



Hidden entertainment. This traditional cupboard hides a flat-screen television and all the accompanying audio and video accoutrements.

A classic furniture form revised for 21st-century entertainment.

Shaker

BY MEGAN FITZPATRICK

Stepback



I have a love-hate relationship with my television. I love (too much, perhaps) to watch shows, but I hate having the TV out in the open as the focal point of my living room. But I also dislike most commercial entertainment centers, as I've a penchant for antique and antique-style furniture.

So, I flipped through a pile of books on Shaker furniture and auction-house catalogs to cull design ideas for a stepback cupboard that could be repurposed as a modern entertainment center that would not only allow me to hide a 32" flat-panel TV behind doors, but also house the cable box, DVD player and various stereo components. (Of course, if you want to use it in your dining room, just omit all the holes in the backboards for air flow and cord management.)

A Plethora of Panels

While this project is quite large, it's surprisingly easy to build – though it's an exercise in organization to keep all the parts

straight. The upper face frame, lower carcass and all four doors are simple mortise-and-tenon joints, with panels floating in grooves in the doors and carcass sides.

The first step is to mill and glue up all the panels. Use your best stock for the door panels, as they'll show the most. And here's a tip I didn't know until after it was too late: Keep all your cathedrals facing in the same direction and your panels will be more pleasing to the eye.

For the four doors, you'll need six $\frac{5}{8}$ "-thick panels, two each of three sizes. You'll also need two $\frac{5}{8}$ "-thick panels for the lower carcass sides.

Unless you have access to a lot of wide stock, you'll also need to glue up $\frac{3}{4}$ "-thick panels for the upper carcass sides, top, bottom and shelves, and the lower carcass bottom, shelf and top.

I glued up all my panels oversized. After the glue was dry, I took them out of the clamps, stickered them and set them aside. I cut each to its final dimension as it was needed, after calculat-

ing its exact measurement from the dry-fit frames and carcass sides. I don't trust cut lists; no matter how religiously I stick to the plan, measurements change in execution.

Mortises and Tenons Galore

With the panels set aside, I moved on to all the pieces that would be joined with mortise-and-tenon joints. Initially, I'd planned to concentrate on one carcass at a time to more easily keep things organized. I quickly realized that's an inefficient work method, as the mortise-and-tenon setups are the same on both the top and bottom pieces of the project. Rather than create each setup twice on the machines, I prepared all my stock and cut the joints at the same time.

First, chuck a $\frac{1}{4}$ " chisel and bit in the mortiser, and take the time to make sure the chisel is dead parallel to the machine's fence. I began with the leg mortises—the only pieces on which the mortises aren't centered. After

choosing the best faces for the show sides of each, mark which leg is which. Mark out your mortises. On the inside back of the rear legs, they're set in 1" so the rail can accommodate the $\frac{5}{8}$ "-thick backboards. On the front and sides, they're $\frac{1}{4}$ " back from the show faces, so that the rails end up flush with the front of the leg faces. The top rails are flush with the top of the legs, so lay out $1\frac{1}{2}$ " mortises on the inside front of the two front legs, and $2\frac{1}{2}$ " mortises on the side, $\frac{1}{4}$ " down from the top. The bottom rails are all 3", so your mortises will be $2\frac{1}{2}$ ", $1\frac{1}{4}$ " up from the bottom of the leg.

Cut the mortises for the back rail first with 1" distance between the chisel and the fence, then change the setup to $\frac{1}{4}$ " spacing, and cut the remaining mortises in the legs. To make clean mortise cuts, most of the *Popular Woodworking* editors use the "leap-frog method." That is, skip a space with every hole, then clean up between the holes. Some woodwork-

ers prefer to overlap each hole to get a clean cut. Try both methods on scrap pieces, and use whichever you prefer.

Assuming your stile stock is exactly $\frac{3}{4}$ " thick, the setup should remain the same for the face frame and door mortises, but double check that the chisel is centered in your stock before making that first frame cut. And, make sure you always work with the same side against the fence – if you are off a little bit, you'll be equally off on every joint, and cleanup will be easier.

Lay out all the mortises on your face frame and door frames and make the cuts. (A sturdy 6" rule is my preferred tool for cleaning the detritus out of the bottom of each mortise.)

Now it's on to the tenons. I prefer to set up the full $\frac{13}{16}$ "-wide dado stack at the table saw, and raise it to just shy of $\frac{1}{4}$ ". That way, I can make two passes on each end of my tenoned workpieces, and simply roll around each face to create the tenons, without hav-



A sea of panels. I wanted to glue up all the panels at the same time – but I ran out of clamps and space. Above are the six door panels and two lower side panels.



Many mortises. The majority of joints in this project are mortise and tenon. Take the time to set the hollow-chisel mortiser to cut dead-on centered mortises, $\frac{1}{4}$ " deep – it will save you a lot of frustration and time later.



Table-saw tenons. The full dado stack on our table saw is $\frac{13}{16}$ " and the tenons are $\frac{1}{4}$ " long, so I made the first cut on each face with the workpiece tight to the fence, then slid it to the left for a second pass. The blades are raised just shy of $\frac{1}{4}$ " so I was able to simply roll the end of each $\frac{3}{4}$ " workpiece to cut the tenons with one setup.

ing to change the setup at all for any of my 1¹/₄"-long tenons.

With the tenons cut just a hair oversized in thickness, I test-fit each one individually in its mortise and used a shoulder plane to reach the final fit. Planing a slight chamfer at the end of the tenon will help it seat. (The fit should be a tight press fit. The tenon shouldn't move around in the mortise – nor should you need a mallet to get things together.)

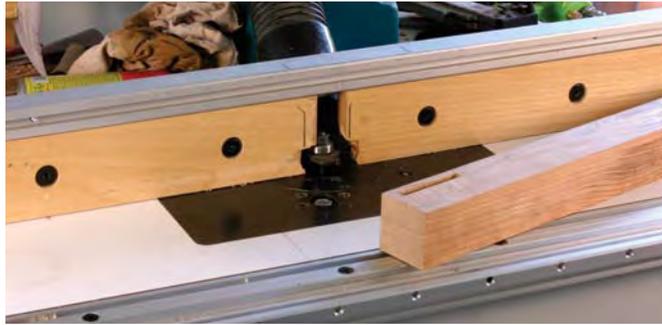
Grooves for Floating Panels

With the mortise-and-tenon joints all dry-fit, it's time to cut the grooves that will accept the floating panels. Chuck a 1/4" three-wing cutter into your router table, and raise it 1/4" (you can use your already cut mortises to set the height – no measuring necessary). Set the fence to make a 3/8"-deep cut.

Start with the legs – and double check to make sure you have the faces marked correctly. The floating panels are on each side of the carcass, so a groove is needed from mortise to mortise on the front face of both back legs, and on the back face of both front legs. Unless your ear protection blocks out all noise, you should be able to hear the difference in sound as the router cutters move from the hollow of the mortise into the groove cut (mark the starting and stopping point if you're worried about recognizing the sound differential). With the leg flat to the table and the mortise toward the bottom, push the leg against the fence so that the router bit is spinning in the empty mortise hole, then move the leg across the table, cutting a groove that stops in the other mortise, then pull the leg away. Repeat until all four leg grooves are cut, and set the legs aside.



Final fit. I purposely cut the tenons just a hair oversized. I reached the final fit by testing each tenon in its mortise, then shaving each cheek as needed with a shoulder plane. And, I planed a slight chamfer on the tenon ends to make them easier to fit.



A home for floating panels. To cut 3/8"-deep grooves for the floating panels, set up a 1/4" three-wing cutter (also known as a slot cutter), using your mortises to set the cutter height. The groove will run from mortise to mortise.



Raised panels. Set up a fence-extension jig on the table saw, set the blade at a 12° angle, set the distance between the fence and blade at 3/16" and raise the blade until it just clears the workpiece as the cut is made. This jig, built by Senior Editor Glen D. Huey, slides along the rail, so the workpiece can be clamped in place.

Test the bit height on your 3/4" stock before proceeding. It shouldn't need adjustment ... but it never hurts to be sure. Grooves are needed on all frame pieces that will house a panel – that's the inside edges of all the door rails and stiles, and on both long edges of the medial rails for the upper doors. On the stiles, the groove goes from mortise to mortise. On the rails, in order to cut a full 3/8" deep across the rail, you'll be nipping the inside edge of the tenon. That's OK – but be careful to cut away as little as possible so that the joint retains maximum strength.

Raised Panels

Now dry-fit the sides and doors and take the final measurements for all the panels. Add 5/8" to both the height and width of each; with 3/8" hidden in the groove on all sides, you build in an 1/8" on either side for your panel. Retrieve the door and side panels from your stickered stack; cut them to final size at the table saw.

Now, set up a fence-extension jig on your saw – a stable flat panel attached to your rip fence will work, but that jig will be stationary and you'll have to carefully move your work-

piece across the spinning blade. It's safer to make a jig that fits over the fence and slides along it. That way, you can clamp the workpiece to the jig and move the unit instead.

For any stock thickness, set the blade angle to 12°, and set the fence so there's 3/16" between the fence and the inside saw tooth as the tooth clears the bottom of the throat plate. Raise the blade enough so that the stock fits between the blade and the fence (approximately 2 3/4"). This ensures the blade will clear the stock completely as the cut is made. Make sure you use a zero-clearance throat plate; otherwise, the thin offcuts will get caught and kick back.

Cut across the grain first, at the top and bottom edges. Any tear-out will be cut away on your second two cuts, which are with the grain. Clamp your workpiece firmly to the fence extension and slide it smoothly across the blade. Now repeat until all six panels are raised, and sand away the mill marks. These panels will fit snug in the 3/8"-deep grooves, and allow for seasonal expansion and contraction. And if you prefer a more country look to a Shaker style? Face the raised panels to the outside of the piece and you're there.

Shapely Feet

At some point before you do any glue up, you'll want to turn your feet at the lathe and create a tenon at the end to join to the leg. (Of course, you could also add 6" to your leg length, and turn the foot on the leg stock. However, I decided I'd rather muck up a 6" length of wood than a 34" piece, so I made the feet as separate pieces.) I first milled each foot blank square, then turned them round and shaped each foot, following the pattern at right.

Even if each foot is slightly different (you can't tell unless they're right next to one another), be careful to turn the tenoned ends as close in size as possible. To achieve this, I set my calipers to $\frac{3}{4}$ " and held them against the tenon as I cut the waste away with a wide parting tool. As soon as I reached a $\frac{3}{4}$ " diameter, the calipers slid over the piece. I then turned the rest of the tenon to match.

Why make those tenons the same? Well, you have to fit the tenons into drilled holes that are centered in the bottom of each leg, and I wanted to use but one drill bit and achieve a tight fit.

I clamped each leg perpendicular to the floor, and drilled $\frac{3}{4}$ "-diameter x $1\frac{1}{4}$ "-deep holes centered in the bottom of each leg. Be careful to keep your drill straight (or set up a drill press for greater accuracy). With the holes drilled, I set the feet aside until the rest of the bottom carcass was done.

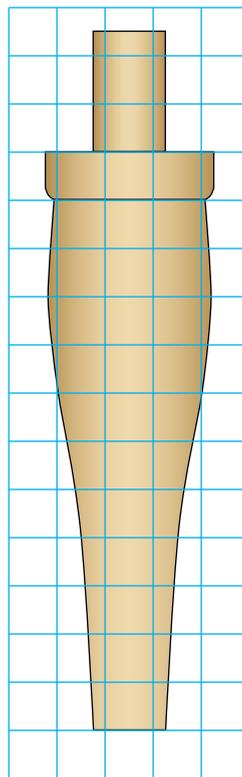
Time for Glue Up

Dry-fit all your panels to the grooves inside the door frames and the bottom case sides, and make any necessary adjustments. Once everything fits snug, get your clamps ready and work with one glue-up at a time (I started with the lower doors and side panels, as they involved fewer pieces).

Use an acid brush to apply a thin layer of yellow glue on the walls of your mortises and



Custom feet. I shaped my 6" feet on the lathe and turned a $\frac{3}{4}$ " x $1\frac{1}{4}$ " tenon at the top of each. While the feet needn't be identical, the tenons should be close in size. I held calipers set to $\frac{3}{4}$ " against the piece as I used a parting tool to make the cut. When I reached $\frac{3}{4}$ ", the calipers slipped over the tenon and I was done.



1 Square = $\frac{1}{2}$ "

FOOT LAYOUT



Foot holes. Before the bottom carcass is glued up, drill holes to receive the tenons on the turned feet. I used a $\frac{3}{4}$ " Forstner bit to drill $1\frac{1}{4}$ "-deep. Match your bit and depth to the size of the tenons on your feet.

Supplies

Lee Valley

800-267-8735 or leevalley.com

4 pr. ■ 3 " x $1\frac{11}{16}$ " narrow extruded brass fixed-pin butt hinges #00D02.04, \$19.60 per pair

Rockler

800-279-4441 or rockler.com

4 ■ $1\frac{1}{8}$ " cherry Shaker pegs #78469, \$5.99 per pair

Prices correct at time of publication.

the tenon faces, slip the rails in place, then slide the panel in place and cap it off with the opposite stile (keep a damp rag handy to wipe away any squeeze-out). Clamp until the glue is dry. (Again, add glue only to the mortise-and-tenon joints; the panels should float.) The upper doors are a bit tricky to glue up, with two panels plus the medial rail in each. I'm sure my contortions were amusing to watch. I recommend getting a friend to help wrangle things in place.

While you're waiting for the lower sides

to dry, glue up the upper face frame, check it for square, clamp and set it aside. Once the lower side panels are set, complete the lower carcass's mortise-and-tenon joints by gluing the lower back rail, the front rails and the center stile in place. (The upper back rail is notched around the legs at both ends, so it's easier to use pocket screws for that joint, though you can cut a mortise-and-tenon joint if you prefer.)

Now it's on to the upper section. Cut your sides, top, bottom and shelves to final size. The

3/4"-thick top, bottom and shelves are housed in 1/4"-deep grooves cut into the side pieces. So set up the dado stack again at the table saw but use only enough blades and chippers to create a 3/4"-wide cut (and be sure to run a few test pieces first). Raise the stack to 1/4". Mark the cuts on one of the case sides and set the fence off that piece, making the cuts in both sides before moving the fence for the next location. Make sure your cuts are on the inside faces of your sides. Note in the illustration that the top and bottom pieces are not at the ends; they're set in to add rigidity, and the bottom protrudes 1/4" above the face-frame bottom and thus functions as a door stop.

Before you take off the dado stack, run a 3/4"-deep x 7/16"-wide rabbet up the back of each side; these will house the backboards.

Now lay one side piece flat on your workbench (groove-side up) and fit the top, bottom and shelves into place. Set the other side piece on top, and use a dead-blow mallet to fully seat the pieces in the grooves. (This is a big workpiece – you might want to grab a helper.) If the pieces fit together snug, you could pull them back out, add a little glue and refit them. But after struggling to get them in place once, I didn't want to go through that exercise again (and it was a lot of exercise). Instead, I chose to toenail the shelves in place from the bottom face at both the front and back edges.

At this point, I also pegged all the mortise-and-tenon joints, and pegged the shelves in the upper carcase into the sides, using 1/4" white oak pegs (for more on pegging, see "Square Pegs, Round Holes" in the techniques section at popularwoodworking.com).

Now fit your doors to the face frame, and mark then cut the hinge mortises. Keep the door fit tight – you'll do the final fitting once the entire carcase is together (things could move when you add the backboards later – trust me). You might as well fit the lower doors and hinges at the same time.

Now, flip the upper carcase on its back and glue the face frame in place, adding enough clamps to pull it tight along each side. If things work out correctly, you'll have a slight overhang on both sides, which, after the glue dries, you can flush to the face frame with a trim router or handplane.

Backboards

Is that dado stack still in your table saw? Good. Mill enough 5/8"-thick stock for your backboards for both the top and bottom, and run 5/16" x 3/8" rabbets on opposing edges for

shiplaps (and don't forget to calculate the rabbets as you're measuring the width of your rough stock). The outside pieces get only one rabbet each.

I used random-width boards pulled from an old stash of sappy cherry. Because the backboards will be on view with the doors open as I watch TV, I didn't want to use a less attractive secondary wood. So I used less-attractive pieces of primary wood. With the rabbets cut, change the table saw set-up back to a rip blade, and rip the outside backboards to final width (the humidity was low here when I built this, so I used dimes as spacers).

Screw the backboards in place, with one screw at the top and bottom of every board set just off the overlapping edge. (That screw holds the joint tight, but allows for slight movement of the underlapped piece. Your last board needs two screws at the top and bottom to keep it secure.) Now do the final fit on your doors, taking passes with a handplane or on the jointer (take a 1" cut on the trailing end first, then reverse the piece to avoid tear-out). I aimed for a 1/16" gap all around (on some sides, I even hit it). After marking locations for any necessary wire and air-circulation holes in the backboards, take the doors and backboards off, drill any needed holes at the drill press, then set the doors and backboards aside for finishing. Drill any cord/air holes at the drill press with a Forstner bit.

Complete the Bottom

Flip the lower carcase and choose your foot position. Line up the grain of the foot with its matching leg so the look is pleasing. One of my holes was a bit off straight, so I used a rasp to

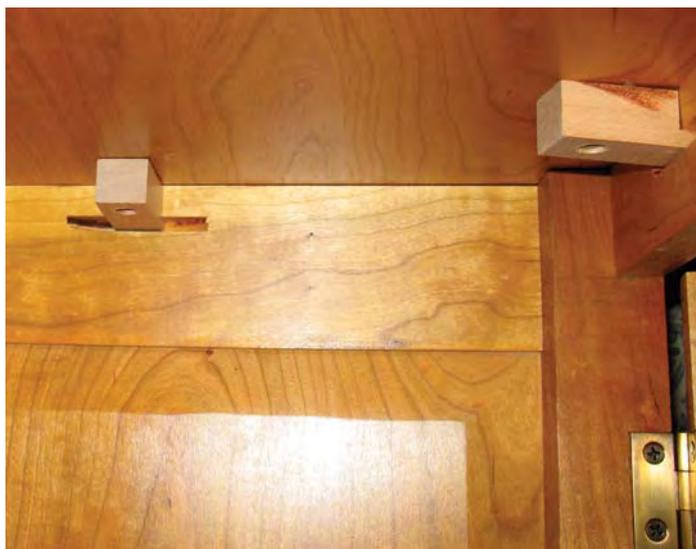
Online EXTRAS

For additional information on cutting cove moulding at the table saw, watch Senior Editor Glen D. Huey's video at popularwoodworking.com/videos, under techniques. For additional information on pegging, see "Square Pegs, Round Holes" in the techniques section at popularwoodworking.com. And for information on adding age to hinges, see Editor Christopher Schwarz's blog entry linked from popularwoodworking.com/feb09.

take down one side of my tenon until I could adjust the angle accordingly. Once everything fits to your satisfaction, drip a little yellow glue in the holes and seat the feet. You don't need clamps here (unless you're using them to pull something in line). If the fits are good, simply flip the piece upright and the weight will keep the feet in place as the glue dries.

With the backboards and doors off, now's the time to fit the cleats that support the bottom and shelf in the lower section, and cut button slots in the top rail to attach the top. The bottom is notched around the legs and the back edge is rabbeted to fit neatly over the back rail. But because I need airflow in the bottom section for A/V equipment, I fit the shelf to the inside corner of each leg and to the front center stile where it serves as a door stop. I left a gap at the back and sides to run wires and for air circulation.

To complete the bottom section, use a biscuit cutter to cut slots in the front and side rails for buttons, and notch the upper back rail around the rear legs and use pocket screws to hold it in place. For added strength,



Buttomed down. The top of the bottom section is attached to the side and front rails with buttons. I used a biscuit joiner to cut two 1/2"-deep x 1/4"-wide slots on each side, and three along the front. I simply screwed through the back rail into the top's bottom to secure it at the back.

countersink a screw through the front edge at each end into the leg, too. Cut the top to final size, and attach it with buttons at the front and sides. Countersink screws underneath through the back rail into the bottom of the lower section.

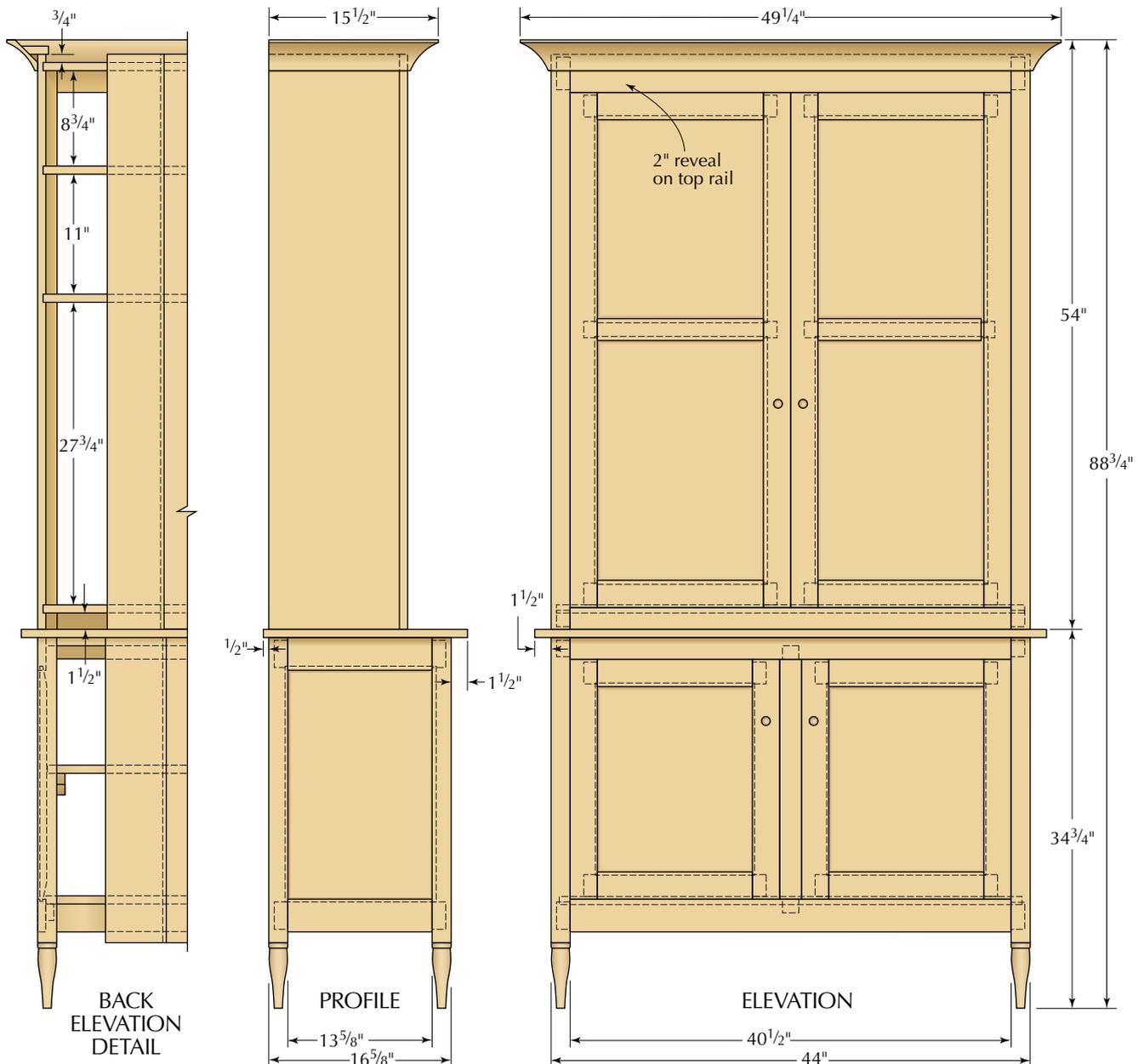
The Crowning Touches

Set up your table saw to cut crown moulding, and sand it smooth before fitting. (For instruction on cutting cove moulding on the table saw, see Senior Editor Glen D. Huey's video under the techniques section at popularwoodworking.com/video).

Often, the crown is connected with a flat piece to the top edge of the sides and face



Cutting crown. The crown is cut by running $\frac{7}{8}$ " x 4" stock at an angle over the table saw. Raise the blade to $\frac{7}{16}$ " then center your stock to the blade. Clamp a long straightedge to the table to guide the stock, then lower the blade and make a series of passes as you gradually raise the blade until you reach $\frac{7}{16}$ " (or your desired depth).



frame. But my face frame and sides weren't high enough, so instead, I cut blocks with 45° angles (on two faces for the corner pieces), glued those to the inside of the crown and added brads to the top of the carcass for a bit of additional strength.

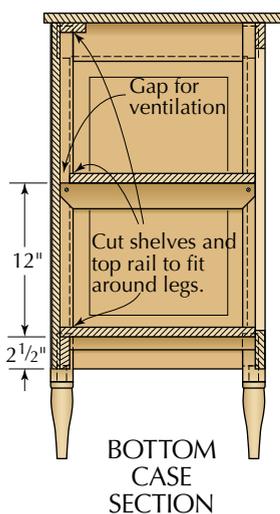
The Finish

I sanded each piece to #180 as I went along, so once the construction was complete, I was ready for the finish. Because I didn't have two decades to wait for a nice warm patina to develop (we shot the opening picture just 20 minutes after the handles were in place), I added warmth with two sprayed coats of amber shellac and a top coat of dull-rubbed-effect, pre-catalyzed lacquer.

Because I couldn't afford five sets of hand-forged iron hinges but wanted an aged look to the hardware, I de-lacquered then added patina to brass hinges with gun bluing.

Oh yes—the handles. I tried to turn them, but ran out of time and talent. Thank goodness for our local woodworking store and its Shaker pull supply. The handles were sprayed separately, set in a scrap of plywood. You see, I didn't know where I wanted to place them until the entire piece was assembled and the A/V components were in place. A friend helped me hoist the upper piece atop the lower cabinet, where it's held in place simply by gravity. I then marked my pull locations, drilled 3/8" holes with a Forstner bit and glued the pulls in place. **PW**

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Blocked in place. I intended for the top of the carcass to match the top of the crown, so I could attach the crown with a piece that tied into both. That didn't happen. So instead, I cut blocks with a 45° angle on the front, and glued them to the top of the carcass and the inside face of the crown — one at each front and back corner and three more along the front. You can also see the shiplapped back in this picture. Each piece is secured top and bottom at the corner by a screw.

Shaker Stepback

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
Upper Section						
□ 2	Face frame stiles	3/4	1 3/4	52 3/4	Cherry	
□ 1	Upper face frame rail	3/4	3 1/2	43	Cherry	TBE*
□ 1	Lower face frame rail	3/4	2	43	Cherry	TBE*
□ 2	Side panels	3/4	12	52 3/4	Cherry	
□ 1	Top	3/4	11 3/8	43	Cherry	
□ 1	Bottom	3/4	11 3/8	43	Cherry	
□ 2	Shelves	3/4	11 3/8	43	Cherry	
□ 4	Door stiles	3/4	2 1/2	47 1/4	Cherry	
□ 2	Door top rails	3/4	2 1/2	17 3/4	Cherry	TBE*
□ 2	Door center rails	3/4	2	17 3/4	Cherry	TBE*
□ 2	Door bottom rails	3/4	2 1/2	17 3/4	Cherry	TBE*
□ 2	Upper door panels	5/8	15 7/8	17 3/4	Cherry	
□ 2	Lower door panels	5/8	15 7/8	22 3/4	Cherry	
□ 1	Front crown	7/8	4	49 1/2	Cherry	Trim to fit
□ 2	Side crown	7/8	4	15 3/4	Cherry	Trim to fit
□ Varies	Backboards	5/8	varies	52 3/4	Cherry	
Lower Section						
□ 4	Feet	1 3/4	1 3/4	7 1/4	Cherry	1 1/4" dowel at top
□ 4	Legs	1 3/4	1 3/4	28	Cherry	
□ 2	Side panels	5/8	13 7/8	21 5/8	Cherry	
□ 4	Side rails	3/4	3	15 3/4	Cherry	TBE*
□ 1	Upper front rail	3/4	2	43	Cherry	TBE*
□ 1	Lower front rail	3/4	3	43	Cherry	TBE*
□ 1	Upper back rail	3/4	2	42 1/2	Poplar	
□ 1	Lower back rail	3/4	2 1/2	43	Poplar	TBE*
□ 1	Center stile	3/4	2	24 1/2	Cherry	TBE*
□ 2	Door panels	5/8	14 7/8	17 5/8	Cherry	
□ 4	Door stiles	3/4	2 1/2	22	Cherry	
□ 4	Door rails	3/4	2 1/2	16 3/4	Cherry	TBE*
□ 2	Middle shelf cleats	3/4	15 1/2	2	Cherry	
□ 2	Bottom shelf cleats	3/4	14 1/2	1	Cherry	
□ 1	Top	3/4	18 3/4	47	Cherry	
□ 1	Shelf	3/4	14 1/2	42 1/2	Cherry	
□ 1	Bottom	3/4	15 1/4	42 1/2	Cherry	
□ Varies	Backboards	5/8	random	27	Cherry	

* TBE=Tenon both ends, 1 1/4"

Coffee with the Brethren

BY MEGAN FITZPATRICK

Build a Shaker-inspired coffee table with through-drawers.

Coffee tables didn't exist as a furniture form until the 1920s (when they were known as cocktail tables). So while there is no true Shaker coffee table, I needed a table to put in front of my couch that would work well with the other Shaker-influenced furniture in my living room. And to my mind, that's one of the best things about being a woodworker – the ability to design and make exactly what you want. So that's what I did.

This table has the same turned feet and post-and-rail base construction that I used for my stepback (from the February 2009 issue, #174), I used the same hardware as on the “Bibliophile’s Bookcase” (from the December 2009 issue, #180) and all three pieces are built from cherry. They’re clearly part of the same family, but different enough that they don’t look like a store-bought suite.

Best Foot Back

I began by squaring six pieces of 8/4 stock for the legs (my turning skills are at best sophomoric, so I wanted two extra legs in case something went terribly wrong).

I labored over one foot until I was satisfied with its appearance, then set that one directly behind the lathe so I could look at it as I turned the others. Though I used calipers to get the top bead and swelling close to the same size on each foot, they're not identical. That doesn't bother me. They're close enough that, when spread apart to the four corners



Designed to complement. This Shaker-inspired coffee table picked up design cues from pieces already in my living room, and thus serves to tie together all the wood furniture therein.

of the table, you don't notice the differences except with close scrutiny.

After all the feet were turned, I decided on the final leg arrangement, (which was in part dictated by the glaring white sapwood on the corner of one

leg that had to face to the inside), then marked out the mortise locations. I cut the 1½"-deep mortises with a ¼" hollow-chisel mortiser.

Rails, Stiles & End Panels

With the legs done, I moved on to the rails, stiles and end panels. After cutting the four rails, two middle stiles and two end panels to size, it was time to tenon. I wasn't feeling adventuresome enough to cut all the tenons by hand, so I loaded up the dado stack in the table

*“I have measured out my life
with coffee spoons.”*

— T.S. Eliot, 1917

“The Love Song of J. Alfred Prufrock”

saw to make the tenons on the rails and end panels. Because the middle stile on each side doesn't have to be as structurally sound, I decided to practice my handsaw skills by cutting the tenons on those two pieces by hand – and they actually fit better right off the saw. I had to clean up the table saw tenons with a router plane, but had very little work to do on the hand-cut ones – next time, it's handsaws for all joinery cuts.

Because the tenons on the end panels traverse 7½", I decided on split tenons (I'd cut the mortises accordingly). I sawed straight down, coped out the majority of the waste, then cleaned up the resulting shoulder with a chisel.

Base Glue-up

With all the pieces for the base done, it was time to get out the glue. I started with the front and back assemblies, and because there are mortises in the top and bottom and on both ends, I had glue dripping everywhere. So much for my sanding-avoidance techniques – I had to wipe off the drips with a damp rag, which raised the grain on my carefully planed surfaces.

After those two assemblies dried, I glued in the two end panels, checked everything for square, then set the completed base aside to dry.



Pleasing arrangement. I tried a bunch of different leg arrangements until I had all the best faces facing out – the white wood on the front right leg in the picture is on the far side of the table from my couch; only the cats will notice it.

Top(ic) of Debate

My next step involved some debate amongst the editors. Is it better to attach the top before making and fitting the drawers? Or is it better to make and fit the drawers with the top unattached, so you can easily reach inside the carcass to make adjustments?

I decided to make and attach the top first, perhaps in part because a top made the thing look closer to finished, but also because I had some trepidation about fitting the through-drawers. I was concerned the base might shift a little as I tightened the buttons to secure the top, and that would affect the drawer fit (three out of four editors agreed).

So it was on to the top. I wanted a two-board glue-up to make the 20" panel, and the piece of wood I'd bought with that in mind was 11" wide. But, there was sapwood running at an angle on both edges, so I couldn't simply cut two pieces to length and join them in the middle. Instead, after cutting each piece of the panel a couple inches overlong, with the face that would become the top

facing up on the band saw table, I cut off the sapwood where it met the heartwood at what would become the glue line. (The sapwood was wider on the bottom, and I wasn't concerned with a white stripe on the bottom center; nothing except spiders will see it.)



Hand-cut. To cut a good tenon by hand, it's best to tilt the workpiece at 45° or so in your vise so you can saw to two lines. Then tilt it toward you to saw down to the baseline on the other side. With those two cuts made, there's a V-shape of waste to saw out of the middle, with the workpiece straight up in the vise. Make the shoulder cut using a crosscut saw and a bench hook.



Front assembly. It's quite a trick to apply glue and get all the tenons in place before a sticky mess ensues. I've seen it done – but I have yet to achieve it.



Halfway there. With the base done, the project is starting to look like a table.

I then straightened those cuts at the jointer, and glued up the panel. What resulted was a parallelogram, which I squared up at the table saw after the glue was dry.

To attach the top, I cut white oak buttons (from scrap that was underneath my bench), drilled and countersunk screw holes in the buttons, then screwed them to the top, with the tongues fitted in $\frac{1}{4}$ " mortises that I cut on the inside edges of the table with a biscuit joiner. There are two buttons on each side and one on either end (and I have a few extras stored in one of the drawers that I can add later if necessary – say, if in the July heat and humidity it starts to curl up at the corners).



A helping hand. With a panel this long and no roller stand, it's helpful to have another person support the end of the board through the cut. But if another person isn't around to help, a handscrew attached to the crosscut sled will do (though you have to use more downward pressure to keep the piece flat to the saw table to compensate for some sag).

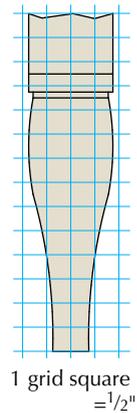
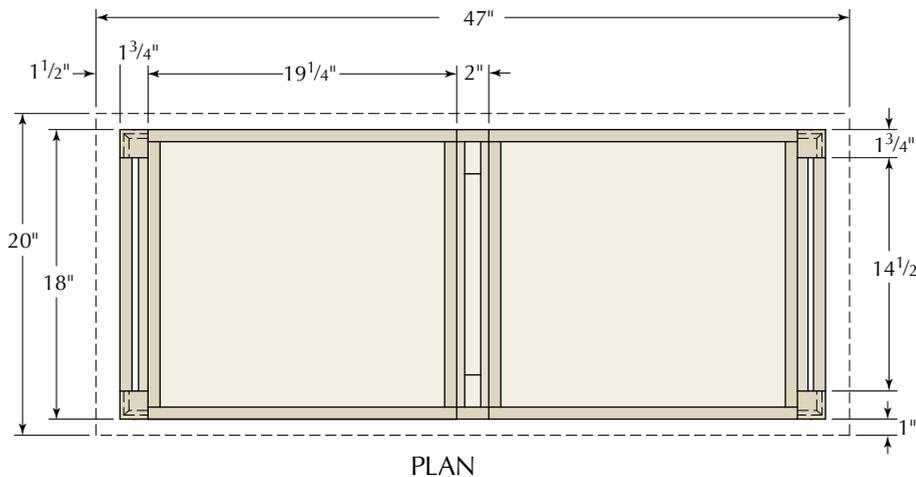
Web Frame

Typically, the web frame on which the drawers rest would be notched around the legs. But I'm cheap (and perhaps a bit lazy) and wanted to use the $\frac{3}{4}$ " pine scraps that were under my bench.

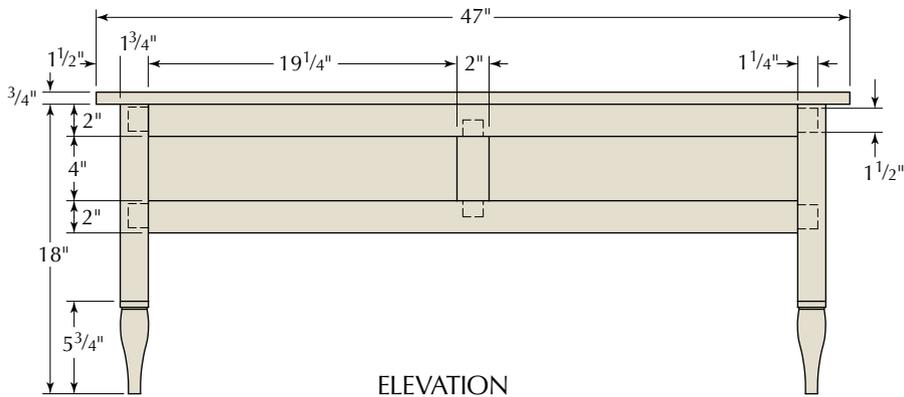
I had no pieces wide enough to work as stiles notched around the legs, and no pieces long enough to use as notched

rails. Nor could I use mortise-and-tenon construction without milling some longer pieces. So instead, I used pocket screws to make a web frame that stretches from end to end on the inside corners. It's simply glued in place to the front and back rails. That made it easy to locate the drawer guides on each

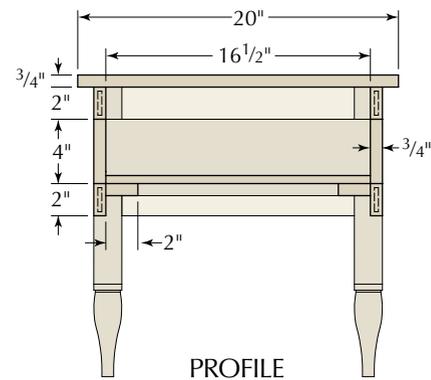
end. I simply butted a $\frac{3}{4}$ " x $1\frac{1}{4}$ " x $14\frac{1}{2}$ " piece in at each end against the frame, then taped and wedged them in place while the glue dried. The $\frac{3}{4}$ " x $\frac{3}{4}$ " x $16\frac{1}{2}$ " interior guides run from center stile to center stile, and were installed with glue after the drawers were done, so I could easily achieve a good fit.



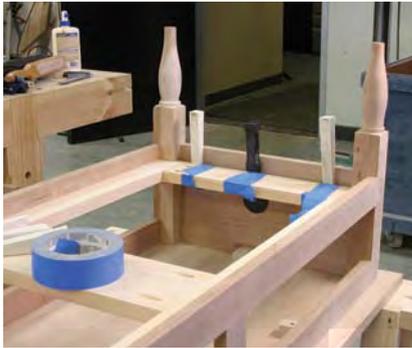
FOOT PATTERN



ELEVATION



PROFILE



Wedge, please. The drawer guides on either end were simply butted against and glued to the web frame. Tape and wedges held them in place while the glue dried.



Falsies. The drawers are through-dovetailed with $\frac{1}{4}$ "-thick pieces of cherry glued to each front. Clamping the glue-up to your benchtop helps to spread the pressure evenly across the face.



Tails of deception. You have to look closely at the completed drawers to tell they aren't constructed with half-blind dovetails.

Drawers

With but two drawers to make, the final steps in the build should have been a cakewalk. Of course, they weren't.

I'd picked out some nicely figured cherry for the drawer fronts; it was a little twisted but it was close to $\frac{7}{8}$ " thick, so I thought that if I cut the four fronts just a little overlong, I'd be able to take out the twist as I milled each front. Nope. By the time the pieces were flat, they were just a hair under $\frac{1}{2}$ " thick – too thin for half-blind dovetails.

But gosh was the figure nice; I was determined to use those pieces as my fronts. So instead of cutting half-blinds for the eight drawer corners, I made through-dovetailed pine drawers that were $\frac{1}{2}$ " too short for the openings, milled the cherry fronts down to $\frac{1}{4}$ " thick and cut them to size, then glued

them on to each pine front. Had I been a little smarter, I'd have used cherry for the front substrate and you'd not be able to tell they weren't through-dovetails. But the drawers were glued up by the time I realized that, and they fit well – it seemed like asking for more trouble to remake them.

One of my drawers was a wee bit short of perfectly square, so I had to add a narrow shim on one guide to even up

Supplies

Rejuvenation

rejuvenation.com or 888-401-1900

8 ▶ square bin pull, oil-rubbed bronze #C1481, \$10 ea.

Price correct at time of publication.

the reveals. Once everything looked good and fit tightly, I planed a couple thousandths off the bottom side of each drawer and waxed the guides for a smooth ride.

After sanding the base up to #220-grit (the top is planed), I sprayed on two coats of amber shellac topped with two coats of dull-rubbed-effect pre-catalyzed lacquer, then went over it with a brown paper bag to remove any dust nibs and dull the finish a bit more.

While the design picks up on the other pieces in the room, the height was determined by the height of my couch cushions. I wanted to stretch out my legs and not have the edge of the table bite into my calves. But after I got the table in place, my ratty old couch looked even worse in comparison ... so I ordered a new one. But I neglected to check the cushion height. I'm waiting for it to arrive, and keeping my fingers crossed. **PWM**

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Shaker-inspired Coffee Table

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
4	Legs	1 $\frac{3}{4}$	1 $\frac{3}{4}$	18	Cherry	5 $\frac{3}{4}$ " turned foot
4	Rails	$\frac{3}{4}$	2	43	Cherry	TBE* (1 $\frac{1}{4}$ ")
2	Center stiles	$\frac{3}{4}$	2	6 $\frac{1}{2}$	Cherry	TBE (1 $\frac{1}{4}$ ")
2	End aprons	$\frac{3}{4}$	8	17	Cherry	Split tenon ends
1	Top	$\frac{3}{4}$	20	47	Cherry	
2	Drawers	4	19 $\frac{1}{4}$	18	Cherry/Pine	Make to fit
WEBFRAME						
2	Rails	$\frac{3}{4}$	2	40 $\frac{1}{2}$	White pine	
2	End stiles	$\frac{3}{4}$	2	12 $\frac{1}{2}$	White pine	
1	Middle stile	$\frac{3}{4}$	6	12 $\frac{1}{2}$	White pine	
2	Drawer guides, ends	$\frac{3}{4}$	1 $\frac{1}{4}$	14 $\frac{1}{2}$	White pine	
2	Drawer guides, interior	$\frac{3}{4}$	$\frac{3}{4}$	16 $\frac{1}{2}$	White pine	

* Tenon both ends

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For links to all these online extras, go to:
▶ popularwoodworking.com/aug11

ARTICLE: Read our article on several ways to make drawers.

ARTICLE: The article for the bookcase that goes with this table is available on our web site, free.

TO BUY: The article on the matching Shaker stepback can be downloaded from our store.

IN OUR STORE: If you like the Shaker style, get "Pleasant Hill Shaker Furniture."

Our products are available online at:

▶ ShopWoodworking.com

BIBLIOPHILE'S BOOKCASE

BY MEGAN FITZPATRICK

With simple lines and straightforward joinery,
this project yields ample shelf space (and drawers to boot).

This large case-on-case shelving unit is adapted from similar pieces I've seen in private libraries and in stately homes. I also dug up a few pictures from the Sotheby's and Christie's auction sites, where the form is referred to as a "bibliotheque" (also the French word for library).

Those examples, however, all feature intricate mouldings and fancy corbels and are more adorned than would look right in my less-than-stately 1895 home. I do, however, have 10' ceilings and an embarrassment of books, so while I didn't want fancy, I did want big. So I reconceived the form in a Shaker-on-steroids style – the piece is just shy of 50" wide x 90" high. It will fit in a room with standard ceiling heights, but in case I ever needed to use the top and bottom separately, I installed a solid top for the bottom case so it can stand alone (and with the addition of a cushion, it would make a handsome hall bench).

The size did have me fretting about stock costs, so I culled the "shorts" bin at our local lumber store for lower-priced cherry, and found a nicely figured wide piece for the drawer fronts, as well as sufficient stock for the lower case and all the shelves. The shelves are made of some rather homely boards,

but because I added a lip to the front for strength and appearance, you can't actually tell – unless you remove the books and take a close look. I did have to go to the regular-price rack for the upper-case face frame and sides, but I saved money by using poplar for the backboards, which I painted to match the trim in the living room.

Bottom's Up First

First, I cut my parts to rough sizes then surfaced and thickened all the stock but the drawer fronts, and glued up panels for the sides, lower case top and upper case top, and all the shelves. I never cut my pieces to final size until I need them – and then I mark cuts using the project as a guide, not the cutlist. No matter how meticulous I am with the measuring, things are never perfect. But, once my pieces are cut to size, I plane and finish-sand as much as possible before assembly because it's hard to maneuver around a piece the size of a New York apartment.

Because I didn't have a 7"-wide piece for the lower rail, or two 49"-long pieces with matching grain that I could glue up, I had to scab on a 4" x 14" piece at each rail end for the curved feet (the downside of parsimony).

I then traced my pattern onto each foot,

cut it at the band saw and smoothed the cuts on a spindle sander – but had to resort to hand-sanding where the curve met the flat.

After setting up the mortiser with a 1/4" bit, I made a 1 1/2"-wide mortise for the 2"-wide center stile dead in the middle of the lower rail, then moved to the table saw to cut 1 1/4"-long tenons on each end using a dado stack.

Holding the workpiece took a little thought, because the two feet created a not-solid surface on the bottom edge (a good argument for spending a little extra to make the lower rail and feet out of one board – or at least a solid panel glue-up, and cutting the tenons before cutting out the feet). But no worries – a 3"-long offcut clamped to the sliding table did the trick. I cut each tenon face in two passes, first removing 3/4" or so at the end before pushing the end against the fence to remove the remainder of the waste on each shoulder.

The resulting tenon was 6 1/2" wide – on the cusp of too wide to offer sufficient mortise-wall strength – so I split it by sawing out a 1"-wide piece with a coping saw, then chiseled the shoulder flat while removing the remaining waste. I cut 1 1/4" tenons on the upper rail and center stile at the table saw,



Simple shelves. Though it's large, this Shaker-inspired bookcase is fairly simple to make – and three adjustable shelves make it simple to fit books of all sizes.



Scabby feet. Because I had very little extra stock, and not enough with matching grain to glue up a solid panel for the curved bottom rail, I had to scab on the foot piece at either end.



Cut the curve. I traced my pattern onto each foot and made the cuts at the band saw.



Jigged up. Because the feet created a non-flat surface, and the sliding table is shorter than my workpiece, I simply clamped a flat piece of scrap to the fence against which I could hold the rail while I made the tenons.

marked then cut the mortises on the side rails at the mortiser. After I glued together the face frame and set it aside to dry, it was on to the side pieces.

I marked the curved cutout on each piece, then made the cuts at the band saw. (Note: the apex is not centered; it's $\frac{3}{4}$ " closer to the front.) Because the full dado stack was still in place, I went ahead and added a sacrificial fence, then cut a $\frac{3}{4}$ " x $\frac{7}{16}$ " rabbet up the back of each side piece to house the backboards. In retrospect, I should have cut an 11" stopped rabbet, because the backboards don't go all the way to the floor. While the unnecessary 7" portion of rabbet doesn't show, the base would be stronger without it.

I adjusted the dado stack to make a $\frac{3}{4}$ "-wide cut, and made a $\frac{1}{4}$ "-deep dado across each side piece 7" from the bottom (the top edge of the dado is flush with the top of the lower front rail) to accept the web frame, which is joined with pocket screws. I glued the web frame into the dados on each side, squared it up and tightened the clamps. After the glue dried, I glued on the face frame and attached a rail across the top of the back, flush with the backboard rabbets, with pocket screws.

Upper Case

First, I cut the mortises and tenons for the face frame and glued it together (luckily, no one had adjusted the mortiser from when I did the lower face frame). I made it about $\frac{1}{8}$ " oversized on the sides (as I did with the lower case face frame), so I could flush it easily to the sides later with a flush-trim router bit.

Then it was on to the side pieces, and cutting dados for the bottom and middle fixed shelves. Workholding was tricky here, because the side pieces are $70\frac{1}{2}$ " long—well over the edge of the saw table. So, I clamped a handscrew around the crosscut sled fence, on which to rest the overhanging part. This, however, meant I couldn't use the stop on the sled, so a stepoff block on the fence solved the problem to locate the $\frac{3}{4}$ " dados for the fixed bottom shelf.

I also cut $\frac{3}{4}$ " dados in each side $30\frac{3}{8}$ " from the bottom for the center fixed shelf, and marked and drilled holes for the adjustable shelf pins. The locations were figured from a graduated shelf progression—but with the remaining three shelves adjustable, it's unlikely that progression will ever be evident.



Split tenon. A 6½"-wide tenon is too big, so I split it using a coping saw then chiseled out the remainder of the waste.

Stiff Lips

With the sides done, I cut the bottom and middle shelves to size (note that the widths are different; the bottom shelf has no lip), and glued a 1½"-wide lip across the front edge of the middle shelf, leaving just better than ¼" of the shelf's front edge uncovered at each end to slip into the dados.

After the glue dried and I sanded the lip flush, I ran a bead of glue in each side-panel dado, set the fixed shelves in place flush with the front edge of the side, clamped across, then toenailed the fixed shelves in place. Be careful with the angle of your nail gun and the length of your nails. I blew through the side once. OK, maybe three times.

While that glue-up dried, I added lips to the three adjustable shelves, keeping them just shy of either end to make shelf adjustment easier (the face frame covers the shelf ends, so the gap won't show).

Next, I added the face frame, and got a little help clamping it up square – there was simply no way for me to reach corner to corner to pull things into place without assistance. Then, I pocket-screwed a rail at the top edge to which I later attached the backboards.

Topping Things Off

I cut the upper- and lower-case tops to size, and rounded over the edges with #80-grit sandpaper until I liked the way it looked, then progressed through grits to #180 until the shaped edge was smooth.

The lower-case top is attached with L-shaped wood buttons, and has a 1" overhang on the front and at each side; the upper-case top (to which the crown attaches) has a 2⅞" overhang on the front and either side. It's screwed to the back rail, sides and face frame.



Framed. The pocket-screwed web frame was glued into the side panel grooves and squared up before I tightened down the clamps.



More jigs. Again faced with secure workholding problems at the table saw, I used a handscrew attached to the sliding table to support one end, and a stepoff block at the other to safely locate the groove for the bottom fixed shelf.



Toenails. Be sure you have ¼" nails in your gun – or if it's loaded with ½" nails, make sure you angle your shots enough so that you don't blow through the sides. Or keep the nippers handy.



A little help please. With a big glue-up, it's best to rope a friend into helping. By oneself, it's difficult to tighten all the clamps down quickly without things sliding around – or reach corner to corner should you need to square things up. Or click a camera button from 9' away.



Crown moulding. To make a simple crown, angle your stock at 45° to the blade and center the blade on the stock (or cut it just off-center so you have a thicker flat on one edge, if you like that look). Then clamp a long offcut beyond the blade to serve as a fence. Make repeated cuts in each piece of stock, raising the blade a little each time. Stay tight against your fence and to the table. Though I'm not wearing one here, a dust mask would be a good idea.

Bibliophile's Bookcase

NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
		T	W	L		
Upper Case						
□ 1	Upper rail	3/4	5 3/4	47 3/16	Cherry	TBE*
□ 1	Lower rail	3/4	3	47 3/16	Cherry	TBE
□ 2	Stiles	3/4	2 5/8	70 1/2	Cherry	
□ 2	Sides	3/4	11 1/4	70 1/2	Cherry	
□ 1	Bottom fixed shelf	3/4	10 1/2	48 15/16	Cherry	
□ 1	Middle fixed shelf	3/4	9 3/4	48 15/16	Cherry	
□ 3	Adjustable shelves	3/4	9 3/4	48 1/4	Cherry	
□ 4	Shelf lips	3/4	1 3/4	48	Cherry	
□ 1	Top	3/4	14 7/8	55 11/16	Cherry	
□ 2	Crown	3/4	4 1/4	54	Cherry	Rough size
□ varies	Backboards	5/8	varies	70 1/2	Poplar	
Lower Case						
□ 1	Upper rail	3/4	3	47 3/16	Cherry	TBE*
□ 1	Lower rail	3/4	3	47 3/16	Cherry	TBE
□ 2	Feet	3/4	4	14 1/4	Cherry	TOE**
□ 2	Outer stiles	3/4	2 5/8	18	Cherry	
□ 1	Center stile	3/4	2	10 1/2	Cherry	TBE
□ 2	Sides	3/4	12 3/4	18	Cherry	
□ 1	Top	3/4	14 1/2	51 15/16	Cherry	
□ 2	Drawer fronts	3/4	8	21 1/4	Cherry	Size sides, bottom to fit
□ varies	Backboards	5/8	varies	11 3/4	Poplar	
Web Frame						
□ 2	Long rails	3/4	2 1/2	43 15/16	Poplar	
□ 2	Short rails	3/4	2 1/2	12	Poplar	
□ 1	Center stile	3/4	4	7	Poplar	

* Tenon both ends, 1 1/4"; ** Tenon one end

A Dusty Crown

I dislike making crown moulding. It is incredibly dusty, and my arms get an unwanted (but not unneeded) workout pushing 3/4" stock at an angle across the table saw blade. But there's no getting around it. So I had to set up the table saw, suck it up (the dust, that is) and get it done. And then there's the sanding. Lots of sanding.

The simplest way to fit the crown is to invert the upper case, then wrap the moulding around the front and two ends. Secure it to the top, sides and face frame with brads.

Put Your Back Into It

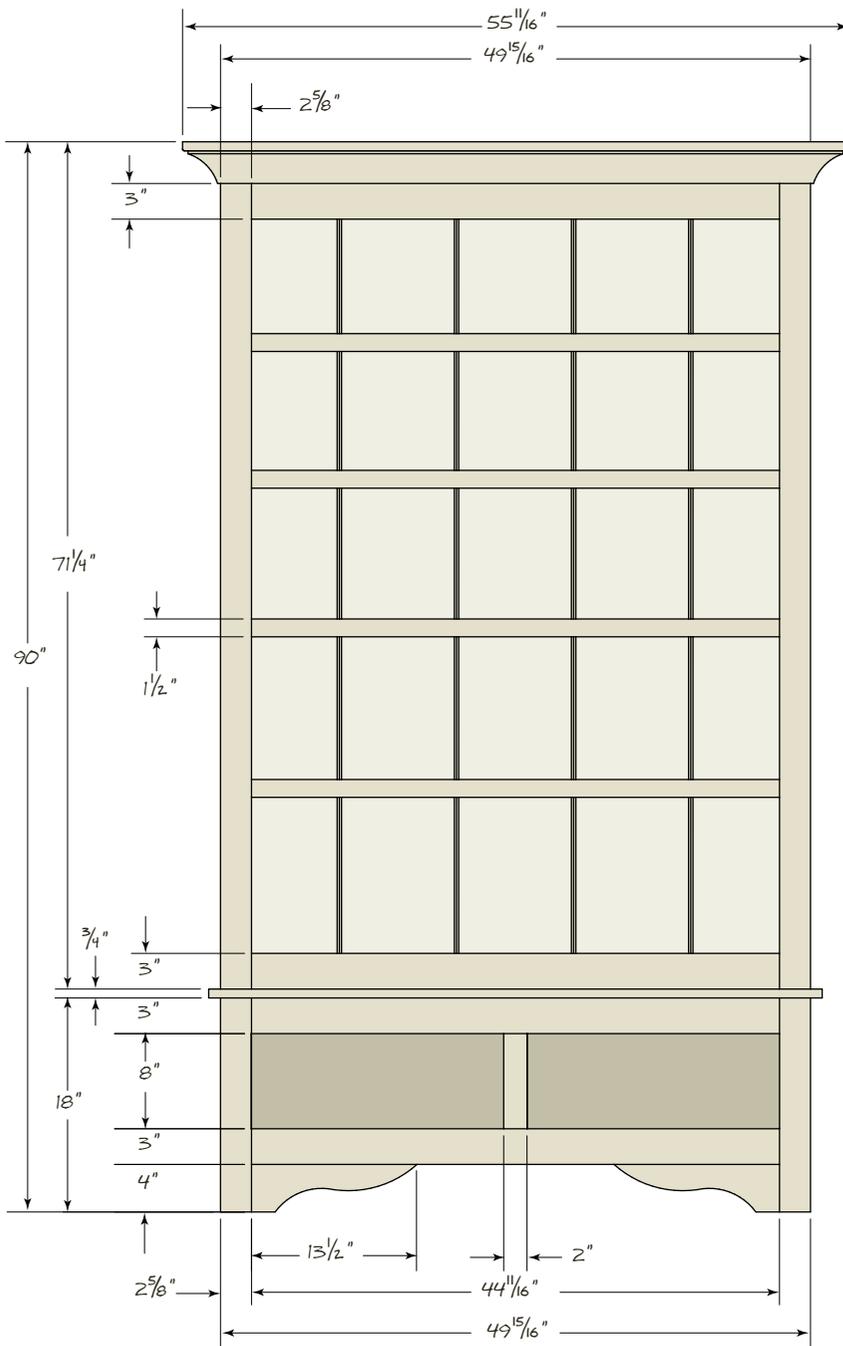
My backboards are shiplapped random-width poplar, and in the upper case they're painted. I did cut a chamfer on the front of each for added visual interest – not that it will show when the case is loaded with books.

In the lower section, the backboards are unpainted and have no chamfer – but they do run vertically to match the top. (If you

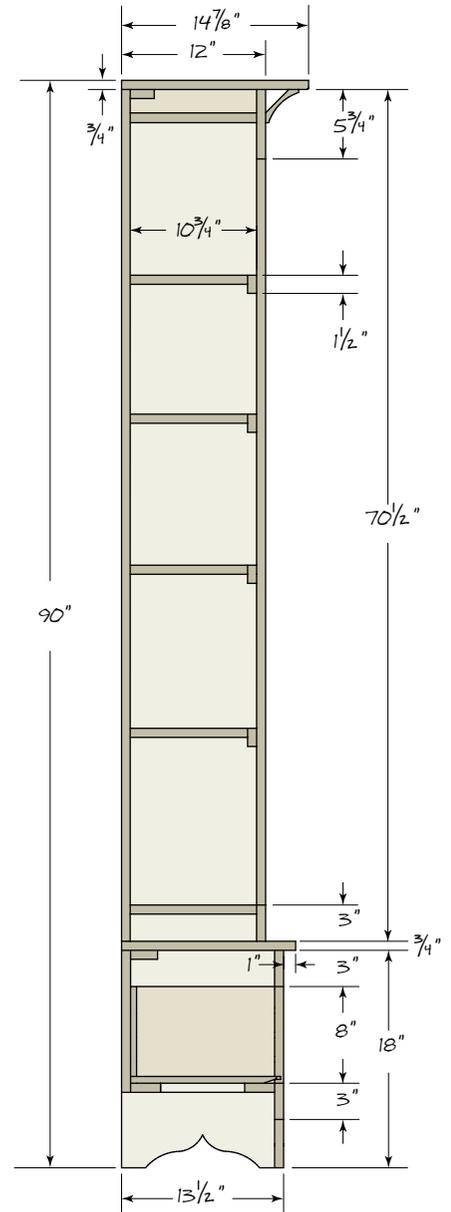
Online EXTRAS

To watch a video of making crown moulding and for more information on fitting crown, go to:

popularwoodworking.com/dec09



ELEVATION



SECTION

have an 11"-wide piece, you could get away with one board, run horizontally. But your co-workers might snicker at the idea.)

Hidden Storage

Last, I fit the inset drawer fronts and constructed drawers with half-blind dovetails at the front, and through-dovetails at the back. The bottom is an upside-down raised panel slid into a groove (the back edge isn't beveled), then secured to the drawer back with a 1 1/2"

shingle nail. I suspect these drawers would have originally housed candles and perhaps paper and writing implements; I'm using them to store extraneous cat toys.

The finish is two sprayed coats of amber shellac (with sanding after each) and a top coat of pre-catalyzed lacquer. **PW**

Megan is managing editor of this magazine. She can be reached at 513-531-2690 x11348 or megan.fitzpatrick@iwmedia.com.

Supplies

Rejuvenation

888-401-1900 or rejuvenation.com

4 ■ square bin pulls in oil-rubbed bronze #EC 7004, \$7 ea.

Rockler

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