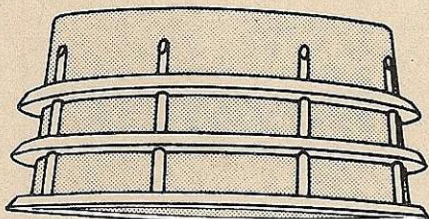
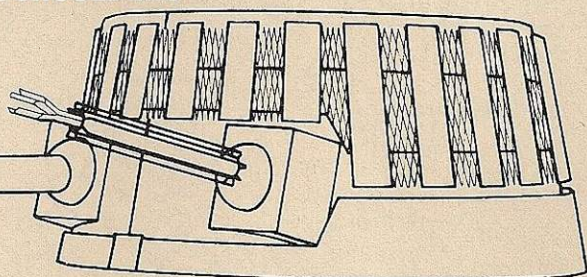


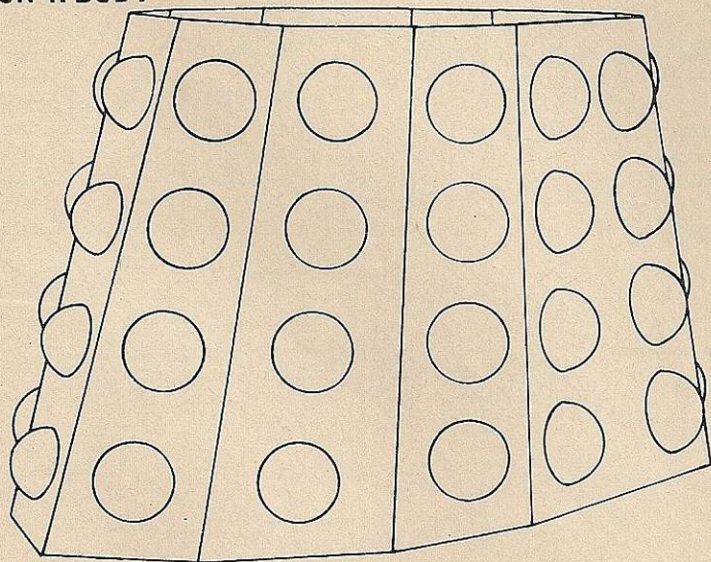
SECTION 1: HEAD



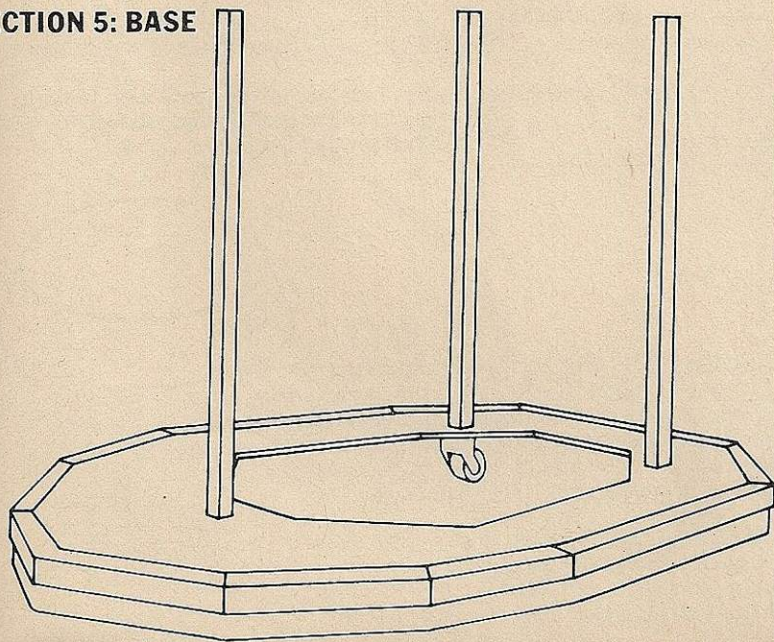
SECTION 2: NECK



SECTION 3: SHOULDERS



SECTION 4: BODY



SECTION 5: BASE

We have designed this Dalek as an exercise for a well-equipped school, using the resources and facilities of several departments—woodwork, metalwork, art and so on. It could also be built at home—but only by someone with considerable ‘do-it-yourself’ experience.

You do not need to be a professional to build a Dalek, but you will need some basic skills, precision, common sense and, above all, enthusiasm! You will need the use of some machinery, such as a woodworking lathe and a band or jig-saw. Don't follow our instructions too slavishly; do not be afraid to improvise.

For clarity, we have divided the Dalek into five sections: 1 is the head—and this needs a full week to complete; 2 is the neck; 3 is the shoulders; 4 the body; 5 the base.

The head could adequately be made from reinforced papier mâché instead of the more complex fibreglass. If you do decide to use fibreglass, exercise extreme care in the process: barrier cream should always be used to protect your hands and the fibreglass should only be handled in a well-ventilated area. Fumes can be unpleasant and dangerous in a confined space. Note well, too, that the accelerator and catalyst used must not be mixed together. That could be dangerous.

To make sure that this Dalek design works, we asked the Technical Sixth Formers of Highbury Grove School, London N5, to produce a Dalek as a feasibility study. With help from their staff, they produced the magnificent black-and-orange specimen (below) in two weeks, at a cost of £12.



‘We based our Dalek on these plans for size and shape, but substituted materials that were to hand or more easily obtainable,’ says the school's Head of Technical Studies, Don Jackson. ‘And with careful marking out, pieces like the neck disc can come from the unwanted centre of the top of the body, and the top of the body can in turn come from the unwanted centre of the baseboard.’

Highbury Grove also cut costs by scrounging aluminium from a scrapyard for £1, instead of paying

more than double from a stockholder. Don Jackson's verdict: ‘A very worthwhile, enjoyable project. There is no process in construction that 12 and 13-year-olds could not do, with supervision.’

Finally, we wish you good luck!

These are the basic materials required to build a Dalek:

- 1 28 lb bag modelling clay
- paper/polystyrene
- 1 roll 500 mm bandage
- 28 lbs fast-setting potter's plaster
- 4 sq yds hessian scrim
- ½ pint shellac
- 1 tin car wax polish
- ½ pint PVA release agent
- 2 oz accelerator
- 2 oz catalyst
- strips of glass matt
- 2 lbs gelcoat resin
- 6 lbs layup resin
- acetone
- soap and water
- 1 tub barrier cream
- sink plunger
- 2 car parking lights (for flashing lights on head)
- 2 6V 0.3 amp bulbs and holders
- 6 volt battery

- 1.5 mm ply 1 sheet 5 ft x 5 ft
- 6 mm ply 4 sheets 5 ft x 5 ft
- 9 mm ply 1 sheet 8 ft x 4 ft
- 15 mm ply 1 sheet 10 ft x 4 ft
- 12 mm wooden dowel
- 27 mm wooden dowel
- 2 wooden balls 95 mm diameter

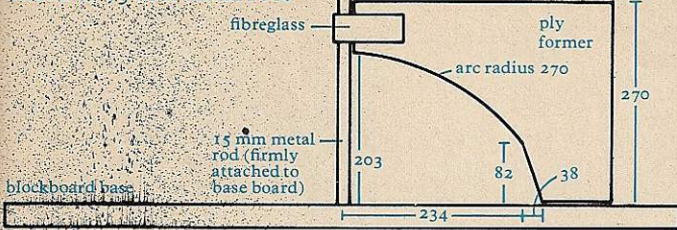
- 24 polystyrene balls 100 mm diameter
 - 6 ball bearings 6 mm
 - 30 gauge fine aluminium mesh 275 mm x 1470 mm
 - 24 gauge large aluminium mesh (2 strips) 655 mm x 180 mm
 - aluminium 1425 mm x 150 mm and two strips 651 mm x 10 mm
 - soft aluminium 40 mm x 170 mm
 - 36 mm aluminium or plastic tube 455 mm
 - 40 mm aluminium or plastic tube 615 mm
 - 3 mm steel rod 315 mm
 - 15 mm rod 270 mm
 - brass shim strip
 - aluminium angle
 - ribbed rubber flooring foam strip
 - 3 plastic rotating castors 1½ in to 2 in diameter
 - perspex 2mm 80 mm x 80 mm
 - 2 brass rings (internal diameter 28 mm, cut to 10 mm long)
 - screws, nuts, bolts, snap rivets, fast-drying enamel paint
- Approximate total cost: £15**

SECTION 1: HEAD

All measurements in mm

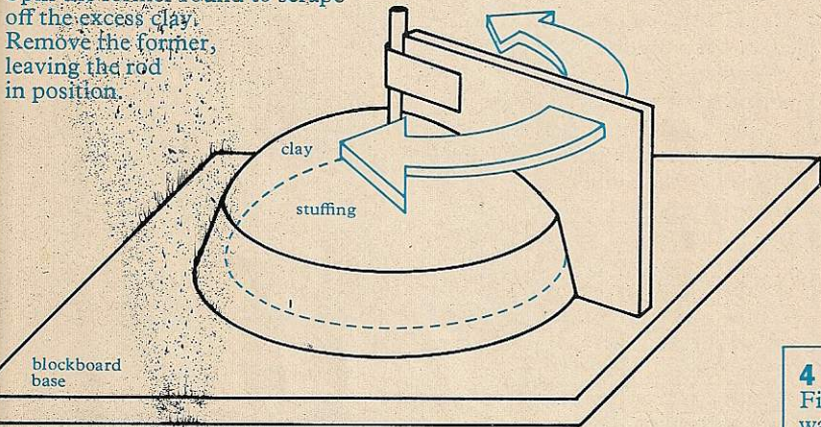
1 MAKING A FORMER

Take a suitable sheet of ply. Cut and shape to make a former. Using fibreglass, attach to 15 mm metal rod.



2 SHAPING THE CLAY

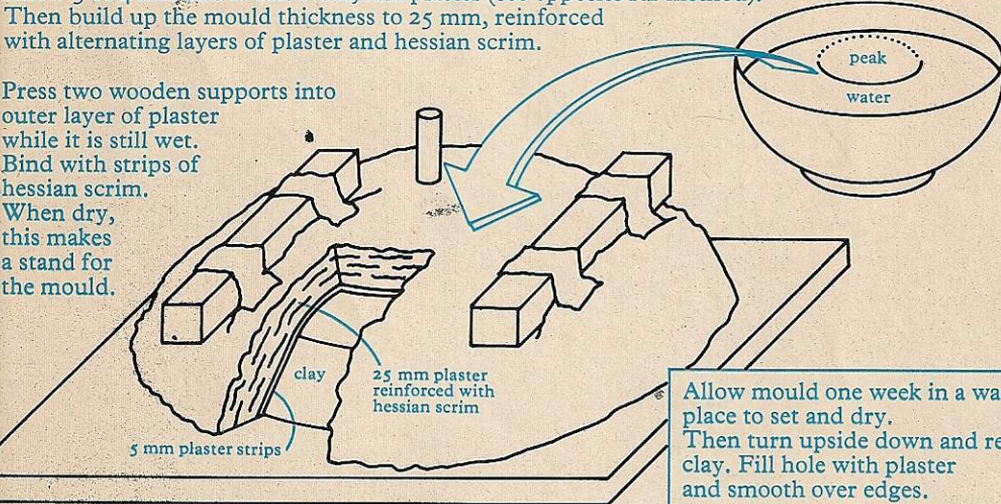
Build up soft clay on the base to approximate shape of the head. Pack the centre with paper or polystyrene to save clay. Spin the former round to scrape off the excess clay. Remove the former, leaving the rod in position.



3 MAKING THE MOULD

Cut plaster-banage into strips of 500 x 800 mm each. Dip in water and lay over clay to 5 mm thickness. Allow 3 or 4 minutes to set. Next, mix plaster (see opposite for method). Then build up the mould thickness to 25 mm, reinforced with alternating layers of plaster and hessian scrim.

Press two wooden supports into outer layer of plaster while it is still wet. Bind with strips of hessian scrim. When dry, this makes a stand for the mould.



Allow mould one week in a warm place to set and dry. Then turn upside down and remove clay. Fill hole with plaster and smooth over edges.

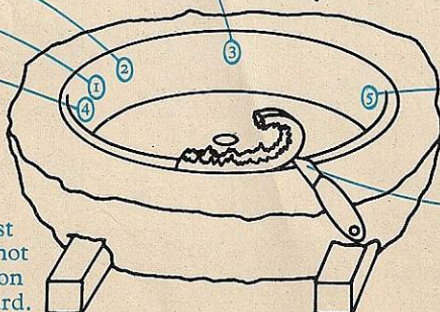
5 MAKING THE FIBREGLASS DOME

Paint the inside of the mould with shellac and allow to dry.

Apply three coats of wax car polish. Shine well to give a good surface.

Using a soft cloth or sponge, apply layer of release agent. Allow 2 or 3 minutes to dry. Protect hands with barrier cream.

Mix gel coat 1/2 gallon resin with accelerator, approximately 5% weight of the resin, and catalyst, approximately 5% of resin weight. But add accelerator and catalyst to gel coat separately. Do not mix them together. Paint on with brush. Allow to go hard.

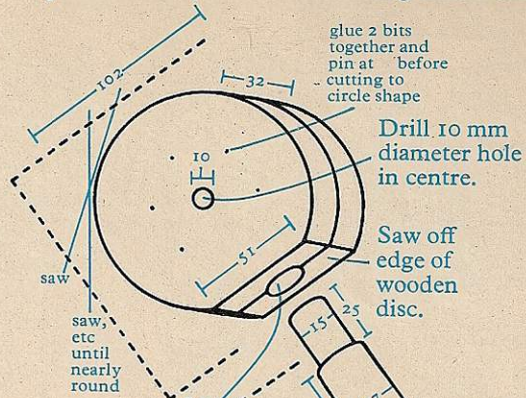


Mix layup resin with accelerator and catalyst. Clean brush in acetone. Wash hands in soap and water. Apply strips of glass matt to the mould and paint with resin. Continue this layering process until approximately 4 mm thick, or 3 layers of glass. Use a paint brush to punch out all the trapped air bubbles from the matt fibres.

When fiberglass is hard enough to cut, trim off the ragged edges with a sharp knife. Then allow it to 'cure' fully for about 24 hours in a warm room. Finally, remove from mould.

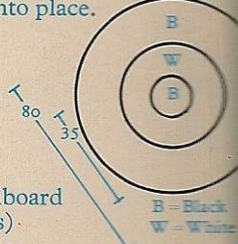
6 MAKING THE ANTENNA

Stick 2 sheets of 15 mm ply together. Draw 102mm circle on it. Saw off corners till nearly round. Chisel, file and sand with glass paper to make a perfect circle (or use woodworking lathe if available).



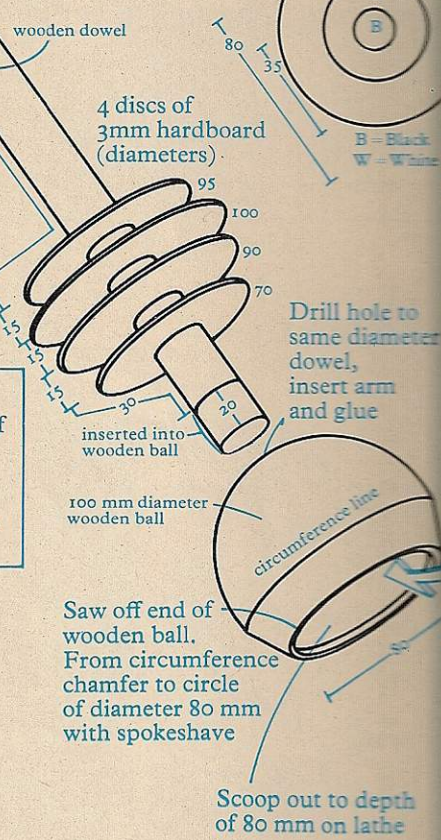
7 MAKING THE EYE

Cut a 2 mm thick sheet of clear perspex to an 80 mm diameter disc. Paint eye (any paint will do) on reverse side of perspex. Insert and glue into place.



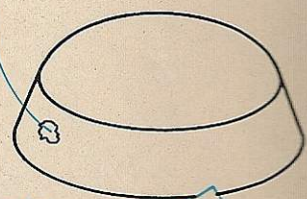
4 MIXING THE PLASTER

Fill a plastic bucket with 50-80 mm of water. Gently sprinkle in plaster until it forms a peak above the water line. Stir gently with hands. The mixture is ready when it does not run off the stick.



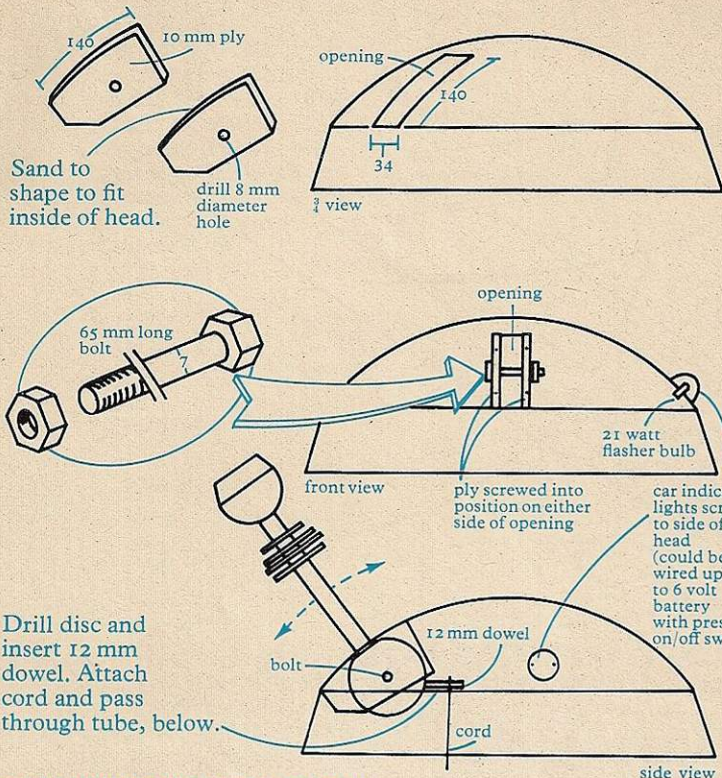
Wash the finished dome in warm, soapy water

Sand surface of the dome with wet and dry paper and make good any defects by filling with fibreglass-putty.



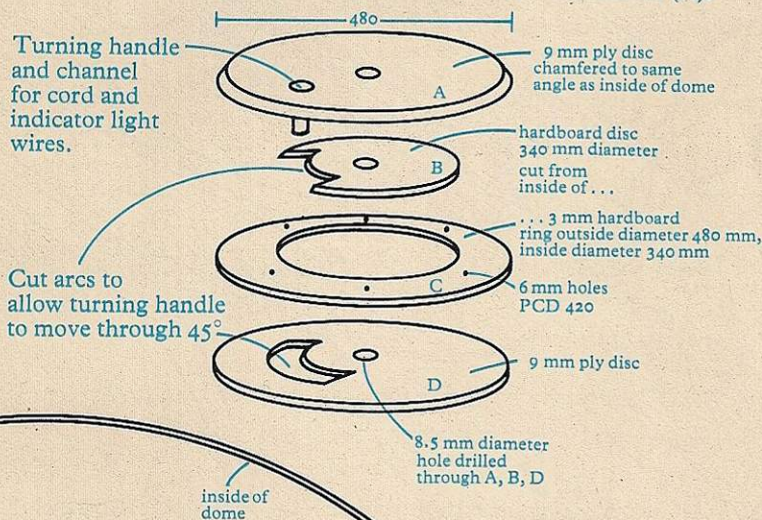
8 FIXING THE ANTENNA

Cut an opening 140 mm long, 34 mm wide, in the head.
Take two pieces of 9 mm ply and cut to shapes shown below.
Fix into inside of head with screws.
Fix antenna into position with 65 mm nut and bolt.

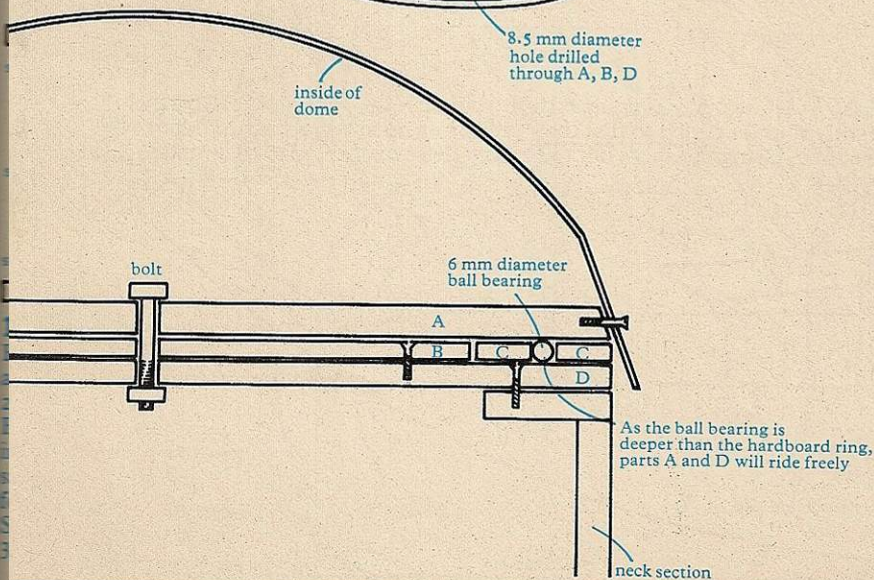


9 MAKING THE HEAD TURN

From a sheet of 9 mm ply cut a disc 480 mm diameter (A) and another disc 480 mm diameter (D). From a sheet of 3 mm hardboard cut a disc 480 mm (C). From that disc, cut an inner disc 340 mm diameter, (B). Drill 6 evenly spaced 6 mm holes right through ring (to hold 6 mm diameter ball bearings). Assemble as below and screw dome to (A).



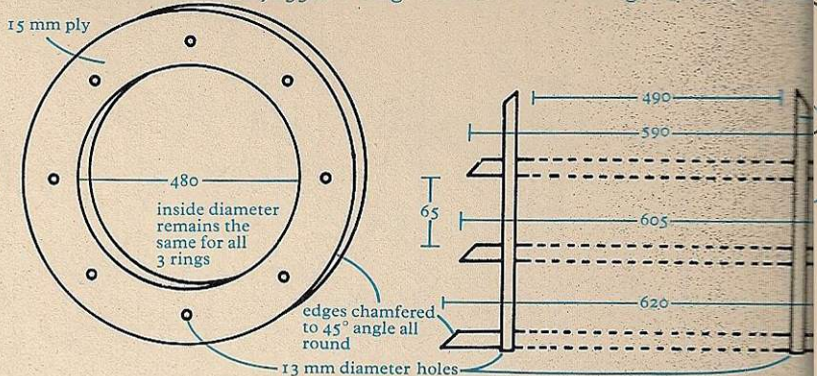
Cut arcs to allow turning handle to move through 45°



SECTION 2: NECK

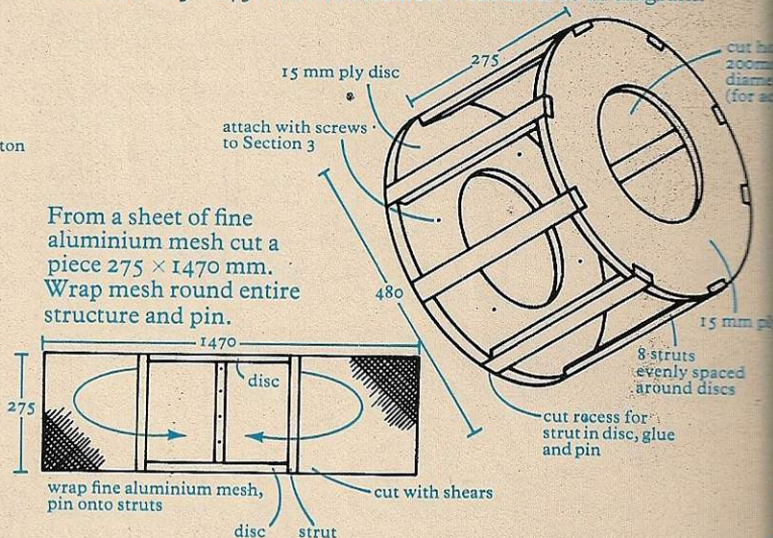
10 MAKING THE RINGS

From a sheet of 15 mm ply, cut 3 rings as shown below. Drill 8 evenly spaced 13 mm diameter holes PCD 530 mm. Insert 8 wooden dowels, 12 mm diameter, 235 mm long. Cut ends to same angle as inside of dome.

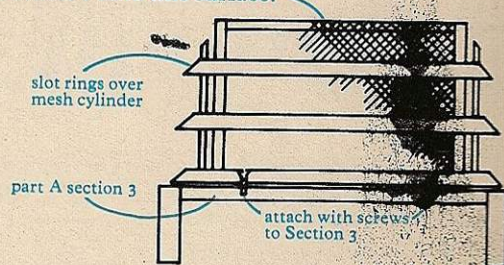


11 MAKING THE MESH CYLINDER

From a sheet of 15 mm ply, cut 2 discs 480 mm diameter. Cut 8 softwood struts 10 x 25 x 275 mm and assemble with discs as in diagram.



Fit the rings over the mesh cylinder. Screw part D of Section 1 onto this surface.

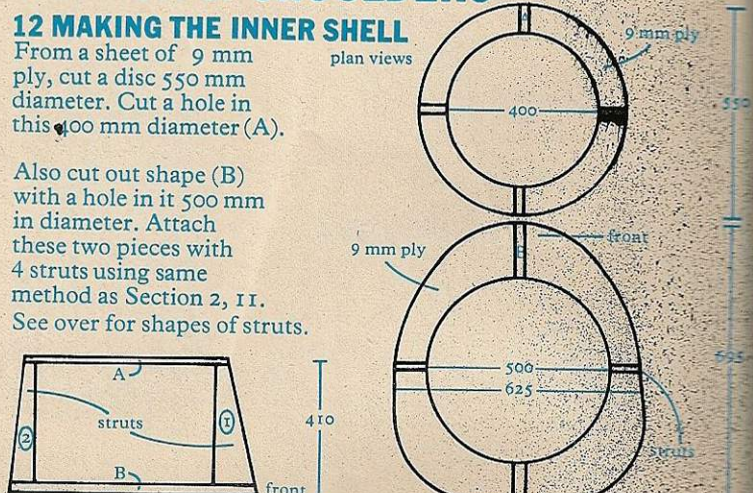


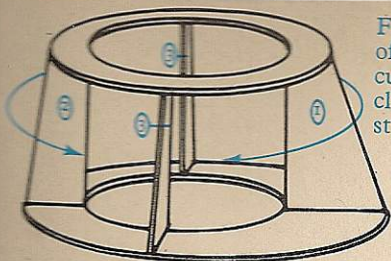
SECTION 3: SHOULDERS

12 MAKING THE INNER SHELL

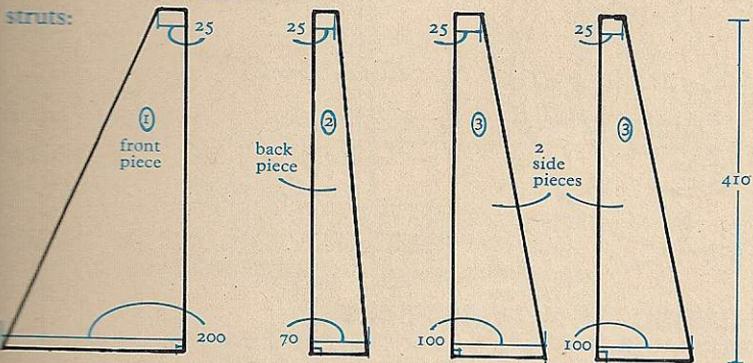
From a sheet of 9 mm ply, cut a disc 550 mm diameter. Cut a hole in this 400 mm diameter (A).

Also cut out shape (B) with a hole in it 500 mm in diameter. Attach these two pieces with 4 struts using same method as Section 2, 11. See over for shapes of struts.



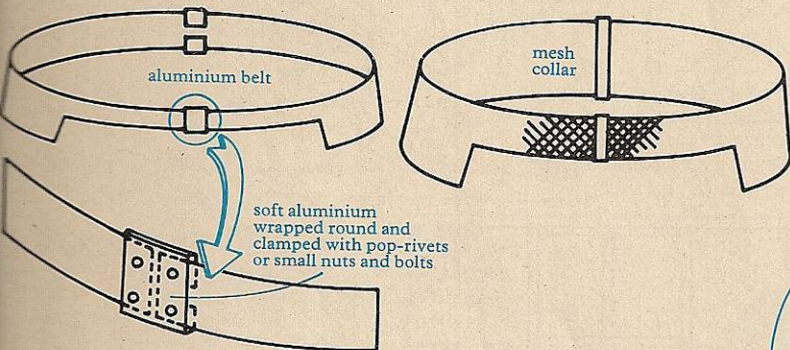


From a sheet of 1.5 mm ply, cut 2 strips to clad assembled structure.

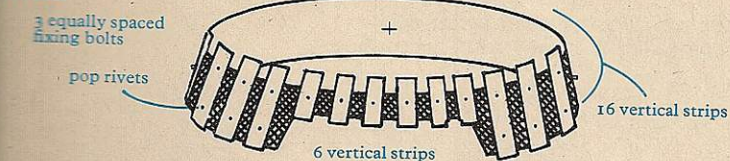


13 MAKING THE MESH COLLAR

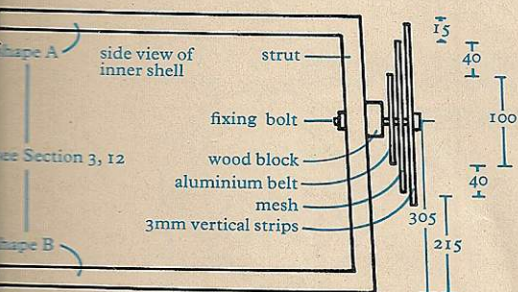
From a sheet of aluminium, cut 2 strips 651 x 10 mm. Join at front and back with a piece of soft aluminium 40 x 170 mm and clamp. From a sheet of large aluminium mesh, cut 2 strips 655 x 180 mm. This fits over aluminium belt. . .



and is held in position with 16 vertical strips of 3mm ply 50mm x 215mm and 6 vertical strips of 3mm ply 50mm x 125mm, all anchored with pop rivets.

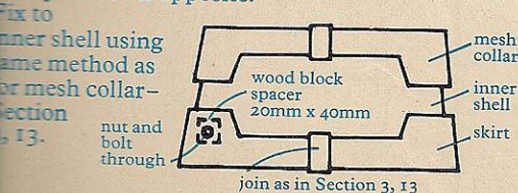


The aluminium belt and the aluminium mesh are separated from the inner shell by a block of wood 20mm thick, 40mm x 40mm, and fixed through to the shell with nuts and bolts.



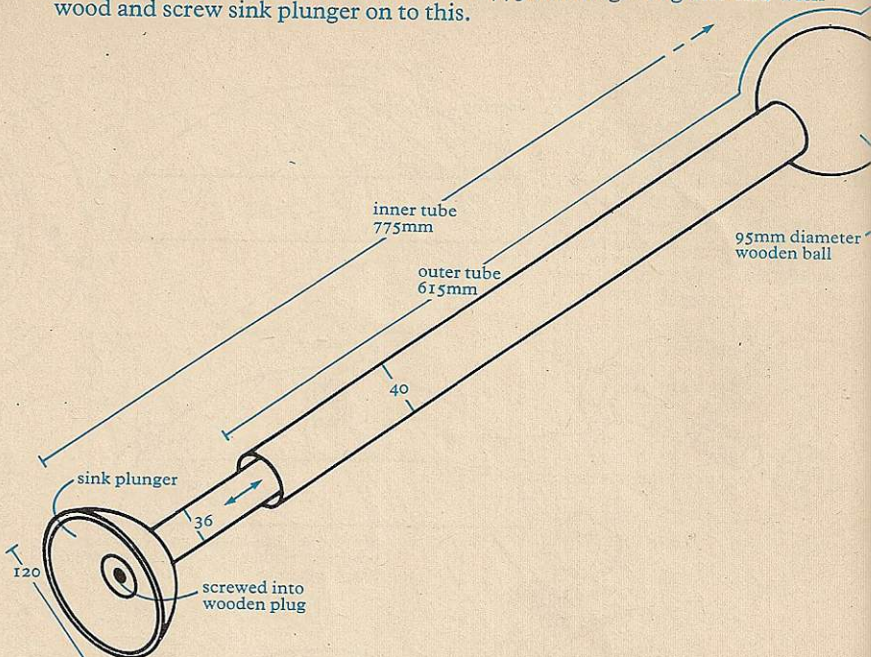
14 MAKING THE ALUMINIUM SKIRT

From a sheet of aluminium, cut 2 shapes shown opposite. Fix to inner shell using same method as for mesh collar - Section 3, 13.



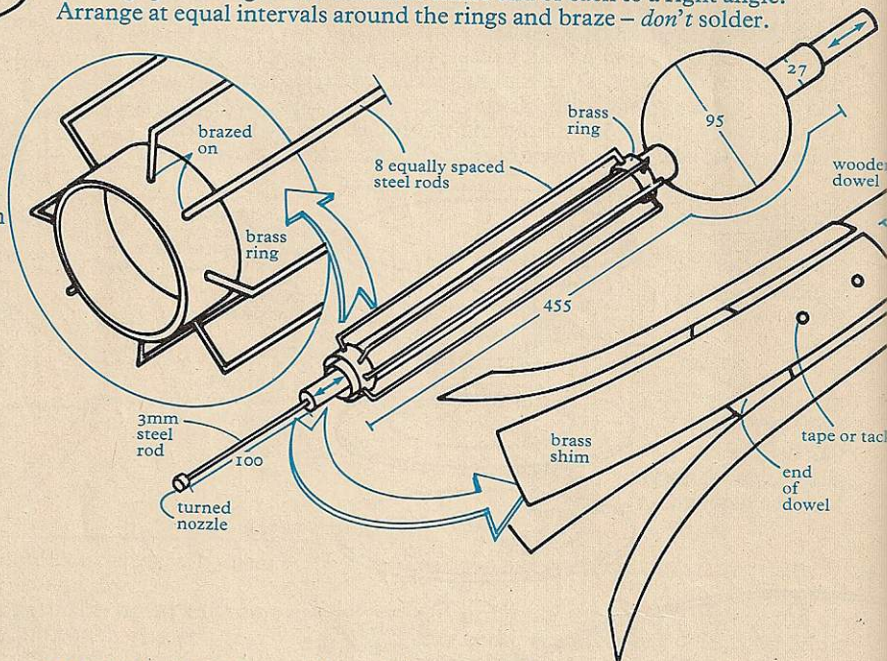
15 MAKING THE ARM

Cut a piece of 40mm diameter aluminium tube to 615mm long. Drill hole through 95mm diameter solid wooden ball and insert tube securely. Cut a piece of 36mm diameter aluminium tube 775mm long. Plug one end with wood and screw sink plunger on to this.

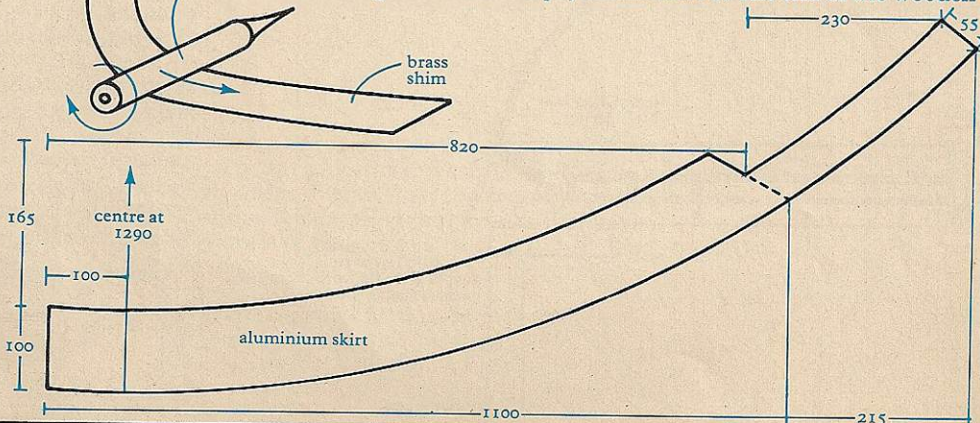


16 MAKING THE EXTERMINATOR

Cut a piece of 26mm diameter aluminium tube to 455mm long. Drill a hole in identical wooden ball and insert tube as shown in Section 3, 15. Fix 2 brass rings in position as shown. Cut 8 equal lengths of 3mm steel rod to 315mm long. Bend 10mm at either end of each to a right angle. Arrange at equal intervals around the rings and braze - don't solder.



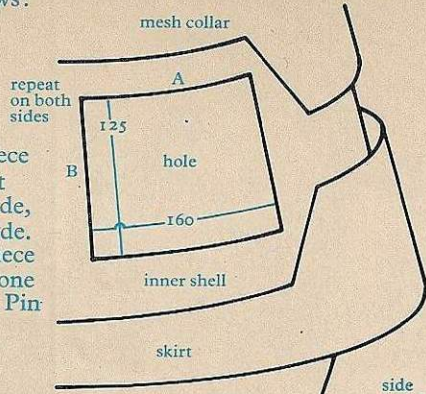
Take 4 identical pieces of brass shim 100mm long, 10mm wide. Roll them tightly round a pencil so that they will spring open when pushed out of the tube. Using fine tacks or tape, attach these to one end of the wooden dowel.



17 MAKING THE ARM AND THE EXTERMINATOR MOVE

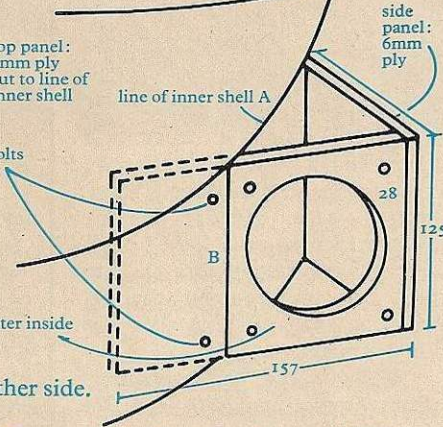
Cut holes in the inner shell as follows:

From a sheet of 15mm ply, cut a piece 125mm x 157mm (front panel). Cut a hole in this 90mm diameter one side, chamfered to 97mm on the other side. From a sheet of 6mm ply, cut one piece 125mm x 112mm (side panel), and one piece 112mm x 135mm (top panel). Pin and glue these together to form a 3-sided box as shown below.

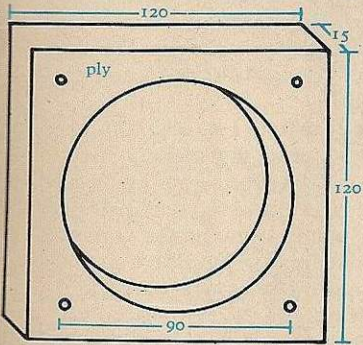


attach box to inner shell with 35mm nuts and bolts

front panel: 15mm ply with hole, 90mm diameter outside chamfered to 97mm diameter inside



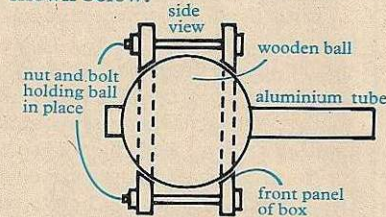
Use same process in reverse for the other side.



From a sheet of 15mm ply, cut 2 pieces 120mm square, each with a hole in the centre 90mm diameter on one side, chamfered to 97mm diameter on the other.

Next, drill 4 holes 4mm diameter in the front panel of the box at \circ and 4 identical holes in same positions through separate ply shape shown opposite.

Assemble arm and exterminator as shown below.

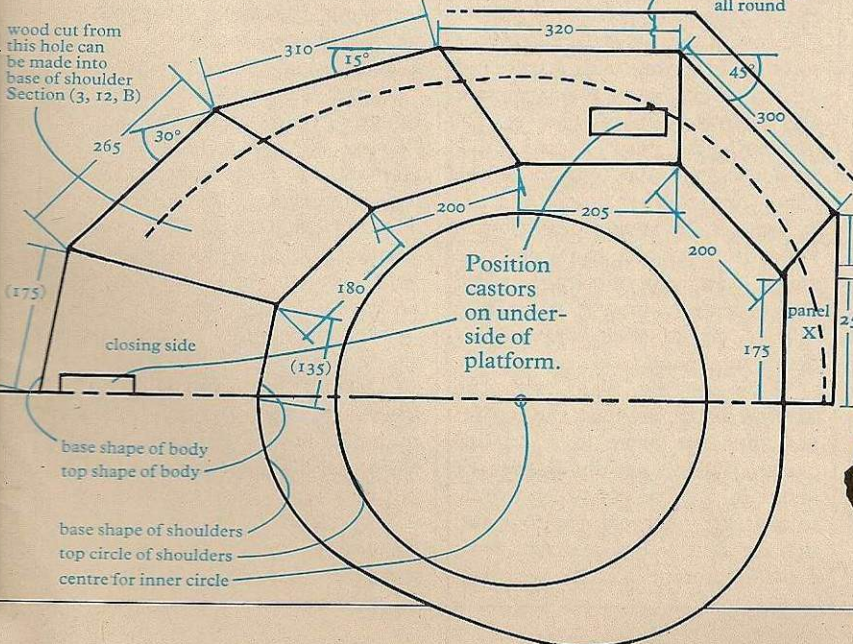


SECTION 4: BODY

18 MAKING THE FRAME

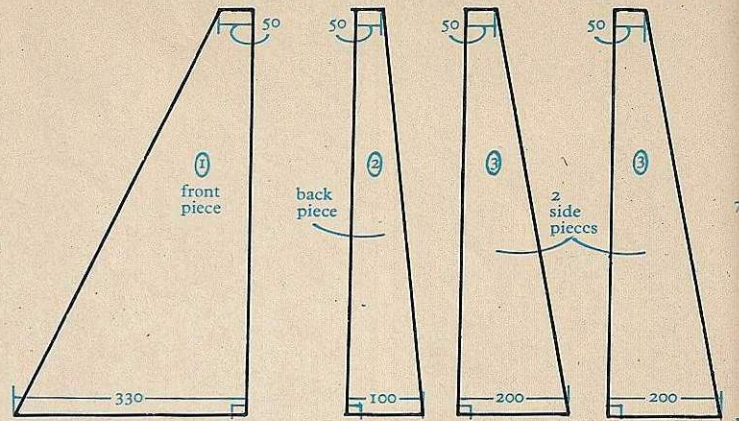
From 15 mm ply, cut base and top shapes.

wood cut from this hole can be made into base of shoulder Section (3, 12, B)



19 ASSEMBLY

From a sheet of 15 mm ply, cut these shapes and assemble as in 3, 12.

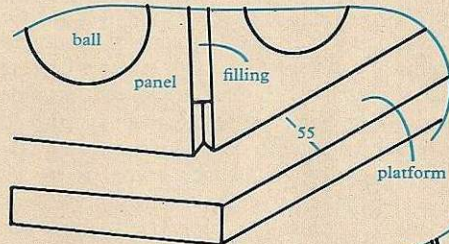
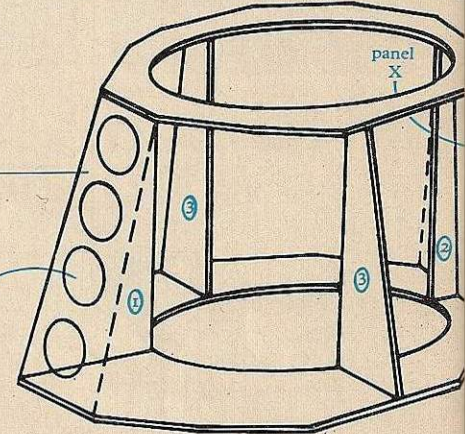


20 CLADDING

Clad frame with 11 panels of 6 mm ply.

21 DECORATING THE PANELS

Cut in half 24 polystyrene (or similar) balls of 100 mm diameter, and glue to panels - 4 to each, except for panel X, which has 8.

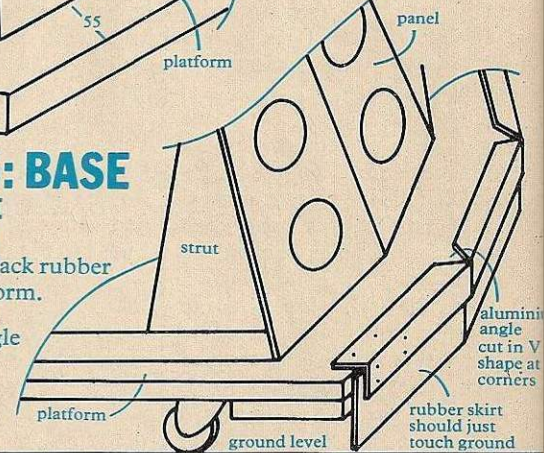


Fill up gaps left between the panels with Polyfilla or plastic wood. Sand to a smooth finish.

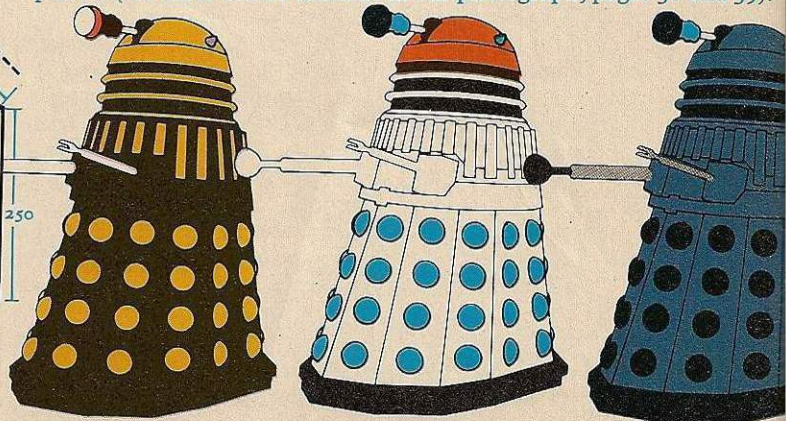
SECTION 5: BASE

22 MAKING THE RUBBER SKIRT

Cut a strip of thin black rubber to encircle the platform. Screw into position with aluminium angle.



Assemble the Dalek, screwing the sections together. All that's left is to paint it (see these colour schemes in our photograph, pages 38 and 39).



Now you've seen how to make a Dalek yourself, turn overleaf and read how the behind-the-scenes professionals bring *Dr Who* to the screen...