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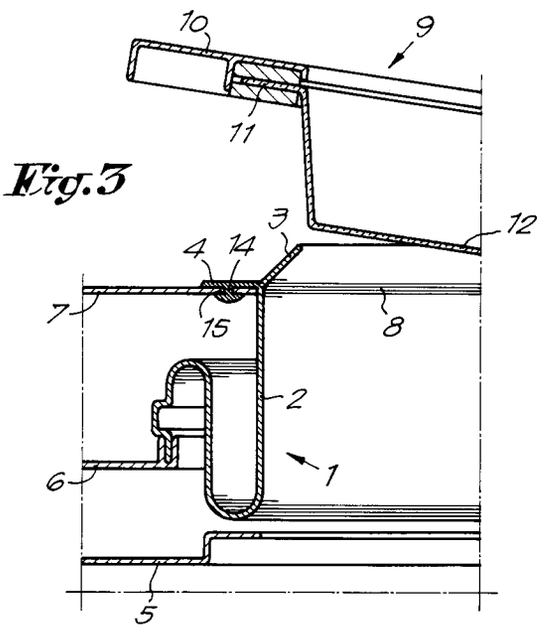
(54) Elastic sealing ring for washing and drying machines and similar machines and a machine provided with such a sealing ring.

(57) The elastic sealing ring (1) for the sealing between the edge of an opening (8) in an outer wall (7) and a part (12) of a door (9) penetrating in said opening (8) has a ring-shaped body (2) and a fastening flange (4) provided on an end thereof protruding outwards as seen from the radial direction made of a hard material for the fastening onto the outer wall (7) and an elastic, deformable lip (3) protruding inwards as seen from this radial direction which forms the actual sealing and is designed to fit up against the penetrating part (12) of the door (9), whereby this lip (3) is made of a thermoplastic elastomer with rubber-like qualities, which forms a whole with the hard material of the fastening flange (4) as a result of injection moulding onto or together with the hard material in one mould.

Fig.3



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The invention concerns an elastic sealing ring for washing and drying machines and similar machines, for the sealing between the edge of an opening in an outer wall and a part of a door penetrating in said opening, whereby said sealing ring has a ring-shaped body and a fastening flange provided on the end thereof protruding outwards as seen from the radial direction for the fastening onto the outer wall and an elastic, deformable lip protruding inwards as seen from this radial direction which forms the actual sealing and is designed to fit up against the penetrating part of the door.

Washing machines usually have a drum which is mounted such that it can revolve in a tub. The whole is surrounded by a housing in which the tub is fixed by means of springs and/or rubber blocks. In an outer wall of this housing, namely the front panel in what is called a front loader, a filling opening is provided which is closed by means of a door, which is usually equipped with a tub-shaped glass part. The sealing ring not only provides a sealing between this door and the outer wall, but also closes off the opening between said outer wall and the drum with its body, and therefore is fixed to the frame on the inside of the housing.

Consequently, this sealing ring must not only provide a sealing, but must also be able to absorb vibrations both during the start-up with an unbalanced load as during different rotational speeds, it must be resistant to detergents and oils and to temperatures up to 120 °C, it must be sufficiently non-abrasive and must have enough flexural strength and must reassume its original shape as much as possible after having been pressed together for a certain time.

In order to meet these requirements as well as possible, the known sealing rings of good quality are made of natural or synthetic rubber.

However, rubber is a relatively costly product, so that such a sealing ring is relatively expensive. Moreover, this sealing ring is relatively heavy. Its fastening onto the outer wall does not only require a special shape of the edge of the opening in the outer wall, since it is stretched over an edge of said outer wall with its outwardly protruding flange, moreover a straining ring must be used for reasons of safety, which makes the mounting of the sealing ring more difficult. Furthermore, the shape of the outwardly protruding fastening flange is relatively complex.

Further, rubber is a material which cannot be recycled in an economic manner.

The invention aims to remedy these disadvantages and to provide an elastic sealing ring for washing and drying machines and similar machines which is relatively inexpensive, which can be easily recycled and which meets the operational requirements to a great extent.

This aim is reached according to the invention because the outwardly protruding fastening flange is made of a hard material (for example polypropylene, a hard thermoplastic elastomer, a metal, etc.), whereas the elastic, deformable, inwardly protruding lip is made of a thermoplastic elastomer with rubber-like qualities, which forms a whole with the hard material of the fastening flange as a result of injection moulding onto or together with the hard material in one mould. Thermoplastic elastomers are known as such. They are described among others by G. Halber & Schroeder in "Thermoplastic Elastomers - A Comprehensive Review" (Hanser Publisher Munich (1987)). Depending on their composition, they have similar qualities as rubber or similar qualities as hard plastic. Naturally, the first-mentioned elastomers must be used for the lip. Thanks to their mechanical qualities they can provide a sealing, absorb the vibrations and ensure the non-abrasion. Thanks to their chemical qualities their resistance against detergents and the high temperature is ensured. The thermoplastic elastomers can be easily recycled. The flange made of hard material can be easily fastened to the outer wall and especially in a secure manner, for example by means of mechanical means, so that no straining ring or such must be used. Moreover, the sealing ring can be made lighter than with rubber because the fastening flange has a simpler shape (the complex shape, known for rubber sealings, can be omitted) and the rest of the ring can be made with a smaller thickness.

It has been tried before to make the sealing ring entirely of such thermoplastic elastomer with rubber-like qualities, but these attempts did not lead to a satisfactory result, among other things because the low tear strength of the material made it difficult to take the ring with the complex shape out of the mould.

Moreover, this sealing ring only met the operational requirements of the washing machine producers with difficulty.

The hard material of which the fastening flange is made can also be a thermoplastic elastomer, but with the qualities of hard plastic. This hard material can also be an ordinary plastic such as polypropylene. In both cases this material is made together with the rest of the sealing ring in a mould by means of injection moulding. The hard material could even be metal.

In a particular embodiment of the invention, also the body of the sealing ring is made of thermoplastic elastomer.

The invention also concerns a washing or drying machine or the like which has an outer wall which is provided with an opening, a door with a part which, in closed position, has penetrated in the opening, and a sealing ring which provides the

sealing between the edge of the opening and the penetrated part of the door and which is characterized in that the sealing ring is a ring according to any of the previous embodiments, in that the fastening flange of hard material is fixed around the opening to the outer wall so that the elastic, deformable lip is situated in or opposite the opening.

The fastening flange of hard material can be fastened on the inside as well as on the outside of the outer wall.

Preferably, the fastening flange of hard material which is fastened against the outer wall forms an angle with the body which is different from the angle in the case where the sealing ring is not mounted so that the lip, which forms an angle with this fastening flange, also forms another angle with the body after the mounting of the sealing ring than before the mounting, and is put under an elastic strain in relation to the body after the mounting.

In order to better explain the characteristics of the invention, the following preferred embodiments of an elastic sealing ring for washing and drying machines and similar machines and of a washing machine equipped with such a sealing ring according to the invention are described as an example only without being limitative in any way, with reference to the accompanying drawings, where:

figure 1 represents a front view of a sealing ring according to the invention;

figure 2 shows a section according to line II-II from figure 1;

figure 3 shows a section analogous to that in figure 2, but after the sealing ring has been mounted on a washing machine of which a part is represented and whose door is open;

figure 4 shows a section analogous to that in figure 3, but with closed door;

figure 5 shows a section analogous to that in figure 3, but with reference to another way of mounting the sealing ring.

The elastic sealing ring 1 represented in the figures consists of a ring-shaped body 2 and, on an end thereof, an elastic, deformable lip 3 on the one hand, and a fastening flange 4 made of hard material on the other hand.

When the sealing ring 1 is not mounted as represented in the figures 1 and 2, and thus when it comes out of the mould, the lip 3 sticks inside in a slanting manner as seen from the radial direction in relation to the body 2 and it sticks outside in a slanting manner as seen from the axial sense in relation to said body 2, whereas the fastening flange 4 forms an angle of approximately 90° with the lip 3, and sticks outside in a slanting manner in relation to the body 2 as seen from both the radial and the axial sense.

The end of the body 2 which is turned away from the lip 3 is, as seen axially from the outside, bent twice over 180 degrees, once towards the opposite end, and again in the opposite sense.

The body 2 and the lip 3 are made of a thermoplastic elastomer with rubber-like qualities, whereas the fastening flange 4 is made of hard material.

Naturally, as a thermoplastic elastomer is selected an elastomer which has practically the same qualities as rubber and which meets the requirements for washing machines. Not only must the elastomer be able to absorb vibrations, it must also be resistant to temperatures of up to 120 °C and to detergents and oils. It must be sufficiently non-abrasive and have a large flexural strength. After having been pressed together or having been deformed for a length of time, it must reassume its original position as well as possible when released again.

According to one embodiment, the hard material for the fastening flange 4 is also a thermoplastic elastomer, but with the qualities of hard plastic.

According to another embodiment, this hard material is an ordinary plastic, in particular a thermoplastic synthetic such as polypropylene.

According to both embodiments, the thermoplastic elastomer with rubber-like qualities and the hard material (or the thermoplastic elastomer with the qualities of plastic) are made of one piece through injection moulding in one and the same mould.

According to yet another embodiment, the hard material is metal. The thermoplastic elastomer with rubber-like qualities was injected onto this metal, which was provided in the mould, through injection moulding.

In all these embodiments, the thermoplastic elastomer with rubber-like qualities of the body 2 and the lip 3 form one whole with the hard material of the fastening flange 4.

Figures 3 to 5 represent a part of a washing machine of what is called the "front loader" type, in which the sealing ring 1 is mounted.

This washing machine contains in the usual manner a drum 5 which is mounted in a rotatable manner around a horizontal shaft in a tub 6. This tub 6 is surrounded by a housing of which a part of the outer wall is represented in figures 3 to 5, namely a part of a front panel 7. The tub 6 is suspended in this housing by means of springy elements which for clarity's sake are not represented in the figures.

The front panel 7 is provided with a round filling opening 8 which can be shut off by means of a door 9 which is fixed on the outside of the front panel 7 by means of hinges. This door 9 consists of a metal ring 10 and a glass 11 mounted therein with a tub-shaped part 12 which, when the door 9

is in closed position, sticks through the filling opening 9 and extends inside the housing.

The above-mentioned sealing ring 1 provides for the sealing between the front panel 7 and more in particular the edge of the filling opening 8 on the one hand, and the tub-shaped part 12 on the other hand.

The fastening flange 4 is fastened mechanically to the edge of the filling opening 8 so that the lip 2 is directed forward in a slanting manner and the body 2 is situated inside the housing. The end of the body 2 situated inside the housing is fixed mechanically to the tub 6. With one of its bends over 180°, this body 2 is situated inside the opening in the tub 6, situated opposite the filling opening 8 in the front panel 7, practically against the rotatable drum 5.

In this way, the part of the body 2 which fits up against the lip 3 and the fastening flange 4 extends almost perpendicular to said fastening flange 4, which implies that during the mounting the fastening flange 4 must be turned from the position represented in figures 1 and 2 which it assumes in relation to the body 2 when it is not mounted. This turning is possible thanks to the elastic deformation of the body 2 and because the fastening flange 4 has interruptions 13 on its perimeter. As the fastening flange 4 is turned, the lip 3 turns slightly with it in the same sense in relation to the body 2, so that the lip 3 is put under strain, which is favourable to the sealing.

For, when the tub-shaped part 12 penetrates in the filling opening 8 as the door 9 is closed, it comes into contact with the elastic, deformable lip 3 under strain and said lip 3 is folded elastically inward as represented in figure 4.

In the embodiment represented in figures 3 and 4, the fastening flange 4 is fastened on the outside, i.e. on the front side of the front panel 7. This flange 4 is provided with taps 14 on its back which fit through the openings 15 which are provided next to the filling opening 8 in the front panel 7. The ends of the taps 14 are flattened on the inside of the front panel 7, for example by means of a warmed stamp, so that these taps so to say form rivets with which the fastening flange 4 is securely fastened to the front panel 7.

The embodiment represented in figure 5 differs from the above-described embodiment in that the fastening flange 4 is fastened against the inside of the front panel 7. Also in this case, the fastening flange 4 is provided with taps 14, but on the front side. Moreover, these taps 14 are threaded. They stick through the openings 15 in the front panel 7, and on the front side of this front panel 7, nuts 16 are screwed on the taps 14.

Thanks to the use of thermoplastic elastomer, the sealing ring 1 is less expensive and easier to recycle than a rubber ring. The part 2,3 made of this material has the same qualities as a rubber ring and has similar or even better mechanical and chemical qualities. Thus, the thickness of the body 2 may be smaller than when rubber is used, so that partly due to the simpler shape of the fastening flange 4, the sealing ring 1 is lighter than if it were made of rubber.

Moreover, as the fastening flange 4 is made of hard material, the fastening onto the outer wall is easy and secure. A hard on hard mounting is obtained which makes it possible to use traditional fastening methods. The use of a straining ring is unnecessary, which simplifies the mounting.

As the lip 3 is put under strain after the mounting, a relatively thin lip will do. This strain is obtained by the mounting itself without any special shape of the front panel being required, unlike in the case of a rubber sealing ring, where a tension is obtained because it is stretched elastically over an edge of the front panel.

The present invention is by no means limited to the above-described embodiments represented in the accompanying drawings; on the contrary, such a sealing ring and washing and drying machines or similar machines equipped with such a sealing ring can be made in all sorts of variants while still remaining within the scope of the invention.

In particular, the fastening of the fastening flange made of hard material must not necessarily be carried out in the manner as described above and represented in the drawings. Any mechanical fastening whatsoever is possible, for example by means of screws, plugs, etc.

Neither is the sealing ring restricted to washing machines with front loading. It can also be used for washing machines with top loading or for drying machines or similar machines, and more in particular for all machines requiring a sealing between an outer wall and a door which in closed position penetrates with a part in an opening in the outer wall, and especially for such machines which have a part which is spring-mounted in a housing which for example carries a rotating drum.

Claims

1. Elastic sealing ring (1) for washing and drying machines and similar machines, for the sealing between the edge of an opening (8) in an outer wall (7) and a part (12) of a door (9) penetrating in said opening (8), whereby said sealing ring (1) has a ring-shaped body (2) and a fastening flange (4) provided on an end thereof protruding outwards as seen from the radial direction for the fastening onto the outer wall (7) and an elastic, deformable lip (3) protruding

inwards as seen from this radial direction which forms the actual sealing and is designed to fit up against the penetrating part (12) of the door (9), characterized in that the outwardly protruding fastening flange (4) is made of a hard material, whereas the elastic, deformable, inwardly protruding lip (3) is made of a thermoplastic elastomer with rubber-like qualities, which forms a whole with the hard material of the fastening flange (4) as a result of injection moulding onto or together with the hard material in one mould.

2. Elastic sealing ring (1) according to the above claim, characterized in that the hard material of which the fastening flange (4) is made is a thermoplastic elastomer with the qualities of hard plastic which is made together with the rest of the sealing ring (1) in a mould by means of injection moulding.

3. Elastic sealing ring (1) according to claim 1, characterized in that the hard material of which the fastening flange (4) is made is plastic which is made together with the rest of the sealing ring (1) in the mould by means of injection moulding.

4. Elastic sealing ring (1) according to claim 1, characterized in that the hard material of which the fastening flange (4) is made is metal.

5. Elastic sealing ring (1) according to any of the above claims, characterized in that also the body (2) of the ring is made of thermoplastic elastomer.

6. Washing or drying machine or the like which has an outer wall (7) which is provided with an opening (8), a door (9) with a part (12) which, in closed position, has penetrated in the opening (8), and a sealing ring (1) which provides the sealing between the edge of the opening (8) and the penetrated part (12) of the door (9) and which is characterized in that the sealing ring (1) is a ring according to any of the previous claims, in that the fastening flange (4)) of hard material is fixed around the opening (8) to the outer wall (7) so that the elastic, deformable lip (3) is situated in or opposite the opening (8).

7. Machine according to the above claim, characterized in that the fastening flange (4) of hard material which is fastened against the outer wall (7) forms an angle with the body (2) which is different from the angle in the case where the sealing ring (1) is not mounted so that the lip (3), which forms an angle with this fastening flange (4), also forms another angle with the body (2) after the mounting of the sealing ring (1) than before the mounting, and is put under an elastic strain in relation to the body (2) after the mounting.

8. Machine according to claim 7, characterized in that the fastening flange (4) of hard material shows local interruptions on the perimeter of the sealing ring (1).

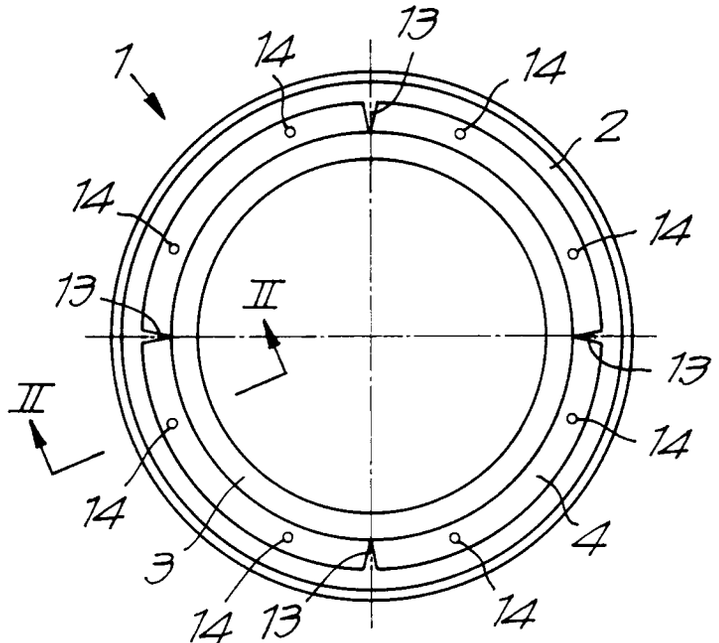

Fig.1

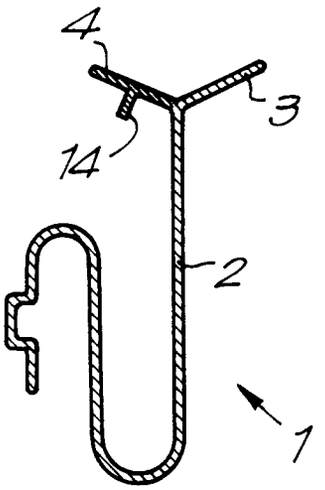

Fig.2

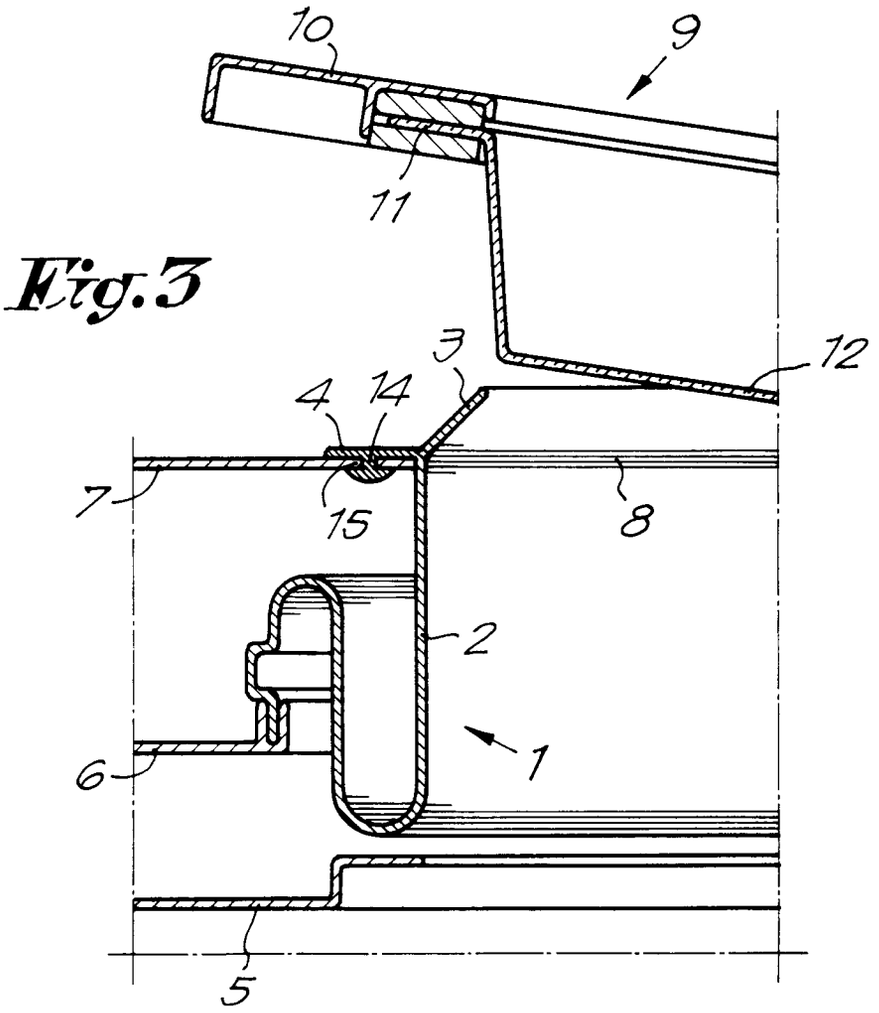

Fig.3

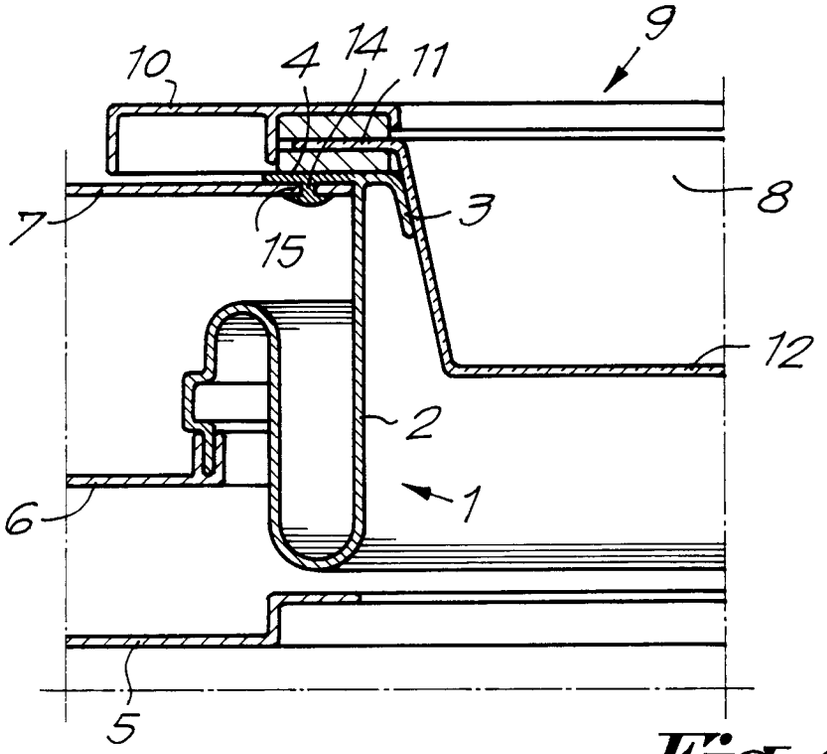

Fig. 4

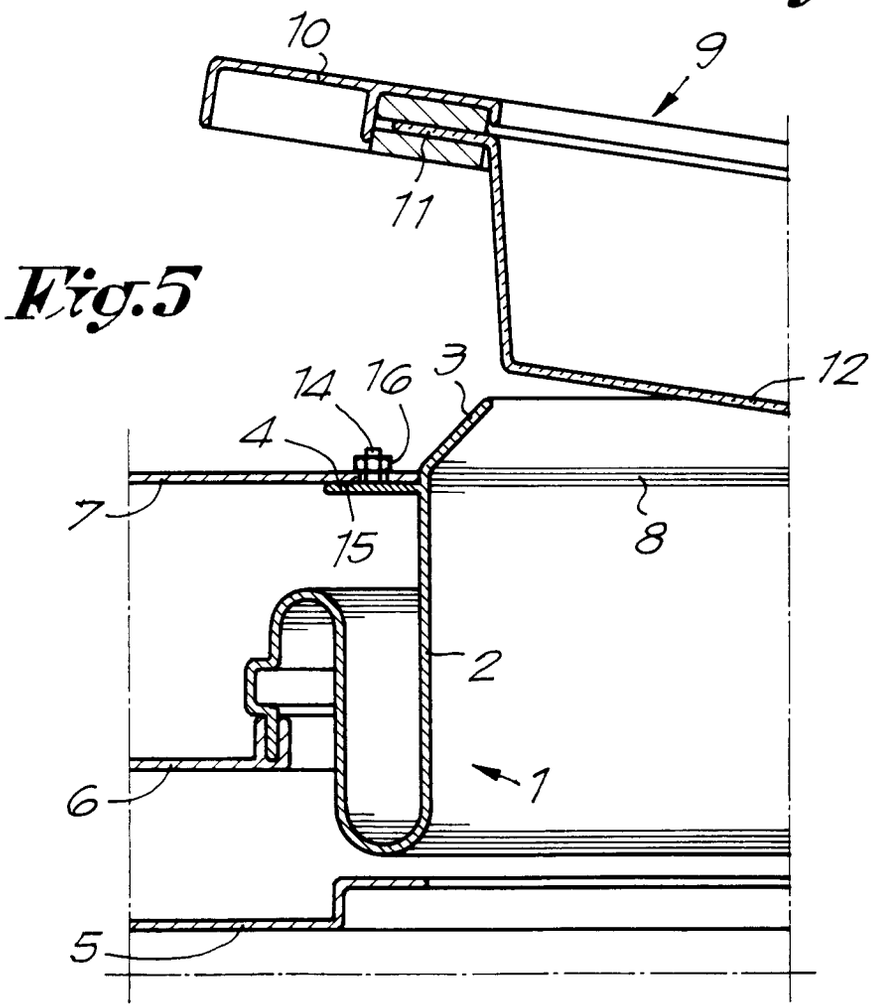

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 94 20 3470

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.6)
A	EP-A-0 266 239 (CIAPEM) * abstract; figures *	1	D06F37/26
A	DE-U-88 01 392 (INDUSTRIE ZANUSSI S.P.A.) * claims; figure *	1	
A	FR-A-2 215 503 (BRITISH DOMESTIC APPLIANCES LIMITED) * page 7, line 6 - line 18; figure 3 *	1	
A	DE-A-15 85 607 (BROWN BOVERI & CIE AG) * figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	23 February 1995	Courrier, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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