Glue up curved slabs in one shot

BY DAVID J. MARKS

About 20 years ago, I received a commission to build a 6-ft.-long dining table with an elliptical glass top. The glass was quite heavy and required a solid base. To challenge myself, I decided to come up with a design that ventured away from the predictable four-legged footprint.

After drawing a number of sketches, I decided on a knockdown design of two coopered uprights connected by a pair of stretchers. I had built previous coopered pieces, gluing the staves in pairs and then gluing the pairs to each other until I had a completed piece. However, the curves of these uprights each consisted of 14 staves. That's a lot of pairs to glue up.

Fortunately, I had taken classes with renowned furniture maker Garry Knox Bennett at his studio in Oakland, Calif. Bennett had demonstrated a cable-clamping jig that he had built, and although I could not remember exactly how he built it, the concept remained with me and I came up with my own jig.

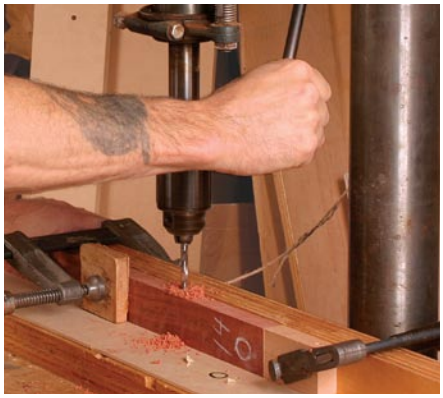
The principle behind a cable clamp

Aside from pure speed, the main advantage of this jig is its flexibility: It can be used to clamp curves of almost any radii, asymmetric curves, even S-shaped curves, all without any modification to the jig. It can be used for clamping any portion of a curved form, but not a full circle like a column, which is more efficiently pulled together with an external system such as a band clamp.

The jig consists of a rectangular wooden frame that houses three long pieces of all-thread steel rod. The rods are connected to steel cables fed through holes in the staves. When all the staves have been glued, the steel rods are drawn back using a socket chucked into an electric drill. The rods pull the cables, which in turn draw the staves together, keeping them aligned.

Lay out and drill the staves

Matching staves. *If the staves come from more than one board, spend time getting the best color sequence. Number the staves and mark them with a carpenter's triangle.*



Precision drilling. *It is critical that each set of holes line up across the staves, so drill the pieces before beveling them. Use a drill press with a fence and a stop block.*

Drill holes before beveling staves

After the staves have been ripped to approximate width, in this case 2 in., bore the holes for the cables. It is critical that all three sets of holes be in alignment: I use a drill press with an adjustable fence bolted to the table to ensure that the holes are centered; a stop-block clamped to the fence ensures that all of the holes are indexed from one end of the staves.

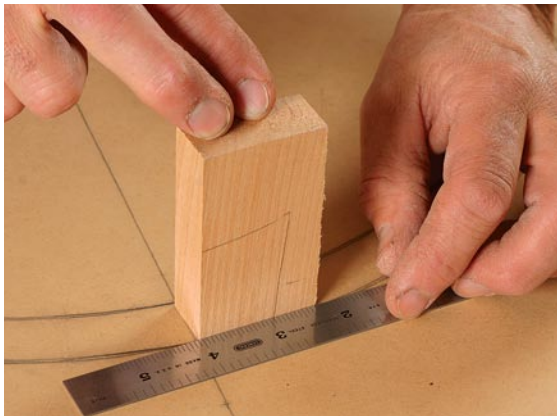
The diameter of the holes is ¼ in. to allow for polypropylene tubing. The tubing stops glue from sticking to the cable, which could prevent it from being removed after the glue has set. Because the tubing stretches when pulled, it breaks free from the glue.

With the holes drilled, the staves can be beveled. If the curve was a section of a circle and all of the staves were exactly the same width, then you could mathematically come up with a consistent bevel angle for all of the staves. However, I find that I can form a more pleasing curve by taking a thin strip of wood and bending it. I draw this curve full-scale onto a piece of plywood or medium-density fiberboard (MDF) and then cut out the shape. I then use

Photos, except where noted: Mark Schofield; this page (top): Don Russel

Align and bevel the staves to fit the template

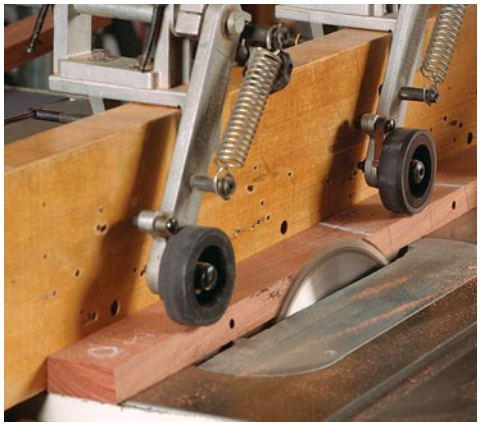
The right curve. *After creating a pleasing curve and cutting it on a template, transfer the curve to a piece of plywood or MDF and mark the centerline.*



Work from the center outward. *Use a sample block in place of the unwieldy stave to discover its correct location at the center of the curve. The center of the block should just touch the outside line. Mark this line using a ruler.*

Mark the line. *Remove the sample block and draw a short line against the edge of the ruler.*

Calculate the angle. *With the base of a protractor on the pencil line just drawn, swing the arm until it bisects the curve on the centerline and record the angle.*

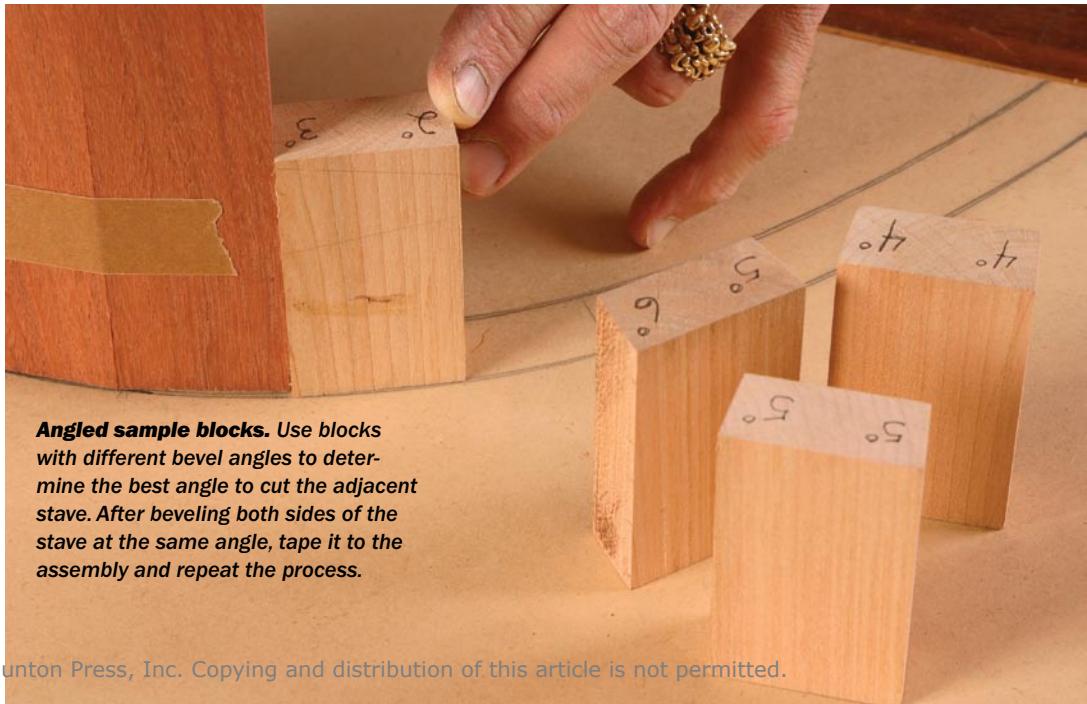


Bevel the stave. *Set the blade to the angle recorded by the protractor and bevel both sides of each stave to the same angle.*

Align the center staves. *Tape together the two beveled center staves and place them on the template.*

this template to draw the curve onto a piece of MDF. By flipping the template, I can check that the curve is symmetrical. Rather than trying to balance a tall stave on the MDF, I cut a series of 3-in.-long scrap pieces the same width and thickness as the stave. Then I bevel their edges at a variety of angles, using the drawing to anticipate the angles I'll need.

Center a block between the inner and outer lines of the curve with one side against the centerline of the curve. Draw a line along the outside edge of the block, and then place the base of a protractor on this line and adjust the arm so that it aligns with the centerline. Record the angle and then bevel both



Angled sample blocks. *Use blocks with different bevel angles to determine the best angle to cut the adjacent stave. After beveling both sides of the stave at the same angle, tape it to the assembly and repeat the process.*

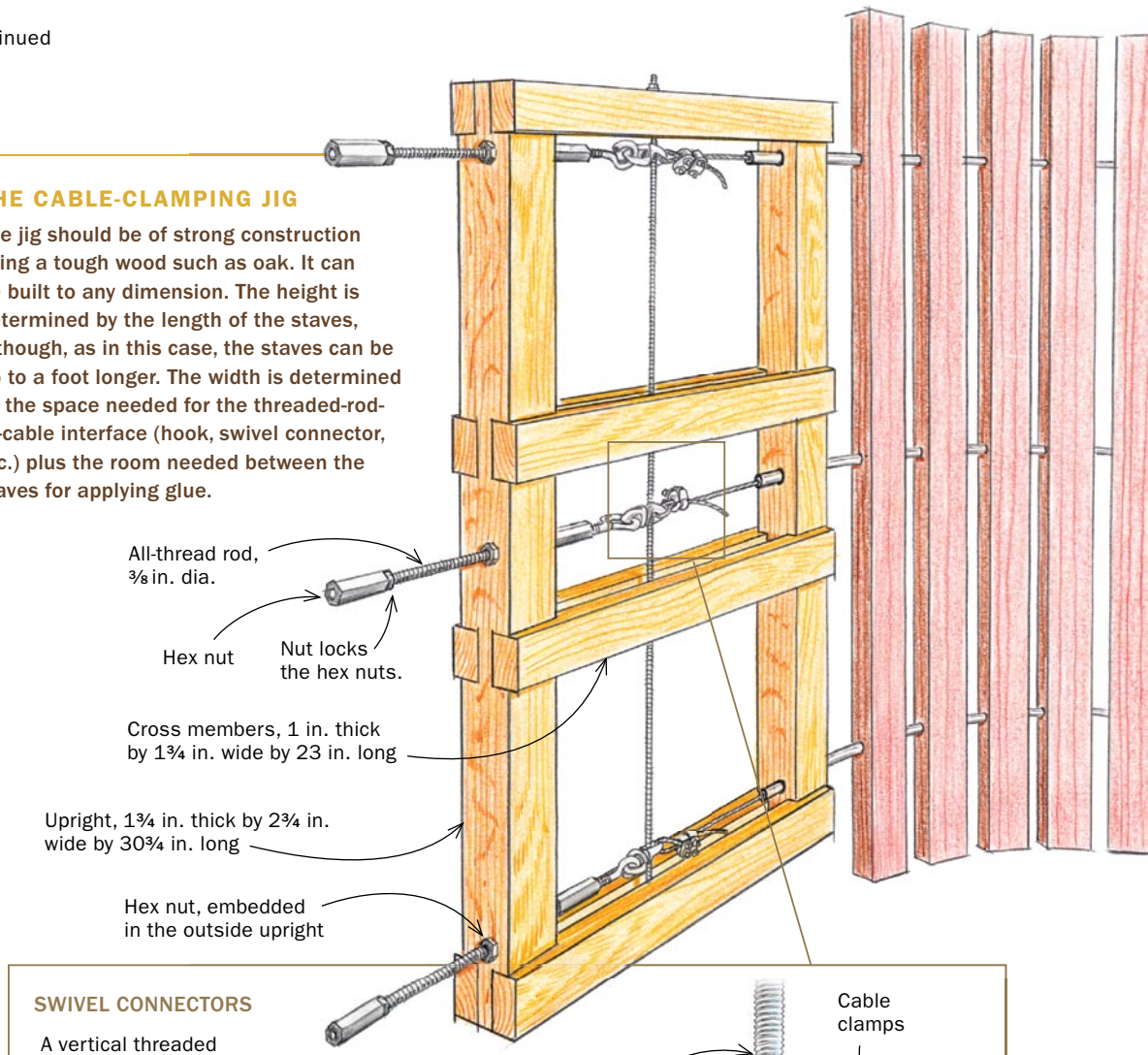
Glue up the slab

Connect the staves. *After feeding the tubing through the holes, stand the staves upright and insert a cable through each tube.*

Glue the staves and put the jig to work. *Apply the glue using a squeeze bottle and a small brush (above), opening up each pair of staves one at a time. Use a powerful electric drill equipped with a socket to turn the threaded rod (below) and gradually pull the staves together.*

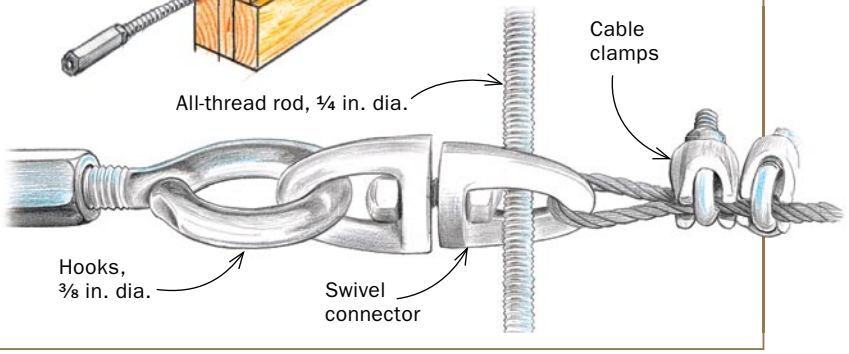
THE CABLE-CLAMPING JIG

The jig should be of strong construction using a tough wood such as oak. It can be built to any dimension. The height is determined by the length of the staves, although, as in this case, the staves can be up to a foot longer. The width is determined by the space needed for the threaded-rod-to-cable interface (hook, swivel connector, etc.) plus the room needed between the staves for applying glue.



SWIVEL CONNECTORS

A vertical threaded rod goes through the sections of the three swivel connectors closest to the workpiece. This helps to stabilize one end of the swivel connectors and prevent the cable from twisting as the threaded rod is turned.

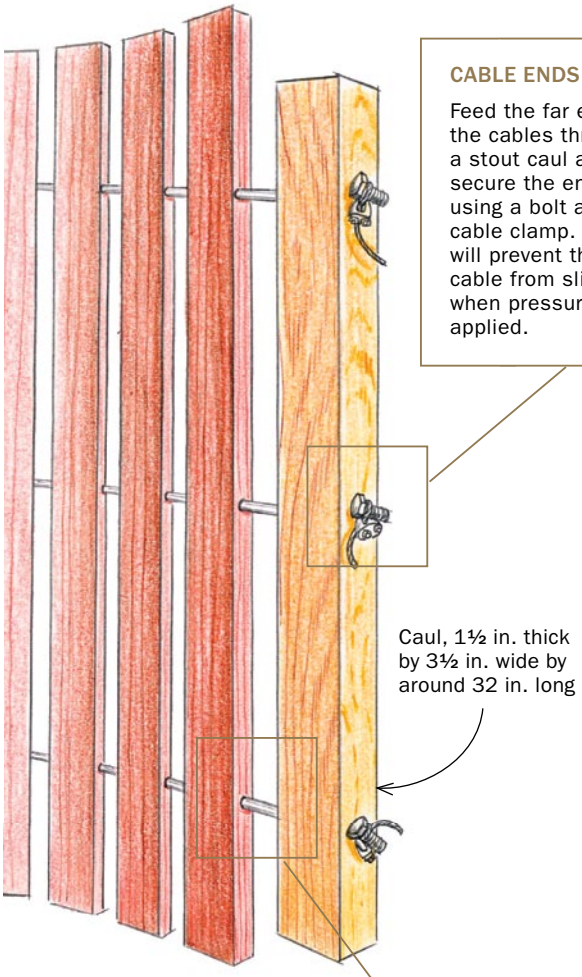


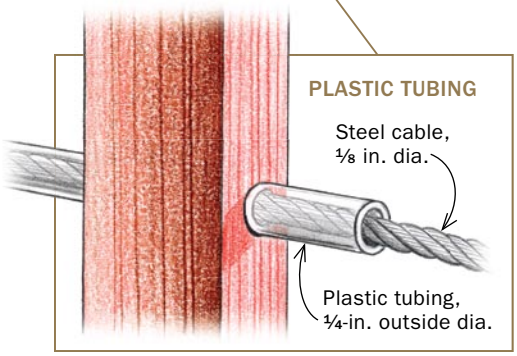
sides of the two center staves at this angle. If you have a right-tilt saw like mine, you'll want to ensure that the inside of the stave is always face up. For a left-tilt saw, it should be face down.

Tape the two staves together and place them on the MDF curve. Use the sample blocks, centered between the layout lines, to find the best angle for the next stave. Bevel both sides of the stave at this angle, tape the stave to the preceding staves, and repeat the process.

After ripping the bevels on the tablesaw, give them a light pass on the jointer

Drawings: John Tetreault





to ensure a clean surface and a tight fit. Once all of the staves are prepared, they can be assembled in the jig.

Test the jig with a dry run

Lay out the staves in their correct order on an assembly table and thread the polypropylene tubing through the holes. You can now stand the assembly upright adjacent to the cable jig and insert the ⅛-in.-dia. cable through the tubing. It's easier to wax both the tubing and the cable with paste wax. The assembly should be loose enough to apply glue to the inside edges of the staves, but snug enough that you can take up all the slack when the rods are tightened. The three cables are then threaded through and secured to a hardwood caul.

Before using the system, I do a dry run to eliminate surprises. Clamp the frame of the jig securely to the assembly table or workbench and begin to turn the all-thread rods. Using the drill to drive all three rods allows you to apply complete clamping pressure within minutes.

Assuming all seems well, reverse the drill to drive the rods back through the frame and pull the staves apart. I use urea-formaldehyde glue because of its long open time, great strength, and resistance to glue creep. Apply the glue to one joint at a time, then snug up that joint to expose the next one for gluing.

When all the joints are glued, retract the rods a bit at a time until the staves are tightly clamped, and let them sit overnight at a minimum temperature of 70°F.

Conceal the cable holes

After you have removed the cables and tubing, use a coarse sanding disk on an angle grinder to remove the squeeze-out and start rounding both surfaces. I then use a curved scraper on the inside and a sander on the outside.

You can conceal the holes in the staves a couple of different ways. You can hold back the two outside staves from each piece and glue them on after the piece is glued up. An easier solution is to fill the holes with plugs that match in color and grain. Square up the holes using a hollow-chisel bit and mallet, and then glue in the matching plugs. □

Clean up

Concave cleanup. *An angle grinder fitted with a sanding disk does the initial shaping, and a curved scraper (above) follows.*

TWO WAYS TO CONCEAL THE HOLES

Add outside staves or plug the holes. *You can reserve a pair of staves and glue them to the finished panel (above), gluing temporary clamping blocks to the workpiece. Or use a piece of matching wood to create a nearly invisible plug (left).*