Popular Woodworking

FEBRUARY 2024 | #276

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Pat Carroll Shows How it's Done

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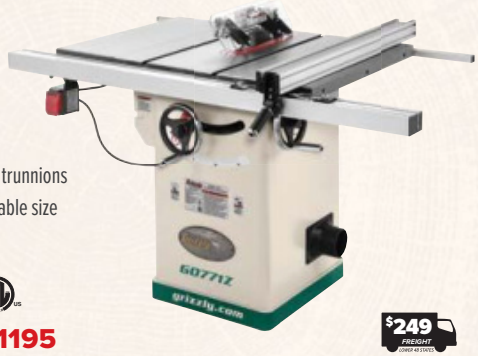

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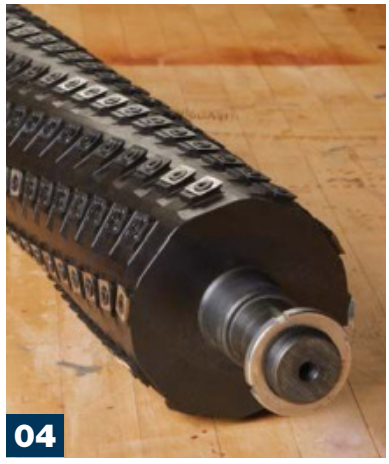

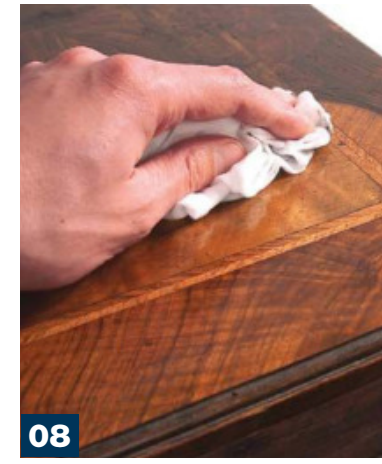

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Craft

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FROM THE EDITOR

Whole Lotta Cutter

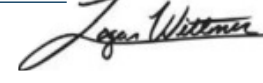
By Logan Wittmer

Who knew that in today's day and age, a piece of mail could send me over the moon. Well, that's what happened in early October when the invoice for the cutter head for my Towsley jointer arrived. I think my kids heard my shouts of joy from down the driveway. (My excitement was quickly quenched by realizing the time had come to write the check.)

After paying the invoice, I got a notification that my shipment was on the way—two items with a combined weight of 250 lbs. One crate contained the original cutter head (which is damaged), and the other was the new head. When they arrived, I was like a 9 year old on Christmas morning.

I'll tell you—this is a thing of beauty. Not only that, but it's also the next step in restoring this jointer. I have been waiting on the new cutter head before having bearing blocks cast, which will be done through the *University of Northern Iowa's Metal Casting Center*. The bearing blocks are due to be cast early in the new year, then it's back to picking up this project. By the amount of emails I received asking when the next part of that project was going to publish, I assume there are a few people that are looking forward to it like I am. Onward. Forward. Cheers.

That's 240 cutters on that bad-boy. I hope that by the time they need rotated, I can pay one of my kids a below-minimum wage fee to sit there with a screwdriver doing it.



ABOUT THE AUTHORS

PAT CARROLL: ***Routed Box*** *– pg. 26*

Pat Carroll is a turner from Ireland. In recent years, Pat has become one of the most in-demand demonstrators in woodturning, having been a keynote demonstrator at the national AAW symposium, as well as several state symposiums. His no-nonsense approach to turning combined with his artistic eye make his work something to behold. Pat runs monthly remote demonstrations and interviews with woodturners from across the world at PatCarrollWoodturning.com.

WILLIE SANDRY: ***Eastwood Chair*** *– pg. 36*

Living in the Pacific Northwest, Willie Sandry is a longtime fan of Arts & Crafts furniture. He enjoys taking inspiration for his projects from antique furniture exhibitions as well as "old barn finds." Never one to do a job partway, Willie has developed a vast skill set to elevate his projects. From sawing lumber and kiln drying it to finishing a chair with top-notch upholstery, Willie sees a project through from the start until finish. YouTube: *The Thoughtful Woodworker.*

DOUG STOWE: ***Wall-Hung Basswood Cabinet*** *– pg. 46*

Doug Stowe started his career in woodworking in 1976. Since then, he's published thirteen books on woodworking, and teaches at various venues across the United States, including the Marc Adams School of Woodworking. Doug has often been referred to as the Master of Boxes, but his work expands far beyond these little beauties he makes. Doug resides in Eureka Springs, Arkansas with his wife Jean and golden-doodle Rosie.

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PHOTOS PROVIDED BY LOGAN WITTMER

NEW TOOLS

BARR SCORP
Barr Tools
BarrTools.com
Price: $170

Barr Tools Chair Scorp

Barr Tools out of Boise, Idaho has a reputation for making high-quality, hand forged tools. I first heard of *Barr Tools* when I saw a video from David Barron, showing his Barr Quarton-forged Cabinet Maker's Chisels. Now, Barr's not made the cabinet maker's chisel for awhile (though, I keep asking every time I email them), but the quality of the tools that *Barr* makes has not wavered. I have a large framing chisel from *Barr*, so I knew what I was getting when I ordered a scorp for an upcoming chair project.

The scorp, as seen above, was a literal razor blade when it arrived. This scorp is designed based on a Mike Dunbar style, and is a 4" diameter. This plays well with the Allan Williams travisher I showed in the last issue. If you've never seen a travisher in use, it's a sight to behold. The travisher is the scrub plane of the chair building world—it quickly removes material and can leave as rough or polished a surface as you'd like. Small cuts off this Barr scorp leave a beautifully textured surface, ready for refinement or finishing.

As with all *Barr* tools, this scorp is hand-forged. This means that there is occasionally a wait for the tools, but trust me, it's worth it. Buying a hand-forged tool from a craftsman that's at the top of their game is something that everyone owes themselves at least once in their lifetime. —*Logan Wittmer*

Ridgid 18V Brushless Cordless Compact Router

Rigid has been on a bit of a tear recently updating and expanding their cordless tool lineup. That streak seems poised to continue with the release of the new 18V Brushless Cordless Compact Router.

The router features a 1/4" collet and seven different speed settings, with a no-load speed of 15,000–30,000 rpm. *Rigid* claims the new R860444 is 50% more powerful than its predecessor, with a 40% reduction in vibration and up to 250 ft. per charge using a 2.0 Ah MAX Output Battery (not included).

I tend to compare new tools I review to any competitors I might have in my shop currently. It's a great way to remember features I've loved in the past and measure benchmarks. The R860444 not only equaled or beat those from a performance perspective, it completely outmatched them from an ergonomic and use standpoint.

The router has a great viewing window for the bit and the easiest dust collection hood you've ever seen (just snap it on, tighten a single butterfly screw, and go). The adjustment dials are smartly-placed and straightforward to use, as is the base adjustment and removal. Vibration was minimal, and the electric brake stopped the motor on a dime—just a smart product start to finish. Whatever the secret sauce that *Ridgid* is cooking with in their design department, it's definitely working. —*Collin Knoff*

R860444 BRUSHLESS COMPACT ROUTER
Ridgid
Ridgid.com
Price: $179

PHOTOS BY THE AUTHORS

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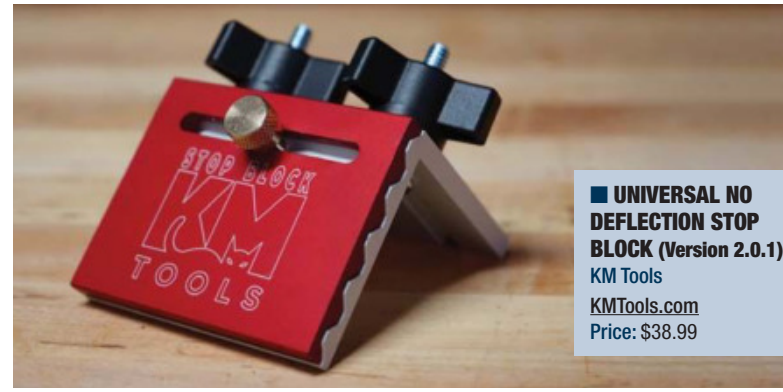
NEW TOOLS

Katz-Moses Tools No Deflection Stop Block



UNIVERSAL NO DEFLECTION STOP BLOCK (Version 2.0.1)
KM Tools
KMTools.com
Price: $38.99

The KISS (keep it simple stupid) principle was reportedly coined by Kelly Johnson, who was the lead engineer at Lockheed Skunk Works back in the 1960s. And while the similarities between the SR-71 and the *Katz-Moses* Universal No Deflection Stop Block are few, there's a certain mindset that exists in the thought process behind the design. The SR-71 put aside superfluous weaponry to be as fast as possible to evade intercepts, while the KM stop block put aside superfluous toggles and trick storage to be absolutely rock solid with zero deflection.

That little bit of magic is all thanks to the two wingnuts on the top, mounted to a pair of t-bolts. Move your stop block into place, apply a reasonable amount of torque to the wingnuts, and it stays put. Loosen the wingnuts and it moves again. Does twisting two wingnuts take ever so slightly longer than flipping a toggle? Probably, but the lack of moving parts means there's nothing to flex when you apply pressure. It's just that easy.

The simple design doesn't compromise functionality though. The stop block can be mounted horizontally or vertically and can be adjusted from 2.25–3.75" tall with positive stops every 1/2". There's a micro-adjust feature that allows you to sneak up on the exact cut you're aiming for, up to 1" from the original mounting point. When not in use, the KM stop block can be mounted to the back of your fence or stored in a drawer. —*Collin Knoff*

Blue Spruce's New Saw Line

BLUE SPRUCE SAWS
Blue Spruce
BlueSpruceToolworks.com
Price: $109-$329

A couple of years back, I introduced our readers to Jared Greene, a saw maker from South Carolina. In the time since, Jared's talents have been recognized by the folks at *Blue Spruce Toolworks*, and during Handworks 2023, they released their new line of handsaws that Jared Greene is heading.

The saws are available in Western-style back saws, as well as gents saws (lower saw, in the image to the right). A couple of lengths are available in each style, as well as tooth patterns (rip and crosscut—carcass vs. dovetail designation). But, the thing that makes these really stand out is that absolutely no expense is spared in the quality of the material or craftsmanship. The steel is imported Swedish spring steel that holds an edge as good as any saw I've used. The tooth-line is precision-ground with CBN wheels, so that it's geometrically perfect. This means a smooth finish straight off the saw. Finally, as with all *Blue Spruce Tools*, the handles are resin-infused. Not only does that make them extremely tough, but it also adds a great weight to the saw that counterbalances the tool. The first four saw designs that *Blue Spruce* has released have been met with praise, and I look forward to seeing what the future holds for this tool line. —*Logan Wittmer*

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NEW TOOLS

David Jeske Joinery Saw

If you've been around hand tools for any amount of time, David Jeske is probably familiar to you. Dave is the founder of *Blue Spruce Toolworks*, and has continued to design tools for them for a few years after stepping away from the business. When I got an email from Dave this past summer about testing out a new saw of his, I jumped at it. The Joinery Saw (shown here) is Dave's newest design through his brand, *David Jeske Designer Maker*. And let me tell you, it hits all the right notes.

The saw, sharing a similar framework with the *Blue Spruce* Coping/Fret Saw, uses a pull-saw style blade, but is set up to cut on the push stroke. This ultra-fine tooth blade is designed for precise, lighter-weight joinery work (think of drawers, cabinets and small boxes—not a massive dovetailed case). The perfect combination of weight, design, and tooth style makes this saw a sheer joy to use. It tracks like a laser—I can't imagine cutting dovetails with light-saber, but this has to be as close as you can get. It cuts very quickly, with minimal effort.

Unlike other joinery or dovetail saws, this saw is not designed to be sharpened. Instead, you can buy inexpensive replacement blades. The blade tension is set via a nut on the front of the saw, similar to a hacksaw blade tensioner. The saw is available with maple or walnut handles (at the Handworks show I was able to snag a limited quantity apple handle for mine, above). —*Logan Wittmer*

JOINERY SAW
David Jeske Designer Maker
DavidJeske.com
Price: $235

Milwaukee Cordless Full-sized Router

Over the last decade, the tool industry has made leaps and bounds when it comes to battery powered tools. Look at a battery pack from ten or fifteen years ago to today... It's mind boggling how far they've come. I figured it was only a matter of time before tool companies started to release full-sized routers that could do everything a corded version could do. With that said, the new MikwaukeeM18 kit comes with both a fixed and plunge base. Being able to flip back and forth between the two bases is a huge benefit—the kit even comes with an edge guide you can add to either base.

One of my favorite features of the M18 router is the fact that the fixed base has a rubber grip around the barrel and a loop for your hand. You still want to use both hands, but it gives you much more control using one hand on the barrel, and one on a knob. The M18 router is available with or without a battery, which is good if you already own *Milwaukee* items. One thing I would point out, however, is that the router, swinging a large bit, will eat through a small battery fairly quickly. If you choose to buy the battery kit, it will come with a 6.0 Ah battery, which is a pretty large one. It's handled all of the routing I do at any one time in my shop. The biggest issue I've found with the router is explaining to my wife why another *Milwaukee* box showed up.—*Bob Reynolds*

M18 FUEL ROUTER
Milwaukee
Milwaukee.com
Price: $349+

PHOTOS BY THE AUTHORS

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WORKSHOP TIPS

Revive a Dull Finish

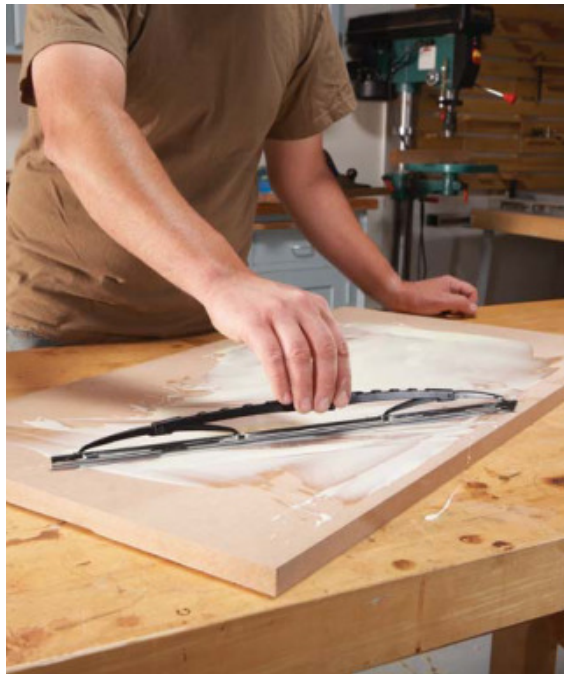
PHOTO BY VERN JOHNSON

All finishes dull as they age, but you can usually bring back their shine. The easiest way is to apply paste wax. If the dulling has progressed too far, however, you must rub the finish with fine abrasives or apply another coat or two of finish.

To rub a finish, choose an abrasive that produces the sheen you want. You can use a powder, such as rotten-stone or pumice, steel wool or a commercial rubbing compound. Rotten-stone produces a glossy finish; pumice and #0000 steel wool produce a satin finish. Use mineral oil or mineral spirits as a lubricant with rotten-stone, pumice, or steel wool. Commercial rubbing compounds don't require an additional lubricant. If you must recoat the finish, be sure the surface is clean. Wash it with mineral spirits to remove grease and wax. Wash it with soap and water to remove sticky dirt. Then apply the finish you originally used, or apply oil, shellac, water-based finish, or any type of varnish, including polyurethane. Lacquer is risky to apply because lacquer thinner may cause the old finish to blister. – *Bob Flexner*

Auto Salvage Glue Spreader

To spread glue rapidly and uniformly over a large area, use an old windshield wiper. You'll find a lifetime supply at any auto salvage yard. – *Arthur Elson*



Make a Gauge Block

Setting up a stacking dado head can be fussy and time consuming. You'll significantly reduce the guesswork of matching your plywood to the right size dado by making a dado gauge block.

To make the block, cut a $^{23}/_{32}$" wide dado in a board big enough to allow for six dadoes and space between. Add a single 0.005" shim to the $^{23}/_{32}$" set up and plow a second dado next to the $^{23}/_{32}$" one. Continue adding shims and making dadoes in 0.005" increments until you get to a $^{3}/_{4}$" dado. Mark the dadoes as you go.

To use, slip your plywood into the test dadoes until you find the perfect fit. Then, read the number of the shims needed.

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Tech Room

It's All About the Bit

By Danielle Lowery

The magic of CNCs lies in the bits... bits determine whether the final result is just okay, or if it's perfect!

CNCs are simply routers controlled by a computer. The electronics tell the router the exact tool path to take, how deep to cut, the speed of the spindle, etc. On the other hand, the bit determines the type of cut that can be made, the quality of the surface left over, the type of material that can be machined, how the chips are removed, and much more. Knowing the differences in CNC router bits will help you achieve the best results possible at your CNC.

How Router Bits Cut

Before we get started discussing CNC bits, it's important to understand how router bits cut. Unlike a drill bit that has a cutting tip and flutes that draw the chips up and away from the cutting edge, router bits are designed to cut laterally. The tip will cut, like a drill, but the fluting (whether straight cutters or spiral) will have the edges sharp and at the correct angle to cut. If you've ever tried to "wallow out" a hole with a drill bit, you'll know that the drill bit flutes simply don't cut. You can see this action in the drawing to the right.

Router Bit Anatomy

Just like any other tool in the shop, there are features of router bits that you need to understand in order to pick the right one for you project. Choosing the right bit will influence how a CNC will behave and its cutting possibilities. Some of these features include type or shape of the bit, the number of flutes, the bit material, and shank diameter. We'll talk about the majority of these features in the charts on the next few pages, but first we need to talk about two details that may separate bits from those you may already have and use in your hand-held router.

QUALITY IS KING:

I know that we're all guilty of buying "budget bits" from the big-box stores. And that's okay in some instances. However, with a CNC bit, quality is king. A lower quality bit is going to dull much faster, be prone to breaking, and leave a rougher surface. With a hand-held router, you get the tactile feedback of a bit getting dull, or how hard you can push it. With a CNC, you can hear how the bit is cutting and see the surface left, but a bit may reach the breaking point long before you realize it's on its last leg.

SHANK DIAMETER:

Before selecting a bit, you must know what size collet your CNC uses. Making sure you have a properly sized shank will reduce the likely hood of collet wear and bits breaking prematurely. The collet size on your CNC may be different than your handheld router. If you have a dedicated CNC spindle, it may use an ER collet which can accept a large variety of bits with different inserts. The most common ER collets are ER-16 and ER-20, which will grip between $1/32"-3/8"$ and $1/16"-1/2"$ respectively. Your hand-held router is probably limited to $1/4"$ and $1/2"$ shanks. If your CNC uses a router motor as the spindle, you'll probably be limited to one of those two sizes.

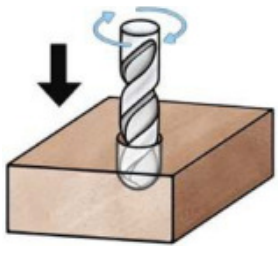
Using Bit Features to Select the Best Bit

So, we've identified that the bits you use in your router may or may not work for your CNC. Now, we can really start to identify what style of bit your project will require.

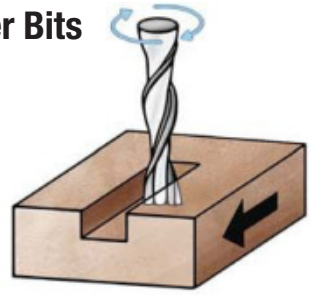
ASK YOURSELF 3 QUESTIONS:

1. What kind of shapes do want? Are you cutting simple 2D shapes like patterns, or are you doing relief carving, such as carving a sign?
2. What kind of material will you be cutting?
3. What are your goals in terms of performance and surface finish?

Drill Bits vs. CNC Router Bits



DRILL BITS:
The cutting end of the drill bit means once they start boring a hole, they will continue on that path.



CNC/ROUTER BITS:
These bits have a cutting tip as well as an edge so that they can move laterally through the material, making use of the entire cutting length, not just the tip.

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ILLUSTRATIONS BY DANIELLE LOWERY

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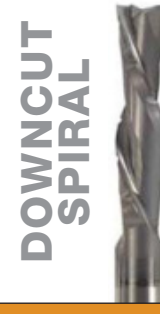
	GENERAL PURPOSE BITS	COMMON SIZES: 30°, 60°, 90°	ROUNDED TIPS	BEST FOR ROUGHING & SURFACING
PROS	• Best for slotting and straight contours • More material on the bit, therefore stronger than a spiral bit • Removes material quickly	• Great for chamfering, deburring edges, letter engraving, and fine details • The smaller the bit angle the finer details that it can carve	• Excel at creating curvature or detail rich 3D shapes	• Creates shallow, wide cuts across large area • Great for spoil board resurfacing • Little to no vibration
CONS	• Straight flutes leaves a rougher edge • Can have more vibration, more tearout and heat build up (causing burns, tear out and lower accuracy)	• Can dull quickly • The detail tip of these bits is not great for large waste removal and doesn't leave a flat bottom.	• Not for removing large amounts of material • Due to the round tip, this bit is not for creating flat surfaces	• Leaves a surface that can have chatter marks, depending on the depth of cut

STRAIGHT VS. SPIRAL

Spiral bits generally cut faster than the equivalent straight bits. How? The curved flutes of spiral bits create a shearing cut that more efficiently removes the material, with a much cleaner cut.



	SPIRAL BITS:	GOOD FOR DEEP SLOTS	GREAT FOR CUTTING THIN MATERIAL	BEST FOR PLYWOOD, LAMINATE, & COMPOSITES
PROS	• Clean cuts when cutting with the grain • Can cut with higher feed speed and lower RPMs = less friction and heat	• Upcut flutes act like drill flutes pulling chips out of the cut • Keep the path clear of chips • Provides a chip free bottom	• Downcut bits push the chips down into the cut • Chips can help to support thinner material as the cut is completed	• Combo or Compression bits combine a downcut bit with a tip of an upcut • The top is pushed down while the bottom is pulled up
CONS	• Cutting against the grain can be a rough cut • Spiral bits can chip plywood	• Can chip the veneered edge of plywood • Creates a fuzzy top edge	• Creates a fuzzy bottom • Chips can easily get packed into the cut (Solution: run cut again to loosen chips then vacuum out)	• Not good at boring holes Why? Once the bit goes beyond the direction change, chips get compressed with no room to escape causing friction and excessive heat.

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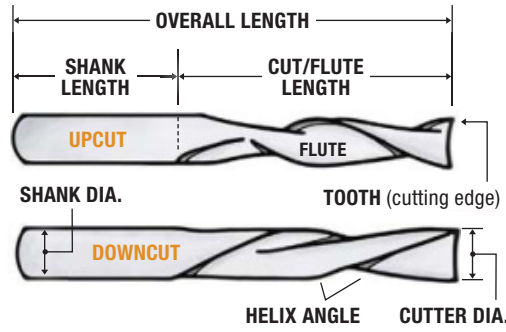
Router Bit Anatomy

Type/shape	Flat tip
No. of flutes	2
Material	Solid carbide
Shank dia.	6 mm
Cutter dia.	6 mm
Overall length	50 mm
Cut/flute length	22 mm
Helix angle	45°



EXAMPLE: Small Serving Tray

I want to machine a pocket and a contour on oak. If I'm making a batch of 10, I want to optimize the machining time. What bit do I need?

This is a 2 step, 2 bit project. First I want to hollow out the pocket for the tray. Then I want to refine that pocket so it has a contoured bottom edge.

The first bit I'll need is one that cuts a flat bottom and will remove a lot of material. If the inside pocket is large and round, a large bit won't effect the final shape. In this case, I'll use a **flat-end, straight flute bit with an 8mm cut diameter**. It will leave the surface a little rough, but the surface will be refined with my second bit.

Next, I want to add a contour to the pocket and refine the surface. For this bit, I need one that is able to handle the dense oak, so a carbide bit would be ideal. I also need to keep it at a higher feed rate since I am using a hardwood (to reduce burning). I can use this to my advantage though. With a higher feed rate, I can increase the number of flutes and still achieve a smooth surface. Next, I need to consider the required cutting depth. With a shallow pocket, I can use a short cutting length which allows chips to evacuate more easily, decreasing the possibility of heat build up. The short length also reduces the odds of tool deflection. Finally, I can consider a higher helix angle to give the surface the best possible resolution allowing me to spend very little time hand finishing. Therefore I will want a **carbide-tipped, 30mm long, 3-fluted, 45° helix, down-cut spiral bit.**

Starter Bit Set

In conclusion, here's a list of recommended CNC router bits to get you started.

- 1/4" Compression bit for cutting out pieces on hard and soft woods (especially plywood)
- 1/8" Down-cut spiral bit for crisp edges on a pocket
- 1/4" Up-cut spiral bit for basic pocket and profile cuts
- 1/2" Straight flute bit for quick profile work
- 60°, 90° V-bit for engraving and fine details
- 2 1/2" Spoil Board Bit bit for flattening spoilboard or wasteboard

Just remember, CNCs may rely on a computer for its precision, but the magic truly lies in the bit selection. **PW** - *Danielle Lowery*

Bit Material:

HSS (High-Speed Steel)

PRO: Comparatively cheaper than carbide
CON: Prone to wear, dull faster
Best for: Softwoods (pine and cedar)

Carbide-Tipped

PRO: Steel body with a carbide cutting area; reduces overall cost of bit and improves life
CON: Difficult to sharpen once dull
Best for: Hardwoods (maple and oak)

SC (Solid Carbide)

PRO: Harder, more rigid, and has a high degree of wear-resistance
CON: Most expensive material; more prone to breaking due to the hardness
Best for: MDF and plywood

Cutting Diameter:

Increasing diameter has two benefits:

1. 2x diameter = 16x rigidity
2. Increase MRR (material removal rate) or the material removed in a given period

No. of Flutes:

Increase # of flutes = smoother finish
Decrease # of flutes = clears chips faster

TIP: When you increase the number of flutes, you must increase the feed rate (speed the bit travels) and decrease the rotational speed (how fast the bit rotates) in order to keep a constant chip load rate.

Cut/Flute Length:

This length of the bit, along with the cutter diameter is what determines how deep of a cut can be made.

TIP: As with a handheld router, make deep cuts in multiple passes. Cutting too deep or using a longer tool than necessary can lead to bit deflection or breaking. As per the cutting diameter box above, the larger the diameter, the stiffer the bit is and can make a deeper cut.

Helix Angle:

Lower the **angle** = stronger the cutter but creates a rougher surface (what's why 0°- 30° bits are general purpose bits)

Higher the **angle** = weaker the cutter, but creates a better surface

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Woodworking Technique

Cut Tenons on Curved Parts

By Willie Sandry

Demystify cutting tenons on curved parts using these simple steps and jigs.

PHOTOS BY THE AUTHOR

Ever wonder how furniture builders cut joinery on curved parts? A common place to see this is on chair backrests, especially large rocking chairs or Morris Chairs with adjustable backrests. The most common technique is to start with thick 8/4 stock and form the tenons before cutting the curved shape. This usually involves cutting offset tenons on the thick stock so the resulting tenon is reasonably centered after cutting the part to the final size. As long as thick stock is available, you can make nicely curved backrest parts this way.

When recently examining an Eastwood chair at an antique shop, I realized the backrest rails were deeply curved. This particular chair would require 12/4 stock to make the curved rails in the typical way, so I searched for alternative methods. I've done quite a bit of experimenting with steam bending and glued laminations and find the latter more reliable to bend. While the amount of "springback" when releasing steam-bent parts is highly variable, glued laminations are quite predictable. In fact, the slats for the Eastwood chair had a total of 1/4" springback when releasing them from the bending form. Whether you laminate or steam bend the parts, there's an interesting challenge when it comes time to cut the tenons or joinery on the ends. Because there's no longer a flat reference surface, joinery on curved parts would be very difficult without the right jig.

I wanted a jig that was simple to construct and could handle both concave and convex parts. Sometimes, jigs for curved parts are ridiculously complicated to build and require multiple curved parts to exactly match the profile of the workpiece. On projects in the past, I've spent almost as much time building jigs as I did making the actual project. So, the emphasis was simplicity with this curved parts tenoning jig. The bonus with this jig is that it'll trim your parts to the final length, as well as the tenon cheeks.

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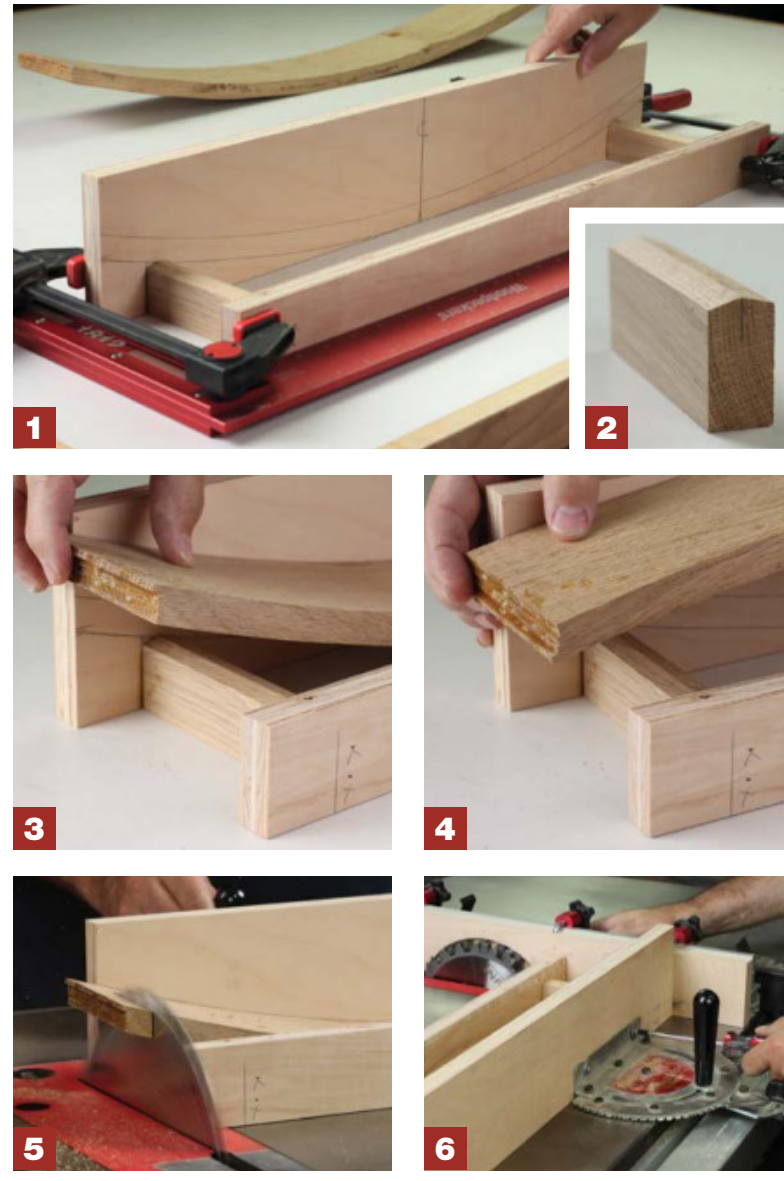
Let's Get This Jig Started

Start with a 4" wide strip of 3/4" plywood, cut to the same length as your overall workpiece, which is 26" in this case. This will form the main rear fence of the jig, and you'll also need a strip of plywood for the front fence, which is 2" tall.

The whole key to accommodating convex and concave parts is a double-bevel cut on hardwood strips that connect the two fences. Using a scrap that's above 10-12" long by about 2" wide, tip your table saw blade to 15°, and bevel one edge. Then, flip the board over and cut another bevel so they form a peak at the center. Draw location marks 1 1/2" in from either end of the plywood fences. With the concave face upwards, the curved part should rest on the table saw and be fully supported by the beveled blocks. Position the curved rail in the jig and trace the curved shape onto the rear fence for reference. This will indicate the required height of the beveled strips, which in this case is 1 1/2". Rip the beveled board to this width before cutting two pieces 4 3/4" long for the jig. Glue and brad nail the strips between the front and rear fence, making sure the assembly is square as it goes together.

With a single kerf blade on the table saw, attach the jig to a sturdy miter gauge with a pair of screws. Align the end of the jig with the blade for this step. Aligning parts in the jig is always based on center marks, so you'll want to clearly mark the center of the jig, as well as the center of the curved parts. If you're using glued laminations, I recommend making the center of your bending jig and strips of wood as you glue them up. That way, you can avoid the challenges of measuring and marking curved workpieces. Then, simply hold the part to be cut in the jig, concave side up. With the center marks aligned, push the jig past the blade to trim one end of the rail. Then



1 Construct the simple jig, consisting of a taller rear fence and shorter front fence, connected by beveled strips of hardwood.

2 The double-bevel strip is the key to accommodating both concave and convex shaped parts.

3 With the concave side up, the inner bevel supports the ends of the curved rail.

4 Flip the rail over and the outer bevel supports the workpiece just as well. Align the parts to the jig using centerlines.

5 Place the curved rail in the jig with center marks aligned and trim the part to length. Flip the workpiece around and trim the other end as well.

6 Install a dado blade on the tablesaw and set the fence for a 5/8" long tenon. Re-mount the jig to the miter gauge so it contacts the sacrificial board on your rip fence.

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flip the workpiece 180° (still concave side up) and trim the other end to length. Complete this step on all parts required for your project before moving on to the next step. Luckily, there are only three curved rails for the Eastwood chair, so they're pretty easy to take care of.

Next, you can trim 5/8" width off each end of the front fence at the bandsaw. This step is optional but avoids the dado blade chewing through the front fence in the next step. Mount a 3/4" wide dado blade and sacrificial fence. Set the rip fence for a 5/8" long tenon and remount the jig to the miter jig. This time, set the edge of the rear fence all the way against the sacrificial fence. Now you're all set to make both the front and rear tenon cheeks with this setup.

Rear Cheek Cuts First

Start with rear cheek cuts, made with the curved rail positioned concave-side up. Butt the end of the rail against the sacrificial fence and make a pass to establish the rear cheek. The blade height for the Eastwood chair is approximately 2 1/8" for this step. Confirm that you have a 1/4" deep shoulder on the rear of the curved rail, and complete this step on all parts for your project. Then, simply flip the part over in the jig and lower the dado blade for a skimming cut. Raise the blade incrementally until the tenon fits in a 5/16" mortise. A word of caution here: the front shoulder is only about 1/16" deep, so sneak up on your cut for a nice fit. Once the blade height is correct, batch out the rest of your parts in the same way. The tendency with the new woodworkers is to make joints "sledgehammer tight," but you'll want to resist the urge here. The joints should slop together without much fuss and shouldn't be overly tight. Remember—you'll be clamping against thin, curved

7 Place the curved rail concave side up in the jig and make the rear cheek cut. The blade height is approximately 2 1/8" for this step.

8 The goal is to create a 1/4" deep shoulder on the back of the curved rail. Once the blade height is correct, complete this step on all parts.

9 Flip the workpiece over in the jig and secure it with a clamp. Lower the blade for an approximately 1/16" deep shoulder on the front of the curved rail.

10 Raise the blade incrementally until you're left with a 5/16" thick tenon that fits the mortise.

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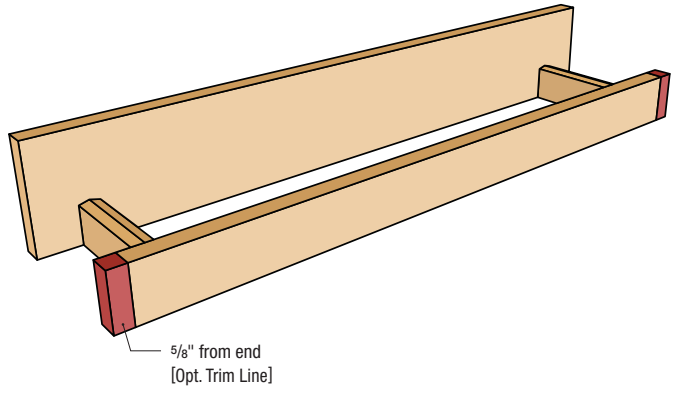
Curved Parts Tenoning Jig



1. Start with a blank. The size should be 3/4" thick x 2" wide x 12" long.

2. Assemble the jig. Assemble the parts with glue, brad nails or screws. Locate beveled strips 1 1/2" in from each end.

3. Trim front fence. (Optional) Trim the waste from the front fence after assembly (making both fences the same length is helpful when squaring the jig).

4. Attach miter gage and workpiece. Attach the jig to the miter gauge with screws. Then secure workpiece with a clamp whenever possible, especially when the convex side faces up.

Cutlist

No.	Items	Dimensions (in) T	W	L	Material
1	A Rear fence	3/4	4	26	Plywood
1	B Front fence	3/4	2	26	Plywood
2	C Beveled strips	3/4	1 1/2	4 3/4	Hardwood

parts to assemble the backrest. I've seen original Gustav Stickley Morris Chairs with 1/2" thick backrest rails, however, that's a common source of failure with antique furniture. For reproductions, I make them a minimum of 5/8" thick.

Tenon Shoulders

Complete the shoulder of the tenons just takes a moment with a dovetail saw. After all, you already have the cheeks established, so it's just a matter of "connecting the dots," as it were. You can fine-tune the tenon fit with a shoulder plane as needed. I was pleasantly surprised with a good consistent fit right off the saw. This jig, like many in my shop, is an experiment for a specific cutting operation. I've never seen anything quite like it, but perhaps you've come up with something similar to solve a specific challenge in your shop.

PW – *Willie Sandry*

11 Complete the shoulder cuts required for your project with a handsaw. With the cheeks already established, this is a quick and easy step.

12 Test fit the completed tenon in a scrap board with 5/16" wide mortise. Arm for an easy fit, as clamping curved parts has it own set of challenges.

PROJECT #2401
Skill Level: **Advanced**
Time: **1 Day**
Cost: **$35**

Bringing a router to the lathe is a great way to add a unique look to your turning projects.

By Pat Carroll

PHOTOS BY LOGAN WITTMER

A Routed Box

In woodturning, boxes are really great projects to hone any woodturners skills. Shape and designs are infinite. Loose top lids, pop fitting lids, and even threaded lids can make these pieces tactile, functional, artistic, and really fun projects. Also, large machines are not necessary. A small mini lathe can produce beautiful intricate pieces. For this project I wanted to go a step further by using a router on the surface. I then finished with the addition of colour to add another element of interest to the piece.

Preparation

The first step with any project is to ensure all safety equipment is working correctly and is safe to use. The machinery is in perfect working order and all manufacturer's safety guidelines are followed. We are all responsible for our own safety! Therefore with a bit of preparation and common sense, a project can be completed to give job satisfaction and keep the creator injury free.

Tools and Materials

In woodturning, blunt tools are far more dangerous than sharp tools. With that said a sharp tool used incorrectly or carelessly can cause harm to the user. Materials should be checked for cracks and defects. If you are unsure if the wood to be used is not good enough, well then it probably is not.

Let's Get Started

For this project, the timber I selected was maple. It was free from defects and had reasonably straight grain. These factors are very helpful when routing wood! Once I marked the ends, the piece was secured between centres. The grain orientation is parallel to the bed ways, or it could be classed as long grain turning or spindle turning.

I began by bringing the piece to a cylinder. To do so, I used a 1" bowl gouge which has an angle of approximately 45° at a speed of approximately 800 RPM. As the tool rest was wider than the wood, I was able to traverse across the complete surface taking light cuts to reduce the corners and work towards a cylinder shape.

Next, size your tenon to the chuck jaw size. This is important as it will ensure maximum gripping power. In this case, I planned to use 2" dovetail chuck jaws. To create the necessary tenon size, I worked in small increment s with my 1/4" parting tool. Lastly, with a small skew, I created the dovetail on the tenon to compliment the chuck jaws. Before continuing, I used a metal rule to check the size. Calipers can also be used. Some woodturners are skillful and confident enough to do this with the piece running. If you are unsure, be sure to stop the lathe to check.

Establish Proportions

Once the tenons are established, I turned my attention to the ratio of the lid to the base. The first thing I needed to check is which end will be the top. Grain patterns or distinguishing marks you may want to be shown in certain ways on a piece. I like to secure the lid in the chuck first. The next thing was to factor the tenons into the design. Do I use them or turn them away afterwards? Not taking this into consideration can have adverse effects on the design. For this box, I had decided that the tenons would be removed. Now determine the ratio you would like to use. The ratio I like to use on this type of box is two thirds for the base and one third for the top. Be sure to also factor in the material you will use for your tenon and the waste wood when parting off. Again this can impact greatly on your design!

After factoring in all of this information, I established the tenon and then softened the corner of it to allow it to have an easier start when fitting on the lid. Now add a witness mark, a mark on the lid which is the exact same size as the

1 Hold your blank between centers for a secure grip.

2 Create the tenon for the chuck jaw size you intend to use. Then double check the size before continuing.

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tenon. This is a very handy trick when making a piece which involves joining two pieces of wood with a recess and tenon. The piece is then parted off almost completely. Lastly, I used a small saw to completely part the two pieces.

Hollow the Lid

I used a 3/8" spindle gouge with a 45° angle to remove the bulk of the waste from the lid. I started with the tool at a reasonable level, the tip on the centre, and flute open approximately 45° or in the 10 o-clock position. I worked from the centre out in small increments. I then used a 3/4" skew which had rolled edges to refine the wall of the lid to get a nice tight fit from the base. This fit will be addressed later. The same skew acting like a negative rake scraper was used to clean up the underside of the lid. Now it's time to move the focus to the exterior of our box.

Turn Focus to Exterior

Once the fit was established, my focus turned to shaping the exterior. I left the top third relatively straight and gave the lower proportion a gentle curve in towards the bottom. This simple shape lends itself well to this kind of box.

With the shape of the box established, it's time for the routed surface. For the routing, I used a homemade routing jig fitted with a 3/8" v-cutter. Guide timbers fitted to the jig allowed the cutter to cut at a depth of 1/8" at a time. Cutting too deep can cause a lot of tear-out. The direction of the cut is also very important. In this case, the router was used working from right to left. The direction of the cutter going to the other way can cause the router to lift, which can be dangerous to the user and may damage the piece. Another safety point is to unplug the lathe. Our first instinct when working at a lathe is to turn it on. Unplugging the lathe keep us from doing just that. Also, don't forget to wear full respiratory, eye, and ear protection while cutting.


3


4


5

3 Establish the box to lid ratio.

4 Parting off the tenon with a parting tool, and chamfering the end.

5 The witness mark on the underside of the lid is indicated by the pencil.


6

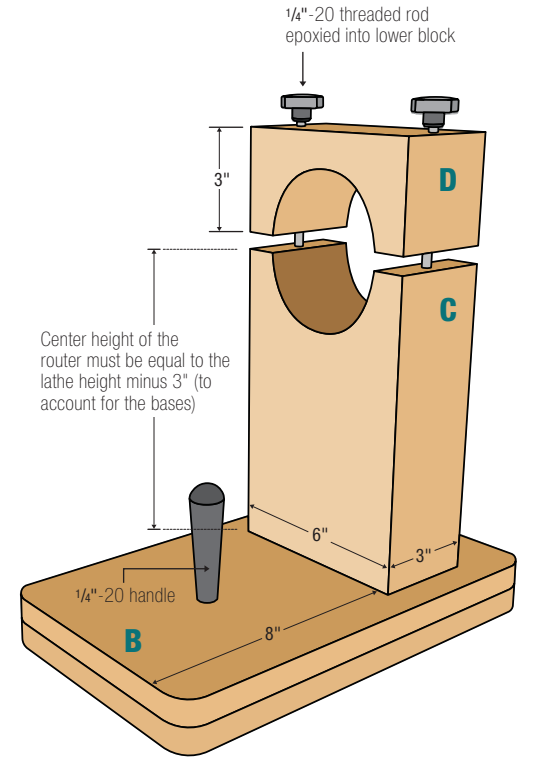

7

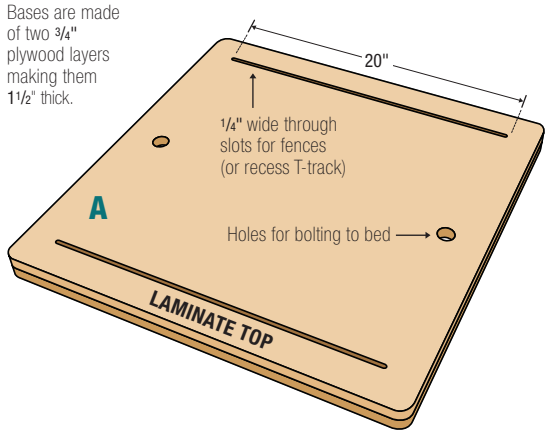
6 To remove the bulk of the waste from the lid, I worked from the centre out in small increments. As the grain orientation is end grain, this technique works really well to remove wood.

7 Refine the wall of the lid to get a nice tight fit on the base.

After three passes with the router, the cuts were complete. You cannot rush this part as the wood will tear and some of the crisp edges will be lost. There were 144 passes in total. Several light clean passes also minimize sanding. A piece of 180-grit sanding paper starts the sanding. Cloth back paper neatly creases to get into the v-cuts, but also be careful not to soften the edges. I continued sanding until I used 180, 240, 320, and 400-grit sandpaper on all routed surfaces.

Router Jig



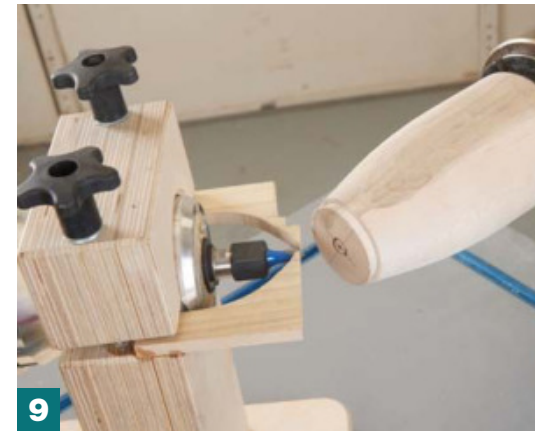


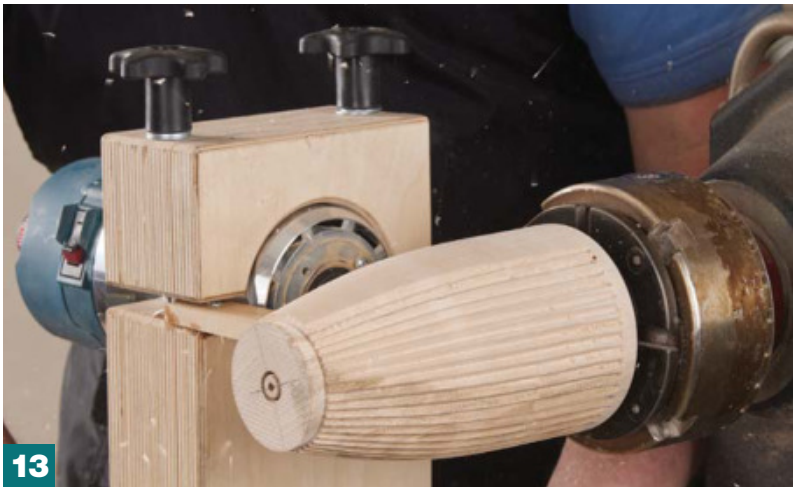
Cutlist

No.	Items	Dimensions (inches) T	W	L
2	**A** Plywood bases	¾	24	24
2	**B** Jig bases	¾	13	8
1	**C** Lower block	3	6	*see above*
1	**D** Upper block	3	6	3

8 Shape the box exterior with your choice of tool, not worrying about the finish due to the routing.

9-10 This shop-built jig holds the router bit exactly center. Disposable plywood guides are screwed to the jig, depending on the project.





11 Guide timber fitted to the jig allowed the cutter to cut at an even 1/8" depth.

12 Take into account safety factors before beginning. This includes noting the direction the cutter must go to prevent the router from lifting and unplugging the lathe so you don't accidentally turn it on.

13 Don't forgot to wear full respiratory, eye, and ear protection!

14 Complete the passes with the router, then sand using 180, 240, 320, and 400-grit sandpaper.

Further Refine the Lid

Before turning the focus to the surface of the top of the lid, further refinement needs to be done on the lid. Start by marking lines on the outside of the lid — one where the outside surface will finish, and another where the inside will finish. Hollow down until you've reached the inside depth of the lid. Finish up the inside corner to a crisp finish with a box scraper or parting tool. A few detail lines on the inside of the lid always add a little something when you open the box. Then, the inside of the lid can be sanded.

Back to the Exterior

Replace the lid back on the base and secure the base into the chuck. The tailstock was brought up for support and the top of the lid was refined using a 3/8" spindle gouge. At this point the box still has a good secure fit. With the router set at the centre, the guide was set in place to create the grooves on the top of the lid. The bit finishes at the centre with a 1/16" depth whereas the outside was set to match the depth of the side. The piece also had to be rotated in the chuck so as to align the tip of the router with the centre of the groove on the side. Rout the grooves in the same manner as the sides. This includes routing each groove three times and use of all four sandpaper grits.

Embellishing the Surface

While the piece was still joined with a tight fit, I painted the outside black with an ebonizing lacquer. This stopped paint from getting on the interior. Several light coats were applied until all the surfaces were adequately covered. Trying to paint a faceted surface with heavy coats would cause the paint to run. After all the routing and sanding, it's important to keep the details crisp.

Once the ebonizing lacquer was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16


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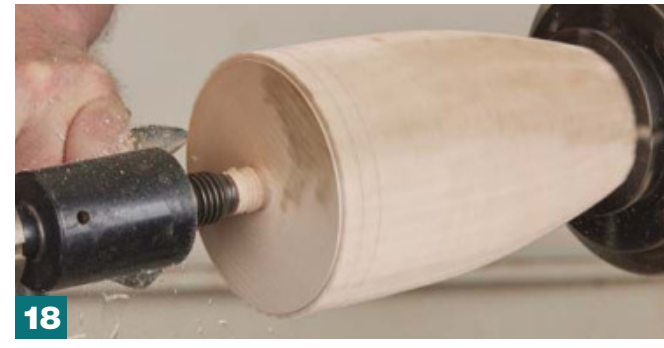
15 Finish hollowing to the final depth. As before, a bowl gouge from the center out quickly hollows the endgrain.

16 A sharp box scraper leaves a square wall with a clean inside corner.

17 A point tool adds detail lines to the inside of the lid.

18 Replace the lid to the base. Secure it into the chuck and rout the lid exterior.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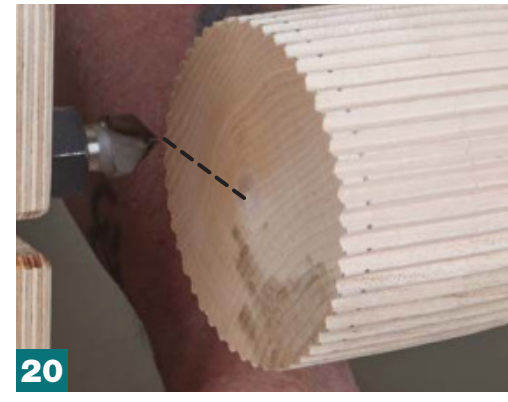
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21

19 Remove the guide timber from the jig and use a fence to guide the router jig base.

20 Be sure to rotate the lid in the chuck so as to align the tip of the router with the centre of the groove on the side.

21 Once the lid is complete, sand the top in the same manner as the sides.

dry, I applied multiple layers of different coloured gilt cream. Gilt cream is often used to restore gilding on picture frames. However, in the woodturning community they are often used more like a grain filler providing a surface embellishment to turned pieces. I used Jimmy Clewe's *Metalic Cream Filler* which can be purchased at WoodWorldTX.com. If desired, one could use just one filler to create a solid one-colour look... however applying multiple colours to the same piece would give a truly unique look! Sparingly applying the cream with a soft brush allowed the colours to build up. I kept applying the creams until I had a patina that I liked. Don't be afraid to experiment with paint on your various woodturnings!

Finalizing the Base

Next the lid was removed to finalize the base. A hole was drilled to the depth required and a piece of tape wrapped around the drill bit acted like a depth stop.

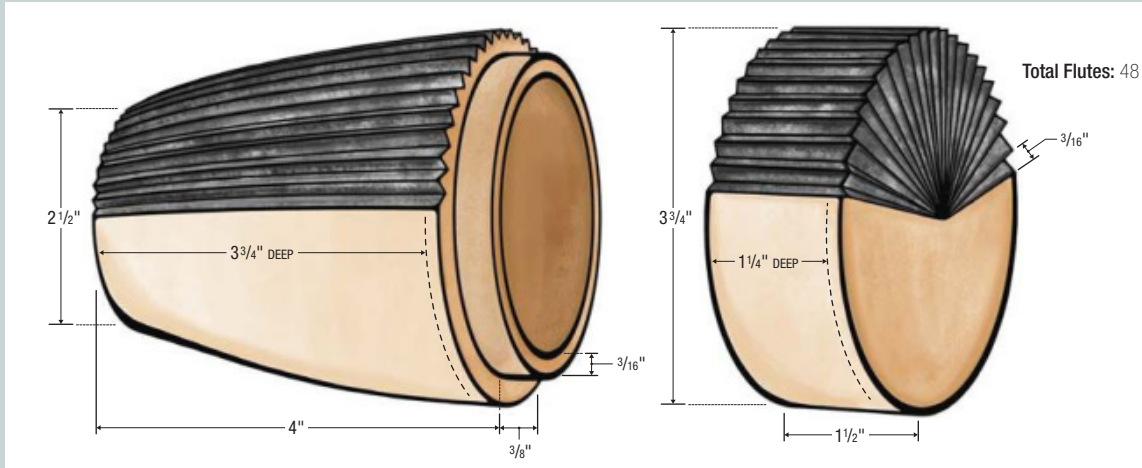
To hollow out the base, I used a mega mate tool. As this was the end grain, hollowing from the centre out was far more efficient. I am always aiming for the best finish possible from the tool. Once the inside was hollowed, I sanded it with the same four grits of

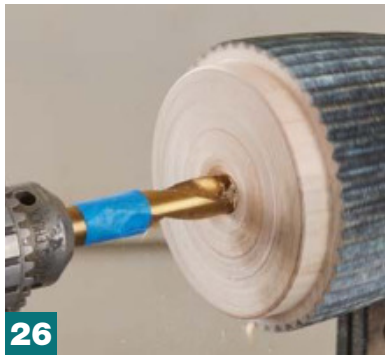
22 Spray several light coats of ebonizing lacquer until all surfaces are adequately covered.

23 The colours which were used for the box include the following colours of *Jimmy Clewe's Metallic Cream Filler:* (from left to right) Beta Chameleon, Alpha Chameleon, Aspen Green, Pearl Turquoise, and Pearl.

24-25 Once the lacquer is dry, apply multiple layers of different coloured gilt cream with a soft brush until you achieve the patina you like. The colors can be layered on top of each other, and after applying a variety of colors, you end up with a shimmering look that changes colors in different light.

A Routed Box





26 At the centre of the base interior, drill a hole to the depth required. The blue tape serves as a depth stop.

27 Hollow out the base interior using a mega mate tool being sure to work from the centre out.

28 Jam chuck the base, using the tailstock as support and remove the tenon.

sandpaper as the exterior. I also sanded the tenon to loosen the fit of the lid. As the piece would be finished with lacquer, I took this consideration with the loose fit I felt worked best on the box.

To finish the bottom, a scrap piece of wood was held in the chuck jaws. It was turned to fit the base onto it as a jam chuck. Sneak up on the fit and check the base's fit often. You want a gentle "pop" as you remove the piece from the jam chuck. Tail stock support was used to ensure safety and security of the piece. Light cuts with a 1/2" spindle gouge cleaned up the surface as much as possible. The base was made concave so it would sit evenly on a surface. Sanding was completed and the small centre piece was removed. The centre area was hand sanded off the lathe.

Apply the Final Finish

Several light coats of lacquer were applied to the interior and exposed wood on the base. The coloured area received two very light coats to help protect the surface. Note that it is important to apply spray in a dust-free, well-ventilated area. It is also important to wear respiratory protection to ensure your safety while using any finish which can cause harm.

Now find a place to display your unique box and enjoy showing it off to your guests. Don't forget to always experiment with surface textures and finishes. The same router jig can be used with a variety of bits for different effects. Experimenting with the router height and orientation can also effect the overall look! **PW** – *Pat Carroll*

PROJECT #2402
Skill Level: Intermediate
Time: 3 Days
Cost: $250

PHOTOS BY THE AUTHOR

Eastwood Chair

Bold oak and classic craftsman style make this arm chair a joy to build. When finished, it's sure to become your favorite seat in the house. **By Willie Sandry**

Popularized by the Stickley magazine, *The Craftsman*, the Arts & Crafts movement took hold and has been an American fixture ever since. Styles come and go, but Craftsman furniture is now a mainstay, and harmonizes surprisingly well with rustic, traditional, or modern furniture. This stout chair was designed and built for the earliest Gusatv Stickley catalog in 1901 and was an immediate success. Named for a neighborhood in Syracuse, New York, the Eastwood chair is truly a massive and imposing form. The only attempt to soften the look was a V-shaped cutout from the armrest supports and curved backrest slats. Clipped corners complete the scant details on the fully 1 1/4" thick armrests.

The chair received renewed interest in 1989 when L&JG Stickley, Inc. was commissioned to build a custom version for the Dalai Lama. Three of these extra-wide chairs were built, one of which resides at the Stickley Museum in Manilus, New York. In 2014, Stickley re-issued a limited edition of just 100 Dalai Lama chairs, based on the original Eastwood design, were snapped up by collectors.

The Eastwood chair appears to be a stocky cube-like form on first inspection. However, it's deceptively complex with angled joinery, through tenons, and deeply curved backrest rails. Luckily, I've come up with a simple jig to handle the most challenging aspect of this built—cutting tenons on the curved backrest rails. All great reasons to hone your woodworking skills—and your hand plane—to build this turn of the century classic. Perhaps *The Craftsman* magazine was hinting at the intricacies of chair building with the motto "The Lyf so Short, the Craft so Long to Lerne."

1 Leg in Front of the Other

I suppose the 2 3/4" square legs could be cut from 12/4 white oak. If you go that route, select rift sawn stock for consistent grain pattern on all four sides. I'll assume you don't have access to kiln dried lumber that thick and demonstrate two additional methods to create thick legs from thinner stock. The front legs are laminated from four strips with veneers glued over the joint lines. I call this the "Gus" methods because Gustav Stickley favored this approach for creating legs with quartersawn figure on all four sides. Later, L&JG Stickley pioneered the "quadrilinear post" and I'll demonstrate a modern version of that for the rear legs. Letting the joinery show is a central tenant of Craftsman furniture, so the exposed locking miter joints are a welcome sight.

Locking Miter Joint for Rear Legs

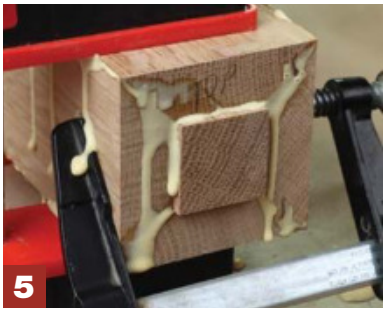
You need a special router bit to tackle the locking miter joint, but it's useful for many projects. The basic idea is to mill one board flat on the router table and the adjacent board held vertically against the fence. This creates a perfect joint with one bit and one setup. I've also come up with my own techniques to improve cut quality and avoid any tear-out or snipe. Luckily, anyone can incorporate these tips into their locking miter routine and all it takes is a few strips of 1/4" MDF. I recommend making all cuts in two passes with this router bit.

First set the proper bit height and fence position, according to your material thickness. Once a sample cut shows everything is set correctly, temporarily secure strips of 1/4" MDF to your router fence with double-sided woodworking tape. Make these the same sizes as your router table fence, as you'll be able to reuse these strips for multiple projects. Make the first pass on all work pieces with these spacer strips in

1 With spacer strips attached to the router fence, rout the first pass on the horizontal boards.

2 Next, rout the first pass on the vertical boards.

3 Remove the spacer strips from the fence and attach a 1/4" MDF strip to the workpiece to complete the second pass on all parts.



4 Assemble the rear legs with a solid core in the middle and glue the parts together.

5 Make the solid core about 0.005" undersized to allow room for glue and to ensure the locking miters seat fully.

place on the fence. This essentially removes less material and leads to a much cleaner cut with less strain on the router. An important note about planning for successful assembly: rout the same profile on both edges of each board. Then rout the opposite profile on both edges of the mating board. This way, the leg blank can be drawn together by clamping in primarily one direction.

Once the first pass is complete on each workpiece, remove the spacer strips from the router fence, and get ready to make the second pass. It's worth noting that the bit height and fence position are unchanged from the first pass. This second pass will form the typical "knife edge" we expect with a locking miter joint. To protect that delicate edge and support the workpiece as it passes over the router bit, add strips of 1/4" MDF (or plywood) with double-sided tape. I made just one strip to save material and transferred it from one workpiece to the next to cut the right components required. The strip is simply sized to match the length and width of your workpiece. This is a very important step and yields consistent cuts, while avoiding common problems like snipe as you push the board past the bit. Complete the second pass on all boards and dry assemble the rear legs to determine the size for a solid core to fill the central void. It should be about 1 1/4" square and is installed as the lock miter legs are assembled.

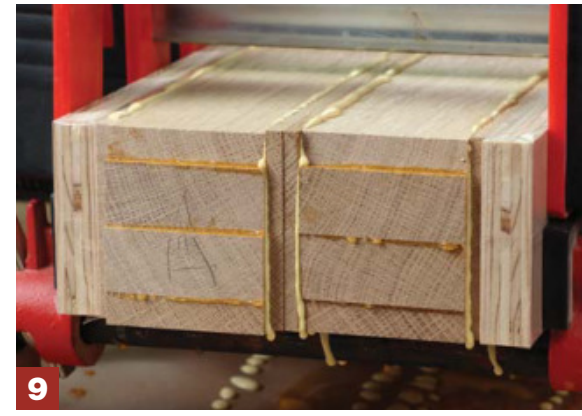
6 Resaw two strips of 7/8" thick stock to yield 1/2" and 1/4" thick parts.

7 Use a disposable paint roller to apply glue evenly to the 2 3/4" wide strips. Only one of the two mating surfaces needs glue when applied with this technique.

6-Way Laminated Front Legs

Luckily, the front legs are more straight forward to build. They're comprised of 6 strips of oak and built with a two-part assembly strategy. First, rip 2 3/4" wide strips at the table saw and glue four strips together. The middle two strips are 1" thick, while the

8 Each leg blank consists of two 1" thick strips, flanked with two 1/2" thick strips. After the glue cures, joint one edge flat and square and plane the blank to 2 1/2" wide x 3" thick for the next step.



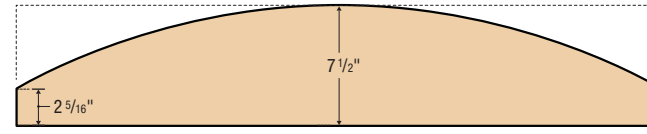
9 For phase two of the assembly, add two 1/4" thick skins to each leg blank. Glue together. 3/4" thick plywood strips are covered with packing tape and used as cauls to evenly distribute clamping pressure.

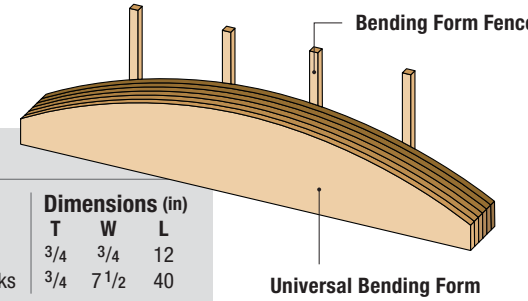
other strips are 1/2" thick. This way, only two boards will be visible in the through tenon that projects through the armrest of this chair. Once this initial assembly comes out of clamps, joint an edge clean and plane the leg blank to 2 1/2" wide x 3" thick. For the second stage, glue "skins" on two edges to hide the glue lines. Although the final thickness of these thin strips will be 1/8" or less, you'll get better results by starting with 1/4" thick strips. Once the glue cures, simply trim it away with a flush trimming router bit and plane the front legs to their final dimensions of 2 3/4" square.

Angled Backrest Mortises

Most of the mortises for the chair frame are pretty standard. They're all 1/2" wide and 1" deep—except for the mortises which receive the backrest rails. Those are 5/16" wide mortises, chopped to a depth of 5/8". This row of three mortises on each back leg are also at an angle to the face of the leg. This reclines the backrest somewhat, making this large armchair feel more like a Morris chair. My hollow chisel mortiser is the X-Y moving table variety, so I made an angled block to set the proper angle. Cut a chunk of wood 21" long and taper it from 1 1/2" thick at one end, feathered down to a wedge at the other. Use double-sided tape to secure the block to your mortiser fence. If the face clamp on your machine is adjustable, set it to fully contact the angled rear leg. If not, just use a pair of offsetting wedges to get good clamping pressure with the face clamp. If you have a benchtop mortiser, you can still make these cuts, but you might want to build a sled type jig. A simple pair of plywood scraps screwed together at a 90° angle should do the trick. This will allow you to move the wedge, leg, and jig all at once for these mortises to set along an angled line. Study the detail rendering for correct mortise sizes and location.

Chair Bending Form





Cutlist

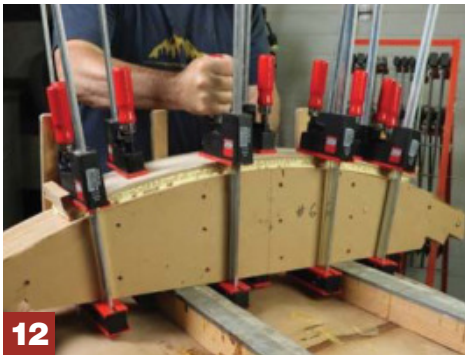
No.	Items	Dimensions (in) T	W	L
4	A Fences	3/4	3/4	12
6	B MDF Blanks	3/4	7 1/2	40

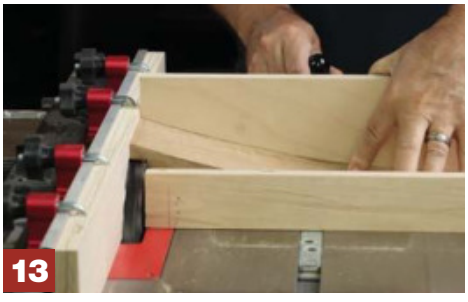
Curved Backrest Rails

If you've built many chairs, you're keenly aware of the three basic ways to make curved parts. You can cut the curve from a solid timber, use steam bending, or laminate the curve. Glued lamination was the technique selected due to the highly repeatable results.

Start by making a universal bending form from 6 layers of 3/4" MDF. Refer to the detail renderings for dimensions, and cut and fair one layer, then pattern rout the other layers to match and screw them together. It can be used for a multitude of projects including rocking chairs, curved, and backrest rails too. Resaw a 1" thick board to yield four strips for each curved rail. The strips need to finish at 5/32" thick to net a 5/8" backrest rail, and a drum sander works best for this step. If you don't have access to a drum sander, a planer can do the job—but leave the strips extra-long to account for the invariable snipe. Next, make a center mark on the strips as well as the form, which will be useful later for the joinery on the curved parts. Use a disposable paint roller to apply glue liberally to one side of each strip as they're assembled on the bending form. Add a flexible caul on top of the stack and clamp it down starting at the center. The caul is just a strip of 1/4" plywood with small wooden cleats on either end to help keep the outer clamps in place. Both the bending form and caul should be covered with packing tape to prevent glue from sticking. I've tested this technique with thin and thick strips, both with and without cauls. I've found 5/32" is the minimum thickness recommended (unless you have a vacuum press) and the flexible cauls make a night-and-day difference in the quality of the glue joint.

Once the curved parts have cured, clean up one edge at the jointer. Then head to the table saw and rip the backrest rails to final width. It's a surprisingly easy cut to make with the concave side up, so long as you clamp a feather board to the rip fence. Now decide how you want to cut the tenons on the curved parts. Some people will elect to cut these by hand, and that's fine, but I've come up with a slick little jig to accomplish this task at the table saw. The jig is quite simple to make, and lets you trim the curved parts to final length as well as make both cheek cuts. Learn more about this jig in the *Cut Joinery on Curved Parts* article on page 18.





10 Mortise the rear legs for the backrest slats using a wedge attached to the mortiser fence.

11 Glue 4 strips of wood over a universal bending form to make the backrest slats.

12 Add a 1/4" plywood caul and clamp the strips to the form.

13 A simple jig helps cut the curved parts to length as well as form tenons. For more on this interesting technique, see the **Cut Joinery on Curved Parts** article on page 18.

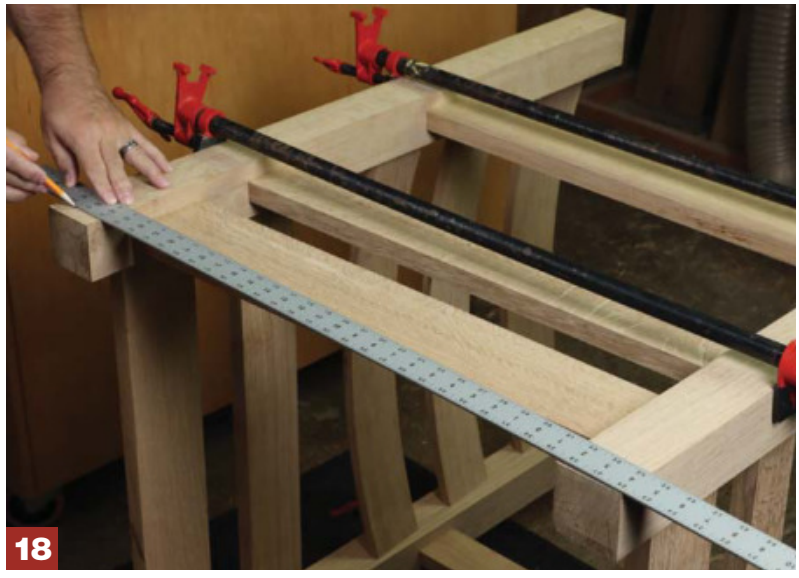
Angled Side Rails

Anytime you have angled joinery to contend with—which is common in chair building—a decision must be made. Should you angle the tenons or angle the mortises? In this case, the side rails are angled at a modest 1.7°, which makes them drop lower in the back of the chair. With such a small angle, I prefer to angle the tenons and use standard mortises. To that end, rip the rails to width and set a miter gauge to 1.7°. Using an auxiliary fence and stop block on the miter gauge, trim all four rails to final length. The rail blanks are about 27 3/8" long initially, before being trimmed. Ultimately, the shoulder-to-shoulder

14 Angle both ends of the side rails to 1.7°. Use a stop block to ensure a uniform length.

15 Cut angled tenons on side rails with a dado blade and miter gauge.

16 Trim the small shoulders at the bandsaw.



length needs to match the armrest support component (25 1/4"), which does not have angled joinery.

Once the ends of the side rails are angled, it's an easy matter to cut the tenon cheeks with a dado blade. With a miter gauge still set to 1.7°, butt the workpiece against the rip fence and establish the cheek cut on one side. This setup lets you cut half of the side rail tenons, before resetting the miter gauge 1.7° in the opposite direction, to complete the last four cheek cuts. Finally, trim the 1/4" shoulder at the bandsaw. At this point, you'll be anxious to do a test fitting and assemble the chair. Confirm that you have tight shoulders on the angled side rails, as well as the armrest support boards. If everything looks good, tip the chair on its side, and mark an angled cut line on the legs. Use a long straightedge to strike a line from your 3/4" mark at the back, down to the tip of the front leg. Extend the lines with a combination square and trim all four legs at the miter saw. For reference, these cuts are made at a 1.4° angle, but you can confidently follow your pencil line. The angled rails, angled backrest mortises, and overall posture of the chair work together for a comfortable reclined position.

Fitting Armrests

There's often a question of which to cut first—the mortise or the tenon. In this case, we'll go the traditional route and cut mortises first. I used a 1/2" hollow chisel at the mortiser, but there are lots of ways to knock it out. Then mill the 1 3/4" square tenon on the front

17 Clean up the tenons with a shoulder plane as needed.

18 Mark an angled cutline to remove 3/4" length from the back legs. The front legs are trimmed to this line as well.

legs, to a length of 1 1/2". If you have a fine-tooth dado blade, you can get clean results for the exposed joinery. Increase the blade height incrementally until the tenon just fits into the top of the mortise. At that point, stop cutting the tenon and make any required adjustments to the mortise wall. This is a key point to ensure crisp, accurate exposed joinery.

Then dry assemble the exposed joints to mark how far the tenon projects above the armrest and shape the tenon as desired. I formed a flattened pyramid shape to match the rear legs at the oscillating belt sander, but a block plane could do the same. Then clamp a scrap board alongside the legs, so it supports the armrest. Position the armrest so the mortise aligns with the tenon and mark the extent of the required notch. Remove the waste at the bandsaw and finish shaping the armrest, including the clipped corner.

Final Prep & Glue-Up

Test the final fit of the armrests, before knocking the chair apart for surface prep. Sand all the parts and ease corners as appropriate with a 1/8" radius roundover bit. Be sure to leave a crisp edge where parts intersect such as the top of the V-shaped armrest support rails. For comfort, a heavier 1/4" roundover is appropriate for the top of the armrests. Final assembly is a two-stage affair starting by gluing the two back legs together with five rails. At the same time, glue the two front legs together with the front seat rail and lower rail. Once these two sub-assemblies come out of clamps, connect them with the side rails and armrest support to complete the chair frame. If you have adequate room for clamps, go ahead and attach the armrests with glue. The armrests are also reinforced with a screw driven into the side of the back leg. Plug the screw holes and cross-peg the

19 Clean up the mortise walls with a file or chisels.

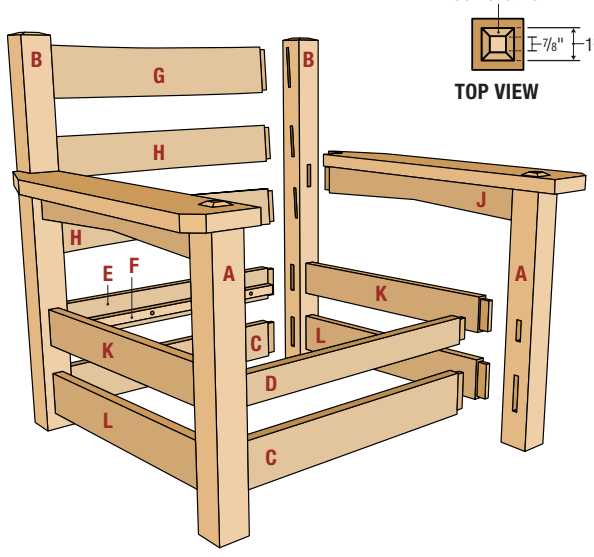
20 Cut square tenons on the front legs, raising the dado blade until the tenon fits the mortise you made earlier.

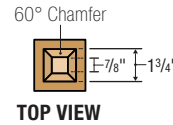
21 Mark the projection of the through tenon, which should be 1/4" and shape the tenon to a flattened pyramid.

22 Clamp a scrap board alongside the two legs to support the armrest and position the mortise directly across from the tenon.

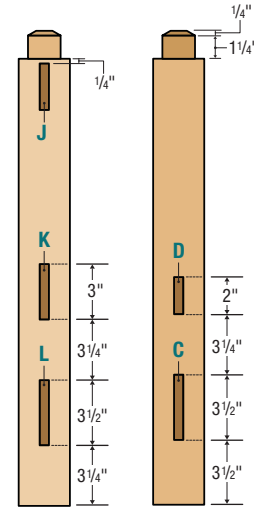
23 Mark the width of the notch at the back of the armrest, which should be about 3".

Eastwood Chair



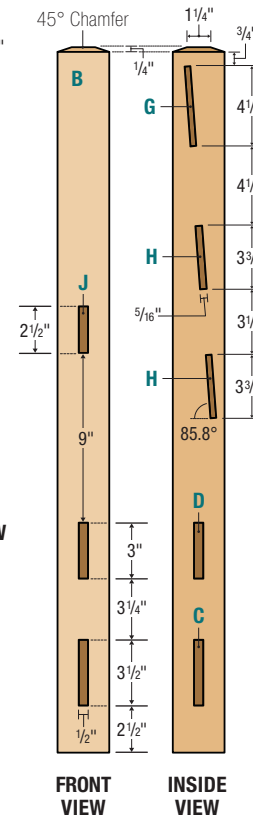


TOP VIEW



BACK VIEW INSIDE VIEW

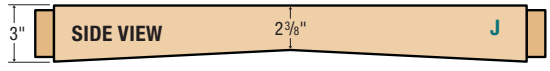
FRONT LEGS



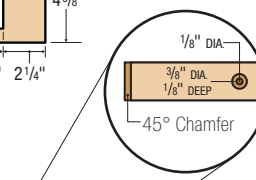
FRONT VIEW INSIDE VIEW

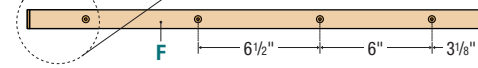
REAR LEGS

ARM BLANK
TOP VIEW

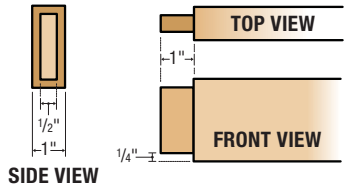


ARMREST RAIL



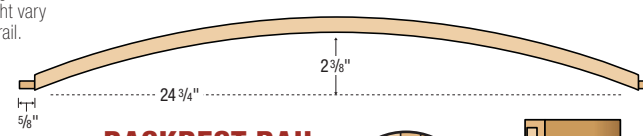


CUSHION RAIL
FRONT VIEW

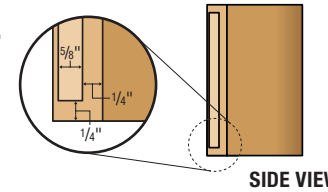


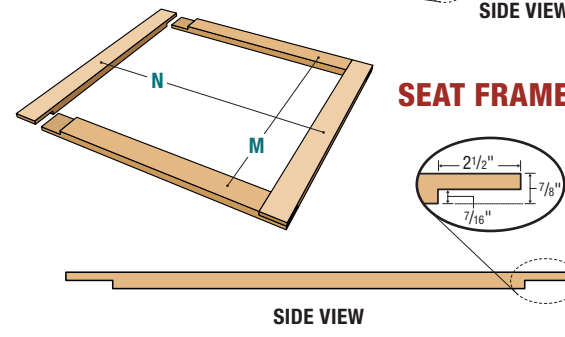
NOTE: Height and tenon height vary with each rail.

FRONT, BACK, & SIDE RAILS



BACKREST RAIL
TOP VIEW





SEAT FRAME

Cutlist

No.	Items	Dimensions (inches) T	W	L
2	A Front legs	2 3/4	2 3/4	25 1/2
2	B Rear legs	2 3/4	2 3/4	37 1/2
2	C Front/back large rails	1	4	26 3/4
1	D Front small rail	1	2 1/2	26 3/4
1	E Back small rail	1	3 1/2	26 3/4
2	F Cushion rails	1	1	24 3/4
4	G Backrest large rail Oak strips	5/32	4 3/4	28
12	H Backrest small rail Oak strips	5/32	3 7/8	28
2	I Armrest blanks	1 1/4	5 7/8	32
2	J Armrest rails	1	3	27 1/4
2	K Small side rails	1	3 1/2	27 17/64
2	L Large side rails	1	4	27 17/64
2	M Seat frame front/back rails	7/8	27	2 1/2
2	N Seat frame side rails	7/8	2 1/2	26 1/2


24


25

24 Glue the back legs together with 3 curved and 2 straight rails.

25 Bring the front and back sub-assemblies together with the side rails and armrest supports.

26 Cross-peg the through tenons and 1" long tenons on the chair frame.

27 Reinforce the armrest with a 2" long x 1/4" screw, capped with an oak plug.


26

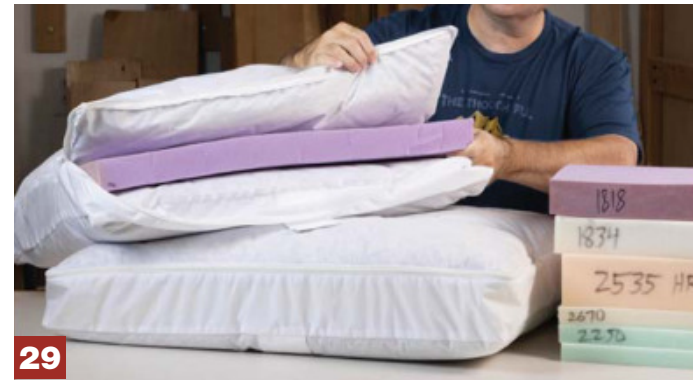

27

1" long tenons, before applying the finish. The finish in this case is a stain-over-dye approach with Dark Mission Brown *TransTint* dye applied to the raw wood and then sealed with a light coat of sprayed shellac. The dye is mixed at a concentration of 1 1/2 ounce per quart of solvent-based NGR thinner (a 50/50 mix of denatured alcohol and lacquer thinner, plus 5 tablespoons of lacquer retarder). Next, *General Finishes* Antique Walnut gel stain is used as a glaze and top-coated with two coats of precatalized lacquer.

Upholstery

The chair has loose cushions for both the seat and backrest. They're quite soft and forgiving thanks to the down envelope that surrounds the 3" thick "1834" medium density foam for the seat and 3" thick "1818" soft foam for the backrest. A half-lapped seat frame is built to fit the opening in the chair and traditional jute webbing is applied with a webbing stretcher. The webbing can actually be installed on either the top or bottom of the seat frame and I chose to install it on the underside. This leaves a cleaner, flatter surface for the leather upholstery trim that will cover the seat frame. However, it also leaves a void inside the frame that must be filled with dense foam, such as "rebond" foam (so named because it's made with multicolored scraps of foam), or something similar.

Down envelopes are custom ordered from upholstery supply houses like FoamOrder.com. If you don't want the expense and lead-time of down envelopes, you can wrap foam in two layers of high-loft batting for a similar effect. Generally, down envelopes give a softer, more rounded looking cushion compared to foam, which can look somewhat square and block-like. For best results, take dimensions for the cushion covers directly from the cushions. Fabric is an option, but I couldn't imagine the Eastwood chair in anything



28 Apply jute webbing to the bottom of the half-lapped seat frame with a webbing stretcher. Add a 1" layer of dense foam, before trimming the frame out in leather.

29 Foam-filled down envelopes are custom ordered and filled with high quality upholstery foam.

30 Next, staple piping to the front cushion panel with a plier-nose stapler.

31 Stapling leather parts together helps keep them from shifting as you sew the cushion covers together. Sew right off the bottom of the cover, before closing up the bottom corner notches. Find detailed videos of each process, from wrapping the seat frame in leather to stuffing down envelopes and sewing leather cushion covers on Willie's Youtube Channel, *The Thoughtful Woodworker.*

32 A top stitched zipper closes the cushion covers. Terminate the piping (AKA cording or welting) just above the bottom corner-notch seam.

but leather. Sew the faux-box style cushions up with 5/32" piping and #4.5 YKK nylon zippers. A faux box simply means it looks like a regular box cushion but has only one central seam. To manage excess slack at the corners, squares of leather are removed and sewn with a simple blind stitch. If you're going to work with leather, you'll need an industrial walking foot machine. Otherwise, hire a local upholsterer, and show them pictures of the desired cushions. I've seen many upholstery shops churn out well-built couch cushions that had no business on a Morris chair or craftsman style armchair.

Perhaps you can find a friend or local maker space with a walking foot. With a little practice, and the right resources, you'll be sewing faux-box cushions to be proud of. By the way, that fetching Eastwood Ottoman was featured in the December 2022 issue of *Popular Woodworking* (issue #268). You'll find helpful resources online for building and upholstering that project as well. **PW** – ***Willie Sandry***

PHOTOS BY LOGAN WITTMER

PROJECT #2403
Skill Level: Intermediate
Time: 2 days
Cost: $100

Simple construction and elegant design make this cabinet a welcome addition to any decor.

By Doug Stowe

Wall Hung Basswood Cabinet

Ever work much with dowels? Many artisans would shy away from the use of dowels having had experience with broken down old chairs where they were pushed by industry beyond their best use. In making small cabinets, however, I'm reminded of the work of James Krenov and his use of them in lighter applications than in making chairs. Chairs are regularly torqued in the wrong direction. Small cabinets rarely face such abuse.

On the other hand, dowels find a great use in this small basswood cabinet, attaching the top and bottom to the sides. Of course, you might use biscuits, dominoes, mortise and tenon joints, or even pocket screws in building this small cabinet and have great, lasting results. However, dowels are a cheap alternative, requiring only a drill, a doweling jig, and a drill press or other means of drilling vertically into a piece of wood. While I sized this cabinet to hold kitchen spices in their usual jar sizes, it can be easily modified for a variety of uses. You can add shelf support holes to make the shelves adjustable for a variety of objects or easily make it deeper by simply using wider stock.

Other features of this cabinet may be more noticeable than the means used to attach parts. For instance, it has a milk paint finish that's been carved through freehand with a simple "v" gouge adding a simple botanical accent to each door. The door pulls are turned in a shaker style. You can turn your own on the lathe as I did or find knobs of suitable style from a store or online. Less noticeable is how easy it is to hang or equally remove for cleaning or in the event it's to be moved or the room must receive fresh paint. The French cleat hanging system assures mounting is easy.

Let's Start Building

After milling the various parts to thickness and size, I start with my trusty model #59 doweling jig, a tool in my shop since the 1970's. I wore that out and never missed it, as a block of wood drilled through from one end to the other with a drill sized to fit the diameter of the dowel choice is better and more reliable in the first place. With the block of wood shortening the length of the drill, simply adjust the drill in the chuck so the necessary length will protrude through the jig.

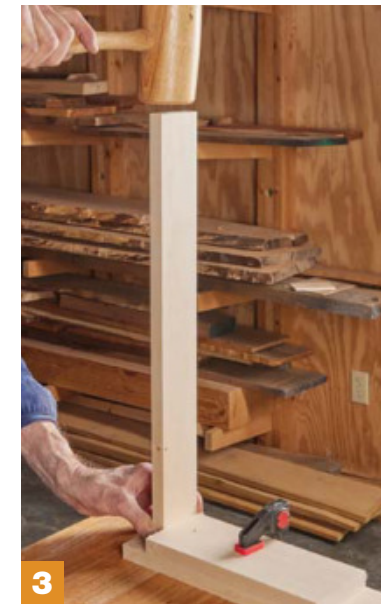
Clamp the cabinet sides firmly on the workbench, align the doweling jig with marks you've made on the ends, and drill. I position the dowel holes, keeping in mind to leave room for the location of the back panel.

Mark Locations & Drill

An easy way to locate where matching holes must be drilled in the top and bottom of the cabinet is to use dowel centers. Dowel centers are small pieces of metal designed to fit in holes of various sizes. They have a point at one end that's used to mark the opposite piece.

You can also mark and measure the holes, but the dowel centers offer an alternative that can compensate for errors that might have accrued in drilling the dowel holes in the cabinet sides. After woodworking for a while or as long as I have, you know that not all goes exactly as planned.

To make certain that the dowel centers mark exactly in the right



1 A block on the drill bit is a good way to set the depth.

2 Use a piece of scrap to position the sides.

3 Tapping the sides with a mallet will transfer the dowel locations via dowel centers.

4 Drill the dowel holes in the top and bottom at the drill press.

5 Rip a chamfer along the ends and front of the top and bottom.

location, I used a spacer block centered in position on the base and top of the cabinet. Cut the space block to represent the inside space measured from one side to the other. Mark the spacer's centerline and align that mark with a centerline you mark on the top and bottom pieces. Then with the spacer clamped in place, insert the dowel centers in the dowel holes in one end of the cabinet sides, hold the cabinet side in position and lightly tap on the end to drive the tips of the dowel centers into the wood. Do this same operation with each of the sides. Note that the sides will need to be positioned parallel to the back edges of the base and top parts of the cabinet. The spacer block will assist in holding the cabinet sides accurately in place.

With the top and bottom of the cabinet marked for drilling, use the drill press to drill the holes for the dowels.

Angle Cuts

A feature that I like in this cabinet is the angle cuts made along the ends and fronts of the top and bottom. That must be completed before the cabinet is assembled. Set the table saw blade angle to

6-7 Rout a stopped groove in the bottom. This is for the back panel.

8-9 With a dado blade, cut a groove in the side panels. You'll also want to cut a groove in an additional part, which will become the integral cleat that the cabinet is hung on.

30°. I use a sliding jig to carry the stock along the fence, finding that safer and more comfortable than simply using the fence. The guide helps to hold the stock square to the top of the saw. Setting the distance between the jig and blade is critical, as the angle must not intrude on the space required for the cabinet side. Cut the ends first. Then make the same cuts along the front edges of the top and bottom.

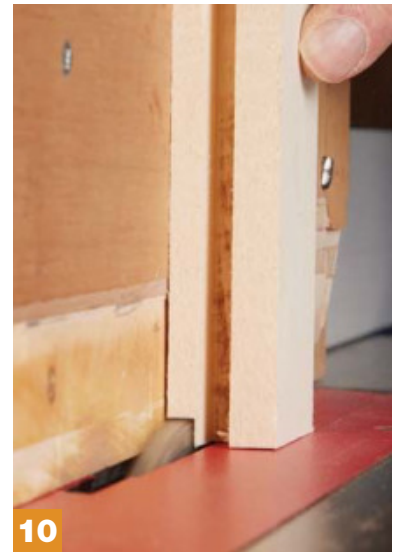
The Cabinet Back

Use a 1/4" spiral up-cut router bit in the router table to rout the groove in the bottom of the cabinet for a 1/4" Baltic birch plywood back to fit. Use stop clamps to the router table fence to control the length of the groove, making sure that it will not be exposed in the finished cabinet. To allow for the French cleat, the space between the fence and the router bit must be 3/8" and the height above the surface of the router table should be 1/4". Then use the table saw to make matching grooves in the cabinet sides. I used a stacking dado for this operation, cutting a 1/4" width of cut, 3/8" from the edge of the stock and a depth of 1/4".

Make the French Cleat

The next step is the most complicated in building this cabinet, as it involves making the French cleat that also serves as the cross stretcher when glued in place to square the cabinet and give it additional hanging strength. With the dado blade still in the saw, raise the cutting height to 1/2". This is to allow for the angle cut for the French cleat, that it can be made while still securing the Baltic birch back panel. After making this cut, form the ends of the hanger to fit into the dado cuts made in the cabinet sides. Set the blade height to 1/4" for this operation. I use the jig that slides along the table saw fence to hold the stock vertical, removing 3/8" from one side of the hanger pieces and 1/4" from the other, leaving a 1/4" x 1/4" tongue on each end that can be glued into the cabinet sides during assembly.

Put the combination blade back in the table saw and tilt the blade angle to 30°. Then make the cut along the back edge of the hanger to form the angle cut to match the French cleat. Cutting the French cleat comes next. Refer to the project rendering on page 51 for the French cleat dimensions.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10-11 Use a vertical jig at the table saw to form a tenon on the ends of the cleat. These fit into the groove that was cut in the sides.

12 Tilt the tablesaw blade and rip a bevel along one edge of the cleat.

13 Create the other half of the French cleat by bevel-ripping a piece of stock that will be attached to the wall.


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17-18 Use a piece of scrap as a fence to guide your router to form stopped dadoes in the shelf sides.

19-20 Assemble the shelf. The shelves are glued into the dadoes, and the top and bottom are glued on with dowels. Don't forget to slip the back in place before you put the clamps on.

Fitting the Shelves

To fit the shelves in the cabinet, rout grooves for them to fit. I use a guide block clamped in place with the two cabinet sides held secure, side by side so I can make certain that the grooves on the opposite sides are aligned. Use a plunge router and 1/4" spiral up-cut bit, and carefully mark stopping points for router travel. Be sure you move the router from right to left against the guide, as that makes certain the router's cut is pulling into the guide rather than pushing away and needlessly widening the cut.

In making the shelves to fit, I make notches at the front edge to cover the stopping points of router travel. This provides a cleaner look provided the notches are properly placed. Because the ends of the router travel are hidden from view, absolute precision in start and stop points of the router is are critical.

Cut the shelves to length and then notch the ends using the table saw sled. A sled and stop block work perfectly for this operation.


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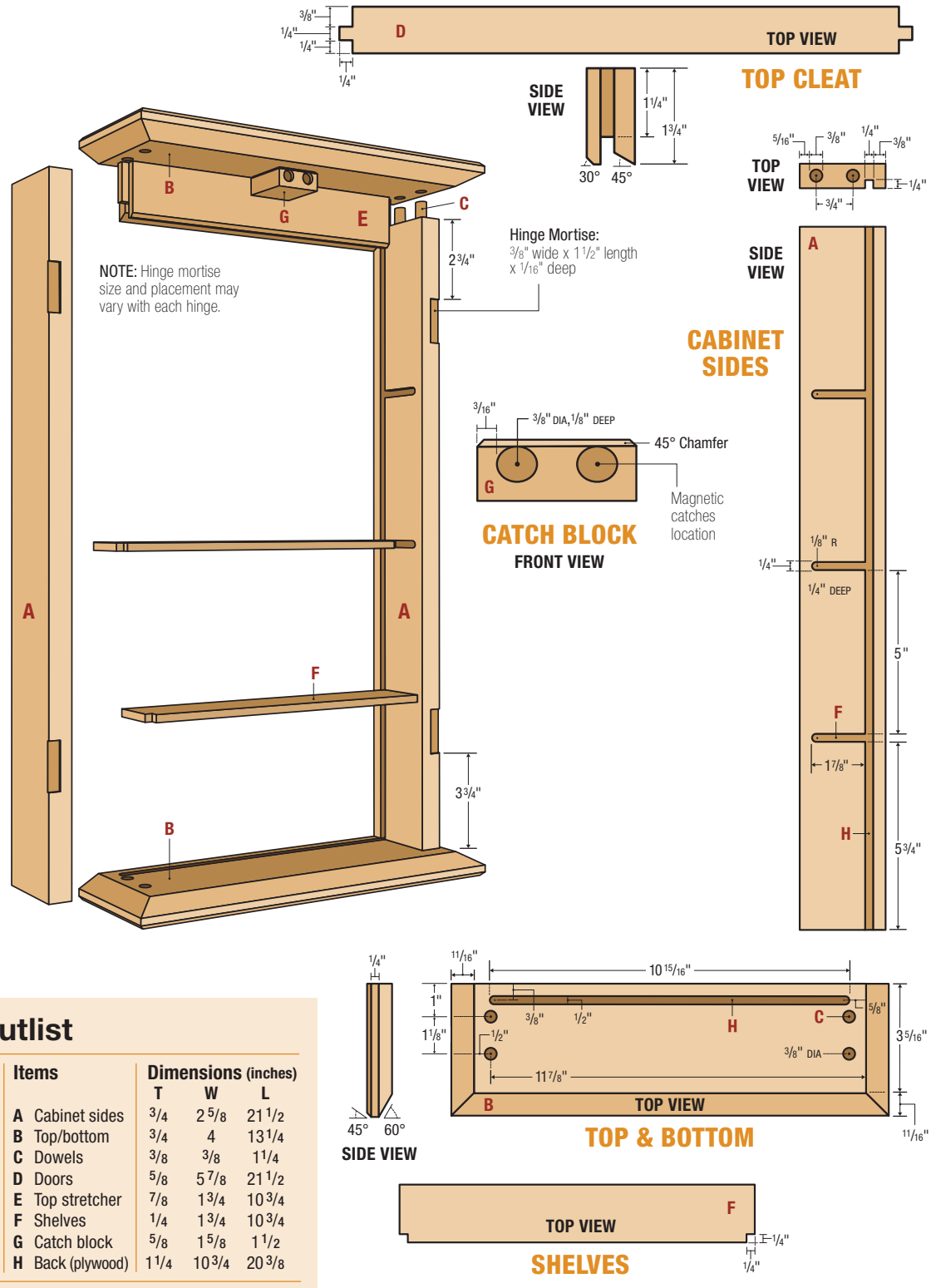
Final Touches Before Assembly

Before assembly, use a 45° chamfering bit to rout a small chamfer on the ends and fronts of the top and bottom. Then thoroughly sand all the surfaces that will be inside the cabinet and the cabinet sides as they will also be difficult to sand following assembly. Gently ease the front edges of the shelves using a sanding block. Also, before assembly cut the back panel to fit and sand it on both sides.

Cabinet Assembly

To assemble the cabinet, apply glue on the sides of the dowel holes in the cabinet sides, then use a small dowel or skewer to spread the glue inside. Tape the dowels in place. Next put the cabinet back and top stretcher/hanger in place. You need not glue the back panel in place but a touch of glue at each end will help establish a rigid structure. Put the shelves in place before adding the second side to the assembly. Then put glue into the dowel holes in the top and bottom and clamp those parts in place. It is particularly important at this time to make certain the assembly is square.

Basswood Cabinet



Cutlist

No.	Items	Dimensions (inches) T	W	L
2	A Cabinet sides	3/4	2 5/8	21 1/2
2	B Top/bottom	3/4	4	13 1/4
8	C Dowels	3/8	3/8	1 1/4
2	D Doors	5/8	5 7/8	21 1/2
1	E Top stretcher	7/8	1 3/4	10 3/4
3	F Shelves	1/4	1 3/4	10 3/4
1	G Catch block	5/8	1 5/8	1 1/2
1	H Back (plywood)	11/4	10 3/4	20 3/8

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DOOR HINGE ROUTING JIG

1. Select your cabinet hinges.

2. Gather your stock.
You'll need a 1/2" thick piece of plywood or MDF that is cut to 3" x 4" and a guide piece of 1/2" stock that will be clamped along one edge.

3. Determine the depth of cut.
I use the table saw to hollow out the necessary space for a mortise clean out bit to follow, but first you must determine the depth of the cut required. This is determined by measuring the thickness of the guide piece and add it to the width of the portion of the hinge that's to be mortised. I want the hinge barrel to protrude. By carefully observing and measuring, and with this particular hinge, I learned that setting the table saw height between 7/8" minimum and 1" maximum would work. NOTE: Using a thicker or thinner guide piece would change the range of acceptable depths.

4. Cut the recess in the jig.
Use the table saw with the sled to cut the recess in the jig representing the hinge mortise. Using two stops, one on each side, allows the space to be hollowed out either by making repeat cuts side by side or by moving the work piece side by side as the sled is gradually moved into the cut. The stop blocks must be set so that the hinge fits snug into the block. This is usually a trial-and-error process. I start by making the space slightly undersized and then gradually widen the cut until I have a perfect fit.

5. Glue guide piece in place.
Then clamp it and leave it to rest for approximately 45 minutes before use.

6. Set the router depth.
The router depth must be set just right. If it's not deep enough there will be too much space between the cabinet doors and cabinet sides. If too deep, the doors will bind at the hinge and not close properly. The photo shows my attempt to align the router bit with the center of the hinge barrel. Slightly below the center seems to work best, as it is worse to have the door bind than for there to be a slight space.

After the cabinet is glued together, it's time to rout mortises for the door hinges to fit. The best way to do so is by building your own routing jig above..

Mark the centerlines of the hinge locations on the doors and cabinet sides. To avoid measurement issues, I cut the door panels to be the same length as the opening at the front of the cabinet, so the same hinge location marks can be made on each. Trimming the doors to final length to provide clearance can come later. The first time I use the jig will be in scrap stock. This will allow me to check the fit of the hinge. By making two test cuts in scrap and putting them together helps assure me that I have set the router for the right depth. After the first use, you can find and mark the centerline of the jig on the guide strip, allowing it to be set in perfect alignment with the hinge centerline marks you've made in the cabinet and in the doors.

After routing the hinge mortises and before removing the jig, use a straight chisel to square the mortise. Then move on to the next being sure to rout both the doors and the cabinet sides. To install the hinges, I use a Vix bit and then use a small cordless screwdriver to put in the screws. Before installing the doors trim them very


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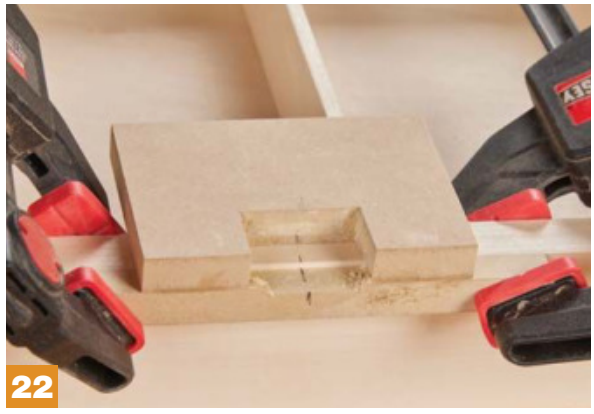
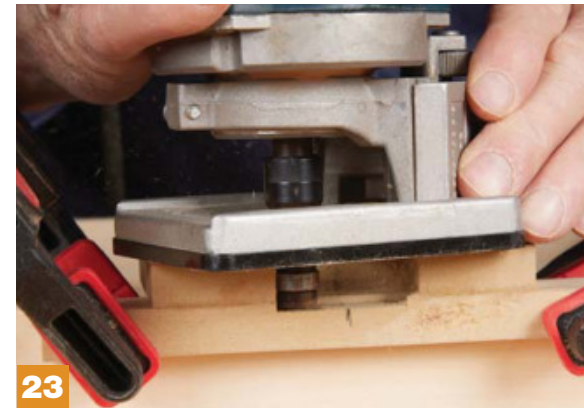
18 Set a stop block on your table saw sled or miter gauge.

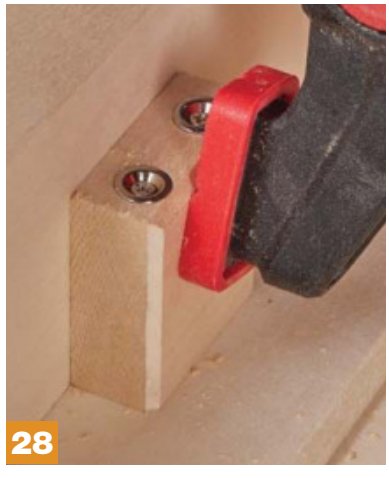
19 Carefully measure your hinge dimensions.

20 Nibble away an opening the same size as your hinges.

21 With a dado clean-out bit loaded in the router, set the height of your bit to cut exactly in the center of the hinge pin.







22 Line up the center line of the jig with the center of your hinge location.

23 Rout the pocket for the hinge, using the bearing to guide the bit around the inside of the jig.

24 Chisel the corners square using the template as a guide.

25-26 Test fit the hinge and install the screws.

27-28 At the drill press, drill recesses for cup magnets. After installing them, you can glue the block inside of the cabinet.

slightly at the top and bottom to provide clearance for opening.

To provide a firm closure to the cabinet, I chose magnetic catches. Cut a block of wood just long enough for the doors to come to a full close against it. I milled the stock so that the wood grain will run parallel to the wood in the top of the cabinet so that the block can be simply glued in place. Drill holes for the magnets to fit. Then glue and clamp the block in place at the top center of the cabinet. Small steel catch plates are then mounted on the doors. I buy magnetic catches (stock no. R622CS-N) for small doors from KJMagnetic.com. Don't forget to also purchase the necessary steel counter sunk washers (stock no. NSW62).

To complete this cabinet, I finished with milk paint and then carved the simple pattern on the cabinet front. I worked this design freehand with a v-gouge cutting through the finish to reveal the natural wood beneath. After the bit of carving was complete, I used a clear acrylic to provide lasting protection. Mounting the cabinet can be done by attaching the French cleat to the wall, and setting the cabinet over it, catching on the beveled cleat at the top of the cabinet. **PW** – *Doug Stowe*

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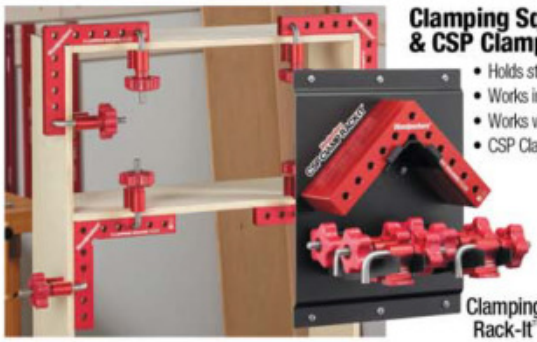

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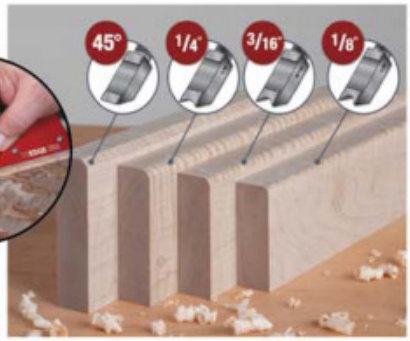

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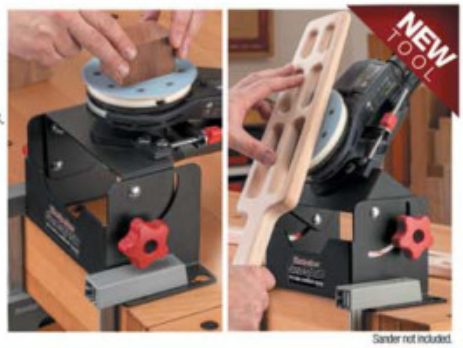

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- Works with most drills.
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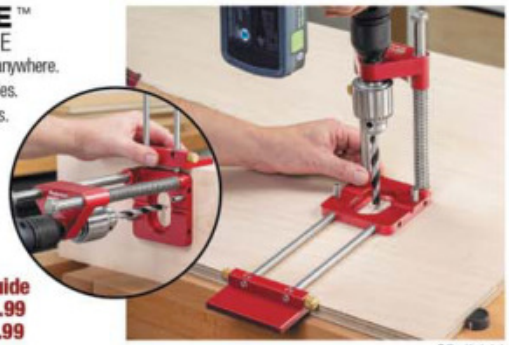

Drill not included.

Auto-Line Drill Guide
Drill Guide....$299.99
Deluxe Kit....$399.99

MULTI-ROUTER
The Joinery Machine

- Heavy-duty, true 3-axis linear control.
- Machined aluminum templates for flawless joinery.
- Built-in dust collection.

Multi-Router
The Joinery Machine
w/Dust Cabinet....$2999.00
w/Mortise & Tenon Package....$4199.00
More Options Available on **Woodpeck.com**

Table Saw not included.

THIN RIP GUIDE®

- Safe, accurate jig for repeat cutting of thin strips.
- Works with 3/8" x 3/4" T-slot table grooves.
- Easily calibrated scales in both inch & metric.
- Ball bearing contact for smooth feeding.

ThinRip Guide
Includes a wall-mountable Rack-It™
....$169.99

Table Saw not included.

Iron-Grip™ Small Parts Holder

NEW TOOL

- Rout small parts safely & accurately.
- Works with bearing guided bits or table-mounted fences.
- Quick-release jaw for fast change over.

Iron-Grip Small Parts Holder
....$169.99
Extended Capacity Fence....$19.99

Spline Jig

NEW TOOL

- Works with both table saw and router table.
- Spline grooves or dovetail keyways.
- Cut splines in projects up to 36" long.
- Stops included for repeat positioning.

Spline Jig
....$149.99

Hold-down clamps sold separately.

StealthStop™ Miter Gauge

- Fits all 3/8" x 3/4" miter gauge slots.
- Patented leaf springs ensure perfect fit.
- Rear fence extends from 21" to 29".
- Micro-adjustable flip stop.
- Positive stops for standard angles.
- Optional zero-clearance inserts.

StealthStop
w/Fence & Stealth Stop
Miter Gauge....$119.99

Table Saw not included.

HexScale Rules

- Six rules in one!
- Inch & metric scales in 3 layouts.
- Right-to-left, left-to-right & centering.
- Stop simplifies repeat marking.
- 6", 12", 24" & 36" lengths.

HexScale Rule
Includes a wall-mountable Rack-It™
Set....$159.99
Individual Sizes Available on **Woodpeck.com**

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