



(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
25.06.2014 Bulletin 2014/26

(51) Int Cl.:

D06F 39/08 (2006.01)

(21) Application number: 12199173.1

(22) Date of filing: 21.12.2012

(84) Designated Contracting States: AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR Designated Extension States: BA ME (71) Applicant: Electrolux Home Products Corporation N.V. 1130 Brussel (BE)	(72) Inventors: • Barro, Paolo 33080 Porcia (PN) (IT) • Colin, Igor 33080 Porcia (PN) (IT) (74) Representative: Nardoni, Andrea et al Electrolux Italia S.p.A. Corso Lino Zanussi, 30 33080 Porcia (PN) (IT)
--	--

(54) Laundry washing machine

(57) The present invention relates to a laundry washing machine (1) comprising a washing tub (3) external to a rotatable washing drum (4) adapted to receive laundry. The machine further comprises a water outlet circuit (25; 125) suitable for withdrawing liquid from a discharge outlet (26) of the washing tub (3), wherein the water outlet circuit (25; 125) comprises a liquid conveying portion (71, 72; 171, 172) connectable to the washing tub (3) at said discharge outlet (26). The machine further comprises a level sensing device (19) comprising a pressure sensor (50) suitable for determining the liquid level (L) inside the washing tub (3), the level sensing device (19) comprising an air chamber (51; 151) having a first part (52; 152) fixedly connected to the liquid conveying portion (71, 72; 171, 172) and communicating therewith through a chamber inlet (58; 158) and a second part (53) associable to the first part (52; 152) and communicating with the pressure sensor through a chamber outlet (59). The second part (53) of the air chamber (51; 151) is obtained in a single piece construction with the washing tub (3).

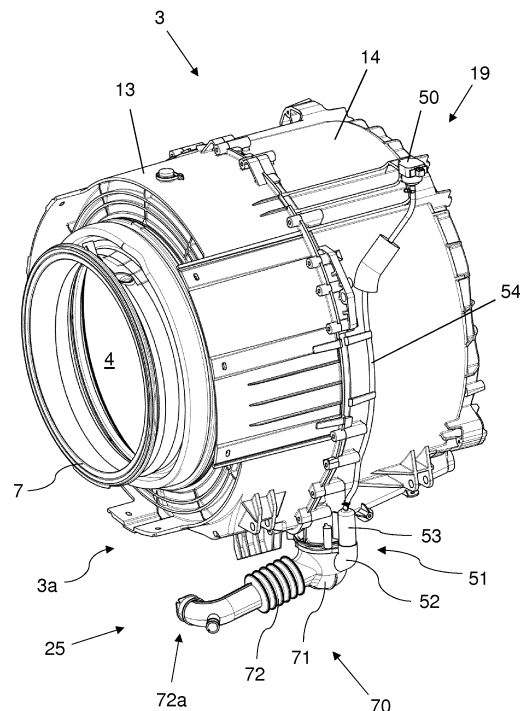


FIG. 2

Description

[0001] The present invention concerns the field of laundry washing techniques.

[0002] In particular, the present invention refers to a laundry washing machine equipped with a level sensing device for sensing the liquid level in the machine.

BACKGROUND ART

[0003] Nowadays the use of laundry washing machines, both "simple" laundry washing machines (i.e. laundry washing machines which can only wash and rinse laundry) and laundry washing-drying machines (i.e. laundry washing machines which can also dry laundry), is widespread.

[0004] In the present description the term "laundry washing machine" will refer to both simple laundry washing machines and laundry washing-drying machines. Laundry washing machines generally comprise an external casing provided with a washing tub which contains a rotatable perforated drum where the laundry is placed.

[0005] A loading/unloading door ensures access to the drum.

[0006] Laundry washing machines typically comprise a water inlet circuit and a products supply unit for the introduction of water and washing/rinsing products (i.e. detergent, softener, etc.) into the tub.

[0007] Known laundry washing machines are also provided with drain liquid devices that may operate during different phases of the washing cycle in order to drain liquid from the bottom of the tub and to convey the liquid either to the outside or inside the same washing tub. In the latter case, the drain liquid device is part of a recirculation circuit.

[0008] The drain liquid devices typically drain water from the tub by means of a discharge pipe connected to the bottom of the tub.

[0009] The laundry washing machines of known type are also typically equipped with a level sensing device for sensing the liquid level in the machine. The liquid level detected by this device is opportunely used, for example, to correctly activate the water inlet circuit and the drain liquid device during the phases of the washing cycle.

[0010] Level sensing devices of known type comprise a pressure sensor, or pressure switch, which communicates with an air volume enclosed in an air chamber via a narrow conduit. The air chamber is typically arranged in the bottom part of the washing machine and is connected to the drain liquid device. More particularly, the air chamber communicates with the discharge pipe at the bottom of the tub. The air chamber is connected to the discharge pipe in such a way that the liquid in the chamber reflects the liquid level in the machine. The air volume enclosed above the liquid in the chamber is therefore subjected to a pressure which is sensed by the pressure sensor and then translated into a measure of the liquid level in the machine.

[0011] A laundry washing machine showing an air chamber for a pressure sensor is disclosed in document CN201598461U.

[0012] The air chamber disclosed in such document is realized in two parts: a lower part connected to the discharge pipe at the bottom of the tub and an upper closing part. The closing part then communicates with the pressure sensor.

[0013] The two parts are assembled to define an air volume therein and the upper part is fixed to the washing tub by means of additional fastening elements.

[0014] In general, the air chambers of known type realized in two parts have the upper part which is fixed to the washing tub by means of fastening elements, like clamps or iron wires.

[0015] However, the level sensing devices above described belonging to the known technique pose some drawbacks.

[0016] A first drawback posed by this known technique is constituted by the fact that the level sensing device is composed by a great number of pieces.

[0017] This determines a complex structural construction which increases the assembling and/or the manufacturing time and costs of the level sensing device and of the machine.

[0018] A further drawback posed by this known technique is constituted by the high failure rate due to the complex structural construction of the air chamber.

[0019] The aim of the present invention is therefore to solve the noted drawbacks and thus providing a laundry washing machine having an improved liquid level sensing device arrangement.

[0020] It is a first object of the invention to implement a laundry washing machine that makes it possible to reduce manufacturing and/or assembling time and costs.

[0021] It is a further object of the invention to implement a laundry washing machine that makes it possible to increase reliability of the machine itself.

[0022] Another object of the present invention is to provide a laundry washing machine that lasts longer than machines of known type.

[0023] Advantages, objects, and features of the invention will be set forth in part in the description and drawings which follow and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention.

DISCLOSURE OF INVENTION

[0024] The applicant has found that by providing a laundry washing machine provided with a level sensing device for determining the liquid level inside the washing tub, in which the level sensing device comprises an air chamber having a first part obtained in a single piece construction with the washing tub, fixedly connected to a liquid conveying portion and communicating therewith through a chamber inlet, and a second part associable to the first part and communicating with the air pressure

sensor through a chamber outlet, it is possible to obtain a laundry washing machine having reduced manufacturing and/or assembling time and costs compared to the machines of known type.

[0025] The present invention relates, therefore, to a laundry washing machine comprising:

- a washing tub external to a rotatable washing drum adapted to receive laundry;
- a water outlet circuit suitable for withdrawing liquid from a discharge outlet of said washing tub, said water outlet circuit comprising a liquid conveying portion connectable to said washing tub at said discharge outlet;
- a level sensing device comprising a pressure sensor suitable for determining the liquid level inside said washing tub, said level sensing device further comprising an air chamber having a first part fixedly connected to said liquid conveying portion and communicating therewith through a chamber inlet and a second part associable to said first part and communicating with said air pressure sensor through a chamber outlet;

wherein said second part of said air chamber is obtained in a single piece construction with said washing tub.

[0026] Preferably, the second part of the air chamber and the washing tub are made with a plastic material, preferably by moulding, more preferably by injection moulding.

[0027] Advantageously, the machine comprises a connecting portion, preferably a rib, obtained in a single piece construction with the tub and the second part and connecting the second part of the air chamber to the washing tub.

[0028] In a preferred embodiment of the invention, the liquid conveying portion of the water outlet circuit is or is part of a drain hose.

[0029] In another preferred embodiment of the invention, the liquid conveying portion of the water outlet circuit is or is part of an integrated drain pump.

[0030] Preferably, the first part of the air chamber is obtained in a single piece construction with the liquid conveying portion.

[0031] More preferably, the first part of the air chamber and the liquid conveying portion are made with a plastic material, preferably by moulding, more preferably by injection moulding.

[0032] Advantageously, the machine comprises a fastening device suitable for connecting the liquid conveying portion to the washing tub at said discharge outlet.

[0033] In a preferred embodiment of the invention, the first part and/or the second part are substantially cylindrically or prismatic or parallelepiped shaped. Oppositely, the liquid conveying portion is arranged below the discharge outlet. Advantageously, the chamber inlet is arranged below the discharge outlet. Preferably, the second part of the air chamber is realized at a lower portion

of the washing tub.

[0034] In a preferred embodiment of the invention, the washing tub comprises two complementary hemi-shells reciprocally coupled.

5 **[0035]** Preferably, the second part of the air chamber is obtained in a single piece construction with one of the hemi-shells or the second part is obtained partially in a single piece construction with one of the hemi-shells and partially in a single piece construction with the other hemi-shell in such a way that when the first and second hemi-shells are assembled one another for forming the tub, also the second part is assembled.

10 **[0036]** In a preferred embodiment of the invention, the discharge outlet is defined by a collar portion, the collar portion comprising a wall surrounding a longitudinal axis of the collar portion and the said second part comprises a wall surrounding a longitudinal axis of the second part, wherein the longitudinal axis of the collar portion is parallel to the longitudinal axis of the second part.

15 **[0037]** In a preferred embodiment of the invention, the machine of the invention is a laundry washing-drying machine.

BRIEF DESCRIPTION OF THE DRAWINGS

25 **[0038]** Further characteristics and advantages of the present invention will be highlighted in greater detail in the following detailed description of preferred embodiments of the invention, provided with reference to the enclosed drawings. In the drawings, corresponding characteristics and/or components are identified by the same reference numbers. In said drawings:

- Figure 1 shows a perspective view of a laundry washing machine according to a preferred embodiment of the invention;
- Figure 2 shows the laundry washing machine of Figure 1 with the external casing and some internal components removed;
- Figure 3 shows a partially sectional view of Figure 2;
- Figure 4 is a lateral plan view of the laundry washing machine of Figure 2;
- Figure 5 shows a partial sectional view taken along line V-V of Figure 4;
- Figure 6 shows a partially exploded view of Figure 2;
- Figure 7 shows an enlarged detail of Figure 6;
- Figure 8 shows a construction variant of Figure 2;
- Figure 9 shows a partially sectional view of Figure 8;
- Figure 10 is a lateral plan view of the components shown in Figure 8;
- Figure 11 shows a partial sectional view taken along line XI-XI of Figure 10;
- Figure 12 shows a partially exploded view of Figure 8;
- Figure 13 shows an enlarged detail of Figure 12
- Figure 14 schematically shows a partial sectional view of the tub during its molding procedure;
- Figure 15 schematically shows a partial sectional

view of the tub during a phase of its molding procedure in which a slider is being extracted from the already molded tub.

DETAILED DESCRIPTION OF THE INVENTION

[0039] The present invention has proved to be particularly advantageous when applied to laundry washing machines, as described below. It should in any case be underlined that the present invention is not limited to laundry washing machines. On the contrary, the present invention can be conveniently applied to laundry washing-drying machines (i.e. laundry washing machines which can also dry laundry).

[0040] In the present description, therefore, the term "laundry washing machine" will refer to both simple laundry washing machines and laundry washing-drying machines.

[0041] Figure 1 shows a laundry washing machine 1 according to a preferred embodiment of the invention.

[0042] The laundry washing machine 1 comprises an external casing or housing 2, in which a washing tub 3 is provided that contains a rotatable drum 4, visible in Figures 2 and 6, where the laundry to be treated can be loaded.

[0043] The tub 3 and the drum 4 both preferably have a substantially cylindrical shape. The housing 2 is provided with a loading/unloading door 8 which allows access to the washing drum 4.

[0044] The tub 3 is preferably suspended in a floating manner inside the housing 2, advantageously by means of a number of coil springs and shock-absorbers, not illustrated.

[0045] The drum 4 is advantageously rotated by an electric motor, not illustrated, which preferably transmits the rotating motion to the shaft of the drum 4, advantageously by means of a belt/pulley system. In a different embodiment of the invention, the motor can be directly associated with the shaft of the drum 4. The tub 3 is preferably connected to the casing 2 by means of an elastic bellows 7, or gasket.

[0046] The tub 3 preferably comprises two complementary hemi-shells 13 and 14 structured for being reciprocally coupled to form the tub 3. Preferably the hemi-shells 13 and 14, namely a front hemi-shell 13 and a rear hemi-shell 14, are realized separately and then fixedly connected to form the tub 3. More preferably, the hemi-shells 13 and 14 comprise a plastic material and are preferably realized by injection moulding.

[0047] The lower portion 3a of the tub 3 preferably comprises a seat 17 suitable for receiving a heater device, not illustrated. Preferably the seat 17 is made in a single piece with the tub 3.

[0048] The laundry washing machine 1 preferably comprises a water supply circuit preferably arranged in the upper part of the laundry washing machine 1 and suited to supply water into the tub 3. The water supply circuit of a laundry washing machine is well known in the

art, and therefore it will not be described in detail.

[0049] The laundry washing machine 1 advantageously comprises a removable drawer 6 provided with various compartments suited to be filled with washing and/or rinsing products (i.e. detergent, softener, etc.).

[0050] The laundry washing machine 1 advantageously comprises a water outlet circuit 25, only partially illustrated in Figures from 2 to 7, suitable for withdrawing liquid from the lower portion 3a of the tub 3.

[0051] At this purpose, the lower portion 3a of the tub 3 is provided with a discharge outlet 26 through which the liquid may be withdrawn from the tub 3, and preferably drained outside the machine.

[0052] The discharge outlet 26 is preferably defined by a collar portion 27. The collar portion 27 comprises a wall 27a which surrounds a longitudinal axis Y1 of the collar portion 27, passing preferably through the centre of the collar portion 27, as illustrated in Figure 5.

[0053] More preferably, the collar portion 27 comprises a wall 27a which is advantageously substantially parallel to the longitudinal axis Y1, passing preferably through the centre of the collar portion 27. The collar portion 27 is therefore preferably cylindrically or prismatic or parallelepiped shaped.

[0054] In different embodiments, nevertheless, the collar portion may comprise a wall differently shaped, for example shaped like a bell, and suitable to be realized by injection moulding with simple steps.

[0055] The water outlet circuit 25 preferably comprises a drain hose 70 arranged below the discharge output 26.

[0056] In a preferred embodiment, the liquid withdrawn from the tub 3 may be conveyed either to the outside or inside the same washing tub 3. In the latter case, the water outlet circuit 25 belongs to a recirculation circuit, not illustrated, which preferably withdraws liquid from the lower portion 3a of the tub 3 and re-admits such a liquid into an upper region of the tub 3.

[0057] Advantageously the laundry washing machine 1 comprises a level sensing device 19 suited to sense (or detect) the liquid level inside the tub 3.

[0058] The level sensing device 19 preferably comprises a pressure sensor 50, or pressure switch and an air chamber 51 enclosing an air volume.

[0059] The air chamber 51 preferably comprises a first part 52, or lower part, and a second part 53, in the following called also upper closing part. The lower part 52 and the upper closing part 53 are preferably substantially cylindrically shaped. Anyway, the lower part 52 and the upper closing part 53 may have different shapes, for example they may be prismatic, parallelepiped, etc.

[0060] The air chamber 51 advantageously communicates at one side with the discharge outlet 26 of the tub 3 and on another side with the pressure sensor 50.

[0061] Advantageously, the lower part 52 of the air chamber 51 communicates with the discharge outlet 26 of the tub 3 through a chamber inlet 58. The upper closing part 53 communicates with the pressure sensor 50 through a chamber outlet 59, and preferably a conduit

54, preferably narrow.

[0062] In the preferred embodiment here described, the air chamber 51 advantageously communicates with the discharge outlet 26 through the drain hose 70 arranged below the discharge outlet 26.

[0063] The drain hose 70 preferably comprises a first portion 71 connectable to the tub 3 at the discharge outlet 26 and a second portion 72 for conveying liquid to the outside and/or, if a recirculation circuit is provided, again inside the tub 3. Preferably, the second portion 72 comprises a flexible plastic tubing.

[0064] A fastening device 80 is preferably provided for connecting the first portion 71 of the drain hose 70 to the tub 3.

[0065] In the preferred embodiment here described, the fastening device 80 comprises a clamp, not illustrated.

[0066] In different embodiments, nevertheless, the fastening device may be of different type. For example, a snap connection may be provided for the connection of the drain hose to the tub, or other elements like screws, etc..

[0067] In different embodiments a gasket may be advantageously interposed between the first portion 71 and the tub 3 in order to improve tight connection. Advantageously, at one end 72a of the second portion 72 of the drain hose 70 a draining pump is connected, not shown, allows withdrawing of the liquid from the tub 3 through the drain hose 70.

[0068] In short, the drain hose 70 defines a liquid conveying element.

[0069] According to a first aspect of the invention, the lower part 52 of the air chamber 51 is obtained in a single piece construction with the drain hose 70.

[0070] The drain hose 70 and the lower part 52 of the air chamber 51 are preferably made with a plastic material (preferably a resilient material, so that the drain hose 70 acts also as a sealing providing also its watertight connection with the tub 3) and are preferably obtained in a single piece construction by moulding, more preferably by injection moulding.

[0071] The drain hose 70 and the lower part 52 of the air chamber 51 therefore define a completed, integral, unitary member.

[0072] According to a main aspect of the invention, the upper closing part 53 of the air chamber 51 is obtained in a single piece construction with the tub 3.

[0073] The upper closing part 53 of the air chamber 51 and the tub 3, therefore, define a completed, integral, unitary member.

[0074] More preferably, the upper closing part 53 of the air chamber 51 is obtained in a single piece construction with the rear hemi-shell 14 of tub 3. Alternatively, the upper closing part 53 of the air chamber 51 could be obtained in a single piece construction with the front hemi-shell 13 of tub 3.

[0075] In a further advantageous embodiment, the upper closing part 53 of the air chamber 51 may be obtained

partially in a single piece construction with the rear hemi-shell 14 and partially in a single piece construction with the front hemi-shell 13 of tub 3, in such a way that when the first and second hemi-shells are assembled one another for forming the tub 3, also the upper closing part 53 of the air chamber 51 is assembled; also this advantageous embodiment is enclosed in the definition of an upper closing part 53 of the air chamber 51 obtained in a single piece construction with the tub 3.

[0076] Preferably, the second part 53 comprises a wall 53a which surrounds a longitudinal axis Y2 of the second part 53, passing preferably through the centre of the second part 53, as illustrated in Figure 5.

[0077] More preferably, the second part 53 comprises a wall 53a which is substantially parallel to the longitudinal axis Y2. The collar portion 27 is, therefore, preferably cylindrically or prismatic or parallelepiped shaped.

[0078] In different advantageous embodiments, the second part 53 may comprise a wall differently shaped, for example shaped like a bell, and suitable to be realized by injection moulding with simple steps.

[0079] The tub 3 and the upper closing part 53 of the air chamber 51 are preferably made with a plastic material and are preferably obtained by moulding, more preferably by injection moulding.

[0080] Preferably, the longitudinal axis Y1 of the collar portion 27 is parallel to the longitudinal axis Y2 passing through the centre of the second part 53 of the air chamber 51.

[0081] Advantageously, moulding process of the tub 3 and upper closing part 53 is simplified. In fact, being the longitudinal axis Y1 and Y2 parallel one another, the collar portion 27 and the second part 53 may be obtained by a single slide (i.e. the moving part of the moulding device used for obtaining hollow elements transversal with respect of the main closing direction of the mould) of the moulding device adapted to be moved, during the moulding procedure, in a direction parallel to longitudinal axis Y1 and Y2; using such a single slider allows keeping the costs for the moulding device low. A single slide 200 adapted to be moved, during the moulding procedure, in a direction Y3 parallel to longitudinal axis Y1 and Y2, and allowing obtaining both the collar portion 27 and the second part 53, is schematically illustrated in Figures 14 and 15, in which only a small portion of the tub 3 has been shown, and in which only the single slide 200, and not other parts of the moulding device, are illustrated.

[0082] On the contrary, if the longitudinal axis Y1 and Y2 are not parallel one another, their moulding would require two different slides, moving respectively in the two directions defined by the two axis Y1 and Y2, and therefore the moulding device would be much more expensive.

[0083] The tub 3 and the upper closing part 53 are preferably connected through a connecting element 57 preferably a rib, as better visible in Figures 5 and 7, made in a single piece construction with the tub 3 and the upper closing part 53, and which preferably extends along sub-

stantially all the entire length of the upper closing part 53.

[0084] In different advantageously embodiments, the shape and the extent of the connecting element 57 may be different. For example, the connecting element may comprise apertures which reduce the weight of the connecting element itself.

[0085] According to the invention, when the drain hose 70 is assembled to the tub 3, the upper closing part 53 fits on the lower part 52 thus forming the air chamber 51. In different embodiments, a gasket may be advantageously interposed between the upper closing part 53 and the lower part 52 in order to guarantee a tight connection.

[0086] As known, when the liquid rises in the tub 3 a liquid column is also created in the air chamber 51. The liquid column applies a pressure to the air volume enclosed thereabove in the air chamber 51 and inside the conduit 54. Said pressure is then sensed by the pressure sensor 50. From the values sensed by the pressure sensor 50 it is possible to determine the liquid level L of the liquid inside the tub 3. Advantageously, the realization of the lower part 52 of the air chamber 51 as a part of the drain hose 70 allows the detection of very low level L of the liquid inside the tub 3, preferably also a level at which the tub 3 is substantially empty, or even a level at which the tub 3 is completely empty. This is due to the fact that the drain hose 70 is advantageously arranged below the discharge outlet 26. More advantageously, this is due to the fact that the chamber inlet 58 is arranged below the discharge outlet 26.

[0087] Still advantageously, as said above, the upper closing part 53 of the air chamber 51 and the tub 3 define a complete, integral, unitary member. Installation of the air chamber 51 is therefore simplified since the use of fastening elements, like clamps or iron wires, to fix to the upper closing part 53 to the washing tub 3 is completely avoided.

[0088] Manufacturing and/or assembling time and costs of the air chamber and of the machine are therefore reduced compared to the known technique.

[0089] Risks of breakage of the fastening elements as it happens in the prior art technique, particularly due to the vibration caused by the drum revolutions, are therefore also completely avoided.

[0090] The reliability of the laundry washing machine is therefore increased compared to the machines of known type.

[0091] With reference to Figures from 8 to 13 a construction variant of the laundry washing machine is described.

[0092] This laundry washing machine differs from the above described laundry washing machine 1 for the different realization of the water outlet circuit 125 and of the air chamber 151.

[0093] The water outlet circuit 125 preferably comprises an integrated drain pump 170 arranged below the discharge output 26.

[0094] Here the air chamber 151 preferably comprises

a lower part 152 and an upper closing part 53. The upper closing part 53 is identical to the upper closing part previously described with reference to the first preferred embodiment. The lower part 152 and the upper closing part 53 are preferably substantially cylindrical or prismatic or parallelepiped shaped.

[0095] The air chamber 151 communicates at one side with the discharge outlet 26 of the tub 3 and on another side with the pressure sensor 50.

[0096] Advantageously, the lower part 152 of the air chamber 151 communicates with the discharge outlet 26 of the tub 3 through a chamber inlet 158. The upper closing part 53 communicates with the pressure sensor 50 through a chamber outlet 59 and narrow conduit 54, as above described.

[0097] The chamber inlet 158 is advantageously arranged below the discharge outlet 26. As for the first embodiment, this arrangement allows the detection of very low level L of the liquid inside the tub 3, preferably also a level at which the tub 3 is substantially empty, or even a level at which the tub 3 is completely empty.

[0098] In the preferred embodiment here described, the air chamber 151 advantageously communicates with the discharge outlet 26 through the integrated drain pump 170 arranged below the discharge outlet 26.

[0099] The integrated drain pump 170 preferably comprises a first portion 171 connectable to the tub 3 at the discharge outlet 26 and a second portion 172 for conveying liquid to the outside, or again inside the tub 3 if a recirculation circuit is provided.

[0100] Preferably, the second portion 172 comprises a plastic duct portion.

[0101] A fastening device 180 is preferably provided for connecting the first portion 171 of the integrated drain pump 170 to the tub 3.

[0102] In the preferred embodiment here described, the fastening device 180 comprises screws, not visible, which engage with respective seats 180a, 181a, 180b, 181b of the tub 3 and of the first portion 171.

[0103] In different embodiments, nevertheless, the fastening device may be of different type. For example, a snap connection may be provided for the connection of the drain hose to the tub, or other elements like clamps, etc..

[0104] In a further different embodiment, the first portion 171 of the integrated drain pump 170 is fixed to the tub 3 by welding.

[0105] A gasket may be advantageously interposed between the first portion 171 and the tub 3 in order to guarantee a tight connection.

[0106] Advantageously, at one end 172a of the second portion 172 a draining pump 173 allows withdrawing of the liquid from the tub 3.

[0107] The first portion 171, the second portion 172 and the draining pump 173 form the integrated drain pump 170. The first portion 171 and the second portion 172 eventually define a liquid conveying element.

[0108] According to a first aspect of the invention, the

lower part 152 of the air chamber 151 is obtained in a single piece construction with the integrated drain pump 170. Advantageously the lower part 152 of the air chamber 151 is obtained in a single piece construction with the first portion 171 and the second portion 172 of the integrated drain pump 170.

[0109] The first portion 171, the second portion 172 and the lower part 152 of the air chamber 151 are preferably made with a plastic material and are preferably obtained, preferably in a single step, by moulding, more preferably by injection moulding.

[0110] The first portion 171, the second portion 172 and the lower part 152 of the air chamber 151 therefore define a completed, integral, unitary member. The same advantages above described for the previous embodiment may therefore be achieved.

[0111] According to a main aspect of the invention, the upper closing part 53 of the air chamber 151 is obtained in a single piece construction with the tub 3. As said above, the upper closing part 53 is identical to the upper closing part previously described with reference to the first preferred embodiment described with reference to Figures 1 to 7.

[0112] According to the invention, when the integrated drain pump 170 is assembled to the tub 3, the upper closing part 53 fits on the lower part 152 thus forming the air chamber 151.

[0113] In this embodiment of Figures 9 to 13, therefore, the upper closing part 53 of the air chamber 151 is obtained in a single piece construction with the tub 3, thus achieving the same advantages above described for the previous embodiment of Figures 1 to 8.

[0114] It should be noted, at this point, that in the two embodiments previously described, the tub 3 and the upper closing part 53 integrated therewith is the same.

[0115] Advantageously, therefore, the same tub 3 may be used to assemble either a first type of laundry washing machine 1 having a drain hose arrangement 70 or a second type of laundry washing machine having an integrated drain pump arrangement 170.

[0116] According to the invention, therefore, the provision of the upper closing part 53 of the air chamber 51, 151 obtained in a single piece construction with the tub 3 advantageously allows the assemblage of different types of laundry washing machines using the same type of washing tub 3 and different types of liquid conveying portions.

[0117] The production and design costs may therefore be reduced compared to known technique.

[0118] It has thus been shown that the present invention allows all the set objects to be achieved. In particular, it makes it possible to obtain an improved liquid level sensing device arrangement in a laundry washing machine with respect to the machines of the prior art and to reduce manufacturing and/or assembling time and costs.

[0119] While the present invention has been described with reference to particular embodiments shown in the

figures, it should be noted that the present invention is not limited to the specific embodiments illustrated and described herein; on the contrary, further variants of the embodiments described herein fall within the scope of the present invention, which is defined in the claims.

Claims

1. A laundry washing machine (1) comprising:

- a washing tub (3) external to a rotatable washing drum (4) adapted to receive laundry;
- a water outlet circuit (25; 125) suitable for withdrawing liquid from a discharge outlet (26) of said washing tub (3), said water outlet circuit (25; 125) comprising a liquid conveying portion (71, 72; 171, 172) connectable to said washing tub (3) at said discharge outlet (26);
- a level sensing device (19) comprising a pressure sensor (50) suitable for determining the liquid level (L) inside said washing tub (3), said level sensing device (19) further comprising an air chamber (51; 151) having a first part (52; 152) fixedly connected to said liquid conveying portion (71, 72; 171, 172) and communicating therewith through a chamber inlet (58; 158) and a second part (53) associable to said first part (52; 152) and communicating with said pressure sensor (50) through a chamber outlet (59);

characterized in that

said second part (53) of said air chamber (51; 151) is obtained in a single piece construction with said washing tub (3).

2. A machine (1) according to claim 1, **characterized in that** said second part (53) of said air chamber (51; 151) and said washing tub (3) are made with a plastic material, preferably by moulding, more preferably by injection moulding.
3. A machine (1) according to any preceding claim, **characterized in that** it comprises a connecting element (57), obtained in a single piece construction with said tub (3) and said second part (53), and connecting said second part (53) of said air chamber (51; 151) to said washing tub (3).
4. A machine (1) according to any preceding claim, **characterized in that** said liquid conveying portion (71, 72) of said water outlet circuit (25) is or is part of a drain hose (70).
5. A machine (1) according to any claim from 1 to 3, **characterized in that** said liquid conveying portion (171, 172) of said water outlet circuit (125) is or is part of an integrated drain pump (170).

6. A machine (1) according to any preceding claim, **characterized in that** said first part (52; 152) of said air chamber (51; 151) is obtained in a single piece construction with said liquid conveying portion (71, 72; 171, 172). 5
7. A machine (1) according to any preceding claim, **characterized in that** said first part (52; 152) of said air chamber (51; 151) and said liquid conveying portion (71, 72; 171, 172) are made with a plastic material, preferably by moulding, more preferably by injection moulding. 10
8. A machine (1) according to any preceding claim, **characterized in that** it comprises a fastening device (80; 180) suitable for connecting said liquid conveying portion (71, 72; 171, 172) to said washing tub (3) at said discharge outlet (26). 15
9. A machine (1) according to any preceding claim, **characterized in that** said first part (52; 152) and/or said second part (53) are substantially cylindrically or prismatic or parallelepiped shaped. 20
10. A machine (1) according to any preceding claim, **characterized in that** said liquid conveying portion (71, 72; 171, 172) is arranged below said discharge outlet (26). 25
11. A machine (1) according to any preceding claim, **characterized in that** said chamber inlet (58; 158) is arranged below said discharge outlet (26). 30
12. A machine (1) according to any preceding claim, **characterized in that** said second part (53) of said air chamber (51; 151) is realized at a lower portion (3a) of said washing tub (3). 35
13. A machine (1) according to any preceding claim, **characterized in that** said washing tub (3) comprises two complementary hemi-shells (13, 14) reciprocally coupled. 40
14. A machine (1) according to claim 13, **characterized in that** said second part (53) of said air chamber (51; 151) is obtained in a single piece construction with one of said hemi-shells (13, 14), or said second part (53) is obtained partially in a single piece construction with one of said hemi-shells (13, 14) and partially in a single piece construction with the other hemi-shell (14, 13) in such a way that, when said first and second hemi-shells (13, 14) are assembled one another for forming said tub (3), also said second part (53) is assembled. 45
50
55
15. A machine (1) according to any preceding claim, **characterized in that** said discharge outlet (26) is defined by a collar portion (27), said collar portion (27) comprising a wall (27a) surrounding a longitudinal axis (Y1) of said collar portion (27) and **in that** said second part (53) comprises a wall (53a) surrounding a longitudinal axis (Y2) of said second part (53), the longitudinal axis (Y1) of said collar portion (27) being parallel to the longitudinal axis (Y2) of said second part (53).

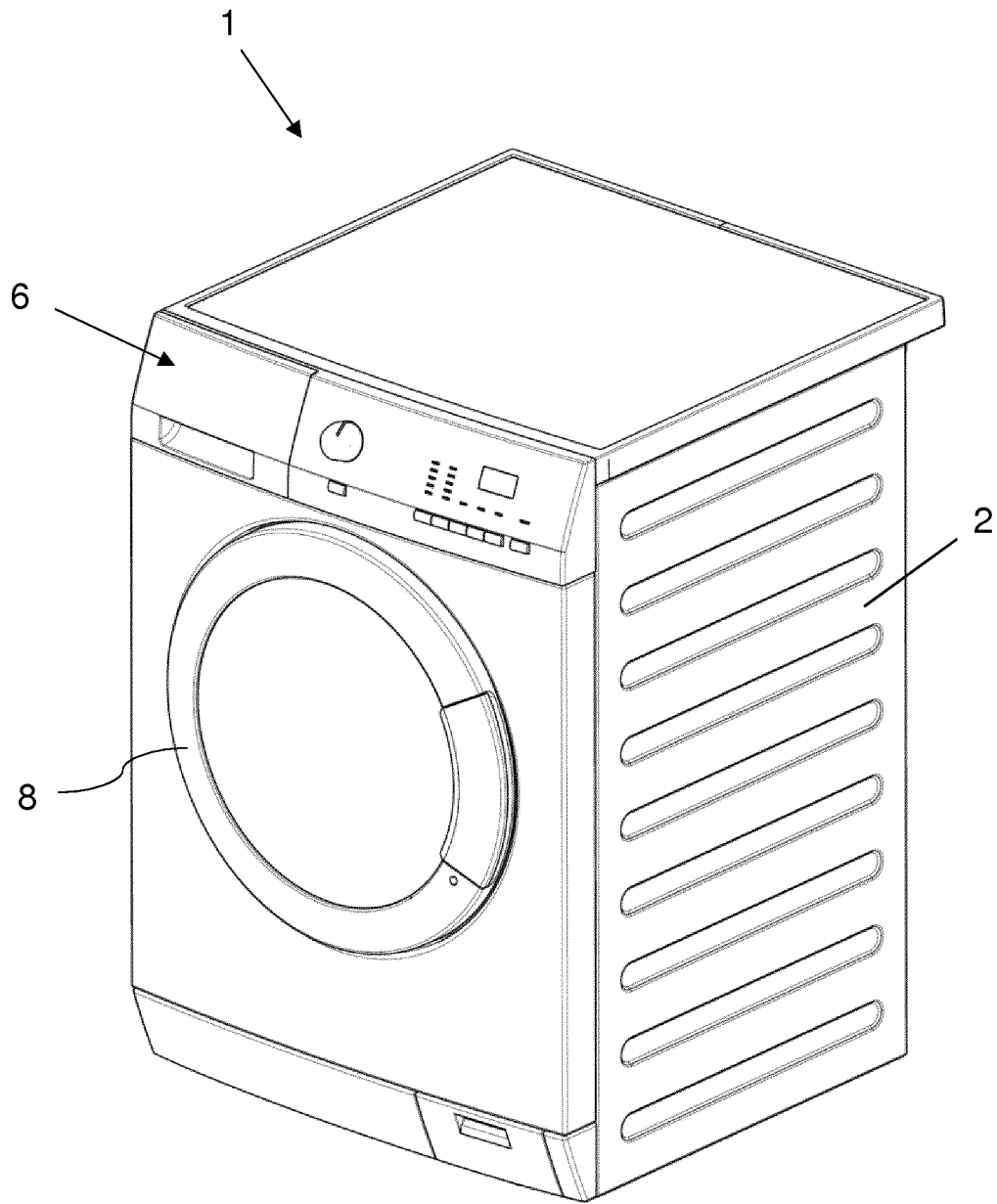


FIG. 1

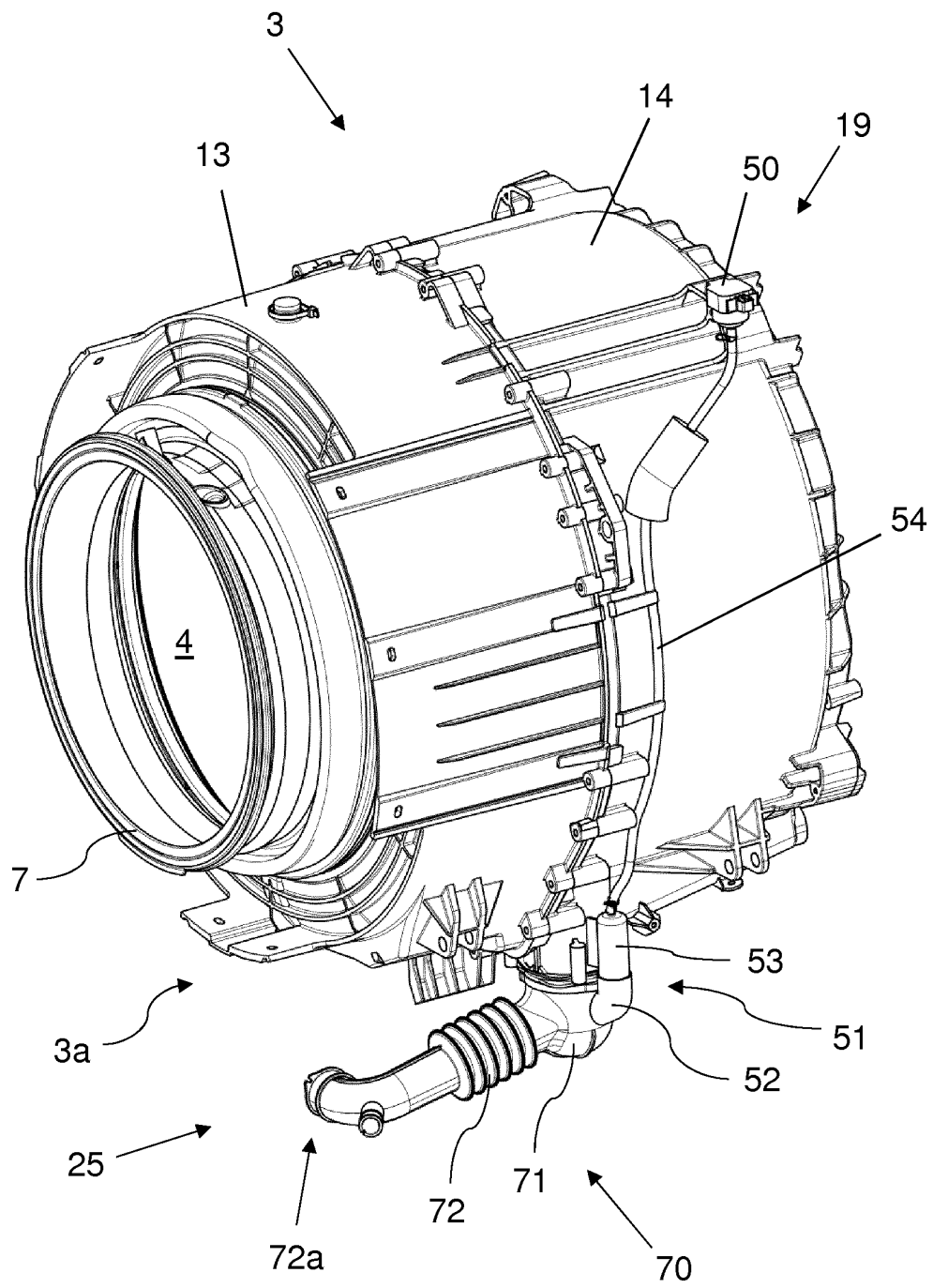


FIG. 2

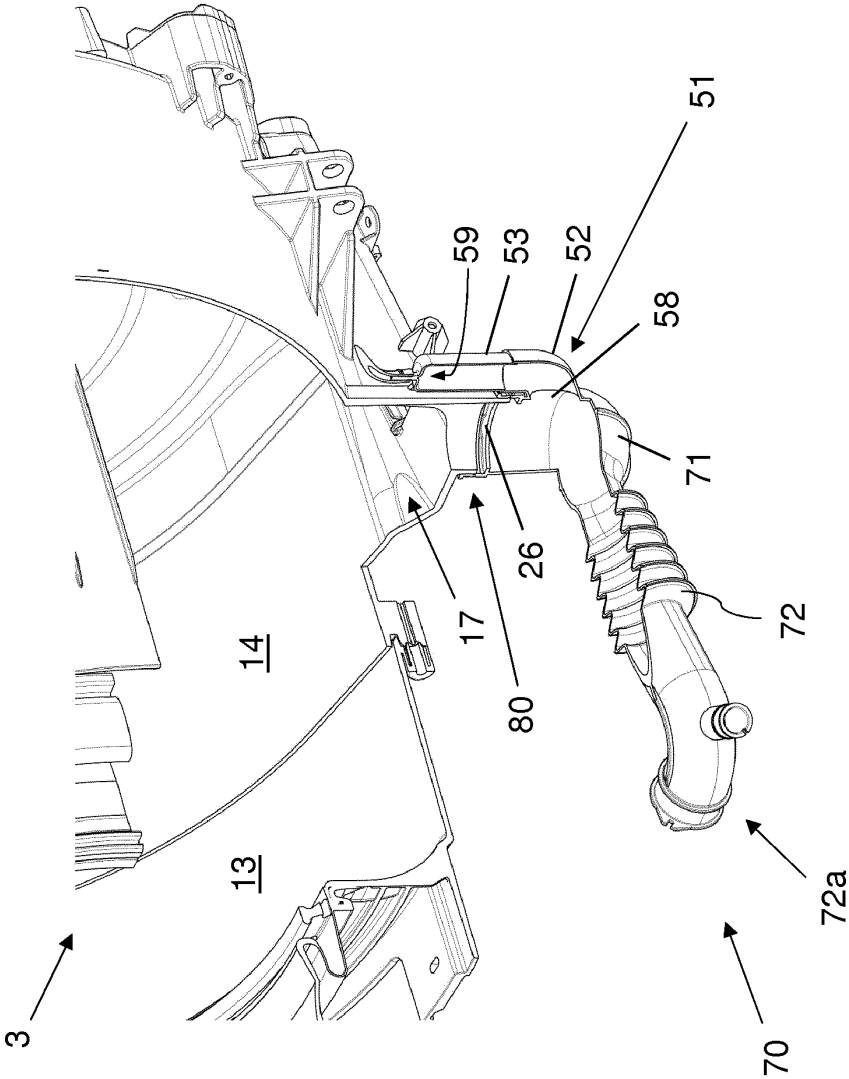


FIG. 3

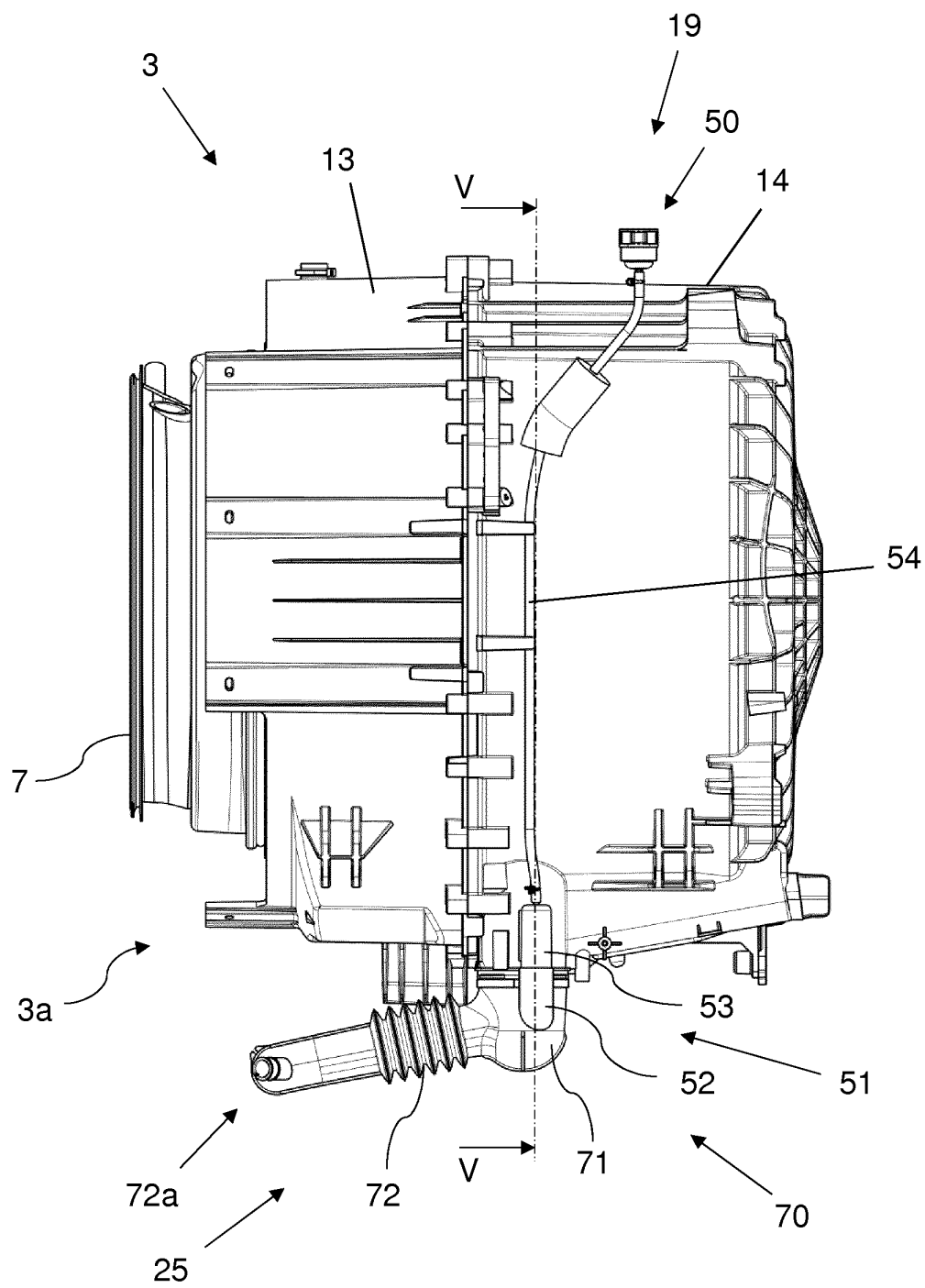
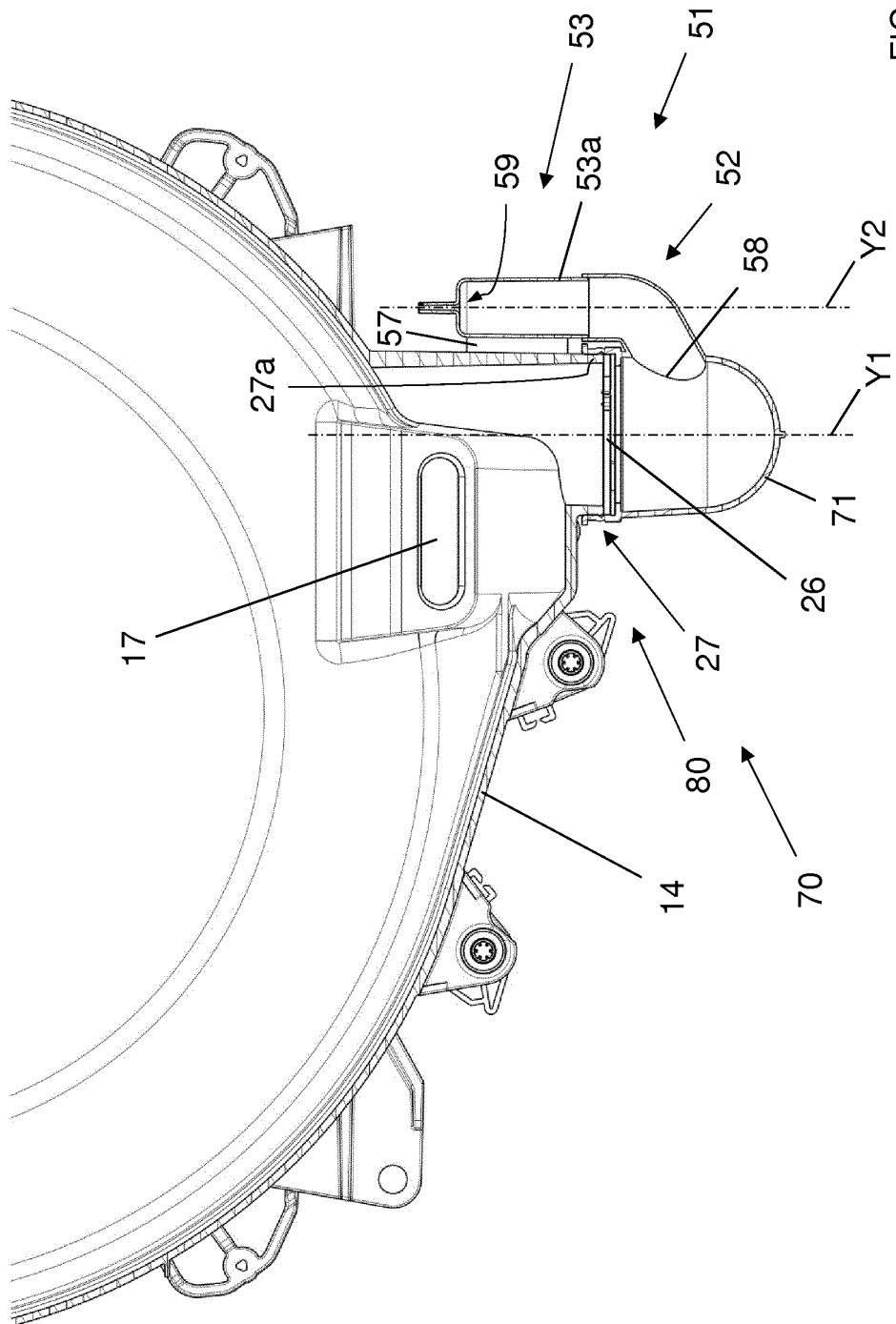


FIG. 4



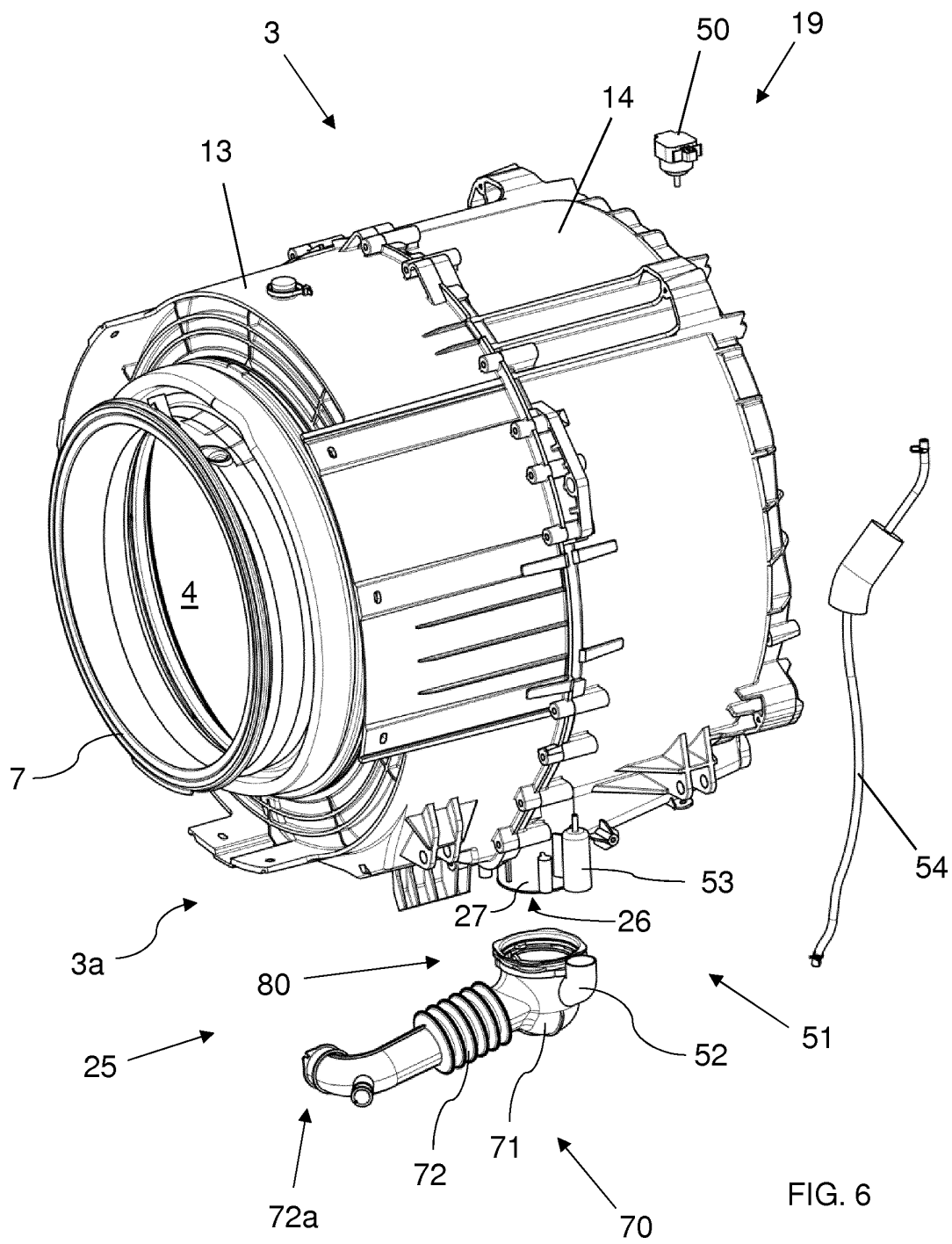


FIG. 6

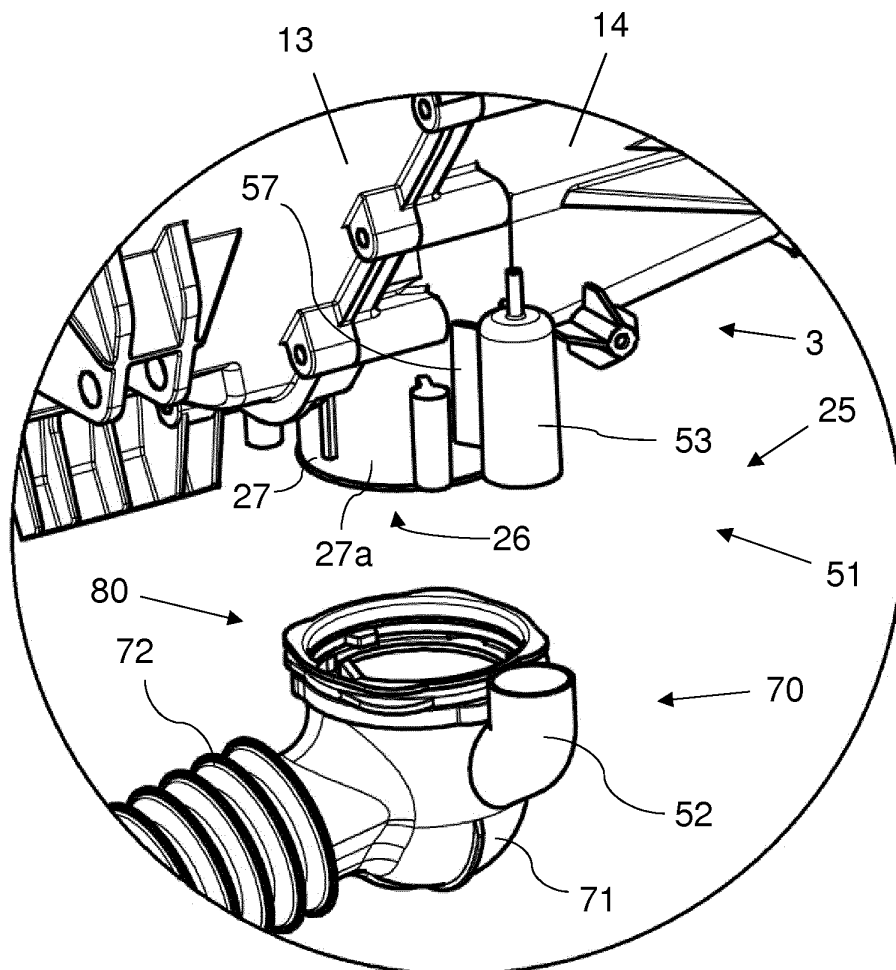


FIG. 7

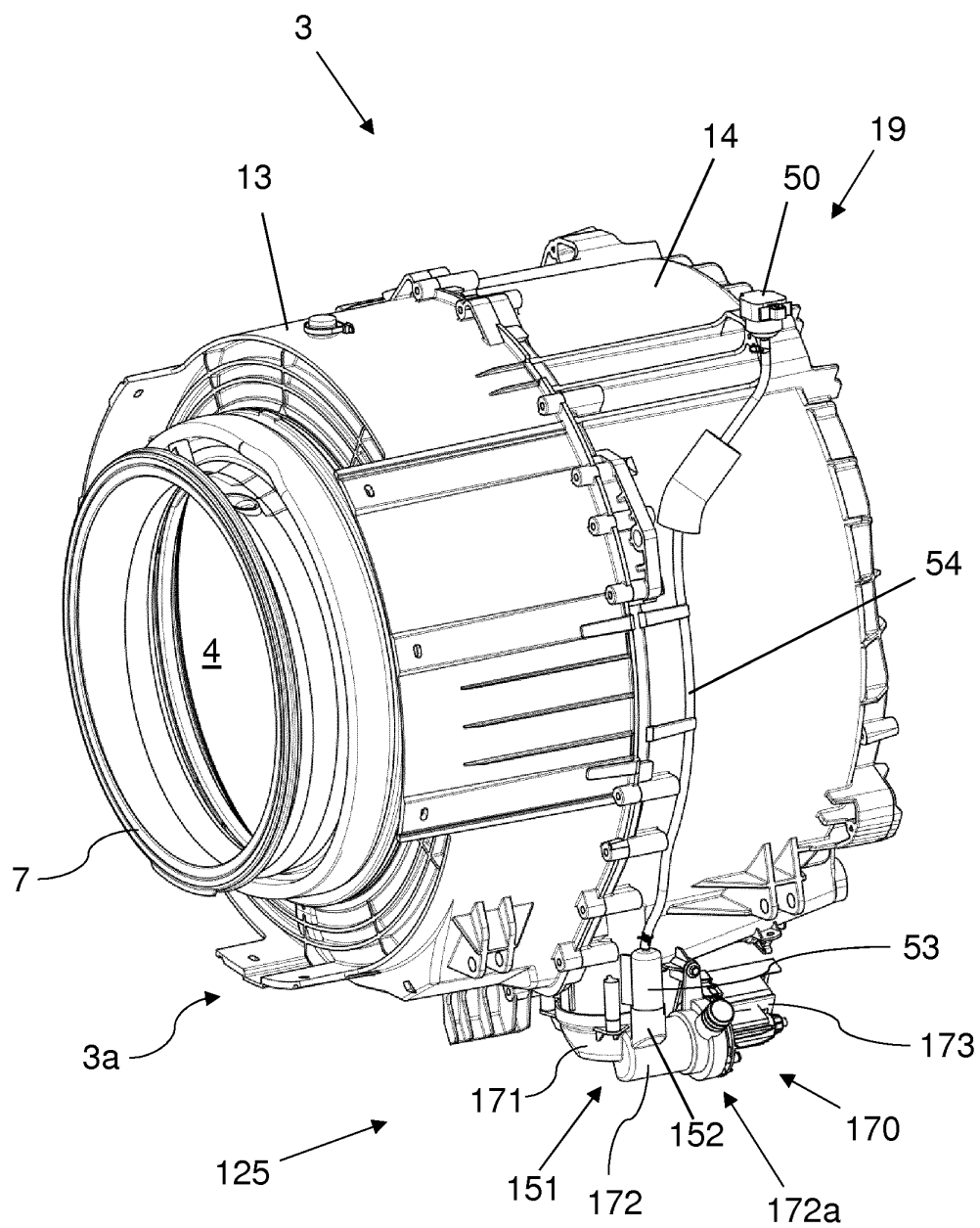


FIG. 8

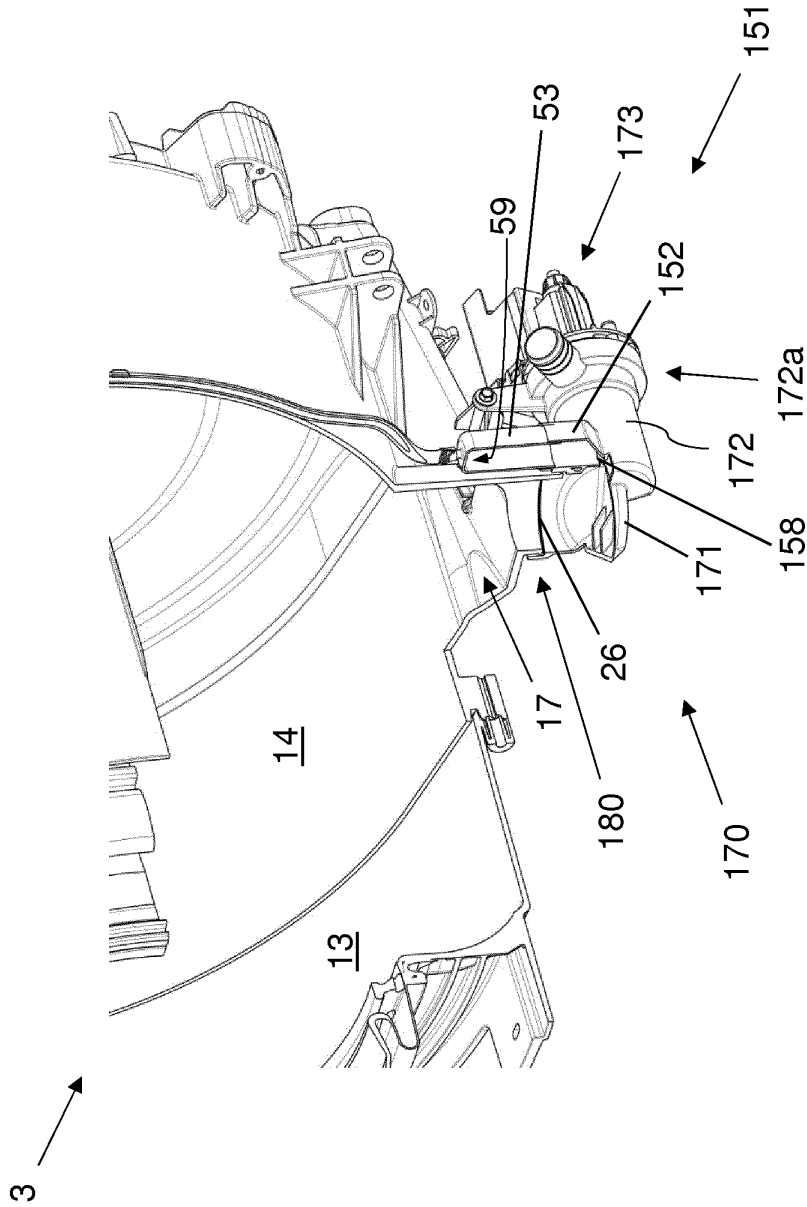


FIG. 9

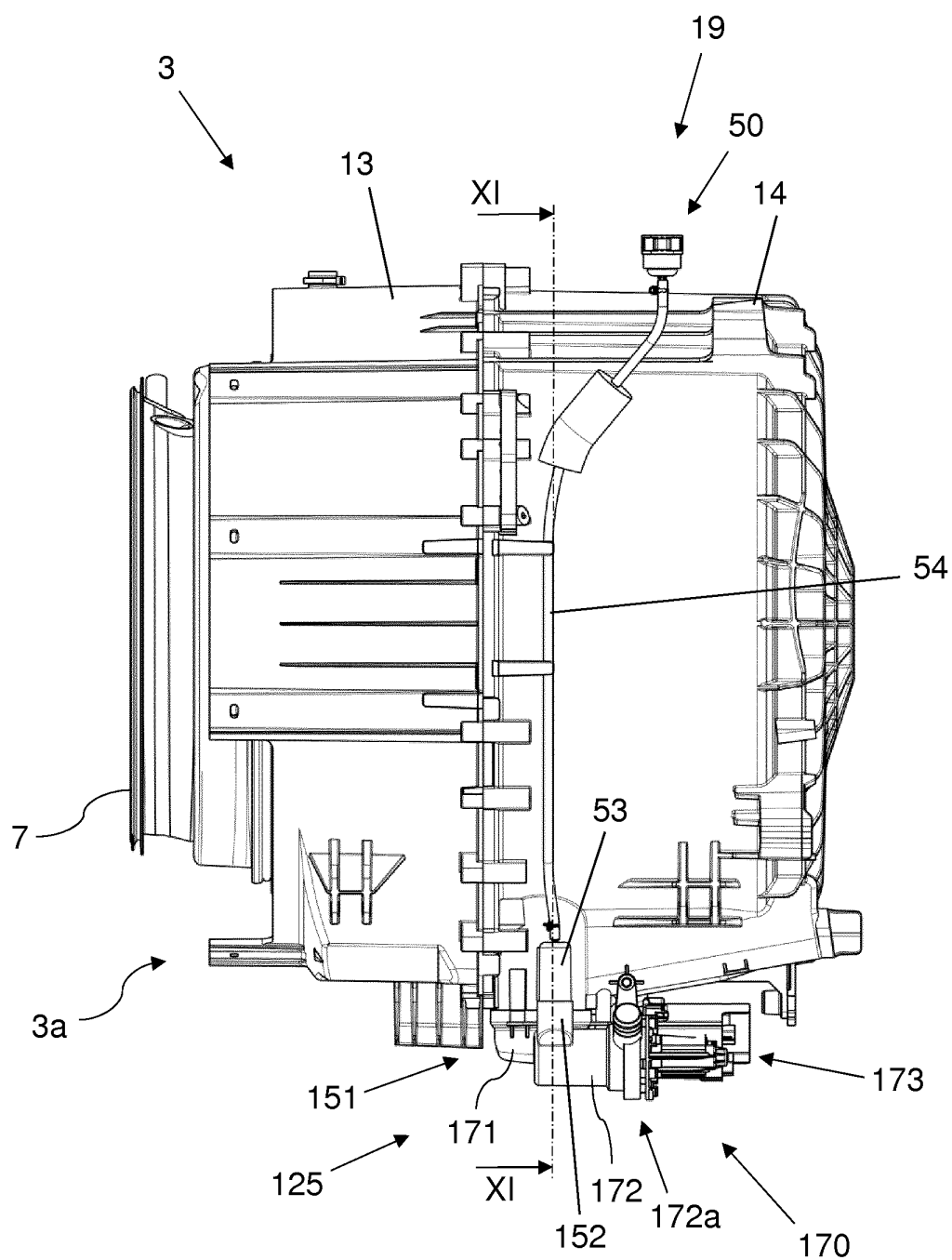


FIG. 10

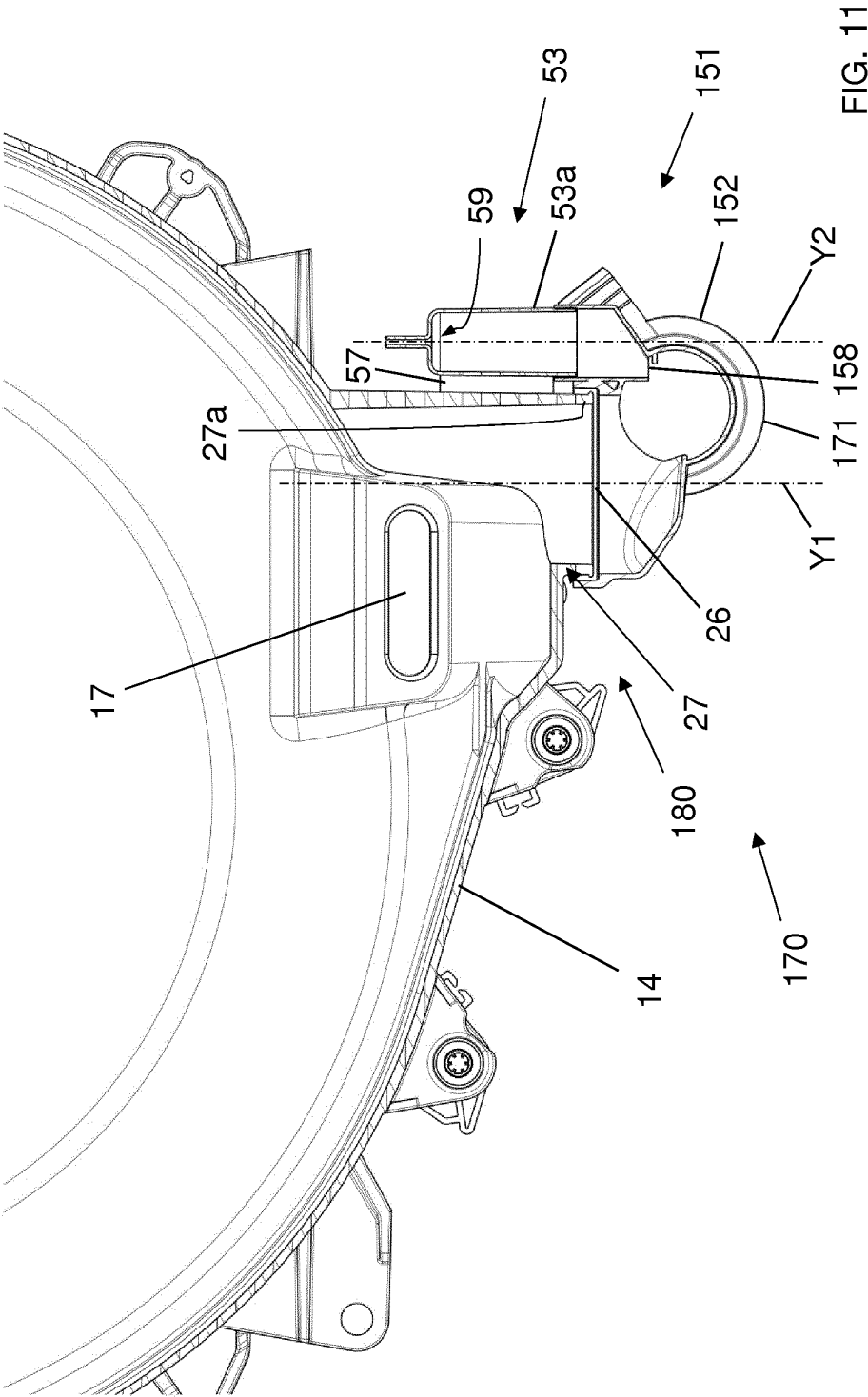


FIG. 11

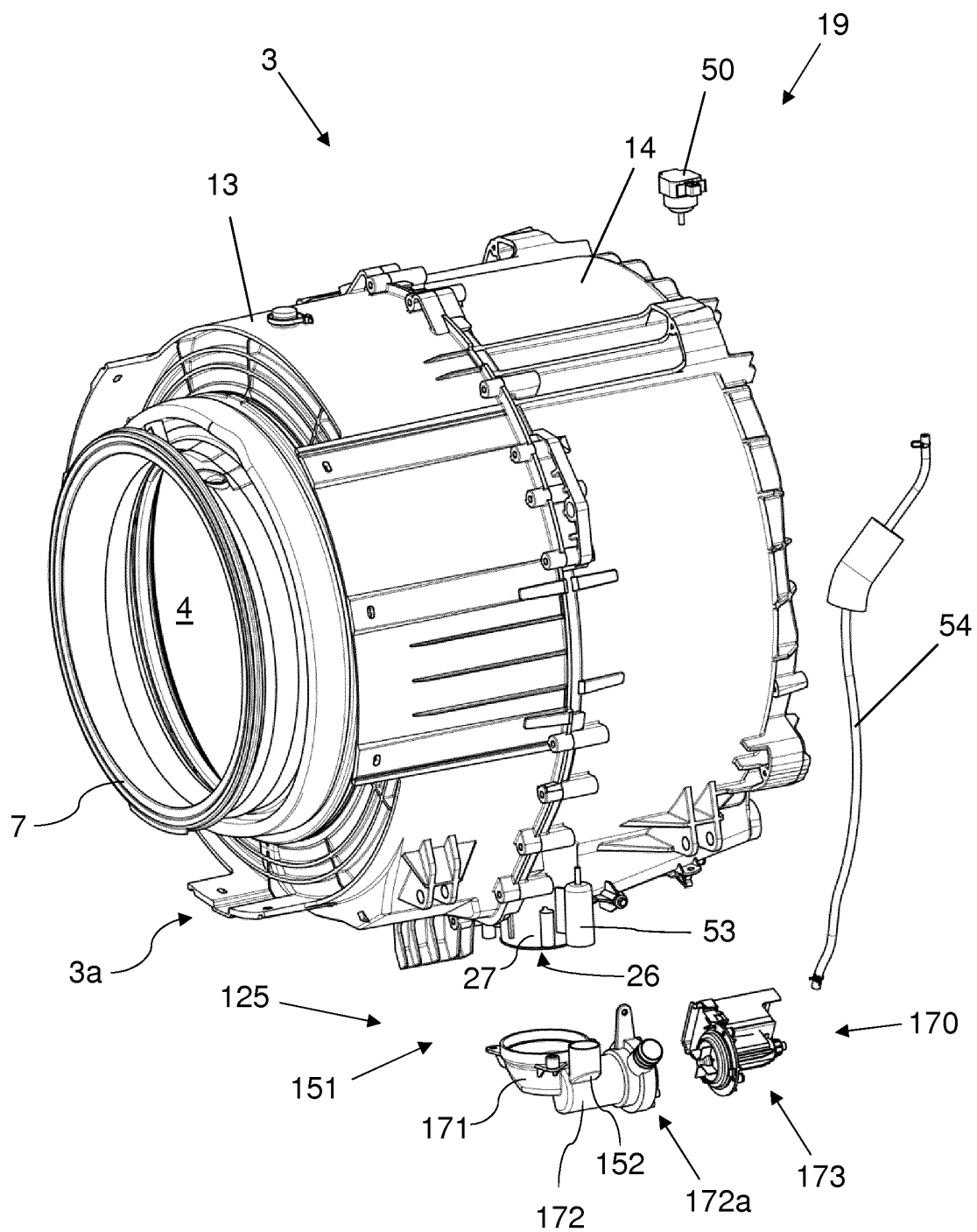


FIG. 12

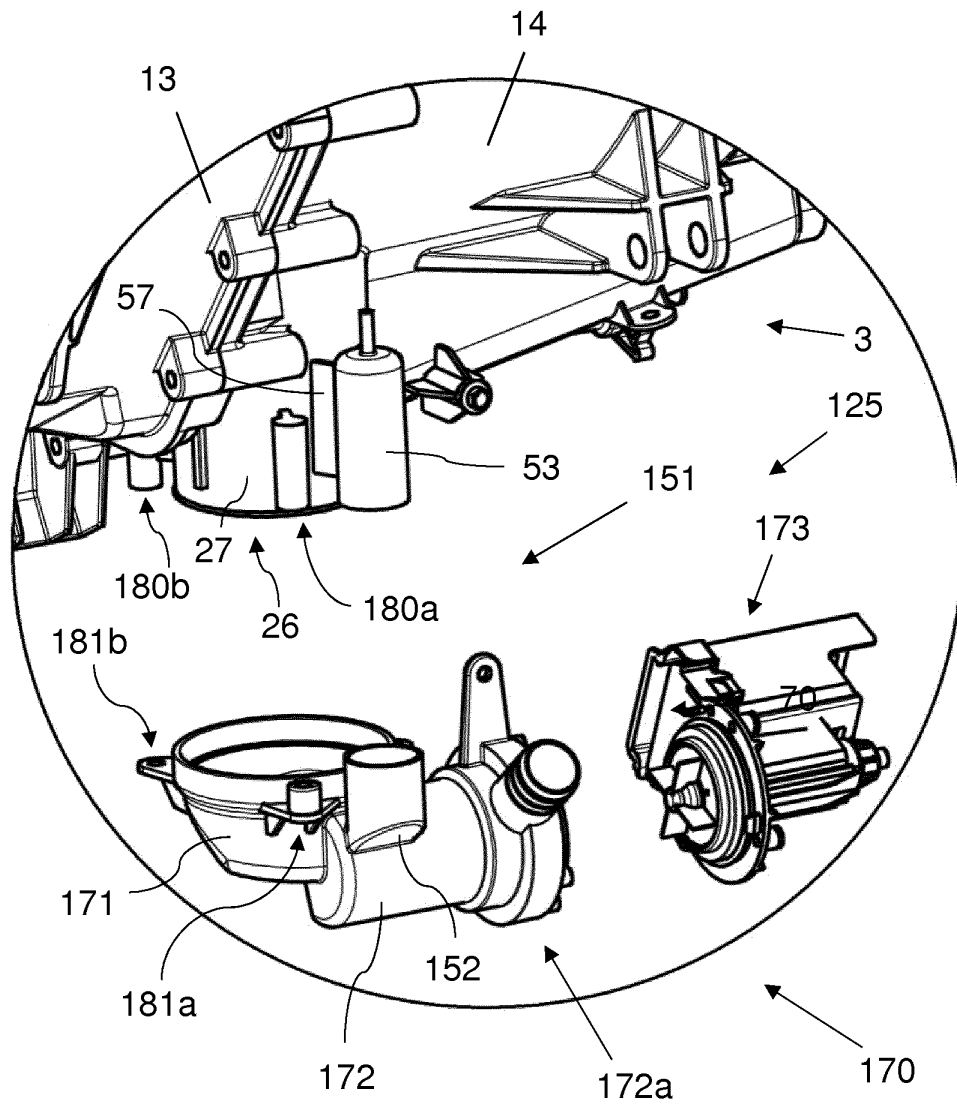
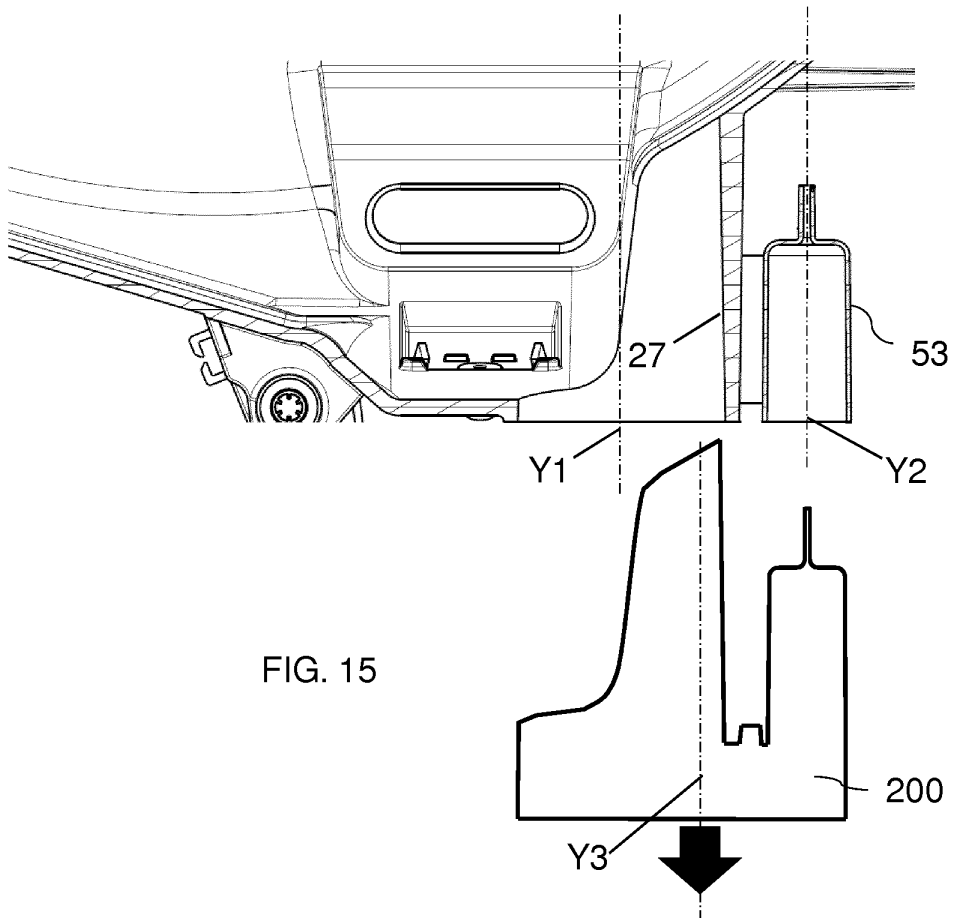
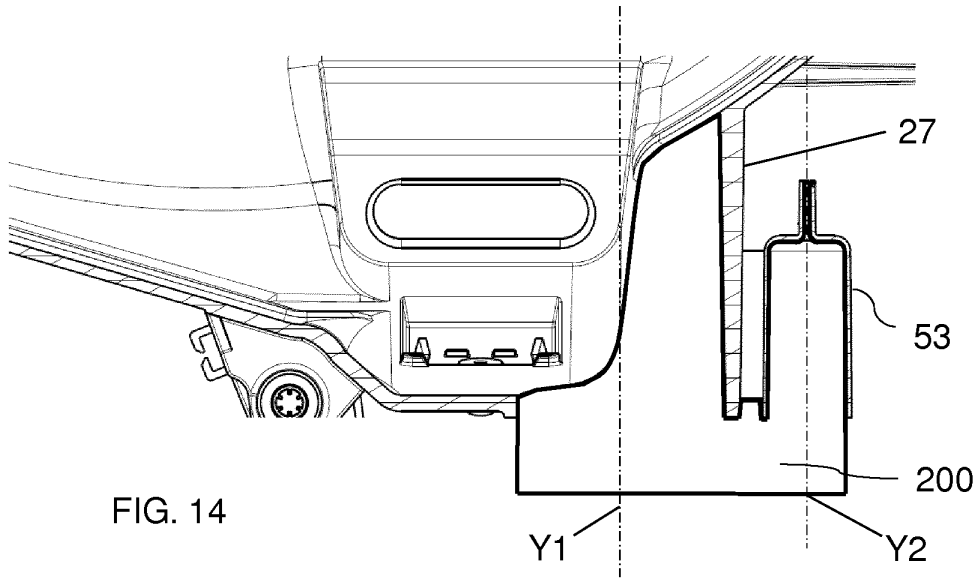


FIG. 13





EUROPEAN SEARCH REPORT

 Application Number
EP 12 19 9173

5

10

15

20

25

30

35

40

45

50

55

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 247 918 A1 (CIAPEM [FR]) 2 December 1987 (1987-12-02) * column 3, lines 52-59; figures 2, 3 *	1-7, 9, 10, 12	INV. D06F39/08
A	DE 10 2004 057943 B3 (MIELE & CIE [DE]) 8 December 2005 (2005-12-08) * abstract; figure 1 *	1-15	
A	FR 2 590 918 A1 (CIAPEM [FR]) 5 June 1987 (1987-06-05) * abstract; figure 2 *	1-15	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC) D06F
Place of search Munich		Date of completion of the search 29 May 2013	Examiner Westermayer, Wilhelm
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 19 9173

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-05-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0247918 A1	02-12-1987	DE 3762357 D1	23-05-1990
		EP 0247918 A1	02-12-1987
		FR 2599394 A1	04-12-1987
		GR 3000604 T3	27-09-1991
		IN 170943 A1	20-06-1992

DE 102004057943 B3	08-12-2005	NONE	

FR 2590918 A1	05-06-1987	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 201598461 U [0011]