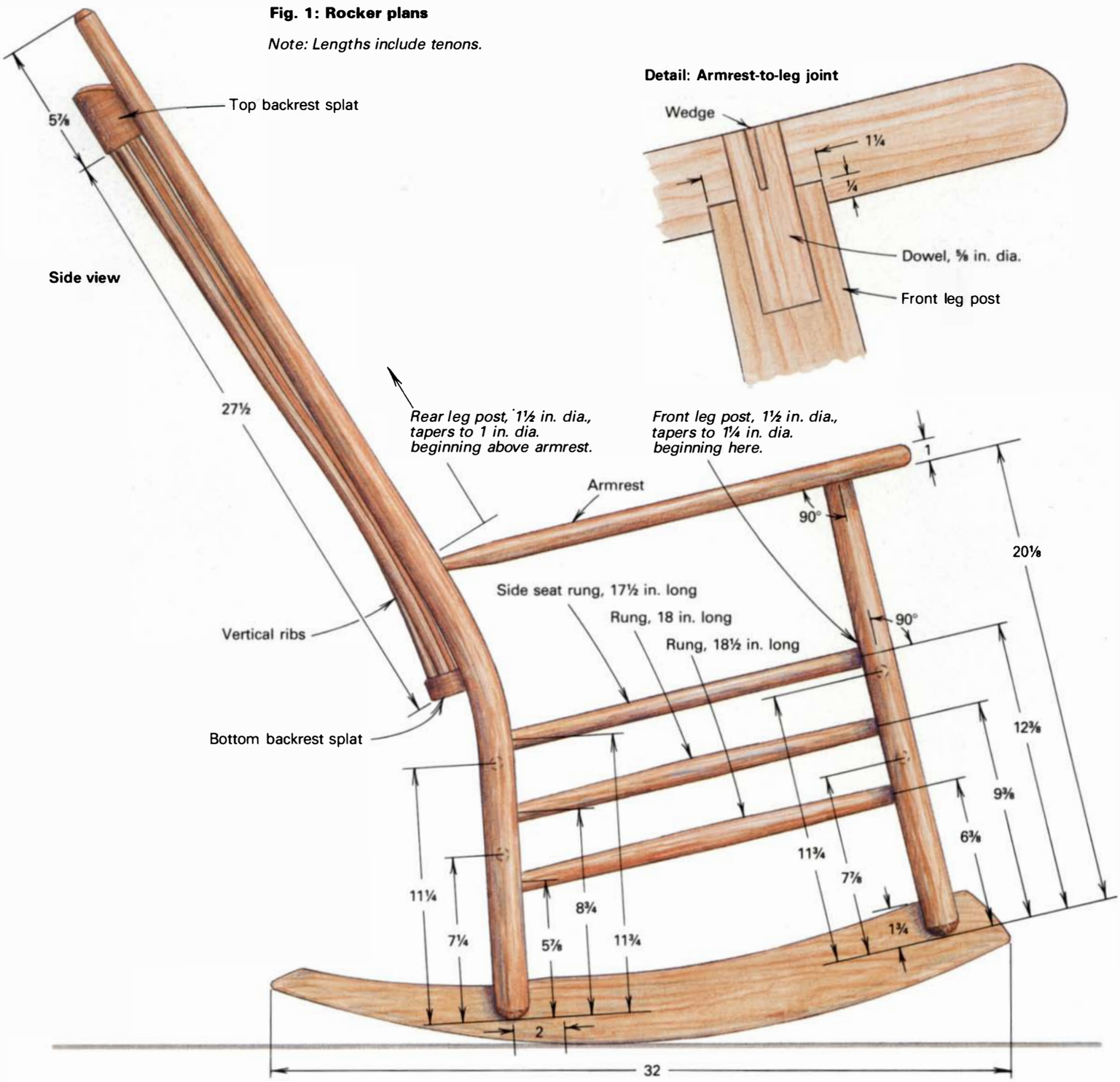
Building a Bent-Back Rocker

Soft rock from hardwoods

by Brian Boggs

Fig. 1: Rocker plans

Note: Lengths include tenons.



Drawings: Lee Hov

After building more than 100 rocking chairs, I've developed a rather non-scientific approach for designing and constructing attractive, strong and comfortable rockers from green hardwoods. My first rocking chair was a straight ladderback chair fit on runners copied from an old chair I liked. Although I was able to construct the chair fairly quickly, I didn't like the piece's visual balance. After more carefully studying how chairs worked, I subsequently altered seat shapes, leg angles, rocker radii and other details to improve the chair's appearance, comfort and my construction methods. The result is the bent-back rocker, shown on p. 45 in the photo at right, which I'll tell you how to build in this article.

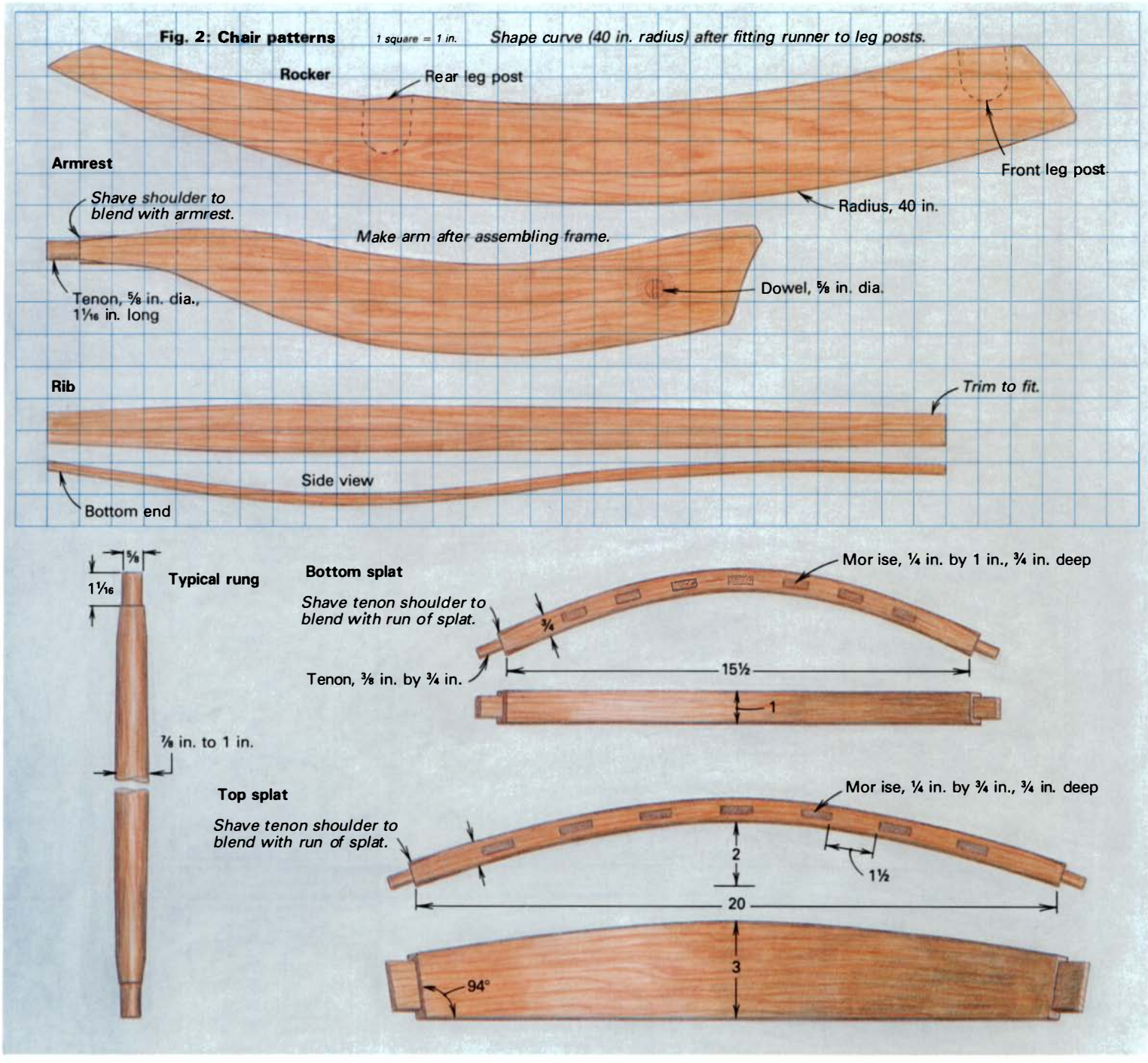
Evolution of my rocker design—All rockers, regardless of style—Windsor, ladderback or sculpted—are basically alike. As with any chair, the frame and seat must comfortably support a sitting person's weight. All chairs must withstand everyday use and abuse, such as the sitter moving in the chair, sliding the chair around and leaning back. These destructive forces, working to pull the joints apart, are intensified with a rocker because of the repetitive, dynamic stresses produced by its rocking motion. The character and speed of the rocking motion is controlled by the shape of the runners. By subtly modifying the runners' curve and by adjusting the length of the legs to change how the frame sits on the runners, you can construct a balanced chair that's both easy to get in and out of and is comfortable. These subtle changes will also smooth the rocking motion so the chair won't awkwardly pitch forward or backward, and won't creep or walk across the floor as you rock. And because an optimumly designed frame is consistent with a visually well-balanced chair, your rocker will be attractive. Finally, if you follow the simple rules for working with green wood, you can expect your chairs to survive hard use; you'll be building heirlooms.

The problem with my first straight ladderback rockers was that they were too upright and boxy. They were not exceptionally comfortable, and they provided insufficient lower-back support, which consequently induced sitting in a slouched position. Increasing the angle between the seat and the backrest eliminated the boxy appearance and provided the needed back support. I found that most people were comfortable in chairs with a 105° to 110° angle between the seat and backrest; increasing the angle more than this reduces the amount of head and neck support provided by the back and makes the chair uncomfortable. Curving the backrest to fit a person's shape also increases comfort, but it shifts body weight farther back in the chair. Because of this, I design chairs with curved backrests, like my bent-back rocker, with the minimum recommended angle of 105°.

Since I angled the backrest, I also had to angle the lower, rear leg posts or else the chair appeared to lean back precariously. Even though these unangled rear legs were safe enough, they no longer directly supported most of the weight. Instead, the stresses were concentrated at the points where the lower side rungs joined the rear leg posts and this arrangement would eventually

Front view

Back view

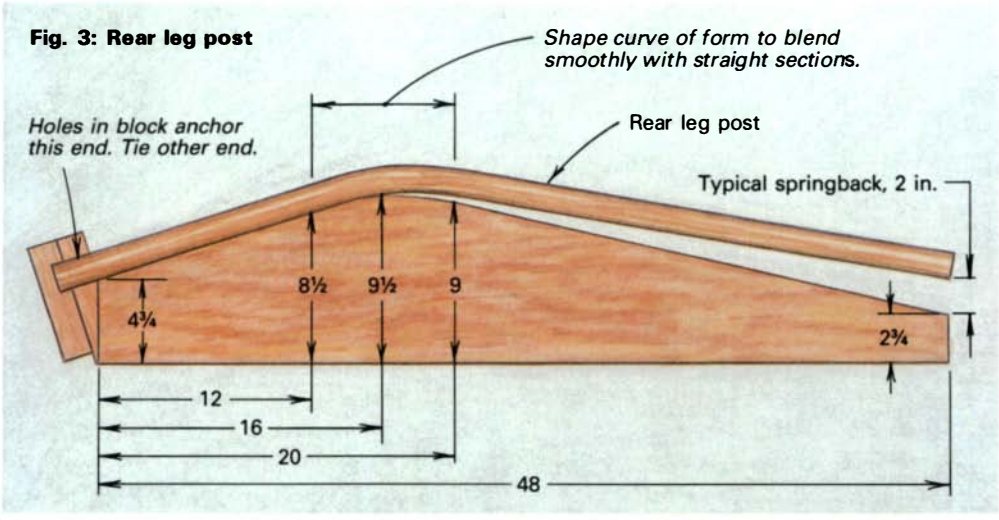


weaken the joints and cause them to fail prematurely. While it didn't eliminate the problem, angling the lower leg backward to match the backrest made the rocker appear more stable and repositioned the weight more directly over the leg, thus reducing the forces on the joints.

Changes in the backrest had the greatest influence on my rocker's design because they altered the chair's appearance, structure and comfort. Other less-significant changes generally involved customizing the chair's size or shape for a particular individual or simplifying construction methods. For example, the armrest looks best to me when it is parallel to the seat; fortunately, the strongest joints result when both the armrest and seat connect to the front leg post at 90°, and it's easy to come up with efficient methods to cut these right-angle joints. To my eye the most attractive and comfortable chairs have seats that taper gently toward the back and have slightly splayed runners. For a smooth ride that's neither too fast nor too slow with this configuration, I eventually settled on runners that have a 40-in. radius.

The dimensions for my standard bent-back rocker, shown in figure 1 on p. 40, work well for most average-size adults. To custom-fit a rocker, I scale the standard dimensions up or down as needed, but I maintain the proportions of the original. The simplest approach to customizing is to have the person sit in a standard chair and see how it "fits." Some things are obvious; short, stocky folks need lower, wider chairs than tall, thin people. But I also look closely for the more subtle, telltale clues: Is the person long legged and in need of a deeper seat? Are the person's knees scrunched up awkwardly, necessitating a change in the seat height? Are the person's shoulders relaxed? Do the forearms rest comfortably on the armrests? With experience, customizing a chair becomes second nature.

Wood selection and joinery—Good joinery methods and wood with proper moisture-content levels are essential for constructing a strong rocker. I split and shave all my chair parts (except for the runners) from green logs. While I prefer oak and hickory, I occa-



The author is shown working at a shaving horse, rough-shaping a green-wood armrest. The job goes quickly because green wood is easy to carve. Boggs removes wood efficiently with a drawknife.

sionally use maple or ash. Select straight-grain logs so the rived parts won't split when they are steam-bent. Although riving wood is hard work, all of the chair parts can be split in about one-half hour. Parts to be tenoned, like the rungs and the armrests, are air dried to about 15% moisture content (MC) and then dried to less than 5% MC in a closed, insulated box, which is heated to about 150° with a 100-w. light bulb. The mortises and tenons are cut to fit together snugly when assembled, but the joints become really tight when the wood reaches its equilibrium moisture content (about 7% in the northeast). This tightening action occurs when the dry tenons absorb moisture and expand, while the wet mortised pieces dry and shrink. For more information on working with green wood, see *Make a Chair from a Tree: An Introduction to Working with Green Wood* by John Alexander, The Taunton Press, 63 S. Main St., Newtown, Conn. 06470, and *FWW* #77, pp. 60-63. I prefer green wood because it can be shaped more easily and more quickly than dried stock. You can build the chair with air-dried stock, however, if you super-dry the tenons. The difference in moisture content between the mortise and tenon is what ensures the tight joinery.

All of the riven parts are shaped with a spokeshave and drawknife. Since it's much better to replace a fouled part than to repair one, I make extra slats, posts and rungs in case something goes wrong. The rungs are kiln dried for a few days before I cut them to length, tenon the ends and shape them. While the rungs are drying, I fire up the steamer and bend the rear leg posts, back splats and vertical ribs. Steamers don't have to be fancy: I simply boil water on a Coleman stove and funnel the steam through a plastic pipe into the closed box that holds the parts. The splats and ribs are steamed for only 10 or 15 minutes, but the thicker leg posts take one hour to two hours. The form used in bending the posts is described in figure 3 above. The rule of thumb for kiln-dried wood is to steam one hour per inch thickness; for green wood, 30 minutes per inch thickness. By preflexing the thin ribs in both directions over an 8-in. radius drum before clamping them in their bent forms, you'll stretch the wood fibers, which will result in a more uniform bend and minimize springback when the pieces are unclamped. Work quickly so you can clamp the pieces before they cool. I leave the parts in the forms to dry overnight or until they're needed.

Building the rocker—The sequence for assembling the chair is pretty straightforward. I begin with the backrest and rear frame, which involves shaping the rear leg posts, splats, rear rungs and vertical ribs as well as cutting the necessary mortises and tenons. I shape the parts on a shaving horse with a drawknife and spokeshave, as shown in the photo above. Mortises are bored with a ⅝-in. Forstner bit in the drill, but all other joinery is done with hand tools. Next, I build the front frame. Aligning the front frame to the backrest/rear frame assembly and marking out the mortises for the rungs is a bit tricky, but the rest is easy. The armrests are shaped and joined to the front and rear leg posts, the assembled frame is squared up and the runners are installed. All of the tenoned joints are pinned and glued for extra strength. After finishing the frame with boiled linseed oil, I weave a hickory or oak splint seat.

Since the back is the visual focal point of the chair and all other parts must align with it, the backrest/rear frame must be assembled symmetrically and twist-free. To ensure this, chop the mortises for the two back panel splats while the back posts are still square, then round the posts with a drawknife. I cut the splats oversize to allow a ⅞-in. tenon on each end. The tenons are cut with a backsaw and chisel, then the shoulders are shaved off to blend with the run of the splat. This prevents an unattractive gap from developing between the leg post and the shoulder when the leg post dries and shrinks. After shaping the splats freehand, I dry-fit them to the leg posts. Since the top splat is wider than the bottom splat, fitting both splats in the posts gives the backrest its tapered appearance. Installing the curved splats also rotates the leg posts about 8° to 10°, which produces the outward splay of the legs at the bottom.

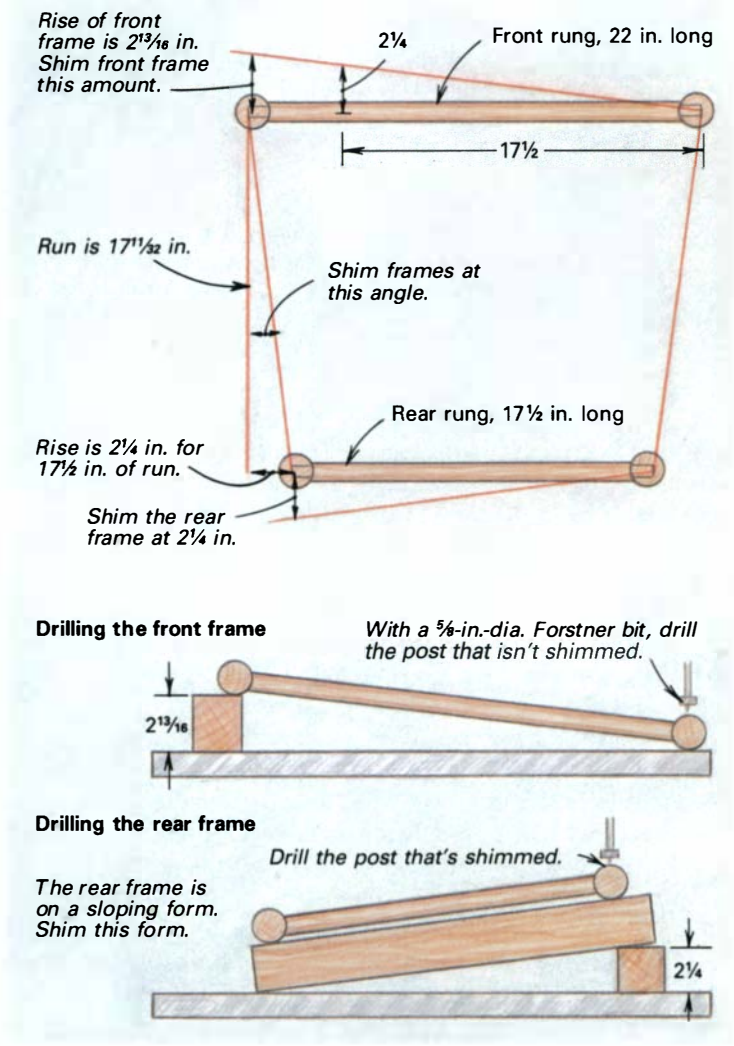
Next, I mark out and chop the mortises in the splats for the vertical ribs. The ends of the vertical ribs, like the splats, are straight, so chop the mortises perpendicular to the long edges of the splats. I fit the center rib first, and then, alternating sides, fit each rib individually. The tenons on the ribs are not shouldered; if the rib is a bit tight, it's thinned on the back side with a chisel or scraper until it's just snug. Fitting the ribs and contouring their shape is all done by eye. I make a final check by dry-fitting the ribs and slats together. If everything looks right, I glue up the back panel and dry-fit it to the leg posts to hold it in position, making sure the centerline of the middle rib is perpendicular to the splats.

Fitting the two back rungs to the leg posts, which are still dry clamped to the back panel, is straightforward. First, line up the mortises by eye between the leg posts, mark them and bore them with a power drill. I shape the rung tenons and, as before, shave off the shoulders to blend with the contour shape of the rung before gluing the rungs and back panel to the leg posts. Next, drill the ⅝-in.-dia. mortises for the front rungs in the front leg posts. I do this on the drill press after drawknifing them round. Then, I fit and glue the rungs to the leg posts to form the front frame.

Because the seat width tapers toward the back, the front frame is

Fig. 4: Setup for drilling side-rung mortises

The side rungs attach to the front and rear frames at an angle that's not 90°. The diagram below shows how to determine the amount to shim the front and rear frames when drilling the mortises.



The rear frame is being set up on the drill-press table for boring the mortises for the side rungs. The frame sits on a form shaped like the bent rear leg post. This form and the shim under its far side, which raises the post being drilled, ensure that the mortises are drilled at the correct angle. Later, the front leg posts will be mortised in a similar way.

wider than the back frame. For this reason, the three parallel rungs on each side of the chair join the leg posts at an odd angle. Aligning the front and rear frames without twisting them is tricky, but not all that difficult if you lay out and cut the mortises correctly. You must first mark the vertical position of the mortises: Measure up from the bottom of the leg post to locate the three mortises, as shown in figure 1 on p. 40. All of the measurements for the rungs on the front leg are also made from the bottom of the post.

Locating the angular position of the mortises is a bit like laying out rafters for a pitched roof. The difference between the rear and front seat width, divided by two, represents the "rise"; the seat depth, the "run." I use this "rise-over-run" ratio to set up the front and rear frames on my drill-press table to drill the mortises. The procedure for doing this is more fully explained in figure 4 at left. A special support for the rear frame is needed to bore the mortises, as shown in the photo below. This support is angled to accommodate the bend in the rear leg post and allow the mortises to be bored at the correct angle on the drill press. Since the length of the rear seat rung is the same as the run, I shim the post being drilled up by an amount equal to the corresponding rise and bore the mortises for all three rungs. The same procedure is used to bore the other rear leg post.

Boring the front posts is less complicated. The frame is flat and sits directly on the drill-press table. The front seat rung is longer than the run, so the rise, equal to the shim thickness, must be proportionately greater. Unlike the rear frame, the shim is placed under the front leg post not being bored.

The rest of the chair is assembled the same way as the front and rear frames. After tenoning and shaping the side rungs, I glue up everything, making sure the frame is symmetrical and sits without rocking on a flat surface. It's usually necessary to wrestle with the frame a bit to remove any twist that would prevent it from sitting flat. I also make sure the side rungs are parallel and join the front leg posts at 90°.

Armrests—The armrests are roughed out on the bandsaw and refined with a drawknife and spokeshave. The armrests are curved along their length, and I sculpt away much of the wood along their top inside surfaces to provide a comfortable hollow for a person's forearm. With a power drill, bore mortises into the rear leg posts while sighting horizontally along the top of the front leg posts for alignment, as shown on the facing page in the photo at left.

It's difficult to install the armrests because two things must happen simultaneously: The tenoned ends must fit into the rear leg posts and the mortises on the underside of the front section must fit over the tops of the leg posts. Loose-fitting tenons provide enough play to do this, but they also produce a weak joint. My solution is to bore the 1¼-in.-dia. mortises for the front leg posts only ¼ in. deep. Then, I seal the armrests in a plastic bag, so only the ends to be tenoned are exposed, and place them in the kiln. When the ends are dry, I form the joint with a tenon cutter chucked in a power drill or hand brace; you could also cut the tenon by hand. The shallow mortise slips easily over the top of the post, which provides sufficient play for the dry, tenoned end to be fit snugly into the rear post. Finally, I bore a ⅝-in.-dia., 1½-in.-deep hole through each armrest into the posts and install dry dowels. The snug-fitting dowels don't split the wood and they can be safely wedged for a tight fit that will become tighter as the armrests and leg posts dry out and shrink.

Runners—I use 38-in.-long runners glued and pinned into 1¾-in.-deep slots in the bottom of the legs. By making small changes in the depth of the slots, I'm able to alter the chair's tilt to improve its

Photo: Albert R. Mooney

Above: Boggs' bent-back rocker design evolved as he experimented with changes in early chair models. Left: With a Forstner bit in a power drill, the author bores the armrest mortise in the rear leg post. The front leg post serves as a guide as he eyeballs the mortise position.

appearance and comfort. Each chair I make is tested and adjusted this way before the runners are permanently secured.

If the chair is not entirely twist-free or doesn't sit squarely on all four legs, now's the time to level the chair and adjust the runners to work in unison. I first set the chair on a level bench and check if all four legs are touching or if the chair leans to one side. Shims placed under one or more legs level the chair. Then, measuring up from the top of the bench, each leg is marked and trimmed with a backsaw. After a final check, lay out the slots for the runners.

With the chair upside down, take a long scrap piece, which is the same thickness as the runners, and place it on edge to span the centers of the front and back legs. Mark the runner positions on the bottom of each leg and with the chair upright again, use a square to extend the lines 1¾ in. vertically up the legs. The slots are cut with a backsaw and coping saw and then pared clean with a sharp chisel.

At this point, I'm ready to make the runners. Stock is planed flat, thicknessed to ¾ in. and scraped smooth. Then, I trace the runner pattern on one of the boards, screw the two pieces together and bandsaw both runners. With the runners clamped together, their edges can be block-planed smooth. I plane in both directions to avoid tearout where the grain changes direction. Sanding blocks, made from curved scraps salvaged from bandsawing the runners, are also good for smoothing the curves. I don't fuss with the straight runs along the top edges until the runners have been fit to the slots.

The sides of the runners are scraped until they can be slid into the slots easily. Don't force them or you'll risk splitting the legs. The flat on the top edge of the runners should extend ½ in. from the front leg posts. After temporarily clamping the runners in position, I place the chair upright on a wood floor and go for a test ride. A ¼-in.-thick piece of plywood has some give to it and works well as a temporary seat. Once the chair is going, I put my feet on the front rung and close my eyes to concentrate on the chair's motion. It should feel smooth, like a swing, and both runners should reach the end of their forward and backward swing at the same time. If one runner stops before the other, the chair will veer toward the stopped side. You can compensate by moving the stopped-side runner forward a bit (or the other runner back) until the two work together.

Next, I completely relax with my feet flat on the floor. You shouldn't have to push back in the chair to get comfortable. If you do, the frame is pitched too far forward on the runners. I shave up to ½ in. from the straight portion of the runners in the rear leg slots to correct this. If the frame tilts back too much, I trim the runners under the front leg slots. If the correction needed is greater than ½ in., I trim the leg posts too.

When the adjustments are complete, mark the leg post positions on the runners. After fairing the curve along each runner's top edge and shaping the ends of the leg posts with a chisel, I glue and clamp the runners in the slots. The runners are secured with ¼-in. square pins once the glue has dried. The tenoned armrest and splat joints are also pinned now. Then, I scrape the parts smooth before applying four to five coats of boiled linseed oil. I don't sand the chair because sanding would eliminate the facets created when the pieces were drawknifed and shaved.

Seats—I use hickory bark for my seats because it wears well and develops a beautiful patina as it ages. This natural fiber is also easy to weave. You can harvest hickory bark yourself in many parts of the country, and it is also commercially available, although supplies are limited. To order hickory bark, contact Unfinished Universe, 525 W. Short St., Lexington, Ky. 40508; (606) 252-3289, or The Caning Shop, 926 Gilman St., Berkeley, Cal. 94710; (415) 527-5010. Oak splints and Shaker tapes also make good seats.

To prevent the seat from sagging, I make a pillow to fit between the woven layers. The pillow is filled with fine wood shavings and is about 1 in. thick when compressed. Hold it in place by tying it to the rungs before weaving the seat. For more on making split-bark seats, see *FWW* #62, pp. 82-87. □

Brian Boggs is a professional chairmaker in Berea, Ky.