

Tri-fold Storage Cabinet

This versatile piece is useful for more than hiding plastic boxes.

Electronic entertainment is a permanent reality in almost every home. Unfortunately the media used to store that entertainment changes quickly. From 8-track to CD and VHS to DVD, our entertainment storage continues to be a tricky proposition.

If these media were as attractive as leather-bound books, that would call for an open bookcase-style solution. But most modern media are, well, pretty ugly. This is especially true if you've gone to the trouble of building attractive period furniture for your home.

After wandering through a home center store and noticing a clever pantry cabinet design, I carried the thought a step further and realized the same multi-layered storage could work next to my entertainment center.

Once the cabinet was finished, I recognized even more uses for this versatile cabinet. It would actually make a very nice dry bar, or you could certainly place it in the kitchen and use it as a pantry. What an idea!

If you would like to see more photos of the construction steps for this cabinet, visit my web site at hueyfurniture.com.

by Glen Huey

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Photos by Al Parrish

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Conception

I went to work deciding what type of storage I'd need. DVDs and CDs were at the top of the list, but I've still got some VHS tapes and LPs sitting around that I wanted to store out of sight as well. I decided a free-standing cabinet would give me ultimate flexibility. And because much of the furniture in my home is early American, I used all these guidelines to work up the storage cabinet shown here.

The main door is capable of holding 150 DVDs, while the interior door will store 125 CDs. The drawer can hold VCR tapes or anything else that might need storing. If you have some LPs in your home, skip the drawer and the lower section will hold them.

Overall Construction

The cabinet is essentially a box with two layers of doors. I simply added a period-appropriate base and crown to dress it up. The outer door is of raised-panel construction to continue the look of finished furniture.

Because of the weight the cabinet would be supporting, I used torsion-box design for the top and dado joinery to hold everything tight and square.

Box First

Construction starts with the box of the cabinet. I built the piece out of solid cherry and poplar, with one exception – a plywood back to add even more rigidity when compared to a solid-wood shiplapped back.

Start with the two sides. The left side is a normal rectangle, but the right side is L-shaped to allow space for the second door. To save a bit of lumber, create the right side of the cabinet by gluing the short piece to the long piece with the top of the short piece held 15" up from the bottom edge.

Because it's always a good idea to leave some room for trimming in a glued-up panel, that 15" mark may actually be 15½". After the glue is dry, all you need to do is clean up the seam and trim the panel to size.

The other panels that create the exterior box are the sub-top and the bottom. To join these panels together, you need to first cut a ½" x ¾" rabbet at the bottom and top edges of both sides. I use a straightedge and a router bit with a top-mount bearing for this step.

While you're routing, cut a ½"-wide x ¼"-deep rabbet on the back edge of both sides to accept the plywood back. As you work, make sure that you end up with a mirror image in the sides, except for the notched area.

Because of the depth of the two doors, the base and sub-top of the cabinet extend forward beyond the sides of the cabinet. To make these pieces look and fit right I notched both the top and bottom pieces to fit around the sides.

To set up the table saw to notch the sub-top and bottom, you need to locate where the blade moves below the table and ends the cut. To do this, raise the blade to ensure that it will cut the required thickness, then with a square against the fence and the blade, slowly rotate the blade toward you by hand until the square stops traveling. Mark the location.

To make the notches, mark the location on the pieces where you want the cut to stop (12¾" in from the edge), then run the piece into the blade until the lines meet. Finish the cut with a hand saw and chisels, then cut a ½" x ¼" rabbet on the back edges of the sub-top and bottom for the back.



Cutting a full board into the above L-shape is wasteful, so I simply glued two boards together to provide the necessary shape for the right side.

Solid Shelving

The shelves for the inside of the case are permanently mounted in the case using stopped dados. The same alignment and routing set-up as is used for rabbeting the bottoms and the sides is used to produce the $\frac{1}{4}$ " x $\frac{3}{4}$ " dados for the shelves in the case.

There's one last dado to cut, the one for the drawer. I used a drawer design that allows the $\frac{1}{4}$ "-thick drawer bottom to extend beyond the width of the drawer. When

the bottom is slid into these $\frac{1}{4}$ " x $\frac{1}{4}$ " dados in the cabinet sides, no drawer slides are necessary.

Because the shelves are $5\frac{5}{8}$ " wide (the full depth of the narrow part of the case) and the dado is stopped at $5\frac{3}{8}$ ", you need to notch the front corners of the upper shelves. Set the table saw fence to cut a $\frac{1}{4}$ " width, including the blade thickness, and raise the blade to $\frac{1}{4}$ " height. Two passes over the blade with the shelves on their front edges (using your miter

gauge) will produce this notch.

With all the notches and grooves cut, you're ready to assemble the case. Align the sub-top and bottom into position. Use a pilot bit with a countersink and fasten the sides to the top and bottom with screws. Then glue and nail the shelves in place.

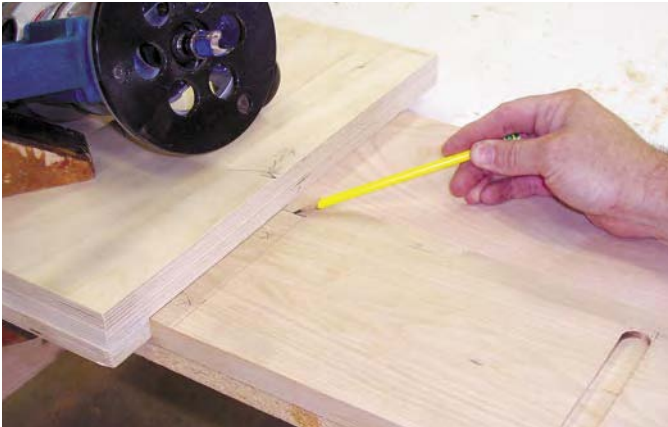
Live, On Stage: The Doors!

Set the case aside to dry and begin the doors by milling the parts to width and length according to the

cutting list. Both doors begin with a 45° -bevel cut at the corners. I cut these on my table saw with the blade tipped over to a 45° bevel.

After the bevels are cut, you can then assemble the front door frame by adding glue to the joints and clamping everything together with a band clamp. Then set it aside and we will return to it later.

The second door requires a couple of other operations before assembling. Cut a $\frac{1}{4}$ " x $\frac{1}{4}$ " groove



To make the dados for the shelves in the case itself, set the bit to cut a $\frac{1}{4}$ " in depth and run the groove in $5\frac{3}{8}$ " from the back edge of the cabinet for the upper shelves, and all the way through for the full shelf that is at the 15" mark produced in the first step.



If you choose to add the drawer, cut one other dado in the sides. Set up a dado blade to run a $\frac{1}{4}$ " groove that is a $\frac{1}{4}$ " deep. The drawer bottom will slip into this groove and serve as a drawer slide.



After notching the front edge of the shelves, slide them into the stopped dados in the case. Then nail them through the outside of the case with a small finish nail.



As you attach the sub-top and bottom with screws, notice that each piece is notched to extend past the width of the sides and fits into a rabbet.



Use biscuits to attach the narrow shelves in the inside door. Add glue to the biscuits and assemble the unit. Clamp, check for square and allow the glue to dry.

along the back edges of all the frame pieces for the back.

Next, cut a $\frac{1}{4}$ " x $\frac{1}{4}$ " groove, $\frac{1}{2}$ " in from the front edge of the door bottom and the two shelves. These grooves will hold the retaining strips that we'll get to in a minute.

Now lay out the position of the two shelves in the second door. I used biscuits to attach the shelves to the sides. Cut the slots for two #20 biscuits in each end of each shelf. Glue the two shelves between the sides. After this is dry, glue the top and bottom of the door in place and clamp with a band clamp.

Tapered Retainers

In building this piece, I challenged myself to find different methods to use in construction. After using the jointer many times to make tapered legs, I decided to use the same process to make the retainer strips that fit into the grooves in the shelves of the second door.

The retainer pieces are called out in the cutting list as $\frac{3}{4}$ " x $1\frac{1}{4}$ " x $21\frac{1}{2}$ ". Each piece will yield two retainers, so you need to run the tapers on two pieces.

Begin by setting the jointer depth to cut one-half the height of the total taper. In this case a $\frac{1}{4}$ " (half of the $\frac{1}{2}$ " taper), and mark

a line that is one-quarter of the length of the retainer (I wanted the piece to peak at the center). Run the board over the jointer up to that line on both ends. Then start with either end and rock the piece until the corner rests on the infeed table and run the final pass to complete the tapering of the retainer. Reverse the piece and repeat the last step.

To finish off the retainer strips, run a bead detail on both sides of the top, tapered edge, using a $\frac{1}{4}$ " corner bead bit. Then resaw the piece to the needed $\frac{1}{4}$ " pieces, leaving the center section as waste. The strips are then glued into the

grooves created in the bottom and two shelves of the door.

Spline Reinforcements

The corner miters for both doors, as well as the drawer box, are reinforced with glued-in spline keys to add strength.

I created the slots for the splines on the table saw, using an auxiliary fence set up. You can arrange the splines in a design or simply fit the cuts to the mitered end. Then, make the spline keys to fit and install them with glue.

Front/Back for the Door

The next step is to create the front of the cabinet, which is also the back of the front door. The front is a twin raised-panel facade. Begin by cutting mortises for the intermediate vertical frame piece (or muntin) in the top and bottom rails as well as the needed mortises at both ends of the stiles that will accept the rails. Then, begin the process of cutting the tenons.

While all four shoulder cuts for the muntin are cut at $1\frac{1}{4}$ ", the rails need to have a haunched tenon as shown below. Complete the cheek cuts with the tenon jig on the table saw and the edge cuts at the band saw.

To create the groove for the

To form the "peaked" retainer, run the piece over the jointer to the quarter-length line on both ends. Then flip the piece and kick the front end up and make another pass on of the retainer.



An auxiliary fence on your table saw makes cutting the spline groove simple. Lay out a 45° angle and attach guide sticks as shown. Raise the blade to cut as much as possible without penetrating the interior of the door and make the cuts.



After the glue on the splines has dried, trim the keys to the piece with a flush-cutting hand saw, then sand to a smooth finish.



After defining the face shoulders for the tenon for the front door panel, offset the edge shoulder to create a haunch on the tenon. That offset is $\frac{3}{8}$ ", or the depth of the groove that will hold the raised panels.

panels I like to use a three-wing 1/4" slot cutter on my router table. Assemble the frame without glue and make any necessary adjustments to the pieces. While the frame is together, check the mea-

surements of the panel spaces. Add 5/8" to the opening to arrive at the final sizes of the panels.

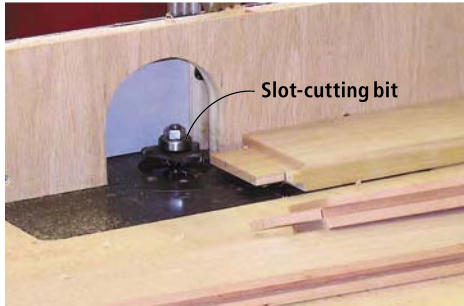
Next, mill the panels to size and raise their edges. You can use a router bit, the shaper or a table

saw to raise the panels. Once complete, assemble the entire front and allow the glue to dry.

When the front is ready, check the fit of the panel to the door frame. Glue the panel to the frame leaving an even overhang on all sides. Clamp the front in place and set it aside to dry. Then use a straight router bit with a bottom-mounted bearing to trim the panel to the frame, then sand flush.

last step before fitting the front door to the case. Locate and drill a 5/16" hole that is 2" above each shelf and the door bottom, and 3/8" from the back edge of the door. Then simply bow the dowels and spring them into the holes.

To cut the panel groove, set up an auxiliary fence on your router table. Align the cutter with the tenon, and cut the groove on the interior edge of the door rails and stiles and on both muntin edges.



Front Door Storage

Next up is the shelves and retainer dowels for the front door. I chose pocket screws here because I wanted to remove the shelves to make finishing easier.

The dowel retainers are the

Home Base With Feet

The base frame is mitered at the front, but not at the rear. To make the base frame, mill the pieces to size, miter the front corner pieces, then lay out and cut the mortises in the base frame sides. To get an accurate length for the base frame back piece, lay out the location of two tenons on the base back using the base front as a guide.

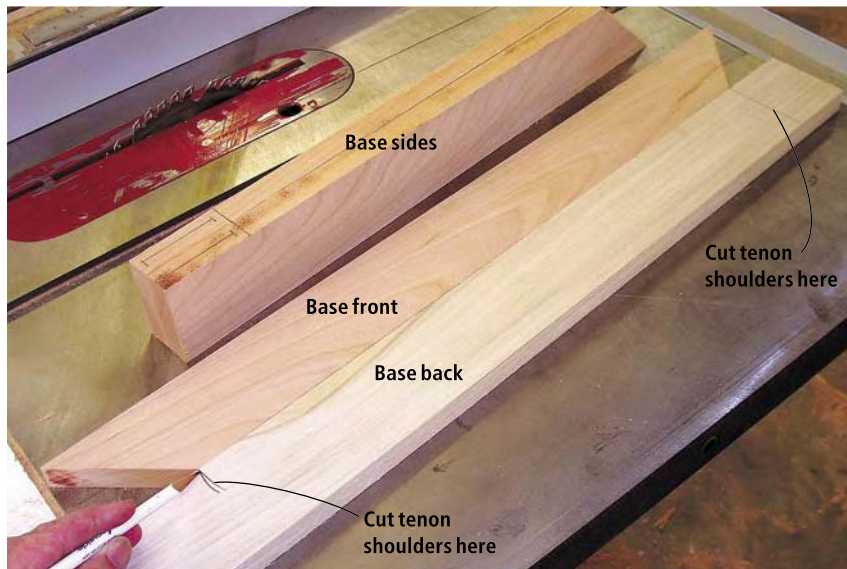
Cut biscuit slots in the mitered



Glue the door panel to the door frame, allowing an even overhang on all sides. Check the door for square after glue-up.



Using pocket hole screws to attach the shelves allows you to remove the shelves to make finishing easier.



Transfer the tenon width to the end of the back. Then position that line at the rear edge of the angle cut in the base frame front and mark the opposite end also at the rear of the angle cut. Cut the back to the mark.



Remember when making the 45° cut for the splines that you need to adjust the blade height as well. Then make the splines that will fit into the slots and glue the front feet together.

ends of the front and sides and make tenons to match the mortises in the ends of the back. To assemble the unit, apply glue to the mortises, then slip them together. Glue the biscuits and apply the remaining clamps. You will be able to apply the necessary pressure to each clamp to align the mitered ends and close up any gaps.

To give your cabinet legs (or in this case, feet), select and mill the material for your front and side feet, then use the pattern to cut the profile of the pieces (shown at right) at the band saw.

The front feet pieces are joined together at a miter, so the next step is to miter those mating edges. Because the blade on a table saw tilts only one way, and you want as large a surface as possible to support the foot during the cut, you'll have to do some shifting to miter the mating feet.

Two feet are cut using the miter gauge in the normal method. To miter the mating feet you need to reverse the miter gauge (still in the same slot) with the auxiliary fence at the outfeed end of the table saw.

Set the A foot to the blade in order to determine where to set a stop block to keep the foot from moving away from the blade while cutting. Position the B foot with the face up and the top edge against the fence. Push the foot through the blade while holding it flat to the table and tight to the fence. The miters need to be cut in only the four pieces selected to be the front feet of your piece.

With the feet cut to matching angles, leave the blade at 45° and move your fence to the blade to make the first cut for a spline. Geometry is your friend here. With the blade set to cut at a 45° angle, making a cut into the mitered corner of the foot results in a cut that will line up with the groove in its mate. Raise the cut

to just over 3/8" and make a pass on the saw. Reposition the fence so that a second pass over the blade will produce a 1/4" groove. The side and back feet are joined with screws. Place the back foot into a 3/4" x 5/8" rabbet made in each side foot, add glue and attach.

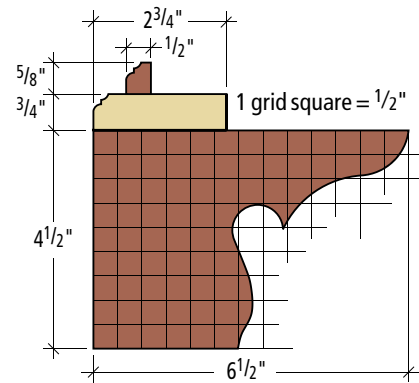
The completed foot assemblies are then attached to the base frame. After the glue is set, add glue blocks to all corners of each assembly.

Sand the base to 180 grit, profile the edge with your favorite router bit, and attach it to the case with 1 1/4" screws at the front and halfway down each side. Finish the process with 1 1/4" nails along the balance of each side and the back edge. Next, add the transition moulding that also has a routed edge.

Hanging the Doors

The doors for this project are built to fit exactly, as in no additional room for hinge gap. Therefore, before each door is hung you need to create a rabbet in the edge of the hinge side of each door to compensate for the hinge spacing.

When attaching the hinge, use



Foot pattern



The screws at front and middle of the base hold the two assemblies tight at the front and force any wood movement to the back where the nails will allow slight movement.



In order to avoid any cross-grain construction problems, the grain in the front-to-back pieces runs the same direction as the grain in my top.

the hinge as a template to locate the screws in both the door and the case. Set the two side by side, reposition the hinge, and attach the door to the case. The hinge for both doors will need to be cut to length. A bi-metal blade at the bandsaw or a hacksaw would work equally well.

Torsion Top

I wanted to add support to the top unit of this project because of the amount of overhang that was needed to swing the second

door. I decided to use a torsion box design, building a stable box structure by adding ribs between the top and sub-top.

Mill the material for your top

to size, then rout a 1/2" roundover profile on the front and sides. Set the top in place on the cabinet and draw a line around the case top, defining its location on the top.

SUPPLIES

Rockler

800-279-4441 or rockler.com

1 • 1 1/16" x 36" piano hinge
#19241, \$8.99

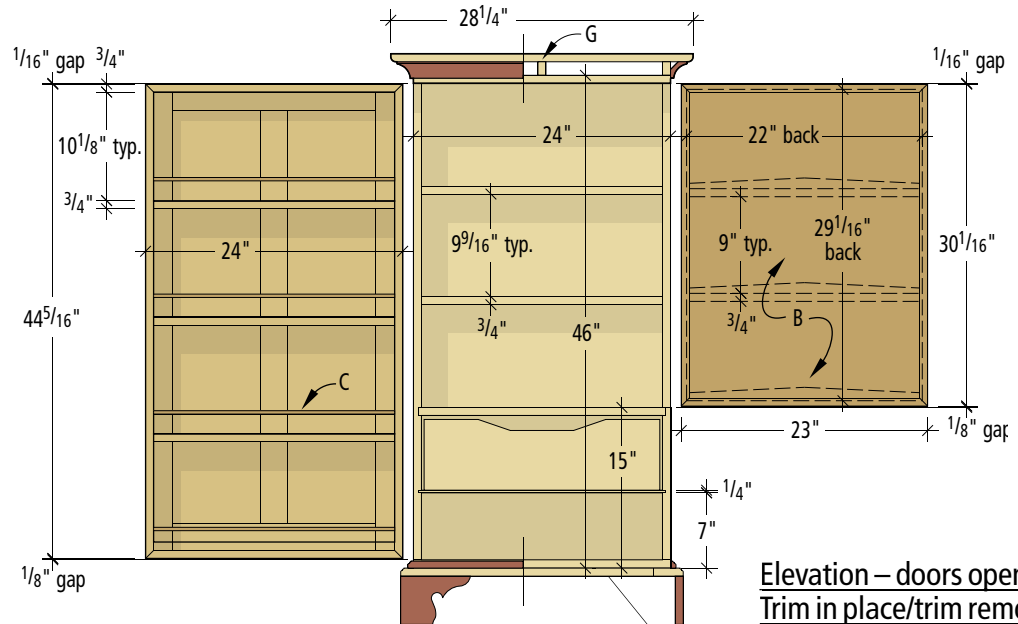
1 • 1 1/16" x 48" piano hinge
#19259, \$9.99

Woodcraft

800-225-1153 or woodcraft.com

1 • draw catch w/eye
#85H98, \$2.99

Prices correct at time of publication.



Elevation – doors open
Trim in place/trim removed

TRI-FOLD STORAGE CABINET

	NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
			T	W	L		
CARCASE	1	Left side	3/4	12 3/4	46	Cherry	
	1	Right side	3/4	5 7/8	46	Cherry	
	1	Right side	3/4	6 7/8	15	Cherry	
	2	Bottom & sub-top	3/4	19 5/8	24	Cherry	
	1	Lower shelf	3/4	12 3/4	23	Cherry	
	1	Case back	1/4	23 1/2	45 1/2	Plywood	
	2	Shelves	3/4	5 5/8	23	Cherry	
	2	Door stiles	3/4	2 1/2	44 5/16	Cherry	
	1	Top rail	3/4	2 1/2	21 1/2	Cherry	1 1/4" TBE
	1	Bottom rail	3/4	3 1/4	21 1/2	Cherry	1 1/4" TBE
FRONT DOOR	1	Muntin	3/4	2 1/2	41 1/16	Cherry	1 1/4" TBE
	2	Panels	5/8	8 7/8	39 3/16	Cherry	5/16" RAS
	2	Stile returns	3/4	6 1/8	44 5/16	Cherry	
	2	Rail returns	3/4	6 1/8	24	Cherry	
	3	Front door shelves	3/4	5 5/8	22 1/2	Cherry	
	4	Dowels	5/16	-	23	Cherry	
	2	Door sides	3/4	6 7/8	30 1/16	Cherry	
SECOND DOOR	2	Door top & bottom	3/4	6 7/8	23	Cherry	
	2	Inner door shelves	3/4	5 5/8	21 1/2	Cherry	
	2	Retainers	3/4	1 1/4	21 1/2	Cherry	
	40	Spline keys	1/8	1 1/4	2 1/2	Cherry	
	1	Door back	1/4	22	29 1/16	Plywood	

	NO.	ITEM	DIMENSIONS (INCHES)			MATERIAL	COMMENTS
			T	W	L		
BASE	1	Base front	3/4	2 3/4	26 1/4	Cherry	MBE
	2	Base sides	3/4	2 3/4	20 3/4	Cherry	MOE
	1	Base back	3/4	2 3/4	23 1/4	Poplar	1 1/4" TBE
	6	Base feet	3/4	4 1/2	6 1/2	Cherry	
	2	Rear feet	3/4	4 1/2	6 1/2	Poplar	
	4	Foot blocks	3/4	3/4	4 1/2	Poplar	
	8	Foot blocks	3/4	3/4	3	Poplar	
	3	Mouldings	1/2	5/8	26	Cherry	Miter to fit
TOP	1	Case top	3/4	21 3/4	28 1/4	Cherry	
	1	Torsion block	3/4	1 1/4	24	Cherry	
	3	Torsion blocks	3/4	18 7/8	1 1/4	Poplar	
DRAWER	3	Cove	3/4	2 1/4	28	Cherry	Miter to fit
	2	Drawer front & back	3/4	6 3/4	22	Cherry	
	2	Drawer sides	3/4	6 3/4	11 1/2	Cherry	
	1	Drawer bottom	1/4	12 1/4	22 7/8	Plywood	
	20	Drawer splines	1/8	1 1/8	2 1/2	Cherry	

Key: TBE= tenons both ends; RAS=rabbets all sides; MBE= miters both ends; MOE=miter one end

I chose to use 1/4" pieces that are countersunk and screwed to the top along those lines made in the previous step. Next, invert the case onto the top unit and attach

the two assemblies with screws. To complete the furniture look of the piece I added a shop-made cove moulding below the top, covering the torsion pieces. The cove

moulding is made at the table saw (See *Popular Woodworking* issue #117 for further information), though you could use a piece of stock moulding if you prefer.

A Drawer and a Finish

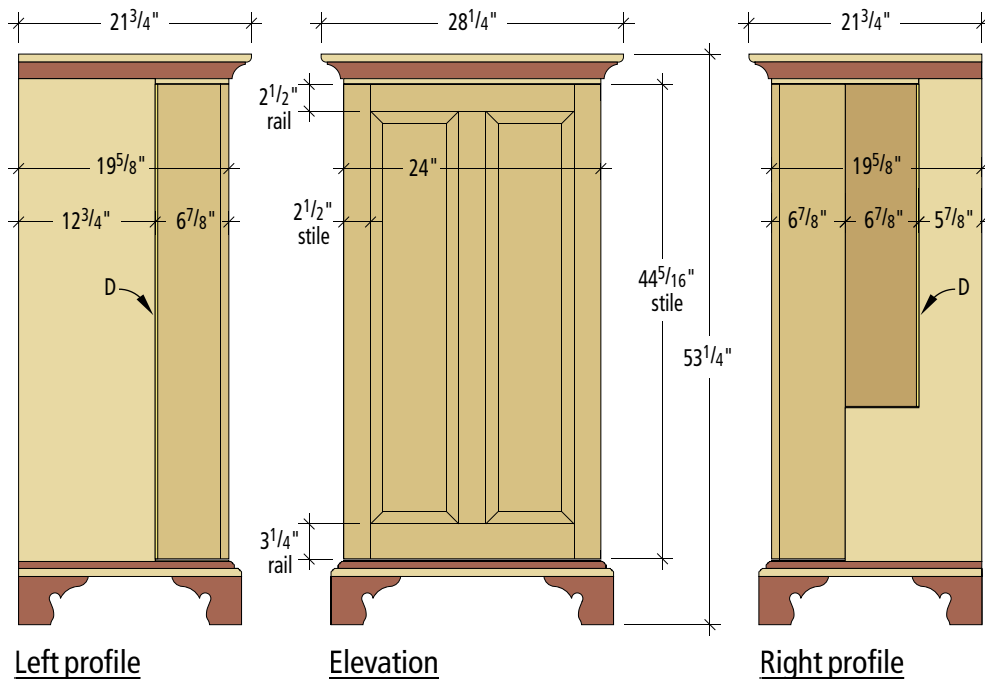
The drawer box for this project is made in the same way as are the door frames. The corners are mitered and then spline keys are added for support. The entire box is set onto a piece of 1/4" plywood where it will slide into the grooves that were dadoed into both sides of the cabinet.

Finally, the front door is attached to the case. Remember to create the rabbet in the hinge side of the door frame that will compensate for the hinge gap. Hang the front door to the case, then make any necessary adjustments.

Before starting to finish the project you will need to cut and fit the plywood for the case back. Do not attach this until after the finishing of the project because you'll want to access the piece from all angles while applying your finish.

I elected to apply a shellac and precatlyzed lacquer finish to this piece—the shellac (GarnetLac) for a mellow shading and the lacquer for protection. This also would have been a great piece for an oil/ varnish finish. From there, just add the continuous hinges and the exterior door latch.

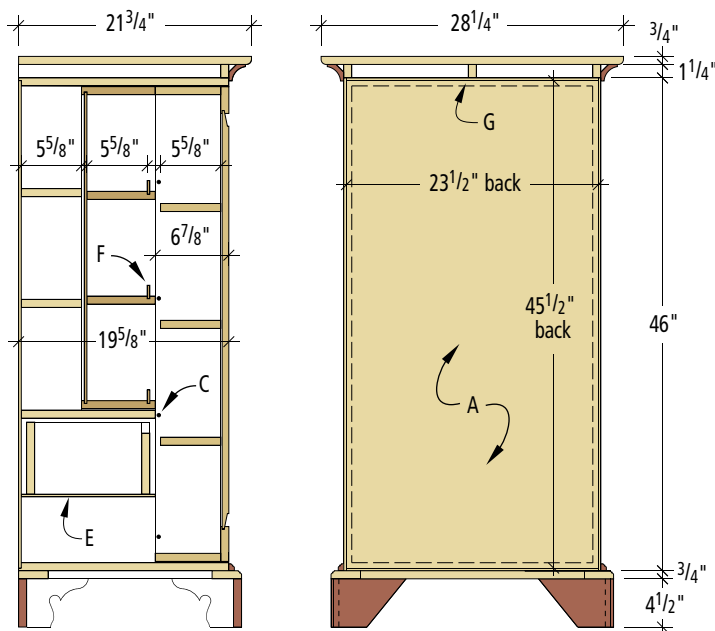
My finished piece is a nice combination of traditional furniture styling with high-tech entertainment storage. I just hope the next electronic "medium" is of a similar size to today's. **PW**



Left profile

Elevation

Right profile



Section

Back

Notes:

- A 1/4" plywood back in 1/2" w. x 1/4" d. rabbet
- B 1/4" plywood back in 1/4" x 1/4" groove
- C 5/16" dowel aligned with front edge of shelf
- D Piano hinge in door rabbet equal to thickness of both hinge leaves
- E 1/4" plywood drawer bottom in 1/4" x 1/4" dado
- F 1/4" thick retainer in 1/4" x 1/4" groove
- G 3/4" x 1 1/4" torsion block



The cove moulding is attached to the torsion buildup, below the top. I used a shop-made cove for this piece.