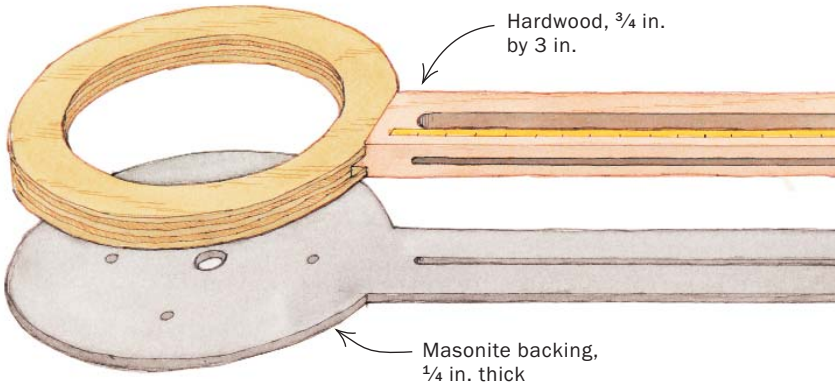
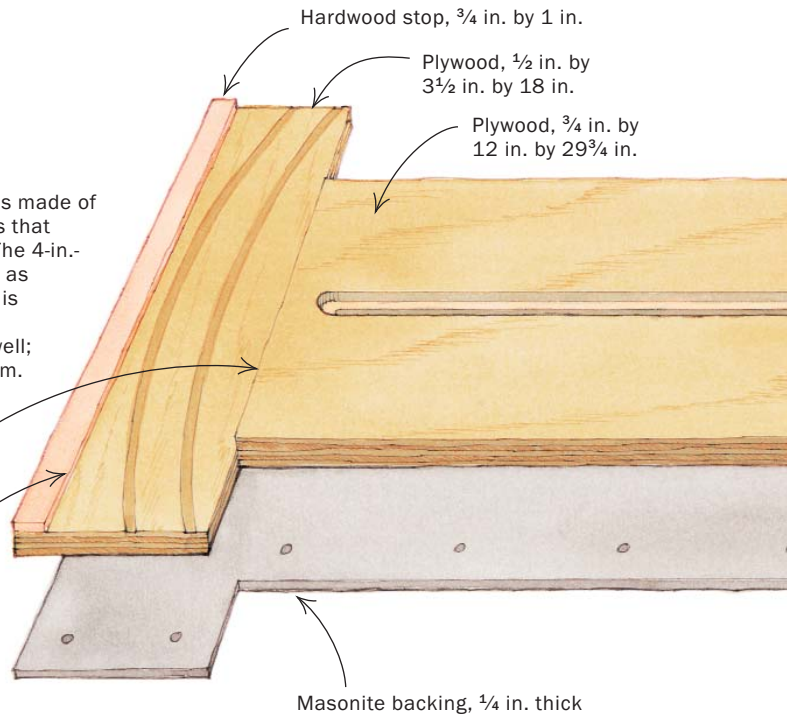
Arched Top

Make arched raised-panel doors

THE RADIUS ARM
The radius arm consists of a piece of hardwood, a wooden circle and a piece of Masonite. Slots in the arm, which accept the adjustable pivot point, are cut on a router table. A tenon at the end of the arm fits into a mortise in the wooden circle. Stick-on measuring tape measures the distance between the pivot point and the router bit. The Masonite backing adds strength and provides a base for the router.



THE BASE
The main body of the jig base is made of ¾-in. plywood with routed slots that house the sliding pivot point. The 4-in.-wide recessed template well is as deep as the template material is thick—¼ in. on this jig. Rail templates butt the top of the well; panel templates butt the bottom. The bottom of the base is covered with Masonite.



BY BILL EWING

In woodworking, as in architecture, arches can be both decorative and functional. Positioned below the main structure, an arch adds strength without the visual weight of heftier underpinnings. Placed higher up, such as in the upper rail of a bookcase, an arch lends a bit of elegance. Adding an arch to the upper rail of a cabinet door is also an easy way to refine the sometimes boxy look of frame-and-panel construction.

I wanted to find a quick way to cut arched doors so that I could offer this design option to my clients. After a little planning and experimentation, and in one quick afternoon, I was able to make an adjustable jig that allows me to cut arched raised-panel doors of almost any size. The few hours spent building the jig proved worth the time; over the last four years I've used it to make countless doors for the kitchen cabinets that are the mainstay of my business.

The only way to get uniformly fair arches is to work from two accurate templates—one for the rail and one for the panel. Each door width also requires a different set of templates. Using the two-piece jig shown here, I can quickly and efficiently cut a set of panel and rail templates to fit a wide range of cabinet-door sizes. By using these templates in conjunction with rail- and stile-cutting bits, you can cut the door parts for a whole set of kitchen cabinets in a day.

The key to this jig is that it can be adjusted in two different ways. The radius arm of the jig (the top piece in the drawing above) allows you to make arcs of different radii. The sliding pivot point in the base (the bottom piece) allows you to move the center point of the arc's radius to accommodate varying widths of door rails. Another great thing about this jig is that it can be adjusted while the router is in place. To cut out the panel and rail templates, I always use a plunge router with a ¼-in. straight bit.

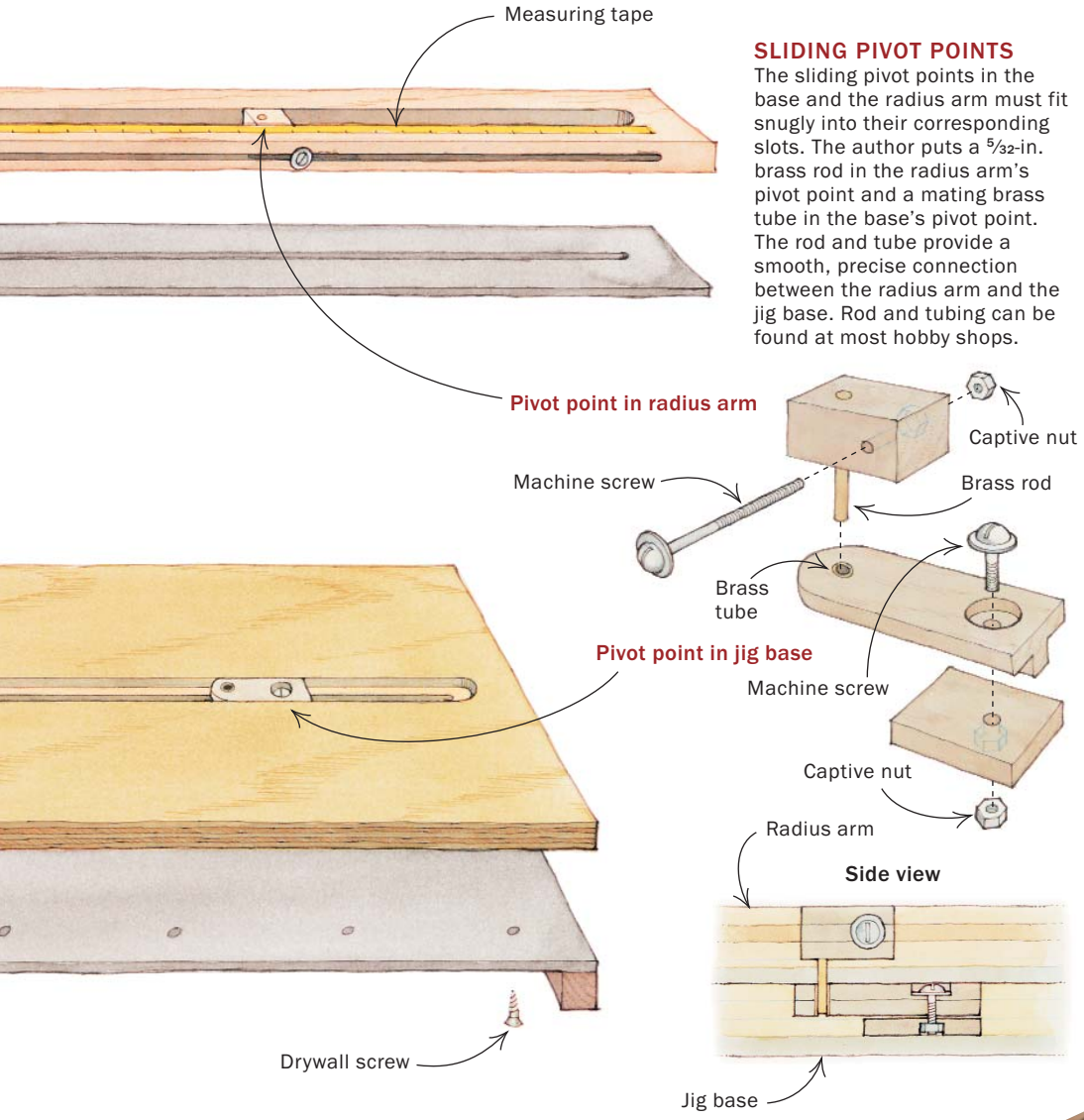
A 1-in. arch looks best on cabinet doors

Before making panel and rail templates, you have to establish a few design parameters: the depth of the arch and the width of the rail. After some experimentation, I've found that a 1-in. arch looks best on most

Drawings: Jim Richey

Cabinet Doors

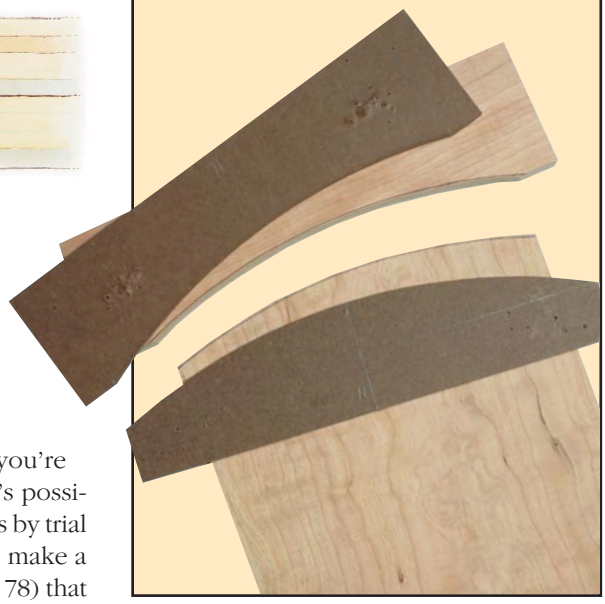
of any size with an adjustable jig and a router



SLIDING PIVOT POINTS
The sliding pivot points in the base and the radius arm must fit snugly into their corresponding slots. The author puts a 5/32-in. brass rod in the radius arm's pivot point and a mating brass tube in the base's pivot point. The rod and tube provide a smooth, precise connection between the radius arm and the jig base. Rod and tubing can be found at most hobby shops.

JIGS CUT TEMPLATES THAT HELP BUILD DOORS

To build arched raised-panel doors, you must have two templates—one for the panel and one for the rail. The author's jig adjusts so that you can cut a matching set of templates. The templates are used to cut fair and complementary curves on a door's panel and rail.



cabinet doors. An arch of less than 1 in. leaves the rail too meaty and the arch too subtle. Making an arch with a depth of more than 1 in. cuts down on rail width so much that it appears weakened.

For both aesthetics and uniformity, I always use 2⅜ in. for my rail and stile widths. I maintain this 2⅜-in. dimension at the midpoint of the arc and increase this measurement by 1 in. at each end of the rail. These measurements remain constant regardless of the rail length.

Templates are easy to make

Once the jig is up and running, you're ready to make templates. While it's possible to determine the measurements by trial and error each time you set out to make a template, I refer to a graph (see p. 78) that

Photos: Matthew Teague

ROUTING THE TEMPLATES

Making the rail template. *With brads securing the template blank in place, a router outfitted with a ¼-in. straight bit cuts a smooth arch in the rail template.*

A slight adjustment. *To cut the panel template, increase the radius on the jig's arm ½ in. to allow for the bit diameter and the panel tongue.*

A matching pair. *Once the radius has been adjusted, tack a Masonite blank onto the jig's well. Cut the panel template with the router in a single pass.*

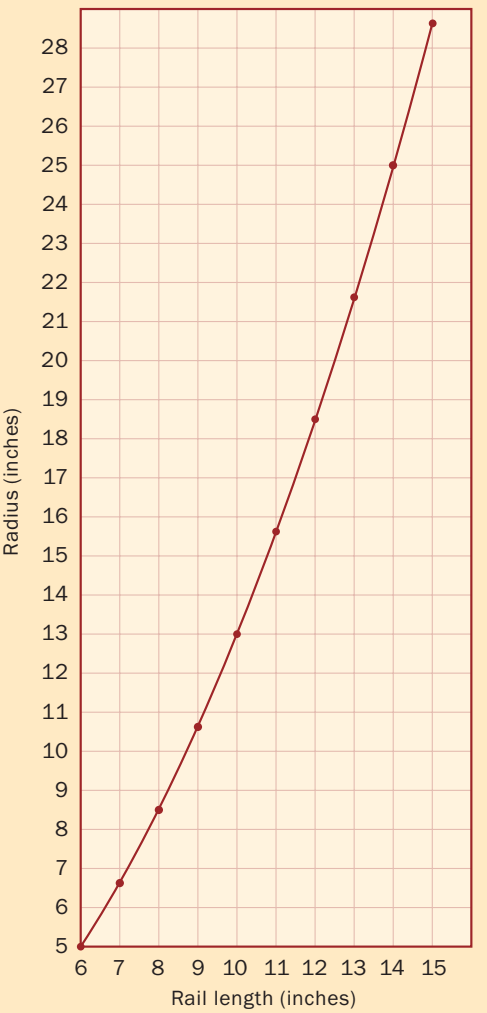
Finding the perfect curve

When you have to handle different-sized arches in a single piece of furniture or in a set of cabinets, it's imperative that the height of the arches be uniform. Even small irregularities in the arches can be seen at a glance.

It's possible to use trial and error to determine the measurements each time you make a template of different rail lengths, but I plotted points on a graph (right) that allow me to see quickly what the radius of the arc needs to be. These measurements will give you a height of 1 in., a suitable arch for most cabinets.

RADII FOR COMMON RAIL LENGTHS

Rail length	Radius
6 in.	5 in.
7 in.	6.625 in.
8 in.	8.5 in.
9 in.	10.625 in.
10 in.	13 in.
11 in.	15.625 in.
12 in.	18.5 in.
13 in.	21.625 in.
14 in.	25 in.
15 in.	28.625 in.
16 in.	32.5 in.



FORMULA FOR SUCCESS

I once had to build doors that required an arch with a radius longer than my jig could handle. I found the radius through trial and error—not my favorite method. Since then, I've avoided the trial of all of these errors using a simple algebra formula my son-in-law (an engineer) derived:

$R^2 = (R-X)^2 + (L/2)^2$,
Where R = arc radius,
L = cord (the distance between the ends of the arc),
X = height at the midpoint of the arc.

Don't panic—the formula reduces to a more manageable size when you substitute the height of the door arch (in this case, 1 in.) for *X*. It becomes:

$R = \frac{1}{2} + L^2/8$.

For example, if your rail length is 8 in.:

$R = \frac{1}{2} + 8^2/8$,
$R = \frac{1}{2} + 64/8$,
$R = 8\frac{1}{2}$ in.

For arch heights other than 1 in., such as in the top face frame of a display cabinet, just substitute the desired height for *X*. I've crunched the numbers for 2-in., 3-in. and 4-in. heights.

2 in.: $R = 1 + L^2/16$;
3 in.: $R = \frac{9}{6} + L^2/24$;
4 in.: $R = 2 + L^2/32$.

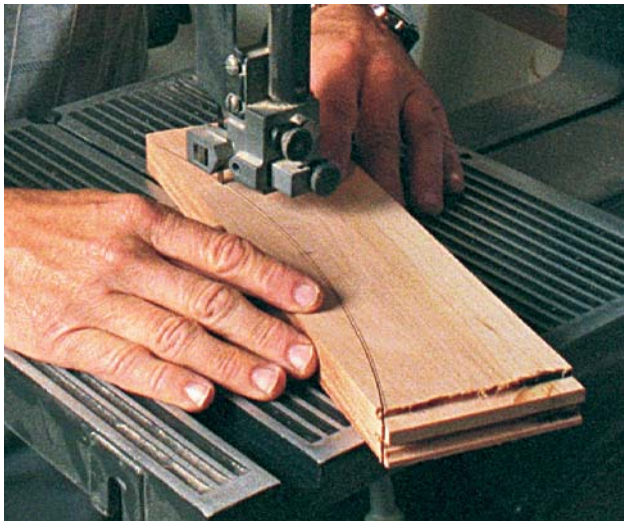
tells the radius and pivot-point measurements needed to cut templates for various rail lengths. If I need to cut an arch with a depth of other than 1 in., I use the simple formula shown on the facing page to gauge the radius.

To make a rail template, first install a ¼-in. Masonite template blank—3½ in. wide and 2 in. longer than the rail length—against the hardwood stop in the recessed well on the jig's base. Set the brass rod in the radius-arm pivot point into the brass tube in the base's pivot point. The pivot point on the radius arm slides and is secured with a machine screw on the side of the arm. Loosen the screw, and move the pivot point to the correct rail length, then retighten it. Then loosen the adjustment screw on the pivot point in the base and retighten it slightly shy of its final position. Measure the distance between the ends of the arc and keep adjusting the pivot point on the jig's base until this end-to-end measurement equals the desired rail length. Now you're ready to rout the arch (see the left photo on the facing page).

Once the rail template has been cut, move on to the panel template. The arc for the panel template will have to be slightly larger than that of the rail template. As you move from making the rail template to making the panel template, you must increase the length of the radius to accommodate the bit diameter because the router is cutting on the opposite side of the bit. You also have to lengthen the radius arm to create a tongue on the panel.

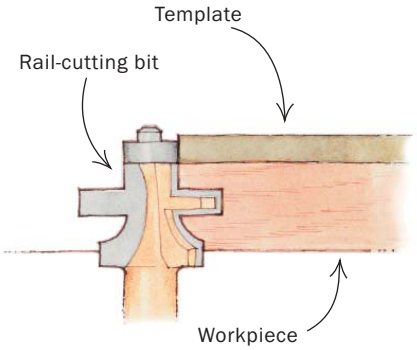
Lengthen the radius arm by ½ in. to compensate for the ¼-in. bit diameter and ¼-in. panel tongue (see the middle photo on the facing page). Start with a template blank that is 3 in. wide and the same length as the rail template. Butt it against the rear stop and attach it with brads. Once the pivot point has been adjusted, simply rout the arc (see the right photo on the facing page). After cutting the templates, you can start building doors.

SHAPING THE RAIL



Roughing out the rail. *Shape one end of the rail on the router table, then cut away the excess material on the bandsaw.*

Cut the profile and curve in one pass. *With the template tacked into place, use a rail-cutting bit to shape the profile and fair the edge.*



Build doors oversized and trim them to fit

Somewhere, perhaps in a parallel universe, frame-and-panel doors always glue up square, and the stile ends are always even with the rails. But in my shop, reality reigns. To correct minor imperfections in assembly, I build my doors ¼ in. long—adding ⅛ in. to the width of both the top and bottom rails—and trim them to size with a crosscut sled on my tablesaw.

Using the tablesaw, cut stock for the upper and lower rail 3½ in. and 2½ in. wide, respectively, and leave them ½ in. longer than the finished length. Because each stile is 2⅜ in. wide and you lose ⅜ in. of each edge when you cut the inner edge profile, the rail length is 4 in. less than the overall door width. Cut the stiles 2⅜ in. wide and ¼ in. longer than the finished door height.

Rail-cutting sequence is key

It is important to follow a particular sequence when shaping the rails and stiles, because you could end up trying to shape the upper rail ends without a straight edge to rest against the router table's miter gauge, or you could encounter serious chipout problems when the stile-cutting bit exits the arch in the upper rail.

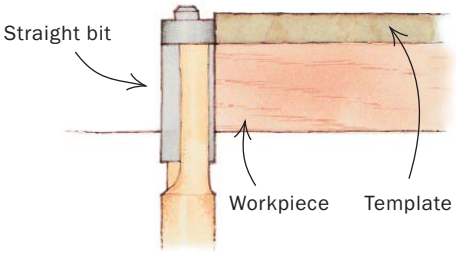
Place the rail template on the back of the upper rail and align the end of the arch with the left (when viewed from the front) end of the rail and draw the arc. With a rail-cutting bit in your router table, shape the left end of the upper rail and the right end of the bottom rail.

Remove the waste material on a bandsaw (see the top photo above), tack the template into position and shape the rail's arch on the router table using the stile-cutting bit with a pilot bearing on top. This is a small piece to cut on a router table, so use a hold-down jig (see the bottom photo above). While the bit is still in place, go ahead and shape the inside edges of the stiles and lower rail, as well as a scrap piece of the same stock to be used in dry-fitting the panel. Finally, cut the upper rail and lower rail to length on a tablesaw or miter box. The only thing left is to replace

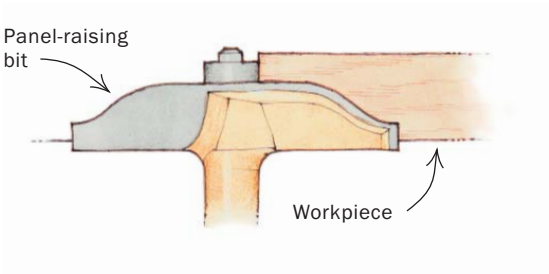
SHAPING THE PANEL

Cut the panel to rough shape. *Trace the arc from the template onto the panel and trim the waste material away on the bandsaw.*

Trim the panel flush. *Tack the template in place and trim the panel flush on the router table using a straight bit with a pilot bearing.*



Raise the panel. *When turning a flat panel into a raised one, you can make a safer cut by using both the fence and the pilot bearing.*



the stile-cutting bit with the rail-cutting bit and shape the remaining rail ends.

A dry run avoids headaches

Dry-fitting the frame allows you to take exact measurements for the panel. Be sure to allow for a ¼-in. tongue on all four edges. Rip the panel to exact width so that the arch of the panel will match up with that of the rail. Leave the length of the panel about 1 in. long so that the arch doesn't have to be cut to the very edge of the panel.

Using a framing square, draw a line across the back of the panel, approximately 1½ in. from the top. Use the square to align the arch of the panel template with the line you've just drawn, making sure that it meets each edge of the panel, and draw the arc. Rough-cut the panel's arch on the bandsaw (see the left photo above) and tack the template back into place. To ensure a nice, smooth edge, clean up the cut with a bearing-driven straight bit on your router table, and trim the panel to finished length (see the middle photo above).

Now you can shape the panel using a panel-raising bit with a top-mounted pilot bearing. Use the fence in the normal fashion for the straight edges. As you shape the curved edge, register the panel against both the fence and the pilot bearing (see the right photo above). This is safe, provided the panel is large enough to grip firmly and you don't try to hog off too much material in a single pass. Use a scrap piece of stile stock to check that you raise the panel to the correct depth.

All that remains is to cut the back rabbet in the panel so that it fits the groove in the rails and stiles. Once everything falls into place, some glue and a couple of clamps bring everything together. Measure the door's exact length off the cabinet and trim the door to length. When you hang the door, the elegant arch serves as a subtle reminder that it was designed with care. ☐

Bill Ewing is a cabinetmaker in Girard, Ohio.

Arched grain for arched doors

When you build custom arched doors, you have the opportunity to use grain that accentuates the design. My general guidelines are simple—straight grain for the frames and more striking grain patterns for the panels.

For the upper rail of an arched door, look for grain with a slight curve that follows the curve of the arch. Don't expect a perfect match, but any slight curve in the grain will help.

Laying out the grain pattern for a door panel is more complex. In general, look for a grain pattern that arches upward so that it draws your eye to the arch in the door. This grain pattern is common in most flatsawn lumber.

Good grain, bad grain. *Whenever possible, the grain patterns should echo the arch (above) rather than fight it (below).*