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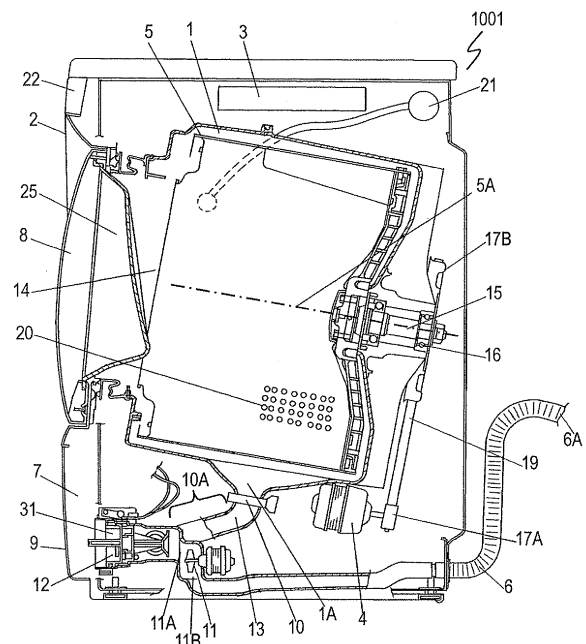
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(54) **Drum type washing machine**

(57) A drum type washing machine includes a rotatable drum adapted to store a laundry, a drain valve, a drain pump, a controller, and a filter unit. The filter unit includes a filter case provided between the drain valve and the drain pump, a filter accommodated in the filter case, a cap for sealing a fixing opening, and a reed switch. The reed switch is activated to outputs an activation signal to the controller when the cap is located at the predetermined position, and deactivated to output a deactivation signal to the controller when the cap is not at the predetermined position. The controller is operable to, when determining that the reed switch outputs the deactivation signal while executing a process out of the washing process and the rinsing process, stop the process. The controller is operable to, when determining that the reed switch outputs the deactivation signal while executing the draining process, stop the draining process, close the drain valve, and drive the drain pump. This washing machine prevents washing water from leaking and safely washes the laundry even when the filter is opened during the washing process, the rinsing process, and the draining process.

FIG. 1



Description

TECHNICAL FIELD

[0001] The present invention relates to a drum type washing machine including a filter unit for trapping particles, such as lint, contained in discharged water.

BACKGROUND OF THE INVENTION

[0002] Fig. 4 is a cross-sectional view of conventional drum type washing machine 501 disclosed in Japanese Patent Laid-Open Publication No.2001-104690. Washing machine 501 includes housing 20, water tub 204 supported in housing 201, rotatable drum 205 rotatably accommodated in water tub 204, drain passage 211 for discharging the washing water stored in water tub 204, drain pump 210 provided at a downstream of drain passage 211, drain hose 227 for discharging washing water through drain pump 210, and filter 220 provided between drain passage 211 and drain pump 210. Drain passage 211 is located below water tub 204. Filter 220 has arms 221 for trapping particles, such as lint, contained in the discharged washing water.

[0003] Filter 220 trapping the particles prevents the clogging of drain pump 210, drain passage 211, and a drain pipe line communicating with a sewage system of a house in which washing machine 501 is installed.

[0004] When a laundry is washed by washing machine 501, washing water always fills a portion from water tub 204 to drain pump 210 and drain hose 227. Drain hose 227 extends from the lower part of housing 201 to the upper part of housing 201, hence preventing the washing water from being discharged during the operation of the washing machine. The particles trapped by filter 220 cannot be removed during a washing process. If filter 220 is taken out during the washing process, the washing water leaks from a part from which filter 220 is taken out.

[0005] Fig. 5 is a perspective view of another conventional washing machine 502 disclosed in Japanese Patent Laid-Open Publication No.2002-282616. Washing machine 502 includes housing 112, cover 101 provided at a right-rear side of the front of housing 112, and filter unit 503 provided in cover 101. Cover 101 can be opened and closed.

[0006] Fig. 6 is an enlarged perspective view of washing machine 502 having cover 101 opened. Cover 101 can be formed by molding resin material. A lower end of cover 101 is pivotally supported by housing 112. An upper end of closed cover 101 moves about the lower end in direction F. Rib 102 extending slantingly and hook 103 protrude from a back surface of cover 101. Cap 106 is provided inside cover 101 to take out filter unit 503 from housing 112 and to attach unit 503 to housing 112. Cap 106 is unitarily formed with handle 106B for rotating cap 106.

[0007] Filter unit 503 includes a filter for trapping particles. Upon cap 106 being rotated to loosen cap 106,

the filter having particles trapped thereon is taken out from the filter unit. Then, the filter is cleaned to remove the particles. Then, the filter is returned into the filter unit. Then, cap 106 is tightened to its original position, thereby preventing water from leaking from a periphery of cap 106.

[0008] Fig. 7 is a front view of the filter unit of washing machine 502. In Fig. 7, cover 101 is properly closed. Specifically, in the case that angle θ between the horizontal direction and a direction along which handle 106B extends is substantially 90 degrees, cover 101 can be closed completely in direction F shown in Fig. 6 while preventing rib 102 of cover 101 from contacting handle 106b of cap 106, as shown in a broken line of Fig. 7, thereby preventing the water from leaking. At this moment, a tip of hook 103 is engaged with engagement hole 104 to prevent cover 101 from easily opening.

[0009] When angle θ of handle 106B is not 90 degrees and when cover 101 is rotated in direction F, rib 102 contacts handle 106B to prevent cover 101 from being closed. Since cover 101 cannot be closed, a user can recognize that cap 106 is incompletely tightened. Then, the user can operate handle 106B again to rotate cap 106 until cap 106 reaches a proper position, thereby preventing the water from leaking. Specifically, the user can determine whether cover 101 is properly attached to housing 112 or not, thus preventing the water from leaking.

[0010] If the user excessively concentrates on the cleaning of the filter, washing machine 502 may cause the user to forget to close cover 101. In this case, the user cannot determine whether the water is prevented from leaking or not.

[0011] Washing machine 502 includes cover 101 preventing the number of components from decreasing.

[0012] Cover 101 is generally formed by molding resin material. Cover 101 is generally provided at the lower part of housing 112. Thus, a toe of a person may collide with cover 101 when the person passes by washing machine 502. The user may forcibly close cover 101 without recognizing that cap 106 is improperly tightened. In these cases, cover 101 may be damaged or removed from housing 112, and thus, the user cannot determine whether the water is prevented from leaking or not.

[0013] Washing machines 501 and 502 are operated by the user who is not an expert, and hence, easily preventing the water from leaking.

SUMMARY OF THE INVENTION

[0014] A drum type washing machine includes a rotatable drum adapted to store a laundry, a drain valve, a drain pump, a controller, and a filter unit. The filter unit includes a filter case provided between the drain valve and the drain pump, a filter accommodated in the filter case, a cap for sealing a fixing opening, and a reed switch. The reed switch is activated to outputs an activation signal to the controller when the cap is located at the pre-

determined position, and deactivated to output a deactivation signal to the controller when the cap is not at the predetermined position. The controller is operable to, when determining that the reed switch outputs the deactivation signal while executing a process out of the washing process and the rinsing process, stop the process. The controller is operable to, when determining that the reed switch outputs the deactivation signal while executing the draining process, stop the draining process, close the drain valve, and drive the drain pump.

[0015] This washing machine prevents washing water from leaking and safely washes the laundry even when the filter is opened during the washing process, the rinsing process, and the draining process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

Fig. 1 is a cross-sectional view of a drum type washing machine according to an exemplary embodiment of the present invention.

Fig. 2A is an enlarged cross-sectional view of the drum type washing machine according to the embodiment.

Fig. 2B is a front view of a cap of the drum type washing machine according to the embodiment.

Fig. 3A and Fig. 3B are flowcharts of an operation of the drum type washing machine according to the embodiment.

Fig. 4 is a cross-sectional view of a conventional drum type washing machine.

Fig. 5 is a perspective view of another conventional drum type washing machine.

Fig. 6 is an enlarged perspective view of the drum type washing machine shown in Fig. 5.

Fig. 7 is an enlarged front view of the drum type washing machine shown in Fig. 5.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0017] Fig. 1 illustrates drum type washing machine 1001 according to an exemplary embodiment of the present invention. Washing machine 1001 includes rotatable drum 5, water tub 1 accommodating therein rotatable drum 5 to allow drum 5 rotatable about center axis 5A, housing 2 accommodating rotatable drum 5 and water tub 1, and door 8 provided at a front of housing 2. Rotatable drum 5 has loading port 25 which has a circular shape and is provided at the front side. Rotatable drum 5 is adapted to store a laundry, such as clothes, put into rotatable drum 5 from door 8 through loading port 25.

[0018] Rotatable drum 5 has a bottom and a cylindrical side wall, and has opening 14 provided opposite to the bottom. Rotatable drum 5 is arranged so that opening 14 faces the front of housing 2, and the bottom faces the back of housing 2. Rotation shaft 15 extends from the

bottom of rotatable drum 5 along center axis 5A. Rotation shaft 15 is rotatably supported by bearing 16 provided at the back of water tub 1.

[0019] Motor 4 is mounted below water tub 1. Belt 19 connects between driving pulley 17A attached to a rotation driving axis of motor 4 and slave pulley 17B attached to rotation shaft 15. Motor 4 drives rotatable drum 5 via driving belt 19 between driving pulley 17A and slave pulley 17B so as to rotate drum 5.

[0020] Water supplier 21 provided at the upper part of an inside of housing 2 supplies washing water into water tub 1. The washing water flows between the inside of rotatable drum 5 and the inside of water tub 1 via a lot of through-holes 20 provided in the side wall of rotatable drum 5. Rotatable drum 5 rotates to move the laundry containing the washing water upward and to then drops the laundry from the upper side, thereby beat-washing the laundry.

[0021] Drain opening 1A through which the washing water is discharged from the water tub is provided at the lower part of water tub 1. Drain valve 10 is provided at the lower part of water tub 1 and at drain opening 1A. Drain valve 10 allows the water to be discharged and stops the discharging of the water from water tub 1 through drain opening 1A. Drain pump 11 discharges the water forcibly from water tub 1. Filter unit 12 is provided in the middle of drain passage 10A connecting drain valve 10 to suction port 11A of drain pump 11.

[0022] Drain valve 10 and filter unit 12 communicating with each other via hose 13 made of elastic material, such as rubber. Discharge opening 11B of drain pump 11 is connected to drain hose 6 for discharging the washing water to an outside of washing machine 1001. If a place to which the washing water is discharged is higher than a floor on which washing machine 1001 is installed, tip 6A of drain hose 6 may be located above drain opening 1A. Even in this case, drain pump 11 discharges the washing water forcibly from water tub 1 to the outside of washing machine 1001. In the case that the washing water is discharged through tip 6A of drain hose 6 to a place, such as a drain ditch, below the floor, drain pump 11 discharges the washing water for a short time.

[0023] Cap 31 for operating filter unit 12 is provided in space 7 provided at the lower part of front of housing 2. Filter unit 12 removes particles, such as lint, suspended in the discharged washing water. The washing water having the particles removed by filter unit 12 is sent to drain pump 11, hence preventing the clogging of drain pump 11 and the clogging of a drainage water pipe line at the exterior of washing machine 1001.

[0024] Controller 3 implemented by, for example, a microcomputer, installed in the upper part of housing 2 controls a series of processes, such as a washing process, a rinsing process, and a spin-drying process, and controls motor 4, drain valve 10, and drain pump 11. An input panel and indicator 22 are provided on the front surface of the upper part of housing 2. The input panel includes a start switch. The start switch starts the operation of

washing machine 1001. The indicator 22 displays, for example, a washing sequence to be executed and a remaining time.

[0025] During the washing process, drain valve 10 is closed, and washing water does not fill hose 13. Thus, even if cap 31 is operated to remove the filter, the washing water does not leak from filter unit 12.

[0026] Fig. 2A is an enlarged cross-sectional view of drum type washing machine 1001 for illustrating filter unit 12. Fig. 2B is a front view of cap 31. As shown in Fig. 2A, cap 31 is accommodated in space 7 of housing 2 and does not protrude from outer contour 9 of housing 2. As shown in Fig. 2B, cap 31 has a circular shape as seen from the front, and has tab 32 extending linearly. A user facing the front surface of housing 2 can pinch tab 32 with fingers to rotate cap 31.

[0027] Filter unit 12 includes filter case 39 having cap 31 detachably attached thereto and filter 34 stored in filter case 39. Filter case 39 has inflow opening 36 connected to hose 13 and outflow opening 37 connected to suction port 11A of drain pump 11. Filter case 39 has installation opening 35 having cylindrical wall 42 adapted to have cap 31 fixed thereto. Sealing ring 40 made of elastic material, such as rubber, is attached to an outer circumference of installation opening 35. Sealing ring 40 contacts front surface 41 of filter case 39 to seal cap 31 and filter case 39. Cap 31 has engaging protrusion 38 extending to the interior of housing 2. Engaging protrusion 38 is engaged with engaging recess 33 formed in filter 34. Upon rotating tab 32, the user can rotate cap 31 to remove cap 31 from installation opening 35 of filter case 39. Then, the user can hold tab 32 with fingers to pull out cap 31, thereby taking filter 34 out of filter case 39.

[0028] When the washing water containing the particles, such as lint, passes through filter 34 through inflow opening 36, the particles are caught by filter 34 and are removed from the washing water. The washing water having the particles removed therefrom is sent from outflow opening 37 to drain pump 11, and is discharged via drain hose 6 to the outside of washing machine 1001.

[0029] Cylindrical wall 42 is formed unitarily with filter case 39 and protrudes toward space 7 in housing 2. Cylindrical wall 42 has a diameter larger than that of installation opening 35, and accommodates cap 31 rotatably. Protrusions 43 are provided on an inner circumference of cylindrical wall 42. Protrusion 45 is provided on outer circumference 44 of cap 31. Upon the user pushing cap 31 to filter 34 to push sealing ring 40 to front surface 41 of filter case 39, sealing ring 40 contacts front surface 41 of filter case 39 securely, thereby preventing the washing water stored in filter case 39 from leaking from cap 31.

[0030] Magnetic body 46 is located at a portion of outer circumference 44 of cap 31. Mounting plate 47 is provided unitarily on filter case 39 above an outer circumference of cylindrical wall 42. Reed switch 48 is mounted to mounting plate 47. Reed switch 48 includes magnetic actuator 49 activated by magnetic field. Reed switch 48 is arranged to allow magnetic actuator 49 to be located

close to magnetic body 46.

[0031] Specifically, when cap 31 is positioned at a predetermined position, cap 31 causes sealing ring 40 to contact filter case 39 securely to seal cap 31 and filter case 39. In this case, magnetic body 46 is located close to magnetic actuator 49 and turns on magnetic actuator 49 to activate reed switch 48, thereby causing reed switch 48 to send an activation signal via signal line 52 to controller 3. On the other hand, when cap 31 is not positioned at the predetermined position, cap 31 and filter case 39 are not sealed completely. In this case, magnetic body 46 is located away from magnetic actuator 49 to turn off magnetic actuator 49 to deactivate reed switch 48, thereby allowing reed switch 48 to send a deactivation signal via signal line 52 to controller 3. Controller 3 determines whether reed switch 48 outputs the activation signal or the deactivation signal. In the case that reed switch 48 which is deactivated does not actually output any signal, controller 3 can determine that reed switch 48 does not output any signal. Thus, even in this case, it is assumed that reed switch 48 effectively outputs the deactivation signal when reed switch 48 is deactivated.

[0032] An operation of drum type washing machine 1001 will be described below. Figs. 3A and 3B are flowcharts illustrating the operation of drum type washing machine 1001.

[0033] As shown in Fig. 3A, the user opens door 8 to put a laundry, such as clothes, and detergent into rotatable drum 5 of drum type washing machine 1001 and turn on a power switch (Step S100). Then, the user sets a desired operation washing sequence (Step S101), and then, turns on the start switch (Step S102). At Step S102, controller 3 closes drain valve 10 and deactivate motor 4, drain pump 11, and water supplier 21.

[0034] When the start switch is turned on at Step S102, controller 3 determines whether reed switch 48 outputs the activation signal or the deactivation signal (Step S103).

[0035] If determining at Step S103 that reed switch 48 outputs the activation signal, controller 3 starts a washing process for washing the laundry by activating water supplier 21 to supply water to rotatable drum 5 and driving motor 4 (Step S104).

[0036] If determining at Step S103 that reed switch 48 outputs the deactivation signal, controller 3 displays a predetermined indication on indicator 22 (Step S111). This indication indicates that cap 31 is not positioned at the predetermined position, and notifies the user of a recoverable abnormality as a message such as "the filter unit must be retightened". At Step S111, indicator 22 may generate a warning sound. When the indication is displayed at Step S111, controller 3 determines at Step S103 whether reed switch 48 outputs the activation signal or the deactivation signal. Then, controller 3 repeats the operations of Steps S103 and S111. While the operations of Steps S103 and S111 are repeated, the user recognizes the indication displayed on indicator 22 at Step S111, and fix cap 31 to the predetermined position (Step

S112). When the user fixes cap 31 at the predetermined position at Step S112, controller 3 determines at Step S103 that reed switch 48 outputs the activation signal, and then starts the washing process at Step S104.

[0037] After starting the washing process at Step S104, controller 3 executes the washing process (Step S105). While executing the washing process at Step S105, controller 3 determines whether reed switch 48 outputs the activation signal or the deactivation signal (Step S106). While determining at Step S106 that reed switch 48 outputs the activation signal, controller 3 executes the washing process at Step S105. When terminating the washing process (Step S105A), controller 3 deactivates water supplier 21 and stops driving motor 4.

[0038] When determining at Step S106 that reed switch 48 outputs the deactivation signal, controller 3 immediately stops the washing process (S210) and displays the above indication on indicator 22 (Step S211). At Step S211, indicator 22 may generate a warning sound. When the indication is displayed at Step S211, controller 3 determines at Step S106 whether reed switch 48 outputs the activation signal or the deactivation signal, and repeats the operations of Steps S106 and S211. While the operations of Steps S106 and S211 are repeated, the user recognizes the indication displayed on indicator 22 at Step S211 and fixes cap 31 at the predetermined position (Step S212). When the user fixes cap 31 at the predetermined position at Step S212, controller 3 determines at Step S106 that reed switch 48 outputs the activation signal, and then, executes the washing process from the stage of the washing process stopped at Step S210. Thus, even if the user opens cap 31 of filter unit 12, the user prevents a washing time from extending by closing cap 31 again.

[0039] During the washing process, drain valve 10 is closed and prevents the washing water from filling filter unit 12 and drain pump 11. Hence, even if cap 31 is opened, the washing water does not leak from filter unit 12.

[0040] After terminating the washing process at Step S105A, controller 3 executes a draining process to open drain valve 10 and drive drain pump 11 so as to discharge the washing water stored in rotatable drum 5 and water tub 1 through drain opening 1A (Step S107A). While executing the draining process at Step S107A, controller 3 determines whether reed switch 48 outputs the activation signal or the deactivation signal (Step S108). While determining at Step S108 that reed switch 48 outputs the activation signal, controller 3 executes the draining process at Step S107A. When the draining process is terminated (Step S109), controller 3 closes drain valve 10.

[0041] When determining at Step S108 that reed switch 48 outputs the deactivation signal, controller 3 immediately stops the draining process (Step S114) and displays the above indication on indicator 22 (Step S115). At Step S115, indicator 22 may generate a warning sound. Simultaneously to the displaying of the indication, controller 3 closes drain valve 10 (Step S116), and drives

drain pump 11 (Step S117) to discharge washing water remaining in hose 13 and filter unit 12 through drain hose 6. After displaying the indication at Step S115 and discharging the washing water at Step S117, controller 3 determines at Step S108 whether reed switch 48 outputs the activation signal or the deactivation signal, and then, repeats the operations of Steps S108 and S115. While the operations of Steps S108 and S115 are repeated, the user recognizes the indication displayed on indicator 22 at Step S211 and fixes cap 31 at the predetermined position (Step S118). When the user fixes cap 31 at the predetermined position at Step S118, controller 3 determines at Step S108 that reed switch 48 outputs the activation signal, and then, opens drain valve 10 and re-starts the draining process from the stage of the draining process stopped at Step S105. Then, the draining process is terminated at Step S109. Thus, even if the user opens cap 31 of filter unit 12, the user prevents a washing time from extending by closing cap 31 again.

[0042] Since the washing water is discharged from filter unit 12 at Steps S116 and S117, no washing water leaks from filter unit 12 even when cap 31 is opened in order to fix cap 31.

[0043] When the draining process is terminated at Step S109, controller 3 closes drain valve 10 and does not activate motor 4, drain pump 11, and water supplier 21.

[0044] After the draining process is terminated at Step S109 shown in Fig. 3A, controller 3 determines whether reed switch 48 outputs the activation signal or the deactivation signal, as shown in Fig. 3B (Step S303).

[0045] If determining at Step S303 that reed switch 48 outputs the activation signal, controller 3 activates water supplier 21 to supply water to rotatable drum 5 and drives motor 4 to start a rinsing process so as to rinse the laundry (Step S304).

[0046] When determining at Step S303 that reed switch 48 outputs the deactivation signal, controller 3 displays the predetermined indication on indicator 22 (Step S311). This indication indicates that cap 31 is not positioned at the predetermined position, and notifies the user of a recoverable abnormality as a message such as "the filter unit must be retightened". At Step S111, indicator 22 may generate a warning sound. After displaying the indication at Step S311, controller 3 determines at Step S303 whether reed switch 48 outputs the activation signal or the deactivation signal, and repeats the operations of Steps S303 and S311. While the operations of Steps S303 and S311 are repeated, the user recognizes the indication displayed on indicator 22 at Step S311 and fixes cap 31 at the predetermined position (Step S312). After the user fixes cap 31 at the predetermined position at Step S312, controller 3 determines at Step S303 that reed switch 48 outputs the activation signal, and controller 3 starts the rinsing process at Step S104.

[0047] Starting the rinsing process at Step S304, the controller 3 executes the rinsing process (Step S305). While executing the rinsing process at Step S305, controller 3 determines whether reed switch 48 outputs the

activation signal or the deactivation signal (Step S306). While determining at Step S306 that reed switch 48 outputs the activation signal, controller 3 executes the rinsing process at Step S305. When the rinsing process is terminated (Step S105A), controller 3 stops driving water supplier 21 and motor 4.

[0048] When determining at Step S306 that reed switch 48 outputs the deactivation signal, controller 3 immediately stops the rinsing process (Step S410) and displays the above indication on indicator 22 (Step S411). At Step S411, indicator 22 may generate a warning sound. When displaying the indication at Step S411, controller 3 determines at Step S306 whether reed switch 48 outputs the activation signal or the deactivation signal, and repeats the operations of Steps S306 and S411. While the operations of Steps S306 and S411 are repeated, the user recognizes the indication displayed on indicator 22 at Step S411 and fixes cap 31 at the predetermined position (Step S412). After the user fixes cap 31 at the predetermined position at Step S412, controller 3 determines at Step S306 that reed switch 48 outputs the activation signal, and restarts the rinsing process from the stage of the rinsing process stopped at Step S305. Thus, even if the user opens cap 31 of filter unit 12, the user prevents a washing time from extending by closing cap 31 again.

[0049] Since drain valve 10 is closed during the rinsing process, no water fills filter unit 12 and drain pump 11. Hence, even when cap 31 is opened, water does not leak from filter unit 12.

[0050] When the rinsing process is terminated in Step S305A, controller 3 executes a draining process to open drain valve 10 and drive drain pump 11 so as to discharge the water stored in rotatable drum 5 and water tub 1 from drain opening 1A (Step S307A). After the draining process is terminated and the water is discharged from water tub 1, while opening drain valve 10, controller 3 drives motor 4 to rotate rotatable drum 5 at a high rotation speed to execute a spin-drying process (Step S307B). While executing the draining process and the spin-drying process being at Steps S307A and S307B, controller 3 determines whether reed switch 48 outputs the activation signal or the deactivation signal (Step S308). While determining at Step S308 that reed switch 48 outputs the activation signal, controller 3 executes the draining process and the spin-drying process at Steps S307A and S307B. When the spin-drying process is terminated (Step S309), controller 3 stops driving motor 4.

[0051] When determining at Step S308 that reed switch 48 outputs the deactivation signal, controller 3 immediately stops a process out of the draining process and the spin-drying process that is executed (Step S314), and displays the above indication on indicator 22 (Step S315). At Step S315, indicator 22 may generate a warning sound. Simultaneously to the displaying of the indication, controller 3 closes drain valve 10 (Step S116), and drives drain pump 11 (Step S317) to discharge water remaining in hose 13 and filter unit 12 from drain hose

6. When displaying the indication at Step S315 and discharging water at Steps S316 and S317, controller 3 determines at Step S308 whether reed switch 48 outputs the activation signal or the deactivation signal, and controller 3 repeats the operations of Steps S308 and S315. While the operations of Steps S308 and S315 are repeated, the user recognizes the indication displayed on indicator 22 at Step S411 and fixes cap 31 at the predetermined position (Step S318). After the user fixes cap 31 at the predetermined position at Step S318, controller 3 determines at Step S308 that reed switch 48 outputs the activation signal. The, controller 3 opens drain valve 10 and restart the process from the stage of the process stopped at Step S314. Then, the spin-drying process is terminated at Step S309. Thus, even if the user opens cap 31 of filter unit 12, the user prevents a washing time from extending by closing cap 31. again.

[0052] Since water is discharged from filter unit 12 at Steps S316 and S317, no water leaks from filter unit 12 even when cap 31 is opened in order to fix cap 31.

[0053] If an excessive amount of particles collects on filter 34 of filter unit 12 during the above processes, the particles increases a draining time abnormally, and may clog drain passage 10A or drain hose 6. In order to remove the particles collected on filter 34 or to replace filter 34 with a new filter, the inside of filter case 39 of filter unit 12 communicates with the outside. Conventional washing machines 501 and 502 shown in Figs. 4 to 7 may discharge water from a filter unit if cap 31 is not fixed at a predetermined position. Washing machine 1001 prevents the washing water from leaking to the outside and allows the particles to be removed from filter 34 even when the inside and the outside of filter unit 12 communicate with each other. Thus, drum type washing machine 1001 can safely wash the laundry while preventing water from leaking.

Claims

1. A drum type washing machine comprising:

a rotatable drum adapted to store a laundry;
a water tub accommodating the rotatable drum rotatably therein, the water tub having a drain opening through which water is discharged;
a drain valve operable to discharge and stop the water from the drain opening of the water tub;
a drain pump for sending water discharged from the drain valve to an outside of the drum type washing machine;
a controller controlling the motor, the drain valve, and the drain motor so as to executes a washing process for washing the laundry, a rinsing process for rinsing the laundry, and a draining process for discharging the water;
an indicator connected to the controller; and
a filter unit including

a filter case provided between the drain valve and the drain pump, the filter case has an inside communicating with the drain valve and the drain pump, the filter case having a fixing opening communicating between the inside and an outside of the filter case,

a filter accommodated in the inside of the filter case, the filter trapping particles contained in the water discharged from the drain valve,

a cap operable to seal the fixing opening upon being at a predetermined position, the cap being operable by a user,

a magnetic body mounted to the cap, and a reed switch activated by the magnetic body to outputs an activation signal to the controller when the cap is located at the predetermined position, and deactivated to output a deactivation signal to the controller when the cap is not at the predetermined position, wherein

the controller is operable to

when determining that the reed switch outputs the deactivation signal while executing a process out of the washing process and the rinsing process, stop the process out of the washing process and the rinsing process, and display a predetermined indication on the indicator, and

when determining that the reed switch outputs the deactivation signal while executing the draining process, stop the draining process, display the predetermined indication on the indicator, close the drain valve, and drive the drain pump.

2. The drum type washing machine according to claim 1, wherein the controller is operable to restart the process out of the washing process and the rinsing process from a stage of the stopped process when determining that the reed switch outputs the activation signal after stopping the process out of the washing process and the rinsing process when determining that the reed switch outputs the deactivation signal while executing a process out of the washing process and the rinsing process, and open the drain valve when determining that the reed switch outputs the activation signal after stopping the draining process and close the drain valve when determining that the reed switch outputs the deactivation signal while executing the draining process.
3. The drum type washing machine according to claim 1, further comprising a sealing ring for sealing the cap and the filter case.

4. The drum type washing machine according to claim 1, further comprising:

a housing for accommodating the water tub therein; and
a water supplier for supplying water into the water tub.

FIG. 1

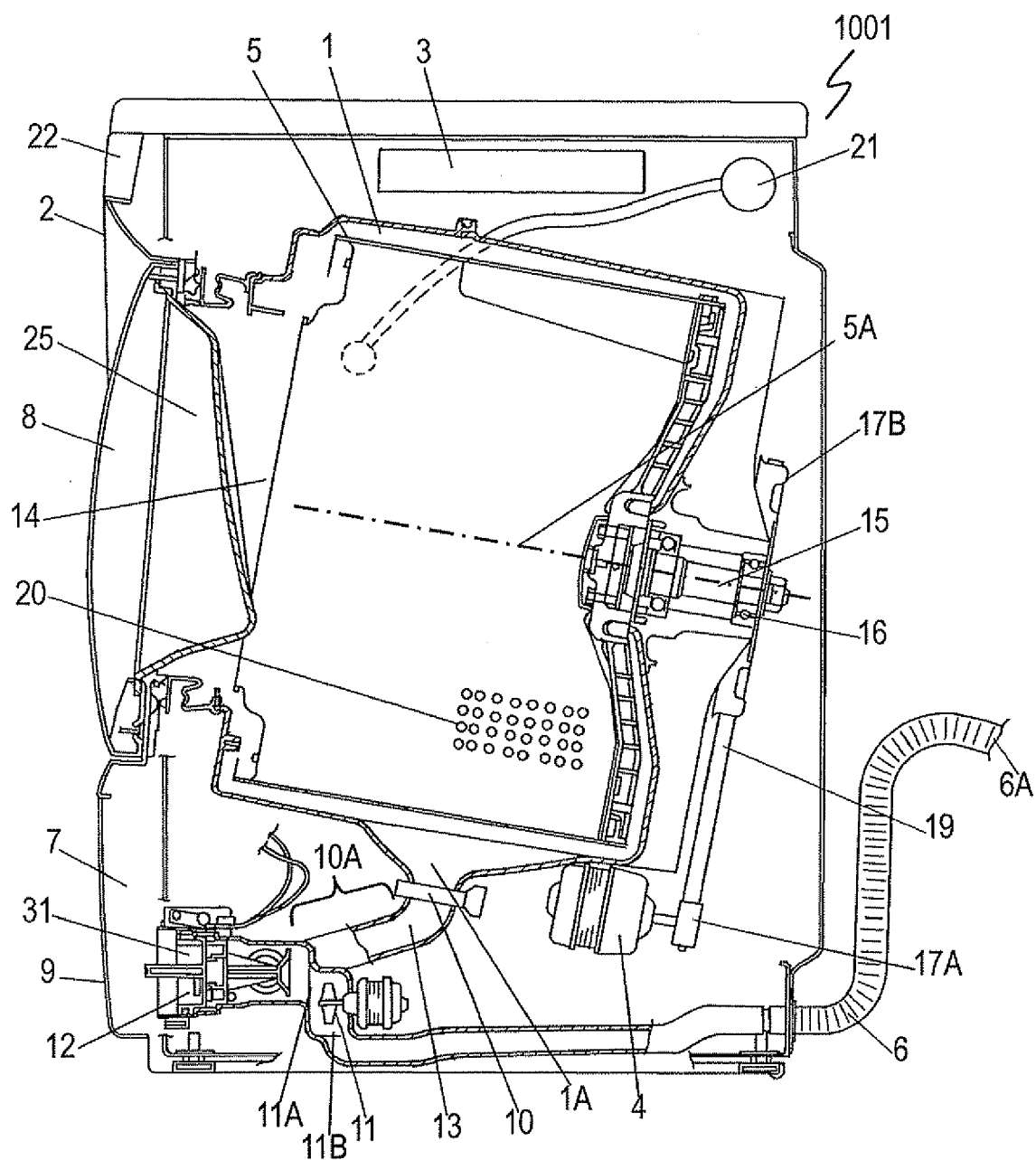


FIG. 2A

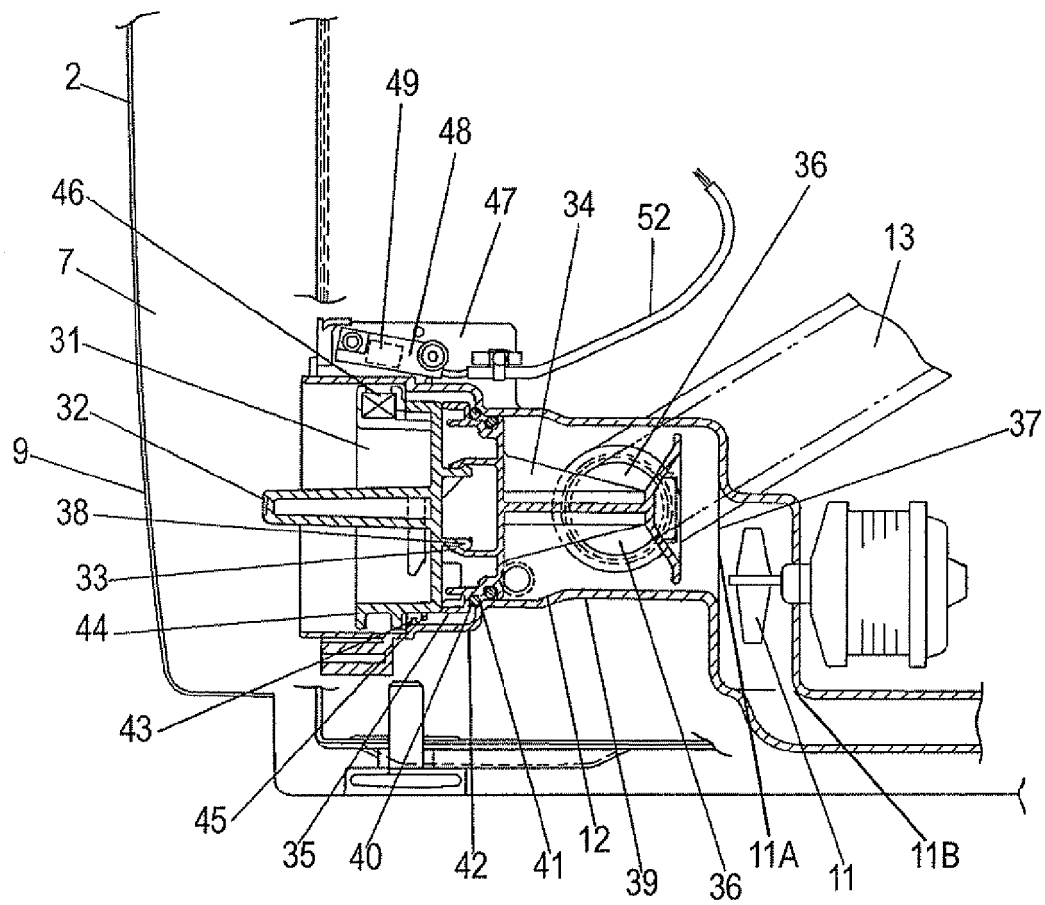


FIG. 2B

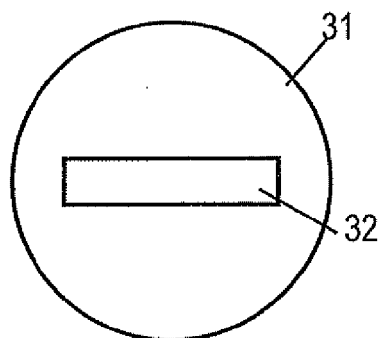


FIG. 3A

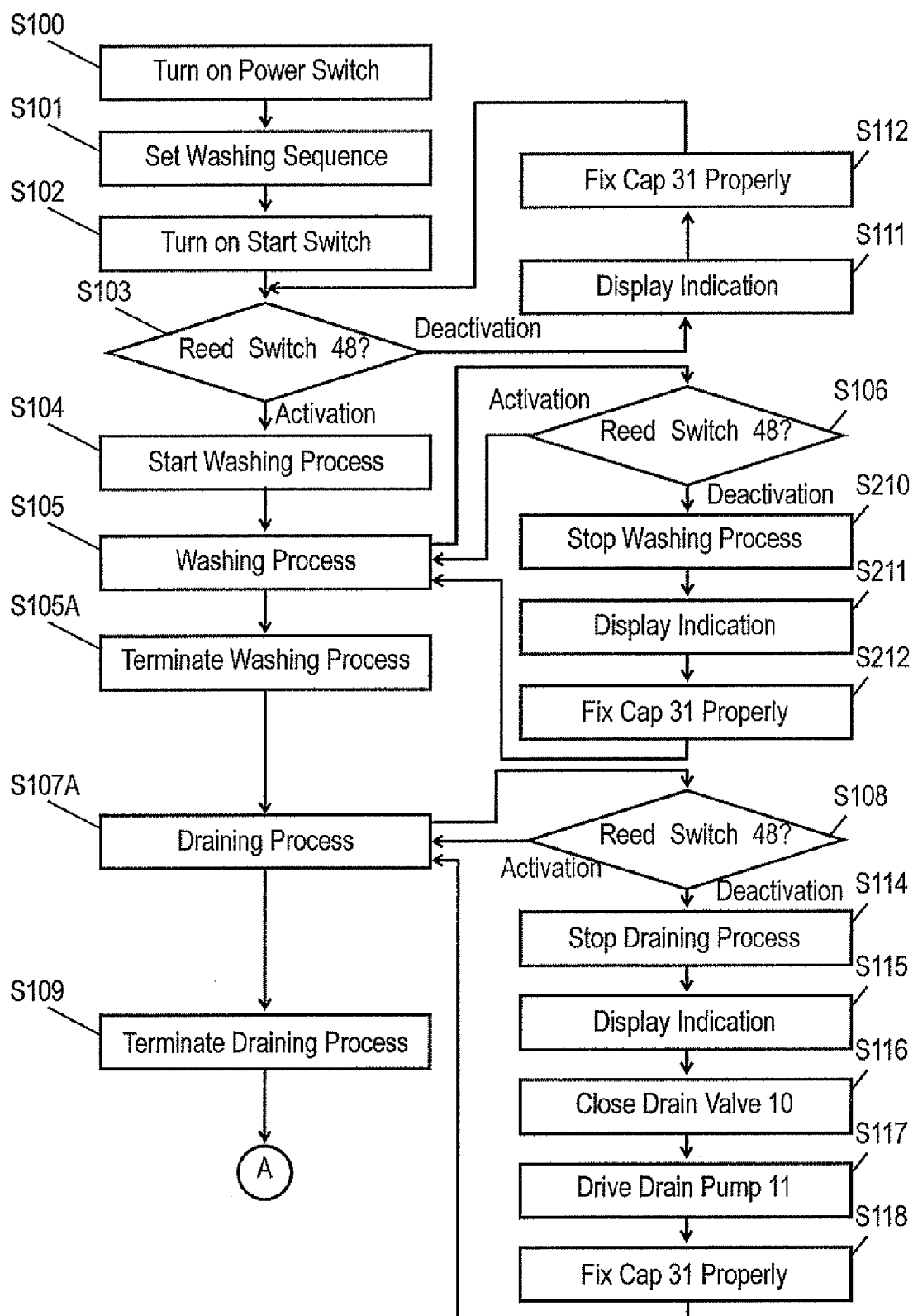


FIG. 3B

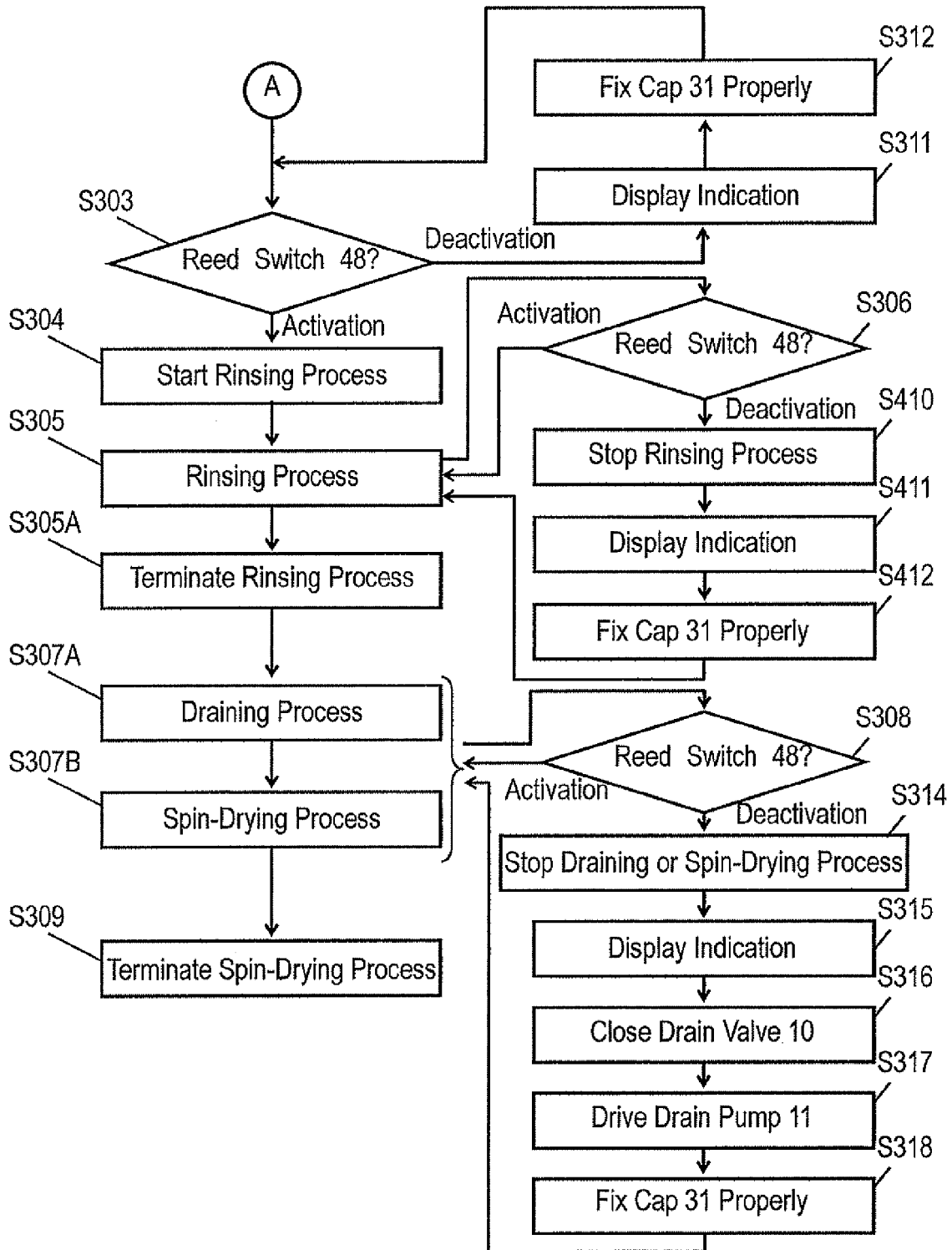


FIG. 4

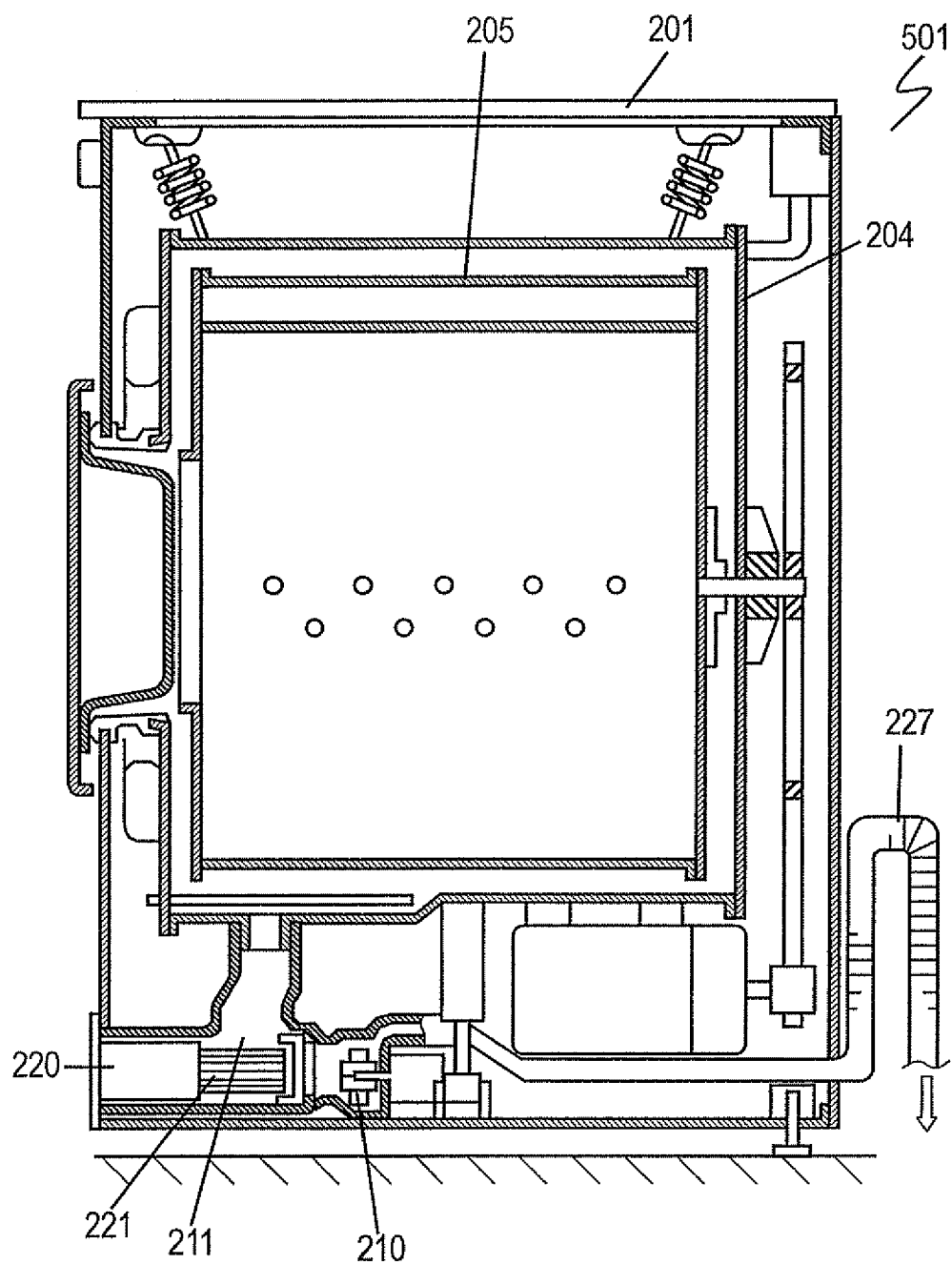


FIG. 5

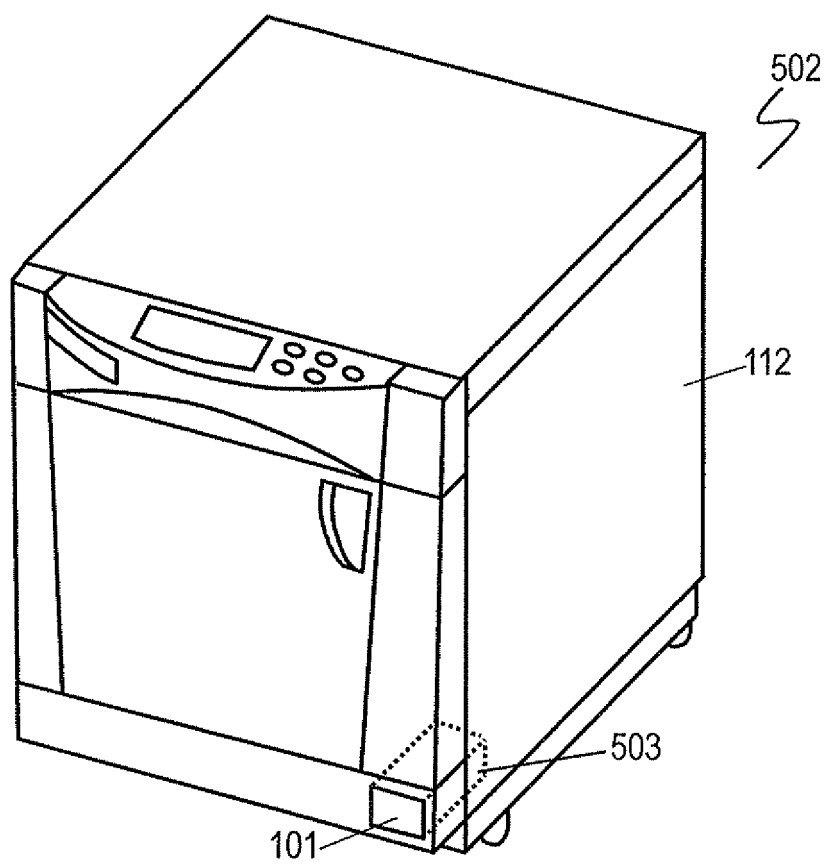


FIG. 6

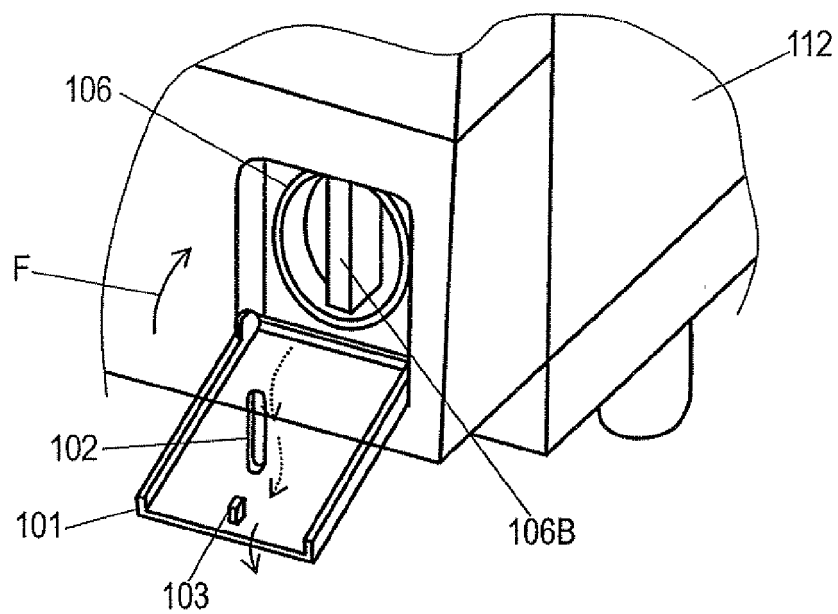
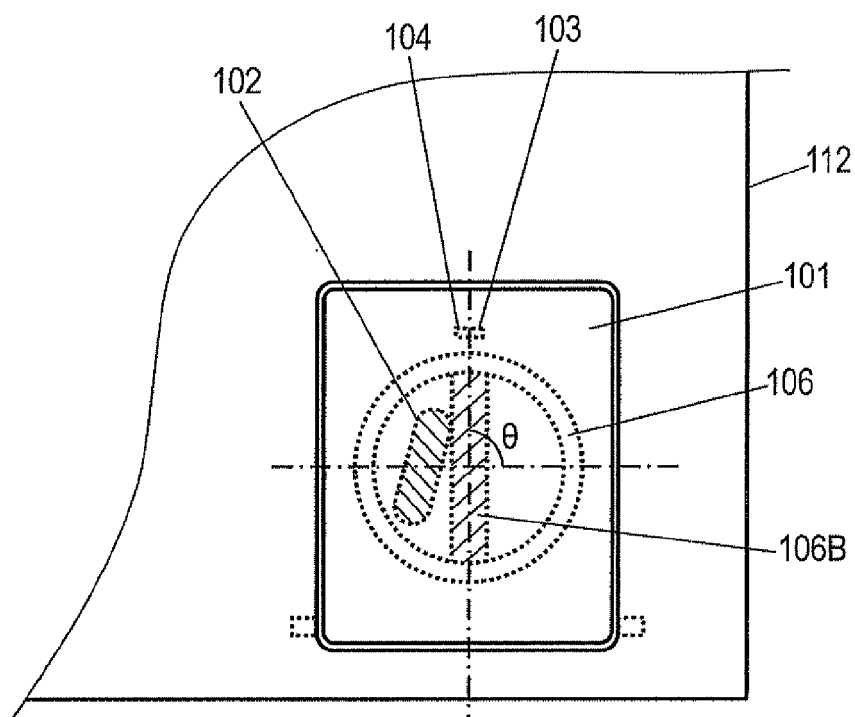


FIG. 7



REFERENCES CITED IN THE DESCRIPTION

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