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(54) **METHOD FOR OPERATING A LAUNDRY TREATMENT MACHINE AND A LAUNDRY TREATMENT MACHINE**

VERFAHREN ZUM BETRIEB EINER WÄSCHEBEHANDLUNGSMASCHINE UND
WÄSCHEBEHANDLUNGSMASCHINE

PROCÉDÉ DE FONCTIONNEMENT D'UNE MACHINE DE TRAITEMENT DE LINGE, ET MACHINE
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Description

Field of the invention

[0001] The invention relates to a method for operating a laundry treatment machine and a laundry treatment machine. In particular, it relates to a method in which a delayed start of the washing routine is conducted.

Background Art

[0002] Nowadays the use of laundry treatment machines is widespread, which are for "simple" laundry washing machines (i.e. laundry washing machines which can only wash and rinse laundry) and laundry washing-drying machines (i.e. laundry washing machines which can also dry laundry), or drying machines (i.e. drying machines which can dry laundry).

[0003] Washing machines in households, also called domestic washing machines, are well-known and usually are used for washing laundry. Washing machines usually comprise washing tubs in which a rotatable drum is housed for receiving goods to be washed, usually laundry. Washing liquid is introduced into the washing tub, which washing liquid consists only of water or mainly of water and detergents or washing or cleaning agents added to or dissolved in the water for improving the washing quality.

[0004] In the present description the term "laundry treatment machine" will refer to simple laundry washing machines or laundry washing-drying machines (washer/dryers). Laundry treatment machines such as washing or washing-drying machines generally comprise an external casing provided with a washing tub which contains a rotatable perforated drum where the laundry is placed. A loading/unloading door ensures access to the drum. Laundry treatment machines typically comprise a water supply unit and a products supply unit or detergent feeding device, preferably a drawer, for the introduction of water and washing/rinsing products (i.e. detergent, softener, rinse conditioner, etc.) into the tub. Known laundry treatment machines are also provided with water draining devices that may operate during different phases of the washing program to drain the dirty water from the tub.

[0005] According to the known art, a complete laundry treating program / cycle typically includes different phases during which the laundry to be washed is subjected to adequate treatments. A laundry treating cycle usually comprises a main washing phase during which the laundry is treated by means of water and a detergent. The water is typically heated to a predetermined temperature based on the washing program selected by the user. It is also possible that hot water is introduced into the tub from the hot water mains. During the main washing phase the drum is rotated, so as to apply also a mechanical cleaning action on the laundry. At the end of the main washing phase the drum is typically rotated at high rotational speed, so in such a way that dirty washing liquid

(i.e. water mixed with detergent) is extracted from the laundry, and this dirty washing liquid is drained to the outside by the water draining devices.

[0006] A laundry treatment cycle usually comprises one or more rinsing phases in which typically a rinsing product which is provided in a compartment of the dispenser / drawer is flushed into the tub together with fresh water or in which fresh water is flushed into the tub directly. These phases which are typically subsequent to a washing phase typically comprise one or more rinsing cycles/steps. In a rinsing cycle or phase, clean rinse water may be first added to the laundry. The rinse water is absorbed by the laundry and the rinse water removes from the laundry detergent and/or dirty water not previously removed by washing liquid in the main washing cycle. The drum is then rotated to extract water and dirty water/detergent from the laundry: the dirty water extracted is drained from the tub to the outside by the water draining devices.

[0007] Washing machines or washing-drying machines typically comprise a detergent dispenser or detergent feeding device, especially a drawer, which comprises at least one compartment for a laundry treatment agent such as detergent, rinsing agent, bleaching agent, softener. The detergent feeding device can comprise a compartment or box for both solid (i.e. powder) and liquid treatment agents, usually comprising a flap suitable to retain the liquid in case of liquid treatment agents provided on said compartment. Due to the required tolerances, and to the necessity to wash the bottom of the compartment, a small clearance must to be assured between the flap and the respective compartment; due to this clearance, in case of a delay start, the liquid starts leaking through the flap and starts flowing / dripping into the washing tub.

[0008] The WO 2011/018452 A1 describes a household appliance with a detergent compartment with a pivoting partition element in this compartment which is built as a flap.

[0009] Usually, before the start of laundry treating cycle, i.e. of the main washing step, a phase to calibrate a water level sensor which includes a draining step is provided, in which the tub is drained of liquid such that a reference signal or value of the water level sensor can be determined which corresponds to a tub with a zero liquid level, namely without liquid inside.

[0010] Some kinds of machines are provided with a delay start function; said function allows the user to set the start of the laundry treating cycle after a set time has been elapsed; usually, just after the setting of the delay start, the delay time, namely the time set by the user to postpone the start of the laundry treating cycle, triggers from the switch of a machine start command.

[0011] As known, when a delay start is programmed, the phase to calibrate a water level sensor including a draining step is provided just before the start of the laundry treating cycle, i.e. before the main washing step; due to the draining step, the liquid detergent provided on said

compartment which has dipped already into the tub due to the clearance between the flap and the liquid compartment, is drained in case of a delay start. When the washing step is then started, less liquid detergent is available for the washing cycle, yielding a laundry treatment with a loss of quality and a reduction of cleaning efficiency.

[0012] The WO 2011/019161 A2 discloses a method for operating a laundry treatment machine in which a delay start of the machine with a delay time interval is set, whereby the delay start is activated to start the washing procedure after the delay time interval. A washing step is conducted in which after the delay time interval the washing procedure is started and a draining step is conducted in which a draining pump is activated.

Summary of the invention

[0013] The aim of the invention is to provide a method for operating a laundry treatment machine in which a delay start of a washing process is performed without the loss of available liquid detergent into the drawer/tub.

[0014] It is a further aim of the invention to provide a laundry treatment machine which delivers a washing cycle with delay start with an optimized cleaning efficiency.

[0015] In a first aspect, the invention relates to a method for operating a laundry treatment machine comprising a washing tub for receiving laundry to be treated and a detergent feeding device and at least one draining pump connected to the tub, the draining pump being connected to a draining circuit for draining liquid collected in the tub when the draining pump is activated, whereby said detergent feeding device comprises at least one compartment adapted to receive liquid detergent, whereby said compartment comprises a closure means with a clearance, the method comprising

- a step of filling liquid laundry treatment agent into said detergent feeding device;
- a draining step in which the draining pump is activated;
- a delay start setting step in which a delay start of said machine with a delay time interval is set;
- a delay start activating step in which the delay start is activated to start the washing procedure after said delay time interval;
- a washing step in which after said delay time interval said washing procedure is started, whereby the draining step is conducted at / immediately after the delay start activating step, and whereby after said draining step during said delay time interval, no further draining of liquid from said tub is performed.

[0016] The invention is based on the consideration that a problem of known procedures to conduct a delay start is that a liquid laundry treatment agent, especially detergent, is not fully confined in the respective compartment until needed but is slowly dripping into the tub. When

after the delay interval the water level sensor is calibrated and water is drained from the tub, the treatment agent which has already entered the tub is drained / removed from the tub and is not available for the treatment of laundry. The amount of treatment agent needed for an adequate treatment of the laundry is therefore reduced, leading to a low-quality treatment of the laundry. This fact also results in a low-quality estimation of the washing machine by the user.

[0017] Applicant has found that the loss of laundry treatment agent can be considerably reduced or even completely avoided by conducting the draining step essentially immediately after the machine has been configured / programmed to conduct a washing step in a delay-start manner. The user typically fills the liquid laundry treatment agent into the dispenser right before she or he programmes the machine to perform a delay start.

[0018] The laundry treatment machine is preferably built as a washing machine or a washing/dryer, i.e. a combined washing and drying machine.

[0019] The detergent feeding device is preferably built as a drawer with at least one compartment for a laundry treatment product such as detergent, bleaching agent, rinsing agent, softener.

[0020] The detergent feeding device preferably comprises a compartment suitable for both a liquid treatment product and a powder treatment product, said compartment further comprising a closure means, preferable a movable flap, to close the compartment to collect said liquid treatment product and to open the chamber to collect said powder treatment product.

[0021] In the draining step, the draining of liquid from the tub is preferably conducted as a preparatory step or as a part of a calibration procedure of a water level sensor.

[0022] The delay start of the machine is preferably set by a user. Preferably, the laundry treatment machine comprises a user interface comprising at least one user interface element for setting the delay start. Most preferably, at least one display element such as an LCD display is arranged on the user interface to display the delay time which is set.

[0023] This setting of the delay start can be performed by setting an absolute time, at which the washing process / washing step should start. Alternatively, a time interval can be set after which the washing step is started.

[0024] In a first preferred embodiment, a delay interval is set by the user through his interaction with a user interaction element by which a timer /counter is set. The user interaction element preferably is built as a button and/or knob located on a user interface on the machine. The delay start interval is preferably set by rotating a rotatable knob. The button and the knob can be combined in a push-button. Alternatively, the delay time interval is set by interacting with keys or buttons on the user interface.

[0025] In a second preferred embodiment, a delay start absolute time is set by the user which can be achieved

by the user interface controls described above.

[0026] After the delay start interval has lapsed or when the absolute time is reached, the washing step is preferably started without any further action needed by the user.

[0027] Preferably, the time interval between the activating step and the draining step is small compared to the delay interval, especially less than $\frac{1}{4}$ or $\frac{1}{10}$ or even smaller. Especially preferably, the draining step is the next step being performed by the laundry treatment machine after the activating step.

[0028] The draining step is preferably performed entirely before the delay interval starts, i.e. it is preferably completed before start of the delay interval. In other words, preferably the delay interval starts running after the draining step has been performed and completed.

[0029] According to the invention, after the draining step and during the delay time interval, no further draining of liquid from the tub is performed. Most preferably, at least before the washing step no further draining of liquid from the tub is performed.

[0030] In a preferred embodiment, the draining step is part of a calibrating procedure for calibrating a water level sensor in which a reference level value is determined. The reference level preferably corresponds to an empty water level of the tub.

[0031] The water level sensor is a sensor which is configured to measure at least one quantity which can represent in a direct or indirect way the level of water and/or washing liquid in the tub.

[0032] Preferably, the water level sensor is a pressure sensor, especially a water pressure sensor. It can also be built or comprise a pipe.

[0033] Advantageously, between the calibrating procedure of the water level sensor and the washing step, no further calibration the said water level sensor is conducted.

[0034] The washing procedure preferably is started based on the determined reference level value of the water level sensor.

[0035] During the calibration procedure, preferably in a measuring step the water level is measured and in a setting step the value of the water level sensor is set to the reference level value representing an empty level of liquid in the tub.

[0036] The measuring and setting steps are advantageously conducted immediately after the draining step.

[0037] The measuring and/or setting steps preferably at least partially overlap in time with the draining step. The measuring step is preferably started during the draining step.

[0038] Advantageously, at least partially during the draining step, the signal of the water level sensor is observed and/or evaluated and/or processed. The signal can for example be observed and compared with an expected behaviour, which allows detecting malfunctioning or outage of the sensor. After a prescribed time interval during which the tub is drained by the draining pump, the

signal should assume a value which does not change anymore, whereby this value corresponds to the empty tub state. If the signal is still varying, a malfunction is identified, and the user can be notified. If the signal does not change at all during draining of the tub or is in a parameter range which lies outside the normal operating range, an outage or complete failure can be detected and the user can be notified.

[0039] Preferably, when/if during a predetermined time span during the draining step the signal varies more than in a tolerance band, an alarm is issued. The allowed variations are expressed as a tolerance band which is a parameter band, preferably with a lower and a higher border. The alarm can also be issued as described above if behaviour of the signal as a function of time decreases from an expected behaviour by more than a tolerance criterion.

[0040] The alarm is advantageously issued acoustically and/or visually, especially on a display of the washing machine.

[0041] The reference level value is preferably compared with a reference level value obtained in a previous calibration procedure, and whereby an alarm is issued if the new value differs from the old value by more than a predetermined tolerance band.

[0042] The delay time interval is advantageously larger than 10 minutes, especially larger than 15 minutes.

[0043] According to the invention, the detergent feeding device comprises at least one compartment adapted to receive liquid detergent, whereby the compartment comprises a closure means with a clearance.

[0044] The detergent feeding device preferably comprises at least one compartment adapted to receive both liquid and powder detergent, whereby the compartment comprises a closure means with a clearance.

[0045] The compartment preferably comprises a movable flap. The flap is preferably mounted on hinges in such a way that it can swing to the discharge side of the compartment when water is flushed into the compartment.

[0046] The compartment preferably comprises a removable flap. The flap can be preferably removed fully from the compartment and/or holding elements are provided in the compartment to which the user can attach the flap when it is not needed, especially when powder is filled into the compartment.

[0047] Preferably, the flap is moveable from a first position in which it retains liquid within the compartment to a second position in which it essentially allows a free passage of detergent/liquid from the compartment into the tub.

[0048] The flap preferably provides a clearance at the bottom of the compartment.

[0049] In a second aspect, the invention relates to a laundry treatment machine comprising a washing tub for receiving laundry to be treated and a detergent feeding device and at least one draining pump connected to said tub, said draining pump being connected to a draining

circuit for draining liquid collected in said tub when said draining pump is activated, further comprising a control unit in which a method according to one of the previous claims is implemented.

[0050] Preferably, the detergent feeding device is built as a drawer with at least one compartment for a laundry treatment product.

[0051] The advantages of the invention are especially as follows. Due to the fact that the draining of the tub for the sensor calibration is performed right after the delay start has been set and not again or immediately before the washing step, detergent which has leaked into the tub during the time interval before the washing step is not lost.

[0052] Since the leaking of detergent into the tub does not result in detergent loss, the liquid box in the dispenser into which the liquid is filled does not need to have a special seal, by which production costs for the box are reduced.

Brief description of the drawings

[0053] Further features and advantages of the present invention shall become clearer from the following detailed description of some of its preferred embodiments, made with reference to the attached schematic drawings and given as an indication and not for limiting purposes.

[0054] In particular, the attached drawings are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification. The drawings together with the description explain the principles of the invention. In the drawings, corresponding characteristics and/or components are identified by the same reference numbers. In these drawings:

- FIG. 1 shows a front-loading laundry washing machine in a perspective view;
- FIG. 2 shows the laundry washing machine according to FIG. 1 in a perspective view with the casing removed;
- FIG. 3 shows the laundry washing machine according to FIG. 1 in another perspective view with the casing removed;
- FIG. 4 shows a cross section of the laundry washing machine according to FIG. 1 without some components;
- FIG. 5 shows a view of a portion of the hydraulic circuit of the laundry washing machine according to FIG. 1;
- FIG. 6 shows the laundry washing machine of FIG. 1 with a drawer in an extracted state in a perspective view;

FIG. 7 shows the laundry washing machine according to FIG. 6 with a detailed view of the drawer in a perspective view with a flap in a first position;

FIG. 7a shows the laundry washing machine according to FIG. 6 with a detailed view of the drawer in a perspective view with a flap in a second position;

FIG. 8 shows a diagram of a method for operating a washing machine with a delay start according to the known art;

FIG. 9 shows a diagram of a method for operating a washing machine with a delay start in a first preferred embodiment;

FIG. 10 shows a flow chart of a method for operating a washing machine with a delay start in a second preferred embodiment; and

FIG. 11 shows a flow chart of a method for operating a washing machine with a delay start in a third preferred embodiment.

[0055] Same parts in the figures are labelled by identical reference numbers.

[0056] With reference to FIGs. 1 to 7a, a laundry treatment machine 1 is shown which is built as a front-loading washing machine which comprises an external housing or casing 2 comprising two side walls, a front wall, a back wall (not shown) and a top plate. Washing machine 1 further comprises a front panel 6b with a user interface 6c, preferably comprising indicators for the current state of the machine and/or user elements. Front panel 6b further comprises a user element 6d for interacting with the machine which is preferably built as a rotatable push button. Next to the front panel 6b an extractable drawer 6a is provided, as described below.

[0057] Inside casing 2, a washing tub 3 is provided which contains a perforated washing drum into which the laundry to be treated can be loaded. The tub 3 and the drum have both preferably an essentially cylindrical shape. Tub 3 is preferably suspended in a floating manner inside casing 2, advantageously by means of a number of coil springs and shock absorbers 9.

[0058] Casing 2 is provided with a door 8 for loading / unloading of laundry with a handle 8a for operating the door 8. The drum is advantageously rotated by an electric motor (not shown) which preferably transmits the rotating motion to a shaft of the drum, advantageously by means of a belt/pulley system. In a different embodiment, the motor can directly be associated with the shaft of the drum. Tub 3 is preferably connected to casing 2 by means of an elastic bellows 7 or gasket. Tub 3 preferably comprises two complementary hemi-shells 13, 14 structured for being reciprocally coupled to form tub 3. The bottom

region 3a of tub 3 preferably comprises a seat or sump 34, suitable for receiving a heating device or heater 10. The heater 10, when activated, in the present preferred embodiment, heats the liquid inside sump 34. The heater 10 preferably is arranged in a draining region of washing machine 1.

[0059] A water supply circuit 5 (see Fig. 3) which can be built according to the known art is arranged at the upper part of the laundry washing machine 1 and is suited to supply water into tub 3. It advantageously comprises at least one supply valve which is properly controlled, opened and closed, during the washing / rinsing cycle. In the present embodiment, water supply circuit comprises three supply valves. Respective inlets are connected to a fresh water supply or water mains, while respective outlets are connected to pipes for delivering water into a flushing device 100 provided on a detergent storage container or detergent feeding device 6 provided on the washing machine 1.

[0060] The drawer assembly / detergent storage container 6 is configured to supply detergents and/or rinsing or other laundry treatment agents into tub 3. The drawer assembly 6 comprises on its frontal side an extractable drawer 6a preferably provided with various compartments 6f, 6g, 6h suited to be filled with washing products, especially a detergent, and at least one a rinse additive, especially a fabric softener. Compartment 6f is preferably adapted to receive liquid or powder detergent. Compartment 6g is preferably adapted to receive softener. Compartment 6h is adapted to receive a laundry treatment agent in the form of powder.

[0061] The extractable drawer 6a may comprise still further compartments suited to be filled with other type of rinse additives, such as fabric conditioners, water-proofing agents, fabric enhancers, rinse sanitization additives, chlorine-based additives, i.e. products which are suitable to be used in the rinsing phase of the washing program. The drawer 6a preferably comprises a compartment configured to accept liquid laundry treatment agent, especially liquid detergent.

[0062] Compartment 6f preferably comprises a flap 7a which acts as a closing means or element for this compartment and which is arranged in compartment 6f at two hinges 7b, 7c. Facing bottom part 8a of compartment 6f, the flap 7a comprises a small clearance 8b. The clearance 8b is required due to tolerances and the necessity to clean / wash the bottom of compartment 6f at the end of the laundry treatment cycle. When the compartment 6f is filled with liquid laundry treatment agent, due to clearance 8a the liquid slowly starts to leave compartment 6f and drip into the tub 3. When the compartment 6f is flushed by water for transport the liquid detergent into tub 3, the flap 7a mounted rotatable on hinges 7b 7c allows the passage of water + powder through the recess 7i (see Fig. 7) and the clearance between the flap and the bottom part 8a of the compartment. The flap 7a is therefore provided to close, at least partially, the compartment 6f for the collection of the liquid detergent; on the other hand,

the flap 7a is movable/removable to open the chamber on the discharge side when the powder detergent is inserted on said compartment.

[0063] In FIG. 7a, the flap 7a is seen in another position to which it can be moved by the user. Preferably, holding elements are provided which keep flap 7a stable in the position shown. In this position, compartment 6f is in an optimized configuration to receive powder treatment agent. The discharge side of compartment 6f does not need to be closed in the case of powder detergent, thus the flap 7a is not needed to retain powder treatment agent in compartment 6f.

[0064] Due to the required tolerances, and to the necessity to wash the bottom of the compartment, a small clearance must be assured between the flap and the respective compartment.

[0065] Alternatively, a liquid detergent compartment can be provided, preferably without a know syphon, having a barrier on the discharge side of the container that must assure a small clearance between the said barrier and the compartment walls.

[0066] In the preferred embodiment here illustrated, the water is supplied into the tub 3 from the water supply circuit 5 by making it flow through the flushing device 100 of drawer assembly 6, through one of the compartment of the extractable drawer 6a and then through a supply pipe 110. The water which reaches the tub 3 can, in this case, selectively contain one of the products contained in the compartments of the drawer 6a. Such water can be clean if the product in the drawer 6a has been already removed. In an alternative embodiment of the invention, a further separate water supply pipe can be provided in the drawer assembly or through an additional pipe, which supplies exclusively clean water into the tub 3, thus bypassing the compartments of the drawer 6a.

[0067] Laundry treatment machine 1 comprises an air chamber 25a (see FIG. 2) connectable to a device suited to sense (or detect) the liquid level inside the tub 3, especially a water level sensor (not shown in the FIGs). The water level sensor preferably comprises or is built as a water pressure sensor which senses the pressure in the tub 3. From the values sensed by the sensor device it is possible to determine the liquid level of the liquid inside the tub 3. In another embodiment, not illustrated, laundry treatment machine 1 may preferably comprise (in addition to or as a replacement of the pressure sensor) a level sensor (for example mechanical, electro-mechanical, optical, etc.) adapted to sense (or detect) the liquid level inside the tub 3.

[0068] The supply pipe 110 is preferably arranged laterally with respect to the tub 3 and preferably terminates at an upper region of the tub 3. More preferably, the supply pipe terminates at a rear side of the washing tub 3.

[0069] Laundry treatment machine 1 advantageously comprises a water outlet circuit 25 suitable for withdrawing liquid from a bottom region of the tub 3. The water outlet circuit 25 preferably comprises a main pipe 17 (see FIGs. 4 and 5) a draining pump 26 and an outlet pipe 28

ending outside the housing or casing 2.

[0070] The water outlet circuit 25 or draining circuit preferably further comprise a filtering device 12 arranged between the main pipe 17 and the draining pump 26. The filtering device 12 is adapted to retain all, or the majority of the undesirable bodies (for example buttons that have come off the laundry, coins erroneously introduced into the laundry washing machine, etc.). This filtering device 12 can preferably be removed, and then cleaned, through a gate 40 (see FIG. 1) placed advantageously on the front wall of the housing casing of the laundry treatment machine 1.

[0071] The main pipe 17 connects the bottom region of the tub 3 to the filtering device 12. An inlet end 17a of the main pipe is advantageously positioned at the lower point of the tub 3, more preferably at the lower point of the sump 34. An outlet end of the main pipe is connected to a front part of the filtering device 12.

[0072] In a further embodiment, not illustrated, the filtering device 12 may be provided directly in the tub 3, preferably obtained in a single piece construction with the latter. In this case the filtering device 12 is fluidly connected to the outlet of the tub 3, in such a way that water and washing liquid drained from the tub 3 enters the filtering device 12.

[0073] The draining pump 26 is preferably connected to the body of the filtering device 12 (see Fig.5) and conveys the liquid to the outlet pipe 28 through an outlet. Activation of the drain pump 26 drains the liquid, i.e. dirty water or water mixed with washing and/or rinsing products, from the tub 3 to the outside.

[0074] Laundry washing machine 1 preferably comprises a first recirculation circuit 20 adapted to drain liquid from the bottom region 7a of the tub 3 and to re-admit the liquid into a second region 20a, or upper/higher region, of the tub 3; in other words, the outlet 23a of the first recirculation circuit 20 is located at a position higher than the position of the inlet 17a of the first recirculation circuit 20 corresponding to the inlet of the main pipe 17 connected to the bottom side of the tub 3. The first recirculation circuit 20 preferably comprises a first recirculation pump 21, a first pipe 22 connecting the filtering device 12 to the first recirculation pump 21 and a second recirculation pipe 23, preferably provided with a outlet / terminal nozzle 23a arranged preferably at the upper region 20a of the tub 3. The terminal nozzle 23a is preferably arranged so that the liquid is flushed/sprayed directly into the drum. More preferably the outlet / terminal nozzle 23a is integrally formed in the bellows, and the liquid is therefore advantageously flushed / sprayed in a direction the center of the perforated drum. The outlet / terminal nozzle 23a, therefore, enhances distribution of liquid over the laundry through the perforated drum.

[0075] The liquid from the bottom region 7a of the tub 3 is conveyed towards the upper region 20a of the tub 3 by activation of the first recirculation pump 21. The first recirculation circuit 20 is advantageously activated in order to improve wetting of the laundry inside the drum and

for reducing the water required in the whole washing program. In general, the first recirculation circuit 20 is properly realized for transferring a portion of a liquid from a bottom region 7a of the tub 3, preferably from the sump 34, to an upper region of the tub 3 in order to enhance absorption of the liquid by the laundry.

[0076] Laundry washing machine 1 advantageously or alternatively comprises a second recirculation circuit 30 or mixing circuit. The mixing circuit is adapted to drain liquid from the bottom region of the tub 3 and to re-admit such a liquid (recirculated mixing liquid) into a first region of the tub, which corresponds substantially to the same bottom region of the tub 3. Preferably, the second recirculation circuit 30 is adapted to drain liquid from the bottom of the sump 34 and to re-admit such a liquid (recirculated mixing liquid) again into the sump 34. More preferably, the liquid is re-admitted again into the sump 34 below the heater 10. More preferably, the outlet 34a (see Fig. 4) of the second recirculation circuit 30 is a position higher than the position of the inlet 17a of said second recirculation circuit 30 corresponding to the inlet of the main pipe 17 connected to the bottom side of the tub.

[0077] The mixing circuit preferably comprises a second recirculation pump 31, a second pipe 32 connecting the filtering device 12 to the second recirculation pump 31 and a second recirculation pipe 33 advantageously provided with a terminal portion 34a, or nozzle. The terminal portion 34a advantageously ends inside the sump 34, as mentioned above.

[0078] The liquid from the bottom region 7a of the tub 3 is conveyed again towards the bottom region of the tub by activation of the second recirculation pump 31. Advantageously, the liquid from the bottom region 7a of the tub 3 is conveyed towards the bottom region 7a of the tub 3 in a gap between the tub 3 and the drum. In a further embodiment, not illustrated, the mixing circuit may comprise a dedicated pipe connecting the bottom region of the tub 3 to the recirculation pump; in this case the mixing circuit is advantageously completely separated from the water outlet circuit, i.e. completely separated from the filtering device 12 and the main pipe 17.

[0079] The mixing circuit (second recirculation circuit 30) is preferably realized for transferring a portion of a liquid from a bottom region of the tub to the same bottom region for mixing and/or dissolution of the products, as better described below. In general, the mixing circuit (second recirculation circuit) is preferably realized for transferring liquid from a bottom region of the tub and for re-admitting such a liquid into the washing tub such that at least a portion of the re-admitted liquid reaches the bottom region of the washing tub without entering the washing drum.

[0080] More preferably, the mixing circuit (second recirculation circuit 30) is preferably realized for transferring liquid from a bottom region of the tub 3 and for re-admitting such a liquid into the washing tub such that all, or substantially all, the re-admitted liquid reaches the bottom region of the washing tub without entering the wash-

ing drum.

[0081] In a preferred embodiment, the heater 10 is arranged in the drainage area of the washing machine 1, whereby near the first and/or the second circulation pump 21, 31 and/or near the first and/or second circulation pipe a water level in a drainage area is increased by means of a rinsing / spinning phase or a water charge while the heater 10 is turned off, and wherein the water level is increased until the heater 10 is at least partially submerged by washing liquid.

[0082] Preferably, the washing liquid is circulated via the first and/or the second circulation pumps 21, 31 and at least a part of the washing liquid is thus again bound in the laundry such that the water level in the drainage area decreases at least below the top side of the heater 10, and whereby the heater 10 is maintained turned off when the water level is below the top side of the heater 10.

[0083] Laundry washing machine 1 comprises a control unit 27 (see FIG. 2), connected to the various parts of the laundry washing machine in order to ensure its operation. The control unit 27 is preferably connected to the water inlet or supply circuit 5 (i.e. to supply valve), the water outlet circuit (i.e. to the draining pump 26), the recirculation circuits 20, 30 (i.e. to the recirculation pumps 21, 31), the heater 10 and the electric motor and receives information from the various sensors provided on the laundry washing machine 1, like possibly the pressure sensor, a temperature sensor, etc.

[0084] The user interface 6c is connected to the control unit, accessible to the user and by means of which the user may select and set the washing parameters, like for example a desired washing program. Usually, other parameters can optionally be inserted by the user, for example the washing temperature, the spinning speed, the load in terms of weight of the laundry to be washed, etc. Based on the parameters acquired by the interface 6c, the control unit sets and controls the various parts of the laundry washing machine 1 in order to carry out the desired washing program.

[0085] For draining liquid from the tub 3, the draining pump 26 is activated. Fresh water is introduced into tub 3 by activating the respective supply valve. The fresh or clean water is then preferably running through the flushing device 100 and then through a wash compartment and the outlet pipe 110, into the tub 3. The recirculation circuits 20, 30 can be employed as described above by activating/deactivating the respective first and/or second recirculation pump. The sensor for detecting the water level can be employed to monitor if the water level of free water is collecting in the tub 3, indicating for example that the laundry is not able to continue to absorb water and is in a saturated or even over-saturated state.

[0086] In the following, a method for operating a laundry treatment machine 1 in preferred embodiments is described in conjunction with some diagrams and the washing machine as described above. The washing machine is only referenced to in an exemplary style; the method can be applied to other washing machines. The method

is implemented in the control unit 27.

[0087] In FIG. 8, a diagram is shown which represents a laundry treatment cycle with a delay start as known from the art. An x-axis 68 represents the time, while an y-axis 66 represents a level of activation or an amount of liquid detergent level, as will be described below. A curve 70 represents the activation state of the washing machine. A steep flank 72 represents the activation of a delay start mode. The user has filled liquid detergent into a compartment of the dispenser / drawer 6a and has inserted laundry into the drum. Preferably, the user has filled the compartment adapted to receive liquid detergent (preferably having at least a small clearance for the detergent passage toward the tub) or to receive either liquid or powder detergent, preferably with a flap positioned to adapt the compartment to receive liquid (preferably assuring at least a small clearance for the detergent passage toward the tub). The user has set a delay time interval or a fixed time at which the machine will prepare to start a washing cycle. The user has preferably pushed a start button.

[0088] During the time interval in which the machine is essentially idle, liquid detergent drips from the compartment and enters the washing tub 3 due to the clearance / tolerances provided on the compartment (see above), as is indicated by curve 74 which represents the amount of liquid detergent which has left the compartment. When the delay time interval has lapsed, the draining pump 26 is activated for a prescribed time interval as indicated by curve 80. The draining pump 26 drains liquid from the tub. As becomes evident from the overlap of curves 74 and 80, when the draining pump 26 is started, a considerable amount of liquid detergent has entered the tub 3 already and now is drained. This amount of liquid detergent is therefore lost and not available for the treatment of the laundry.

[0089] A curve 82 represents a calibration of the water level sensor, which is preferably built as a water pressure sensor which measures the pressure in a pipe connected to the tub. The draining of the tub 3 has performed in such a way that the tub can safely be assumed to not contain more liquid than a prescribed value (small amount of liquid can get soaked by the laundry). The signal of the water level sensor in this state of the tub 3 then corresponds to an empty liquid / water level in the tub 3 and can be used for the washing cycle.

[0090] A curve 90 represents the loading of water into the tub 3 by which the washing step commences. Since liquid detergent has been drained from the tub 3, the amount available is most probably not enough for a desired cleaning effect of the laundry. A curve 94 indicates the activation of the laundry treatment program which comprises one or more washing steps and can comprise one or more rinsing steps and/or one or more drying steps.

[0091] This problem is solved by the method according to the present invention which is shown in FIG. 9 in a preferred embodiment. The curve 70 again indicates the

start of the washing machine, i.e. the setting of the delay start. The draining of the tub 3, again indicated by curve 80, is conducted essentially immediately after the start of the washing machine. After the draining step has finished, the water level sensor is calibrated as indicated by curve 82. In another preferred embodiment, the calibration of the water level sensor, indicated by curve 108, is already started while the draining of the tub is still performed (see FIG. 11). Both phases can partly or fully overlap in time. By performing the draining step immediately after the delay start has been set and the washing machine has been activated, only a very small amount of or essentially no liquid laundry treatment agent has dripped into the tub and is therefore removed from the tub during the draining step. According to the invention, after draining and calibrating processes (curves 80, 82 / 108), no further draining of the tub is performed before the washing step / the water loading of the tub. Most preferably, also no calibration of the water level sensor takes place after the first calibration (curves 82 / 108). The washing step is therefore started and performed by using the reference level value which has been determined in the calibration shown in curves 82/108.

[0092] Preferably during the draining step, the signal of the water level sensor is observed. By observing the signal, irregularities in the signal-value as a function of time can be found and identifies as characteristics for a sensor failure. Also, a failure of the washing machine can be detected, for instance the inability to empty the tub of liquid, if the signal of the sensor is found to be reliable.

[0093] The signal is preferably evaluated and/or processed, especially it is compared with values which correspond to an expected regular behavior of level sensor and/or machine. If during a specified time interval during the draining step the signal varies more than a tolerance band and/or its values leave a tolerance band of values, preferably an alarm is issued to the user, which can be done acoustically and/or visually. A visual alarm is preferably issued on user interface 6c, especially on a display which is arranged on user interface 6c.

[0094] In a preferred embodiment, values of previous calibrations or at least one value of a previous calibration of the sensor is stored. The new value of the calibration can be compared with one or more previous values. The comparison can reveal that the sensor signal over time shows systematic or irregular behavior. If the calibrated value differs from more or several values, especially also an average of previous value, an irregular condition is recognized and the user is preferably warned with an alarm as described above.

[0095] A preferable delay time of the described delay start of the washing machine is preferably larger than 10 minutes.

[0096] FIGs 8 and 9 are only schematic figures to indicate the order of processes which are conducted. The time intervals between the various processes as indicated are preferably not to be interpreted as literal relations. For instance, the time interval between the draining step

and the beginning of the water loading is typically much larger than appearing in the figures.

[0097] In FIG. 10, the method is shown in another preferred embodiment in a flow chart. In a block 130, detergent is filled into a compartment of the detergent dispenser. In a block 70a, the laundry treatment cycle is started. The laundry treatment cycle encompasses all steps which follow the activation of the machine by the user, especially by pressing a start button.

[0098] In a block 80a, the tub 3 is drained. In a block 82a, the water level sensor, which in the preferred embodiment is a water pressure sensor, is calibrated. The reference level value is reset and set to a new value based on the current pressure value, which corresponds to an empty level of the tub 3.

[0099] In a decision 134, it is decided if a delay start should be conducted. If no delay start was set by the user, the method continues in block 90a in which water is loaded into the tub. Block 140 indicates a washing cycle. Block 146 indicates a rinsing cycle. As indicated by a dashed box 148, one or more washing cycles and one or more rinsing cycles can be performed, preferably depending on the selected laundry treatment program. Washing and rinsing cycles are preferably conducted as known from the art.

[0100] If a delay start was set by the user, the method continues in a step 136, in which the washing machine waits for the selected delay time interval. After the delay time interval has lapsed, the method continues in block 90a as described above. In a block 152, the laundry treatment cycle ends.

[0101] A method in still another preferred embodiment is shown in FIG. 11. This variant of the method differs from the embodiment shown in FIG. 10 by the time order of blocks 80a and 82a. The calibration of the water level sensor is already started during the draining of the tub in block 80a. The drain phase has preferably a first phase in which the tub is drained and which is configured in such way that the tub 3 can be considered to be empty. In a second phase, the water level sensor signal is observed for changes. If the signal changes are larger than specified in a tolerance band, a malfunction is diagnosed and the user is preferably warned. Since the first phase has led to an empty tub 3, this diagnosis can be made with certainty.

[0102] The invention thus conceived can be subjected to numerous modifications and variants all falling within the scope of the following claims.

Claims

1. Method for operating a laundry treatment machine (1) comprising a washing tub (3) for receiving laundry to be treated and a detergent feeding device (6) and at least one draining pump (26) connected to said tub (3), said draining pump (26) being connected to a draining circuit (25) for draining liquid collected in

said tub (3) when said draining pump (26) is activated, whereby said detergent feeding device (6) comprises at least one compartment adapted to receive liquid detergent, whereby said compartment comprises a closure means with a clearance (8b),

the method comprising

- a step of filling liquid laundry treatment agent into said detergent feeding device (6);
- a draining step in which said draining pump (26) is activated;
- a delay start setting step in which a delay start of said machine (1) with a delay time interval is set;
- a delay start activating step in which the delay start is activated to start the washing procedure after said delay time interval;
- a washing step in which after said delay time interval said washing procedure is started,

characterized in, that

said draining step is conducted at / immediately after said delay start activating step, whereby after said draining step during said delay time interval, no further draining of liquid from said tub (3) is performed.

2. Method according to claim 1, whereby said draining step is part of a calibrating procedure for calibrating a water level sensor in which a reference level value is determined.
3. Method according to claim 2, whereby during said calibration procedure in a measuring step the water level is measured and in a setting step the value of the water level sensor is set to said reference level value representing an empty level of liquid in said tub (3).
4. Method according to claim 2 or 3, whereby at least partially during said draining step, the signal of said water level sensor is observed and/or evaluated and/or processed.
5. Method according to claim 4, whereby when during a predetermined time span during said draining step said signal varies more than in a tolerance band, an alarm is issued.
6. Method according to one of the claims 1 to 5, whereby said delay time interval is larger than 10 minutes.
7. Method according to one of the claims 1 to 6, whereby said detergent feeding device (6) comprises at least one compartment (6f) adapted to receive both liquid and powder detergent, whereby said compart-

ment (6f) comprises the closure means (7a) with a clearance (8b).

8. Method according to claim 7, whereby said compartment (6f) comprises a movable flap (7a).
9. Method according to claim 7 or 8, whereby said compartment comprises a removable flap (7a).
10. Method according to claim 8 or 9, whereby said flap (7a) is moveable from a first position in which it retains liquid within said compartment (6f) to a second position in which it essentially allows a free passage of detergent/liquid from said compartment (6f) into said tub (3).
11. Method according to one of the claims 7 to 10 comprising a flap (7a) providing a clearance at the bottom of said compartment.
12. Laundry treatment machine (1) comprising a washing tub (3) for receiving laundry to be treated, a water level sensor and a detergent feeding device (6), whereby said detergent feeding device (6) comprises at least one compartment adapted to receive liquid detergent, whereby said compartment comprises a closure means with a clearance (8b) and a flap (7a), and at least one draining pump (26) connected to said tub (3), said draining pump (26) being connected to a draining circuit (25) for draining liquid collected in said tub (3) when said draining pump (26) is activated, further comprising a control unit (27) in which a method according to one of the previous claims is implemented.

Patentansprüche

1. Verfahren zum Betreiben einer Wäschebehandlungsvorrichtung (1), die einen Waschtrog (3) zum Aufnehmen von zu behandelnder Wäsche und eine Waschmittelzuführungsvorrichtung (6) und mindestens eine mit dem Bottich (3) verbundene Entleerungspumpe (26) umfasst, wobei die Entleerungspumpe (26) mit einem Entleerungskreislauf (25) zum Entleeren von in dem Bottich (3) gesammelter Flüssigkeit verbunden ist, wenn die Entleerungspumpe (26) aktiviert ist, wobei die Waschmittelzuführungsvorrichtung (6) mindestens ein Fach umfasst, das dazu ausgelegt ist, flüssiges Waschmittel aufzunehmen, wobei das Fach ein Verschlussmittel mit einem Spalt (8b) umfasst,

wobei das Verfahren umfasst

- einen Schritt zum Füllen flüssigen Wäschebehandlungsmittels in die Waschmittelzuführungsvorrichtung (6);

- einen Entleerungsschritt, in dem die Entleerungspumpe (26) aktiviert wird;
 - einen VerzögerungsstartEinstellschritt, in dem ein Verzögerungsstart der Maschine (1) mit einem Verzögerungszeitintervall eingestellt wird;
 - einen Verzögerungsstartaktivierungsschritt, in dem der Verzögerungsstart aktiviert wird, um den Waschvorgang nach dem Verzögerungszeitintervall zu starten;
 - einen Waschschrift, in dem nach dem Verzögerungszeitintervall der Waschvorgang gestartet wird,
- dadurch gekennzeichnet, dass**
- der Entleerungsschritt bei dem/unmittelbar nach dem Verzögerungsstartaktivierungsschritt ausgeführt wird, wobei nach dem Entleerungsschritt während des Verzögerungszeitintervalls kein weiteres Entleeren von Flüssigkeit aus dem Bottich (3) durchgeführt wird.
2. Verfahren nach Anspruch 1, wobei der Entleerungsschritt Teil eines Kalibrierungsvorgangs zum Kalibrieren eines Wasserpegelsensors ist, in dem ein Referenzpegelwert bestimmt wird.
 3. Verfahren nach Anspruch 2, wobei während des Kalibrierungsvorgangs in einem Messschritt der Wasserpegel gemessen wird und in einem Einstellschritt der Wert des Wasserpegelsensors auf den Referenzpegelwert eingestellt wird, der einen leeren Pegel von Flüssigkeit in dem Bottich (3) darstellt.
 4. Verfahren nach Anspruch 2 oder 3, wobei zumindest teilweise während des Entleerungsschritts, das Signal des Wasserpegelsensors beobachtet und/oder ausgewertet und/oder verarbeitet wird.
 5. Verfahren nach Anspruch 4, wobei, wenn während einer vorbestimmten Zeitspanne während des Entleerungsschritts das Signal mehr als in einem Toleranzbereich variiert, ein Alarm ausgegeben wird.
 6. Verfahren nach einem der Ansprüche 1 bis 5, wobei das Verzögerungszeitintervall größer als 10 Minuten ist.
 7. Verfahren nach einem der Ansprüche 1 bis 6, wobei die Waschmittelzuführungsvorrichtung (6) mindestens ein Fach (6f) umfasst, das dazu ausgelegt ist, sowohl flüssiges als auch pulverförmiges Waschmittel aufzunehmen, wobei das Fach (6f) das Verschlussmittel (7a) mit einem Spalt (8b) umfasst.
 8. Verfahren nach Anspruch 7, wobei das Fach (6f) eine bewegliche Klappe (7a) umfasst.

9. Verfahren nach Anspruch 7 oder 8, wobei das Fach eine entfernbare Klappe (7a) umfasst.
10. Verfahren nach Anspruch 8 oder 9, wobei die Klappe (7a) von einer ersten Position, in der sie Flüssigkeit in dem Fach (6f) zurückhält, zu einer zweiten Position, in der sie im Wesentlichen einen freien Durchgang von Waschmittel/Flüssigkeit aus dem Fach (6f) in den Bottich (3) erlaubt, beweglich ist.
11. Verfahren nach einem der Ansprüche 7 bis 10, umfassend eine Klappe (7a), die einen Spalt am Boden des Fachs bereitstellt.
12. Wäschebehandlungsmaschine (1), umfassend einen Waschbottich (3) zum Aufnehmen von zu behandelnder Wäsche, einen Wasserpegelsensor und eine Waschmittelzuführungsvorrichtung (6), wobei die Waschmittelzuführungsvorrichtung (6) mindestens ein Fach umfasst, das dazu ausgelegt ist, flüssiges Waschmittel aufzunehmen, wobei das Fach ein Verschlussmittel mit einem Spalt (8b) und eine Klappe (7a) und mindestens eine Entleerungspumpe (26) umfasst, die mit dem Bottich (3) verbunden ist, wobei die Entleerungspumpe (26) mit einem Entleerungskreislauf (25) zum Entleeren von in dem Bottich (3) gesammelter Flüssigkeit verbunden ist, wenn die Entleerungspumpe (26) aktiviert wird, ferner umfassend eine Steuereinheit (27), in der ein Verfahren nach einem der vorhergehenden Ansprüche implementiert wird.

Revendications

1. Procédé de fonctionnement d'une machine de traitement de linge (1) comprenant une cuve de lavage (3), pour recevoir du linge destiné à être traité, et un dispositif d'alimentation en détergent (6) et au moins une pompe de drainage (26) raccordée à ladite cuve (3), ladite pompe de drainage (26) étant raccordée à un circuit de drainage (25) pour drainer un liquide, accumulé dans ladite cuve (3), lorsque ladite pompe de drainage (26) est activée, dans lequel ledit dispositif d'alimentation en détergent (6) comprend au moins un compartiment adapté pour recevoir un détergent liquide, dans lequel ledit compartiment comprend un moyen de fermeture avec un espace libre (8b),

le procédé comprenant

- une étape de remplissage d'agent liquide de traitement de linge, dans ledit dispositif d'alimentation en détergent (6) ;
- une étape de drainage, dans laquelle ladite pompe de drainage (26) est activée ;
- une étape de réglage de démarrage diffé-

- ré, dans laquelle un démarrage différé de ladite machine (1), avec un intervalle de temps différé, est réglé ;
- une étape d'activation de démarrage différé, dans laquelle le démarrage différé est activé pour démarrer la procédure de lavage après ledit intervalle de temps différé ;
 - une étape de lavage, dans laquelle, après ledit intervalle de temps différé, ladite procédure de lavage est démarrée,
- caractérisé en ce que**
- ladite étape de drainage est réalisée à/immédiatement après ladite étape d'activation de démarrage différé, dans lequel, après ladite étape de drainage, durant ledit intervalle de temps différé, aucun drainage supplémentaire de liquide depuis ladite cuve (3) n'est effectué.
2. Procédé selon la revendication 1, dans lequel ladite étape de drainage fait partie d'une procédure d'étalonnage, pour étalonner un capteur de niveau d'eau, dans laquelle une valeur de niveau de référence est déterminée.
 3. Procédé selon la revendication 2, dans lequel, durant ladite procédure d'étalonnage, dans une étape de mesure, le niveau d'eau est mesuré et, dans une étape de réglage, la valeur du capteur de niveau d'eau est réglée à ladite valeur de niveau de référence représentant un niveau vide de liquide dans ladite cuve (3).
 4. Procédé selon la revendication 2 ou 3, dans lequel, au moins partiellement durant ladite étape de drainage, le signal dudit capteur de niveau d'eau est observé et/ou évalué et/ou traité.
 5. Procédé selon la revendication 4, dans lequel, lorsque, durant une étendue temporelle prédéterminée, durant ladite étape de drainage, ledit signal varie plus que dans une bande de tolérance, une alarme est émise.
 6. Procédé selon l'une des revendications 1 à 5, dans lequel ledit intervalle de temps différé est supérieur à 10 minutes.
 7. Procédé selon l'une des revendications 1 à 6, dans lequel ledit dispositif d'alimentation en détergent (6) comprend au moins un compartiment (6f) adapté pour recevoir un détergent à la fois liquide et en poudre, dans lequel ledit compartiment (6f) comprend le moyen de fermeture (7a) avec un espace libre (8b).
 8. Procédé selon la revendication 7, dans lequel ledit compartiment (6f) comprend un volet mobile (7a).
 9. Procédé selon la revendication 7 ou 8, dans lequel ledit compartiment comprend un volet amovible (7a).
 10. Procédé selon la revendication 8 ou 9, dans lequel ledit volet (7a) est mobile d'une première position, dans laquelle il retient un liquide à l'intérieur dudit compartiment (6f), à une seconde position, dans laquelle il permet essentiellement un passage libre de détergent/liquide, depuis ledit compartiment (6f), dans ladite cuve (3).
 11. Procédé selon l'une des revendications 7 à 10 comprenant un volet (7a) fournissant un espace libre au fond dudit compartiment.
 12. Machine de traitement de linge (1), comprenant une cuve de lavage (3) pour recevoir du linge destiné à être traité, un capteur de niveau d'eau et un dispositif d'alimentation en détergent (6), dans laquelle ledit dispositif d'alimentation en détergent (6) comprend au moins un compartiment adapté pour recevoir un détergent liquide, dans laquelle ledit compartiment comprend un moyen de fermeture avec un espace libre (8b) et un volet (7a), et au moins une pompe de drainage (26) raccordée à ladite cuve (3), ladite pompe de drainage (26) étant raccordée à un circuit de drainage (25) pour drainer un liquide, accumulé dans ladite cuve (3), lorsque ladite pompe de drainage (26) est activée, comprenant en outre une unité de commande (27) dans laquelle un procédé selon l'une des revendications précédentes est mis en œuvre.

FIG. 1

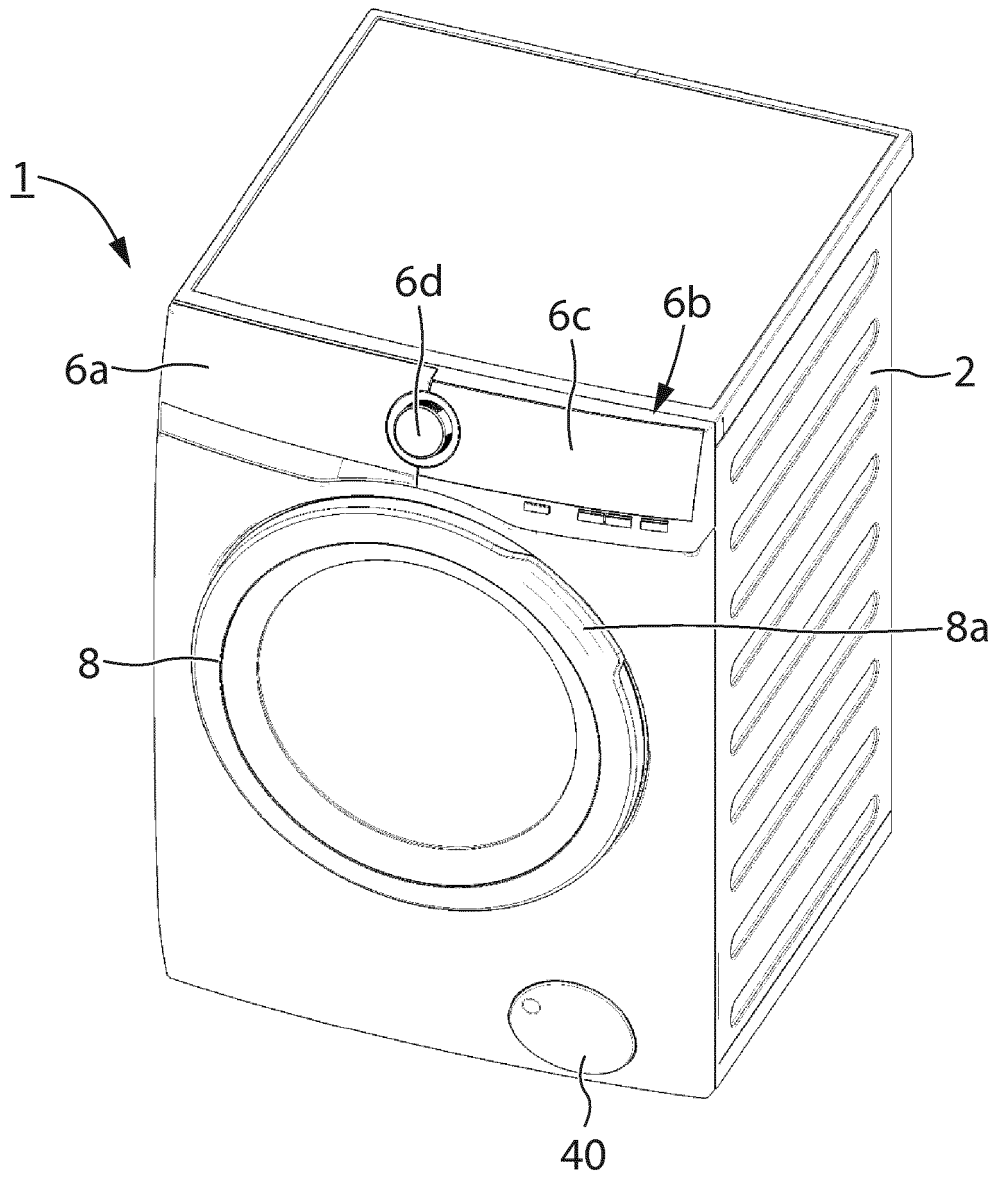


FIG. 2

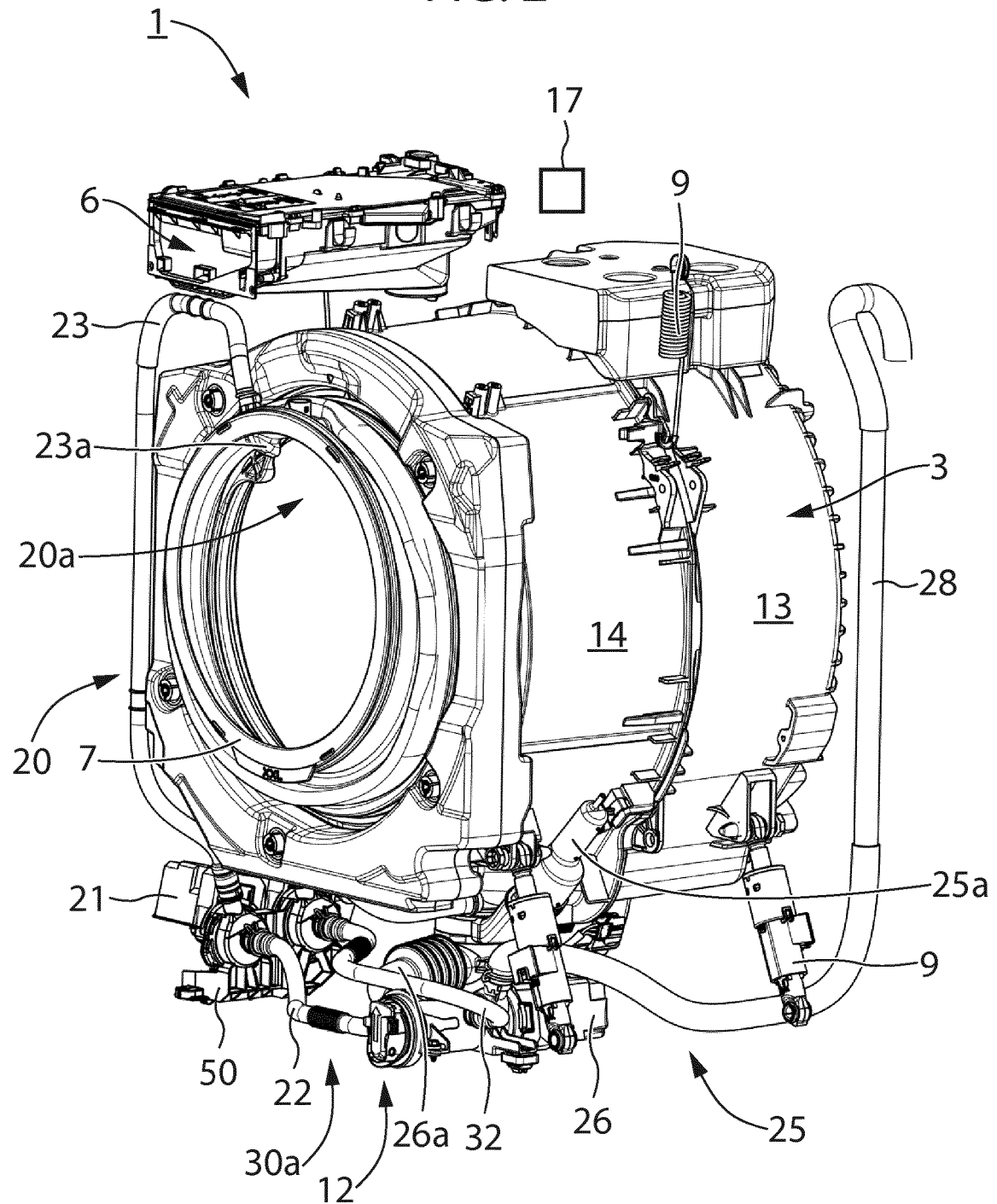


FIG. 3

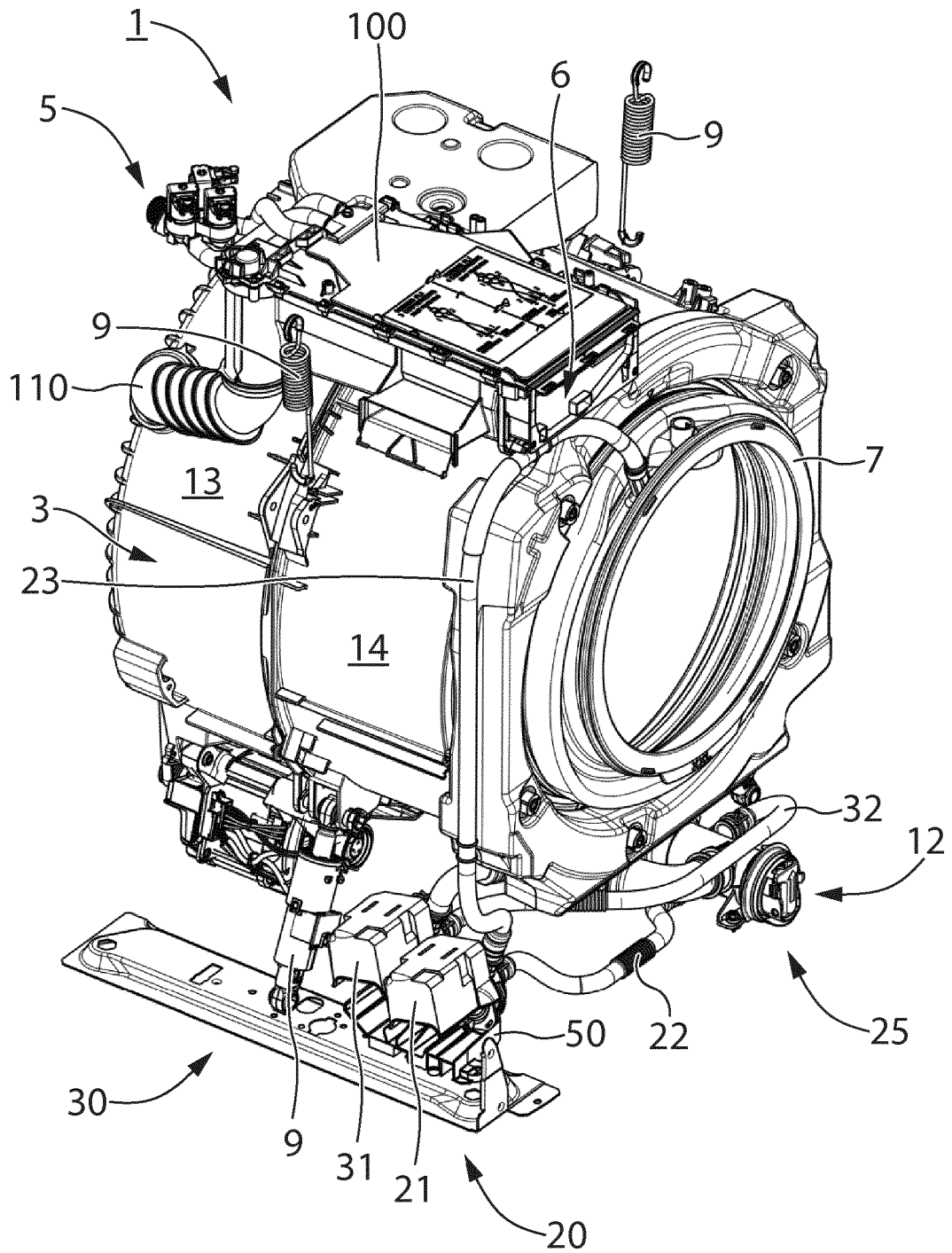


FIG. 4

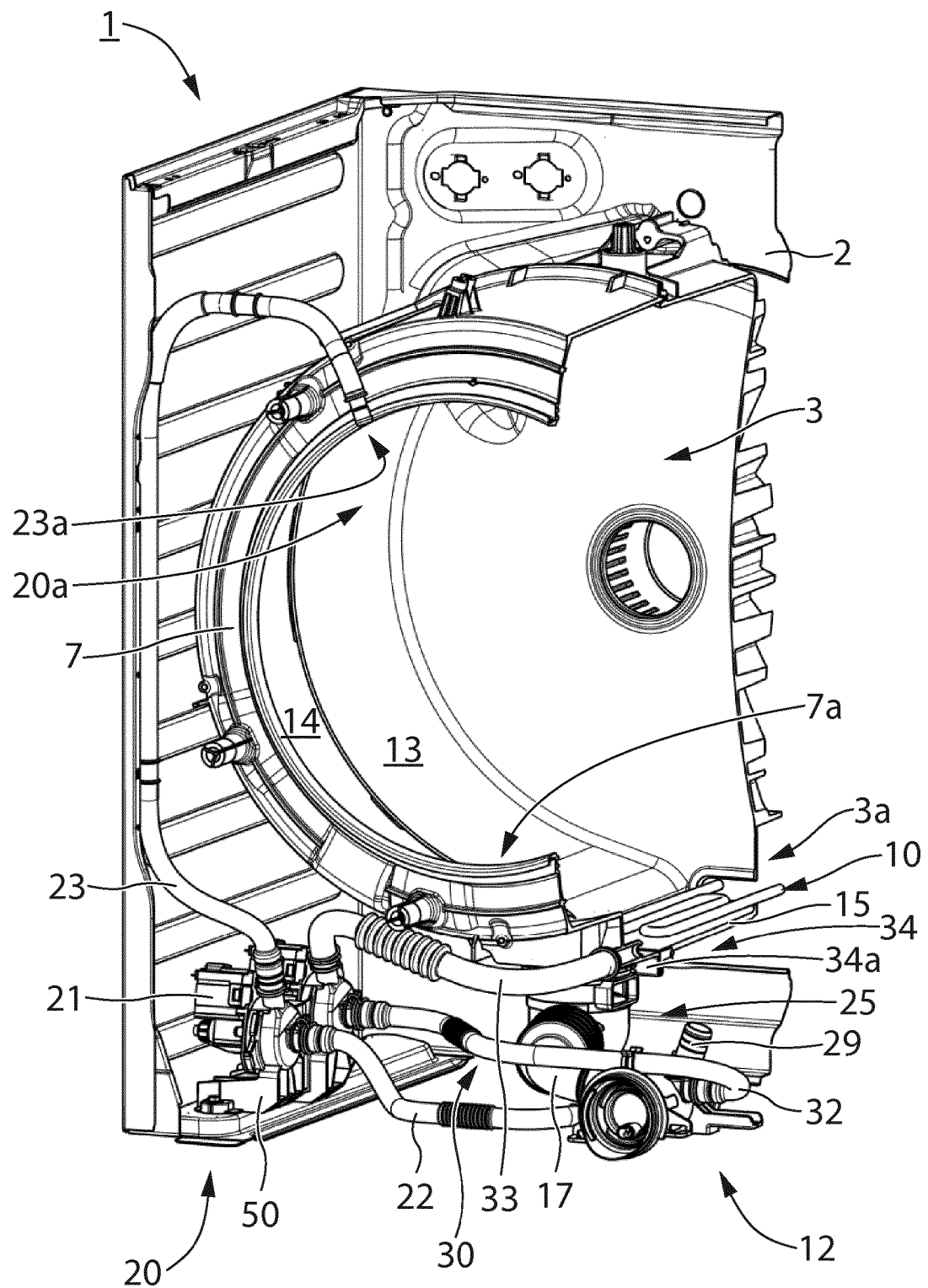


FIG. 5

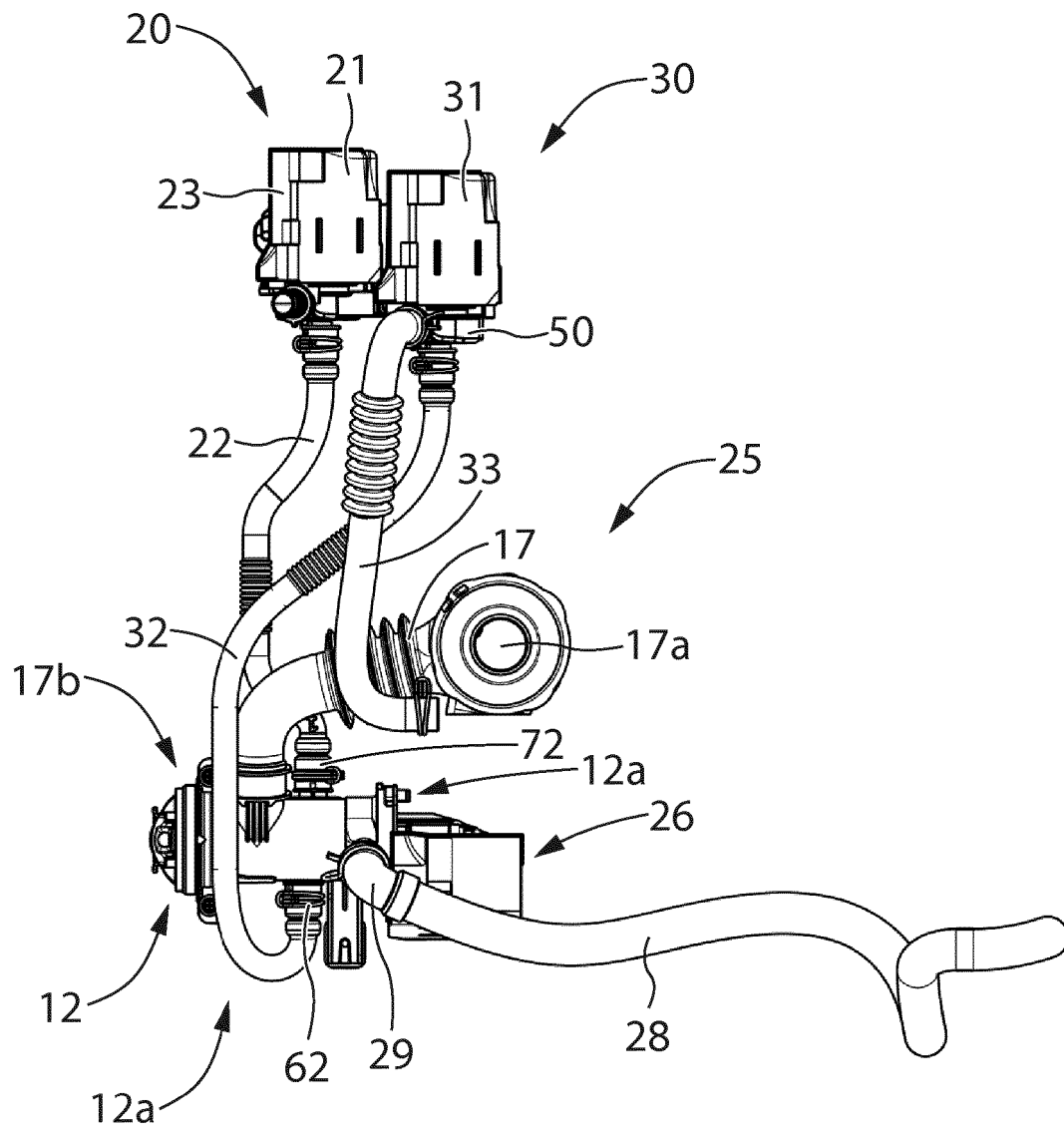


FIG. 6

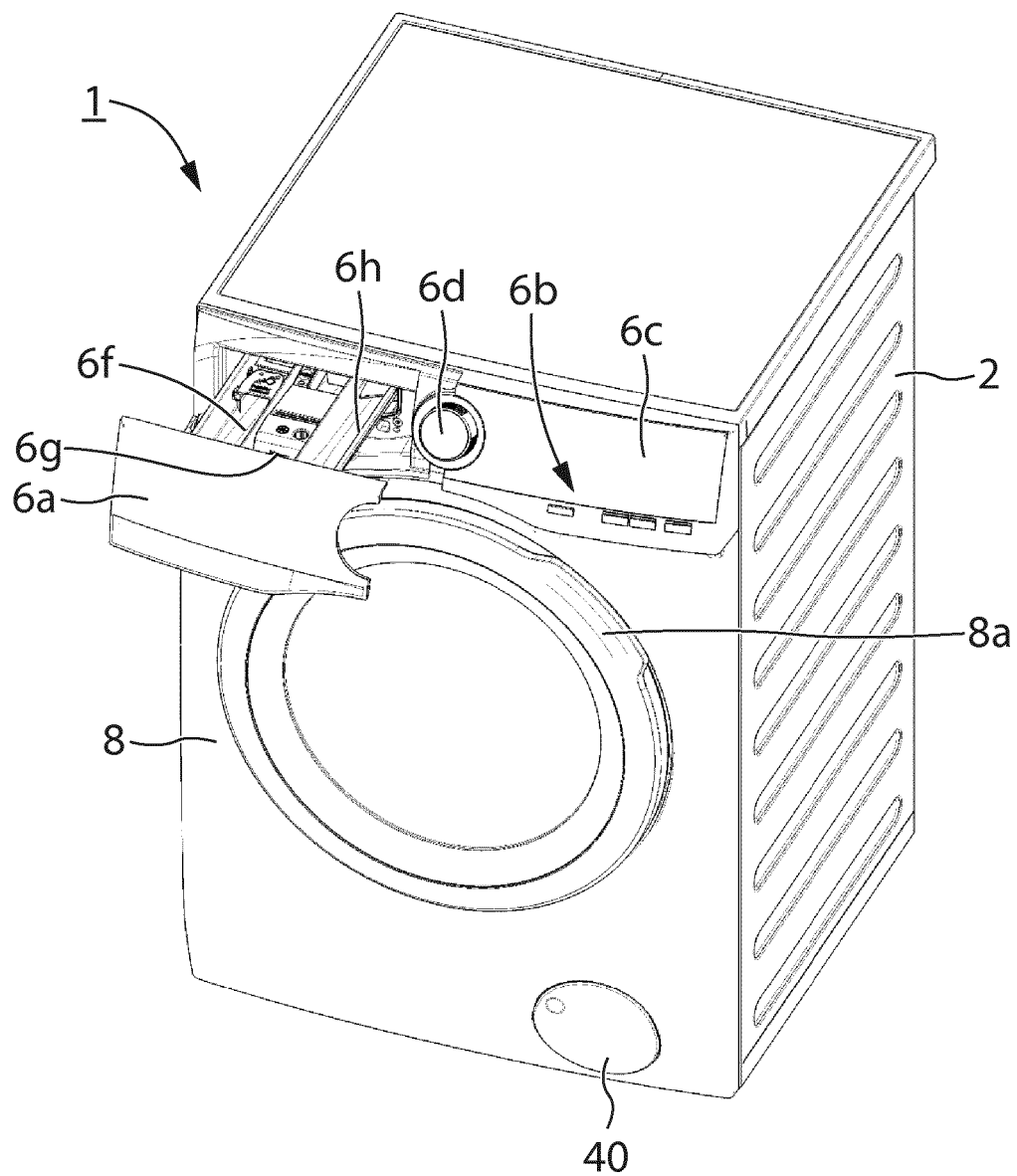


FIG. 7

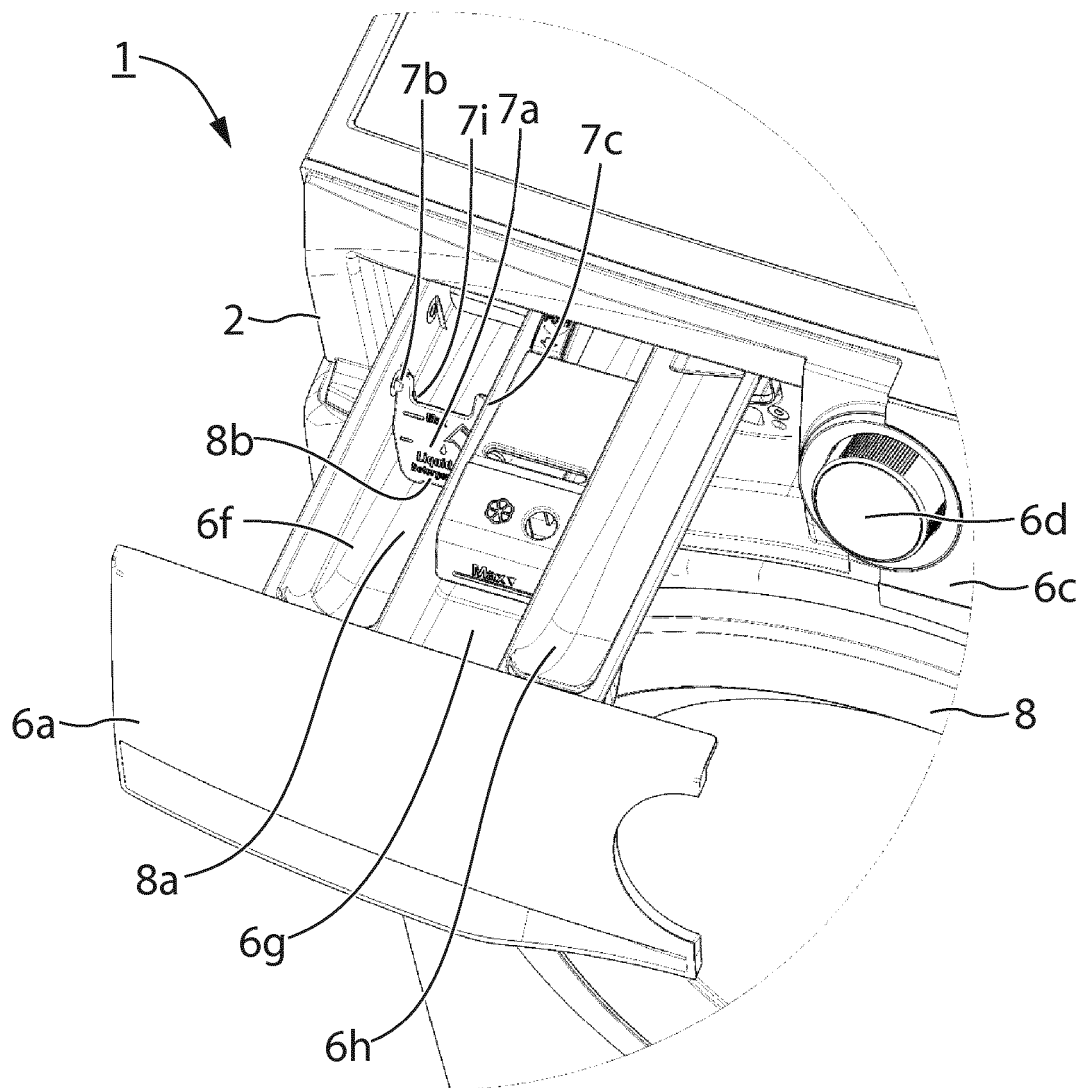


FIG. 7a

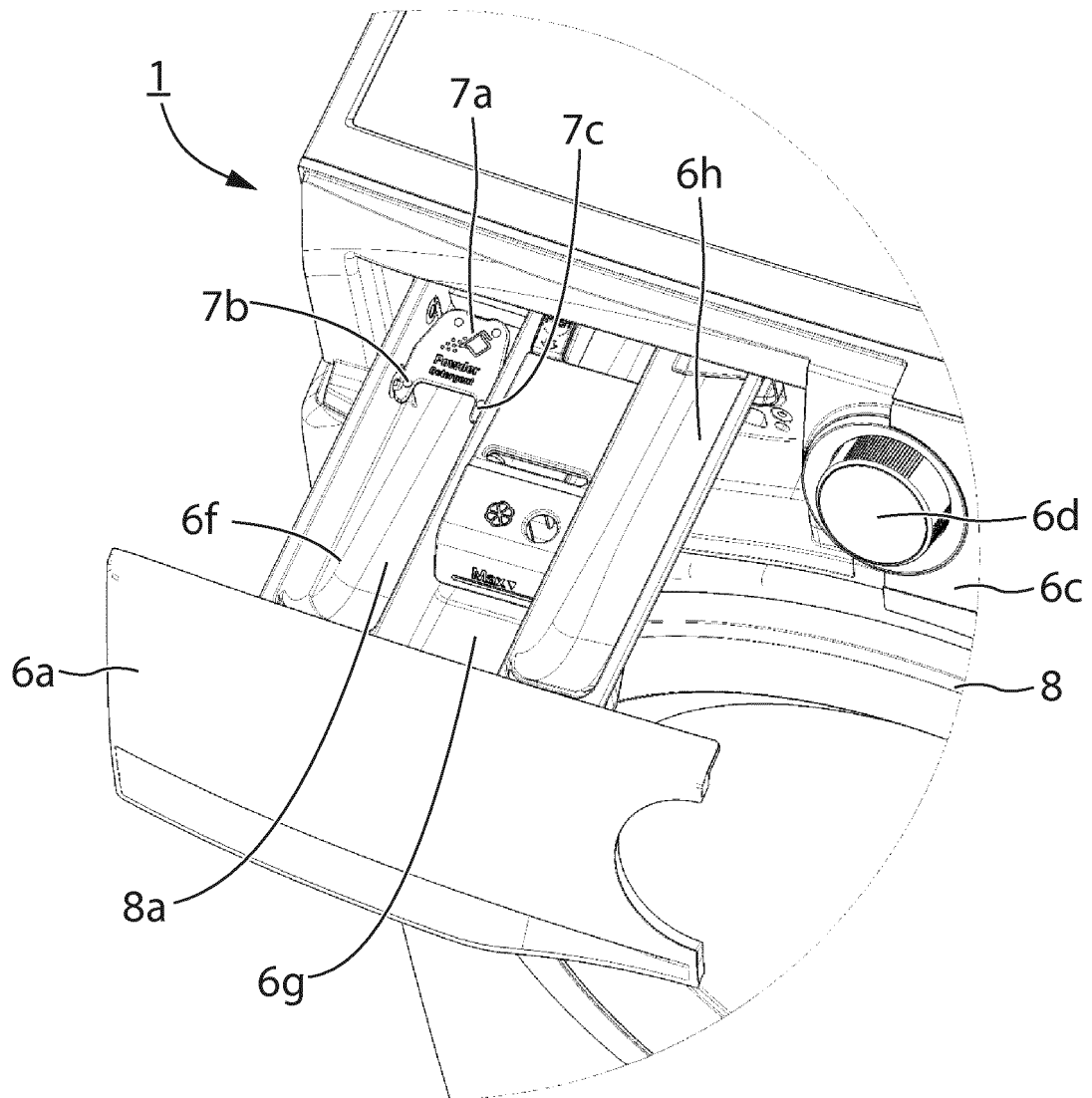


FIG. 8

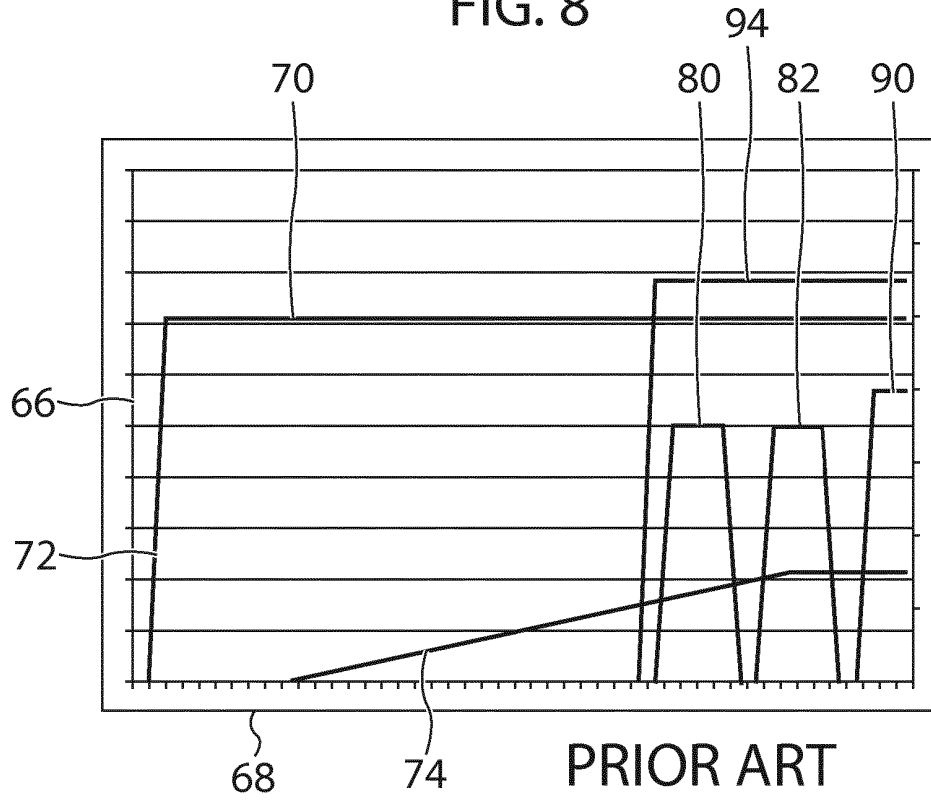


FIG. 9

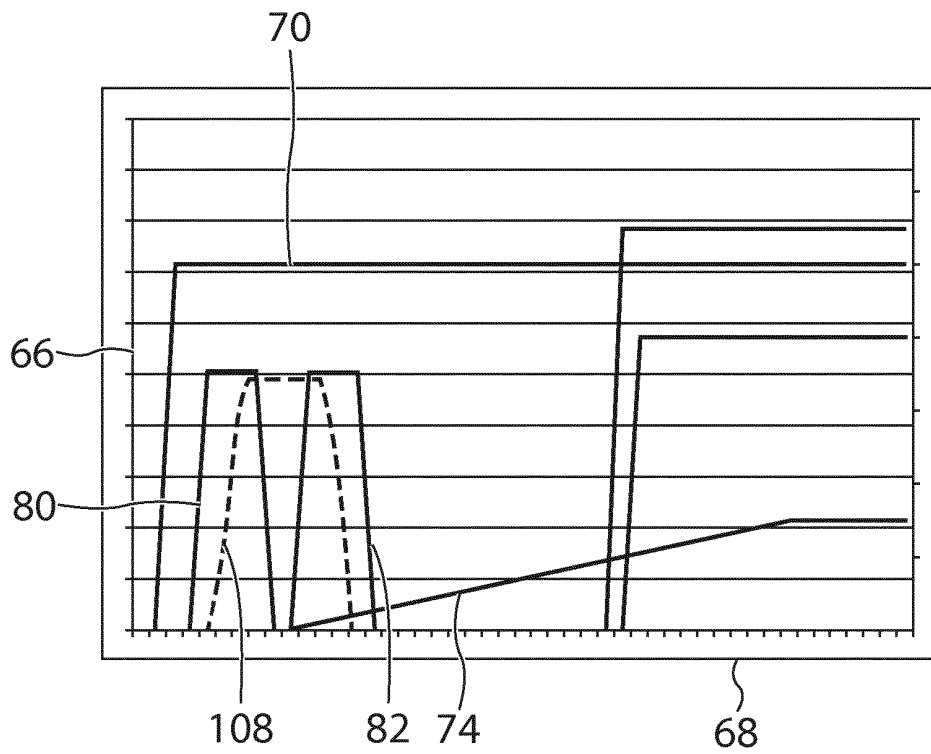


FIG. 10

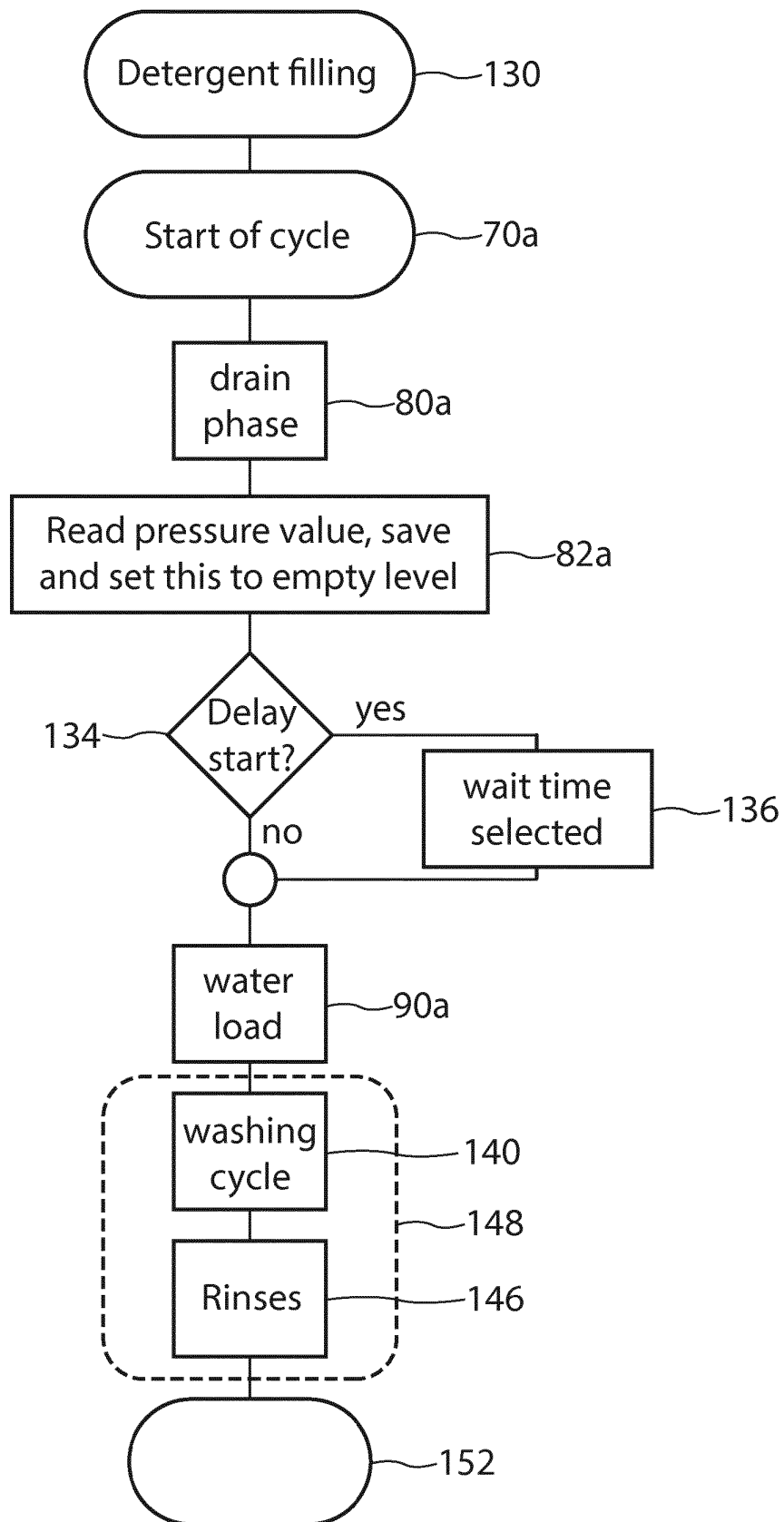
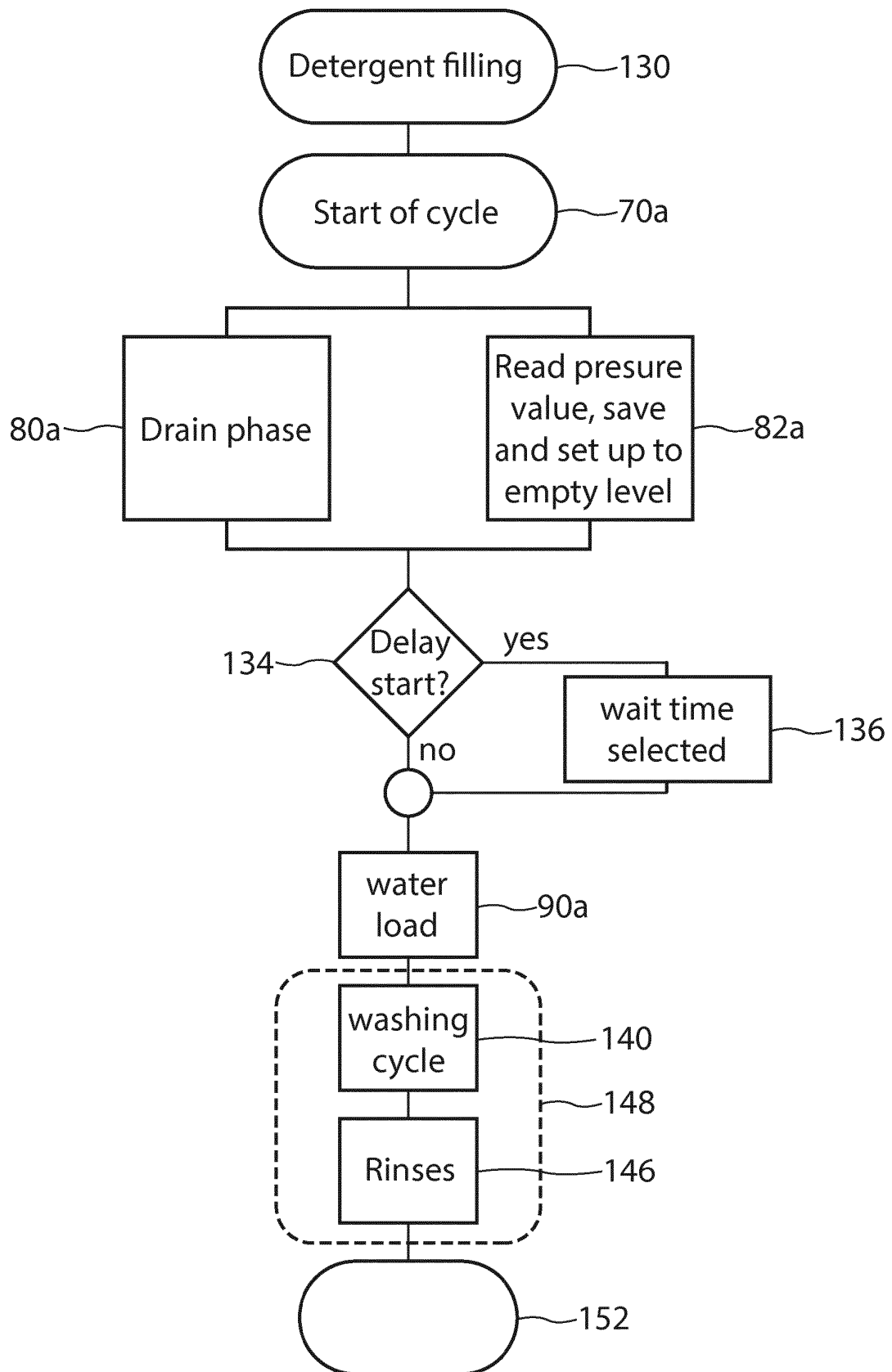


FIG. 11



REFERENCES CITED IN THE DESCRIPTION

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