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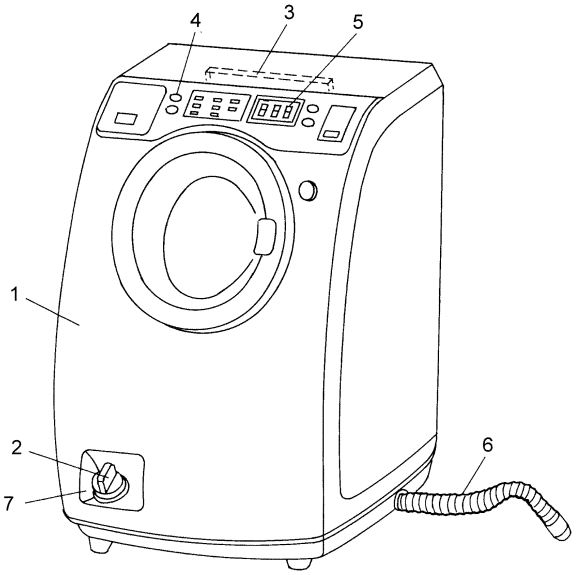
(54) Filter device of washing machine

(57) A filter device of a washing machine of the present invention includes a filter body (11) for catching foreign matters, a cap (2) having a knob (9) capable of operating the filter body (11) in the rotation direction and axis direction and a magnetic body (24), a reed switch (26), an O-ring (18) for water sealing, and a control device. The reed switch (26) is turned on when the position of the cap (2) in the rotation direction and axis direction corresponds to a predetermined position. When an ON signal is not input from the reed switch (26), the control device stops proceeding of processes and notifies that the filter device is not mounted completely on a display, thereby notifying a user of abnormality that can be corrected by a user's simple procedure and a procedure to be taken.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a filter device for catching foreign matters such as lint included in drain water from a washing machine, and the like.

2. Background Art

[0002] When a washing machine is used, foreign matters such as lint and impurities from clothes are often generated in wash water. At this time, if the wash water is discharged from a washing machine main body without removing such foreign matters, clogging may occur in a drain pump, a drain valve, and a drain route of the washing machine main body, and further in a drain pipe toward a sewage and the like of a house in which the washing machine is placed. Therefore, conventionally, a filter device for catching lint and the like mentioned above and a washing machine equipped with the filter device have been proposed (see, for example, Japanese Patent Unexamined Publication No. 2002-282616).

[0003] Fig. 7 is an appearance view showing a washing machine having a filter device in accordance with a conventional technology. Fig. 8 is a perspective view showing a surrounding of the filter device, showing a state in which a lid is opened. Fig. 9 is a sectional view showing the filter device; and Fig. 10 is a front view showing a lid portion of the filter device.

[0004] In Fig. 7, lid 101 is provided in the lower right part of the front surface of main body 1 of the washing machine, and a filter device described below is disposed in the inner side of lid 101. Fig. 8 shows a state in which lid 101 is opened. Lid 101 is generally formed as a plastic molded member, and pivotally supported rotatably on the lower end in a way in which the upper end side is closed in the direction of arrow J around the lower end as a center. A single line of rib 102 extending slantingly and hook 103 whose tip is processed in a hook shape are protruded on the rear surface of lid 101. Furthermore, cap 35 to be operated when the filter device is taken out or mounted on main body 1 is disposed in the inner side of lid 101. Furthermore, holding part 35b for rotating cap 35 is protruded together with cap 35.

[0005] In the sectional view shown in Fig. 9, diameter expanding part 47 whose diameter is increased with stepped part 34d is provided at the front part (left side in Fig. 9) of cylindrical filter case 34. Diameter expanding part 47 has screw 37. Cap 35 is secured to filter case 34 by screw 37 via water sealing packing 42 formed of an elastic body such as rubber.

[0006] In the rear side (right side in Fig. 9) of cap 35, convex engage part 35a is formed, and concave engage part 36a attached by latching to convex engage part 35a is integrated with filter body 36. Then, by engaging convex engage part 35a and concave engage part 36a with each other, cap 35 and filter body 36 are linked to each other. Therefore, by rotating cap 35 and detaching it from screw 37, filter body 36 can be taken out from filter case 34, that is, main body 1 of the washing machine.

[0007] Net-like net part 51 is formed in a cylindrical shape on filter body 36 so that it allows water to pass and catches foreign matters. Filter body 36 is disposed between inlet hole 38 and outlet hole 39 of filter case 34 inside filter case 34.

[0008] Therefore, drain wash water containing foreign matters passes from inlet hole 38 thorough net part 51 and flown out to the outside from outlet hole 39 via a drain route in a state in which the foreign matters are removed.

[0009] According to the filter device having such a configuration, cap 35 is rotated, filter body 36 is taken out from filter case 34, and then lint and the like retained in filter body 36 is removed. Thereafter, cap 35 is normally secured to the original position of filter case 34, and thereby water must be prevented from leaking from this part.

[0010] Therefore, in this conventional example, water is prevented from leaking by the following configuration.

[0011] Cap 35 has caved part 351 that is caved in a shape of a cup at the side of lid 101 thereof. Holding part 35b, which is also shown in the perspective view of Fig. 8, is protruded in a way in which it passes the center of the substantially circular-shaped caved surface and extends in the diameter direction. Furthermore, latch hole 104 into which hook 103 is inserted and latched is provided in the portion corresponding to hook 103 of lid 101 of main body 1.

[0012] The front view of lid 101 of Fig. 10 shows a state in which lid 101 is normally closed. Herein, central angle θ is an angle which holding part 35b is rotated from reference line 105. That is to say, when holding part 35b is located in the position in which central angle θ is approximately 90°, lid 101 is closed in the direction of arrow J of Fig. 8. Then, as shown by a broken line of Figs. 9 and 10, rib 102 on lid 101 and holding part 35b on cap 35 are not brought into contact with each other, so that lid 101 can be completely closed. At this time, since hook-shaped part at the tip of hook 103 is latched to latch hole 104, lid 101 cannot be easily opened even if an external force is applied from the outside of the washing machine.

[0013] On the contrary to the above-mentioned normal mounted state, when central angle θ of holding part 35b is displaced from 90° and is other than 90°, even if lid 101 is closed, rib 102 is brought into contact with holding part 35b and lid 101 cannot be closed. Therefore, lid 101 cannot be closed normally, which makes it possible to easily detect that cap 35 is not mounted completely. Thus, a user operates holding part 35b again so as to rotate cap 35 and secure it to an appropriate position. Then, a state in which water does not leak can be easily recovered. That is to say, in this configuration, a user accurately judges whether or not lid 101 is normally mounted on main body 1 and prevents water from leaking.

[0014] Note here that as conventional technology information related to the invention of the present application, for example, Japanese Patent Unexamined Publication No.2002-282616 is known.

[0015] However, in the configuration of the conventional technology, whether or not cap 35 is correctly mounted and thereby water leakage can be prevented is judged based on the premise that a user confirms the closing state of lid 101, that is, the state in which lid 101 is correctly mounted on main body 1.

[0016] However, if a user is concentrated on cleaning, for example, removing foreign matters from filter body 36, and forgets closing lid 101, prevention of water leakage may not be able to be confirmed.

[0017] Alternatively, from the demand from design or the demand for reducing the number of components in order to reduce the cost, when a configuration of a washing machine that does not include lid 101 is desired, the above-mentioned conventional configuration cannot be realized because it needs a structure of a filter device including lid 101 as requirement.

[0018] Furthermore, lid 101 is generally formed of, for example, a plastic molded material, and the position in which lid 101 is disposed is generally in the lower part of a washing machine. Therefore, when a foot of a user or a family member who walks in the vicinity of the washing machine hits the position, or when a user pushes lid 101 forcedly without recognizing the fastening failure of cap 35, lid 101 may be broken or lid 101 may be detached from a washing machine main body. In such a state, it is not possible to confirm whether or not water leakage is prevented.

[0019] In addition to these problems, since such an operation of a washing machine is carried out not by an expert but by a homemaker, water leakage should be prevented in a simple and easy manner.

SUMMARY OF THE INVENTION

[0020] A filter device of the present invention is made in order to solve conventional problems mentioned above and ensures prevention of water leakage when a washing machine is used by detecting a mounting state of a cap of a filter without an influence of the presence of a lid and notifying a user of an abnormality when a cap is not mounted completely.

[0021] Therefore, a filter device of a washing machine of the present invention includes a cap opened and closed when foreign matters are removed from the filter device, a filter case to which the cap is mounted, and an electric signal transmitter-receiver operating in the normal position provided to the filter case. When the cap is not normally mounted, abnormality of a user's operation is displayed and a user is notified to fasten the cap again.

[0022] According to this configuration, the filter device of the washing machine of the present invention can prevent water from leaking.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

Fig. 1 is an appearance view showing a washing machine having a filter device in accordance with a first embodiment of the present invention.

Fig. 2 is a sectional view showing a state when the filter device of the washing machine is mounted.

Fig. 3 is a sectional view showing a state when the filter device of the washing machine is not mounted completely.

Figs. 4A to 4D are plan views showing an operation of the filter device of the washing machine when a cap is mounted.

Fig. 5 is a partial sectional view showing an operation of the filter device of the washing machine in a state in which a cap is mounted.

Fig. 6 is a control flow chart of the washing machine.

Fig. 7 is an appearance view showing a washing machine having a filter device in accordance with a conventional technology.

Fig. 8 is a perspective view showing a surrounding of the filter device of the washing machine in accordance with a conventional technology.

Fig. 9 is a sectional view showing the filter device of the washing machine in accordance with a conventional technology.

Fig. 10 is a front view showing a lid portion of the filter device of the washing machine in accordance with a conventional technology.

DETAILED DESCRIPTION OF THE INVENTION

[0024] Hereinafter, an embodiment of the present invention is described with reference to drawings. The same reference numerals are given to the same configuration as in the conventional example and the description thereof is omitted. Note here that the present invention is not limited by this embodiment.

(FIRST EMBODIMENT)

[0025] Fig. 1 is an appearance view showing a washing machine having a filter device in accordance with a first embodiment of the present invention. Fig. 2 is a sectional view showing a state in which the filter device is mounted. Fig. 3 is a sectional view showing a state in which the filter device is not mounted completely. Figs. 4A to 4D are plan views showing an operation of the filter device in a state in which a cap is mounted. Fig. 5 is a partial sectional view showing an operation of the filter device in a state in which a cap is mounted. Fig. 6 is a part of a control flow chart of the washing machine.

[0026] As shown in the appearance view of the washing machine of Fig. 1, concave portion 7 is formed in the lower part on the front surface of main body 1 of the washing machine, and cap 2 whose planer shape is substan-

tially circular for the operation of a filter device for removing foreign matters such as lint in drain water is provided in concave portion 7. Cap 2 has a configuration capable of moving in the rotation direction for attaching / detaching the below-mentioned filter device and in the axis direction for removing filter device.

[0027] Inside of the upper part of main body 1, control device 3 incorporating a microcomputer and the like for controlling a series of processes including washing, rinsing, dehydration, and the like, is provided. Furthermore, on the upper part on the front surface of main body 1, switch part 4 for inputting an operation course and the like into control device 3, and display 5 for notifying a user of an operation state, remaining time, and the like, are disposed. On the lower part of the right side surface of main body 1, drain hose 6 for discharging wash water is connected.

[0028] As shown in the sectional view of Fig. 2, cap 2 is accommodated in concave portion 7 formed in main body 1 in a way in which cap 2 does not protrude to the outside from outer line 8. Minus-sign shaped knob 9 is integrated with cap 2 in the front surface side (left side in Fig. 2) of main body 1 so that a user picks it by the fingers and rotates it. Furthermore, filter body 11 having net-like net portion 10 allowing water to pass and catching foreign matters is connected to the rear side, that is, the inner side of main body 1 in a way in which concave engage part 16 formed on filter body 11 is rotatably attached by latching to convex engage part 15 formed on cap 2 them each other. Thus, by picking knob 9 by the fingers and the like, and pulling it out in the axis direction of cap 2, filter body 11 can be taken out to the outside of the machine.

[0029] Cap 2 and filter body 11 are accommodated in the inside of filter case 14 having inlet hole 12 and outlet hole 13. O-ring 18 formed of an elastic body such as rubber is mounted on the outer periphery of outer peripheral cylindrical part 17 of the connection part at the side of cap 2 of filter body 11, and it is brought into close contact with inclined wall 19 of filter case 14. Thus, water sealing is carried out.

[0030] When drain wash water containing foreign matters such as lint passes from inlet hole 12 through net part 10, foreign matters are removed. Then, the wash water is discharged to the outside of the machine from outlet hole 13 via drain hose 6 shown in Fig. 1.

[0031] Cylindrical part 20 having a large diameter is integrated with the side of concave portion 7 of main body 1 accommodating filter case 14, and cap 2 is rotatably accommodated in cylindrical part 20. In addition to this, on the inner peripheral part of cylindrical part 20, a plurality of projected part 21 are formed. Projected part 21 push protrusions 22 provided on outer peripheral part 23 of cap 2 toward the side of filter body 11. Thus, O-ring 18 is pressed to inclined wall 19 via outer peripheral cylindrical part 17, thereby water-sealing the wash water inside filter case 14 from the outside.

[0032] Magnetic body 24 is accommodated in a part of outer peripheral part 23 of cap 2, and attaching plate 25 is integrated with the upper part of the outer periphery of cylindrical part 20 of filter case 14. Then, reed switch 26 is attached to attaching plate 25 on the upper part of the outer periphery of cylindrical part 20. Herein, reed switch 26 is disposed so that magnetic corresponding operation part 27 disposed inside of reed switch 26 can be closely positioned with respect to the position of magnetic body 24.

[0033] In the sectional view of Fig. 3 showing a state in which the filter device is not mounted completely, as shown in Fig. 3, protrusion 22 of cap 2 does not enter the inner side of projected part 21 of cylindrical part 20 of filter case 14. In such a state, cap 2, filter body 11 and O-ring 18 disposed therebetween, and the like, are positioned at the outer side of main body 1 in Fig. 3 (i.e., left side in Fig. 3) as compared with the position in which the filter device is mounted as shown in Fig. 2. Therefore, the water-sealing effect by O-ring 18 and the like is not achieved, and water may leak. In this case, since magnetic body 24 and magnetic corresponding operation part 27 in reed switch 26 are displaced from each other by dimension H in the axis direction, magnetic corresponding operation part 27 is not affected by magnetic body 24 and cannot operate. Therefore, since reed switch 26 does not operate, an ON signal from reed switch 26 is not transmitted to control device 3.

[0034] In plan views showing an operation of the filter device in a state in which cap is mounted in Figs. 4A to 4D, Fig. 4A shows a preparation position, that is, a state before cap 2 is mounted. In Fig. 4A, reed switch 26 and magnetic corresponding operation part 27 are positioned right above cap 2 in the circumferential direction (in the direction of the 12 o'clock position) since they are attached in the vicinity of attaching plate 25 provided on the upper part of cylindrical part 20 of filter case 14. On the other hand, magnetic body 24 attached to cap 2 is positioned in the left direction with β of approximately 90° (in the direction of the 9 o'clock position). Knob 9 of cap 2 is set so that the minus-sign shape is directed substantially vertically.

[0035] In the preparation position before cap 2 is mounted shown in Fig. 4A, total two protrusions are provided on outer peripheral part 23 of cap 2. Protrusion 22 having stopper 30 in one end and a shape with width D is provided on the lower part, and similarly, second protrusion 22e having a symmetrical shape is provided on the opposite side at 180°. The position of projected part 21 provided in the inner periphery of cylindrical part 20 of filter case 14 is set so as to have a gap by dimension C from the left end of width D of protrusion 22 of cap 2 in the rotation direction.

[0036] Fig. 4B shows a state of β ofapproximately 45° in which cap 2 is rotated clockwise only 45° by using knob 9. Protrusion 22 of cap 2 enters behind projected part 21 on the inner peripheral part of cylindrical part 20 of filter case 14 as shown in the sectional view of Fig. 2. However, since magnetic body 24 and magnetic corresponding op-

eration part 27 inside reed switch 26 are displaced from each other by about 45° in the angle direction and apart from each other, magnetic corresponding operation part 27 does not detect magnetic body 24.

[0037] Furthermore, when cap 2 is rotated by about 80° from the state of Fig. 4A and the state is changed into state of Fig. 4C, firstly, the water-sealing effect of O-ring 18 occurs. Although magnetic body 24 and magnetic corresponding operation part 27 in reed switch 26 are displaced from each other by β of approximately 10° in the angle direction, magnetic corresponding operation part 27 starts to detect magnetic body 24. Therefore, reed switch 26 starts to detect ON and at the same time, cap 2, filter body 11 and O-ring 18 disposed therebetween, and the like, are configured in the axis direction approximate to the sectional view of Fig. 2.

[0038] As shown in Fig. 4D, when knob 9 is rotated by approximately 90° from the state of Fig. 4A, magnetic body 24 and magnetic corresponding operation part 27 in reed switch 26 are in the position relation expressed by β = 0, that is, they are not displaced from each other in the angle direction. Therefore, magnetic body 24 is detected by magnetic corresponding operation part 27 reliably. Then, the detection of ON of reed switch 26 is completely carried out, and stopper 30 is brought into contact with projected part 21. Thus, a user can judge that cap 2 is completely mounted.

[0039] Fig. 5 is a partial sectional view seen from the direction of arrow A of Fig. 4B. Based on Fig. 5, the relation in the axis direction between protrusion 22 on cap 2 and projected part 21 on cylindrical part 20 of filter case 14 is described. Protrusion 22 has three kinds of heights in the range of width D, that is, thin part 22a, inclined part 22b, and pressing part 22c from the side of operation portion 22d. Then, gap E formed by pressing part 22c and collar 31 is set to be approximate to or slightly larger than thickness dimension F of projected part 21 of filter case 14. In accordance with the rotation of cap 2, since cap 2 and inclined part 22b slide, and entire cap 2 moves in the direction of arrow G with respect to the fixed side of projected part 21, projected part 21 presses outer peripheral cylindrical part 17 of filter body 11 of Fig. 2, and the water sealing effect of O-ring 18 is exhibited.

[0040] Point K as an end part of inclined part 22b is set so that β is approximately 10° in Fig. 4C and the water sealing effect by O-ring 18 occurs earlier than an ON operation by reed switch 26.

[0041] Note here that as shown in Fig. 4A, when knob 9 is set substantially vertically and insertion is carried out in the axis direction from an arrangement in which projected part 21 and pressing part 22c do not interfere with each other in a plane state, pressing part 22c is disposed at the side of filter body 11 with respect to projected part 21. In this case, when knob 9 is rotated, as shown in Fig. 2, O-ring 18 is pressed correctly and reed switch 26 is also operated. However, for example, when filter body 11 is inserted into filter case 14 only in a state in which it is set horizontally, projected part 21 and pressing part 22c interfere with each other. Therefore, even if magnetic body 24 and magnetic corresponding operation part 27 are adjacent to each other in the plan view, mounting is not carried out completely as in Fig. 3. Since magnetic body 24 and magnetic corresponding operation part 27 are displaced from each other by dimension H in the axis direction, a signal is not transmitted to control device 3.

[0042] As mentioned above, only when magnetic body 24 and magnetic corresponding operation part 27 match to each other in the rotation direction and in the axis direction of cap 2, reed switch 26 is tuned on. Thus, it is input from signal wire 28 into control device 3 that cap 2 is normally mounted.

[0043] Next, a control flowchart of a washing machine when a signal is not output from reed switch 26, that is, when a filter is not mounted completely when a user is intended to start washing operation is described based on Fig. 6.

[0044] Firstly, a user puts clothes, detergent, and the like, in a predetermined position of a washing machine, and turns the power switch on (S100), and then sets a course that is desired to be operated (S101). Next, the start switch is turned on and an input operation is carried out (S102), and it is determined whether reed switch 26 of the filter portion is input or not, or whether the reed switch 26 is turned on or off in the following step (S103).

[0045] When reed switch 26 is on, the washing machine starts to operate (S104) and proceeds to a series of processes including washing, rinsing, dehydration, and the like. When reed switch 26 is off, as shown in Fig. 6, the process is stopped and immediately proceeds to notification of an abnormality (S105). In this case, display 5 of Fig. 1 shows, for example, a predetermined set display signifying "Fasten filter portion again" as "notification that abnormality can be corrected by a user's operation," so that a user is notified and an operation of a washing machine is not carried out. Then, it is detected that a user carries out correcting operation and that filter is mounted normally. Then, the step returns to the step of confirming whether reed switch 26 is on or off (S103). When reed switch 26 is on, no new operation is carried out and an operation is started (S104). Thus, the washing process is started.

[0046] That is to say, the filter device of the washing machine of the present invention includes filter body 11 disposed in a middle of a drain route and catching foreign matters; cap 2 having knob 9 capable of operating filter body 11 in the rotation direction and the axis direction; and filter case 14 accommodating filter body 11 and cap 2. The filter device further includes reed switch 26 attached to filter case 14 and magnetic body 24 attached to a position corresponding to reed switch 26 of cap 2. Then, the filter device further includes O-ring 18 for water sealing between filter body 11 and filter case 14, and a control device for controlling the process and a display of the washing machine.

[0047] Then, protrusion 22 whose thickness is changed in the axis direction is provided at the outer pe-

riphery of cap 2. Projected part 21 corresponding to protrusion 22 is provided at the inner periphery of cylindrical part 20 of filter case 14 so as to press protrusion 22. Thus, O-ring 18 is pressed, and thereby water-sealing between filter case 14 and cap 2 is carried out.

[0048] Reed switch 26 is turned on when magnetic body 24 attached to cap 2 is located in the position corresponding to reed switch 26 in the rotation direction and the axis direction of cap 2. When the start signal of the process is input, when an ON signal from reed switch 26 is not input, control device 3 stops proceeding of processes. At this time, display 5 notifies that abnormality can be corrected by a user's operation. Thereby, when cap 2 is not located in the predetermined position in the circumferential direction, it cannot be inserted into the predetermined position in filter case 14 in the axis direction. At this time, reed switch 26 does not operate. On the other hand, when cap 2 is located in the predetermined circumferential direction, with the rotation of knob 9, O-ring 18 is pressed and reed switch 26 is turned on.

[0049] Furthermore, even when an input of the operation of the washing machine is carried out but when a signal from reed switch 26 is not received, control device 3 distinguishes the abnormality from usual disorder/failure, and notifies that the cap is not attached completely. For example, control device 3 notifies a washing machine user to take a procedure on the display. Therefore, although notification of an abnormality is displayed, since the notification shows that a user can correct the abnormality in a simple and easy manner and a procedure to be taken by a user, the filter device has a configuration that can be easily understood and handled by a user.

[0050] Hereinafter, operations, effects, and advantages of the filter device of the washing machine configured as mentioned above are described.

[0051] When cap 2 is not located in a predetermined position in the circumferential direction, cap 2 is in the positional relation shown in Fig. 3 in which cap 2 is not mounted completely, so that cap 2 cannot be inserted into a predetermined position of filter case 14 in the axis direction. In addition to this, the dimension in the axis direction between magnetic body 24 in cap 2 and magnetic corresponding operation part 27 in reed switch 26 is out of the range of operation of reed switch 26. Therefore, abnormality information can be notified reliably.

[0052] Furthermore, since an input of the operation of the washing machine is carried out but when a signal from reed switch 26 is not received, control device 3 carries out notification of an abnormality when mounting cannot be carried out completely by a display signifying "Fasten filter portion again" as "notification that abnormality can be corrected by a user's operation." That is to say, control device 3 distinguishes this abnormality from usual disorder/failure, and notifies that a user can correct the abnormality in a simple and easy manner and procedure to be taken. Then, when the filter device is recovered to a normal state, the operation starts immediately without carrying out a new switching operation. Thus, this configuration is simple and easy for a user to handle.

[0053] When cap 2 is mounted, the rotation operation of cap 2 is carried out as follows, firstly, cap 2 is inserted in the axis direction with knob 9 directed in the vertical direction, and then an operation before the attachment of the filter device to the operation after the filter device is completely mounted are carried out in the range of the rotation angle of approximately 90°. In addition to this configuration, at an end position, stopper 30 is brought into contact with projected part 21, and it is determined whether or not cap 2 is mounted by sense. Therefore, the operation is easy and the rotation force of a user's fingers is easily added to cap 2, so that the reliable operation can be carried.

[0054] That is to say, in the operation of knob 9 in the rotation direction, the water sealing effect by O-ring 18 is completed, and thereafter, reed switch 26 is turned on. Thus, the rotational operation of cap 2 is carried out as follows, that is, firstly, cap 2 is inserted in the axis direction with knob 9 directed in the vertical direction, and at an end position, stopper 30 is brought into contact with projected part 21. Thus, it can be determined whether or not cap 2 is mounted by sense. Therefore, the rotation force of the user's fingers is easily added to cap 2, and reliable operation can be carried.

[0055] Furthermore, it is necessary to regularly remove foreign matters such as lint retained in the filter device. Therefore, when filter body 11 is taken out from filter case 14 by operating knob 9, wash water contained in foreign matters and the like is usually dripped to the inner and outer peripheries of the lower part of cylindrical part 20 of filter case 14. In the present filter device, reed switch 26 is attached inside attaching plate 25 formed on the upper part of the outer periphery of cylindrical part 20. Therefore, because reed switch 26 is located in the upper part of cylindrical part 20, there is no risk that dripping of wash water is spread over reed switch 26 part of the electrical equipment member, causing failure in terms of safety, for example, short-circuit or insulation deterioration.

[0056] That is to say, reed switch 26 is disposed in the upper part of filter body 11. Thus, when filter body 11 is taken out from filter case 14 by operating knob 9, even if wash water contained in foreign matters and the like is dripped to the inner and outer peripheries of the lower part of cylindrical part 20 of filter case 14, failure in terms of safety may not occur. This is because reed switch 26 is attached inside attaching plate 25 formed on the upper part of the outer periphery of cylindrical part 20. Therefore, there is no risk that the dripping of the wash water is spread over reed switch 26 portion of electrical equipment member, causing failure in terms of safety, for example, short-circuit or insulation deterioration.

[0057] As mentioned above, in the first embodiment, only when cap 2 is correctly mounted in the rotational direction and axis direction, a signal is transmitted to control device 3 and the operation of cap 2 can be carried out within an angle of approximately 90°. Furthermore,

if an abnormality occurs, since abnormality notification that can be easily understood by a user is displayed, the filter device of the present invention can simplify prevention of leakage of water during washing. Thus, the filter device is easy to be used.

[0058] According to a filter device of a washing machine in accordance with the present invention, an operator can easily carry out attachment/detachment operation of a filter device when foreign matters contained in drain water are manually removed regularly. Moreover, the filter device of the present invention has a configuration capable of carrying out abnormality information with respect to water leakage due to incomplete attachment in attachment/detachment operation and allowing the following processes to be carried out in a simple and reliable manner. Therefore, the filter device of the present invention is useful because they can be applied and employed in equipment such as a washing machine, accompanied with drain water containing foreign matters.

Claims

1. A filter device of a washing machine comprising:

a filter body disposed in a middle of a drain route and catching foreign matters;
a cap having a knob capable of operating the filter body in a rotation direction and an axis direction;
a filter case for accommodating the filter body and the cap;
a reed switch attached to the filter case;
a magnetic body attached to a position, which corresponds to the reed switch, of the cap;
an O-ring for water-sealing between the filter body and the filter case; and
a control device for controlling a process of the washing machine and a display,

wherein a protrusion having a thickness varying in the axis direction is provided at an outer periphery of the cap, a projected part corresponding to the protrusion is provided at an inner periphery of a cylindrical part of the filter case, and pressed to the protrusion so as to press the O-ring, thereby water-sealing between the filter case and the cap,
the reed switch is turned on when the position of the magnetic body attached to the cap in the rotation direction and the axis direction of the cap corresponds to the reed switch, and
when a start signal of a process is input but an ON signal from the reed switch is not input, the control device stops proceeding of processes and notifies a washing machine user to take a procedure on a display.

2. The filter device of a washing machine of claim 1, wherein the cap is set so that the reed switch is turned on after a water sealing effect by the O-ring is completed in an operation of the knob in the rotation direction.

3. The filter device of a washing machine of claim 1 or 2, wherein the reed switch is disposed on an upper part of the filter body.

FIG. 1

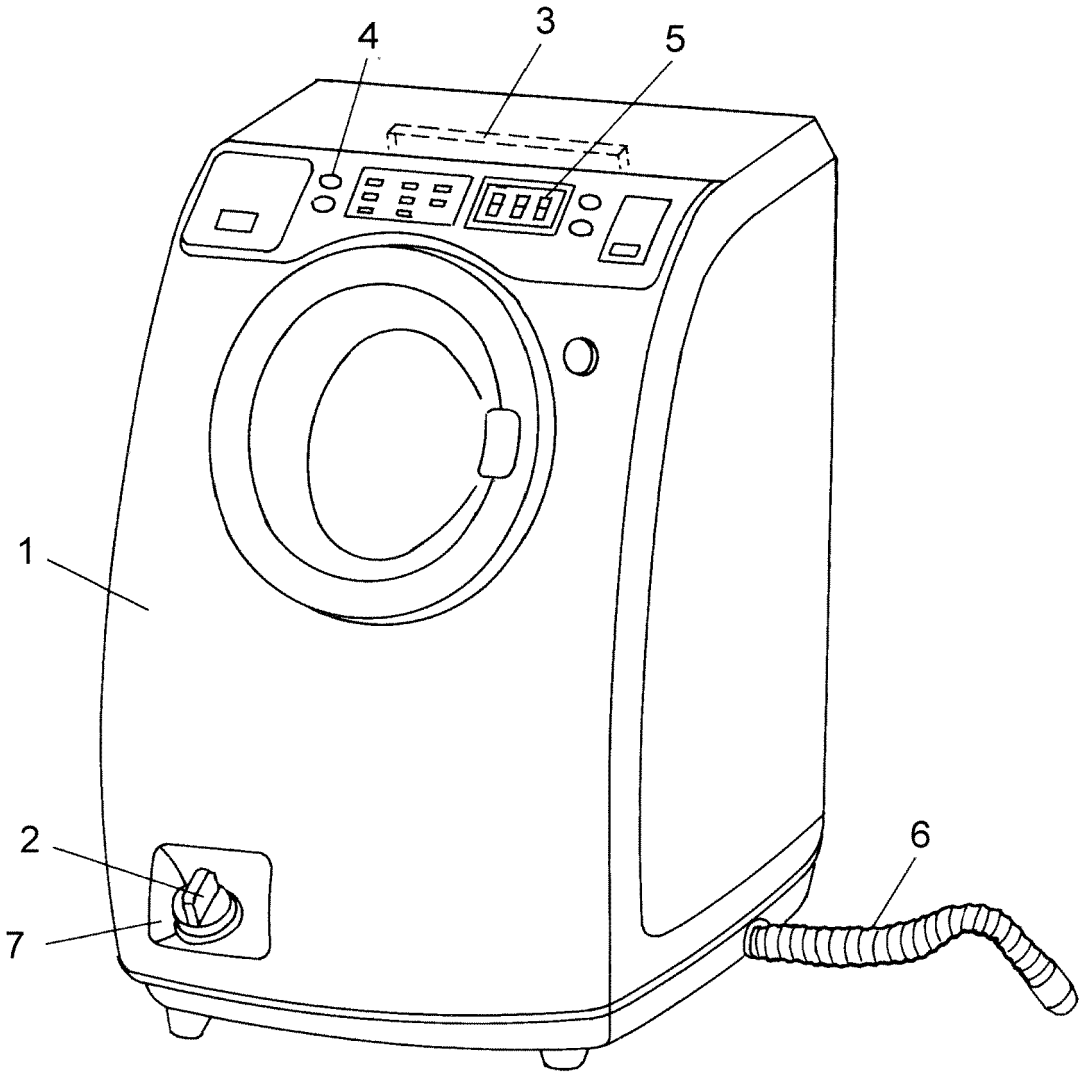


FIG. 2

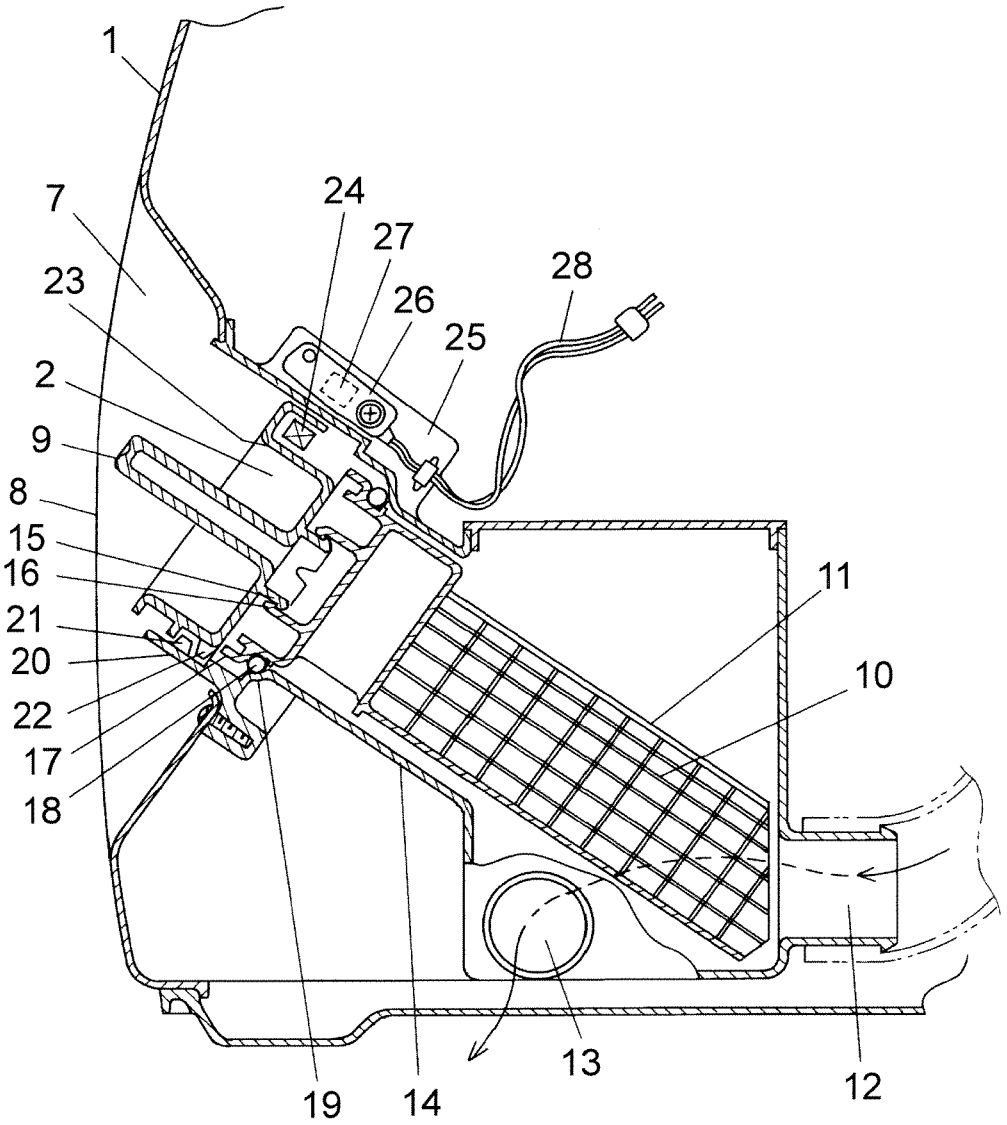


FIG. 3

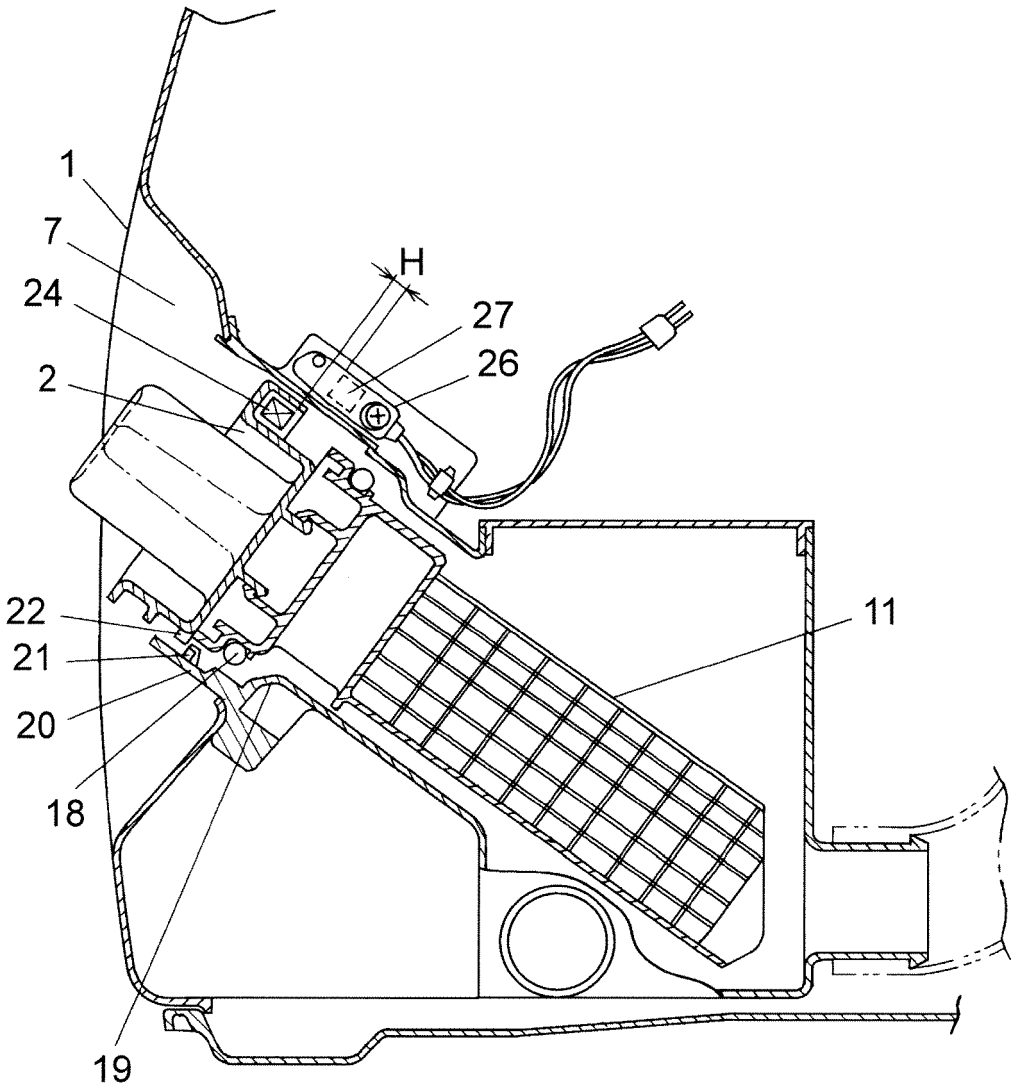


FIG. 4A

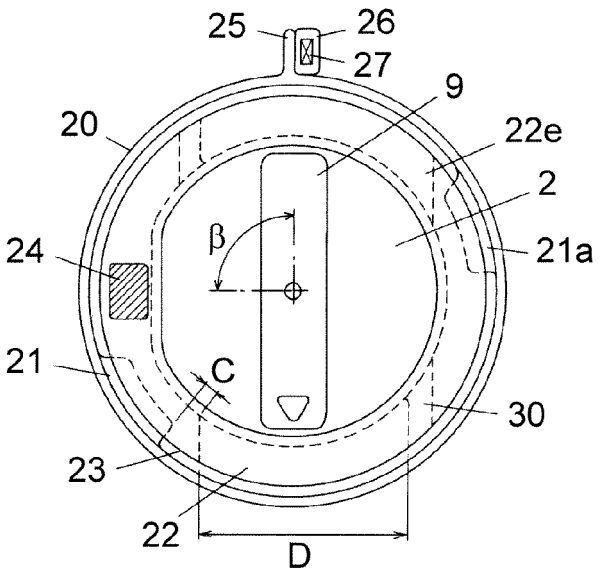


FIG. 4B

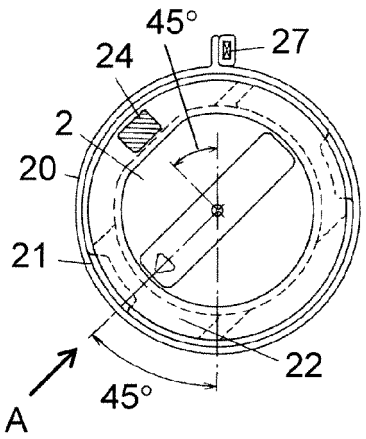


FIG. 4C

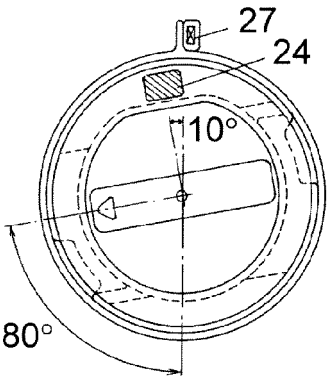


FIG. 4D

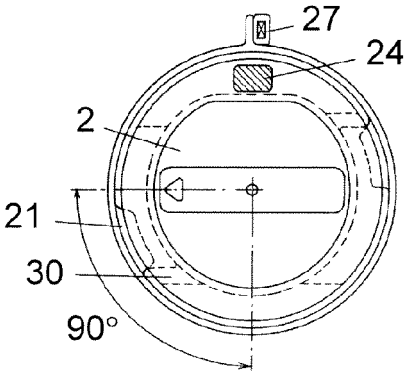


FIG. 5

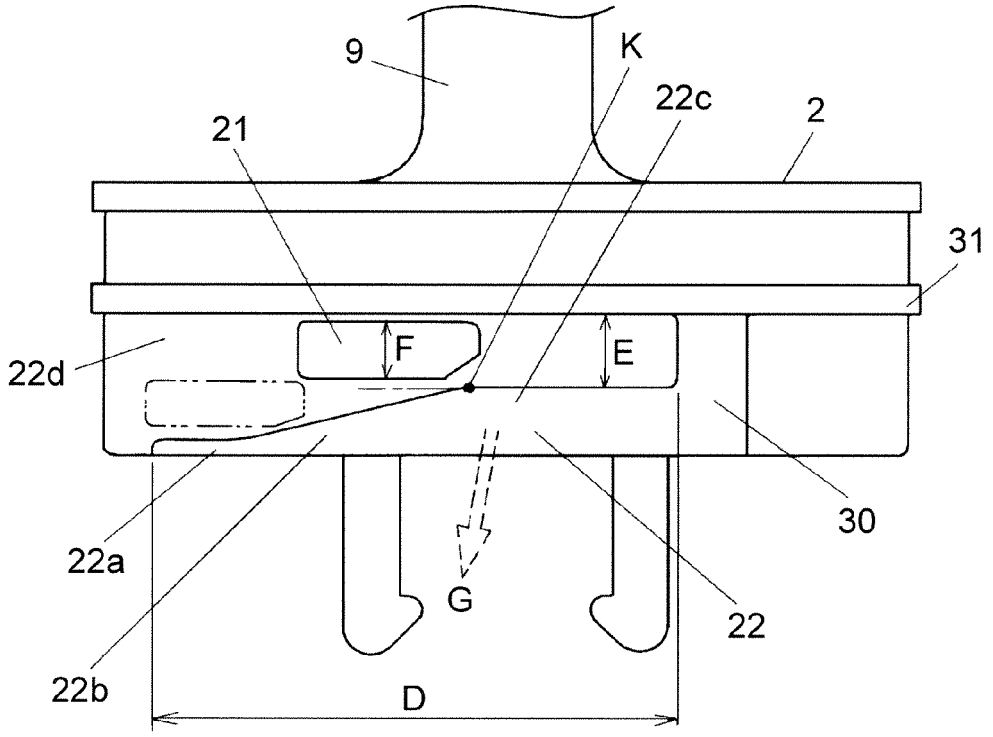

9
K
22c
2
21
31
F
E
22d
30
22a
G
22
22b
D

FIG. 6

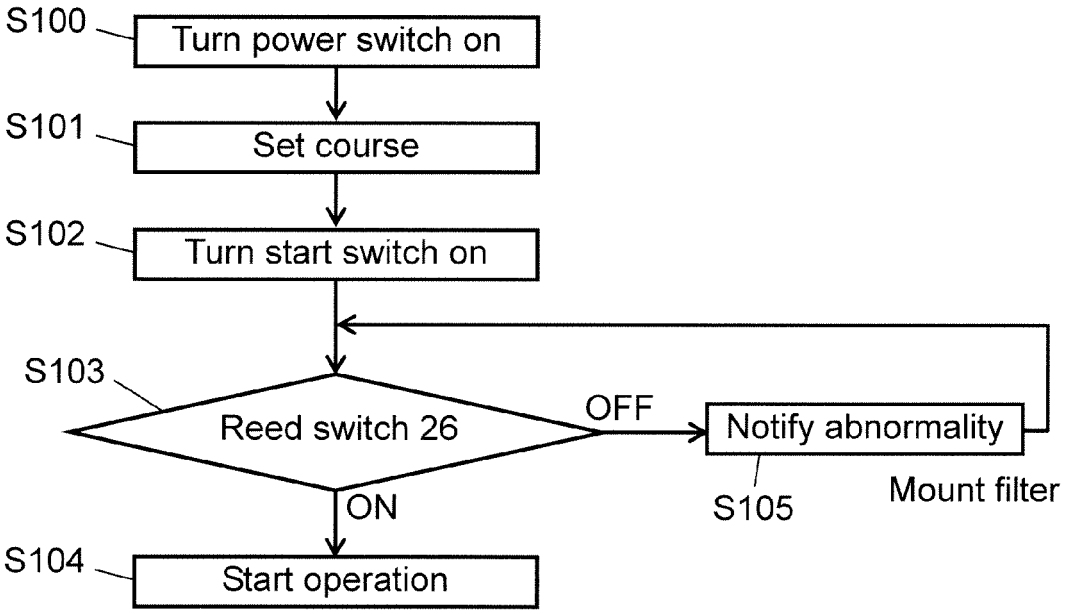

S100
Turn power switch on
S101
Set course
S102
Turn start switch on
S103
Reed switch 26
OFF
Notify abnormality
S105
Mount filter
ON
S104
Start operation

FIG. 7

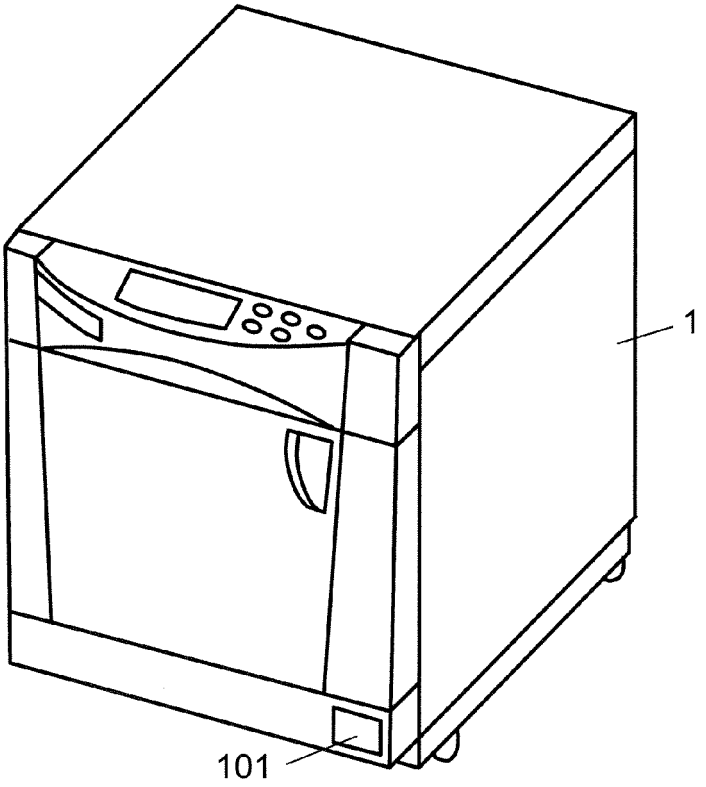


FIG. 8

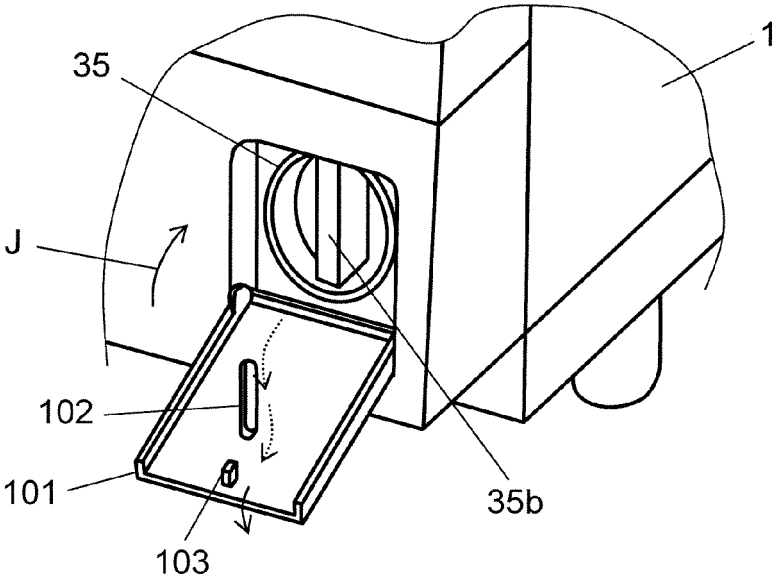


FIG. 9

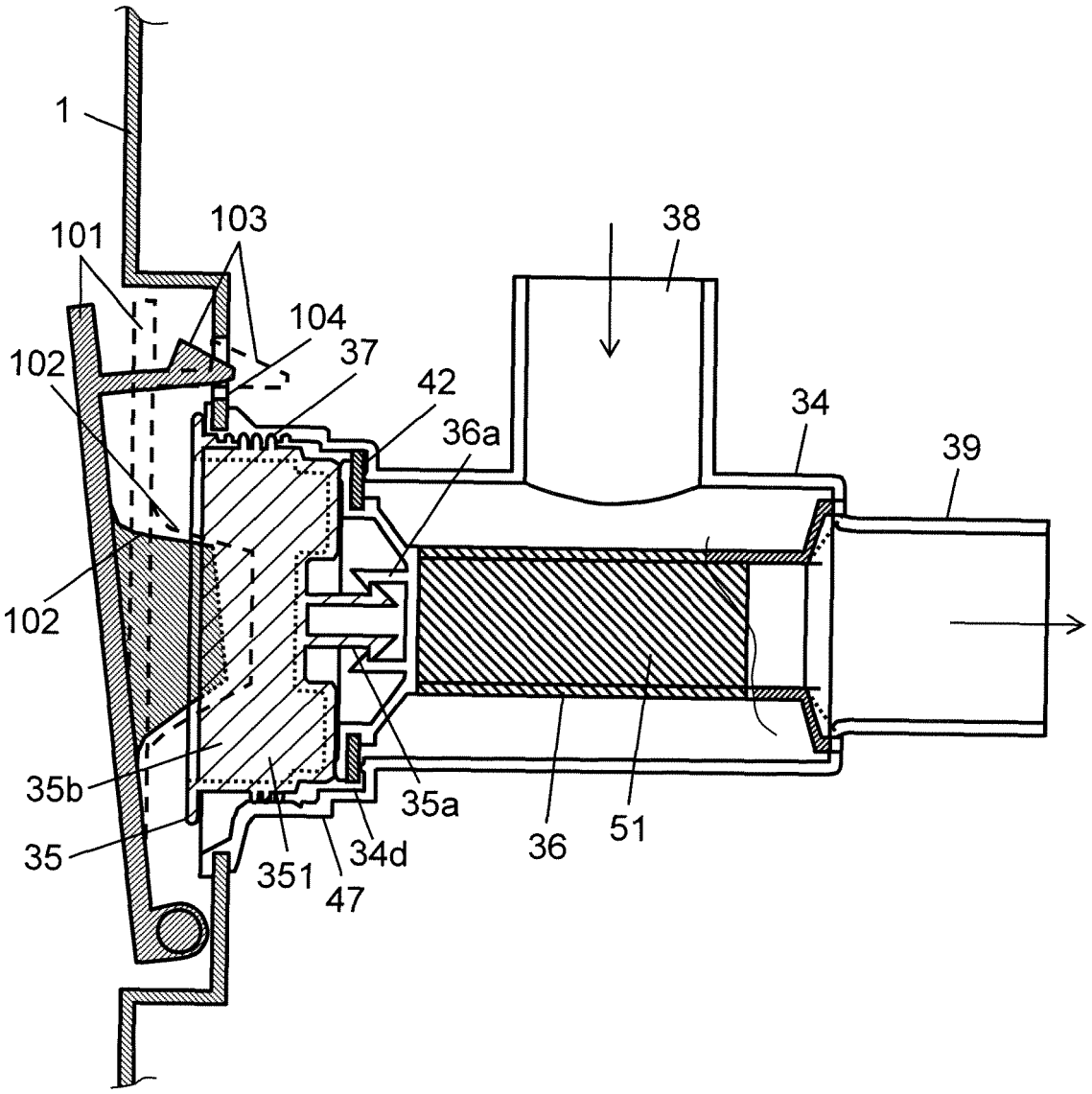
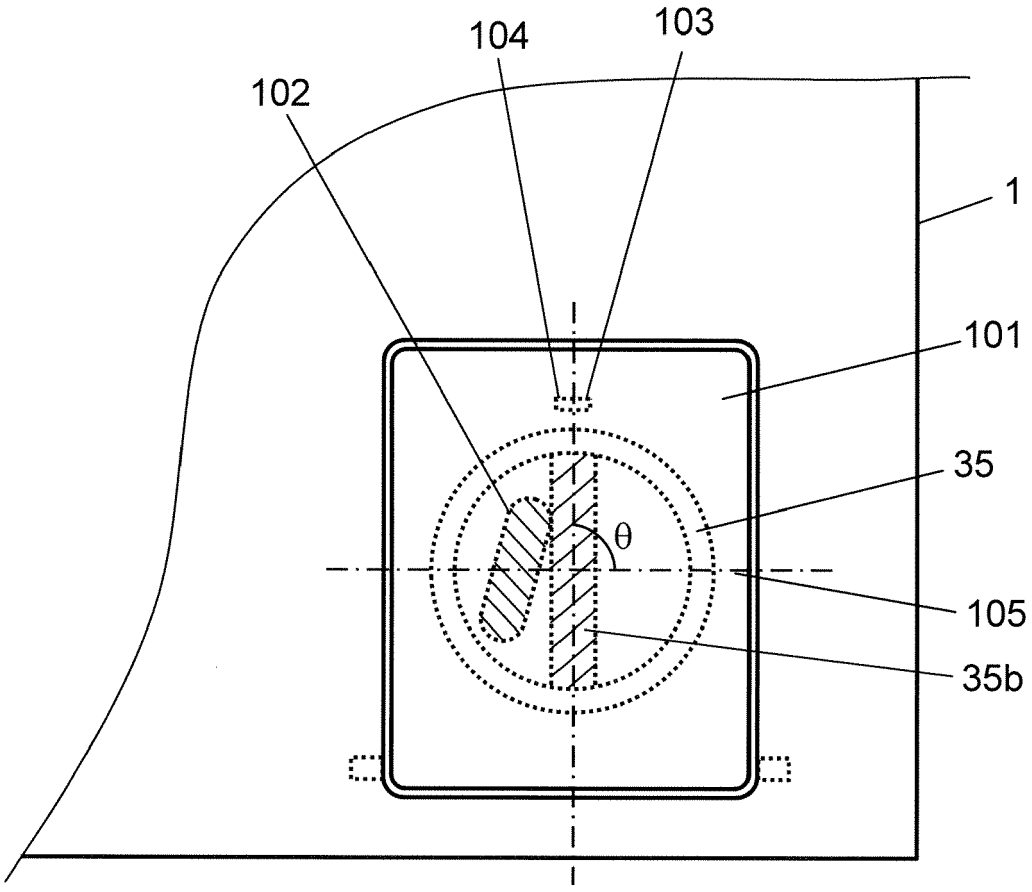


FIG. 10



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Patent documents cited in the description

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