

Joinery for Curved Work

Full-scale drawings and custom-made hold-down jigs are the keys to cutting accurate joints in curved parts

BY GARRETT HACK



Full-scale drawings help eliminate mistakes. In addition to helping figure out exactly how a piece goes together, the drawings can be used to transfer layout marks onto stock.

Many of us began our woodworking journey by building Shaker and Craftsman furniture. The predominantly square edges and flat surfaces common to these styles are ideal for laying out and cutting accurate joinery. But as you mature as a woodworker, you may wish to make curves a part of your repertoire, too.

The slightest curve adds elegance to any furniture design. To my eye, straight lines are nowhere as interesting as curved lines, which capture the imagination. Curved parts can add physical strength to a design while preserving its visual lightness.

Curved surfaces open a whole new realm of furniture styles: Chippendale, Federal and Hepplewhite, for starters. Yes, curves add complexity, especially when it comes to joinery. But with full-scale drawings and custom-made jigs, you can work out the problems of angled joints and cut them using machines and hand tools.

Full-scale drawings are crucial

It is difficult to visualize the joinery of curved parts without making drawings. I often start with quarter-scale drawings to work out the overall design, then move on to full-scale drawings to figure out the particulars, which includes joinery.

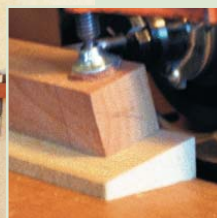
A project may require one or more views. Two-dimensional curves, such as the edge of a tabletop or the rails of a chair, can be fully rendered in a top (plan) view. The curving back leg of a chair, a common three-dimensional shape, usually requires both front and side views to be fully visualized.

For laying out curves I use thin, flexible wood battens. A typical batten is about $\frac{3}{4}$ in. wide and $\frac{3}{16}$ in. thick and is made of a good bending wood such as oak or ash. A steel ruler also works, but it's not very flexible for tight curves. Besides, I prefer the natural curve of a wooden batten. Perhaps I get a slightly less precise curve than I would with a steel ruler, but that is, after all, the way the wooden parts themselves behave when steam-bending or laminating.

The dilemma of working with curved parts is that they often end up meeting at odd angles. Try to make all of your joinery decisions during the drawing stage, including whether you wish to angle mortises, tenons or both. As a rule, I prefer to angle the mortise and keep the tenon at right angles to its shoulders. That rule is based on the fact that it's easy to get an angled mortise using a horizontal mortiser or a hollow-chisel mortiser. But if I were to cut mortises by hand, I'd lean toward keeping the mortises square because it's tough to chop at a consistent angle using chisels.

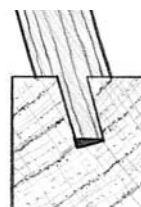
During the design stage it's important to visualize how the piece will be assembled. Can you get all of those angled joints together

MORTISING CURVED PARTS

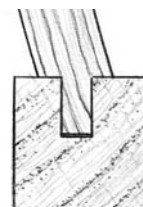


Machine mortising. To cut an angled mortise with a horizontal mortiser, orient the stock using angled wedges. The same method will work if you use a vertically mounted hollow-chisel mortiser.

MORTISE OPTIONS



BY MACHINE



BY HAND

It's easier to cut an angled mortise (left) using a machine. When chopping a mortise by hand, it's easier to keep the mortise straight. Be aware that a severe angle on the tenon may result in weak short grain.

in an orderly progression without stressing some part? And is there a way to jig a part to make the necessary cuts?

Once the drawings are complete, it's a good idea to make patterns of some parts using thin, flexible pieces of wood or plywood. Flexible patterns make it easy to transfer layout marks onto parts, especially when dealing with pieces that have compound curves.

Cut the mortises first using shims to hold parts at the correct angle

Mortises are cut first because it's a lot easier to handplane a tenon to fit than it is to enlarge a mortise by a whisker. I use an old horizontal mortiser modified to accept a router for cutting mortises. Although the sliding table doesn't tilt, I have no trouble cutting angled mortises. I make up wedges or use shims to hold the workpiece at the proper angle (see the photo above). If you use a hollow-chisel mortiser, the same techniques would apply.

Transfer layout marks for the mortises directly from the drawing or from patterns you've copied from the drawing. On a part with compound curves, it's best to use a pattern that can be clamped to the part, then transfer layout marks.

Steam-bent or laminated parts with compound curves usually do not have any true flat surfaces, which can make it difficult to mark out joints accurately as well as to cut parts that mate tightly. To overcome this difficulty, once I've steam-bent or laminated the parts, I plane small flats at the joints. Take, for example, the laminated rear leg of a chair (see the photos at right). After the glue dries, clean up the leg using handplanes. Then use a pattern taken from the drawing to mark the location of joints. Don't mark all of the joinery at once. First, mark the outside edges of where the rail meets the leg. Then plane that section flat, which makes it possible to rest a square or bevel gauge solidly to both lay out the joint and



When possible, design a joint to come together with flat mating surfaces. Using a block plane, the author planes a flat spot where this compound-curve laminated leg mates with a chair rail.



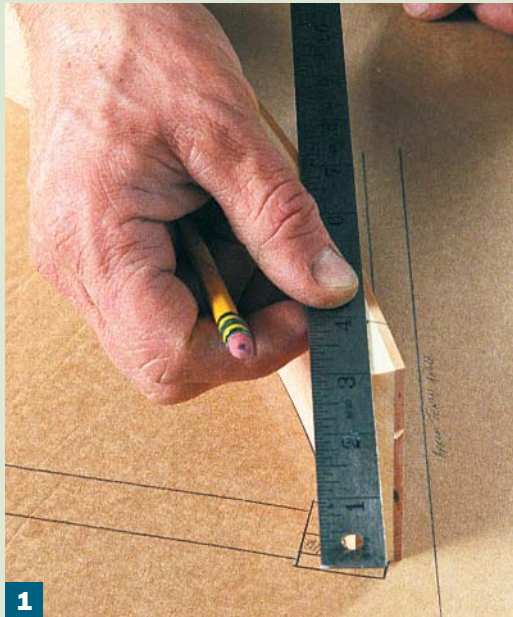
Mark the mortise using the matching piece. Layout marks are transferred from a chair rail onto the leg.



Cut the mortise. Depending on the shape of the piece, sometimes it's easier to clamp the workpiece in a vise and chop the mortise by hand than it is to build a complex jig to hold it steady for machining.

TENONING CURVED PARTS

A combination of machines, shop-made jigs and hand tools are often required to cut tenons on curved parts.



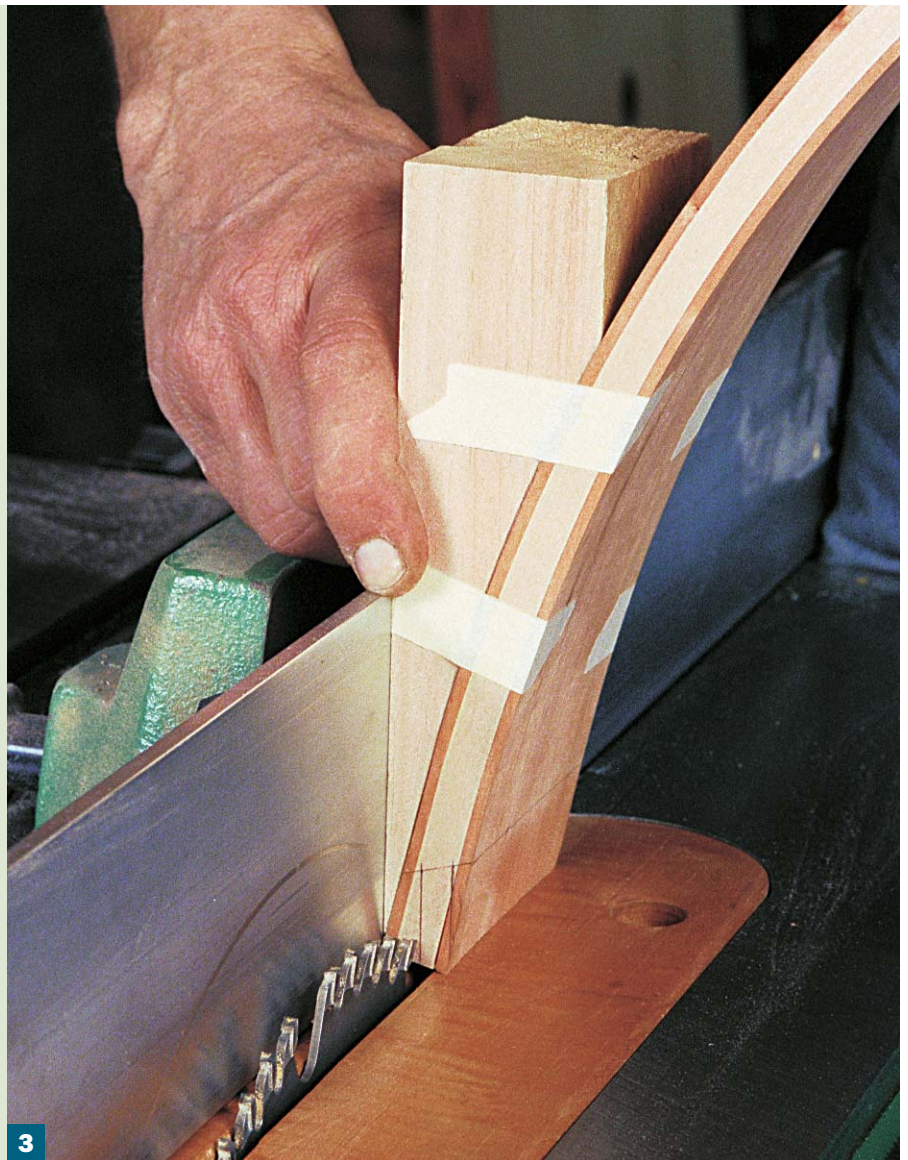
1

Use a full-scale drawing to transfer layout marks to a curved piece. The line to the immediate right of the ruler is an extension of the tenon. The one next to it is a parallel line. Sight the ruler by eye using the lines for guides and mark the tenon.



2

Mark the shoulder. Hold a sliding bevel gauge steady against the concave section of a curved piece, such as this table apron.

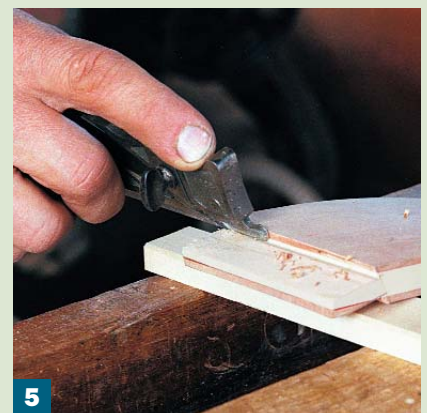


3

A large, curved part needs a jig to hold it steady when cutting tenons. Cut a large shim that mates to a curved part and use the tablesaw's rip fence as a guide when cutting a tenon. Attach the shim using tape.



4



5

Cut an angled shoulder using a handsaw held at the correct angle. Refer to the layout marks on the top and edges of the stock when guiding the saw (left). Clean up the shoulder using a handplane.

Using a tenoning jig



When possible, cut joints before cutting all of the curves. This chair rail still has one flat face, which goes against the tenoning jig. Bandsaw the convex curve after cutting the tenons.

check it as you cut. Shoulder lines will then be straight and a lot easier to cut than if they were curved. At a minimum, I like to leave a flat surface and one—or preferably two—edges square to it.

Once the area has been planed flat, finish the layout and cut the joint. When working with oddly shaped parts, it may be easier to hand-chop a few mortises than it would be to make a complicated hold-down jig. It depends on how many duplicate parts are required in a project.

Parts to be tenoned also require hold-down devices

Curved work frequently relies on parts made from laminations or steam-bending. These parts are generally formed before you can lay out and cut the joinery.

Once the part has been formed, check to see whether it indeed follows the drawing exactly. If it does not, don't worry. Steam-bent or laminated parts don't always obey drawings. If there's a slight deviation due to springback, make changes using the actual part as a drawing template and revise the angles of joints if necessary.

Although I make patterns of many curved parts to aid in transferring layout marks, often all that's necessary is the drawing itself. Just lay parts on the drawing and transfer the layout (see the photos on the facing page). I often add extra lines to the drawing to help with transferring layout lines. For example, in the case of an angled tenon on a curved apron, I extend the lines marking the tenons as well as add a line parallel to it. That way, I can lay a ruler on top of the apron, line it up with the extra lines of the drawing and accurately mark the locations of the tenons.

I prefer to cut tenons on the tablesaw. I have a tenoning jig that



If parts are laminated or steam-bent, make a jig for a jig. A simple jig supports this curved piece at the correct angle and still makes it possible to use a tenoning jig.

works fine with square stock. If possible, I cut tenons using the jig before shaping the curve (see the left photo, above). But when working with already curved pieces, I have to get inventive.

A wide, laminated table apron won't fit in a tenoning jig no matter how hard you try. To cut the tenons on a piece like this on a tablesaw, find some scrap and cut a large shim that will allow you to guide the workpiece safely along the saw's rip fence. Attach the shim to the workpiece with masking tape or double-sided tape.

If the workpiece is small and curved slightly, such as a rail of a chair, I make a jig that lets me use my tenoning jig (see the right photo, above). Whenever possible, I design the piece and the jig so that the tenon is cut with the tablesaw blade at 90°. Some designs, however, necessitate tilting the blade, too.

Once the cheeks have been cut, go back to the drawing and transfer layout marks for the shoulders. If the shoulders are angled, transfer the angle using a sliding bevel gauge and marking knife. Cut the shoulders a hair proud using a handsaw and trim them to the line using a shoulder plane.

In the construction of complex, curved work, there are bound to be slight deviations from the drawing. Take time to see how parts are fitting together, and be prepared to make changes. I call this working from reality. Dry-fit parts as you go, and make a new pattern for an adjoining part if something is off slightly. This is good advice in much of furniture building. Using an accurate pattern is a good strategy whenever you have a tricky part to fit. □

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