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(54) Improvement in the structure of a washing machine.

(57) Clothes washing machine or dishwashing machine comprising an outer housing and a back wall that features an aperture delimited by edges (5) that are connected to the outer structure of said housing, said aperture being closed by a double-wall rear panel (1) forming a cavity (2) that extends almost all over the whole surface of said rear panel and is filled with noise-deadening material (3), preferably calcium carbonate. Said rear panel (i) is made of plastic material, in particular by the blow-moulding process; a metal net-like screen (6), which is connected to the grounding terminal of the machine, is applied on to said rear panel. The ballast means used in these machines consist of an outer enclosure (7) of preferably blow-moulded plastics, said outer enclosure being filled with ballast material comprising calcium carbonate (8).

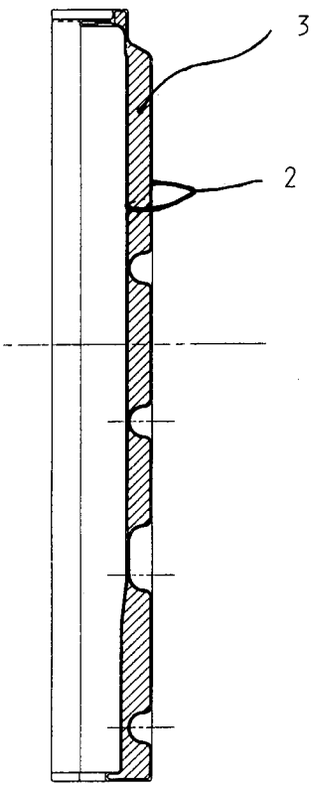

FIG. 2

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The present invention relates to the development, manufacture and use of economical structural elements which have particularly effective sound-deadening properties and are made of a material that is particularly suited to be recycled and reused when the machine in which they are used is ultimately dismantled or scrapped at the end of its life.

Covered by the present invention are in particular structural elements that are especially fit for use in a number of home appliances, mainly clothes washing machines and dishwashers.

In the following description, and by way of non-limiting example, reference is made to a clothes washing machine. However, it will be appreciated that the herein described features and embodiments may as well be applied to combined clothes washing and drying machines, or even dishwashing machines, without any major modification beyond the obvious changes that anyone skilled in the art would easily be able to identify and perform to adapt the elements to the particular application.

Clothes washing machines and dishwashers are known to usually comprise, inside an outer housing or cabinet, a number of operational means that undesirably generate noise during the operation of the machine. In clothes washing machines, in particular, a so-called washing assembly is provided which is associated with at least a motor-driven drain pump, is suspended or hanged elastically inside said outer cabinet, and comprises a wash load holding drum that is adapted to be rotatably driven by an electric motor.

Furthermore, in order to limit the unbalance situations of said washing assembly when the drum is rotating, the same washing assembly is provided with appropriate ballast means which usually consist of a cast-iron and/or concrete mass.

According to traditional methods, the outer cabinet further houses a number of further operational means such as a motor-driven drain pump, electromagnetic solenoid valves, etc., which also generate noise in an undesirable way during operation.

In particular, the drum driving motor is known to generally generate noise having relatively low frequency components (in the region of approx. 200 to 300 Hz), which not only have a particularly annoying effect in living spaces inside the house, but are also quite difficult to get rid of by means of traditional sound-deadening or absorbing systems.

In all cases, it is known that a strongly felt need is currently arising for an effective reduction of the noise generally generated by such machines, in particular the noise generated by the drum driving motor or the motor-driven drain pump, said noise being particularly felt as a serious annoyance in all cases in which, according to rapidly expanding habits, the washing machine is operated at night.

In order to obviate this drawback, a number of solutions have been devised which make use of various devices arranged or adapted to reduce noise generation or noise emission, such as for instance silenced or muffled motors, wash tubs made of plastics, etc.

However, although they proved quite adequate and effective all such solutions actually require that the washing machine be radically redesigned, and in most cases this is clearly not feasible owing to economic or industrial reasons.

In view of reducing noise efforts have been therefore directed at improving washing machines in their water-carrying circuits, electric component parts and mechanical elements in general. But the results have hitherto been quite unsatisfactory. On the other hand, the use of special sound-deadening, sound-absorbing or sound-insulating panels in the washing machine makes the structure of the machine undesirably more complicated and the machine itself more difficult to manufacture, since washing machines usually have no enough inner space left to adequately accomodate such supplementary parts.

Anyway, tests have widely shown that all such solutions are capable of reducing noise components at a relatively high frequency, but are substantially ineffective as far as noise components at a relatively low frequency are concerned, ie. the noise components which are actually more annoying in the home.

Washing machines and dishwashers are further known to be manufactured in a traditional way by dressing inner operational component parts with an outer metal cabinet or housing. This technique is universally used to manufacture simple and cost-effective cabinets for such washing machines, said cabinets normally consisting of a sheet-metal band that wraps the machines on their sides and frontally, and a rear panel that is formed separately and can be installed or removed in an equally separate manner to allow access to be gained to the main operational component parts from the rear side of the machine.

However, such a type of construction, albeit reliable, effective and economical, does not enable the noise generated inside the machine to be reduced to any significant extent, so that the same noise is able to almost freely propagate outside since in most cases said metal walls act as a real sound box with regard to said types of noise.

Furthermore, a sheet-metal cabinet of the traditional type is such as to give rise to considerable thermal leakage processes and, therefore, considerable losses of the heat contained within the cabinet and generated substantially by the washing tub

being heated up by the hot water contained therein. Such a thermal loss determines practically a need for an increase in the energy consumption required to heat up the wash liquor contained in the washing tub and, after all, causes the overall energy efficiency of the machine to deteriorate sensibly.

It should also be noticed that a rear panel of the traditional type, ie. made of painted sheet-metal material, is particularly affected by its exposure to the moisture generated in the washing machine, which eventually causes the rear panel to undergo rusting and corrosion.

A further factor causing the rear panel to be particularly liable to corrosion is due to the fact that it normally is almost in close contact with the wall and, as a consequence, the moisture building up thereupon will not be easily or quickly removed since there is practically no air circulation around it to promote its drying up, whereas the other walls are almost in all cases open to ambient air and can therefore be dried either naturally or manually in a much easier, more convenient way.

The clothes washing machine further comprises a ballast means of the type as disclosed in GB-A-1 240 034, ie. comprising a vessel installed on the washing tub and filled with water.

As far as the dishwashing machine is concerned, it normally comprises a ballast means, typically consisiting of a concrete slab, preferably arranged in correspondence of the rear wall of the machine so as to prevent the same machine from tilting forward by using its weight to counterbalance the weight of the front loading door when it is opened.

There is finally a further aspect which design engineers in general are increasingly required to duly bear in mind for economical and environmental reasons, as well as for considerations deriving from special law regulations that are expected to be introduced in the next future: that is the need for the most important industrial products, such as home appliances in general, to be manufactured using such techniques and materials as to make it very easy and practical to both dismantle them at the end of their utilization life and recover their various component parts for recycling and re-use, without having to embark on cost-intensive, time-wasting operations for sorting and grading materials of a different kind and nature.

It is therefore one of the main purposes of the present invention to provide a clothes washing machine or a dishwashing machine which is sound-proofed in an effective way and further has a simple and economical structure.

It is a further scope of the present invention to provide a clothes washing machine or a dishwashing machine of the above cited type, with which it may be possible to minimize the waste of materials through the simple and immediate recovery of a number of component parts of the machine at the end of the utilization life thereof.

A further purpose of the present invention is to provide household appliances with reduced heat losses so as to cut their energy consumption.

A still further purpose of the present invention is to provide household appliances which have a rear wall that is not so easily or quickly brought to corrosion by the adverse effects of moisture.

These and other aims are reached in a clothes washing machine equipped with a characteristic rear panel and a characteristic ballast means, or in a dishwashing machine equipped with said rear wall with hollow space, said rear panel or wall being preferably made of plastic material, as substantially described in the appended claims.

The invention will be further described by way of non-limiting example with reference to the accompanying drawings in which:

- Figure 1 is a view from the rear of a machine according to the invention, with the rear panel installed;
- Figure 2 is a cross-sectional view of the rear panel shown in Figure 1;
- Figure 3 is a view from the rear of an improved embodiment of the rear panel shown in Figure 1;
- Figure 4 is a cross-sectional view of the rear panel shown in Figure 3; and
- Figures 5 and 6 are a cross-sectional view and a front view, respectively, of a circular ballast means for washing machines according to the present invention.

The solution that has been devised according to the present invention basically consists in providing a rear panel 1, in which a cavity 2 is formed having a thickness limited to a few centimeters at the most and extending substantially all over the whole surface of said rear panel.

During the manufacture of said rear panel, its cavity is filled, using *per sè* known techniques, with high-density ground or powder material 3, preferably of mineral origin. It has for instance been found that dry sand or a similar material would be quite appropriate for use to this purpose.

Once the manufacture of a rear panel of the above described type is completed, the same panel needs only to be applied on to the aperture in the rear wall of the machine, whereas care shall be taken in ensuring that its outer edges 4 are rigidly fixed against the corresponding edges 5 on the rear side of the cabinet. As a result, the vibration damping effect, and therefore also the sound-deadening effect, is in this way passed on from said rear panel to the whole cabinet, thereby contributing to a further reduction of the overall noisiness of

the machine.

Any appropriate material may obviously be considered for use in manufacturing this rear panel. However, it is particularly advantageous, in view of both achieving greater simplicity and ease in manufacturing and enhancing inherent corrosion strength, that the rear panel is made of plastic material, using *per sè* known moulding techniques and, preferably, a blow-moulding process.

In the case that this rear panel is made of moulded plastics, it will be obvious, owing to the economic and environmental advantages deriving from a recovery of reusable materials from discarded industrial products at the end of the life cycle thereof, to arrange for the plastic material of the rear panel to be recovered for recycling through grinding, according to a technique that is well-known to anyone skilled in the art.

However, in the case of the recovery of such a rear panel made of plastic material , it will be necessary, before grinding, that the moulding forming the actual rear panel be duly separated from the sound-deadening material contained in the cavity thereof. This of course would imply additional processing that may make recovery uneconomical.

In order to avoid this additional processing step, it has turned out to be of particular advantage using calcium carbonate as the sound-deadening material, wherein the inherent advantage of such a material resides in the fact that it is an element which is normally used to "reinforce" plastics in view of enhancing particular performance abilities and proprieties thereof.

Furthermore, calcium carbonate is an inert, low-cost material that not only is easily found in nature as a constituent of marble stone, limestone and concretions in general, but can also be produced artificially. As a matter of fact, comprehensive tests have shown that calcium carbonate has a surprisingly good sound-absorbing effect, in particular as far as noise components at a relatively low frequency are concerned. As a consequence, the material is actually capable of substantially absorbing most of the noise spectrum generally produced by the operational component parts of the washing machine. This applies in particular to the low-frequency noise components emitted by the drum driving motor.

Therefore, if calcium carbonate is used as the sound-deadening element in the afore described arrangement, there is no need any longer to go through the afore mentioned step of separating the different materials for recovery, since it will be possible to just grind the whole rear panel directly in order to obtain a recycled polymeric material that is automatically reinforced and ready for further processing.

However, since a rear panel made of plastic material might not be able to ensure effective shielding against electrical interferences and disturbances that arise from the operation of electrical component parts used inside the machine, it is an advantageous improvement in the afore described object of the present invention to apply a preferably net-shaped metal shielding means 6 on to said rear panel, said net-like shielding means being connected with the metal structure of the machine through appropriate grounding terminals that are not shown in the Figure since their construction and installation are well within the capabilities of anyone skilled in the art.

A further improvement in the arrangement according to the present invention consists in embedding said net-like shielding means 6 in the plastic material forming the structure of said rear panel as the latter is moulded by blow-moulding or any other appropriate moulding process, according to the particular technique that is selected to manufacture it, thereby making it easier, more cost-effective to provide and install such a net-like RFI/EMI shielding means in a very reliable way.

The washing machine substantially comprises an outer cabinet in which a ballasted washing tub is hanged through spring suspension means, said tub accomodating a rotating drum accessible through a loading door. According to a feature of the present invention, the ballast means used for said washing tub has the same type of structural construction as the one described for the afore illustrated rear panel. Referring to Figures 5 and 6, it can be seen how an outer shell 7 of plastic material is prepared in this connection to such a shape and size as to be capable of being conveniently applied and fixed to that washing tub, wherein the method used to manufacture said outer shell can be selected among several appropriate ones being available from the state of the art.

Said outer shell 7 is then filled, much in the same way as just described for the rear panel, with sound-absorbing material 8, wherein calcium carbonate is preferably used to this purpose, considering its inherent advantages as described above.

Furthermore, a ballast means as the above illustrated one has additional advantages over traditional cast-iron or concrete ballast means. A first advantage over concrete ballast means, which tend to crumble at the long run due so as to give off concrete particles or powder that are likely to obstruct and clog operational and control devices such as in particular control buttons and the moving parts of the programme control switch, resides in that the ballast means according to the present invention does completely away with this drawback.

A second advantage derives from the fact that using plastics to make such a shell 7 enables it to

be moulded into a wide variety of shapes and volumes according to any particular need, owing to the inherent flexibility of plastics processing techniques.

As a result, especially in the case of washing machines that perform spin-extraction at high revolution speeds of the rotating drum and therefore require a considerable balancing effect through correspondingly sized ballast means, it is possible that said shell be moulded into such a shape as to achieve full adaptability and optimum utilization of spaces or volumes available all around the tub, so as to practically maximize the inner volume of said shell. This enables the overall weight of the ballast means to be increased in a significant way, doing away with the need of making use of a cast-iron ballast means which, for a similar weight, would be much more expensive.

In an advantageous way, the flange 9 used in some types of washing machines to join the ballast means to the tub, and consisting of a metal ring embedded in the concrete mass of the ballast means, can with the above described manufacturing technique be easily made integral, ie. as a single piece, with said outer shell 7, thereby achieving a further simplification in the construction along with a reduction in costs.

Referring now specially to dishwashing machines, the teachings of the descriptions set forth above enable anyone who is skilled in the art to implement an appropriate plastic enclosure, filled with calcium carbonate, whose shape and size are such as to provide the required ballast means with the desired properties and features.

Il will further be appreciated that each clothes washing machine or dishwashing machine with structural elements and/or ballast means similar or substantially equivalent to the afore described ones can be made also to other forms than those described and illustrated herein, without however departing from the scopes of the present invention.

Claims

1. Clothes washing or dishwashing machine comprising an outer cabinet and a rear wall that has an aperture delimited by edges (5) joining to the outer structure of the cabinet, said aperture being closed by a rear panel (1), characterized in that a cavity (2) having a limited thickness, and extending to cover substantially the entire surface of said rear panel, is formed in said rear panel (1), said cavity (2) being filled with sound-absorbing material (3).

2. Machine according to claim 1, characterized in that said rear panel (1) is made of plastics, preferably by a blow-moulding technique.

3. Machine according to claim 2, characterized in that a metal shielding means (6) is applied to said rear panel (1).

4. Machine according to claim 3, characterized in that said metal shielding means (6) consists of a net-like element.

5. Machine according to claim 3 or 4, characterized in that said metal shielding means (6) is embedded in the plastic structure of said rear panel.

6. Machine according to claim 3 or 4 or 5, **characterized in that** said metal shielding means (6) is connected with a grounding terminal of said machine.

7. Machine according to any of the preceding claims, **characterized in that** said sound-absorbing material (3) comprises calcium carbonate.

8. Clothes washing or dishwashing machine, comprising an outer cabinet in which a washing tub and ballast means are arranged, **characterized in that** said ballast means consist of an outer enclosure (7) made of preferably blow-moulded plastics, said outer enclosure being filled with ballast material comprising calcium carbonate (8).

9. Machine according to claim 8, **characterized in that** said outer enclosure (7) comprises an outer flange (9) being substantially circular in shape and moulded integrally with said outer enclosure (7).

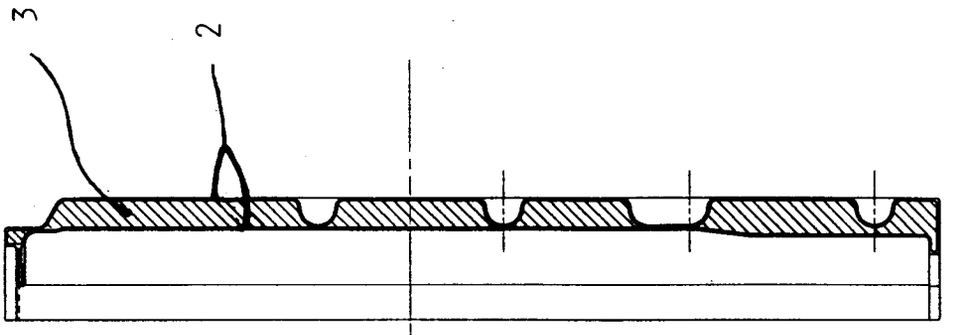


FIG. 2

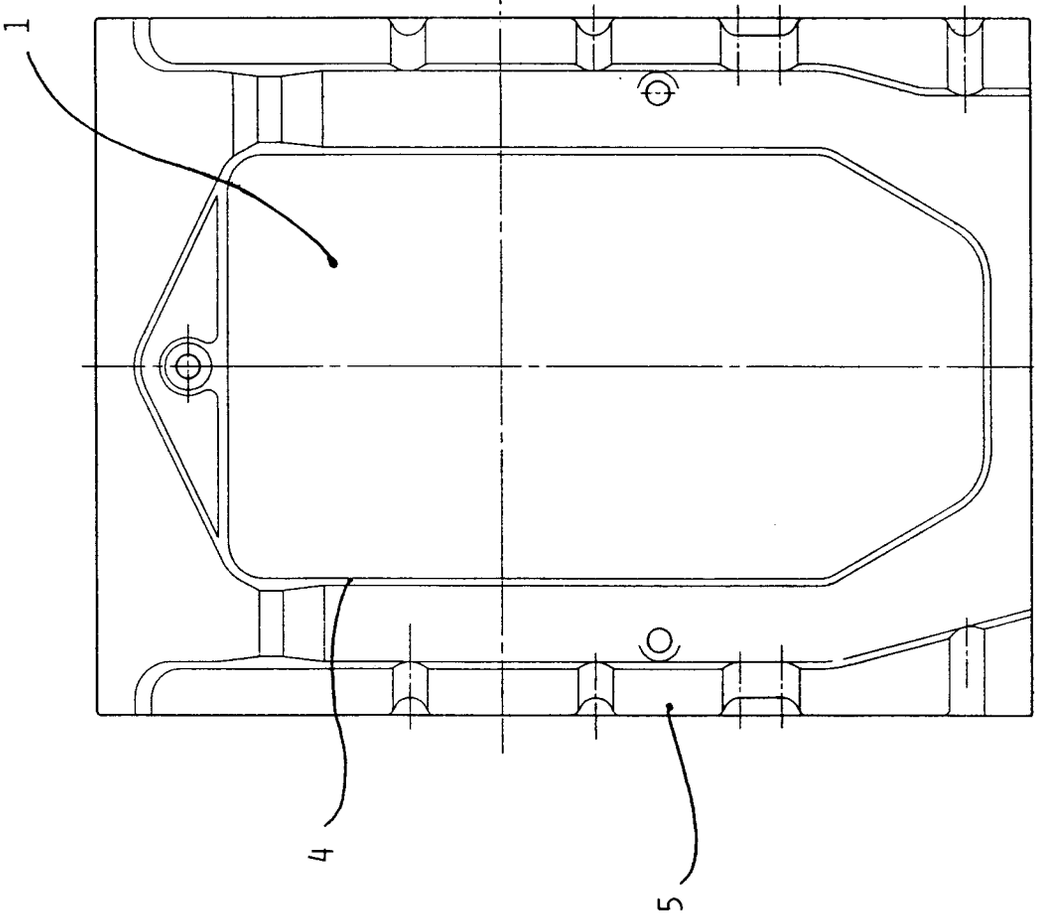


FIG. 1

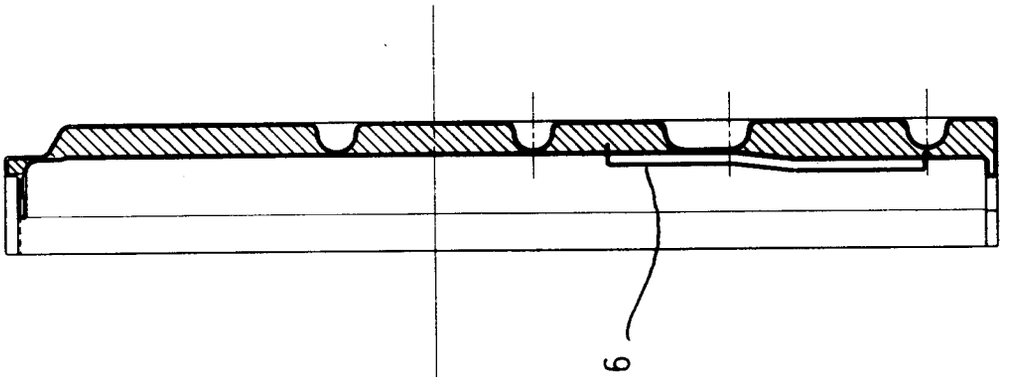


FIG. 4

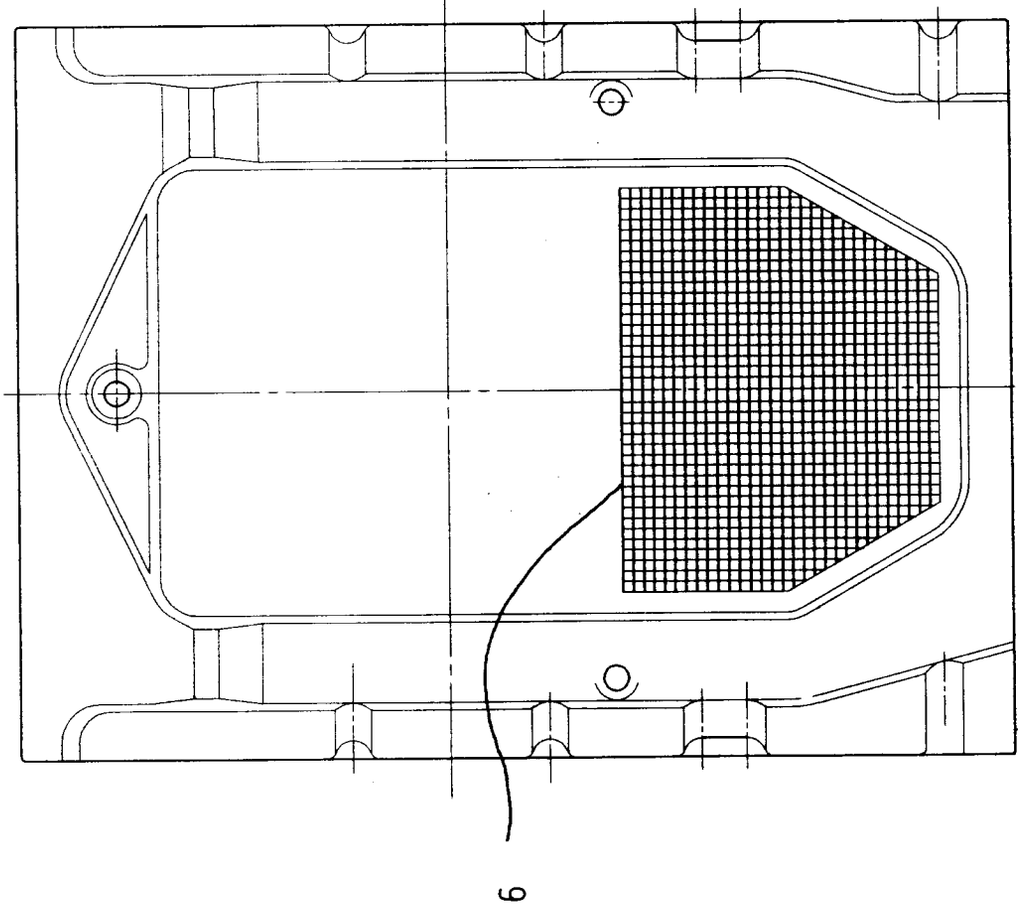
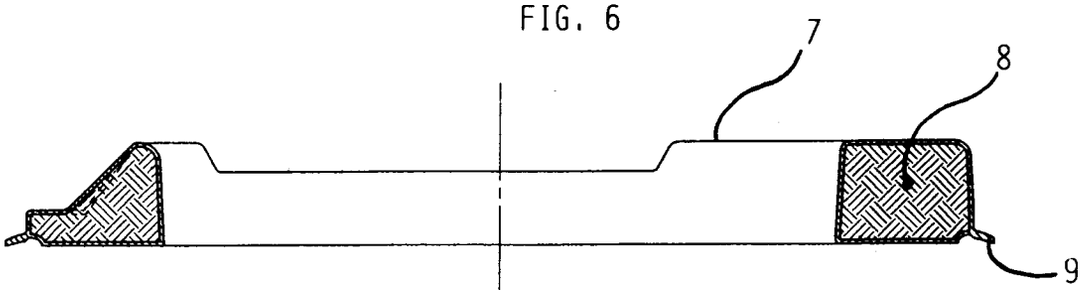


FIG. 3

FIG. 6



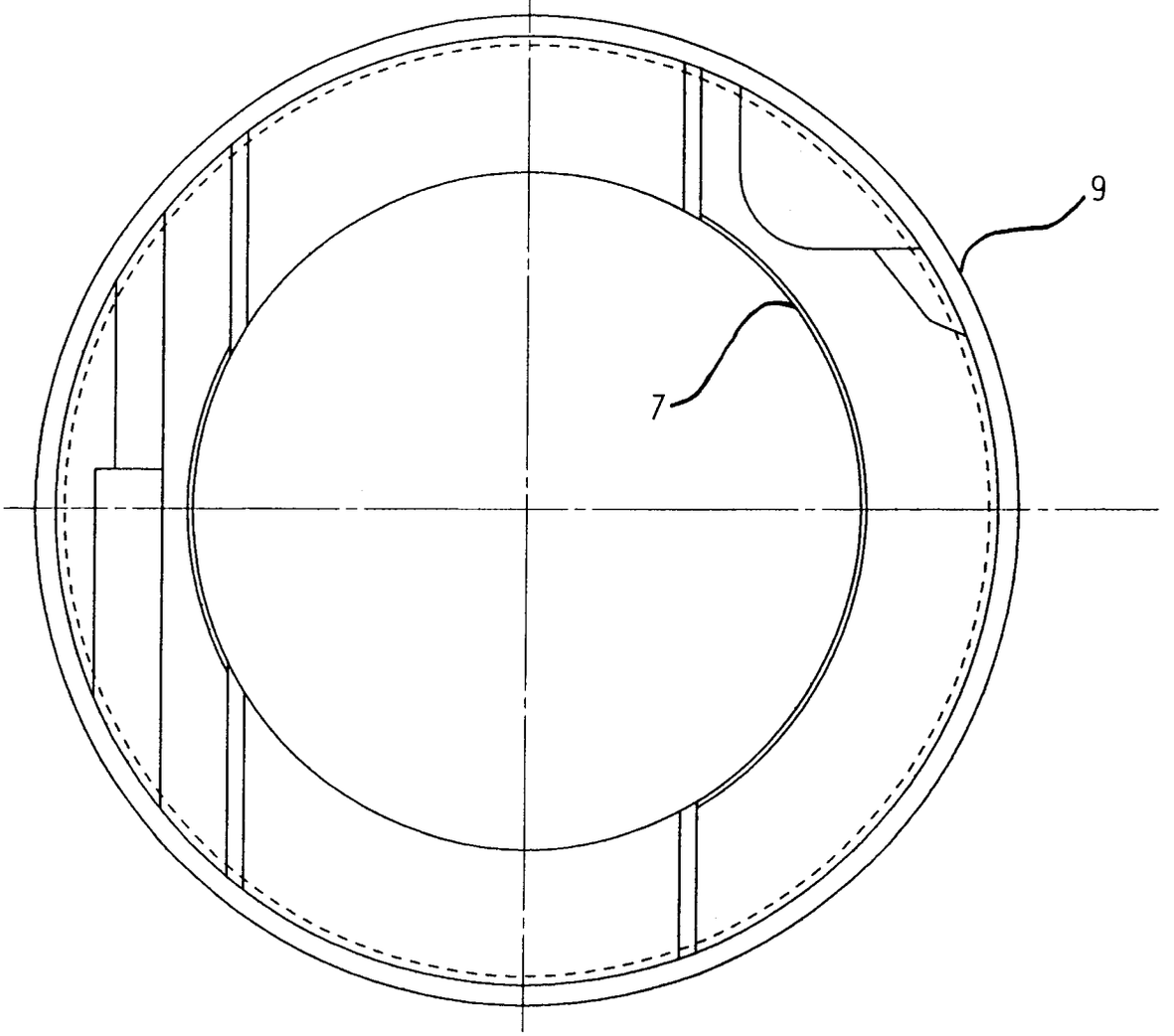


FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 93 10 3205

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-1 536 089 (BOSCH-SIEMENS HAUSGERÄTE GMBH) * claims; figure *	1,2	D06F39/12 D06F37/26 D06F37/22 A47L15/42
A	GB-A-2 232 422 (SANYO ELECTRIC CO LTD) * claims; figures *	1,2,7	
A	DE-U-7 408 514 (BLOMBERG-WERKE KG) * claims; figures *	1,2	
A	PATENT ABSTRACTS OF JAPAN vol. 015, no. 167 (C-0827)26 April 1991 & JP-A-30 37 024 (MATSUSHITA ELECTRIC IND CO LTD) 18 February 1991 * abstract *	1,2	
A	DD-C-283 293 (VEB WASCHGERÄTEWERK SCHWARZENBERG) * page 2; figures *	1	
A	GB-A-2 168 387 (DOMAR SA) * figure 1 *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	FR-A-2 654 443 (INDUSTRIE ZANUSSI S.P.A.) * page 6, line 11 - line 18; claim; figures *	8,9	D06F A47L
A	EP-A-0 326 502 (G. MARTINEZ) * figures *	8	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 JUNE 1993	COURRIER G.L.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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