

OAK BOOKCASE

Assembled with frames and panels, this bookcase is a strong and beautiful place to hold a growing home library.



Although a bookcase doesn't have to be fancy to do its job, it ought to get more respect than the old "boards and bricks" approach. This bookcase not only looks great, but it's strong as well.

One reason that it's so strong is that I built it from red oak. But there's another reason that you can't see right away — the joinery.

JOINERY. I used a variety of joints, each one designed to add strength to a different part of the project.

First, the sides and back are frames and panels assembled with stub tenons

and grooves. Then the three frame units are joined together with rabbets and grooves.

Next, stopped sliding dovetail joints hold the apron that spans between the side frames.

The top and bottom are made from $\frac{3}{4}$ " oak plywood held within a mitered frame. And the base pieces are connected with yet another strong joint — a splined miter.

Finally, there's a bullnose edging strip added to the front of the $\frac{3}{4}$ " plywood shelf with a classic tongue and groove joint.

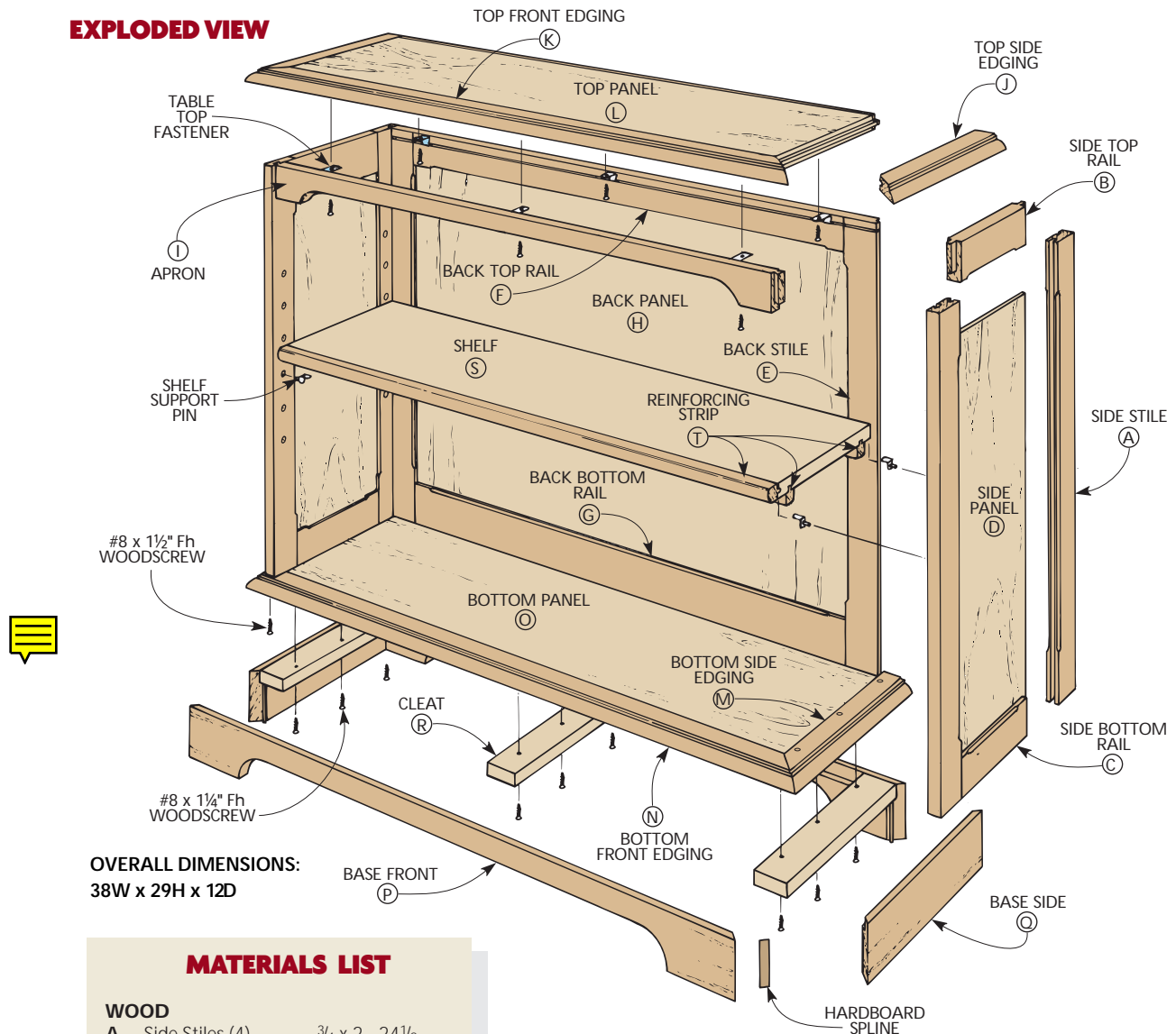
SHELF REINFORCEMENT. There's one other thing that I did to add strength to this bookcase.

Over time, shelves filled with books can start to droop like a swaybacked horse.

I don't think the shelf in this bookcase ever will. That's because it's reinforced with oak strips that run *under* the length of the shelf.

FINISH. Once all of the joints were cut and the project assembled, I finished it with two coats of Minwax Early American stain and then applied two coats of tung oil for protection.

EXPLODED VIEW



OVERALL DIMENSIONS:
38W x 29H x 12D

MATERIALS LIST

WOOD

A	Side Stiles (4)	$\frac{3}{4}$ " x 2 - 24 $\frac{1}{2}$
B	Side Top Rails (2)	$\frac{3}{4}$ " x 2 - 8
C	Side Btm. Rails (2)	$\frac{3}{4}$ " x 2 $\frac{1}{2}$ - 8
D	Side Panels (2)	$\frac{1}{4}$ ply - 8 x 21
E	Back Stiles (2)	$\frac{3}{4}$ " x 2 - 24 $\frac{1}{2}$
F	Back Top Rail (1)	$\frac{3}{4}$ " x 2 - 32
G	Back Btm. Rail (1)	$\frac{3}{4}$ " x 2 $\frac{1}{2}$ - 32
H	Back Panel (1)	$\frac{1}{4}$ ply - 32 x 21
I	Apron (1)	$\frac{3}{4}$ " x 2 - 35 $\frac{1}{4}$
J	Top Side Edging (2)	$\frac{3}{4}$ " x 1 $\frac{3}{4}$ - 11 $\frac{3}{4}$
K	Top Frt. Edging (1)	$\frac{3}{4}$ " x 1 $\frac{3}{4}$ - 37 $\frac{1}{2}$
L	Top Panel (1)	$\frac{3}{4}$ ply - 10 x 34 $\frac{1}{2}$
M	Bot. Side Edging (2)	$\frac{3}{4}$ " x 1 $\frac{3}{4}$ - 12
N	Bot. Frt. Edging (1)	$\frac{3}{4}$ " x 1 $\frac{3}{4}$ - 38
O	Bottom Panel (1)	$\frac{3}{4}$ ply - 10 $\frac{1}{4}$ x 35
P	Base Frt./Back (2)	$\frac{3}{4}$ " x 3 - 37 $\frac{1}{2}$
Q	Base Sides (2)	$\frac{3}{4}$ " x 3 - 11 $\frac{3}{4}$
R	Cleats (3)	$\frac{3}{4}$ ply x 2 - 11
S	Shelf (1)	$\frac{3}{4}$ ply x 9 $\frac{1}{4}$ - 34 $\frac{3}{8}$
T	Reinforc. Strips (3)	$\frac{3}{4}$ " x 1 - 34 $\frac{3}{8}$

HARDWARE SUPPLIES

- (6) Table top fasteners with $\frac{3}{4}$ " Rh screws
- (4) Pin style shelf supports
- (6) No. 8 x 1 $\frac{1}{2}$ " Fh woodscrews
- (9) No. 8 x 1 $\frac{1}{4}$ " Fh woodscrews

CUTTING DIAGRAM

$\frac{3}{4}$ " x 7 $\frac{1}{4}$ " - 96 (4.8 Bd. Ft.)



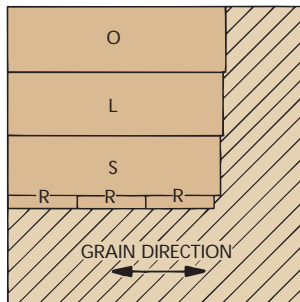
$\frac{3}{4}$ " x 5 $\frac{1}{2}$ " - 72 (2.8 Bd. Ft.)



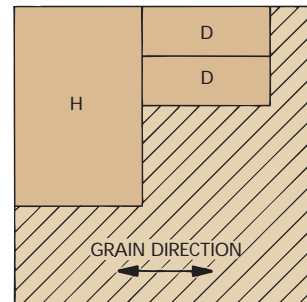
$\frac{3}{4}$ " x 7 $\frac{1}{4}$ " - 72 (3.6 Bd. Ft.)



$\frac{3}{4}$ PLYWOOD 48 X 48



$\frac{1}{4}$ PLYWOOD 48 X 48



FRAMES

I started construction by making the two side frames and the back frame.

Begin by ripping all the bottom rails (C and G) 2½" wide; see Fig. 1. Then adjust the fence to rip the top rails (B and F) and stiles (A and E) 2" wide. Now cut the pieces to final length.

EDGE GROOVES. After all the pieces are cut to size, they're ready for the tongue and groove joints that hold them together. The grooves are centered on

the inside edge of all the frame pieces. (These grooves accept ¼" hardwood plywood which is usually thinner than ½". So cut the grooves to fit the actual thickness of the plywood.)

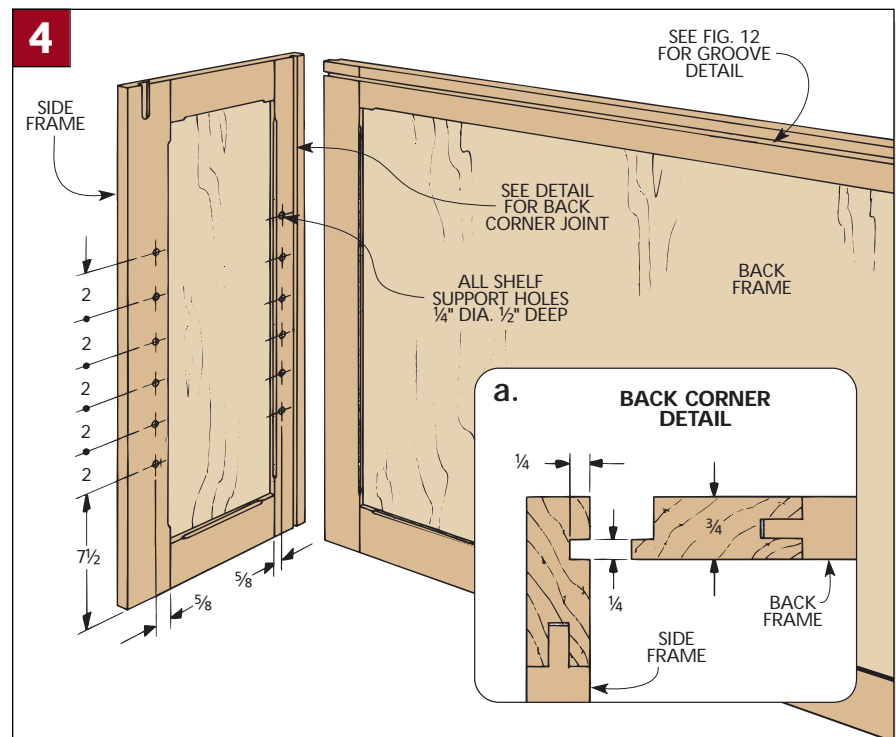
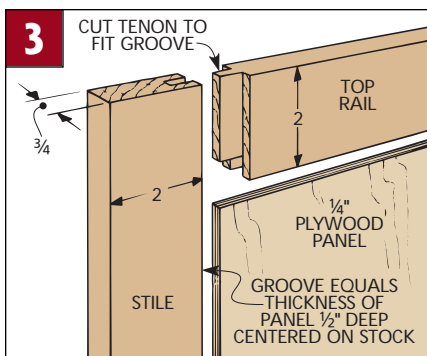
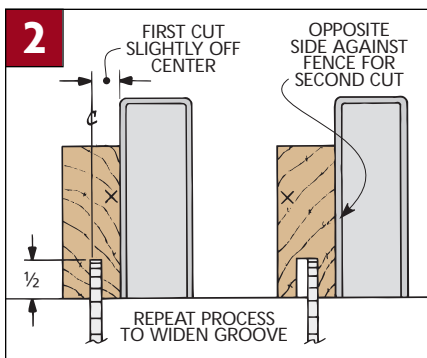
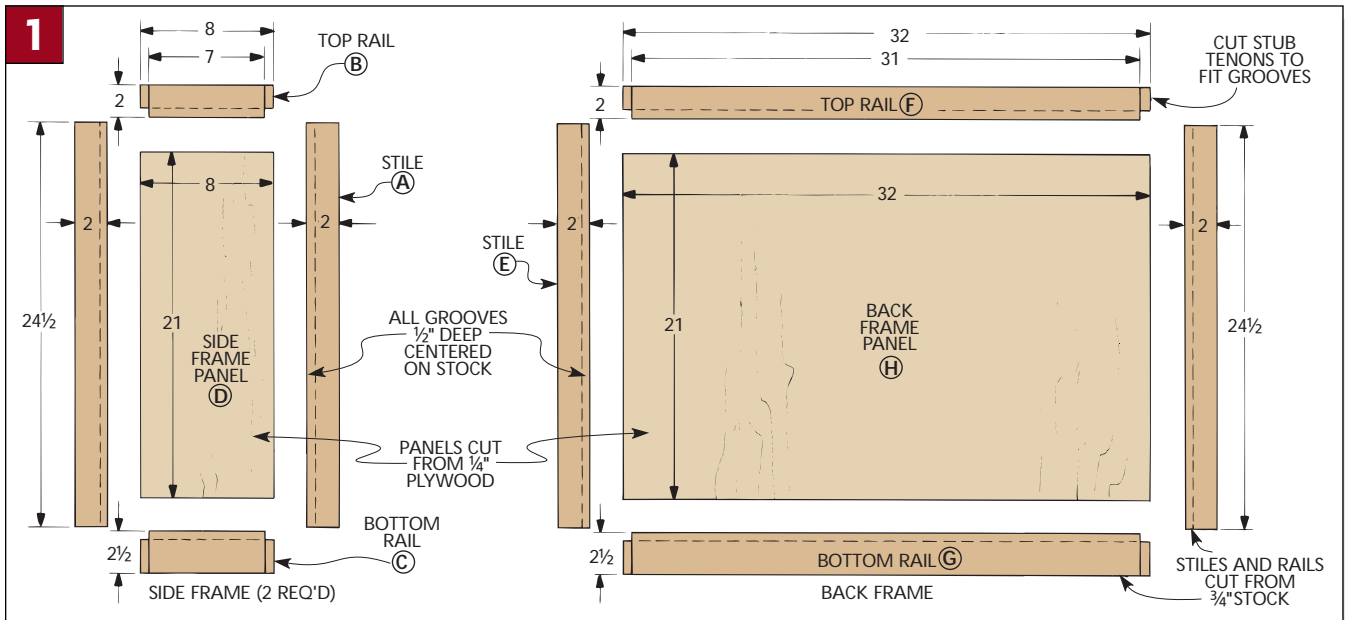
To cut the centered grooves, position the fence so the blade is slightly off center; see Fig. 2. Then cut a ½"-deep kerf the length of the workpiece. Now flip it end-for-end and make a second pass. This produces a centered groove.

SIDE GROOVES. After cutting the grooves on the inside edges, another

set of grooves is cut to join the back frame to the side frames. These grooves are cut on the inside face of the side frame's rear stiles (A); see Fig. 4.

It's important that these grooves be positioned so the distance from the back edge of the stile to the far side of the groove is equal to the thickness of the back frame's stile; see Fig. 4a.

STUB TENON. The tongues that connect the ends of the rails to the stiles are actually stub tenons that fit into the panel grooves; see Fig. 3.



These stub tenons are cut by making multiple passes over the saw blade to leave a tongue that fits the groove.

PLYWOOD PANELS. After the stub tenons are cut, dry-assemble the frames and take measurements for the plywood panels. Then cut the panels to size making sure the grain runs the height of the case; see Fig. 1.

BACK FRAME TONGUES. Before gluing up the frames, I also cut the tongues on the back frame stiles that join the side frames; see Fig. 4a.

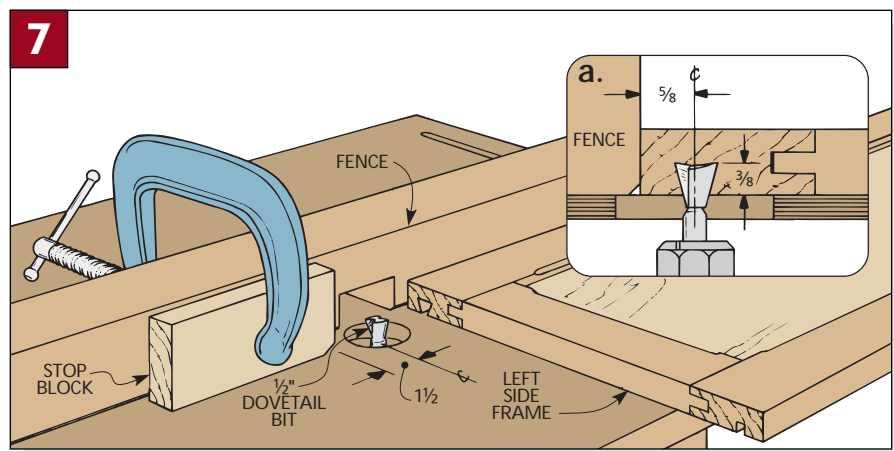
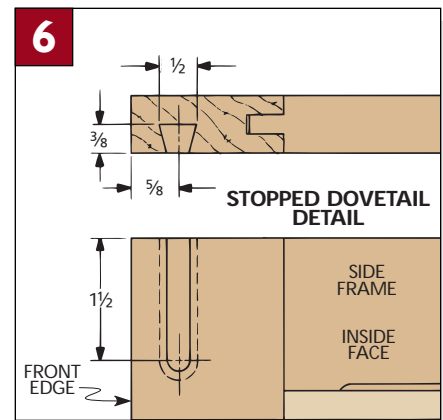
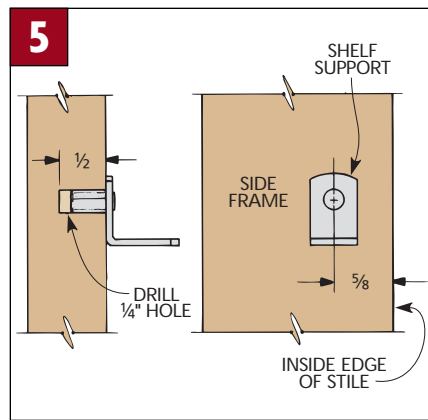
ASSEMBLE PANELS. Now each of the three frame and panel assemblies can be glued up. As I was gluing up the frames, I glued the panels into the frame grooves for maximum stability.

CHAMFERS. After the assemblies dried, there are a few more steps to complete the three units. First, I routed $\frac{1}{8}$ "-wide decorative chamfers around the *inside* edges of the stiles and rails; see the tip box below.

SHELF HOLES. Next, drill holes for the shelf pins that support the center shelf; see Figs. 4 and 5.

DOVETAIL GROOVES. The last step is to rout stopped dovetail grooves in the side frames to accept a top apron (I). (This apron spans the front of the case; refer to Fig. 13 on page 5.) The grooves are located on the inside face of each front stile; see Fig. 6.

To rout the groove in the left frame,



clamp a stop block to the left of the bit on the router table; see Fig. 7. For the right frame, move the stop block to the right of the bit and repeat the cut from

the opposite direction.

Shop Note: After making these cuts, don't change the setting on the bit. You need it to cut the dovetail tongues later.

Inside Chamfers

If a frame and panel are already assembled it's difficult to rout a chamfer on the frame because the panel gets in the way of the pilot on the chamfering bit.

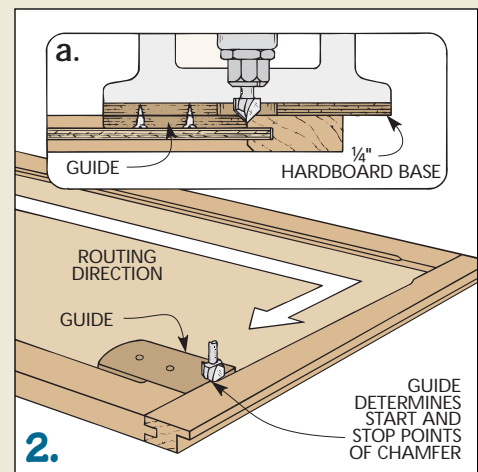
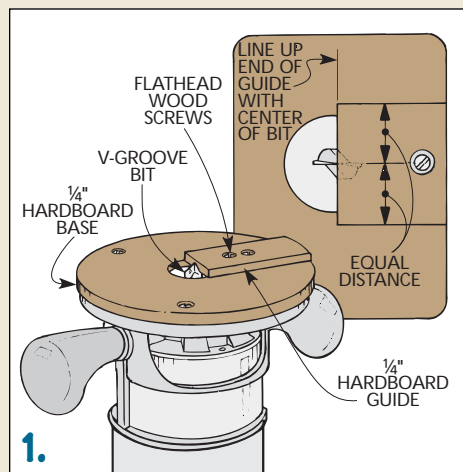
To deal with this problem, I used a "V-groove" bit instead. And to guide the bit, I made an auxiliary base and special $1\frac{1}{2}$ "-wide guide from $\frac{1}{4}$ " hardboard; see Fig. 1.

The primary function of this guide is the same as that of the pilot on a chamfering bit. It keeps the bit a uniform distance from the edge being chamfered. But the guide also stops

the chamfer a uniform distance ($\frac{3}{4}$ " in this case) from the corners.

To make the chamfer, just adjust the depth of cut. The guide will maintain a uni-

form chamfer and stop the cut exactly $\frac{3}{4}$ " from the corners; see Fig. 2.



FRONT APRON

After the frames and panels were complete, I started work on the front apron; refer to Fig. 13.

CUT TO SIZE. Begin by cutting the apron (I) 2"-wide; see Fig. 8. The length

of the apron equals the shoulder-to-shoulder length of the back frame (*without* the tongues), plus $\frac{3}{4}$ " (for the two $\frac{3}{8}$ " dovetail tongues).

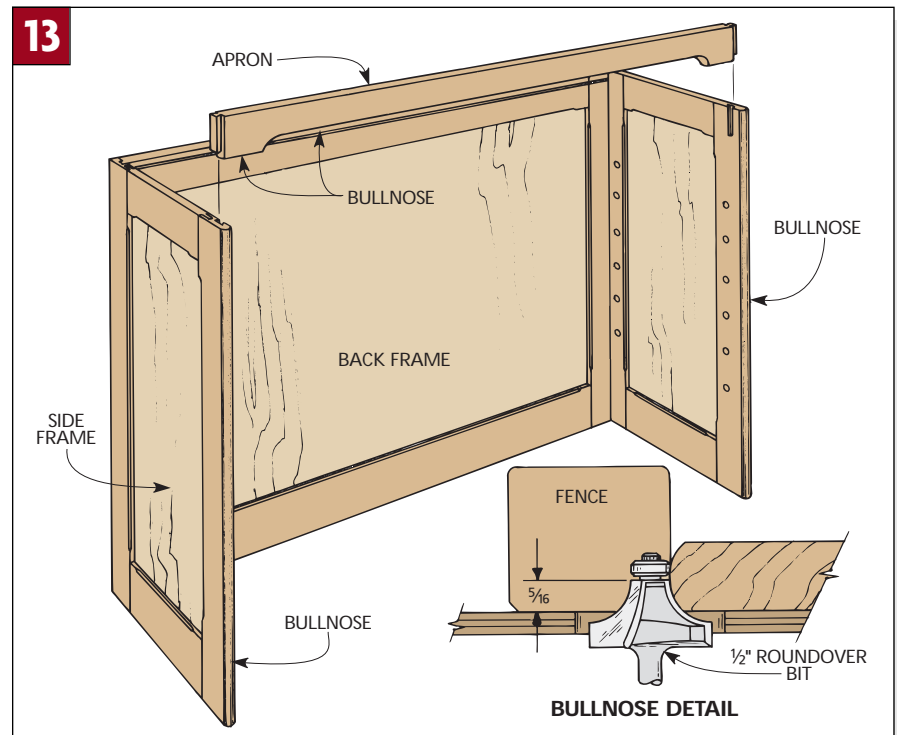
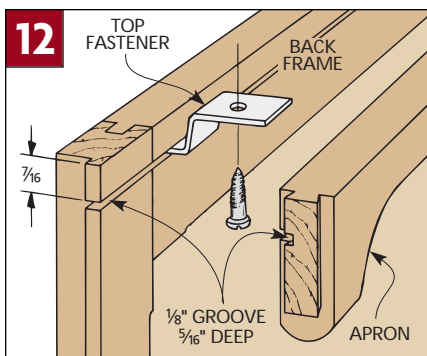
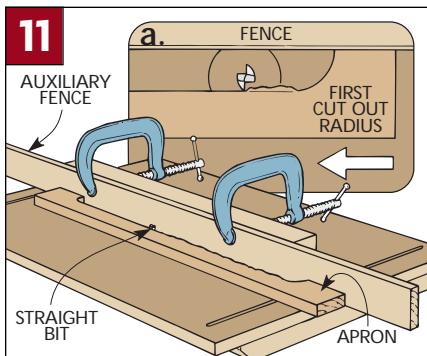
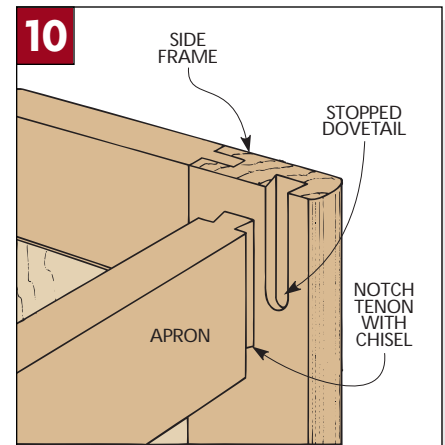
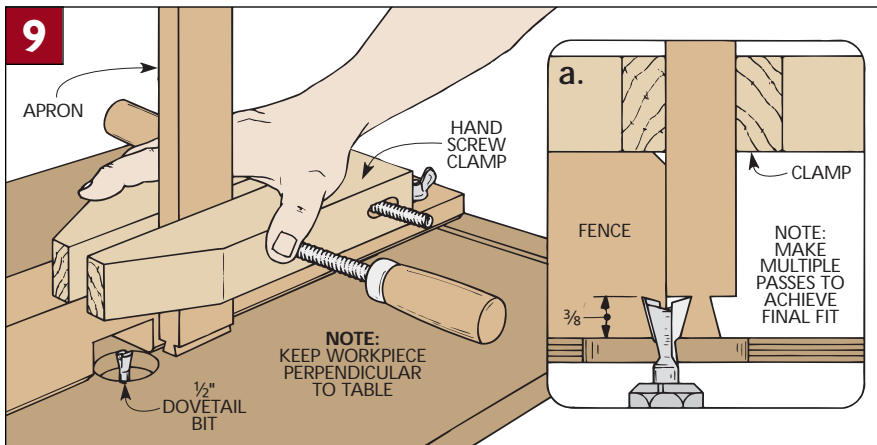
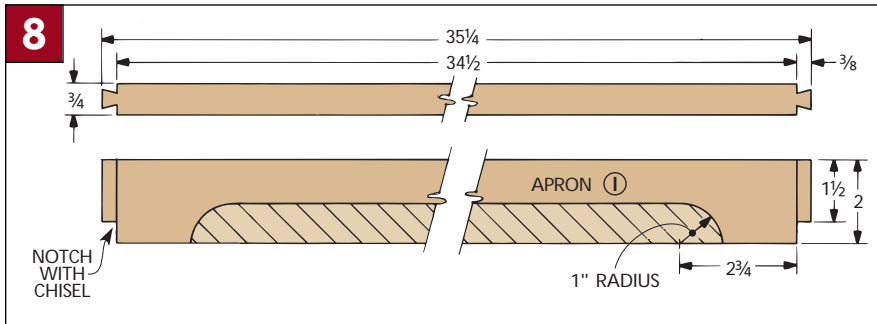
DOVETAIL TENONS. To hold the apron securely while forming the dovetail tenons, I clamped it in a hand screw

clamp; see Fig. 9. Then I adjusted the fence to take just a little off each face to form the tenon. Now creep up on the final thickness by moving the fence and repeat the process until the tenons fit the dovetail grooves.

Next, trim about $\frac{1}{2}$ " off the bottom of each tenon so when it slides into the groove, the top of the apron is flush with the top of the frame; see Fig. 10.

CUT PROFILE. Now the curved profile can be cut. To do this, draw a 1"-radius curve near each end; see Fig. 8. Then cut out the shape staying about $\frac{1}{8}$ " outside the pencil line.

To finish up to the line, I used the router table with a long fence and a straight bit; see Fig. 11. Make a series of light passes until the edge is straight



and smooth, and lines up with the radiused corners.

FASTENER GROOVES. Next it's time to plan ahead for fastening the top. I used stamped metal fasteners that fit into grooves. Cut the grooves along the inside edges of the apron and top rail of the back frame; see Fig. 12.

SOFTEN EDGES. The last step before assembling the case is softening the edges with a bullnose profile; see Detail in Fig. 13. Rout the front of the side frames and the bottom of the apron.

ASSEMBLY. Finally, the case can be assembled; see Fig. 13. First glue the side frames to the back frame. Then add the front apron.

TOP AND BOTTOM

Once the case is assembled, the top and bottom can be made. I started by cutting the two plywood panels (L and O) to size; see Fig. 14.

Shop Note: The top frame hangs over the case $\frac{3}{4}$ " on the sides and front, so it should be built $\frac{3}{4}$ " deeper and $1\frac{1}{2}$ " wider than the outside dimensions of the assembled case. The bottom frame hangs over 1", so it should be 1" deeper and 2" wider than the case.

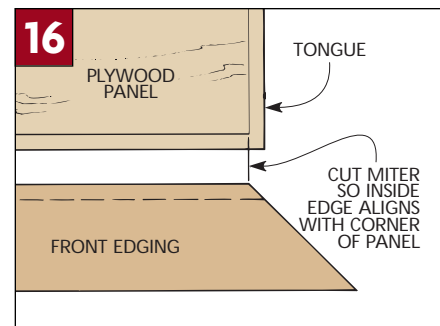
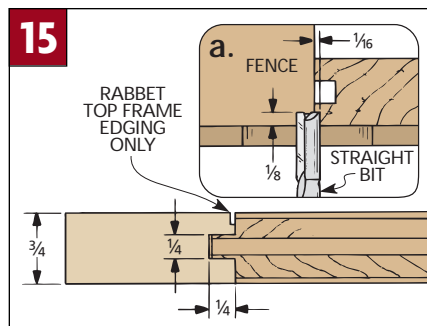
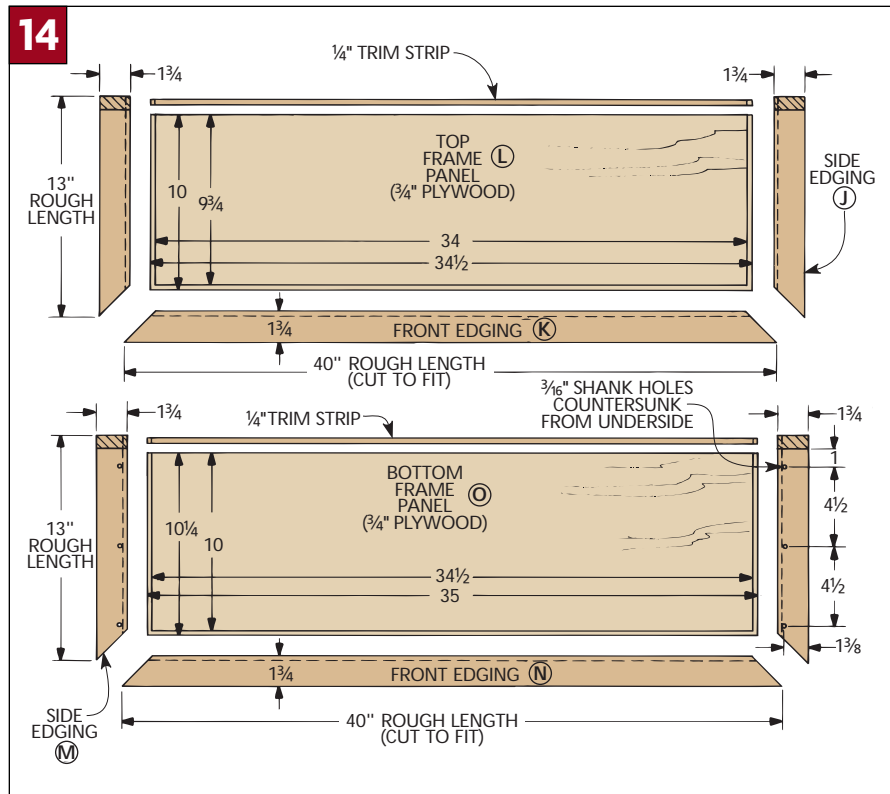
EDGING STRIP. The back edge of the plywood is covered with a $\frac{1}{4}$ "-thick trim strip. Rip this strip from $\frac{3}{4}$ " stock and glue it to the plywood.

MITERED FRAMES. Next, the mitered frames can be made. Begin by ripping the pieces $1\frac{3}{4}$ " wide, see Fig. 14. These pieces are joined to the plywood with tongue and groove joints. So, cut a $\frac{1}{4}$ " x $\frac{1}{4}$ " groove centered on the inside edge of all the pieces. Then form a matching tongue on the front and sides of the plywood panels by cutting rabbets on the top and bottom faces; see Fig. 15 and the box at right.

When cutting the mitered corners, I concentrated on shaving the ends of the frame's front pieces (K and N) until the inside corners fit the inside corners of the panel; see Fig. 16. Then I mitered the ends of the frame sides (J and M), leaving the back end a little long.

RABBET. There's one more small step. Cut a tiny rabbet on the inside of the top frame pieces; see Fig. 15a. (This adds an accent line and makes the joint more forgiving than a butt joint.)

ASSEMBLY. Now glue up the frames and panels and trim the back ends of the frame pieces flush with the panel.



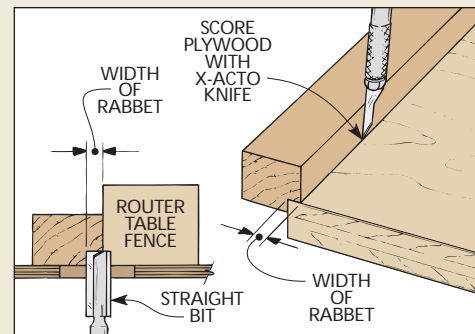
Scoring For A Smooth Rabbet

Cutting a rabbet across the grain on plywood almost always results in tearout along the shoulder line. The way to eliminate this is to score the edge before routing.

The problem with scoring is locating the score line exactly where the edge of the rabbet will be. I solved this problem by routing an identical rabbet in a strip of scrap on the router table. The strip was then used as a guide to score the plywood.

After the rabbet is routed in the strip, just fit the strip over

the end of the plywood to guide an X-Acto knife while scoring. Then, flip the plywood over and rout a clean rabbet.



EDGE PROFILE

To dress up the edges of these frames, I wanted to make a fancy profile with a roundover bit and a core box bit. However, I ran into problems on the router table because the shank of the bit had to be pulled too far out of the collet.

A safer alternative is to work with a hand-held router so the collet can get a full grip on the bit. The problem is that when the bit projects full depth, there isn't anything for the pilot to ride on.

To solve this problem, I cut some $\frac{1}{4}$ " hardboard and fastened it with carpet tape to the underside of the frame flush with the edges; see Fig. 17. When the bit reaches full depth, the pilot rides along the hardboard; see Fig. 17a.

ROUT COVE. To complete the profile, I routed a small cove on the shoulder of the roundover; see Fig. 18.

BASE

With the basic cabinet complete, I was ready to make the base. The base is a frame joined with splined miter joints.

CUT TO SIZE. To begin, rip the sides (Q) and front and back pieces (P) to a finished width of 3" and rough length; see Fig. 19.

RABBETS. The base is attached to the case by three plywood cleats. I found the easiest way to mount these cleats was to cut a rabbet on the inside top edge of all the base pieces; see Fig. 19a.

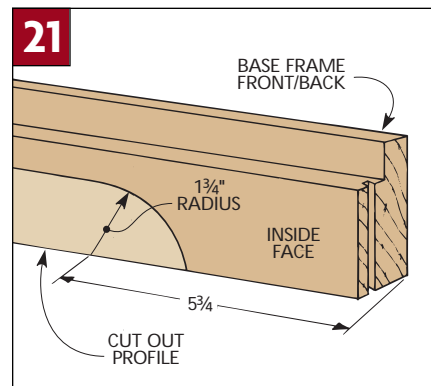
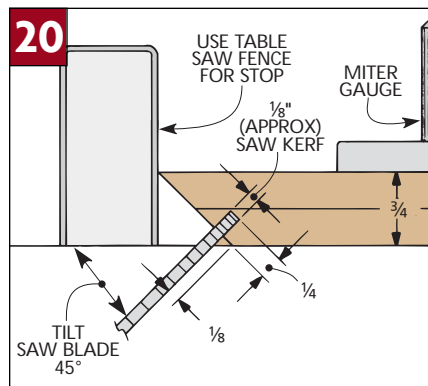
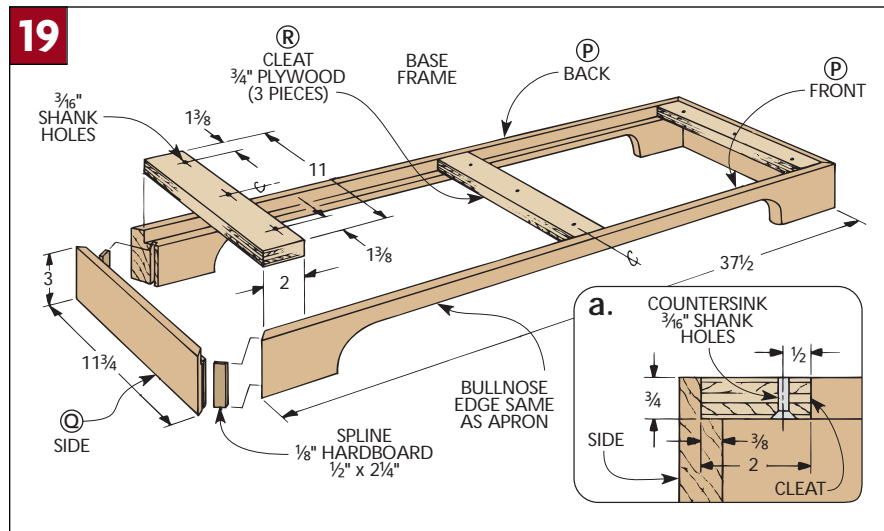
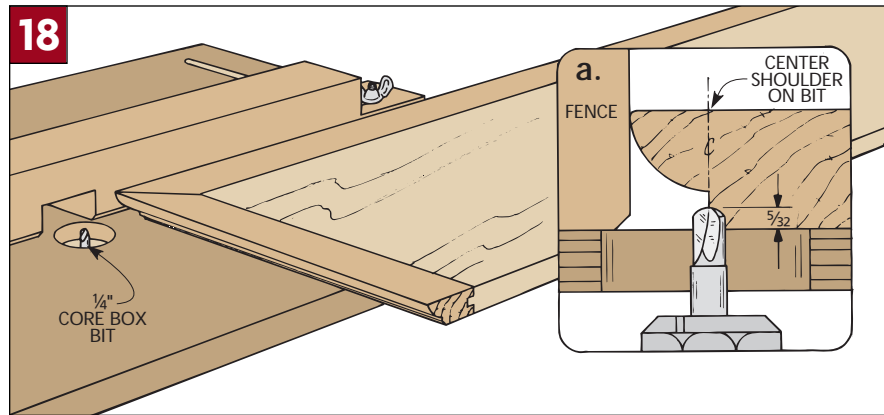
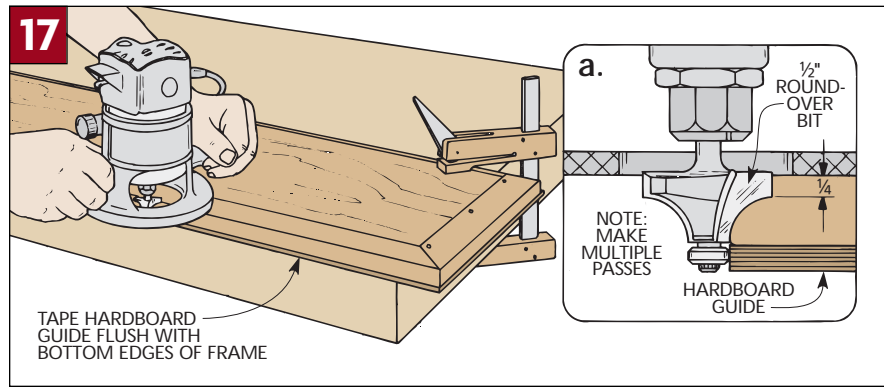
MITER ENDS. After the rabbets are complete, cut the pieces to final length with a 45° miter on each end. Note: The length of the pieces is determined by the size of the bottom frame. The base should set back $\frac{1}{4}$ " on the front and sides and be flush on the back; refer to Figs. 23 and 27 on page 8.

SPLINES. To strengthen the corners and help keep them aligned while gluing, the mitered joints are splined with strips of $\frac{1}{8}$ " hardboard. I cut the kerfs on the table saw; see Fig. 20.

BOTTOM PROFILE. Next, a curved profile can be made on the front and back pieces; see Fig. 21. I did this the same way as I did the apron (I).

CLEATS. Now dry-clamp the base and measure between the rabbets for the cleats (R); see Fig. 19.

ASSEMBLY. The base frame is assembled by gluing the corners together with the splines in place. While the glue is wet, glue the cleats in place.



MOUNT BOTTOM FRAME. While the base is drying, the bottom plywood frame can be fastened to the case. To do this, turn the case upside down and align the bottom frame on it; see Fig. 22.

Now glue and screw the bottom frame and case together.

MOUNT BASE FRAME. To mount the base frame, drill pilot holes and drive screws through the cleats into the plywood bottom; see Fig. 23.

MOUNT TOP. Next, the top frame can be attached with fasteners; see Fig. 24. Turn over the top frame and center the case on it. Then slip the fasteners into the grooves and screw them down.

SHELF

The shelf starts as a piece of plywood 10" wide and $\frac{1}{8}$ " less in length than the inside of the bookcase; see Fig. 26.

BULLNOSE PIECES. To keep the shelf from sagging, I added reinforcing strips (T) into $\frac{1}{4}$ " grooves on the front edge and bottom face; see Fig. 26.

After cutting the grooves, rip 1"-wide strips and cut rabbets to produce a tongue that matches the grooves; see Step 1 in Fig. 25.

To complete the strips, rout a bullnose profile on the other edges; see Step 2. Finally, glue the strips in place. ■

