

GUILD ♦ EDITION

Woodsmith®

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Vol. 43 / No. 253

HORIZONTAL MORTISING MACHINE

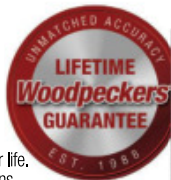
Inside this Issue:

- ▶ **Boost Your Hand Saw Skills**
Cut Faster & More Accurately
- ▶ **Router Workshop**
Flush Trim Bits
- ▶ **SketchUp**
High-Tech Design Help

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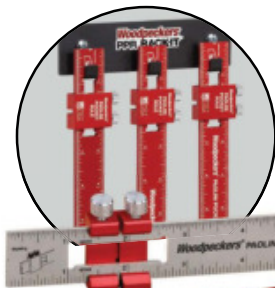
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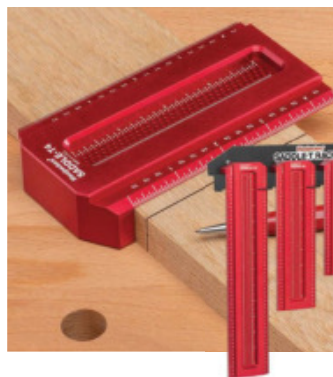
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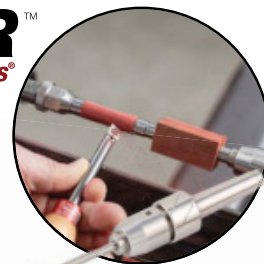
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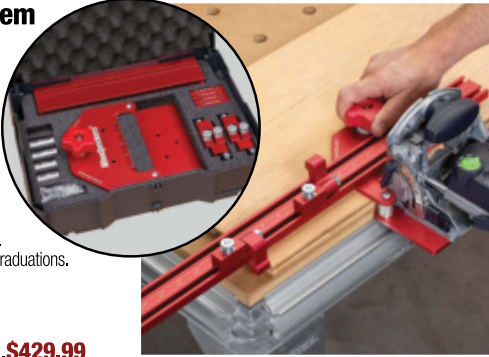
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Domino not included.

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Offset Base System....\$429.99

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Made for Festool® Track Saws

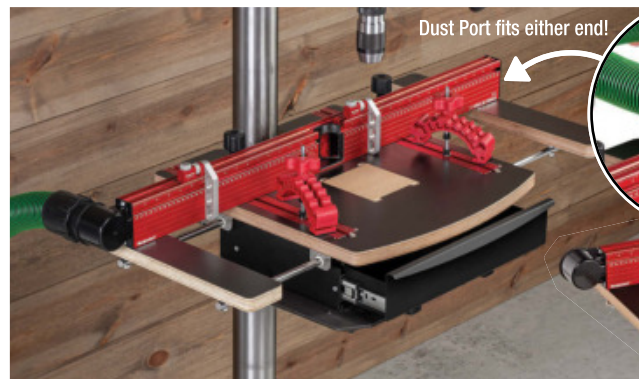
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TOOL

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Woodworkers Edge Rule

Includes wall-mountable Rack-It™.
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from the editor Sawdust

"Something fun in every issue." Creative Director Chris Fitch and I were talking about this year's project lineup not long ago. And that's the motto we adopted. Woodworking is a hobby and it should be fun. Clearly, your idea of fun probably is different from mine, but I think this issue offers several projects that compete for the fun prize.

My winner is the set of three pub signs. The goal here is to offer appealing designs you can make while teaching the skills and techniques you could apply to your own custom sign — maybe a workshop sign?

Based on the messages I get from readers, I have a sneaking suspicion that the router mortising machine may rank high on the fun meter, too. Shop-built tools prove to be quite popular. And with all the features of a high-end tool (but without the high-end price tag), there's a lot to like.

We had a "desk" on the list of projects for some time now. And with all the upheaval of working and learning from home, the time seemed right. Chris came up with a great-looking and easy to build desk that fits right it. The desk and shelf are part of our line of "essential" furniture. Keep an eye out for a bookcase to go with it in the next issue.

I'd like to hear what your fun project is. Happy woodworking!



SHANNON ROGERS, CONTRIBUTING WRITER

◀ Shannon started a woodworking blog called *The Renaissance Woodworker* back in 2008 that straddled the line between power tools and hand tools. He finally unplugged his last power tool in 2010 and started making shavings using only Twinkie power. He currently runs *The Hand Tool*

School teaching thousands of woodworkers on 6 continents how to become better woodworkers with hand tools. By day, he's the Director of Marketing for one of the oldest lumber companies in North America, J. Gibson Mcllvain Co. So basically he is a wood nerd living the dream.

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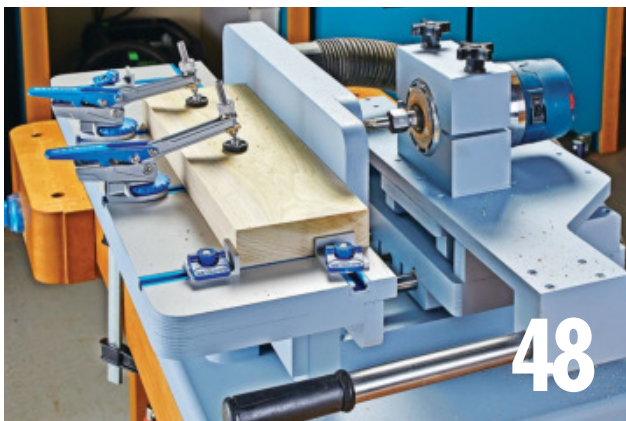
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READER'S Tips



Heat. After clamping the acrylic in between a pair of boards, use a heat gun on low heat to slowly soften the plastic along the board.



Bend. When the plastic starts to droop, use another board to bend the warmed plastic down, making an even bend.

Mortising Machine Dust Cover

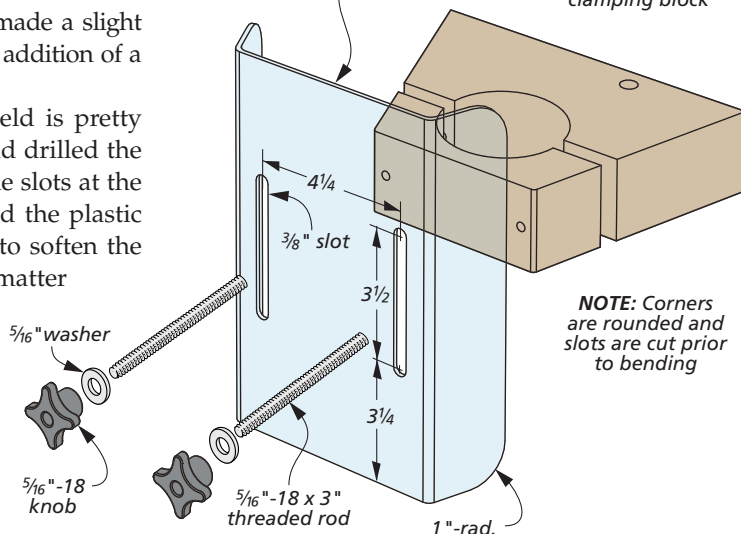
One of my favorite tools happens to be a shop-built tool from *Woodsmith*. It's the mortiser seen here from issue No. 217. I made a slight improvement that you see in the photo above — it's the addition of a clear safety shield in front of the router.

FORMED ACRYLIC. Molding a piece of acrylic into a shield is pretty straightforward. I started with a flat piece of stock, and drilled the end locations for the mounting slots. Then, I routed the slots at the router table. After rounding the corners, I sandwiched the plastic between a pair of wood blocks and used a heat gun to soften the plastic enough to form the shape. Then, it's a simple matter of mounting it to the router clamping block.

*Regis Volesky
Austin, Texas*

SHIELD
(10" x 10" - 1/8" Acrylic)

NOTE: Drill and install
T-nuts into the mortiser
clamping block



For complete plans for these
design options, go to:
Woodsmith.com/253



▲ The drum is buried in the table and also in a notch in the fence. This allows the fence to be adjusted for different recesses.

Straight-Up Sanding

If you've ever tried to sand a straight line with a sanding drum, you know it's easy to go past the line. Recently, I came up with a simple solution for this problem.

FENCE. As you can see in the photo, I added a fence behind my sanding drum. I position the fence so that it only allows the drum to sand up to the line. The key

is making sure the fence is long enough for the workpiece feet to contact the fence the entire way.

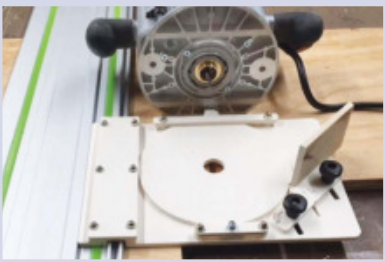
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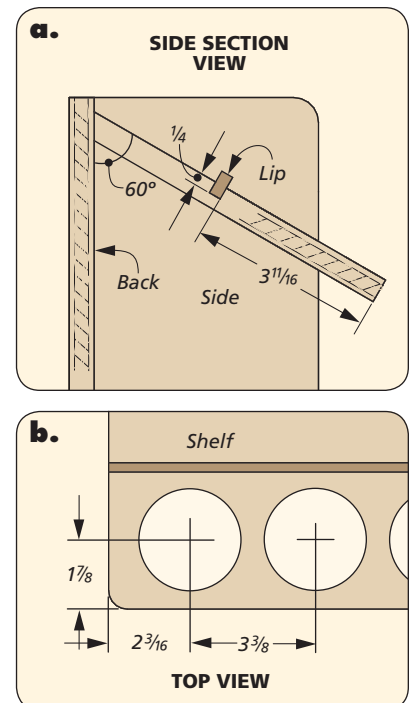
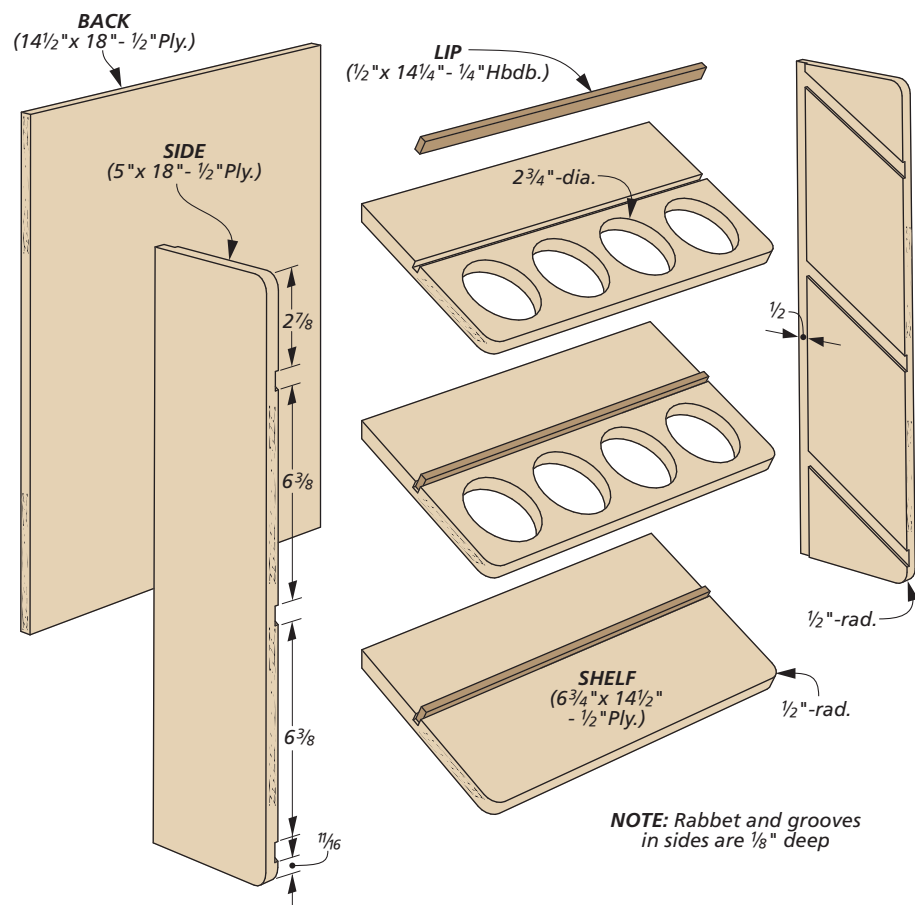
Spray Paint Storage

Storing spray cans in my shop has always been a headache. While I've seen a lot of different storage ideas, a recent mission to use up some of the small scraps in my shop led me to the can holder you see here.

SLANT SHELVES. As you can see from the photo and drawing below, the can holder is a wall rack. Three slanted shelves hold the cans in place. The holes are drilled with a hole saw, and each shelf is the same, with the exception of holes in the upper two shelves. The great thing about this design is that you can expand it to hold as many cans as you need by simply making more shelves and lengthening the sides.

WALL MOUNTED. The rack hangs on the wall with a couple of screws through the back. A hardboard cleat holds the bottoms of the cans. Now, I can store all my cans of paint and lubricant where they're easy to access.

*John Doyle
Ankeny, Iowa*



QUICK TIPS



Dull Edges. Larry Hilton of Green Bay, WI was having a problem remembering which edges of his carbide turning tools he had used. To leave himself a reminder, Larry now colors the dull edge of the carbide tool before he rotates it. That way, when he needs a fresh, sharp edge, he knows which edges he's already used.



Power Strip Mounting. Sarah Vallient of Princeton, MO found it frustrating to get screws correctly spaced for the slots on the back of power strips. As a simple solution, Sarah discovered that she could cover the strip with a piece of masking tape and use a marker to mark the slot locations. Then, she can peel the tape off and put it on the mounting surface. The marks on the tape make it easy to drill and drive the screws in the correct spot.

SUBMIT A TIP TO WIN



If you have an original shop tip, we would like to hear from you! Jump online and go to:

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You'll be able to tell us all about your tip and upload your photos and drawings. You can also mail your tips to "Woodsmith Tips" at the editorial address shown on page 4. If your tip is selected it will get published right here in the magazine. You'll be entered to win a gift cart to Lee Valley.



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CREATE WITH CONFIDENCE

Flush Trim Bits

When I first started woodworking, I didn't have a router and created "identical" parts one at a time, measuring, cutting, and shaping them one by one. I kept my fingers crossed that they'd match.

After getting my first router and bit set, I was able to create identical parts by making a template and trimming my rough-cut workpieces with a flush-trim bit. Over the years I learned a few tips and techniques for getting the best results.

These tips don't require any specialized bits. For the majority of my work, I use the three basic bits you see at left. My workhorse bit is the flush-trim bit at the top. Its bearing is attached at the end of the bit and I use it in my router table, so I can see the bit in relation to my template, as you can see in the main photo above.

If I need to do hand-held work, I often switch to the pattern bit in the center. It's where the bearing is attached to the shank.

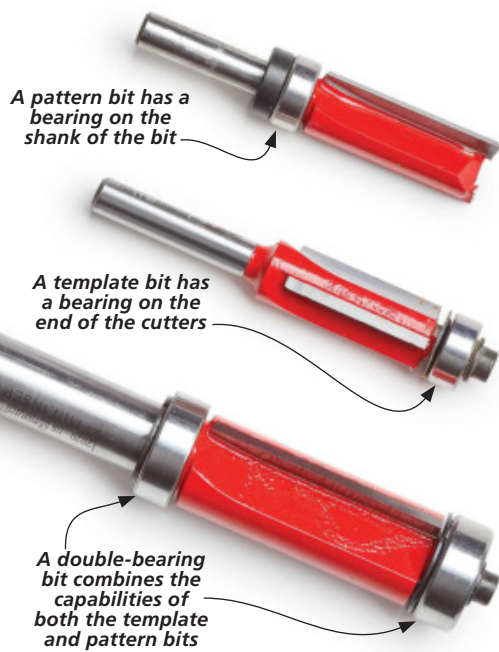
Again, I can more easily see how the bearing and pattern are working together. The third option is to buy a double-bearing bit (bottom). This style allows you to use the bearing that best suits the task at hand.

A TEMPLATE FOR SUCCESS. The whole point of flush trimming is to make a precisely shaped workpiece using a template as a guide for the router bit. So the results are only as good as the template.

One often overlooked consideration is the thickness of the template. I like to use $\frac{1}{4}$ " hardboard because it's easy to shape and has a fine consistency.

The challenge is that flush-trim bits have a gap between the bearing and cutting edges. If the template is too thin, it may not allow you to raise the bit high enough to make a full cut while keeping the bearing in contact.

The solution is to glue two layers of hardboard together. The resulting template is still easy to shape and provides a wider edge



A pattern bit has a bearing on the shank of the bit

A template bit has a bearing on the end of the cutters

A double-bearing bit combines the capabilities of both the template and pattern bits

▲ Three basic bits above will cover the bulk of your flush-trimming needs. Start with a template and add from there to meet your needs.



▲ An extra-thick template keeps the entire cutting edge of the bit engaged with the workpiece while the bearing is still fully supported along the edge of the template.



Smooth Start. The shape of your workpiece is going to match the template. This means you'll want to spend extra time sanding the edge as smooth and even as possible.



Accurate Tracing. Once the template is exactly the shape you want, you'll use it to trace its shape onto your workpiece. Use a sharp pencil to make an accurate mark on one face.



A Close Cut. At the band saw, remove the bulk of the waste by cutting close to the layout line. The less waste you have to trim away with your flush trim and router means smoother results.

for the bit (upper left photo).

SMOOTH AS SILK. Any irregularities in the template will transfer to the edge of the workpiece. So it pays to take extra care and make the template as smooth as possible (upper right photo).

Time spent smoothing the template means less work later on your actual workpieces.

LESS IS MORE. Before you start routing, there's another important thing to keep in mind. It has to do with the amount of waste

material you need to remove. To avoid spoiling the workpiece, it makes sense to stay away from the line as you remove the waste. Removing the remaining material in one pass, however, puts a lot of stress on the router bit and can cause the wood to tear.

The solution is simple. After tracing the template (lower left photo above), aim to leave just $\frac{1}{8}$ " of waste, as shown in the lower right photo. This is easily handled by the router and is quicker than routing in most cases.

ATTACHING THE TEMPLATE. The final step before routing is to attach the template to the workpiece. Double-sided tape is the key here, as you can see in the photo at left. It securely holds the template in place while still making it easy to remove and reuse for the next workpiece.



▲ To secure the template to the rough-cut workpiece you can't beat double-sided tape. A single strip or even a few shorter pieces is all it takes to make sure the template doesn't shift as you work.

ROUTING

With the template taken care of and securely attached to your workpiece, you're ready to create a perfectly matched part. Here are the tips I follow for success.

THE BASICS. Trimming a workpiece flush is a simple matter of making a smooth, steady pass along the edge (photo at right). Straight sections and areas that are gently curved are easy to take care of this way.

As you do this, it's best to take a look at the amount of waste that needs to be removed. Sometimes, I'll end up straying away from my layout line when I'm using my band saw to remove the bulk of the waste. The result is having to rout away more material than



▲ After adjusting the bit height so the bearing rides along the edge of the template, creating a matching part is easy. Make a steady pass along the workpiece with the bearing firmly against the template.

I'd like to. In situations like this, I find it best to take some skim cuts first. This way, I can knock down the high spots before making my final pass with the bearing running against the template.

CURVES & GRAIN. Another thing to pay attention to as you're routing is the grain direction of the wood. You can see what I mean in the photo at left. On certain sections of a curved workpiece, you may find you're routing "uphill" against the grain. Because the wood fibers aren't supported, the wood can tear as the bit trims away the waste.

There are a couple of options for dealing with this. The first is to take light, freehand passes, similar to knocking down the high spots. This reduces the amount of waste being removed,

so there's less chance of tearout. But this does require careful routing and a steady hand.

PATTERN BIT. A better option is to switch to the pattern bit I mentioned earlier. Since the bit's bearing is on the shank, you'll need to flip the workpiece and template over. This means you'll approach the cut from the opposite direction, and the wood fibers will be supported. Having to swap to a pattern bit to do this is a small price to pay to get a clean edge. For another smooth edge option, no matter what type of flush-trimming you're doing, check out the box below.

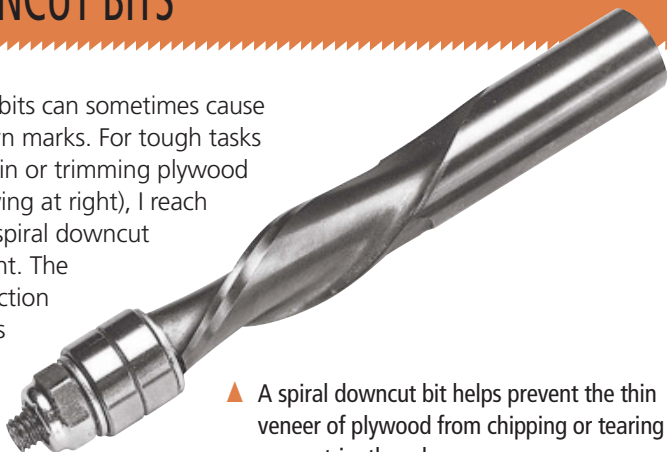
Using these tips as part of your routing approach will yield better results and parts that fit (and look) better. And that means a better-looking project. **W**



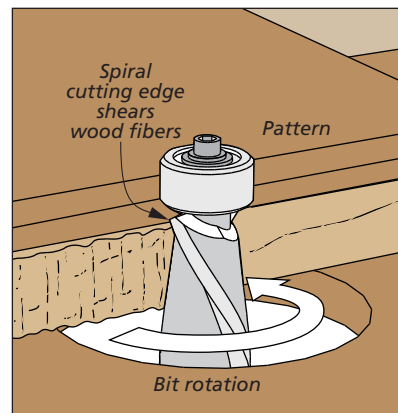
▲ To avoid tearout in tight curves it's best to switch to a pattern bit. This way you can flip the assembly and rout with the grain for a smooth cut.

SPIRAL DOWNCUT BITS

Ordinary flush-trim bits can sometimes cause tearout or leave burn marks. For tough tasks like routing end grain or trimming plywood panels to size (drawing at right), I reach for a solid carbide, spiral downcut bit, as shown at right. The downward slicing action of the cutting edges prevents tearout and leaves a perfectly smooth surface behind.



▲ A spiral downcut bit helps prevent the thin veneer of plywood from chipping or tearing as you trim the edge.



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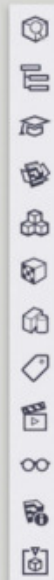
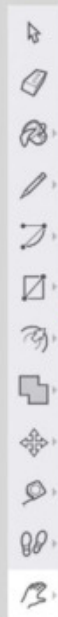
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Intro to SketchUp

When it comes to wood working, nothing beats a solid set of plans. And here at *Woodsmith*, we've prided ourselves on our plans. But, like most woodworkers, I often build things

"off the cuff." Sometimes it's from a picture someone sends me and says "Here, can you build this?" or it's something that's been in my head and is trying to break free. But there are times, especially when designing a commission piece or working through a complex project, that you need to flesh out the napkin sketches that so many of us often work from.

free for personal use) software for the home workshop trying to put a design onto paper. However, like most 3D design software, *SketchUp* can be a little overwhelming when you first dig into it. Luckily, if you take baby steps and master a handful of key functions and tasks, you're well on the way to converting your design to a full 3D model.

THE SKETCHUP WORKSPACE. Before we start talking about designing and drawing parts, let's eat our vegetables and understand how *SketchUp* functions. The world of *SketchUp*, and most other 3D software, is built off of a 3-axis design. You can see this in the image in the upper right on the next page.

SKETCHUP. I'm sure by now you've heard of *SketchUp*. Formerly, it was powered by *Google*, but has since been under a company by the name of *Trimble*. Regardless of the company that owns it, *SketchUp* remains a powerful (and

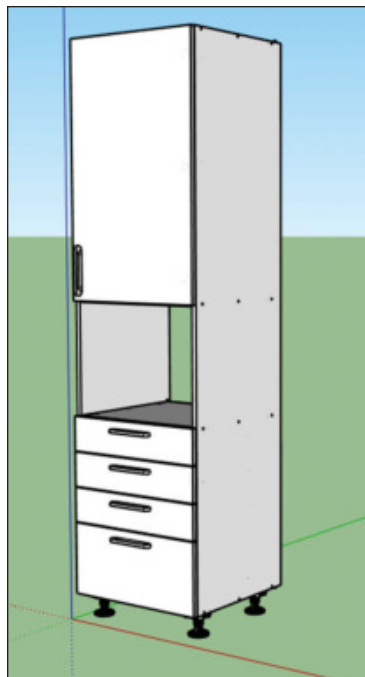


▲ A *SketchUp* model often serves as a starting point for a project, and comparing the finished piece to the model is always a fun experience.

That means that parts exist in the X, Y and Z axes. This is important as you start to design and move around in *SketchUp*. Parts will be built and oriented around and in relation to these axis and remembering that will help avoid a lot of headache as you work.

3D WAREHOUSE. One of the great things about *SketchUp* is the *3D Warehouse*. This is a large collection of designs (models) that have been built by people all over the world. When you're finished with a design, you can choose to upload your design to the 3D Warehouse. This makes the design you just completed available for all *SketchUp* users.

This can be a great way to learn to move around in *SketchUp* and can also serve as the foundation of a project. If you find a design that is close to what you're wanting to build, you can often use it as the starting point of your own design and just modify the parts.



Free Drawings. By performing a quick search on the 3D warehouse, you can often find a drawing to use as the start of your design.

NAVIGATION

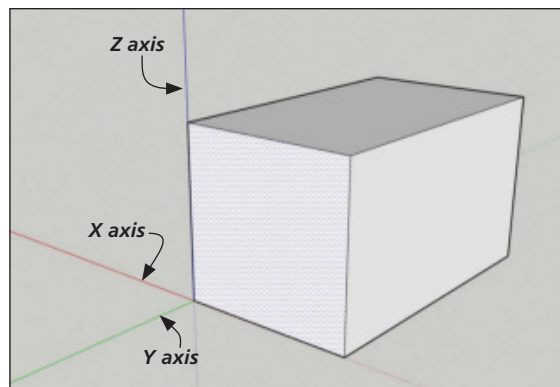
When it comes to the *SketchUp* tools that you find in the left hand toolbar, I tend to break them up into two categories — navigation tools and building tools. The first category, navigation tools, are what you use to move the “camera” around on your design and look at it from different angles.

SELECTION TOOL. The first navigation tool, the selection tool (hot key “space bar”), can be seen in the list to the right. This is the tool that is used to select items that you’ve built. After you’ve built a shape, you can use the selection tool to highlight one pane of the shape. You can see this in the upper right drawing. This is designated by the blue dots across that pane. To highlight the entire cube, you can drag a box around the shape (but it will also grab other shapes that you happen to cross over), or my preferred method is to hold down shift — this allows you to select multiple panes at once.

ORBIT TOOL. Up next is the orbit tool (hot key “O”). The orbit tool allows you to rotate the camera around your design, viewing it from all different angles. When using the orbit tool to change camera views, the camera will be anchored off of the center of where your screen is currently positioned. To move the camera laterally or vertically, you need a different tool — the pan tool.

PAN TOOL. The pan tool (hot key “H”) allows you to click and drag the camera around your design. This will move the camera along the X, Y and Z axis, in a linear fashion. This is good to move around to different areas on your project as you build it.

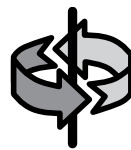
Zoom. Finally, to move the camera in and out on your project, you will use the zoom tool (hot key “Z”). This will allow you to zoom in and focus on



3-Axis. When first opening a *SketchUp* model, you'll see three lines designating the axes. A blue Z-axis, a red X-axis and a green Y-axis.



Selection Tool. Select different shapes, lines, edges, panes and objects. Can click to select or click and hold to drag a selection area.



Orbit Tool. The orbit tool is used to spin the camera around your model, and look at it from all different angles.



Pan Tool. The pan tool moves the camera side to side and up and down. Combined with the orbit tool, it allows you look at your model.



Zoom Tool. To zoom in and inspect parts of your model close up, the zoom tool is the perfect choice for the job.

small parts, joinery, etc. You can zoom by selecting the zoom key and clicking and dragging the design in or out. Another way to access the zoom function without changing your current tool is to scroll the mouse wheel. This will allow the camera to move in and out while keeping your current active tool at the ready. Now that you're familiar with the navigation tools, let's draw something.

Building parts in *SketchUp* is done by first drawing the shape in two dimensions. Then, after the shape is drawn, you give it depth. The tools that you use for this can be seen below.

CIRCLE TOOL. The circle tool (hot key "C") is used to draw circles. After selecting the center point of the circle with your cursor and clicking, you can drag out a circle to any size that you'd like. If you want to draw a circle for a specific size (a 48" diameter tabletop, for example), you can click the center point and type the radius of the circle (in this case, 24"). In addition to circles, you can use the circle tool combined with other shapes to create radii on corners of parts and roundovers on edges.

RECTANGLE TOOL. By far the most used tool for furniture design,

at least when I'm working on a design, is the rectangle tool (hot key "R"). It creates parts with four square sides. After selecting the rectangle tool, clicking on the work area locks a corner of the shape and you can drag a square or rectangle to whatever size you'd like.

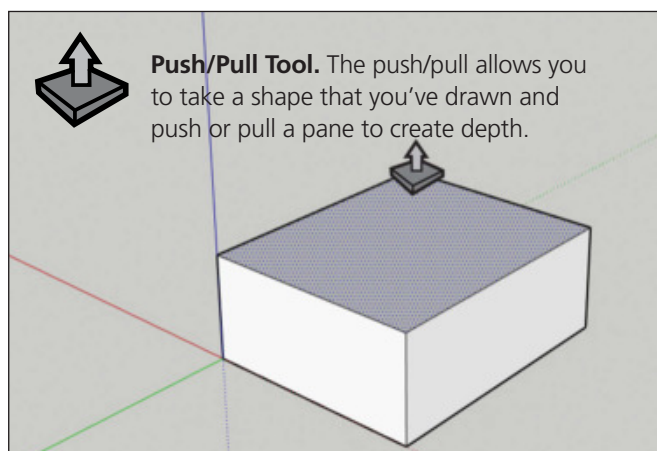
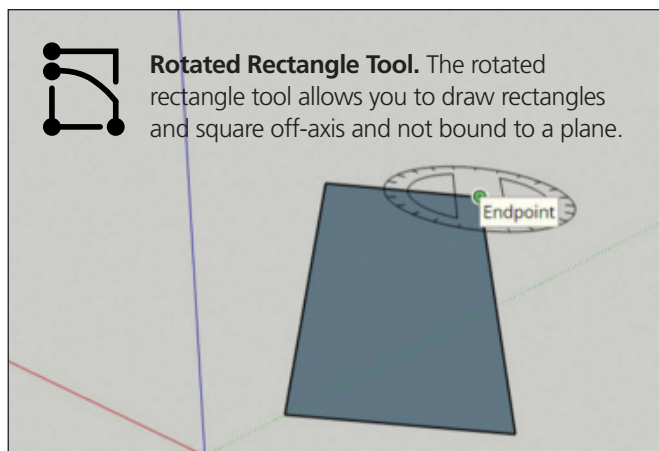
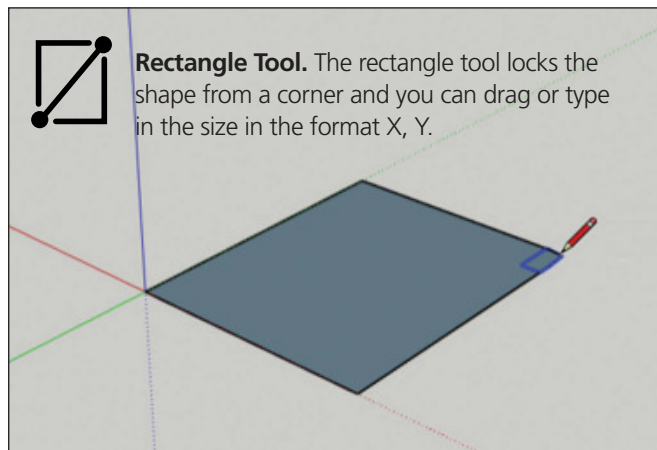
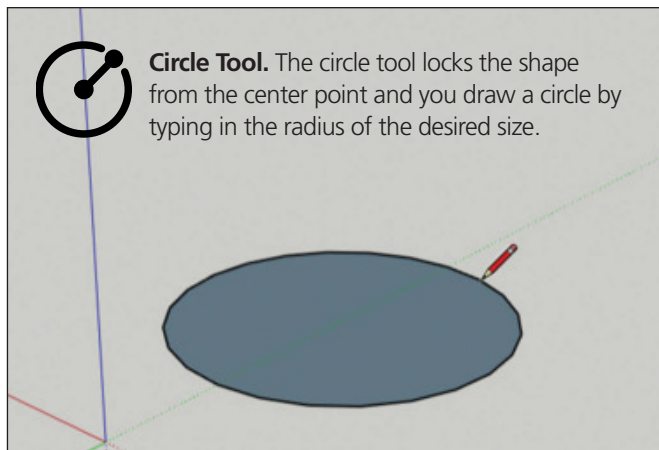
Alternatively, you can lock the corner of the shape by clicking, and type in the dimensions of your part. For example, creating a rectangle (such as the base of an apron), you would type in "3, 24" to create a part that is 3"x 24".

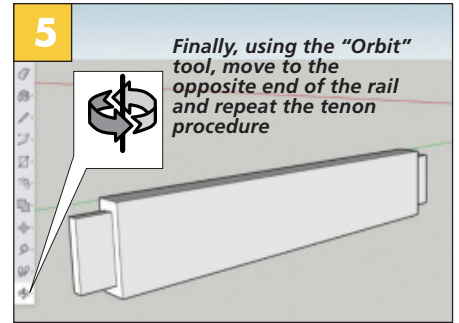
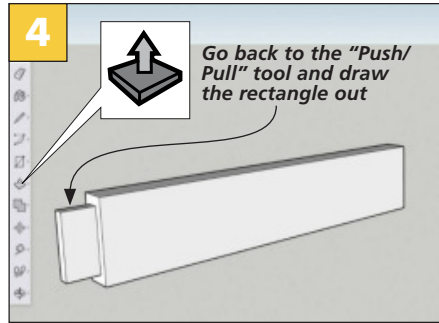
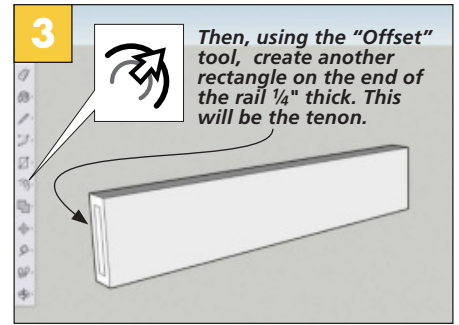
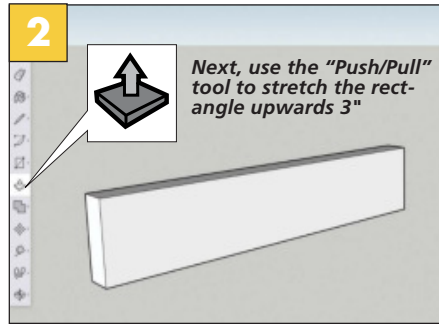
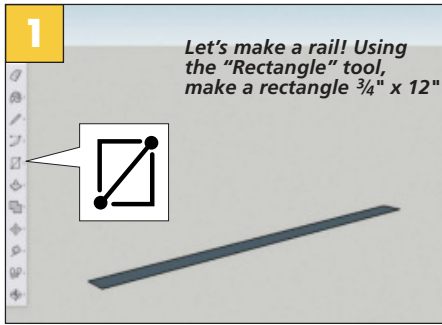
ROTATED RECTANGLE TOOL. Like the rectangle tool, the rotated rectangle tool allows you to draw rectangles, but rotated (off-axis) instead of being snapped to a plane. Picture drawing a three-dimensional triangle. Personally, I haven't found

much use for it in most of my *SketchUp* designs.

PUSH/PULL TOOL. Now, here's where the rubber meets the road. The push/pull tool (hot key "P") is used on a shape that you've already drawn. This tool will take the flat shape and allow you to "push" or "pull" it out to create dimension, like you see below. Like many of the other drawing tools, you can free hand how far you push or pull an object, or you can also type in a dimension. If you want to make a board a specific thickness, you can either type in the fraction (such as "3/4") or the decimal equivalent (.75).

One thing to note about the push/pull tool. After you've added depth to an object, that object's depth is now "0." Meaning, if you pull it out .75"





and lock that dimension in, performing another pull on the object for .75" will result in a part that is 1.5" thick.

MAKE A RAIL

Now that we've walked through the basics of navigating and the simplest forms of drawing, let's practice a part — for example, a rail with a tenon on each end. You can see the steps to create this shape above.

RECTANGLE FIRST. The first step to create a part is to draw a rectangle that is the "shadow" of the part. In this case, the rectangle tool is used to create a part that is $\frac{3}{4}$ " x 12" long (Figure 1). You can drag out the rectangle to this dimension, but I find it just as easy to type it in.

ADD DEPTH. You can now stretch the shadow into a part. Use the push/pull tool to pull the part to the height that you want. Here again, you can eyeball it, or type in the height. In Figure 2, we've created a height that is 3".

TENON. Here's where it gets interesting. To create a tenon on the end of the part, you can either use the rectangle tool to draw a rectangle on the end of the rail, or you can use a new tool — the offset tool. Click and hold push/pull tool, and you will see a few options pop up. The offset tool is one of them.

Selecting the end of the rail will create a shape that is an "offset" of the outer shape. Take a look at Figure 4 above. You can type in the amount of offset you would like. In this case, the tenon will be $\frac{1}{4}$ " smaller in all dimensions than the rail, so type in ".25".

With the push/pull tool selected, make sure the tenon panel is highlighted and draw it out. 1" seems like a good length for this tenon. You can see the finished tenon in Figure 4. As a side note, this is the same way you would create a mortise. Instead of drawing the rectangle outward to create a tenon, you would push it in to create a mortise.

REPEAT & ADMIRE. Repeat Steps 1-4 again on the opposite end of the rail. This will create a rail with a tenon on each end. Take a minute and orbit, pan, and zoom around the part to check your work.



For Your Finest Work...



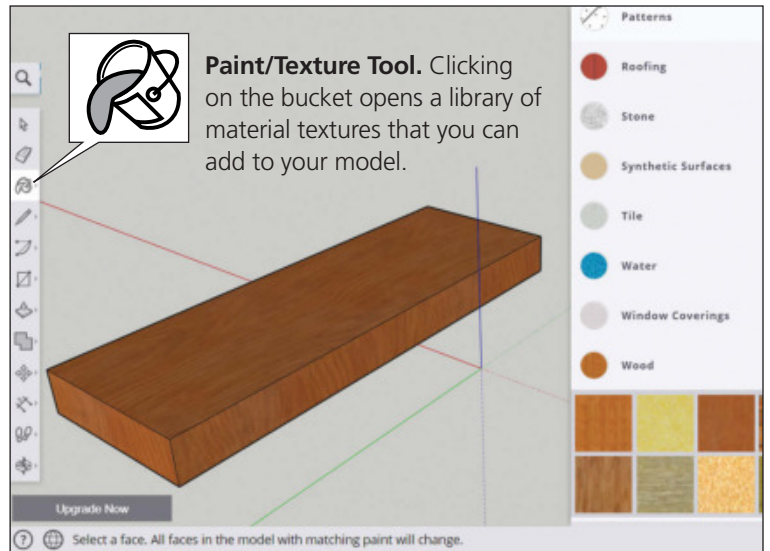
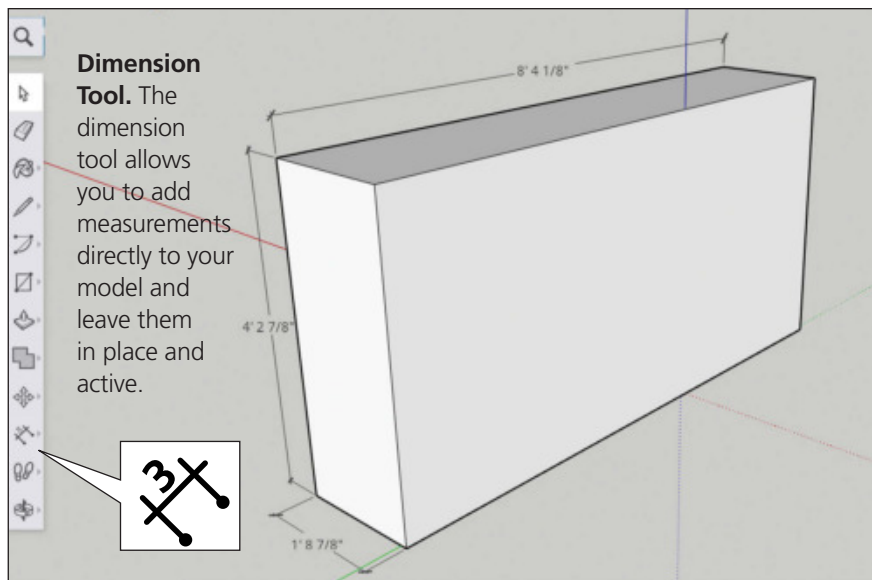
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OTHER TOOLS

At this point, with tenons drawn on both ends of your rail, it's a good time to get familiar with a couple of the other tools that you can use in *SketchUp*. One of these tools that you'll use quite often is the set of measuring tools.

TAPE TOOL. The tape tool can be selected by pressing "T." This tape measure acts exactly like a tape measure that you'd use in your shop. You select two points and the lower right hand corner reads out the measurement between them. However, after you move on, the tape measure reading is removed and you'll lose your measurement. Like the other tools in the tool bar, additional measuring tools can be accessed by holding down the tape measure button.

One of those additional tools is the dimension tool. This tool acts like the tape measure, but it puts the measurements directly on the model, like you see below. I find this particularly helpful after I've finalized a design and I want to bring a few of drawings of these parts into the shop and make them. I can use the dimension tool to draw the critical dimensions on the model and use it as my plans.



TEXTURE & PAINT TOOL. This next tool, the texture and paint tool (hot key "B") allows you to add color or a texture to your model. The poker table design on the first page of this article has a "walnut" texture applied that gives you a sense of how the finished project will look.

Likewise, you can paint colors or any other "texture" that's available in the window that pops up. This tool isn't something that I use every time I design something, but I do use it when I'm working on a design for a client and I want to give them a sense of what the overall aesthetics of the project will look like.

TIPS & TRICKS

Because I have taught myself most of what I know in *SketchUp*, there are a few tricks that I wish I had figured out sooner. So, I figured I would give you some insight and share a few of those.

ARROW KEYS. When drawing a part and trying to get the tool to snap to the correct axis, try pressing the arrow key. This will rotate through the axis one at a time so you can draw the part in the correct orientation instead of fighting the snap feature.

GROUPING. Like many design programs, *SketchUp* allows you to group parts. After selecting parts that you want to lock together, right click and select group. This combines the parts so you can select it by simply clicking any part.

On the same note, there is a "make component" option. This is valuable when you have duplicates of the same part, such as a table leg. Once you make the shape a component, making a change to one of the legs updates all of the parts duplicated from that component.

SELECTING. For the longest time, I would drag a box to select a part, and go back and deselect each and every part that I didn't want. That is, until I

learned that double or triple clicking a part will select all parts connected to the object you're clicking.

GUIDES. If you've ever worked in any design program, you're probably familiar with guide lines. Well, *SketchUp* has them as well. You can create a guide based on any line on a part. For example, if you draw a 12"x 12" rectangle, you can snap a guide 1" inside the edge.

This is valuable for creating shapes, such as mortises, that are not set an equal distance from each edge (such as the tenon you made earlier). This is done by selecting the tape tool and selecting a line. Then, after dragging down the pane where you want the line, you can click to set the guide. Alternatively, like most other tools, you can type in the guide measurement to set them, as well.

BECOMING EFFICIENT IN SKETCHUP. I hate to sound cliché, but the old

saying of "practice makes perfect" holds true with *SketchUp*. The first couple of times that I worked on a model, I felt like I was spinning my wheels. However, the more and more I worked with a model, the more comfortable I became.

Now, don't get me wrong. I didn't learn *SketchUp* simply by trial and error — although there was a lot of that. I actually found

this wonderful *SketchUp* resource. It's called *Google*. Seriously, if you're working on something you can't figure out, spend a minute and *Google* it. The amount of *SketchUp* tutorials, videos, and how-tos that are out there is amazing. Once you get comfortable with the software, I think that you'll become not only a better designer, but a better woodworker, as well. **W**

Useful SketchUp Hot Keys

Z  Zoom

C  Circle

B  Materials

M  Select

A  Arc

S  Scale

F  Offset

H  Pan

L  Line

Q  Rotate

E  Eraser

R  Rectangle

T  Measure

O  Orbit

P  Pull



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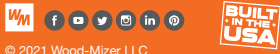
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WEEKEND Project



Coffee Accessories

This small trio of java accessories make the perfect gifts for the coffee lovers in your life, or to build for yourself.

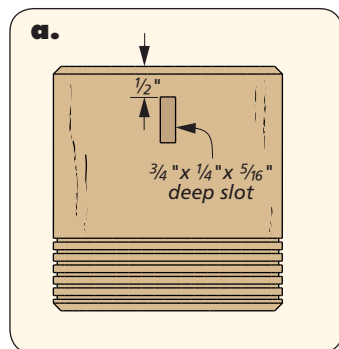
Joe, cuppa, java, brew — coffee. If there's one thing that transcends generations, countries, and people from all walks of life, it's coffee. Many people, myself included, savor that morning cup of rich, roasted goodness. And with other things in our lives, why not enrich the coffee experience with a few small items you can make in your shop?

THREE AMIGOS. As you can see in the photo, the three coffee accessories span the coffee experience — from roasting to sipping. First up is a turned coffee mug. A stainless steel insert alleviates any moisture concerns, and the aluminum and wood handle makes it a pleasure to hold. Up next is a combination bag clip and scoop. Its duty is to keep your bag closed and beans fresh, while doubling as a small scoop for grounds. Finally, the filter caddy keeps all of those paper filters ready for use next to the coffee pot.

VARIED CONSTRUCTION. Just because these accessories are small, doesn't mean you won't get in some good woodworking. You'll spend a little time at the lathe for the mug, the band saw for the clip, and a little bit of everything for the filter holder. They're a great way to use up a few of those small scraps of stock that we all seem to accumulate. They also go together quickly, so it's easy to batch out a handful of each. So, pour yourself a cup and head into the shop to get started.

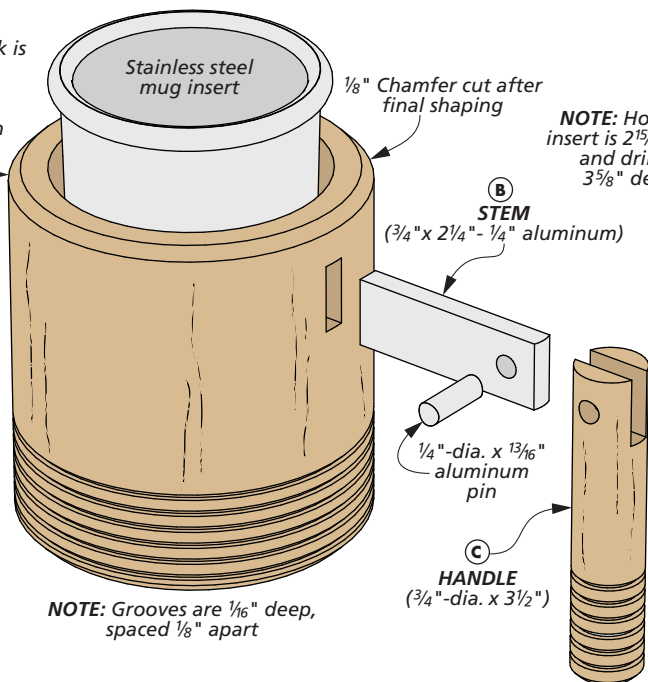


▲ Not only does the clip hold a bag of beans closed to keep them fresh, but it also serves as the perfect scoop to measure out your grounds while making a pot of coffee.



NOTE: Mug blank is glued up from 2"-thick stock and left long to hold in chuck jaws

A **MUG**
(3 3/4"-dia. x 4")



NOTE: Hole for insert is 2 15/16"-dia. and drilled 3 3/8" deep

B **STEM**
(3/4" x 2 1/4" - 1/4" aluminum)

1/4"-dia. x 13/16" aluminum pin

C **HANDLE**
(3/4"-dia. x 3 1/2")

NOTE: Grooves are 1/16" deep, spaced 1/8" apart

Start with the **MUG**

This coffee journey starts by making a mug to hold a cup of hot coffee. The first task at hand is to glue up a blank for the mug. You can see this in the drawing below.

HANDLE SLOT. Before stepping over to the lathe, let's do a little work on the blank first. You'll spend a few minutes at the router table to rout a slot for the aluminum handle stem that you'll add later. Start by loading up a straight bit in the router table and locating the front and back edge of the bit. Use these locations to set up a pair of stop blocks. These stop

blocks will limit the length of slot that you're getting ready to cut.

Turn the router on and lower the blank over the spinning bit, holding one end firmly against the right stop block. Rout until the blank touches the second stop block and shut the router off. You can see this in Figure 1 below. Repeat this step a couple of times until the slot is at the final depth.

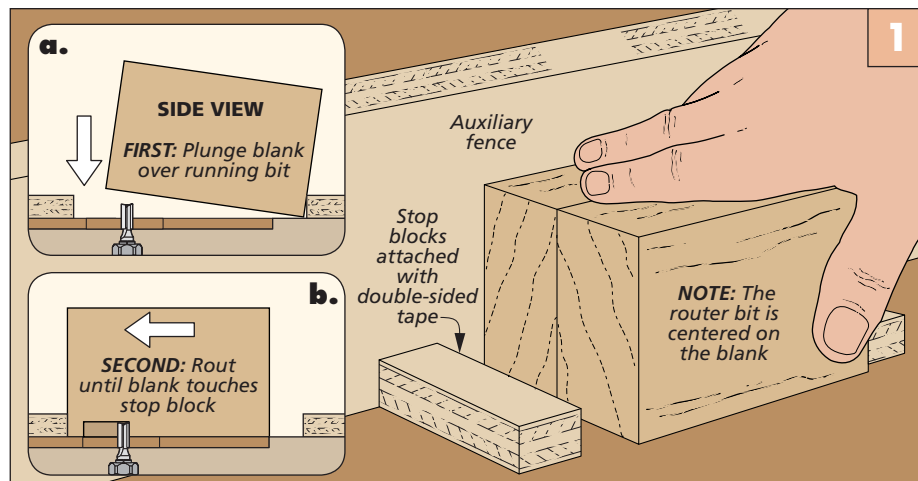
(Because you're using a steel insert, there's no fear of going too deep with this slot). Then, square up the ends with a chisel. This is a good time to check the fit of the aluminum as well, and make any size adjustments while the blank is still square.

TURN IT RIGHT ROUND. At this point, you can head over to the lathe to turn the mug round. How you hold the blank is up to you — if you have chuck jaws large enough to grip it, that's my preferred method. However, a drive spur works as well. Just be sure to use the tailstock to support the blank while you work.

Now, use a spindle roughing gouge to knock the corners off the blank and turn it into a cylinder. If you have a sharp gouge and use the flat wing of the tool in a planing cut, the finish will be pretty dang smooth and require minimal sanding. If you have some bumps, you can use a skew chisel on edge to scrape the mug smooth.

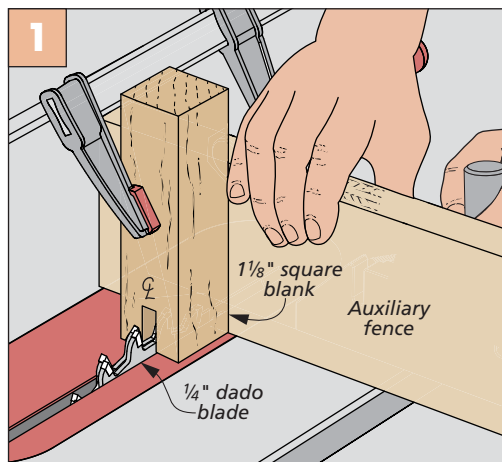
REVERSE & DRILL IT. After gripping the cylinder tight, load a Forstner bit into a Jacobs chuck, and

STOPPED SLOT FOR MUG STEM



Plunge Handle Slot. After turning the router on, slowly lower the blank over the running bit (detail 'a'). Then, move the blank along the fence, routing until the blank touches the stop block (detail 'b').

SLOT THE HANDLE BLANK



Start Square. Use a dado blade to cut a notch in the end of a long blank. A tall auxiliary fence on the miter gauge supports the blank.

put it in the tailstock. Then, with the lathe on, feed the tailstock into the blank and in turn drill out the waste in the center. Double check the fit of the stainless steel insert, and if needed, use a bowl gouge or parting tool to slightly taper the inside wall.

TURN IT AROUND ... AGAIN. With the center waste removed, turn the blank around and grip it back in the chuck. Now, you can clean up the bottom with either a parting tool, or better yet, a skew chisel. The final thing to take care of is to use a point tool to add a series of decorative grooves in the bottom of the mug. Now, let's concentrate on getting a grip on your mug.

HANDLE

The handle of the mug is a turned piece of stock with an aluminum stem connecting it to the mug. Like the mug, the handle starts off square.

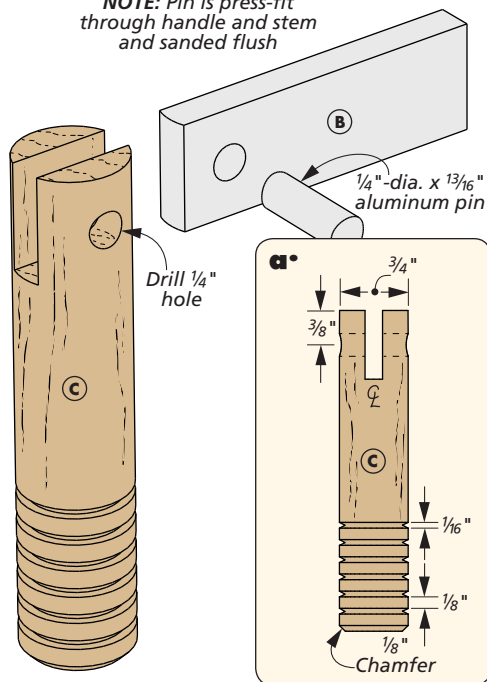
STEM SLOT. As you can see in Figure 1 above, the first step for the handle is to make a slot in one end of a square blank. This is sized to fit the aluminum stem. Do this at the table

saw, guiding the blank with a tall miter gauge fence. Make this slot a little deeper than the stem is wide, then you can sand the parts flush when it's all assembled.

HIGH SPEED TURNING. With the slot done, take another trip over to the lathe. It might seem like a small part like the handle should be turned slow. After all, a small part is more delicate, right? In reality, the smaller the part the faster, generally, it should be turned. For this handle, I set my lathe on maximum speed (it's one notch before light-speed). It hums along at about 3500 RPM. The fast speed and sharp tools make this a fast process. After it's round and the grooves are cut, you can part it to final size.

PIN IT TOGETHER. With your two wood parts in hand, it's time for the final piece — the aluminum stem. This is simply cut to size with a hack saw. Fit the aluminum into the handle and then drill a hole through both parts. This will be for a pin that will lock everything together, along with a little bit of epoxy. After inserting the

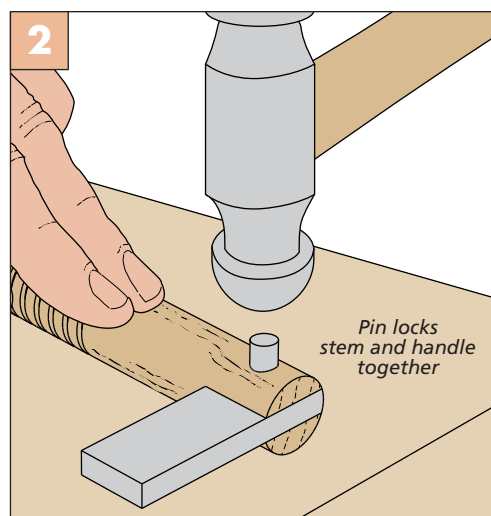
NOTE: Pin is press-fit through handle and stem and sanded flush



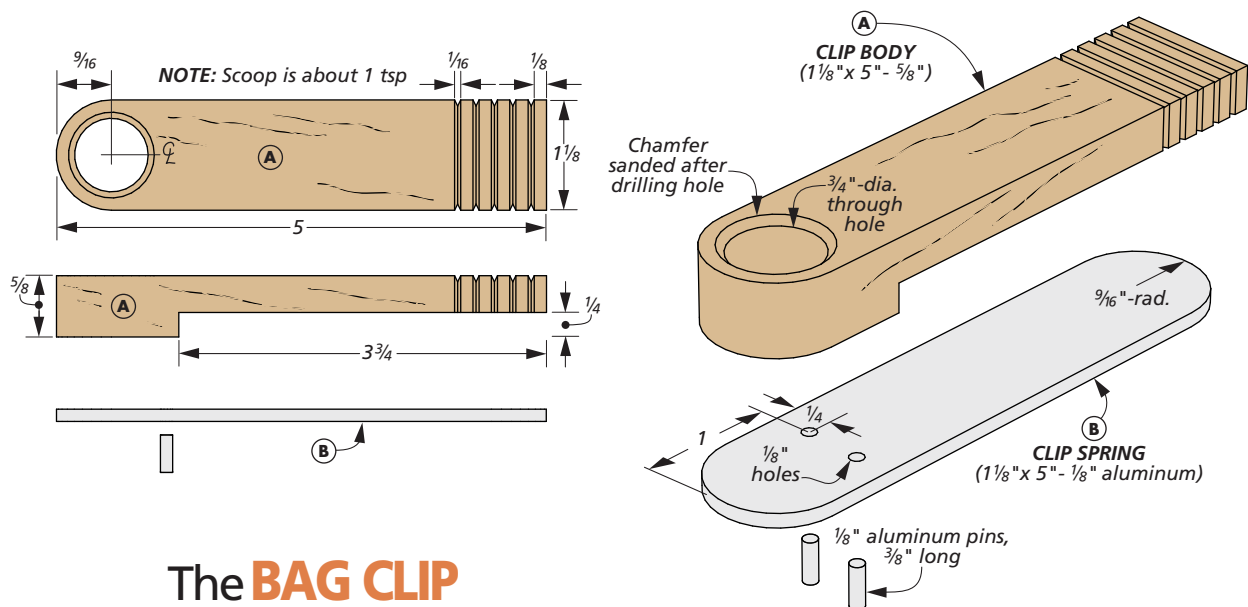
NOTE: Stem is epoxied into the mug body and handle.

pin, peen it down with a hammer (Figure 2 below). Sand the pin flush, along with any aluminum parts on the stem that protrude past the handle. Finally, epoxy the handle (and stainless insert) into the mug body. Then, you can apply finish to the mug.

PIN THE HANDLE



Pin It. Apply epoxy in the handle slot. The aluminum pin is then tapped through the handle and stem, peened, and sanded flush.



The BAG CLIP



▲ The notch is sized to hold the folded top on a standard-size bag of coffee.

Ask any coffee aficionado's advice, and you'll hear one common theme — having fresh beans is the first step in making a good cup of coffee. This clip is designed to keep your opened bag of java sealed and the freshness locked in. As an added benefit, the clip also has a small scoop on one end to help you measure your grounds. The clip is made from two layers — one of aluminum and one of wood.

WOOD BLANK FIRST. To tie the entire set together, the clip features grooves that match the mug.

After cutting a blank to size, head over to the router table. Here, you'll use a small V-groove bit to rout the grooves. The trick is to make sure the lines match the entire way around the clip. Do this by registering the blank against a stop block on the miter gauge fence and cut the groove on each edge and on the face. Reposition the block after you've completed one series of grooves and cut the remainder.

DRILL & NOTCH. Now, take your blank over to the drill press and drill the hole that serves as a scoop. You can either sand a small chamfer on the hole, or spend a moment at the router table doing it. The hole is fairly small, so I opted to simply sand the chamfer around the hole.

At this point, you can create the large notch that allows room for the bag. This can easily be done at the band saw. Cut the end of the notch first with a miter gauge, then guide the blank along the fence to remove the waste (Figure 1, left). Sand away any blade marks that are left.

ALUMINUM CLIP. The next task is to install the aluminum bar. Cut it to size with a hack saw, and round over one end. You can see the radius you're going for

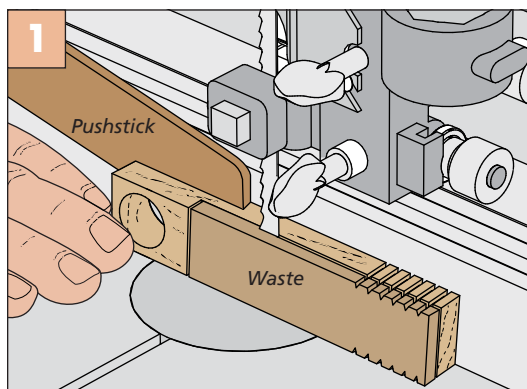
in the drawing above. You can round it over with a belt sander, or some good old fashion filing. Then, attach it to the clip using some epoxy and a pair of pins (detail 'a' above). Finally, round over the aluminum and wood end of the clip.

FILTER STAND

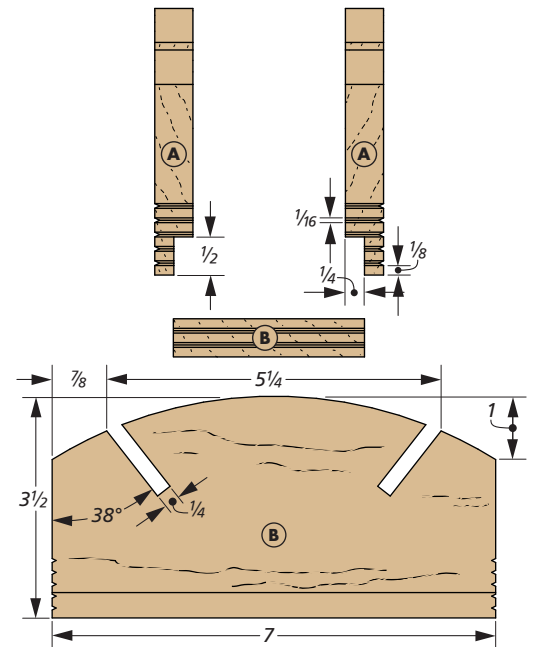
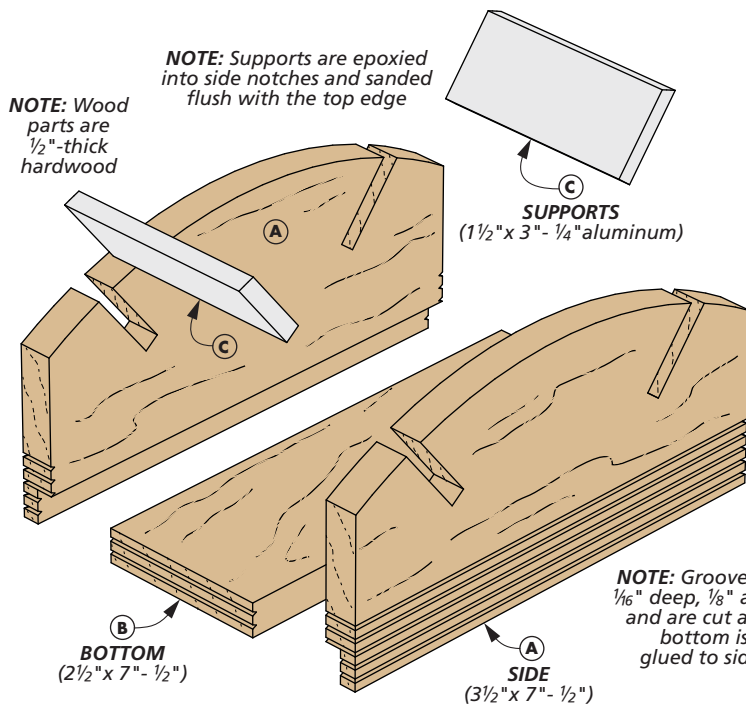
Depending on your preferred method of brewing, you may or may not use paper filters. However, with the vast majority of coffee drinkers using either a drip coffee pot or a pour-over method, the likelihood is that you do. So, to keep them close at hand, this filter stand is the perfect accessory.

ANGLED NOTCHES. As you can see in the drawing on the next page, the stand sides have angled notches in them to hold aluminum supports. The sides are also gently curved. Forming the notches is easiest when the sides are still square. Do this at the table saw with a miter gauge, as you see in Figure 1 on the bottom of the next page. Then, head over to the band saw to shape them. You can easily perform these two operations on both sides at the same time. Just use some double-sided tape to stick them

NOTCH AT THE BAND SAW



Notch. Use a miter gauge to guide the first cut, then set the fence to make a rip cut, removing the waste from the clip.



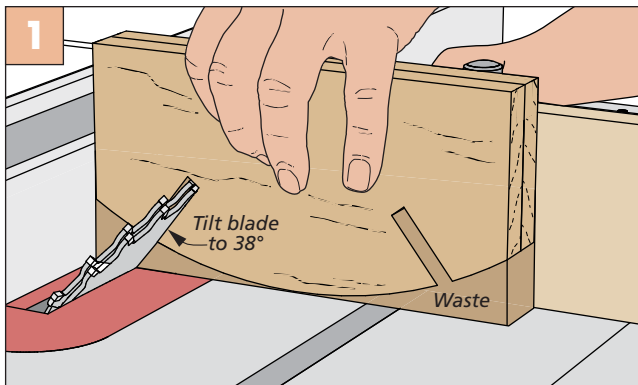
together as you notch and shape the sides.

RABBIT TO JOIN THEM. After those operations are done, peel the sides apart and head back over to the table saw. Load up a dado blade and cut a rabbet along the bottom, inside edge of each side. This is to fit over the bottom. After you've cut the bottom to size (it's just a rectangular part), you can glue the bottom piece to the sides.

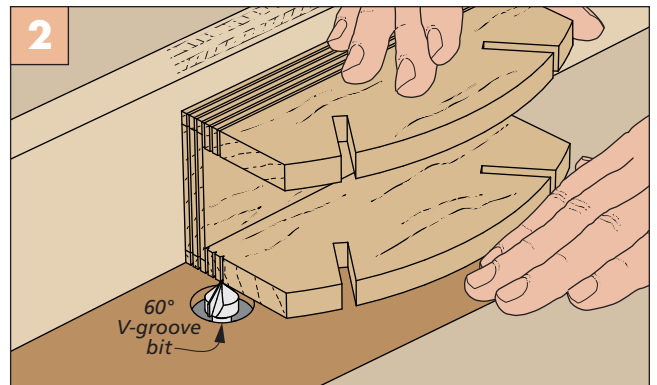
FINAL DETAILS. As before, you're going to add groove details to the filter stand. Using the same V-bit that you used on the clip, set the fence position and create a groove on both sides of the stand before moving the fence to the next groove (Figure 2 below). With the grooves done, the last thing to do is to cut the aluminum supports and epoxy them in the notches. Finish up by sanding them smooth.

A LITTLE FINISH. After completing these coffee accessories, you'll want to add a finish to them. And before the debate even gets started—almost all finishes are food-safe after completely curing. Note that curing can often take weeks. Curing takes much longer than just “drying.” For mine, I sprayed on some lacquer and let them sit for a few weeks before enjoying that first, hot cuppa joe. **W**

FILTER STAND DETAILS



Angled Notches. Tilt a dado blade in the table saw and form the notches in the square blanks. Guide the workpiece with an auxiliary fence on the miter gauge.



Add Accent Lines. Rout the grooves using a small V-groove bit. Rout the groove on both sides and ends before repositioning the fence for the next groove.



Carved Pub Signs

Carving these signs will flex your woodcarving muscles. Three different signs, three ways to create them. Before long you'll be creating signs with your own vision.

The history of pub signs in England goes way back. By way back I mean that the Romans brought the novel idea of signage to the British isles during their "visit." Signs with strong, clear, visual references helped the largely illiterate population navigate the needs of daily life. Like, "let's meet at the green dragon, they have the best happy hour." Once the British convinced the Romans that their welcome was worn out, they sent them packing. But, they kept the marketing tool of pub signs, along with other cultural trappings.

OPTIONS. The three examples you see here were each created using different methods. The dragon is crafted mostly with woodcarving tools (and a little help from your router to get the ball rolling). The horse is assembled in built-up sections with enough carving involved to give the sign life. The Blackbird was fashioned at a CNC machine followed by some hand-carved human touches. You could do it by hand like the other two. The choice is up to you, there are CNC files available for all three signs.

All three signs are made from basswood, which is an agreeable wood for all manner of carving tactics. And they're painted with long-lasting milk paint. Whether you choose to carve one, or all three signs, you have a fun adventure ahead.



▲ There's a fun workout to be had carving a pub sign that incorporates a dragon. You'll get to experiment with all sorts of woodcarving tools to bring this sign to life. And a clever way to tackle dragon dental work.



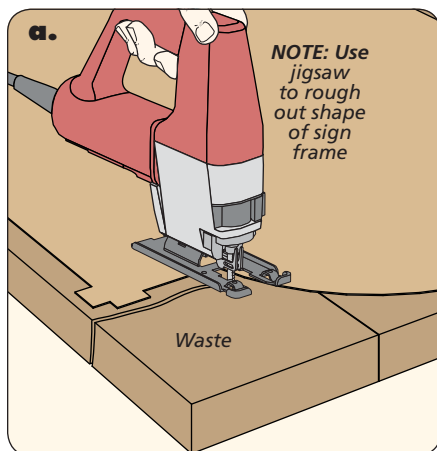
▲ But wait, there's more. If carving a dragon doesn't trip your trigger, you've got options. There's a pair of blackbirds in a tree on a starry early evening. Or a workhorse that's confidently calling you to visit his Inn.



For full-sized patterns of all three pub signs, go to:

Woodsmith.com/253

NOTE: Dragon sign is made from 1½"-thick softwood. Wings and legs are made from ¾"-thick softwood



NOTE: Use jigsaw to rough out shape of sign frame

Carving a DRAGON

Before we start, I think it's important to address the level of detail needed when creating the signs. They're made with a big brush, or in this case, a big chisel. Remember the setting for these signs is above an entryway or on the corner of a building, with the goal of pointing the way to relaxation and refreshments.

Because of this distance, you don't have to sweat the carving, most flaws won't be seen.

OVERSIZED BLANKS. The main drawing above shows starting out by gluing up 8/4 blanks slightly larger than the final dimensions of the sign.

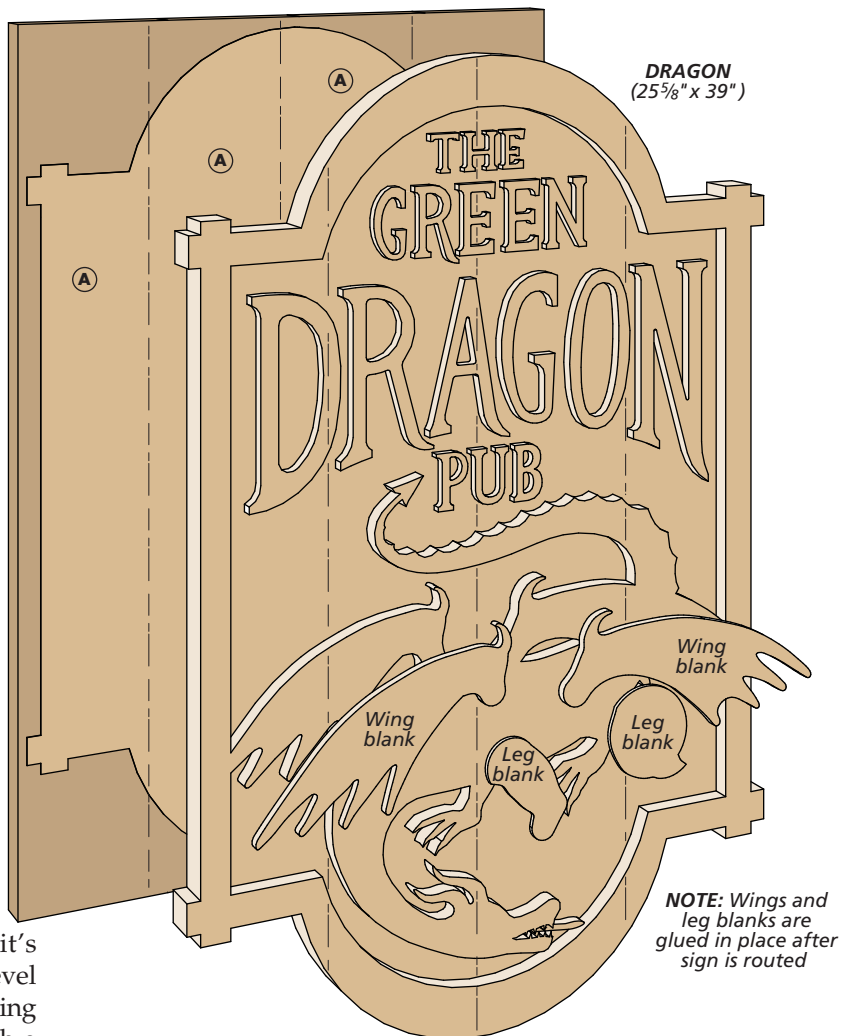
Then scrape the surface clean enough to attach the full-sized paper drawing of the sign (a full-size pattern is available at woodsmith.com/253).

TRANSFER THE DRAWING. There are several ways to transfer the drawing of the sign to the basswood blank. You can attach carbon paper

to the back of the drawing. If carbon paper is not close at hand, there's a low-tech solution that's just as effective. You'll need two pencils, one with soft lead and a dull point to draw over the lines of the drawing from the back side. The other pencil should have a harder lead that will hold a sharp point. This is for transferring the drawing to the board once it's taped in place. Which ever method you choose, remove the pattern and go over the lines with a ballpoint pen to set the drawing into the wood.

SHAPE THE CONTOUR. I started shaping the sign with a jigsaw, as you see in detail 'a' above. For now, loosely rough out the profile of the frame to provide support for the router in the next step. Later, you'll shape the frame with woodcarving tools.

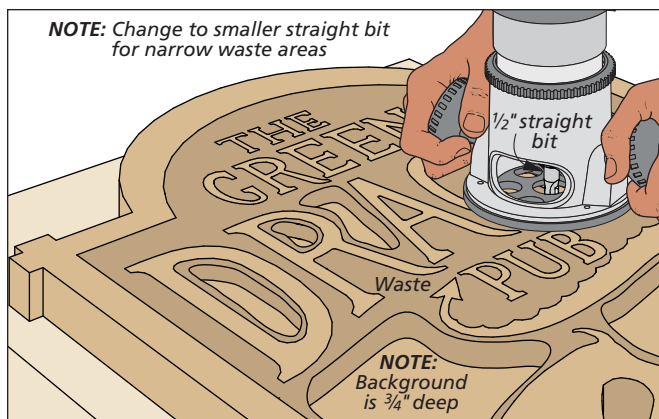
DRAGON
(25⅝" x 39")



NOTE: Wings and leg blanks are glued in place after sign is routed

ROUGH OUT THE SIGN

NOTE: Change to smaller straight bit for narrow waste areas



NOTE: Background is ¾" deep

ROUT THE LEVELS

The strategy here is to use your hand-held router to remove most of the waste from the sign. Start by routing the background down to $\frac{3}{4}$ " as shown in the box on the previous page. Leave the dragon and the letters at the initial height. Later, you'll pare those down with a chisel.

WINGS & LEGS. To increase the dragon's sense of depth, there are extra layers of wood glued to the surface of the wings and haunches of the legs (main drawing, previous page). This, combined with the carving process, will integrate these pieces perfectly into the body of the dragon and lift the wings above the surface of the frame.

CARVING ADDS LIFE. The flat, plain surface of the sign is brought to life with your woodcarving tools. Start by trimming the letters and removing the ballpoint line at the same time. Clean up the base of these shapes where they meet the background with a V-tool (Figure 1).

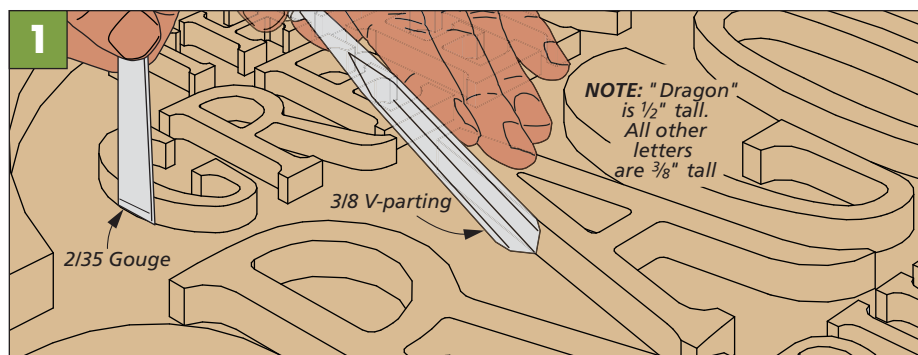
Scallop the background with a narrow gouge for distinct texture, along with the trio of back bent, spoon and fishtail gouges for the tricky spaces (Figure 2). Also, shape the surface of the letters. Some of the tools used are detailed on page 33.

Wide, shallow gouges give a rough-hewn look to the body of the dragon (Figure 3). The frame gets a rustic treatment with the addition of faux miters and lapping corners.

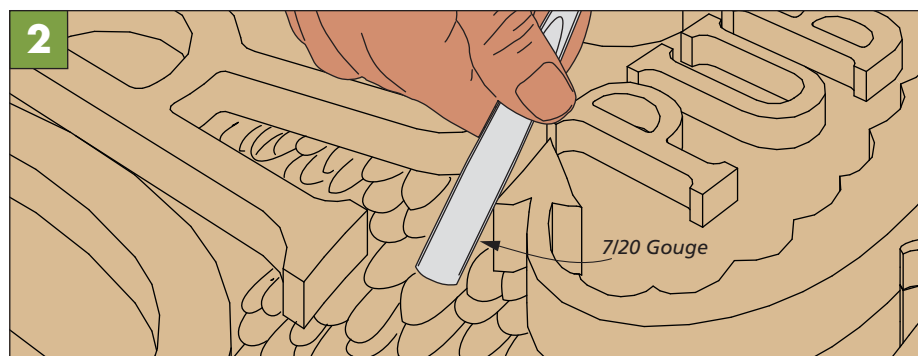
A DRAGON FACIAL. Steve Johnson, the shop craftsman who carved the dragon did a great job on developing the head. First, he carved and painted the tongue and mouth. Then he drilled holes for the toothpicks that are glued in place for teeth.

PAINTING. Painting proceeds from the background out. A list of the colors and where they were used is on page 33.

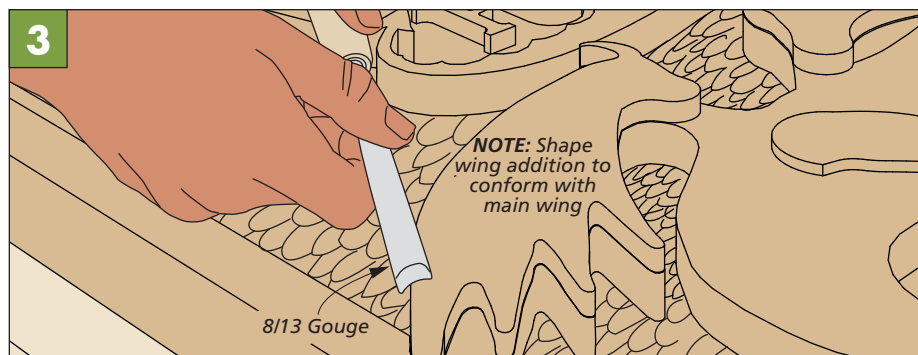
CARVING FROM BACK TO FRONT



Squaring the Shapes. Match the profiles of your woodcarving chisels to the contours of the letters. Use a V-parting tool to define where the letters meet the background.



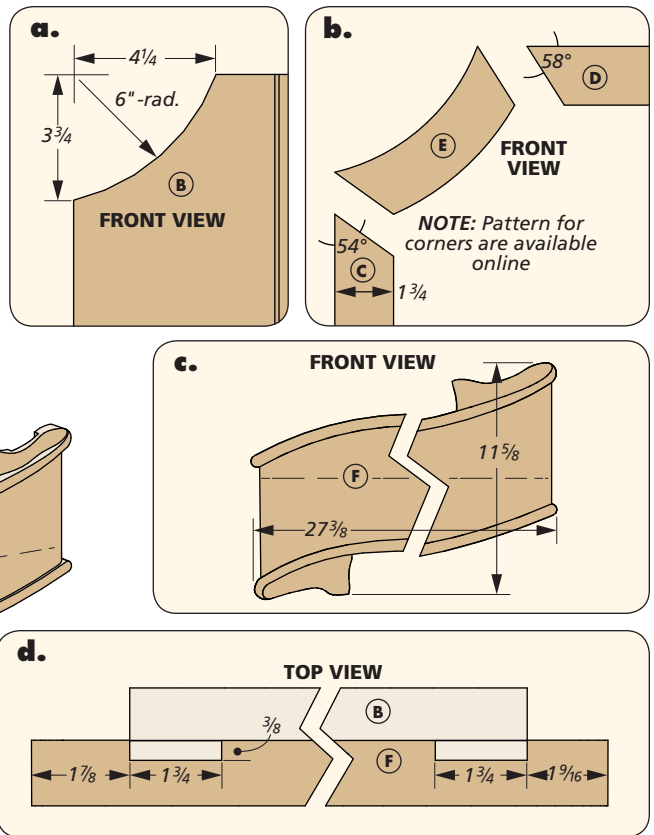
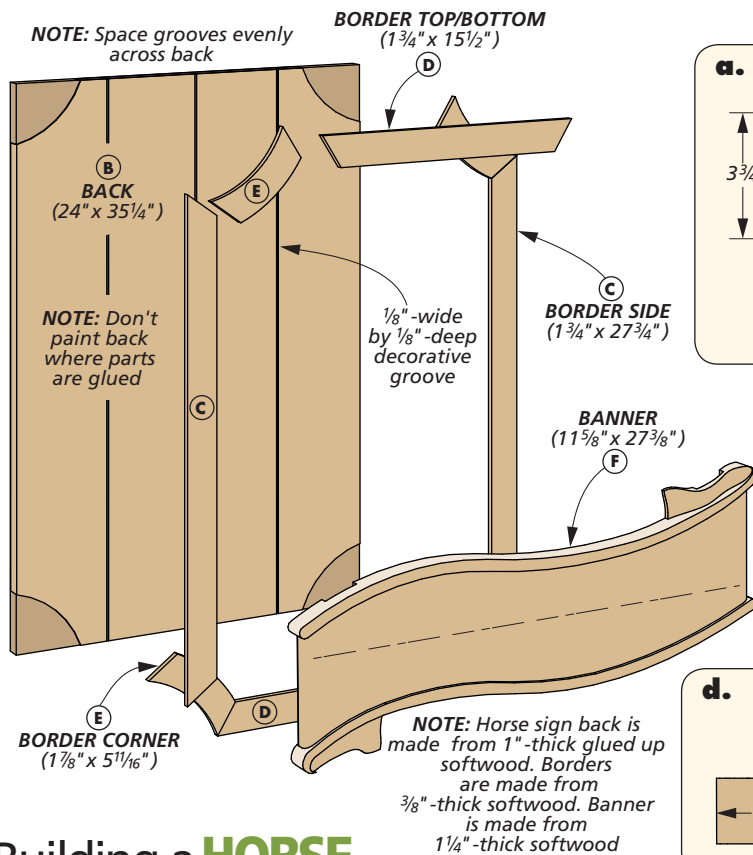
Background & Letters. Carving the scalloped pattern in the background of the sign requires a variety of gouges. Follow this with scalloping the surface of the letters.



The Wing. The last step starts with gluing on extra wood to the top of the sign. Finally, carving it enhances the form of the dragon by adding a bit of dynamic depth.



◀ The dragon's face is the focal point of the sign. Spending the time to develop the details of the tongue and the contrasting teeth adds a lot of life to the sign.



Building a HORSE

Now for a little history behind the name that was chosen for this sign. The Percheron is a draft horse breed that has its origins in the Le Perche region of France. The gentle, hardworking horse was prized for many duties prior to its retirement by the combustion engine. Its calm, strong demeanor is a great visual brand for a pub sign.

The building process of the horse is completely different than the dragon. The horse doesn't have as much carving as the dragon, but there are more parts to make and assemble. After each part is made, it's carved and painted before it's glued to the back. So logically, I started with the back. The main drawing above shows the details.

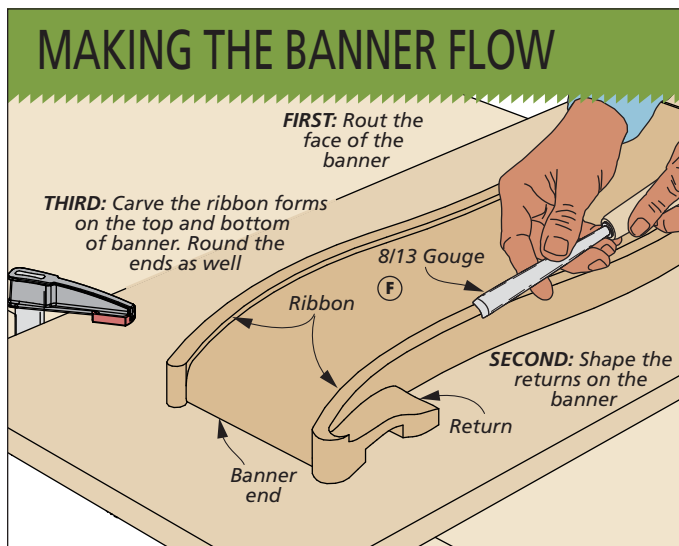
PANEL PROFILE. To create the decorative concaved corners of the panel, I drew the radius you see in detail 'a' above. A jigsaw, or band saw will get the corners close. Smooth the corners with a sanding drum installed in your drill press.

GROOVES. Three shallow kerfs spaced across the panel help to visually break up the large space. This is a simple task at the

table saw with a sharp blade. I think it gives the sign a more rustic look. Then you can paint the back, while it's drying, you can work on the borders.

ADDING BORDERS. A thin border wraps the edge of the panel to create the illusion of a thick frame. As detail 'b' shows, the ends of the corners aren't parallel. There's a pattern online for these pieces that you can trace and cut to size perfectly. After painting at least the inside edge of the border pieces, glue the pieces to the panel. (You can wait to paint the rest of the border, along with the edges of the back, once the assembly of the sign is done.) It's time to turn your attention to the blanks for the banner and horse.

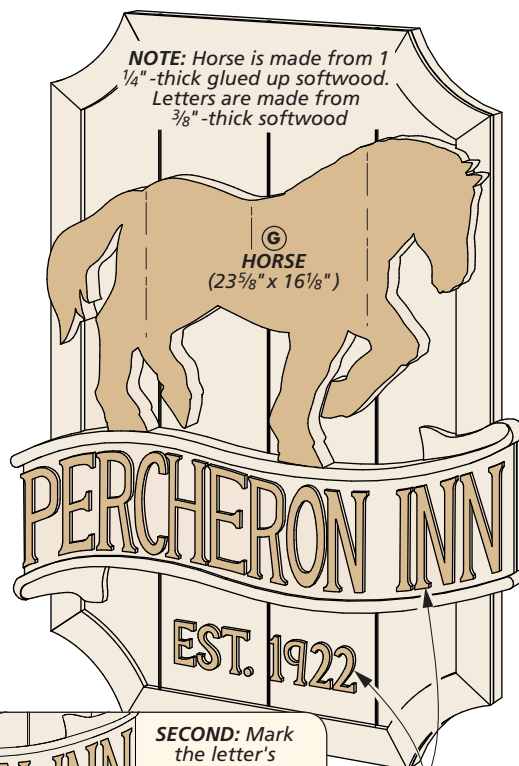
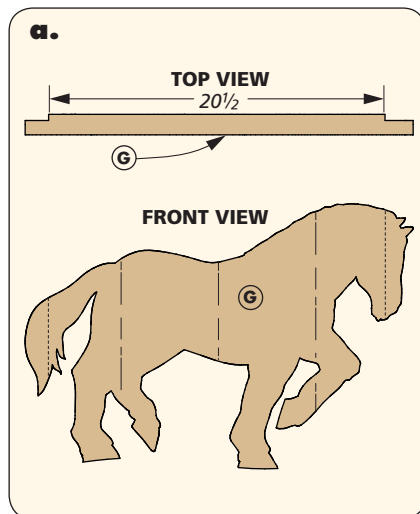
BANNER PANEL. The banner that holds the letters for the pub's name is the visual anchor of the sign (detail 'c'). It extends beyond the sign in width and depth, adding a dynamic bridge between the back and the horse.



It supports the horse with a bend-but-don't break flow that makes the horse's gait come alive. Other than that, it's just a couple of boards with the grain running parallel to the length.

SHAPE THE BANNER. Once the panel is dry from the glue up, head over to the table saw to cut the dadoes you see in detail 'd' on the previous page. The dadoes lock the banner to the panel frame. Follow this by roughing out the shape at the band saw. Then, as the box on the previous page shows, glue the plank to a sacrificial plywood backer with hide glue and a paper layer to separate the banner later.

Clear away the waste inside the banner with your router like you did on the dragon. After that mess is cleaned up, you can spend time carving the returns and ribbons of the banner. When you're happy with the results, you can paint the banner, remove it from the backer board, and glue it in place. Now it's time for the horse.



A PERCHERON PRINCE

The horse is similar to the banner, it's glued up from several boards, here though, the grain

runs vertically. The profile of the horse stays within the frame of the sign, so instead of dadoes, the ends have rabbets to allow

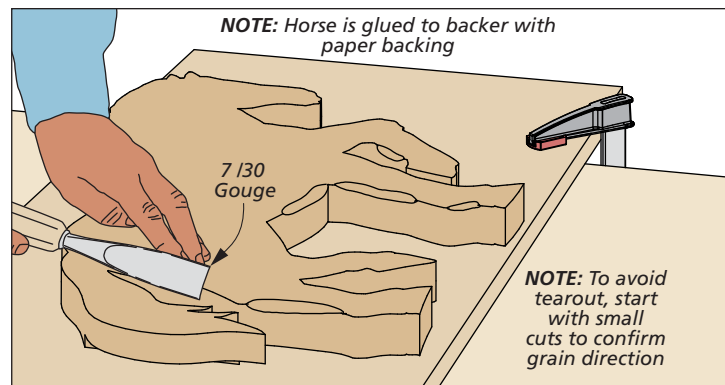
for the border (detail 'a'). The rabbets are done at the table saw with a dado blade. Then rough out the profile at the band saw.

Like the banner, it's time to glue the horse to a backer board for the wood carving process. The box to the left shows this. The carving is all about boldly shaping the anatomy of the horse. Big cuts will give the horse a solid, sturdy frame.

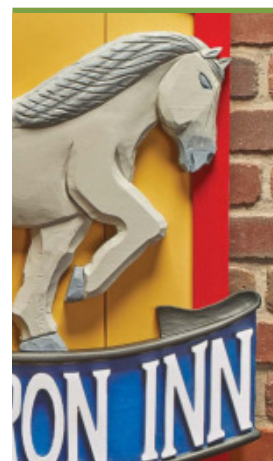
LETTERS. The letters and numbers for the sign are cut out with a CNC machine. If a CNC machine is on your wish list but not yet in your shop, you can cut them all with a scroll saw.

Detail 'b' above shows the letters properly spaced on, and below the banner. I positioned the letters and lightly marked their location before painting them. There's a blackbird waiting for you on the next page.

SHAPING A WORK HORSE



Broad Strokes. Big, broad, bold strokes reflect the strength of the horse. But start with small cuts to test the grain direction. A list of woodcarving tools, big and small, are on page 33.



▲ Big, slightly hollowed chamfers add strength to the look of the horse.

Finally, a **BLACKBIRD**

The blackbird sign was mostly created on our CNC machine. If you don't have one, or wish to do this by hand, you can use the same process and tactics that were applied to the dragon. Either way, the first order of business is to glue up the panel.

The machine not only shapes the objects in the sign, it also does a great job of defining the frame and the portion on the wing that extends beyond the frame. As the main drawing shows, you will have a small piece that's glued to the top of the wing.

BLANK FOR THE WING. While the CNC machine is chewing away on the sign, you can size the piece for the wing that's glued on top of the sign. Once the machine is done with the heavy lifting, you can start adding a human touch to the sign. That starts with the wing. It's glued in place and carved in the same manner as the wings and legs on the dragon.

MAKE THE BLACKBIRDS FLY. On the bottom edge of next page you see some of the carving tools that were used to bring the

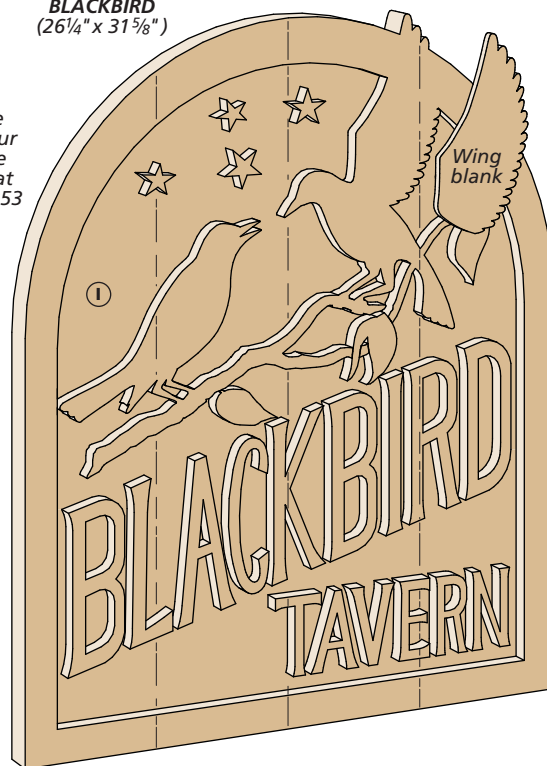
NOTE: Files for making all three of the signs on your CNC machine are available online at Woodsmith.com/253

NOTE: Wing blank is glued in place after sign is routed by CNC machine

NOTE: Blackbird sign is made from 1 1/2"-thick glued up softwood. The wing is made from 3/8"-thick softwood

NOTE: This sign can be carved in the same manner as the dragon

BLACKBIRD
(26 1/4" x 31 5/8")



▲ The cool, darkish blackbird sign is a nice switch from the other two signs.

blackbird sign to life. You'll use these to finesse the branches, birds, stars, and the letters.

In fact, all the tools shown on the next page are not exclusive to the sign they're next to. If this is your first foray into carving, you'll soon learn what the masters know, the craft and love of woodcarving often involves stretching the use of your tools.

PAINTING. The painting procedure for the blackbird sign is the

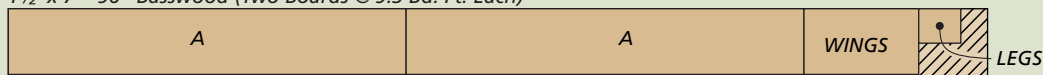
same as the horse and dragon. Start with the background and work your way forward.

As well as the carving tools shown on the next page, you'll see all three signs with corresponding charts listing the colors used. The list of colors are just suggestions from the line of milk paint that *General Finishes* provides. But the choice colors are up to you when it comes to the creative finish. **W**

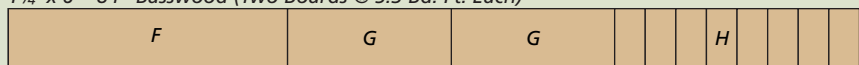
Materials & Cutting Diagram

A Dragon Sign	1 1/2" x 25 5/8" - 39	D Border Top/Bottom (2)	3/8" x 1 3/4" - 15 1/2	G Horse (1)	1 1/4" x 23 5/8" - 16 1/8
B Horse Back (1)	1 x 24 - 35 1/4	E Border Corners (4)	3/8" x 1 7/8" - 5 11/16	H Letters	1/4" x 6 - 42
C Border Sides (2)	3/8" x 1 3/4" - 27 3/4	F Banner (1)	1 1/4" x 11 5/8" - 27 3/8	I Blackbird Sign	1 1/2" x 26 1/4" - 31 5/8

1 1/2" x 7" - 96" Basswood (Two Boards @ 9.3 Bd. Ft. Each)



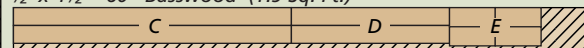
1 1/4" x 6" - 84" Basswood (Two Boards @ 5.3 Bd. Ft. Each)



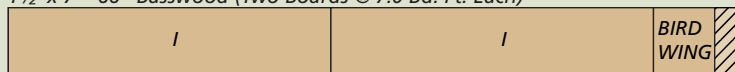
1" x 7" - 72" Basswood (Two Boards @ 4.4 Bd. Ft. Each)



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



1 1/2" x 7" - 66" Basswood (Two Boards @ 7.0 Bd. Ft. Each)



TOOL SUGGESTIONS & PAINT COLORS

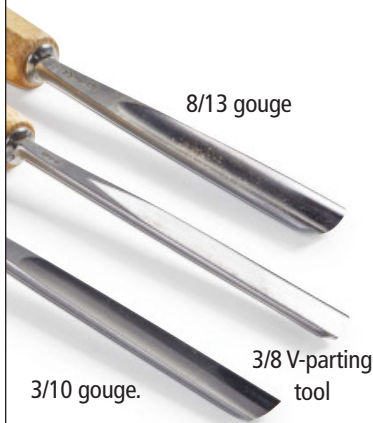


All the carving tools shown to the left are *Pfief* Swiss made. They're used on all the signs. The milk paints are from *General Finishes*.

The colors used for the dragon sign are shown at right. The background (1) is a mixture of *Harvest Yellow*, *Emerald*, and *Sunglow*. The body of the dragon, and the words "Green," and "Dragon," are *Emerald* (2). The border (3) is *Dark Chocolate*. The belly and horns are *Harvest Yellow* (4). The tongue, and the words "The," and "Pub," are *Persimmon* (5).



The horse sign's palette of colors is more contrasting than the dragon. The background (1) is *Harvest Yellow*. The border and letters below the banner are *Holiday Red* (2). The banner (3) is a mixture of *Lamp Black* and *Klien Blue*. The letters in the banner are *Snow White* (4). The body of the horse is *Seagull Gray* (5). The hooves, tail, and mane are *Perfect Gray* (6).



The cool colors of the blackbird sign set it apart from the other two. The background (1) is a mixture of *Halcyon* and *Klien Blue*. The border and stars are *Snow White* (2). The word "Blackbird" (3) is *Lamp Black*, while the word "Tavern" and the leaves are *Emerald* (4). The branch is a mixture of *Lamp Black* and *Snow White* (5). The birds are *Lamp Black* (6). The wings are *Holiday Red* and *Sunglow* (7). The bird's feet are *Harvest Yellow* (8).



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▲ The decorative nails used to hold the canvas sling in place are called clavos nails. Although they're decorative, they have plenty of strength to do the job required. The large, round heads add a nice accent to the chair.

Campeche Chair

Combine centuries of solid service, with an elegantly simple design, and you get this — a chair from the Caribbean that's loved by all.

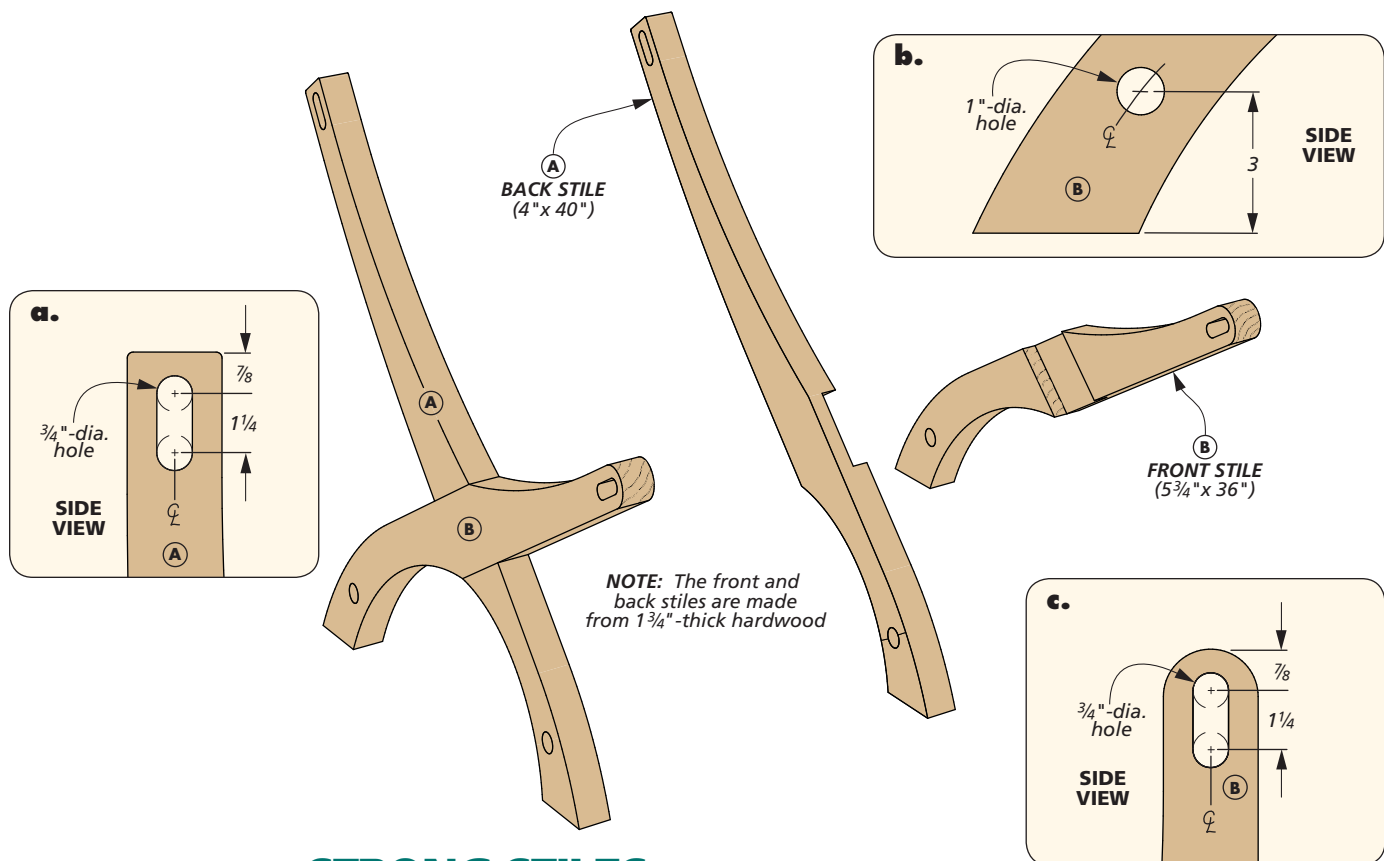
If Thomas Jefferson had an *Instagram* account, you can bet there would be a picture of this chair's ancestor proudly displayed there. He loved the easy nature of this piece of furniture. This strong, lightweight chair by legend hails from the port town Campeche, located on Mexico's gulf side. Right out of the gate, you can see that this is not a conventional project. To build a chair out of eight pieces

of wood (20 if you count the wedges) is a testament to good design. Other iterations sport a wide variety of seating options, from tooled leather to humble wood slats. Dillon Baker, the designer behind this project, has streamlined the look of his version. He chose rugged duck canvas for the seat.

Mahogany is a Caribbean commodity that was in abundant supply at the time. It's used here as an homage to the

chair's legacy. Plus, it's easy to work with and so beautiful when finished.

EFFICIENT JOINERY. As you see in the main photo, one big lap joint where the side stiles intersect is the foundation of the chair. The sides are then brought together with mortise and tenons. The tenons on the rails and stretchers are rounded to echo the other curves in the project. Enough said, let's hit the shop.



It starts with **STRONG STILES**



For full sized templates to make the stiles, go to:

Woodsmith.com/253

Milling large workpieces like these stiles is a lot of fun, especially when they flow together like they do here. The stiles have a split personality that's intriguing as well. Like how the back stiles are also the front legs. While the front stiles are the back legs. All this is due to the use of a large lap joint to make the sides.

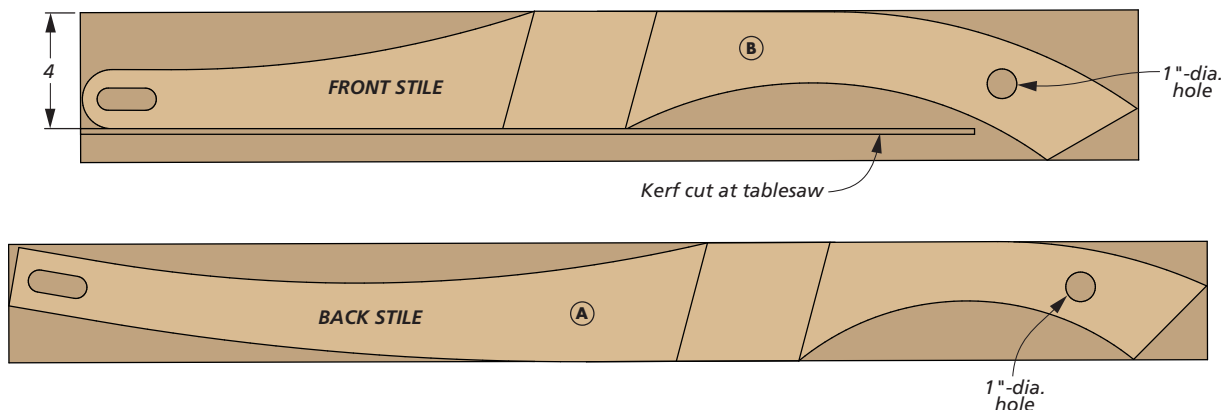
We'll get to the lap joint after we shape each of the stiles. For now, the process starts by milling the four blanks to thickness.

Then trim them to length at the table saw. You can see the overall size of the blanks in the drawings below. I want to give you a heads-up at this point about shaping the stiles.

Ultimately, when the stiles come together, they form the scissor-like sides that you see in the main drawing above. To keep the chair wobble-free, the mortises in the ends of the stiles need to align perfectly to its partner on the other side. If they

don't, well, it's a shame to spend this much money for firewood.

TEMPLATES. Not to worry though, full-size templates will lead the way. Normally, I would make one template and use it on multiple workpieces. Here though, I chose to make a template for each stile. There are two benefits in doing this. First you can guarantee the templates are identical to each other. Second, this allows you to leave the templates on the workpiece during



the milling process, ensuring that there are no errors in moving the template from one piece to another.

The full-sized templates are online at Woodsmith.com/253. Each pair of 1/4" hardboard templates can be held together with double-sided tape while you're making them. Before pulling them apart, there's one more thing to do. It's critical that you use a square to mark the locations of the half laps on the edges of the templates. With that, you're ready to shape the stiles.

SHAPING THE STILES. Use double-sided tape to hold the templates on the workpieces. It's best to attach the templates to the outer face of the stiles. You'll see why shortly. As shown in Figure 1, the process starts at the band saw. Cut as close as you can, but not into the template.

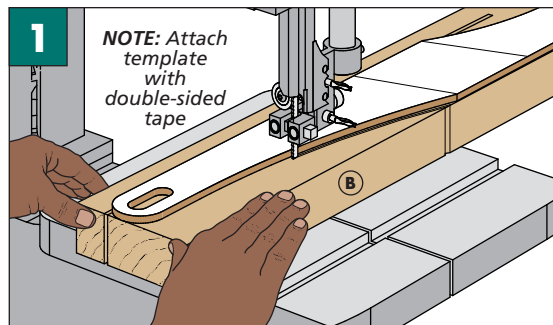
The router table is the next stop for the stiles. Figure 2 shows how a flush trim bit will make quick work of smoothing all of the edges. When starting, go slow with this step and be wary of the potential of chipout.

MORTISES. Figure 3 shows drilling the mortises for the crest rail. Here's why it's a good thing to orient the templates on the outside face of the stiles. Any blow out that you might have, which shouldn't be much, will be on the inside face of the stiles. As the template will show, you'll need to swap out to a larger Forstner bit to drill the mortises for the stretchers.

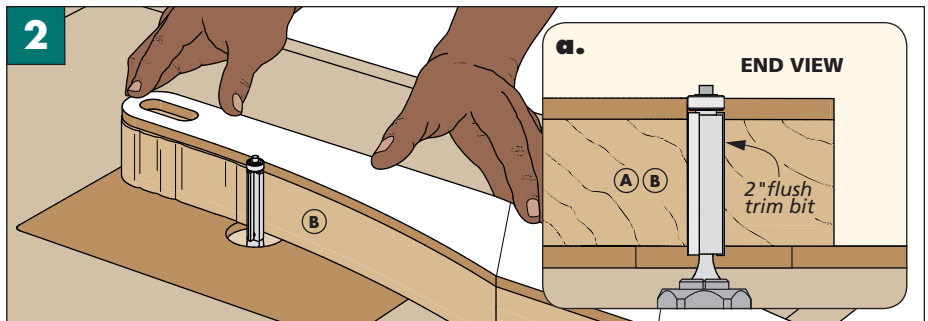
HALF LAPS. The simple jig you see in Figure 4 will align to the marks you transferred from the templates to the stiles. After the router is put away, you can glue up the stiles.

When the glue is dry on the sides, you can sand smooth the lap joints. Now you can turn your focus to the parts that bring the sides of the chair together — the rails and stretchers.

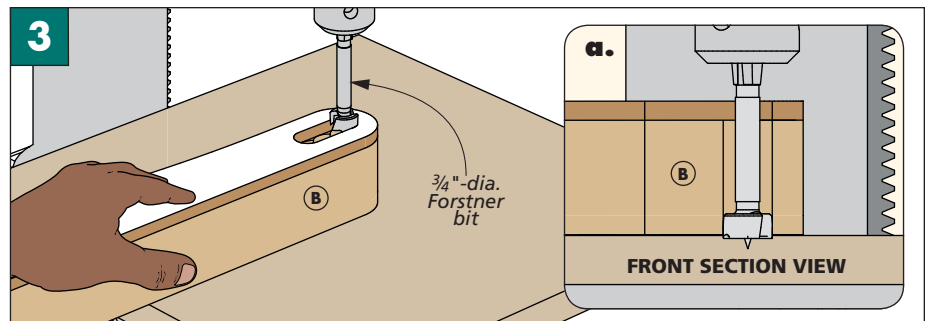
PERFECTLY MATCHING STILES



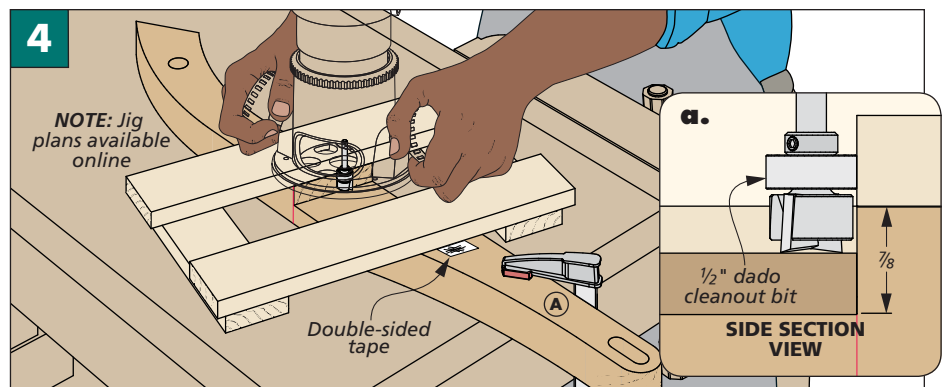
Rough Shaping. Start by ripping the straight sections at the table saw. Then attach the templates to the stiles with double-sided tape and head over to the band saw. Here, you want to cut close to the template in preparation for the next step.



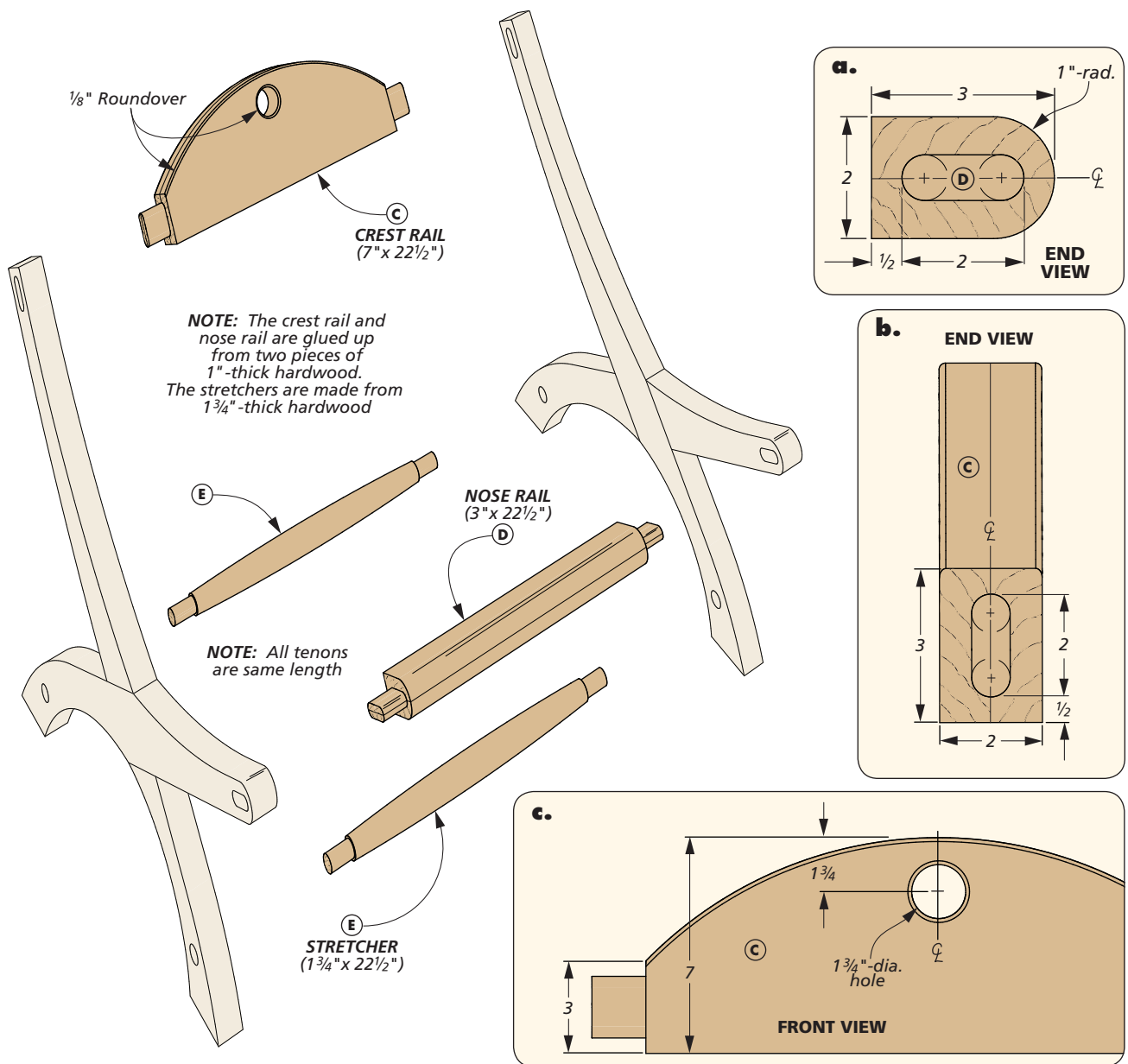
Smooth Shaping. Your router table and a flush trim bit will complete the shaping of the stile profiles. Don't remove the templates after this step is done.



Drill the Mortises. Drill the mortises for the crest rail first. Then switch over to the larger Forstner bit to make the mortises for the stretchers.



Routing the Half Laps. Before removing the templates, mark the locations of the half laps. Then rout the dadoes in multiple passes with the jig shown here.



Next up are **RAILS & STRETCHERS**

Now you can address the remaining pieces of the chair. These four parts (two rails and two stretchers) are more conventional than the sides you just completed. The main drawing above shows how the rails bring the sides of the chair together. The stretchers do the same at the base of the chair. Later, I'll turn the stretchers at the lathe. I started with the rails.

THE RAILS. The sides of the chair are two inches wide where the mortises are located for the crest rail. (Likewise at the nose rail on the front end of the chair.)

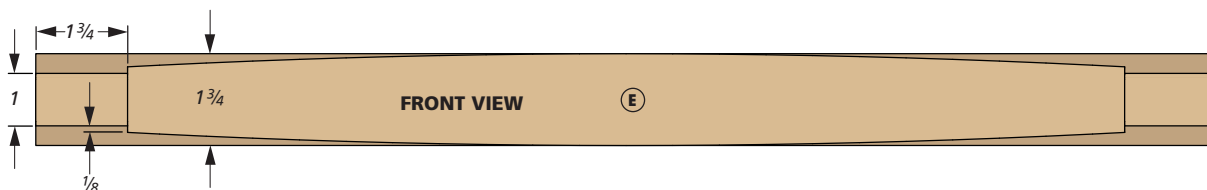
Instead of trying to find hardwood thick enough for the rails, I face-glued the parts up from 5/4 stock. While the glue was drying, I planned my strategy for shaping the crest rail.

CREST RAIL. The crest rail at the top of the chair is arguably the focal point of this piece. What minimal decoration the chair has resides in the arc you see in detail 'c' above. Making the arc is a little more calculated than you might think. If you flip back to the first page in this article, you'll notice that the shoulder

of the arc ends exactly at the top of the chair sides. So you'll want to be mindful of that junction when making the crest rail.

The box on the next page shows how to cut the joinery on the crest rail. After shaping the tenon in Figure 1 and 2, hold the crest rail against the sides and confirm the starting position of the arc.

Now, you can confidently rough out the shape of the arc at the band saw (Figure 3) and sand it smooth. Follow this with drilling the hole that's centered



at the top of the crest rail.

TENON. Matching the shape of the tenons to the mortise openings is next. At the router table, with a $\frac{3}{8}$ " roundover bit, shape the ends of the tenons. Be careful here, as you know, router bits can get grabby, so ease the tenon into the bit just enough to shape the outer edge of the tenon, Figure 4 shows how to do this. Back at the bench, finish shaping the tenons up to the shoulder (Figure 4a).

THE NOSE RAIL. The process for

making the nose rail (detail 'a,' previous page) is a little different. After sizing the glued-up blank, shape the tenons in the same manner as you did on the crest rail. From there, you should dry fit the nose rail to the chair sides to confirm the profile on the rail blank.

Then it's just a matter of roughing out the shape of the rail at the table saw (with the blade set to 45°). Then back at the router table, sneak up on the final shape of the nose rail with

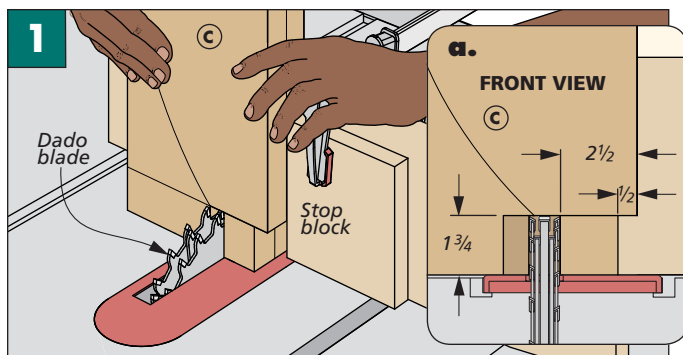
a 1" roundover bit.

THE STRETCHERS

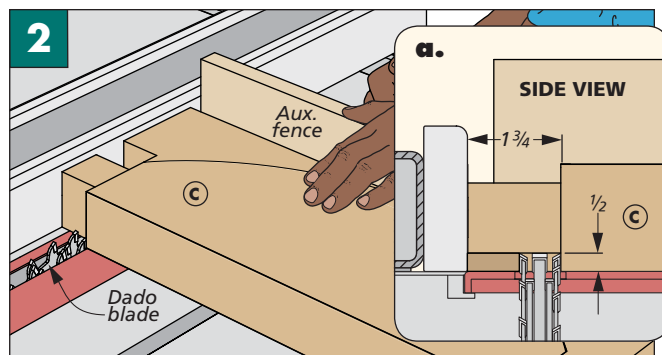
The stretcher you see in the drawing above is almost boring compared to the parts you've made so far. Not really, I always love an excuse to make shavings at the lathe. The two stretchers required for the chair didn't take long to turn and sand smooth.

There's a little more work to do before you can assemble the chair. It involves cutting a slot in the tenons and making some

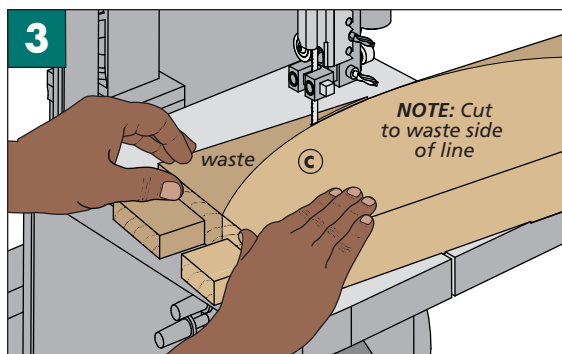
MAKING & SHAPING THE TENONS



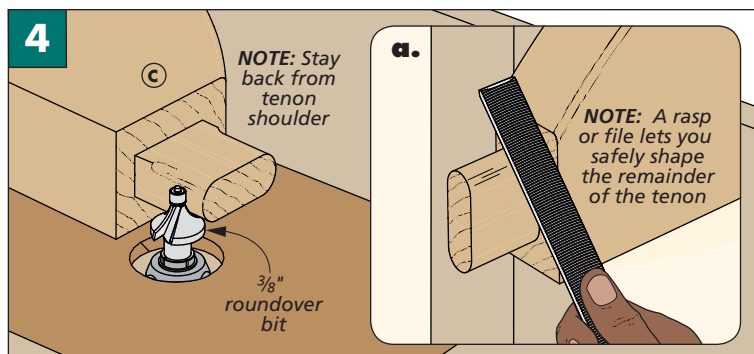
Locate the Tenons. The table saw with a tall auxiliary fence attached to the miter gauge is how to start the tenon. Stand the rail against the fence to define the upper shoulder.



Cut the Shoulders. To finish roughing out the tenons, lay the crest rail flat and use the rip fence as a stop block. The miter gauge will support the rail while making the cut.



Shape the Arc. Shaping the arc that's on top of the crest rail begins at the band saw. Sand smooth the marks from the band saw blade.



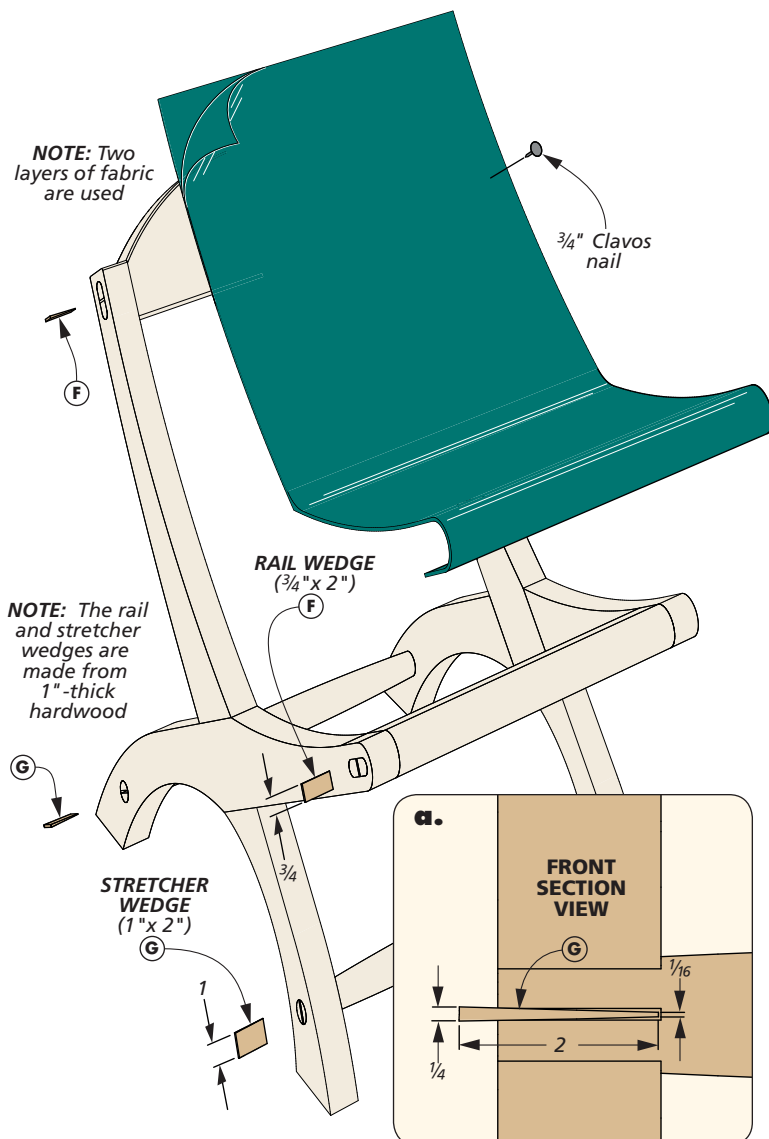
Roundover the Tenons. A roundover bit installed in your router table will shape the tenon to match the mortise. Use files and rasps to complete the shape of the tenon close to the body of the crest rail.

Some **FINISHING TOUCHES**

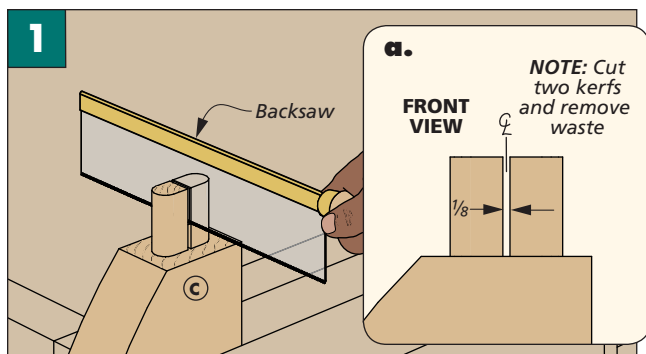
The finish line is within sight for this lovely little chair. There are just a few things left to do — make some wedges, glue-up the chair, install the wedges, finish the chair, sew the seat, and attach it to the chair. Do six or seven things qualify as a few? Who knows. At any rate, I started with the last bit of work needed on the rails and stretchers — cutting a slot for the wedges.

KERFS IN THE TENONS. Figure 1 below shows the kerfs being made with a backsaw. I like using hand tools as often as possible. Plus, it's easier to work on the turned stretchers with the aid of your bench vise.

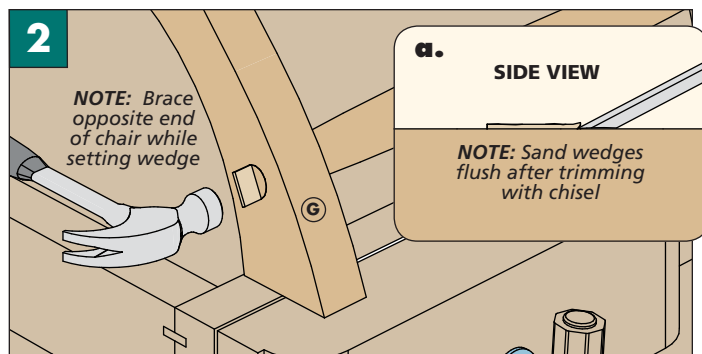
GLUE UP. To avoid anxious moments during a multi-piece glue-up I do two things. A dry run comes first. This will reveal any bumps or ill-fitting parts ahead of time. And I use slow-set glue to give me some fiddle room. So, with one side of the chair face down on the bench, fit the rails and stretchers in their openings. To keep a consistent look, I rotated the stretcher so the groove for the wedge runs parallel to the grain. Now slide



ADDING WEDGES TO THE TENONS

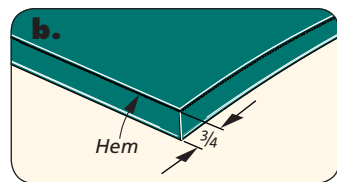
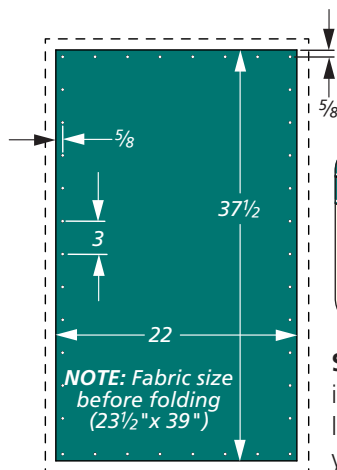


Slots for Wedges. A back saw is a good choice for making the slots in the tenons. To avoid cutting into the face of the workpiece, be careful as you near the shoulder.

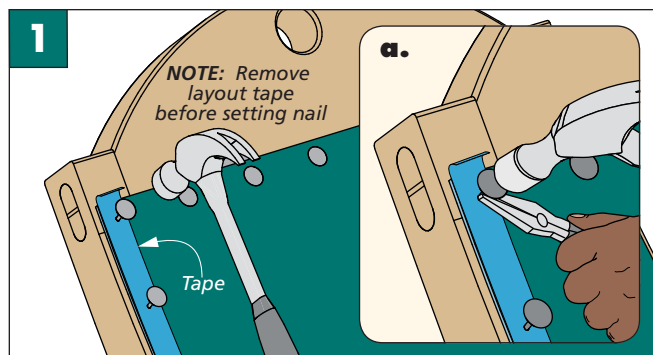


Installing the Wedges. After the chair is glued up you can tap the wedges in place. To trim the wedge flush, a chisel will do just fine. Then a little sanding will yield a flawless look.

MAKING & ATTACHING THE SEAT



Shaping the Seat. A thick hem in the canvas brings the two layers together and guarantees years of worry-free relaxation.



Spacing the Nails. Installing the nails is a two-step process. First hold the nail steady with needle nose pliers. Once it's set, drive it tight to the canvas material.

the other side in place. Flip the chair upright and clamp it up.

THE WEDGES. You'll notice in the main drawing on the previous page, that there are two sizes of wedges. The narrow wedges are for the rails. While the wider wedges are for the tenons on the stretchers. Both sets of wedges are made at the band saw. With glue and hammer in hand, you can install the wedges. When they're dry, cut the wedges flush to the surface and sand smooth (Figure 2, previous page). It's time to ease all the edges with an $\frac{1}{8}$ " roundover bit. A sanding block takes care of the tight corners where the bit won't reach.

Before installing the seat, the chair needs to be finished. That called for *Varathane's* Gunstock oil stain, and two coats of lacquer. Next is the seat.

THE SEAT

Having an upholstered seat isn't practical in a humid environment such as the Caribbean. In keeping with that insightful position, Dillion employed a dyed cotton duck canvas. As you see in the drawing above, two layers with a folded seam will make a long-lasting seat. Hemming the seat is going to require a machine with some muscle. A local sewing and alteration shop will be able

to do the job properly for a modest fee.

Figure 1 above shows how to install the seat. The tape lets you lay out and mark the location of the nails evenly across the seat (detail 'a'). Before setting the nails,

This has been a fun build. You'll find it's a good idea to hold on to those templates, and the half-lap jig for the stiles. I have a hunch that once friends and family have a chance to try out a Campeche chair, there's a good chance you'll get called to make more. **W**



▲ Clavos nails are good-looking fasteners that add style to the chair.

Materials, Supplies & Cutting Diagram

A Back Stile (2)	$1\frac{3}{4} \times 4 - 40$	F Rail Wedges (4)	$\frac{1}{4} \times \frac{3}{4} - 2$
B Front Stile (2)	$1\frac{3}{4} \times 5\frac{3}{4} - 36$	G Stretcher Wedges (4)	$\frac{1}{4} \times 1 - 2$
C Crest Rail (1)	$2 \times 7 - 22\frac{1}{2}$	• (2) $23\frac{1}{2} \times 39$ " 10 oz Duck Canvas	
D Nose Rail (1)	$2 \times 3 - 22\frac{1}{2}$	• (38) $\frac{3}{4}$ " Clavos Nails	
E Stretchers (2)	$1\frac{3}{4} \times 1\frac{3}{4} - 22\frac{1}{2}$		

$1\frac{3}{4}$ " x 6" - 84" Mahogany (2 Boards @ 7.0 Bd. Ft. each)



1" x 7 1/2" - 48" Mahogany (2 Boards @ 3.8 Bd. Ft. each)



Small-Scale Home Office

This sleek and modern desk and wall shelf combo is the perfect workstation that the whole family can share, anywhere in the house.

What can I say — the year 2020 has been an interesting one. Among the many challenges this year has presented, one of the largest was learning to work remotely. To compound this “work from home” model, many parents found their children migrating to online learning as well.

While I was amazed how well most of the school districts handled the remote learning, I was vastly unprepared to have my children learning from home. All of a sudden, many parents, myself included, were forced to put together a “learning area” for our kids. In a response to this, Chris Fitch designed the desk and shelf you see here.

SLEEK DESIGN. Looking at the desk, you can see that not only is it the perfect place for a student to learn at, but its modern design makes it equally attractive for an adult working at home. The maple construction comes together quickly, and a pull-out tray keeps all your supplies close at hand. For a little more storage, Chris designed a simple wall shelf to sit above the desk. It matches the desk nicely and offers more storage than the desk alone. An additional benefit is that it transforms the desk from just a table into more of a work area.



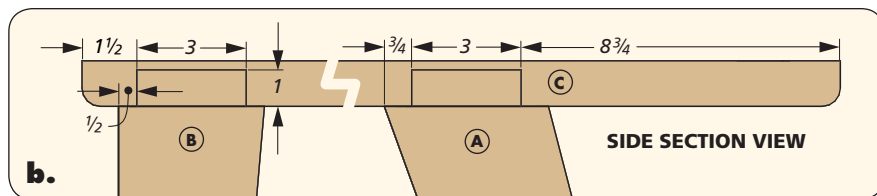
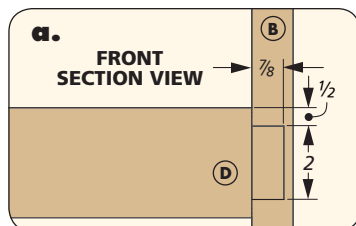
▲ Sliding doors on the left and right provide easy access to storage cubbies. We left ours open, but you could easily add shelves to break up the interior.



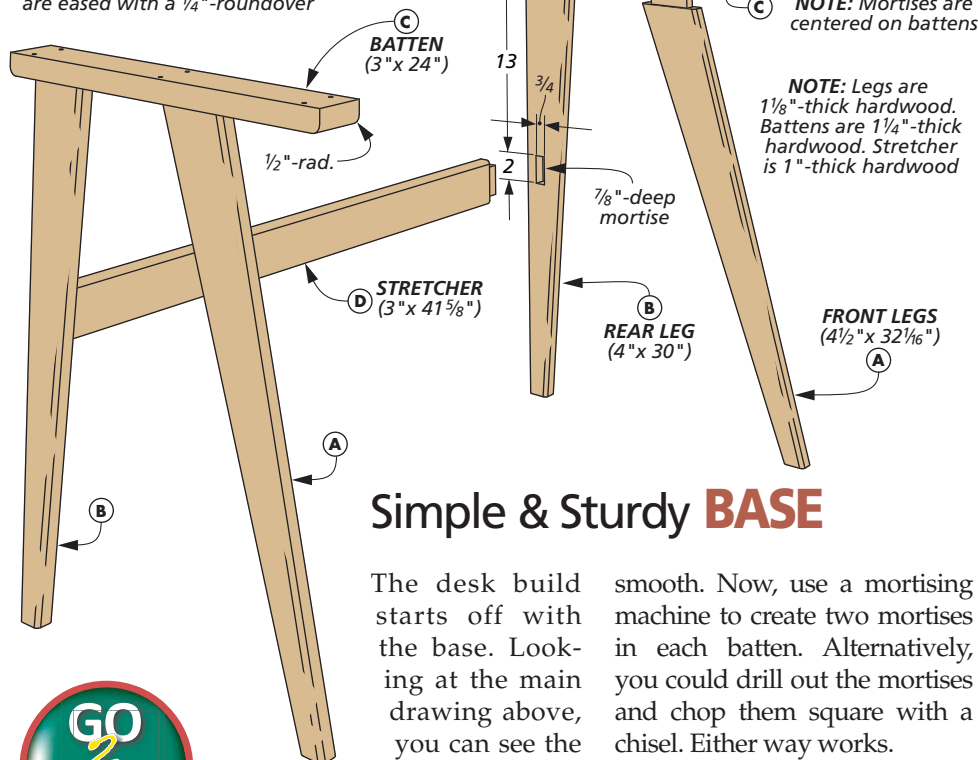


► Keeping the clean and simple design of this desk in mind, we opted for a low-key storage option in the form of a simple, commercially available slideout tray.





NOTE: Legs and stretcher are eased with a $\frac{1}{4}$ "-roundover



Simple & Sturdy **BASE**

The desk build starts off with the base. Looking at the main drawing above, you can see the parts that form the base. The first thing to take care of is creating the legs.

ANGLED LEGS. The front legs are set at an angle in relation to the top. The back legs also have a taper along the front edge. Create the legs by laying out the taper on your stock (here, we used maple) and use double-sided tape to hold the stock down to a sled, with the taper aligned to the edge. Then, cut the taper at the table saw, with the sled running along the fence. Now, you can set the legs aside for a bit while you work on other parts.

BATTENS. A pair of battens are used to attach the legs to the top (detail 'b'). Create the battens by cutting them to size and cutting the radius on the ends at the band saw before sanding them

smooth. Now, use a mortising machine to create two mortises in each batten. Alternatively, you could drill out the mortises and chop them square with a chisel. Either way works.

TENONS. At the table saw, you can cut the tenons on the legs. This process is shown below. You'll need a way to hold the legs at an

angle to create the tenons. Here, I used a jig that straddles the rip fence (available online). The leg is supported by a cleat and clamped in place. Then, it's business as usual to cut the tenons. Sneak up on the fit, and test the tenons in the mortises.

A QUICK STRETCHER. The last thing to do on the base is to make the stretcher to connect the back legs. This is simply cut to size and a tenon is cut on both ends. You'll also need to cut the matching mortises in the rear legs. Mortising machine for me when it comes to these, but again, choose your own adventure. Before assembling anything, spend a minute at the router table adding a roundover to the edges of the legs.

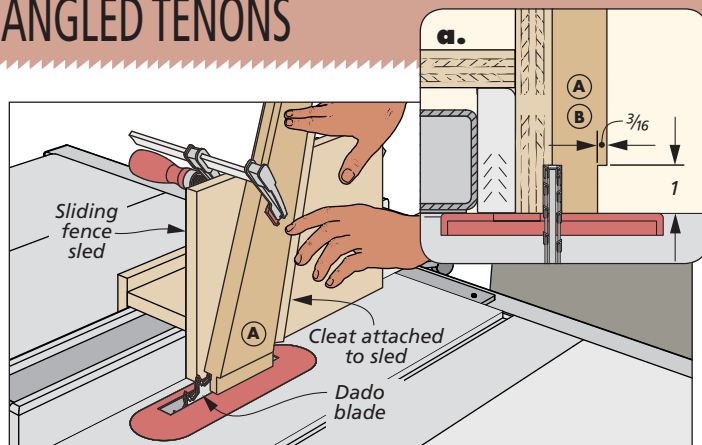
GLUE IT UP. At this point, let's see some progress. Start by gluing the legs into the battens. Then, join the two leg assemblies with the stretcher. With the base drying, it's time to concentrate on the top.



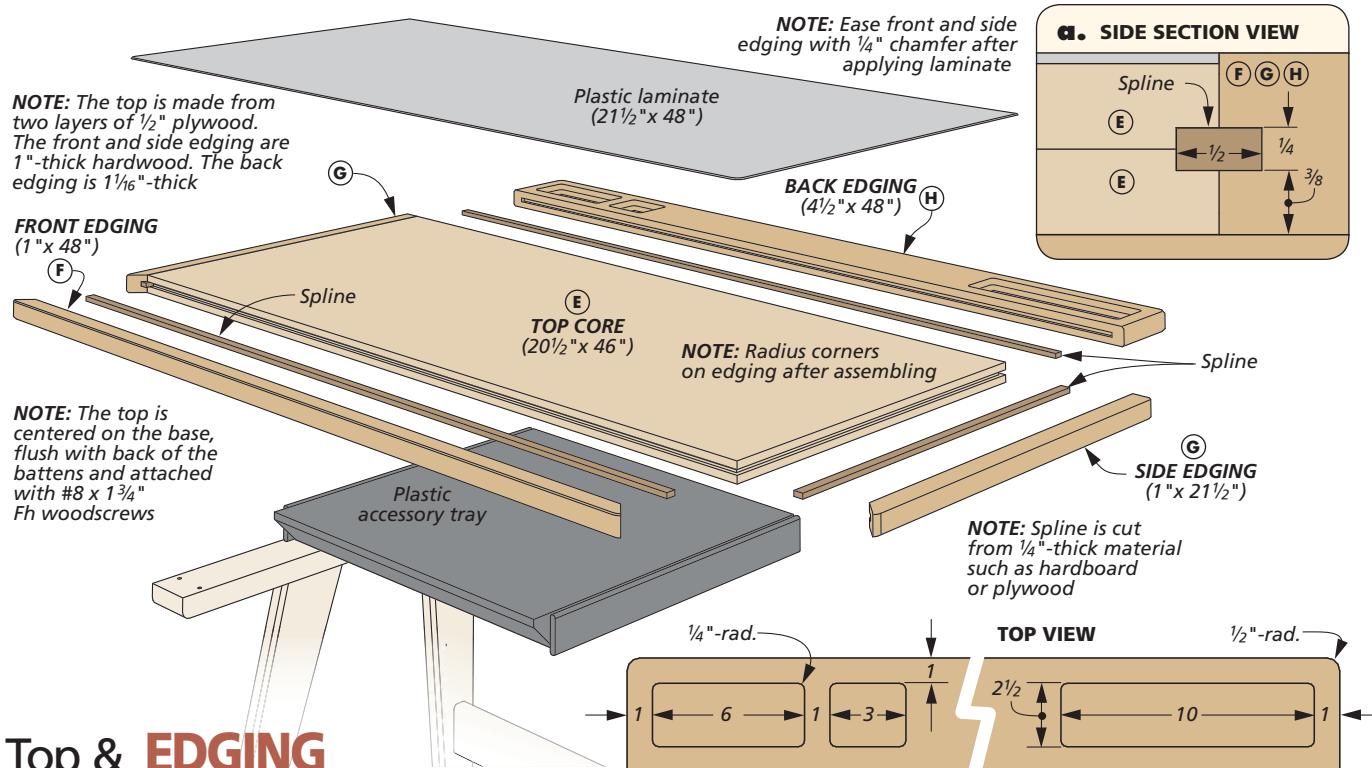
For full-size leg patterns and tenon jig, go to our website:

Woodsmith.com/253

ANGLED TENONS



Angled Tenons. Use a sled to guide the legs while cutting the tenons. Then, clamp the leg to a tall auxiliary fence attached to the miter gauge to nip off the front and back of the tenons.



Top & EDGING

The top of the desk is built from two layers of plywood covered in plastic laminate. Hardwood edging wraps the plywood, with the back edging being wider to accommodate a few routed dishes for storage.

PLYWOOD CORE. Cut the plywood cores to size and glue them together. I left the top core

slightly oversized, and used a flush trim bit to trim it down to size. Now, cut a groove along the edges of the top with a slot cutter in a router. This groove will hold a hardboard spline, as you see in detail 'a.'

EDGING. Create the edging by cutting extra long blanks to size, then rout a groove down

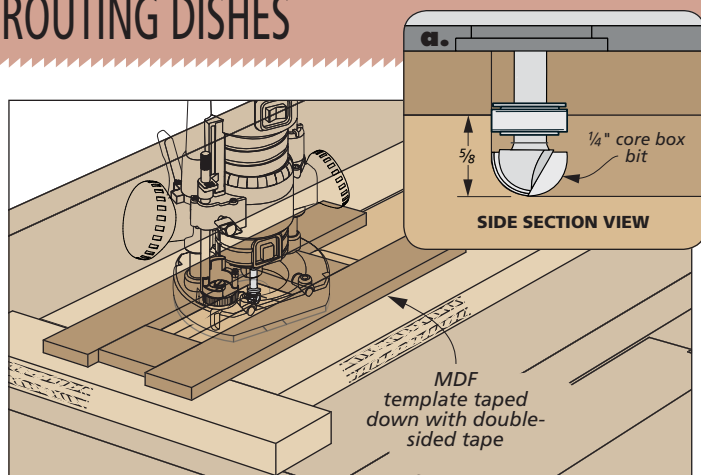
the center for the spline. Test fit the edging in place and mark the miter locations on the ends. After cutting the miters, install the edging with glue and splines.

LAMINATE NEXT. Before adding the back edging let's attach the laminate to the top. Apply contact cement to both the laminate and the desk top. Once it's dry, stick the laminate down with a roller. Now you can flush trim the laminate to the back edge and chamfer the front and side edging.

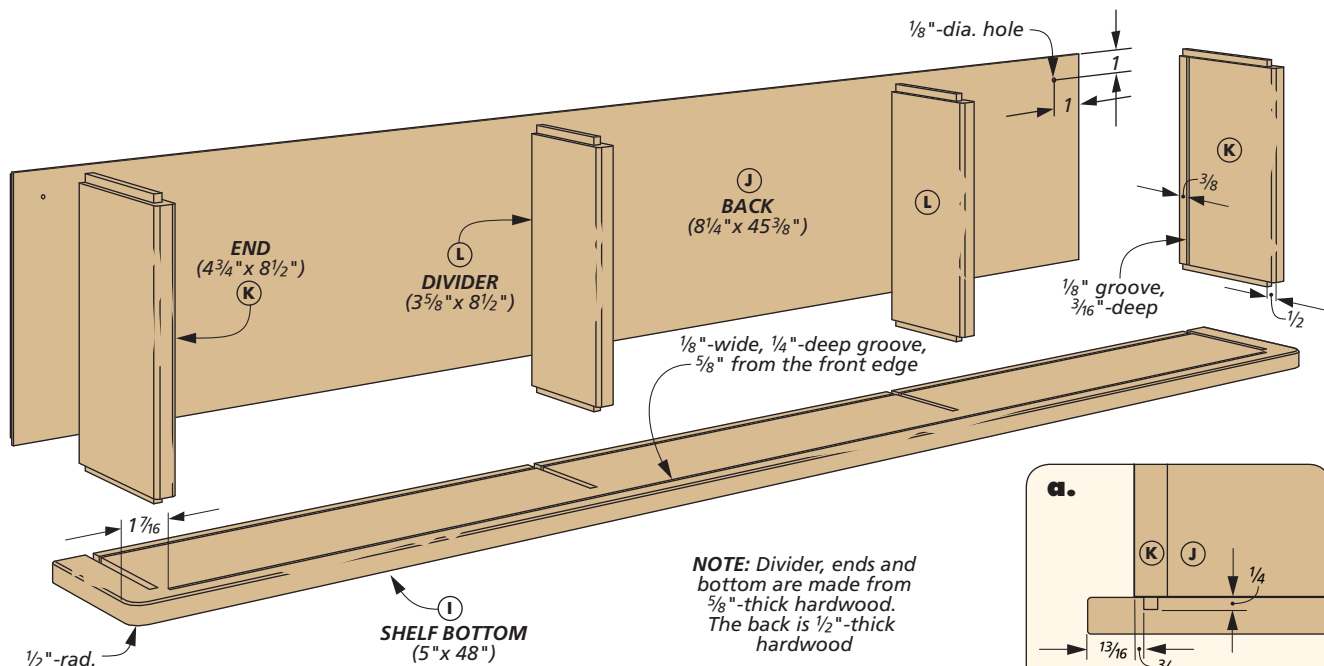
BACK EDGING. The back edging is wider and thicker than the other edging. Cut it to length and draw a couple of lines on your router table showing where the front and back of your bit are. These will help you rout the stopped groove for the spline.

Before attaching the edging on the top, rout some dishes for storage. You can see this setup to the left. Use some scrap MDF held to the edging with some double-sided tape. Then, rout out the dishes with a bowl and tray or core box bit.

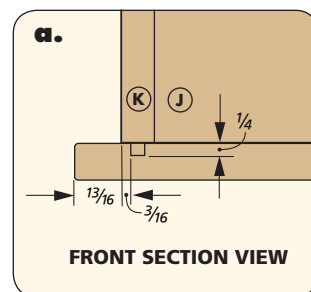
ROUTING DISHES



Routing Dishes. Using a core box bit, rout the dishes following the MDF template. On each successive pass, cut a little deeper until you reach the final depth.



NOTE: Divider, ends and bottom are made from $\frac{5}{8}"$ -thick hardwood. The back is $\frac{1}{2}"$ -thick hardwood



Floating SHELF

With the desk complete, you can tackle the shelf. Like the desk, the shelf is built out of hard maple. The shelf needs to be assembled in a particular order, but because the top and bottom are almost identical, you'll make them at the same time.

TOP & BOTTOM. The groove in the top is slightly wider than the groove in the bottom (detail 'b' on the next page). Cut the top and bottom to length, and radius the corners of each at the band saw.

Be careful as you lay out the stopped dadoes. Any variance here will cause the shelf to be out of square. I clamped the top and bottom back-to-back and laid everything out at once. Use a piece of MDF as a fence to guide your router. Here, I prefer to use a router with a plunge base. You can see the router setup in the box on the next page. Rout the dadoes for the end panels, along with the dividers in both parts.

STOPPED GROOVES. Now is the time to rout the stopped grooves in the top and bottom. This can

be done at the router table with a pair of straight bits. Rout the back groove, along with the door groove in each part. Remember that the top and bottom are a little wider.

Finally, cut the back panel to size and rout a rabbet along each edge. This will from a

tongue to fit in the grooves. you just cut. This is quick and easy at the table saw.

DIVIDERS, DOORS & ASSEMBLY

Making the sides, dividers, and doors are the final steps before assembling the shelf. The sides and dividers follow a similar

DIVIDER TENONS

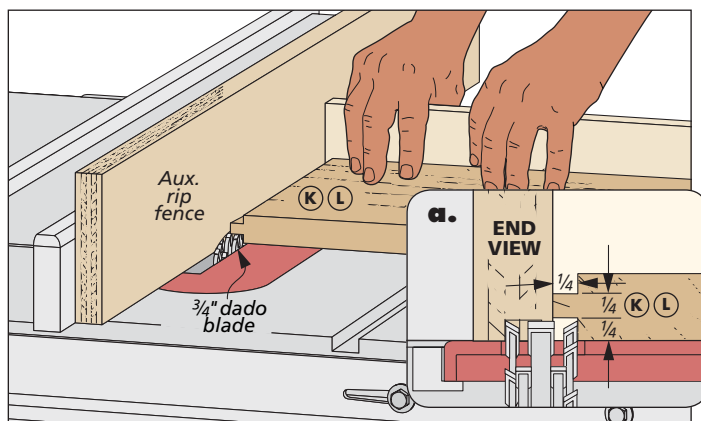
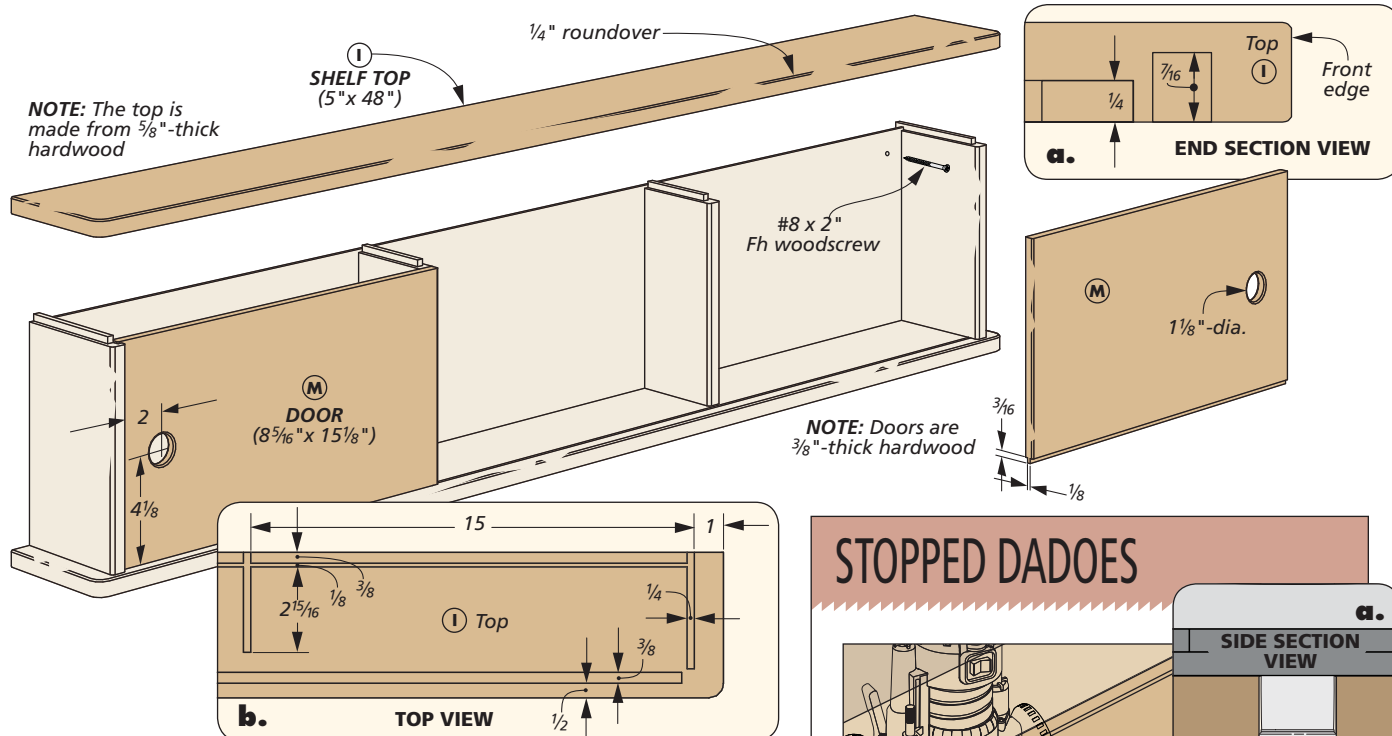


Table Saw Tenons. Cut the end and divider tenons using a dado blade. Stand the parts on end and guide them with the miter fence to nip the front edge of the tenon off.



process, so start with those first.

SMALL TENONS. After cutting the dividers and sides to size, you'll need to cut a tenon on each end to fit in the stopped grooves you routed in the top and bottom. Do this at the table saw, as seen in the box on the previous page. Make a pass along each face before standing the workpiece on end and nibbling off the front edge of the tenon.

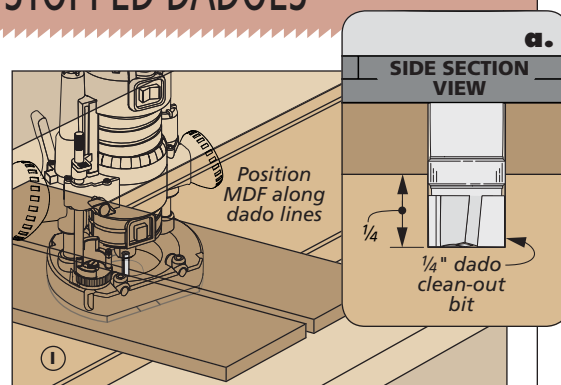
ONE MORE GROOVE. Before cracking open the glue bottle, you'll need to rout a groove along the inside face of the end panels. These are to hold the tongue on the back panel. With that done, you can assemble the shelf. Glue the dividers and sides into the top and bottom, but install the back without glue so it may float in the grooves. With clamps applied, set the shelf to the side and make the doors.

THE DOORS. The doors are simply hardwood panels cut to size. There is a small tongue along the bottom edge, that's easy enough to cut at the table saw. The doors slide into the top groove then drop into the bottom groove.

Sand the doors so they slide smoothly. Finally, drill the finger hole in each door.

After a final sanding, all that's left on the desk and shelf is to add a finish, like spray lacquer. Then, you can bring the desk inside, and mount the shelf to the wall with screws. Then, it's time to get some actual work done. **W**

STOPPED DADOES



Stopped Dados. Attach some MDF with double-sided tape to create a fence. Then, rout the grooves with a dado clean out bit.

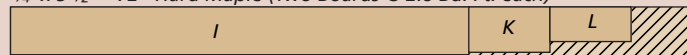
Materials, Supplies & Cutting Diagram

A Front Legs (2)	$1\frac{1}{8}$ x $4\frac{1}{2}$ - 32 $\frac{1}{16}$	I Shelf Bottom/Top (2)	$\frac{5}{8}$ x 5 - 48
B Rear Legs (2)	$1\frac{1}{8}$ x 4 - 30	J Back (1)	$\frac{1}{2}$ x $8\frac{1}{4}$ - 45 $\frac{3}{8}$
C Battens (2)	$1\frac{1}{4}$ x 3 - 24	K Shelf Ends (2)	$\frac{5}{8}$ x $4\frac{3}{4}$ - 8 $\frac{1}{2}$
D Stretcher (1)	1 x 3 - 41 $\frac{5}{8}$	L Shelf Dividers (2)	$\frac{5}{8}$ x $3\frac{5}{8}$ - 8 $\frac{1}{2}$
E Top Cores (2)	$\frac{1}{2}$ ply - 20 $\frac{1}{2}$ x 46	M Doors (2)	$\frac{3}{8}$ x $8\frac{5}{16}$ - 15 $\frac{1}{8}$
F Front Edging (1)	1 x 1 - 48		
G Side Edging (2)	1 x 1 - 21 $\frac{1}{2}$		
H Back Edging (1)	$1\frac{1}{16}$ x $4\frac{1}{2}$ - 48		

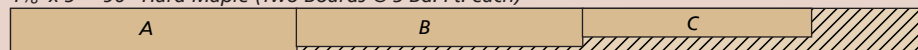
$\frac{1}{2}$ " x 5" - 84" Hard Maple (Two Boards @ 3.0 Sq. Ft. each)



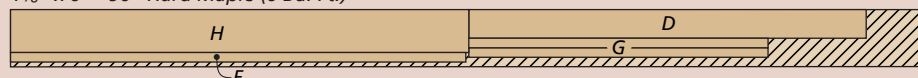
$\frac{3}{4}$ " x 5 $\frac{1}{2}$ " - 72" Hard Maple (Two Boards @ 2.8 Bd. Ft. each)



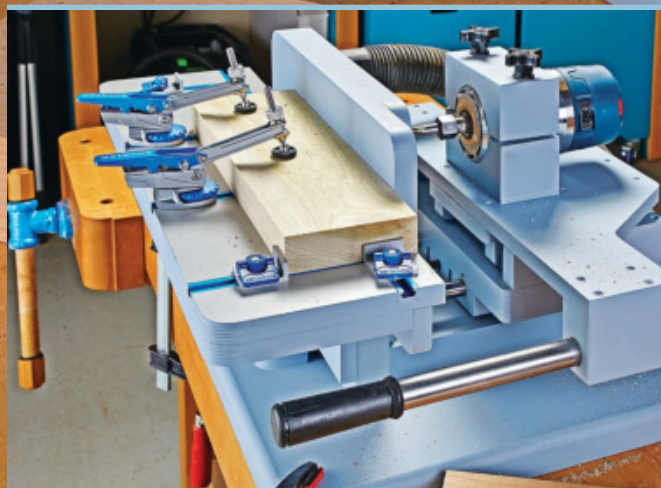
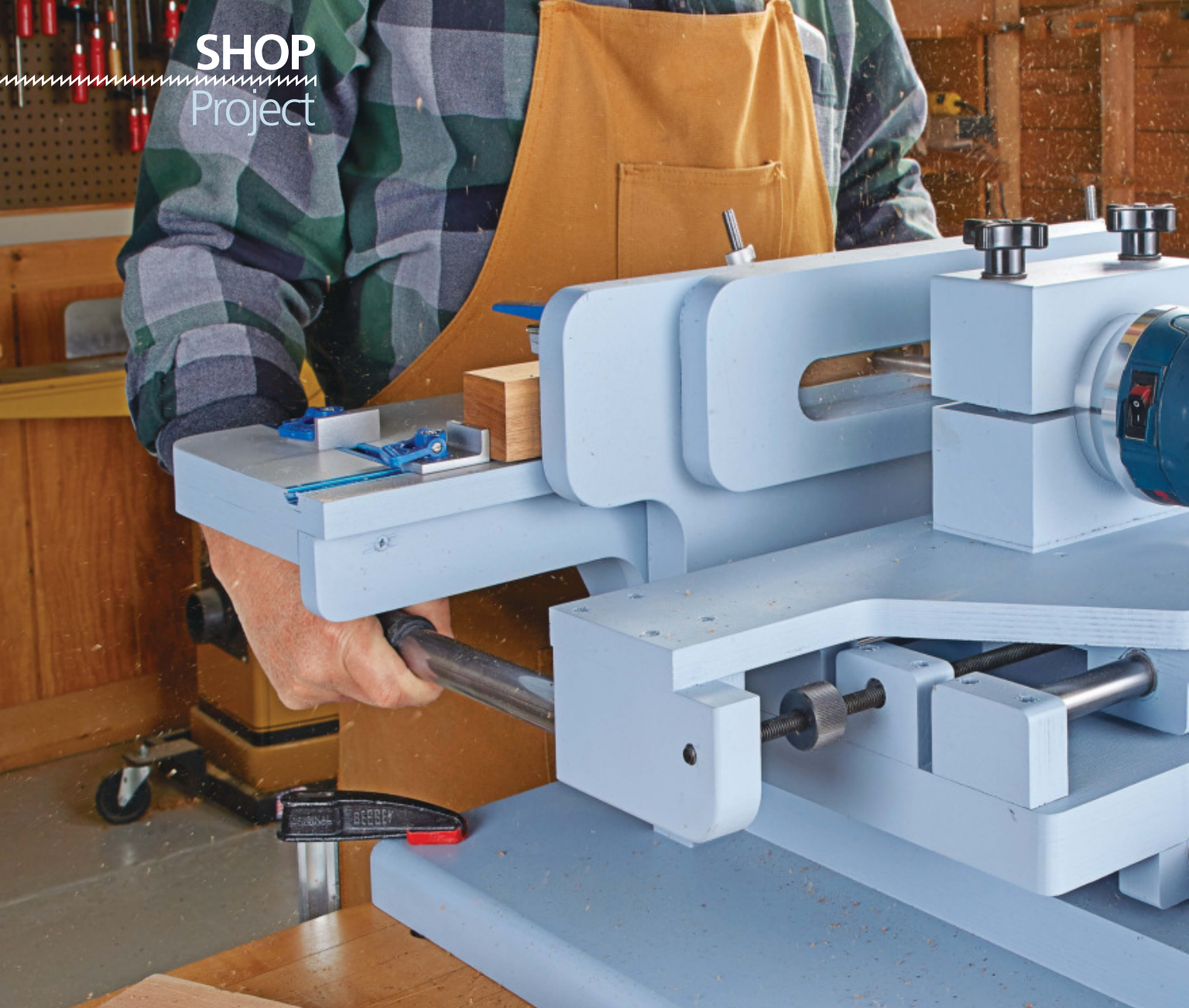
$1\frac{1}{8}$ " x 5" - 96" Hard Maple (Two Boards @ 5 Bd. Ft. each)



$1\frac{1}{8}$ " x 6" - 96" Hard Maple (6 Bd. Ft.)



SHOP Project



▲ T-tracks installed in the table are ideal for adding stops and hold-downs that secure a workpiece during the mortising process. Handlebars on the router carriage give you maximum control.

▲ This shop-made knob raises and lowers the table to locate the workpiece in relation to the router bit. A pair of large knobs lock the table in position for making a cut.

Mortising Machine

Turn your router into a high-end joinery machine. A smooth-sliding carriage and secure workholding ensure accuracy and increased control.

Dedicated, production-style joinery machines fascinate me. The precise control, smooth cuts, and ease of setup set the bar pretty high. Of course, mortising machines, slot mortisers, and other similar tools have a price tag that goes with the performance. I've been bugging creative director Chris Fitch enough to come up a shop-made machine that can hold its ground with the commercial models. What he came up with makes my heart beat fast.

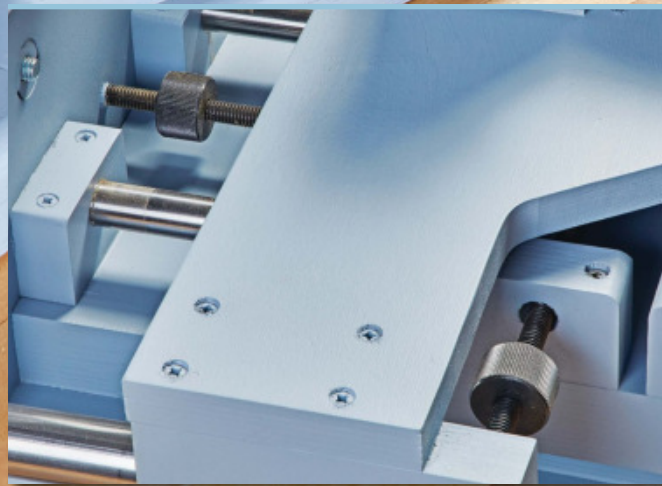
In our talks, one of the primary goals was simplicity. He wanted to avoid a complicated contraption. I wanted a way to rout mortises in the edges and ends of my workpieces. Layered plywood assembled with screws makes up most of the construction. A minimized hardware list avoids "Unobtainium" items and keeps the cost down.

At the core of this machine is an ordinary router motor. It's mounted to a carriage that slides side to side as well as forward and back to create mortises. Easy-to-adjust stops offer consistent mortise sizing.

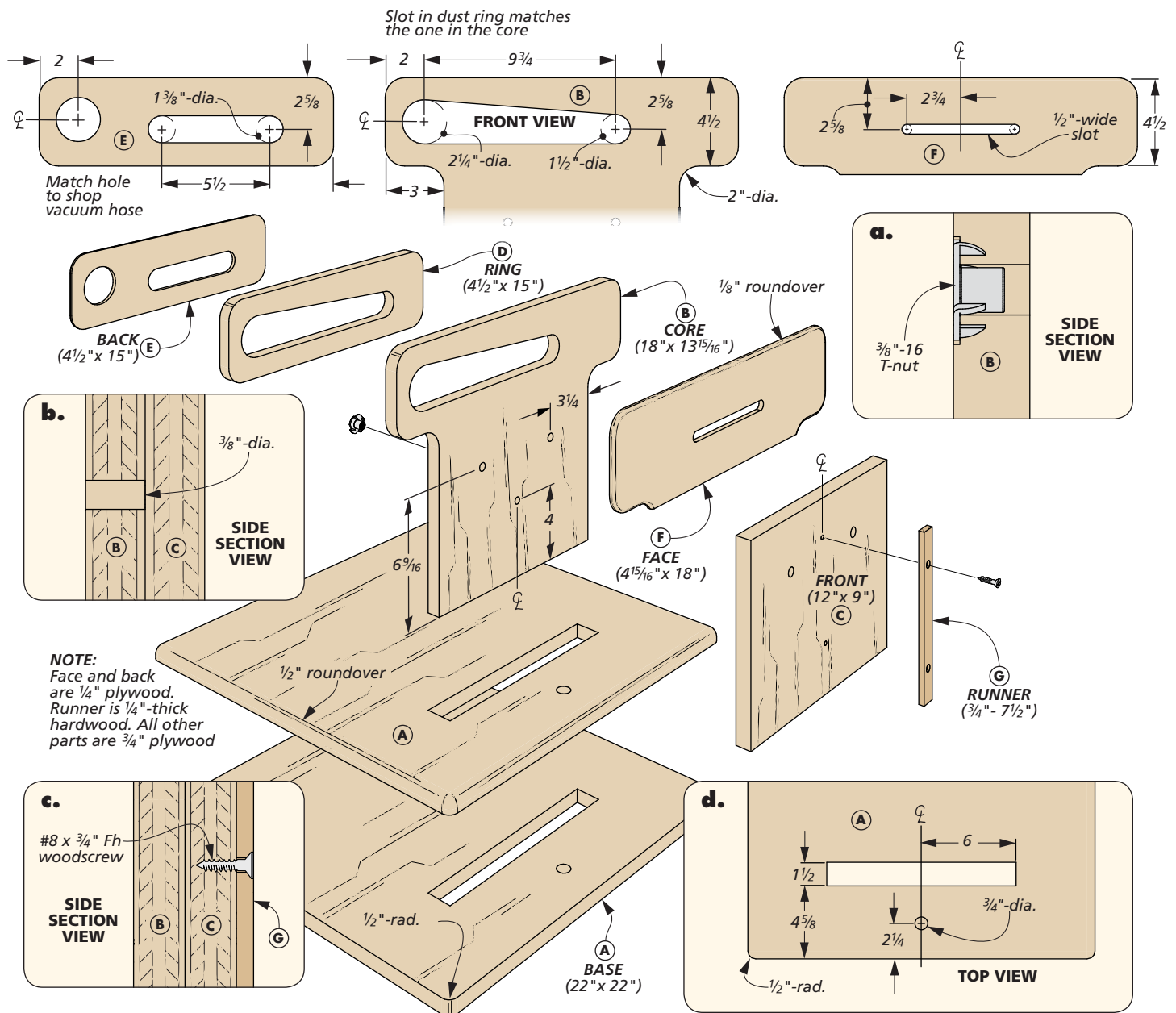
The workpiece is fixed on a table using stops and hold-downs. The table adjusts vertically to locate the bit on the thickness of the workpiece.

Another feature I like is the dust collection. It sounds a little lame, but many router-based machines and jigs spew dust and chips all over. The shroud on this machine registers the workpiece and collects chips before they can get away.

In a twist, you operate the tool from up front with a pair of handlebars, as if you're riding a motorcycle. Once you fire up this high-performance tool, you'll see how it can make cutting mortises fun.



▲ The router carriage slides side to side and front to back. Threaded rod and push-button stop nuts set the depth and length of the mortise but are easily repositioned.



Plywood PLATFORM

We've showcased several shop-built tools in the past. And one comment I hear is that they look complicated. Let's dispel that notion. Like the others, this mortising machine is largely made from pieces of plywood that are cut to size and glued together.

The construction builds up in groups of components or sub-assemblies. Take care with each step and in a short time, you have a high-performance tool.

SOLID BASE. A good way to see the proof of this concept is in

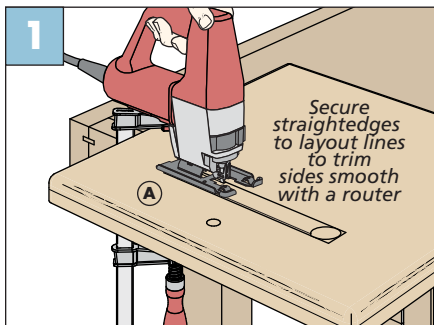
making the platform of the machine, as shown in the drawing above. It consists of a double layer of plywood. The corners are radiused (as shown in detail 'd' above) and the upper edges are rounded. Once the tool is painted, these details lend the look of a legit power tool.

The base has a through mortise sized to hold an upright assembly. I used a jigsaw to rough out the mortise. Then using two pieces of plywood as a form, tape strips of plywood

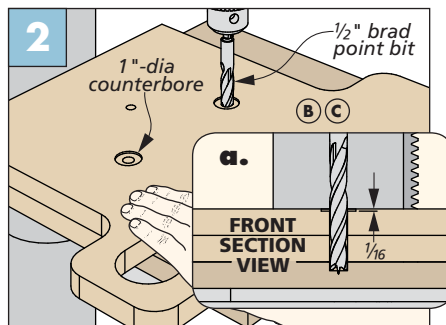
around the perimeter of the mortise, and clean up the edges with a router and a pattern bit. You need to square up the corners with a chisel. Wrap it all up by drilling a hole to accept the table lift mechanism.

UPRIGHT ANATOMY. The upright is a T-shaped, five-part assembly that serves to register the workpiece, anchor the workpiece table, and creates a dust collection shroud. The core is cut to size with a tapered slot to accommodate the router

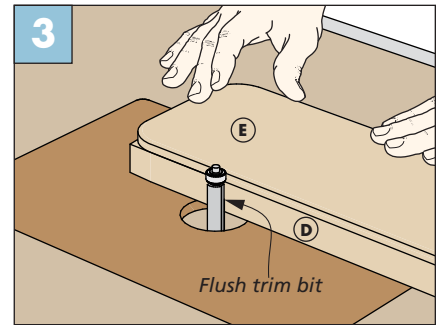
CREATING THE DETAILS ON THE UPRIGHT



Saw & Square. Cut out most of the mortise. Clean up the edges with a router, flush trim bit, and guide strips.



T-Nuts. The T-nuts rest in counterbored holes so that they are flush with the surface of the upright.



Making Copies. A flush trim bit in the router table allows you to create identically shaped parts.

collet and bit. The front of the upright adds rigidity. Drill a couple counterbored holes here to accept T-nuts. You can see this in Figure 2 in the box above. You'll also drill a hole for the depth stop rod.

DUST COLLECTION. The upright face is made from hardboard and has a narrow slot for the router bit. This is shown in the drawing on the previous page. I used the shape of the core as a template to trim the face flush after it was glued in place.

On the backside, you add a plywood ring that creates a path for dust and chips. The ring has

a slot that's identical to the one in the core. Here again, a flush trim bit or pattern bit in your router is your friend for creating both this slot and the outer profile.

A hardboard back encloses the assembly. At the end, drill a hole to accept the hose from your shop vacuum. When you've glued all these parts together and trimmed them, you can ease the edges of the face and back with a roundover bit.

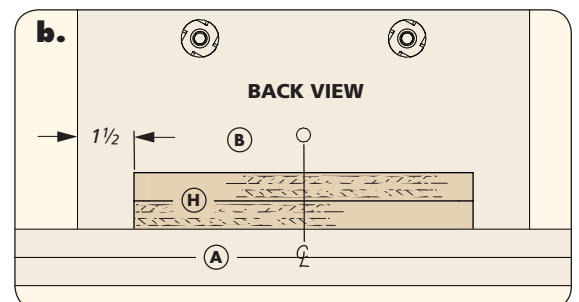
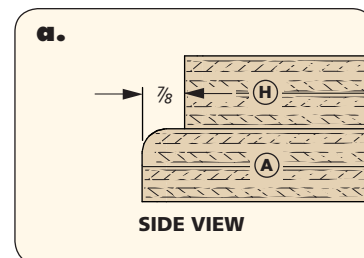
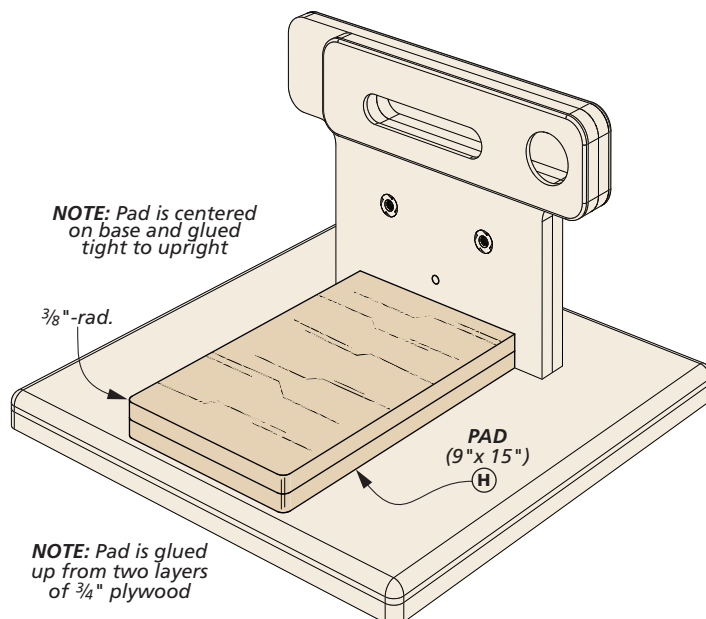
This assembly can now be glued into the mortise in the platform. It's critical that the upright is square to the base. So double-check it and perhaps

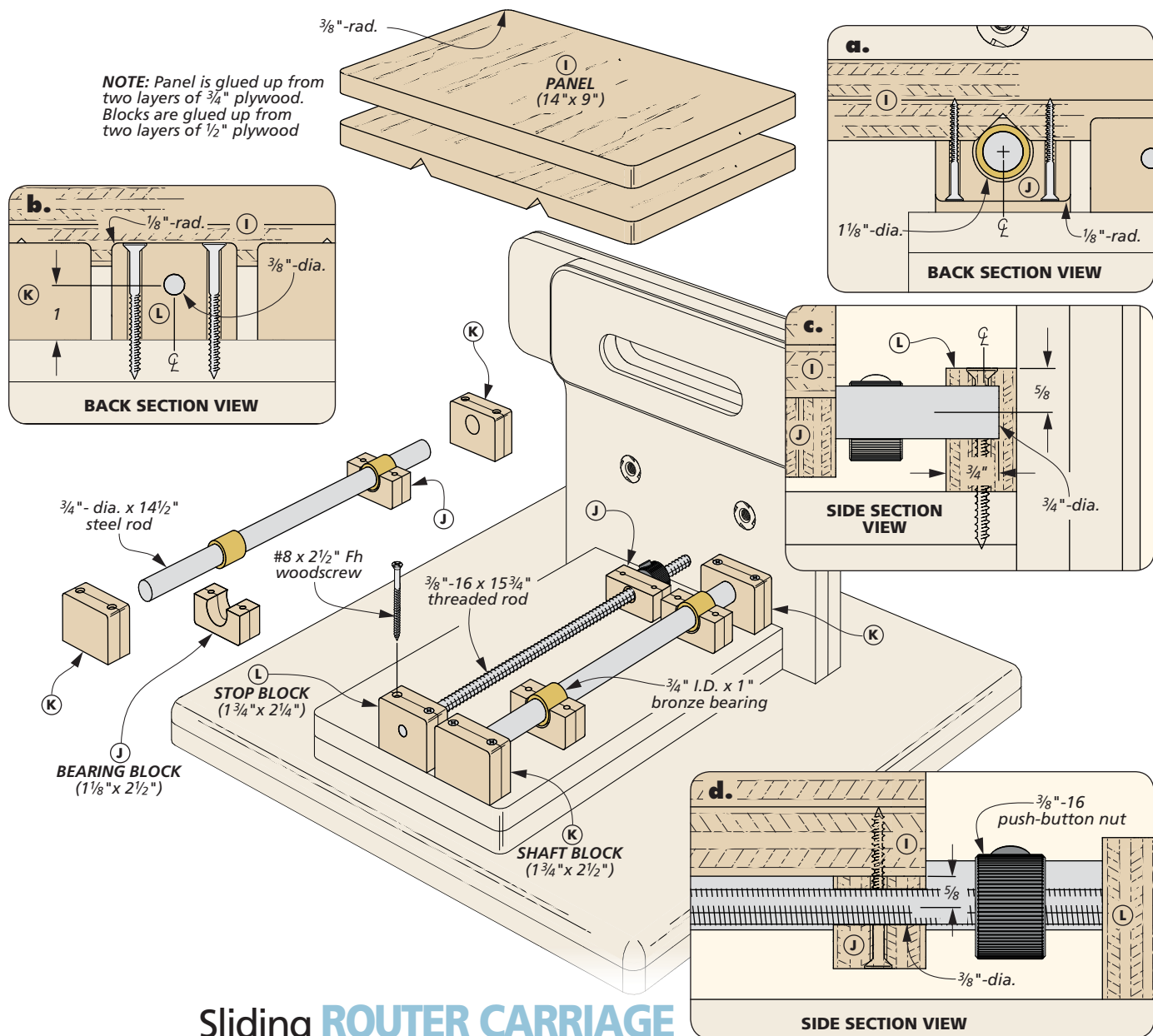
use clamping squares to ensure it stays square while the glue dries.

There's one other part to add. That's a hardwood guide to keep the table square to the router.

THE PAD

Wrapping up this part of the machine is adding a pad behind the upright. You can see this in the drawing below. The pad supports and provides clearance for the router carriage that's coming up. The pad consists of two layers of plywood. The back corners are rounded. If you're painting the tool (and you should), now's is a good time.





Sliding ROUTER CARRIAGE

The attention moves to the back of the mortising machine where the router carriage resides. This assembly consists of two sliding panels that guide the router. One section controls movement forward and back, while the other moves the router side to side.

The construction of each section is similar, so what you do here on the lower sliding assembly applies to the upper section as well. Take a look at the drawing above to orient yourself before diving into making parts.

TWO-LAYER PANEL. Begin with gluing up the lower panel and

rounding the corners. On the bottom face, you need to cut a pair of parallel V-grooves. These are used to register bushings that hold the guide rods. Cut the grooves at the table saw with the blade tilted 45°. This is shown in Figure 1 on the top of the next page.

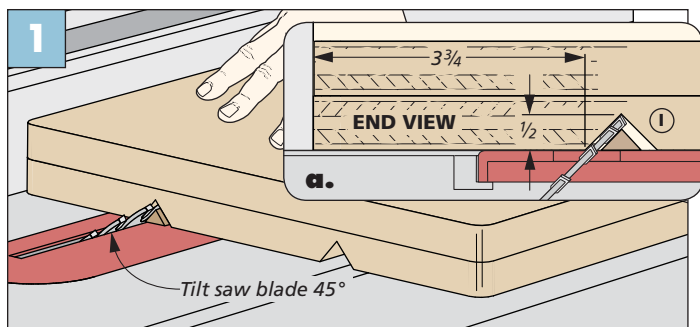
BLOCKS, LOTS OF BLOCKS. Between the sliding panel and the base of the tool are a series of blocks. There are three types: bearing blocks, shaft blocks and stop blocks. Each set is drilled to accept a particular piece of hardware. What's important

here is that all the holes in the corresponding parts align. So I set up a fence and stop block at the drill press to get consistent results from part to part.

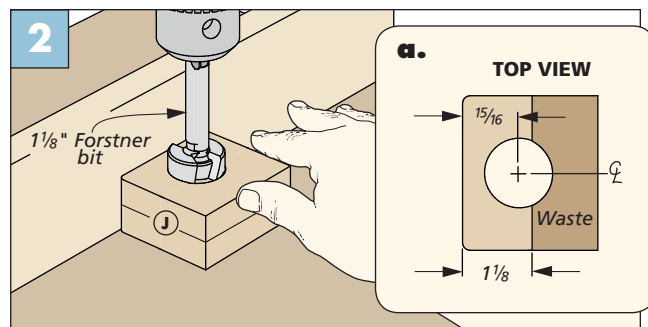
The bearing blocks have an exposed hole along the upper edge. This traps the bronze bushing between the sliding panel and block. You can see one method of drilling this hole in Figure 2 on the next page.

It's a good idea to apply a bit of epoxy to the bushing during installation. Place the bearing in the groove. Then slide a length of the guide rod between each set of

CUTTING GROOVES & DRILLING BLOCKS



Cut V-Grooves. To create symmetrical, parallel grooves, flip the blank around without resetting the fence. Then position the rip fence to cut the other side of the groove.



Bearing Blocks. In order to give the drill bit the most support (and create an accurate hole), start with extra-wide blanks for the bearing blocks.

bushings. As the epoxy cures, the rod keeps the bushings in perfect alignment. The blocks are screwed to the sliding panel, as shown in Figure 1 below.

The shaft blocks are up next. These anchor the guide rods to the base of the tool. The holes are sized to match the rod.

STOP BLOCKS. The final blocks to make are for the adjustable stop. The front block gets attached to the sliding panel, as in Figure 2 below. It's the same size as the bearing block. The rear block mounts to the platform.

The blocks accept a length of threaded rod. To allow quick and precise adjustment, there's a push-button nut installed.

INSTALLATION. Getting all the parts installed on the machine takes a little bit of planning. Cut the two guide rods and the threaded stop rod to their final lengths. Slip the shaft blocks on the ends of the rods.

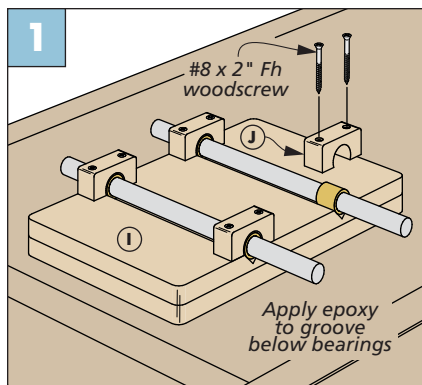
Fit one end of the stop rod into the block on the back of the panel, then slide the other block on. Then slip the stop nut onto the rod. The other end of the stop

rod fits into the hole in the back of the upright.

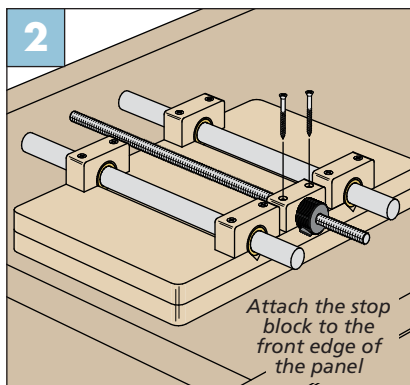
At this point, you can then drive screws (no glue) through the blocks that mount to the base of the machine (four shaft blocks and one stop block), as shown in Figure 3 below.

The important part here is to make sure this assembly is installed perpendicular to the upright assembly. This way the mortises you cut will be square to the surface of the workpiece. By only using screws, you can make adjustments if necessary.

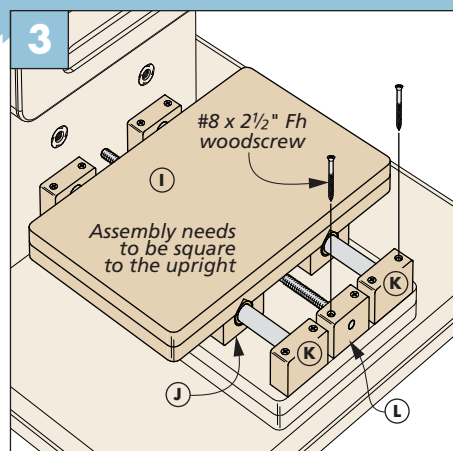
ASSEMBLY PROCESS



Install Bearing Blocks. Slip the guide rods into the bearings to hold the bearings in alignment.



Stop Block. The front stop block is attached to the panel. Slip the rod in place for the next step.



Shaft Blocks. The final blocks to add are the shaft blocks that anchor the assembly to the pad on the platform.

Side-to-side **CARRIAGE**

The second part of the router carriage manages the side-to-side travel, which creates the length of the mortise. In addition, this assembly is where you, as the operator of the machine, control the router. The ends of this assembly hold handlebars to guide the carriage during the mortising process.

SECOND VERSE SAME AS THE FIRST. Like I said before, the overall building process is the same as the lower carriage, but there are

some details that make it stand out. The drawing below shows where to begin.

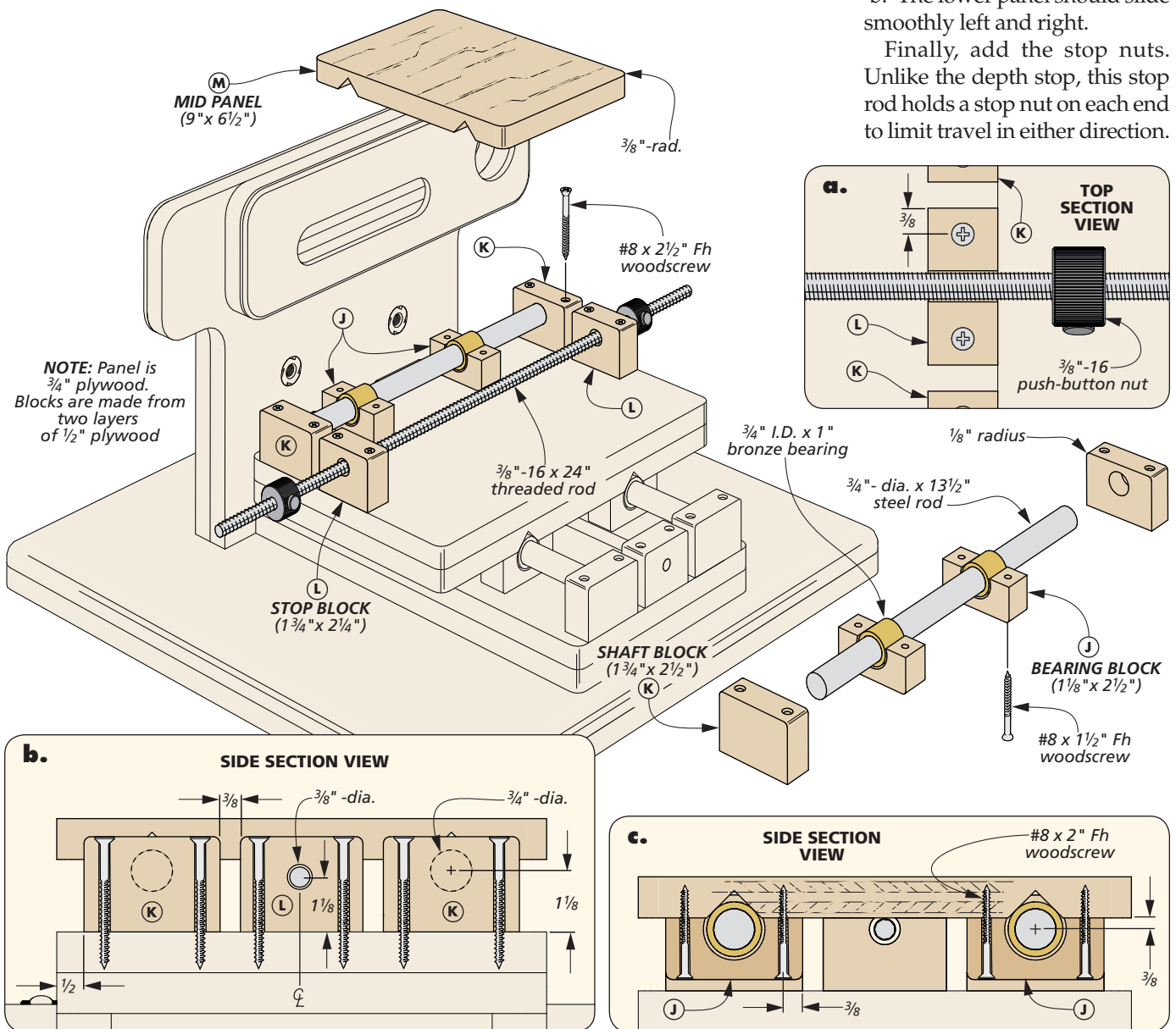
Make the upper sliding panel and V-grooves in the bottom face. Take note that this panel is only a single layer thick. The upper layer is added later and is shaped differently.

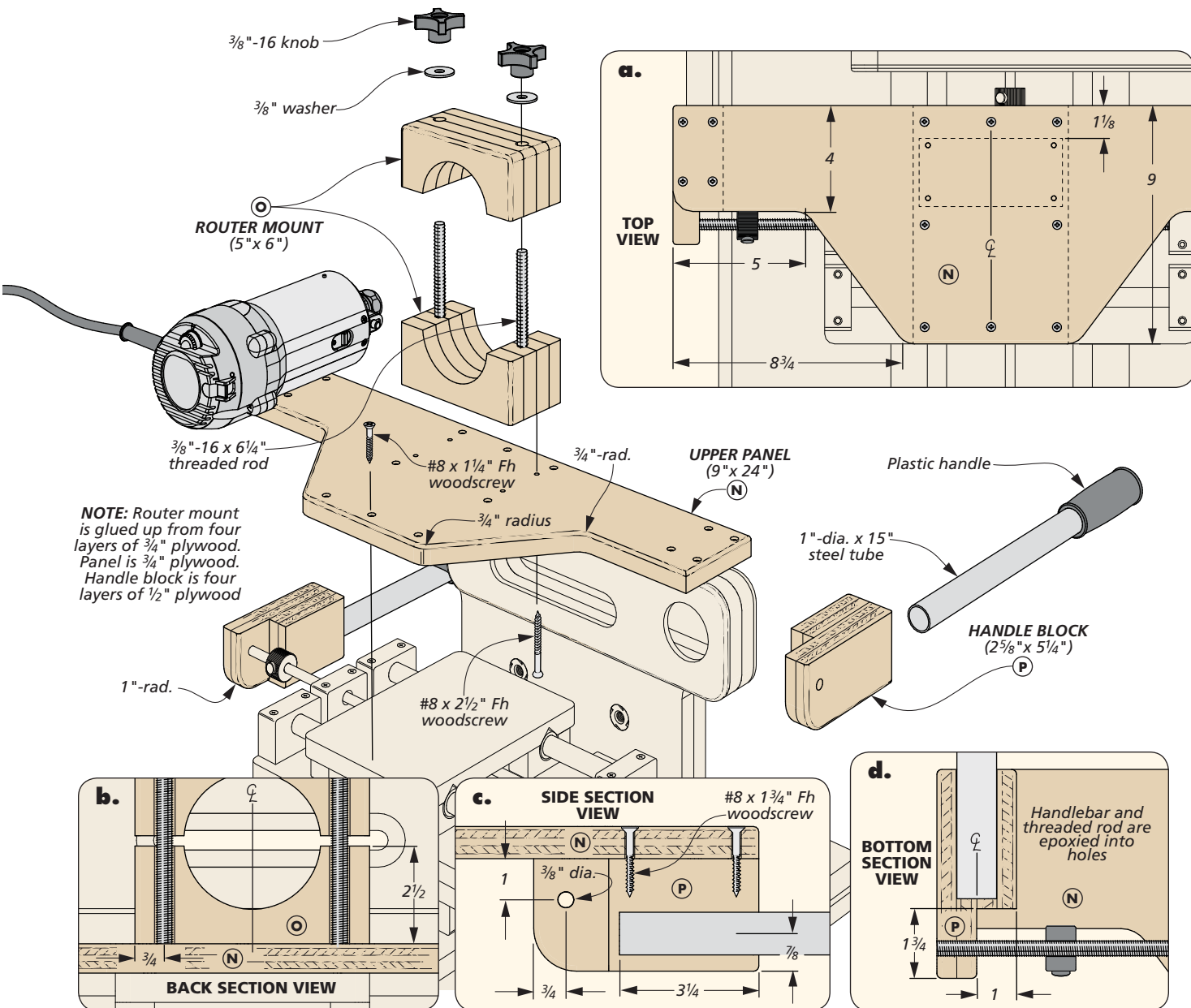
PLAYING WITH BLOCKS. Then it's back to making blocks. The bushing blocks are attached to the underside of the panel, as shown in detail 'c' below. Don't

forget to add a dab of epoxy and use the guide rods to keep the blocks properly aligned as you install them.

The remaining blocks are screwed to the previous part of the router carriage (details 'a' and 'b'). As you install the blocks and sliding panel, focus on making the mechanism parallel with the upright. This ensures that the mortises you create have a consistent depth. The spacing for the blocks is shown in detail 'b.' The lower panel should slide smoothly left and right.

Finally, add the stop nuts. Unlike the depth stop, this stop rod holds a stop nut on each end to limit travel in either direction.





CONTROL CENTER

The upper portion of the router carriage is shown in the drawing above. The two main functions here are the mounting point for the router and the controls for operating the machine.

The first thing to do is make an upper panel that accommodates both of these items. Its width matches the sliding panel, but as you can see, it's much longer, extending beyond the upright in the base. This provides clearance to add handlebars later.

There isn't anything cosmic about shaping the panel. Just cut it based on the dimensions

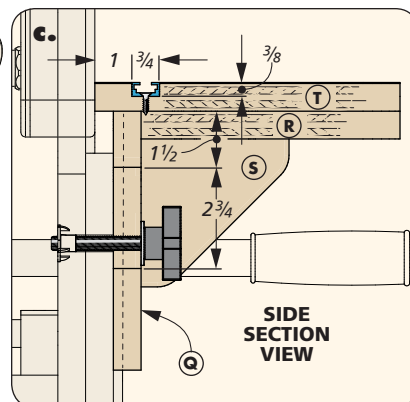
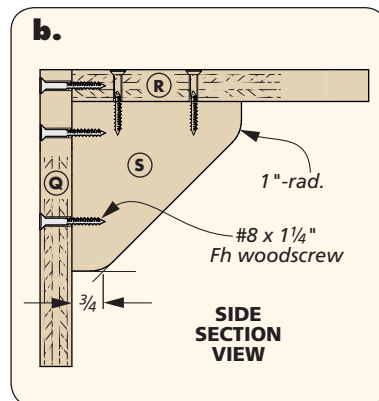
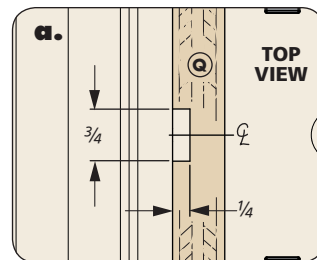
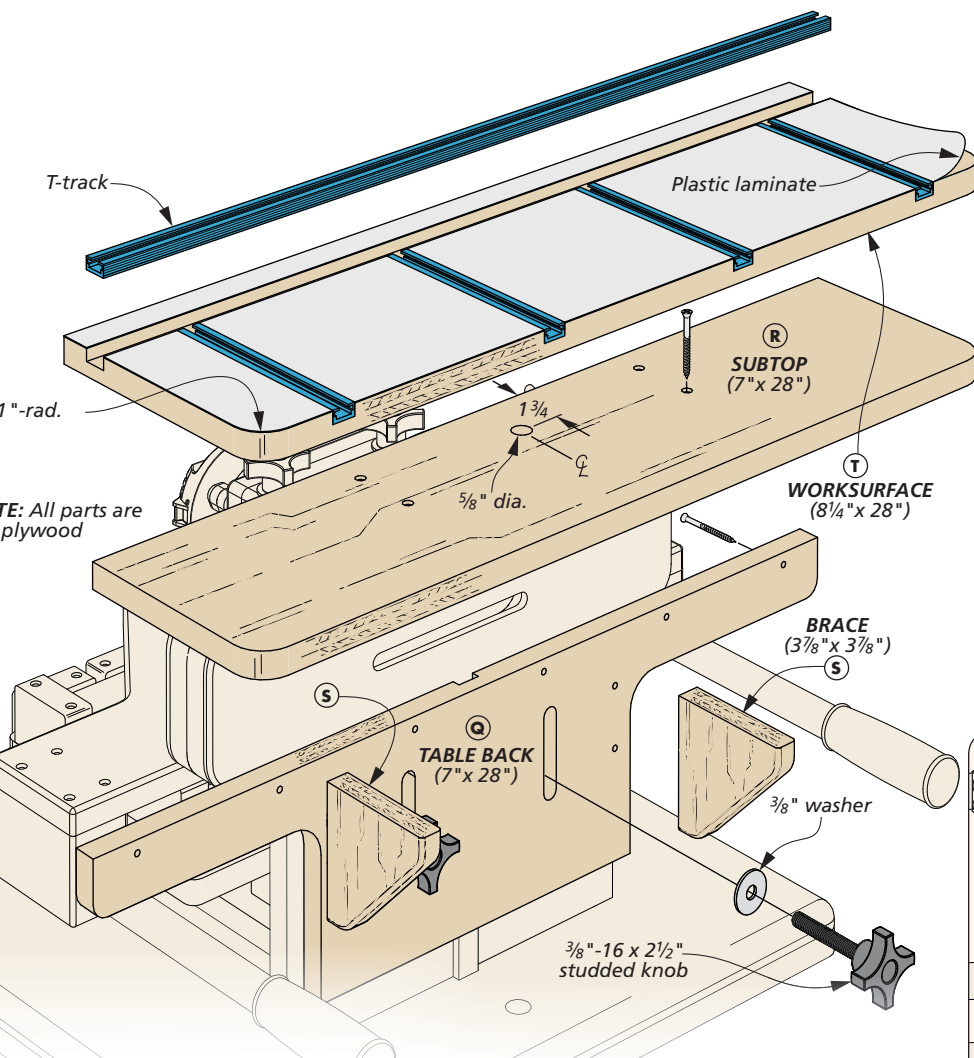
shown in detail 'a' above. I rounded the corners and softened the edges with a roundover bit in a router.

ROUTER MOUNT. Before attaching the panel, you need to make and attach the router mount. This begins as a block glued up from four layers of plywood. The block has a pair of holes drilled to house threaded rods that secure the router (detail 'b').

Then draw a circle on the face that matches the diameter of your router's motor. I split the block at the band saw and cut out the half circles. Refine the curve to get a solid grip.

Use epoxy to glue a couple of pieces of threaded rod in the lower block. Knobs, and washers fasten the upper part of the block and grip the router. Attach this to the panel with screws from below. This needs to be perpendicular to the upright. You can then attach the panel to the sliding carriage.

HANDLEBARS. The final parts to make are the blocks on each end of the upper panel. They're made up of an outer and inner block (details 'c' and 'd'). The metal tubes for the handlebars are glued to the blocks. Plastic handles give you a firm grip.

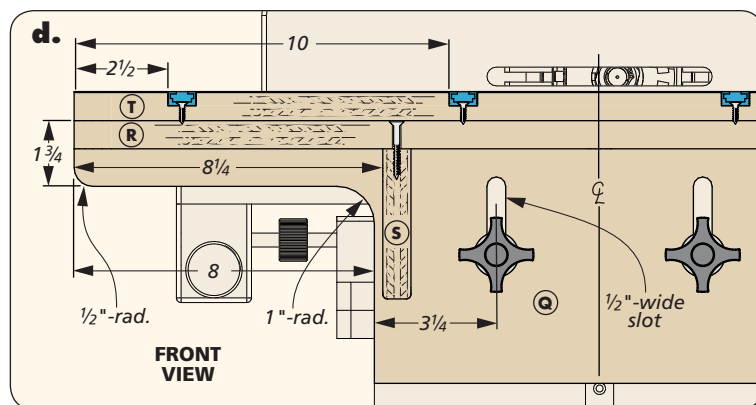


Support TABLE

We come now to the final part of the mortising machine — the table at the front. In use, the table is fixed in a given position. It is adjustable vertically to locate the router bit on the workpiece.

This implies a few characteristics. First, it needs to be rigid enough to support a workpiece without deflecting. The table should hold the workpiece square to the router bit and parallel with the travel of the bit. Finally, you need a way to adjust the position of the table with finesse.

BACK. The table assembly attaches to the upright with a wide plywood back. The back has a centered dado that



matches the hardwood runner on the upright as shown in detail 'a.' You want this to be as close a fit as possible. Not so much that it binds, but this is what keeps the table level.

A pair of slots align with the T-nuts in the upright to fix the

table once it's in position, as in details 'c' and 'd.' Then you can cut the table to shape to provide clearance for the handlebars.

SUBTOP. The next part is the subtop. It's glued and screwed to the top of the back, as shown in detail 'b.' The outside corners

are rounded for comfort. The subtop has a hole drilled to accept a threaded rod that's used to adjust the table height. Below this, a pair of triangular braces add rigidity. These are glued and screwed in place.

WORKSURFACE. The working surface of the table is another layer of plywood. It's the same length as the subtop, but it's wider so that it meets the face of the upright, as in detail 'c' on the previous page.

The worksurface is covered with plastic laminate and has stopped dadoes and a groove to hold several pieces of T-track.

This permits the use of hold-downs and stops in order to secure a workpiece. Cut the groove and dadoes with a handheld router after applying the laminate. I glued the worksurface to the subtop. Install the table assembly to the base before gluing it up. This way, you can register the worksurface against the upright. At last, trim the corners to match the subtop with a jigsaw and router.

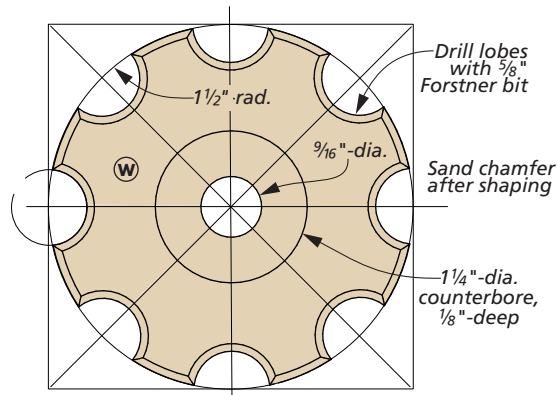
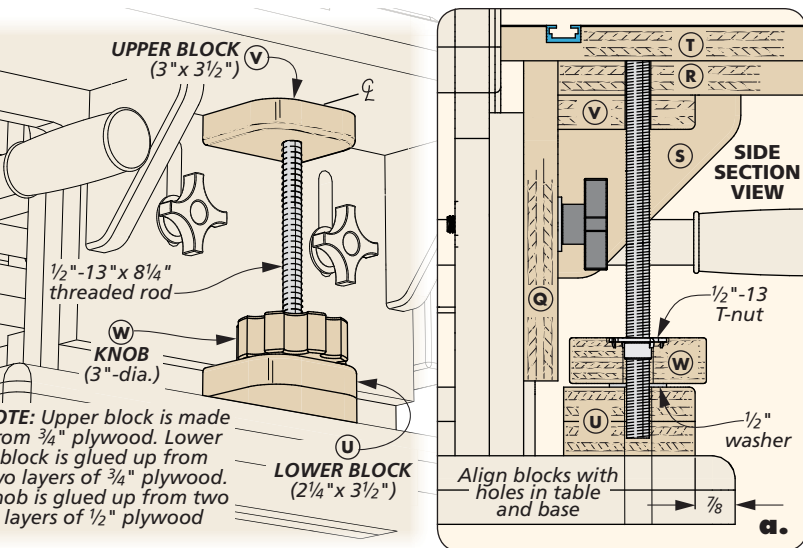
HEIGHT ADJUSTMENT

The table at this point would work, but it lacks a means to fine-tune the height. That's

where the mechanism below comes into play. There's a simple elegance to it. A threaded rod is glued into a block and a hole in the subtop, as in detail 'a.'

The rod passes through a hole in a thick block attached to the base. To adjust the table up and down, you use a large shop-made knob, as you can see in the drawing below. The lobes of the knob are formed by drilling holes around the perimeter of a square blank. A counterbored center hole accepts a T-nut. The knob can be cut to shape on the band saw. Soften the edges with a sanded chamfer.

Before use, I painted the remaining parts. After this, it's time to make mortises. Check out the video online to see how it works. [W](#)



Materials, Supplies & Cutting Diagram

A Base (1)	1 1/2 ply. - 22 x 22
B Core (1)	3/4 ply. - 18 x 13 15/16
C Core Front (1)	3/4 ply. - 9 x 12
D Ring (1)	3/4 ply. - 4 1/2 x 15
E Back (1)	1/4 hdbd. - 4 1/2 x 15
F Face (1)	1/4 hdbd. - 4 15/16 x 18
G Runner (1)	1/4 x 3/4 - 7 1/2
H Pad (1)	1 1/2 ply. - 9 x 15
I Panel (1)	1 1/2 ply. - 14 x 9
J Bearing Blocks (9)	1 ply. - 1 1/8 x 2 1/2
K Shaft Blocks (8)	1 ply. - 1 3/4 x 2 1/2
L Stop Blocks (3)	1 ply. - 1 3/4 x 2 1/4
M Mid Panel (1)	3/4 ply. - 6 1/2 x 9
N Upper Panel (1)	3/4 ply. - 9 x 24
O Router Mount (1)	3 ply. - 5 x 6
P Handle Blocks (2)	2 ply. - 2 5/8 x 5 1/4

Q Table Back (1)	3/4 ply. - 7 x 28
R Subtop (1)	3/4 ply. - 7 x 28
S Braces (2)	3/4 ply. - 3 7/8 x 3 7/8
T Worksurface (1)	3/4 ply. - 8 1/4 x 28
U Lower Block (1)	1 1/2 ply. - 2 1/4 x 3 1/2
V Upper Block (1)	3/4 ply. - 3 x 3 1/2
W Knob (1)	1 ply. x 3 - 3

- (2) 3/8"-16 T-Nuts
- (34) #8 x 1 1/4" Fh Woodscrews
- (22) #8 x 2 1/2" Fh Woodscrews
- (18) #8 x 2" Fh Woodscrews
- (8) 3/4" I.D. x 1" Bronze Bearings
- (4) 3/4" x 15" Steel Rods
- (3) 3/8"-16 x 24" Threaded Rods
- (3) 3/8"-16 Push-Button Nuts

- (1) 1"-dia. x 36" Steel Tube
- (2) Plastic Handle Grips
- (2) 3/8"-16 Knobs
- (4) 3/8" Washers
- (2) 3/8"-16 x 2 1/2" Studed Knobs
- (1) 12" x 36" Plastic Laminate
- (2) 36"-long T-Tracks w/screws
- (1) 1/2"-13 x 8 1/4" Threaded Rod
- (1) 1/2"-13 T-nut
- (1) 1/2" Washer

ALSO NEEDED: One 4' x 8' sheet of 3/4" birch plywood and one 4' x 4' sheet of 1/2" birch plywood



For a video on using the mortising machine, go to:

Woodsmith.com/253

Hand Sawing Techniques

Whenever someone tells me they are getting more involved with hand tools they inevitably have a bunch of questions about hand planes and which ones to get. I usually disappoint them when I tell them to buy a jack plane and move on to getting saws. I consider hand sawing to be the most important skill to master and the path to the most enjoyment and success. Maybe it's the same thing when using hand tools to build your projects. After all, there is no better feeling than sliding together a dovetail or mortise and tenon right off the saw. It's also pretty fast when you don't have to finesse the joint with a chisel or a plane. Hence my focus on saws.

So the next logical question I get is "what saws do I need?" Really any "what tool do I need" answer is highly dependent on the type of work you do. Moreover how much of your work is hand tool related. I'm a nut who does everything by hand so I put a lot of emphasis on full sized hand saws. But for those of the more hybrid bent, the answer could be more focused on back saws for joinery. Let's start with some definitions and get you started with just a few saws.

BACK SAWS

Back saws have, well, a back. That folded or grooved metal spine stiffens the saw and makes it more precise for joinery cuts. It also limits how deeply the saw will cut however. Back saws come in all shapes, sizes, and tooth geometry. This article is not the place to dive into tooth geometry but I will warn you it is a rabbit hole filled with joy and long hours of boring your non woodworking friends. Maybe someday the fine folks at *Woodsmith* will be so starved for articles that they will ask me



▲ Saws come in all shapes and sizes, varying in form and the intended use. From top to bottom: a panel saw, hand saw (with thumb-hole handle), tenon saw, carcass saw, and a dovetail saw.

to wax poetic on tooth geometry. For now let's just say that more teeth means a finer but slower cut. Dovetail saws have a lot of teeth while an aggressive tenon saw will have fewer teeth. The length of the saw plate and the depth under the back will also dictate the type of saw. But here again we are perched on the edge of that aforementioned rabbit hole. I'm going to skip all of the details and suggest that the first back saw you pick up is called a carcass saw. This is about 12" long with 2-3" under the back and pitched around 12-14 points per inch (ppi). It is the jack plane of back saws and will let you do just about anything well.

HAND SAWS

Saws without a back are just called hand saws. More specifically, a backless saw that is 24" and longer is called generically a hand saw. Backless saws under 24" down to about 18" are actually called panel saws. I make this point because I hear too many people refer to all backless saws as panel saws. The panel saw is a specific saw designed for panels

that are already planed thinner. This saw makes a finer, more precise cuts because it assumes some work has already been done to the board you are sawing. A good example is sawing the panel of a frame and panel door to final size to fit into the frame. I recommend one starts with a 26" hand saw pitched at 8 ppi and filed crosscut. This will allow you to break down rough lumber to length quickly to get it in the car at the lumber yard or just to allow it to acclimate faster to your shop when you bring it home. You can also rip with this saw, albeit a bit slower. The finer pitch will also function as that finer panel saw for those already surfaced or S2S bought lumber.

One point I will add is some will tell you to size the hand saw based on your height and arm length. Personally I don't believe in this and have found that everyone from 4'10" to 6'7" tall will find a 26" hand saw to be most efficient in use. There will always be outliers, but there is also a reason the *Disston Company* made literally millions of 26" long saws.



▲ Ripping at a saw bench utilizes the sawing knee to hold the work down. Keep your body in position so that the saw plate is lined up with your hand, elbow and shoulder to ensure an accurate cut.



▲ Poor sawing form, shown here, is not only uncomfortable to saw with, but also will lead to an inaccurate cut and sawing that will leave you exhausted.

#1 SAWING TIP. The first and only thing you need to remember to saw accurately and efficiently is that you want to create a straight line from the saw plate to your shoulder. One geometric plane from point to point and the saw will do what it does best: saw a straight line. Sawing should not be physically demanding.

Getting your breath and heart rate up means that something is binding or the saw is dull. Certainly this doesn't mean that ripping 6' of hardwood won't tire you out, but normal sawing operations shouldn't be overly strenuous.

HAND SAWING TECHNIQUE. The ideal place to use your hand saw is on a low sawing bench. One that is set to about kneecap height. This puts your torso over the top of the work when you kneel on the bench. If a saw bench isn't part of your shop then sawing at a regular height workbench will work too but the grip changes.

RIPPING ON A SAW BENCH. Start by placing your lumber on the bench, then kneel on it with your sawing hand knee. This holds the board in place. I highly recommend you do not clamp the board to the bench. The ability for the board to move around will tell you a lot about whether or not you are creating that straight line from saw to shoulder. A straight line won't move the board but if you are leaning one way or the other the board will want to move under your knee.

The saw is going to pass down along the opposite side of the bench from where you are standing or even possibly out in front of the bench. This is why you will often see a V-shaped notch in saw benches.

Now take a step forward with your standing leg. You will feel like your balance is too far forward honestly but this step moves your torso forward of your arm and allows it to move freely in that straight line. Take a few strokes with the saw here then step back again so your feet are next to one another or within a few inches and you will quickly feel the saw bind and start to make a lot of noise as it vibrates.

In this position, your elbow is bumping into your side and forced out and around pulling the saw through an arc rather than a straight line. In fact I keep scooting that standing leg forward until I hear the saw get quiet in the cut and you can actually feel the force required to push it decrease. The optimal angle of the saw is about 60° here and this step forward will facilitate that.



▲ An alternative to kneeling on a saw bench is using your weight and sitting on the workpiece. I find this is easier on the back and makes long rip cuts much easier.



- ▲ A loose grip on the saw, body weight holding the workpiece down, and a properly sharpened and set saw are keys to getting a smooth, accurate and easy cut with a hand saw.



- ▲ At a workbench, the hand saw must be held differently. Using a two-handed overhand grip allows the saw to cut very aggressively, but also allows you to see where the saw is in relation to the work.

CROSSCUTTING ON A SAW BENCH. Here we do everything opposite of the rip cut. Kneel on the wood on your bench with your opposite knee and your saw hand side leg you stand on. We still step forward with that leg until the knee is touching the saw bench. This prevents the board from sliding toward you as you saw and binding the saw. It also positions your shoulders and body in the right alignment to again allow the arm to pass by without deviating from that magical straight line.

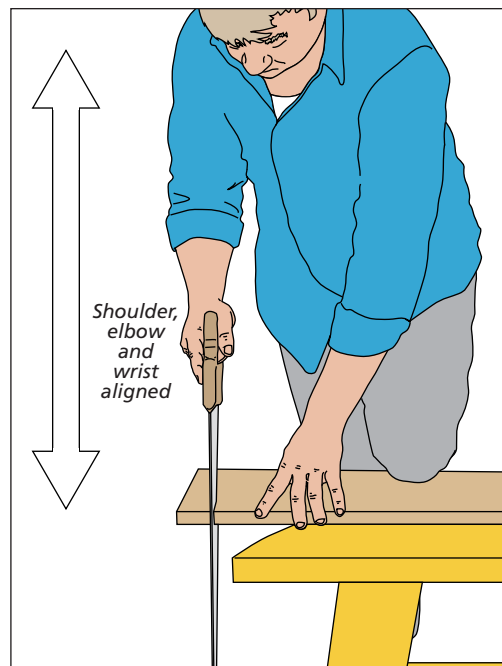
The other knee is the most common issue I see. The step forward feels like you are losing leverage and stepping back feels better, but I guarantee it will throw your cut out of plumb and possibly off your layout line on the face of the board. That step back will also lower the saw and make it cut slower whereas the knee up against the bench raises the saw to about 45° which is the optimal angle for crosscut teeth.

AT THE BENCH. Ripping and crosscutting at your workbench is done the same way. I secure the board to the top of the bench

with a holdfast because now I can't rely on my own weight to hold the board in place. Place your sawing side hip right up against the bench and do your best to line up the kerf with the edge of the bench only allowing an inch or so of clearance. You start the cut with the traditional grip used at the saw bench but it will feel a bit awkward and you will have to drop the handle. Fortunately it is easier to start a cut and follow a line like this.

Once the cut is started, stand the saw up vertically and grasp the handle overhand with both hands. You can step back with both feet a few inches and very easily be able to see that your saw is standing plumb. From this position you have an aggressive sawing angle and a clear view of the saw in relation to your workpiece. Now your body is totally out of the way and you can let the saw do its thing. In many ways, this is the easier way to saw accurately.

The drawback is it is tiring because you are holding the saw out in front of you and you lose all leverage. You have



Crosscut. Crosscutting can be accomplished by holding the work with your off knee, and keeping the saw aligned with your shoulder.

to lift the saw up higher making your arms work and taking your back muscles completely out of the equation. It's accurate, but not sustainable for long periods of sawing.



For a video on hand sawing techniques, go to:

Woodsmith.com/253



▲ At the bench, stepping back moves the torso out of the way, drops your center of gravity, and brings all of the wiggly parts into line creating a perfect line from saw to shoulder.

▲ Stepping too close to the bench with shoulders squared up naturally will push your sawing elbow outward and disrupt the perfect line from saw to shoulder.

BACK SAW TECHNIQUES

This work is done at the workbench either using a vise to hold the wood or up against the fence of a bench hook. Now we are still trying to make that straight line from saw plate to shoulder.

Here, you want a wide stance with your sawing leg back. Use your non-sawing hand and pinch your thumb and forefinger

together along the line. Press the saw plate against those fingers (lower left photo). Notice as you pinch your fingers together or relax them they move the saw slightly left and right. This pinch can micro-adjust your saw right on your line while acting like a guide throughout the saw cut.

STARTING. Concentrate on the lower horn of the saw handle.

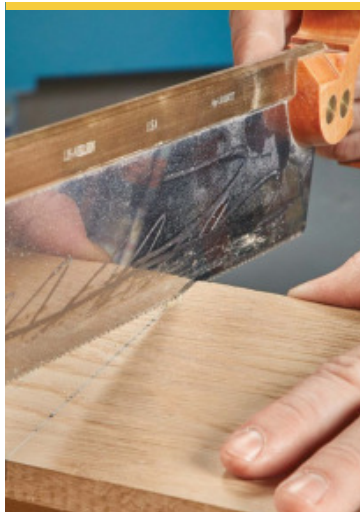
Pressure here takes weight off the toe of the saw and allows you to start the cut on a smooth push forward. None of those repeated back strokes that deform the wood and create problems for your saw tracking. Start on the push stroke. If the saw binds and sticks, press your palm into the lower horn more and relieve the weight from the saw toe. It's magic but with this idea, you can start even the coarsest pitched saw on a smooth push stroke.

Next resist the urge to run the saw's toothline parallel to the surface of the wood. This engages every tooth along the cut line making the work harder and increasing the chance the saw will skate out of the kerf. It also doesn't allow the sawdust to be removed from the kerf and the saw will essentially stop cutting.

Finally, focus on one line at a time. Joinery is not achieved just across the surface of the board but also through its thickness. A dovetail cut exactly on the angle line on the face of the board but out of square across the thickness



▲ Positioning the saw before making a cut is as easy as pinching your fingers together near your start point. By squeezing, you can fine-tune the position of the saw plate.



▲ Dropping the heel of the saw allows you to start the saw easier and steer the cut.



▲ A cut, such as sawing a tenon can be broken into three steps. First, saw down one line to define one edge of the tenon.



▲ Next, lift the heel of the saw and make the cut across the end grain, making sure to keep the saw along the line.



▲ Finally, create the tenon by continuing to saw down the far edge. The saw will naturally ride in the kerf made in step 1.

will not fit together. Likewise with tenons. It won't work if you track the line across the end of the board but deviate along the edge creating a loose tenon cheek. To combat this focus on one line at a time, as you see above.

DOVETAIL CUTS. For a tails-first dovetail, I start the cut with a smooth forward stroke across the end of the board. My goal is to create a shallow kerf on my line on the end grain. With that established now I drop the handle and focus on the angled line on the face of the board. The kerf on the edge guides the

saw keeping it square while my focus on the face steers down the dovetail. This is true many times over on longer tenons. Just saw one line at a time, multi-tasking is a myth unless your initials are IBM, so don't even try to track two lines at once.

PARTING TIPS

In conclusion let me say that you have to be able to see the line to saw to it. If you position your body in a way that won't let you see the line, change it. Sawing is not set in motion with the initial seconds of a cut and you should

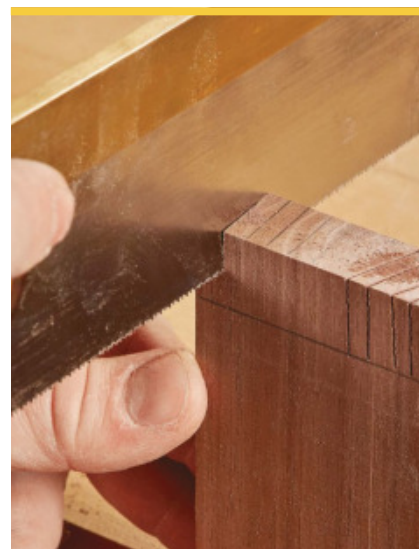
always be micro-adjusting and steering the cut. You have to see the line to steer to it. Angles mean nothing to a hand saw. There is no bevel limit on a hand saw and no cut depth limit. So get it out of your head that dovetails are hard because of that angle. After all a 90° cut is still an angle.

Finally, wax is your friend. Keep a block of paraffin wax around and keep doodling smiley faces on your saw plate with it. That wax keeps the saw running smoothly with less effort.

This barely scrapes the surface of the things you need to know



▲ Marking lines across a workpiece and cutting them off is great crosscut practice.



▲ Practice dovetail cuts by marking several angled pin marks on a board and saw down each line, one after another.

to saw well, but it puts you on the path to learn that stuff. If a cut is going wrong, stop and check the line from the saw to your shoulder. Keeping that foundation in place you will learn all the other stuff just by keeping at it. Practicing with your saws will lead to huge rewards. The two photos to the left are good practice exercises and I bet 10-20 minutes of focused sawing will net you huge rewards. In fact, sometimes I warm up this way before I start on a project. Give it a shot and you will quickly realize how saws are the true MVPs in your shop. **W**

A Fresh Angle on Tilted Tenons



▲ Two types of angled tenons are easily solved by making a simple wedge to guide the workpiece.

One of the best aspects of woodworking is noodling out a process to accomplish a task. In my experience though, I then look for a different approach that offers a simpler way of getting the same result. The obstacle this time was cutting angled tenons. A couple of recent projects illustrate this.

ROCKING CHAIR. First up is a rocking chair. The design calls for the seat to be wider at the front and narrower at the back. This means the side rails angle from front to back. So I needed a way to cut an angled tenon on each end to fit the front and back legs, as shown in the photo at left.

My usual approach to straight and square tenons is to use a dado blade in the

table saw and guiding the workpiece with a miter gauge. I use the rip fence as an end stop to get consistent tenon lengths.

I tried modifying this method in order to cut the tenons for the rocking chair. It can work, but you end up with quite a few setups where errors can creep in. Doing a little research in some books and online led me to a shockingly straightforward solution — a wedge.

WEDGE SECRET. The gist is that you make a wedge that matches the angle of the tenon. Then you use it to position the workpiece in relation to the saw blade. One of the main advantages is that the one wedge serves as a reference for all the cuts, so it guarantees consistency.

Another advantage is that the saw blade remains fixed at 90°.

MAKING THE WEDGE. For wedges, I like using pine construction lumber. It cuts easily, and I can refine the shape with hand tools with little effort.

Lay out the slope of the angle you need along a face. Cut close to that line at the band saw (though a jigsaw works, too). I use a hand plane to trim the wedge down to the layout line. Just be sure to keep the edge square to the face.

I want to make a point here about accuracy. In very few instances do you need to hit the angle dead on. If you end up a fraction of a degree off, don't sweat it. Since the wedge is your reference, all the joints are going to be consistent and things will turn out just fine.

CUTTING THE TENON. It's time to put the wedge to work. For this, I'm using a tenon jig that rides along the rip fence, as in the main photo on the previous page. (Find the plans for the jig at www.WoodsmithPlans.com.) Secure the wedge to the jig and high enough to remain clear of the dado blade.

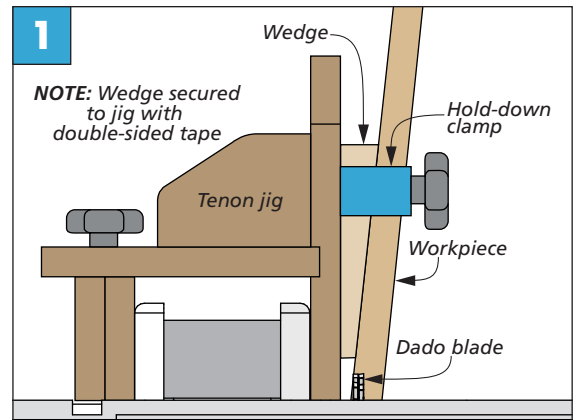
Figure 1 at right shows the setup for the first cut. Side note: It doesn't matter which tenon cheek you start with. Install a dado blade to form the cheek in a single pass. It's always a good idea to make test cuts on a scrap piece to dial in the settings.

To cut the opposite cheek, all that's necessary is to reposition the fence (Figure 2). To form the top and bottom shoulders of the tenon, I've found a hand saw works just as well as making another setup on the saw.

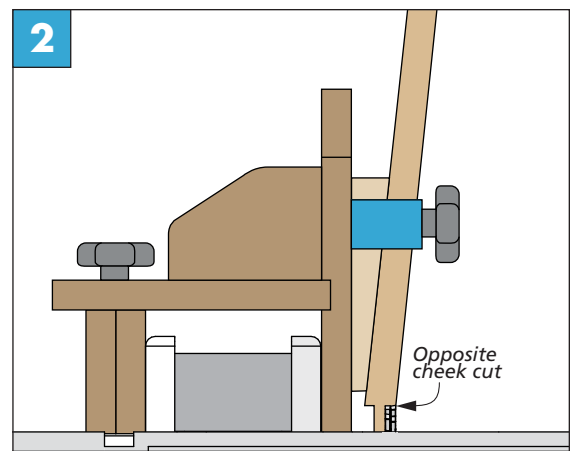
GARDEN BENCH. The other project (and another type of angled tenon) is a garden bench. Here the legs angle out, so the tenons on the stretcher that connects them must be angled as well (left photo on the previous page).

The drawings below show how a wedge works here. The wedge fits between the workpiece and the miter gauge (which stays at 90°). To cut the opposing cheek, all you need to do is flip the wedge around.

Angled tenons don't come up often. However, knowing a simple solution for accurate results means you can approach the project with confidence. **W**

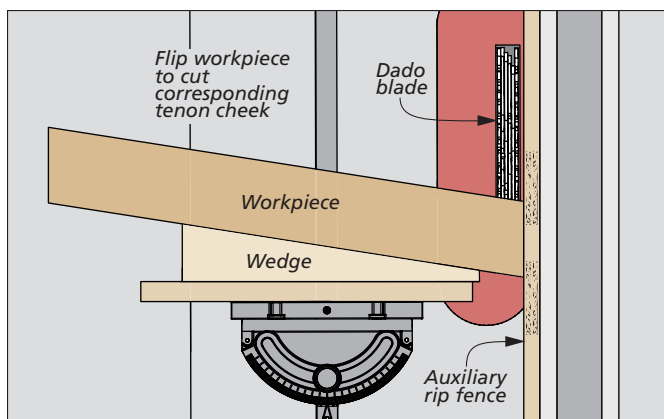


Tenon Jig. Slip the wedge between the tenon jig and the workpiece to tilt the part in relation to the blade. Make a cut on one face of the tenon.

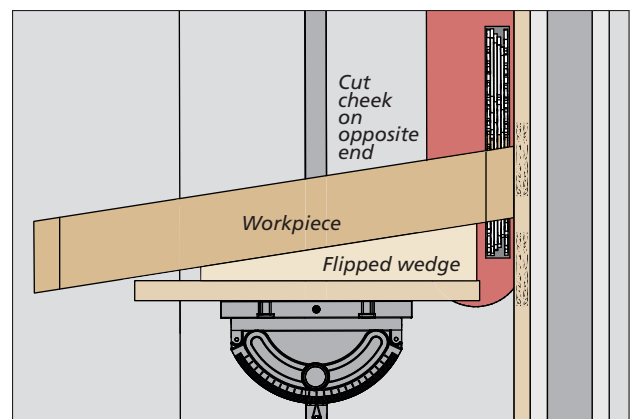


Opposite Face. To cut the opposite tenon cheek, all you need to do is reposition the rip fence. Make small adjustments until the tenon fits the mortise.

TENONS ON THE ENDS OF ANGLED PARTS



One Face. Align the wedge to match the angle at the end of the workpiece. Use the rip fence as an end stop to control the length of the tenon. Repeat on the opposite end of the piece.

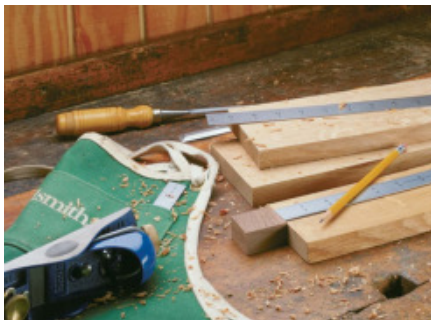


Then the Other. To cut the other face, flip the wedge end for end. Leave the rip fence set to the tenon length. Then complete the tenons at both ends.

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Sources

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

COFFEE ACCESSORIES (p.20)

- **Greens Steel**
Kid's Tumbler 10oz. 10oz
The grooves on the coffee accessories were painted with *General Finishes' "Basil"* milk paint before applying a couple of coats of lacquer.

PUB SIGNS (p.26)

- **Woodcraft**
2/35 Gouge 05C04
28/6 Back Bent Gouge . . . 05R07
12a/3 V-Parting Tool 05I02
7/30 Gouge 05E08
7/20 Gouge 05W91
9/10 Gouge 05G07
8/13 Gouge 05F05
3/8 V-Parting Tool 05R01
3/10 Gouge 05E33

This is a basic list of woodcarving tools that were used on the sign. Paint selections are listed in the article on page 33.

CHAIR (p.35)

- **Marsidian**
10oz dyed canvas . . . Kale Green
- **Wild West Hardware**
3/4" Clavos Nail CLR-750
The chair was stained with *Varathane's "Gunstock."* It was then sprayed with two coats of satin lacquer.

DESK & SHELF (p.42)

- **Rockler**
Organizer Drawer 68264
- **Cabinet Parts**
Plastic Laminate French Blue . .
NMR3003T-T-H5

The desk and shelf were finished with a couple of coats of spray lacquer prior to applying the plastic laminate.

MORTISING MACHINE (p.48)

- **McMaster-Carr**
Bronze Bushings 2868T19
Shafts 6061K345
3/8" Threaded Rod 94210A178
Push Button Nuts . . . 98150A750
Handle Grips 97065K44
Insert Knobs 5993K31
Studded Knobs 5993K59
Steel Tubing 7767T39
- **Cabinet Parts**
Plastic Laminate Maritime Gray
NS6027T-V3-4X8
The mortising machine was painted with *Benjamin Moore's Regal* in "New Hope Gray."



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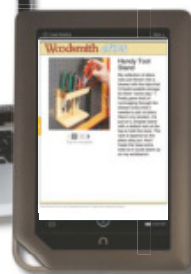


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