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(54) Front load laundry washing-machine

(57) A front load laundry washing-machine is described which comprises a cabinet (10) provided with a front wall (9) that has an opening (11) for the loading of laundry to be washed and has a door (210) suitable to close said opening (11). The cabinet comprises a washing tub (12) mounted inside of it and containing a drum (150) mounted inside the tub (12) in revolving way; the drum (150) and the tub (12) have respective openings (152, 17) lined up with each other and with the opening (11). A coupling duct (200) is also provided between the opening (17) of the washing tub (12) and the opening (11) of the cabinet (10). The drum (150) comprises an opening mouth (151) provided with an annular wall (153) that is suitable to cover a portion (201) of said coupling duct (20); said mouth (151) defines with the internal surface (211) of the door (210) in closed position, an additional space of the loading space of the drum (150).

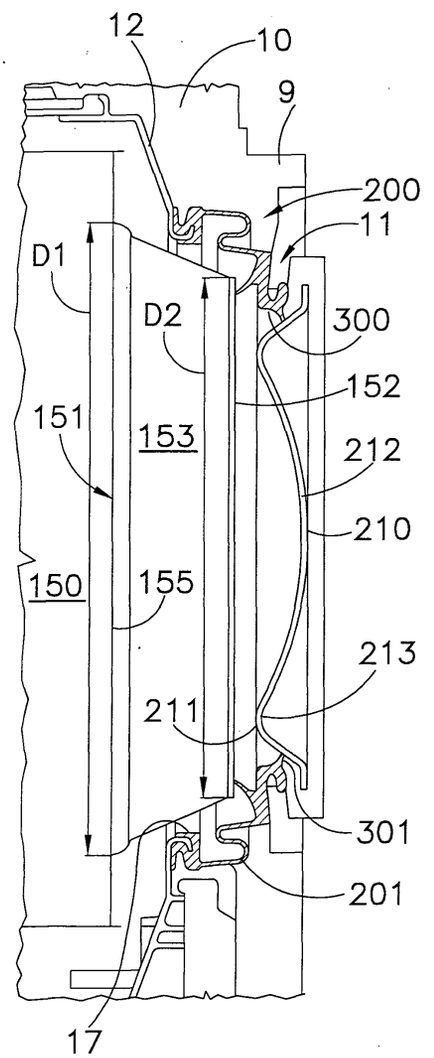

FIG.3

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Description

[0001] The present invention refers to a front load laundry washing-machine.

[0002] As it is usually known, front load laundry washing-machines are made up of a cabinet 10 having a front wall 9 provided with an opening 11 for the loading or the unloading of the laundry, as visible in Figure 1. The cabinet 10 contains a tub 12 suitable to be filled with a laundry washing liquid 14; means 13 for the support and for the suspension of the tub 12 inside the cabinet 10 are provided. A pierced drum 15 is mounted inside the tub 12 in revolving way and it is suitable to contain the laundry. Both the drum 15 and the tub 12 have respective front openings 16 and 17 substantially lined up with the opening 11 of the cabinet 10 for the loading of the laundry into the drum 15. An electric motor 18 with opportune kinematic means 19 allows the rotation of the drum 15 according to pre-established speeds, time and senses of rotation. A coupling duct 20, usually an annular elastic bellows joint, is mounted between the opening 16 of the tub 12 and the opening 11 for the loading of the cabinet 10, as better visible in Figure 2; the opening 11 is closed tightly by a door 21 that is hinged to the front wall 9 of the cabinet 10. Said door 21 has a recess 22 that, once the door has been closed, totally closes the opening of the tub in such a way that no piece of laundry gets in contact with the joint 20 during the washing; the friction between a piece of laundry and the joint could lead to damage said piece of laundry and could also cause a wear of the joint.

[0003] In the patent application EP 1321558 a front load laundry washing-machine with an increased loading space is described. The peculiarity of said laundry washing-machine as compared with the known laundry washing-machines resides in the fact that the coupling duct of said machine, which is mounted between the opening of the tub and the load opening of the cabinet and which is made up of an elastic bellows joint, comprises at least a substantially rigid annular band that covers at least in part said elastic bellows joint of the coupling duct. Said annular band delimits, with the internal surface of the door in closing position, a space that forms an extension of the loading space of the drum.

[0004] In view of the state of the art herein described, scope of the present invention is to provide a front load laundry washing-machine provided with a increased loading space made up in a way different from the known art.

[0005] According to the present invention, such scope is attained by means of a front load laundry washing-machine comprising a cabinet comprising a front wall provided with an opening for the loading of laundry to be washed and with a door suitable to close said opening, a washing tub mounted inside the cabinet and containing a drum mounted inside the tub in revolving way, the drum and the tub having respective openings lined up with each other and with the opening of the cabinet, a coupling duct between the opening of the washing tub and the opening of the cabinet, characterised in that said drum comprises an opening mouth provided with an annular wall that is suitable to cover a portion of said coupling duct, said mouth defines with the internal surface of the door in closed position an additional space of the loading space of the drum.

[0006] The characteristics and the advantages of the present invention will become evident from the following detailed description of embodiments thereof, that are illustrated as non-limiting examples in the enclosed drawings, in which:

Figure 1 schematically shows in vertical section a laundry washing-machine according to the known art;
Figure 2 schematically shows in transversal section a detail of the laundry washing-machine of Figure 1;
Figure 3 schematically shows in vertical section a detail of a laundry washing-machine according to a first embodiment of the invention;
Figure 4 schematically shows in section a detail of a laundry washing-machine according to a second embodiment of the invention;
Figure 5 schematically shows in transversal section a detail of the laundry washing-machine in Figure 3;
Figure 6 shows a magnified detail of Figure 5;
Figure 7 schematically shows in perspective a laundry washing-machine according to one of the previous embodiments but provided with a different door.

[0007] With reference to Figure 3 there are shown only a few parts of a laundry washing-machine according to the invention. The parts that not shown are of known type and of a traditional laundry washing-machine in addition the parts that are in common with the machine in Figure 1 will be identified by the same numerical references. The coupling duct 200, arranged between the opening 17 of the washing tub 12 and the opening 11 of the front wall 9 of the cabinet 10, comprises a first portion 201, preferably made up of an elastic bellows joint as shown in Figure 3, that is covered by an extension of the opening 152 of the washing drum 150. In fact the washing drum 150 has a mouth 151 whose annular wall 153 extends to get close to the internal surface 211 of the door 210. Said mouth 151 is defined by an extension of the drum and its annular wall 153 it has dimensions such as to cover the portion 201 of the coupling duct 200.

[0008] The mouth 151 defines with the internal surface 211 of the door 210 in close position, an additional space of the loading space of the drum 150.

[0009] The coupling duct 200 comprises the annular bellows type joint 201 associated with the opening 17 of the washing tub 12 and an additional portion made up of an elastic annular joint 300 located between the external opening 152 of the mouth 151 and internal surface

211 of the door 210. The annular joint 300 is connected with the bellows joint 201 and it is located on a part of the opening 11 of the front wall 9 of the cabinet 10.

[0010] The mouth 151 has a funnel shape since the diameter D1 of its opening 155 inside the drum 150 is greater than the diameter D2 of its external opening 152 in proximity to the door 210. Said funnel shape allows the laundry to rest on the internal wall of the mouth and to neutralise the compression action due to the thrust action of the laundry on the glass of the door during the washing step or the centrifugal step. In addition said funnel shape favours the sliding of the laundry toward the inside of the drum 150.

[0011] In the embodiment of Figure 3 the mouth 151 comprises an annular wall 153 having a substantially rectilinear longitudinal section; in this way the diameter D1 of the opening 155 is slightly greater than the diameter D2 of the external opening 152.

[0012] In a second embodiment of the present invention, shown in Figure 4, the mouth 151 comprises an annular wall 153 having a curvilinear longitudinal section; the diameter D1 of the opening 155 is almost equal to the internal diameter of the drum 150 whereas the diameter D2 remains unchanged. With such type of mouth 151 an additional loading space larger than the previous embodiment is obtained.

[0013] With the presence of the mouth 151 the space destined to the loading of the laundry to be washed is greater than the one usable with a known laundry washing-machine. During the washing the annular wall 153 also serves as a screen of the elastic bellows joint 201 and since its internal surface is resistant and smooth it guarantees a low friction support for the laundry during the washing step.

[0014] The mouth 151, since it has an annular wall 153 that is inclined with respect to the evolving axis of the drum 150, allows a passage movement of the pieces of laundry towards the drum 150 thus favouring a frequent immersion of the laundry in the central zone of the drum 150 in which the level of the water is higher.

[0015] With an equal volume of loading drum the washing efficiency is improved thus allowing the attainment of higher standard classes of washing and an energy save.

[0016] The door 210 in the embodiment shown in Figure 3 has an internal surface 211 having a concave central part 212 that couples with a convex peripheral part 213. The latter favours the watertight closing of the door 210 since the elastic joint 300 can be conformed with the brim 301 with which the door 210 engages in abutment. The door 210 can be made for example of printed glass with a frame of various material.

[0017] The door 210 can also have a completely flat surface; in such case the elastic joint 300 will be made in such way so as to be able to abut with same the door 210 in closing position thus assuring the watertightness.

[0018] The door 210 is normally hinged to an edge of the opening 11 of the wall 9 of the cabinet 10, however it can be of the type shown in Figure 7 and described in the European patent application No. 02425324.7 of 22 May 2002. Said door comprises two levers arranged on opposite sides of the door and having first ends in revolving engagement with the door and second ends in revolving engagement with the front wall; the levers are suitable to assure the vertical movement of the door in a way parallel to the front wall from a closing position of the opening 11 to an opening position in which the door is arranged below or above the opening 11 of the front wall 9 of the cabinet 10 and adjacent to the same front wall.

[0019] On the elastic joint 300 a projection 400, preferably of plastic, is preferably arranged in its bottom part and it extends in radial direction but in a slanted direction with respect to the revolving axis of the drum 150, as visible in Figures 5 and 6. The main function of the projection 400 is to guarantee a movement of the laundry back into the drum 150. The projection 400 induces also a local secondary rotation of the laundry around the axis along the direction of the same projection in axial sense. In order to carry out at best said functions the projection 400 can have an opportune shape; in Figure 5 a projection 400 with a roundish shape is arranged in the bottom part of joint 300. The projections can be one or several and they can be arranged in various parts of the elastic joint 300 in order to carry out the aforesaid functions opportunely.

[0020] The advantages of the laundry washing-machine of the present invention as compared with known laundry washing-machine are multiple, in particular there is a greater loading volume, with equal volume of the drum being utilised, since the mouth 151 confers the laundry washing-machine an additional loading space.

[0021] In addition there is an improved loading ergonomics because the door, usually hinged to the front wall of the cabinet, when opened does not have projecting parts that can hinder the passage of the laundry.

[0022] The thrust of the laundry against the door during the washing step is also reduced therefore the weight and the dimensions of the door can be reduced too.

[0023] Even if not shown in the figures as variation of the embodiment described a laundry washing-machine with slanted axis can be provided with one mouth similar to the mouth 150 as an extension of the drum. The mouth having preferably a funnel shape carries out all the functions already described for the laundry washing-machine of Figures 1-7. The elastic joint of separation between the door and the tub can comprise fins or blades too in order to facilitate the movement of the laundry back into the drum during the washing action.

Claims

1. Front load laundry washing-machine comprising a cabinet (10) comprising a front wall (9) provided

with an opening (11) for the loading of laundry to be washed and with a door (210) suitable to close said opening (11), a washing tub (12) mounted inside the cabinet (10) and containing a drum (150) mounted inside the tub (12) in revolving way, the drum (150) and the tub (12) having respective openings (152, 17) lined up with each other and with the opening (11) of the cabinet (10), a coupling duct (200) between the opening (17) of the washing tub (12) and the opening (11) of the cabinet (10) **characterised in that** said drum (150) comprises an opening mouth (151) provided with an annular wall (153) that is suitable to cover a portion (201) of said coupling duct (20), said mouth (151) defines with the internal surface (211) of the door (210) in closed position an additional space of the loading space of the drum (150).

2. Laundry washing-machine according to claim 1, **characterised in that** said mouth (151) has a funnel shape, said mouth (151) having an internal opening (155) and an external opening (152) in proximity to the internal surface (211) of the door (210), the diameter (D1) of the internal opening (155) being greater than the diameter (D2) of the external opening (152).

3. Laundry washing-machine according to claim 2, **characterised in that** the annular wall (153) of said mouth (150) has a substantially rectilinear section.

4. Laundry washing-machine according to claim 2, **characterised in that** the annular wall (153) of said mouth (150) has a substantially curvilinear section, the diameter (D1) of the internal opening (155) of said mouth (150) being substantially equal to the diameter of the drum (150).

5. Laundry washing-machine according to claim 1, **characterised in that** the portion of said coupling duct (200) covered by the annular wall (153) of said mouth (151) is made up of an annular joint (201) associated with the opening (17) of the washing tub (12).

6. Laundry washing-machine according to claim 5, **characterised in that** said coupling duct (200) comprises an additional portion made up of an additional elastic annular joint (300) located between the external opening (152) of said mouth (151) and the internal surface (211) of the door (210), said additional portion being connected with the annular joint (201) associated with the opening (17) of the washing tub (12).

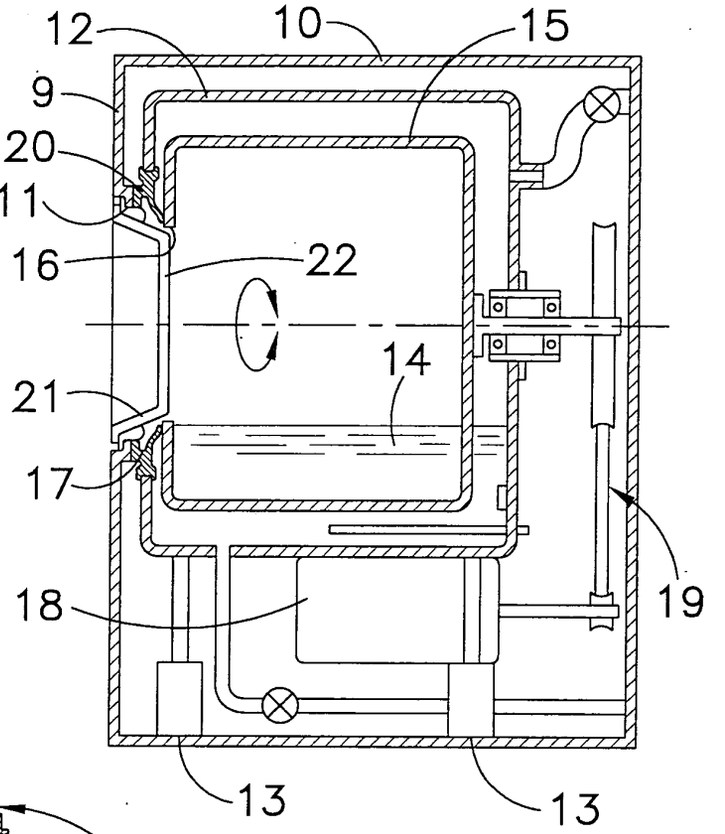
7. Laundry washing-machine according to claim 5, **characterised in that** it comprises at least one projection (400).

8. Laundry washing-machine according to claim 7, **characterised in that** said at least one proj ection (400) extends in a direction inclined with respect to the direction of the revolving axis of the drum (150).

9. Laundry washing-machine according to claim 1, **characterised in that** said internal surface (211) of said door (210) is substantially flat.

10. Laundry washing-machine according to claim 1, **characterised in that** said internal surface (211) of said door (210) comprises a concave part (212).

FIG.1



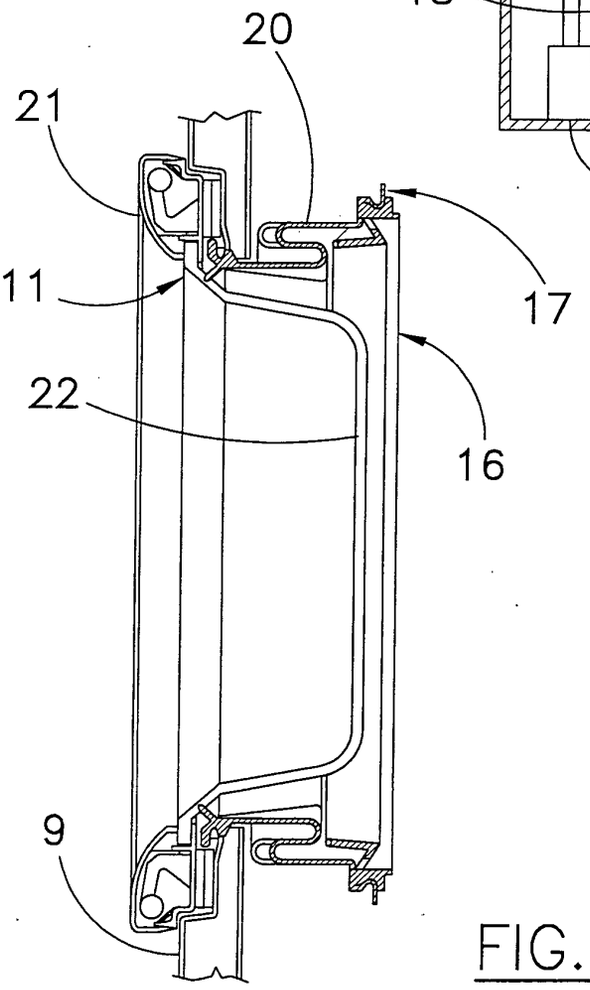


FIG.2

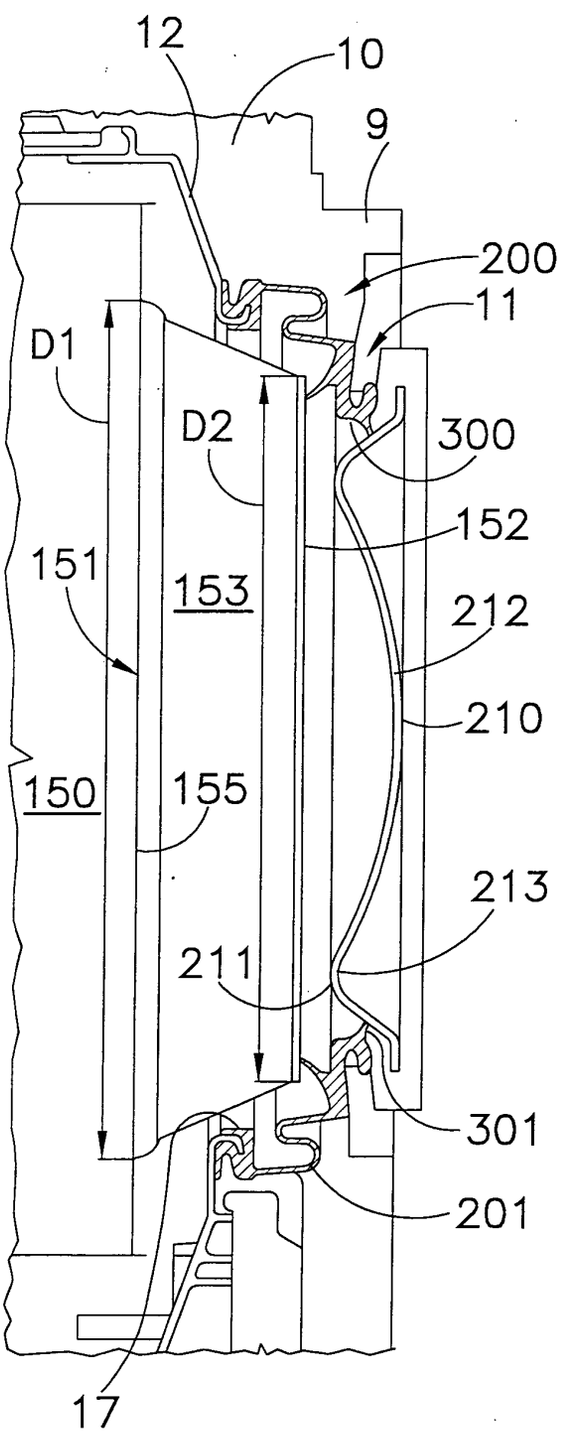

12
10
9
200
11
D1
D2
300
152
151
153
212
210
150
155
213
211
301
201
17

FIG.3

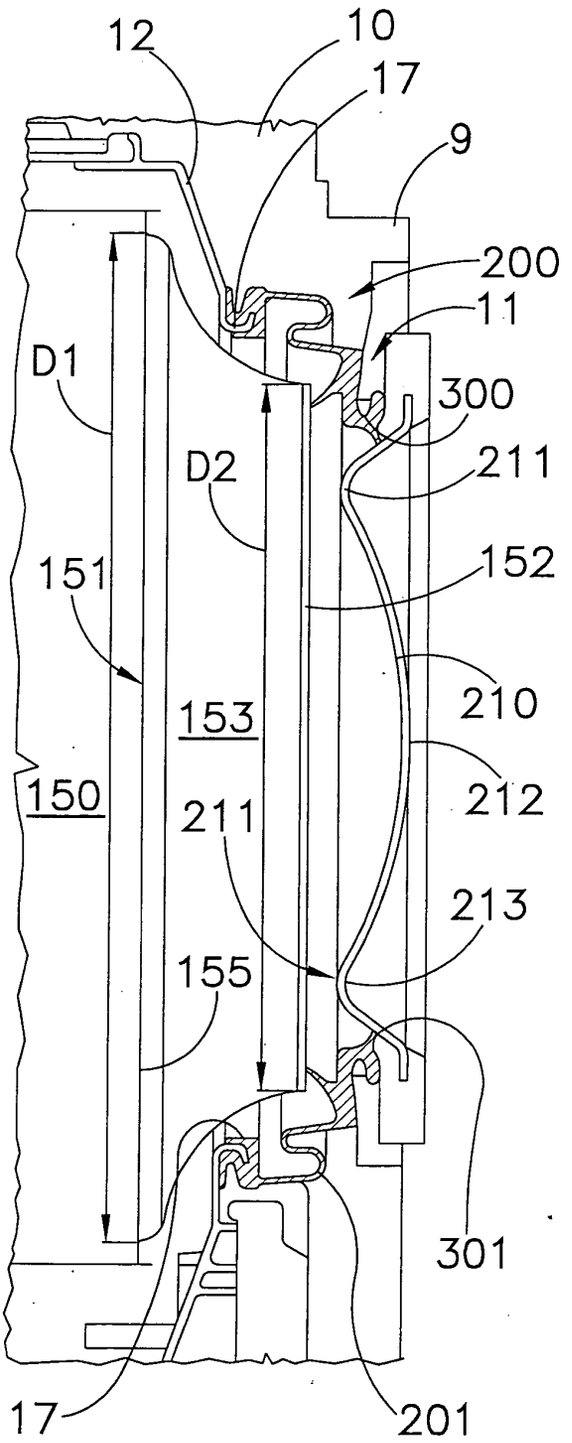

12
10
17
9
200
11
D1
300
D2
211
152
151
153
210
212
150
211
213
155
301
17
201

FIG.4

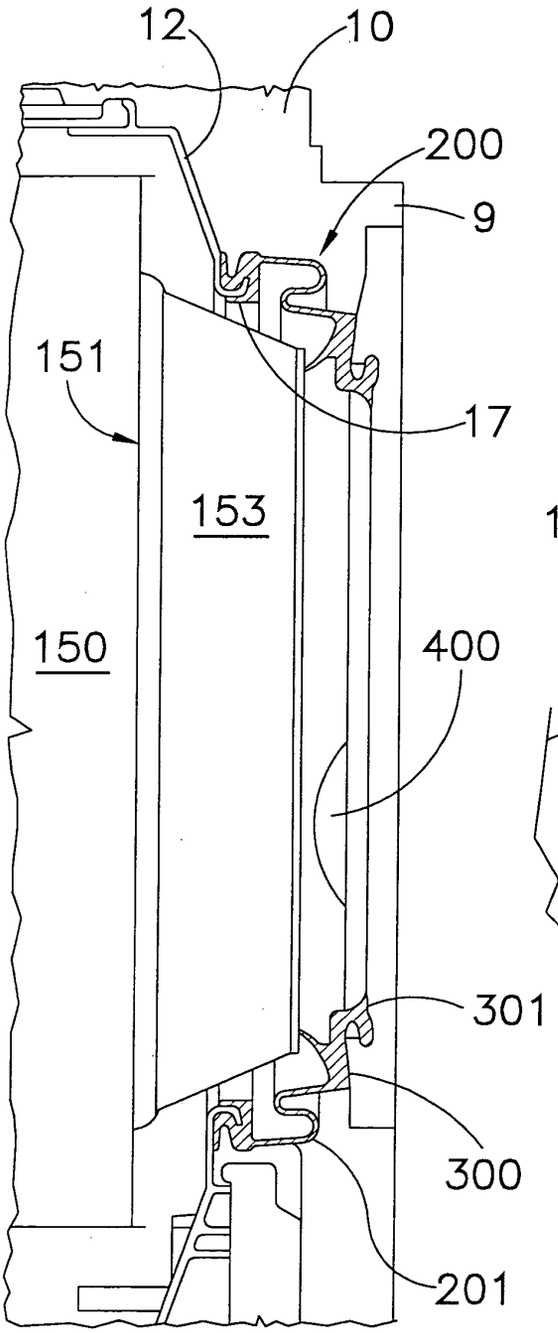


FIG.5

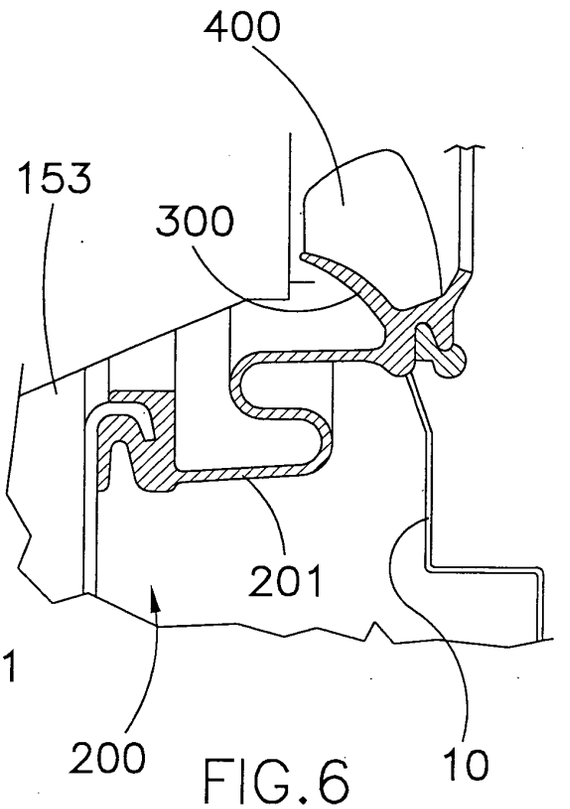


FIG.6

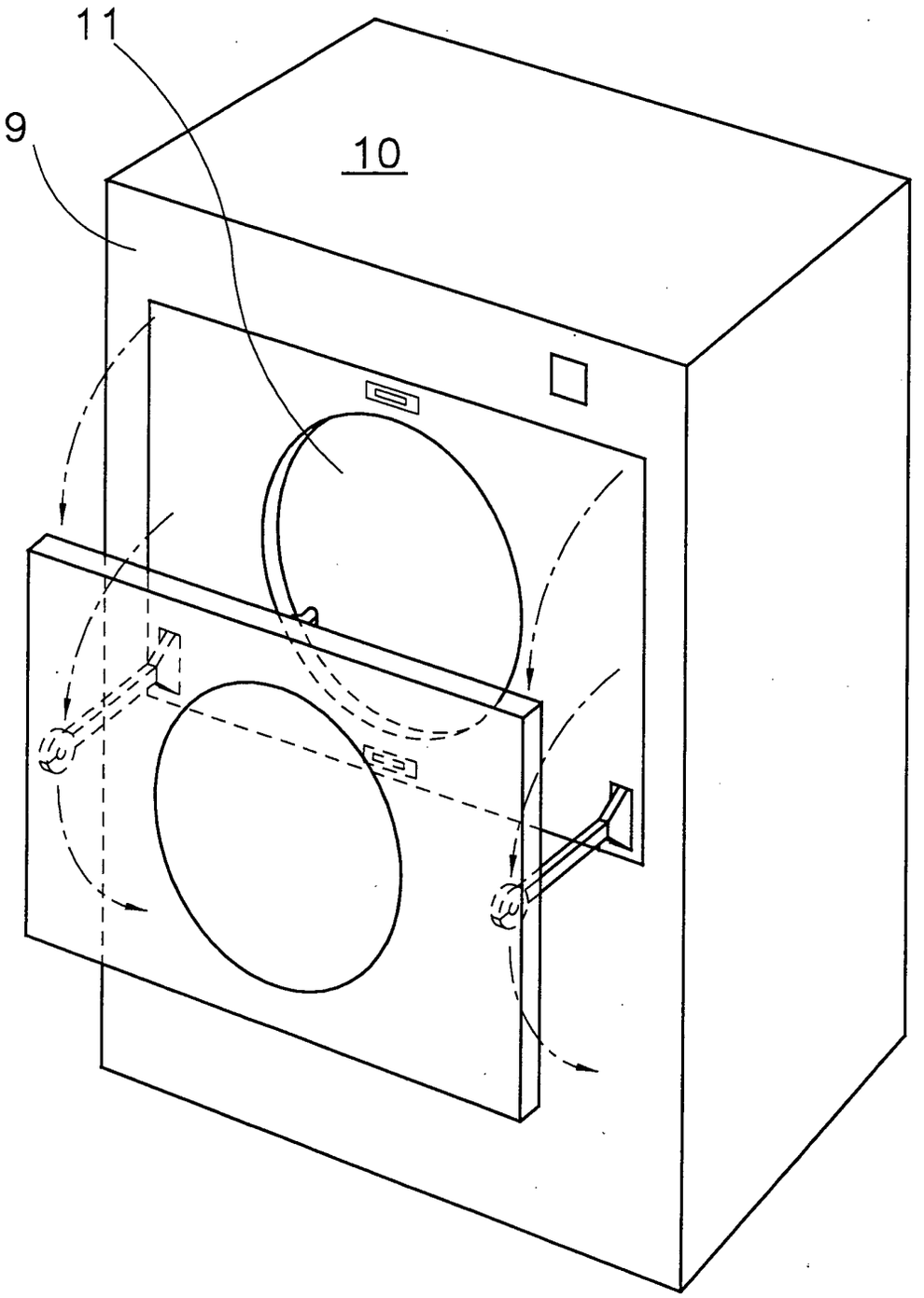


FIG.7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 42 5655

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	* figure 3 *	1	

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 March 2004	Norman, P

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