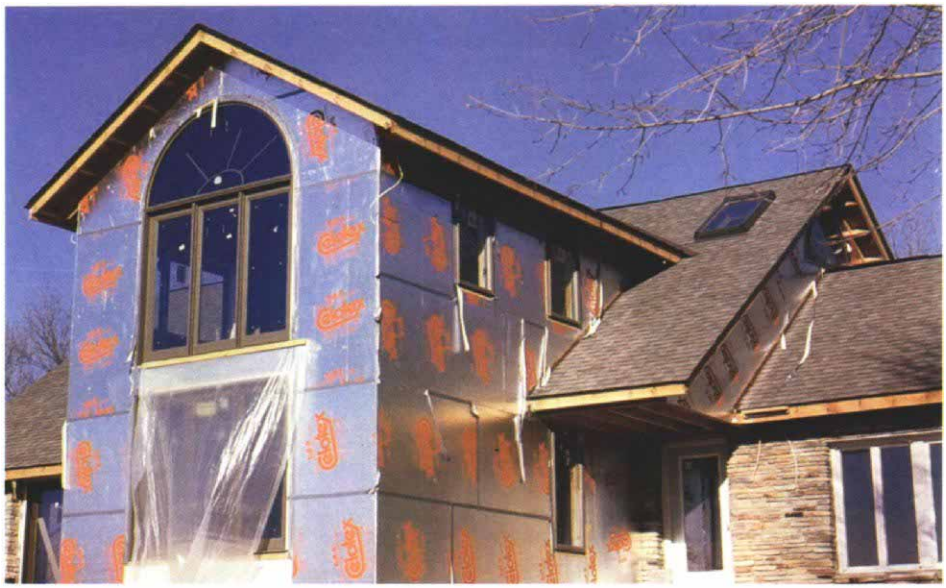
Installing Arch-Top Windows

How one builder supports the loads without a conventional header, then uses a trammel jig to cut siding and casing

by Douglas Goodale



Arch-top windows have caught the fancy of home buyers, so carpenters have to contend with the difficulties of framing and finishing these semicircles within rectilinear walls.

Round-top, circle-top or arch-top, whatever you call them, such windows have become a popular architectural feature. They add light and view and a touch of grandeur to a house. But these windows require carpenters to come up with some resourceful solutions when it comes to installation and trimming. Here, I'll describe techniques that work for me, including some I used on a recent project in rural Hunterdon County, New Jersey (photo above).

Solving the structural problems—A typical rectangular window has a structural header at the top of the rough opening, and the header is supported by trimmer studs that pick up any loads above. This header—I usually use a doubled 2x10 with a 2x4 laid flat on the bottom—sits below the double top plates, which means the top of the window is about 13 in. below the ceiling.

With arch-top windows, however, it's common to want the top of the window closer to the ceiling, which means there's no room for a conventional header. Usually the arch top will stop 5 in. or 6 in. below the ceiling line, so that after installing the casing, you still have some clearance between the casing and the ceiling.

I use two methods to eliminate the conventional header. The first method is used if the window is in the first-floor wall of a two-story house. In this case, second-floor deck, wall and roof loads must be supported. I move the header up above the top plate (bottom drawing, facing page). In 2x4 framing, this would call for a double 2x10 with ½-in. plywood sandwiched between; in 2x6 framing, it would call for a triple 2x10 with ½-in plywood. In either case, I use the rim joist as the outside layer of the header. If the ends of floor joists bear above windows, I then install metal hangers to support the joists that meet at the header.

I use a different method if the window is in a wall supporting only ceiling and roof loads, where we often have less depth to work with. I usually have room for a smaller dimension header that's beefed up to carry the roof loads. For window openings 3 ft. to 4 ft. wide, I use a piece of ½-in. by 5½-in. steel sandwiched between 2x6s, or a piece of 4-in. by 4-in. steel angle (such as masons use for lintels) packed with two 2x4s. I bolt these headers together with ⅜-in. carriage bolts.

Framing and cathedral ceilings—On the house shown here (photo left), all the arch-top windows were in gable-end walls of rooms with cathedral ceilings. Cathedral ceilings present special problems because their construction usually requires a structural ridge beam. You cannot build a cathedral ceiling with conventional pairs of rafters opposing at a ridge board. Without ceiling joists or collar ties, the weight of the roof will push the outside walls apart. By making the ridge beam structural, however, the weight of the roof bears on the outside walls and on the ridge beam.

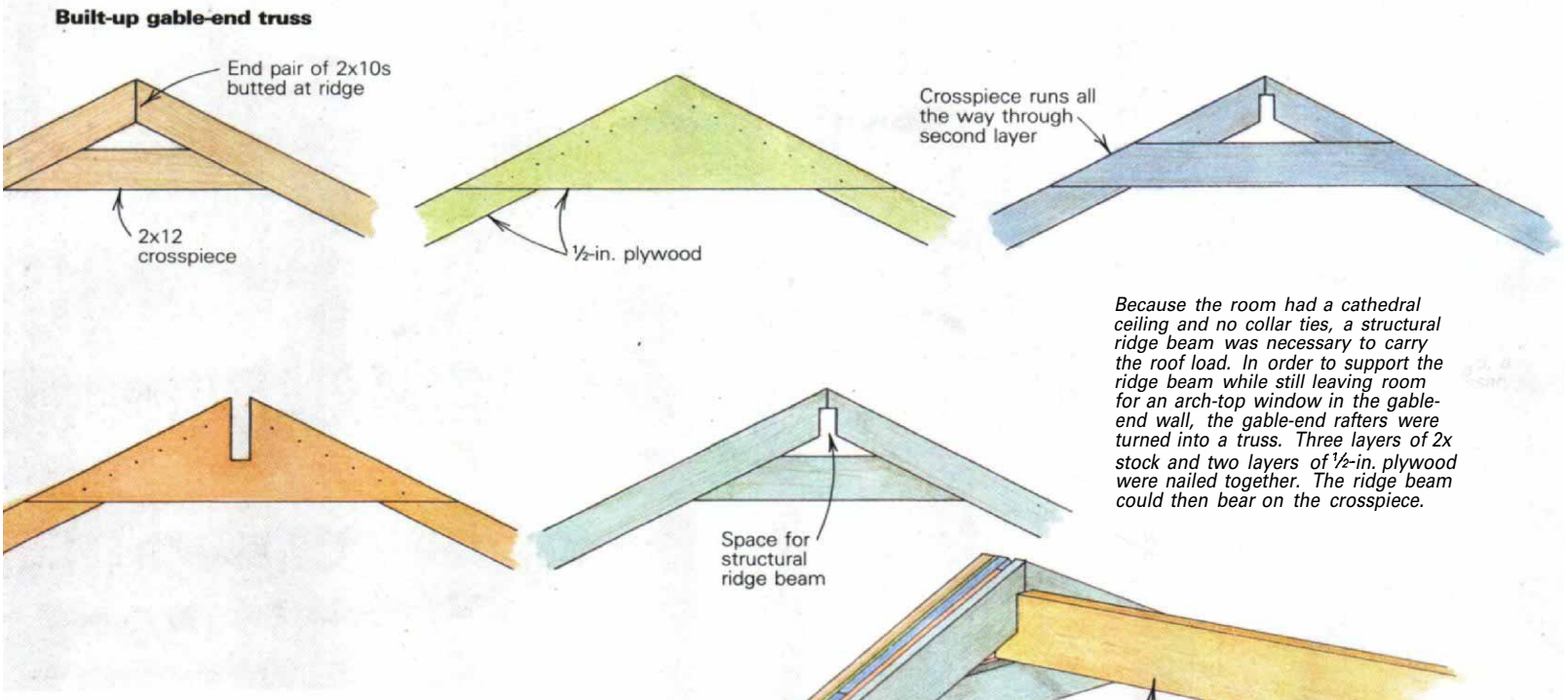
If there are no windows centered in the gable wall, the ridge beam is usually supported by a solid or built-up post, or by a header distributing loads to a pair of posts. When you place an arch-top window in the center of the gable, however, there is no room for the post and rarely is there room for a conventional header. Let's consider, for example, the 8-ft. dia. arch top I installed in the master bedroom. To support the ridge beam (a 5½-in. by 13-in. glulam) while keeping the arch-top window close to the peak, I turned the gable-end rafters into a truss.

First I made a pair of gable rafters out of 2x10s (the other rafters were 2x8s). I butted this first pair of gable rafters together in full plumb cuts. Then I fit a 2x12 crosspiece to the underside of the rafters so that the bottom edge of the crosspiece was even with the top of the rough opening for the arch top (top drawing, facing page).

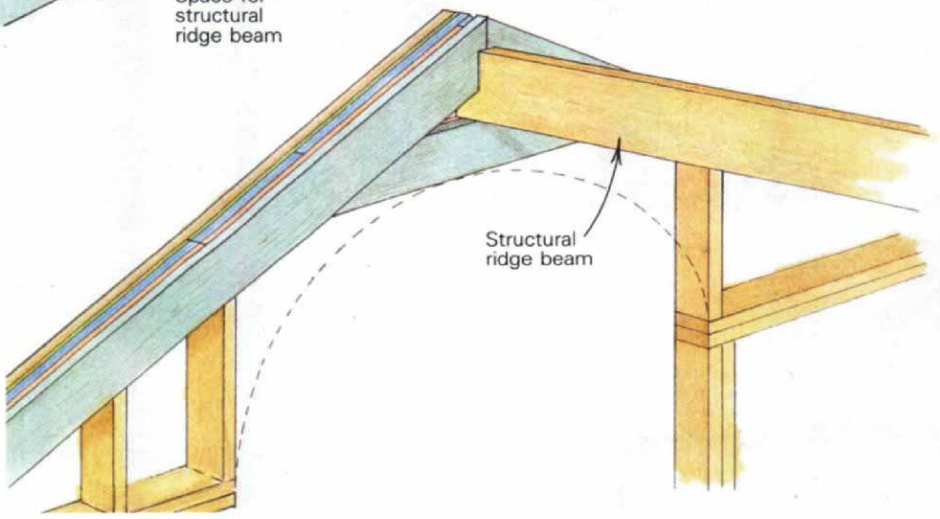
Next I sheathed the inside face of this assembly with plywood, starting with a triangle whose sides followed the top edges of the rafters and the bottom edge of the crosspiece. I filled out the remaining faces of the rafters with ripped lengths of plywood.

Then I added another layer of 2x stock. But this time I ran a 2x12 chord all the way through—flush with the top edges of the rafters—and filled in with 2x10 stock above and below it. At the ridge, I notched the plumb cuts to create a pocket for the ridge beam. Next I added another layer of plywood, and finally, a third layer of 2x stock. I used construction adhesive between all the layers, and

Photo: Ross Cameron



Because the room had a cathedral ceiling and no collar ties, a structural ridge beam was necessary to carry the roof load. In order to support the ridge beam while still leaving room for an arch-top window in the gable-end wall, the gable-end rafters were turned into a truss. Three layers of 2x stock and two layers of ½-in. plywood were nailed together. The ridge beam could then bear on the crosspiece.



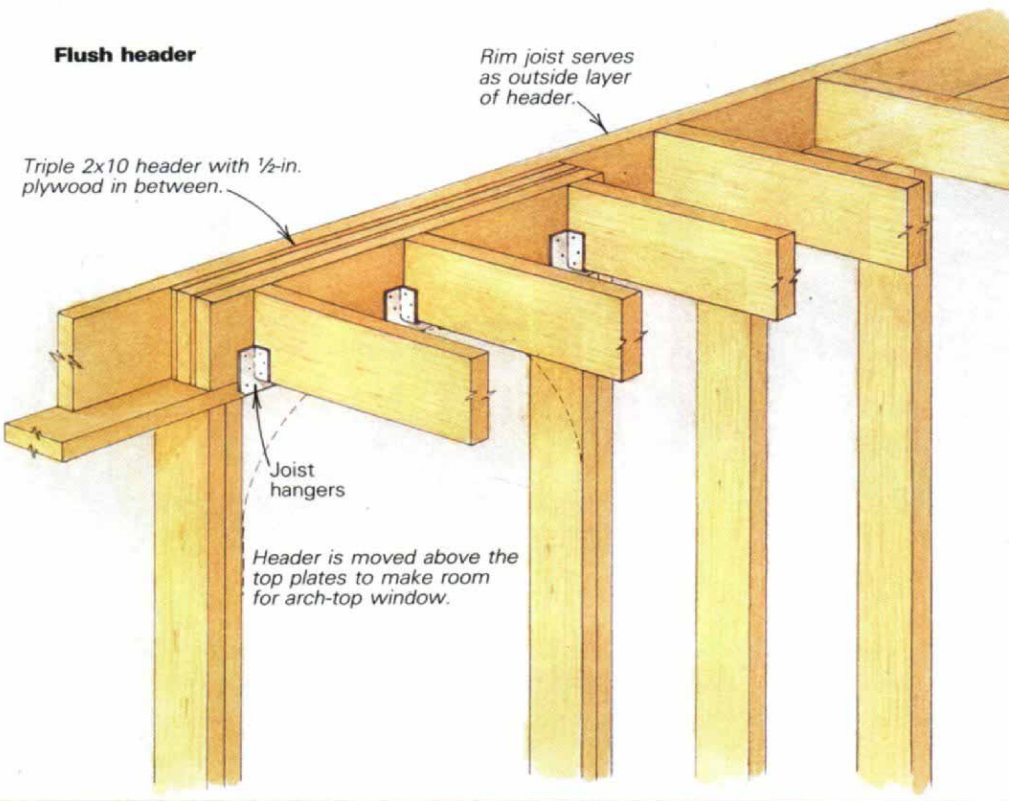
once the whole thing was assembled, I nailed it off with 16d commons, three across, 12 in. o. c. In this manner, the built-up crosspiece became the bearing header for the ridge beam. Although this was a solution that I worked out on site, without benefit of an architect or engineer, it passed the framing inspection with flying colors.

Installing the window—No matter which type of arch-top application I'm dealing with, the procedure for preparing the rough opening is pretty much the same. To cut plywood sheathing, I lay the window on a sheet of plywood oriented to follow the layout of the studs, trace the outline with a compass/scriber set at ⅛ in. and carefully cut this line with a sabersaw. Then I install the plywood, double-checking to be sure it is properly centered and that the top of the cut-out is at the proper height.

Before infill framing is installed, the only points of solid attachment for the arch top are the top of the rough opening (where the arch is tangent to the bottom of the header), and at the two bottom corners of the arch top (where the arch is tangent to the gable studs). I install the window at this point, tacking it through the nailing flanges or exterior casing at these three points.

Then I fabricate a curved ladder of infill framing to provide nailing for the sheathing outside, and the drywall and casing inside (drawing, next page). I use 2-in. wide plywood for the curved "rails" of the ladder, then nail 5/4 by 3-in. blocks radially along the plywood every 6 in. to 8 in., except where I turn the blocks on edge so they don't stick out past the plumb-cut ends of the plywood.

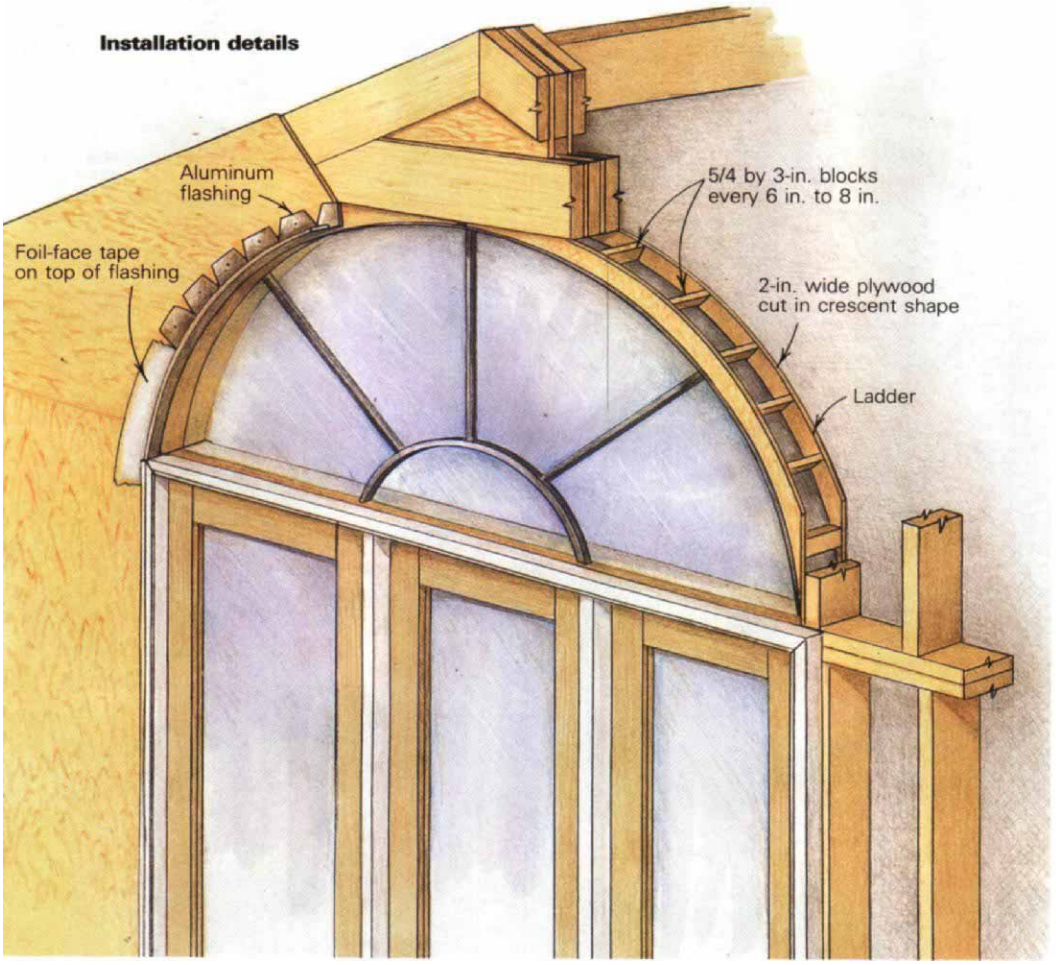
I fit the ladders on either side of the rough opening, shim them snugly against the outside surface of the arch-top jamb and secure



Drawings: Michael Mandarano

To provide nailing for sheathing, drywall and trim around arch tops, Goodale installs curved ladders made of plywood sides with blocks nailed between them.

With the cedar siding tacked in place on the trammel jig, Goodale pivots the swing arm and neatly trims the boards for a perfect fit against the arch-top window.



them in place by screwing through the sheathing into the ladders. They provide continuous nailing inside and out, and also allow me to insulate around the window right up to the jamb. Rather than bang nails into the lightweight ladders, I run #6 1¼-in. drywall screws through the nailing flange of the window and into the plywood.

Curved flashing—Most vinyl-clad windows are designed so that the nailing flange acts as flashing. Metal-clad and all-wood windows are more of a problem. Some manufacturers offer vinyl flashing as an accessory that you can buy. Or you can have custom flashings made (out of copper, for instance), but that gets pretty expensive. I usually make my own flashing on site. Sometimes I'll even add this to a vinyl-clad arch top so that its flashing will match the windows and doors on the rest of the house.

I use a sheet-metal brake to bend 6-in. aluminum flashing into a Z-shaped profile, the dimensions of which vary depending on the window. In this case the bends measured 4⅜ in. up the wall, 1⅛ in. across the top of the window and ½ in. over the edge of the window. Then I make cuts in the 4-in. edge, right up to the bend. The spacing of these cuts also varies with the radius of the arch top—the smaller the arch, the closer the cuts must be.

Another series of cuts about 2½ in. apart in the ½-in. flange allows the metal to bend to the shape of the arch top. When fitting the flashing, a helper supports the uncut end while I make the cuts in the ½-in. flange and fit it to the trim. The flashing is attached by nailing through the 4-in. flange

Photos this page: David Schiff

with roofing nails, using one nail per tab. I've tried cutting the flange on a bench, but it makes the stock too flexible to handle without distorting. As an alternative to cutting the ½-in. flange, you can crimp it with a three-leaf crimper (used by sheet-metal workers and woodstove installers).

I know that the cuts in the flashing are a vulnerable area, so I use a good quality foil-faced tape to seal the joint where the wall and window meet. I tear off short lengths of tape, and starting at the bottom, overlap the pieces as I work my way up the window. Lastly, I run a generous bead of clear caulk before installing siding. So far, none of my installations has leaked.

Using the trammel jig—My trammel jig is a worktable with an adjustable arm that swings arcs of any radius from 6 in. to 60 in. I use it as a giant compass to lay out half circles on plywood, and with a router mounted on the arm, I use it to cut siding and molding for arch tops.

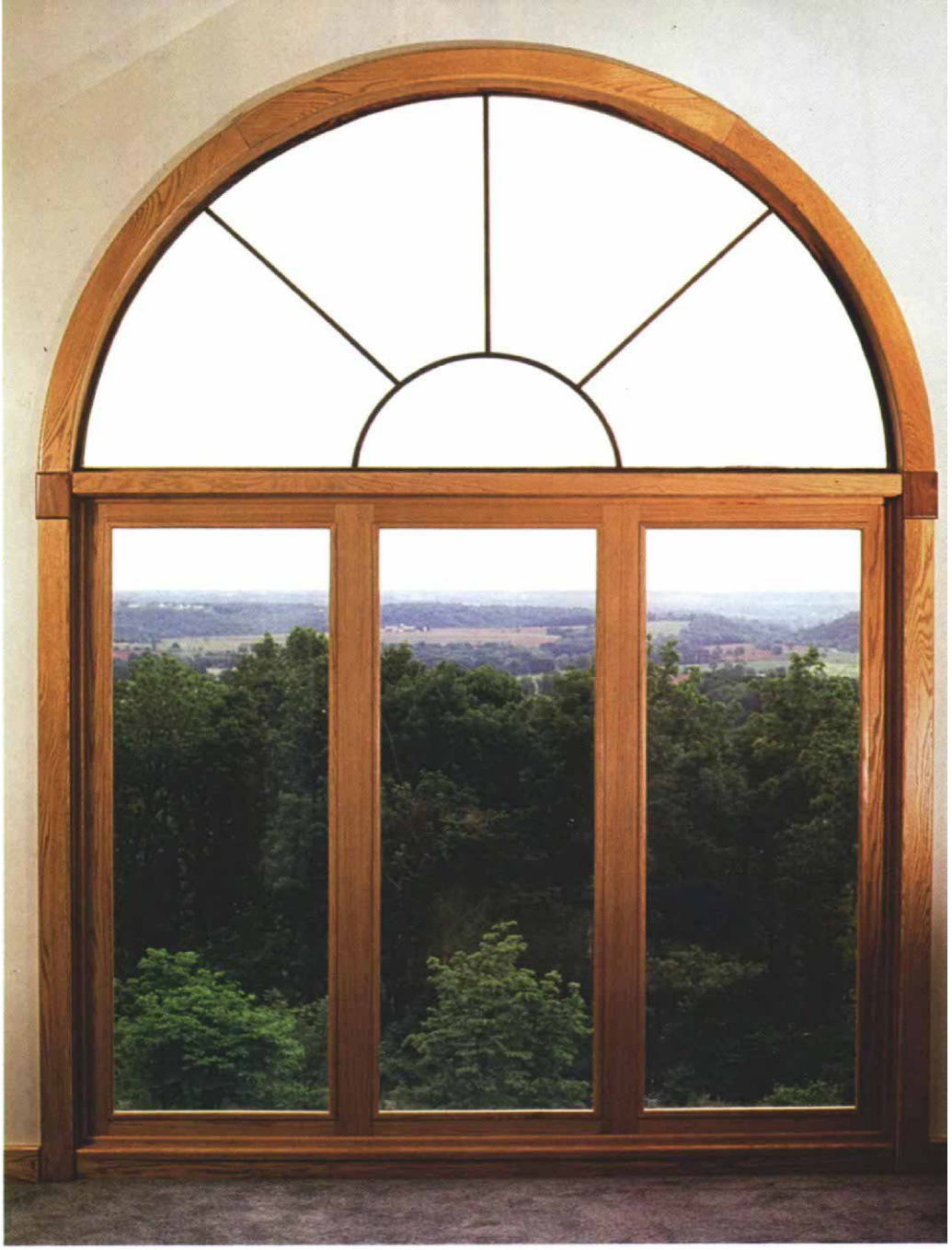
To build the trammel jig, I start with a full sheet of plywood and add smaller sheets to the two bottom corners and the top edge of the jig. The corner panels are 16 in. by 24 in. The top panel is 16 in. by 48 in. These extension panels are attached to the full sheet with 1x3 cleats, glued and screwed through the back.

The adjustable arm is a length of ½-in. plywood, 4 in. wide by 60 in. long. It has a centered 1-in. hole 2 in. from one end and a ⅝-in. wide slot cut down the length, stopping 2 in. short of the 1-in. hole and 2 in. short of the other end. The router is centered over the 1-in. hole and screwed to the plywood.

The arm pivots on a carriage bolt running through the base of the jig and through the slot in the swing arm. The radius of any arc is determined by the position of the crosspiece, which has a hole drilled in it for the carriage bolt, and which can be screwed to the arm at any point along the slot. It's important that the pivoting end of the arm be shimmed up the thickness of the stock being cut.

On this house, the T&G cedar siding runs square to the pitch of the roof. The trammel jig allowed us to cut all of the pieces for the window at the same time so they fit perfectly. As a guide for the top edges of the stock, I tacked two boards to the table at the roof pitch. To use the jig, I tacked the stock to the trammel jig, carefully keeping the nails out of the line of cut.

With the stock positioned in the jig, I mounted a pencil in the swing arm and marked the line of cut on the stock. I removed the pieces and cut each one individually with a sabersaw to minimize the amount of work the router would have to do and to avoid blowing out the edges of the stock. Then I replaced the pieces on the jig and made the final cut with two or three passes of the router fitted with a ½-in. carbide straight cutter bit (top right photo, facing page).



A common location for arch-top windows is in the gable end of a room with cathedral ceilings, but this creates the problem of supporting a structural ridge beam. Goodale solved the problem with a site-built wood truss. The arched casing in the photo above was made on a trammel jig.

I also made interior casings with the trammel jig, beginning by mounting a pencil in the swing arm and drawing the inside and outside edges of the casing directly on the worktable. Then I layed out short sections of stock, overlapping each piece. The number of pieces needed to complete the arch varies depending upon the width of the stock—wider boards will require fewer pieces to complete an arc, but will also produce long run-out in face grain and should be avoided unless the casings are to be painted.

I joined the pieces by slot-cutting the matching ends and gluing them together with a spline. Once the pieces were glued up, I mounted the resulting polygon in the trammel jig, and using it as a compass again, redrew the inside and outside lines of the casing on the stock. Just as with the siding, I cut the stock close to the line with a sabersaw and then remounted it in the jig for final passes with the router.

To avoid putting unnecessary nail holes in the face of the casing, I held stock in the jig with drywall screws run through the back. Once the inside and outside edges were cut, I simply nailed it up (photo above). But you can switch the router bit to any desired molding profile and shape the edges or even the face of the casing. □

Douglas Goodale is a builder in Frenchtown, New Jersey. David Schiff is a writer and an amateur builder who assisted with the writing of this article.

Photo: Ross Cameron