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54 Wash tubs.

57 Wash tubs for domestic front loading washing machines, where rigidity of the back plate supporting the rotatable drum is an essential requisite, are made more rigid, quicker, stronger and cheaper as solid mouldings than as structural foam mouldings, the latter being the accepted norm for maximising panel stiffness. Preferred materials are fibre reinforced thermoplastic compositions free from blowing agents. The back plates are moulded in a Greek Fan configuration comprising a plurality of sectors adjacent ones of which are relatively displaced axially of the wash tub and are joined at their radial edges by axially extending webs, the sectors preferably being thicker than the webs.

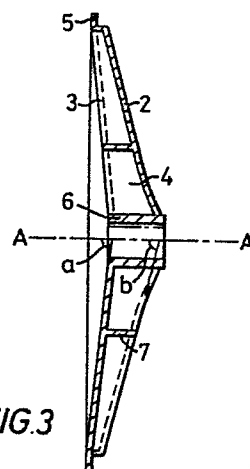


FIG.3

Wash Tubs

The invention relates to wash tubs suitable for use in domestic front loading washing machines for laundering clothes, and in particular to wash tubs moulded, at least in part, from plastics materials.

- 5 Washing machines of this kind are provided with a wash tub within which is mounted a rotatable drum for holding the clothes to be washed. The wash tubs are usually substantially cylindrical in shape with a back plate closing one end of the tub and a water-retaining flange at the other end of
10 the tub, the tubs also having various lugs or brackets for mounting them in an outer casing.

To avoid requiring excessive amounts of water, during washing, it is desirable to have minimum clearance between the rotatable drum and the wash tub. However, the drum of a
15 front loading machine is mounted solely on a bearing located at the centre of the back plate of the tub, and this may be subjected to strong mechanical stresses, especially during spin drying of an out-of-balance washing load. Any small flexing which occurs in the back plate is magnified at the
20 open end of the drum, so that small clearances there may be lost, usually with catastrophic results.

Flexing of the back plate is generally more difficult to

prevent in tubs moulded from plastics materials than in those using traditional metals, and current designs have tackled this problem by using back plates having particularly stiff spatial configurations, and by using moulding compositions and procedures which are well known techniques for obtaining stiffer products. Thus the preferred shape which has been developed is that often referred to as a "Greek Fan" and comprises a plurality of sectors, typically between twelve and eighteen in number. The inner end of each sector adjacent the bearing for the drum is displaced axially of the tub with respect to the adjacent sectors. There is usually little or no relative axial displacement at the outer ends of the adjacent sectors. Adjacent sectors are inter-connected along their radial edges by axially extending webs; thus an annular section of the back plate at part radius has a castellated configuration.

It is a well known general principle in plastics technology, that a foamed moulding, by virtue of its greater thickness, will have a greater panel stiffness than an unfoamed panel of the same weight. It is therefore not surprising that with the intention of obtaining maximum panel stiffness, wash tub back plates are currently being moulded from plastics compositions containing foaming agents to produce relatively thick foamed panels, e.g. as a foamed core with substantially solid skins on either side often referred to as "Structural Foam".

However, as a basis for this invention it has now been found that for wash tub back plates in a Greek Fan configuration, panel stiffness is not the critical parameter in determining its overall rigidity. The major stresses are tensile and
5 compressive rather than bending. Consequently a more rigid back plate with less material and shorter moulding cycles, and hence at substantially lower cost, can be obtained by producing thinner panels without using a foaming cycle.

Accordingly, the present invention provides a wash tub for
10 a front loading washing machine in which the back plate has a Greek Fan configuration comprising a plurality of sectors adjacent ones of which are relatively displaced axially of the tub and are joined along their radial edges by axially extending webs, the back plate being moulded from a plastics
15 composition which is free from foaming agents.

A preferred wash tub is one having a tubular shell which is integrally moulded with the back plate from the same plastics composition which is free from foaming agent. The tubular shell preferably has a slight taper, e.g. about 4° , to
20 assist in its removal from the moulding tool. It can also have a stepped radius, strengthening ribs and mounting lugs.

A number of advantages accrue from the present invention. For example, the strength of a solid moulding is more predictable than that of a foamed moulding which has to be

over-engineered to some extent to ensure adequate strength. A further requirement which is satisfied by the invention is that the back plate must not only be stiff, but it must have sufficient strength to withstand the repeated substantial loadings around the drum-supporting bearing without fracture. It has been found that when using a foaming composition, it was unfortunately in these most highly stressed areas where most foaming occurs during moulding. Moreover, the very presence of foaming agent necessitates longer cycle times to prevent post moulding blowing, with a result that for this particular shape, any saving in material cost which might have been achieved by foaming would be small, and the additional production costs can be a greater effect. Indeed, this can be exacerbated when demand for a high production rate can only be met on the longer foaming cycles by using additional moulding tools.

In practice a back plate is preferred in which the thickness of the sectors is greater than the thickness of their interconnecting webs. Advantageously the thickness of the sectors is between 5 mm. and 6 mm. The thickness ratio of web to sector lies preferably within the range 0.75 to 0.9, especially about 0.8. Thus, for example, 5.5 mm. thick solid sectors combined with only 4.5 mm. thick interconnecting webs, give a strong and stiff back plate configuration for moulding from 30% glass filled polypropylene. Also, advantageously the thickness of the cylindrical shell portion

of the wash tub is less than the thickness of the sectors and is, for example, the same as the thickness of the axially extending webs.

The sectors of the back plate are preferably all orientated
5 with their planes at an angle of less than 90° to the axis
of rotation of the drum and all slope in the same direction.
This is in contrast to known Greek Fan back plates the
planes of whose sectors slope in opposite directions. The
angle of orientation of alternate sectors is preferably
10 less than that of the other sectors therebetween by an
amount within the range 5 to 25° , such that the outer ends
of adjacent sectors are closer together than the inner ends
of adjacent sectors.

It has also been found that rigidity may be improved by
15 providing part way along the radius of the sectors an
annular web joining together the axially extending webs,
the annular web being coaxial with the axis of drum rotation.
The annular web is most suitably at a radius of between one
quarter and one half, preferably about one third, the radius
20 of the back plate, and the axial length of the web is
preferably equal to the axial length of the interconnecting
webs at the same radius.

Preferred plastics compositions are fibre reinforced
thermoplastics materials, especially glass filled polypropy-
25 lene containing at least 20% by weight of glass fibres.

The invention is further illustrated by reference to a specific embodiment thereof shown in the accompanying drawings, in which

Figure 1 is an axial view of a back plate according to the
5 invention,

Figure 2 is a section along the line II II of Figure 1,

Figure 3 is a section along the line III III of Figure 1,
and

Figure 4 is a detail of Figure 3 modified to show an
10 alternative configuration.

The back plate 1 shown in the drawings has a Greek Fan configuration comprising a plurality of sectors 2, 3 displaced from each other along the axis A-A of the wash tub those marked 2 in Figure 1 being closer to the viewer than
15 those marked 3. Adjacent sectors 2 and 3 are interconnected along their radial edges by axially extending webs 4, as shown in the section of Figure 2. The thickness 'X' of the sectors 2, 3 is greater than the thickness 'Y' of the webs 4.

The planes of the sectors 2 and 3 slope at angles 'a' and
20 'b', both less than 90° , with respect to the axis A-A and they all slope in the same direction, i.e. towards the open mouth of the wash tub. The difference between the angles 'a' and 'b' is in the range 5 to 25° .

Around the circumference is a flange 5, which is joined to all the sectors 2 and 3 and their interconnecting webs 4, and is provided for bolting the back plate to a separately formed tubular shell (not shown). The inner ends of the sectors 2 and 3 are joined to a hub 6 for housing a drum-supporting bearing (not shown), adjacent sectors being connected to opposite ends of the hub, as shown in Figure 3. At about one third of the back plate radius, is an annular web 7, which is joined to each of the webs 4.

10 A back plate substantially as illustrated was injection moulded from a polypropylene composition containing 30% by weight of glass fibre, and in the absence of any blowing agent it emerged as a single integral moulding of solid plastics composition. The diameter of the back plate was 15 470 mm., plus a 35 mm. flange 5 around its circumference. The thickness of the sectors 2, 3 was 5.5 mm., with the interconnecting webs 4 and tubular web 7 being thinner at 4.5 mm.

The modification shown in Figure 4 is a suitable edge configuration when moulding a tubular shell together with the back plate as an integral moulding. A portion of the shell 8 is shown in section, joined to radial segments 2, 3 and interconnecting web 4. No circumferential flange is needed with such integral mouldings, but supporting brackets and 25 other standard fittings can be moulded on to the outer

surface of the shell, as required. The shell 8 is shown as having a thickness 'Y' the same as the webs 4.

CLAIMS

1. A wash tub for a front loading washing machine having a back plate comprising a plurality of sectors
adjacent ones of which are relatively displaced axially of the tub and are joined along their radial edges
5 by axially extending webs, the back plate being moulded from a plastics composition which is free from foaming agents.
2. A wash tub according to Claim 1, and comprising a tubular shell which is integrally moulded with the back plate from the same plastics composition which is free
10 from foaming agent.
3. A wash tub according to Claim 1 or 2, wherein the thickness of the sectors is greater than the thickness of the axially extending webs.
4. A wash tub according to Claim 3, wherein the sectors
15 have a thickness in the range 5 mm. to 6 mm.
5. A wash tub according to Claim 3 or 4 wherein the thickness ratio of web to sector lies within the range 0.75 to 0.9.
6. A wash tub according to any one of Claims 3 to 5,
20 and having a tubular shell whose wall thickness is less

than the thickness of the sectors.

7. A wash tub according to Claim 6, wherein the wall thickness of the tubular shell is the same as the thickness of the axially extending webs.

5 8. A wash tub according to any one of the preceding Claims wherein the sectors of the back plate are all orientated with their planes at an angle of less than 90° to the axis of the rotation of the drum.

9. A wash tub according to Claim 8 wherein the angle of
10 orientation of alternate segments is less than that of the other segments therebetween by an amount within the range 5 to 25° , such that the outer ends of the sectors lie in planes closer together than the inner ends of the sectors.

10. A wash tub according to any one of the preceding
15 Claims wherein the plastics composition is a fibre reinforced thermoplastics material.

11. A wash tub according to Claim 10, in which the plastics composition is a glass filled polypropylene containing at least 20% by weight of glass fibres.

