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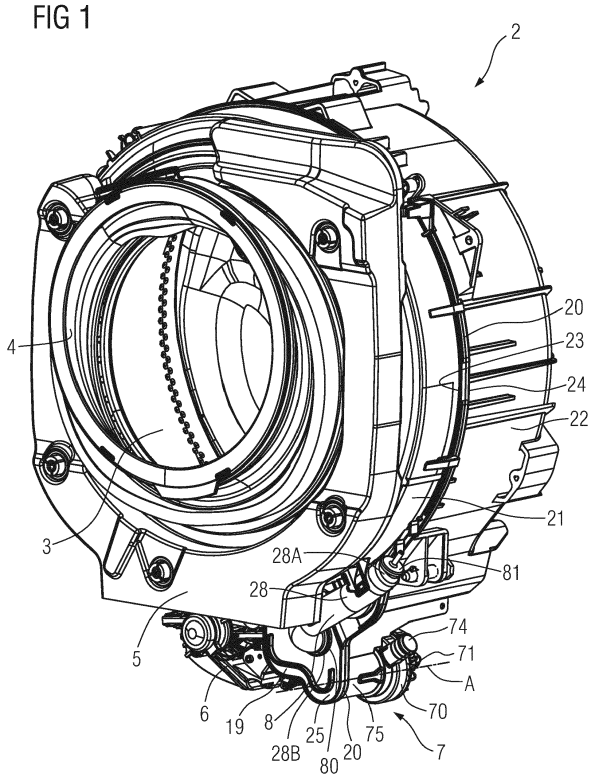
(54) Washing tub unit and washing machine

(57) The invention relates to a washing tub unit for a washing machine comprising
a) a washing tub (2) having a tub interior (9) and housing a rotatable drum (3) for receiving goods to be washed,
b) a level detection housing (28) of a level detection device (8) for detecting a level of washing liquid (L) within the level detection housing (28)
c) wherein the level detection housing (28) is mounted at the washing tub (2),
d) wherein a connecting end (28B) of the level detection housing (28) is connected with a connecting opening (80) in or at the washing tub (2) for fluid communication of washing liquid (L),
e) wherein the level detection housing (28) is pivotable about a pivoting axis (B) running through the connecting opening (80) along a pivoting trajectory or pivoting movement and is fixed in an end position of said pivoting trajectory or pivoting movement.

Furthermore the invention relates to a washing machine having a washing tub unit according to the invention and to a method for mounting a level detection housing at a washing tub of a washing tub unit according to the invention.

FIG 1



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Description

[0001] The invention relates to a washing tub unit for a washing machine and a washing machine.

[0002] Washing machines in households, also called domestic washing machines, are well-known and usually are used for washing laundry.

[0003] Washing machines usually comprise washing tubs in which a rotatable drum is housed for receiving goods to be washed, usually laundry. Washing liquid is introduced into the washing tub, which washing liquid consists only of water or mainly of water and detergents or washing or cleaning agents added to or dissolved in the water for improving the washing quality.

[0004] Usually at the bottom of the washing tub a sump is arranged for draining the washing liquid from the tub into a draining circuit or draining device in order to either feed back the washing liquid from the sump into the washing tub again, often being heated by a heating element arranged in or near the sump, in a closed circuit or circulation mode or to drain the washing liquid out of the washing machine into a sewage conduit, in an open circuit, when it is not needed any more.

[0005] EP 2 198 081 B1 discloses a plastic washing-machine tub with a front wall, a rear wall and a cylindrical wall enclosing an inner tub compartment. The tub comprises two tub shells made from injection-moulded plastic that can be connected together by means of an assembly plane in a tub closure direction, the first tub shell comprising the front wall and the second tub shell comprising the rear wall, and further an integral bulge emerging from the cylindrical wall and defining a cavity serving as draining sump connected to the inner tub compartment via an inlet opening for emptying washing water form the inner tub compartment and a subsequent draining pipe or conduit with an outlet opening. The assembly plane divides the bulge into two parts, a first bulge part being arranged in the first tub shell and a second bulge part in the second tub shell, one of the bulge parts having at least one part of the inlet and outlet opening. Furthermore, the conduit of the bulge is in the tub closure direction divided by the assembly plane. The two tub shells are connected using a welding technique, in particular hot plate welding. The bulge is centered in the cylindrical wall projecting therefrom at a bulge distance from the front wall and/or from the rear wall. By this construction the use of runners or moveable parts in the form during injection-moulding of the plastic tub parts is dispensed with. The closure/joining direction of the shells of the tub is the same as the demoulding direction of each of the shells in the injection-moulding from and is perpendicular to the assembly plane. When the two shells are hermetically joined, the bulge is also sealed by means of the parting line of those shells. Furthermore, the bulge extends from lower tub part to the upper tub part while the assembly plane defining a part of the cavity as a pressure chamber which is connected to the inner tub compartment by a lower chamber part and isolated from the inner tub compartment by an upper chamber part and which has a ventilation hole arranged in its upper part.

[0006] EP 0 835 956 B1 discloses a tubular shaped housing for a washing liquid level sensor for a washing machine. The housing is in fluid connection to a draining outlet bellows by mounting its end base surface with a stub pipe of the outlet bellows part in an axial direction and fixing it by means of a fastening strap. The tubular housing is injection-moulded and has a clip integral with the housing and having two arms ending in form of a barbed wire and being inserted into an opening of the washing tub of the washing machine for fastening the housing at the washing tub. Due to the relative positions of the fastening strap and the clip, the insertion of the two arms into an opening of the washing tub requires a deformation of the draining outlet bellows or the washing liquid level tubular housing.

[0007] It is a purpose of the invention to propose a washing tub unit with a level detection device which can be easily mounted.

[0008] This purpose is achieved by a washing tub unit having the features of claim 1. Preferred embodiments and improvements according to the invention are claimed in the dependent claims.

[0009] According to claim 1 a washing tub unit for a washing machine is provided comprising

a) a washing tub having a tub interior and housing (or: containing) a rotatable drum for receiving goods to be washed,
b) a level detection housing of a level detection device for detecting a level of washing liquid within the level detection housing,
c) wherein the level detection housing is mounted at the washing tub,
d) wherein a connecting end of the level detection housing is connected with a connecting opening in or at the washing tub for fluid communication of washing liquid,
e) wherein the level detection housing is pivotable about a pivoting axis running through the connecting opening along a pivoting trajectory or pivoting movement and is fixed in an end position of said pivoting trajectory or pivoting movement.

[0010] Preferably, the level detection housing is fixed to the washing tub in the end position.

[0011] In particular, at least one fastening element is provided for fixing the level detection housing in its end position, preferably at least one fastening element being provided at the washing tub and at least one further fastening element being provided at the level detection housing.

[0012] Advantageously, at least one screw-fastening element having an internal thread and at least one corresponding screw element and a holding element having a guiding channel for the screw element are provided as fastening elements, wherein preferably the holding ele-

ment is provided at the level detection housing and the screw-fastening element is provided at the washing tub.

[0013] Preferably, at least one bearing element is provided, preferably at the washing tub, having at least one contact surface which a corresponding contact area of the level detection housing rests on or bears against in an end position of the pivoting movement, wherein preferably the contact surface(s) of the bearing element(s) are adapted in their shape to the shape of the corresponding contact area of the level detection housing, in particular having a curved shape.

[0014] Advantageously, at least two bearing elements are provided at opposite sides of the level detection housing, preferably two bearing elements on one side and another bearing element on the other side.

[0015] In particular, the pivoting movement or pivoting trajectory of the level detection housing, as seen towards the end position, is oriented upwardly and/or the contact area(s) of the level detection housing are oriented upwardly or arranged at least partly in an upper half of the level detection housing.

[0016] Preferably, the level detection housing is in its end position oriented or inclined upwardly and/or has at a distal end, preferably an upper end, an air pressure sensor of the level detection device for detecting the pressure of the air in the level detection housing which depends on the level of the washing liquid in the level detection housing.

[0017] Advantageously, the washing tub is composed of a pre-formed front tub part and a pre-formed rear tub part being connected with the front tub part in a connecting area, wherein preferably the pre-formed tub parts are each injection-moulded or formed by injection-moulding from a thermoplastic material and wherein preferably the connection between the two tub parts is made by hot welding.

[0018] In particular, the at least one fastening element is arranged at the front tub part and preferably formed integral with the front tub part, in particular formed from the same thermoplastic material and/or formed in the same injection-moulding process as the front tub part.

[0019] Preferably, the at least one bearing element is arranged at the front tub part and preferably formed integral with the front tub part, in particular formed from the same thermoplastic material and/or formed in the same injection-moulding process as the front tub part.

[0020] Advantageously, the connecting opening for connecting the connecting end of the level detection housing is arranged in the front tub part, preferably in a front wall of a draining sump and/or opposite to a sump outlet of the draining sump.

[0021] In particular, the connecting end of the level detection housing is connected with the connecting opening in a translational movement or along a translational trajectory parallel or axial to the pivoting axis, wherein preferably at least one stopping element is provided for stopping the translational movement of the connecting end in a translational inner position.

[0022] Furthermore, a washing machine is claimed having a washing tub unit according to the invention.

[0023] Furthermore, a method for mounting a level detection housing at a washing tub of a washing tub unit according to the invention is claimed, comprising

a) inserting the connecting end of the level detection housing into the connecting opening in a translational movement coaxial or parallel to the pivoting axis of the opening,
b) pivoting the level detection housing about the pivoting axis until the end position is reached,
c) fixing the level detection housing in the end position.

[0024] Instead of the word "draining" also the word "drainage" can be used in this application and *vice versa.*

[0025] "Circumferential wall" means a wall that is arranged, in particular in a closed manner, around something like an axis for instance and is not limited to a cylindrical or circular shape.

[0026] Further exemplary embodiments are described and explained in the following with reference to the drawings, which show in

FIG 1 a washing tub unit with a draining device in a three-dimensional perspective from the front under a viewing angle from the side,

FIG 2 the washing tub unit of FIG 1 in a perspective view from the rear under a viewing angle from the side,

FIG 3 a lower part of a rear tub part of the washing tub unit with the draining sump in a perspective view from the front in a viewing angle from above.

FIG 4 a lower part of a washing tub unit according to FIG 1 to 3 with a mounted level detection device and with the draining device,

FIG 5 the lower part of the washing tub unit with the mounted level detection device and the draining device of FIG 4 in a, for illustrative purposes, partially sectioned view from the side,

FIG 6 the lower part of the washing tub unit with the mounted level detection device and the draining device of FIG 4 and FIG 5 in a perspective and, for illustrative purposes, partially sectioned view from the rear under a viewing angle from above,

FIG 7 the lower part of the washing tub unit during mounting of the level detection device in a first mounting step in a perspective view similar to FIG 4,

FIG 8 the washing tub unit with the detection level device after the first mounting step of FIG 7 and during a second mounting step,

FIG 9 the mounted level detection device at the washing tub unit according to FIG 4 to FIG 8 in a perspective rear view.

[0027] Identical or at least corresponding parts and quantities in FIG 1 to 9 are designated with the same reference numerals.

[0028] The washing tub unit for a washing machine as shown comprises a washing tub 2 and a draining device 7.

[0029] The washing tub 2 is basically assembled from two parts, in this case a front tub part 21 and a rear tub part 22, which are connected in a connecting area 20 in order to form the washing tub 2 that it is closed in a liquid-tight manner, at its rear and at its circumference. In the connecting area 20 at least one front connecting part 23 of the front tub part 21 and at least one rear connecting part 24 of the rear tub part 22 are connected with each other, in particular by hot welding in order to form a sort of liquid-tight welding seam in the connecting area 20. The front connecting part 23 and the rear connecting part 24 are in particular formed at least partially like connecting flanges which are pressed against each other and then connected, in particular welded by hot welding, to form a permanent connection between the two connecting parts 23 and 24 and thus between the two tub parts 21 and 22. The connecting area 20 is preferably arranged in or forms a connecting or joining plane. In particular the connecting parts 23 and 24 have planar surfaces that are joined, in particular welded, in the connecting plane.

[0030] The front tub part 21 and the rear tub part 22 are, therefore, at least in their connecting parts 23 and 24, formed or made of a material that can be hot welded, preferably a suitable thermoplast or thermoplastic material, as are well known in the art. Preferably the complete rear front tub part 21 and the complete rear tub part 22 are formed from such a thermoplast or thermoplastic material and are produced by moulding between or in at least two complementary moulding forms, in particular injection-moulding in the moulding forms. The hot welded connection also ensures a water tight connection so that no water or washing liquid can escape from the washing tub 2 through or in the connecting area 20 and no further seals or sealing rings are required.

[0031] At the front of the washing tub unit there is an opening 4 for loading of goods to be washed, such as laundry, into the tub interior 9 inside the washing tub 2 which opening 4 is formed in the front tub part 21. As shown, the opening 4 is at least partially surrounded by a counterweight structure 5 associated to the front tub part 21 for balancing the washing tub unit during operative conditions. The opening 4 allows access from the exterior or outside of the washing tub 2 to a carrier, in this case a rotatable or rotating drum 3, arranged in the tub interior 9 of the washing tub 2. Adapted to the rotating drum 3 the washing tub 2 is preferably mainly formed in a cylindrical shape. The drum 3 is rotatable or can be rotated by a rotation drive or drum drive 6 a part of which is shown in FIG 1 below the washing tub 2 but is not explained any further as the rotation and the drive of the rotating drum are well-known in the art.

[0032] The drum drive 6 is fastened at fastening section 61 arranged in the lower section of the rear tub part 21. The rear tub part 21 has a central through-hole 60 for a drive axle (not shown) connecting the drum drive 6 with the drum 3 for rotation of the drum 3 and bearing the forces and momenta exerted by the rotating drum 3 and the load of the laundry or the washing goods within the drum 3. For this purpose, as can be seen in FIG 2, the rear side of the rear tub part 22 is reinforced with reinforcing ribs 62 around the through-hole 60.

[0033] In the tub bottom 12 a sump 10 is formed which has a mainly horizontal and, for example partly slightly sloped, sump bottom 13 and a side wall structure 11 rising upwards from the sump bottom 13 up to the tub bottom 12, so that the sump bottom 13 is the lowest wall of the sump 10 and arranged below the tub bottom 12. An opening in the tub bottom 12 surrounded by the side wall structure 11 forms a sump inlet 18 for the washing liquid in the uppermost part of the sump 10.

[0034] The sump bottom 13 and the side wall structure 11 are arranged lower than the tub bottom 12 so that washing liquid in the washing tub 2 can be collected and drained in the sump 10 under the influence of gravity and/or, in addition, low pressure exerted by a draining pump 70 of the draining device 7.

[0035] A carrier bridge 14 extends within the sump inlet 18 over the sump 10 as a protrusion or extension of the tub bottom 12 inwards from a side wall part 11B and serves as a resting surface or element for coupling a holding element for a heating element (not shown) for heating the washing liquid within the tub 2 which heating element is connected electrically outside the tub 2 through a through-hole 63 in the back of the rear tub part 22.

[0036] A rear tub bottom part 12A and adjacent side wall parts 11A, 11B, 11C and 11D of the side wall structure 11 of the sump 10 and the sump bottom 13, that is to say all limiting walls of the sump 10 except for a front sump wall 11E, are integral with or part of the rear tub part 22, preferably formed from the same thermoplastic material and in the same injection-moulding process in the same moulding form.

[0037] The side wall parts 11A, 11B and 11C follow each other around the sump 10, preferably arranged rectangularly to each other, and are at least approximately vertical walls with sloped upper entry sections at the sump inlet 18 and preferably horizontally curved intermediate transition sections in between the side wall parts 11A, 11B and 11C. The side wall part 11D is arranged above the vertical side wall part 11C and slopes upwardly from the vertical side wall part 11C forming a bottom wall

of an air channel 16 of the sump 10 for releasing air bubbles caught in the liquid in the sump 10.

[0038] A sump front wall 11E which closes the side wall structure 11 of the sump 10 at the front is formed integral with the front tub part 21 and connected with the adjacent side wall parts 11A and 11C and 11D and with the sump bottom 13 at the connecting parts 23 and 24 in the connecting area 20 to close and also seal the sump 10. Preferably the front wall 11E lies in the connecting plane of the two tub parts 21 and 22 and is surrounded by the connecting parts 23 and 24 which are connected, in particular welded, together in the connecting area 20.

[0039] A front tub bottom part 12B of the tub bottom 12 is integral with the front tub part 21 and partly connected by the hot welding in a sealed manner with the rear tub bottom part 12A in or at the connecting area 20 and partly separated from the rear tub bottom part 12A at least by the sump 10.

[0040] Adjacent to the sump 10 and arranged at least partly lower than the sump 10 and its sump bottom 13 there is a draining conduit 75 of the draining device 7.

[0041] The draining conduit 75 has, next to the sump 10, a mainly cylindrical circumferential wall 17 in which an opening is formed as a sump outlet 15 through which the sump 10 is in fluid connection with the draining conduit 75. The sump outlet 15 is arranged above the sump bottom 13, the sump bottom 13 slightly sloping downward towards the section of the circumferential wall 17 which is below the sump outlet 15, and/or arranged in an upper region of the circumferential wall 17 to allow for smooth draining flow from the sump 10 into the draining conduit 75.

[0042] The draining conduit 75 also comprises at a first end, here a rear end 75A, a pump receiving part 37 which has a mainly cylindrical circumferential wall 87 in which a draining outlet 74 is formed. A central (geometrical) axis A of the draining conduit 75 runs through the central region of the circumferential wall 17 and the pump receiving part 37 being their respective central or cylinder axis. The pump receiving part 37 or its circumferential wall is arranged coaxially and subsequent to the circumferential wall 17 with respect to the central axis A at an opposite end of the circumferential wall 17 than the front tub part 21. The circumferential wall of the pump receiving part 37 has a greater diameter or radius from the axis A than the circumferential wall 17. The circumferential walls of the draining conduit 75 together enclose an inner chamber 85 of the draining conduit 75.

[0043] Now, the circumferential wall structure of the conduit 75, in particular the circumferential wall 17 in the front of the conduit 75 and also a part of the circumferential wall of the pump receiving part 37 in the rear of the conduit 75, protrudes or extends into the sump 10 and connects the sump bottom 13 with the side wall parts 11B and 11C of the side wall structure 11 of the sump 10, thus forming a rigid structure. Therefore, the circumferential walls of the draining conduit 75 form themselves curved side wall parts of the side wall structure 11 of the sump 10 and, at the same time, separation wall(s) between the sump 10 and the conduit inner chamber 85 and, preferably, describe or cover an angle range β of usually at least 90°, preferably between 100° and 120°, measured around the central axis A. The corresponding opening angle α of the sump outlet 15 is smaller than the angle range β and typically 80° or less.

[0044] This design and arrangement of the sump outlet 15 as an, preferably rectangular, opening in a curved, preferably cylindrical, and concave as seen from the sump 10 (or convex as seen from the conduit inner chamber 85) separation wall between the sump 10 and the inner chamber 85 of the conduit 75 leads to very good flow results within the sump 10 and at the same time to a very solid and rigid construction. In particular, due to the sump outlet 15 being oriented towards the sump inlet 18 there is a direct and short flow path for the drained liquid thorugh the sump 10 resulting in less turbulences. Also, the conduit 75 is rigidly connected with the sump side wall structure 11 and the sump bottom 13 and the tub bottom 12 over a pre-determined length so that forces exerted on the conduit 75 are distributed and born in a larger section into three dimensions.

[0045] In addition to the draining conduit 75 having the sump outlet 15 as the draining conduit inlet the draining device 7 comprises a draining pump 70 with a pump wheel 72 (only visible in FIG 5) as well as a pump drive 71, usually an electric motor with or without a gear and preferably with, usually electronic, control of the rotational speed, for rotating the pump wheel 72 about a rotational axis which is the central axis A of the draining conduit 75 in the mounted state.

[0046] The pump drive 71 is fixed at a rear side of the pump receiving part 37 of the draining conduit 75 at the rear end 75A, preferably by means of a circular planar drive flange 82 and screws 83 to be guided through guidings 84 in the drive flange 82 and to be screwed into corresponding screw holes at the rear side. Therefore, the pump receiving part 37 and thus the whole conduit 75 has to bear the weight of the pump 70 which is accomplished by the rigid tube-like construction and the rigid connection with the sump 10 as already described. Preferably, a gasket or sealing ring (not shown) is arranged between the pump receiving part 37 of the draining conduit 75 and the drive flange 82 for sealing. The pump wheel 72 together with its mainly cylindrical pump wheel housing (not shown) is introduced through a rear opening into the inner conduit chamber 85 and arranged within the pump receiving part 37 or, more specifically, inside the part of the inner conduit chamber 85 of the draining conduit 75 that is surrounded by the circumferential wall of the pump receiving part 37.

[0047] The whole circumferential wall structure and the pump receiving part 37 of the conduit 75 are formed integral with the rear tub part 12, i.e. formed in the same material and/or injection-moulding process.

[0048] The front tub part 21 has a cover wall 25. The cover wall 25 covers or closes the draining conduit 75

and its inner chamber 85 at a second end, here a front end, 75B which is, as seen axially along the central axis A, opposite to the rear end 75A and, further upwardly, forms the sump front wall 11E of the sump 10 and continues into a front tub bottom part 12B of the tub bottom 12 which is more or less directed at a right angle to the cover wall 25. So the front cover of the conduit 75 and the sump 10 are formed integrally by the same cover wall 25 which in turn is formed integrally with the front tub part 21.

[0049] The cover wall 25 is at least at the side towards the conduit 75 or sump 10 mainly flat or planar and is at least at the front end 75B of the conduit 75 oriented orthogonal to the central axis A of the conduit 75. Furthermore, the cover wall 25 is connected with the circumferential wall 17 of the conduit 75, usually in the connecting area 20 and/or in the connecting plane, which connection is made at the same time the two tub parts 21 and 22 are connected by hot welding. Due to the front wall of the conduit 75 formed by the cover wall 25 and the front wall 11E of the sump 10 also formed by the cover wall 25 being planar, preferably lying in the same connecting plane, the cavity or volume or the conduit 75 as well as of the sump 10 is in each case formed entirely in the rear tub part 22 and only closed by the front tub part 21. This allows for simple moulding forms and manufacture.

[0050] In the sump front wall 11E, which is preferably constituted or formed by the cover wall 25, there is a hole or an opening 80 for mounting a level detection tube (or: pipe) 28 of a level detection device 8. The level detection tube 28 is arranged at least slightly upwardly and is closed at a distal end or upper end 28A opposite to the connecting end 28B which is connected in the opening 80. The level detection tube 28 forms a housing of the level detection device 8 for receiving washing liquid and air above the washing liquid level, which has in the case shown a cylindrical shape. Other forms than the form of a tube or cylindrical shape are possible too for this housing. A different level of washing liquid in the sump 10 and the tub bottom 12 will result in a different filling level in the level detection tube 28 and cause a variation of the air pressure above the liquid level which can be detected or sensed by an air pressure sensor 81 at the upper end 28A of the level detection tube 28.

[0051] The opening 80 for connecting the connecting end 28B of the level detection tube 28 is arranged above the draining conduit 75 and on the other side of the sump 10 than the sump outlet 15, basically opposite to the sump outlet 15, which results in the level detection tube 28 being emptied efficiently by the pump pressure being exerted in the sump 10 through the sump outlet 15. A central axis B of the, preferably circular, opening 80 and/or an inserting direction for inserting the connecting end 28B of the level detection tube 28 is preferably oriented parallel to the central axis A of the conduit 75.

[0052] In FIG 3 to 5 and 8 the level detection device 8 is mounted and fixed to the washing tub 2 and, thus, shown in the mounted state.

[0053] The level detection tube 28 rests at one side and in its upper half against at least one contact surface 101 of a first bearing element 100. At the same side of the level detection tube 28 as the first bearing element 100 and again in its upper half a third bearing element 120 with a contact surface 121 is arranged and the level detection tube 28 rests also against this bearing surface 121. The third bearing element 120 comprises an opening 140 which is arranged so as to be engaged by a protrusion 141 formed on the outer surface of the level detection tube 28. The opening 140 and the protrusion 141 form fixing or fastening elements, in particular, snapping or clipping elements that allow the level detection tube 28 to be removably attached to the washing tub 2. Even if, in FIG 4, 7, 8, opening 140 has been shown as formed on the third bearing element 120, it can be provided in any of the bearing elements 100, 110. The protrusion 141 has to be formed on the outer surface of the level detection tube 28 in a position adapted to engage the opening 141.

[0054] At the opposite side of the level detection tube 28 facing away from the side where the first bearing element 100 and the third bearing element 120 are arranged, there is a second bearing element 110 which is arranged basically in between the first bearing element 100 and the third bearing element 120 as seen in an axial direction of the level detection tube 28. This second bearing element 110 has several rib-like elements each having a contact surface 111 against which the level detection tube 28 rests with a corresponding contact area in the upper half of its outside surface.

[0055] The contact surfaces 101, 111 and 121 are shaped in a manner complementary or adapted to the outer shape of the level detection tube 28, which in the embodiment shown is a concavely curved, preferably mainly cylindrical, shape in order to rest on the outer surface of the level detection tube 28 over a significant contact area. In particular, as the contact surfaces 111 are at the opposite side of the level detection tube 28 than the contact surfaces 101 and 121 they are curved in the opposite direction or mirror-symmetric to the contact surface 101 or 121 of the first bearing element 100 and the third bearing element 120. If the outer shape of the level detection housing differs from a tube-shape the contact surfaces 101, 111 and 121 will be adapted in their shape accordingly to rest over a sufficient area on the outer surface of the level detection housing.

[0056] The level detection tube 28 or housing in general is therefore held in a shape locking manner in between the opposing and axially displaced contact surfaces 101, 111 and 121 and can be brought into contact with these contact surfaces 101, 111 and 121 by moving the level detection tube 28 upwardly until it rests with its outer surface in its upper half against the contact surfaces 101, 111 and 121. The contact surfaces can also be called or serve as bearing surfaces or supporting surfaces or resting surfaces.

[0057] All bearing elements 100, 120 and 110 are ar-

ranged, in the embodiment shown, at the front tub part 21, preferably at the outside and from below in a lower or bottom section of the front tub part 21, and are preferably integrally formed with the front tub part 21 or integral parts with the front tub part 21, in particular formed from the same thermoplastic material and/or formed in the same injection-moulding process as the front tub part 21.

[0058] In order to bring the level detection tube 28 in the mounted state shown in FIG 4 to 6 and 8 a sequence of at least two, preferably three, mounting steps according to the invention is provided which is explained with reference to FIG 6 and 7.

[0059] A first mounting step is shown in FIG 6. The connecting end 28B of the level detection tube 28 is inserted into the opening 80 in the cover wall 25 in an axial mounting direction (or: translational direction) M1 which is coaxial or parallel to the central axis B of the opening 80, until the flange 38 rests or abuts or stops against the outer wall and periphery of the opening 80 which acts as a stopping surface for the axial movement of the connecting end 28B into the opening 80 along the central axis B. A sealing ring 39 provided in front of the flange 38 seals the intermediate gap and serves to achieve a liquid-tight connection. This first mounting step therefore is a translational mounting step.

[0060] In this intermediate mounting state, reached after the first translational mounting step, the level detection tube 28 still points slightly downwardly and will now, in a second mounting step, as shown in FIG 7, be rotated or pivoted about the central axis B of the opening 80 in a second mounting direction M2 in a second and rotational mounting movement or step along a pivoting trajectory. This rotational mounting movement in the rotational mounting direction M2 will be continued until the level detection tube 28 stops at or abuts with or is in contact with the contact surfaces 101, 111 and 121 of the bearing elements 100, 110 and 120. When level detection tube 28 approaches the contact surfaces 101, 111, and 121, fixing or fastening elements 140, 141 begin to engage each other so as to removably fix the level detection tube 28 onto the washing tub 2. The fixation of the level detection tube 28 onto the washing tub 2 is completed when the level detection tube 28 abuts with the contact surfaces 101, 111 and 121 of the bearing elements 100, 111, 121. This is the end position or final position of the level detection tube 28, in which the level detection tube 28 is now inclined upwardly with respect to a horizontal plane.

[0061] In this final position the level detection tube 28, according to a third optional mounting step, may be further fixed to the front tub part 21 by means of at least one fixing or fastening element 130 which is preferably also provided at, in particular integrally formed with, the front tub part 21.

[0062] In the embodiment shown the fastening element 130 is a screw bolt having an internal thread 131. At the outside of the level detection tube 28 a holding element 132 is provided or attached which has a guiding channel 134 for inserting a fastening screw 133 which is screwed into the internal thread 131 of the fastening element 130. The guiding channel 134 for the screw 133 is formed in a special way and is partially opened to the outside, so not completely closed. Nevertheless, when the screw 133 is inserted, the holding element 132 and thus the level detection tube 28 it is attached to cannot be loosened or removed from the screw 133 any more and will be fixed to the tub 2, in particular the front tub part 21. This can be accomplished by leaving a circumferential gap which is smaller than the diameter of the screw 133 or by arranging the internal thread 131 downwardly and the screw 133 upwardly so that the screw head of the screw 133 rests upwardly against the front face of the guiding channel 134 and prevents the level detection tube 28 from rotating downwards again due to its weight. Other arrangements of screw connections or other fastening elements than screw connectors are of course possible too.

[0063] So the sequence of mounting steps comprises

- a translational first mounting step
- a pivoting or rotational second mounting step
- a fixing or fastening third mounting step

[0064] The last, third mounting step is not necessarily a separate mounting step, being combinable with the second mounting step by providing fixing or fastening elements which cooperate already when the bearing elements 100, 110 and 120 come into contact with the level detection tube 28.

[0065] Due to the pivoting movement in the second mounting step it is possible to mount and fasten the level detection tube 28 from below at a lower section of the front tub part 21 in a relatively simple manner and with sufficient space in the mounting process.

[0066] Apart from an upward pivoting movement it is in principle also possible to provide a pivoting movement downwards or sidewards if the contact surfaces 101, 111 and 121 and the fastening element 130 are arranged accordingly.

[0067] Within or in the interior or inner chamber 85 of the draining conduit 75 a filter element 76 (only shown partly in FIG 4) is arranged, having a filtering section for filtering out objects of specific size and/or dimensions, in particular larger and/or longer objects, from the draining liquid to prevent them from reaching the pump wheel 72. The filtering section is arranged essentially within the circumferential wall 17 of the conduit 75 when the filter element 76 is mounted. The filter element 76 has further a, preferably mainly cylindrical, pump wheel housing (not shown) formed integral with the filter element 76 or the filtering section and being arranged within the pump receiving part 37 of the conduit 75 in the mounted state.

[0068] The central axis A of the conduit 75 extends, in the mounted state, preferably in a horizontal direction or in a horizontal plane orthogonal to the direction of gravity

which results in a horizontal axial flow of draining liquid through the draining conduit 75 and improves the filtering effect of the filter element 76. The main draining flow direction of the liquid in the direction from the sump outlet 15 to the rear end 75A to the pump wheel 72 is, thus, horizontal and orientated from the front to the rear or away from the front tub part 21 and its front cover 25. The draining outlet 74 of the pump receiving part 37 of the draining conduit 75 consists of a short pipe or tube extending fro the circumferential wall 87 outwardly, essentially in radial direction from the axis A, and is inclined upwardly with respect to the axis A or a horizontal plane.

[0069] Once the filter element 76 is correctly inserted into the conduit 75 the pump wheel 72 of the pump 70 can be introduced into the pump wheel housing of the filter element 76. In the mounted state the central axis A is the central axis of the pump wheel housing and the pump wheel 72 as its rotational axis and preferably axis of inertia for balanced rotation. The pump wheel 72 is rotated about the axis A in order to suck or draw in washing liquid from the sump 10 through the sump outlet 15 into the inner conduit chamber 85 and through the filtering section of the filter element 76 and thereafter into the pump wheel housing and, then, to dispense or pump the liquid out of the pump wheel housing and through the draining outlet 74 in a mainly radial direction. So, the draining pump 70 and its pump wheel 72 have an axial inflow and a radial outflow for the washing liquid with respect to the central axis A.

[0070] In order to facilitate and improve the connection between the front tub part 21 and the rear tub part 22 at the connecting area 20 connecting elements 26 and 27 can be provided wherein, as shown, the connecting element 26 arranged at the front tub part 21 is a protruding part and is received by a receiving recess as a second connecting element 27 which design improves the connecting properties of hot welding and constitutes a welded water tight sealing. Also the connecting parts 26 and 27 allow for a pre-positioning of the two tub parts 21 and 22 before welding.

[0071] The front tub part 21 and the rear tub part 22 are, in the preferred embodiment shown, both formed in such a way that they can be injection-moulded from a thermoplastic material between two moulding forms in a moulding process reducing the use of runners or moveable form parts in further moulding steps. At least one, preferably both, of the two moulding forms, usually an inner moulding form, forms cavities and concave spaces in the tub parts 21 and 22 such as the sump 10 or the tub interior 9 or the draining conduit 75 which cavities or concave spaces start at the connecting line between the two moulding parts and are open towards the connecting part line of the moulding parts, wherein the sump 10 and the conduit 75 are preferably basically formed in the rear tub part 22. In particular, the front tub part 21 and preferably also the most part of the rear tub part 22, have a shape that allows for direct linear retraction of the moulding forms along a common retraction direction which is parallel to an axis running through the tub part 21 or 22 in case of tub part 22 the central axis A of the draining conduit 75. In order to be able to withdraw or retract each of the moulding forms after the moulding process it is necessary that no moulded part of the freshly moulded tub part is in the way of a moulding form section along the retraction direction. The moulding process will be anyway greatly simplified if the number of moulded parts in the way of a moulding form section along the retraction direction is very little, for example just one.

[0072] This is achieved in the construction of the tub parts 21 and 22 by not allowing or by limiting in number, in a direction opposite to the retraction direction, any broadening or increase in the diameter or inner dimension of each of the cavities or concave spaces in the tub parts 21 and 22 in any lateral direction which is orthogonal to the retraction direction of each of the two moulding forms. In other words, the inner dimensions or diameters of each cavity and concave space, as seen in a linear projection along the retraction axis, in particular along or parallel to the central axis A, in the front tub part 21 and in the most part of the rear tub part 22, in particular the sump 10, the tub interior 9 and the draining conduit 75, stay the same or decrease, i.e. do not increase, in a direction which is opposite to each moulding form retraction direction. This allows linear retraction of an inner moulding form which has the complementary shape to these cavities or concave spaces out of these cavities and spaces of a freshly moulded front tub part 21 and the most part of rear tub part 22 in a retraction direction parallel to the retraction axis, in particular central axis A.

List of reference numerals

[0073]

2	washing tub
3	drum
4	opening
5	counterweight structure
6	drum drive
7	draining device
8	level detection device
9	tub interior
10	draining sump
11	side wall structure
11A	side wall part
11B	side wall part
11C	side wall part
11D	side wall part
11E	front side wall part
12	tub bottom
12A	front tub bottom part
12B	rear tub bottom part
13	sump bottom
14	carrier bridge
15	sump outlet
16	air channel

17	circumferential wall
18	sump inlet
19	reinforcing rib
20	connecting area/seam
21	front tub part
22	rear tub part
23	front connecting part
24	rear connecting part
25	front cover
26,27	connecting element
28	level detection tube
28A	distal end
28B	connecting end
30	deflector element
37	pump receiving part
38	flange
39	sealing ring
60	through-hole
61	fastening element
62	reinforcing ribs
63	through-hole
70	draining pump
71	pump drive
72	pump wheel
74	draining outlet
75	draining conduit
75A	first end
75B	second end
76	filter element
80	connecting hole
81	air pressure sensor
82	drive flange
83	screws
84	screw guidings
85	inner conduit chamber
91	positioning element
92	positioning slot
100	first bearing element
101	contact surface
110	second bearing element
111	contact surface
120	third bearing element
121	contact surface
130	fastening element (screw bolt)
131	internal thread
132	holding element
133	fastening screw
134	guiding channel
140	opening
141	protrusion
A	central axis
B	middle axis of hole 80
M1	axial mounting direction
M2	rotational mounting direction
α	opening angle
β	angle range

Claims

1. Washing tub unit for a washing machine comprising

a) a washing tub (2) having a tub interior (9) and housing a rotatable drum (3) for receiving goods to be washed,
b) a level detection housing (28) of a level detection device (8) for detecting a level of washing liquid (L) within the level detection housing (28),
c) wherein the level detection housing (28) is mounted at the washing tub (2),
d) wherein a connecting end (28B) of the level detection housing (28) is connected with a connecting opening (80) in or at the washing tub (2) for fluid communication of washing liquid (L),
e) wherein the level detection housing (28) is pivotable about a pivoting axis (B) running through the connecting opening (80) along a pivoting trajectory or pivoting movement and is fixed in an end position of said pivoting trajectory or pivoting movement.

2. Washing tub unit according to claim 1, wherein the level detection housing (28) is fixed to the washing tub (2) in the end position.

3. Washing tub unit according to claim 1 or claim 2, wherein at least one fastening element (130, 132, 133, 134, 140) is provided for fixing the level detection housing (28) in its end position, preferably at least one fastening element (130, 140) being provided at the washing tub (2) and at least one further fastening element (132, 141) being provided at the level detection housing (28).

4. Washing tub unit according to claim 3, wherein at least one screw-fastening element (130) having an internal thread (131) and at least one corresponding screw element (133) and a holding element (132) having a guiding channel (134) for the screw element (133) are provided as fastening elements, wherein preferably the holding element (132) is provided at the level detection housing (28) and the screw-fastening element (130) is provided at the washing tub (2).

5. Washing tub unit according to any of the preceding claims, wherein at least one bearing element (100, 110, 120) is provided, preferably at the washing tub (2), having at least one contact surface (101, 111, 121) which a corresponding contact area of the level detection housing (28) rests on or bears against in an end position of the pivoting movement, wherein preferably the contact surface(s) (101, 111, 121) of

the bearing element(s) (100, 110, 120) are adapted in their shape to the shape of the corresponding contact area of the level detection housing (28), in particular having a curved shape.

6. Washing tub unit according to claim 5, wherein at least two bearing elements (100, 110, 120) are provided at opposite sides of the level detection housing (28), preferably two bearing elements (100, 120) on one side and another bearing element (110) on the other side.

7. Washing tub unit according to any of the preceding claims, wherein the pivoting movement or pivoting trajectory of the level detection housing (28), as seen towards the end position, is oriented upwardly and/or the contact area(s) of the level detection housing (28) are oriented upwardly or arranged at least partly in an upper half of the level detection housing (28).

8. Washing tub unit according to any of the preceding claims, wherein the level detection housing (28) is in its end position oriented or inclined upwardly and/or has at a distal end (28A), preferably an upper end, an air pressure sensor (81) of the level detection device (8) for detecting the pressure of the air in the level detection housing (28) which depends on the level of the washing liquid (L) in the level detection housing (28).

9. Washing tub unit according to any of the preceding claims, wherein the washing tub (2) is composed of a pre-formed front tub part (21) and a pre-formed rear tub part (22) being connected with the front tub part (21) in a connecting area (20), wherein preferably the pre-formed tub parts are each injection-moulded or formed by injection-moulding from a thermoplastic material and wherein preferably the connection between the two tub parts (21, 22) is made by hot welding.

10. Washing tub unit according to claim 9 and claim 3 or claim 4, wherein the at least one fastening element (130) is arranged at the front tub part (21) and preferably formed integral with the front tub part (21), in particular formed from the same thermoplastic material and/or formed in the same injection-moulding process as the front tub part (21).

11. Washing tub unit according to claim 9 and one of claims 5 and 6,
wherein the at least one bearing element (100, 110 and 120) is arranged at the front tub part (21) and preferably formed integral with the front tub part (21), in particular formed from the same thermoplastic material and/or formed in the same injection-moulding process as the front tub part (21).

12. Washing tub unit according to claim 9, wherein the connecting opening (80) for connecting the connecting end (28B) of the level detection housing (28) is arranged in the front tub part (21), preferably in a front wall (11E) of a draining sump (10) and/or opposite to a sump outlet (15) of the draining sump (10).

13. Washing tub unit according to any of the preceding claims, wherein the connecting end (28B) of the level detection housing (28) is connected with the connecting opening (80) in a translational movement or along a translational trajectory parallel or axial to the pivoting axis (B), wherein preferably at least one stopping element (38) is provided for stopping the translational movement of the connecting end (28B) in a translational inner position.

14. Washing machine having a washing tub unit according to one of the preceding claims.

15. Method for mounting a level detection housing (28) at a washing tub (2) of a washing tub unit according to any of claims 1 to 13, comprising

a) inserting the connecting end (28B) of the level detection housing (28) into the connecting opening (80) in a translational movement coaxial or parallel to the pivoting axis (B) of the opening (80),
b) pivoting the level detection housing (28) about the pivoting axis (B) until the end position is reached,
c) fixing the level detection housing (28) in the end position.

FIG 1

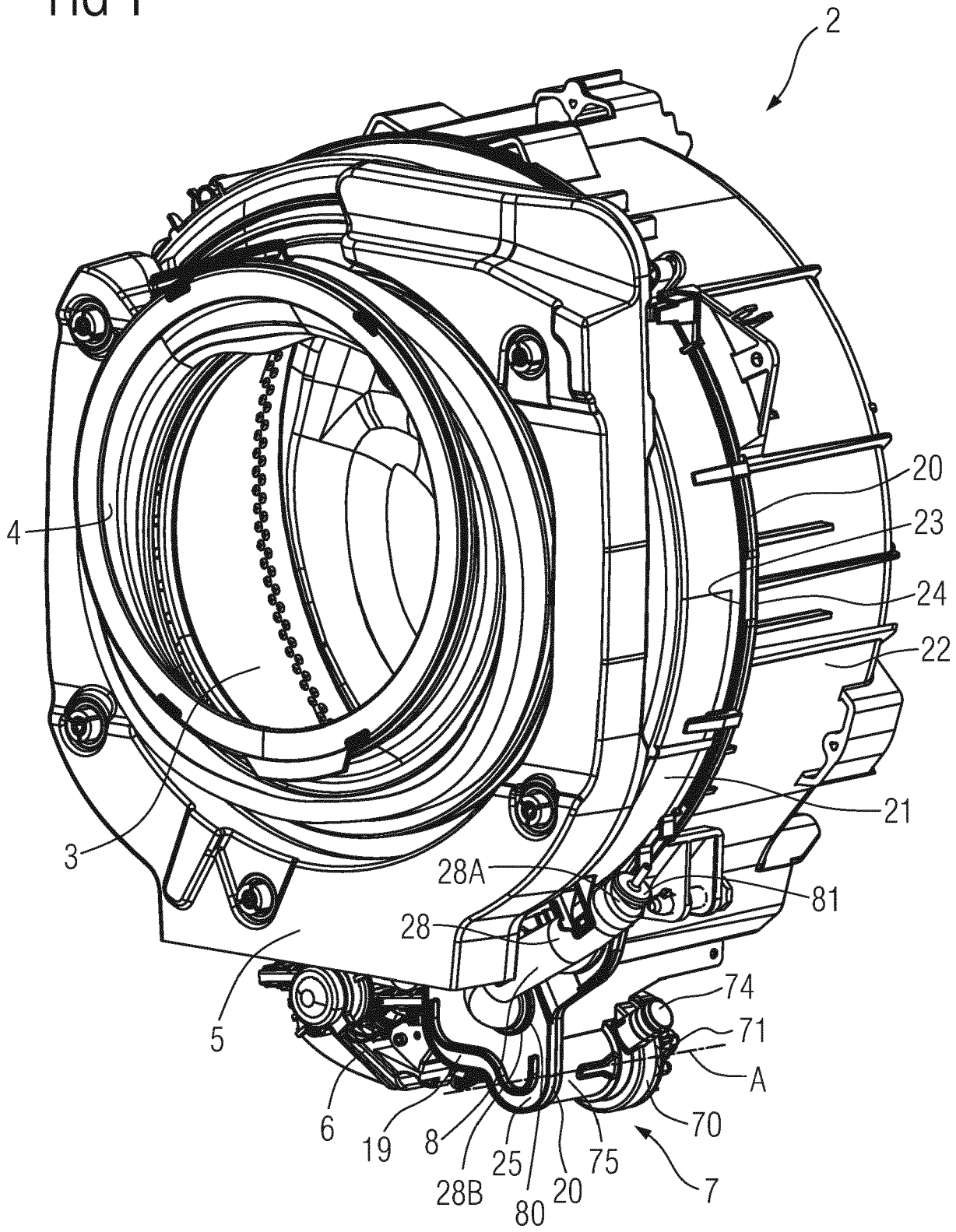
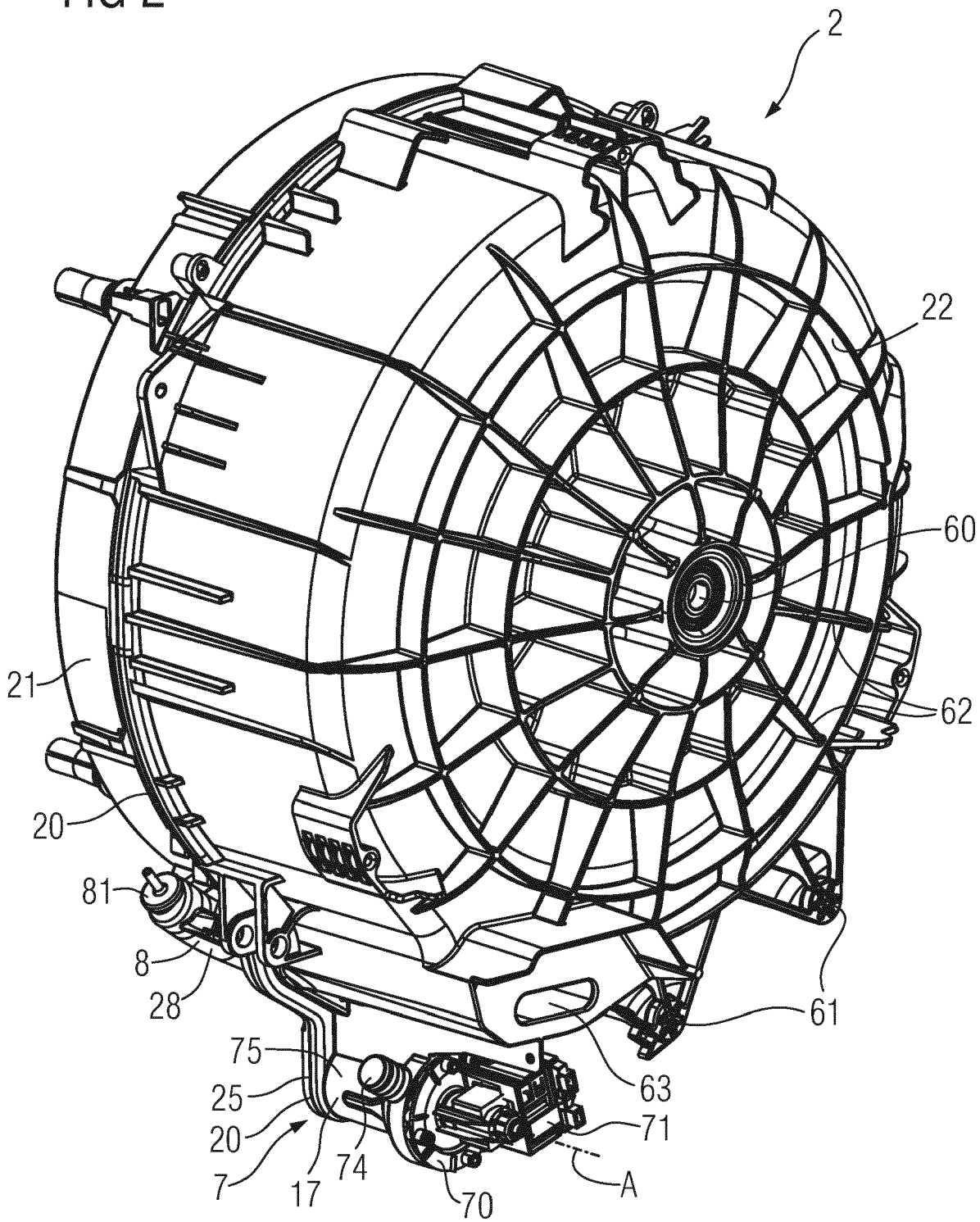


FIG 2



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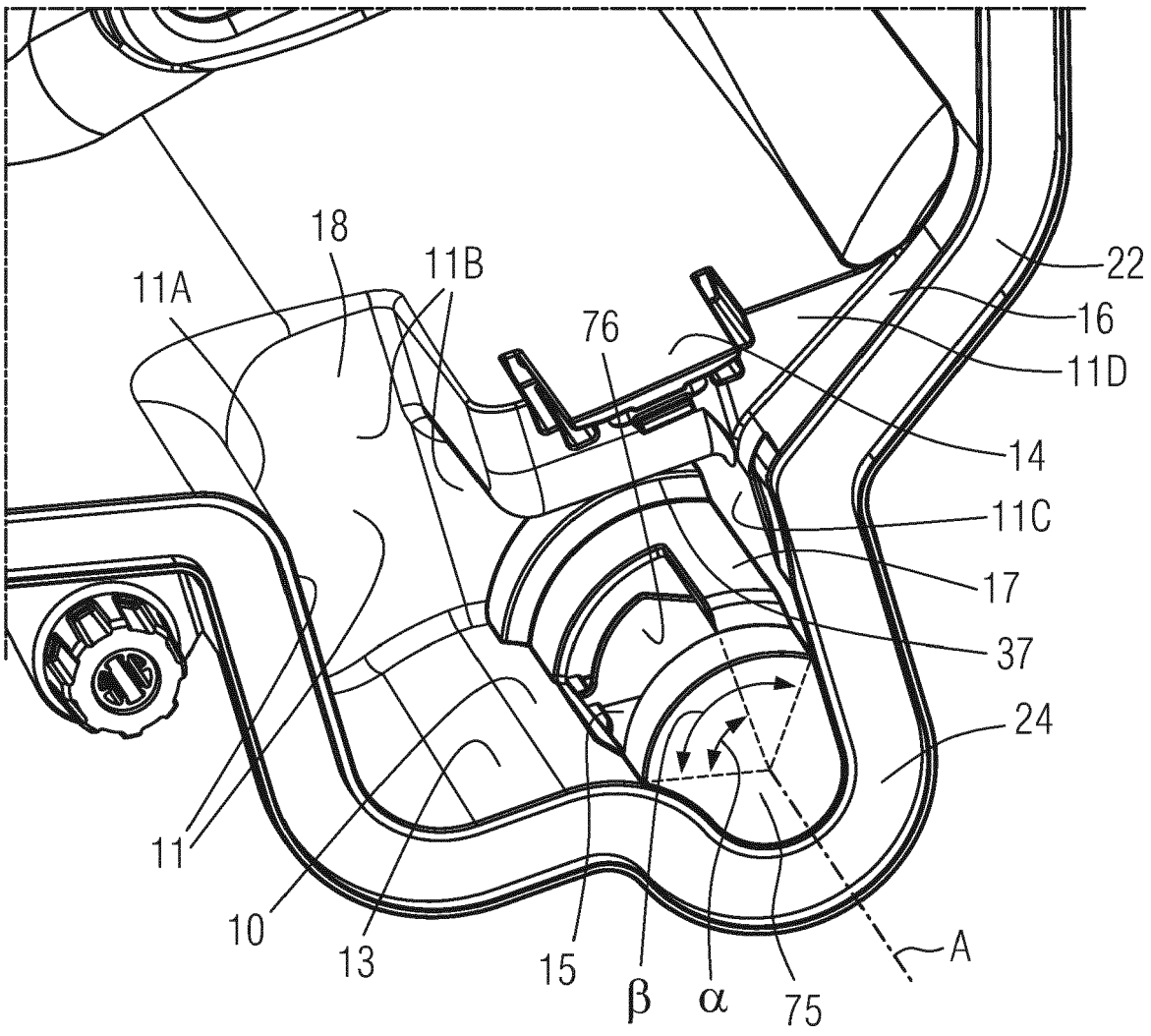

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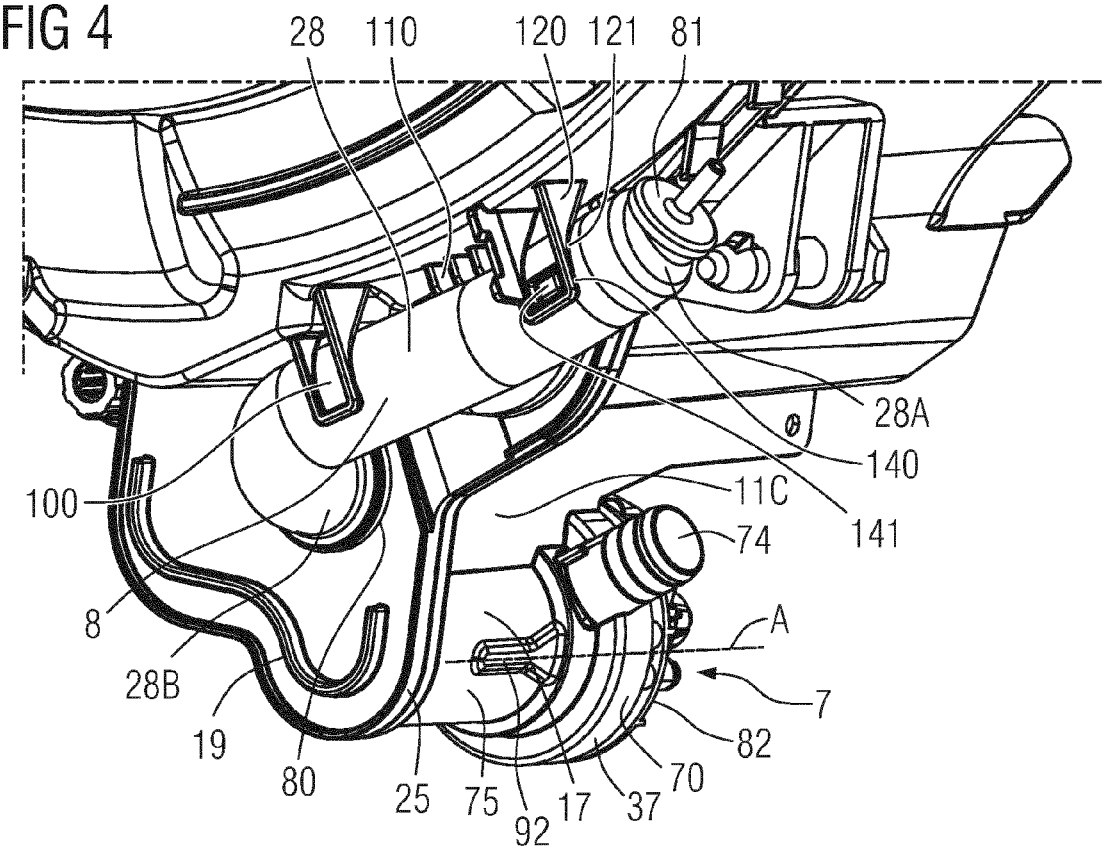
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110
120
121
81
28A
140
11C
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74
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8
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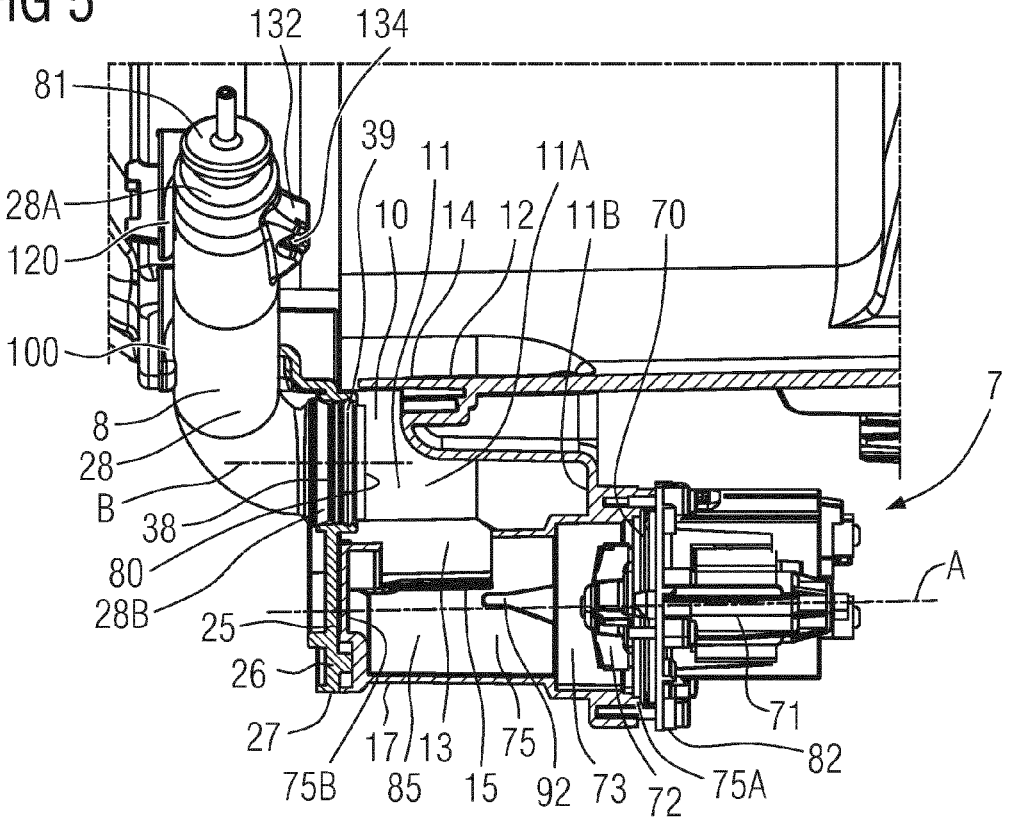
25
75
92
17
37

FIG 5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13
75
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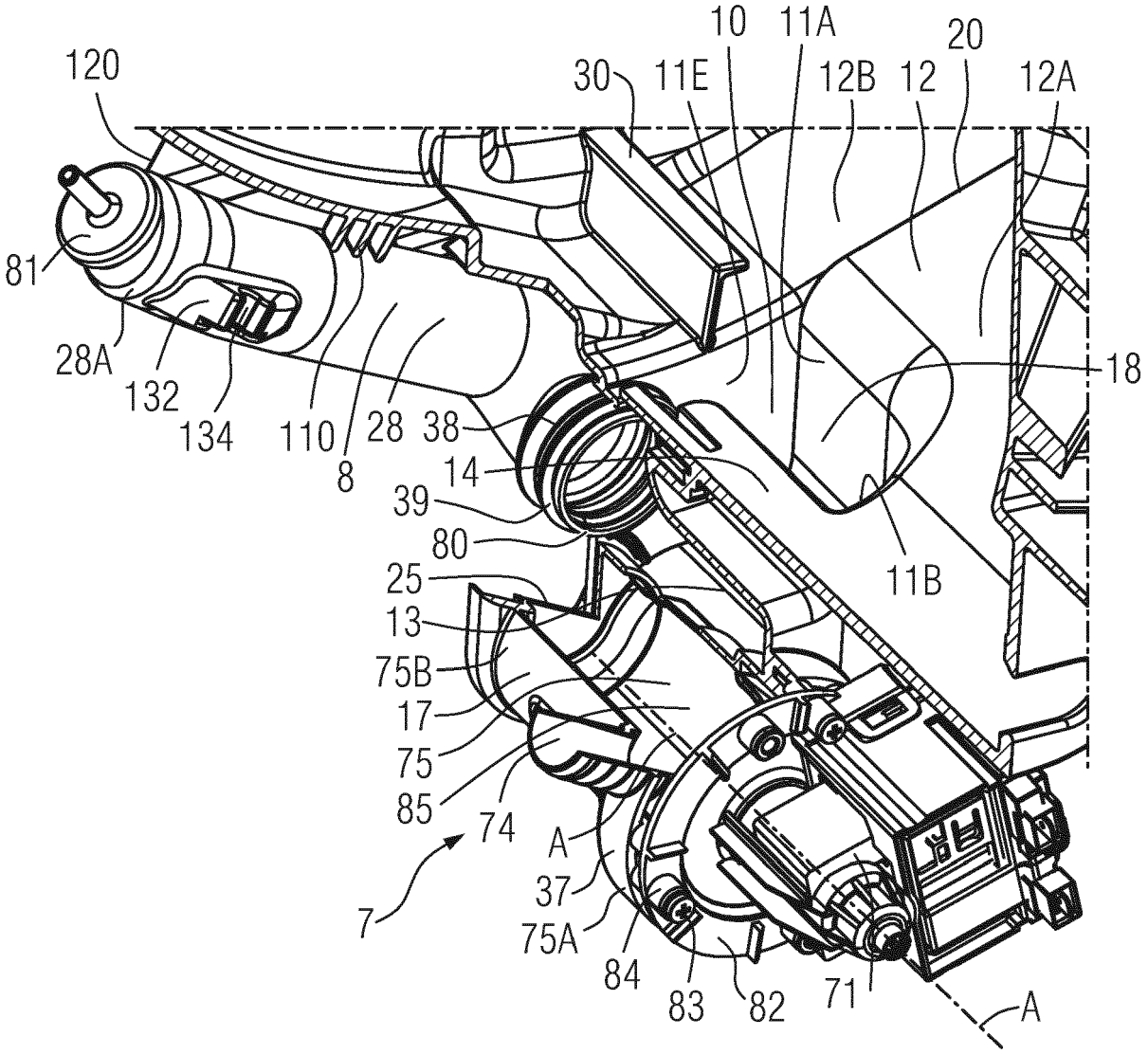
75B
85
15
92
73
72
75A

FIG 6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11B
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75B
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75A
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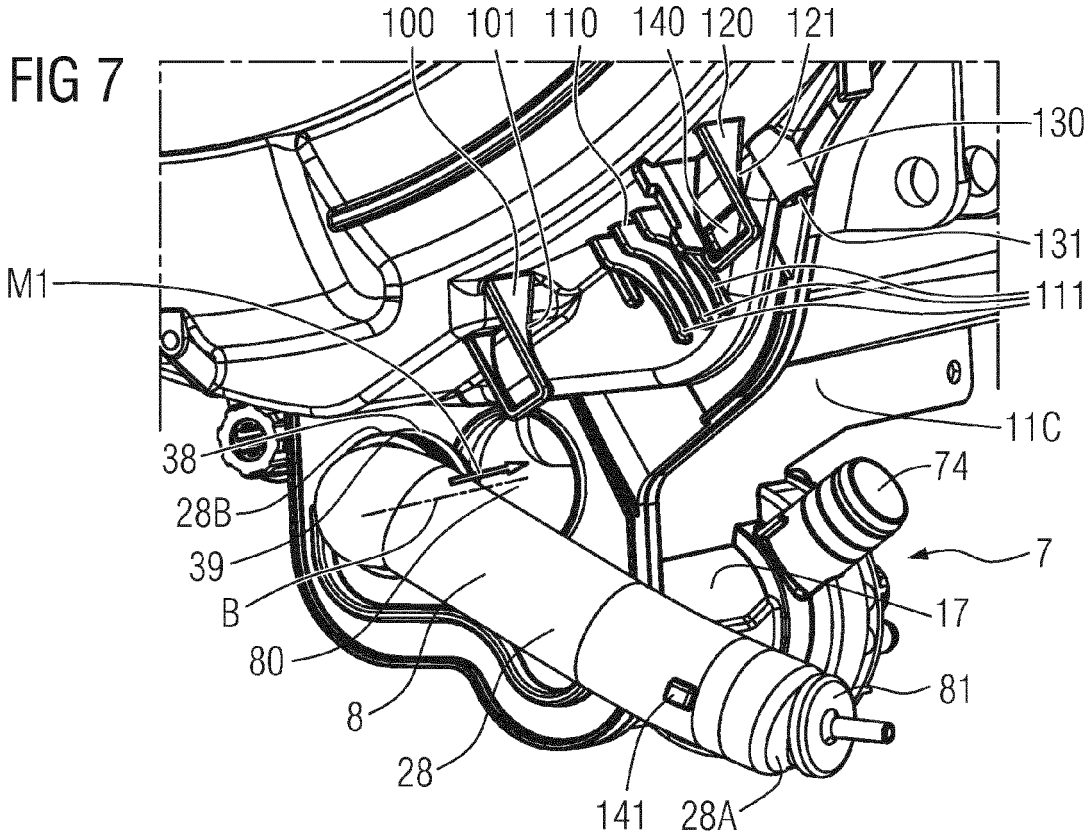
82
71
A
7

FIG 7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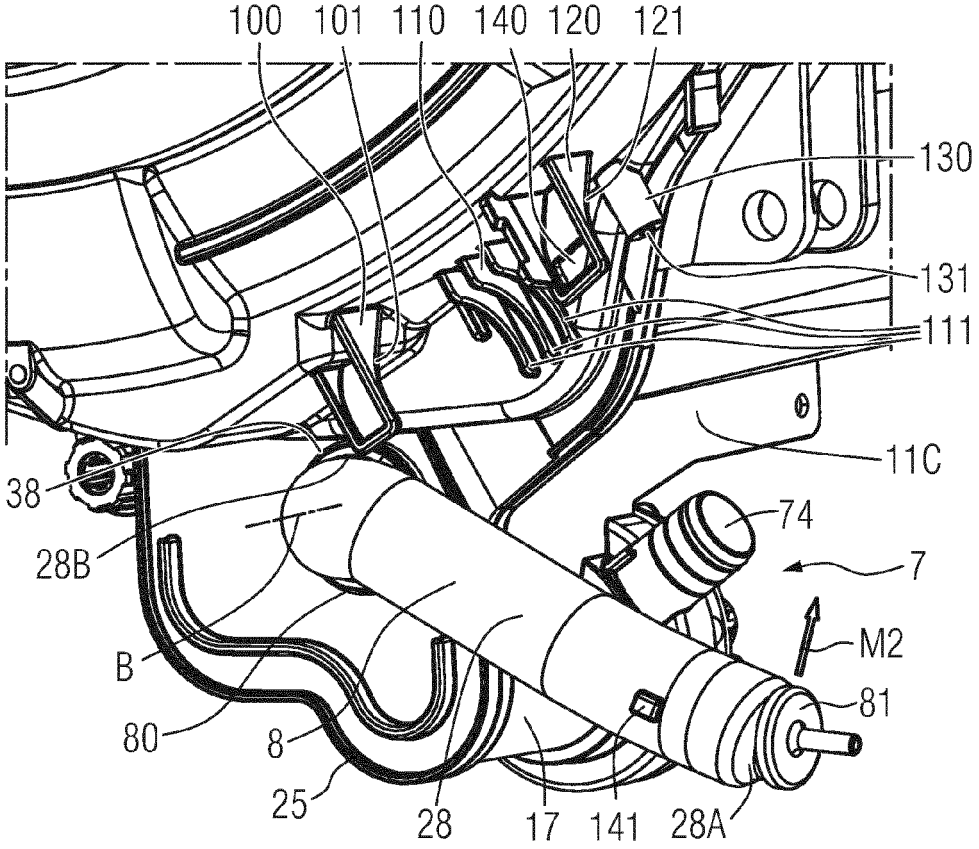
28A

FIG 8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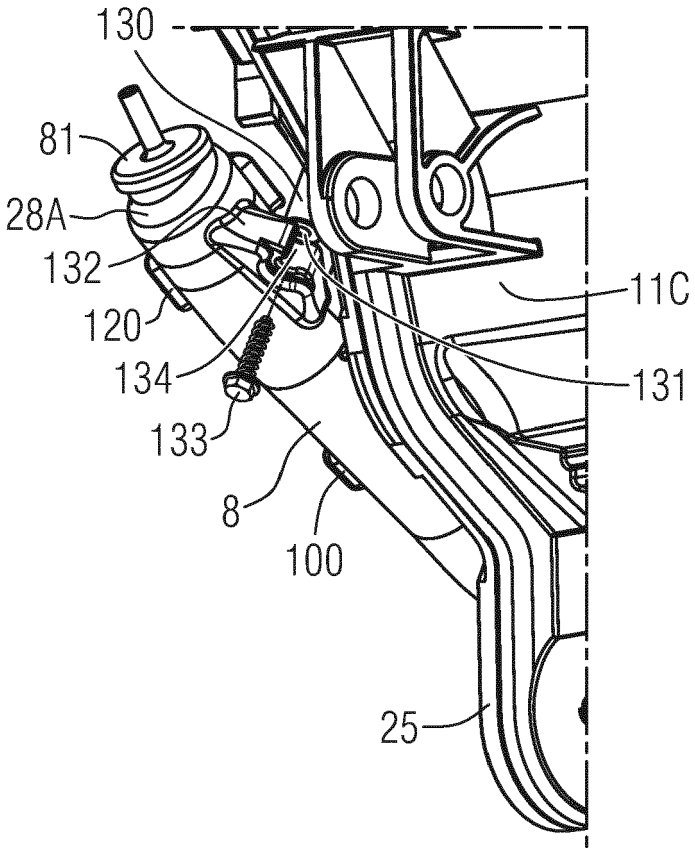
28
17
141
28A

FIG 9



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EUROPEAN SEARCH REPORT

Application Number
EP 12 15 7050

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 37 43 395 A1 (BOSCH SIEMENS HAUSGERAETE [DE]) 29 June 1989 (1989-06-29) * column 4, line 3 - column 4, line 64; figure 3 *	1,14,15	INV. D06F39/08 D06F37/26
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			TECHNICAL FIELDS SEARCHED (IPC)
			D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	10 August 2012	Fachin, Fabiano

CATEGORY OF CITED DOCUMENTS

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10-08-2012

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