and unlocking the cutterhead between passes takes time. But by locking the cutterhead to the posts that it rides on, you can practically eliminate any snipe. If there's any snipe at all, it's easily removed with a quick pass of a hand plane or during the final sanding of the workpiece. For me, that's worth taking the time to lock the cutterhead.

[7] Remove Less Material

One thing that often increases the amount of snipe is how much material you're trying to remove. Hogging off a lot of material on each pass is a sure way to end up with snipe.

Here again, the solution is simple, decrease the amount of material you're removing, especially as you get closer to the final thickness. It's especially important to do this on wider workpieces as the planer has to do more work. I try to make sure my last pass only removes about $\frac{1}{32}$ " to $\frac{1}{64}$ " of material.

COMBINE THEM. With these tips and tricks up your sleeve, dealing with snipe doesn't have to be an effort in frustration. You can even combine some of the tips if you want. You'll find you can make better use of the lumber you have, with the end result being snipe-free workpieces. **W**

Look up for more Storage Options



Storage and floor space is at premium in my small shop. One day it occurred to me that I wasn't taking advantage of all the real estate my shop had to offer. All I had to do was look up.

ABOVE THE WORKBENCH. My workbench sits out in the middle of the shop space. I realized there are a lot of items I use on a regular basis while I'm at the workbench — things like small clamps, drills and drivers, glue, sandpaper, and paper towels.



▲ A simple rack made from PVC pipe keeps small bar clamps handy near the workbench for glue-up and assembly.

The solution I came up with is the ceiling-mounted organizer you see in the photo above. It keeps the items I use most often within easy reach.

The design of the organizer is really up to you and what items you want to keep handy. A power strip not only powers the battery chargers, but provides easy access for other corded tools.

You can take advantage of the storage space on all sides of your organizer, inside and out. Use pegboard for the sides and back as I did, or use plywood to make it easy to use nails, screws, and custom holders to store accessories. The most important thing to remember is to make sure the organizer is firmly fastened to ceiling rafters.

OVERHEAD CLAMP STORAGE. The things I seem to reach for the most when at the workbench are clamps. When you're in the middle of gluing up a project, you don't want to have to hunt for clamps.

The clamp rack shown at left is easy to make and can be mounted on the ceiling or wall. The rack rails are made from



▲ This shop-made trolley system allows easy movement of hoses and cords to right where you need them.

2x4s drilled to accept 1½" PVC pipe, then ripped down the middle. The pipe is cut to length and sandwiched between the halves of the rails that are then screwed back together. The rail assemblies are fastened to the plywood ends.

CABLE SYSTEM. One of the handiest upgrades I made to my shop was a



▲ Clear storage bins make it easier to see contents in this drop-down storage assembly. A simple frame forms openings sized to fit the bins. The bins feature locking lids to prevent spills when the assembly is lowered and raised.

“trolley” system mounted near the ceiling (photo, previous page). It’s made from wire cable, swivel pulleys, and screw eyes. Add a turnbuckle at one end to tension the cable easily.

This system keeps extension cords, air hoses, and vacuum hoses suspended out of the way during use so I’m not tripping over them. At the end of the day, simply slide them against the wall.

A step up from the cable system is the *Ceiling Track System* from Rockler. You can read about it in the box below. It’s a heavy-duty solution you may want to consider for your shop.

DROP-DOWN TRAYS. One simple way to gain storage in your shop is to mount

drop-down trays on the ceiling, as in the photos above. They fold flat between rafters or against the ceiling, taking advantage of unused space. These systems store items that you may not use frequently, but need ready access to.

The tray system (left photo above) consists of frames that hold small storage bins. The openings in the frame are sized for the bins. The bins have locking lids to prevent items from spilling.

The frames are mounted between rafters using spring-loaded hinges (see Sources, page 67). A barrel bolt holds them secure when raised.

The drop-down “shelves” (right photo above) are partitioned off into separate



▲ This drop-down storage system uses a screen door closer to prevent the tray from suddenly dropping.

bins for storing smaller items. The case assembly is mounted using a continuous hinge. A screen door closer helps prevent the unit from suddenly dropping. A shop-made turnbutton locks the system up between the rafters.

If you’re like me, extra storage is a bonus. If space is at a premium in your shop, just turn your eyes upward. **W**

Track Time: OVERHEAD TROLLEY SYSTEM

The *Ceiling Track System* by Rockler consists of heavy PVC track and trolleys designed to slide along the track. The track resembles a heavy-duty, upside-down T-track. The trolleys fit inside the track and include a stem used for mounting hanger hooks. You can purchase sliding trolleys and locking trolleys, depending on your needs. Track stops close off the ends of the track.





Tips for using a **Bevel Gauge**

Woodworking has a number of challenges. None more so than when you have to deal with angled cuts. For most of the projects I build, the workpieces come together at 90°, with an occasional 45° here and there. When I have to deal with angles other than those, I can't check them accurately with a

combination square or easily set up my machinery using the adjustment options offered on the tool.

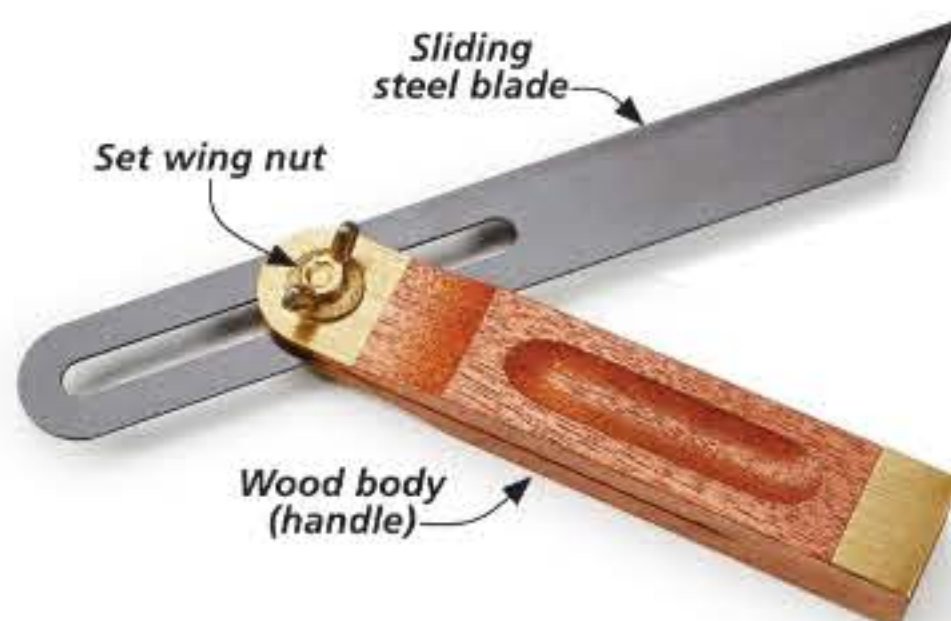
THE SOLUTION. In most cases, you'll find that a bevel gauge is the tool of choice to solve the problem (photo at left). A bevel gauge is also referred to as a sliding T-bevel, carpenter's bevel or sliding bevel gauge. Regardless of the name, its purpose is to duplicate an angle exactly, without having to do any measurement.

A bevel gauge is a simple tool. In its basic form, it consists of a wood (or metal) body, a steel or brass blade, and a wing nut (or knurled knob) to lock the two parts in place at the desired angle. You'll want to note that if a wing nut is used to lock the parts, it's important that it not extend past the body or blade where it might interfere with an accurate setting.

A slot in the blade allows you to adjust its position as needed during use. This blade (and the body) can vary in size. I find a 6" blade works best for most tasks.

MATCHING AN EXISTING ANGLE. One of the more common uses for a bevel gauge is to duplicate an existing angle. When that's the case, simply loosen the blade of the bevel gauge and place the body against one of the surfaces of the angle you want to copy, like you see in the top left photo on the following page. Then it's just a matter of rotating the blade until it rests securely against the mating surface and locking it in place. From there, you can transfer that angle to another workpiece if you're doing layout work, or quickly set up a machine to make the cut, as you'll see next.

MACHINE SETUP. Another use for a bevel gauge is tool setup, especially if you need to adjust the tilt angle of your



▲ A basic bevel gauge is a simple tool consisting of a body and blade with a locking mechanism.



▲ Don't know the existing bevel angle of a workpiece? No problem. Loosen the bevel gauge and rest the blade and body against the desired angle and then lock it in place.

▲ The next step is to set up your machine, like the table saw shown above. Rest the body of the bevel gauge on the tabletop and adjust the table saw blade to match.

table saw blade. I find it's best not to rely on the angle scale on most tools. I don't find them accurate enough.

Once your bevel gauge is set, either from a workpiece (left photo above) or



▲ Sliding a bevel gauge along a hand-planed bevel makes quick work of checking the accuracy of your work.

using one of the methods shown in the box below, it's a simple matter to tilt the saw blade until it matches the angle of the bevel gauge (right photo above). For an accurate setup, be sure the blade of the bevel gauge isn't touching any of the teeth on the saw blade.

This process works just as well for setting the angle of a miter gauge relative to the table saw blade. Again, keep the bevel gauge blade clear of any teeth on the saw blade.

DOVETAIL LAYOUT. One of the main tasks I use my bevel gauge for is laying out dovetails. Unlike a dovetail layout gauge that's designed for one specific angle, a bevel gauge can be adjusted to suit the design needs of the project. Once you set the bevel gauge to the desired angle, you can quickly and easily transfer that angle to any workpiece,

like you see in the main photo on the previous page.

HAND TOOL WORK. There are times when I like to add a chamfer or bevel to a project. For example, undercutting the edge of a tabletop to make it look a little thinner. Depending on the project, I may or may not be able to create it using one of my stationary tools.

When that's the case, I'll use a hand plane to form the angle. Keeping track of where I'm at is the challenge. As you may have guessed, a bevel gauge is the solution. You can set the bevel gauge to the desired angle and make sure the angle is correct by spot checking across the edge (photo at left).

PROBLEM-SOLVER. As you can see, a bevel gauge is a handy shop tool. It may not see daily use, but it's a must-have when the task at hand demands it. **W**

How-To: SETTING A BEVEL GAUGE



▲ A drafting triangle is an easy and accurate way to set a specific angle, such as the 30° angle shown here.



▲ A protractor is best for intermediate angles, just rest the blade against the base and lock in the setting.



▲ Commercial jigs make quick work of setting commonly used angles. The accuracy can't be beat.



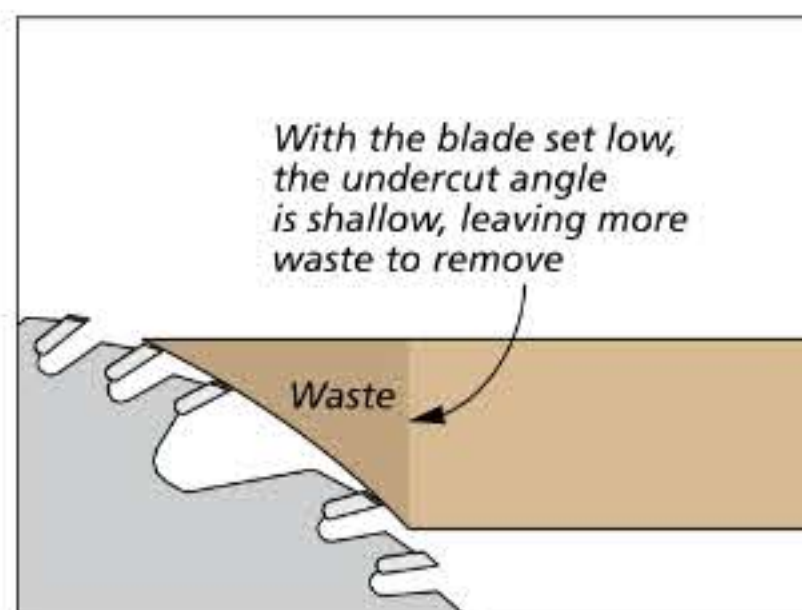
Table saw

Stopped Cuts

When it comes to the table saw, most of us think of it as a tool for cutting through a workpiece. But occasionally, you may have a need to make a stopped cut. And while there are several different tools you can use to make stopped cuts, from a band saw to a jig saw to a hand saw, sometimes the cut demands the precision and accuracy that can best be provided by a table saw.

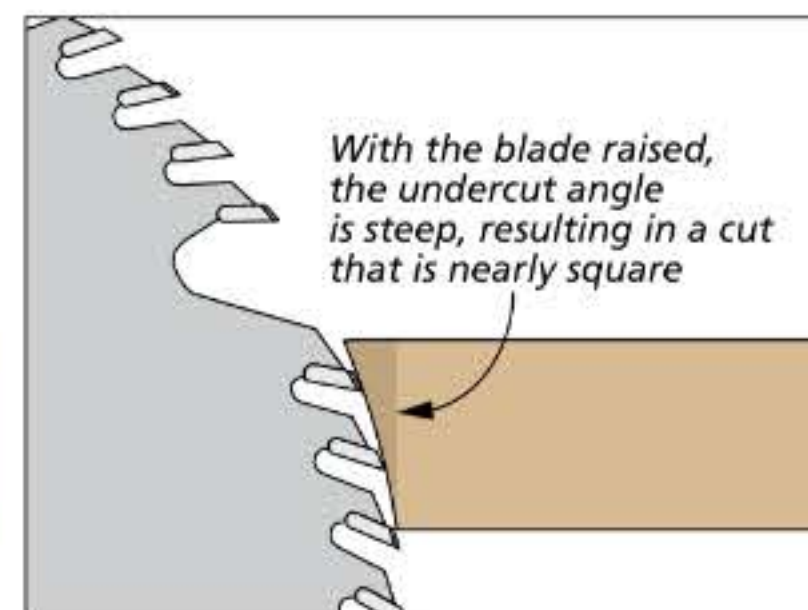
A stopped table saw cut is just what it sounds like. You push the workpiece part way into the blade, stopping at a given point. Then after turning the saw off, simply back the workpiece out of the cut. Making stopped cuts isn't difficult, but there are a few things that you'll definitely want to be aware of in order to get good results.

Because saw blades are round, the end of a stopped table saw cut will be



curved, matching the profile of the blade. The drawings above illustrate the difference in blade heights and the affect they have on the angle of the cut.

There's no way around this, but you can minimize the amount of this curvature by raising the blade to its full height. Doing so allows the blade to meet the workpiece at a steeper angle, resulting in a cut that's almost square.



Safety Note: Because more of the blade is exposed, use extra caution when making cuts with the blade raised to maximum height. And whenever possible, use a blade guard.

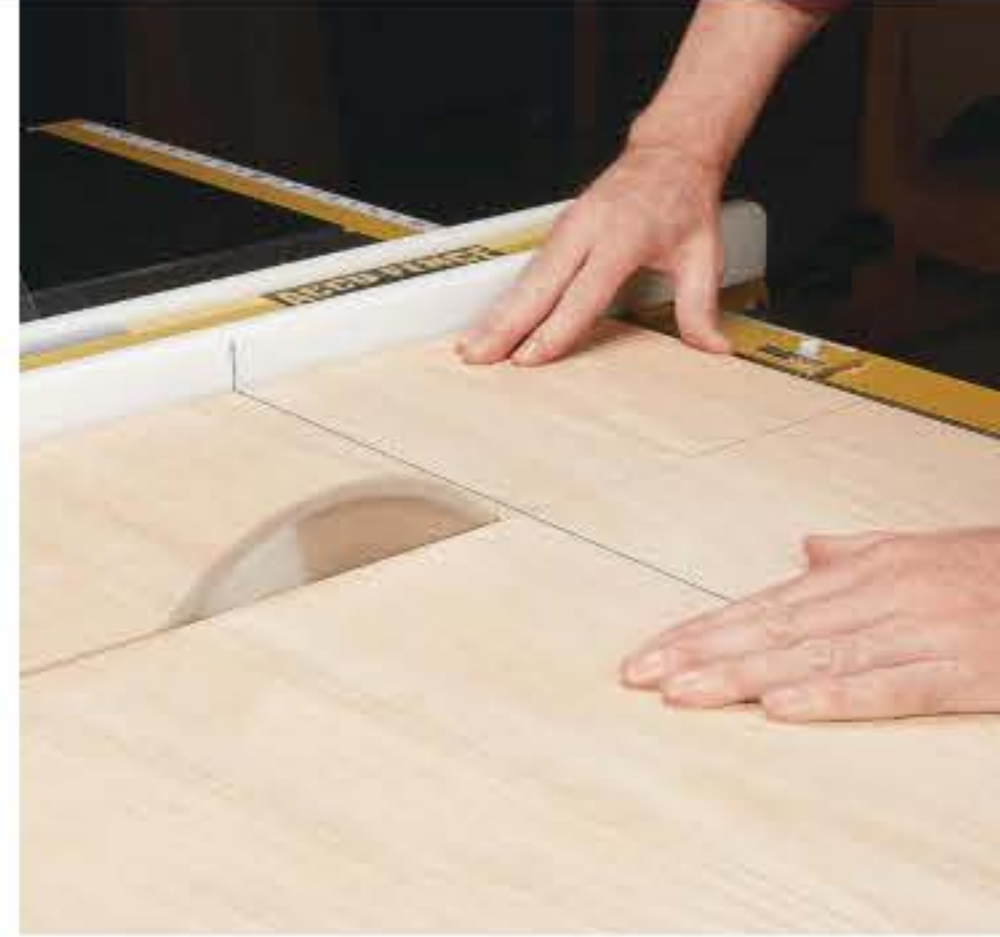
END OF THE CUT. These drawings also demonstrate another peculiarity of stopped cuts. You'll notice that the blade cuts further into the bottom face of the workpiece than the top. And since



- ▲ To mark the blade location, use a drafting triangle to draw a line from the front tooth of the blade to the rip fence.



- ▲ Extend the line up the face of the rip fence to indicate the leading edge of the saw blade. This will be your stop line.



- ▲ Stop the cut when the layout line on the top of your workpiece meets up with the stop line on the rip fence.

you can't see the bottom face, you can't really tell where the cut truly ends without turning the workpiece over. This can make it difficult to cut precisely to a line. But there are a couple of ways you can work around this.

For relatively short stopped cuts, you can use a stop block to control the length of the cut, as shown in the main photo on the previous page. By clamping the stop block along the rip fence, you can regulate the length of the cut.

This technique is especially useful if you have a number of identical stopped cuts to make.

A second method for gauging the end of a stopped cut is to transfer the location of the leading edge of the blade to the rip fence (upper left photo). A line drawn on the face of

the rip fence (center photo) indicates the location of the front of the blade. Then all you have to do is lay out the end of the stopped cut on the top of your workpiece. When the layout line on your workpiece meets the line on the rip fence, you can stop the cut (upper right photo).

COMPLETING THE CUT. Because the end of the stopped cut isn't perfectly square, you may need to complete the cut with a hand saw or band saw. If you are making intersecting cuts to create a notch or opening, you can clean up any remaining waste at the end of the cuts with a chisel.

GO VERTICAL. The stopped cuts I've described so far have all been made with the workpiece lying flat on the table saw. But for short stopped cuts (less than 3" in length), you have another option. By holding the workpiece vertically on edge, you can make perfect stopped cuts.

For this method, you'll want to use a miter gauge with a tall auxiliary fence to support the workpiece, as shown in the photo at left. This technique comes in handy for operations such as notching the corners of a panel to fit around the legs of a table or inside a case.

STOPPED DADOES. Another type of stopped cut is a stopped dado. You can read more about making stopped dados in the box at left.

Stopped table saw cuts are generally not something you'll find yourself making every day. But it's helpful to know a few tricks and techniques for tackling them when the need arises. **W**



- ▲ Standing a workpiece on edge is a simple way to make short stopped cuts. A tall auxiliary fence on the miter gauge supports the workpiece.

How-To: CUT STOPPED DADOES

The same techniques used to make stopped table saw cuts can also be applied to making stopped dados using a dado blade. The key difference here is that because you can't raise the dado blade very high, you'll end up with fairly long curved area at the end of the cut.

The solution here is simple. Just square up the end of the cut with a chisel. Most of the time, a stopped dado is used to hold a shelf or divider, so the end of the cut will be hidden anyhow.



- ▲ A sharp chisel and a steady hand make quick work of squaring up the end of a stopped dado that has been cut on the table saw.



Shop Notes

Bevel Gauge Jig

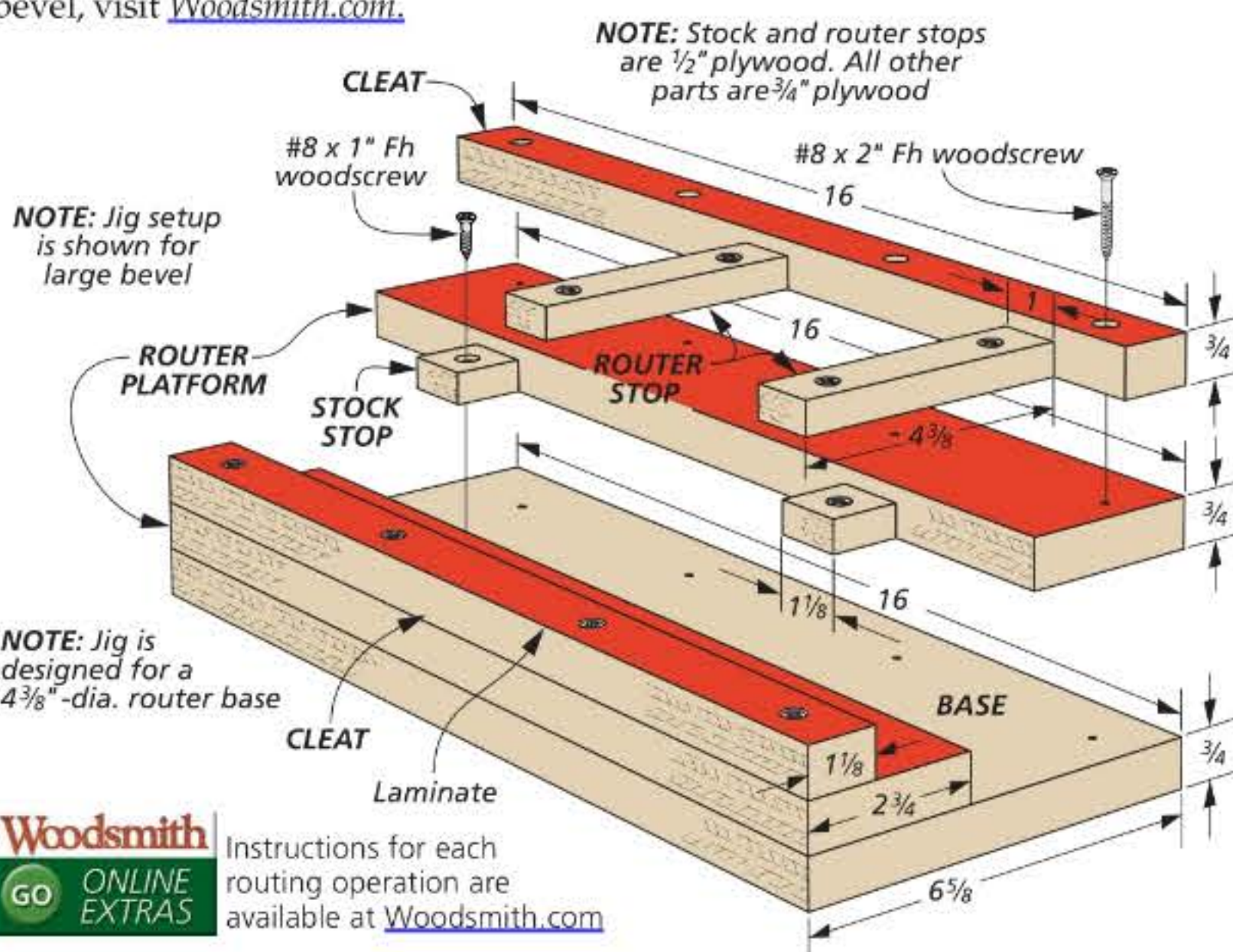
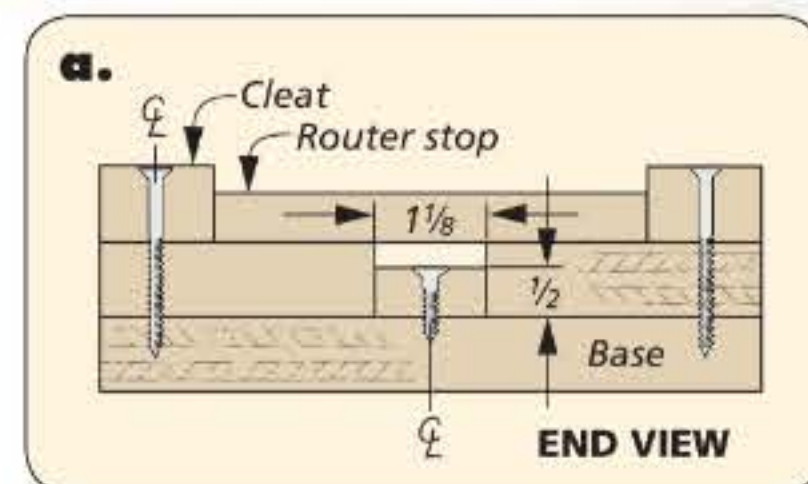
The bevel gauges on page 38 require accurately routing small parts. To ensure safety and repeatability, I used the router jig shown here. It's designed to use in conjunction with a small palm router.

EASY TO BUILD. The construction of the jig is pretty simple. It consists of a plywood base with two layers of plywood on top. The first layer creates an opening for the workpiece and acts as a platform for the router base. The second layer is a set of cleats that help keep the router aligned during use. I applied plastic laminate on the top layers of plywood to allow my router to slide smoothly.

SLICK OPERATION. As I mentioned, this jig was designed to be accurate and repeatable. That's accomplished with a couple of sets of stops. The first set sits in the opening of the router platform. These stock stops keep the workpiece in place during routing.

The real meat and potatoes, however, is the second set of stops. These are located on top of the router platform and are adjustable. They are screwed in place and stop the router bit in a pre-determined location.

The stops have two positions. The first is for routing the recesses in the sides and drilling the counterbore and hardware holes. The second position is for routing the slot in the blade of the bevel, as seen in the photo above. To see a full detailed illustration of each stop position, and for using the jig for the small bevel, visit Woodsmith.com.



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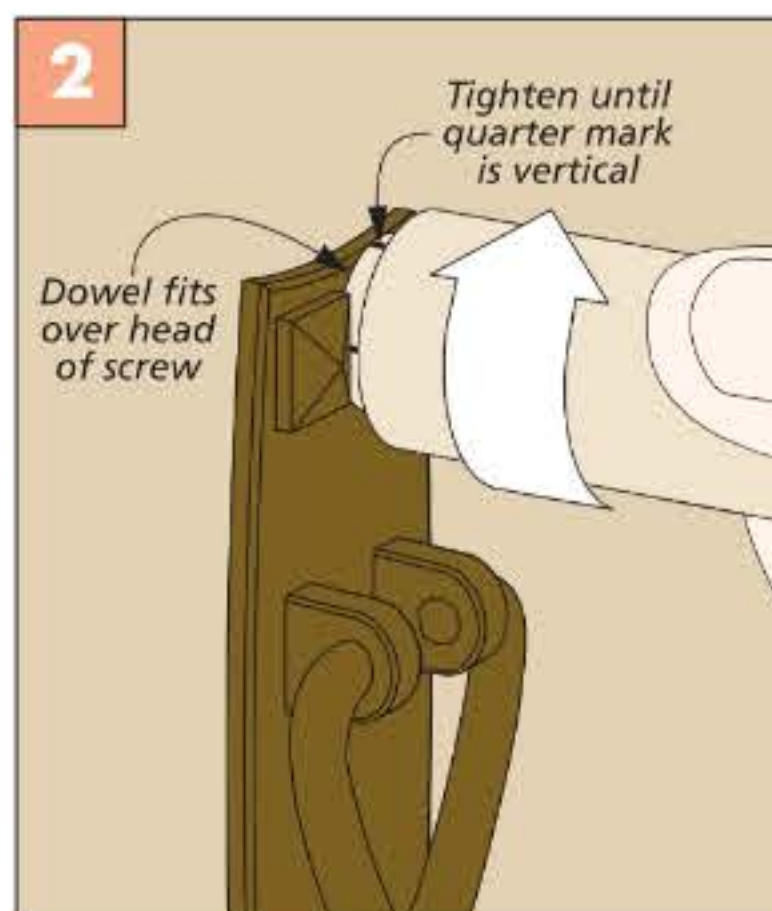
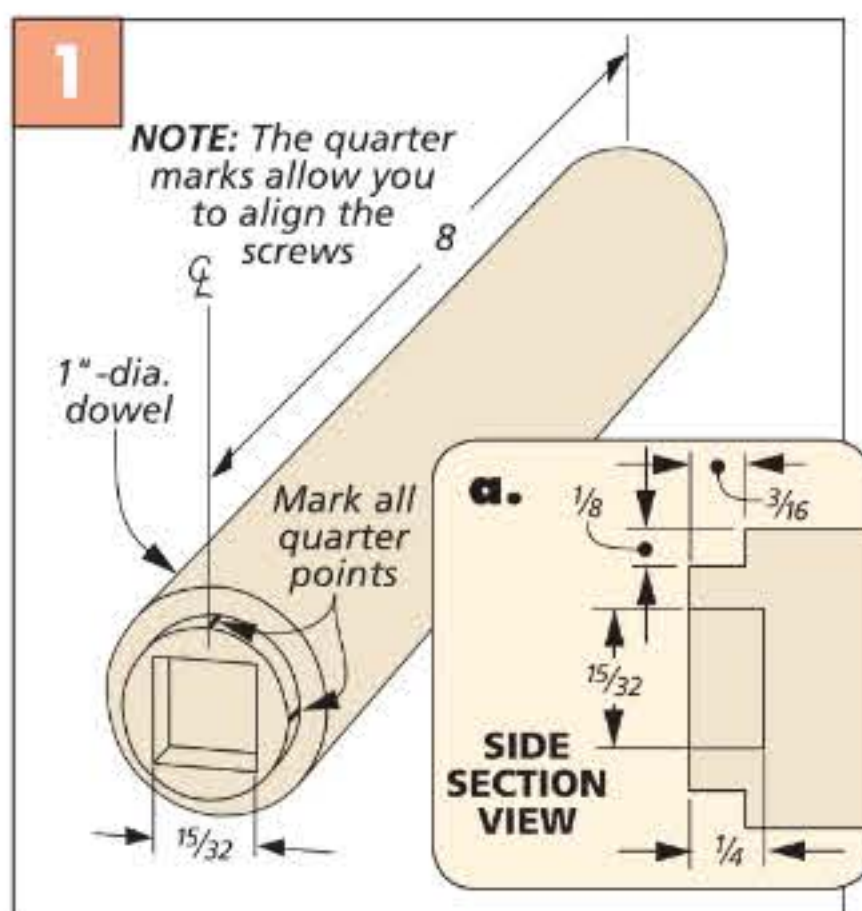
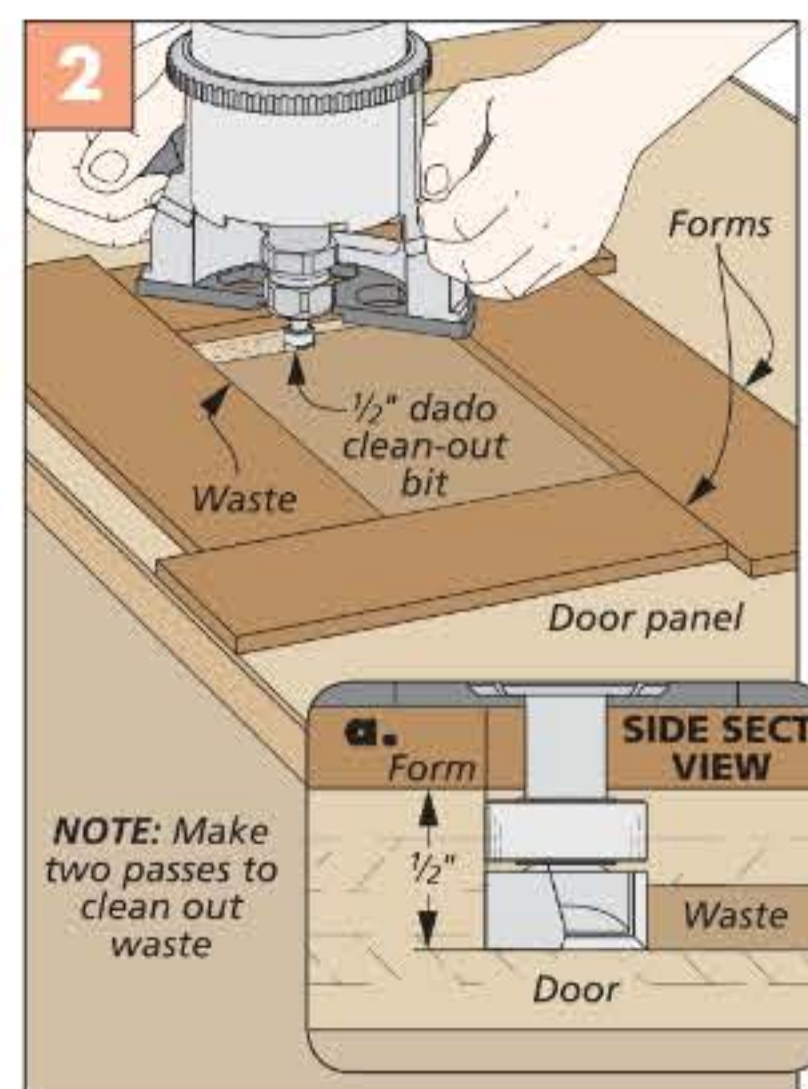
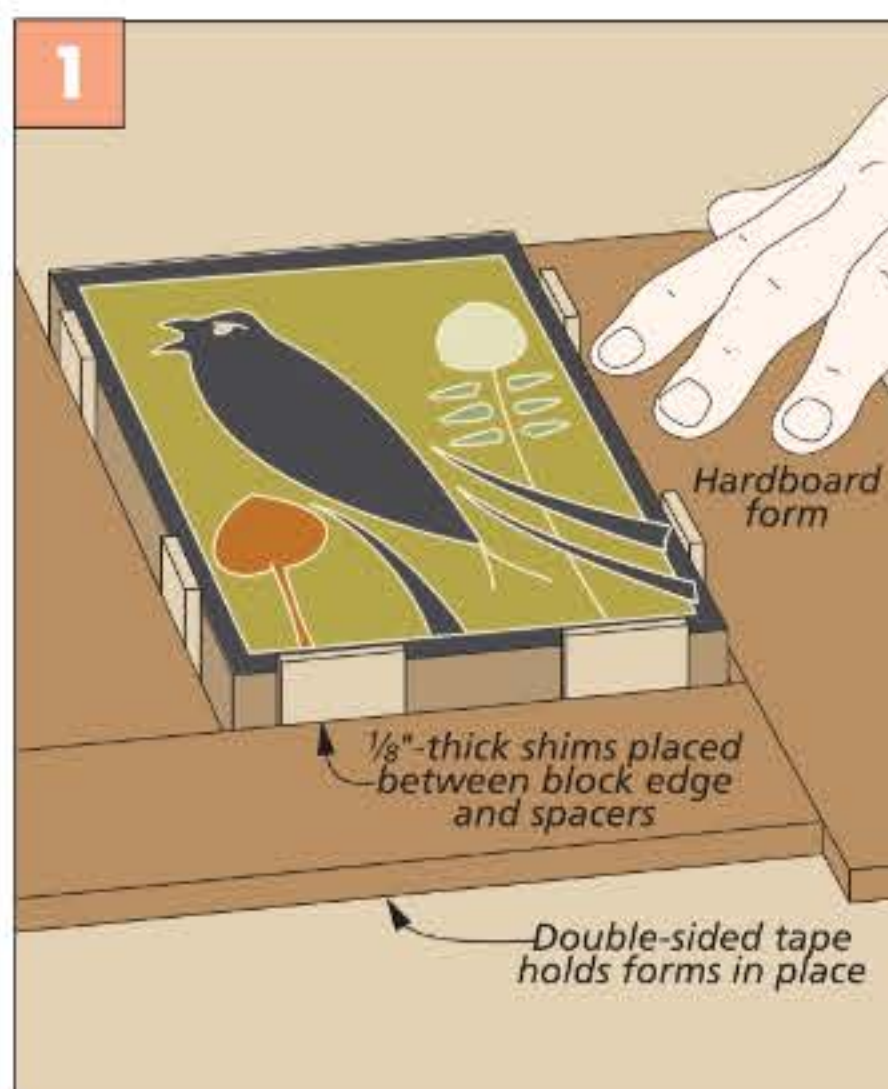
Instructions for each routing operation are available at Woodsmith.com

Recess for Door Tiles

To accurately fit the tiles in the doors of the armoire on page 42, I used the tiles and some shims to set the boundaries needed for the recess. (The shims are a stand-in for the hardwood tile trim that lines the opening of the recess.)

Start by positioning the tile on the door, as shown in Figure 1. Follow this up with the shims at the edges. Next, I cut some hardboard forms to pinwheel around the tile and shims. They're held in place with double-sided tape.

Figure 2 shows the details for routing the recess. (I did this in multiple passes.) Rout the perimeter first, then nibble away the rest of the waste.



Dowel Wrench

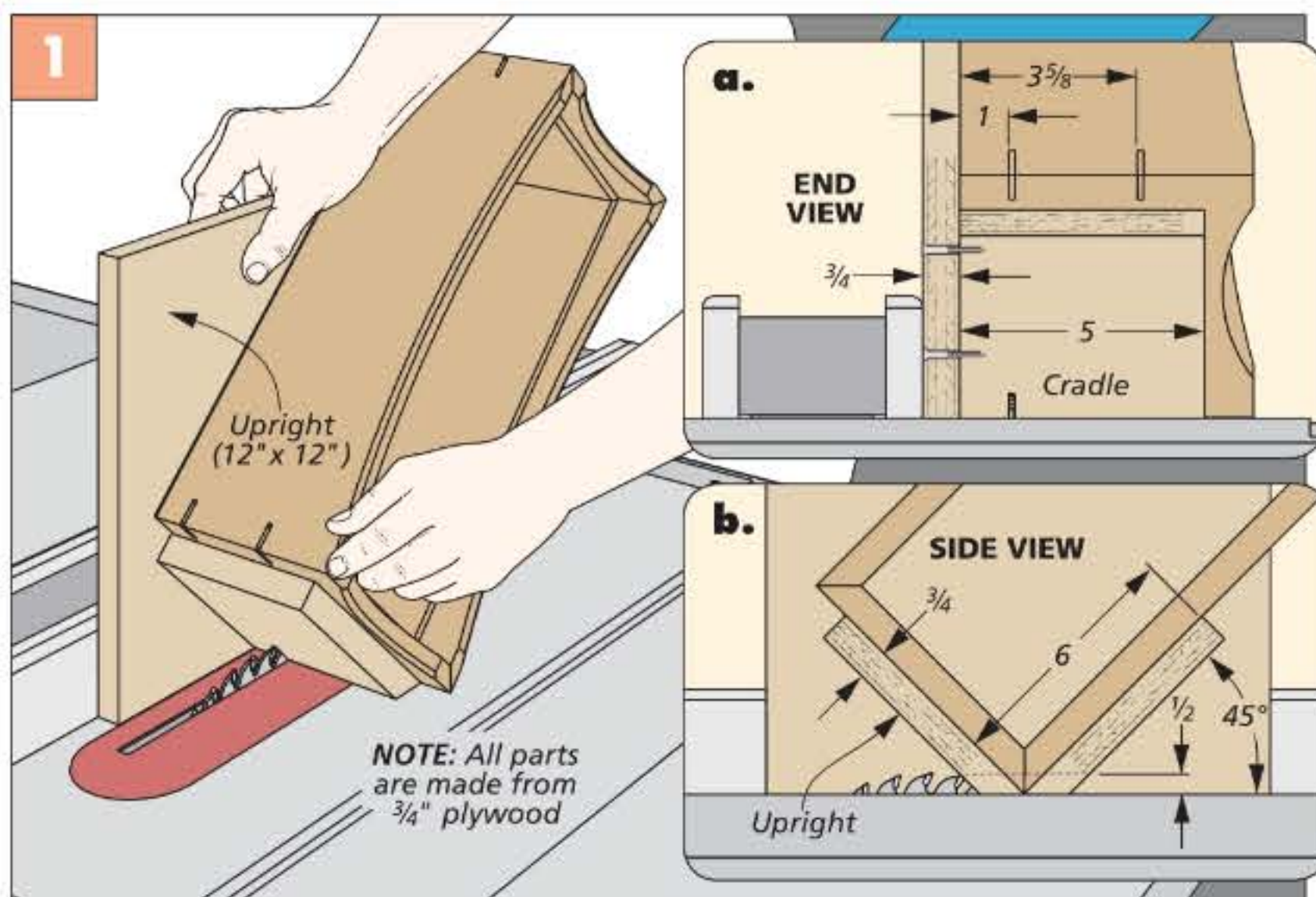
The pulls for the door and drawer hardware on the armoire (page 42) employ square-head screws. To prevent marring the screws while installing them I made the wrench you see in Figure 1 from a length of maple dowel. I cut out the socket on the end with a chisel.

CLOSE QUARTERS. The dowel wrench works great for the pulls on the drawers. But to install the screws on the door pulls (Figure 2), I notched the end of the dowel so it will turn past the installed screw (detail 'a'). The quarter-mark lets you align the screws to each other.

Slot-Cutting Jig

The sound chamber for the tongue drum on page 16 is constructed using miters at the corners. In order to provide some strength and a nice, decorative detail, two splines are added to each corner. The tricky part is cutting the slots for the splines so they end up a consistent depth and evenly spaced around the perimeter of the box.

SIMPLE JIG. I turned to this easy-to-build jig for use at the table saw. It goes together quickly and holds the box at the proper angle for cutting the slots. Simply place the box in the cradle and slide the upright along the rip fence to make the slots. After cutting one slot at each corner, move the rip fence over and cut the second slots, rotating the box between cuts. **W**



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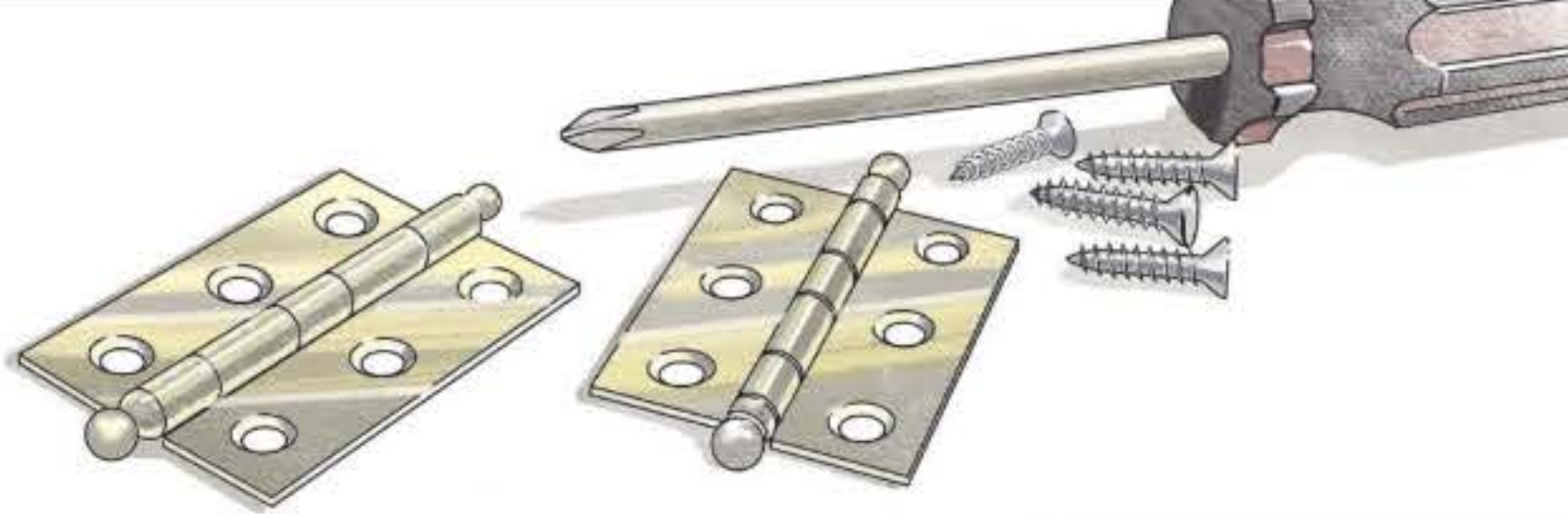
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hardware & supplies

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 right margin for contact information.

COPING & FRET SAWS (p.14)

- **Blue Spruce Toolworks**
Ultimate Coping Saw . . . varies
- **Knew Concepts**
Coping Saw 125.012
Titanium Fret Saw . . . 125.005T
- **Elkhead Tools**
Knew Concepts Handle . . varies

TONGUE DRUM (p.16)

- **McMaster-Carr**
Neoprene Balls (black) . 9957K12
Poly. Balls (semi-clear) . 6490K14
- The tongue drum was finished with two coats of spray lacquer.

DRILL BIT STORAGE (p.22)

- **Amazon**
Bar Magnets B07DFZH4WT

DOG KENNEL (p.30)

- **Lee Valley**
128mm Drawer Pull . .01W86.32
Small Latch 01W63.20
Standard Hinges 01W98.10
- The case of the kennel was painted with Benjamin Moore "Balsam." The cherry parts were stained with Varathane "Traditional Cherry" gel stain, followed by a couple coats of clear lacquer.

BEVEL GAUGES (p.38)

- **McMaster Carr**
Brass Washer 92916A395
Brass Knob 5125K51
Barrel Extension 93122A335
Post & Screw 93813A336

ARMOIRE (p.42)

- **Cabinet Parts**
110° Hinge Soft Cls .BH71B3750
9mm Mntng Plt . . BH175H7190
20" Full Ext. Slides . VLS-20-SC
Wardrobe Rail . . HAF-801.42.656
- **Rockler**
1/4" Black Shelf Pins 22781
1/4" Black Pin Sleeves . . . 22872
- **Craftsman Hardware**
Vertical Pull CH-1017ACP

Horizontal Pull . . . CH-1016ACP

- **Motawi Tile**
Songbird Facing Right 4868
Songbird Facing Left 4867
- The armoire is stained with Varathane "Traditional Cherry" Gel Stain. Then, it's sprayed with a couple coats of clear lacquer.

TAMING TEAROUT (p.54)

- **Lie-Nielsen**
No. 62 Low-Angle Jack 1-62
Toothed Blade 1-BL-62T
90° Blade 1-BL-62-90
- The Low-Angle Jack from Lie-Nielsen ships with the blade used for smoothing (1-BL-62).

STORAGE OPTIONS (p.58)

- **Rockler**
Starter Kit Ceiling Track . 56867

BEVEL GAUGE TIPS (p.60)

- **Amazon**
General Protractor . B00004T7TB
- **Lee Valley**
Bevel Setter 05N66.01

MAIL ORDER SOURCES

Project supplies may be ordered from the following companies:

[amazon.com](https://www.amazon.com)

Blue Spruce Toolworks
[bluesprucetoolworks.com](https://www.bluesprucetoolworks.com)

Cabinet Parts
800-857-8721
[cabinetparts.com](https://www.cabinetparts.com)

Craftsman Hardware
509-766-4322
[craftsmanhardware.com](https://www.craftsmanhardware.com)

Elkhead Tools
[elkheadtools.com](https://www.elkheadtools.com)

General Finishes
800-783-6050
[generalfinishes.com](https://www.generalfinishes.com)

The Home Depot
800-466-3337
[homedepot.com](https://www.homedepot.com)

Knew Concepts
831-234-4652
[knewconcepts.com](https://www.knewconcepts.com)

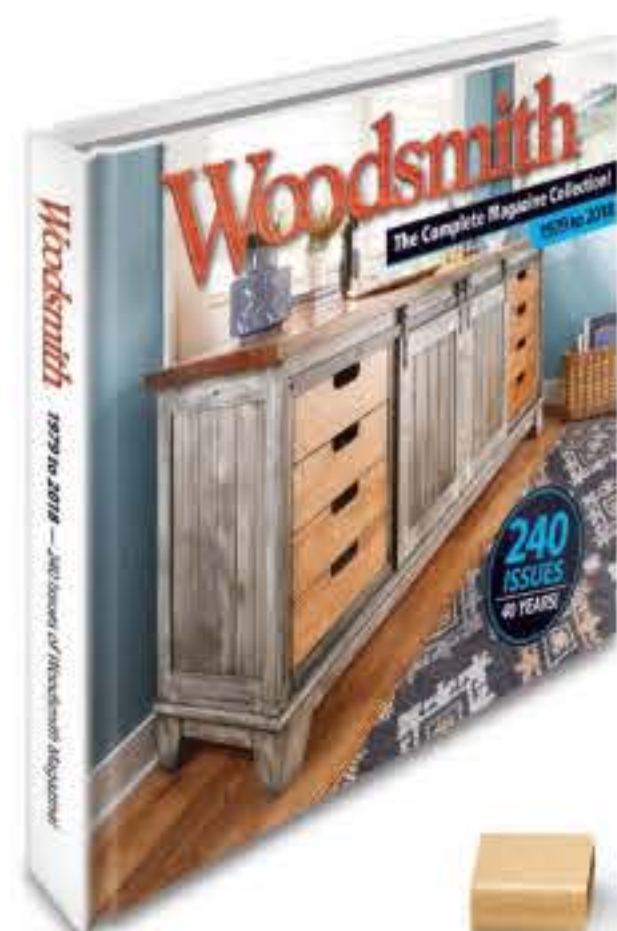
Lee Valley
800-871-8158
[leevalley.com](https://www.leevalley.com)

Lie-Nielsen
800-327-2520
[lie-nielsen.com](https://www.lie-nielsen.com)

McMaster-Carr
630-833-0300
[mcmaster.com](https://www.mcmaster.com)

Motawi Tileworks
734-213-0017
[mowtawi.com](https://www.motawitile.com)

Rockler
800-279-4441
[rockler.com](https://www.rockler.com)



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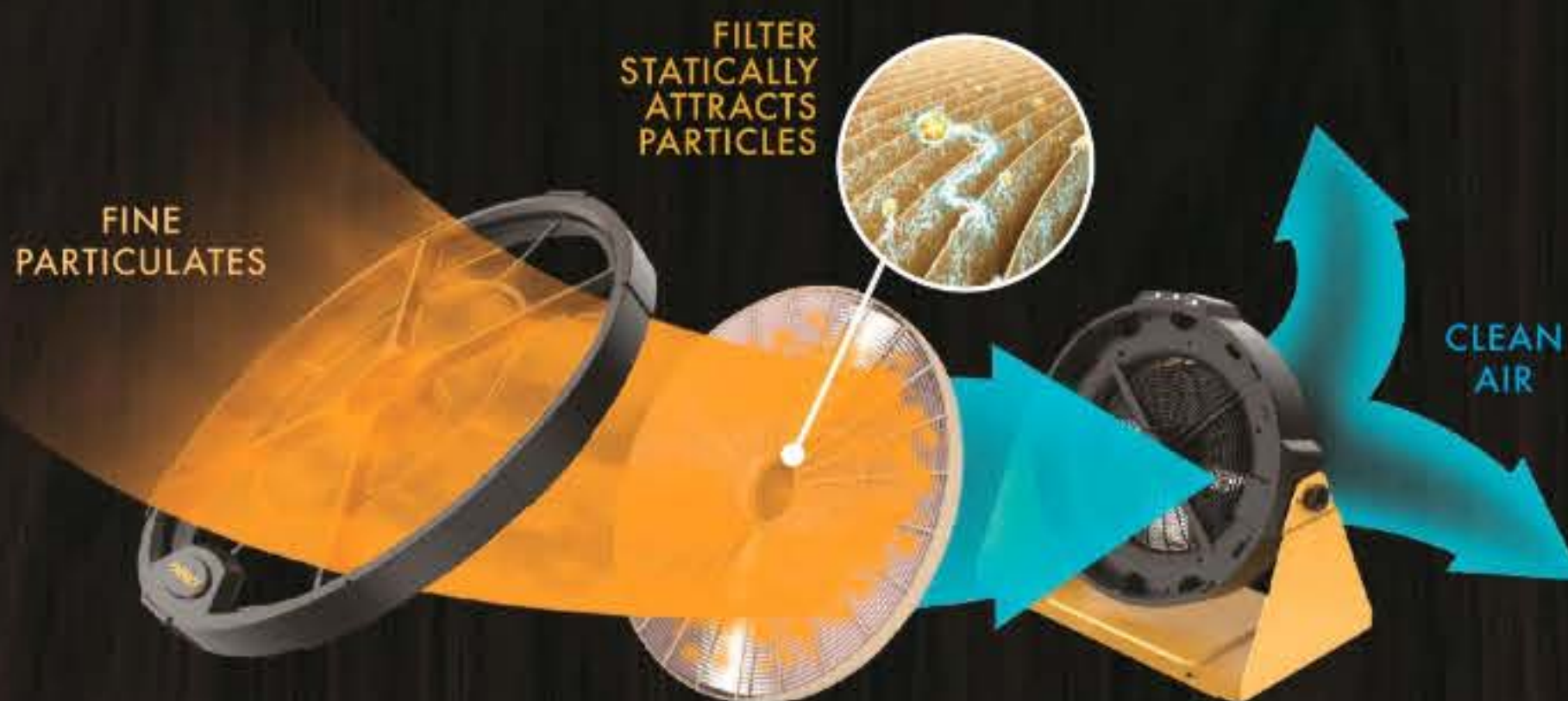
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