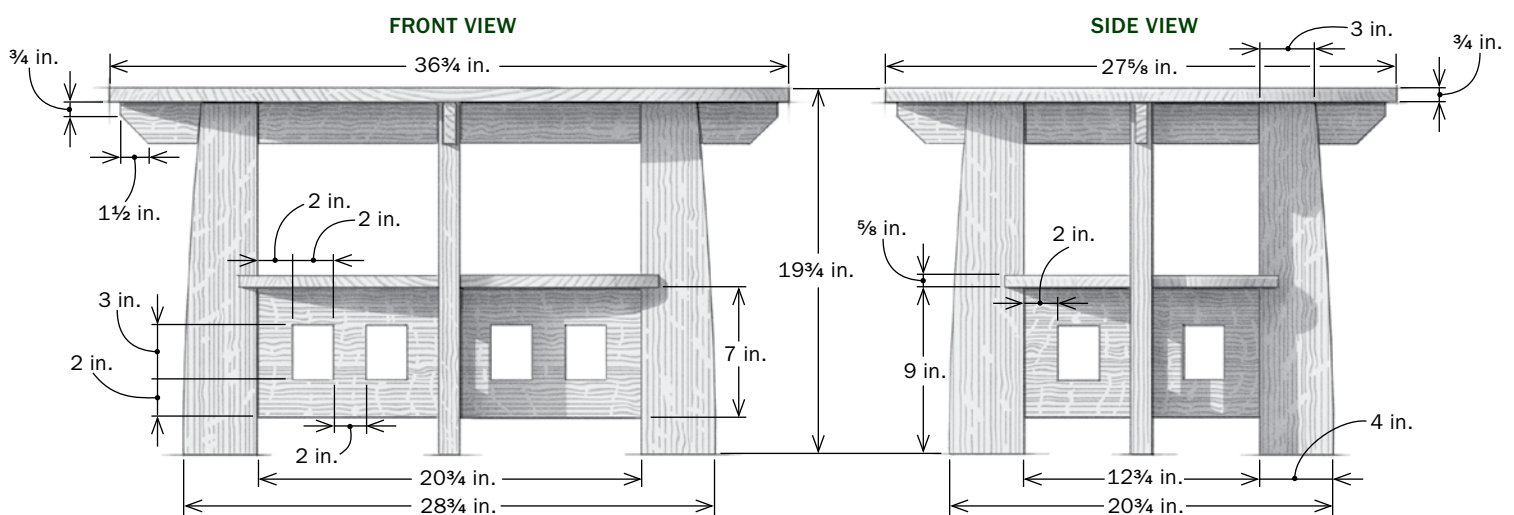


Make a Limbert-Style Coffee



Learn to cut perfect ellipses and tight bridle joints



Table

BY
GREGORY
PAOLINI

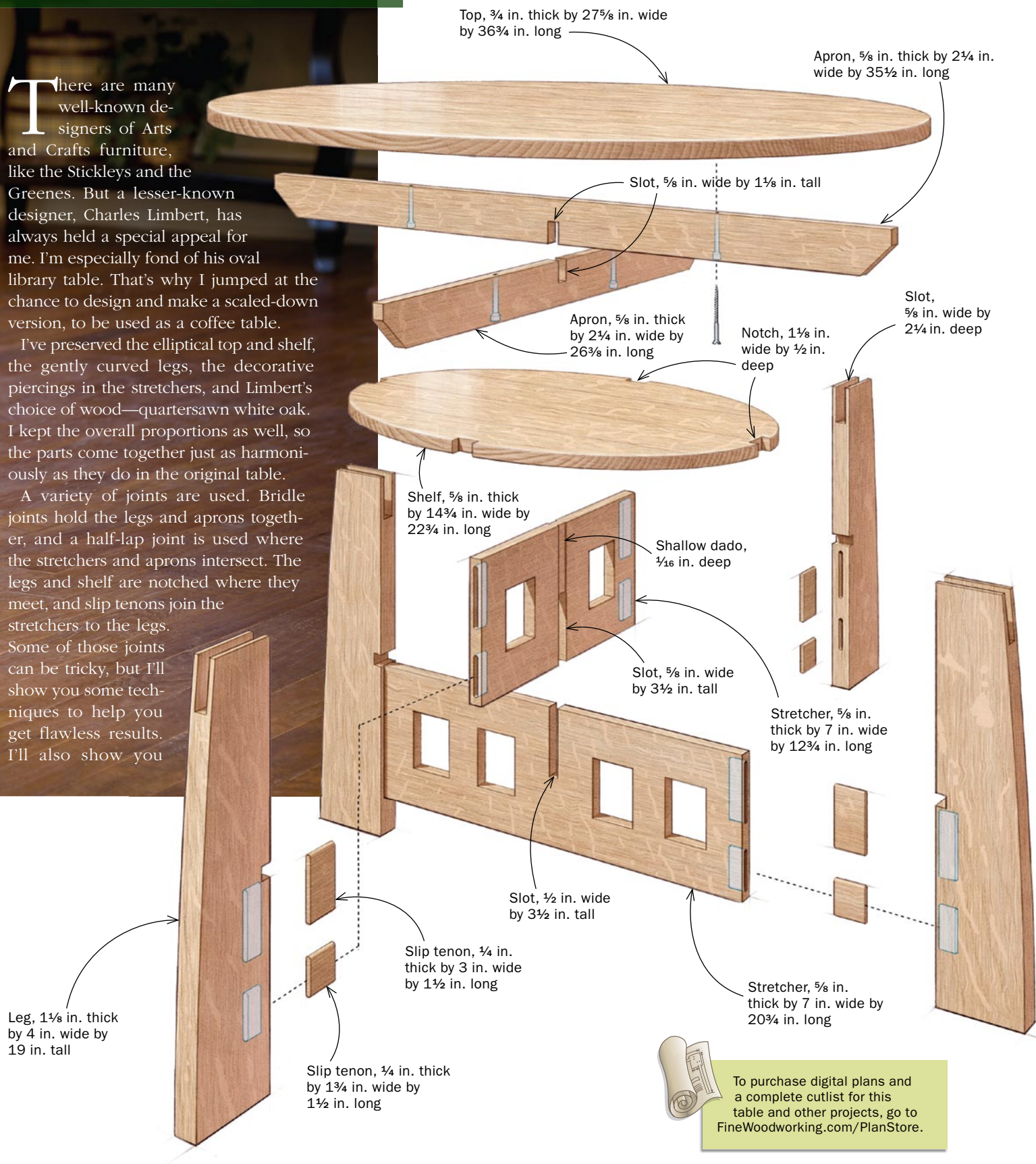
There are many well-known designers of Arts and Crafts furniture, like the Stickleys and the Greenes. But a lesser-known designer, Charles Limbert, has always held a special appeal for me. I'm especially fond of his oval library table. That's why I jumped at the chance to design and make a scaled-down version, to be used as a coffee table.

I've preserved the elliptical top and shelf, the gently curved legs, the decorative piercings in the stretchers, and Limbert's choice of wood—quartersawn white oak. I kept the overall proportions as well, so the parts come together just as harmoniously as they do in the original table.

A variety of joints are used. Bridle joints hold the legs and aprons together, and a half-lap joint is used where the stretchers and aprons intersect. The legs and shelf are notched where they meet, and slip tenons join the stretchers to the legs. Some of those joints can be tricky, but I'll show you some techniques to help you get flawless results. I'll also show you

STRENGTH AND BEAUTY

An elliptical top, arched legs, and decorative piercings add grace and beauty. Slip tenons and bridle joints ensure decades of service.



TOP AND SHELF

HOW TO MAKE A PERFECT ELLIPSE

Both the top and shelf are elliptical. You can use a simple nail-and-string technique to make patterns for these. Each pattern does double duty. First, it lays out a line to follow at the bandsaw. And after the shape has been roughed out, the pattern serves as a template for a bushing-guided router.

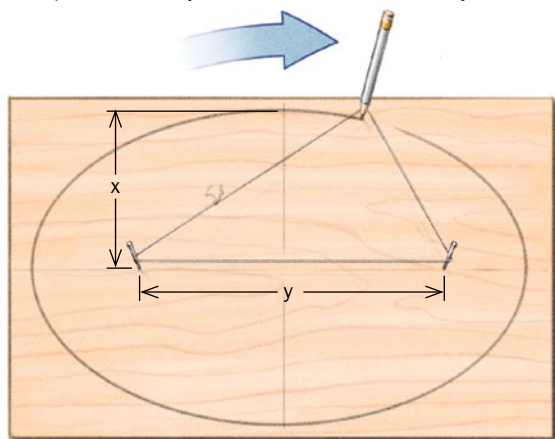
Nails and string. Driven into the focal points, nails guide the string loop, which in turn guides the pencil along the perimeter of an ellipse.



KEY DIMENSIONS

Here's how to lay out the nails and size the string for each ellipse:

Top: $x = 13\frac{13}{16}$, $y = 24\frac{1}{4}$ Shelf: $x = 7\frac{3}{8}$, $y = 17\frac{5}{16}$



Simple, accurate ellipses. Size the string so the pencil reaches the x dimension (see diagram at left). Then keep the string taut as you trace an ellipse.



Cut the pattern at the bandsaw. Cut just outside the line, so there is less waste to remove when smoothing the curves.

how to draw an accurate ellipse to take the mystery out of the top and shelf.

Pattern-rout the top and shelf

Begin by gluing up panels for the top and shelf and milling all of the parts. Then make full-size patterns for them. You'll need to draw two ellipses, which is easy to do with string, a pencil, and two small nails. To begin, draw the ellipse's axes on a piece of plywood 1 in. longer and wider than the ellipse and mark its length and width. Next, locate the foci, drive a nail into both foci, and tie a loop of string around them. When you stretch out the loop, it should just reach the side of the ellipse (see drawing, above left). Put a pencil inside the loop and draw, keeping the string taut.

With both ellipses drawn, cut them out at the bandsaw. Use 100-grit (CAMI) sandpaper, glued to a thin strip of wood, to remove the saw marks and fair the curves. Then trace the patterns on the panels for the top and shelf. Before cutting out the top and shelf, cut the notches in the shelf that join it to the legs. This is far easier to do now, when the sides and ends are square, than after cutting



Notch the shelf before cutting the ellipse. Because its width is critical, cut each side of the notch first and then remove the middle. Use stop blocks on your crosscut sled to ensure that notches on opposite sides will line up.

the shelf into an ellipse. Lay out the notches by placing the legs on the shelf and transferring their thickness onto it. Then cut them at the tablesaw, using a crosscut sled. The width of the notches is critical, so cut the notch sides first and then nibble away the inside. Cut the notches a bit tight and fit them with a chisel later.

After all four notches have been cut, head to the bandsaw and cut out the elliptical top and shelf. The top is heavy and unwieldy, so cut away the bulk of each corner first. Then make a second pass close to the line. I use a flush-trimming bit to rout the top and shelf flush to their patterns (right).

Join legs and aprons

With the top and shelf done, you can get started on the joinery. The stretchers are joined to the legs with slip tenons. Because the stretchers are 7 in. wide and could expand as much as $\frac{1}{16}$ in., break the mortise into two. The tenon will fit tight in the upper mortise but loose in the lower one, forcing the stretcher's movement downward and away from the shelf. I make the slip tenons by milling some white oak to the correct thickness and width, rounding over the edges at the router table, and then crosscutting the tenons to length. Now cut a notch in each leg. Paired with the notches in the shelf, they form a strong joint that

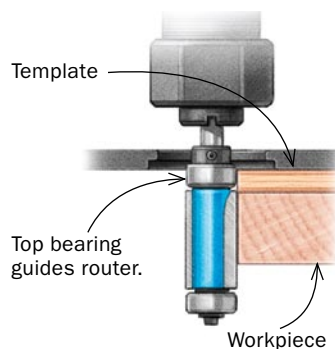


Cut the top and shelf at the bandsaw. Use the patterns to trace the shapes. When bandsawing, leave about $\frac{1}{8}$ in. of waste for the next step: routing the edges flush to your template.

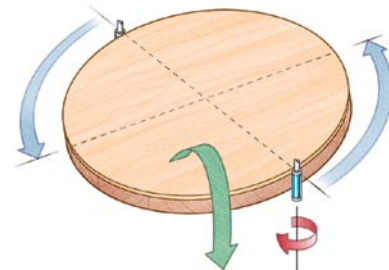


Always rout downhill. If you try to rout the whole circle in one pass, you'll tear out the grain in some areas. So you'll need to flip the workpiece. Use a double-bearing, flush-trimming bit so there's no need to change bits or re-attach the template on the other side. Just adjust the bit height to use the other bearing.

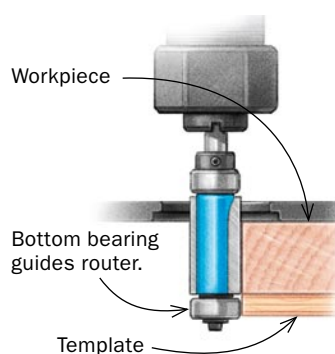
1. ROUT TWO QUARTERS WITH TEMPLATE UP



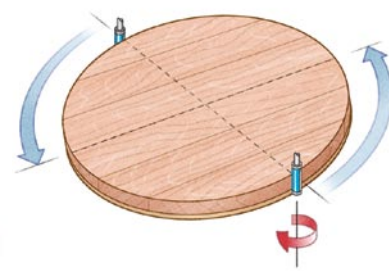
Rout downhill to eliminate tearout. To avoid climb cuts, which can be dangerous, you'll only be able to trim two of the ellipse's quarters.



2. THEN FLIP THE WORKPIECE



With template and workpiece flipped, the two remaining quarters can now be trimmed cleanly.



holds the shelf in place and prevents the base from twisting or racking. Cut them just as you did the notches in the shelf. While you're at the tablesaw, go ahead and cut the slot for the bridge joint into the top of each leg. I use a tenoning jig, starting at the center of the slot and working outward. As you get close to the sides of the slot, use the apron to test the fit.

A half-lap joint is used to connect the aprons where they intersect. For this joint, I cut a slot halfway through each apron. Unlike

BASE

A LESSON IN BRIDLE JOINTS AND SLIP TENONS

Other than the mortises and slip tenons holding the stretchers to the legs, every joint in this table is some type of bridle joint or half-lap joint. A router makes quick work of the mortises, and a tablesaw, equipped with a standard combination blade, is the right tool for the bridle joints and half-laps.

TIP

FENCE AND GUIDE BLOCK KEEP THE MORTISE ON LINE



No wiggle room. It will be straight and parallel to the sides because the fence and guide block prevent the router from wandering.

Route mortises in the legs. Use a spiral bit that matches the mortise's width, and use a fence on both sides of the router: Set up the router's edge guide and then clamp on a simple shopmade fence. The mating mortises in the stretchers are done the same way.

the notches in the legs and shelf, which were cut from the sides in, cut this joint from the center out. That will keep the joint centered on the aprons.

To complete the legs, cut the curve on the outside edge. I made a pattern out of 1/4-in.-thick plywood and traced it on the legs. Save the offcuts to use as cauls during glue-up.

Slot and rout the stretchers

As with the aprons, a half-lap joint is used where the stretchers intersect. However, cut a shallow dado on both sides of the shorter stretcher to conceal the joint and reinforce it against racking.

LEGS

Bridle joints must be centered.

Using a tenoning jig for the slot, cut in the middle of the leg first. Then flip the leg side to side to make the subsequent cuts. As you work out to the sides of the joint, it remains centered on the leg.



Cut the curve last. After tracing the shape onto the leg, cut away the waste on the bandsaw, and then clean up the saw marks with a hand-plane or sander.

APRONS



Slot the aprons and test the fit. After marking the joint, cut each side first and then nibble away the waste one pass at a time (above). Cut the slots a bit tight at first, and then sneak up on a tight joint, checking the fit (right) after each trimming cut.



After cutting the dados, raise the blade and cut a slot on the bottom edge of the stretcher. You won't be able to get the full depth with a 10-in. sawblade, so cut as deep as you can and finish up the slot with a handsaw and chisel. With the short stretcher done, cut the slot in the longer stretcher.

Now it's time to rout mortises in the ends of the stretchers to accept the slip tenons that join them to the legs. Do this the same way you routed the mortises in the legs, with a router and spiral bit.

After routing the mortises, use a template, plunge router, guide bushing, and spiral bit to rout the decorative piercings in the stretchers. Make the template from a piece of plywood and lay out the piercing on it, taking the bushing's offset into ac-

count. Head to the router table and cut out the opening. Attach a fence to the bottom side, lay out the location of the piercings on the stretchers, and you're ready to rout the openings (see "A Guide to Guide Bushings," *FWW* #207, p. 67).

Hog out most of the waste with a Forstner bit at the drill press. With most of the waste removed, clamp the template to the stretcher and the stretcher to the bench. Make a clockwise pass around the opening, increase the bit's depth, and make a second pass. Make a third pass to complete the piercing.

Dry-fit, stain, and glue up

This little table is kind of like a puzzle, in that there are pieces that interlock and must be

STRETCHERS



Cut the dado with a standard-kerf blade. That way you can sneak up on the final width, testing how well the long stretcher fits into it as you go.



Start the slot at the tablesaw. With the blade as high as possible, cut the sides to line up with the dado, and nibble away the waste in between.



Go deeper with a handsaw. Follow the sides of the slot with the saw and then remove the rest of the waste with a chisel.

APRONS

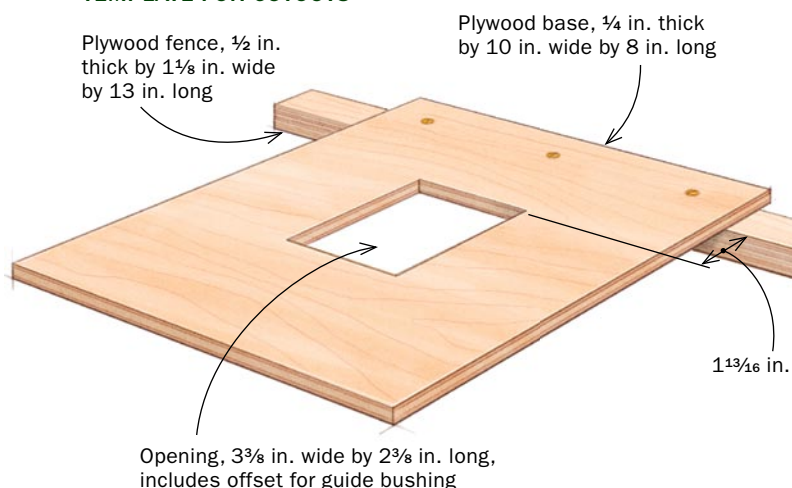
USE A ROUTER TEMPLATE FOR CLEAN CUTOUTS

There are six rectangular piercings. Use a router and template to make them all the same. A spiral bit is best because its shearing action will cut the end grain areas smoothly.

Make the template at the router table. Paolini routs one side of the opening at a time, lowering the template onto a ¼-in.-dia. spiral bit. He stops the last cut about ½ in. before the end and finishes it with a handsaw and sandpaper.



TEMPLATE FOR CUTOUTS



on the top edge also is a good idea.

After disassembling the table, break the edges with a block plane and then use a random-orbit sander to sand all of the parts up to P180 grit. Do not sand the areas you marked earlier: the half-lap joint where the aprons intersect and the area where the aprons pass through the bridle joint in the legs. Next, wipe all of the parts with a damp rag to raise the grain, then use a sanding block and P220-grit paper to remove the raised grain.

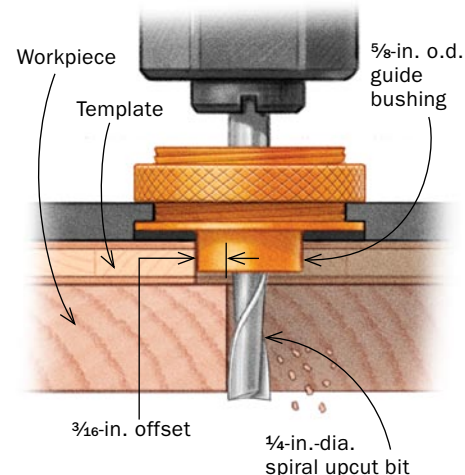
I finish the table before the glue-up. The advantage of finishing first is that any glue squeeze-out will not soak into the grain and become a problem when you try to finish over it. And squeeze-out doesn't stick to the finish, so it just peels away without fuss. To stain the table, I used the same finishing recipe that I used on my bow-arm Morris chair ("Build a Bow-Arm Morris Chair," *FWW* #205). Tape off any area where glue will



Clamp the template in place. Remove most of the waste in the cutout using a Forstner bit. Then clamp the template to the stretcher. Place scrap beneath the stretcher to protect your bench.



Trim flush in three passes. Set the bit depth to ¼ in. for the first pass, ½ in. for the second, and ¾ in. on the last one.



assembled in a particular order for the table to come together. Dry-fitting the table will help you not only learn and get comfortable with that puzzle, but also find any joints that need to be tweaked.

Begin by putting the stretchers together and adding one leg. Fit the shelf into that leg and add the opposite leg. Then add the last two legs. Now add the aprons and put the top in place. Before you take the table apart, use a pencil to mark the joint where the aprons intersect and where they pass through the legs. The marks will remind you not to sand those areas, which would cause the joints to become loose. Also, as you take off the legs, number the inside of the notches—I use a felt-tipped marker—and number the corresponding legs to match. Numbering the aprons

ASSEMBLY

A DRY RUN SORTS OUT SURPRISES

The table's base is a three-dimensional puzzle, and you don't want to be figuring it out with glue on the joints. So do a dry run to get comfortable with the steps.



Start with the stretchers. As the core of the table, these should fit snugly and squarely.



Fit the slip tenons. The top should be a close fit, but leave the bottom tenon a bit narrow to allow for wood movement.



The shelf is next. Lock it in place with opposing legs, then add the last two. If you assemble the legs first, you won't be able to get the shelf in place.

be applied, like the bridle and half-lap joints on the aprons, and use caution when staining around them and the slots.

Now you're ready for the glue. You can do it in stages or, if you're feeling lucky, all at once. Repeat the assembly order from the dry-fitting and use the leg cutoffs as cauls for the clamps. After the glue is dry, peel away any squeeze-out. Then rub out the finish with 0000 steel wool and paste wax, and buff the wax with a shoe-shine cloth or brush. Finally, attach the top with four screws, driving through the aprons and into the top. Slot the holes on the short apron to allow for wood movement. □

Gregory Paolini makes Arts-and-Crafts-style furniture in Waynesville, N.C.

Aprons are the last piece to the puzzle. They hold the legs in place and make the base rigid.

