



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
25.05.2011 Bulletin 2011/21

(51) Int Cl.:
D06F 39/10 (2006.01)

(21) Application number: **09176727.7**

(22) Date of filing: **23.11.2009**

(84) Designated Contracting States:
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 SE SI SK SM TR
Designated Extension States:
AL BA RS

- **Buso, Danny**
33080 Porcia (PN) (IT)
- **Zardetto, Ennio**
33080 Porcia (PN) (IT)
- **Nadalín, Diego**
33080 Porcia (PN) (IT)

(71) Applicant: **Electrolux Home Products Corporation N.V.**
1130 Brussels (BE)

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

(72) Inventors:
• **Zanello, Fabio**
33080 Porcia (PN) (IT)

(54) **Washing machine with improved filter for the draining circuit**

(57) Washing machine (1) comprising:
- a washing tub (5);
- a draining sump (9) fluidly communicating to the internal of the washing tub (5) and fluidly connected to a draining circuit (10);
- a filter (12), removably associable to a seat (9a) provided between the washing tub (5) and the draining sump

(9), adapted for allowing the passage of a liquid and to impede the passage of bodies of fixed dimensions.

The filter (12) comprises an indicator adapted to be displaced in a first position if the filter (12) is correctly inserted into the seat (9a), and in a second position if the filter (12) is incorrectly inserted into seat (9a).

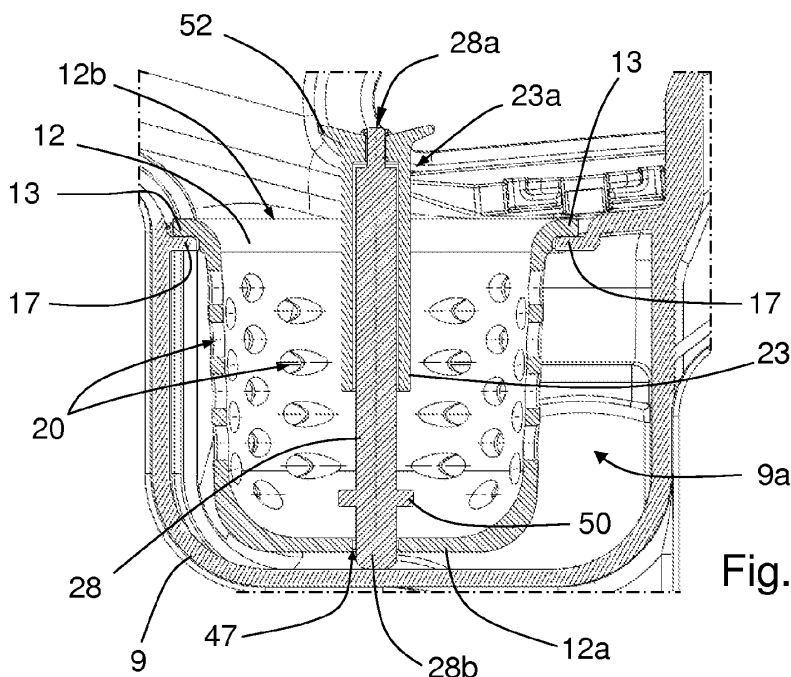


Fig. 3

Description

[0001] The present invention relates to a laundry washing machine with an improved filter for the draining circuit.

[0002] It is underlined that in the present application the expression "washing machine" may as well indicate a "simple" washing machine (i.e. a washing machine which can only wash and rinse the laundry) and a washing-drying machine (i.e. a washing machine which can also dry the laundry).

[0003] Moreover, even if in the following the present invention will be described, purely by way of example, in relation to a front-loading laundry washing machine, it is clear that the present invention may be applied, substantially without any crucial modification, to a top-loading washing machine.

[0004] Nowadays washing machines generally comprise an external casing provided with a loading/unloading door which allows the access to a washing tub containing a rotatable perforated drum in which the laundry to be washed can be loaded.

[0005] Known washing machines comprise a water inlet circuit adapted to feed water and washing/rinsing products (i.e. detergent, softener, etc.) into the tub.

[0006] Known washing machines also comprise a water outlet circuit, typically comprising a drain pump and some draining pipes, adapted to drain the washing/rinsing liquid (i.e. water and water mixed with washing and/or rinsing products) from the tub after the washing and rinsing phases.

[0007] The water outlet circuit usually comprises a filtering device, placed between the bottom of the tub and the drain pump, adapted to retain all undesirable bodies (for example buttons came off from the laundry, coins erroneously introduced into the washing machine, etc.) passed through the holes located on the periphery of the drum, or fell to the bottom of the tub by passing between the drum and the tub, which could damage or obstruct the drain pump.

[0008] The most common of these filtering devices consists of a cylindrical box attached to the base of the washing machine and containing a removable filter fluidly connected upstream of the drain pump. This box containing the filter is accessible through a quick-removable plug that allows the filter to be removed and cleaned, the plug being hidden by a gate located, depending on the case, on the front or back wall of the external casing of the washing machine.

[0009] There are also known washing machines comprising a draining sump, obtained on the lower region of the lateral surface of the tub (i.e. in the bottom of the tub), fluidly communicating with the internal of the latter and fluidly connected upstream of the drain pump.

[0010] A filter is placed in the draining sump for retaining all undesirable bodies which may be contained in the washing/rinsing liquid, so as to avoid that such bodies could reach the draining pump; this filter is typically a cup-shaped body provided with a filtering surface, i.e. a

surface provided with a plurality of apertures which are dimensioned in order to allow the passage of the washing/rinsing liquid, but to impede the passage of foreign bodies of prefixed dimensions.

[0011] In this case the rotatable drum of the washing machine is provided with at least one opening, closed by a removable lid, adapted for allowing a user to reach the filter from the internal of the washing machine, for example for cleaning such filter; typically the filter may be removed from and repositioned into the draining sump, so as to facilitate its cleaning.

[0012] A prior art washing machine containing a filter used to prevent residual particles of dirt from reaching and obstructing the pump and its drainage duct, and which can be removed from the internal of the tub, for inspection, cleaning and replacement, is illustrated, for example, in GB 1197919, which discloses a washing machine comprising a tank (i.e. a tub) for liquid with an opening in its base, a draining pump connected by a pipe to the opening of the tank, and a basket (i.e. a rotary drum) disposed within the tank; a cup-like filter element having filter openings in its side wall is removably seated in the tank opening, and an opening is provided in the basket, provided with a removable closure, to provide access to the filter element.

[0013] Another example of known washing machine provided with a filter which can be removed from the internal of the tub is illustrated in FR 2190966, which discloses a top-loading washing machine comprising a tub containing a rotary drum provided, on its lateral surface, with a first door, adapted for loading/unloading the laundry, and with a second door, disposed opposite to the first door and adapted for allowing the recovering of linen which would have slipped between the tank and the drum. A connector is fixed to the bottom of the tub, such connector being provided, at his inferior region, with a duct adapted to receive one of the extremities of a discharging pipe. A housing is provided in the connector, adapted to receive a filter accessible by simultaneously opening the two doors of the drum.

[0014] A further known washing machine comprising a filter accessible from the internal of the tub is illustrated in the European patent n. EP 1849904, which discloses a top-loading washing machine comprising a draining filter access apparatus integrated in a lifter diametrically opposite to the drum access door (i.e. to the internal lid allowing the access to the drum). The draining filter access apparatus comprises a body, including an opening aligned with an opening of the same shape and dimensions made in the body of the drum, and a lid, hinged to the body and locking on the body by a simple ratchet mechanism.

[0015] The above mentioned known washing machines provided with a draining sump in the bottom of the tub and with a filter placed in the sump for retaining all undesirable bodies which may be contained in the washing/rinsing liquid, have however a drawback; in fact if the filter, after its removal, for example for cleaning, is

not correctly repositioned into the draining sump, there is the possibility that foreign bodies (for example buttons came off from the laundry, coins erroneously introduced into the washing machine, lint, fluff, etc.) would enter the draining sump and would go into the draining pump with the risk of damaging or obstructing the latter.

[0016] The aim of the present invention is therefore obtaining a washing machine which, in a simple and economical way, could inform a user if the drain filter is correctly inserted into the draining sump or not, so as to reduce the risk that a washing cycle will be erroneously activated when the filter is placed in an incorrect position which could allow foreign bodies entering the draining sump.

[0017] Within this aim, another object of the invention is informing a user if the drain filter is correctly inserted into the draining sump or not without increasing the power consumption of the washing machine.

[0018] Another object of the invention is to be applicable also to a known washing machine with only few modifications of the latter.

[0019] It is therefore an object of the present invention to solve the above-noted problems, thereby doing away with the drawbacks of the cited prior art.

[0020] The Applicant has found that if a filter removably associable to a seat provided between the washing tub and a draining sump comprised in the draining circuit of a washing machine is provided with an indicator adapted to be positioned in a first position if the filter is correctly inserted into the seat, and in a second position if the filter is incorrectly inserted into the seat, it is possible to visually inform a user if the filter has been correctly positioned into the seat or not; in this way the risk that a washing cycle is erroneously activated with the filter incorrectly positioned into the seat is reduced.

[0021] In particular, the above-mentioned aim and objects, as well as others that will become better apparent hereinafter, are achieved by a washing machine comprising:

- a washing tub;
- a draining sump fluidly communicating to the internal of the washing tub and fluidly connected to a draining circuit;
- a filter, removably associable to a seat provided between the washing tub and the draining sump, adapted for allowing the passage of a liquid and to impede the passage of bodies of fixed dimensions.

[0022] The filter comprises an indicator adapted to be displaced in a first position if the filter is correctly inserted into the seat, and in a second position if the filter is incorrectly inserted into the seat.

[0023] Advantageously the indicator is arranged in such a way that if the filter is correctly inserted into the seat, the indicator engages the internal surface of the seat and is displaced in the first position.

[0024] Opportunely the indicator comprises a movable

element slidably associated to the filter.

[0025] Preferably the filter comprises a guide adapted for allowing the sliding of the movable element between the first and second position.

[0026] Advantageously the indicator comprises a pin, slidably associated to the guide in such a way that if the filter is correctly inserted into the seat, the pin is displaced in the first position, while if the filter is incorrectly positioned into the seat, the pin is displaced in the second position.

[0027] Preferably in the first position a first end of the pin protrudes externally from the guide, so that it may be seen and/or touched by a user, while in the second position the first end of the pin is fully contained inside the guide, so that it can't be seen and/or touched by a user.

[0028] Advantageously the seat is accessible from the internal of the drum.

[0029] Opportunely the filter comprises a coupling device adapted for fixing it in a removable way to the seat.

[0030] Advantageously the filter comprises a grasping element adapted for facilitating the removal of the filter from the seat.

[0031] Preferably, in the first position the indicator is visible from the external of the filter, and in the second position the indicator is not visible from the external of the filter.

[0032] In a further aspect the invention concerns a filter for the draining circuit of a washing machine, comprising an indicator adapted to be displaced in a first position and in a second position depending on the positioning of the filter with respect to the washing machine.

[0033] Preferably the indicator comprises a movable element slidably associated to the filter.

[0034] Opportunely the filter comprises a guide adapted for allowing the sliding of the movable element.

[0035] Advantageously the indicator comprises a pin slidably associated to the guide in such a way that in the first position a first end of the indicator is visible from the external of the filter, and in the second position the first end is not visible from the external of the filter.

[0036] Features and advantages of the present invention will anyway be more readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- **Figure 1** is a schematic, lateral and partially sectioned view, of a washing machine according to the invention;
- **Figures 2** is a frontal sectioned view, with parts removed for clarity, of the washing tub of a washing machine according to the invention, with the filter correctly inserted into the seat;
- **Figure 3** is an enlarged particular of Figure 2;
- **Figure 4** is a lateral sectioned view of the filter of figure 2 and 3, in which the filter is not correctly positioned into the seat;
- **Figure 5** is a frontal sectioned view of the filter of

- figure 2 and 3, during the insertion of the filter into the seat;
- **Figure 6** is a lateral sectioned view of the filter of figure 2 and 3, during the insertion of the filter into the seat;
 - **Figure 7** is a exploded prospective view of the filter of Figures 2 to 6;
 - **Figure 8** is a prospective view of the filter of Figure 7;
 - **Figure 9** is a frontal view of the filter of Figures 7 and 8;
 - **Figure 10** is an isometric view, with parts in section and parts removed for clarity, of the washing tub of a further embodiment of washing machine according to the invention;
 - **Figure 11** is an enlarged particular of Figure 10;
 - **Figure 12** is a sectional lateral view of the washing tub of Figure 10;
 - **Figure 13** is an enlarged particular of Figure 12;
 - **Figure 14** is a sectional lateral exploded view of the filter of the washing machine of Figure 10;
 - **Figure 15** is a sectional lateral view of the filter of Figure 10;
 - **Figure 16** is an exploded prospective view of the filter of Figures 14 and 15;
 - **Figures 17** is a prospective exploded view, with parts in section and parts removed for clarity, of the draining sump and of the filter of a further washing machine, before the insertion of the filter into the seat;
 - **Figures 18** is a prospective of the draining sump and of the filter of figure 17, with the filter inserted into the seat.

[0037] The washing machine 1 according to the invention which is illustrated in the enclosed Figures is advantageously of the front-loading type; it is however clear that the invention is applicable, substantially without any crucial modification, to a top-loading washing machine.

[0038] It is also clear that the invention can be applied, substantially without any modification, both to a "simple" washing machine (i.e. a washing machine which can only wash and rinse the laundry) and to a washing-drying machine (i.e. a washing machine which can also dry the laundry).

[0039] With reference to the enclosed Figures, the washing machine 1 according to the invention, schematically represented in Figure 1, comprises an external casing 2 in which frontal wall 2a an access opening 3 is obtained, provided with a loading/unloading door 4, which allows the access to a washing tub 5 contained in the external casing 2; the washing tub 5 contains a rotatable perforated drum 6 in which the laundry to be washed, not illustrated, can be loaded (in the enclosed Figures, the holes obtained in the lateral surface of the rotatable perforated drum 6 have not been represented).

[0040] The washing tub 5 is connected the external casing 2 preferably via a flexible bellows 7, connected between the frontal, opened, surface of the washing tub

5 facing the access opening 3, and the border of the latter.

[0041] The washing machine 1 comprises a water inlet circuit 8 adapted to feed water and washing/rinsing products (i.e. detergents, softeners, etc.) into the washing tub 5; the water inlet circuit 8 advantageously comprises a removable drawer 8a, adapted to be filled with washing and/or rinsing products, for example detergents, softener, bleaching substances, etc.

[0042] The water inlet circuit 8 comprises also an inlet duct 8b, connectable to water delivery mains present outside the washing machine 1, and adapted to deliver fresh water to the drawer 8a; the water inlet circuit 8 comprises also an outlet duct 8c, fluidly connecting the drawer 8a and the tub 5 and adapted to deliver water and washing/rinsing products into the washing tub 5. Advantageously the water inlet circuit 8 comprises also one or more valves, not represented, adapted to regulate the flow of water.

[0043] When fresh water is admitted into the drawer 8a via the inlet duct 8b, such fresh water washes away the washing/rinsing products contained in the drawer 8a, and delivers these products into the washing tub 5 via the outlet duct 8c.

[0044] In another embodiment, not illustrated, the water inlet circuit 8 comprises one or more reservoirs for one or more washing/rinsing products from which a certain amount of these washing/rinsing products, depending on the washing program, is automatically delivered to the washing tub 5.

[0045] The washing machine 1 comprises a draining sump 9, obtained preferably on the lateral surface 5a of the tub 5, fluidly communicating with the internal of the tub 5, and fluidly connected to a draining circuit 10 adapted to drain the washing/rinsing liquid (i.e. water and water mixed with washing and/or rinsing products) from the washing tub 5.

[0046] Advantageously, as it will be better explained in the following, in the present embodiment the draining sump 9 is accessible from the internal of the drum 6.

[0047] Advantageously the draining sump 9 is placed in the lower region of the washing tub 5, so that the liquid contained in the latter can be conveyed by gravity towards this draining sump 9, and therefore to the draining circuit 10.

[0048] In other words the draining sump 9 is a sort of container associated downstream to the washing tub 5 and adapted for collecting the washing/rinsing liquid exiting the latter.

[0049] Preferably the draining sump 9 is obtained in a single-piece construction with the lower region of the tub 5, advantageously by moulding of a plastic material.

[0050] The draining circuit 10 comprises a draining pump 11 provided with an impeller, not illustrated, housed in an impeller chamber 11a which is preferably, but not necessarily, obtained in a single-piece construction with the draining sump 9 and with the washing tub 5, preferably in correspondence to an extension of the draining sump 9.

[0051] In a further embodiment, not illustrated, the draining circuit 10 can be also provided with a recirculation circuit, adapted to drain the washing/rinsing liquid from the bottom of the tub 5, and to re-admit such liquid into an upper region of the tub, for improving the wetting of the laundry. The recirculation circuit of a washing machine is well known in the art, and therefore will not be described in detail.

[0052] The washing machine 1 comprises a filter 12, removably associated to a suitable seat 9a provided between the washing tub 5 and the draining sump 9, and adapted for allowing the passage of washing liquid and to impede the passage of bodies of fixed dimensions from the washing tub 5 to the draining circuit 10 (and therefore to the pump 11 of the latter). These bodies can be, for example, buttons came off from the laundry, coins or other little objects contained in the pockets of trousers or other clothes and erroneously introduced into the washing machine 1, lint, fluff, etc.

[0053] In the embodiments illustrated in the enclosed figures, the seat 9a for the filter 12 is advantageously obtained inside the draining sump 9, and partially coincides with the latter; in a further embodiment, not illustrated, the seat 9a may be provided partially internally and partially externally to the draining sump 9, or totally externally to the draining sump 9, provided that it is arranged in such a way that when the filter 12 is correctly inserted in the seat 9a, all the washing/rinsing liquid has to traverse the filter 12 in order to flow into the draining sump 9.

[0054] In the embodiments illustrated in the enclosed figures, the seat 9a is accessible from the internal of the drum 6.

[0055] In the embodiments illustrated in Figures 1 to 16, the filter 12 is box-shaped (or cup-shaped) and it is advantageously substantially cylindrical (but it may be also prismatic, or cubic, or parallelepiped, or may have any other box-shaped conformation).

[0056] The filter 12 advantageously comprises a filtering surface 19 adapted for allowing the passage of a liquid and for impeding the passage of bodies of fixed dimensions; the filtering surface 19 allows the passage of the washing liquid from the washing tub 5 to the draining circuit 10, but impedes the passage of bodies of prefixed dimensions, for example buttons, coins, etc.

[0057] In the embodiments illustrated in Figures 1 to 16, the filter 12 is substantially cylindrical, and the filtering surface 19 is comprised in the lateral cylindrical surface of the filter 12.

[0058] In a further embodiment the filtering surface 19 may be comprised in the lateral cylindrical surface and/or in the bottom surface 12a of the filter.

[0059] Advantageously the filtering surface 19 is provided with a plurality of openings 20 adapted for allowing the passage of liquids, but for avoiding the passage of objects (e.g. coins, buttons, etc.) whose dimensions are higher than a prefixed value depending on the dimensions of the openings 20.

[0060] The filter 12 is adapted to be inserted in a removable way into the seat 9a, and advantageously comprises a coupling device adapted for fixing it in a removable way to the seat 9a.

[0061] Advantageously the coupling device comprises an outwards-projecting peripheral flange 13, projecting from the upper border 12b of the filter 12 and adapted (as illustrated for example in Figure 3) to be put in abutment against the border of washing tub 5 surrounding the seat 9a, while the rest of the filter 12 is positioned inside the seat 9a, and in this case inside the draining sump 9, for avoiding that such filter 12 would fall into the draining sump 9.

[0062] In the embodiment illustrated in Figures 2 to 16, the coupling device also comprises snap-fitting means adapted for allowing a snap-fitting connection of the filter 12 to the seat 9a. Advantageously the snap-fitting means comprise two or more arms 14a, 14b, associated to the filter 12, and elastically deformable so that they may be elastically pressed in a radial direction with respect to the lateral cylindrical surface of the filter 12.

[0063] Advantageously, as in the embodiment of Figures 2 to 9, the arms 14a, 14b may be connected to the filter 12 in proximity of the upper border 12b of the latter; in particular, in the embodiment of figures 2 to 9 the arms 14a, 14b are connected to the peripheral flange 13, but in a further embodiment, not illustrated, they may be connected to the lateral cylindrical surface of the filter 12.

[0064] With reference to the embodiment of Figures 2 to 9, the arms 14a, 14b comprise a first region 42, attached to the filter 12, sloped in such a way that its distance from the lateral cylindrical surface of the filter 12 increases while moving away from the region of the filter 12 to which it is attached (and therefore, in the embodiment of Figures 2 to 9, from the peripheral flange 13).

[0065] Advantageously the arms 14a, 14b comprise a second region 43, contiguous to the first region 42 and sloped in an opposite direction with respect to the first region 42 of the same arm, comprising the free end 16 of each arm; in other words the arms 14a, 14b in proximity of their free ends 16 are sloped in such a way that their distance from the lateral cylindrical surface of the filter 12 decreases while moving away from the region of the filter 12 to which they are attached (and therefore, in the embodiment of Figures 2 to 9, from the peripheral flange 13).

[0066] An annular riddle 17 advantageously protrudes from the border of the washing tub 5 surrounding the seat 9a, towards the internal of the seat 9a.

[0067] With reference to Figure 6, and 4, during the insertion of the filter 12 into the seat 9a, the second region 43 of the arms 14a, 14b slides against the annular riddle 17, and, due to the slope of such second region 43, the arms 14a, 14b are elastically pushed towards the lateral cylindrical surface of the filter 12. After the second region 43 of the arms 14a, 14b goes beyond the annular riddle 17, the arms 14a, 14b elastically move towards the external of the filter 12, positioning below the annular riddle

17, and therefore opposing to the removal of the filter 12 from the seat 9a.

[0068] For removing the filter 12 from the seat 9a, a user has to pull the filter 12 in the opposite direction with respect to the draining sump 9; the first region 42 of the arms 14a, 14b slide against the annular riddle 17 and, due to their particular slope, they cause the arms 14a, 14b to elastically move towards the lateral cylindrical surface of the filter 12, allowing the removal of the filter 12.

[0069] Also in the embodiment illustrated in Figures 10 to 16 the arms 14a, 14b comprise a first region 42, but in this case this region 42 is connected to the lateral cylindrical surface of the filter 12 in proximity of the bottom surface 12a of the filter 12, and it is sloped in such a way that its distance from the lateral cylindrical surface of the filter 12 increases while approaching the upper border 12b of the filter 12. Also in this embodiment the arms 14a, 14b comprise a second region 43, contiguous to the first region 43 and sloped in an opposite direction with respect to the first region 42 of the same arm, comprising the free end 16 of each arm; the arms 14a, 14b, in proximity of their free ends 16, are therefore sloped in such a way that their distance from the lateral cylindrical surface of the filter 12 decreases while approaching the upper border 12b of the filter 12.

[0070] With reference to Figure 13, during the insertion of the filter 12 into the seat 9a, the first region 42 of the arms 14a, 14b slides against the annular riddle 17, and, due to the slope of such first region 42, the arms 14a, 14b are elastically pushed towards the lateral cylindrical surface of the filter 12. After the free end 16 of the arms 14a, 14b goes beyond the annular riddle 14, the arms 14a, 14b elastically move towards the external of the filter 12, positioning with their free ends 16 below the annular riddle 17; the filter 12 is therefore locked to the seat 9a.

[0071] For removing the filter 12 from the seat 9a, a user has to pull the filter 12 in the opposite direction with respect to the draining sump 9; the free ends 16 of the arms 14a, 14b slide against the annular riddle 17 and, due to their particular slope, they cause the arms 14a, 14b to elastically move towards the lateral cylindrical surface of the filter 12, releasing the arms 14a, 14b from the annular riddle 17, and allowing the free removal of the filter 12.

[0072] In a further embodiment, not illustrated, the coupling device may comprise a thread, not illustrated, provided on the lateral cylindrical surface of the filter 12; this thread is adapted to engage a corresponding further thread, also not illustrated, provided on the internal surface of the seat 9a, so that the filter 12 may be fixed to and removed from the seat 9a by screwing.

[0073] In a further embodiment thereof, also not illustrated, the coupling device may comprise a bayonet coupling.

[0074] Advantageously the filter 12 comprises a grasping element, which will be better described in the following, adapted for allowing a user to easily remove the filter 12 from the seat 9a.

[0075] The access to the filter 12, for example for its cleaning and/or replacement, is performed from the internal of the drum 6 via a suitable aperture, not illustrated, provided on the lateral surface 6a of the drum 6 so that in a particular angular position of the latter this aperture faces the seat 9a; during the functioning of the washing machine this aperture is closed by a closing device 18, for example a lid or a porthole, adapted for selectively closing the opening. In the embodiment illustrated in Figure 1 the closing device 18 advantageously comprises a lifter which is pivotable with respect to the lateral surface 6a of the drum 6, so that it can be lifted for allowing the access to the underlying aperture; when not lifted, this lifter operates as a traditional lifter, and is therefore useful for improving the stirring of the laundry during the rotation of the drum 6.

[0076] As will be better explained in the following, the filter 12 comprises an indicator adapted to be displaced in a first position if the filter 12 is correctly inserted into the seat 9a, and in a second position if the filter 12 is incorrectly inserted into the seat 9a.

[0077] As it will be better explained in the following, this allows a user to verify if the filter 12 has been correctly inserted into the seat 9a or not, simply by looking at the position of the indicator; if the indicator is in the first position the user is aware that the filter 12 has been correctly inserted into the seat 9a, while if the indicator is in the second position, the user is aware that the filter 12 has been incorrectly inserted into the seat 9a.

[0078] It is underlined that the expression "correctly inserted" means that the filter 12 has been introduced in the seat 9a in such a way that substantially all the washing/rinsing liquid (i.e. water or water mixed with washing and/or rinsing products, such as detergents, bleaching, softeners, etc.) has to pass through the filter 12 before entering the draining sump 9; in other words the filter 12 is correctly inserted into the seat 9a if it obstructs substantially the entire inlet of the draining sump 9, so that the washing/rinsing liquid has to pass through the filter 12, in particular through its filtering surface 19, before entering the draining sump 9 and going to the draining circuit 10. When the filter 12 is correctly positioned into the seat 9a, therefore, all the foreign bodies which may be contained in the washing/rinsing liquid are trapped in the filter 12.

[0079] Moreover the expression "incorrectly inserted" means that the filter 12 hasn't been inserted into the seat 9a in such a way that substantially all the washing/rinsing liquid has to pass through the filter 12 in order to enter the draining sump 9. An example of a filter 12 incorrectly inserted into the seat 9a is illustrated for example in Figure 4; in this case the filter 12 is inclined with respect to the seat 9a, and the peripheral flange 13 of the filter isn't placed in abutment against the border of washing tub 5 surrounding the seat 9a, so that the washing/rinsing liquid, and therefore also the foreign bodies contained in the latter, may reach the draining sump 9 via the gap which remains between the peripheral flange 13 and the

border of the washing tub 5. In this case these foreign bodies aren't trapped by the filter 12, and therefore may reach the draining pump 11, with the risk of damaging the latter.

[0080] Preferably, but not necessarily, in the above mentioned first position the indicator is visible from the external of the filter 12, while in the second position the indicator is not visible from the external of the filter 12.

[0081] In another embodiment the indicator may be visible from the external of the filter 12 in both the first and second positions.

[0082] Advantageously, as will be better explained in the following, the indicator is arranged in such a way that if the filter 12 is correctly inserted into the draining sump 9, the indicator engages the internal surface of the draining sump 9 and is moved in the first position.

[0083] In the embodiment of Figures 2 to 9, the indicator comprises a movable element, preferably, but not necessary, a pin 28, associated the filter 12, in such a way that, if the filter 12 is correctly inserted into the seat 9a, the pin 28 is displaced in a first position, while if the filter 12 is incorrectly inserted into the draining seat 9a, the pin 28 is displaced in a second position.

[0084] In particular, with reference to the embodiment of Figures 2 to 9 in the first position, illustrated for example in Figure 3, a first end 28a of the pin 28 protrudes externally to the guide 23, in such a way that it may be seen and/or touched by a user, while in the second position, illustrated for example in Figure 4, the first end 28a of the pin 28 is fully contained inside the guide 23, so that it can't be seen nor touched by a user.

[0085] In a further embodiment, not illustrated, the pin 28 and the guide 23 are arranged in such a way that the pin 28 protrudes from the guide 23 both in the first position and in the second position, but in such a way the part of the pin 28 which protrudes from the guide 23 in the two positions is different, so that a user may easily identify if the pin 28 is in the first or in the second position.

[0086] In the embodiment of Figures 2 to 9, the guide 23 is advantageously tubular and it is fixed, preferably, but not necessarily in a removable way, to the filter 12; in this embodiment the guide 23 is advantageously positioned internally to the filter 12.

[0087] Opportunely the guide 23 is fixed to the filter 12 by one or more fixing elements comprising, for example, two wings 44a, 44b, protruding externally from the lateral surface of the guide 23 and adapted to be fixed, for example by snap-fitting, into suitable seats 45a, 45b provided in the internal surface of the lateral cylindrical surface of the filter 12.

[0088] In the embodiment of Figures 2 to 9 the guide 23 is substantially aligned with the central longitudinal axis 60 of the filter 12; in a further embodiment, not illustrated, the guide 23 may be also not aligned and/or inclined with respect to the central longitudinal axis 60 of the filter 12.

[0089] In a further embodiment, not illustrated, the guide 23 is fixed externally to the filter 12, for example

to the external side of its lateral cylindrical surface.

[0090] Advantageously, in the embodiment of Figures 2 to 9 the second end 28b of the pin 28 is slidably associated to a hole 47 provided on the bottom surface 12a of the filter 12 and aligned with the guide 23.

[0091] Advantageously the filter 12 comprises retaining means adapted for impeding the extraction of the pin 28 from the guide 23.

[0092] Preferably, but not necessarily, the first end 28a of the pin 28 has a section which is reduced with respect to the rest of the pin 28, so as to define a step 48 adapted to be put in abutment against a first flange 49 protruding from the inner lateral surface of the guide 23, towards the internal of the latter, in proximity of its upper end 23a, so as to avoid the extraction of the pin 28 from the upper end 23a of the guide 23.

[0093] Advantageously an annular riddle 50 protrudes from the lateral surface of the pin 28, in proximity of the second end 28b of the latter, adapted to be put in abutment against the border of the hole 47, so as to avoid the extraction of the pin 28 from the hole 47.

[0094] In this case, therefore, the above mentioned retaining means advantageously comprise the step 48, the first flange 49, the annular riddle 50 and the border of the hole 47.

[0095] Advantageously the length and the positioning of the pin 28, and the positioning of the step 48 are such that when the filter 12 is correctly inserted into the seat 9a, as illustrated for example in Figure 3, the second end 28a of the pin 28 is in abutment with (i.e. engages) the internal surface of the seat 9a (in this case with the bottom surface of the sump 9), and therefore the pin 28 is pushed in the first position, in which the upper end 28a of the pin 28 protrudes externally from the guide 23, so that it may be seen and/or touched by a user. In this case the user is therefore aware that the filter 12 has been correctly positioned into the seat 9a.

[0096] Moreover the length and the positioning of the pin 28, and the positioning of the annular riddle 50 on the pin 28 are such that if the filter 12 is incorrectly inserted (as in Figure 4) into the seat 9a, the second end 28b of the pin 28 protrudes from the bottom surface 12a of the filter 12 via the hole 47, while the first end 28a of the pin 28 is fully placed inside the guide 23, so that it can't be seen and/or touched by a user. In this case the user is therefore aware that the filter 12 hasn't been correctly positioned into the seat 9a.

[0097] As mentioned above, the filter 12 is advantageously provided with a grasping element adapted for facilitating the removal of the filter 12 from the seat 9a.

[0098] In the embodiment of Figures 2 to 9, the grasping element advantageously comprises a blade 52, provided at the upper end 23a of the guide 23 and substantially perpendicular to the latter, which may be grasped by the user in order to remove the filter 12 from the seat 9a; it is underlined that the guide 23 is arranged in such a way that once it has been associated to the filter 12, a traction applied on the blade 52 can't separate the guide

23 from the filter 12.

[0099] Also in the embodiment illustrated in Figures 10 to 16 the filter 12 comprises a guide 23 adapted for allowing the sliding of the pin 28 therein.

[0100] In this case the filter 12 is advantageously substantially cylindrical, and the bottom surface 12a of the filter 12 is opportunely substantially frustum-conical, with an aperture 12c preferably provided in correspondence of the minor base of the frustum of cone.

[0101] The filter 12 advantageously comprises a hollow body 22, preferably tubular, projecting from the border of the aperture 12c provided at the bottom surface 12a of the filter 12, partially positioned internally to the lateral cylindrical surface of the filter 12 and extending with its upper end 22a above the upper border 12b of the filter 12, so that when the filter is positioned into the seat 9a the upper end 22a of the hollow body 22 protrudes above the bottom of the washing tub 5, so as to be stricken by the flux of water moved by the rotatable drum 6 during its rotation.

[0102] Moreover the upper end 22a, extending above the upper border 12b of the filter 12, may be grasped by a user in order to remove the filter 12 from the seat 9a; in this case, therefore the grasping element comprise the upper end 22a of the hollow body 22.

[0103] Advantageously, but not necessarily, the hollow body 22 is substantially concentric with the filter 12, that is the hollow body 22 is positioned in such a way that its longitudinal axis, not represented, substantially coincides with the longitudinal axis, also not represented, of the filter 12. In a further embodiment, not represented, the hollow body 22 is positioned in such a way that its longitudinal axis doesn't coincide with the longitudinal axis of the filter 12; for example the longitudinal axes of the hollow body 22 and of the filter 12 may be parallel one another, or may also be sloped one with respect to the other.

[0104] The washing liquid enters the filter 12 from the upper border 12b of the latter, and goes to the draining sump 9 traversing the filtering surface 19 (i.e. traversing the holes 20); foreign bodies contained in the washing liquid and which dimensions are bigger than the holes 20 remains trapped between the filtering surface 19, the bottom surface 12a of the filter 12 and the external surface of the hollow body 22.

[0105] In particular, a certain amount of washing/rinsing products (i.e. detergent) which is not yet melted in the washing water may reach the draining sump 9 via the holes 20, and so it may accumulate on the bottom of the draining sump 9.

[0106] In this embodiment a guide 23, preferably substantially cylindrical, for the movable element, is advantageously provided inside the hollow body 22, preferably, but not necessarily, concentrically to the latter, in such a way that there is a first gap 24 between the internal surface of the hollow body 22 and the external surface of the guide 23.

[0107] Opportunely, but not necessarily, the upper end

23a of the guide 23 is opened, and it is placed in correspondence of the free end 22a of the hollow body 22.

[0108] Advantageously the hollow body 22 comprises one or more apertures 25, provided on its upper end 22a, fluidly communicating with the first gap 24 and adapted for allowing the entrance of washing liquid from the washing tub 5 into the above mentioned first gap 24. Advantageously the apertures 25 are adapted for allowing the passage of liquids, but for avoiding the passage of objects (e.g. coins, buttons, etc.) whose dimensions are higher than a prefixed value depending on the dimensions of the apertures 25; in particular the dimensions of the apertures 25 are such that if a body can't pass through the filtering surface 19, it can't neither pass through the apertures 25 (in the embodiments illustrated in the enclosed figures, therefore, the dimensions of the apertures 25 are equal or smaller than the dimensions of the holes 20).

[0109] Advantageously the apertures 25 are positioned in such a way that when the filter 12 is in the seat 9a, they are stricken by the flux of water moved by the rotatable drum 6 during its rotation.

[0110] In this embodiment the indicator comprises a pin 28 slidably arranged inside the guide 23 and adapted to be positioned in a first position if the filter 12 is correctly inserted into the seat 9a, and in a second position if the filter 12 is incorrectly inserted into the seat 9a.

[0111] Also in this embodiment in the first position the pin 28 is visible from the external of the filter 12, while in the second position it isn't visible from the external of the filter 12.

[0112] A foot 27 protrudes from the second end 28b of the pin 28, preferably at least partially countershaped to the external surface of the bottom surface 12a of the filter 12, and therefore, in this embodiment, substantially frustum-conical.

[0113] The pin 28 may therefore slide from the first position, not illustrated, in which a stopping element 30 (for example an annular riddle) provided on the lateral surface of the pin 28, contacts a second flange 31 protruding from a lower end 23b of the guide 23, towards the internal of the latter, and the second position, illustrated in Figure 15, in which the foot 27 contacts a plurality of spacing elements 29 protruding from the external surface of the bottom surface 12a of the filter 12.

[0114] When the pin 28 is in the second position, a second gap 32 is obtained between the external surface of the bottom surface 12a of the filter 12 and the foot 27; this second gap 32 fluidly communicates with the first gap 24.

[0115] Advantageously the length of the pin 28 is such that when it is in the first position, illustrated in Figure 15, the first end 28a of the pin 28 protrudes from the upper end 23a of the guide 23, so as to be visible and/or touchable from outside the filter 12; on the contrary when the pin 28 is in the second position, the first end 28a of the pin 28 is totally contained in the guide 23, and therefore can't be seen non touched by a user. As explained above with reference to the embodiment of Figures 2 to 9, this

feature allows a user to easily verify if the filter 12 has been correctly inserted into the seat 9a or not.

[0116] Clearly the pin 28 may be arranged in such a way that it is visible both in the first position and in the second position, but in such a way that in these two positions it protrudes from the guide 23 in two different ways.

[0117] Advantageously the cross section of the second gap 32 is smaller than the cross section of the first gap 24, so that a liquid is accelerated when passes from the first gap 24 to the second gap 32; this ensures that the flux of liquid hits the washing/rinsing products accumulated on the bottom of the draining sump 9 with a force sufficient to sweep them away and to promote their melting in the washing water.

[0118] The apertures 25, the first gap 24 and the second gap 32 define a by-pass conduit which by-passes the filtering surface of the filter 12, and which is adapted to direct a flow of washing liquid from the washing tub 5 to the bottom of the draining sump 9, so as to sweep away the washing/rinsing products accumulated in the bottom of the draining sump 9, favouring the melting of these products in the washing water and the re-admission of the water containing these melted products in the washing tub 5.

[0119] As illustrated in Figure 13, when the filter 12 is correctly inserted into the seat 9a, the foot 27 contacts (i.e. engages) the internal surface of the seat 9a (in this case the bottom of the draining sump 9), and the pin 28 is positioned in the first position; in this position the by-pass conduit, comprising the apertures 25, the first gap 24 and the second gap 32, fluidly connects the washing tub 5 and the internal of the draining sump 9, by-passing the filtering surface 19 of the filter 12.

[0120] During the washing cycle the washing water, pushed by the rotation of the drum 6, enters the apertures 25 (which corresponds to the inlet of the by-pass conduit), goes through the first gap 24 and to the second gap 32 (i.e. passes through the by-pass conduit), and is spurted towards the bottom and the lateral surface of the draining sump 9, so as to hit the washing/rinsing products which may be accumulated thereon, sweeping them away and favouring their melting in the washing water. The liquid entering the draining sump 9 via the by-pass conduit also causes a vortical motion which favours the re-admission of the water contained in the draining sump 9 (in which the washing/rinsing products previously accumulated in the bottom of the draining sump 9 are now melted) in the washing tub 5.

[0121] In the embodiment illustrated in the enclosed Figures, the indicator is a movable element adapted to be moved substantially linearly with respect to the filter 12; in another embodiment, not illustrated, the indicator may comprise a movable element pivotable or rotatable with respect to the filter 12.

[0122] Clearly the indicator may be a movable element adapted to move substantially in any way with respect to the filter 12; for example the motion allowed to the movable element may be a combination of a linear motion

and of a circular motion.

[0123] In the embodiment illustrated in the enclosed Figures, the filter 12 comprises only one indicator; in a further embodiment, not illustrated, the filter 12 may also comprise more than one indicators.

[0124] In all the embodiments described above the indicator comprises a single movable element; clearly, in a further embodiment, not illustrated, the movable element may comprise a complex body, comprising two or more elements connected one another.

[0125] The detection of the correct or incorrect insertion of a filter into the seat, and the transmission of this information to a user may be obtained also by electric and/or electromagnetic devices associated to the filter and /or to the draining sump, but these electric and/or electromagnetic devices would increase the complexity and the cost of the washing machine and they would involve also an additional electrical consumption.

[0126] For example Figures 17 and 18 illustrate a filter 112 for a draining sump 109 in which a magnet 170 is provided at the bottom of the filter 112; the magnet 170 may be fixed to the bottom of the filter by gluing or any other fixing means, or it may also be encompassed in the bottom of the filter 112 during the moulding of the latter.

[0127] A sensor 171 is provided in the draining sump 109 adapted for detecting the presence of the magnet 170 only if the filter 112 is correctly inserted into the seat 109a; if the filter 112 isn't inserted or is incorrectly inserted into the seat 109a, the sensor 171 doesn't detect the presence of the magnet 170.

[0128] The sensor 171 may be operatively connected to the electronic control of the washing machine, which may be programmed in such a way that, according to the fact that the sensor 171 detects or not the presence of the magnet 170, activates one or more specific functions; for example the electronic control may be programmed in such a way that if the sensor 171 doesn't detect the presence of the magnet 170, and a user tries to activate a washing cycle, an alert message is displayed on the display of the washing machine, and/or an alert sound is played by a loudspeaker provided in the washing machine, and/or the possibility to start the washing cycle is forbidden.

[0129] In a further embodiment the sensor 171 may be directly associated to an alert device provided at or in proximity of the draining sump 109 and/or at the filter 112, which is activated or deactivated according to the fact that the sensor 171 detects the magnet 170 or not; for example the alert device may comprise a LED (Light Emitting Diode), provided at the washing tub in proximity of the draining sump 109. The LED is arranged in such a way that it is in a turn-on condition if the sensor 171 doesn't detect the magnet 170, while is in a turn-off condition when the sensor 171 detects the magnet 170. In this way if a user sees that the LED is in the turn-on condition, he knows that the filter 112 has been incorrectly inserted into the seat 109a.

[0130] Clearly the magnet 170 may be provided also in the draining sump 109 and the sensor 171 on the filter 112.

[0131] It is seen therefore how the invention achieves the proposed aim and objects, there being provided a washing machine which, thanks to the indicator which is adapted to be displaced in a first position when the filter is correctly inserted into the seat provided between the washing tub and the draining sump, and in a second position when the filter is incorrectly inserted into the seat, allows informing a user, in a simple and economical way, if the drain filter is correctly positioned into the seat or not, so as to reduce the risk that the user, believing that the filter is correctly positioned into the seat even if this wouldn't be true, could activate a washing cycle, with the risk that foreign bodies contained in the washing/rinsing liquid may reach the draining pump.

[0132] Moreover the presence of the indicator allows informing a user if the drain filter is correctly positioned into the seat without using electric energy, and therefore doesn't increase the power consumption of the washing machine.

[0133] In addition, a filter according to the invention, provided with one or more indicators according to the invention, may be used instead of a traditional filter in a known washing machine; this allows achieving the proposed aim and objects also in this known washing machine, without other modifications of the latter.

Claims

1. Washing machine (1) comprising:

- a washing tub (5);
- a draining sump (9) fluidly communicating to the internal of said washing tub (5) and fluidly connected to a draining circuit (10);
- a filter (12), removably associable to a seat (9a) provided between said washing tub (5) and said draining sump (9), adapted for allowing the passage of a liquid and to impede the passage of bodies of fixed dimensions;

characterized in that

said filter (12) comprises an indicator adapted to be displaced in a first position if said filter (12) is correctly inserted into said seat (9a), and in a second position if said filter (12) is incorrectly inserted into said seat (9a).

2. Washing machine (1), according to claim 1, wherein said indicator is arranged in such a way that if said filter (12) is correctly inserted into said seat (9a), said indicator engages the internal surface of said seat (9a) and is displaced in said first position.

3. Washing machine (1), according to claim 1 or 2,

wherein said indicator comprises a movable element slidably associated to said filter (12).

4. Washing machine (1), according to claim 3, wherein said filter (12) comprises a guide (23) adapted for allowing the sliding of said movable element between said first and second position.

5. Washing machine (1), according to claim 4, wherein said indicator comprises a pin (28), slidably associated to said guide (23) in such a way that if said filter (12) is correctly inserted into said seat (9a), said pin (28) is displaced in said first position, while if said filter (12) is incorrectly positioned into said seat (9a), said pin (28) is displaced in said second position.

6. Washing machine (1), according to claim 5, wherein in said first position a first end (28a) of said pin (28) protrudes externally from said guide (23), so that it may be seen and/or touched by a user, while in said second position said first end (28a) of said pin (28) is fully contained inside said guide (23), so that it can't be seen and/or touched by a user.

7. Washing machine (1), according to one or more of the previous claims, wherein said seat (9a) is accessible from the internal of said drum (6).

8. Washing machine (1), according to one or more of the previous claims, wherein said filter (12) comprises a coupling device adapted for fixing it in a removable way to said seat (9a).

9. Washing machine (1), according to one or more of the previous claims, wherein said filter (12) comprises a grasping element adapted for facilitating the removal of said filter (12) from said seat (9a).

10. Washing machine (1), according to one or more of the previous claims, wherein in said first position said indicator is visible from the external of said filter (12), and in said second position said indicator is not visible from the external of the filter (12).

11. Filter (12) for the draining circuit of a washing machine (1) **characterized by** comprising an indicator adapted to be displaced in a first position and in a second position depending on the positioning of said filter (12) with respect to said washing machine (1).

12. Filter (12), according to claim 11, wherein said indicator comprises a movable element slidably associated to said filter (12).

13. Filter (12), according to claim 12, wherein said filter (12) comprises a guide (23) adapted for allowing the sliding of said movable element (28).

14. Filter (12), according to claim 13, wherein said indicator comprises a pin (28) slidably associated to said guide (23) in such a way that in said first position a first end (28a) of said indicator (28) is visible from the external of said filter (12), and in said second position said first end (28a) is not visible from the external of said filter (12).

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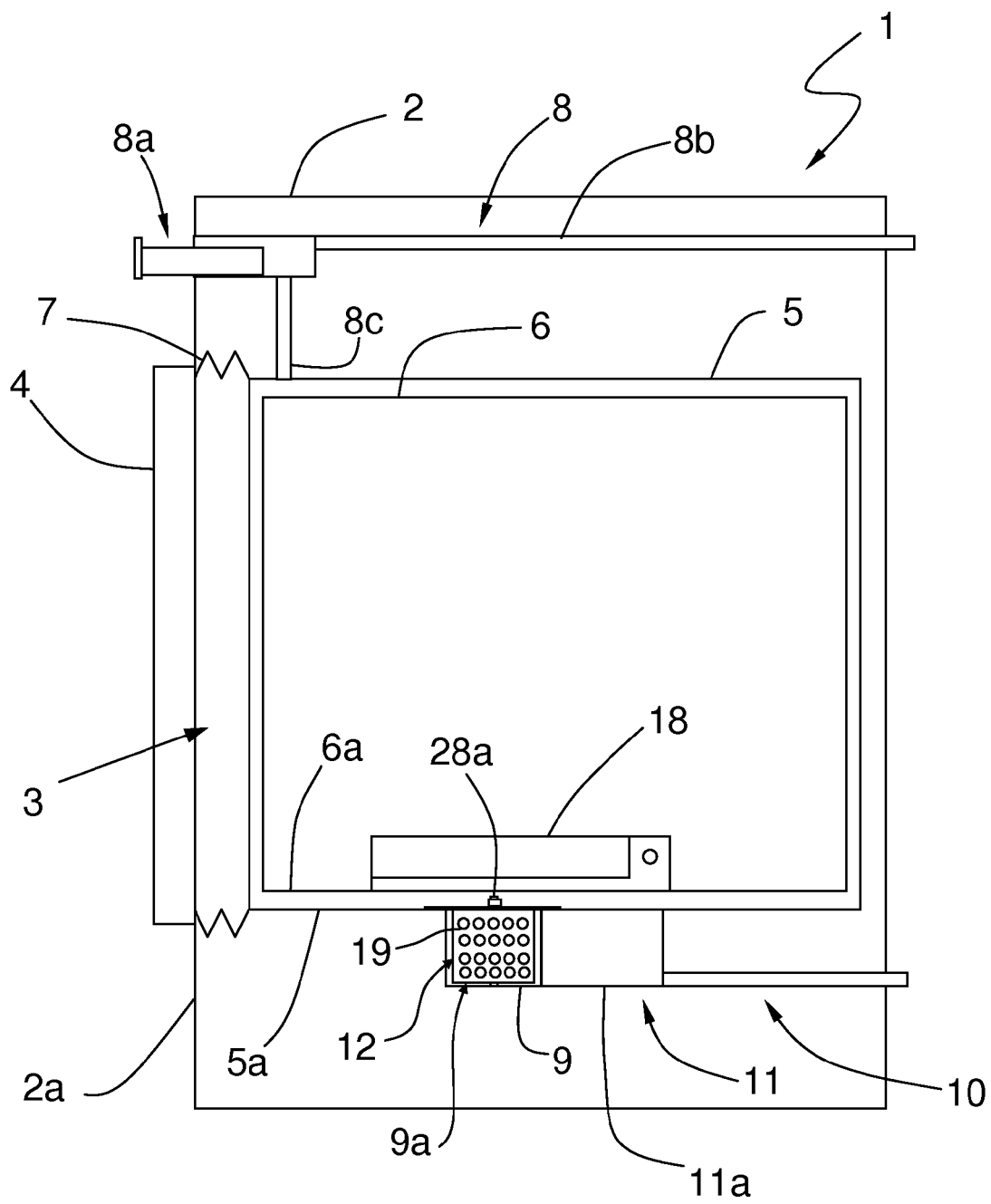


Fig. 1

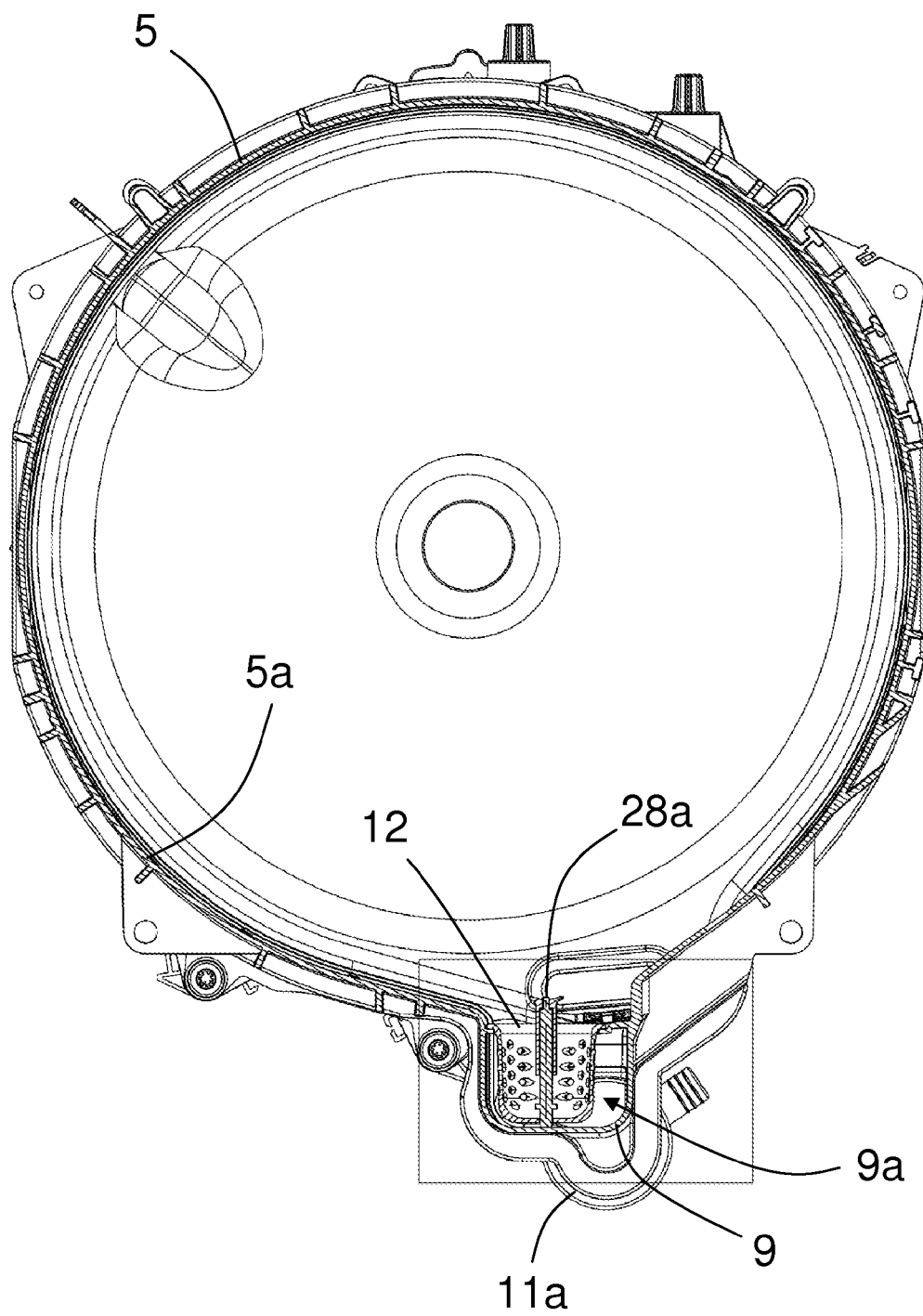
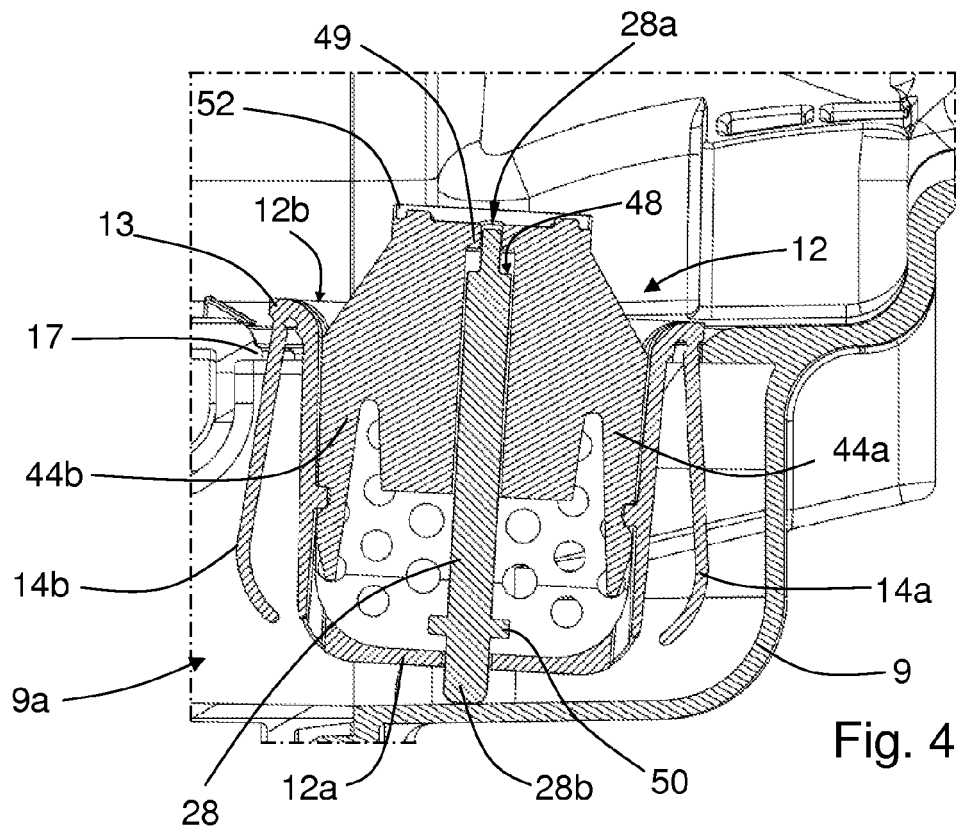
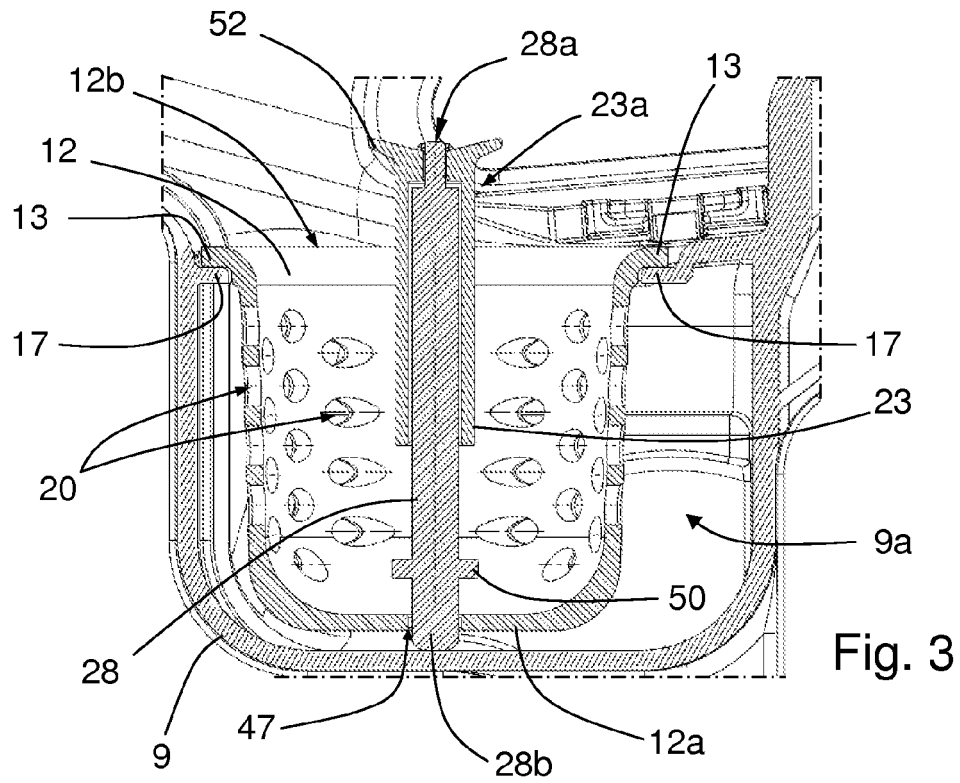
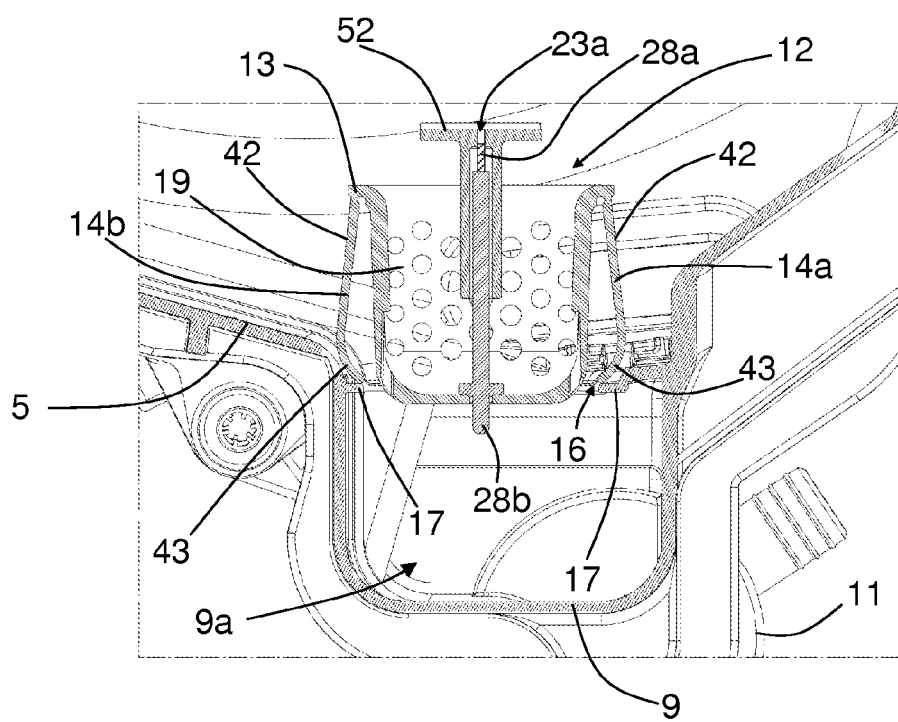
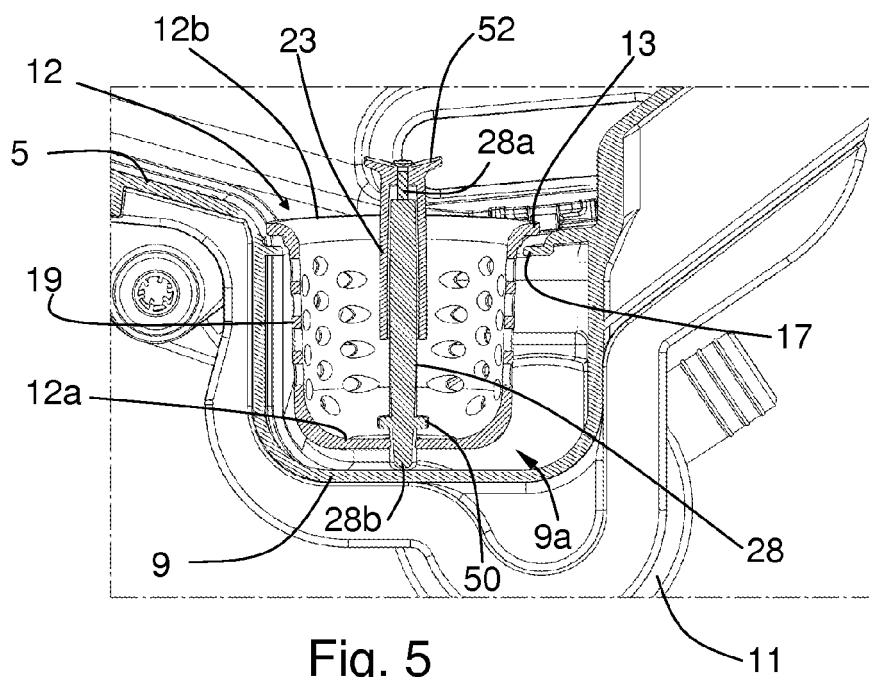


Fig. 2





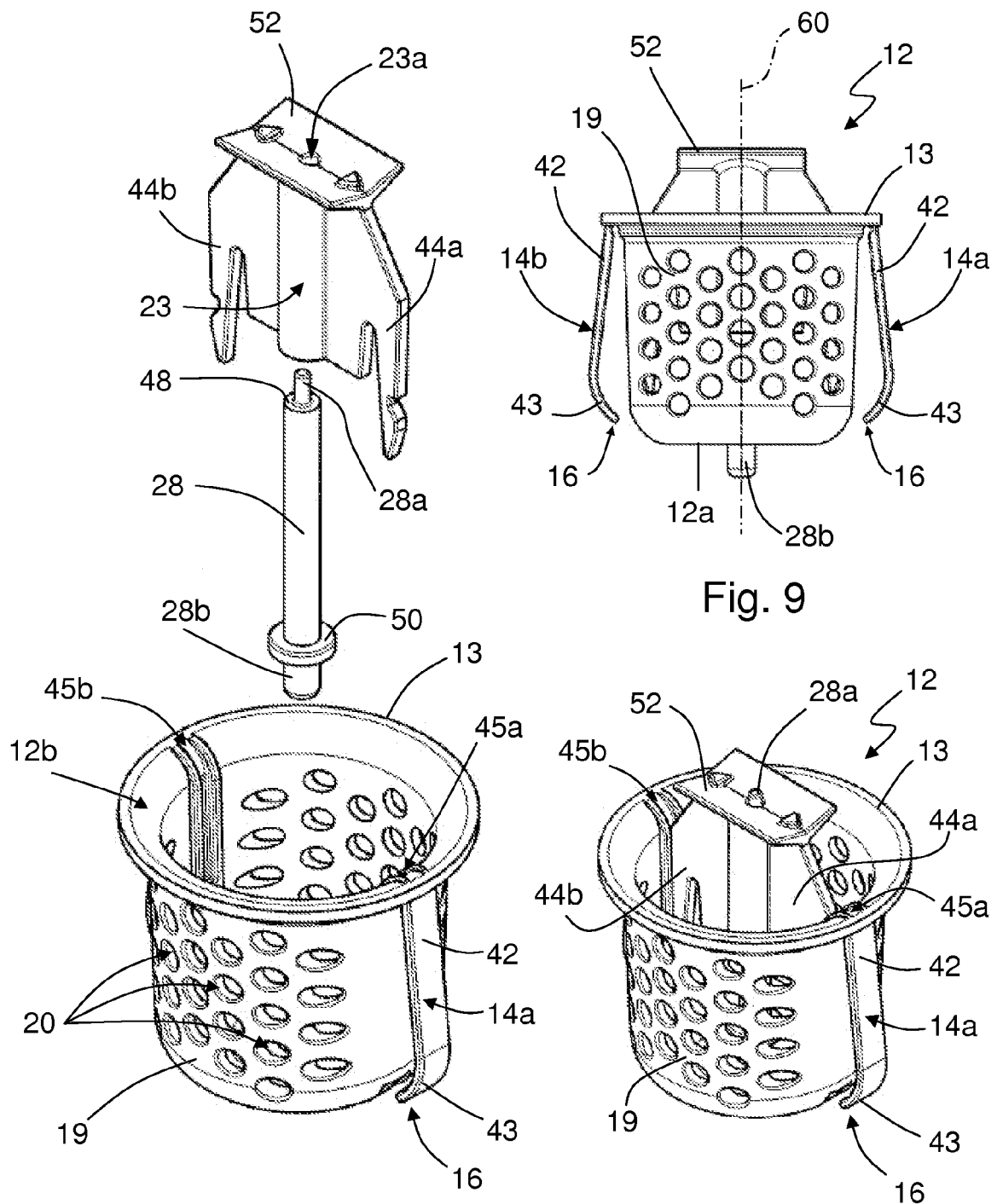
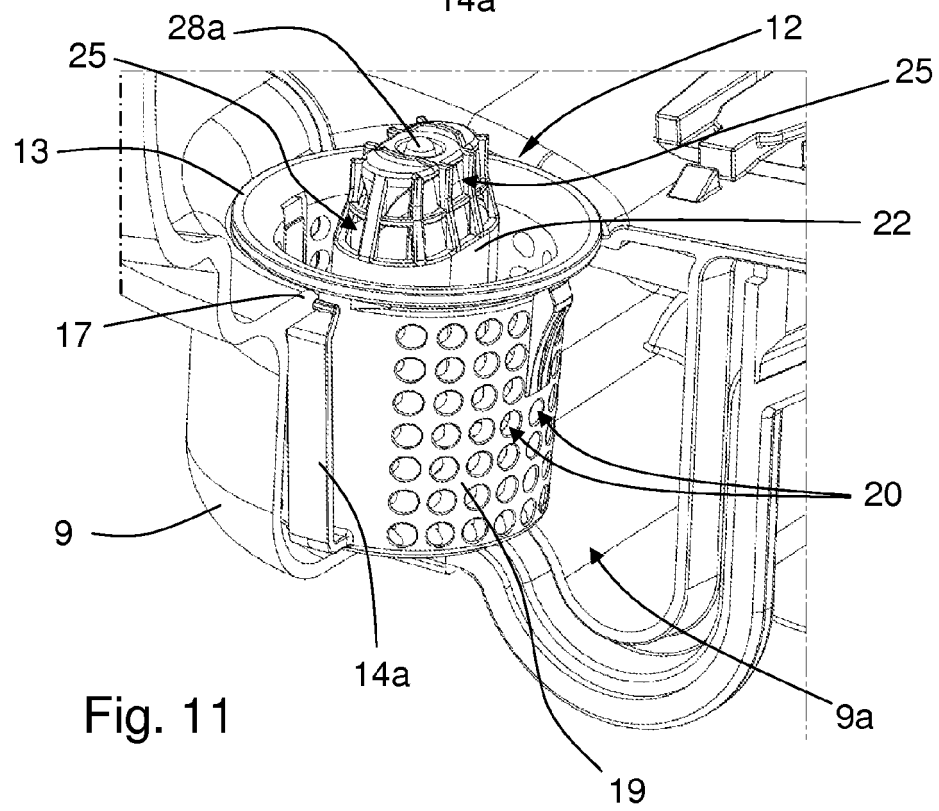
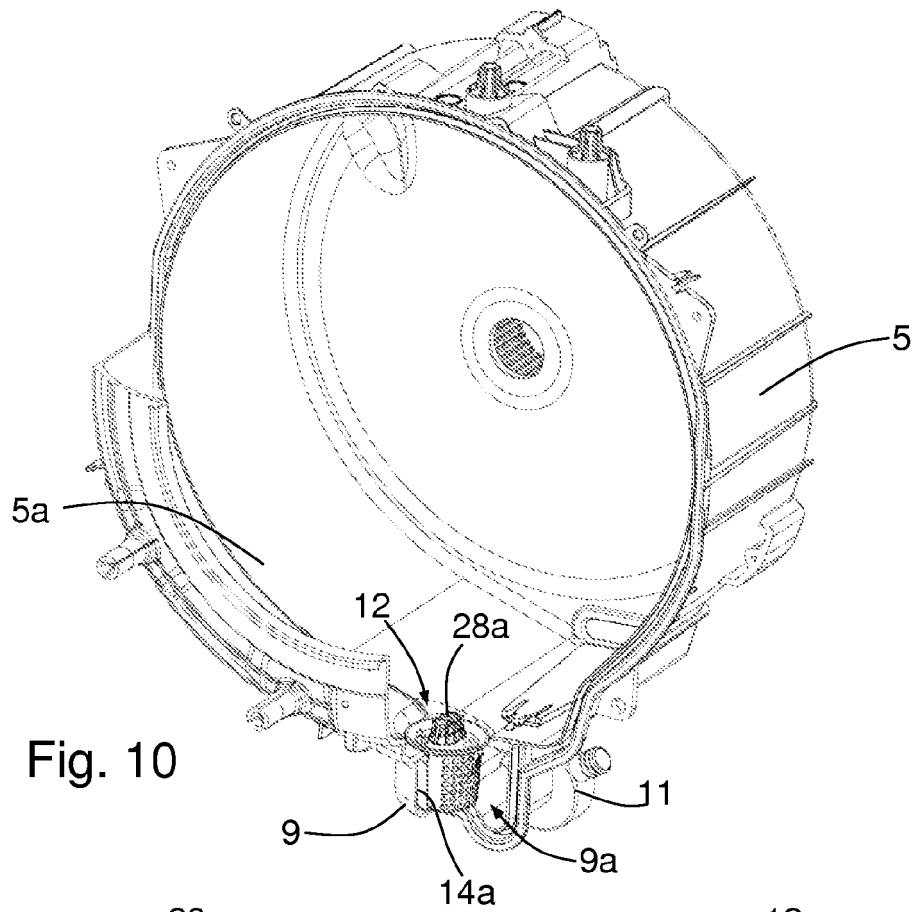
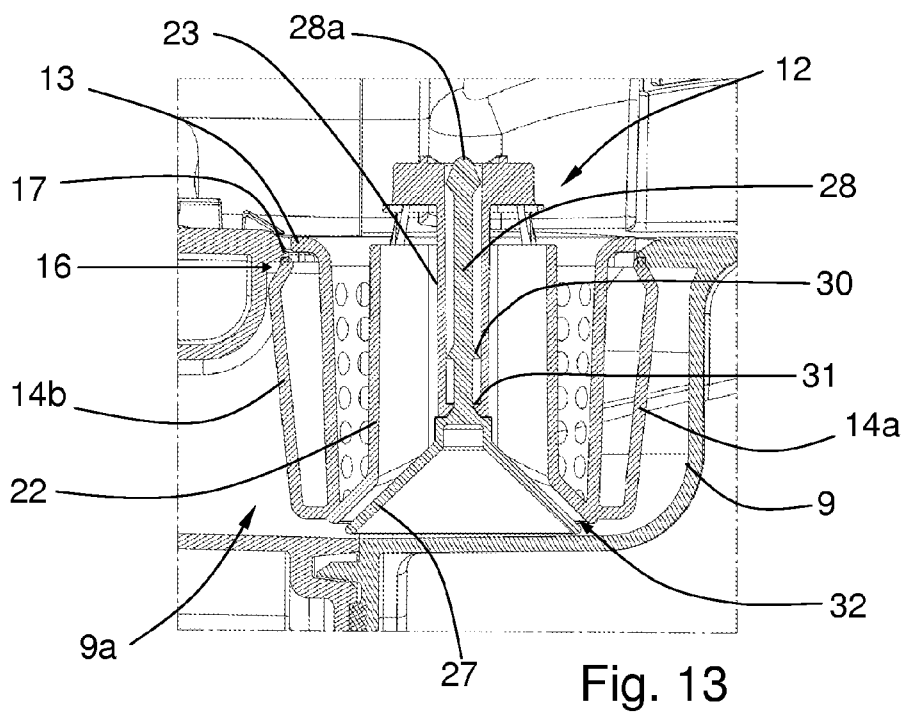
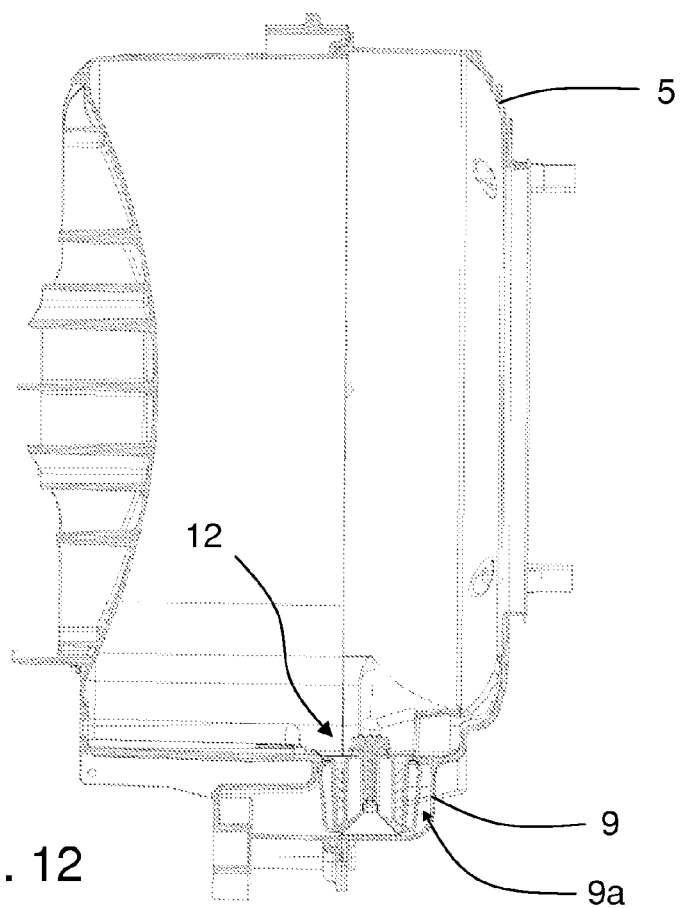


Fig. 7

Fig. 8

Fig. 9





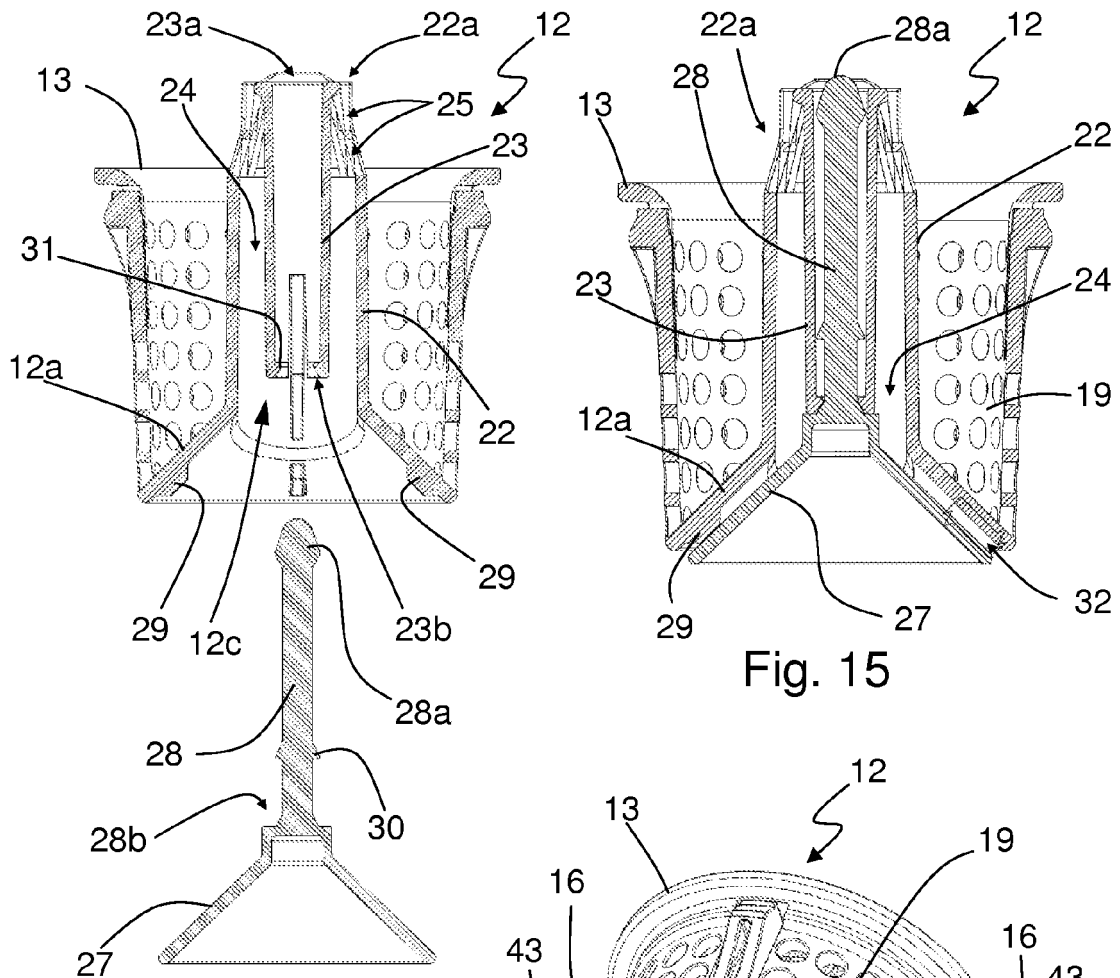


Fig. 14

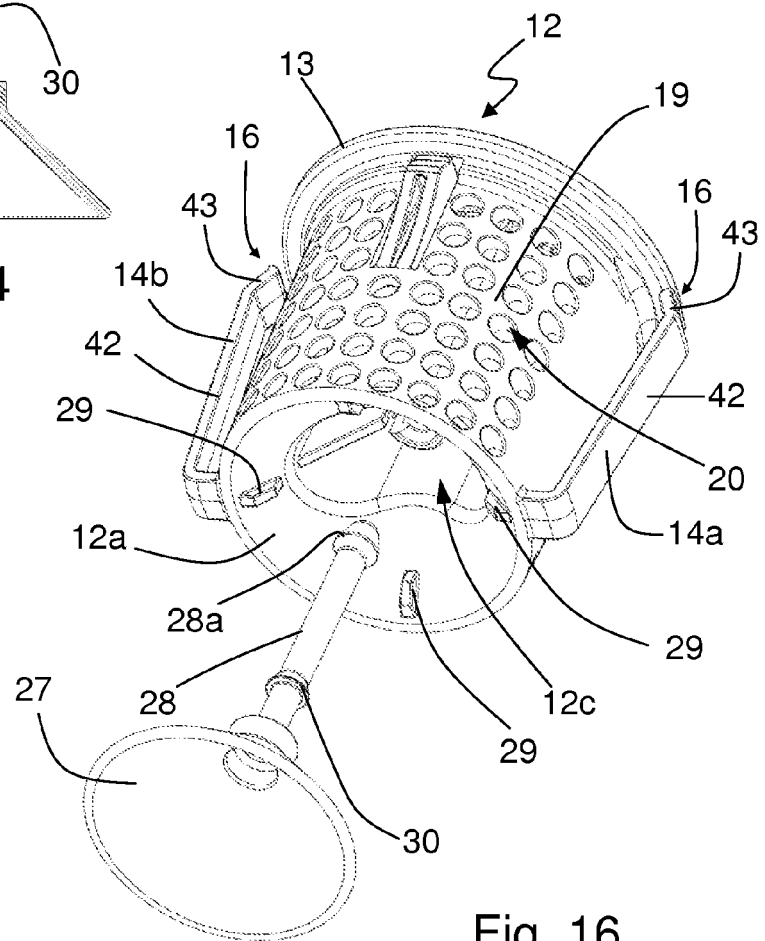


Fig. 16

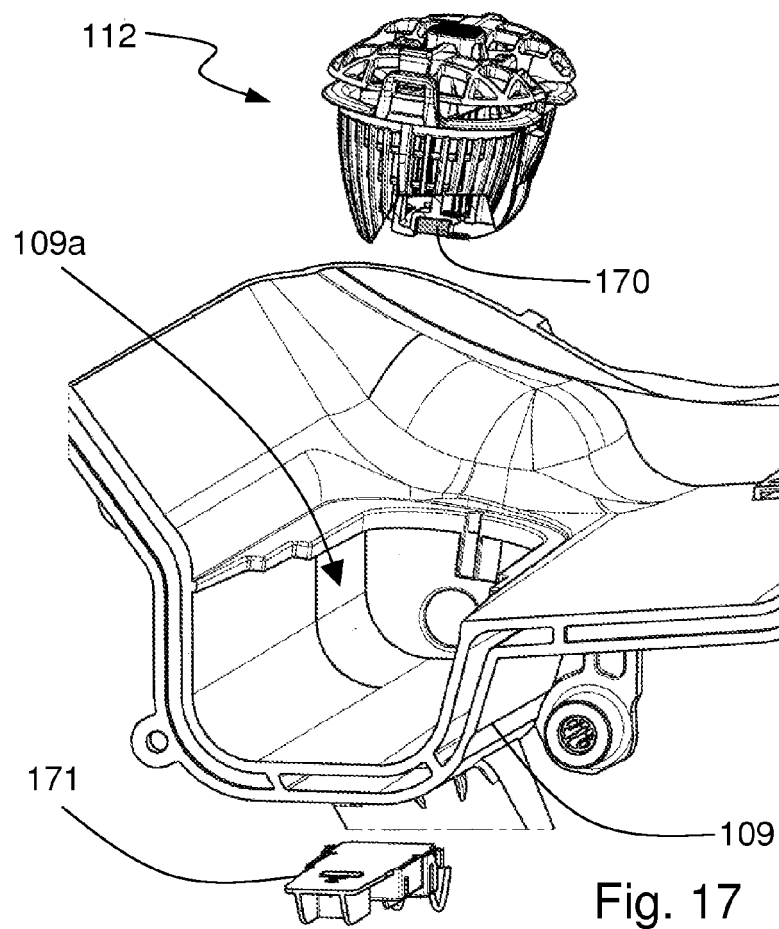


Fig. 17

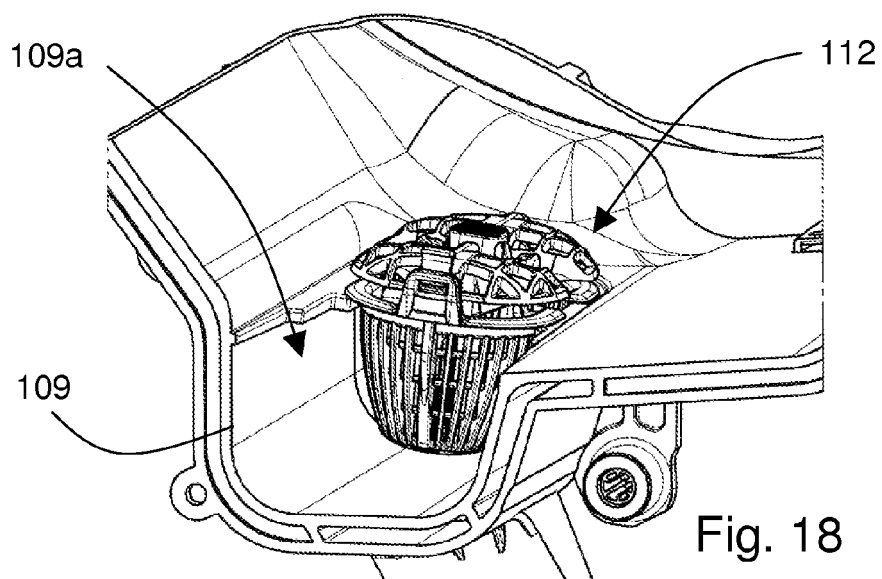


Fig. 18



EUROPEAN SEARCH REPORT

Application Number
EP 09 17 6727

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	DE 10 2006 043516 B3 (MIELE & CIE [DE]) 4 October 2007 (2007-10-04)	1,11	INV. D06F39/10
A	* paragraph [0004] * * paragraph [0007] - paragraph [0008]; figures 1-5 *	2-10, 12-14	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
Place of search		Date of completion of the search	Examiner
Munich		16 April 2010	Hannam, Martin
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			

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

EP 09 17 6727

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
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16-04-2010

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