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(54) **Method for washing laundry in a laundry washing machine**

(57) The present invention relates to a method for washing laundry (10) in a laundry washing machine (1), the laundry washing machine (1) comprising a washing tub (3) external to a washing drum (4) suited to receive the laundry (10), a containing unit (6) suitable to receive a quantity (Qd) of a washing product (D) and a water supply system (15) suitable to convey water (W) to the containing unit (6). The method comprising a step of conveying a first mixing flow (F1) of water (W) from the water

supply system (15) to the containing unit (6) to form a washing solution (S) for wetting said laundry (10) with said washing product (D) and a step of conveying the washing solution (S) from the containing unit (6) to the washing tub (3). The method further comprises the step of withdrawing at least a portion of the washing solution (S) from the washing tub (3) in order to create a second mixing flow (F2) of liquid (S) and the step of conveying the second mixing flow (F2) to the containing unit (6).

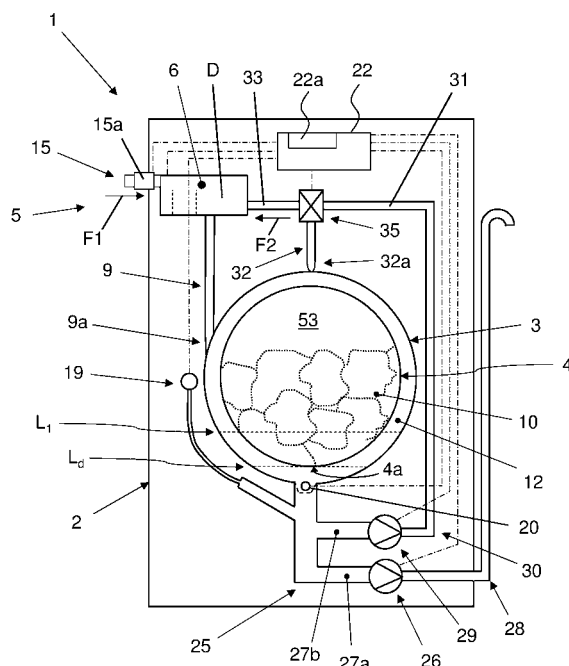


FIG. 2

Description

[0001] The present invention concerns the field of laundry washing techniques.

[0002] In particular, the present invention refers to a method for washing laundry in a laundry washing machine.

[0003] More particularly, the present invention refers to a method for mixing water and detergent in a laundry washing machine.

BACKGROUND ART

[0004] Nowadays the use of laundry washing machines, both "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), is widespread.

[0005] In the present description the term "laundry washing machine" will refer to both simple laundry washing machines and laundry washing-drying machines. Laundry washing machines generally comprise an external casing provided with a washing tub which contains a rotatable perforated drum where the laundry is placed.

[0006] A loading/unloading door ensures access to the tub and the drum.

[0007] Laundry washing machines typically comprise a detergent supply unit and a water inlet circuit for the introduction of water and washing/rinsing products (i.e. detergent, softener, etc.) into the tub.

[0008] Known laundry washing machines are also provided with water draining devices that may operate both during the initial phases of the washing cycle and at the end of the same to drain the dirty water.

[0009] Heating means are provided in order to heat the liquid, namely water or water with detergent, inside the tub.

[0010] According to the known technique, a washing cycle typically includes different phases during which the laundry to be washed is subjected to adequate treatments.

[0011] A washing cycle usually comprises an initial phase during which the laundry is wetted by means of the introduction of water into the tub. During this wetting phase preferably a preset quantity of washing detergent is also added to form a washing solution which is then absorbed by the laundry.

[0012] According to the known technique, therefore, the initial wetting phase includes the step of mixing a predetermined amount of detergent with water to form a liquor which is introduced in the tub for wetting the laundry.

[0013] A wetting method belonging to the known technique comprising a mixing step is disclosed in document US4489455A. In this document the wetting phase includes first the preparation of a wash liquor in a wash liquor reservoir. The liquor is prepared by introducing in

the wash liquor reservoir a predetermined amount of detergent composition, which may be in granular, paste, gel or in liquid form, and a predetermined amount of water. A proper mixing of the detergent and of the water takes place in the reservoir by the recirculation of the liquid from the bottom of the reservoir back into the reservoir through connecting lines.

[0014] Recirculation of the liquid is carried out until the detergent composition is substantially dissolved or dispersed in the water.

[0015] The liquor is then distributed by means of a high pressure spray nozzle as the drum rotates and the laundry is distributed about the periphery of the movable drum.

[0016] To further enhance distribution of the detergent, wash liquor application may be carried out in several stages, with the drum being momentarily stopped and restarted between each stage to allow the articles to completely redistribute themselves prior to each stage of wash liquor application. Also, multiple spray nozzles may be employed.

[0017] However, the method of wetting the laundry with a mixed solution above described belonging to the known art poses some drawbacks.

[0018] A first drawback posed by this known technique is the fact that the wetting method with the mixing step takes a long time to be completed.

[0019] A further drawback of the known technique is the fact that the wetting method with the mixing step requires a complex structural construction for the washing machine wherein it is performed.

[0020] The object of the present invention is therefore to overcome the drawbacks posed by the known technique.

[0021] It is a first object of the invention to implement a washing method that makes it possible to reduce the duration of the mixing phase.

[0022] It is a further object of the invention to implement a washing method that can be carried out in a washing machine which has a simplified structural construction with respect to the known washing machine.

DISCLOSURE OF INVENTION

[0023] The applicant has found that by providing a method for washing laundry in a laundry washing machine, the laundry washing machine comprising a washing tub external to a washing drum suited to receive the laundry, a containing unit suitable to receive a quantity of a washing product, a water supply system suitable to convey water to the containing unit, wherein the method comprises a step of conveying a first mixing flow of water from the water supply system to the containing unit and a step of conveying a second mixing flow to the containing unit it is possible to obtain a reduction of the duration of the mixing phase.

[0024] The mixing phase of the present washing method is advantageously performed in any washing method

which requires a good mixing of a detergent with water, independently of the washing program selected.

[0025] The present invention relates, in a first aspect thereof, to a method for washing laundry in a laundry washing machine, said laundry washing machine comprising:

- a washing tub external to a washing drum suited to receive said laundry;
 - a containing unit suitable to receive a quantity of a washing product;
 - a water supply system suitable to convey water to said containing unit;
- said method comprising a step of conveying a first mixing flow of water from said water supply system to said containing unit to form a washing solution for wetting said laundry with said washing product and a step of conveying said washing solution from said containing unit to said washing tub, wherein said method comprises the further step of withdrawing at least a portion of said washing solution from said washing tub in order to create a second mixing flow of liquid and the step of conveying said second mixing flow to said containing unit.

[0026] Preferably the step of conveying a first mixing flow of water from the water supply system to the containing unit comprises conveying a quantity of water sufficient to remove all the washing product from the containing unit. Advantageously the quantity of water sufficient to remove all the washing product is stated based on the type and/or the quantity of the washing product. Opportunely the step of conveying a first mixing flow of water from the water supply system to the containing unit takes place for a predetermined duration time.

[0027] Advantageously the step of withdrawing at least a portion the washing solution from the washing tub and the step of conveying the second mixing flow to the containing unit take place for a predetermined duration time.

[0028] In a preferred embodiment of the invention, the predetermined duration time is a value set by a control unit which controls the operations of the laundry washing machine.

[0029] In a further preferred embodiment of the invention, the step of withdrawing at least a portion of the washing solution from the washing tub and the step of conveying the second mixing flow to the containing unit continue after the step of conveying a first mixing flow of water from the water supply system to the containing unit is terminated.

[0030] Advantageously the step of withdrawing at least a portion of the washing solution from the washing tub is carried out by means of a re-circulation circuit connecting the bottom of the washing tub to the containing unit.

[0031] In a preferred embodiment of the invention, the re-circulation circuit further connects the bottom of the washing tub to another part of the washing tub in order to recirculate the washing solution inside the washing tub.

[0032] Opportunely, the step of conveying the second mixing flow to the containing unit and the step of recirculating the washing solution inside the washing tub are carried out selectively by driving a two-way valve associated to the re-circulation circuit.

[0033] Preferably, the method further comprises the step of rotating the washing drum after the step of conveying the washing solution from the containing unit to the washing tub.

[0034] Advantageously the step of rotating the washing drum is carried out when the level of the washing solution inside the washing tub is above the level of the lower part of the washing drum.

[0035] Preferably, the method further comprises the step of recirculating the washing solution inside the washing tub after the step of conveying the washing solution from the containing unit to the washing tub.

[0036] Advantageously the step of recirculating the washing solution inside the washing tub is carried out when the level of the washing solution inside the washing tub is above the level of the lower part of the washing drum.

[0037] In a further preferred embodiment of the invention, the method further comprises the step of heating the washing solution inside the washing tub after the step of conveying the washing solution from the containing unit into the washing tub.

[0038] In a second aspect thereof, the present invention concerns a laundry washing machine suited to implement the method of the invention described above.

[0039] In a further aspect thereof, the present invention concerns a laundry washing machine comprising:

- a washing tub external to a washing drum suited to receive the laundry to be washed;
- a containing unit suitable to receive a quantity of a washing product;
- a water supply system suitable to convey a flow of water to said containing unit;
- an output associated to said containing unit suitable to convey liquid from said containing unit to said washing tub;

the laundry washing machine further comprising a first recirculation circuit connecting said washing tub to said containing unit suitable to withdraw liquid from said washing tub in order to create a second flow of liquid which is conveyed to said containing unit.

[0040] In a further preferred embodiment of the invention, the laundry washing machine further comprises a second recirculation circuit connecting a bottom part of the washing tub to another part of the washing tub suitable to withdraw liquid from the washing tub and to re-admit such a liquid into the washing tub. Advantageously the laundry washing machine comprises a switching device suitable to activate selectively the first recirculation circuit and the second recirculation circuit.

[0041] Preferably the switching device comprises a

two-way valve.

[0042] In a preferred embodiment of the invention, the first recirculation circuit and the second recirculation circuit comprises a common portion for the connection to the washing tub.

[0043] In a further preferred embodiment of the invention, the first recirculation circuit and the second recirculation circuit are realized separately.

BRIEF DESCRIPTION OF THE DRAWINGS

[0044] Further characteristics and advantages of the present invention will be highlighted in greater detail in the following detailed description of some of its preferred embodiments, provided with reference to the enclosed drawings. In the drawings, corresponding characteristics and/or components are identified by the same reference numbers. In particular:

- Figure 1 shows a schematic isometric view of a laundry washing machine implementing the method according to the invention;
- Figure 2 shows a schematic front view of the laundry washing machine of Figure 1;
- Figure 3 is a simplified flow chart of the basic operations of a method for washing laundry in the laundry washing machine of Figure 1 according to a first embodiment of the invention;
- Figure 4 shows a further embodiment of Figure 3;
- Figure 5 shows a further embodiment of the laundry washing machine of Figure 2.

DETAILED DESCRIPTION OF THE INVENTION

[0045] The method of the present invention has proved to be particularly advantageous when applied to laundry washing machines, as described below. It should in any case be underlined that the present invention is not limited to this type of application. On the contrary, the present invention can be conveniently applied to other equipments, like for example laundry washing-drying machines, wherein a wetting of the laundry with a mixing step for the detergent is required.

[0046] With reference to Figure 1 and Figure 2, a laundry washing machine 1 is described, in which a method according to a first embodiment of the invention is implemented.

[0047] The laundry washing machine 1 is advantageously a front loading laundry washing machine. The present invention has proved to be particularly successful when applied to front loading laundry washing machines. It should in any case be underlined that the present invention is not limited to this type of application. On the contrary, the present invention can be usefully applied to different types of loading washing devices, as for example top loading laundry washing machines or top loading laundry washing-drying machines.

[0048] The laundry washing machine 1 comprises an

external casing or casing 2, in which a washing tub 3 is provided that contains a rotatable perforated drum 4, where the laundry 10 to be washed can be loaded.

[0049] The tub 3 and the drum 4 both have preferably a substantially cylindrical shape. A hollow space 12 is defined between the tub 3 and the drum 4.

[0050] The casing 2 is provided with a loading/unloading door, not illustrated, which allows access to the washing tub 3 and the drum 4.

[0051] The tub 3 is preferably suspended in a floating manner inside the casing 2, advantageously by means of a number of coil springs and shock-absorbers, not illustrated herein.

[0052] The tub 3 is preferably connected to the casing 2 and/or the door by means of an elastic bellows 7, or gasket.

[0053] The drum 4 is advantageously rotated by an electric motor which preferably transmits the rotating motion to the shaft of the drum 4, advantageously by means of a belt/pulley system. In a different embodiment of the invention, the motor can be directly associated with the shaft of the drum 4.

[0054] A water inlet circuit 5 is arranged preferably in the upper part of the laundry washing machine 1 and is suited to supply water W and washing/rinsing products (i.e. detergent, softener, etc.) into the tub 3.

[0055] The water inlet circuit 5 advantageously comprises a removable drawer 6 provided with various compartments suited to be filled with washing and/or rinsing products.

[0056] In the embodiment herein described, the water W is advantageously supplied into the tub 3 by making it flow through the drawer 6 and through a supply pipe 9 which extends toward the tub 3.

[0057] The water W is advantageously supplied into the drawer 6 by making it flow from a main pipe 15.

[0058] The main pipe 15 is opportunely connected to an external water supply line, not illustrated, preferably by means of a controlled supply valve 15a.

[0059] The supply pipe output 9a of the supply pipe 9 preferably ends in correspondence of the tub 3. More preferably the supply pipe output 9a ends in correspondence of a lateral side of the tub 3, as better visible in Figure 2. In another advantageous embodiment, not illustrated, the supply pipe output 9a ends in correspondence of a suitable opening of the bellows 7, so as to be directed towards the internal of the tub 3.

[0060] In a preferred embodiment, the water W which reaches the tub 3 can selectively contain one of the products contained in the compartments of the drawer 6, or such water W can be clean (i.e. without products) and in this case it may reach the tub 3 directly, bypassing the compartments of the drawer 6.

[0061] This may depend on the phase of the washing cycle selected. In the initial phases of the washing cycle, for example, the products are conveyed into the tub 3. In other phases, as for example during the rinsing phase, only water W is conveyed into the tub 3.

[0062] In an alternative embodiment of the invention, a further separate water supply pipe can be provided, which supplies exclusively clean water W into the tub 3. The water inlet circuit 5 also preferably comprises a water flow sensor, for example a flow meter, which makes it possible to calculate the quantity of water W supplied into the tub 3.

[0063] The laundry washing machine 1 advantageously comprises a water outlet circuit 25.

[0064] The water outlet circuit 25 advantageously comprises a drain pump 26, a first pipe 27a connecting the tub 3 to the drain pump 26 and an outlet pipe 28 ending outside the casing 2. The water outlet circuit 25 is suited to drain the liquid, i.e. dirty water or water mixed with washing and/or rinsing products, from the tub 3 to the outside.

[0065] The laundry washing machine 1 is advantageously provided with a recirculation circuit 30 adapted to drain liquid from a bottom region of the tub 3 and to re-admit such a liquid into a higher region of the tub 3 or into the drawer 6, as better explained below.

[0066] The recirculation circuit 30 advantageously comprises a recirculation pump 29, a first pipe 27b connecting the tub 3 to the recirculation pump 29 and a recirculation pipe 31. The recirculation pipe 31 is advantageously selectively connected to a conveying pipe 32 and to a recirculation duct 33 by means of a controlled two-way valve 35.

[0067] The conveying pipe 32 advantageously ends with an injection nozzle 32a placed in an upper region of the tub 3, or of the bellows 7.

[0068] The recirculation duct 33 terminates in correspondence of the drawer 6, so as to be able to drain liquid into the latter.

[0069] The two-way valve 35 is preferably properly controlled in order to allow selective drainage of liquid towards the washing tub 3 (or bellows 7) through the conveying pipe 32 or towards the drawer 6 through the recirculation duct 33 (in a configuration where the recirculation pump 29 is activated).

[0070] In case of drainage of the liquid from the tub 3 towards the outside, preferably only the drain pump 26 is activated. In case of drainage of the liquid from the tub 3 towards the upper region of the tub 3 or towards the drawer 6, only the recirculation pump 29 is activated.

[0071] Advantageously the laundry washing machine 1 comprises a device 19 suited to sense (or detect) the liquid level inside the tub 3.

[0072] The device 19 preferably comprises a pressure sensor which senses the pressure in the tub 3. From the values sensed by the device 19 it is possible to determine the liquid level L of the liquid inside the tub 3. In another embodiment, not illustrated, laundry washing machine 1 comprises (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.

[0073] The laundry washing machine 1 advantageously

ly comprises a heating element 20, preferably comprising an electric resistor suited to come into contact with the liquid present on the bottom of the tub 3 to heat said liquid.

[0074] In further embodiments the heating device may be different and suitable to heat the liquid at the bottom of the tub, as for example microwaves source, infra-red rays, etc.

[0075] Advantageously, laundry washing machine 1 comprises a temperature sensor, not illustrated in the figures, for sensing the temperature of the liquid inside the tub 3. Preferably the temperature sensor is placed in correspondence or in proximity of said heating element 20, more preferably integrally made with it.

[0076] A control unit 22 is connected to the various parts of the laundry washing machine 1 in order to ensure its operation. The control unit 22 is preferably connected to the water inlet circuit 5, the input valve 15a, the water outlet circuit 25, the recirculation circuit 30, the two-way valve 35, the heating element 20, the electric motor 11, and receives information from the various sensors provided on the laundry washing machine 1, like the flow meter of the water inlet circuit 5, the pressure sensor 19 on the bottom of the tub 3 (level sensor), the temperature sensor, etc.

[0077] The control unit 22 is advantageously connected also to an interface unit 22a which is accessible to the user and by means of which the user may select and set the washing parameters from time to time, in particular the desired washing program. Advantageously, 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, the type of fabric of the load, etc.

[0078] Based on the parameters acquired by said interface unit 22a, the control unit 22 sets and controls the various parts of the laundry washing machine 1 in order to carry out the desired washing program.

[0079] A first embodiment of the washing method according to the invention is described here below with reference to the laundry washing machine 1 shown in Figures 1 and 2 and with reference to the operation flow chart of Figure 3.

[0080] The laundry 10 to be washed is first placed inside the drum 4 (step 100). By operating on the interface unit 22a the user selects the desired washing program (step 110) depending for example on the type and on the dirty-level of the products to wash. Furthermore, as said before, in a preferred embodiment it is possible for the user to insert some parameters directly by the interface unit 22a, for example the value of the washing temperature, the rotating speed of the drum 4 in the spinning phase, the duration of washing cycle, etc.

[0081] Before starting the washing program (e.g. before or after step 100 and/or step 110) the washing and/or rinsing products are loaded inside the drawer 6 by the user. Different products may be loaded in the drawer 6, as for example detergent, bleach, softener, etc.

[0082] For example, a quantity Qd of detergent D may

be loaded in the proper compartment of the drawer 6, the detergent D being in granular, paste, gel or in liquid form.

[0083] For the sake of simplicity only the compartment for the detergent D is illustrated in the figures. It is clear that the drawer 6 may comprise different compartments with different shapes. Also the drawer 6 may comprise different ducts for conveying water W to the different compartments, when provided.

[0084] In a further embodiment, the selection of the desired washing program (step 110) may be performed before placing the laundry 10 into the drum 4 (step 100). Once the user has selected the desired washing program, the control unit 22 sets the laundry washing machine 1 so that it starts the washing cycle.

[0085] In a successive phase (step 120) the supply valve 15a is opened and a first flow F1 of water W is introduced into the drawer 6 through the main pipe 15.

[0086] The first flow F1 of water W is mixed with the detergent D inside the drawer 6. The water W and the detergent D start to flow together through the supply pipe 9 up to the supply pipe output 9a.

[0087] The water W and the detergent D introduced inside the tub 3 by means of the supply pipe 9 advantageously fall down on the bottom of the tub 3. This is Preferably the supply pipe output 9a is placed in a lateral position with respect to the tub 3, so as to guarantee that the water W and the detergent D introduced inside the tub 3 by means of the supply pipe 9 fall down on the bottom of the tub. The water W and the detergent D form a washing solution S inside the tub up to a level L. The level L reached by the washing solution S is advantageously sensed by means of the pressure sensor 19. In further embodiment, the level L may be sensed by means of different level sensors, for example a mechanical sensor, an electro-mechanical sensor, an optical sensor, etc..

[0088] According to the present invention during the phase of supplying water W into the drawer 6 (step 120) a recirculation and mixing phase (step 130) is performed. This phase (step 130) is advantageously carried out by means of the activation of the recirculation circuit 30.

[0089] The two-way valve 35 is opportunely driven by the control unit 22 in order to allow the drainage of liquid towards the drawer 6 through the recirculation duct 33.

[0090] The washing solution S which lies on the bottom of the tub 3 is drained towards the drawer 6 by means of the recirculation pump 29. The recirculation pump 29 takes the washing solution S from the bottom of the tub 3 and conveys it towards the drawer 6 through the recirculation pipe 31, the two-way valve 35 and the recirculation duct 33.

[0091] A second flow F2 of washing solution S is therefore introduced into the drawer 6 through the recirculation duct 33.

[0092] Inside the drawer 6, preferably, the first flow F1 of water W and the second flow F2 of washing solution S combine. Such a combination of flows F1 and F2 en-

hances the mixing between the quantity Qd of detergent D and the water W to form a higher effective solution S.

[0093] In fact, by means of the combination of the two flows F1 and F2 the detergent D is properly dissolved or dispersed in the water W.

[0094] Furthermore the mixing effect is enhanced along the recirculation circuit, namely along the first pipe 27b, the recirculation pipe 31 and the recirculation duct 33. Advantageously, the mixing effect is carried out while the water W of the first flow F1 is introduced into the drawer 6. Therefore, the mixing between water W and detergent D takes place more rapidly with respect the known techniques. Preferably, the mixing process (step 130) takes place for a period of time t_r deemed sufficient to at least remove all the quantity Qd of detergent D from the drawer 6.

[0095] This may depend on the type and/or on the quantity Qd of detergent D introduced into the drawer 6 by the user. The period of time t_r may also depend on the way the two flows F1 and F2 act inside the drawer 6.

[0096] In fact, the pressures and the directions of the flows F1 and F2 may affect the efficiency of the removal of the detergent D inside the drawer 6.

[0097] The quantity Q_{rw} of water W necessary for removing all the quantity Qd of detergent D from the drawer 6 may be advantageously set by the control unit 22 by knowing the quantity Qd of detergent D introduced into the drawer 6. The quantity Qd of detergent D may be determined, for example, by means of a detergent quantity sensor placed in inside the drawer 6.

[0098] In a further embodiment, the quantity Q_{rw} of water W necessary for removing all the quantity Qd of detergent D from the drawer 6 may be estimated/set by the control unit 22.

[0099] In another embodiment, the mixing phase (step 130) may continue even after the first flow F1 has been stopped. In this case, the recirculation circuit 30 advantageously keep working. The washing solution S from the bottom of the tub 3 is drained towards the drawer 6 by means of the recirculation pump 29. The recirculation pump 29 takes the washing solution S from the bottom of the tub 3 and conveys it towards the drawer 6 through the recirculation pipe 31, the two-way valve 35 and the recirculation duct 33. The washing solution S from the drawer 6 then flows again into the tub 3 by gravity through the supply pipe 9. The mixing effect is carried out substantially along the recirculation circuit, namely along the first pipe 27b, the recirculation pipe 31 and the recirculation duct 33, the drawer 6 and the supply pipe 9.

[0100] The mixing phase (step 130) preferably takes place for a suitable period of time t_m deemed sufficient to obtain a well mixed solution S.

[0101] In a preferred embodiment of the invention, the quantity of washing solution S which is formed inside the tub 3 and which is re-circulated inside the drawer 6 reach a level L inside the tub 3 which remains below the drum level L_d . The drum level L_d may be defined as substantially the level of the lower part of the bottom 4a of the

drum 4, as shown in Figure 2.

[0102] Once the mixing phase (step 130) is terminated, then the washing program will continue according to the selected washing program.

[0103] The mixing phase described in the present washing method is advantageously performed in any washing method which requires a good mixing of a detergent with water, independently of the washing program selected and therefore independently from the steps performed before or after the mixing phase. Further steps of the washing program may preferably comprise a heating phase (step 140), introduction of further washing water into the tub (step 150), drum rotations (step 160), a draining step (165) for draining dirty water out from the machine, a rinsing phase (step 170) and a spinning phase (step 180).

[0104] Once the spinning phase (step 180) terminates, the washing program is completed.

[0105] At this point, the user may take the laundry 10 out of the drum.

[0106] In case the washing program is performed in a laundry washing-drying machine, after the spinning phase (step 180) the laundry 10 may be advantageously subjected to a drying phase inside the drum 4 (step 190).

[0107] It has to be noted that a heating phase may also be provided at the beginning of the washing program. In a further embodiment in fact, a heating phase (step 200) may preferably be performed during the mixing phase (step 130). The heating phase is preferably carried out by means of the activation of the heating element 20. The heating element in this case increases the temperature of the washing solution S up to a predetermined temperature.

[0108] Again, during one or more of the different phases of the washing program, the recirculation circuit 30 may advantageously be activated for conveying the liquid from the bottom of the tub 3 towards the laundry 10 by properly controlling the two-way valve 35. In this case, the recirculation pump 29 takes the washing liquid from the bottom of the tub 3 and conveys it towards the laundry 10 through the recirculation pipe 31, the two-way valve 35, the conveying pipe 32 and finally through the injection nozzle 32a in the upper region of the tub 3.

[0109] In a further preferred embodiment of the invention, during the mixing phase (step 130) the quantity of washing solution S which is formed inside the tub 3 may reach a level L_1 which is higher than the drum level L_d .

[0110] In this case, the mixing process (step 130) may preferably continue even when the level of the washing solutions S goes over the drum level L_d (as shown in Figure 2).

[0111] When the level of the washing solutions S goes over the drum level L_d , part of the washing solution S is absorbed by the laundry 10.

[0112] In this case, as shown in the flow chart of Figure 4, during the mixing process (step 130) the drum 4 is preferably set rotated (step 210), so as to enhance the absorption of the washing solution S by the laundry 10

inside the drum 4.

[0113] In a further preferred embodiment of the invention, the mixing process (step 130) may be temporarily interrupted and a recirculation process of the washing solution S inside the tub 3 may be advantageously performed (step 220).

[0114] The two-way valve 35 is opportunely driven by the control unit 22 in order to allow the drainage of the washing solution S towards the upper part of the tub 3 through the conveying pipe 32 and finally through the injection nozzle 32a.

[0115] The washing solution S which lies on the bottom of the tub 3 is drained towards the drawer 6 by means of the recirculation pump 29. The recirculation pump 29 takes the washing solution S from the bottom of the tub 3 and conveys it towards the upper part of the tub 3 through the recirculation pipe 31, the two-way valve 35, the conveying pipe 32 and finally through the injection nozzle 32a.

[0116] By means of this recirculation process, uniform wetting of the laundry 10 with the washing solution S can be accomplished.

[0117] After this recirculation process, the mixing phase (step 130) may be preferably performed again.

[0118] Advantageously, by providing a mixing phase (step 130) and a recirculation phase inside the tub 3 (step 220) the washing solution S is effectively mixed and at the same time the laundry 10 is uniformly wetted with the washing solution S. With reference to Figure 5 a construction variant of a laundry washing machine 61 is described.

[0119] The laundry washing machine 61 shows in Figure 5 differs from the laundry washing machine 1 described with reference to Figures 1 and 2 for the fact that it is advantageously provided with a first recirculation circuit 30 adapted to drain liquid from a bottom region of the tub 3 and to re-admit such a liquid into the drawer 6 and with a further separate second recirculation circuit 30' adapted to drain liquid from a bottom region of the tub 3 and to re-admit such a liquid into a higher region of the tub 3. The first recirculation circuit 30 advantageously comprises a recirculation pump 29a, a first pipe 27b connecting the tub 3 to the recirculation pump 29a and a recirculation duct 33'. The recirculation duct 33' terminates inside the drawer 6. In case of drainage of the liquid from the tub 3 towards the drawer 6 the recirculation pump 29a is activated.

[0120] The second recirculation circuit 30' advantageously comprises a recirculation pump 29b, a pipe 27c connecting the tub 3 to the recirculation pump 29b and a conveying pipe 32'. The conveying pipe 32' advantageously ends with an injection nozzle 32'a in an upper region of the tub 3.

[0121] In case of drainage of the liquid from the tub 3 towards the upper region of the tub 3 the recirculation pump 29b is activated.

[0122] In this laundry washing machine 61 the method according to the invention above described may be easily

performed by activating and controlling the two recirculations circuits 30 and 30' separately.

[0123] Furthermore, in the laundry washing 61 illustrated in Figure 5, the re-circulations circuits 30 and 30' may be even advantageously contemporaneously activated.

[0124] In a further embodiment of the invention, not illustrated in the enclosed figures, the laundry washing machine is substantially the same as the one described with reference to Figure 5, with the only difference that the separate second recirculation circuit 30' is not provided; in this case the method according to the invention above described may be easily performed by activating and controlling only the re-circulations circuits 30 (which in this embodiment is the only recirculation circuit present).

[0125] It has thus been shown that the present invention allows all the set objects to be achieved. In particular, it makes it possible to obtain a wetting and mixing phase in a washing cycle of a laundry washing machine that allows reducing the duration of the mixing phase.

[0126] While the mixing phase of present invention has been described with reference to a particular washing cycle, it should be noted that the present invention is not limited to the specific embodiment illustrated and described herein; on the contrary, further variants of the embodiments described herein fall within the scope of the present invention, which is defined in the claims.

[0127] It is underlined that the laundry washing machines illustrated in the enclosed figures, and with reference to which some embodiments of the method according to the invention have been described, are of the front-loading type; however it is clear that the method according to the invention can be applied as well to a top-loading laundry washing machine, substantially without any modification.

Claims

1. Method for washing laundry (10) in a laundry washing machine (1), said laundry washing machine (1) comprising:

- a washing tub (3) external to a washing drum (4) suited to receive said laundry (10);
- a containing unit (6) suitable to receive a quantity (Qd) of a washing product (D);
- a water supply system (15) suitable to convey water (W) to said containing unit (6);

said method comprising a step of conveying a first mixing flow (F1) of water (W) from said water supply system (15) to said containing unit (6) to form a washing solution (S) for wetting said laundry (10) with said washing product (D) and a step of conveying said washing solution (S) from said containing unit (6) to said washing tub (3), **characterized in that**

said method comprises the further step of withdrawing at least a portion of said washing solution (S) from said washing tub (3) in order to create a second mixing flow (F2) of liquid (S) and the step of conveying said second mixing flow (F2) to said containing unit (6).

2. Method according to claim 1, **characterized in that** said step of conveying a first mixing flow (F1) of water (W) from said water supply system (15) to said containing unit (6) comprises conveying a quantity (Q_{rw}) of water (W) sufficient to remove all said washing product (D) from said containing unit (6).
3. Method according to claim 2, **characterized in that** said quantity (Q_{rw}) of water (W) sufficient to remove all said washing product (D) is stated based on the type and/or the quantity (Qd) of said washing product (D).
4. Method according to any of the preceding claims, **characterized in that** said step of conveying a first mixing flow (F1) of water (W) from said water supply system (15) to said containing unit (6) takes place for a predetermined duration time (t_r).
5. Method according to any of the preceding claims, **characterized in that** said step of withdrawing at least a portion of said washing solution (S) from said washing tub (3) and said step of conveying said second mixing flow (F2) to said containing unit (6) take place for a predetermined duration time (t_m).
6. Method according to claim 5, **characterized in that** said predetermined duration time (t_m) is a value set by a control unit which controls the operations of said laundry washing machine (1).
7. Method according to any of the preceding claims, **characterized in that** said step of withdrawing at least a portion of said washing solution (S) from said washing tub (3) and said step of conveying said second mixing flow (F2) to said containing unit (6) continue after said step of conveying a first mixing flow (F1) of water (W) from said water supply system (15) to said containing unit (6) is terminated.
8. Method according to any of the preceding claims, **characterized in that** said step of withdrawing at least a portion of said washing solution (S) from said washing tub (3) is carried out by means of a re-circulation circuit (30) connecting the bottom of said washing tub (3) to said containing unit (6).
9. Method according to claim 8, **characterized in that** said re-circulation circuit (30) further connects the bottom of said washing tub (3) to another part of said washing tub (3) in order to recirculate said washing

solution (S) inside said washing tub (3).

10. Method according to claim 9, **characterized in that** said step of conveying said second mixing flow (F2) to said containing unit (6) and said step of recirculating said washing solution (S) inside said washing tub (3) are carried out selectively by driving a two-way valve (35) associated to said re-circulation circuit (30).
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11. Method according to any of the preceding claims, **characterized in that** it further comprises the step of rotating said washing drum (4) after said step of conveying said washing solution (S) from said containing unit (6) to said washing tub (3).
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12. Method according to claim 11, **characterized in that** said step of rotating said washing drum (4) is carried out when the level of said washing solution (S) inside the washing tub (3) is above the level (L_d) of the lower part (4a) of said washing drum (4).
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13. Method according to any of the preceding claims, **characterized in that** it further comprises the step of recirculating said washing solution (S) inside said washing tub (3) after said step of conveying said washing solution (S) from said containing unit (6) to said washing tub (3).
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14. Method according to claim 13, **characterized in that** said step of recirculating said washing solution (S) inside said washing tub (3) is carried out when the level (L_1) of said washing solution (S) inside the washing tub (3) is above the level (L_d) of the lower part (4a) of said washing drum (4).
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15. Method according to any of the preceding claims, **characterized in that** it further comprises the step of heating said washing solution (S) inside said washing tub (3) after said step of conveying said washing solution (S) from said containing unit (6) into said washing tub (3).
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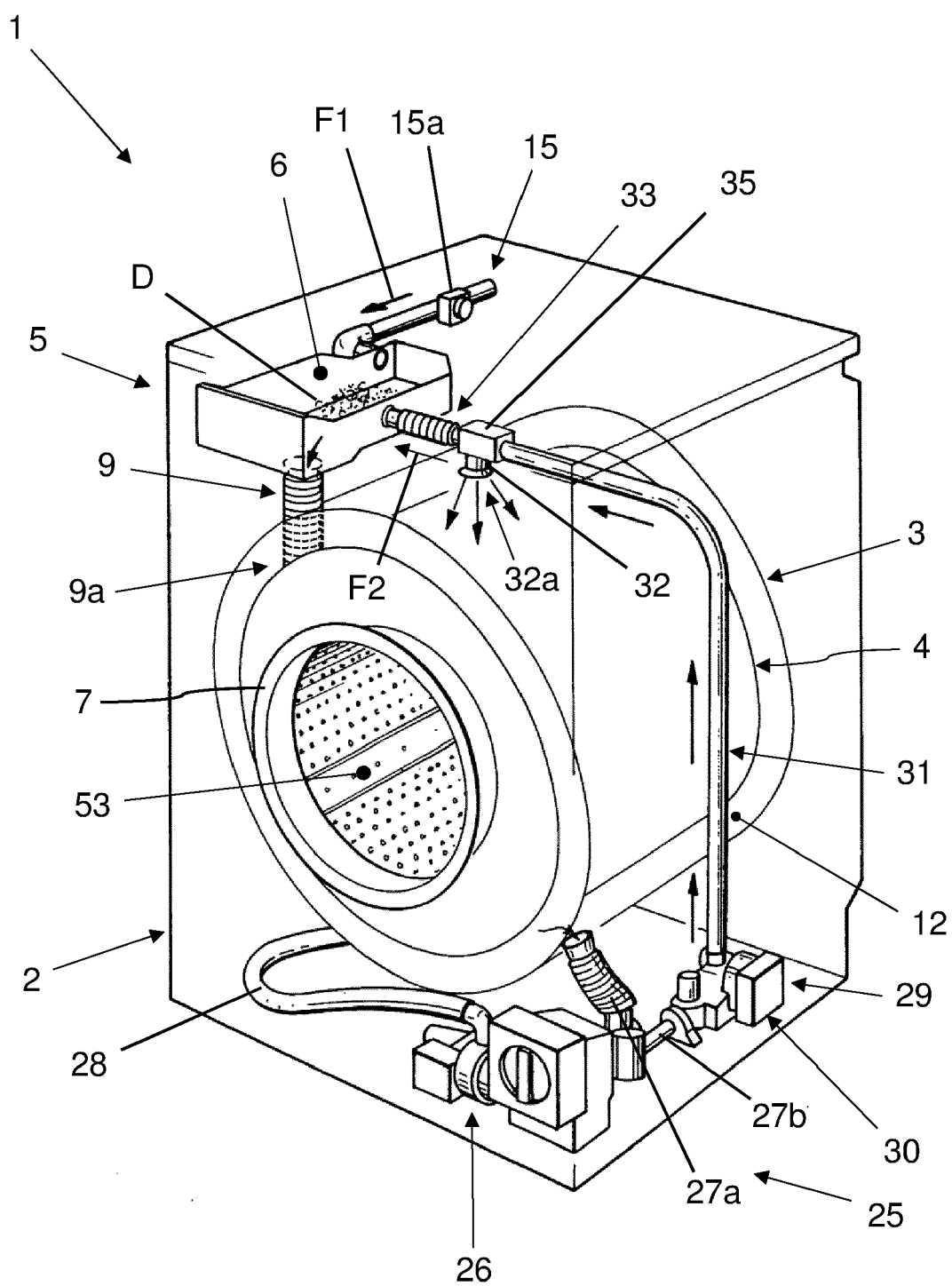


FIG. 1

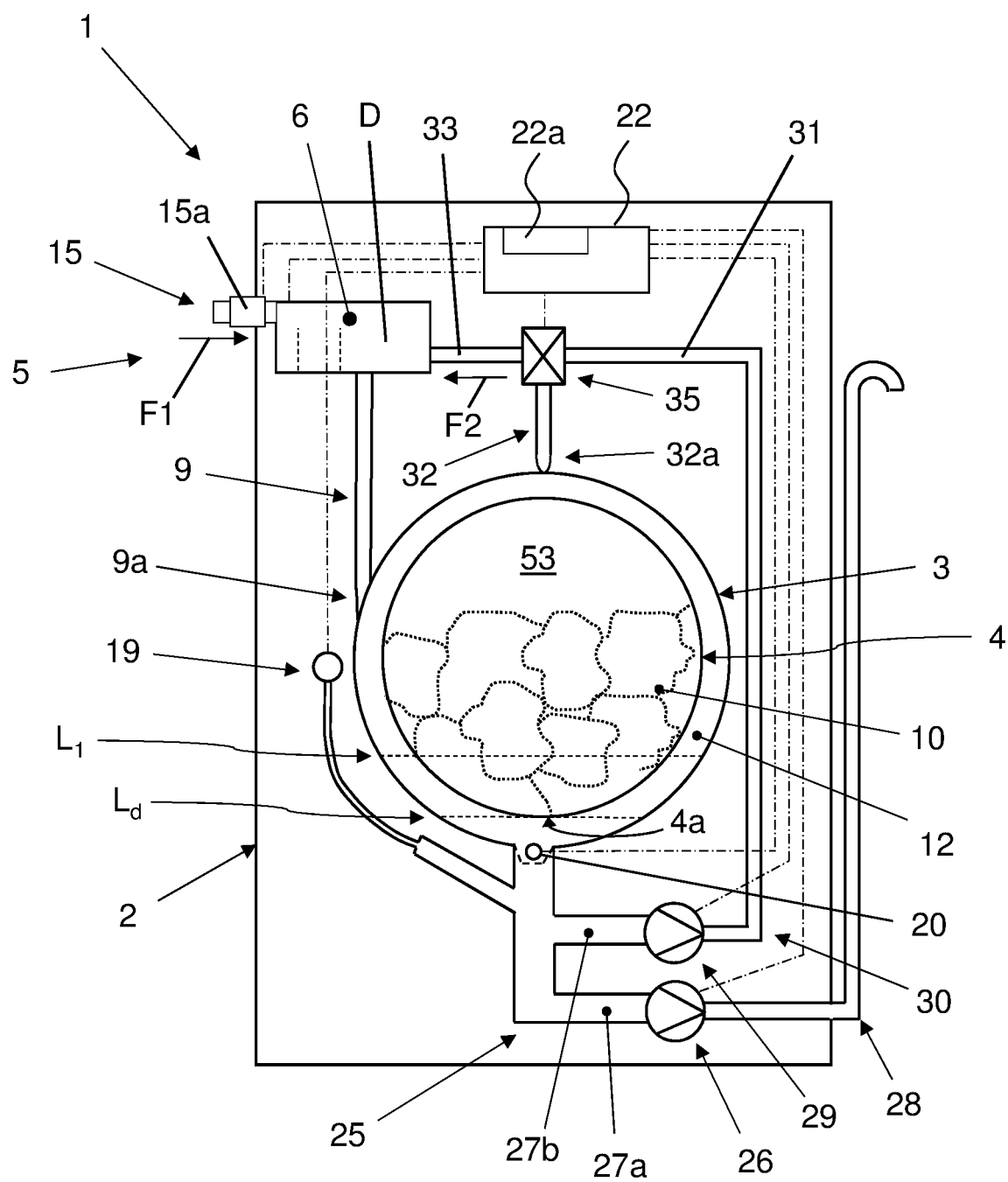


FIG. 2

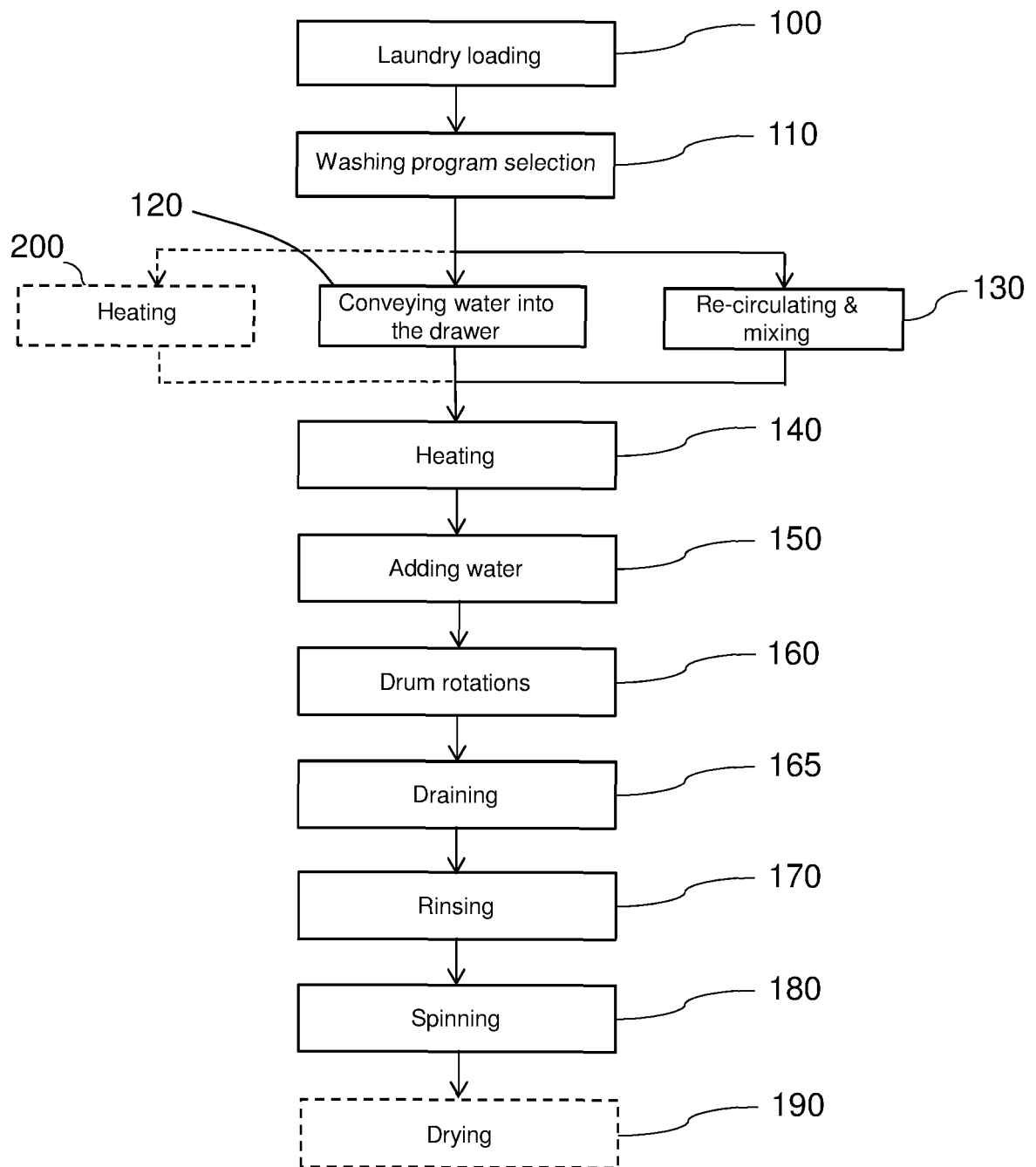


FIG. 3

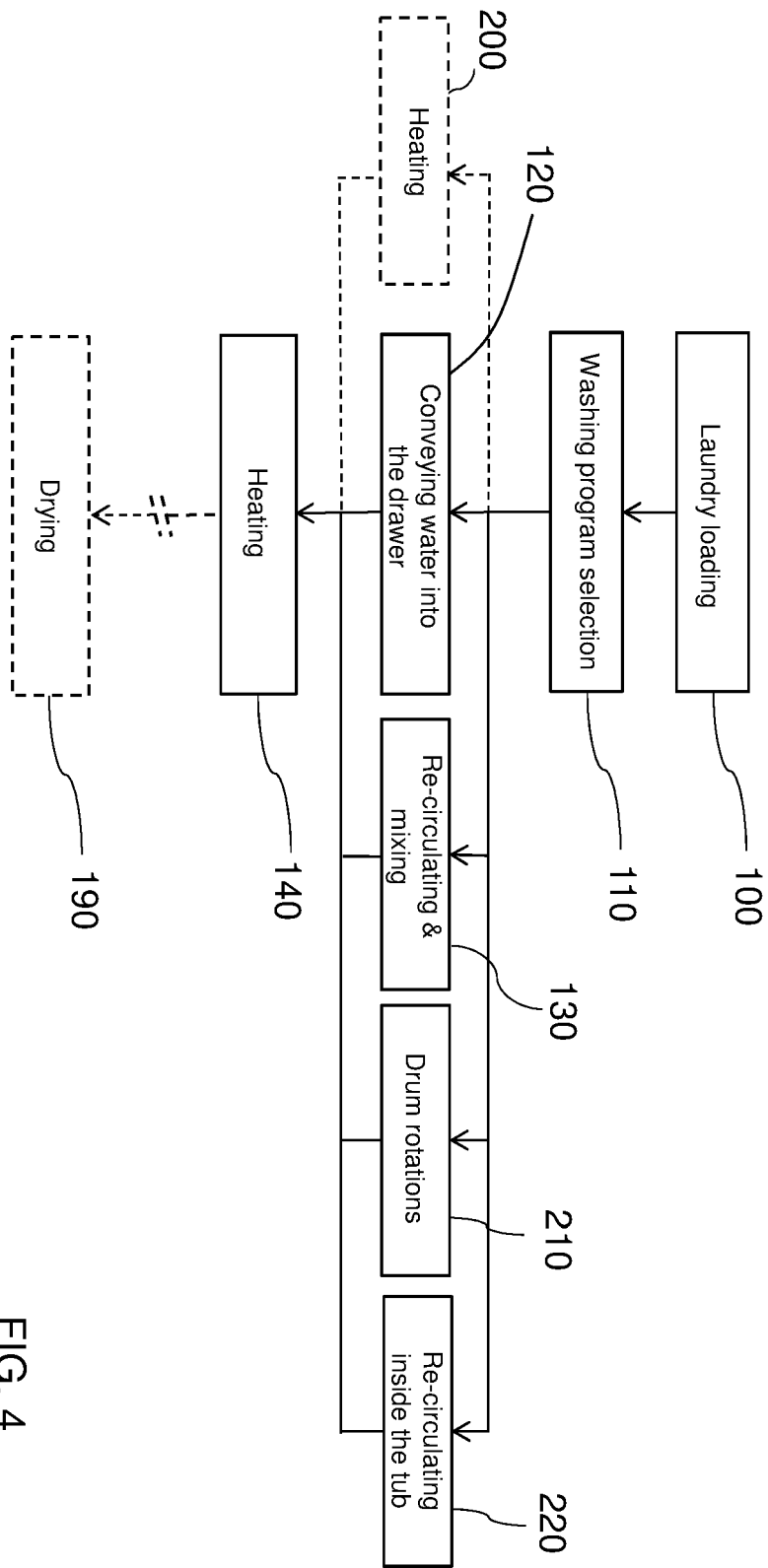


FIG. 4

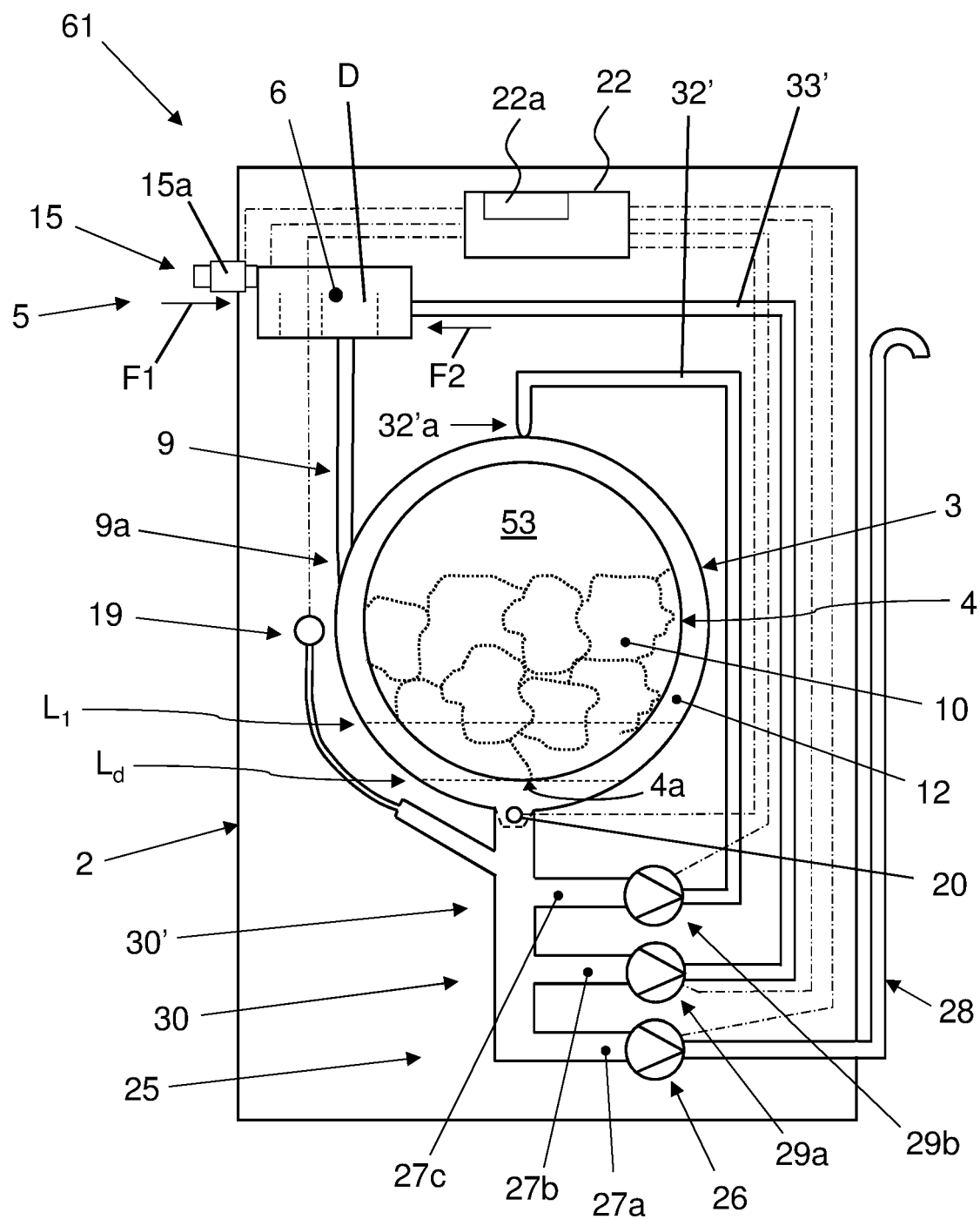


FIG. 5



EUROPEAN SEARCH REPORT

Application Number
EP 11 18 3720

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 688 529 A1 (ELECTROLUX HOME PROD CORP [BE]) 9 August 2006 (2006-08-09) * paragraph [0027] - paragraph [0034]; figures 1-2 *	1-15	INV. D06F39/02 D06F39/08
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A	EP 0 240 992 A2 (DOMAR SA [ES]) 14 October 1987 (1987-10-14) * page 2, line 5 - page 3, line 8; figure 1 *	1-15	
A	DE 16 10 190 A1 (SIEMENS ELEKTROGERAETE GMBH) 8 July 1971 (1971-07-08) * page 3 - page 4; figure 1 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 March 2012	Examiner Hannam, Martin
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 11 18 3720

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05-03-2012

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