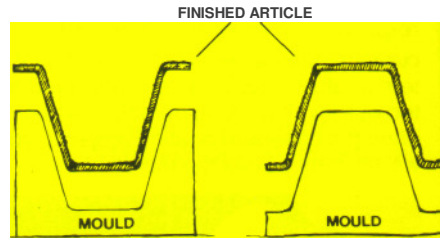


LAMINATING

Making a Mould

With a few exceptions, the first requirement in nearly all GRP projects is a mould in which to lay up the laminate. Some moulds can be very simple - you can lay up GRP flat panels on no more than a sheet of hardboard faced with self-releasing polyester film. Moulds are male or female, with the laminate applied to the outside of a male mould and the inside of a female. The finished item has a smooth surface on the side nearest the mould, so a male mould is used when a smooth interior is required (shower trays, for example). For boat hulls, a female mould would be used, which gives a laminate with a smooth exterior. In some cases, particularly canoes, it is possible to buy or hire ready-made moulds, but usually you would have to make one yourself. You can use most solid materials for mouldmaking. Wood, hardboard, plaster,



Female (left) and male (right) moulds.

clay, steel and concrete can all be used, but the best material is glassfibre itself. The GRP mould is made by laminating over a suitable item. You can take a mould from an existing boat or canoe (although be wary of infringing design copyright!) but usually you will have to make a "plug" (sometimes called a pattern or former) which is an exact mock-up of the finished item.



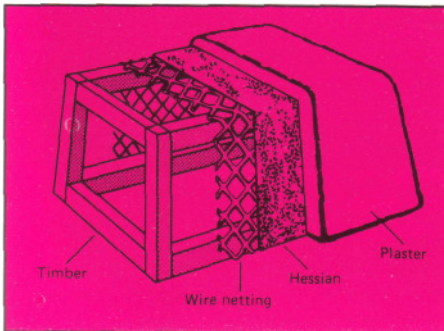


MAKING THE "PLUG"

Almost any material can be used, as long as the plug is accurate, rigid and has a highly finished surface. A small plug can be modelled in clay, or built from ply or fibreboard. Typically, a large plug might have a wooden framework covered with plywood or hardboard, or with clay or plaster reinforced with wire netting or hessian - or any combination of these. The glassfibre mould will faithfully reproduce the plug surface, so it must be totally smooth and unblemished - nails must be hammered well in and screws countersunk, with the heads covered with filler, and all dents, joints and seams must be carefully filled, preferably with resin putty. In wooden plugs, the grain should be filled and carefully smoothed down

then painted with Furane Resin, a coating resin which helps to give a wooden plug a highly glazed surface. If the plug has a deep draught or undercuts, it will be necessary to make the mould in two or more sections, otherwise the laminate will lock into the undercuts and be impossible to remove.

This is often the case with boat hulls, where the mould may be split along the keel line to allow for "tumble-home" at the stern. These sections will need flanges, so they can be bolted together. To produce the flanges, the plug should have "fins" fitted along the split-lines which separate each section. The fins can be made of any suitable material, such as thin aluminium sheet. Alternatively, the plug itself can be made in sections.

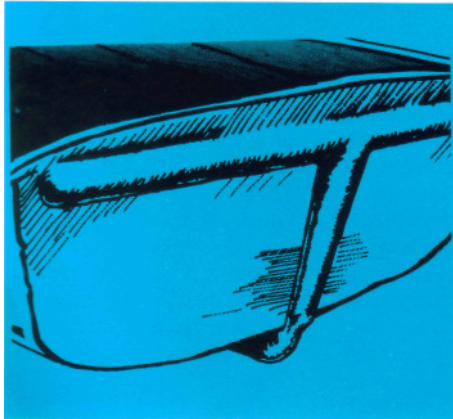


Typical Construction of a plug

When the plug is completed, it must be treated with release agents prior to laminating the glassfibre mould. If the plug is made from porous materials, such as plaster, the surface should be sealed with several coats of Release Agent No 1. Then wax and polish the plug with four to six coats of Release Agent No 3 - buff each coat and leave for an hour to harden thoroughly before the next is applied. When the final layer has hardened, Release Agent No 2 is used to provide a surface coat. The mould can now be laminated over the plug.

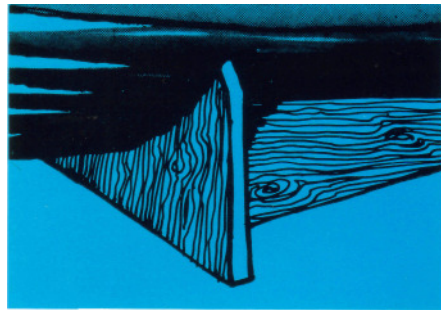
The GRP Mould

The mould is produced by the same method used for any other glassfibre lay-up - a layer of gelcoat, followed by successive layers of glassfibre impregnated with Resin A. This is explained in detail in the section on Laminating Technique. The only difference is that the mould needs to be much thicker than the finished item - it will often need to be twice as thick. This would involve considerable expense on large moulds, but economies can be obtained by the judicious use of strengthening ribs and stiffeners. These will prevent the mould flexing or distorting during use. Add these ribs after the mould has partly cured, or contraction of the surrounding laminate may leave an impression on the mould surface. The ribs are easily made by laminating over a suitable former. A popular material for formers is paper rope, made of paper wound on a flexible wire core. It has a flat side which is laid on the GRP surface in the required position.



You then laminate strips of glassfibre over it to produce reinforcing ribs, which give added stiffness with little extra weight. The former itself provides none of the extra stiffness - this results entirely from the box section of the laminated rib (see "Formers").

If the mould is in two or more sections, these will need flanges (preferably about 75mm wide and at least 50% thicker than the rest of the mould) which can be drilled later so the parts can be bolted together. Leave the mould to cure completely (preferably for at least two weeks) before removing from the plug - too early removal can result in distortion. To support a large mould, and make it more rigid, a timber framework can be bonded on. This



should be done after the mould has cured, but before it is removed from the plug. After removal, let the mould "breathe" for a few days before filling or sanding any imperfections - there should not be many of these if the plug was properly finished.