The Family Handyman®
PROJECT PLAN

Mission oak built-in bookcase

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THE FLAW
Handyman

This handsome bookcase may look difficult, but we've engineered it to go together easily without special woodworking skills

Mission oak built-in **bookcase**

by **David Radtke**

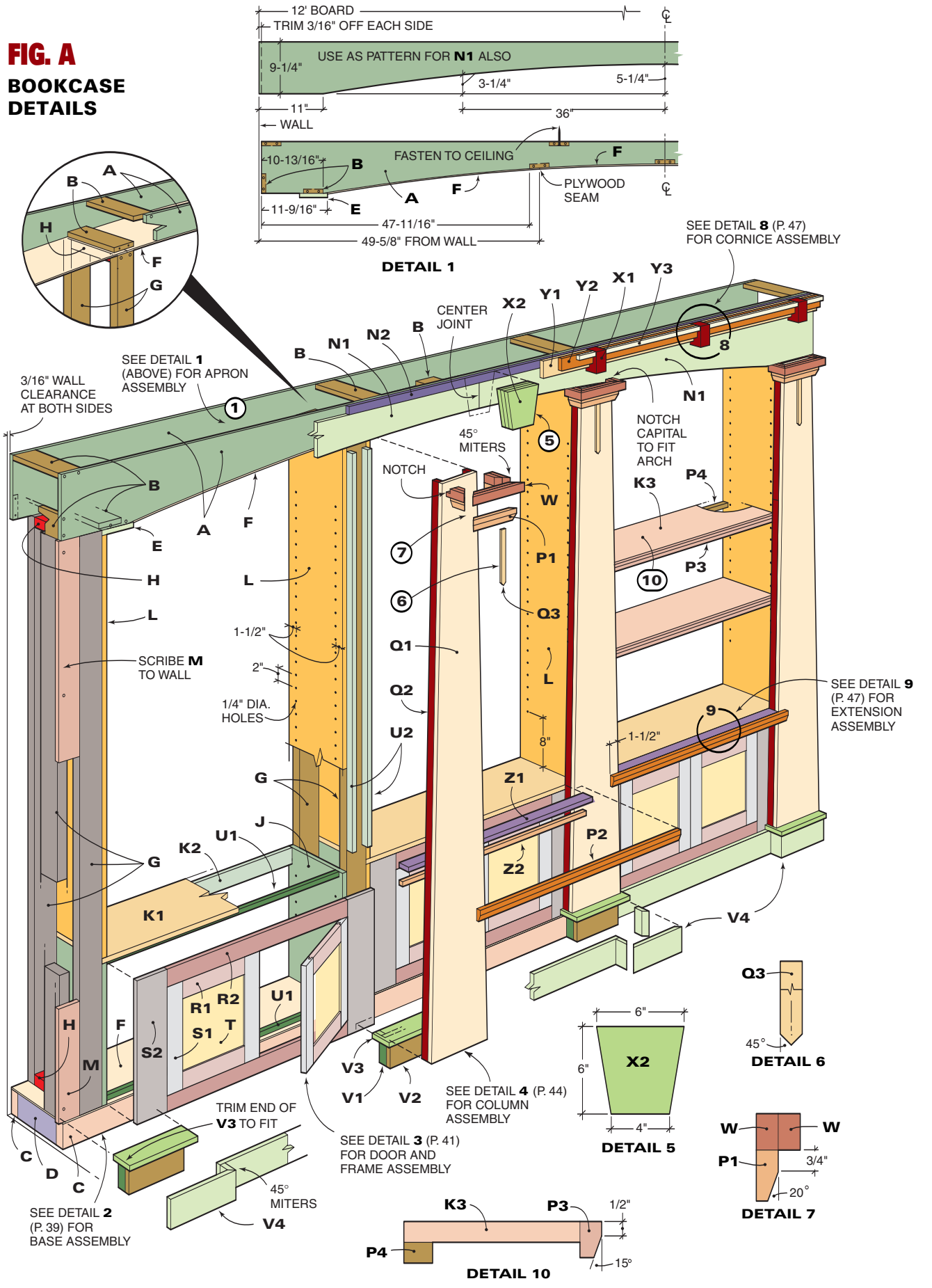
This solid oak built-in bookcase has plenty of room for displaying your favorite books and collectibles plus lots of hidden cabinet space below. And it's easy to build. Just cut the 2x4 framework from standard lumber and screw it together. Then cut oak plywood and solid oak trim and nail them to the framework. You make the paneled cabinet doors with an ordinary table saw and join the face frames with an easy-to-use pocket hole jig.

- **Loads of adjustable shelf space**
- **Vertical-grain solid oak construction**
- **Easy-to-alter dimensions to fit your room**
- **Tapered columns—simplified**

Another plus is that you can pick up wherever you leave off at any time. You can prebuild most of it in your garage or shop and assemble the pieces as you go. Allow about five weekends for this project.

More **BOOKCASE** ➤➤

FIG. A
BOOKCASE DETAILS



Cutting List

KEY	QTY.	SIZE & DESCRIPTION
A	2	3/4" x 9-1/4" x 144" pine arch (cut to fit)
B	11	3/4" x 3-1/2" x 10-3/8" cross ties
C	2	1-1/2" x 3-1/2" x 144" 2x4 base (cut to fit)
D	9	1-1/2" x 3-1/2" x 8-7/8" 2x4 cross ties
E	2	3/4" x 5" x 11-7/8" oak fillers
F	3	1/4" x 11-7/8" x 96" oak plywood rips (cut to fit)
G	10	1-1/2" x 3-1/2" x 96" vertical supports (cut to fit)
H	8	1-1/2" x 3-1/2" x 8-7/8" 2x4 filler blocks
J	6	3/4" x 11-7/8" x 20" oak plywood cabinet sides
K1	3	3/4" x 11-7/8" x 41-1/2" oak plywood cabinet tops (cut to fit)
K2	3	3/4" x 2-1/2" x 40" pine cleats (cut to fit)
K3	12	3/4" x 10-3/4" x 40" oak plywood shelf blanks (cut to fit)
L	6	3/4" x 11-7/8" x 70" oak plywood bookcase sides (cut to fit)
M	2	3/4" x 3-1/4" x 84" oak filler boards (cut to fit)
N1	1	3/4" x 9-1/4" x 144" oak arch (cut to fit)
N2	1	3/4" x 1-1/4" x 144" pine filler (cut to fit)
P1	6 ft.	3/4" x 1-3/4" oak capital face molding (cut to fit)
P2	12 ft.	3/4" x 1-1/2" cabinet top front molding (cut to fit)
P3	12	3/4" x 1-1/4" x 40" oak shelf nosing molding (cut to fit)
P4	12	3/4" x 1" x 40" oak shelf back reinforcing slat (cut to fit)
Q1	4	3/4" x 10" x 87" oak column blanks
Q2	8	3/4" x 1-1/4" x 87" oak column sides
Q3	4	5/16" x 3/4" x 8" oak daggers
R1	12	3/4" x 2-1/2" x 11" oak door rails
R2	6	3/4" x 2-1/2" x 30" oak face frame rails
S1	12	3/4" x 2-1/2" x 15" oak door stiles
S2	6	3/4" x 4-3/4" x 20" oak face frame stiles
T	6	1/4" x 10-7/8" x 10-7/8" oak plywood door panels
U1	6	3/4" x 3/4" x 39-1/2" pine face frame cleats
U2	8	3/4" x 1-1/4" x 60" pine upper column backers
V1	4	1-1/2" x 4" x 8-1/2" pine column base fillers
V2	4	3/4" x 4" x 8-1/2" pine column base fillers
V3	4	3/4" x 3-1/2" x 11" oak column plinths
V4	16 ft.	3/4" x 4" oak baseboards
W	10 ft.	3/4" x 1-1/4" oak capital molding
X1	6	2-1/4" x 2" x 3-1/2" oak cornice blocks
X2	1	2-1/4" x 6" x 6" oak keystone
Y1	12 ft.	3/4" x 2-3/4" oak cornice molding (cut to fit)
Y2	12 ft.	3/4" x 2" oak cornice molding (cut to fit)
Y3	12 ft.	3/4" x 5/8" oak cornice molding (cut to fit)
Z1	3	3/4" x 2" x 39" oak plywood cabinet top extensions (cut to fit)
Z2	3	3/4" x 3/4" x 39" pine top extension cleats (cut to fit)

Shopping List

DESCRIPTION	QTY.
1x10 x 12' No. 2 pine arches (A)	2
1x4 x 12' No. 2 pine (B, K2, N2)	3
1x6 x 8' No. 2 pine (Z2, U1, U2, V2)	3
2x4 x 12' pine (C)	2
2x6 x 8' pine (V1)	1
2x4 x 8' pine (G, D, H)	12
1/4" x 4' x 8' oak plywood (F, T)	1
3/4" x 4' x 8' oak plywood (J, L, K1, K3, Z1)	4
1x4 x 8' oak (M, W, V3, X1)	5
1x10 x 12' oak (N1)	1
1x4 x 8' oak (P1, P2, P3, Q2)	8
1x6 x 12' oak (E, P4, Y1, Y2, Y3, R1, R2, S1, S2)	5
1x6 x 8' oak (Q1)	8
1x6 x 16' oak base (V4)	1
1x8 x 2' oak (X2)	1
1/2" x 5-1/2" x 12' cedar siding	1
No-mortise hinges	6 pr.
Shelf clips	48
Wood glue	16 ozs.
1" nails for nail gun	1 pkg.
1-1/2" nails for nail gun	1 pkg.
2" nails for nail gun	1 pkg.
10d casing nails	2 doz.
Knobs and magnet catches for doors	6
Stain	2 qts.
Varnish	3 qts.

Customize it to fit your room

The bookcase measurements we give are based on our room, which has an 8-ft. ceiling and measures just a skosh over 12 ft. wide. If your room is a bit wider, just move each middle column away from the side walls by one-third of the difference. The columns near the wall stay where we've located them. For example, if your room is 12 ft. 9 in. wide, just move each center column one-third the difference of 9 in., or 3 in., farther from each wall than the measurement we give in **Photo 4**. If your room is taller, you'll need to stretch out the section of the bookcase above the cabinet doors; your columns

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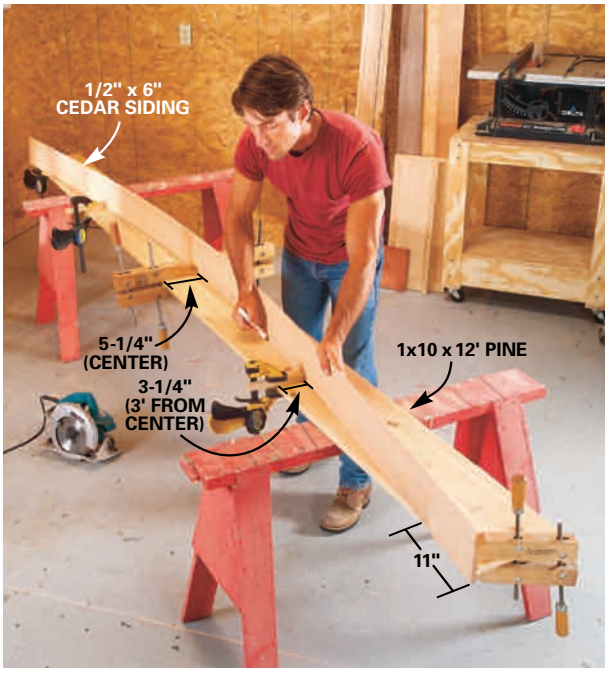


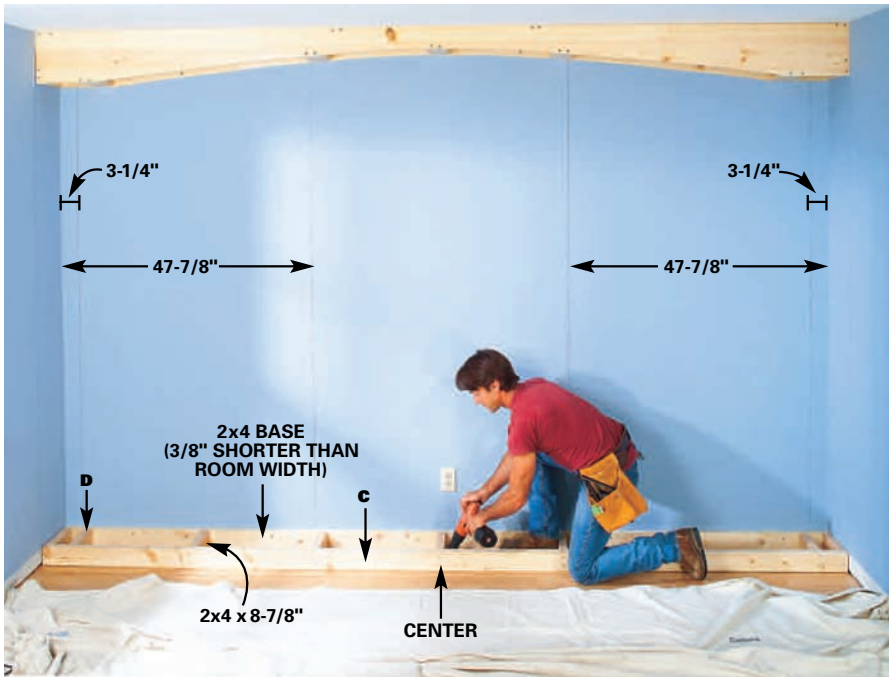
1 **BEND a piece of clear cedar siding to form an arch. Trace the curves as shown onto the two 1x10 x 12-ft. upper arch pieces of the frame. Cut these pieces 3/8 in. shorter than the width of your room so you'll be able to maneuver it into position.**

2 **CARRY** the two arched aprons into your room and screw 1x4s between them as shown with 1-5/8 in. wood screws. Drill pilot and countersink holes to avoid splitting the wood. Be sure to complete the layout lines on the wall (Photo 4 and Detail 2, p. 39).

will taper more gradually, but not enough to notice.

Our bookcase cost about $1,400, including the hardware and finish. That's not a lot of money compared with the price of a quality store-bought bookcase. If you shop around at local lumber suppliers, you may be able to save money. We used special rift-sawn oak, which we ordered from a local supplier. Its long, straight grain keeps the project from looking too busy and helps disguise glue joints like those in the center of the columns. The effect is a wide, evenly grained board. You can,

3 **LIFT** the apron assembly to the ceiling and build a temporary stand for each end to keep it tight to the ceiling as you screw it to the framing. If framing is difficult to find in key areas, use wall anchors (bottom photo, p. 39) to fasten it to the ceiling and side walls.



4 **BUILD** the 2x4 base as shown in Detail 2, p. 39, and screw it to the floor with 1-1/2 in. x 1-1/2 in. steel angles. Space the 2x4 blocks so the vertical uprights marked on the walls will stand directly over them later.

Undersize the upper apron and base assemblies

Measure the room width at the top, middle and base of your room. Take the narrowest measurement and subtract 3/8 in. from that. This will give you just the right amount of maneuvering room to get the apron assembly (Photo 3) off the floor and up to the ceiling without having to use a sledgehammer. Do the same for the 2x4 base assembly (Photo 4).

5 CUT two 3/4-in. x 5-in. blocks 11-7/8 in. long (E) and screw them to the underside of the aprons 11-3/4 in. from each side wall. These blocks will catch the edge of the 1/4-in. plywood top and hold it in place. Rip the 1/4-in. oak plywood to 11-7/8 in. and hold it tight to the apron while you mark the length. Install it so the splice will be hidden under the column as shown. Do the same to cover the base assembly as well. Use 1-in. finish nails in your nail gun to secure the plywood to each assembly.

however, sort through pieces at a home center and find nice-looking pieces that will match well. Whatever wood you choose, figure on spending about 40 hours or more to build and finish this project.

You'll need a table saw and a circular saw for this project, and we suggest using a pocket hole jig (see Buyer's Guide, p. 47) for the face frames (**Photo 10**) and the cabinet top extensions (**Photo 21**). If you've never used a pocket hole jig, you'll find it easy to use with the instructions provided. It's a slick way to firmly hold wood joints without gluing and clamping. A doweling

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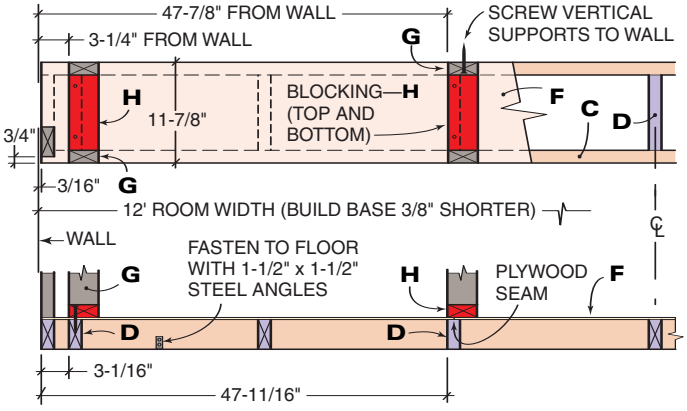
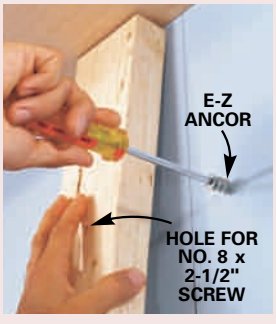
Detail 2
BASE ASSEMBLY



Anchoring 2x4s to drywall

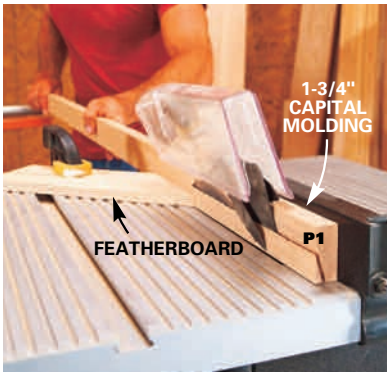


You'll most likely need to drill holes and screw the vertical supports to the drywall with screws and wall anchors. Place the 2x4 and drill 3/16-in. holes to mark the drywall. Remove the 2x4, then screw anchors into the drywall at these locations. If there's framing behind the 2x4, screw the support directly to it with 3-in. wood screws.

6 FASTEN the 2x4s to the wall as shown. Use E-Z Ancors (photo at left) if wall framing isn't available behind the 2x4s. Scribe the 2x4 supports to fit under the curve. Note that the 2x4 supports on each side wall are set back 3/4 in. behind the 11-7/8 in. mark.

7 **RIP** 3/4-in. oak plywood to 11-7/8 in. and then drill 1/4-in. holes for standard shelf clips. Use a strip of 1/4-in. Peg-Board as a template for the shelf clip holes. Drill the holes, positioning the template to the bottom of each piece to ensure the shelves will be level when installed.

8 **NAIL** a 3/4-in. x 1-1/4 in. filler to the top of the apron assembly, then nail the arched 1x10 oak pieces (cut in half to fit) to the apron assembly. Scribe the pieces to the side walls if necessary. The center joint will be covered by the keystone trim later.



9 **SET** your saw to 20 degrees and taper the upper capital molding and the top shelf face molding (Fig. A). Make the front shelf molding in the same manner, only cut it from 1-1/2 in. strips.

jig, however, is a good substitute for this part of the project. If you don't have an air-powered finish nailer, here's a good excuse to buy one! You can buy inexpensive finish nailers at home centers or rent them when you do the major assembly work. I'd recommend an 18-gauge brad nailer ($100) for the smaller pieces of trim and a 15-gauge finish nailer ($150) for nailing the columns and baseboards in place. You'll also need a screw gun, a belt sander and a finish sander along with your basic carpentry and layout tools.

Study **Fig. A** on p. 36 carefully for construction details, then read the text for added information and tips on building the doors, columns and cornice details. Follow the how-to photos as a step-by-step guide to the building process.

Tip **Sand plywood sides, columns and door assemblies before you install them. You'll do a better job if you avoid working in difficult, strained positions.**

Measure carefully as you lay out the room

The design of this project is forgiving for rooms that are a bit out of whack. If one of your side walls is out of plumb slightly, the taper of the columns will disguise it. If your floor slopes slightly from left to right, it's best to split the difference and make it flow with the room rather than trying to level the whole project. Just be sure to install the 2x4 verticals plumb.

The odd measurement of 11-7/8 in. for the depth allows you to cut four sides (**Photo 7**) from a single sheet of 4 x 8-ft. oak plywood. We

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10 **BUILD** the face frames as shown in Detail 3 using the pocket hole jig (see Buyer's Guide, p. 47). The jig drills holes at sharp angles to connect the stiles and rails tightly without glue. If you have a doweling jig, this will work as well.

11 **GROOVE** the inside edges of stiles and rails for each door using a table saw. Cut the 1/2-in. deep grooves in the center of the edge. Run the piece through on one side, then flip it end-for-end and run it through on the other side to ensure the groove is centered. Because we had a wide throat plate space next to our saw blade, we measured to our fence first, lowered the blade, then installed a 1/2-in. piece of plywood on the saw table and raised the blade. This gave us a safe, stable, flat surface to cut the grooves.

found that even oversized books fit comfortably on the bookcase, especially on the cabinet tops just above the doors. Here the depth increases to nearly 14-3/4 in. Follow **Photos 2 – 6** to get your layout lines in the right spots.

Buy good framing lumber

It's essential to use straight 2x4s and 3/4-in. boards to get the skeletal part of the bookcase correct. Bows and twists will make your job more difficult. Buy a couple of extra pieces and store all your lumber in the house for about a week to acclimate it. Central heating has a way of taking a reasonably straight piece of lumber and quickly turning it into a banana. If you buy lumber at a home center where the stuff is reasonably dry and stored inside, you can usually assume it'll hold its shape.

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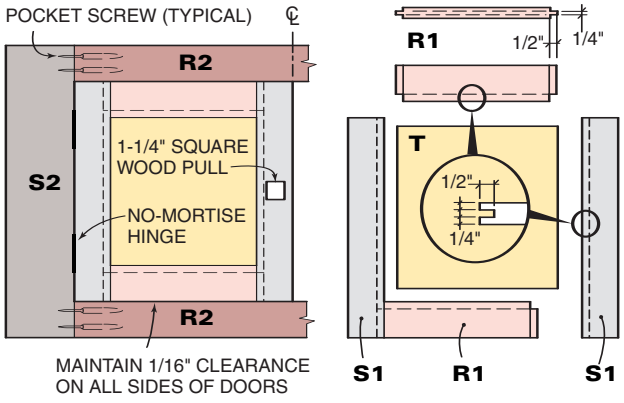
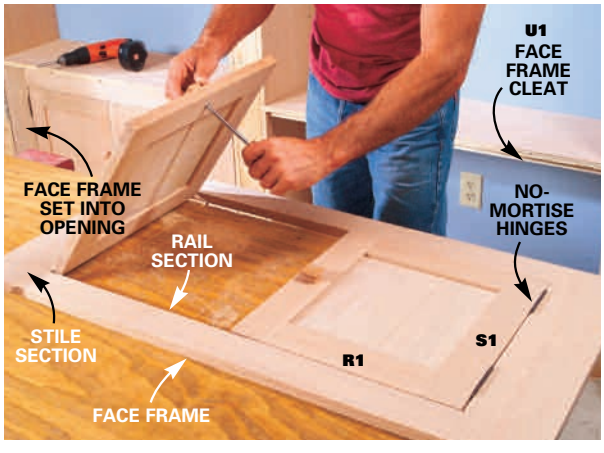
Detail 3
DOOR AND FRAME ASSEMBLY



12 **CUT** tenons on each end of the door rails using your table saw fence as a guide. The tongues should be 1/2 in. long and must fit snugly into the grooves of the stiles. Cut a test piece first to get the right setting.

13 **ASSEMBLE** the doors as shown. First, glue the tenons of the top rail into the grooves of the stiles, then slip the plywood panel in place. No need to glue the plywood; just let it float in the grooves. The plywood should be 1/8 in. narrower and shorter than the distance from groove to groove to ensure a foolproof assembly. Clamp the doors, making sure they lie flat. Clamps can pull the frames and warp them if you're not careful.



14 **INSTALL** no-mortise hinges (see Buyer's Guide) on the stiles and the door edges before installing the face frames in the bookcase. Make sure to leave 1/16-in. clearance between the doors and the face frame. If necessary, use a belt sander to fit the doors precisely in the face frame openings. Attach the knobs to the doors, hang them on the hinges and nail the assembly to 3/4-in. x 3/4-in. pine strips set back and glued into the cabinets.

Use a strip of 1/4-in. Peg-Board as a drilling guide

Getting precise holes into the 3/4-in. plywood sides for your shelf supports is a must for a project like this. To make a foolproof template, rip a 3-in. wide strip from a sheet of Peg-Board (use the rest of it to organize your shop space). Label the top and bottom, then use small brads to temporarily tack it to each panel. The holes on the Peg-Board are spaced every 2 in. Tape over the holes you won't be using. Then drill 1/4-in. holes 1/2 in. deep into the panels (J and L). Buy a stop collar and a new brad point bit to get clean, unsplintered holes. We left 8 in. free of holes on the bottom of each side panel, since it would be useless to position a shelf any lower. Reuse this same strip for each piece. Don't be sloppy here or you could widen the holes of your template and pay the price with uneven shelves.

Tip **When you glue up your door pieces, apply glue both to the sides of the tenon and in the groove where the tenon will fit. Don't use too much glue or you'll have extra scraping and sanding to do when it oozes. A good glue job will force only tiny beads from the joint as you clamp it.**

Make the doors with your table saw

You won't need a router or a shaper or even a dado blade for your table saw to make these simple doors. A standard carbide blade set at the correct height and some careful fence adjustments will give you great results. The key to success here is to use sacrificial scraps to get your settings just right. It usually takes a bit of tweaking to get your setups just right.

Start by cutting the grooves. Set the fence just a hair over 1/4 in. from the blade, then lower the blade below the table. For safety, place a 1/2-in. piece of plywood over the blade area and against the fence and clamp it to the saw table (**Photo 11**). Start your saw and raise the blade until it comes through about 3/4 in. Shut off the

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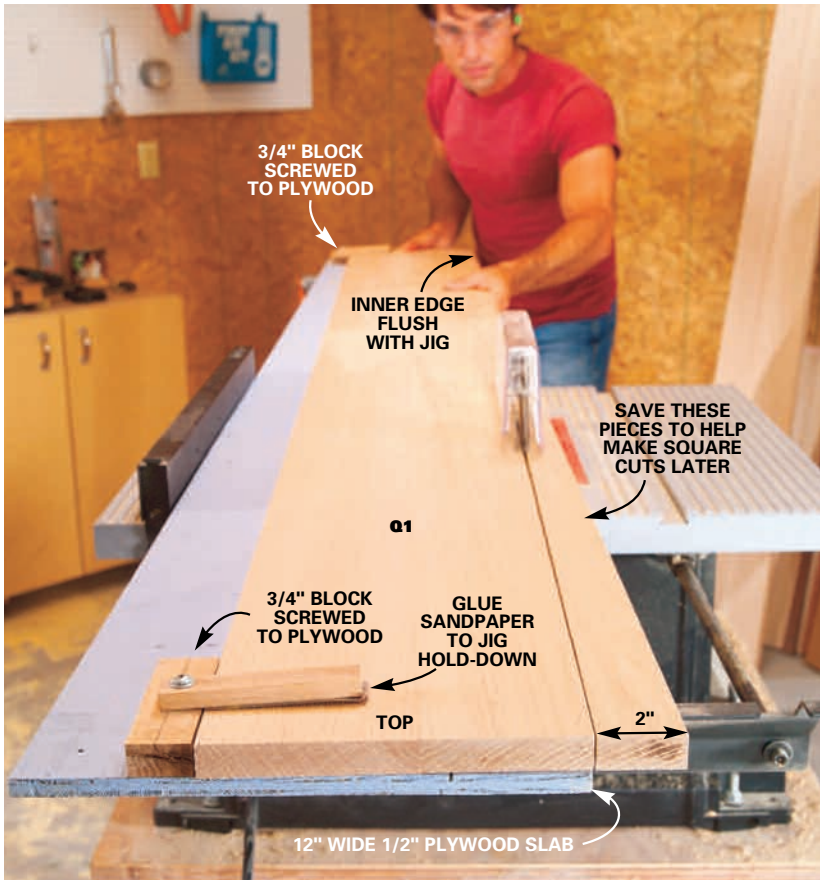
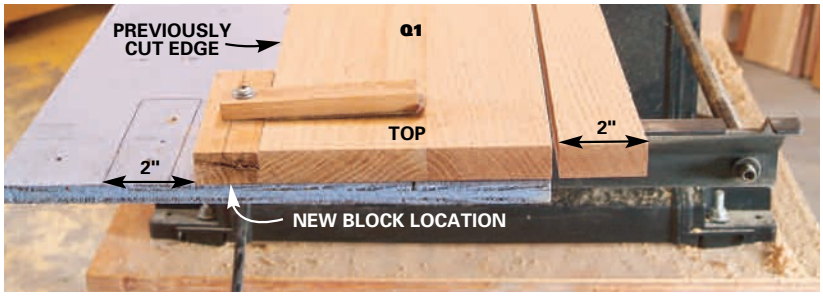
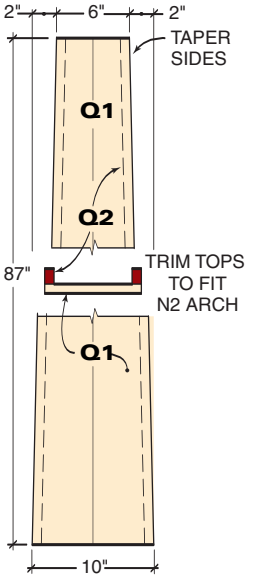


15 **GLUE** and clamp two pieces of 1x6 x 87-in. oak together and then rip them to 10 in. wide, keeping the glue joint at the center. Square both ends. Cut tapers on each side of each of the blanks using the homemade taper jig shown. Set the fence 12 in. from the blade, then rip a piece of plywood and cut it to 87 in. long. Cut a 2-in. taper on one side of each blank as shown, aligning the backside of the blank with the inner edge of the plywood and letting the side to be tapered hang over 2 in. as shown. Clamp the board with the jig levers over the board and run it through the saw.



16 **REPOSITION** the block in your jig and cut the opposite side of each blank. Always have the top of the blank at the tapered end of the jig and the wide base end even with the inner edge of the jig. Move the workpiece through, making sure the plywood is tight to the fence and have an outfeed stand to support the jig as it leaves the saw. Next, glue and finish-nail 3/4-in. x 1-1/4 in. strips (Q2) to the sides of each column as shown in Detail 4 to give the columns a heavier and deeper look. Once the glue is dry, sand them with 100-grit sandpaper followed by 150-grit sandpaper.

Detail 4
COLUMN ASSEMBLY



saw and lower the blade until it's 1/2 in. above the plywood surface. Now, start the saw and run the scrap piece through the blade on edge as shown in **Photo 11**. When you've made the cut, flip the piece end-for-end and run the other side of the board through the blade, keeping it tight against the fence. Now test the groove by slipping in a piece of 1/4-in. plywood. It should slide into the groove without your pushing it firmly. If the fit is too loose, move the fence slightly away from the blade. If the fit is too tight, move the fence closer to the blade. Now cut all the inside edges of the rails and stiles.

Make your tenons by setting the fence exactly 1/2 in. from the blade (don't use the 1/2-in. plywood on top of your saw for this). Raise the blade 1/4 in. Make sure your miter gauge for your saw is set at 90 degrees. Push your scrap piece through the saw, keeping it firmly against the miter gauge and the fence. After one pass, move it away

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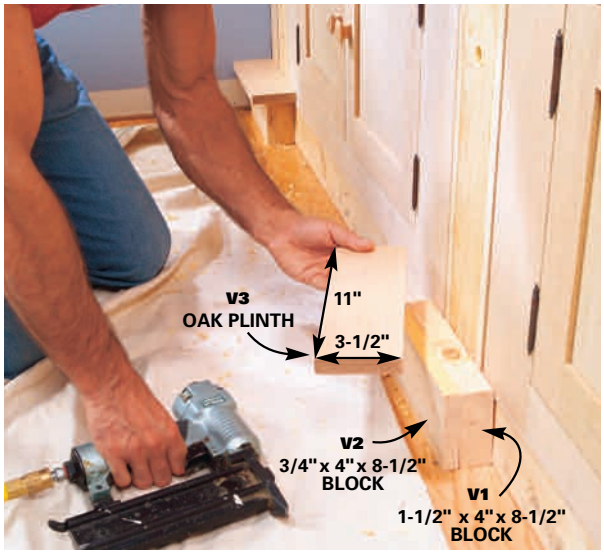


17 **RIP** 2x6 and 1x6 pine to 4-in. widths and nail them to the base assembly at the center of each 2x4 vertical support. These pieces will support the base cap. Next, wrap these supports with 3/4-in. x 4-in. oak base pieces and continue installing these base pieces between the column bases.

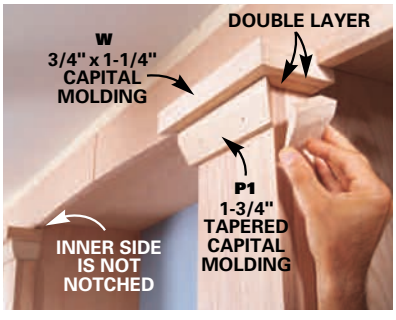
from the fence about 1/8 in. and send it through again. Continue until you've completed that side of the tenon. Then flip it over and do the other side. If there are some saw marks, scrape them off with a flat file. Test-fit your tenon in the groove you've just made. If it fits too tightly, raise the blade just slightly and recut the piece. If the fit is loose, lower the blade slightly and try another test piece. When you've got it right, cut the ends on all of the door rails as shown in **Photo 12**.

Make your cornice blocks from built-up strips

You could special-order thick slabs of wood for the cornice detail at the top of the bookcase (**Photo 20**), but that's impractical when you've got plenty of small scrap left over. Cut three strips to size from 3/4-in. oak for the cornice blocks and the keystone. Glue and clamp them.

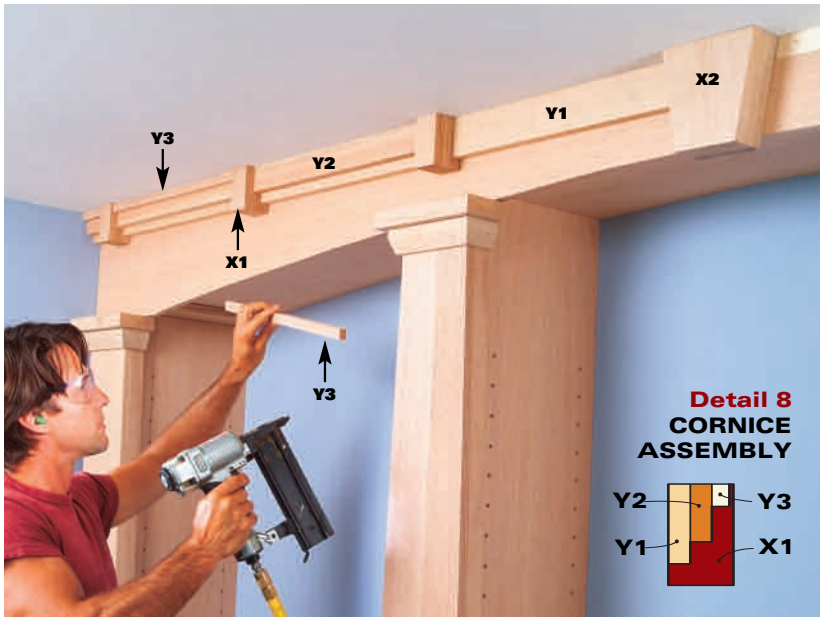
Tip

You'll find that your square is of little use when you need to cut the tops of your two side column assemblies to length. To mark a square cut, tape the discarded strip from your taper cut (Photo 15) to the side of your column. Then use your square to mark a straight line and your circular saw to make the cut.

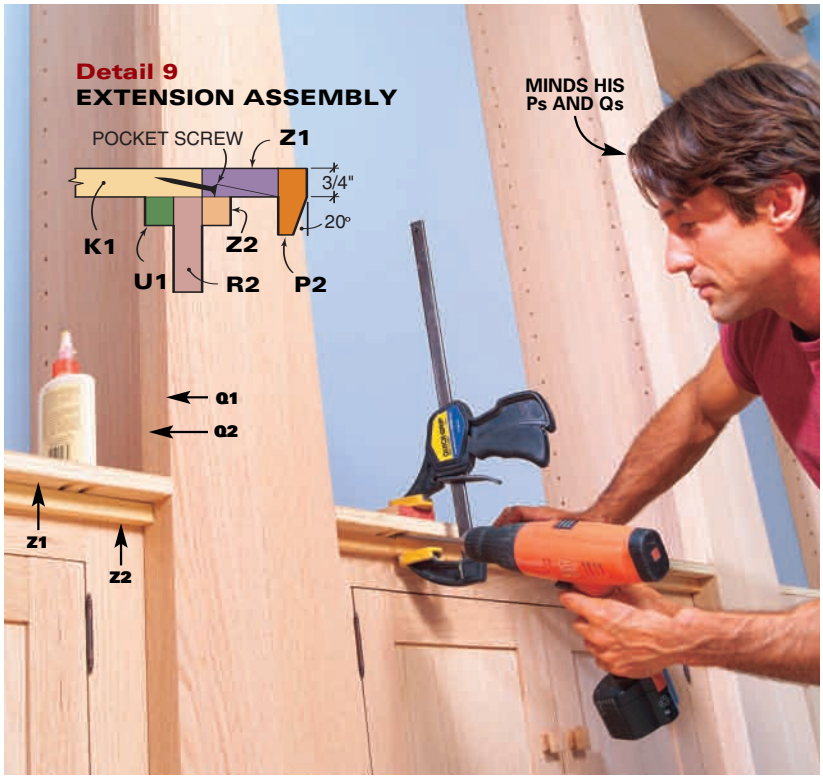


19 **FIT** the capital moldings around the tops of the columns. Use a double layer at the top to build out the surface and notch these layers around the lower edge of the curve. Place the 3/4-in. x 1-3/4 in. tapered molding directly below and nail it in place with the brad nailer.

18 **SET** the columns onto the base caps and mark each side of the column where it meets the upper arch. Be sure the column is centered on the 2x4 support behind. Build up the upper face of the 2x4 supports with 1-1/4 in. deep strips to ensure the column lies 1-1/4 in. in front of the oak arch. Nail the columns to these strips and to the face of the 2x4 and face frame below with 10d finish nails.



20 **CUT** cornice blocks from 3/4-in. oak, then stack them in layers and glue them to achieve the 2-1/4 in. thickness. Make the tapered keystone center block in the same manner. Predrill, glue and hand-nail the cornice blocks to the curved apron with 10d finish nails. Next cut the cornice strips on the table saw and nail them in layers between the blocks with your finish nailer.



21 **FASTEN** the front top extensions with your pocket hole jig. Nail a 3/4-in. x 3/4-in. strip to the top of the face frame and glue the extension to this for added support.

When the glue is dry, belt-sand them smooth on each side and then finish-sand them. Use your jigsaw or a miter saw to cut the keystone angles.

Buyer's Guide

Get a pair of no-mortise hinges (part No. 90437; $2.99) from Rockler Hardware (800-279-4441; www.rockler.com). Package of 16 shelf clips (part No. 33894; $3.69).

Buy the Kreg pocket hole jig kit (part No. Kreg R-2; $59.95) and an extra pack of 1-1/4 in. pocket screws ($5.50) from 7 Corners Hardware (800-328-0457). www.7corners.com

Ace oil stain in Early American. Buy it at your local Ace Hardware.

22 **GLUE** and nail the top shelf edge molding to the top shelf, extending it 1-1/2 in. onto each column. To finish the building process, make the shelves as shown in Detail 10, p. 36, to fit between the vertical bookcase sides. (You'll also need to make three narrower shelves if you want extra storage inside the cabinets. Measure and cut them to fit.) Sand your bookcase with 100-grit sandpaper followed by 150-grit. Stain (see Buyer's Guide) then finish it with two coats of satin urethane or your choice of varnish.

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