A Zigzag Rocker

By

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The unique design of this rocker (**Photo 1 & Figure 1**) exploits the strength and durability of epoxy resin glue, which is used for all of its joinery. The 3.5 mm thick keys that reinforce the mitres joining the legs to the rockers provide a total glue area of about 100 square centimetres in each joint, in addition to the 35 square centimetres of glue area on the joint face. The chair's mortices can either be routed with a 5/16" spiral upcut bit, or else be milled with an 8 mm cutter mounted on a Domino tenon-joiner.

Photo 1. The zigzag rocker.

If you have a well-equipped workshop, the chair is not difficult to build. Its floating-tenon joinery is easily done with a router and a morticing jig, and is easier still, if you own a Festool Domino tenon-joiner. To shape the glued laminations for the back slats

and the rocker, you will need to make formers (**Figure 2**), either out of solid hardwood or from MDF sheets, face-glued to a thickness of 45 mm.

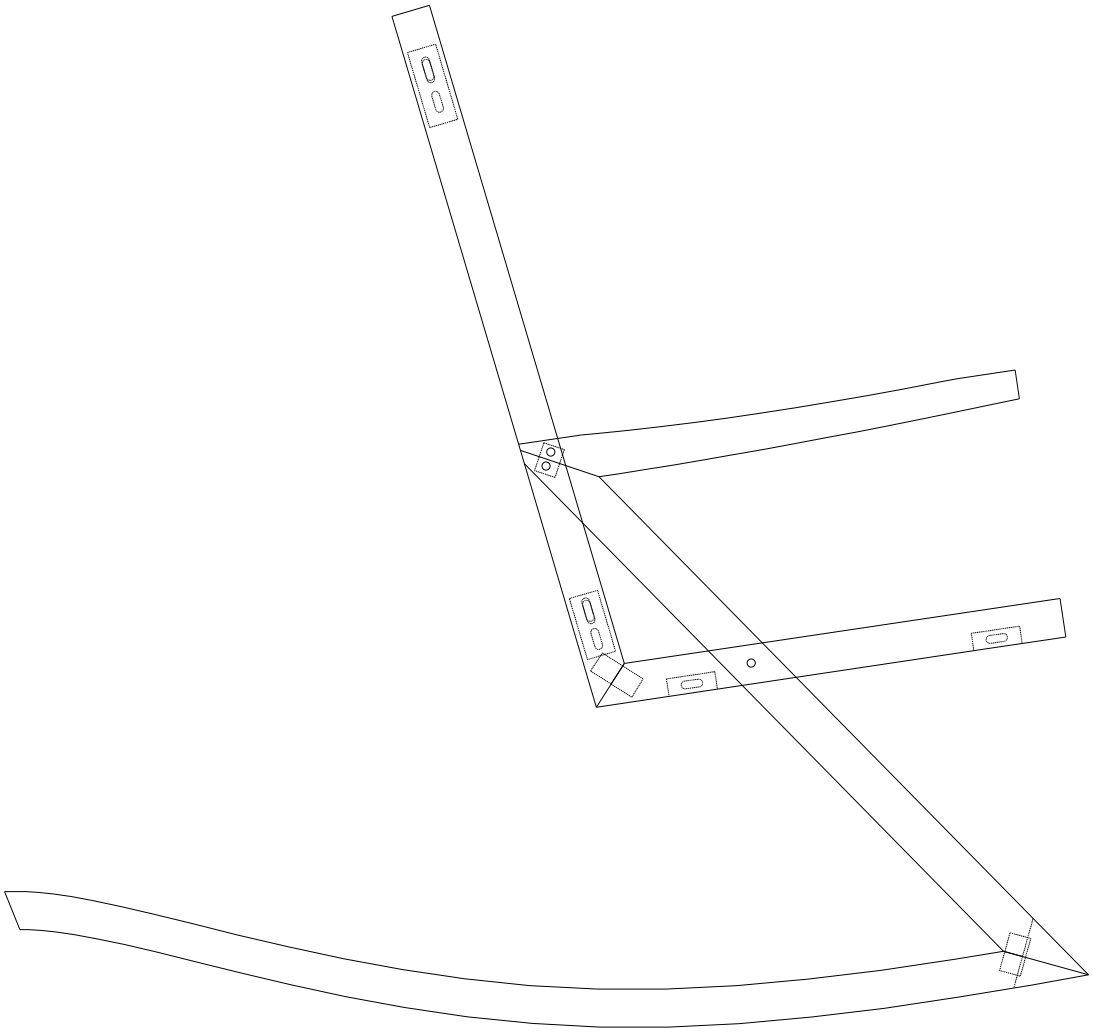

Figure 1. Side view of the chair.

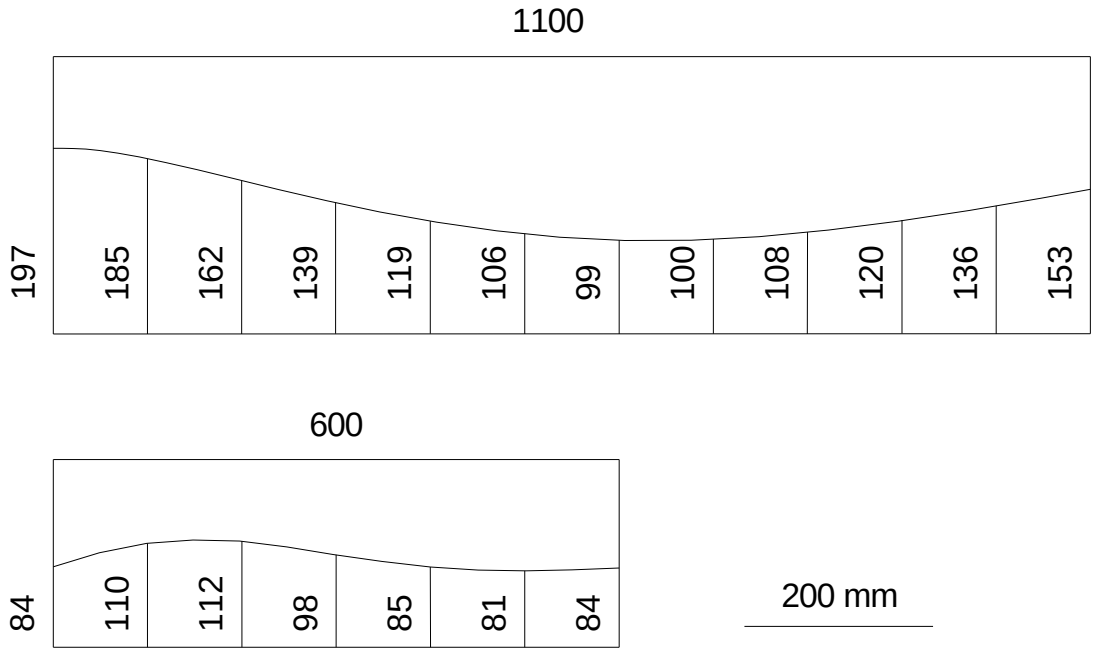

Figure 2. Formers for the rockers and back slats.

Construction

The parts for the chair, apart from the seat frame and the laminations for the rockers and back slats, can all be cut from a 45 x 175 x 2200 mm board of primary hardwood such as jarrah, or walnut (**Figure 3**). The twelve 6.5 mm thick laminations for the rockers can be ripped from a 45 x 150 x 1200 mm board of matching hardwood. The twelve 4 mm thick laminations for the back slats, and the four mitre keys, can be ripped from a 22 x 150 x 1500 board of contrasting hardwood, such as maple.

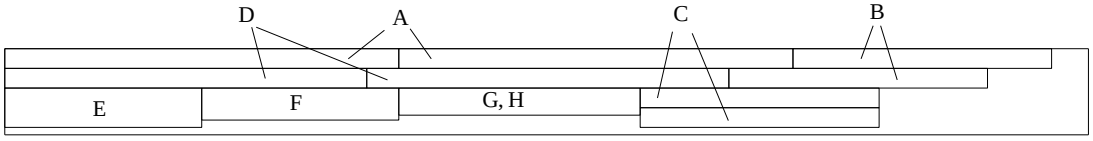

Figure 3. Layout of the main chair parts. The letters refer to codes in the cutting list.

Making the rockers

After band-sawing the curve for the rocker former, sand its faces smooth, and line them with polypropylene packaging tape, to prevent glue from adhering to the former. Rip the laminations for the rockers about 8 mm thick, and plane them to a uniform thickness of 6.5 mm. To glue up the laminations, I used two-part epoxy resin glue with a gel consistency and a slow hardener. It is essential to use at least two high-quality clamps with parallel jaws, such as Bessey K-body clamps, supplemented by two or more heavy-duty bar-clamps, for the glue-up of each rocker. The rockers should be glued up one at a time, so as to allow plenty of time to spread the epoxy on the six laminations. As the clamps are successively tightened on the formers, ensure that the edges of the laminations remain level with one another, using a block of wood to hammer down any lamination that is squeezed upwards relative to its neighbours. After the epoxy is cured, plane away the squeezed-out epoxy, and then plane each rocker to a uniform width of 40 mm.

Making the zigzag side-assemblies
Rip the parts for the legs and arms, and plane and joint them to finish with the dimensions given in the cutting list. With the broader (45mm) face resting on the saw table, cut 27° mitres on the top ends of the legs and the rear ends of the arms. Cut 30° mitres on the bottom ends of the legs.

The easiest way to cut the leg and arm mitres is to use a sliding mitre saw, with a 5° wedge clamped between the workpiece and the fence (**Photo 2**). Otherwise, you can make a simple triangular plywood jig (**Figure 3**), which is clamped to a mitre gauge on the table saw (**Photo 3**). The mitres could be also be cut with a back-saw, and planed to the mark-out lines. The mitres on the rockers need to be planed by hand anyway, since there is no way of cutting them accurately with machinery, short of building an elaborate specialized jig.

Photo 2. Cutting a 27° mitre on a sliding mitre saw, using a 5° wedge clamped between the workpiece and the fence. You must ensure that the blade will clear the clamp before making the cut.

Photo 3. Cutting a mitre on the table saw with a jig clamped to a mitre gauge.

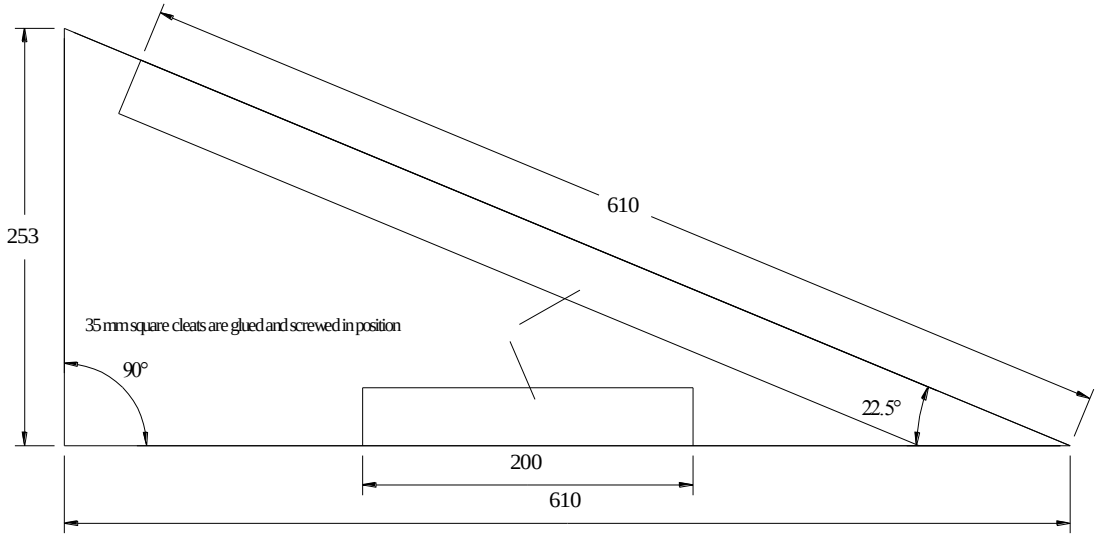

Figure 4. The jig used to cut the leg and arm mitres on the table saw.

Mark out the plane of the mitre on the outer face of one of the rockers, making the length of the line 90 mm - the same as the length of the mitre face of the bottom leg mitre. The line should make an angle of about 25.5° with the underside of the rocker. The angle is smaller than that of the leg mitre, since the rocker is only about 39.5 mm thick, whereas the leg is 45 mm thick. Square the mark-out lines round all four faces of the rocker. Use a back-saw to cut away the waste, and then use a block plane to plane to the mark-out lines. Lay the rocker on top of the other rocker to match up their curves, and scribe the plane of the mitre face onto the second rocker. Then cut its mitre in a similar fashion. Make sure that the mitre faces of the rockers fit snugly against those on the bottom of the legs.

Before glueing the rockers to the legs, mill an 8 x 22 x 20 mm deep mortice in each mitre face near its rear end for a domino or tenon to align the joint during glue-up (**Figure 5**). Cover a level surface, such as the table of your saw, with a polythene sheet to protect it from the epoxy; spread epoxy on the mitre faces and clamp them, using wedges to which sandpaper has been glued to facilitate clamping (**Photo 4**). After sanding away the squeezed-out epoxy, you are ready to cut the kerfs for the mitre keys, using a micro-adjustable tenoning jig on the table-saw (**Photo 5**).

Photo 4. Glueing up the leg/rocker mitres.

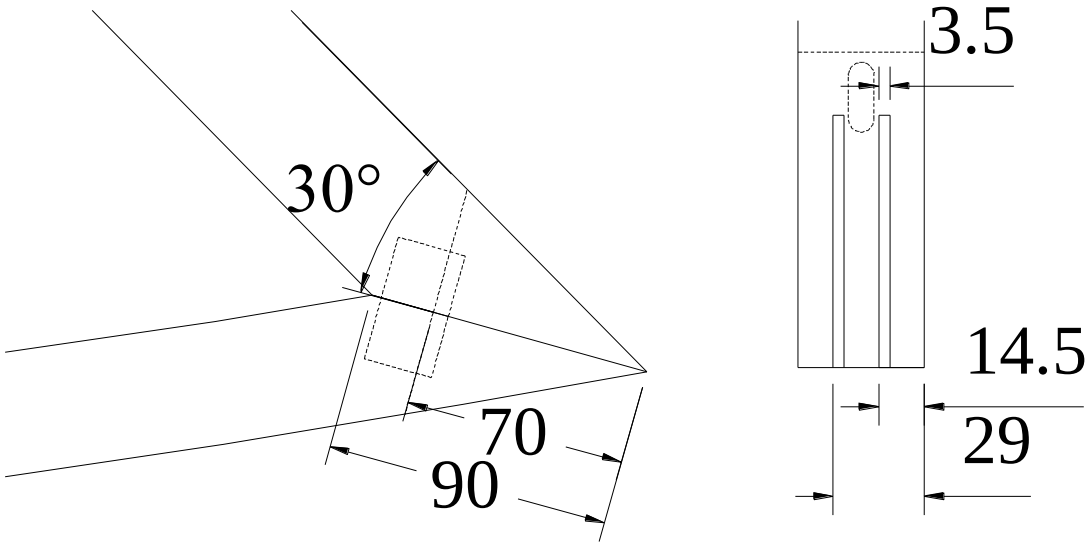

Figure 5. The leg/rocker joint, side and top views.

Photo 5. Cutting the kerfs for the mitre keys.

To cut the first kerf, the leg/rocker assembly is clamped firmly to the jig and the saw blade is raised to a height of 70 mm. The jig is adjusted so that the distance from its face to the far side of the blade is 14.5 mm (**Figure 5**). To cut the second kerf, adjust the jig so that the distance from its face to the far side of the blade is 29 mm. Plane the stock for the mitre keys to finish about 0.1 mm less than the width of your saw blade. Trim away about 8 mm from the tip of the mitre joint, and then glue in the keys, tapping them home with a hammer to ensure that they are fully seated in the kerfs. When the epoxy has cured, cut away the waste with a back-saw, and plane the keys level (**Photo 6**).

Photo 6. The leg/rocker mitre joint.

Before glueing the arms to the legs, mill 8 x 22 mm mortices 15 mm deep for reinforcing tenons in their mitre faces (**Figure 6**). Then band-saw the curved top and bottom profiles of the arms, and sand the curves smooth. Glue up the leg/arm mitre joints, using an 8 x 22 x 29 mm tenon for reinforcement. Sand the completed assemblies, and round over all their edges with a 3 mm radius roundover bit; use a 10 mm roundover bit for the bottom edges of the rockers.

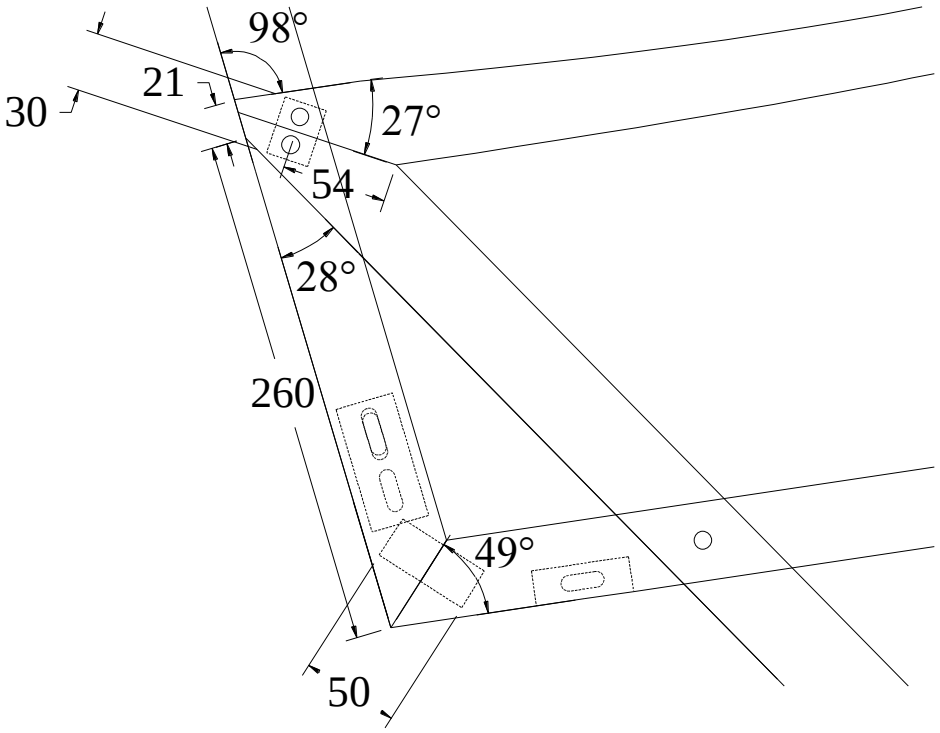

Figure 6. Joinery details.

Making the back-stile/seat side-rail assemblies
Mill the parts for the seat side-rails and the back stiles to the dimensions given in the cutting list; cut the 49° mitres on their ends, and mill 8 x 22 mortices for the reinforcing tenons 25 mm deep in the mitre faces. Mark out the centre lines for the 8 x 22 mortices on their inner faces, taking care to ensure that the assemblies are mirror-images of one another (**Figure 7**). Mill the mortices 20 mm deep. One of the mortices in each pair for the back rails should be milled longer, say 27 mm instead of 22 mm, to allow wiggle room for fitting the 8 x 22 x 40 mm floating tenons.

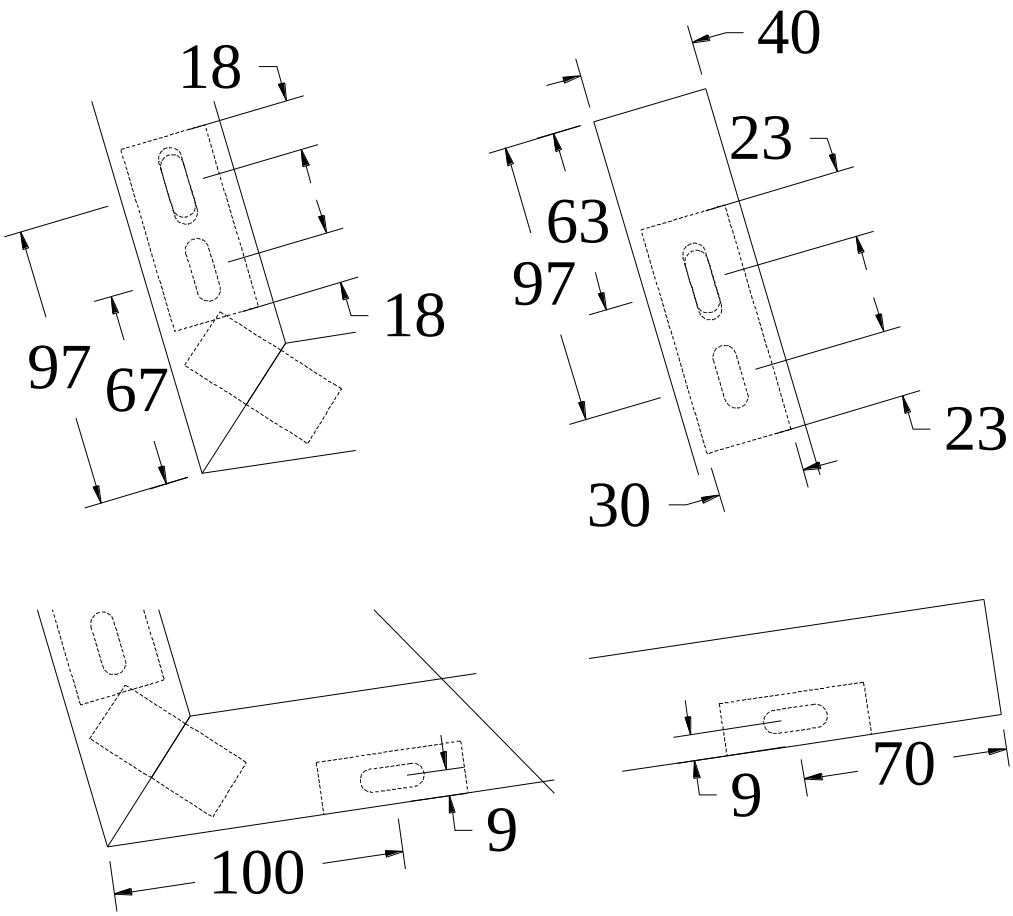

Figure 7. Positions of the rail mortices.

Mark out, on the outer faces of the back stiles, the 10 mm deep housings into which the leg/arm mitre joints will be set (**Figure 6**). I made the 98° cut on the table saw, using a mitre gauge, but cut the 28° kerf with a back-saw, using a clamped-on block of wood to guide the cut (**Photo 7**). The waste between the two kerfs is removed with a router, and the hand-cut kerf is then pared to the mark-out line with a chisel.

Photo 7. Cutting the housing on a back stile.

Glue up the L-shaped assemblies on a flat surface, using 8° wedges to assist in clamping. When the glue has cured, sand away the squeeze-out, and round over the edges of the assemblies with a 3 mm round-over bit.

The 5 mm-deep interlocking housings on the outer faces of the seat side-rails, and on the inner faces of the legs, are marked out by fitting the leg/arm mitres snugly into the housings on the back stiles, and scribing lines on the legs and side-rails. The cuts are then made with a back-saw, and the waste is routed away, as before.

Use a 3/8" forstner bit to counterbore holes in the leg, and in the leg/arm mitre joints, for reinforcing screws (**Figure 6**). Prepare six plugs for the holes, using a 3/8" tapered plug-cutter.

Making the back rails (**Figures 7 and 8**)
Trim the ends of the back rails at an angle of 84° to their front faces. The 20 mm deep mortices in their angled ends must be milled before the waste is cut away from their back and front faces. They can either be routed, using a 6° wedge to angle the workpiece on a morticing jig, or else they can be milled with a Domino tenon-joiner. The bulk of the waste can then be cut away from their back faces on the band-saw. The curved back faces are then faired and sanded smooth with a random-orbit sander; but the front faces are left flat until the mortices for the back-slats have been milled. The mortices can either be routed, using a curved fence attached to the router's edge-guide, with the workpiece held in a vice, or else they can be milled with a Domino tenon-joiner. To stabilize the Domino's fence on the curved back face, 1 mm-thick strips of wood are attached with double-sided tape to the outer edges of the fence plate. If using a Domino, only the centre line of the first mortice needs to be marked

out; the remaining mortices can be positioned by using the machine's index pins. The curve of the front face can now be cut on the band-saw, faired with a compass plane, and sanded smooth. Finally, the edges of the top and bottom faces of the rails are rounded over.

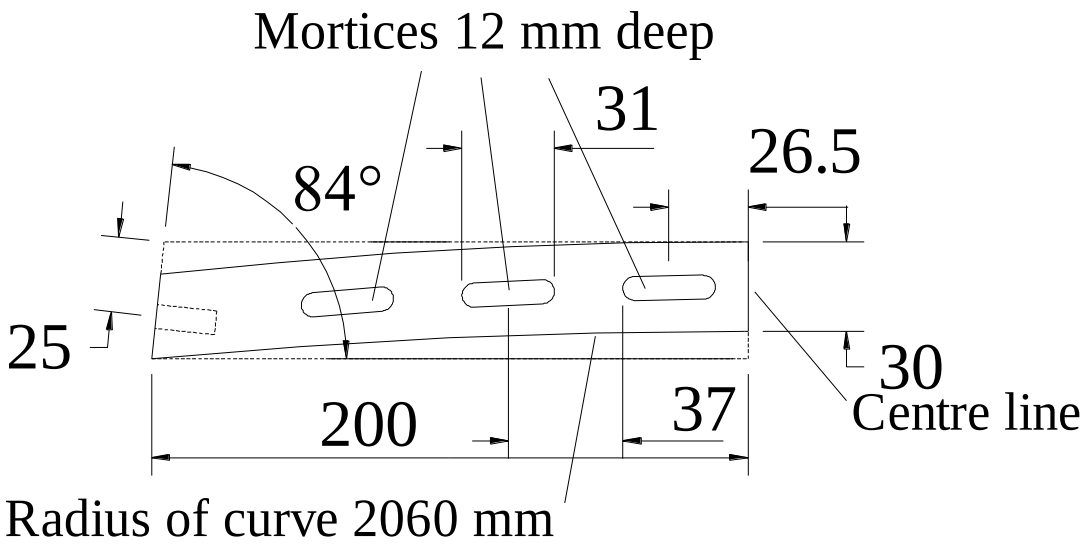

Figure 8. The back rails, top/bottom view.

Making the back-slats
Cut the back-slat laminations to a thickness of about 5 mm on the table-saw; then plane them to finish 4 mm thick. The laminations for two back-slats, separated by a strip of polythene to prevent them sticking together, can be clamped simultaneously in the polypropylene-tape-lined former, while the epoxy cures. Plane the back-slats to finish 31 mm wide, and then round over their edges on the router-table with a 5 mm-radius bit, guiding the slat on its edge against the bit's bearing. Sand the back-slats smooth and pare away about 2 mm from the bottom rear edge of each slat so that it can emerge at an angle from its mortice in the top of the bottom back rail.

Dry-assemble the back rails between the two back-stile/seat side-rail assemblies; insert the back slats into their mortices in the bottom rail with their tops in front of the top rail. Then mark trim-lines on the slats, and trim them so that each slat will penetrate about 9 mm into its mortice in the top rail.

Completing the seat/back assembly
Mill the parts for the seat cross rails to size (**Figure 9**), and trim one end on each at an angle of 84° to the front edge. Mark a centre line on the top face for the mortice in the trimmed end of the rail. Align the centre-line with the centre-line of the corresponding mortice on the inner face of the seat side rail, and use the inner edge of the opposite side rail to scribe the trim line at the other end of the cross rail. Do the same with the other rail, and trim its ends in the same way. Mill the mortices in the ends of the cross rails. After testing the fit of the back slats and the seat cross-rails by dry-assembling all the parts of the seat/back assembly, it is ready for glue-up, using wedges to facilitate clamping (**Photo 8**). I smeared carnauba wax on areas where the epoxy squeeze-out was likely to occur, so that, when the glue had cured, the squeeze-out could be peeled away easily. The wax was then cleaned up with mineral spirit.

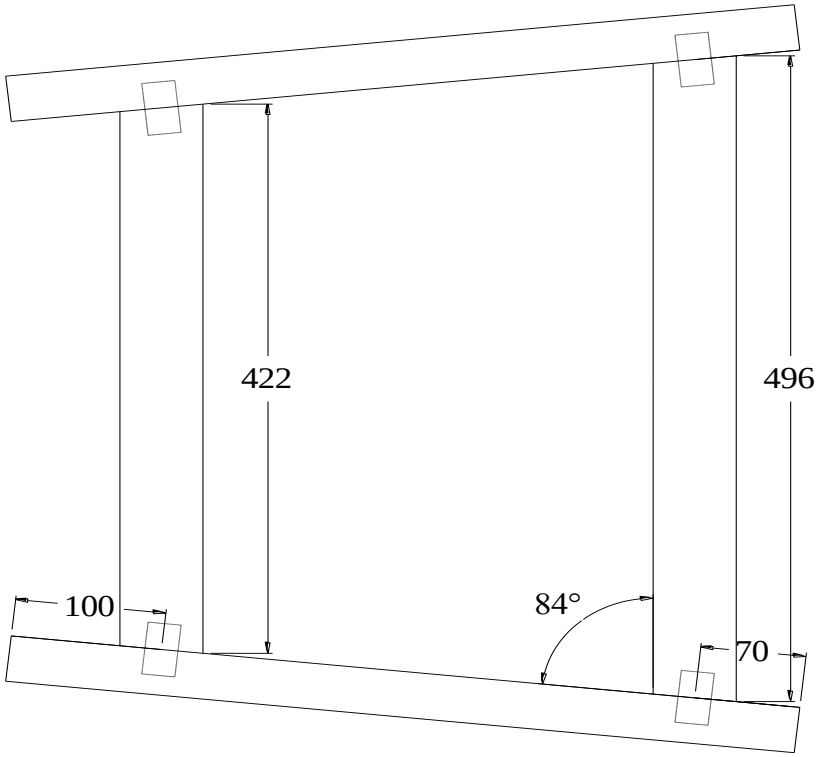

Figure 9. The seat cross-rails.

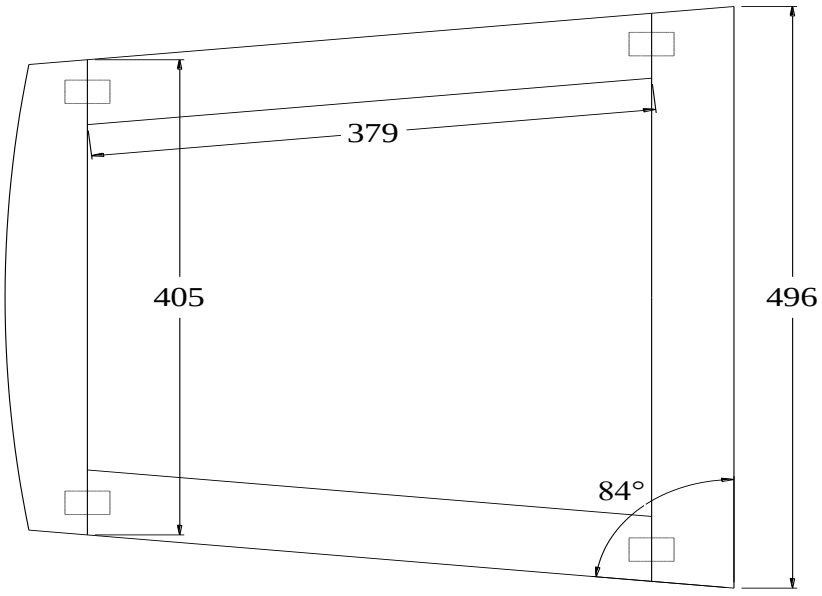

Figure 10. The seat frame.

Photo 8. Glueing up the seat/back assembly.

Finally, the zigzag side-assemblies are glued and screwed to the seat/back assembly; and the plugs are glued into the counterbored screw holes. After trimming the plugs and the tips of the leg/arm mitres level, the chair is sanded, and four coats of Minwax wipe-on poly are applied.

The slip-seat frame is made from 16 x 55 mm secondary hardwood, using domino or floating tenon joinery (**Figure 10**). Unless you are expert in upholstery, it is best to have that done professionally, using foam, supported by elastic webbing, and covered with leather.

Cutting List

Part *	Thickness	Width	Length	Comments
A. Legs (2)	40	45	800	
B. Arms (2)	40	45	525	
C. Seat side rails (2)	35	40	485	
D. Back stiles (2)	35	40	735	
E. Top back rail	40	80	400	Trim ends at 84° to front face. Bandsaw 2060 mm-radius curves; curved rail finishes 30 mm thick.
F. Bottom back rail	40	65	400	Trim ends at 84° to front face. Bandsaw 2060 mm-radius curves; curved rail finishes 30 mm thick.
G. Seat cross rail, front	18	55	500	Trim to length; see Figure 9.
H. Seat cross rail, back	18	55	430	Trim to length
Rocker laminations (12)	6.5	43	1150	Finish 40 mm wide
Back slat laminations (12)	4	33	600	Plane to 31 mm width after glue-up
Seat frame front rail	16	55	496	Trim to length; see Figure 10.
Seat frame back rail	16	55	405	Trim to length.
Seat frame side rails	16	55	390	Trim to length.
Mitre keys (4)	3.5	75	75	
Dominoes, or shop-made floating tenons (2)	8	22	48	For back stile/seat side rail joints.
Dominoes, or shop-made floating tenons (12)	8	22	38	For cross rails.
Dominoes, or shop-made floating tenons (4)	6	20	30	For seat frame.

* The code letters for the parts refer to Figure 3.