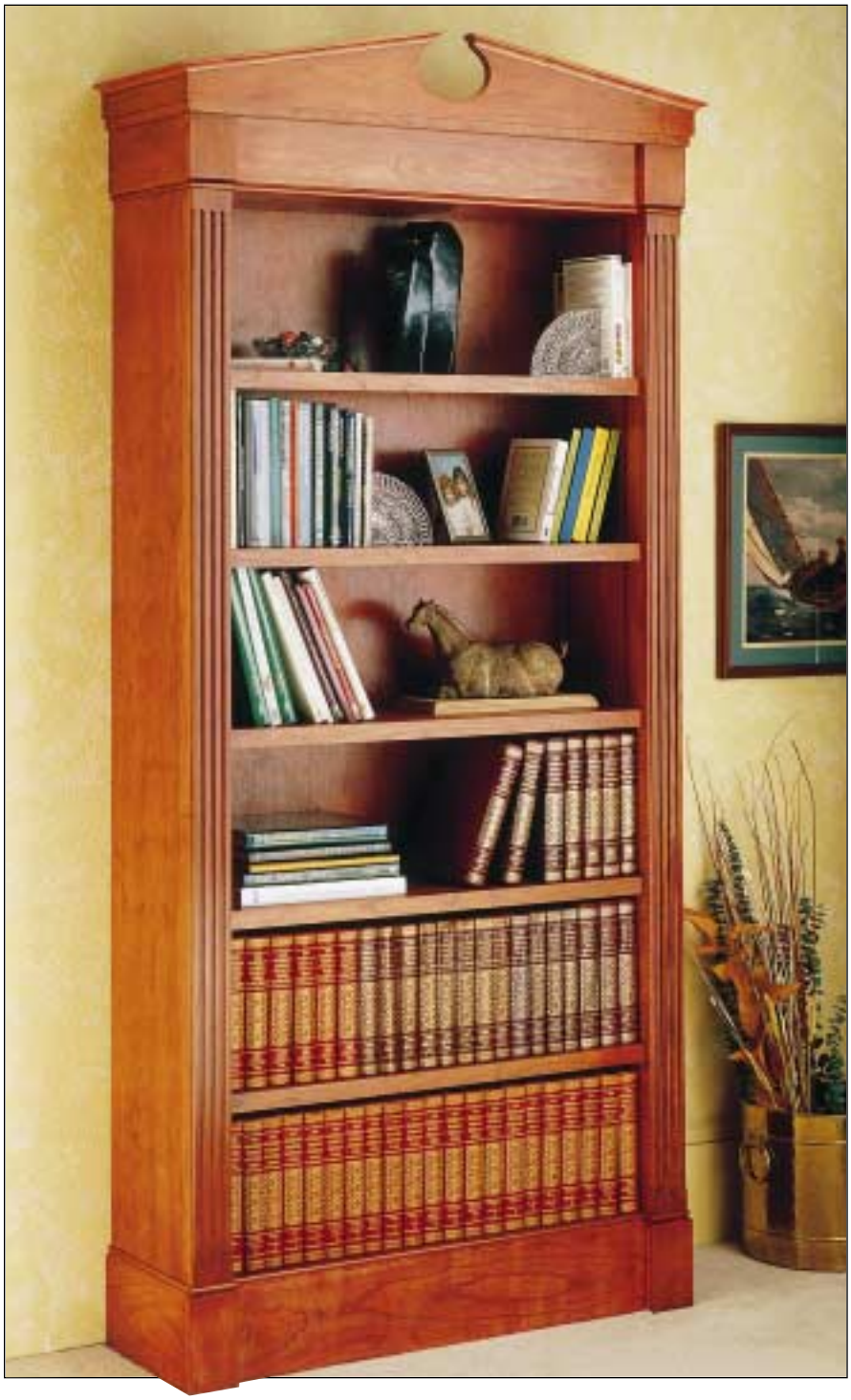
from Woodsmith MAGAZINE

CLASSIC BOOKCASE

It's what you don't see that makes this project unique. Knock-down hardware makes it easy to assemble and convenient to move.



I've always wanted to build a large, formal-looking bookcase. But I had visions of wrestling it around my shop when the time came to assemble and finish it.

The design of this bookcase changed all that. A simple, straightforward system breaks the project down into manageable sized pieces that are easy to handle.

To see what's special about the design, you need to look inside. Here you'll find a "knock-down" system using bolts and nuts to hold things together. Not something you'd expect on a classic piece of furniture.

What makes this system work are the individual components used to build the bookcase. The base, sides, and top are all built as separate units. Once completed you just bolt them together.

And it's just as easy to take it apart. You won't need to hire a moving crew if you get tired of it in the living room.

Another benefit to using components is being able to change the overall appearance. By building a different top assembly, the project takes on a completely new look. For example, the classic top with the oval can be replaced with a straight one; see page 7.

WOOD. A classic project requires a classic wood. And tight-grained cherry and cherry plywood with its subtle grain pattern is perfect. For the back panel I used $^1/_4$" cherry plywood.

FINISH. When it came time to apply a finish I decided to use a cherry stain. I wanted the rich reddish-brown color without waiting for the aging process. And using stain would even out the color differences between the lighter sapwood and darker hardwood.

I stained with Bartley's Pennsylvania Cherry Gel Finish. A gel finish doesn't penetrate as deep as other stains so it isn't as likely to leave dark blotches.

After the stain dried, I wiped on three coats of Bartley's Clear Varnish.

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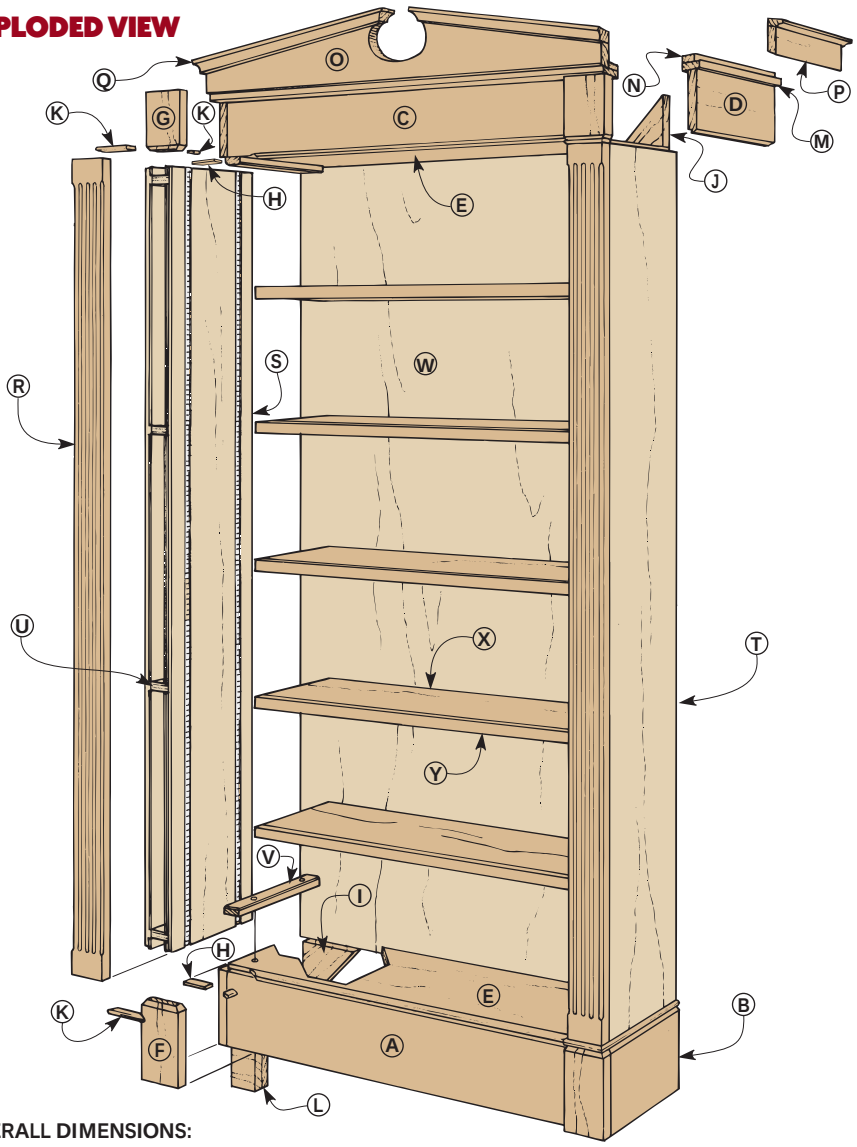
EXPLODED VIEW



OVERALL DIMENSIONS:
91H x 42 7/8W x 13 11/16D

MATERIALS LIST

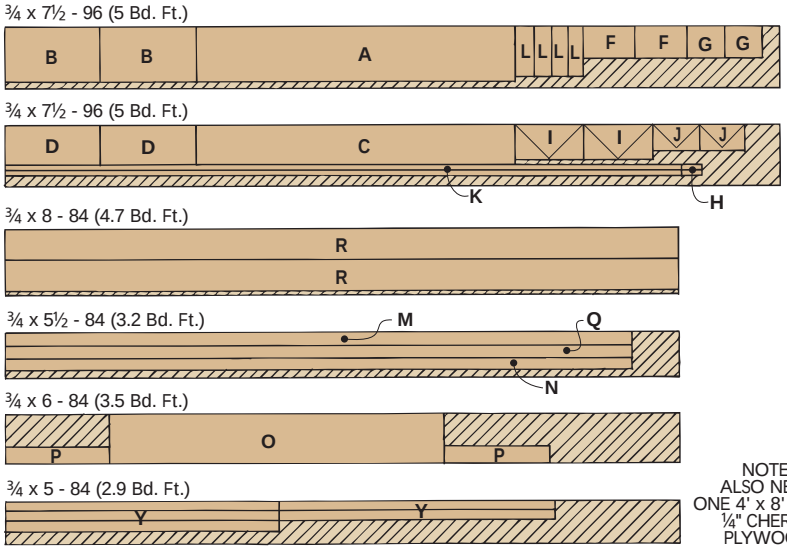
WOOD

A	Lwr. Case Frt. (1)	3/4 x 6 5/8 - 39 5/8
B	Lwr. Case Sides (2)	3/4 x 6 5/8 - 11 13/16
C	Upr. Case Frt. (1)	3/4 x 4 5/8 - 39 5/8
D	Upr. Case Sides (2)	3/4 x 4 5/8 - 11 13/16
E	Top/Btm. Panls. (2)	3/4 ply - 11 3/16 x 39 7/8
F	Lwr. Case Blks. (2)	3/4 x 3 5/8 - 6 5/8
G	Upr. Case Blks.(2)	3/4 x 3 5/8 - 4 5/8
H	Filler Pieces (4)	3/8 x 3/4 - 2 1/8
I	Lwr. Crnr. Blks. (2)	3/4 x 5 - 9 rough
J	Upr. Crnr. Blks. (2)	3/4 x 4 - 6 rough
K	Bead Molding (1)	3/8 x 5/8 - 14 feet
L	Leveler Blocks (4)	3/4 x 5 3/4 - 2 1/8
M	Top Molding (1)	3/4 x 1 3/4 - 78
N	Cleat (1)	3/4 x 1 1/4 - 78
O	Top Front (1)	3/4 x 6 - 44 rough
P	Top Sides (2)	3/4 x 3 - 14 rough
Q	Cove Molding (1)	3/4 x 1 3/8 - 78
R	Fluted Caps (2)	3/4 x 3 3/4 - 84 rough
S	Interior Panels (2)	3/4 ply - 11 1/2 x 72
T	Exterior Panels (2)	3/4 ply - 11 3/4 x 72
U	Ribs (8)	3/4 ply - 2 x 11 1/4
V	Align. Blocks (4)	3/4 ply - 1 1/2 x 11 1/4
W	Back (1)	1/4 ply - 38 1/2 x 73 1/2
X	Shelves (5)	3/4 ply - 10 1/2 x 33 15/16
Y	Trim Pieces (5)	3/4 x 1 1/4 - 33 15/16

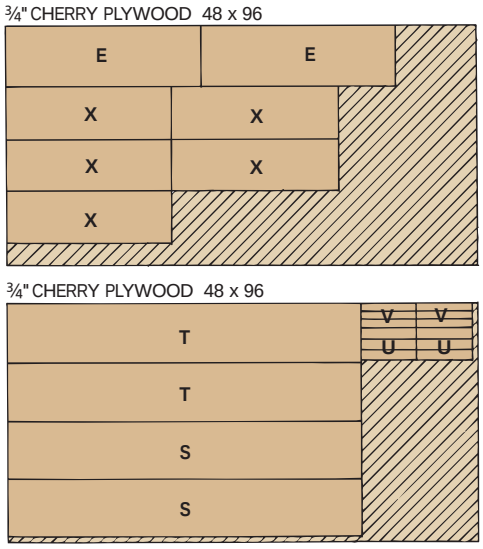
HARDWARE SUPPLIES

(68) No. 8 x 1 1/4" Fh woodscrews
(8) 1/4-20 x 3" Hex head bolts
(8) 1/4" Flat washers
(8) 1/4-20 T-nuts
(2) 1 1/8"-dia. Levelers with T-nuts
(4) 72" Shelf standard brackets (brown)
(52) Bracket nails (brown)
(20) Shelf supports (brown)

CUTTING DIAGRAM



NOTE:
ALSO NEED
ONE 4' x 8' SHEET
1/4" CHERRY
PLYWOOD



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UPPER & LOWER CASE

This bookcase is built in separate assemblies. Normally, I'd build them one at a time. But here, the upper and lower case assemblies are almost identical. (The upper case is 2" shorter.) Building them at the same time reduced the number of setups.

FRONT & SIDES. Both the upper and lower case assemblies start with a front and two side pieces. I began by cutting the lower case front (A) and sides (B) to finished size; see Fig. 1. And then repeated the same steps to make the upper case front (C) and sides (D).

Next, I used a locking rabbet joint to hold the front and side pieces together; see Fig. 2. A tongue cut on the front pieces fits in a $^1/_4$"-deep dado cut on the side pieces. The important thing here is to make the tongue fit snug in the dado.

After cutting the tongue, I rabbeted the top edge of the lower case assembly and the bottom edge of the upper case assembly; see Fig. 3. These rabbets will hold a top and bottom panel which are made next.

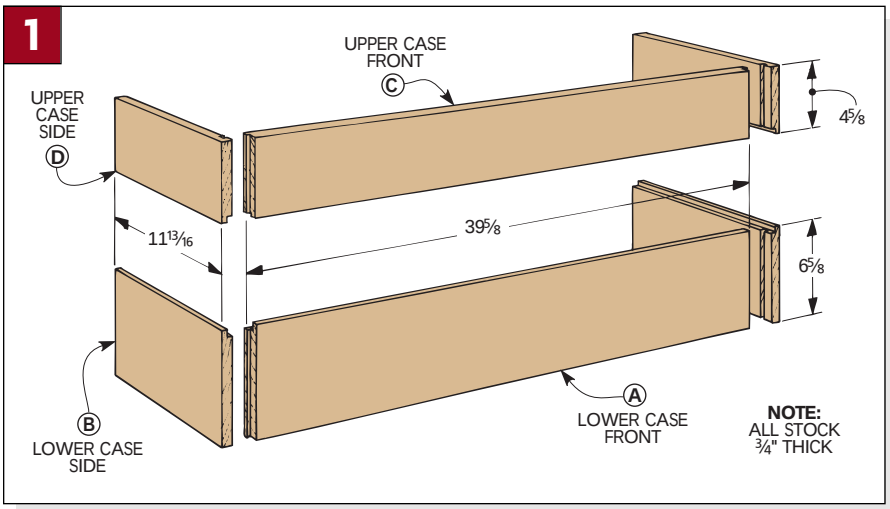
TOP/BOTTOM PANELS. To determine the length of the top/bottom panels (E), dry assemble the fronts and sides and measure the distance between the rabbets on the sides; see Fig. 4.

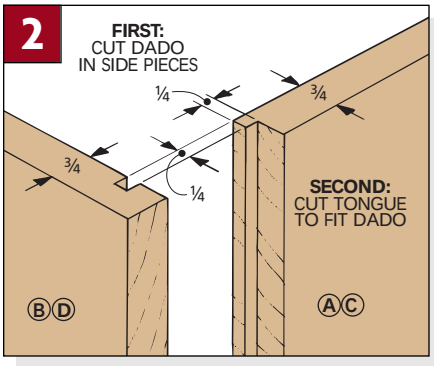
Then to determine the width, measure from the rabbet on both front pieces to the back edges of the sides. But you need to leave room for the plywood back (added later). So the width of each panel is cut so it's $^1/_4$" short of the back edge; see Fig. 4a. In my case, the finished size of both top/bottom panels (E) was $11^3/_{16}$" x $39^7/_8$".

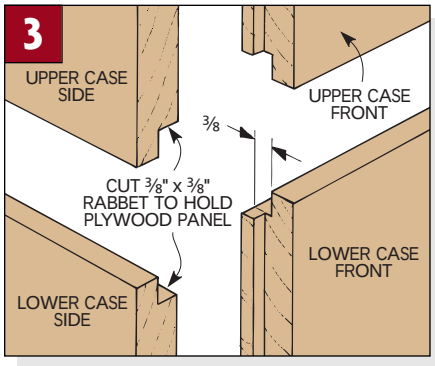
After the panels are cut to size, the next step is to rabbet three edges of each panel (front and side edges); see Figs. 4 and 4a. This rabbet creates a "shelf" for molding that's added later; refer to Fig. 10 on page 72.

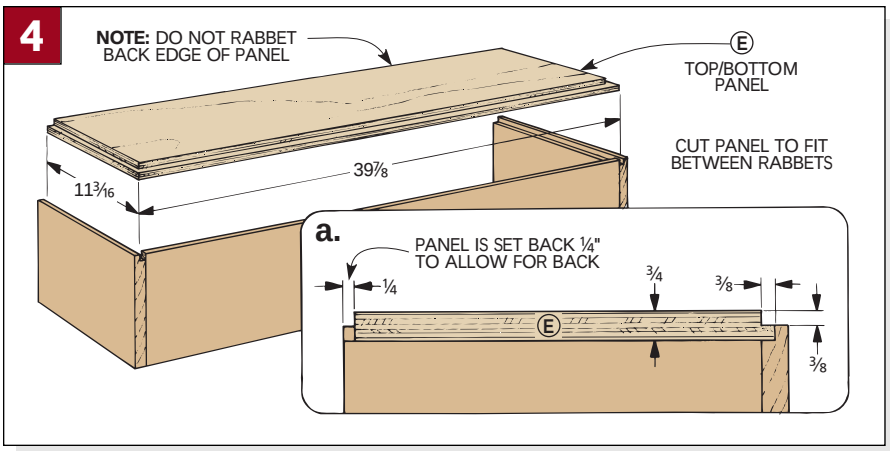
Once both panels have been rabbeted, glue the upper/lower case sides, fronts, and panels together. Clamp the pieces and check that everything remains square.

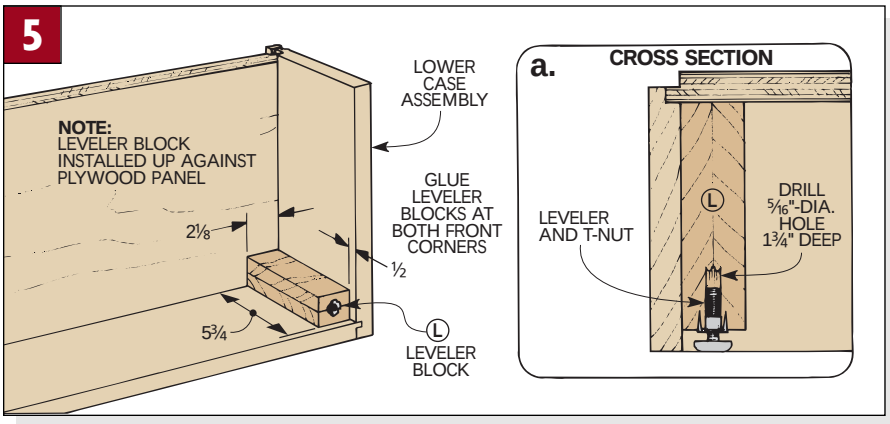
LEVELER BLOCKS. Because the bookcase stands so tall, levelers are added to the lower case assembly to keep the back tight against the wall. To hold these levelers, I added blocks (L) at both front corners; see Fig. 5. The leveler blocks also act as glue blocks and help strengthen the corners.











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Each leveler block is glued up from two pieces of $^3/_4$"-thick stock. A T-nut is installed in one end and the levelers screw into the nut; see Fig. 5a.

When installing the blocks, position them tight against the plywood panel. Then glue and clamp them in place.

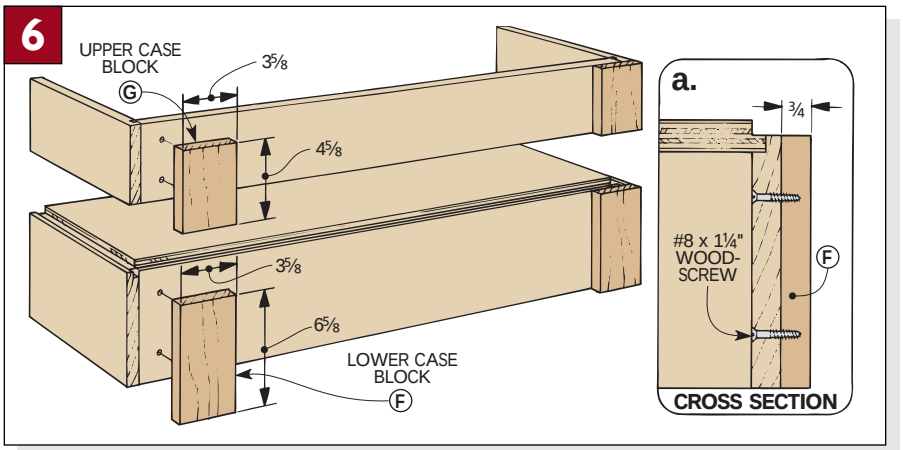
CASE BLOCKS. The next step is to add lower case blocks (F) and upper case blocks (G). The blocks cover up the end grain on the side pieces and give the bookcase a distinctive look.

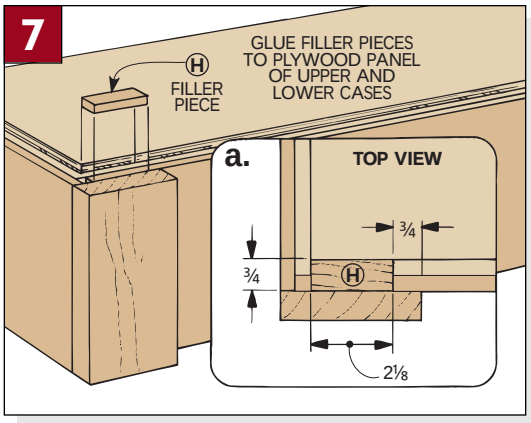
Both sets of blocks are cut to the same width ($3^5/_8$"). But the height of each set is determined by the height of the upper and lower assemblies; see Fig. 6. (Note: For tight-fitting case blocks I made relief cuts on the back faces; see the tip box below.)

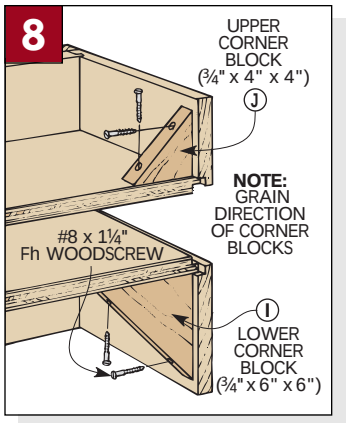
You might be tempted to glue the blocks directly to the front pieces. But the wood grain on the blocks runs in a different direction than the front pieces. So there's a good chance the blocks would "pop-off" if the wood moved from changes in humidity.

Instead, I drilled two shank holes through the case fronts and screwed the blocks in place; see Fig. 6a.

FILLER PIECES. Next I added filler pieces. These act as backing for bead molding that will be glued to the top of the case blocks later. I cut the hardwood filler pieces (H) $^3/_8$"-thick and glued them in place; see Fig. 7.







CORNER BLOCKS. Then I turned the assemblies around so I could glue and screw on lower (I) and upper (J) corner blocks at the back corners; see Fig. 8. These triangular-shaped blocks add support to each assembly. Note: The blocks are installed flush with the back edge of the plywood.

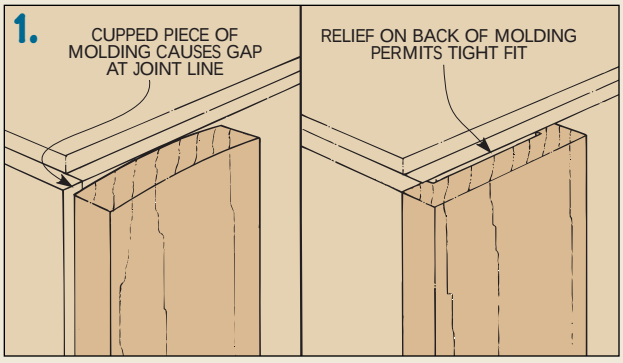
Relief Cuts

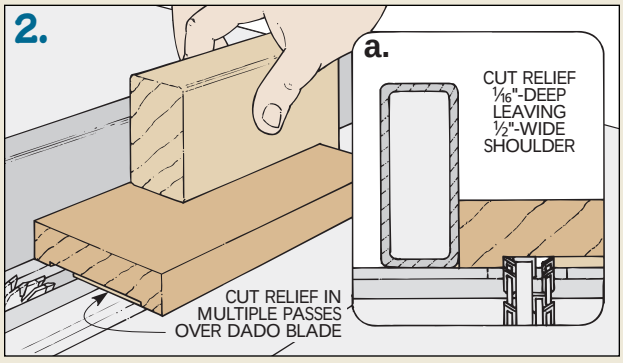
The success of a project depends on the fit of the parts. This is especially true for a piece of trim that's applied to the face of a project such as the case blocks on this bookcase.

The blocks should fit tight to the case along their edges. But if the blocks are cupped even slightly the edges *won't* fit tight; see Fig. 1.

This is the same problem faced by carpenters who install trim molding in houses. Their solution is to use molding that's milled with a shallow "relief" on the back side to fit up tight against a wall.

So I cut a shallow channel across the back side to create relief behind the block; see Fig. 2. Note: In order to avoid weakening the block, only cut the channel $^1/_{16}$" deep.





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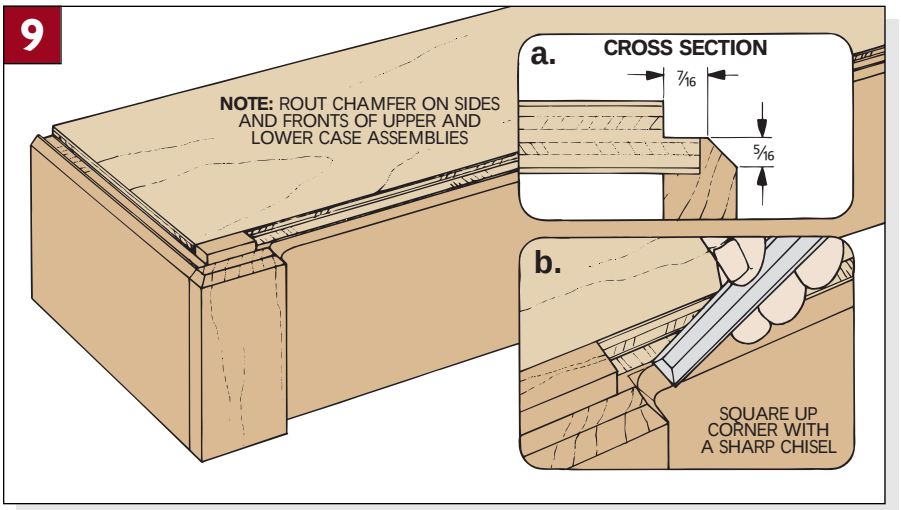
CHAMFER EDGES. After installing the corner blocks, I turned the upper and lower assemblies over and routed a chamfer around three edges; see Figs. 9 and 9a. (See the box below for tips on preventing chipout when routing.)

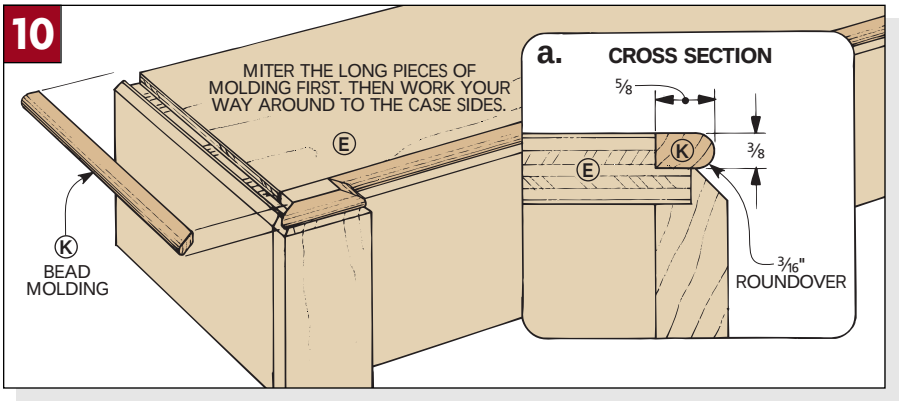
One problem here is that the chamfer bit won't cut a square inside corner. So to clean up the inside corners right up next to the case blocks, I used a sharp chisel and followed the profile of the bevel; see Fig. 9b.

BEAD MOLDING. The next step is to make the bead molding (K). The molding fits on the rabbeted edge on both the upper and lower cases and wraps around the filler piece; see Fig. 10.

First I cut the molding to size; see Fig. 9a. Then I used a $^{3}/_{16}$" roundover bit in the router table to rout a bullnose profile on the front edge of each piece. Note: I made extra molding in case I cut a piece or two that didn't quite fit.

When installing the molding, cut the long pieces first (the ones that cover the lower and upper case fronts). That way if you cut one a little short, it still can be used for the side pieces. Then work your way around to the sides, cutting and fitting the pieces as you go. Finally, glue all the pieces in place.





Backrouting

You can run into a problem when freehand routing around a corner.

That's the situation I faced while building the bookcase. Both the upper and lower assemblies call for chamfers around the sides and front.

If you try to rout these chamfers in the normal way (feeding the router from left to right), you will be approaching the corner of the front trim piece from *behind*; see Fig. 1.

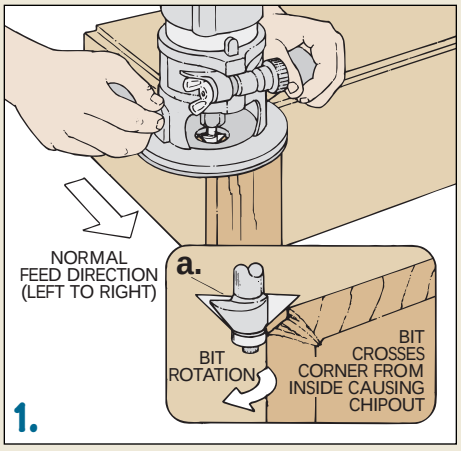
As the router bit exits the corner, it will take a chunk of wood with it; see Fig. 1a. But chipout like this can be avoided by approaching the corner from the front; see Fig. 2.

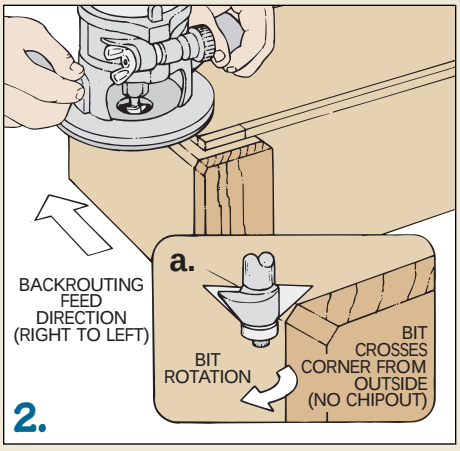
Freehand routing from right to left is called "backrouting." There are a couple things to keep in mind when backrouting.

First, keep a firm grip on the router. In the normal feed direction, the router bit pulls itself smoothly along the workpiece.

But it's different when backrouting. Now the bit tends to "hop" taking little nibbles out of the wood.

The second tip for backrouting is to take light (shallow) passes. Again, the reason for this is control. By taking smaller nibbles, the router bit will do less hopping.





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UPPER CASE MOLDING

At this point, the lower case assembly is done, so you can set it aside for now and start work on the upper case. It's built with several layers of molding.

TOP MOLDING. The first piece is the top molding (M); see Fig. 11. The molding starts out as a single workpiece cut into three pieces. It's the base for the rest of the molding.

Installing the molding is pretty straightforward. Simply miter the pieces so the molding overhangs the sides and the case blocks on the front by $^1/_4$"; see Figs. 11a and 11b. Then glue and screw them in place.

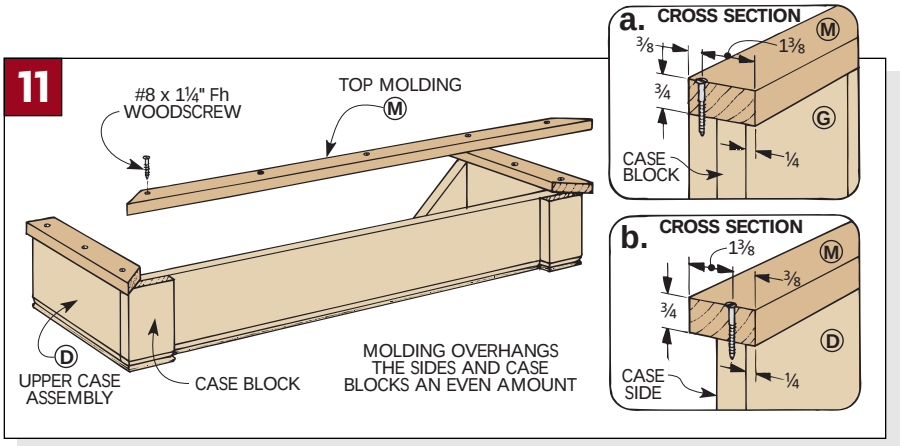
CLEAT. The next "layer" added to the top assembly is the cleat (N); see Fig. 12. The $1^1/_4$"-wide cleat is installed so its back edge is flush with the back edge of the top molding; see Fig. 12a. This creates a $^1/_2$" wide "shelf" for the next layer of molding to rest on.

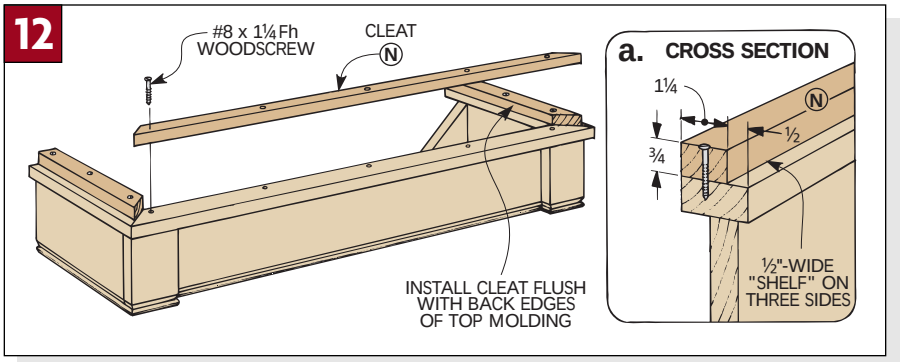
TOP FRONT. Now the top front (O) can be added; see Fig. 13. (Note: For an alternate design, see page 7.)

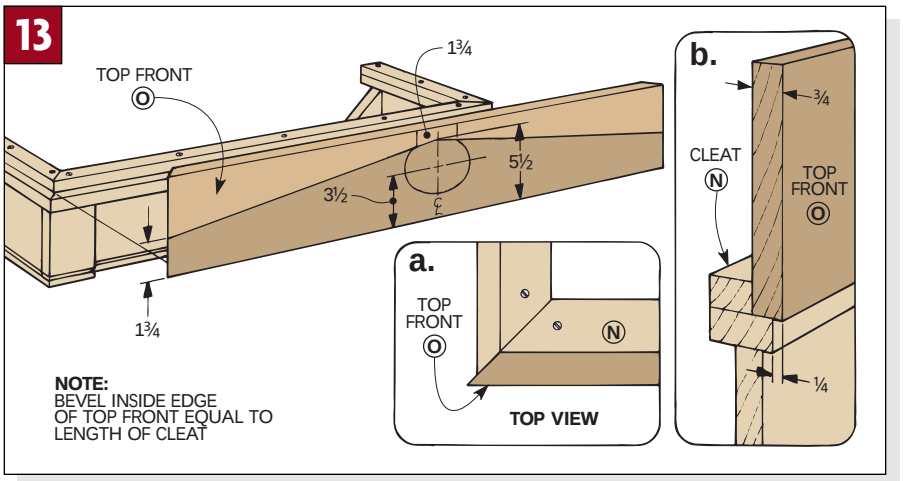
The top front is a beveled piece of molding with two tapered sides and an oval cut out of the middle. I cut the beveled ends first; see Fig. 13a. And then marked the centerline on the length of the board.

From the center of the top front I drew an oval. (For more on drawing ovals, see the box below.) Then I marked the tapered cuts on each side of the oval.

I cut out the oval with a sabre saw close to the line and cleaned up to the line with a drum sander. Then cut the tapers and glue and clamp the top front to the cleat; see Fig. 13b.



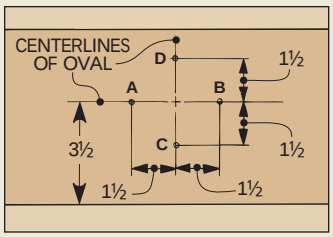




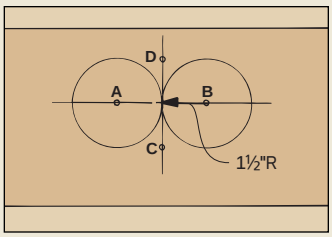
Drawing An Oval

You don't have to be a whiz kid in geometry to draw an oval.

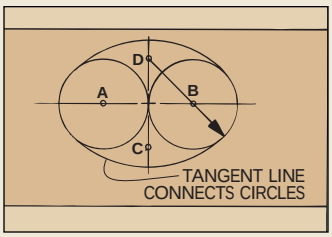
First, only four points need to be drawn. Then all you have to do is draw two circles and two arcs with a compass.



1. From the center of the oval, measure and mark the centerpoints A, B, C, and D.



2. Use centerpoints A and B to draw two 3" circles to form the ends of the oval.



3. Use centerpoints C and D to draw arcs connecting the tangents of the circles.

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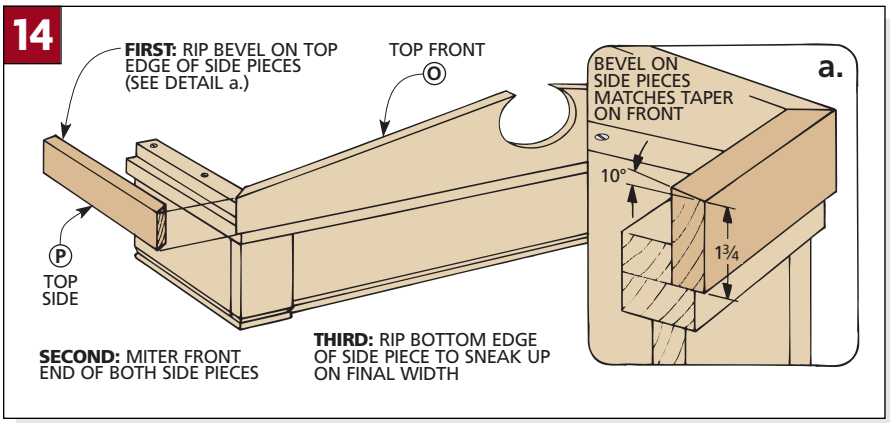
TOP SIDES. Once the top front was installed, I started work on the top sides (P); see Fig. 14. The goal here is to make the sides flush with the tapered edge on the front piece; see Fig. 14a.

The simplest way to do that is by starting with a board that's wider than needed (in my case, 3"). Then rip a 10° bevel along one edge; see Fig. 14a.

Next, miter one end to match the miter on the top front and cut the sides to length.

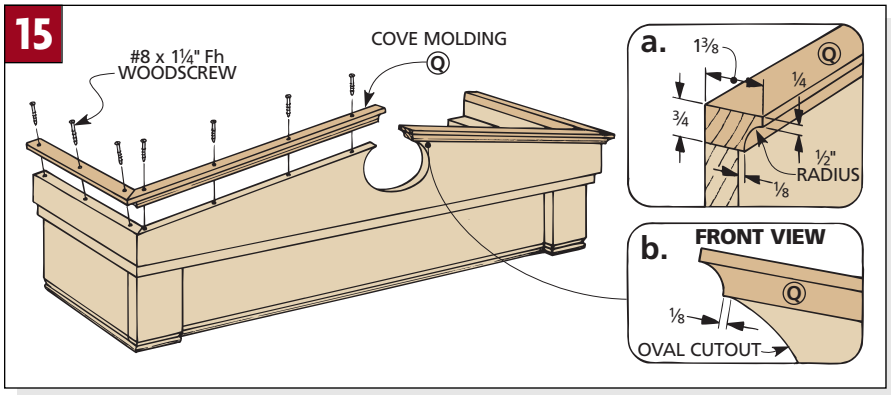
Then sneak up on the final width by making several rip cuts on the edge *opposite* the 10° bevel. After the top edges are flush, glue them to the cleats.

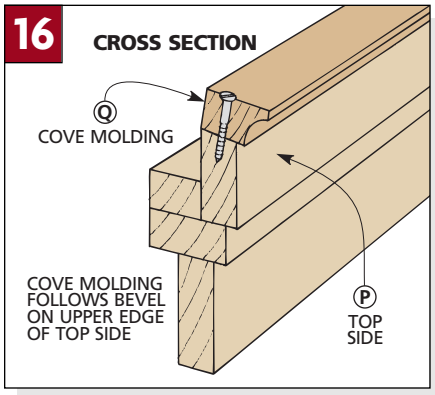
COVE MOLDING. The final piece of molding added to the top assembly is the cove molding (Q). It's attached to the top front and sides; see Fig. 15.



I started by cutting the molding to its finished width (1⅜"). And then routing a ½" cove; see Fig. 15a.

Next, I cut pieces to fit on the sides and front (with overhang over the oval; see Fig. 15b). Then glue and screw these pieces in place. Note: The back edge of the cove molding is installed flush with the inside face of the top front and sides; see Fig. 16.



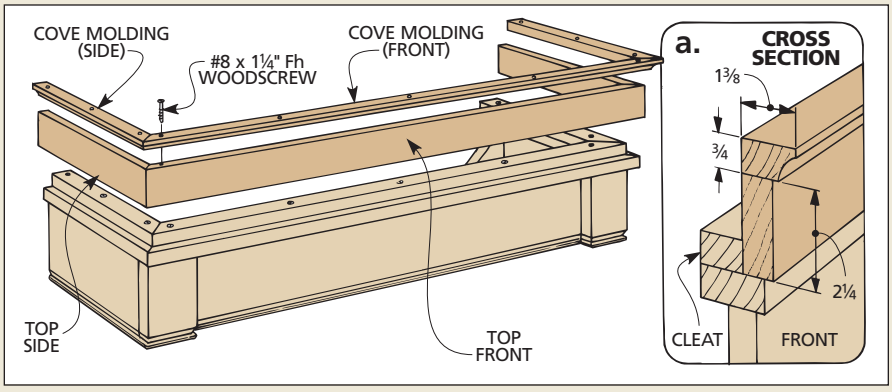


Alternate Top

By changing one component of the bookcase the whole appearance of the bookcase can change. For a simpler approach we designed a top assembly that uses straight pieces.

Actually, this is easier to construct than the other version. There aren't any tapers or bevels to cut on the top front or side pieces.

The cove molding is the same and it's glued and screwed down on top of the top front and side pieces.



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SIDE ASSEMBLIES

Once the top and bottom assemblies were complete I started work on the side assemblies. What makes them unique is they're built with double wall construction. And the space between the walls is for knockdown hardware. This hardware connects the sides with the top and bottom assemblies. A fluted cap on the front hides the hardware.

FLUTED CAP. I began to work on the side assemblies by making the fluted caps (R). They have evenly spaced flutes on the face and half flutes on each edge. To help space the flutes evenly, I used a fluting jig (see page 10).

I used an oversized blank to make each cap; see Fig. 17. They were longer than needed so stop blocks could be clamped on the ends. These blocks stop the jig in the same spot to keep the flute lengths equal.

The blanks were also wider than needed ($3\frac{3}{4}$"). That way the two outside flutes could be ripped in half when cutting the blanks to their finished width; see Fig. 17a.

Now use the fluting jig, router, and a $\frac{3}{8}$"-dia. core box bit (sometimes called a round nose bit) to rout the five flutes in each cap.

Shop Tip: I made a scraper from an old hacksaw blade to clean up some burn marks on the ends of the flutes. Just file a hacksaw blade to a profile that matches the flutes.

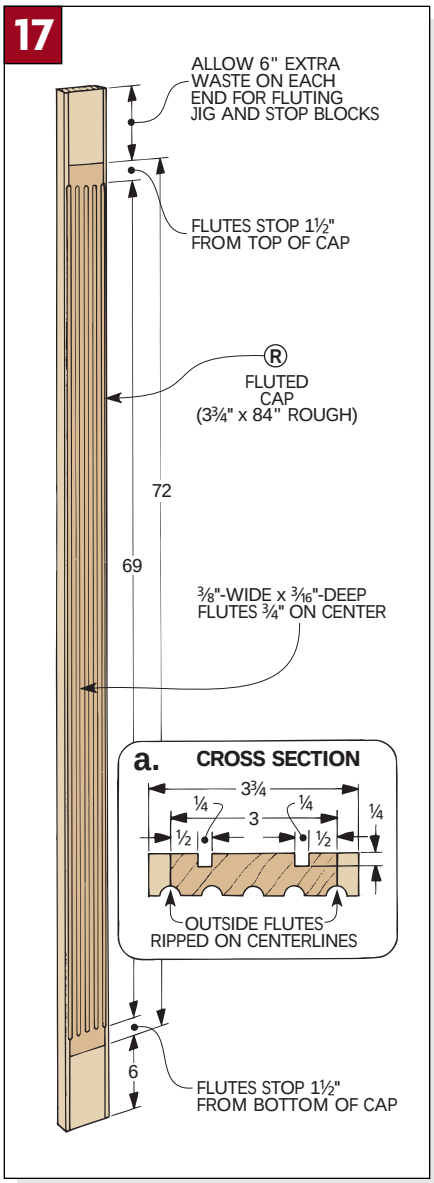
After the flutes are cut, the caps can be cut to finished size; see Fig. 17.

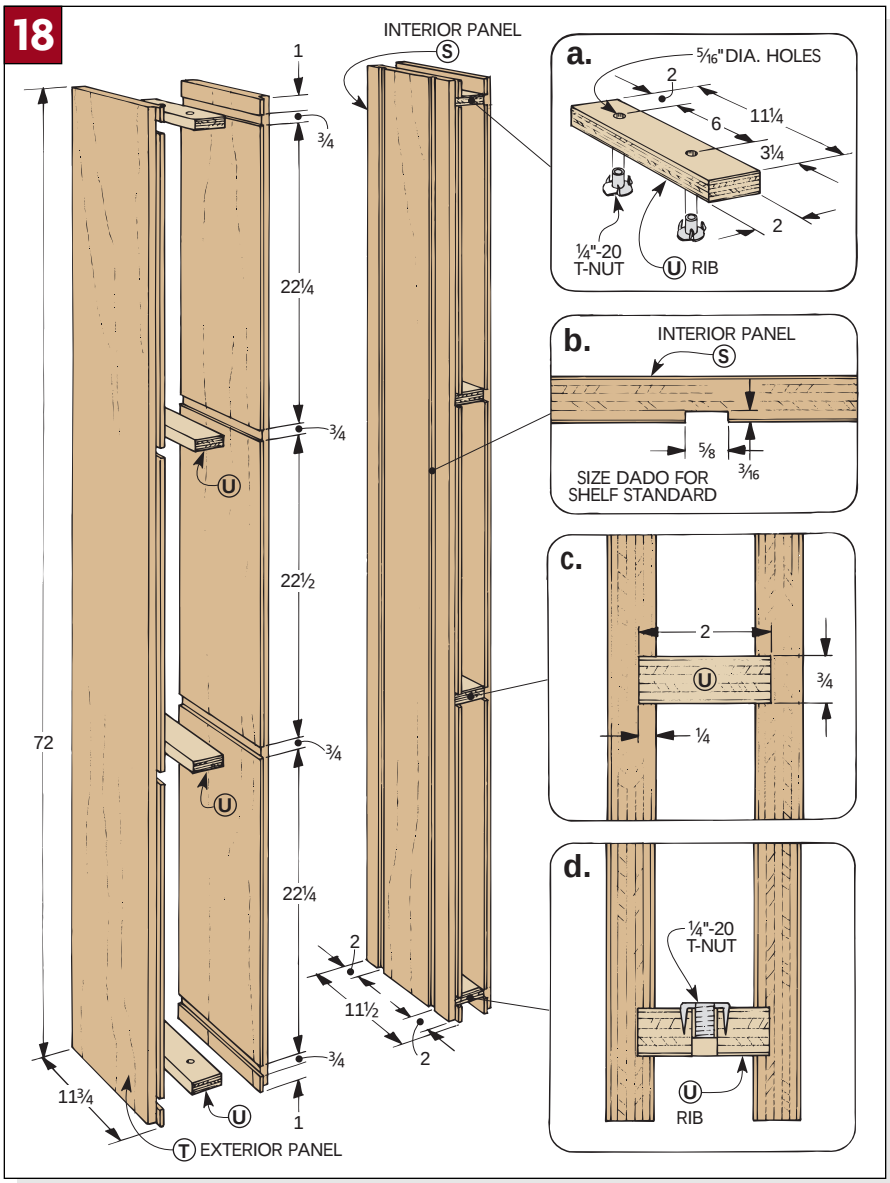
Next, I cut two grooves on the back side of each cap; see Fig. 17a. These grooves will accept tongues on the front edge of the side panels.

When the case is ready to be assembled the grooves help keep the cap aligned with the sides.

SIDES. After cutting the grooves in the cap, I started work on the sides. Both sides have an interior panel (S) and exterior panel (T) made from plywood; see Fig. 18. These panels are identical in length, but the interior panel is cut $\frac{1}{4}$" narrower. This allows for the thickness of the plywood back that's installed later.

After the panels were cut to finished length and width, I rabbeted the front edge of each panel to form a tongue. The tongues are cut so they'll fit snug in the grooves on the back of the caps.





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Next, four dadoes are cut on the inside walls of both the interior and exterior panels; see Fig. 18c. Plywood ribs fit in these dadoes to help keep the panels aligned.

Then two full-length grooves are cut in the inside face on both interior panels; see Fig. 18b. These are for metal shelf standards which are added later.

RIBS. After the grooves are cut, I made four ribs (U) for each side assembly; see Fig. 18a. These ribs fit in the dadoes cut in the interior and exterior panels. Two of the ribs are drilled to accept T-nuts. Bolts inserted through the top and bottom assemblies and into the T-nuts are used to draw everything together during final assembly.

SIDE ASSEMBLY. After the T-nuts are installed in the ribs, the side units can be assembled. First glue and install the ribs in the dadoes; see Fig. 18. As you install them, remember to put the ribs with the T-nuts at the top and bottom locations.

Then glue and clamp the fluted caps on the front of both side assemblies.

ALIGNMENT BLOCKS. To help put the bookcase back together if it's taken apart, alignment blocks (V) are added to the upper and lower case assemblies. They automatically align the sides and the cases.

First, the blocks are cut to fit into the top and bottom openings in the sides; see Fig. 19. Chamfer the edges so it's easy for the sides to slip over the blocks.

Next, glue and screw the blocks to the top and bottom panels; see Figs. 20 and 20a.

Then drill oversize holes through the blocks and top and bottom panels. The larger holes make it easier to get the bolts aligned with the T-nuts.

INSTALLATION. After the holes were drilled, I attached the sides to the upper and lower case with bolts and washers; see Fig. 21.

BACK. Now measure the opening for the back (W) and cut it to size; see Fig. 22. (Note: The back butts up against the *inside* edge of both exterior panels.) Finally, screw the back in place with No. 8 x 1¼" flathead woodscrews.

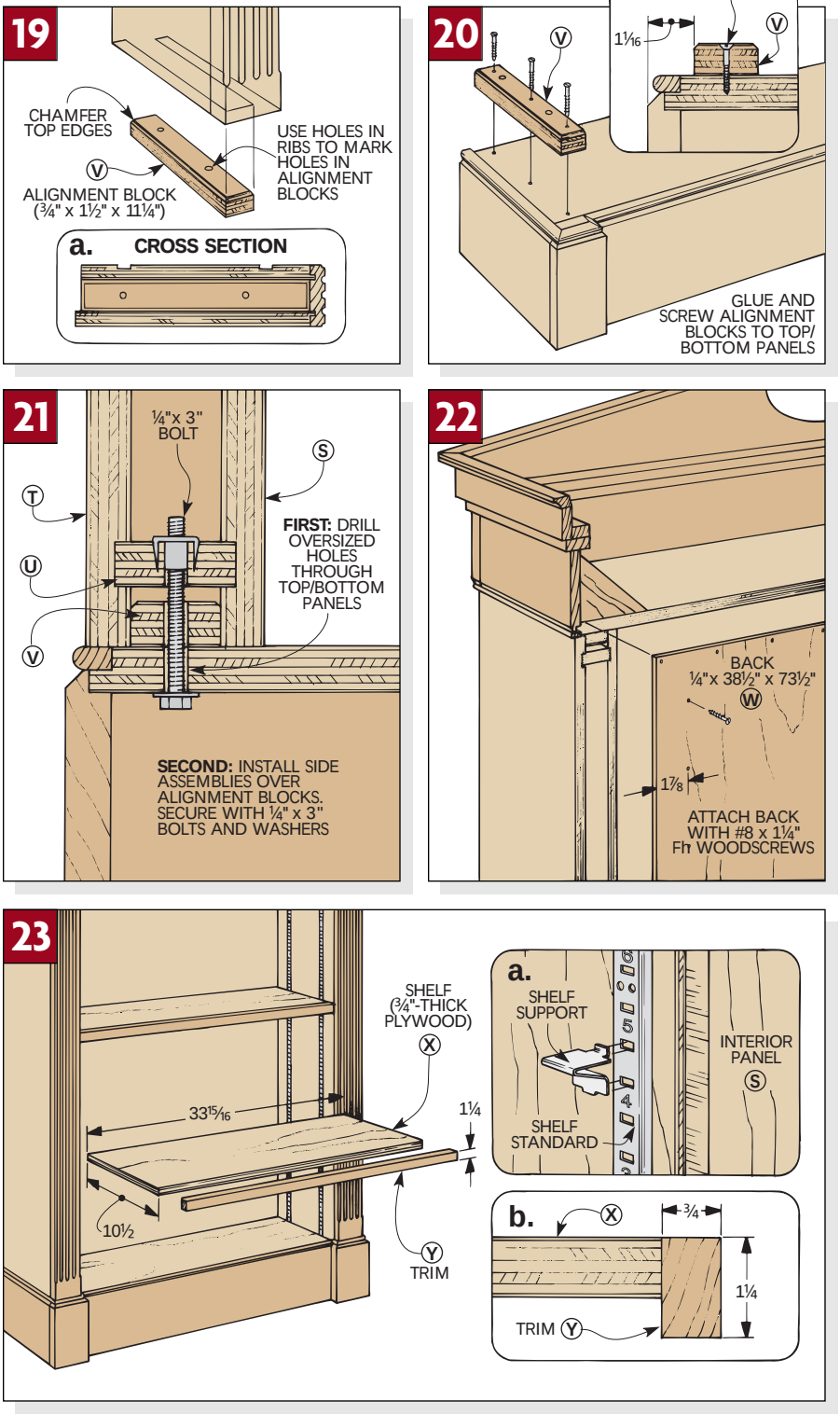
SHELVES

To support the shelves, I used metal shelf standards that are readily available at most home and building centers and hardware stores. They're installed in the grooves you cut earlier in the interior panels.

One thing to keep in mind as you install the standards is to check that they're positioned in the same direction (the numbers stamped on the brackets are all right side up); see Fig. 23a. Then use the nails that came with the standards to hold them in place.

SHELVES. The last step is to make the shelves (X); see Fig. 23. They're cut to fit between the standards.

To strengthen the shelves and hide the edges of the plywood, I added trim pieces (Y) to the front of each shelf; see Fig. 23b. Glue and clamp the trim pieces in place so they're flush with the top of the shelves. ■



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SHOP JIG . . . . . Fluting Jig

When I first saw the shop drawings for the classic bookcase, I was pleased. Nice design, basic joinery, and useful, too. Then I saw the flutes (vertical grooves running up and down the caps). These would be interesting.

My first question was how to make them. Right away I knew it would be with a core box bit in the router. But what's the best way to rout the flutes an equal distance apart? What was needed was some sort of indexing jig.

The jig in the photo is the result. It has just two main parts. A piece of hardboard that replaces the base plate on the router; see Fig. 1. And a set of spacer strips attached to the hardboard.

SPACER STRIPS. The spacer strips are the key to the jig. The width of each spacer is critical — it should equal the desired distance between the centers of the flutes; see Fig. lb.

The two outside strips act as fences for guiding the jig on the workpiece; see Fig. la.

BASE PLATE. The base plate should be cut long enough to accommodate the strips on either side of the bit plus the width of the workpiece; see Fig. 2.

Then cut two slots parallel to the long edge of the plate. These are for securing the strips; see Fig. 1.

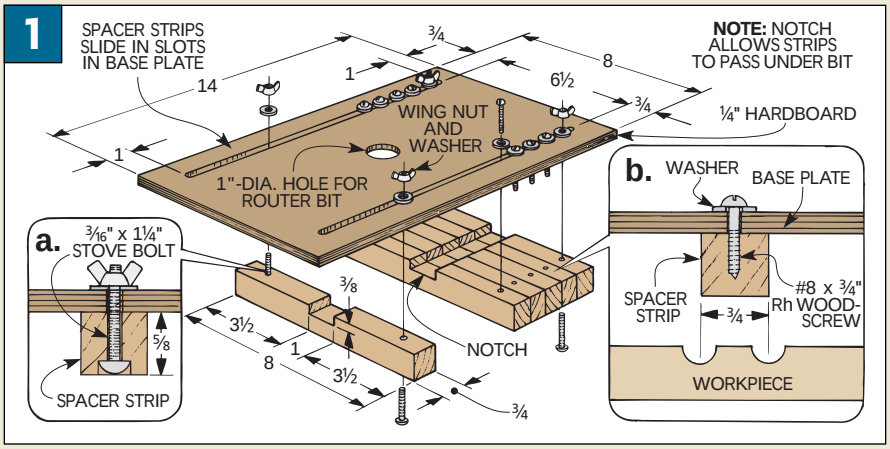
SET-UP. To set up the jig, start by positioning the spacer strips in relation to the bit; see first drawing in Fig. 2.

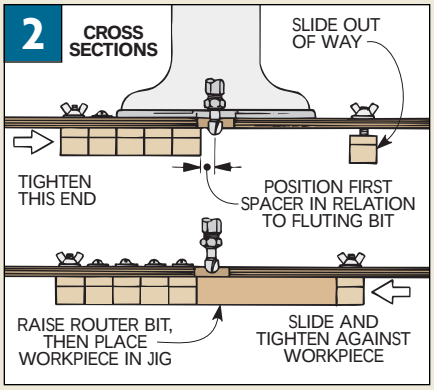
Then the clamping strip needs to be positioned so it rides along the other edge of the workpiece; see second drawing in Fig. 2.

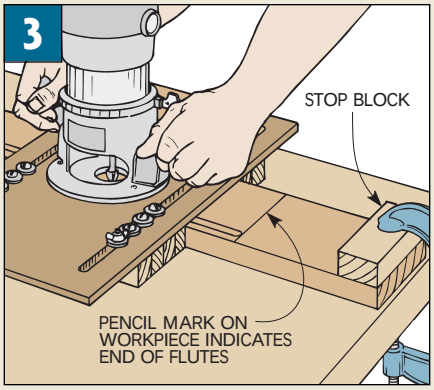
Now the router bit can be adjusted to the desired depth of the flutes. And the flutes routed; see "Using the Jig" below.

Shop Note: It's a good idea to start with a test piece to get a feel for using the jig. And it helps if the test piece is the same width as the actual workpiece.

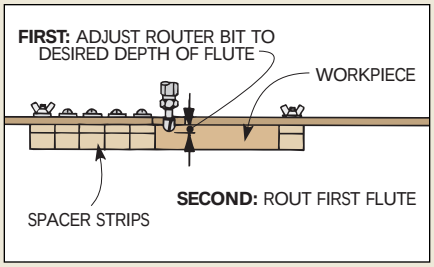
STOPPED FLUTES. For stopped flutes, like on the bookcase, simply clamp a block on each end of the workpiece; see Fig. 3.



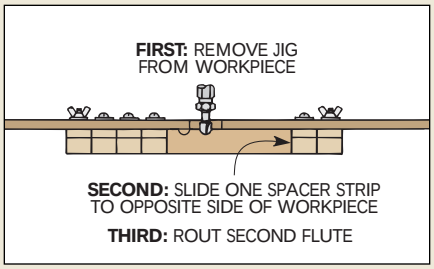




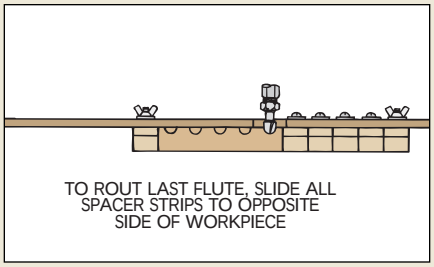
Using the Jig



1 *Position the outside strip so there will be a shoulder left along the edge of the workpiece. Then rout the first flute with a 3/8" core box bit.*



2 *Remove the jig and loosen the next spacer strip. Then move it to the opposite side of the workpiece, retighten, and rout the next flute.*



3 *Continue moving the spacer strips and routing until all the flutes are complete. Then cut the workpiece to finished width and length.*

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