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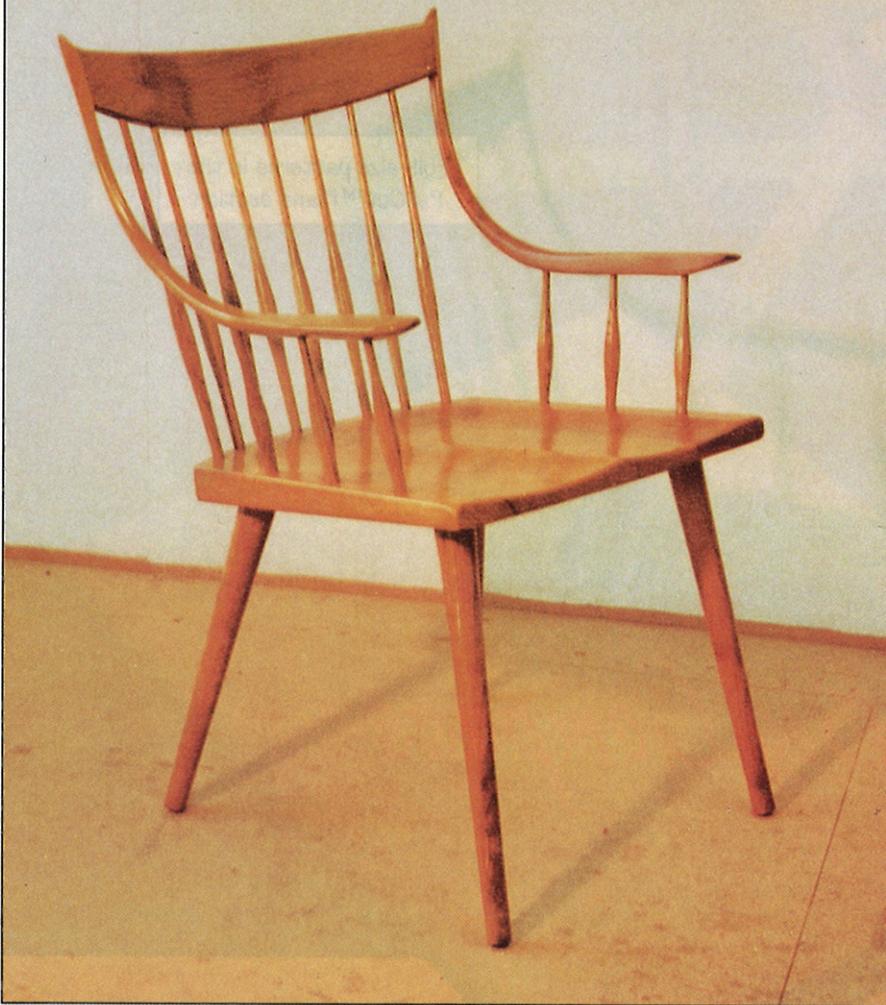
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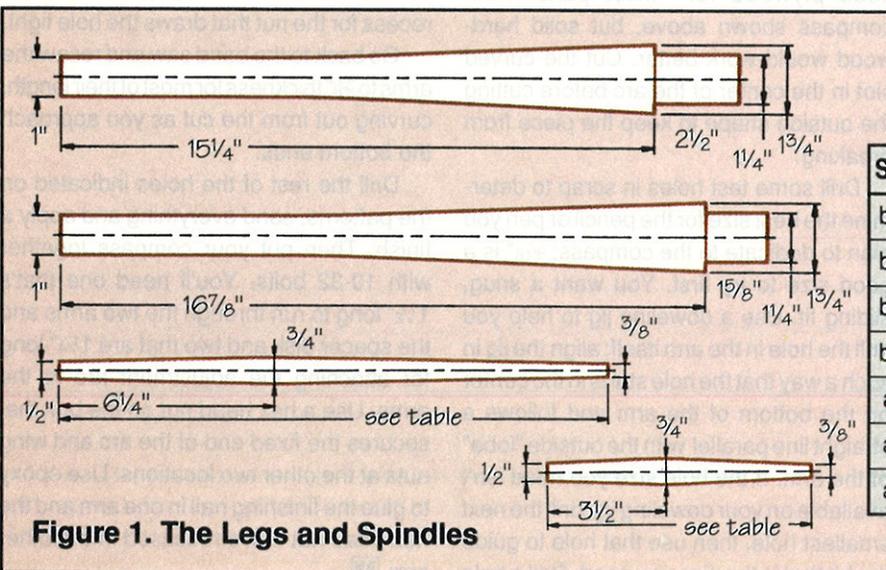


by Ken Sadler

The first story I wrote for *Popular Woodworking* was about furniture design ("Design Your Own Furniture," *PW* #53, March 1990). Among the pictures accompanying the story was one of a spindle back arm chair. Several readers wrote in and asked if they could get information and drawings to build "that chair." The editors said yes, it would happen, and now it has. Here is "That Chair."

Those of you who built the high back chair in the November '90 issue ("Have a Seat," *PW*#57, pp. 66) already have a leg up on this one. The seat and the legs and the manner of their assembly are exactly the same with one slight exception which I'll cover later. Although the top rail is different in shape, it can be laminated in the same jig you built for that part on the other chair. All the jigs and accessories for turning long thin spindles for that chair are necessary here, as is the angle jig for drilling the seat. If you don't have that article, you can get a **free** photocopy by sending a self-addressed, stamped, #10 envelope to: *PW* Chair Reprint, 1320 Galaxy Way, Concord, CA 94520. Include

That Chair



Tom Larson

Spindle Name	Blank Length	Finished Length
back spindle #1	17 1/2"	16 3/4"
back spindle #2	17"	16 1/4"
back spindle #3	16 3/4"	16"
back spindle #4	16 5/8"	15 7/8"
arm spindle #1	8 3/4"	8 1/4"
arm spindle #2	8 1/4"	7 3/4"
arm spindle #3	8 1/4"	7 3/4"

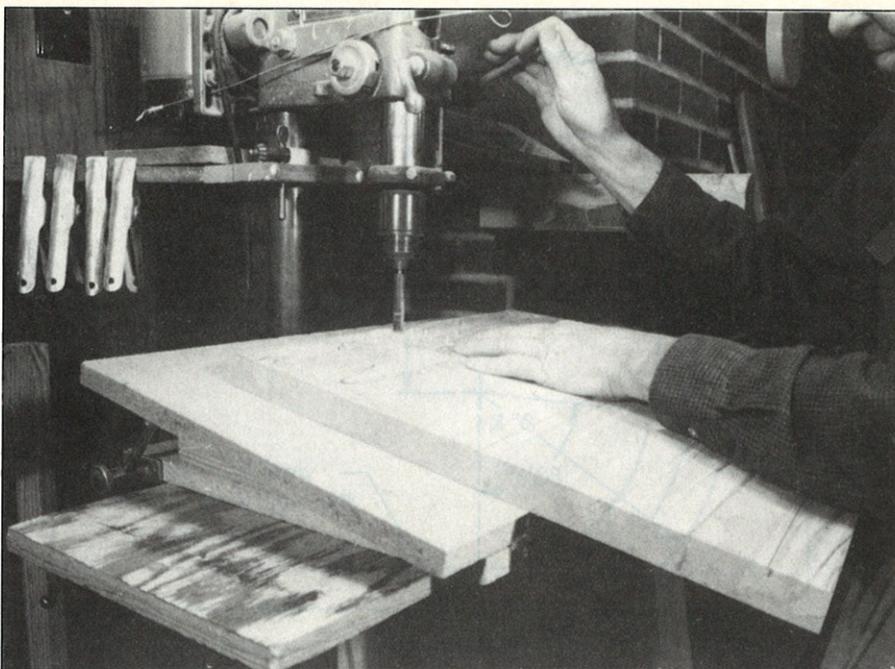
Figure 1. The Legs and Spindles

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enough postage for a two-ounce letter. However, by purchasing the actual back issue instead (see the order form on page 77), you'll get the information plus the full-size patterns in that issue's PullOut™ Plans section.

I am going to assume that you have all that information and can go ahead and turn the legs and spindles, and form and drill the seat as described therein. Note that the back spindles for this chair are shorter and that you have "arm spindles" instead of "support spindles" (see Figure 1 and the table below). The difference I mentioned in the seat is that instead of one hole for a support spindle, there are three holes for arm spindles. Their position on the seat is shown in Figure 2, and you should indicate them on your top surface template. The holes are the same diameter as the back spindle holes and are drilled at the same angle (100°). When drilling them, be sure that the bulk of the seat is between you and the drill bit and that the edge of the seat is parallel to the top edge of the drill jig. Aside from this, you can go ahead and finish the seat and leg assembly just as in that other article—right down to the final sanding.

The back spindles are turned in the same manner as for the previous chair, using the steadyrest. However, the arm spindles are so short that they don't need it.



Drill holes at 100° to the seat blank to accept the spindles. You'll need the angle-drilling jig and the 10° blocks described in "Here's An Angle" (PW #57, p. 72).

The laminations for the top rail of this chair are thinner than before because the part is $\frac{5}{8}$ " thick instead of $\frac{3}{4}$ ". For this chair, you'll need three pieces that are $\frac{7}{32}$ " X 4" X 24". Cut the pieces from one board and assemble them in the jig in the order in which you cut them. If you do the cutting on a circular saw, use a hollow-ground planer blade with as narrow a kerf as you can get.

The arms come next. I'll tell you right off, these are difficult and tricky parts to

make. A band saw and a good spokeshave are essential tools. As you can see from the picture, they are curved and we get that curve by lamination. That necessitates the jig shown in Figure 3. I made the base of the jig out of $\frac{3}{8}$ " CDX plywood. The straight jig blocks are cut from a piece of fir 4 X 4, and the curved block is made up of three layers of $\frac{3}{4}$ " CDX plywood. Fasten them in place with glue and screws driven through the base and into the blocks. They

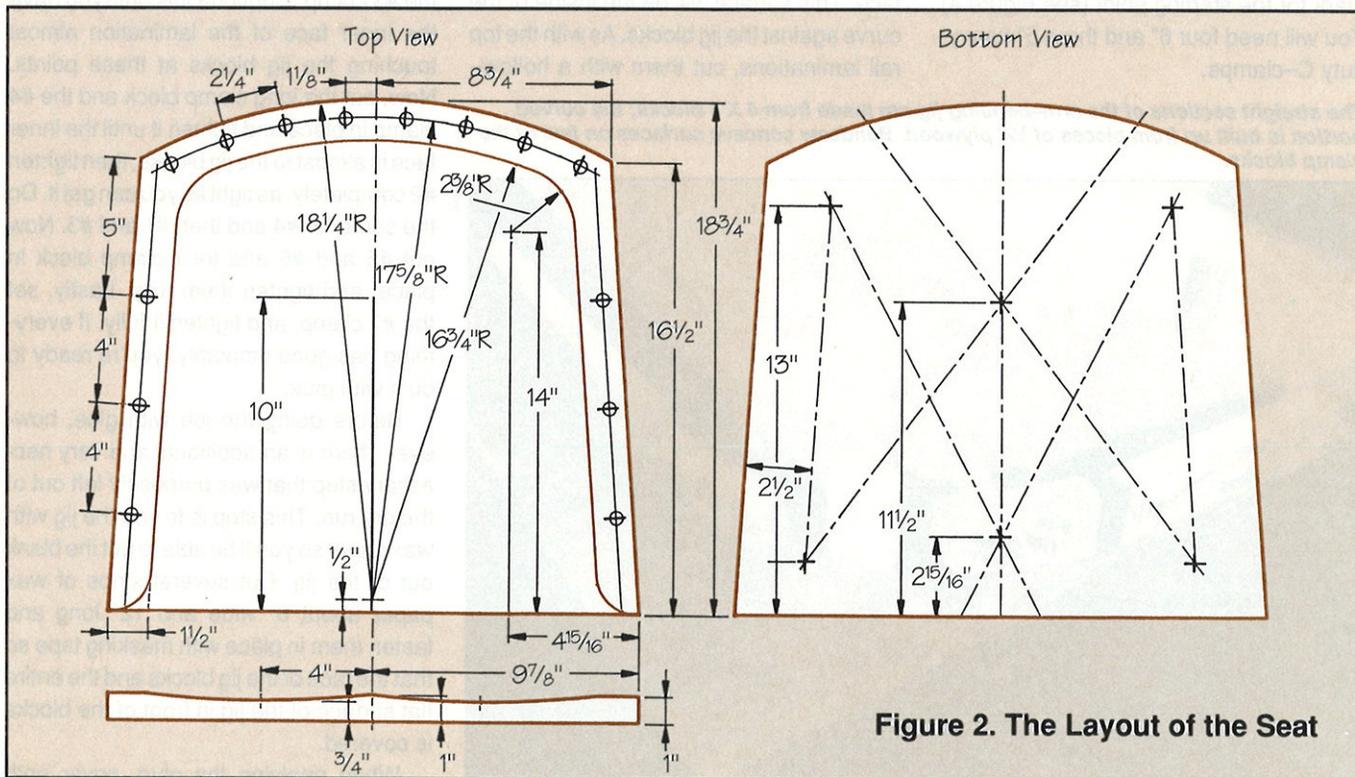
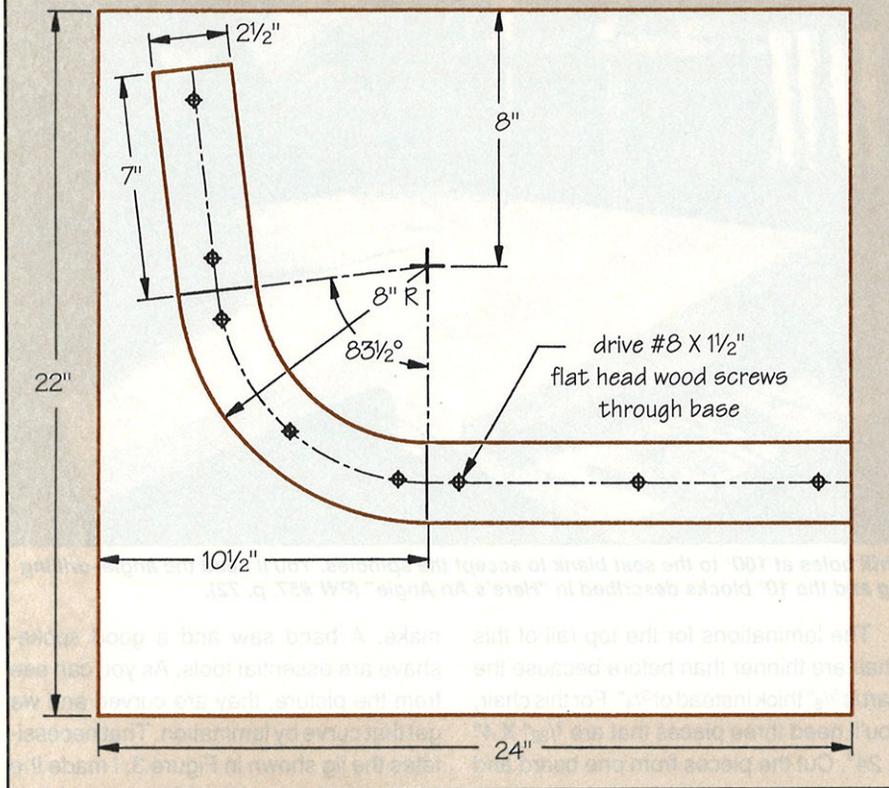


Figure 2. The Layout of the Seat

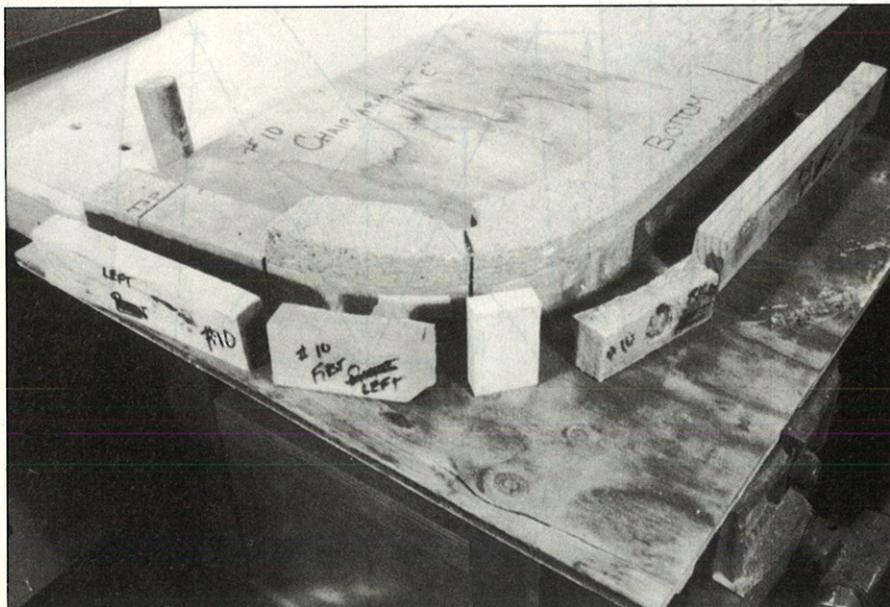
Figure 3. The Arm-Bending Jig



will be subjected to some strong forces so they must be securely fastened. The clamp blocks can be cut from scrap material to fit as shown in Figure 4. Don't neglect to put in the top and bottom marks as well as the mark for the starting point (see Figure 4). You will need four 6" and three 5" heavy-duty C-clamps.

The straight sections of the arm-bending jig are made from 4 X 4 blocks; the curved portion is built up from pieces of 3/4" plywood. Bandsaw concave surfaces on two of the clamp blocks.

The laminations are 3/16" X 2 1/4" X 29" and six are required for an arm. Cut them from a 2" X 2 1/4" X 29" board. The 2 1/4" face that goes against the rip fence first should be jointed smooth and square to the 2" face. This surface will be the inside of the curve against the jig blocks. As with the top rail laminations, cut them with a hollow-



ground planer blade, and keep them in the order in which you cut them. As each set is cut, tape them together so that they won't get mixed up. It's also a good idea to mark them left and right so you won't get confused later.

Before actually gluing up a set, it would be a good idea to have a dry run, in order to get the hang of things. Once the glue is in place there isn't much room for error or time to run after something you forgot.

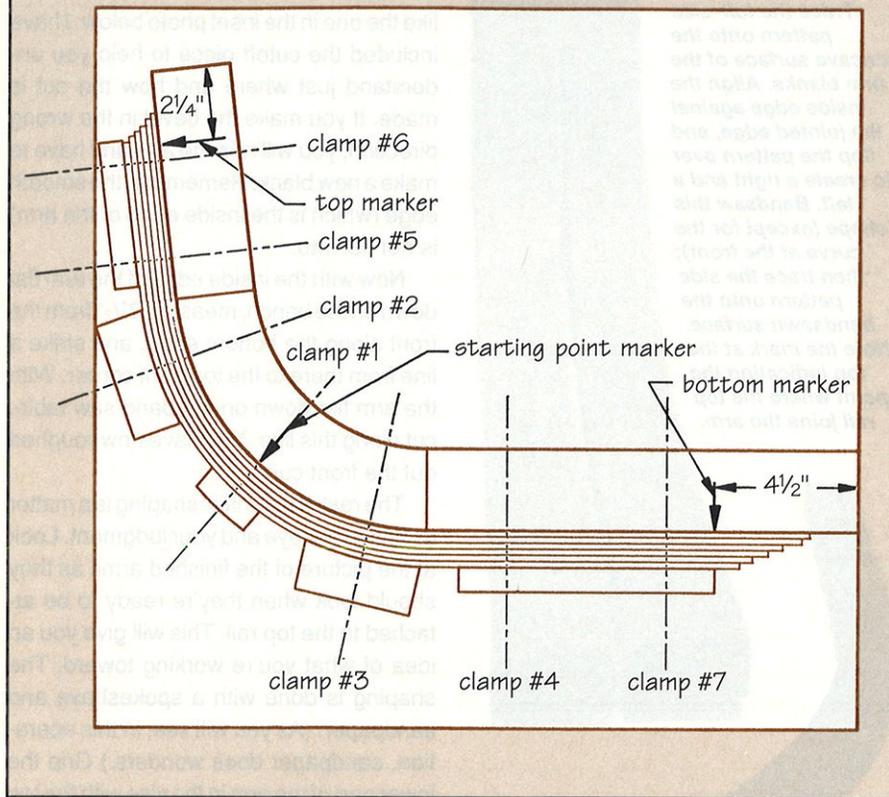
I've found that the best way to hold the jig while doing the job is to grip it between the adjustable dog on your vise and a pin in the bench behind the vise.

Measure along the jig blocks from the top marker to the position of the #1 clamp or starting point marker (see Figure 4). Add about 1 1/2" and measure this distance from the top end of your set of laminations. Make a heavy mark across all the laminations at this point on the side that will be up. The weight of this mark is not so important on the dry run, but with the glue in place, a light line can become obscured. Now, place the set in the jig with the mark at the starting point marker. Put the #1 clamp with its clamp block in place and tighten it, but not entirely. Put the #2 clamp and block in place and pull it up enough to hold it firm. Position the #3 clamp and its clamp block, and pull it up enough to hold it in place. Now slowly tighten the #2 clamp two or three good turns, then do the same with the #3 clamp. Continue this until you have the inner face of the lamination almost touching the jig blocks at these points. Now, put the long clamp block and the #4 clamp in place and tighten it until the inner face is almost to the jig blocks, then tighten #2 completely, as tight as you can get it. Do the same for #4 and then #1 and #3. Now put #5 and #6 and their clamp block in place, and tighten them fully. Lastly, set the #7 clamp, and tighten it fully. If everything has gone smoothly, you're ready to do it with glue.

Before doing the job with glue, however, there is an additional and very necessary step that was purposely left out of the dry run. This step is to line the jig with wax paper so you'll be able to get the blank out of the jig. Cut several strips of wax paper about 6" wide and 12" long and fasten them in place with masking tape so that the face of the jig blocks and the entire flat surface of the jig in front of the blocks is covered.

When applying the glue, cover both

Figure 4. The Jig in Use



surfaces of the mating faces entirely. Be sure to keep the pieces in order. Put them in the jig and proceed as in the dry run. Now that there is glue between the laminations, they will want to move around relative to each other. You won't be able to control this entirely but you should push them back into place as best you can during the tightening process. (That's the reason for the extra width and length.) You will also have excess glue oozing out top and bottom. Don't be concerned about this; it will all clean up later.

After about six hours you can take the blank out of the jig and glue up the other set. When the blanks come out of the jig, the wax paper will stick to the underside and there will be wet glue between the paper and the blank. Peel the paper away and scrape off as much wet glue as you can. It will speed the final drying and save work later on.

While the arm blanks are drying, take the top rail blank out of the jig. Joint what will be the top edge until it is even and square with the convex face. Rip the blank to $3\frac{5}{8}$ " wide. When it comes out of the jig the ends of the blank will be uneven. Mark the center of the portion that is the full thickness. Make a template from the full-

size pattern in the PullOut™ Plans section and align its centerline to this point, with the top edge flush to the top edge of the blank. Tape it firmly to the concave face and trace the pattern onto the blank. The two lines indicating the ends of the rail must be accurate and straight. Remove the template but do not cut the curved

Make the compound cut on one end of the chair rail with the blade set at 21° and the miter gauge at 10° to the right. Turn it to 10° the other way, and put the opposite edge against it to cut the other end.



edge at this time.

The ends of the rail are cut at a compound angle and the operation is a bit tricky. Using the planer blade, set your table saw blade angle at 21° and the miter gauge at 10° to the right. Place the convex face of the blank down and the top edge against the miter gauge, hold the blank flat on the table at the point of the cut, and cut along the line. Reverse the miter gauge to 10° left, reverse the blank so that the bottom edge is against the miter gauge and make the cut on the other end. Now you can bandsaw the curved bottom. Clean up the sawed edge with a spokeshave and round the corners just a little. Don't touch the end cuts, and don't round the corners of the top edge at this time.

On the bottom edge lay out the centers of the spindle holes as shown on the pattern. With a $\frac{3}{8}$ " Forstner bit chucked in the drill press, drill the holes to a depth of $\frac{3}{4}$ " at the hole centers. Be sure that the top edge is flat on the drill press table and that, regardless of which hole you're drilling, most of the rail is supported by the table. This will ensure that the holes are parallel to the faces of the rail and straight from side to side. Set this part aside for now.

By this time you should have two arm blanks made up with the glue dried for at least 24 hours, so you're ready to start making the arms. The first step on each blank is to joint one edge flat and at right angles to the convex side. In doing this, recognize that the longer straight section, marked "bottom" on the jig, is the main part

of the arm and that, being arms, they must be opposites. Thus, when placed on the bench side by side with the bottoms down, the *inner* faces must be smooth. Once you've done this, place the arm that will fit with the smooth side down, back in the bending jig, and mark the top and bottom cutoff points. Make these cuts, put the arms together, mark the other one and make those cuts.

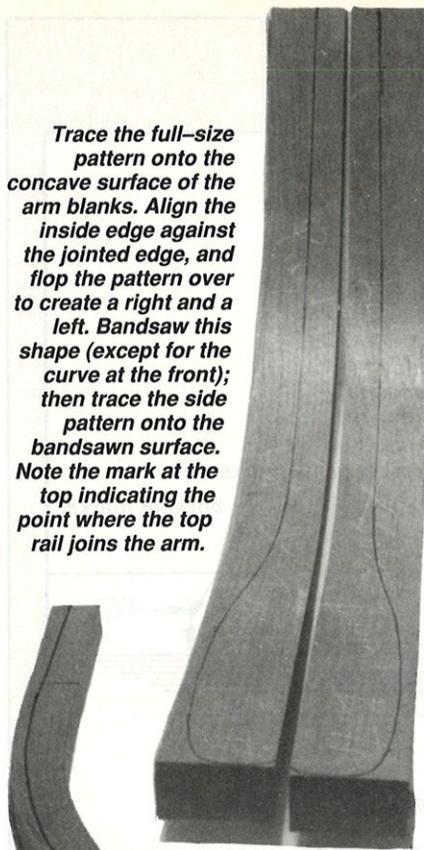
You are now ready to begin shaping. This is where arm-making gets a bit tricky. In the PullOut™ Plans you will find full-size patterns for the top of the arm and the side of the arm. Make templates from these on light cardboard. Place the first template on the top of the arm with its straight edge flush with the smooth edge of the arm, and the front edge of the template as far forward as possible, and trace the template onto the arm (flop the template over for the opposite arm). Go to the top of the arm and measure $\frac{3}{4}$ " from the smooth edge and make a mark. Connect that mark and the upper end of the outside line from the top template with a straight line. Bandsaw the shape, leaving the line, but leave the front corners square. Be sure to keep the convex face of the arm flat on the table while making this cut. There is a tendency to tip it when negotiating the curved section.

Place the side template on the newly sawn edge with its concave edge flush to the concave face of the arm. Trace the outer edge of this template. Now bandsaw this shape, leaving the line, and again, do not cut the front part of the shape. You will need it to guide you when cutting the bevel I will discuss shortly.

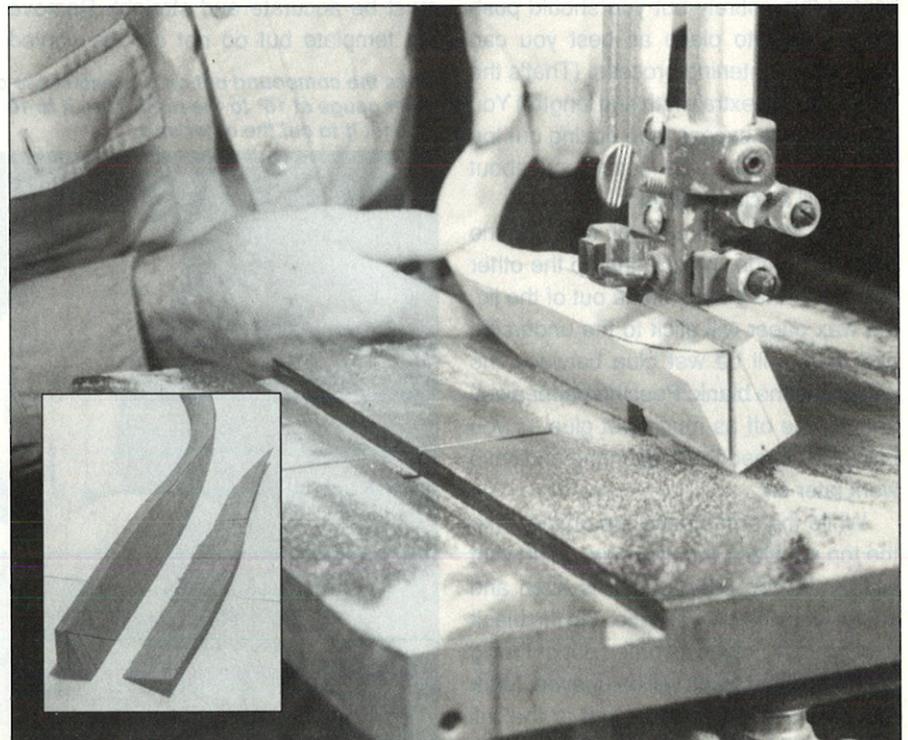
On the pattern you will notice a line near the top of the arm marker which indicates the bottom edge of the top rail. Transfer this line to the blank and carry it around to all four sides of the blank. This line is important for two reasons: it is where you stop the initial shaping of the arm, and it is vital while assembling the arm to the top rail.

This next roughing cut is the most difficult to make; it's even hard to explain. It makes a bevel on the bottom surface of the main part of the arm, and you can see me making the cut in the photo to the right. The bevel runs from the lower corner of the smooth edge upward toward the top of the shaped face. The edge of the bevel runs parallel to the top face. The saw blade enters at the bottom of the second lamina-

Trace the full-size pattern onto the concave surface of the arm blanks. Align the inside edge against the jointed edge, and flop the pattern over to create a right and a left. Bandsaw this shape (except for the curve at the front); then trace the side pattern onto the bandsawn surface. Note the mark at the top indicating the point where the top rail joins the arm.



Bevel the underside of the arm by cutting freehand on the band saw. You want the thicker portion to remain on the inside surface of the arm, as shown in the inset photo below.



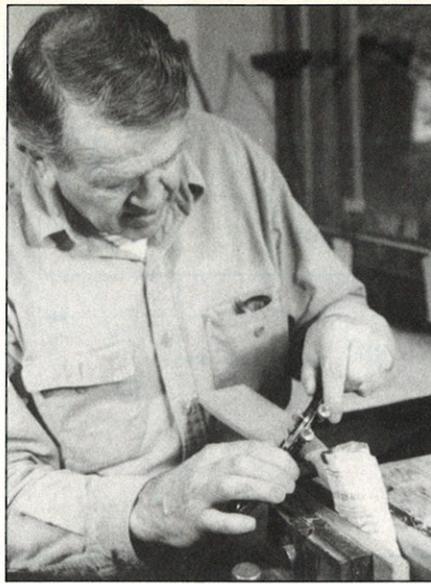
tion and comes out just above the corner of the smooth edge and the bottom face. The only way to make the cut is freehand on the band saw. When finished the arm will look like the one in the inset photo below. I have included the cutoff piece to help you understand just where and how the cut is made. If you make the bevel in the wrong direction, you will ruin the arm and have to make a new blank. Remember, the smooth edge (which is the inside edge of the arm) is not cut into.

Now with the inside edge of the arm flat down on the bench, measure $2\frac{1}{2}$ " from the front along the bottom edge, and strike a line from there to the top front corner. With the arm flat down on the band saw table, cut along this line. You have now roughed out the front curve.

The rest of this initial shaping is a matter of using your eye and your judgment. Look at the picture of the finished arms as they should look when they're ready to be attached to the top rail. This will give you an idea of what you're working toward. The shaping is done with a spokeshave and sandpaper. (As you will see, in this operation, sandpaper does wonders.) Grip the lower part of the arm in the vise with the top pointing up and shape from the bottom to the top, stopping



photos by the author



Use a spokeshave to shape the upper portion of the arm from oval to round and blend the surfaces that form the flat lower portion.

short of the top rail line you have marked. The shape goes from oval as it comes out of the flat part of the arm, to round at the top line. At this point it should be slightly over $\frac{5}{8}$ " in diameter. When you have the shape to your liking, sand it smooth with 80-grit paper and finish it with 150-grit. Wrap the upper end you have just finished in folded newspaper to protect it, and grip it firmly in the vise with the lower portion pointing toward you. Shape toward you and blend the upper part into the lower part as you work. Don't take any more material than is necessary to smooth and blend the surfaces. If you get the arm too thin, there won't be sufficient depth to hold the arm spindles securely. Again, when you have the shape the way you want it, sand it smooth with 80- and finish with 150-grit paper.

Still gripping the upper arm in the vise, turn it so that you can work on the flat surface of the lower arm. Don't use the spokeshave on the flat itself; just use it to blend the upper flat into the upper arm and to round the corners a little. In this position you can also round the front corners; then do some more finishing with sandpaper.

The last step before attaching the arms to the top rail is to drill them for the spindles. Figure 5 on the following page shows a simple jig to support

the arm while you do this. Make the jig and mark it as shown. Place the flat face of an arm on the jig so that the front is flush with the front of the jig. At each marked point, carry a line across the bottom surface of the arm. On the front line, measure $\frac{11}{16}$ " from the high side and make a mark. At the rear line find the center of the surface and make a mark. Lay a straightedge across the two marks and where it crosses the middle line make a third mark. Indent the intersections of these marks with a center punch. Using a pair of calipers, measure the thickness of the arm at each of the marks. You should have a minimum of $\frac{3}{4}$ " in order to get a $\frac{5}{8}$ " deep hole. If you haven't got $\frac{3}{4}$ ", then reduce the depth of the hole by the difference. Note this somewhere, because you will have to shorten the top of the spindle that goes in that hole by that amount.

Put the jig on the drill

When the arms look like this, you can give the spokeshave and the sandpaper a break. The upper portion of the arm should still be square at this point, so you can attach the top rail.

press table, and set the arm back on the jig as you had it before. Position it and the table so that the upper part of the arm hangs over the rear of the table and you can reach all three holes without shifting the table. You will need a $\frac{3}{8}$ " brad-point drill bit. In order to be sure that I don't drill too deep, I measure the depth on the drill bit and wrap it with masking tape above that point. You don't have much leeway and you don't want to come through the top surface. In the drilling operation, you hold the arm on the jig with the left hand, moving the jig and the arm from position to position, and operate the drill press with your right hand.

It is now time to fit the back and arms together. Start with the back. First fit all the back spindles to their holes in the seat and in the top rail. This should be a snug but not a tight fit. Mark them as you go. I always mark each spindle on the bottom 1R, 2R 1L, 2L, etc. Then fit the spindles to the top rail. Put the two outside spindles in place in the seat, and put the top rail on them. Measure the height from the seat at each end, and if it isn't equal, make it so. This fitting operation is going to require considerable trimming of the spindles. It's usually not much, but sometimes it can be quite a bit. The main reason for this is that the spindle hole depths will vary. Drilling into tapered parts makes it impossible to use the depth gauge on the drill press, and your eye is not that accurate—at least mine isn't. With the top rail in place on the two outside spindles, put the other spindles in their respective seat holes so that they are *behind* the top rail. Position each spindle behind its proper hole in the rail,

and mark it at the bottom edge of the rail. Remove the rail and the back spindles. Cut each spindle at $\frac{3}{4}$ " past the mark you just made. This is the same procedure used in fitting together the back of the high back chair in the November 1990 issue. That article has pictures illustrating the process.

Assemble all the back spindles and the rail in their proper positions. Next, fit the arm spindles to their respective holes, and then put the arm in place. When the arm spindles are fully seated in their holes, the height of the bottom edge of the arm—from the seat at the front spindle, measured at the inside face of the arm—should be $6\frac{1}{2}$ ". The height at the back spindle should be 7", and the uncarved portion at

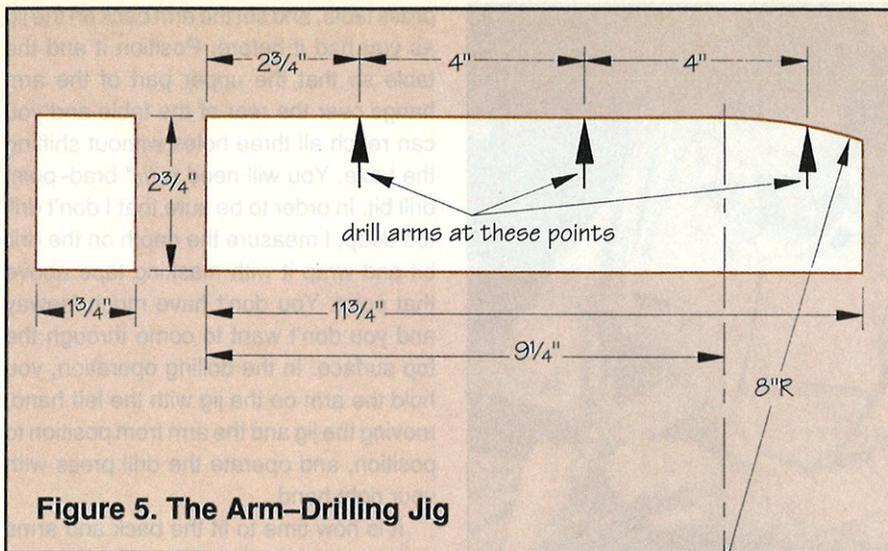
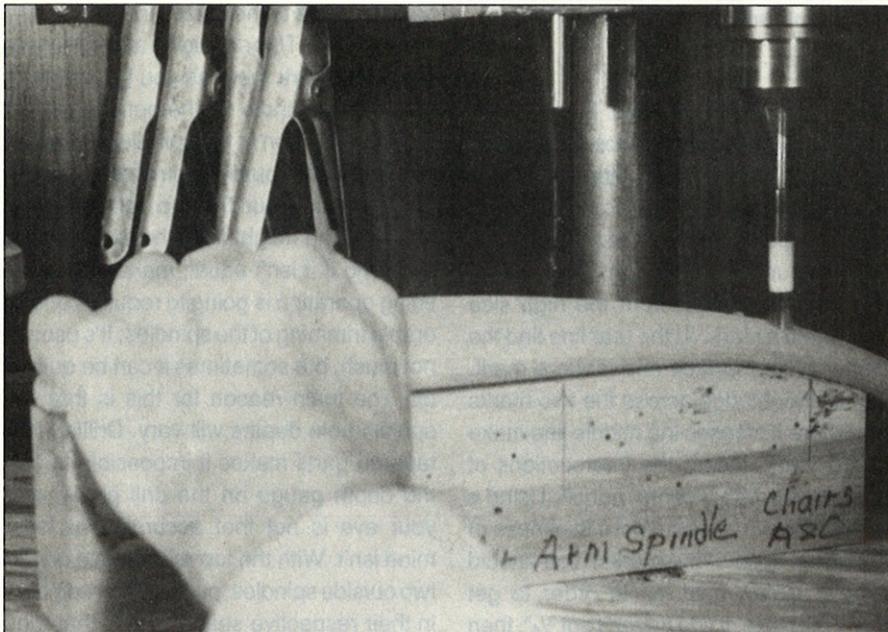


Figure 5. The Arm-Drilling Jig



This slightly curved block supports the arm while you drill the underside for the spindle holes. Use masking tape on the drill bit as a visual depth stop.

the top of the arm should line up pretty closely with the end of the top rail. If it's too high and too far forward, trim the back spindle (at its top end). If it's too low and too far back, trim the front spindle. The bottom edge of the top rail should be close to if not on the mark you made on the arm.

It is now time to glue the arms to the top rail. Do not put any glue in any of the spindle holes at this time. To do this operation right, you will need two 12" bar clamps, one 24" or larger bar clamp, four small 10° wedges, two spring clamps that will open at least 7/8", and two thin flat wooden pads. It is best to do this clamping operation dry first, in order to make sure you have everything you need and that it all works. Once the glue is in the joint, it's too late to correct mistakes.

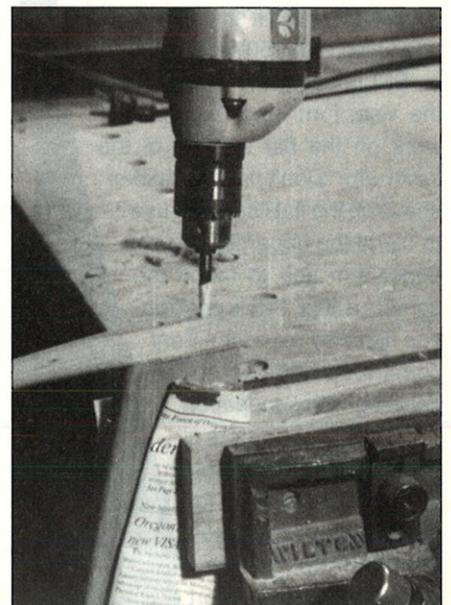
Using a wedge under the seat and a pad on top of the arm, clamp the arm assembly to the seat with one of the 12" bar clamps. Place it between spindles 2 and 3. Using masking tape, tape a wedge to each arm opposite the top rail end. Place a spring clamp across the bottom of the joint to hold the parts in line while you apply the 24" bar clamp across the front. The joint faces should mate but the relative positions of the rail and arms don't have to be perfect. You're going to do quite a bit of final shaping in this area. If everything has worked as it should, take the bar clamp and the two spring clamps off, put glue in the joint and replace the clamps. Allow this to dry for at least 24 hours. This is a naturally weak joint, and although you're going to strengthen it later, you don't want

it to come apart in the process.

When you're sure that the glue is thoroughly dry, remove the arm and top rail assembly from the chair and remove all the spindles. Be sure that you mark them carefully so that you can get them back in the right places. Using several layers of newspaper, grip the assembly in the vise as shown in the photo below. Use a spokeshave to flatten the top edge of the upper arm parallel with the end of the rail. Draw a line across this flat about 5/8" from top and bottom of the rail. Choose a point on these lines that is midway of the thickness of the rail (this will have to be as much by eye as by measurement). Now with a 1/4" spur bit in your hand drill, drill through the upper arm and about 3/4" into the rail as shown in the picture. This takes careful aiming so that you don't come out the side of the rail. Prepare a 1/4" dowel of sufficient length that it will extend past the surface when fully in the hole. The dowel should have a breather groove down one side and be a tap fit in the hole. Put glue in the top half of the hole and tap the dowel in as far as it will go. Now do the other arm the same way.

Allow time for the glue to dry and you're ready for final shaping of the upper arms. Grip the assembly in the vise the same way you did for the drilling, except the arm should be somewhat higher above the vise to give you more freedom to use the spokeshave. In doing this shaping, the outer edge of the arm should be a straight line, no bulge opposite the end of the rail. The front and back of the arm should blend

After gluing the arms to the back rail, strengthen the joint with screws.



Tom Larson
author



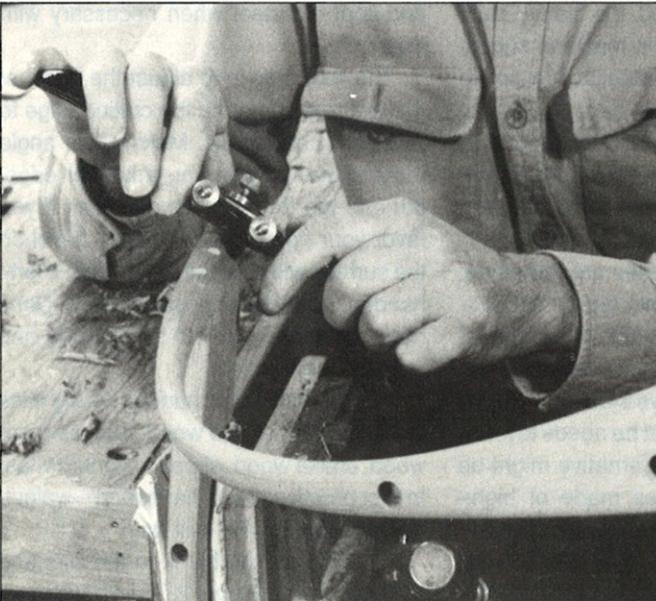
Glue the arms to the back rail with the spindles dry-assembled in place. Wedges with a 10° taper help the clamps apply even pressure.

into the rail and the arm should be the same thickness as the rail at this point. The inside of the arm should be rounded as close as possible to the bottom edge of the rail. This part will take a little file work and considerable sandpaper work. Sand the joint area all over, and use the sandpaper to help smooth out the final shaping. I find that 80-grit paper is excellent for this.

The last operation before final assembly is the shaping of the ears. Grip the assembly in the vise as shown in the right-

hand photo below. Measure up from the top of the rail about $\frac{1}{2}$ " to $\frac{5}{8}$ " and draw a line around the arm extension. Now draw a concave line from the line at the outside of the arm to the top of the rail. Using a coping saw, saw along this line (leaving the line). With a half-round, fine-cut file and sandpaper, shape and smooth the ear as shown in the picture. Then round the top corners of the rail (using a spokeshave) and sand the top edge smooth.

With the arm-to-back joint reinforced and the screw holes plugged, you can finish shaping the assembly. Round the upper edges of the arms, and saw and file the tops to blend nicely with the rail.



Now for final assembly. Do this dry first so that you're sure you have all the spindles in the right places and that everything fits properly. The best way to make this assembly is to put the spindles in the arm and rail assembly first, then fit that assembly to the holes in the chair seat. Make sure that all the spindles bottom in their holes. You may find that the two front arm spindles want to pop up a little. If this is the case arrange some means of holding them down firmly before you put the glue in. When you're sure everything is okay, take it all apart and start gluing. Glue the spindles in the arm and rail assembly first, and allow the glue to set for an hour or so. Then put glue in the seat holes and fit the assembly as before. Be sure you put glue only in the top half of the holes. If you put it all the way, you'll have too much, and the spindle will push the excess to the bottom which will keep the spindle from going home.

Only finishing is left. I will say what I always say, no stain. I use several coats of Formby's Tung Oil Finish hand-rubbed on.

When you have finished with this project I think you will be pleased with what you have done. Some of you will also have acquired a new skill, shaping with a spokeshave, one that you will find most useful in the future. This design makes a great desk or dining chair. It looks good and it is very comfortable. When I was in business, I sold almost a hundred of them—usually in groups of four or six, as dining chairs. I hope you like it as well as my clients did. **PW**