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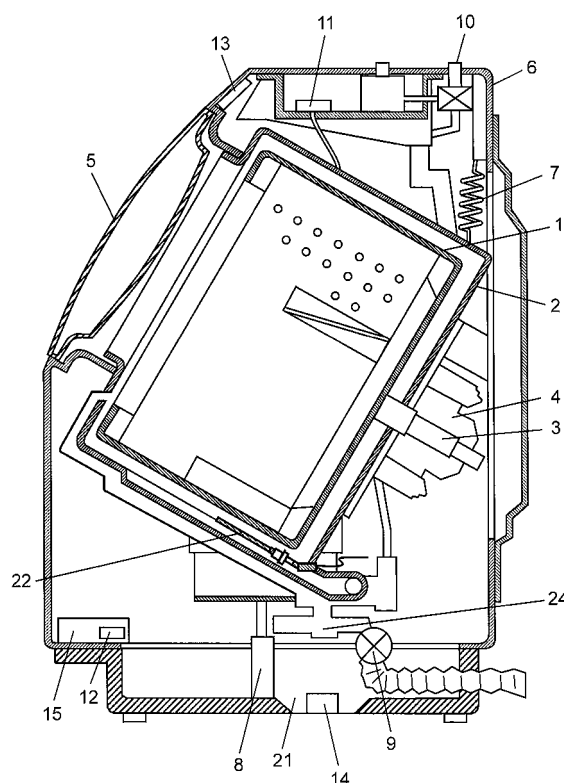
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(54) **Drum type washing machine**

(57) A drum type washing machine including a rotary drum (1), a water receiving tank (2) elastically supported by the washing machine main body (6) and rotatably incorporating the rotary drum (1), a motor (4) for rotating and driving the rotary drum (1), a water feeding part (10) for feeding washing water into the water receiving tank (2), a water level detector (11) for detecting the water level of the washing water, a water discharging part (9) for discharging the washing water, an input setting and display part (13) for setting the strokes of washing, rinsing, and dewatering, a water leak detector (14) for detecting water leak in the washing machine main body (6) provided in the bottom plate (21) in the lower part of the washing machine main body (6), and a control part (12) for controlling the motor (4), the water feeding part (10), the water level detector (11), and the water discharging part (9) based on the stroke setting determined by the input setting and display part (13), thereby executing the washing operation, in which the control part (12) stops the washing operation and notices abnormality when water leak is detected by the water leak detector (14).

FIG. 1



Description

FIELD OF THE INVENTION

[0001] The present invention relates to a drum type washing machine.

BACKGROUND OF THE INVENTION

[0002] Fig. 3 is a sectional view of a conventional washing machine disclosed in Japanese Patent Unexamined Publication No. H7-685. As shown in Fig. 3, waterproof pan 101 has a drain port, and a drain hose of the washing machine is inserted into the drain port to discharge water. Outer case 102 of the washing machine is a frame body of the washing machine including the surrounding of its internal mechanism. Outer case 102 has opening 103 at its bottom, and communicates with the inside of waterproof pan 101 by way of opening 103.

[0003] The inside of outer case 102 incorporates tank 106 composed of outer tank 104 and inner tank 105. Outer tank 104 is supported by plural sets (only one set is shown) of elastic suspension mechanisms 107. The plural sets of elastic suspension mechanisms 107 individually have suspension rod 108 and spring 109. Elastic suspension mechanisms 107 are designed to allow oscillation of tank 106, and allow descent depending on the weight of the content in tank 106.

[0004] Agitator 110 is disposed in the bottom of inner tank 105. Inner tank 105 is attached to outer tank 104 by means of screws 113, with support plate 112 attached to a plurality of boss parts 111 in the outer lower part. Motor 114, mechanical part 115, and water level detector 116 are attached to support plate 112. The signal from water level detector 116 is sent into control device 130.

[0005] In this configuration, the remaining water not discharged due to clogging off an indoor discharge piping ahead from the drain port of waterproof pan 101, and the water due to leak from inside of the washing machine are collected inside of waterproof pan 101, and the water level is raised gradually. This water level is detected by water level detector 116, and the detected signal is sent to control device 130. In response, control device 130 stops the operation (stops water discharge) based on the input signal from water level detector 116, thereby noticing abnormality.

SUMMARY OF THE INVENTION

[0006] However, in water level detection by waterproof pan 101 of the conventional washing machine, for example, when the drum type washing machine is installed in parallel to the kitchen in built-in type (such as the kitchen in one-room apartment house), water cannot be collected, and the water level cannot be detected. Or when the washing machine is installed in a bath room, or the waterproof pan cannot be installed, water cannot be collected, and the water level cannot be detected.

[0007] Or the water leaking out from the washing machine may drop on the floor and soak the floor, possibly corroding the floor, and damages may be caused. If any other component for collecting water is used in place of the waterproof pan, when the water level (water leak) is detected, if discharge of water is stopped while water is contained in tank 106, water may leak out due to breakdown of tank 106, and water leak continues and finally flooding may occur.

[0008] Accordingly, the drum type washing machine of the present invention includes a rotary drum having a rotation center axis in the horizontal direction or a direction inclined from the horizontal direction, a water receiving tank elastically supported by the washing machine main body and rotatably incorporating the rotary drum, a motor for rotating and driving the rotary drum, a water feeding part for feeding washing water into the water receiving tank, a water level detector for detecting the water level of the washing water, a water discharging part for discharging the washing water, an input setting and display part for setting the strokes of washing, rinsing, and dewatering, a water leak detector for detecting water leak in the washing machine main body provided in the bottom plate in the lower part of the washing machine main body, and a control part for controlling the motor, the water feeding part, the water level detector, and the water discharging part based on the stroke setting determined by the input setting and display part, thereby executing the washing operation, in which the control part stops the washing operation and notices abnormality when water leak is detected by the water leak detector.

[0009] The drum type washing machine having such configuration is capable of detecting water leak into the washing machine, preventing further spreading disaster by water leak, avoiding water leak to outside from the washing machine main body, and informing the user of occurrence of abnormality.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 is a sectional view of a drum type washing machine in a preferred embodiment of the present invention.

Fig. 2 is a block circuit diagram of part of the drum type washing machine.

Fig. 3 is a sectional view of a conventional washing machine.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0011] A drum type washing machine in a preferred embodiment of the present invention is specifically described below while referring to the accompanying drawings. It must be noted, however, that the present invention is not limited to the illustrated preferred embodiment

alone.

(Preferred embodiment)

[0012] Fig. 1 is a sectional view of a drum type washing machine in a preferred embodiment of the present invention. As shown in Fig. 1, rotary drum 1 is rotatably disposed in water receiving tank 2. In the center of rotation of rotary drum 1, rotation shaft (rotation center shaft) 3 is disposed in a direction inclined from the horizontal direction. Rotary drum 1 is disposed by inclining the axial center direction downward toward the back side from the front side. Motor 4 attached to the back side of water receiving tank 2 is coupled to rotation shaft 3, and rotary drum 1 is rotated and driven in normal and reverse directions by means of motor 4.

[0013] An opening provided in an upward slope at the front side of water receiving tank 2 is covered with lid body 5 so as to be freely opened and closed. By opening lid body 5, the laundry can be put in or out of rotary drum 1. Since lid body 5 is provided in the upward slope, when putting in or out the laundry, it is easy to handle without lowering the waist position.

[0014] Water receiving tank 2 is oscillatably suspended and supported from washing machine main body 6 by spring body 7 and damper 8. On the way of the drain passage from the bottom of water receiving tank 2, detachable lint filter 24 and water discharging part 9 are disposed, and the washing water from water receiving tank 2 is discharged. That is, lint filter 24 is installed from the bottom of water receiving tank 2 to water discharge part 9.

[0015] Water feeding part 10 supplies tap water as washing water into water receiving tank 2. Water level detector 11 detects the water level of the washing water in water receiving tank 2.

[0016] In the preferred embodiment of the present invention, rotation shaft 3 is installed in a direction inclined roughly from the center of rotation of rotary drum 1, and the axial center direction of rotary drum 1 disposed by inclining downward toward the back side from the front side. However, rotation shaft 3 may be provided nearly in the horizontal direction of the center of rotation of rotary drum 1, and the axial center direction of rotary drum 1 may be disposed nearly in the horizontal direction.

[0017] In the lower part of washing machine main body 6, control part 12 is provided, and in the upper front part of washing machine main body 6, input setting and display part 13 for setting a series of strokes from washing, rinsing, and dewatering is disposed. Control part 12 controls the operation of motor 4, water discharging part 9, water feeding part 10, and water level detector 11 when operation is started based on the information from input setting and display part 13, and starts operation of washing, rinsing, and dewatering.

[0018] Water discharging part 9 for discharging the washing water may be realized, for example, by drain valve or the like, but a drain pump may be used. Or both

may be used, and they may be combined depending on the environment of use of the washing machine.

[0019] The lower bottom plate of washing machine main body 6 is provided with water leak detector 14 disposed at a position appropriate for detecting water leak. Water leak detector 14 detects water leak inside of washing machine main body 6. Water leak detector 14 is composed of, for example, two electrodes, and water leak is detected by a potential difference between these electrodes. That is, if leaking water deposits between the electrodes, the potential difference is eliminated, and water leak is detected.

[0020] Fig. 2 is a block circuit diagram of part of the drum type washing machine in the preferred embodiment of the present invention. Control circuit 15 is composed of control part 12 formed of a microcomputer, input circuit 16, motor drive circuit 17, and switching part drive circuit 18. Control part 12 sends out various display signal to input setting and display part 13, and also controls the rotation of motor 4 by way of motor drive circuit 17. That is, based on the stroke setting determined by input setting and display part 13, control part 12 controls motor 4, water feeding part 10, water level detector 11, and water discharging part 9, and carries out the washing operation.

[0021] Control circuit 15 controls switching part 19 by way of switching part drive circuit 18, and controls the operations of water feeding part 10, water discharging part 9, and lid lock device 20. Lid lock device 20 prohibits opening and closing of lid body 5 for covering the opening as the laundry inlet provided in water receiving tank 2 during operation. Lid lock device 20 is composed of a solenoid and a lever.

[0022] Control part 12 receives various operation signals from input setting and display part 13, and also receives detection signals from water level detector 11 and water leak detector 14 by way of input circuit 16, and detection signals showing the detached or attached state of lint filter 24.

[0023] In the drum type washing machine having such configuration, the operation and action are explained below. By opening lid body 5, the laundry is put into rotary drum 1, and lid body 5 is closed, and the strokes are set in the input setting and display part 13, and the operation is started. Control part 12 sets an appropriate water level depending on the weight of the laundry, and controls water feeding part 10, and water is supplied into rotary drum 1 and water receiving tank 2. The water level is detected by water level detector 11, and when reaching a predetermined water level, water feeding is stopped, and motor 4 is controlled, and rotary drum 1 is put into rotation, and the washing stroke is started.

[0024] After finishing the washing stroke, water discharging part 9 is controlled, and the washing water is discharged. At this time, the washing water passes through lint filter 24, and lint is captured. This operation is the same during rinsing stroke or in water discharge process before the dewatering stroke. After the dewatering stroke, water feeding part 10 is controlled again, and

water is supplied into rotary drum 11 and water receiving tank 2.

[0025] The water level is detected by water level detector 11, and when reaching a predetermined water level, supply of water is stopped, and motor 4 is controlled, and rotary drum 1 is put into rotation, and the rinsing stroke is started. After finishing the rinsing stroke, water discharging part 9 is controlled, and the water after rinsing is discharged, and a dewatering stroke is executed finally, and the operation is finished.

[0026] Control part 12 continues to monitor input signals from water leak detector 14 all the time from start of operation until the operation is terminated and the power source is turned off, including the initial waiting time right after the power switch is turned on. For example, water escaping from cracks or breakage in water receiving tank 2 and water feeding part 10, or water leaking from cracks in the pressure hose with water feed valve may drop into the bottom plate, flow into the portion of throttling shape 21 provided in the bottom plate, and gather in the location of water leak detector 14.

[0027] Meanwhile, the pressure hose with water feed valve has a double structure, having a water feeding hose in the inside, and a wiring for controlling the water feed valve attached to the faucet side communicating between the water feeding hose and the outside covering. Accordingly, if the water feeding hose is cracked, the leaking water runs through the outside covering, and flows into the washing machine.

[0028] Control part 12 immediately stops water feeding and rotation of rotary drum 1 when receiving a detection signal of water leak state, and notices abnormality after discharging water. Herein, the abnormality is noticed by emitting an alarm sound from a sound generating device or the like, so that the user is informed of the occurrence of abnormality.

[0029] The location of water leak detector 14 is not limited to the bottom plate, and an appropriate position may be selected depending on the state of each product. The input signal from water leak detector 14 may not be always monitored, but the input signal may be monitored at an appropriate timing as far as water leak can be detected securely.

[0030] Throttling plate 21 of the bottom plate may be formed in an appropriate shape so that the water may be collected at an intended place depending on the state of each product. If necessary, not limited to the bottom plate, a guide shape throttle may be provided at the side face or the like so that the water may flow in easily.

[0031] In this way, water leak detector 14 for detecting water leak into the main body is disposed in the bottom plate of the washing machine, and when water leak detector 14 detects water leak, control part 12 immediately stops the operation (water feeding and drum rotation). Consequently, the water in water receiving tank 2 is discharged, and abnormality is detected, and any water leak into the washing machine can be detected, and water can be discharged. Accordingly, further spread of disas-

ter by water leak can be prevented, and without allowing water leak to outside from washing machine main body 6, the user may be safely informed of occurrence of abnormality.

[0032] As shown in Fig. 1 and Fig. 2, in the lower part of rotary drum 1, heater 22 is provided for heating the washing water supplied into water receiving tank 2, and control part 12 is controlling the operation of heater 22. Near heater 22, temperature detector 23 is provided for detecting the temperature of the heated washing water, and the detected signal is fed into control part 12 by way of input circuit 16.

[0033] In this configuration, after charging of the laundry, the washing stroke by warm water is set by input setting and display part 13, and the operation is started. Control part 12 controls water feeding part 10, and water is supplied into rotary drum 1 and water receiving tank 2. Consequently, control part 12 detects water level by water level detector 11, and supply of water is stopped when reaching a predetermined water level. Further, control part 12 controls motor 4, rotates rotary drum 1, and executes the washing stroke.

[0034] During the washing stroke, control part 12 controls heating part 22 so as to reach the preset water temperature depending on the detection signal from temperature detector 23. During operation of heating part 22, that is, during the washing stroke by warm water, if water leak is detected by water leak detector 14, the washing operation is stopped immediately, and water feeding and agitation operation is started, and the washing water is cooled to less than a specified temperature, and thereby the water is discharged.

[0035] However, in the event of trouble of water feeding part 10, by controlling motor 4 in water receiving tank 2 to carry out agitation operation, the high temperature water and clothes are cooled. By detection signal from temperature detector 23, when temperature detector 23 detects that the temperature of washing water is below a specified temperature, the washing water in water receiving tank 2 is discharged, and the lid lock is released and abnormality is detected.

[0036] The water temperature of washing water may be judged according to appropriate conditions so as to be less than a specified temperature.

[0037] Thus, during washing operation in high-temperature water, if water leak detector 14 detects water leak, the operation of the drum type washing machine is stopped immediately. In the event of trouble of water feeding part 10, by agitating operation and cooling, when the temperature of the washing water drops below a specified temperature, the water in water receiving tank 2 is discharged, and abnormality is noticed. As a result, the water can be safely discharged from the drum type washing machine, and occurrence of abnormality can be noticed.

[0038] During operation of heating part 22, that is, during washing stroke by using high-temperature water, when water leak is detected by water leak detector 14,

if motor 4 is defective, water feeding part 10 is controlled, and water is supplied into water receiving tank 2, and by water feeding operation, the high-temperature water and clothes are cooled. That is, by the detection signal from temperature detector 23, when the temperature of the washing water becomes lower than a specified temperature, the washing water in water receiving tank 2 is discharged, and the lid lock is released, and the abnormality is noticed.

[0039] In this manner, when water leak is detected by water leak detector 14 during washing operation in high-temperature water, the washing operation of the drum type washing machine is stopped immediately. If motor 4 is defective, by cooling by water feeding operation, when the temperature of the washing water becomes lower than a specified temperature, the water in water receiving tank 2 is discharged, and the abnormality is noticed.

[0040] During operation of heating part 22, that is, during washing stroke by using high-temperature water, when water leak is detected by water leak detector 14, if water discharging part 9 is defective, motor 4 and water feeding part 10 are controlled, and water is supplied into water receiving tank 2, and water receiving tank 2 is agitated. That is, by water feeding operation and agitating operation, the high-temperature water and clothes are cooled, and by the detection signal from temperature detector 23, when the temperature of the washing water becomes lower than a specified temperature, lid lock 20 is released, and the abnormality is noticed.

[0041] In this manner, when water leak is detected by water leak detector 14 during washing operation in high-temperature water, the washing operation of the drum type washing machine is stopped immediately. If discharging part 9 is defective, by cooling by water feeding operation and agitating operation, when the temperature of the washing water becomes lower than a specified temperature, lid lock 20 is released, and the abnormality is noticed.

[0042] During operation of heating part 22, that is, during washing stroke by using high-temperature water, when water leak is detected by water leak detector 14, motor 4 and water feeding part 10 are controlled, and water is supplied into water receiving tank 2, and water receiving tank 2 is agitated. By water feeding operation and agitating operation, the high-temperature water and clothes are cooled. When the temperature of the washing water becomes lower than a specified temperature and the water in water receiving tank 2 is discharged, if detachable lint filter 24 has been detached, the washing operation of the drum type washing machine is stopped, and the abnormality is noticed. After lint filter 24 is put back by the user, successively, motor 4 and water feeding part 10 are controlled, and water supply and agitation are started. When the temperature of the washing water becomes lower than a specified temperature and the water in water receiving tank 2 is discharged, lid lock 20 is released, and the abnormality is noticed.

[0043] Thus, during washing operation in high-temperature water, if water leak detector 14 detects water leak, by cooling by water feeding operation and agitating operation, the water temperature of the washing water is cooled below a specified temperature. When discharging the water in water receiving tank 2, if detachable lint filter 24 provided on the way of the discharge route is detached, the washing operation of the drum type washing machine is stopped, and the abnormality is noticed. Therefore, if lint filter 24 has been detached, the high-temperature water and clothes in water receiving tank 2 are cooled, and without allowing water leak from the detached portion of lint filter 24, the user is informed of occurrence of the abnormality. When lint filter 24 is put back, the water may be discharged safely, and the abnormality is noticed.

Claims

1. A drum type washing machine comprising:

a rotary drum having a rotation center axis in a horizontal direction or a direction inclined from the horizontal direction;
a water receiving tank elastically supported by a washing machine main body and rotatably incorporating the rotary drum;
a motor for rotating and driving the rotary drum;
a water feeding part for feeding washing water into the water receiving tank;
a water level detector for detecting the water level of the washing water in the water receiving tank;
a water discharging part for discharging the washing water;
an input setting and display part for setting strokes of washing, rinsing, and dewatering;
a water leak detector for detecting water leak in the washing machine main body provided in a bottom plate in a lower part of the washing machine main body; and
a control part for controlling the motor, the water feeding part, the water level detector, and the water discharging part based on the stroke setting determined by the input setting and display part, thereby executing washing operation,

wherein the control part stops the washing operation and notices abnormality when water leak is detected by the water leak detector.

2. The drum type washing machine of claim 1, further comprising:

a heating part provided at a lower part of the rotary drum for heating the washing water; and
a temperature detector disposed near the heat-

ing part for detecting the water temperature of the washing water,

wherein in a case where the water leak detector detects the water leak during operation of the heating part, the washing operation is stopped, and if the water feeding part is defective, the water receiving tank is agitated, and when the temperature detector detects that the water temperature becomes lower than a specified temperature, the washing water is discharged, and the abnormality is noticed.

3. The drum type washing machine of claim 1, further comprising:

a heating part provided at a lower part of the rotary drum for heating the washing water; and a temperature detector disposed near the heating part for detecting the water temperature of the washing water,

wherein in a case where the water leak detector detects the water leak during operation of the heating part, the washing operation is stopped, and if the motor is defective, water is supplied into the water feeding tank, and when the temperature detector detects that the water temperature becomes lower than a specified temperature, the washing water is discharged, and the abnormality is noticed.

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

a heating part provided at a lower part of the rotary drum for heating the washing water; and a temperature detector disposed near the heating part for detecting the water temperature of the washing water,

wherein in a case where the water leak detector detects the water leak during operation of the heating part, the washing operation is stopped, and if the water discharging part is defective, water is supplied into the water feeding tank and the water feeding tank is agitated, and when the temperature detector detects that the water temperature becomes lower than a specified temperature, the abnormality is noticed.

5. The drum type washing machine of claim 2 or 3, wherein if a detachable lint filter provided on the way of a route from a bottom of the water receiving tank to the water discharging part has been detached when discharging the washing water, the washing operation is stopped, and the abnormality is noticed.

FIG. 1

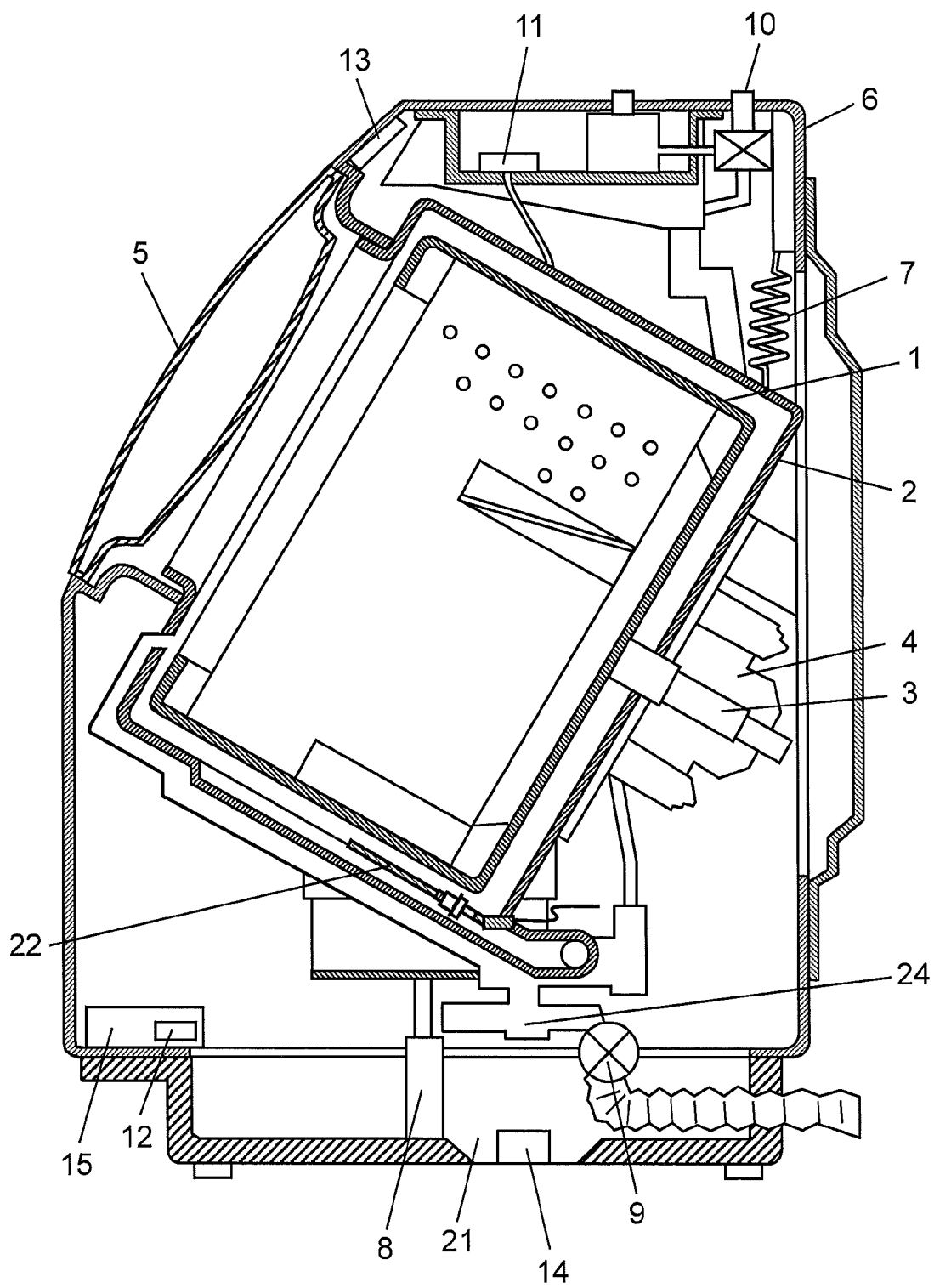


FIG. 2

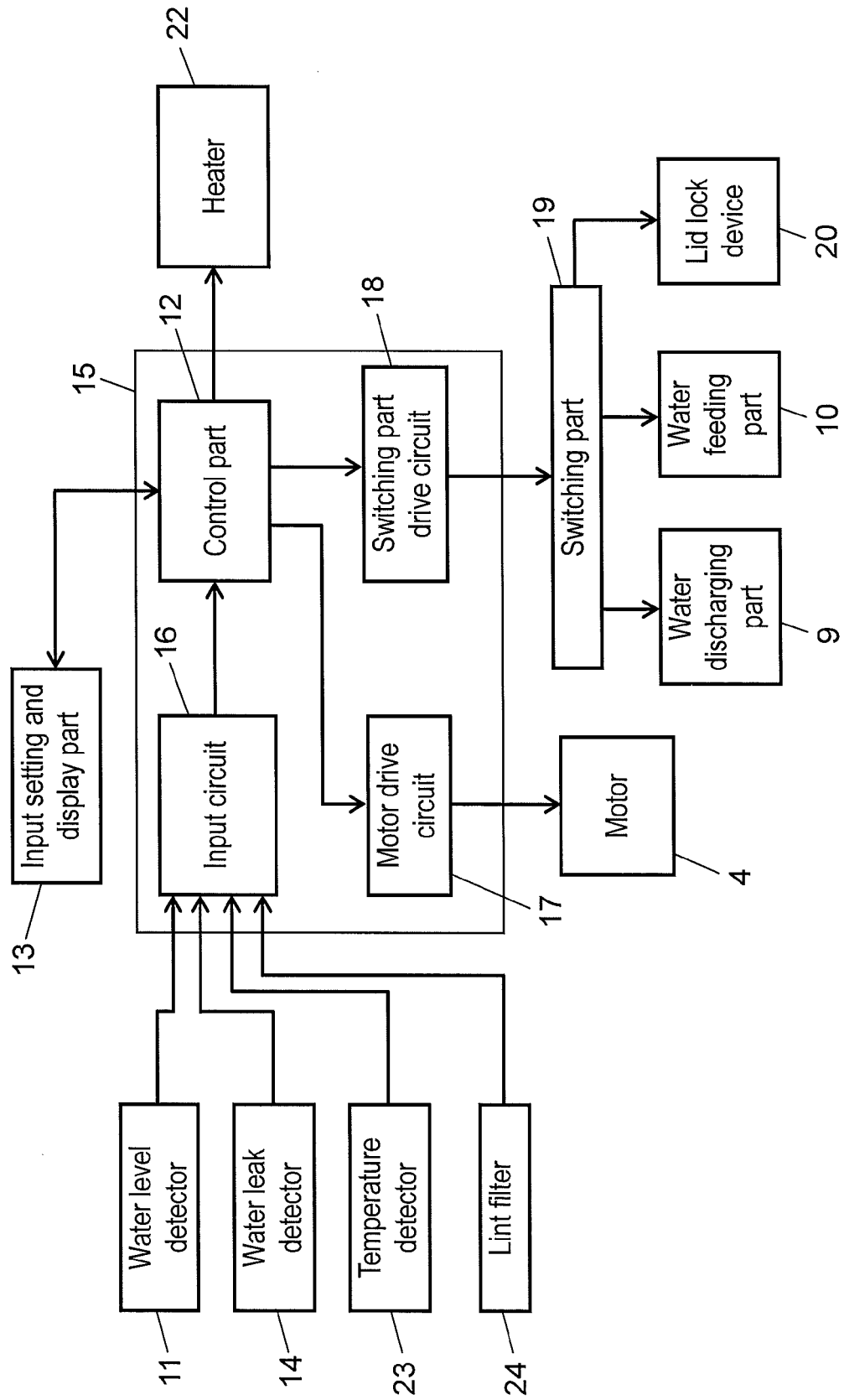
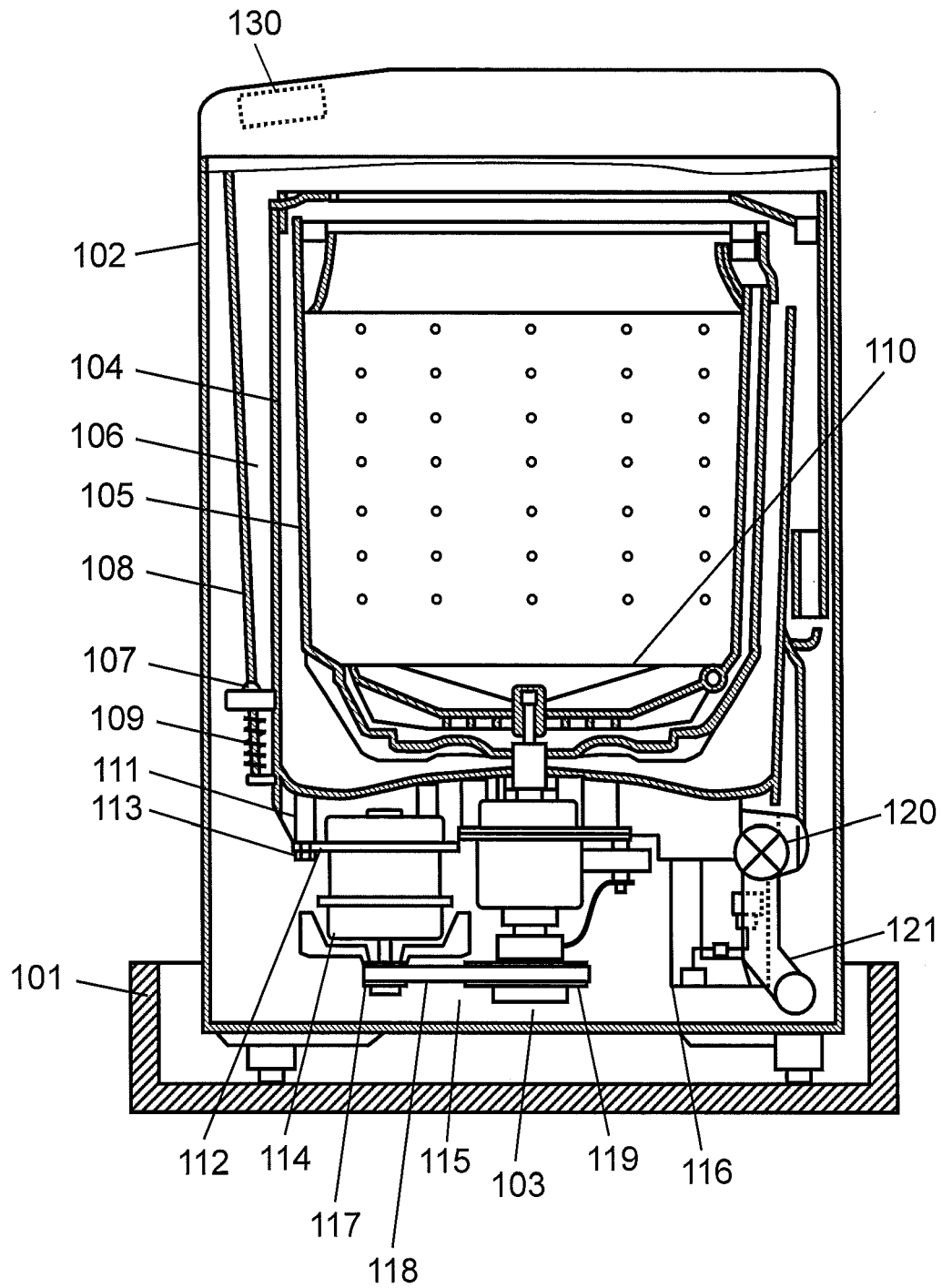


FIG. 3





EUROPEAN SEARCH REPORT

Application Number
EP 10 15 0045

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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1	Place of search Munich	Date of completion of the search 2 June 2010	Examiner Clivio, Eugenio
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 10 15 0045

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