Drawing Big Curves

Let drawing tools, jigs, and a little intuition help you design graceful furniture

BY PAUL SCHÜRCH

For centuries, wooden-boat builders have been drawing templates and designing components that feature long, curved lines and surfaces, thus creating boats of grace, beauty, and strength. The term *fairing a curve* comes from boatbuilding and refers to the process of creating an organically flowing line that continues gracefully without flat spots or kinks, bringing various curved surfaces into alignment. If a line is not fair in a boat design, it can undermine the boat's beauty and strength. Having worked as a boat builder early in my career, I find that creating pleasing curves is equally as important when designing furniture.

Everyone has the ability to look critically at a curve, but I find that many woodworkers distrust their intuition. When evaluating whether or not a line works in a piece of furniture, it comes down to instinct and gut feelings. Just as important as trusting your design sense, though, is having the right tools and jigs to draw and shape curved furniture components.

Tools for drawing circles

One of the most basic curves that can be incorporated into a furniture piece is the radius curve, or arc. These are prevalent in every type of woodworking, from tabletops to aprons to the doors on a cabinet.

Producing an arc is relatively straightforward. We're all familiar with drawing a portion of a circle with a compass. The only adjustments you can make are to increase or decrease the radius.

When it comes to drafting furniture components, you often will require large-scale radii. To draw these large-radius arcs you need trammel points, which are standard drawing aids available from

Photos, except where noted: Matt Berger

many woodworking-, art-, and drafting-supply dealers. Trammel points act like an oversize compass when mounted to a beam. The only limitation to the size of the radius they can draw is the length of the beam. You can create a simple trammel using a stick, a nail (for the pivot point), and a pencil that is secured to the stick.

To draw a curve with a trammel, tape your drawing paper to a large, flat surface, such as a sheet of smooth plywood, melamine, or medium-density fiberboard (MDF), and then draw a centerline beyond the paper, at least the length of the desired radius. Plant the pivot point of the trammel along the centerline and draw an arc with the secured pencil. If the radius seems too dramatic, you can flatten out the arc simply by moving the pivot point farther away from the centerline.

Arc jig—Another way to draw an arc without a compass is with a simple arc jig. This jig consists of two long, narrow strips of plywood fastened together at an angle at the center of the arc's radius (see the drawing on the facing page). Drive a nail into the drawing surface at each end of the desired arc, and set the angle of the jig so that the strips intersect at a height above the nails equal to the highest point of the arc.

Moving the jig from side to side against the nails—with a pencil at the intersection of the plywood strips—will create a perfect arc. To change the radius, increase the pitch of the angle where the two pieces of plywood are fastened together. In addition to drawing arcs, I have used this jig with a router to cut arc templates.

Fair curves with a batten

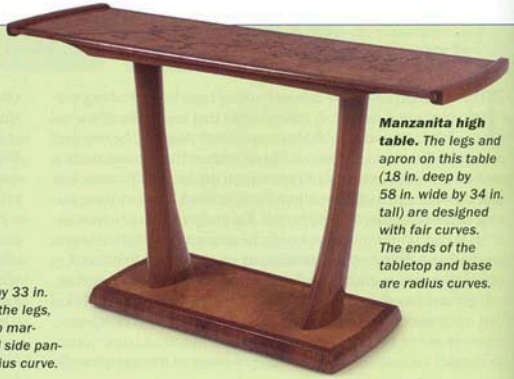
I often use a type of changing-radius curve, better known as a fair curve, in my furniture. These are a bit more challenging to create because they can't be plotted mathematically or with a compass. One portion of the curve might be a dramatic bend that gradually flows into a straight line.

I make most fair curves using a long and straight, defect-

Furniture with curves

Much of the curvy work in my portfolio was drawn full-size using fair- and radius-curve drawing tools. My plans require a great deal of time. Once they're down on paper, the furniture has been methodically built in my mind. The easy part is going out to the shop and constructing it.

Rose Chest. *This piece (21 in. deep by 46 in. wide by 33 in. tall) features fair curves on the legs, an oval medallion on the top marquetry, and bowed front and side panels created with a 10-ft. radius curve.*



Manzanita high table. *The legs and apron on this table (18 in. deep by 58 in. wide by 34 in. tall) are designed with fair curves. The ends of the tabletop and base are radius curves.*

Photos, this page (bottom left, right) and facing page (bottom left, right): Wayne McCall

SIMPLE ARCS

Radius curves, also called arcs, are the most common curves used for tabletops, aprons, and some door frames. Because they have a single center point, they are the simplest to draw.

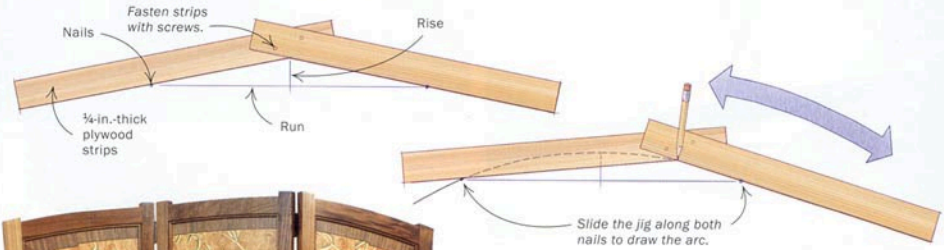
TRAMMEL POINTS

Commercially available trammel points are excellent for drawing large-radius circles and curves. Because the two-part drafting tool can be mounted on a beam cut to any length, they allow you to draw circles and arcs of almost any diameter.

A JIG FOR LARGE-RADIUS ARCS

This simple jig requires two nails and two long, narrow strips of plywood. First, locate the nails at the desired width, or run, of the arc. Connect the nails with a straight line, then draw a perpendicular line at its center point to indicate the height, or rise, of the arc. Position the plywood strips so that they rest against the nails and intersect at the rise. Screw the strips together and place the pencil at the intersection to draw the arc.

Arc jig. *This simple jig allows you to draw a perfect arc of almost any size without having to calculate the radius.*



Folding screen. *This hinged three-panel screen (56 in. wide by 64 in. tall) has bamboo marquetry laid out with fair-curve tools. The top and bottom rails are designed with a radius, while the outermost leg rails are fair curves.*

Round table. *Schürch's Ribbon Butterfly coffee table (42 in. dia. by 19 in. tall) features a circular tabletop and lower shelf and fair-curve legs.*

Adjustable jig for fair curves. *Schürch designed this pinch fairing jig to create fair curves when drawing full-size furniture plans.*

free square stick, called a batten. When held under slight tension, a batten usually will yield a fair curve and can be adjusted easily.

Depending on the curve you wish to produce, you can make a batten from a number of materials, as long as they are free of internal tensions, knots, or defects that otherwise would create kinks or flat spots in the curve. The best materials include MDF, mahogany, spruce, a long, thin metal rule, or even a plastic pipe.

The thickness of the batten also is important and depends on the size of the curve you are making. For example, a 4-ft.-long bend in the back leg of a chair can be done with a batten measuring about ¼ in. square. Whereas an 8-ft.-long bend may require a batten that is 1 in. square.

There are a few basic principles to follow when bending a batten into a fair curve. After determining the two end points of the curve, secure the batten slightly past these two points; then apply pressure to any point along the length of the line to create the curve, lining up the jig so the batten crosses over the two end points. Then trace the line with a pencil.

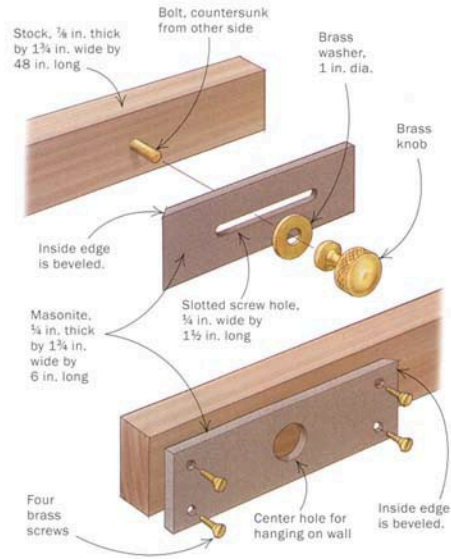
Adjustable pinch fairing jig—If my desired curve isn't too long, as when designing the top of a frame-and-panel door or the legs of

GRACEFUL CURVES

A fair curve has an ever-changing radius and mimics the graceful curves found in nature. A truly fair curve flows naturally, with no awkward transitions.

ADJUSTABLE PINCH FAIRING JIG

Fair curves are easy to create with this jig, which bends a metal rule into a curve and then allows you to set the apex of the curve anywhere along its length with a dowel.



Commercial drawing tool. *A flexible curve, available from a woodworking-, art-, or drafting-supply catalog, can be bent into a fair curve and hold its form.*

Drawings: Chuck Lockhart

Play with the stops until the curve looks right. *Position one brick stop at each end of the metal-rule batten to set the end points, and then push on the apex of the curve with a third brick stop.*

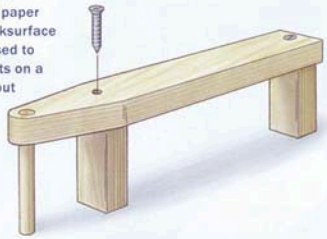
a chair or cabinet, I use a shopmade jig that bends a metal rule. This pinch fairing jig traps both ends of the rule and creates a bend when the two points are compressed slightly. Then, when you jam a dowel along the length of the curve between the rule and the jig, it creates a pressure point on which the fair curve wraps.

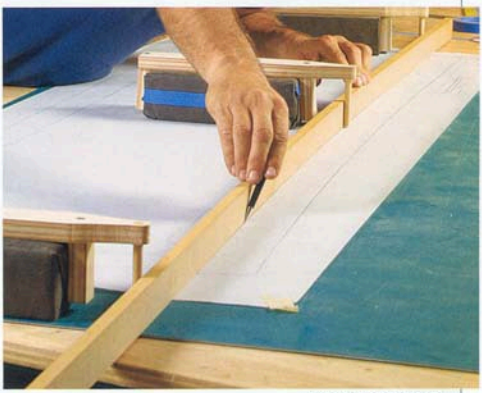
The pinch faring jig is mobile and keeps the fair curve fixed when you move the jig. It can be flipped over to create the mirror image for drawing the other side of a piece of furniture, or used to draw a reveal next to your original fair line when shifted to the new location on the drawing. Don't compress the metal rule too much, or the jig will yield a nonfair curve. Let the dowel do the bending.

Brick-stop batten for long curves—When drawing long curves, such as the 86-in.-tall stile on my folding screen (shown on p. 75), I use a brick-stop jig to hold a batten at three points of a bend. One brick stop at each end secures the batten a little past its start and stop point, and the third brick stop pushes on any one point along the length of the batten to create a curve. There should be light pressure on the bend to ensure that the batten will be fair while under tension. Try bending battens of different dimensions until

BRICK-STOP BATTEN

A simple plywood jig, anchored by a brick wrapped in heavy paper to protect the worksurface and drawing, is used to set the three points on a batten for laying out a fair curve.





MDF for big curves. *MDF is an ideal material for drawing long curves because it has a consistent density and no stress points.*

Thin stock for dramatic curves. *A thin piece of straight-grain mahogany works well for drawing tight curves like the bamboo marquetry on Schürch's hinged three-panel screen.*

you achieve the correct tension for the curve. When sighting down the curve, you should see no flat spots or kinks, and there should not be so much tension that the bricks slide while you're applying pressure with the middle brick stop.

Elements of an ellipse

Another curve I like to use in marquetry designs or tabletop shapes is an ellipse, which can be plotted mathematically using two focal points located on the long axis. Ellipses have a notable characteristic: You can measure from any point on the ellipse to each focal point, and the sum of those two distances will always be the same.

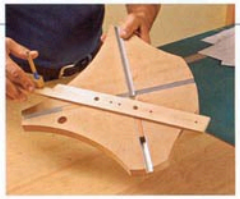
There are several ways to draw an ellipse (see *FWW* #138, p. 112), but I find the easiest method is with an oval maker's jig, which can be made in the shop or purchased commercially. My shopmade version is essentially an MDF board that has dadoes cut at 90° to each other in which hardwood axis blocks can slide. My jig has axis blocks sliding in ½-in. aluminum U-channel that I found at the hardware store. The pencil arm is loosely screwed onto each

PRECISE ELLIPSES

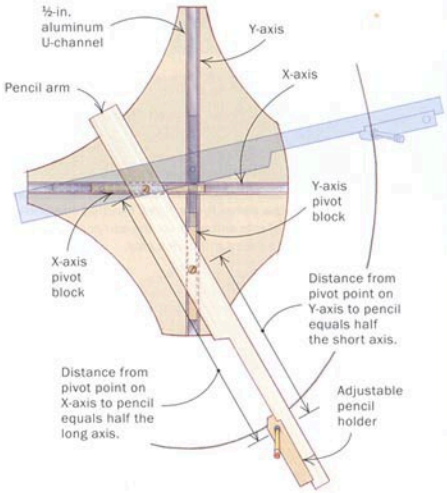
An ellipse often is used for tabletop designs. It has an X-axis and a Y-axis, which can be lengthened or shortened to create everything from a circle (equal axes) to an elongated oval. A jig can help you draw ellipses of all sizes.

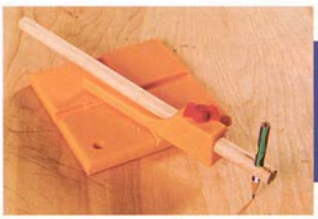
OVAL MAKER'S JIG

This jig for drawing ellipses (or circles and ovals) has a pencil arm attached to two pivoting axis blocks, which ride in T-tracks as the arm rotates around a center point.



How to change the shape and size of an ellipse. *Adjust the axis locations on the pivot blocks as well as the location of the pencil.*





Oval drawing jig. *This commercially available jig allows you to draw ellipses, circles, and ovals with a maximum axis of 30 in.*

axis block. When the arm is rotated, both axis blocks move back and forth within the dadoes.

Begin plotting an ellipse by drawing the rough shape on scrap paper and then aligning the jig so that its center is rooted where the X-axis and Y-axis intersect. Then measure the distance from the center of the rough ellipse to the farthest point on the short axis, drill a hole in the arm, and screw it onto the axis block. Repeat the same procedure to determine the distance of the long axis. After drilling and fastening both axis blocks to the arm, manipulate the jig to ensure the action is smooth enough to draw the ellipse. The axis blocks cross over the center when you draw the full ellipse.

The height-to-width proportions of the ellipse are adjusted by drilling new pivot points through the arm where it fastens to the axis blocks. To increase the size and maintain the proportion, simply move the pencil farther out on the arm.

Another way to enlarge or reduce the size of the ellipse is to draw one on paper and then enlarge or reduce it on a copy machine. For my jig, I have cut the MDF down on two sides to make smaller ellipse sections. The oval maker's jig is good for drawing tabletops, crown or apron elements on a cabinet, and decorative veneering designs. □

Paul Schürch builds custom furniture in Santa Barbara, Calif. You can see more of his work online at www.schurchwoodwork.com.

Adjust the curve of the sole. *In addition to setting the blade, an adjustment knob on the compass plane changes the curve of the sole to a convex or a concave shape.*

A handplane for curves

Compass planes, also known as radius planes, have a long history in furniture making and boatbuilding due to their unique ability to handplane curved surfaces. I find a compass plane indispensable for shaping curves. This tool lets me take curved plywood templates as well as curved workpieces straight from the bandsaw to completion. It creates a smooth line and leaves a square edge on the template to aid bearing-guided router bits better than a sanded edge.

A compass plane works similarly to a standard bench plane and has a depth-adjustment screw and a lateral adjustment lever for the iron. Unlike a bench plane, though, its thin metal sole can be adjusted to a convex or concave curve. When setting up a compass plane to fair a concave curve, give the sole a slightly tighter inside radius than the curve to be planed. For convex curves, set the plane to the precise curve. When set correctly, it takes only a few passes with the plane to create a smooth, fair curve.

The Stanley No. 113 compass plane I use is no longer being produced, but it can be purchased secondhand. At least two toolmakers, Kunz and Anant, currently have compass planes on the market.

Plane a concave curve. *Tune the sole to a slightly tighter inside radius than the curve to be planed and keep pressure on the nose with each pass.*

Plane a convex curve. *With the sole of the compass plane set to the desired curve, make several passes, putting pressure on the nose of the plane until the curve in the workpiece is fair.*