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(54) **Washing machine and pump filter thereof**

Waschmaschine und Pumpenfilter dafür

Machine à laver et filtre à pompe associé

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EP 2 792 783 B1

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Description

BACKGROUND

1. Field

[0001] Embodiments of the present disclosure relate to a pump of a washing machine which circulates or drains wash water and a filter which is detachably mounted in the pump.

2. Description of the Related Art

[0002] In general, a washing machine is an apparatus which washes laundry by rotating a cylindrical drum in which the laundry and wash water are contained. Washing machines are divided into a drum washing machine which washes laundry by tumbling the laundry through rotation of a drum and a pulsator washing machine which washes laundry by water current generated by rotation of a pulsator.

[0003] A washing machine includes a tub to contain wash water, a drum rotatably installed within the tub and provided with spin-drying holes formed on the circumferential surface thereof for spin-drying, and a drive device to drive the drum.

[0004] The washing machine further includes a water supply device to supply wash water into the tub, and a pump to drain the wash water in the tub.

[0005] Recently, a washing machine having a bubble generator to improve washing performance of the washing machine becomes increasingly popular.

[0006] A pump of the washing machine having such a bubble generator is connected to a drain pipe and a circulation pipe in both directions, and is thus provided with a cylindrical pump filter to filter out foreign substances from wash water.

[0007] DE 100 46 349 A1 discloses a washing machine with a tub and a drum. A pump case comprises some chambers as for example a chamber in which wash water is introduced. There is a circulation pump and a drain pump as well as a kind of circulation pump chamber and drain pump chamber. Wash water introduced into an inflow part is directed to the circulation pump through corresponding chamber and also to drain pump through corresponding chamber. The two chambers are arranged on opposite sides of the corresponding inflow part to discharge water to the outside or to supply wash water again back to the tub.

[0008] KR 2009006393 A discloses a pump case with inflow chamber, circulation pump chamber, and drain pump chamber. The pump case may be used in a washing machine and there is further a pump filter. This pump filter has one filter part with openings which have different diameters and which are assigned to all of the other chambers, see circulation pump chamber or drain pump chamber. Spacers are positioned between the filter unit and the filter chamber so that the inner walls of the filter unit and the filter chamber are arranged at some distance from each other.

SUMMARY

[0009] Therefore, it is an object of the present disclosure to provide a washing machine with a pump filter which reduces accumulation and growth of foreign substances while effectively filtering out the foreign substances from wash water, and which is easily adjusted in position.

[0010] Additional aspects of the disclosure will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the disclosure. This object is solved by the features of the independent claim.

[0011] Advantageous embodiments are disclosed by the sub-claims.

[0012] The pump filter may have a hollow cylindrical shape.

[0013] The pump filter may further include an inflow hole formed at one end thereof to enable wash water to be introduced into the pump filter through the inflow hole.

[0014] A blocking wall may be formed at the center of the first filter part.

[0015] The first filter part includes a plurality of first collection holes formed at both sides of the blocking wall to filter out foreign substances from the wash water detoured via the blocking wall.

[0016] The second filter part includes a plurality of second collection holes to filter out foreign substances from the wash water.

[0017] The second filter part may include an opening to effectively drain the wash water.

[0018] The second filter part may include a conical filter part protruding inwardly to effectively drain the wash water.

[0019] The pump case further includes a direction adjustment rib protruding to be inserted into the direction adjustment groove of the pump filter.

[0020] The pump filter may further include a head provided with a handle, and the head may be rotatably connected to the first filter part and the second filter part.

[0021] The pump filter may be detachably connected to the inflow chamber of the pump case. Bubbles may be generated in wash water in the circulation pump chamber of the pump case and the wash water having the bubbles may be supplied to the tub.

[0022] The plurality of first collection holes have a smaller size than the plurality of second collection holes.

[0023] An opening to effectively drain the wash water may be formed at the second filter part.

[0024] A conical filter part protruding inwardly to effectively drain the wash water may be formed at the second filter part.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] These and/or other aspects of the disclosure will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a cross-sectional view of a washing machine in accordance with one embodiment of the present disclosure;
FIG. 2 is an exploded perspective view of a pump of the washing machine of FIG. 1;
FIG. 3 is a perspective view of the pump of the washing machine of FIG. 1 in an assembled state;
FIG. 4 is a cross-sectional view taken along the line A-A of FIG. 3;
FIG. 5 is a cross-sectional view taken along the line B-B of FIG. 3;
FIG. 6 is a view illustrating a pump filter in accordance with one embodiment of the present disclosure;
FIG. 7 is a view illustrating a pump filter in accordance with another embodiment of the present disclosure;
FIG. 8 is a view illustrating a pump filter in accordance with yet another embodiment of the present disclosure; and
FIG. 9 is a view illustrating a conical filter part of FIG. 8.

DETAILED DESCRIPTION

[0026] Reference will now be made in detail to the embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0027] FIG. 1 is a cross-sectional view of a washing machine in accordance with one embodiment of the present disclosure.

[0028] As shown in FIG. 1, a washing machine 1 in accordance with this embodiment of the present disclosure includes a main body 10 forming the external appearance of the washing machine 1, a tub 11 installed within the main body 10 to contain wash water during washing, and a drum 12 rotatably installed within the tub 11 and provided with a plurality of spin-drying holes 15.

[0029] An inlet 13 through which laundry is put into the drum 12 and a door 14 to open and close the inlet 13 are formed on the front surface of the main body 10.

[0030] A water supply device 20 to supply wash water and a detergent supply device 30 to supply detergent are installed at the upper portion of the inside of the main body 10.

[0031] The water supply device 20 includes a water supply valve 21 to control supply of wash water and a water supply pipe 22 connecting the water supply valve 21 to the detergent supply device 30.

[0032] Wash water having passed through the detergent supply device 30 is guided to the inside of the tub 11 through a connection pipe 23.

[0033] A drive motor 41 to rotate the drum 12 is installed on the outer surface of the rear portion of the tub 11, and a drive shaft 42 to transmit drive force of the drive motor 41 to the drum 12 is installed between the drum 12 and the drive motor 41. Further, a bearing housing 43 to rotatably support the drive shaft 42 is installed on a rear plate of the tub 11, and bearings 44 are installed between the bearing housing 43 and the drive shaft 42.

[0034] A pump 90 to pump the wash water contained in the tub 11 is installed at the lower portion of the inside of the main body 10, and a bubble generator (not shown) to generate bubbles is provided within the pump 90.

[0035] The pump 90 is connected to a plurality of connection pipes. The plural connection pipes include a first drain pipe 50 connected to a drain hole 17 of the tub 11, a second drain pipe 60 pumping wash water to discharge the wash water to the outside of the main body 10, a circulation pipe 80 connected to the upper surface of the tub 11 to generate bubbles within the wash water to supply the wash water having the bubbles to the inside of the tub 11, and an air supply pipe 70 connected to the upper portion of the tub 11 to supply air to the bubble generator (not shown) within the circulation pipe 80.

[0036] FIG. 2 is an exploded perspective view of the pump of the washing machine of FIG. 1, and FIG. 3 is a perspective view of the pump of the washing machine of FIG. 1 in an assembled state.

[0037] As shown in FIGS. 2 and 3, the pump 90 includes a pump case 100, and a filter 150 mounted in the pump case 100.

[0038] The pump case 100 includes a circulation pump chamber 123, an inflow chamber 113 and a drain pump chamber 133. The circulation pump chamber 123 and the drain pump chamber 133 are opposite each other across the inflow chamber 113.

[0039] The inflow chamber 113 is provided with an inflow port 114 so as to communicate with the first drain pipe 50. During operation of the pump 90, the wash water in the tub 11 flows into the inflow chamber 113 via the first drain pipe 50 and the inflow port 114.

[0040] The filter 150 is mounted in the inflow chamber 113 and removes foreign substances from the wash water flowing from the tub 11.

[0041] An entrance hole 102 through which the filter 150 enters and exits the inflow chamber 113 is provided at the front portion of the inflow chamber 113, and a screw thread 103 to which the filter 150 is screw-connected is formed on the inner circumferential surface of the entrance hole 102.

[0042] A direction adjustment rib 104 to adjust the direction of the pump filter 150, which will be described later, protrudes from one side of the inner surface of the inflow chamber 113.

[0043] Impellers 121 and 131 to forcibly intake and discharge the wash water in the inflow chamber 113 are respectively installed within the circulation pump chamber 123 and the drain pump chamber 133, and pump

motors 122 and 132 are respectively connected to the impellers 121 and 131. The respective impellers 121 and 131 are rotated by drive force transmitted from the pump motors 122 and 132, intake the wash water in the inflow chamber 113 in the axial direction, and discharge the wash water in the radial direction.

[0044] A circulation port 124 is formed at the circulation pump chamber 123 so as to communicate with the circulation pipe 80.

[0045] The bubble generator (not shown) generating bubbles is provided within the circulation pipe 80, and an air supply pipe 70 to supply air within the tub 11 to the circulation pipe 80 communicates with the circulation pipe 80.

[0046] The bubble generator (not shown) is of a venturi pipe type formed within a part of the circulation pipe 80. The bubble generator (not shown) mixes air, introduced through the air supply pipe 70 using a pressure difference due to pressure lowering caused by a flow of wash water, with wash water, thereby generating bubbles.

[0047] Further, a drain port 134 is formed at the drain pump chamber 133 so as to communicate with the second drain pipe 60 to discharge wash water to the outside of the main body 10.

[0048] The pump filter 150 to filter out foreign substances from wash water is detachably mounted in the pump case 100.

[0049] The pump filter 150 is formed in an approximately hollow cylindrical shape, and includes a head 160 and a body 170, one end of which is connected to the head 160. An inflow hole 172 through which wash water is introduced into the pump filter 150 is formed at the other end of the body 170 (with reference to FIG. 6).

[0050] When the pump filter 150 is mounted in the pump case 100, the body 170 of the pump filter 150 is accommodated within the inflow chamber 113 of the pump case 100.

[0051] A screw thread 162 enabling the pump filter 150 to be screw-connected to the pump case 100 is formed on the outer circumferential surface of the head 160. Further, a handle 161 gripped by a user to rotate the head 160 is provided on the front surface of the head 160.

[0052] The circumferential surface of the body 170 formed to filter out foreign substances from wash water is divided into a first filter part 180 and a second filter part 190. This will be described later.

[0053] Further, the head 160 and the body 170 are mutually rotatably connected.

[0054] FIG. 4 is a cross-sectional view taken along the line A-A of FIG. 3, FIG. 5 is a cross-sectional view taken along the line B-B of FIG. 3, and FIG. 6 is a view illustrating a pump filter in accordance with one embodiment of the present disclosure.

[0055] As shown in FIG. 5, wash water, shown by the arrow A, introduced through the inflow hole 172 passes through the first filter part 180 and flows into the circulation pump chamber 123, shown by the arrow C, or passes through the second filter part 190 and flows into the drain pump chamber 133, shown by the arrow B.

[0056] Further, as shown in FIG, 6 the pump filter 150 includes the first filter part 180 formed at one of two sections divided from the circumferential surface of the pump filter 150, and the second filter part 190 formed at the other of the two sections.

[0057] Plural first collection holes 182 and 183 to filter out foreign substances from wash water are formed at both ends of the first filter part 180. A blocking wall 181 to change a flow of wash water introduced through the inflow hole 172 is formed at the center of the first filter part 180.

[0058] Plural second collection holes 191, 192 and 193 are formed on the entirety of the second filter part 190, and have a size slightly larger than the first collection holes 182 and 183. Therefore, the second collection holes 191, 192 and 193 may pass relatively larger foreign substances, as compared to the first collection holes 182 and 183.

[0059] Wash water flowing into the circulation pump chamber 123 through the first filter part 180 is blocked by the blocking wall 181 formed at the center of the first filter part 180, and thus does not flow rectilinearly and detours to pass through the first collection holes 182 and 183 (shown by the arrow C).

[0060] Wash water flowing into the circulation pump chamber 123 through the first filter part 180 detours in such a manner and moves, and thus both accumulation and growth of foreign substances at the first collection holes 182 and 183 are reduced.

[0061] In accordance with the embodiment of the present disclosure, the first filter part 180 filtering wash water flowing toward the circulation pump chamber 123 is provided with the blocking wall 181 to detour the wash water, and the second filter part 190 filtering wash water flowing toward the drain pump chamber 133 is provided with the second collection holes 191, 192 and 193 having a relatively large size, and thereby, the pump filter 150 reduces accumulation and growth of foreign substances while effectively filtering out foreign substances from the wash water.

[0062] As shown in FIG. 6, a direction adjustment groove 173 to determine the position of the blocking wall 81 within the inflow chamber 113 is formed on the pump filter 150.

[0063] The direction adjustment rib 104 protrudes from one side of the inner surface of the inflow chamber 113, as described above, so as to be inserted into the direction adjustment groove 173.

[0064] The direction adjustment groove 173 and the direction adjustment rib 104 are respectively provided at proper positions such that the first filter part 180 of the pump filter 150 faces the circulation pump chamber 123 of the pump case 100.

[0065] When the pump filter 150 enters the inflow chamber 113 of the pump case 100 and the head 160 of the filter 150 is rotated, the direction adjustment rib 104 of the pump case 100 is inserted into the direction ad-

justment groove 173 of the pump filter 150 at one position. Then, from this time, the body 170 of the pump filter 150 is fixed under the condition that the first filter part 180 faces the circulation pump chamber 123 of the pump case 100 and the second filter part 190 faces the drain pump chamber 133 of the pump case 100, and only the head 160 of the pump filter 150 is continuously rotated.

[0066] Through such a configuration, wash water flowing toward the circulation pump chamber 123 passes through the first filter part 180 of the pump filter 150, and wash water flowing toward the drain pump chamber 133 passes through the second filter part 190 of the pump filter 150.

[0067] FIG. 7 is a view illustrating a pump filter in accordance with another embodiment of the present disclosure, FIG. 8 is a view illustrating a pump filter in accordance with yet another embodiment of the present disclosure, and FIG. 9 is a view illustrating a conical filter part of FIG. 8.

[0068] In the same manner as the earlier embodiment, wash water flowing toward a drain pump chamber 133 passes through a second filter part 190.

[0069] As shown in FIG. 7, an opening 251 to effectively drain wash water is formed on the second filter part 190 of a pump filter 250. Through such a configuration, the pump filter 250 filters out foreign substances having a relatively large volume, such as pins and coins, from wash water flowing toward the drain pump chamber 133 and discharged to the outside of the main body 10 and passes foreign substances having a relatively small volume, thereby facilitating drain and suppressing accumulation and growth of the foreign substances, simultaneously.

[0070] Further, as shown in FIG. 8, a conical filter part 351 protruding inwardly to effectively drain wash water is formed on a second filter part 190 of a pump filter 350.

[0071] Such a conical filter part 351 has an approximately conical shape and includes a first frame part 353 contacting the circumferential surface of the pump filter 350 and a second frame part 352 formed opposite the first frame part 353, as shown in FIG. 9. The first frame part 353 and the second frame part 352 are connected by a plurality of ribs 354, and a plurality of third collection holes 355 are formed between the plurality of ribs 354.

[0072] Through such a configuration, the pump filter 350 filters out foreign substances having a relatively large volume from wash water flowing toward the drain pump chamber 133 while passing foreign substances having a relatively small volume, thereby increasing filtering effects. Although a few embodiments of the present disclosure have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles of the invention, the scope of which is defined in the claims.

Claims

1. A washing machine (1) comprising:

   a tub (11) containing wash water;
   a pump case (100) including an inflow chamber (113) into which the wash water in the tub (11) flows, a circulation pump chamber (123) provided at one side of the inflow chamber (113) to supply wash water to the tub (11), and a drain pump chamber (133) provided at the other side of the inflow chamber (113) to discharge the wash water to the outside of a main body (10); and
   a pump filter (150) installed in the inflow chamber (113) to filter out foreign substances from the wash water, wherein:

   the pump filter (150) includes a first filter part (180) passing wash water flowing into the circulation pump chamber (123) through a plurality of first holes (182, 183) and a second filter part (190) passing wash water flowing into the drain pump chamber (133) through a plurality of second holes (192, 193) bigger than the first collection holes (182, 183);
   characterized in that the first filter part (180) includes a blocking wall (181) preventing the wash water from rectilinearly flowing into the circulation pump chamber (123) and guiding detouring of the wash water, wherein pump filter (150) further includes a direction adjustment groove (173) formed to adjust positions of the first filter part (180) and the second filter part (190) within the inflow chamber (113) wherein the pump case further includes a direction adjustment rib (104) protruding to be inserted into the direction adjustment groove (173) of the pump filter (150).

2. The washing machine according to claim 1, wherein the pump filter (150) has a hollow cylindrical shape.

3. The washing machine according to one of the previous claims, wherein the pump filter (150) further includes an inflow hole (172) formed at one end thereof to enable wash water to be introduced into the pump filter (150) through the inflow hole (172).

4. The washing machine according to one of the previous claims, wherein the direction adjustment groove (173) is formed at the first filter part (180).

5. The washing machine according to one of the previous claims, wherein the direction adjustment groove (173) is formed at the second filter part (190).

6. The washing machine according to one of the previous claims, wherein the second filter part (190) includes an opening (251) to effectively drain the wash water.

7. The washing machine according to one of the previous claims, wherein:

the pump filter (150) further includes a head (160) provided with a handle (161); and
the head (160) is rotatably connected to the first filter part (180) and the second filter part (190).

8. The washing machine according to one of the previous claims, wherein the pump filter (150) is detachably connected to the inflow chamber (113) of the pump case (100).

Patentansprüche

1. Waschmaschine (1), umfassend:

einen Bottich (11), der Waschwasser enthält;
ein Pumpengehäuse (100), das eine Einströmkammer (113), in die das Waschwasser aus dem Bottich (11) fließt, eine Umwälzpumpenkammer (123), die auf einer Seite der Einströmkammer (113) angeordnet ist, um dem Bottich (11) Waschwasser zuzuführen, und eine Abflusspumpenkammer (133) umfasst, die auf der anderen Seite der Einströmkammer (113) vorgesehen ist, um Waschwasser aus einem Hauptkörper (10) nach außen abzugeben; und
einen Pumpenfilter (150), der in der Einströmkammer (113) installiert ist, um Fremdsubstanzen aus dem Waschwasser auszufiltern, wobei der Pumpenfilter (150) einen ersten Filterteil (180), den Waschwasser durchläuft, das in die Umwälzpumpenkammer (123) durch eine Vielzahl erster Öffnungen (182, 183) fließt, und einen zweiten Filterteil (190) umfasst, den Waschwasser durchläuft, das in die Abflusspumpenkammer (133) durch eine Vielzahl zweiter Öffnungen (192, 193) größer als die ersten Öffnungen (182, 183) fließt,
dadurch gekennzeichnet, dass
das erste Filterteil (180) einer Blockierwand (180) aufweist, die das Waschwasser an einem geradlinigen Fließen in die Umwälzpumpenkammer (123) hindert und zu einer Umleitung des Waschwassers führt, wobei der Pumpenfilter (150) weiterhin eine Richtungsjustiernut (173) aufweist, die zum Justieren der Position des ersten Filterteils (180) und des zweiten Filterteils (190) innerhalb der Einströmkammer (113) gebildet ist, wobei das Pumpengehäuse weiterhin eine Richtungsjustierrippe (104) aufweist, die zum Einsetzen in die Richtungsjustiernut (173) des Pumpenfilters (150) vorsteht.

2. Waschmaschine nach Anspruch 1, wobei der Pumpenfilter (150) eine hohle zylindrische Form aufweist.

3. Waschmaschine nach einem der vorangehenden Ansprüche, wobei der Pumpenfilter (150) weiterhin ein Einströmloch (172) aufweist, das an seinem einen Ende ausgebildet ist, um es dem Waschwasser zu ermöglichen, in den Pumpenfilter (150) durch das Einströmloch (172) eingeleitet zu werden.

4. Waschmaschine nach einem der vorangehenden Ansprüche, wobei die Richtungsjustiernut (173) an dem ersten Filterteil (180) gebildet ist.

5. Waschmaschine nach einem der vorangehenden Ansprüche, wobei die Richtungsjustiernut (173) an dem zweiten Filterteil (190) gebildet ist.

6. Waschmaschine nach einem der vorangehenden Ansprüche, wobei der zweite Filterteil (190) eine Öffnung (251) zum effektiven Abgeben von Waschwasser aufweist.

7. Waschmaschine nach einem der vorangehenden Ansprüche, wobei der Pumpenfilter (150) weiterhin einen Kopf (160) mit einer Handhabe (161) aufweist und der Kopf (160) mit dem ersten Filterteil (180) und dem zweiten Filterteil (190) drehbar verbunden ist.

8. Waschmaschine nach einem der vorangehenden Ansprüche, wobei der Pumpenfilter (150) lösbar mit der Einströmkammer (113) des Pumpengehäuses (110) verbunden ist.

Revendications

1. Machine à laver (1) comprenant :

une cuve (11) contenant de l'eau de lavage ;
un carter de pompe (100) comprenant une chambre d'entrée (113) dans laquelle s'écoule l'eau de lavage de la cuve (11), une chambre de pompe de circulation (123) prévue d'un côté de la chambre d'entrée (113) pour alimenter la cuve (11) en eau de lavage, et une chambre de pompe de vidange (133) prévue de l'autre côté de la chambre d'entrée (113) pour décharger l'eau de lavage vers l'extérieur d'un corps principal (10) ; et
un filtre de pompe (150) installé dans la chambre d'entrée (113) pour filtrer des substances étrangères provenant de l'eau de lavage, dans

laquelle :

le filtre de pompe (150) inclut une première partie de filtre (180) filtrant de l'eau de lavage s'écoulant dans la chambre de pompe de circulation (123) à travers une pluralité de premiers trous (182, 183) et une deuxième partie de filtre (190) filtrant de l'eau de lavage s'écoulant dans la chambre de pompe de vidange (133) à travers une pluralité de seconds trous (192, 193) plus larges que les premiers trous de collecte (182, 183) ;
caractérisée en ce que
la première partie de filtre (180) inclut une paroi de blocage (181) empêchant l'eau de lavage de s'écouler de manière rectiligne dans la chambre de pompe de circulation (123) et guidant la déviation de l'eau de lavage, dans laquelle
le filtre de pompe (150) inclut en outre une rainure de réglage de direction (173) formée pour ajuster des positions de la première partie de filtre (180) et de la deuxième partie de filtre (190) à l'intérieur de la chambre d'entrée (113), dans laquelle le carter de pompe inclut en outre une nervure de réglage de direction (104) faisant saillie pour être insérée dans la rainure de réglage de direction (173) du filtre de pompe (150).

2. Machine à laver selon la revendication 1, dans laquelle le filtre de pompe (150) a une forme cylindrique creuse.

3. Machine à laver selon l'une des revendications précédentes, dans laquelle le filtre de pompe (150) inclut en outre un trou d'entrée (172) formé à une extrémité de celui-ci pour permettre à l'eau de lavage d'être introduite dans le filtre de pompe (150) à travers le trou d'entrée (172).

4. Machine à laver selon l'une des revendications précédentes, dans laquelle la rainure de réglage de direction (173) est formée au niveau de la première partie de filtre (180).

5. Machine à laver selon l'une des revendications précédentes, dans laquelle la rainure de réglage de direction (173) est formée au niveau de la deuxième partie de filtre (190).

6. Machine à laver selon l'une des revendications précédentes, dans laquelle la deuxième partie de filtre (190) inclut une ouverture (251) pour vidanger efficacement l'eau de lavage.

7. Machine à laver selon l'une des revendications précédentes, dans laquelle :

le filtre de pompe (150) inclut en outre une tête (160) pourvue d'une poignée (161) ;
et
la tête (160) est reliée de manière rotative à la première partie de filtre (180) et à la deuxième partie de filtre (190).

8. Machine à laver selon l'une des revendications précédentes, dans laquelle le filtre de pompe (150) est relié de manière détachable à la chambre d'entrée (113) du carter de pompe (100).

FIG. 1

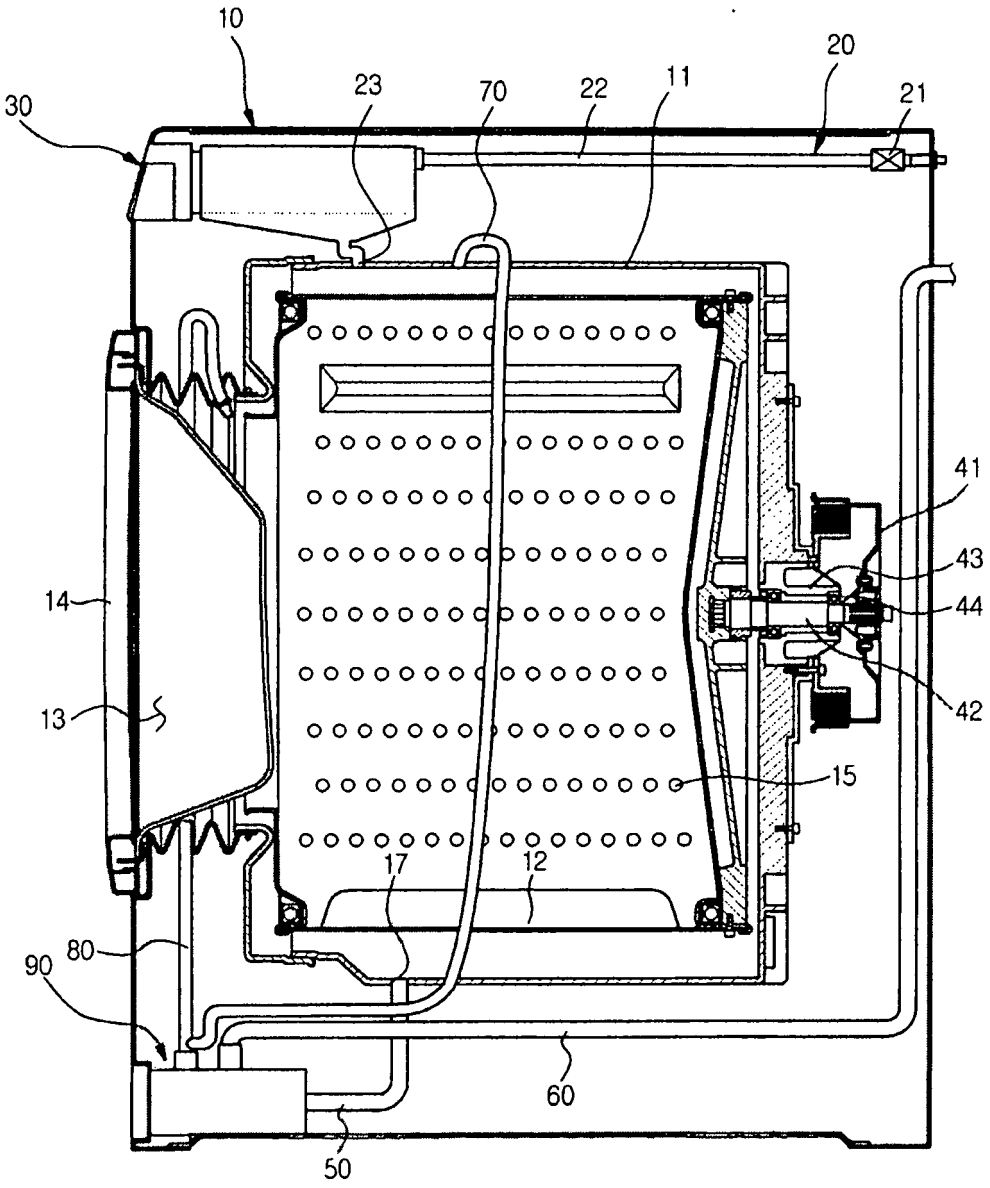
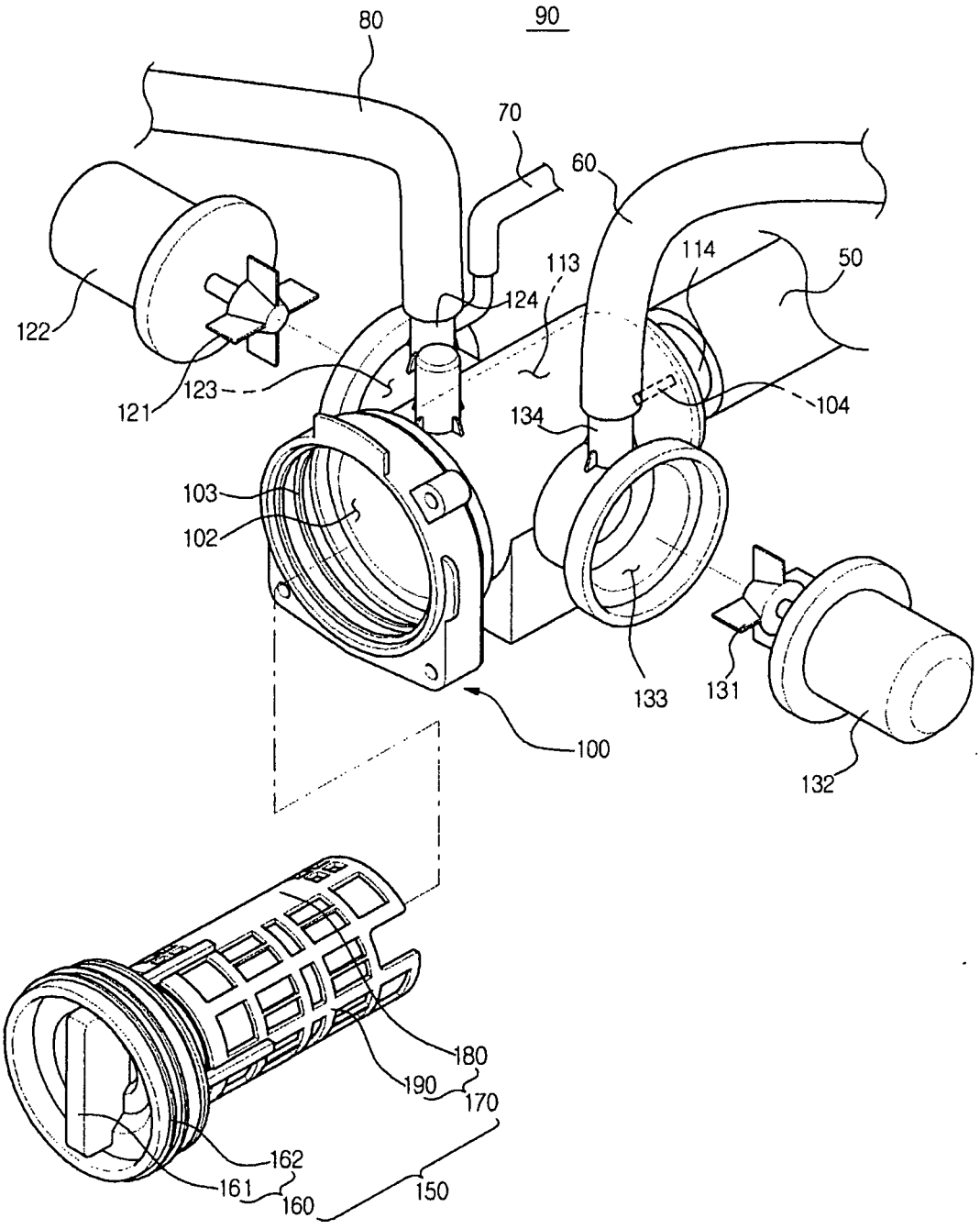


FIG. 2


80
90
70
60
50
114
113
124
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104
134
103
102
133
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100
132
180
190
170
162
161
160
150

FIG. 3

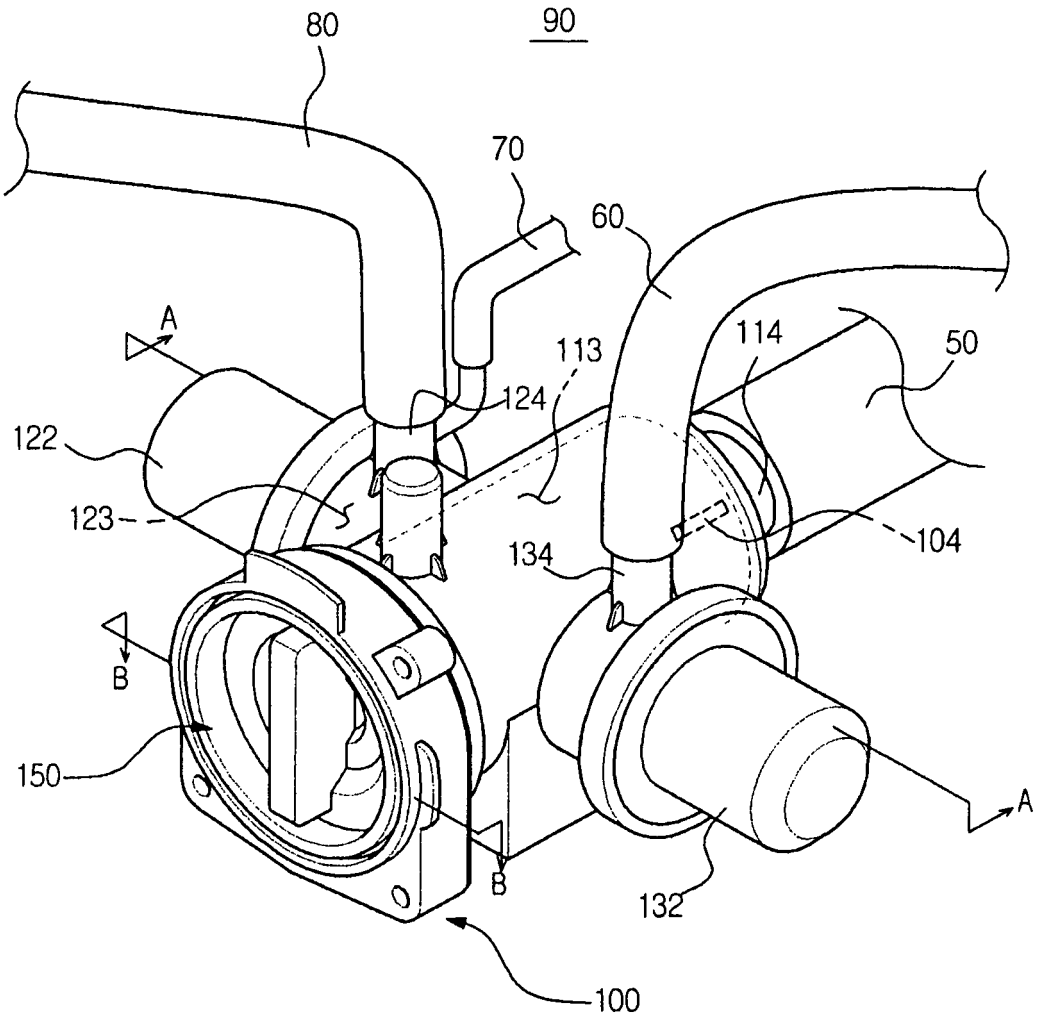

FIG. 4

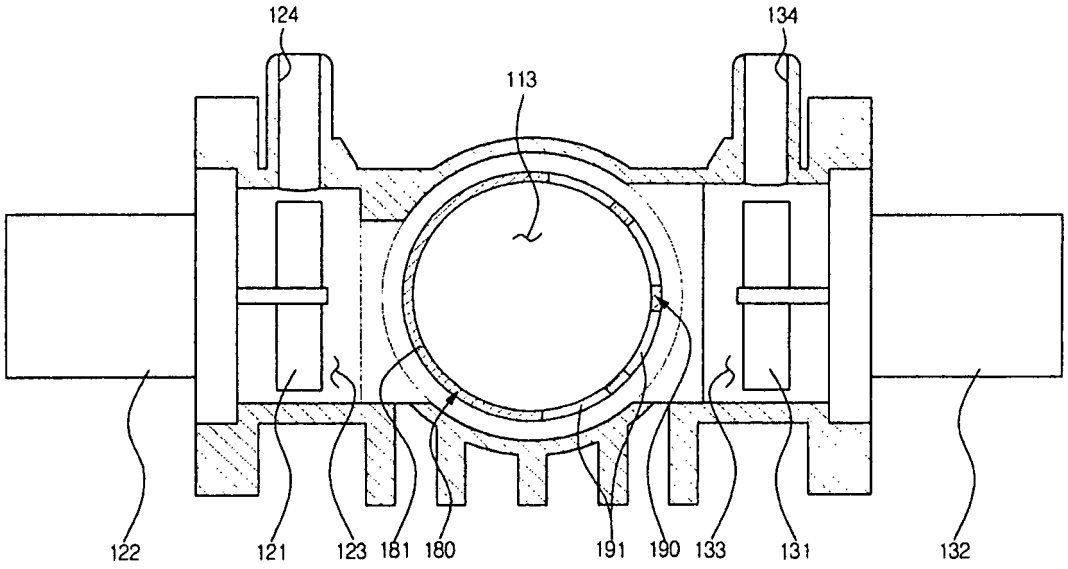

FIG. 5

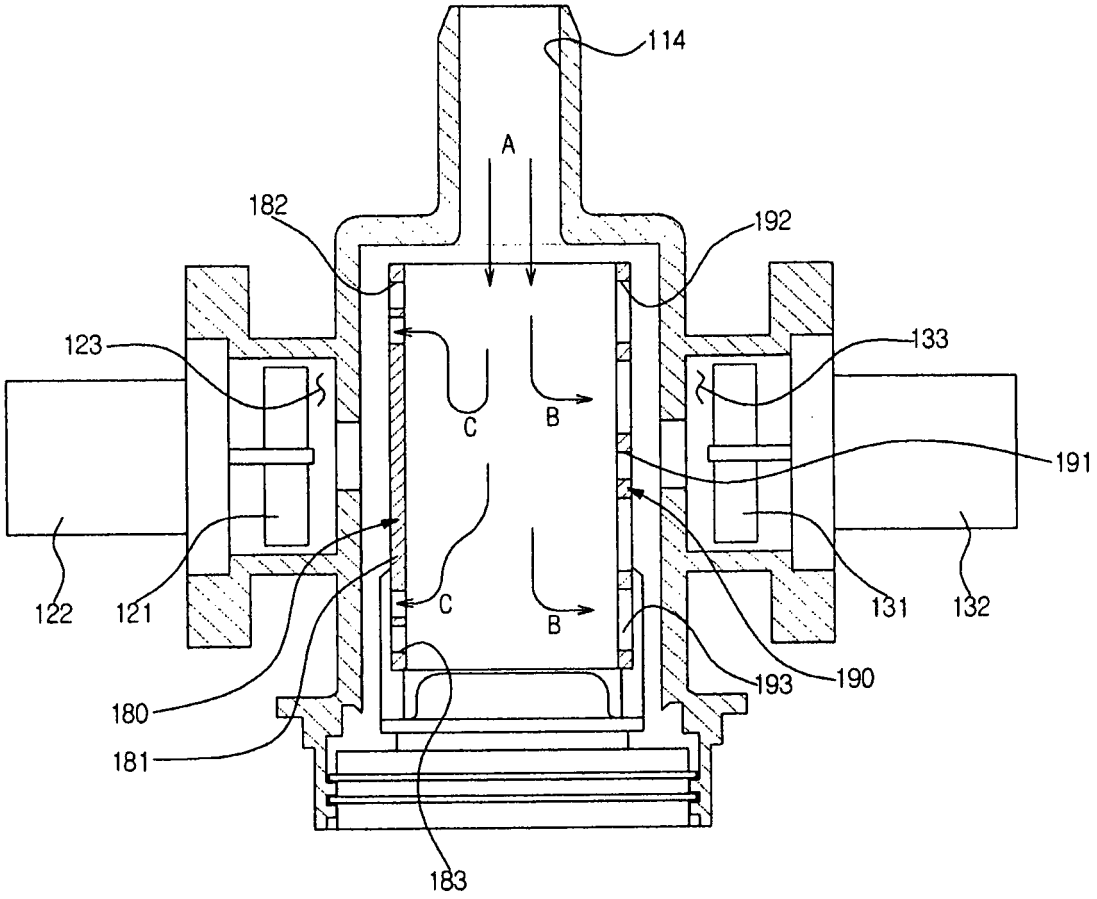
114
A
182
192
123
133
C
B
191
122
121
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FIG. 6

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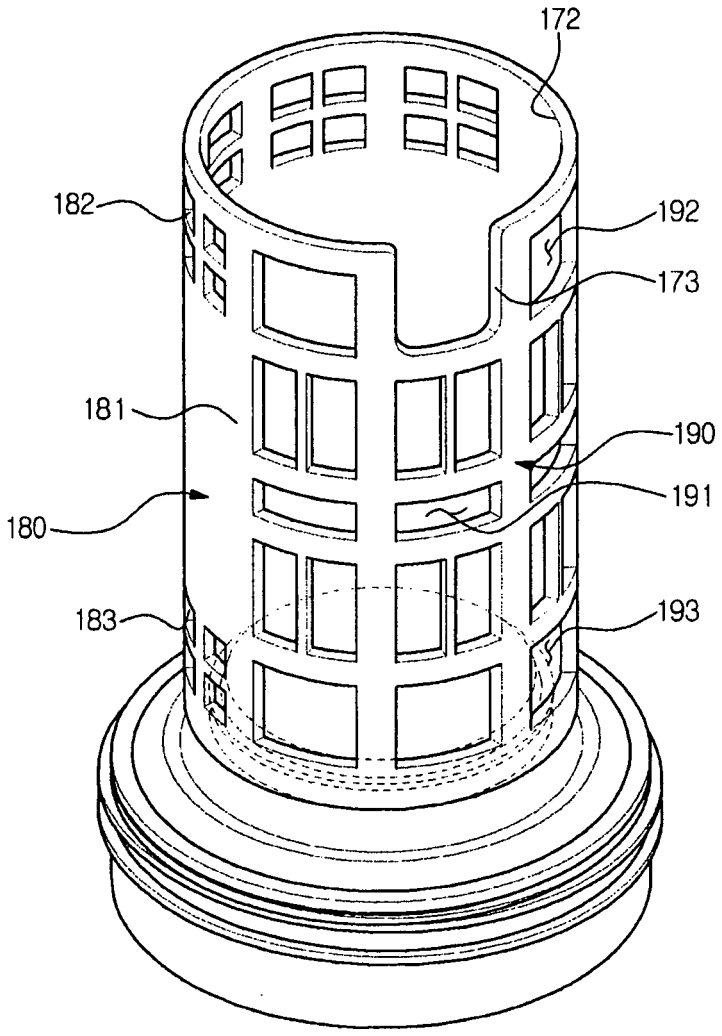


FIG. 7

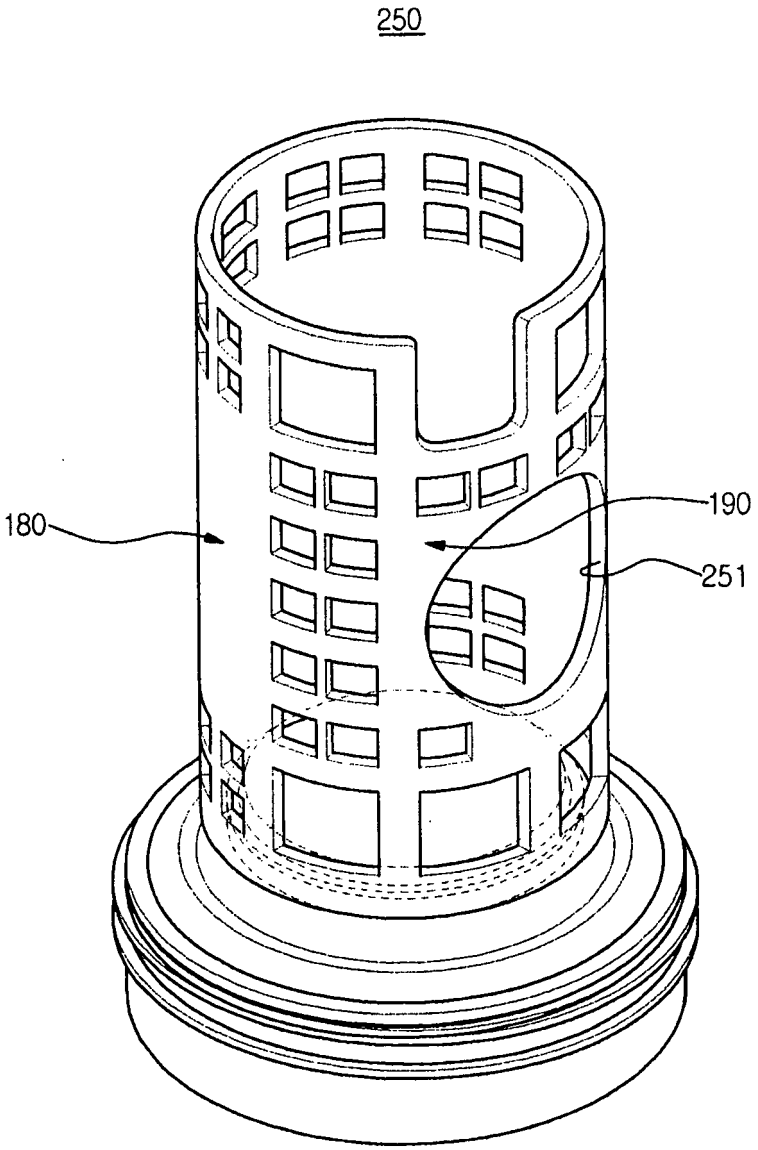


FIG. 8

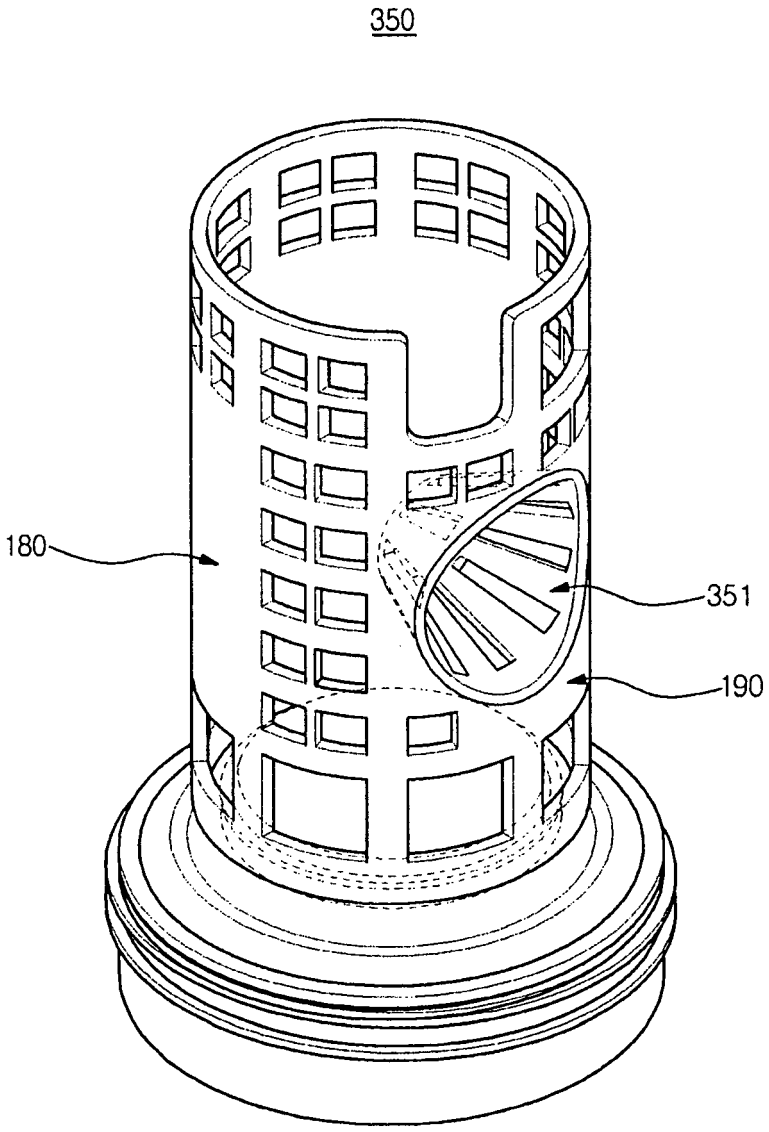
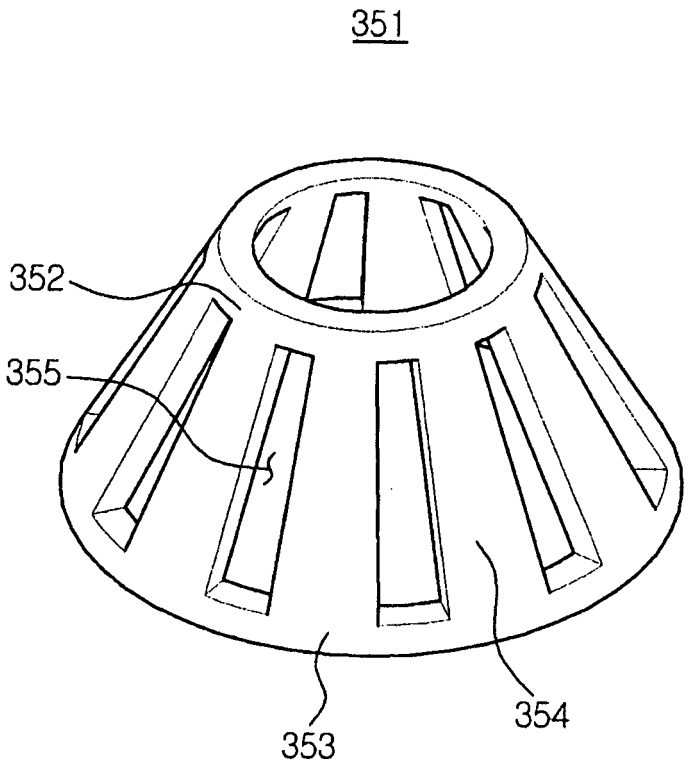


FIG. 9



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