

Tapered Laminations Made Easy

A single jig tapers the plies on the bandsaw and then guides them through the planer

BY MICHAEL C. FORTUNE



Bent and split. Fortune sawed into the tops of these bent, tapered legs to insert stretchers.

Incorporating tapered, curved laminations in your furniture opens up an incredible range of designs. However, tapering the component after it has been laminated has two disadvantages. If too many gluelines are broken, then the part will begin to straighten. Also, the severed gluelines are likely to show as a series of ugly lines.

A better way is to taper the individual plies, so that when they are glued together, both the inside and outside curves are continuous wood with no disfiguring gluelines. I have a jig that makes creating tapered plies a snap. It works not only to cut the tapered plies on the bandsaw, but also to clean them up on the planer.

Determine the dimensions of the plies

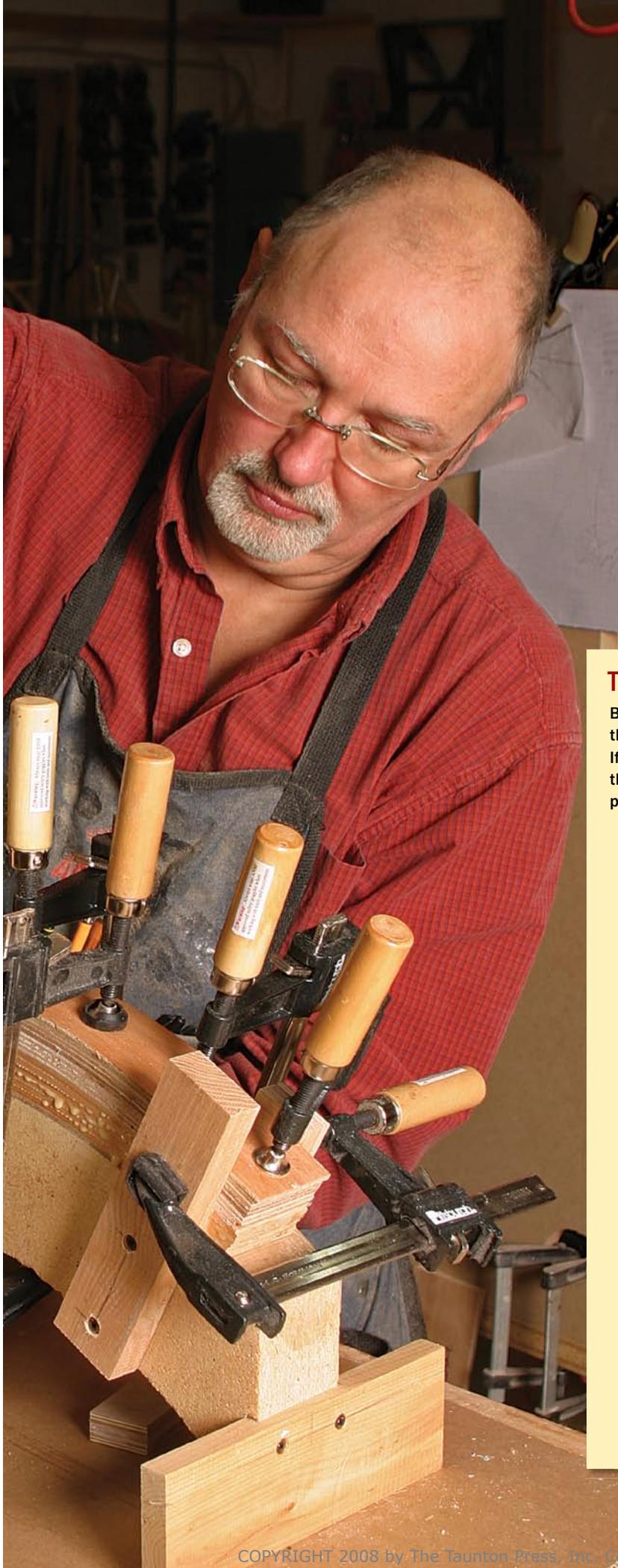
After creating a full-scale drawing of the piece, the first step is to figure out the number and thickness of the plies. This is a balancing act: The bond between thick, curved plies with only a few gluelines might weaken, letting the part slowly straighten, a process known as “cold creep.” Conversely, too many plies introduces too much glue, increasing the risk that the piece will contract or warp as it dries. As a guide, a 1-in.-thick laminated part bent around a 12-in. radius should comprise about 10 plies. You should be able to bend the plies around the form by hand; if not, make them thinner and add more.

When calculating the number of plies, start at the thin end of the finished part, maintaining a minimum



Mitered together. He made each leg from two tapered, laminated parts mitered together along their length. A miter reinforced with loose tenons joins legs to aprons.





thickness of $\frac{1}{16}$ in. at the tapered end of each ply. Any thinner and they may not survive being passed through the planer. Then divide the thick end by the number of plies to get the maximum thickness of each ply. I recommend making the plies $\frac{1}{4}$ in. wider than the finished part, and 1 in. longer (measured along the outside of the lamination) at both ends, to allow for cleanup and final sizing.



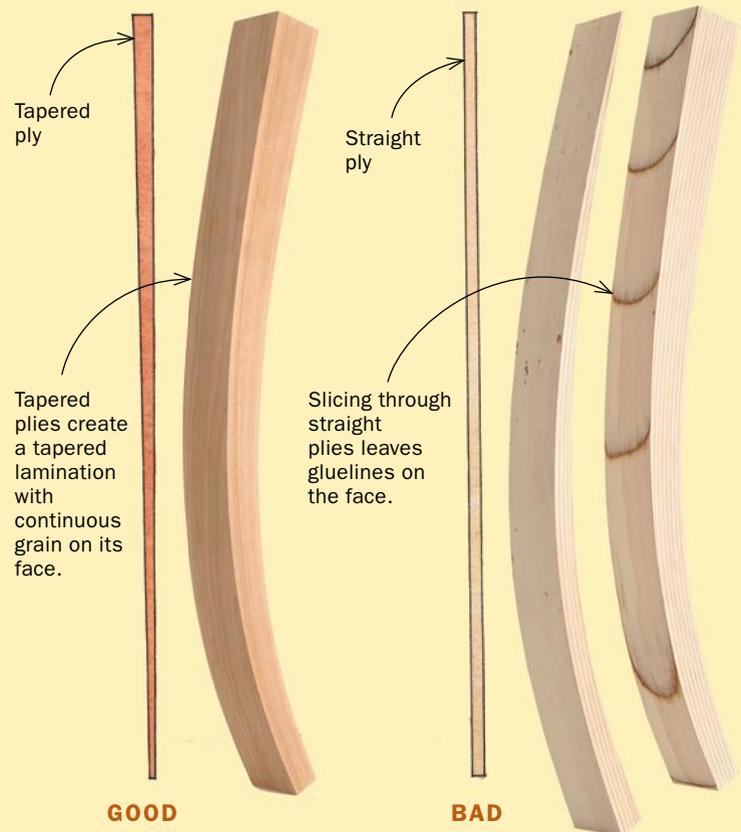
Graceful chair.
Fortune used bent, tapered laminations for the legs and stretchers of this armchair.

Make the bandsaw/planer taper jig

The dimensions of the jig can be changed to suit the project. I've used these jigs for making tapered parts from 1 ft. to 14 ft. long. Make the jig 2 in. longer at each end than the length of the plies. This 2-in. space accommodates end stops on the jig and any planer snipe. Make the jig wide enough to accommodate your plies, but be aware that the width of the jig is limited by the resaw

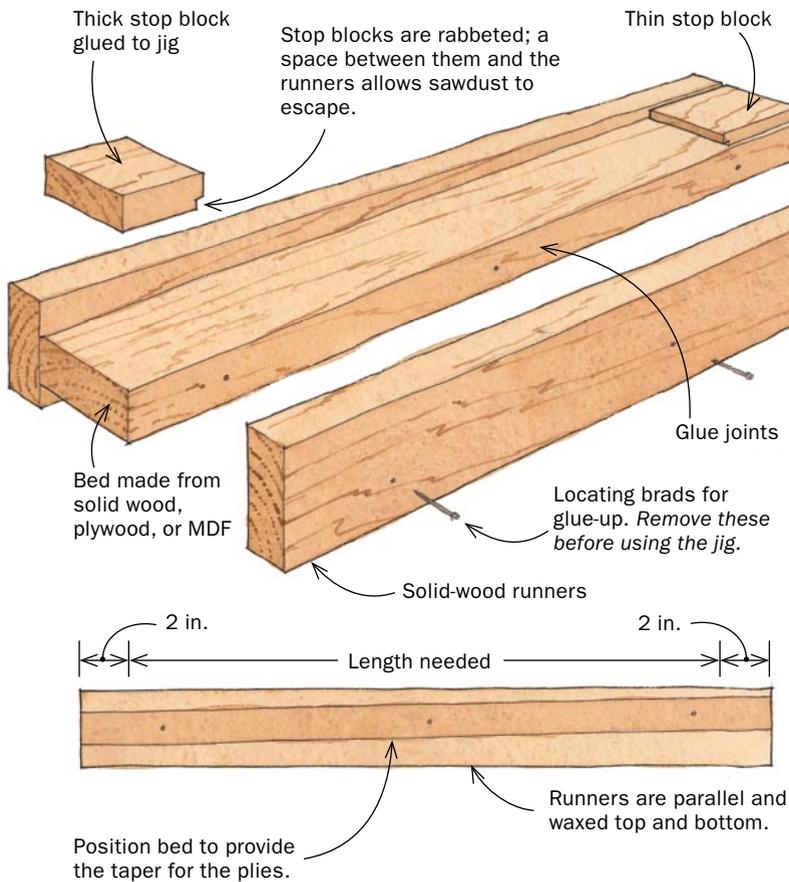
TAPER THE PLYS FOR A CLEAN LOOK

By tapering the individual plies before they are glued into a lamination, the tapered outer surfaces remain solid with no visible gluelines (left). If you taper the piece after it has been laminated, you will cut through the gluelines, spoiling the appearance and potentially weakening the piece (right).



Make the tapered plies

BANDSAW AND PLANER TAPERING JIG



capacity of your bandsaw. The jig is made up of three pieces: two solid-wood parallel runners ($\frac{3}{4}$ in. thick is best) and an inclined solid-wood or plywood bed that provides the taper. The three pieces should be jointed and planed as straight as possible.

Two inches from each end of the runners, carefully measure down from the top edge and mark the thin dimension of the ply on one end and the thick dimension on the other. Draw a line connecting the two points. Align the top surface of the bed with this line and clamp the parts together without glue. Drive in two or more small finishing nails on each side so that they penetrate the bed by $\frac{1}{8}$ in. Leave the nail heads proud so they can be pulled out later.

Separate the parts, apply glue, and reassemble them, aligning the nails in the holes to stop the parts from sliding as clamps are applied. Remove the nails when the glue is dry.

Position the end stops so the blank just slips in and out between them. If more than one blank is involved, all must be cut to the same length. To keep sawdust from accumulating and affecting the fit, the stops are rabbeted on the inside with space on either side next to the runners.

Set up the bandsaw and make tapers

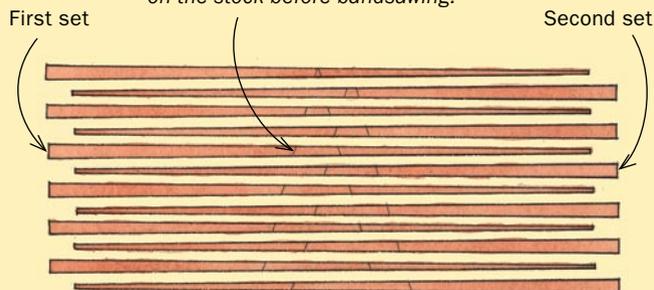
Make sure your bandsaw is tuned up and ready for resawing (see "Five Tips for Better Bandsawing," *FWW* #173). Set the fence so that the blade is $\frac{1}{32}$ in. to the right of the jig and cutting paral-

BANDSAWING

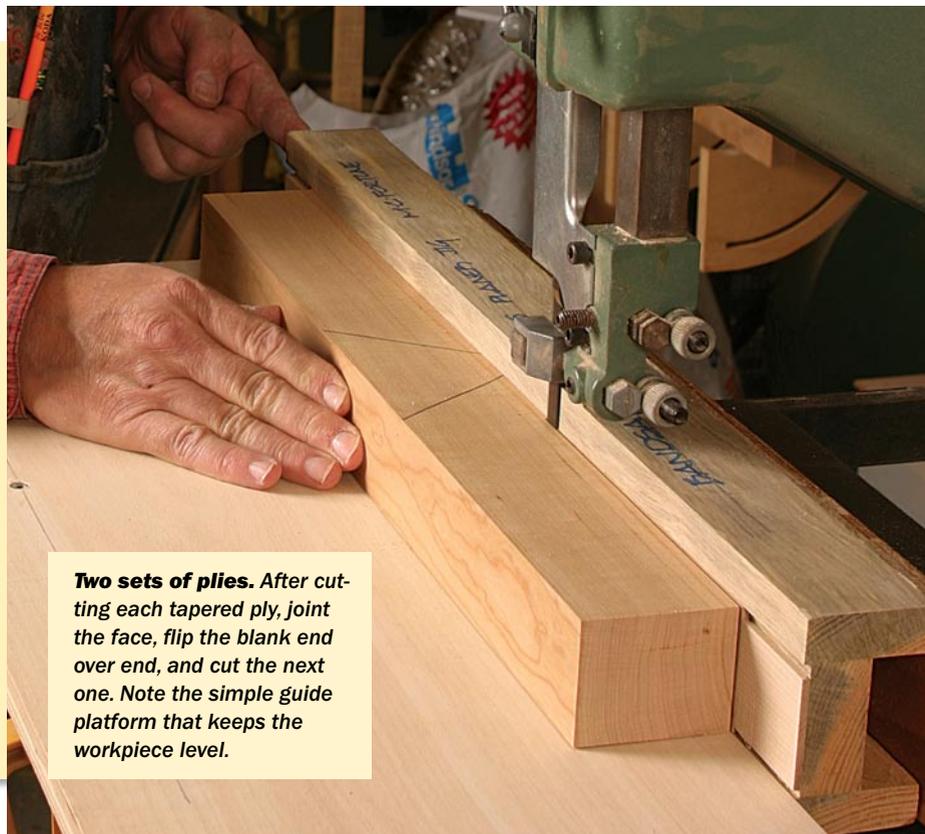
Stop blocks secure the blank. On either end of the jig, glue and clamp a stop block. You should just be able to slip a piece of paper in between the blank and each stop block.



To keep sets in order, mark a triangle on the stock before bandsawing.



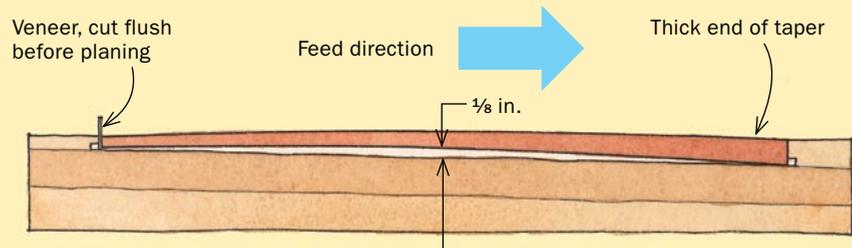
Two sets of plies. After cutting each tapered ply, joint the face, flip the blank end over end, and cut the next one. Note the simple guide platform that keeps the workpiece level.



PLANING



Run each ply through the planer. Glue a piece of veneer to one stop block (left), causing the ply to bow upward about $\frac{1}{8}$ in. When pushed down by the infeed roller of the planer, this bow greatly reduces the risk of the ply being picked up and shredded by the planer knives. With straight-grained wood, feed the thick end of the ply into the planer first (above) so that the knives are cutting downhill and not against the grain.



l to the fence. If both runners don't contact the fence, attach a taller auxiliary fence. Bring a guide platform with a small cutout around the blade up to the jig and attach it to the bandsaw table. This can be done with double-sided tape, or with screws set into a block of wood clamped to the edge of the table. The platform helps to support the blank while it is carried past the blade. For this reason, the thickness of the platform should match that of the jig's runners. The guide platform should extend beyond the front and back of the blade by a little over half the length of the blank. When cutting long plies, the ends of the platform can rest on adjustable stands.

The tapered plies are cut from a blank of solid wood. It is a good idea to draw a triangle on the top surface of the blank to keep the laminates in order.

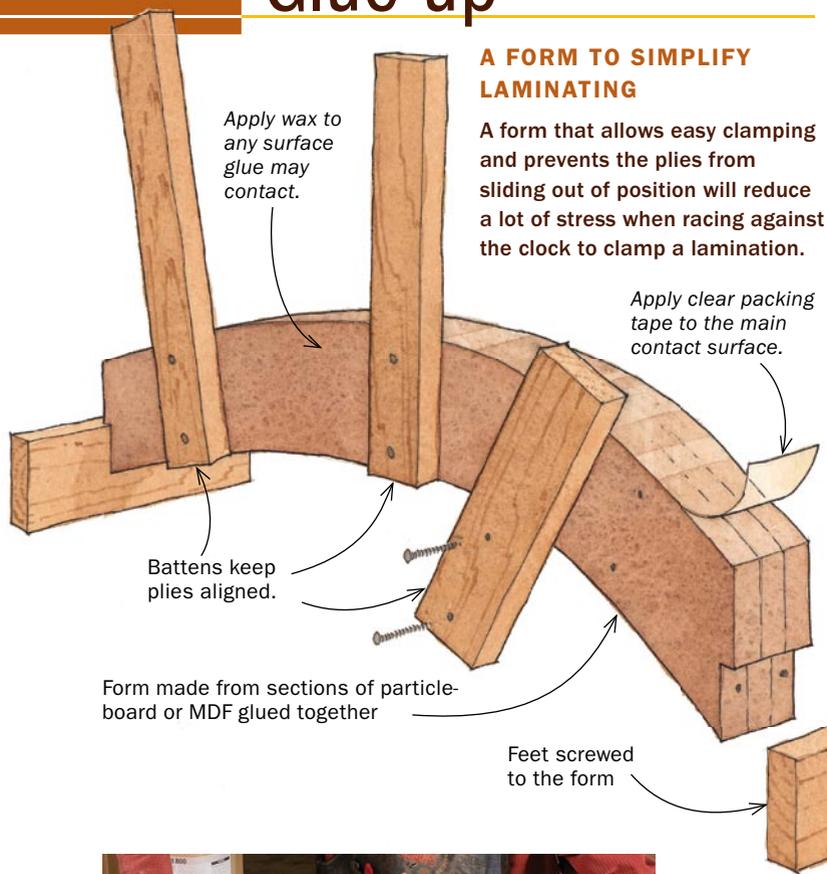
The blank must be flipped end-for-end each time a tapered ply is cut away. If not, the thick end of each ply comes from the same end of the blank, and the blank becomes increasingly tapered. You will quickly run out of wood on one end of the blank, and each successive ply will have more and more weak cross-grain. The blank should be wide enough to provide enough plies for at least two packets of laminations.

Place the blank in the jig (triangle pointing up) and run it through the bandsaw. The thick stop should be toward you so the blank is less inclined to slip off. After each pass, lightly joint



One board, two sets of plies. After planing the plies, use the triangle drawn on the original blank to stack the two groups in their correct sequence for grain-matched laminations.

Glue-up



A FORM TO SIMPLIFY LAMINATING

A form that allows easy clamping and prevents the plies from sliding out of position will reduce a lot of stress when racing against the clock to clamp a lamination.

Apply clear packing tape to the main contact surface.

Apply wax to any surface glue may contact.

Battens keep plies aligned.

Form made from sections of particle-board or MDF glued together

Feet screwed to the form



Apply the glue. With a limited open time, it is important to apply the glue quickly. Tape the plies to a piece of cardboard and use a metal spreader with a serrated edge to apply an even coat of glue.



Clamp from one end. Place the plies and the packing strips on the form, and keep them parallel by clamping them to a batten (above). Then begin clamping them to the body of the form, working from one end to the other (right).

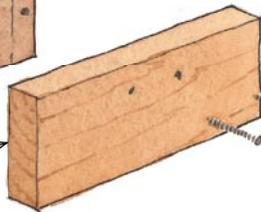
the bandsawn face of the blank, then flip it end-for-end so the triangle is pointing down, reinsert it in the jig, and cut another taper. Pile the tapered plies in these two groups according to the triangle marks as they come off the bandsaw.

Shim the plies and run them through the planer

The bandsaw leaves surfaces too rough for making tight glue joints, so you'll need to plane these surfaces smooth. Glue a piece of veneer or thick card to the face of the thicker end stop on the jig. When inserted, the plies should bow up about $\frac{1}{8}$ in. at the center point. The infeed roller on the planer will press the bow flat, which in turn will jam the ply against the end stops, greatly reducing or eliminating shredding. The $\frac{1}{32}$ -in. gap you set between the jig and the bandsaw blade will provide enough material to plane before you get down to the tops of the jig's runners.

Install a ply in the jig, bandsawn face up. The thick end of the ply usually enters the planer first so that the grain slopes away from the rotating planer knives, reducing tearout. The exception is plies with crooked grain, so examine the grain first.

Run the sled through the planer, carefully lowering the cutterhead until it begins cutting the taper. One pass might do it, but be cautious about taking off too much material at once. Also, be certain that the plies retain their desired thickness.

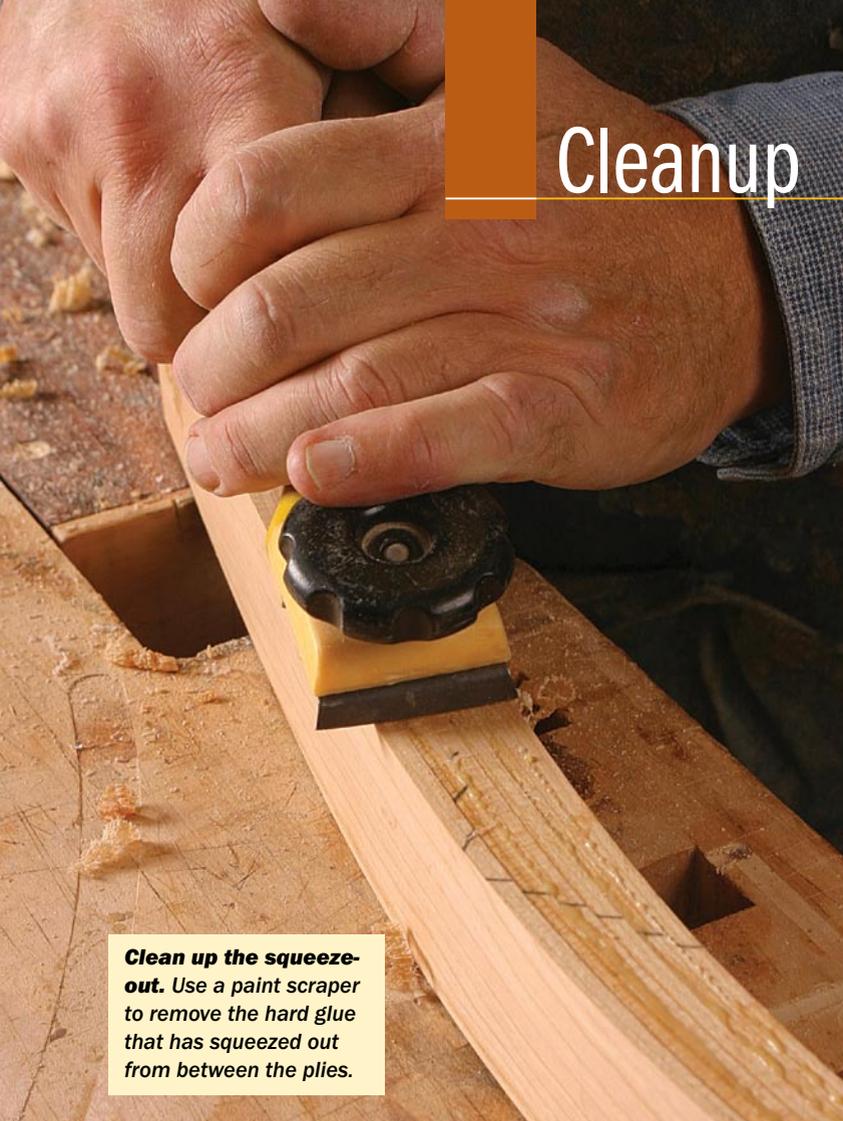


A better form for bending

For all my laminating and steam-bending, I use a one-piece "male" bending form (the plies are bent over the form rather than into a concave



Cleanup



Clean up the squeeze-out. Use a paint scraper to remove the hard glue that has squeezed out from between the plies.



Joint one edge. Run the edge that was scraped across the jointer.



Saw safely to width. Using a bandsaw to rip the lamination to width is safer than using a tablesaw and risking kickback.



Plane to thickness. Run the lamination through the planer to remove the bandsaw marks and bring the lamination to final thickness. Trim the ends on a miter saw using a jig, or on the tablesaw using a sled.

form) made from particleboard or medium-density fiberboard. The shape is bandsawn and the inside curve runs parallel to the outside so the clamps won't slip off. Attach battens long enough to guide the unclamped plies as they are brought around the form.

The form's surface should be smooth and true. You can either remove the bandsaw marks with a stationary disk or belt sander, or surface the face with a 1/8-in.-thick layer of Masonite, taking into account the extra thickness when designing the form. Cover the surface with packing tape, and apply paste wax to all the other parts of the form to resist glue adhesion.

Before you apply glue, do a dry run

Pressure radiates from a clamp's pad at about a 45° angle. To achieve uniform pressure but avoid having clamps placed almost next to each other, you need to position the clamp pads farther away from the workpiece so that the cones of pressure overlap. I use at least a 1-in.-thick stack of padding strips made from 1/8-in.-thick plywood, and apply packing tape to the face of the strip in contact with the plies.

For most woods I use urea/formaldehyde glue. Its rigidity and lack of cold creep make it ideal for laminations. I always do a dry-clamping run and time it to ensure I am within the adhesive's open time of about 30 minutes, depending on temperature. I use a metal mastic spreader with 1/32-in. curved notches stamped along

the edge (Hyde Co., part No. 19120; www.hydetools.com). The notches deposit the perfect amount of glue (for veneer work, too), and the spreader is easy to clean with a damp cloth.

Tape the ends of the plies down to a piece of cardboard on a bench, paying attention to the triangle mark sequence. Leave aside the top piece, which isn't glued. Pour the glue onto the plies and spread it with the notched spreader. Draw the glue down the length of the plies to avoid forcing it between them.

On oily tropical woods I use an epoxy, applying the glue to both sides of each laminate. After gluing one face using the above procedure, I take the strips off the cardboard one at a time and glue the second side with a 2-in.-wide piece of spreader.

Gather the plies and the packing strips together and move the entire assembly to the form. Starting at one end, clamp the lamination to the batten, then clamp it to the form, and then repeat these steps until you reach the far end, alternating clamps front and back of the form. Let the lamination dry overnight.

Remove the dried glue from one face with a paint scraper, run that face across the jointer, and then finish the cleanup as shown in the photos above. You are now ready to use my mortising jig (see pp. 74-75) to do the joinery on these curved parts. □

Michael C. Fortune is a nationally recognized woodworker who lives near Peterborough, Ont., Canada.