(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 631 344 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.08.2013 Bulletin 2013/35

(51) Int Cl.:
D06F 37/26 *(2006.01)* ***D06F 39/08*** *(2006.01)*

(21) Application number: **12157041.0**

(22) Date of filing: **27.02.2012**

(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)

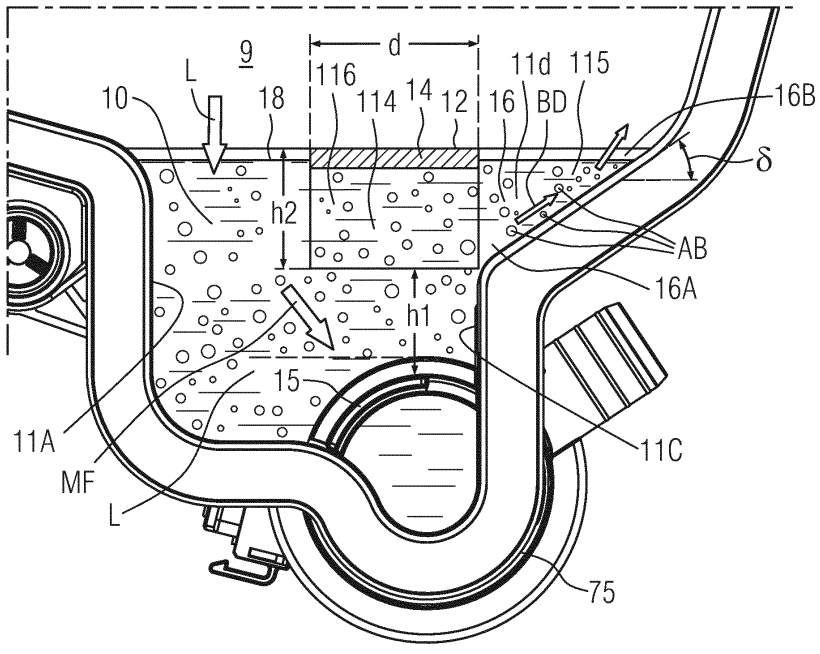
(72) Inventors:
- **Bondi, Martino**
  33080 Porcia (PN) (IT)
- **Perosa, Vittorio**
  33080 Porcia (PN) (IT)
- **Sacilotto, Francesco**
  33080 Porcia (PN) (IT)

(74) Representative: **Nardoni, Andrea et al**
Electrolux Italia S.p.A.
Corso Lino Zanussi, 30
33080 Porcia (PN) (IT)

(54) Washing tub unit and washing machine

(57) 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 draining sump (10) arranged in a lower region of the washing tub (2) for draining washing liquid from the tub interior (9), the draining sump (10) having a sump inlet (18) and a sump outlet (15),
c) wherein an air channel (16) is arranged in fluid communication with the sump (10) at a first end (16A) and with the tub interior (9) at a second end (16B),
d) the air channel (16) serving for releasing at least a part of air bubbles (AB) out of the washing liquid (L) which is contained in or flows through the sump (10) into the tub interior (9).

FIG 6



EP 2 631 344 A1

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] In the drained washing liquid air bubbles can form due to turbulences which air bubbles hinder the flow of washing liquid and thus slow down the draining process.

[0006] It is a purpose of the invention to propose a washing tub unit which has good draining properties.

[0007] 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.

[0008] Washing tub unit for a washing machine according to claim 1 comprises

a) a washing tub having a tub interior and housing a rotatable drum for receiving goods to be washed,
b) a draining sump arranged in a lower region of the washing tub for draining washing liquid from the tub interior, the draining sump having a sump inlet and a sump outlet,
c) wherein an air channel is arranged in fluid communication with the sump at a first end and with the tub interior at a second end,
d) the air channel serving for releasing into the tub interior at least a part of air bubbles out of the washing liquid which is contained in or flows through the sump.

[0009] As air bubbles are at least partly released (or: removed) from the flow of the washing liquid by means of the air channel according to the invention the draining properties are significantly improved.

[0010] In an advantageous embodiment the first end of the air channel is arranged lower than the second end of the air channel and than the sump inlet and the second end is horizontally displaced to the sump inlet.

[0011] Preferably, the second end of the air channel is horizontally displaced from the sump inlet by a portion of the tub bottom.

[0012] In a preferred embodiment the sump inlet is arranged upstream the air channel along the main drum rotational direction in a spinning phase of a laundry treating process. This avoids air flowing opposite to the stream of the washing liquid during that phase and further improves the draining.

[0013] In a further preferred embodiment the first end of the air channel is formed by an opening in or between side wall parts of a side wall structure of the sump. Furthermore, preferably, the second end of the air channel is formed by an opening in a tub bottom.

[0014] Advantageously and preferably, at least a bottom wall of the air channel is inclined with respect to a horizontal plane and in a direction away from the sump inlet. The inclination angle can in particular be between 10° and 60°.

[0015] Also, a main flow direction of the air bubbles upwardly through the air channel can be at least approximately orthogonal to a main flow direction of the washing liquid towards the sump outlet.

[0016] In a preferred constructional embodiment there is an overhang and/or a bridge of the tub bottom arranged between the air channel and the sump inlet and reaches into the sump defining a horizontal distance between the second end of the air channel and the sump inlet. The overhang and/or bridge preferably extends at least partly over the sump outlet at a pre-determined first vertical distance and/or has at its lowermost area a pre-determined second vertical distance from the sump inlet. The vertical distance of the second end from the first end of the air channel corresponds in particular to the vertical distance of the lowermost area of the overhang and/or bridge from the sump inlet. Preferably the overhang and/or bridge defines a horizontal distance between the second end of the air channel and the sump inlet.

[0017] In a further improvement on the tub bottom adjacent to the sump inlet at least one directing element is arranged The directing element has an impact wall protruding upwardly from the tub bottom towards an outside wall of the drum, but keeping a distance from the outside wall of the drum, and extending continuously to the edge of the sump inlet, thereby directing washing liquid running down the inner tub wall and impacting onto the impact wall directly towards and into the sump inlet.

[0018] In a further preferred embodiment the washing tub is composed of a pre-formed front tub part having a front tub bottom part and a pre-formed rear tub part having a rear tub bottom part, wherein the rear tub part is connected with the front tub part in a connecting area. Now, at least one wall of the air channel is an integral part with the front tub part and the other walls of the air channel are integral parts with the rear tub part. Furthermore or alternatively, a front side wall part of the side wall structure of the sump is an integral part with the front tub part and wherein the other parts of the side wall struc-

ture of the sump are integral parts with the rear tub part.

[0019] According to claim 15 a washing machine comprises a washing tub unit according to the invention.

[0020] Further exemplary embodiments are described and explained in the following with reference to the drawings, which show in

FIG 1 a washing tub unit in a three-dimensional perspective view 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 the washing tub unit of FIG 2 in a partially cut perspective view from the rear under a viewing angle from the side so that the tub interior can be partly seen,

FIG 4 the lower section of the washing tub unit according to FIG 3 with the front tub part and the rear tub part in a partially sectioned three-dimensional view from the side,

FIG 5 the sump of the rear tub part of FIG 3 in greater detail in a perspective view from the front under a viewing angle from above,

FIG 6 the lower section of the washing tub unit according to FIG 5 in a sectional view.

[0021] Identical or at least corresponding parts and quantities in FIG 1 to 6 are designated with the same reference numerals. Reference is made also to the list of reference numerals if a reference numeral is not mentioned in the text.

[0022] FIG 1 to 3 show a washing tub unit for a washing machine comprising a washing tub 2 and a draining device 7. 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 (or: joined) in a connecting (or: joining) 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.

[0023] In the connecting area 20 at least one front connecting (or: joining) 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.

[0024] 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.

[0025] 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

[0026] 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.

[0027] 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.

[0028] 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 a front tub part 21. 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 rotatable or rotating drum 3, arranged in the tub interior 9 of the washing tub 2 and provided for receiving goods such as laundry to be washed.

[0029] Adapted to the rotating drum 3 the inner wall 121 of the washing tub 2 is preferably mainly formed in a cylindrical shape or as a cylindrical surface or wall. The drum 3 is rotatable or can be rotated about a rotational axis RA in at least one, preferably two, rotational direction (s) RD 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.

[0030] The drum drive 6 is fastened at fastening section 61 arranged at 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 about the rotational axis RA in the at least one, usually two rotational directions RD 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 and 3, the rear side of the rear tub part 22 is reinforced with reinforcing ribs 62 around the through-hole 60.

[0031] As can be seen best in FIG 3 to 6 in the tub bottom 12 a sump 10 is formed. The sump 10 has a mainly horizontal 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. 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.

[0032] A carrier bridge 14 extends adjacent to 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.

[0033] 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.

[0034] 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.

[0035] 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.

[0036] 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.

[0037] 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 by the sump 10 and by the air channel 16 of the sump 10.

[0038] Now, referring to the draining device 7, it has a draining conduit 75, which is adjacent to the sump 10 and arranged at least partly lower than the sump 10 and its sump bottom 13 there is of the draining device 7.

[0039] The draining conduit 75 has, next to the sump 10, a mainly cylindrical circumferential wall 17 in which a rectangular 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.

[0040] The draining conduit 75 also comprises a draining outlet 74. A central (geometrical) axis A of the draining conduit 75 runs through the central region of the circumferential wall 17 which is preferably parallel to the rotational axis RA of the drum 3 , preferably in a horizontal direction.

[0041] 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, as can be seen best in FIG 3 and 4. Therefore, the circumferential wall structure of the draining conduit 75 forms itself 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.

[0042] 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 through the sump 10 resulting in less turbulences.

[0043] The conduit 75 is, thus, rigidly connected with the sump side wall structure 11 and the tub bottom 12 over a pre-determined length and with at least two sump side wall parts 11B and 11C and the sump bottom 13 so that forces exerted on the conduit 75 are distributed and born in a larger section into three dimensions.

[0044] 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 (not shown) 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 about a rotational axis which is the central axis A of the draining conduit 75 in the mounted state. A pump receiving part 37 of the conduit 75 receives a pump wheel (not shown) of the pump 70 and carries the drive 71.

[0045] 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, which is, as seen axially along the central axis A,

opposite to the rear end 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 covers 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.

[0046] 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 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 in the connecting area 20 by hot welding.

[0047] The whole wall structure of the conduit 75 except for the cover wall 25 is formed integral with the rear tub part 12, i.e. formed in the same material and/or injection-moulding process. 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.

[0048] In order to improve the draining of the washing liquid L, in particular in the front tub bottom 12B, a directing element 30 is arranged on the tub bottom 12, in particular the front tub bottom 12B, for directing washing liquid L running down the inner wall 121B of the front tub part 22 of the tub 2 into the sump 10. This directing element 30 has an impact wall 31 which can be inclined under an inclination angle α towards the direction where the washing liquid L comes from as shown, wherein the inclination angle α can be in particular between 70° and 88°. The washing liquid L impacts or impinges on the impact wall 31 and is re-directed in a flow direction along the impact wall 31 towards the sump 10. The re-directed washing liquid flowing along the impact wall 31 into the sump 10 is designated by L'. The directing element 30 has, in particular, an overhang 32 arranged above the impact wall 31 to catch washing liquid L splashing upwardly when impacting on the impact wall 31 and keep it from spilling over the directing element 30 but rather direct it downward and towards the sump 10. The directing element 30 is preferably formed integral with the tub wall, in particular with the front tub bottom 12B or front tub part 22, and is brought into its position relative to the sump 10 when the front tub part 22 and the rear tub part 21 are connected in the connecting area 20.

[0049] As can be seen best in FIG 5, below the carrier bridge 14, there is an overhang (or: balcony-shaped walls structure) 114, extending from the tub bottom 12 down into the sump 10. This overhang 114 extends, with its lower wall, horizontally into the sump 10 starting from the side wall part 11B which it is connected with and overlapping or covering at a vertical distance h1 at least partly the sump outlet 15. A free front wall 116 of the overhang 114 is, in the embodiment shown, parallel to the side wall part 11B and orthogonal to the side wall part 11C of the sump 10 the latter of which the overhang 114 is connected with too

[0050] On the one side facing the side wall 11A the sump inlet 18 in the tub bottom 12 is arranged between the side wall 11A and the overhang 114 at the level of the tub bottom 12.

[0051] On the opposite side of the overhang 114 an air channel 16 is arranged. The side wall part 11D of the sump 10 is arranged above the vertical side wall part 11C and in front of the overhang 114 and slopes upwardly from the vertical side wall part 11C. This side wall part 11D forms a bottom wall of the air channel 16. The air channel 16 is sloped with respect to the horizontal plane, pointing away from the sump inlet 18, preferably by an inclination angle δ which is typically between 10° and 60°, preferably around 30°. A, thus, more or less triangular rear channel wall 115 of the air channel 16 is displaced to the front wall 116 of the overhang 114 in a direction to the front.

[0052] At the other side opposing the rear channel wall 115 there is a front channel wall 117. The front channel wall 117 is connected to the front tub bottom part 12B and thus integral part of the front tub part 21 whereas the other walls of the channel, in particular the rear channel wall 115 and the bottom wall defined by the side wall part 11D, are integral parts with the rear tub part 22 as is the overhang 114. The distance between the front channel wall 117 and the rear channel wall 115 defines a width w of the air channel 16 (see FIG 4) which is much smaller than the dimensions of the sump inlet 18. In particular the second end or outlet 16B of the air channel 16 is smaller in its cross section or size than the sump inlet 18 so that, if at all, only a small proportion of washing liquid L can enter the sump 10 through the air channel 16.

[0053] The main flow of washing liquid L through the sump 10 will be generated by the low pressure in the conduit 75 and take place and be directed between the sump inlet 18 and the sump outlet 15. However, due to turbulences and other effects in the flow air bubbles AB will be generated and be contained in the washing liquid L within the sump 10. The air bubbles AB are also generated by the air flows over the rotating drum in particular when water or washing liquid L is extracted from the laundry by the centrifugal forces.

[0054] These air bubbles AB will hinder and deteriorate the flow of the washing liquid L from the sump inlet 18 to the sump outlet 15 and does cause a delay in the draining process. In particular the air prevents the water of washing liquid L to drop down into the sump outlet 15.

[0055] In order to at least decrease the number of air bubbles AB in the flow of the washing liquid L through the sump 10 the aforementioned air channel 16 is provided.

[0056] The air channel 16 has a channel inlet or first

end 16A below and in front of the overhang 114, right above the side wall 11C and well below the sump inlet 18 by which inlet or first end 16A the air channel 16 is in fluid communication with the sump 10. At the second end or outlet 16B of the air channel 16 the air channel 16 is connected to the tub interior 9.

[0057] The inlet or first end 16A of the air channel 16 is arranged at a horizontal distance d, defined by the lower wall of the overhang 114, from the sump inlet 18. The outlet or second end 16B of the air channel 16 is arranged at a horizontal distance d, defined by the tub bottom 12 and bridge 14 above the overhang 114, from the sump inlet 18, and the air channel 16 is inclined away from the sump inlet 18. The height or vertical distance h2 of the overhang 114 from the sump inlet 18 corresponds in particular to the vertical distance of the first end 16A from the second end 16B of the air channel 16. The vertical distance or height of the first end 16A above the sump outlet 15 corresponds to h1, wherein typically $h1 < h2$ and preferably $h1 < d$.

[0058] By this construction and the dimensioning of the air channel 16 and its distances d, h1 and h2 the air channel 16 is rather far apart from the direct flow of washing liquid L between sump inlet 18 and sump outlet 15, and, therefore, the washing liquid L in the area of the air channel 16 in particular at its inlet or first end 16A is relatively calm. Therefore, air bubbles AB can, due to their lower weight or mass density compared to the washing liquid L, escape upwardly through the channel 16 in the bubble main flow direction BD designated by arrows and will escape from the washing liquid L at its surface. There, the air bubbles AB will, depending on the liquid level of the washing liquid L, either join the air in the air channel 16 below the second end 16B or already enter the tub interior 9 when the liquid level has reached the second end 16B already. The inclination by the inclination angle δ provides a smooth release of air bubbles AB through the air channel 16.

[0059] The main flow direction BD of the air bubbles AB is in particular approximately orthogonal to the main flow direction MF of the washing liquid L in front of and towards the sump outlet 15.

[0060] It has to be noted that the sump inlet 18 is arranged upstream the air channel 16 along the main rotational direction RD (see Figure 3) of the drum 3 during a spinning phase of a laundry treating process. Said main drum rotational direction is the prevalent rotational direction during a spinning period of a laundry treating process. In the attached Figures such main drum rotational direction RD during a spinning phase is anticlockwise. In this way the water exiting the drum 3 due to centrifugal forces acting on wet laundry is prevented from remaining attached to (i.e. dragged by) the outer surface 33 of the drum 3 itself by the depression created by the draining pump 70 within the sump 10 and by the air channel 16 that allows air to escape from the sump 10 through a way that is different from the way allowing water to enter the sump 10. It is therefore advantageously avoided that air bubbles AB go against the current of water entering the sump 10, thereby obstructing the water flow.

[0061] Furthermore, the directing element 30 prevents the washing liquid L from reaching the second end 16B of the air channel 16, thus increasing the air release effect. The draining effect is in particular enhanced during spinning or washing liquid extractions from the laundry at high rotational speeds of the drum.

[0062] 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 pipe or level detection tube 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. 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. This opening 80 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 of the, preferably circular, opening 80 and/or an inserting direction for inserting the connecting end 28B of the level detection tube 28 is oriented parallel to the central axis A of the conduit 75.

[0063] In a preferred embodiment not shown, a filter element is mounted into the inner chamber 85 of the draining conduit 75 by inserting the filter element through a rear opening of the conduit in an axial direction along the central axis A.

[0064] 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.

[0065] 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.

[0066] 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, the shape of the directing element 30 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

[0067]

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	rear tub bottom part
12B	front tub bottom part
13	sump bottom
14	carrier bridge
15	sump outlet
16	air channel
16A	first end
16B	second end
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	directing element
31	impact wall
32	overhang
37	pump receiving part
60	through-hole
61	fastening element
62	reinforcing ribs
63	through-hole
70	draining pump
71	pump drive
74	draining outlet
75	draining conduit
80	connecting hole
81	air pressure sensor
114	overhang
115	rear channel wall
116	front wall
121	inner tub wall
121A	inner wall of rear tub part 22
121B	inner wall of front tub part 21
A	central axis
AB	air bubbles
BD	bubble direction
L	washing liquid
L'	re-directed washing liquid (flowing into sump 10)
MF	Main flow direction
RA	rotational axis
RD	rotational direction
α	opening angle
β	opening angle
δ	inclination angle
w	width
d1,d2	distance
h1,h2	height

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 draining sump (10) arranged in a lower region of the washing tub (2) for draining washing liquid from the tub interior (9), the draining sump (10) having a sump inlet (18) and a sump outlet (15),
   c) wherein an air channel (16) is arranged in fluid communication with the sump (10) at a first end (16A) and with the tub interior (9) at a second end (16B),
   d) the air channel (16) serving for releasing at least a part of air bubbles (AB) out of the washing liquid (L) which is contained in or flows through the sump (10) into the tub interior (9).

2. Washing tub unit according to claim 1, wherein the first end (16A) of the air channel (16) is arranged lower (h2) than the second end (16B) and the sump inlet (18), the second end (16B) being horizontally displaced (d1) to the sump inlet (18).

3. Washing tub unit according to claim 1 or claim 2, wherein the second end (16B) of the air channel (16) is horizontally displaced (d) from the sump inlet (18) by a portion of the tub bottom (12, 14).

4. Washing tub unit according to any preceding claim wherein the sump inlet (18) is arranged upstream the air channel (16) along the main drum rotational direction (RD) in a spinning phase of a laundry treating process.

5. Washing tub unit according to one of claims 1 to 4, wherein the first end (16A) of the air channel (16) is formed by an opening in or between side wall parts (11D, 115) of a side wall structure (11) of the sump (10) and/or the second end (16B) of the air channel (16) is formed by an opening in a tub bottom (12).

6. Washing tub unit according to any of the preceding claims, wherein at least a bottom wall (11D) of the air channel (16) is inclined with respect to a horizontal plane away from the sump inlet (18).

7. Washing tub unit according to claim 6, wherein an inclination angle inclination angle (δ) is chosen to be between 10° and 60°.

8. Washing tub unit according to any of the preceding claims, wherein a main flow direction (BD) of the air bubbles (AB) upwardly through the air channel (16) is at least approximately orthogonal to a main flow direction of the washing liquid towards the sump outlet (15).

9. Washing tub unit according to any of the preceding claims, wherein in between the air channel (16) and the sump inlet (18) an overhang (114) and/or a bridge (14) of the tub bottom (12) is arranged and reaches into the sump (10) defining a horizontal distance (d) between the second end (16B) of the air channel (16) and the sump inlet (18).

10. Washing tub according to claim 9, wherein the overhang (114) and/or bridge (14) extends at least partly over the sump outlet (15) at a pre-determined first vertical distance (h1) and/or has at its lowermost area a pre-determined second vertical distance (h2) from the sump inlet (18).

11. Washing tub according to claim 10, wherein the vertical distance (h2) of the second end (16B) from the first end (16A) of the air channel (16) corresponds to the vertical distance of the lowermost area of the overhang (114) and/or bridge (14) from the sump inlet (18).

12. Washing tub unit according to one of claims 9 to 11, wherein the overhang (114) and/or bridge (14) defines a horizontal distance (d) between the second end (16B) of the air channel (16) and the sump inlet (18).

13. Washing tub unit according to any of the preceding claims, wherein

   a) on the tub bottom (12) adjacent to the sump inlet (18) at least one directing element (30) is arranged,
   b) the directing element (3) having an impact wall (31) protruding upwardly from the tub bottom (12) towards an outside wall of the drum (3) but keeping a distance from the outside wall of the drum (3) and extending continuously to the edge of the sump inlet (18), thereby directing washing liquid running down the inner tub wall (121) and impacting onto the impact wall (31) directly towards and into the sump inlet (18).

14. Washing tub unit according to any of the preceding claims,

   a) wherein the washing tub (2) is composed of a pre-formed front tub part (21) having a front tub bottom part (12B) and a pre-formed rear tub part (22) having a rear tub bottom part (12A) the rear tub part (22) being connected with the front tub part (21) in a connecting area (20),
   b) wherein at least one wall (117) of the air channel (16) is an integral part with the front tub part

(21) at the other walls (11D, 115) of the air channel (16) are integral parts with the rear tub part (21) and/or

c) wherein a front side wall part (11E) of the side wall structure (11) of the sump (10) is an integral part with the front tub part (21) and wherein the other parts (11A to 11D) of the side wall structure (11) of the sump (10) are integral parts with the rear tub part (22).

15. Washing machine comprising a washing tub unit according to any of claims 1 to 14.

FIG 1

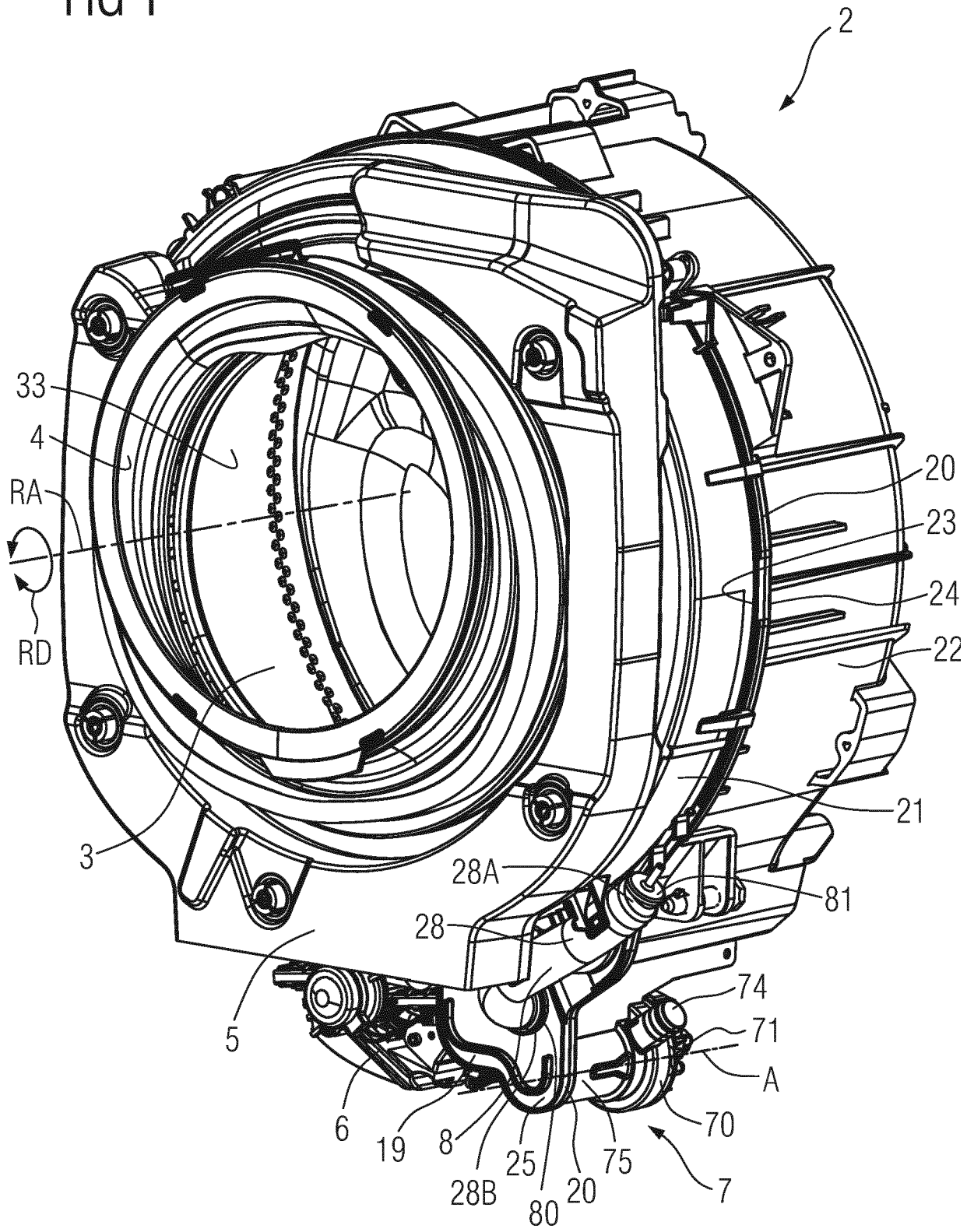

2
33
4
RA
RD
3
20
23
24
22
21
28A
81
28
74
71
A
5
6
19
8
25
20
75
70
7
28B
80

FIG 2

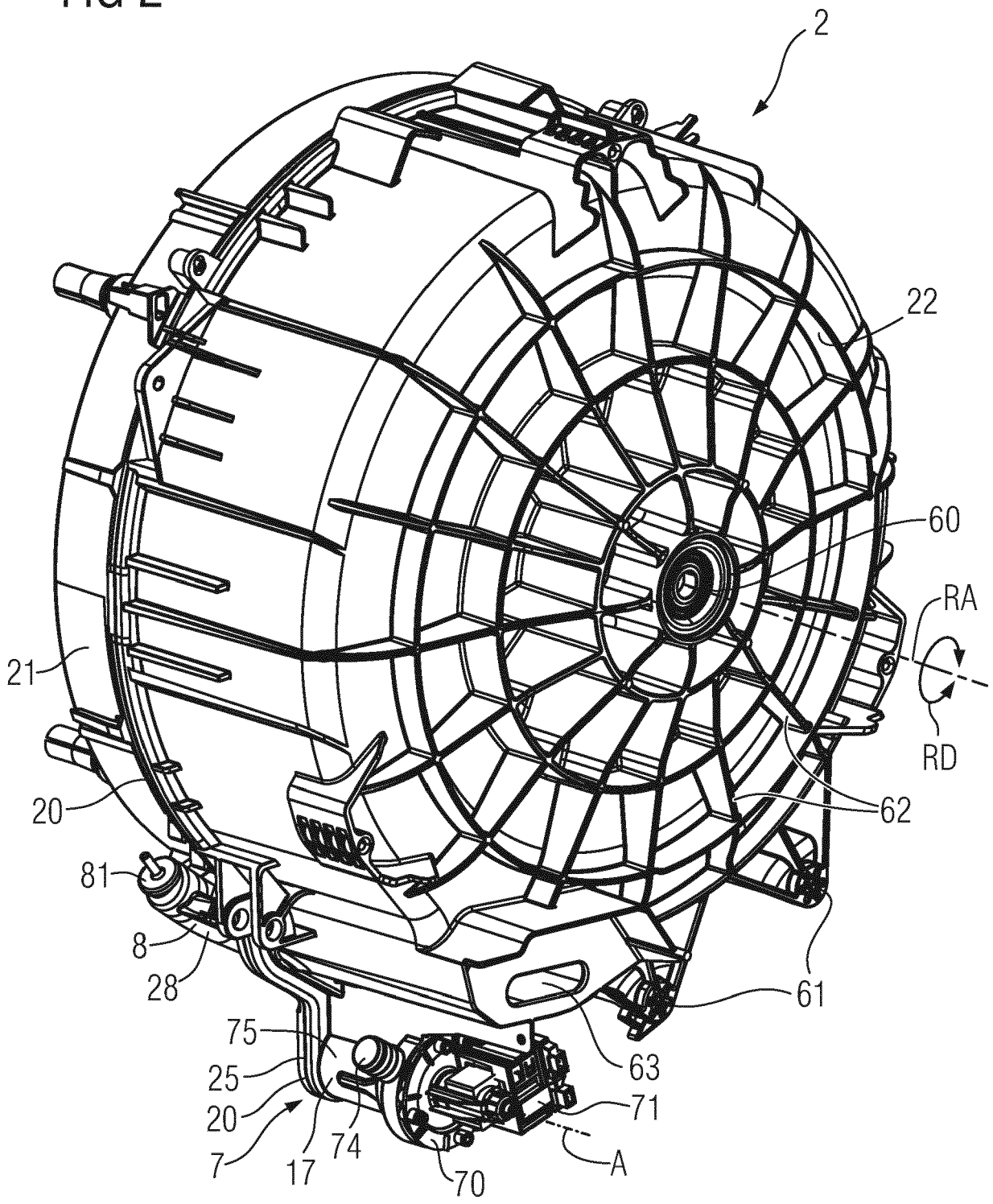
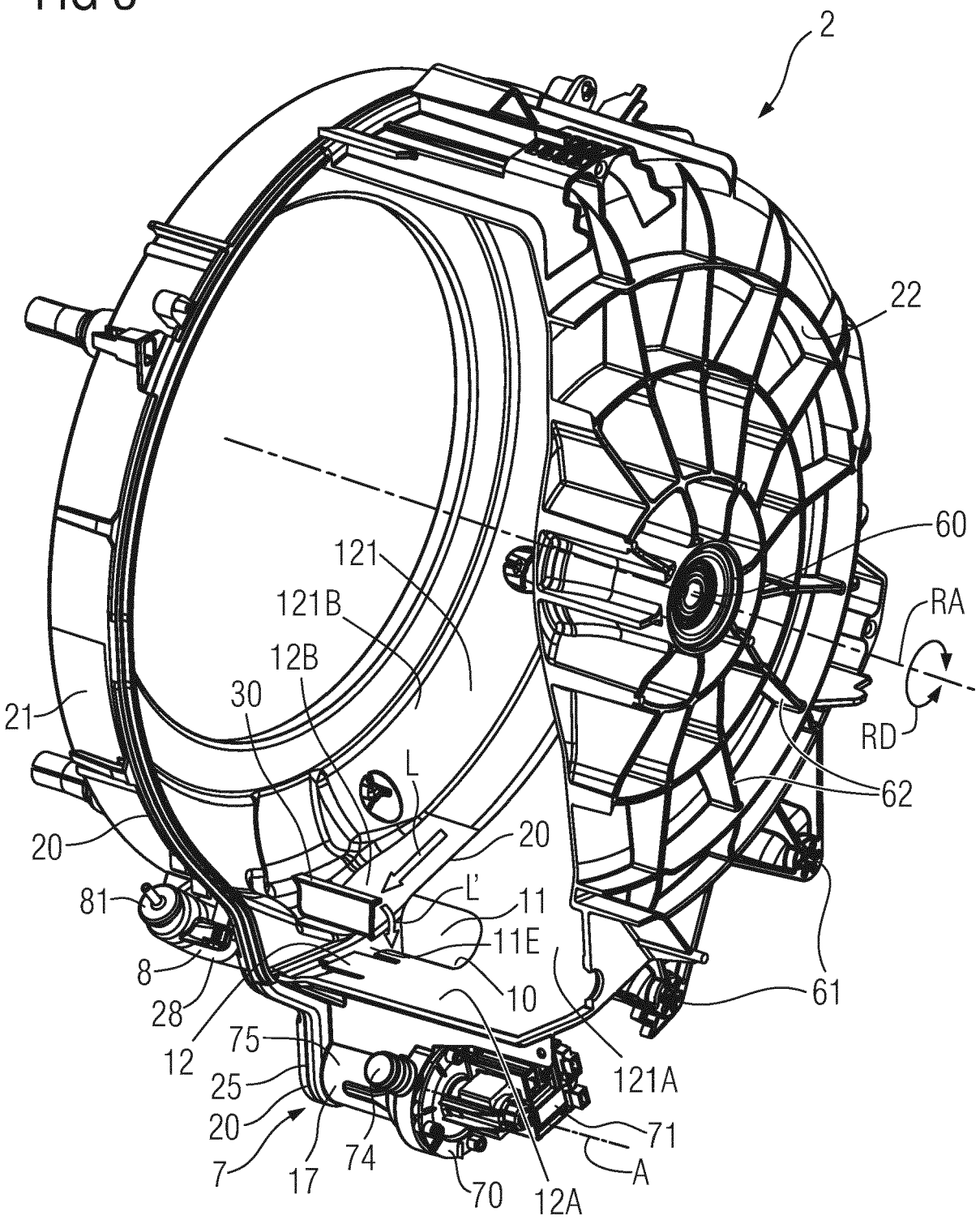


FIG 3


2
22
60
RA
RD
62
121
121B
12B
30
21
L
20
20
81
L'
11
11E
8
28
12
10
61
75
25
20
7
17
74
70
12A
121A
71
A

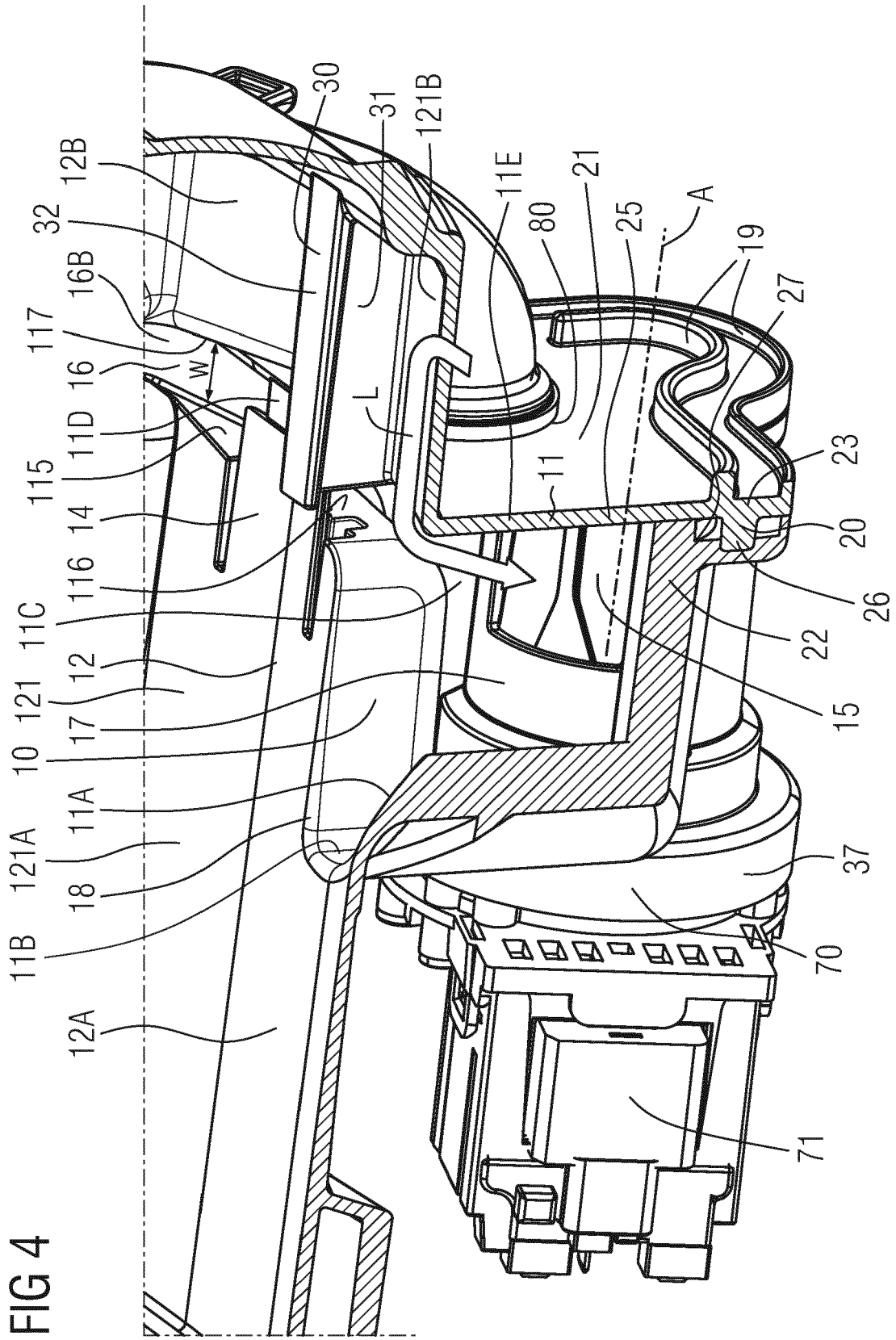

30
31
121B
12B
32
16B
117
16
11D
115
14
116
11C
12
121
17
10
11A
121A
18
11B
12A
11E
80
21
25
A
19
27
23
20
26
22
15
37
70
71
w
L
11

FIG 4

FIG 5

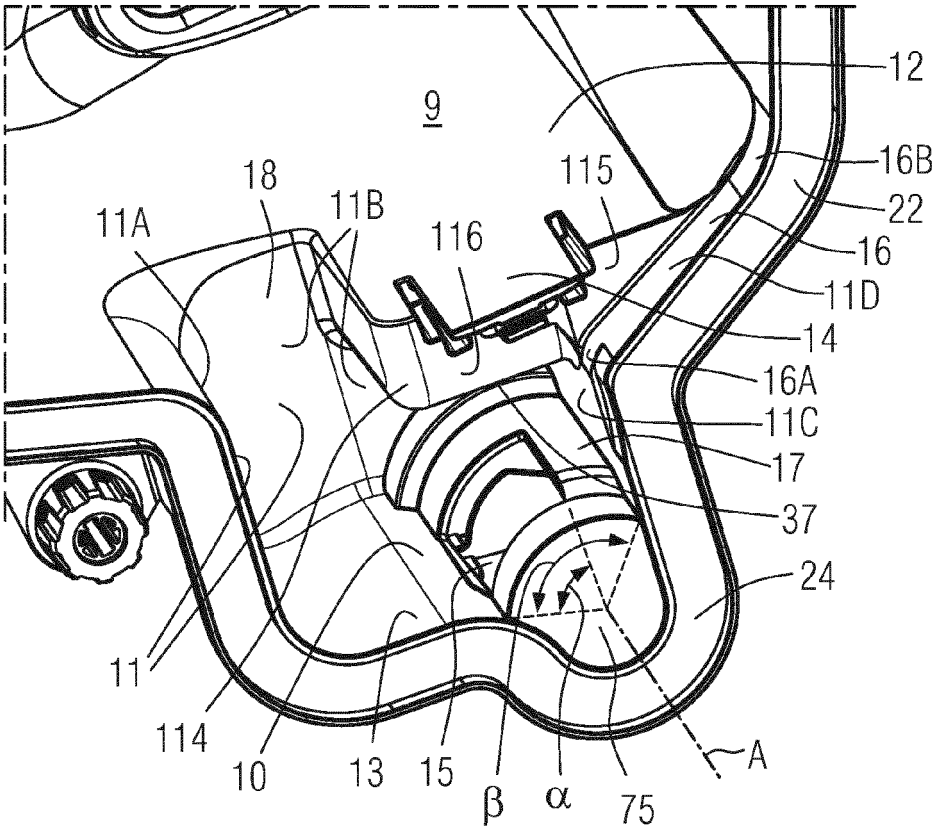
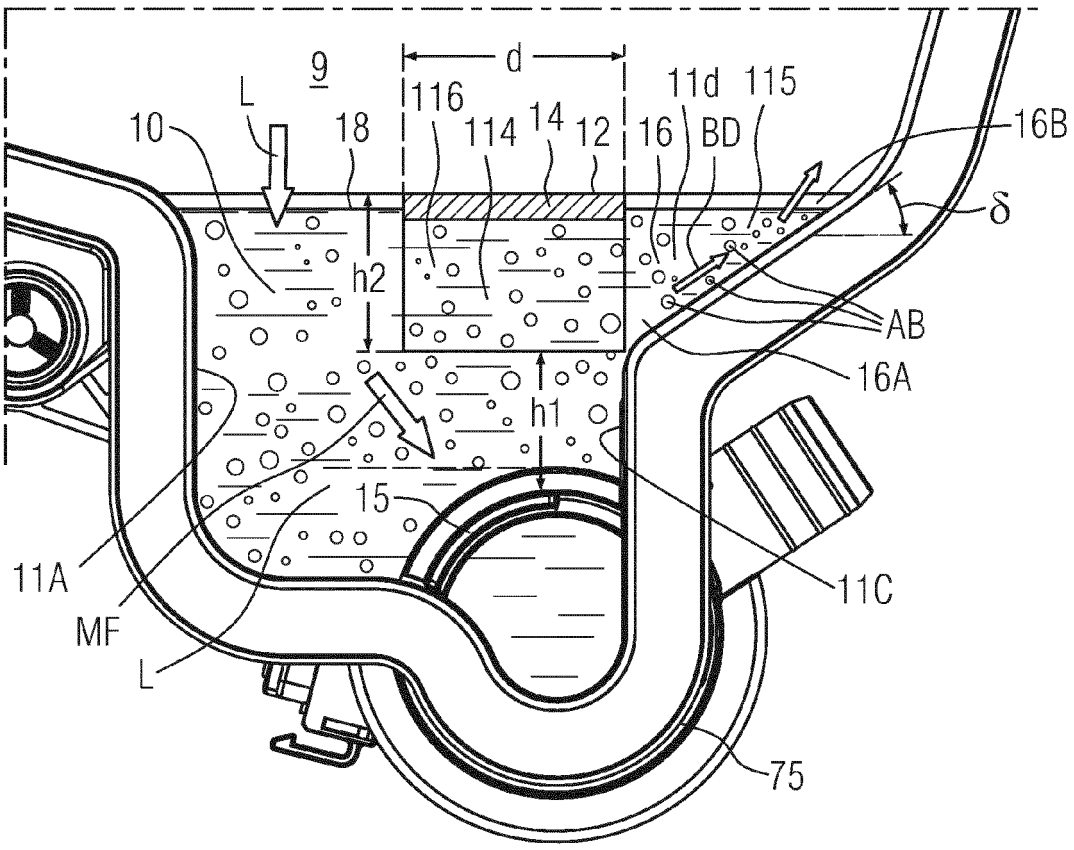

12
9
18
115
16B
11A
11B
116
22
16
11D
14
16A
11C
17
37
24
11
114
10
13
15
β
α
75
A

FIG 6


9
d
L
116
11d
115
10
18
114
14
12
16
BD
16B
δ
h2
AB
16A
h1
15
11A
11C
MF
L
75

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 12 15 7041

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	US 6 574 996 B1 (JACOBUS DWIGHT WILLIAM [US] ET AL) 10 June 2003 (2003-06-10) * column 2, line 67 - column 3, line 19; figures 1-3 * -----	1-6	INV. D06F37/26 D06F39/08
E	EP 2 434 044 A1 (VESTEL BEYAZ ESYA SANAYI VE TICARET A S [TR]) 28 March 2012 (2012-03-28) * paragraph [0015] - paragraph [0016]; figures 1-3 * -----	1-4	

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	9 August 2012	Fachin, Fabiano

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

1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 15 7041

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.

09-08-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6574996 B1	10-06-2003	NONE	
EP 2434044 A1	28-03-2012	EP 2434044 A1	28-03-2012
		TR 201007806 A2	21-12-2010

EPO FORM P0459

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