(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 703 537 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.03.2014 Bulletin 2014/10

(51) Int Cl.:
D06F 33/02 *(2006.01)* ***D06F 39/08*** *(2006.01)*

(21) Application number: **12182198.7**

(22) Date of filing: **29.08.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(71) Applicant: **Electrolux Home Products Corporation N.V.**
1130 Brussel (BE)

(72) Inventors:
- **Del Pos, Maurizio**
  33080 Porcia (PN) (IT)
- **Favaro, Daniele**
  33080 Porcia (PN) (IT)
- **Pesavento, Elena**
  33080 Porcia (PN) (IT)
- **Stabon, Elisa**
  33080 Porcia (PN) (IT)

(74) Representative: **Nardoni, Andrea et al**
Electrolux Italia S.p.A.
Corso Lino Zanussi, 30
33080 Porcia (PN) (IT)

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

(57) The present invention relates to a method for washing laundry in a laundry washing machine (1; 200; 300) of the type comprising: a washing tub (3) external to a rotatable washing drum (4) adapted to receive laundry; a water supply circuit (5) to supply water into the washing tub (3); a washing/rinsing products supplier (6) to supply washing/rinsing products (D) into the washing tub (3); a heater device (10) placed at the bottom (3a) of the washing tub (3) for heating a liquid coming into contact with it; a recirculation circuit (20) suitable for withdrawing liquid from a bottom region (3a) of the washing tub (3) and for re-admitting such a liquid into the washing tub (3) in such a way that the re-admitted liquid wets the laundry.

The method comprises the steps of: introducing (120) a quantity (Qd) of a washing/rinsing product (D) and a quantity ($Q1_w$) of liquid (W) into the washing tub (3); decreasing the liquid level inside the washing tub (3) by activating (130) the recirculation circuit (20) for withdrawing liquid (S) from the washing tub (3) and re-admitting the liquid into the washing tub (3) in such a way that the re-admitted liquid wets the laundry; detecting the liquid level inside the washing tub (3) and, if the liquid level reaches a threshold level (Lm, Lb) which is below the heater device (10): deactivating (140) the recirculation circuit (20); introducing (150) into the washing tub (3) a quantity ($Q1'_W$) of liquid (W') in such a way that the quantity ($Q1'_w$) of liquid (W') falls at the bottom (3a) of the washing tub (3) and strikes the liquid present therein so as to improve the dissolution of the washing/rinsing product (D) collected therein.

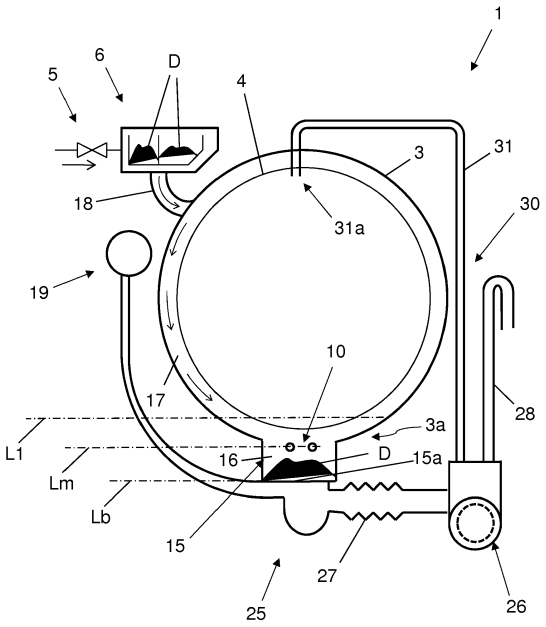

FIG. 2

EP 2 703 537 A1

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 capable of performing a more efficient detergent dissolution.

BACKGROUND ART

[0003] 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.

[0004] 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.

[0005] A loading/unloading door ensures access to the drum.

[0006] Laundry washing machines typically comprise a water inlet circuit and a products supply unit for the introduction of water and washing/rinsing products (i.e. detergent, softener, etc.) into the tub.

[0007] Known laundry washing machines are also provided with water draining devices that may operate both during the initial phases of the washing program and at the end of the same to drain the dirty water.

[0008] According to the known technique, a complete washing program typically includes different phases during which the laundry to be washed is subjected to adequate treatments.

[0009] A washing cycle usually comprises a laundry wetting phase with addition of a washing detergent and a main washing phase during which the drum is rotated and the water contained therein is heated to a predetermined temperature based on the washing program selected by the user. 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, 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 by the water draining devices.

[0010] A successive step of the cycle typically comprises a rinsing phase which usually comprises one or more rinsing cycles. In the rinsing cycle, clean rinse water is first added to the laundry, so as to be absorbed by the laundry and remove from the latter detergent and/or dirty particles not previously removed by washing liquid, and then the drum is rotated to extract water and dirty particles/detergent from the laundry: the dirty water extracted is drained from the tub to the outside by the water draining devices.

[0011] After the rinsing phase, a final spinning phase allows the extraction of the residual water contained in the wet laundry.

[0012] The water extracted during the spinning phase is drained towards the outside by means of the water draining devices (during or after the spinning phase).

[0013] A laundry washing machine performing a washing program is disclosed in document EP0464776.

[0014] Such laundry washing machine comprises a tub having a cylindrical structure for containing washing water and a rotary drum rotatably installed in the tub.

[0015] The machine further comprises a heater for heating washing water. The heater is installed in the lower portion of the tub.

[0016] The machine further comprises a recirculating circuit provided with a recirculating pump which withdraws liquid from the bottom of the tub and re-admits said liquid into the tub.

[0017] However, the laundry washing machines of the known art pose some drawbacks. A drawback posed by the laundry washing machines of the known art lies in that the washing products, or the rinsing products, which are introduced into the washing tub during the washing program, move towards the bottom part of the tub, due to their high density and, therefore, tend to accumulate on the bottom of the tub below the heater.

[0018] Accumulation of the products does not ensure a complete and/or a fast dissolution of the products themselves in the water. It is well known that a fast and/or complete dissolution has a positive impact on the washing performance. Due to such undesired accumulation of products, therefore, the machine of known type does not have a high efficiency.

[0019] Furthermore, washing performance may be different for each washing program depending on the percentage of product which accumulates on the bottom of the tub and hence does not completely dissolve.

[0020] Therefore, the washing performance may vary from time to time and cannot be properly controlled.

[0021] Another drawback deriving from accumulation of washing/rinsing products in the bottom of the tub is that the sedimentation of such products may favour the proliferation of bacteria, which may then worsen the hygienic conditions and may cause bad smells.

[0022] The object of the present invention is therefore to overcome the drawbacks posed by the known technique.

[0023] It is an object of the invention to provide a laundry washing machine that makes it possible to improve the detergent dissolution with respect to the machines of the prior art.

[0024] It is another object of the invention to provide a laundry washing machine that makes it possible to improve the washing efficiency of the machine itself.

[0025] It is a further object of the invention to provide a laundry washing machine that makes it possible to

guarantee invariable efficiency during the time.

[0026] It is another object of the invention to provide a laundry washing machine that makes it possible to reduce proliferation of bacteria therefore improving hygienic conditions.

DISCLOSURE OF INVENTION

[0027] The applicant has found that by providing a method for washing laundry in a laundry washing machine wherein the method comprises the steps of introducing a quantity of a washing/rinsing product into a washing tub, introducing a quantity of water into the washing tub from a water supply circuit, activating a recirculation circuit in order to decrease the liquid level inside the washing tub below a heater device placed at the bottom of the washing tub and introducing a quantity of liquid again into the washing tub which falls at the bottom of the washing tub where the product accumulates, it is possible to obtain an improved dissolution of the washing/rinsing product compared to the machines of known type.

[0028] The present invention relates, therefore, to a method for washing laundry in a laundry washing machine of the type comprising:

- a washing tub external to a rotatable washing drum adapted to receive laundry;
- a water supply circuit to supply water into said washing tub;
- a washing/rinsing products supplier to supply washing/rinsing products into said washing tub;
- a heater device placed at the bottom of said washing tub for heating a liquid coming into contact with it;
- a recirculation circuit suitable for withdrawing liquid from a bottom region of said washing tub and for re-admitting such a liquid into said washing tub in such a way that the re-admitted liquid wets the laundry;

the method comprises the steps of:

- introducing a quantity of a washing/rinsing product and a quantity of liquid into said washing tub;

wherein the method further comprises the steps of:

- decreasing the liquid level inside said washing tub by activating said recirculation circuit for withdrawing liquid from said washing tub and re-admitting said liquid into said washing tub in such a way that the re-admitted liquid wets the laundry;
- detecting the liquid level inside said washing tub and, if said liquid level reaches a threshold level which is below said heater device:
    - deactivating said recirculation circuit;
    - introducing into said washing tub a quantity of liquid in such a way that said quantity of liquid falls at the bottom of said washing tub and strikes the liquid present therein so as to improve the dissolution of the washing/rinsing product collected therein.

[0029] In a preferred embodiment of the invention, the threshold level is set at the lower point of the washing tub.

[0030] In a further preferred embodiment of the invention, the threshold level is set at the lower point of a seat of the washing tub which receives the heater device.

[0031] In a preferred embodiment of the invention, the quantity of liquid in said phase of introducing a quantity of liquid into the washing tub which improves the dissolution of the washing/rinsing product is fresh water coming from the water supply circuit.

[0032] Preferably, the method provides for repeating at least one time the steps of activating the recirculation circuit, deactivating the recirculation circuit and introducing a quantity of liquid into the washing tub.

[0033] More preferably, the method provides for repeating a determined number of times the steps of activating the recirculation circuit, deactivating the recirculation circuit and introducing a quantity of liquid into the washing tub. Preferably the determined number of times is two or more times.

[0034] Preferably the determined number of times depends on the amount and on the absorption characteristics of the loaded laundry.

[0035] Advantageously, the method further comprises an auxiliary recirculating phase suitable for recirculating liquid at the bottom of the washing tub so as to further improve the dissolution of the washing/rinsing product collected therein. Opportunely, the method provides for switching-off the heater device when the liquid level inside the washing tub is below the heater device.

[0036] In a further aspect thereof, the present invention concerns a laundry washing machine suited to implement the method of the invention described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0037] Further characteristics and advantages of the present invention will be highlighted in greater detail in the following detailed description of preferred embodiments of the invention, provided with reference to the enclosed drawings. In said drawings:

- Figure 1 shows a perspective view of a laundry washing machine implementing the method according to a first embodiment of the invention;
- Figure 2 shows a schematic 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 sche-

matic view of the laundry washing machine of Figure 2;

- Figure 6 is a simplified flow chart of the basic operations of a method for washing laundry in the laundry washing machine of Figure 5;

[0038] Figure 7 shows another embodiment of the schematic view of the laundry washing machine of Figure 2.

DETAILED DESCRIPTION OF THE INVENTION

[0039] 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 laundry washing machines. On the contrary, the present invention can be conveniently applied to laundry washing-drying machines (i.e. laundry washing machines which can also dry laundry).

[0040] In the present description, therefore, the term "laundry washing machine" will refer to both simple laundry washing machines and laundry washing-drying machines.

[0041] With reference to Figure 1 a laundry washing machine 1 is illustrated, in which a method according to a first embodiment of the invention is advantageously implemented.

[0042] The laundry washing machine 1 comprises an external casing or housing 2, in which a washing tub 3 is provided that contains a washing drum 4 where the laundry to be treated can be loaded, as illustrated in Figure 2.

[0043] The tub 3 and the drum 4 both preferably have a substantially cylindrical shape, thus forming a substantially annular gap 17 therebetween.

[0044] The housing 2 is provided with a loading/unloading door 8 which allows access to the drum 4.

[0045] The tub 3 is preferably suspended in a floating manner inside the housing 2, advantageously by means of a number of coil springs and shock-absorbers, not illustrated.

[0046] 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.

[0047] The lower portion 3a of the tub 3 preferably comprises a seat 15 suitable for receiving a heater device 10. Preferably the seat 15 is made in a single piece with the tub 3, for example by injection moulding.

[0048] The heater device 10 preferably comprises an electrical resistor of serpentine type. The heater device 10 is advantageously horizontally placed in the seat 15 and it extends preferably substantially from the front part up to the rear part of the tub 3.

[0049] Between the lower side of the heater 10 and the upper surface 15a of the seat 15 a gap 16 is defined, as illustrated for example in Figure 2.

[0050] A water supply circuit 5 is arranged in the upper part of the laundry washing machine 1 and is suited to supply water into the tub 3. The water supply circuit of a laundry washing machine is well known in the art, and therefore it will not be described in detail.

[0051] The laundry washing machine 1 advantageously comprises a removable drawer 6 provided with various compartments suited to be filled with washing and/or rinsing products (i.e. detergent D, softener, etc.).

[0052] In a preferred embodiment, the water is supplied into the tub 3 from the water supply circuit 5, advantageously by making it flow through the drawer 6 and then through a supply pipe 18.

[0053] The water which reaches the tub 3 can, in this case, selectively contain one of the products contained in the compartments of the drawer 6, or such water can be clean and in this case it may reach the tub 3 directly, for example bypassing the compartments of the drawer 6, or passing through an empty compartment of the drawer 6.

[0054] In an alternative embodiment of the invention, a further separate water supply pipe can be provided, which supplies exclusively clean water into the tub 3.

[0055] The water supply circuit 5 also preferably comprises a water flow sensor, for example a flow meter, which makes it possible to calculate the quantity of water supplied into the tub 3.

[0056] Laundry washing machine 1 advantageously comprises a water outlet circuit 25 suitable for withdrawing liquid from the lower portion 3a of the tub 3.

[0057] The water outlet circuit 25 advantageously comprises a drain pump 26, a first pipe 27, only schematically represented in enclosed figures, connecting the tub 3 to the drain pump 26 and an outlet pipe 28 ending outside the housing 2. Advantageously, the first pipe 27 communicates with the upper surface 15a of the seat 15, preferably via a draining hole, not illustrated, provided in seat 15. 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.

[0058] The water outlet circuit 25 advantageously comprises a filtering device, not shown in the figures, placed between the bottom of the tub 3 and the drain pump 26 and adapted to retain all the undesirable bodies (for example buttons that have come off the laundry, coins erroneously introduced into the laundry washing machine, etc.) which could damage or obstruct the drain pump 26.

[0059] This filtering device can preferably be removed, and then for example cleaned, for example through a gate 14 placed advantageously on the front of the housing 2 of the laundry washing machine 1.

[0060] 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.

[0061] Laundry washing machine 1 advantageously further comprises a recirculation circuit 30 adapted to

drain liquid from the the lower portion 3a of the tub 3 and to re-admit such a liquid into an upper region of the tub 3.

[0062] The recirculation circuit 30 preferably comprises the drain pump 26 and a recirculation pipe 31. The recirculation pipe 31 advantageously ends with a terminal nozzle 31a, placed advantageously in an upper region of the tub 3.

[0063] The exit of the drain pump 26 is advantageously fluidly connected to a valve, not illustrated, properly controlled in order to allow selective drainage of the water exiting drain pump 26 towards the outside through the outlet pipe 28, or towards the upper region of the tub 3 through the recirculation pipe 31.

[0064] In a further embodiment, not illustrated, the recirculation circuit may comprise a dedicated recirculation pipe connecting a bottom region of the tub with a higher region of the latter, and provided with a dedicated recirculation pump; in this case the recirculation circuit is advantageously completely separated from the water outlet circuit.

[0065] In general, the recirculation circuit is properly realized for transferring a portion of a liquid from a region of the tub to another region of the tub in order to enhance absorption of washing liquid by the laundry.

[0066] The laundry washing machine 1 advantageously comprises a liquid level sensor device 19 suited to sense (or detect) the liquid level inside the tub 3.

[0067] The sensor device 19 preferably comprises a pressure sensor which senses the pressure in the tub 3. From the values sensed by the sensor device 19 it is possible to determine the level of the liquid inside the tub 3. In another embodiment, not illustrated, laundry washing 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] Laundry washing machine 1 advantageously comprises a control unit, not illustrated, connected to the various parts of the laundry washing machine 1 in order to ensure its operation. The control unit is preferably connected to the water inlet circuit 5, the water outlet circuit 25, the heating device 10 and the electric motor and receives information from the various sensors provided on the laundry washing machine 1, like the pressure sensor 19, a temperature sensor, etc.

[0069] Laundry washing machine 1 advantageously comprises an interface unit 12, connected to 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..

[0070] Based on the parameters acquired by said interface 12, the control unit sets and controls the various parts of the laundry washing machine 1 in order to carry out the desired washing program.

[0071] A first embodiment of the washing method according to the invention is described here below with reference to Figures 2 and 3.

[0072] The laundry to be washed is first placed inside the drum 4 (step 100 of Figure 3). By operating on the interface unit 12 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 12, for example the value of the washing temperature, the rotating speed of the drum 4 in the spinning phase, the duration of washing program, etc.

[0073] Once the user has selected the desired washing program, the control unit sets the laundry washing machine 1 so that it starts the washing program.

[0074] In a further embodiment, the selection of the desired washing program (step 110) may be performed before placing the laundry into the drum 4 (step 100).

[0075] In a successive phase (step 120) a quantity Qd of detergent D together with a first quantity $Q1_w$ of water W is introduced into the tub 3. The quantity Qd of detergent D and the first quantity $Q1_w$ of water W substantially form a washing solution intended to wet the laundry.

[0076] The introduction of the quantity Qd of detergent D takes place preferably through the water inlet circuit 5; the quantity Qd of detergent D, be it powder or liquid, is preferably brought out of the apposite compartment of the drawer 6 by the first quantity $Q1_w$ of water W that passes through the proper compartment of the drawer 6.

[0077] In different embodiments, the quantity Qd of detergent D and the first quantity $Q1_w$ of water W may be advantageously introduced singularly (i.e. one independently from the other) into the tub 3, preferably, but not necessarily, at different times.

[0078] Advantageously, all the quantity Qd of detergent D and all the first quantity $Q1_w$ of water W introduced into the tub 3 in said phase (step 120) fall down on the lower portion 3a of the tub 3.

[0079] Therefore substantially all the detergent D and the water W reache the lower portion 3a of the tub 3 without any absorption from the laundry.

[0080] That is advantageously guaranteed by the advantageous lateral position of the supply pipe 18 with respect to the tub 3. The detergent D and the water W, in fact, fall down until the lower portion 3a of the tub 3 by flowing inside the annular gap 17 between the tub 3 and the drum 4, as schematically illustrated in Figure 2.

[0081] Nevertheless, a minimum quantity of the detergent D and/or of water W may also reach the laundry inside the drum 4.

[0082] The detergent D moves towards the lower portion 3a of the tub 3 due to its density which is higher than the density of water W.

[0083] More particularly, the detergent D tends to accumulate in the gap 16 below the heater device 10.

[0084] At the same time, the water W inside the tub 3 reaches a first level L1.

[0085] In a preferred embodiment, the first level L1 is advantageously a level at which the water W at least partially touches the drum 4.

[0086] According to the invention, the liquid level inside the tub 3 is decreased by activating the recirculation circuit 30 (step 130).

[0087] In fact, while the recirculation circuit 30 is activated (step 130), the liquid inside tub 3 is drained towards the upper part of the tub 3 by means of the drain pump 26. The drain pump 26 takes the liquid from the lower portion 3a of the tub 3 and conveys it towards the upper part of the tub 3 through the recirculation pipe 31. The liquid comprising detergent D and water W, from the recirculation pipe 31, and advantageously from its terminal nozzle 31a, is sprayed over the laundry which absorbs the liquid.

[0088] At the same time, the liquid level in the lower portion 3a of the tub 3 decreases. The recirculation circuit 30 is deactivated when the liquid level inside the tub 3 reaches a threshold level Lm which is preferably set substantially below the heater device 10 (step 140).

[0089] More preferably, the recirculation circuit 30 is deactivated when the liquid level inside the tub 3 reaches a threshold level Lb which is set at the bottom of the seat 15, i.e. when the liquid is substantially totally drained and the tub 3 is advantageously empty. This may preferably happen when the laundry inside the drum 4 absorbs all the recirculated liquid introduced into the tub 3. This, in turn, may depend on the quantity (i.e. weight) of loaded laundry and on the type of laundry. In fact, for example, cotton absorbs many water that synthetic fibres, and therefore a certain quantity of laundry made of cotton requires, in order to be completely wetted, much water than a same quantity of laundry made of synthetic fibres.

[0090] After the recirculation circuit 30 is deactivated (step 140), part of the detergent D usually remains in the gap 16 below the heater device 10 inside the seat 15.

[0091] In a successive step, a quantity $Q1'_w$ of liquid W' is introduced again inside the tub 3 (step 150).

[0092] According to the invention, such quantity $Q1'_w$ of liquid W' falls at the bottom 3a of the tub 3 striking the liquid present therein. This advantageously helps the dissolution of the deposited detergent D, as better explained below.

[0093] In a preferred embodiment of the invention, the quantity $Q1'_w$ of liquid W' introduced inside the tub 3 (step 150) that falls at the lower portion 3a of the tub 3 is a quantity $Q1'_w$ of new fresh water W' introduced into the tub 3 by means of the water inlet circuit 5.

[0094] Again, substantially all the quantity $Q1'_w$ of liquid W' introduced inside the tub 3 reaches the lower portion 3a of the tub 3 without any absorption from the laundry. As said before, this is preferably guaranteed by the lateral position of the supply pipe 18 with respect to the tub 3.

[0095] The dissolution effect of the detergent D is achieved by the mechanic effect of liquid W' introduced inside the tub 3 which contacts and strikes the liquid at the lower portion 3a of the tub 3 that is at its threshold level Lm, reached in the previous phase (step 140).

[0096] The threshold level Lm, as said before, is advantageously set below the heater device 10.

[0097] The kinetic energy of liquid W' introduced inside the tub which falls over the liquid at the lower portion 3a of the tub 3 creates a turbulence which dissolves the deposited detergent D in the water. Said turbulence is advantageously achieved thanks to the low level Lm of the liquid at the lower portion 3a of the tub 3. In fact, the low level Lm of the liquid at the lower portion 3a of the tub 3 corresponds to a low quantity of the same inside the tub 3. In turn, also the mass of such liquid is relatively low. In this favourable condition, the liquid at the lower portion 3a of the tub 3 does not offer a great resistance to the liquid W' falling over it. Therefore, the kinetic energy of the liquid W' introduced inside the tub which falls over the liquid at the lower portion 3a of the tub 3 is sufficient to create the turbulence which dissolves the deposited detergent D in the water.

[0098] It is clear that the lower is the level Lm of the liquid at the lower portion 3a of the tub 3, the higher is the dissolution effect of liquid W' falling over it.

[0099] On the contrary, as it happens in the prior art technique, if the level of the liquid at the lower portion 3a of the tub 3 is high, for example above the heater device, the dissolution effect of the liquid introduced inside the tub which falls over the liquid at the lower portion 3a of the tub 3 is substantially null, or very low. In this case, in fact, the mass of the liquid at the lower portion 3a of the tub 3 offers a great resistance to the liquid falling over it.

[0100] Therefore, the dissolution of the detergent D is maximum if the tub 3 is substantially empty, i.e. if in the previous steps the liquid was drained up to the lower level Lb. In this case, the quantity $Q1'_w$ of liquid W' introduced into the tub 3 collides directly on the accumulated detergent D thus improving its mechanic effect and therefore the dissolution effect. Very good results have been achieved with a level of the liquid, measured from the upper surface 15a of the seat 15, comprised between 0 mm and 11 mm; more preferably this level is 1 mm.

[0101] Once the phase of introduction of liquid W' inside the tub 3 (step 150) has been completed, the washing program may continue with the following programmed phases, until the washing program ends (step 160).

[0102] It should be noted that the heater device 10 may be, for some time, not covered by liquid and therefore exposed to the air. In this situation, the heater device 10 is properly switched-off to guarantee its good functioning and thus avoiding its damaging. Advantageously, the phase of introducing water inside the tub 3 (step 150) according to the invention, avoids accumulation of products, in particular of the detergent D, at the bottom of the tub 3 and enhances a complete and/or a fast dissolution of the products themselves in the water/liquid.

[0103] The washing performance of the washing program and the efficiency of the machine 1 are therefore increased.

[0104] Furthermore, all the products D introduced by the user in the drawer 6 are used in the washing program without any losses.

[0105] Still advantageously, the phase of introduction of water inside the tub 3 (step 150) according to the invention performs a cleaning effect since no products D accumulate at the lower portion 3a of the tub 3.

[0106] This guarantees good hygienic conditions inside the tub 3, in particular when the laundry washing machine in not used for a long time between two successive washing programs.

[0107] It should be noted that the determination of the liquid level inside the tub 3 in any of the method steps above described is advantageously carried out by means of the liquid level sensor device 19.

[0108] In further embodiment, as already explained above, the laundry washing 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.

[0109] Figure 4 shows the flow chart of a further embodiment of the washing program of the invention performed in the laundry washing machine 1 of Figures 1 and 2. This method differs from the method described with reference to Figures 1 and 2 for the fact that the steps of activating the recirculation circuit 20 (step 130), deactivating the recirculation circuit 20 (step 140) and introducing liquid into the tub 3 (step 150) are cyclically repeated.

[0110] Preferably, said steps are cyclically repeated a determined number N of times (more preferably two or more times); the value of such number N depends on the amount and on the absorption characteristics of the loaded laundry. Advantageously, the repeated phases of introducing liquid inside the tub 3 (step 150) according to this preferred embodiment of the invention enhance a complete and/or a fast dissolution of the products D in the water/liquid and avoid accumulation of products D at the lower portion 3a of the tub 3.

[0111] All the advantages above-mentioned with reference to the first embodiment are therefore achieved.

[0112] Figure 5 shows a further embodiment of a laundry washing machine 200 wherein a method according to the present invention may be performed.

[0113] The laundry washing machine 200 differs from the laundry washing machine 1 described with reference to Figures 1 and 2 in that it comprises an auxiliary recirculation circuit 40.

[0114] The auxiliary recirculation circuit 40 is adapted to drain liquid from the the lower portion 3a of the tub 3 and to re-admit such a liquid into the same lower portion 3a of the tub 3.

[0115] The auxiliary recirculation circuit 40 comprises a recirculating pump 41 and a recirculation pipe 42. The recirculating pump 41 is connected to the tub 3 by means of the first pipe 27. The recirculation pipe 41 advantageously ends inside the seat 15.

[0116] In a further embodiment, not illustrated, the auxiliary recirculation circuit may comprise a dedicated pipe connecting the bottom region of the tub to the recirculating pump; in this case the auxiliary recirculation circuit may be advantageously completely separated from the water outlet circuit.

[0117] The auxiliary recirculation circuit 40 is advantageously activated when an auxiliary mixing and/or dissolution of the washing products D is needed.

[0118] Preferably, as illustrated in Figure 6, the auxiliary recirculation circuit 40 is activated (step 125) for a determined period of time after the step of introducing detergent D and water W inside the tub (step 120). The auxiliary recirculation circuit 40 allows the liquid recirculation inside the tub 3. The detergent D and the water W are therefore preliminary dissolved in the lower portion 3a of the tub 3, before the method continues with the following steps as above described.

[0119] The auxiliary recirculation circuit 40, therefore, helps the dissolution of the products D in the water.

[0120] Figure 7 shows a further embodiment of a laundry washing machine 300 wherein a method according to the present invention may be performed.

[0121] The laundry washing machine 300 differs from the laundry washing machine 1 described with reference to Figures 1 and 2 in that the lower portion 3 a of the tub 3 does not comprise a seat for the heater device 10. The heater device 10 is horizontally placed between the tub 3 and the drum 4 and it extends preferably substantially from the front part up to the rear part of the tub 3.

[0122] Between the lower side of the heater 10 and the upper surface 3b of the tub 3 a gap 116 is defined.

[0123] In this preferred embodiment, the product D tends to accumulate in the gap 116 below the heater device 10.

[0124] The threshold level Lm, which is used as a parameter in the washing method, is preferably set substantially below the heater device 10. The threshold lower level Lb, which is also used as a parameter in the washing method, is set at the upper surface 3b of the tub 3, i.e. at a level which indicates that the tub 3 is empty.

[0125] The above described method, as shown in Figure 3, may then be advantageously performed in the preferred embodiment of the laundry washing machine 300 here described, without any modification.

[0126] Still advantageously, the phase of introduction of water inside the tub 3 (step 150) according to the invention avoids accumulation of products, in particular of the detergent D, at the bottom of the tub 3 and enhances a complete and/or a fast dissolution of the products themselves in the water/liquid.

[0127] All the advantages above-mentioned with reference to the first embodiment are therefore achieved.

[0128] 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 laundry washing machine with improved detergent dissolution with respect to the machines of the prior art. 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 washing machine, substantially without any modification.

[0129] While the present invention has been described with reference to the particular embodiments shown in the figures, it should be noted that the present invention is not limited to the specific embodiments 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.

Claims

1. Method for washing laundry in a laundry washing machine (1; 200; 300) of the type comprising:

- a washing tub (3) external to a rotatable washing drum (4) adapted to receive laundry;
- a water supply circuit (5) to supply water into said washing tub (3);
- a washing/rinsing products supplier (6) to supply washing/rinsing products (D) into said washing tub (3);
- a heater device (10) placed at the bottom (3a) of said washing tub (3) for heating a liquid coming into contact with it;
- a recirculation circuit (20) suitable for withdrawing liquid from a bottom region (3a) of said washing tub (3) and for re-admitting such a liquid into said washing tub (3) in such a way that the re-admitted liquid wets the laundry;

the method comprises the steps of:

- introducing (120) a quantity (Qd) of a washing/rinsing product (D) and a quantity ($Q1_w$) of liquid (W) into said washing tub (3);

characterized in that the method further comprises the steps of:

- decreasing the liquid level inside said washing tub (3) by activating (130) said recirculation circuit (20) for withdrawing liquid from said washing tub (3) and re-admitting said liquid into said washing tub (3) in such a way that the re-admitted liquid wets the laundry;
- detecting the liquid level inside said washing tub (3) and, if said liquid level reaches a threshold level (Lm, Lb) which is below said heater device (10):
  - deactivating (140) said recirculation circuit (20);
  - introducing (150) into said washing tub (3) a quantity ($Q1'_w$) of liquid (W') in such a way that said quantity ($Q1'_w$) of liquid (W') falls at the bottom (3a) of said washing tub (3) and strikes the liquid present therein so as to improve the dissolution of the washing/rinsing product (D) collected therein.

2. Method according to claim 1, **characterized in that** said threshold level (Lm, Lb) is set at the lower point of said washing tub (3).

3. Method according to claim 1, **characterized in that** said threshold level (Lm, Lb) is set at the lower point of a seat (15) of said washing tub (3) which receives said heater device (10).

4. Method according to any of the preceding claims, **characterized in that** said quantity ($Q1'_w$) of liquid (W') in said phase of introducing a quantity ($Q1'_w$) of liquid (W') into said washing tub (3) which improves the dissolution of the washing/rinsing product (D) is fresh water coming from said water supply circuit (5).

5. Method according to any of the preceding claims, **characterized by** repeating at least one time said steps of activating (130) the recirculation circuit (20), deactivating (140) the recirculation circuit (20) and introducing (150) a quantity ($Q1_w$) of liquid (W) into said washing tub (3).

6. Method according to any of the preceding claims, **characterized by** repeating a determined number (N) of times said steps of activating (130) the recirculation circuit (20), deactivating (140) the recirculation circuit (20) and introducing (150) a quantity ($Q1_w$) of liquid (W) into said washing tub (3).

7. Method according to claim 6, **characterized in that** said determined number (N) of times is two or more times.

8. Method according to claim 6 or 7, **characterized in that** said determined number (N) of times depends on the amount and on the absorption characteristics of the loaded laundry.

9. Method according to any of the preceding claims, **characterized in that** it further comprises an auxiliary recirculating phase (125) suitable for recirculating liquid at said bottom (3a) of said washing tub (3) so as to further improve the dissolution of the washing/rinsing product (D) collected therein.

10. Method according to any of the preceding claims, **characterized by** switching-off said heater device (10) when said liquid level inside said washing tub

(3) is below said heater device (10).

11. A laundry washing machine (1; 200; 300) suited to implement a method according to any of the preceding claims.

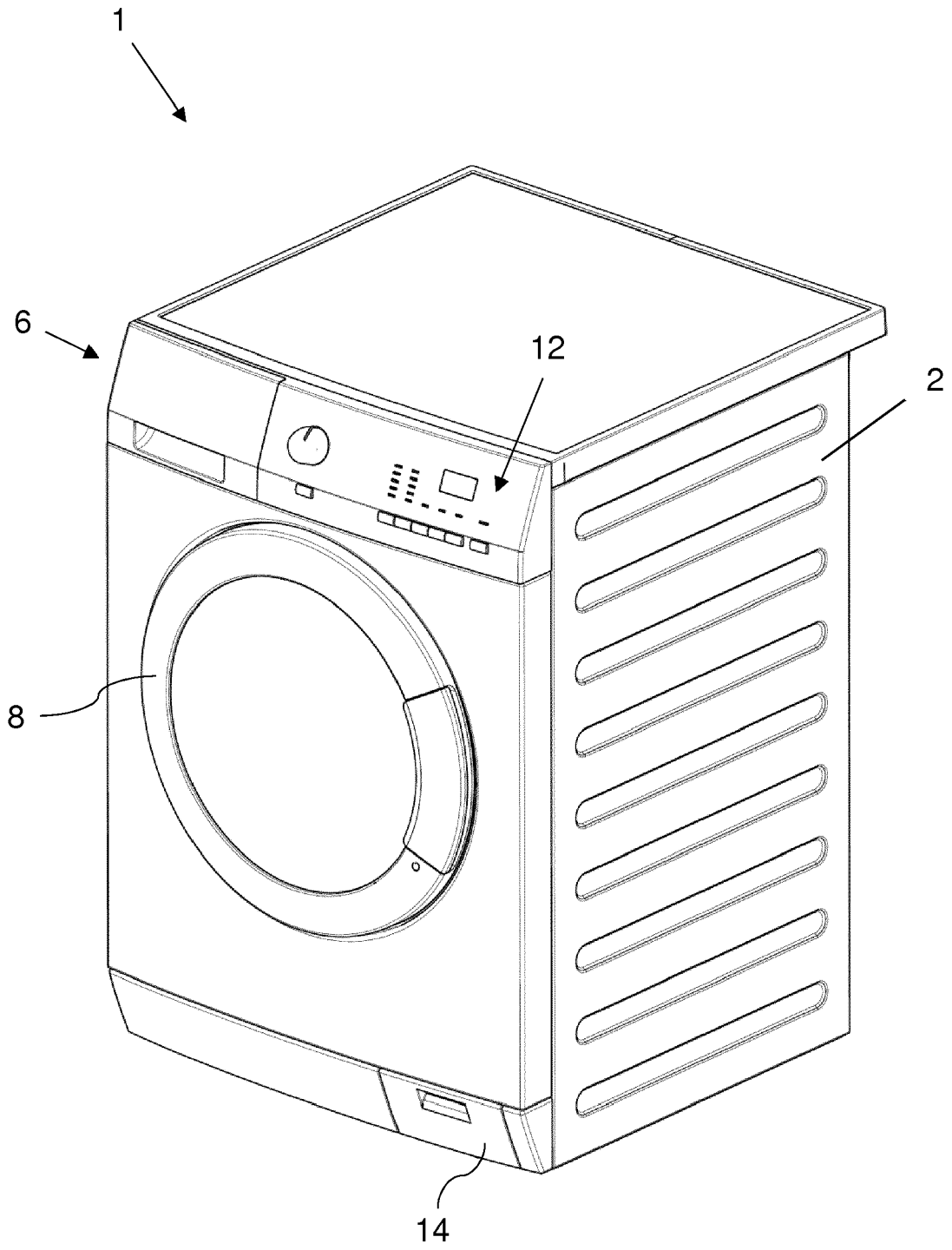

FIG. 1

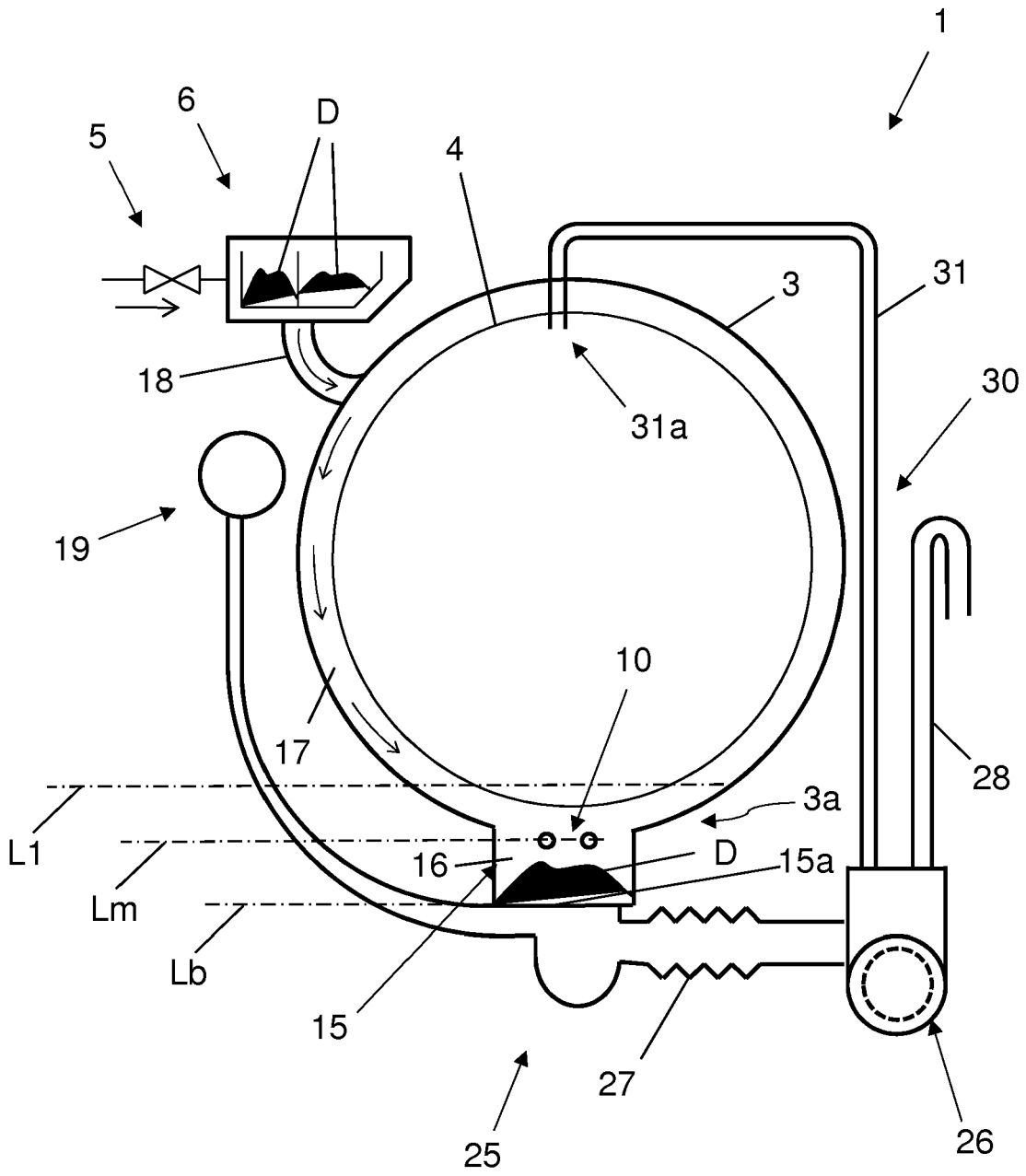

FIG. 2

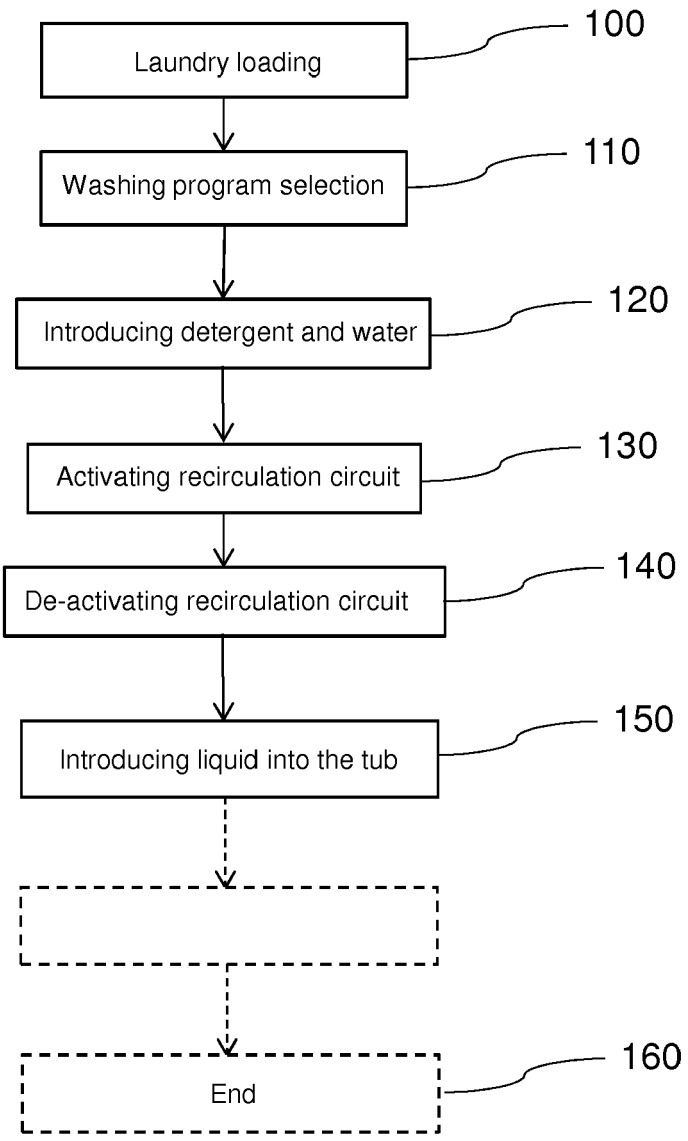
Laundry loading
100
Washing program selection
110
Introducing detergent and water
120
Activating recirculation circuit
130
De-activating recirculation circuit
140
Introducing liquid into the tub
150
End
160

FIG. 3

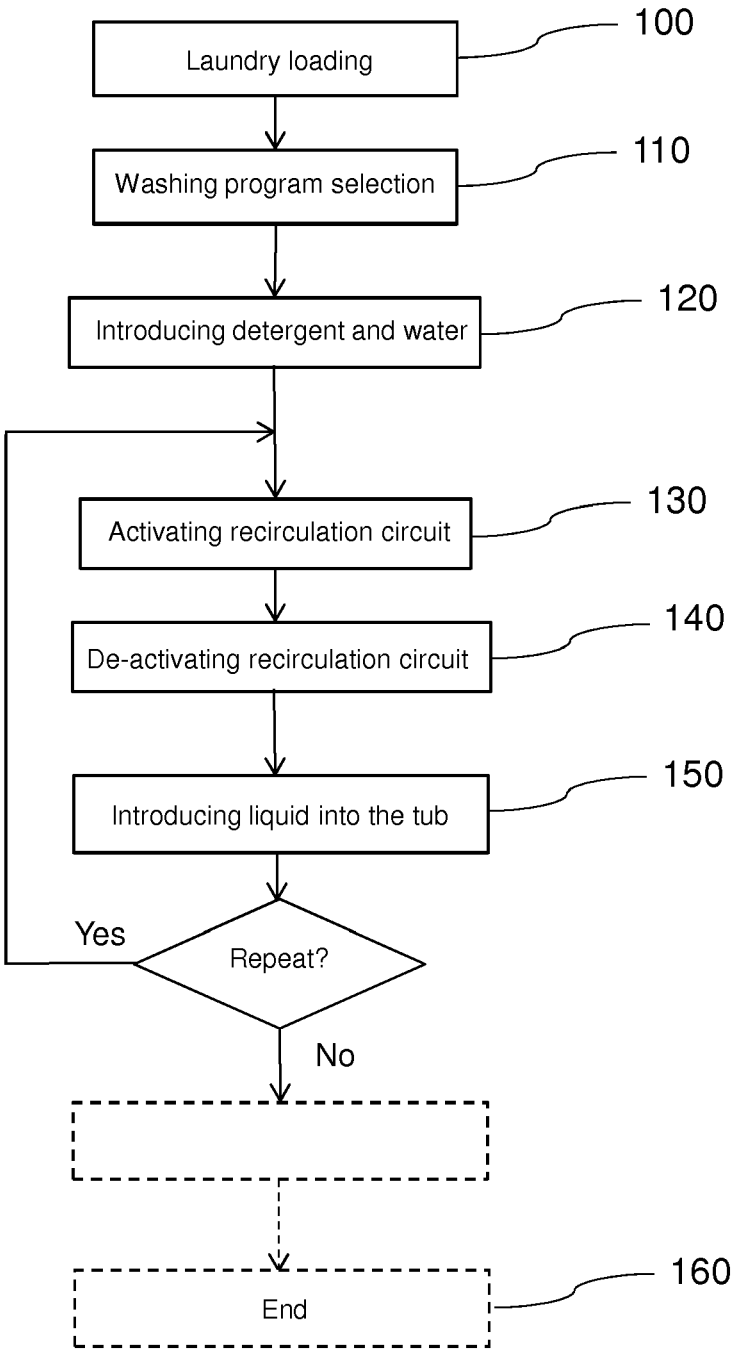
Laundry loading
100
Washing program selection
110
Introducing detergent and water
120
Activating recirculation circuit
130
De-activating recirculation circuit
140
Introducing liquid into the tub
150
Repeat?
Yes
No
End
160

FIG. 4

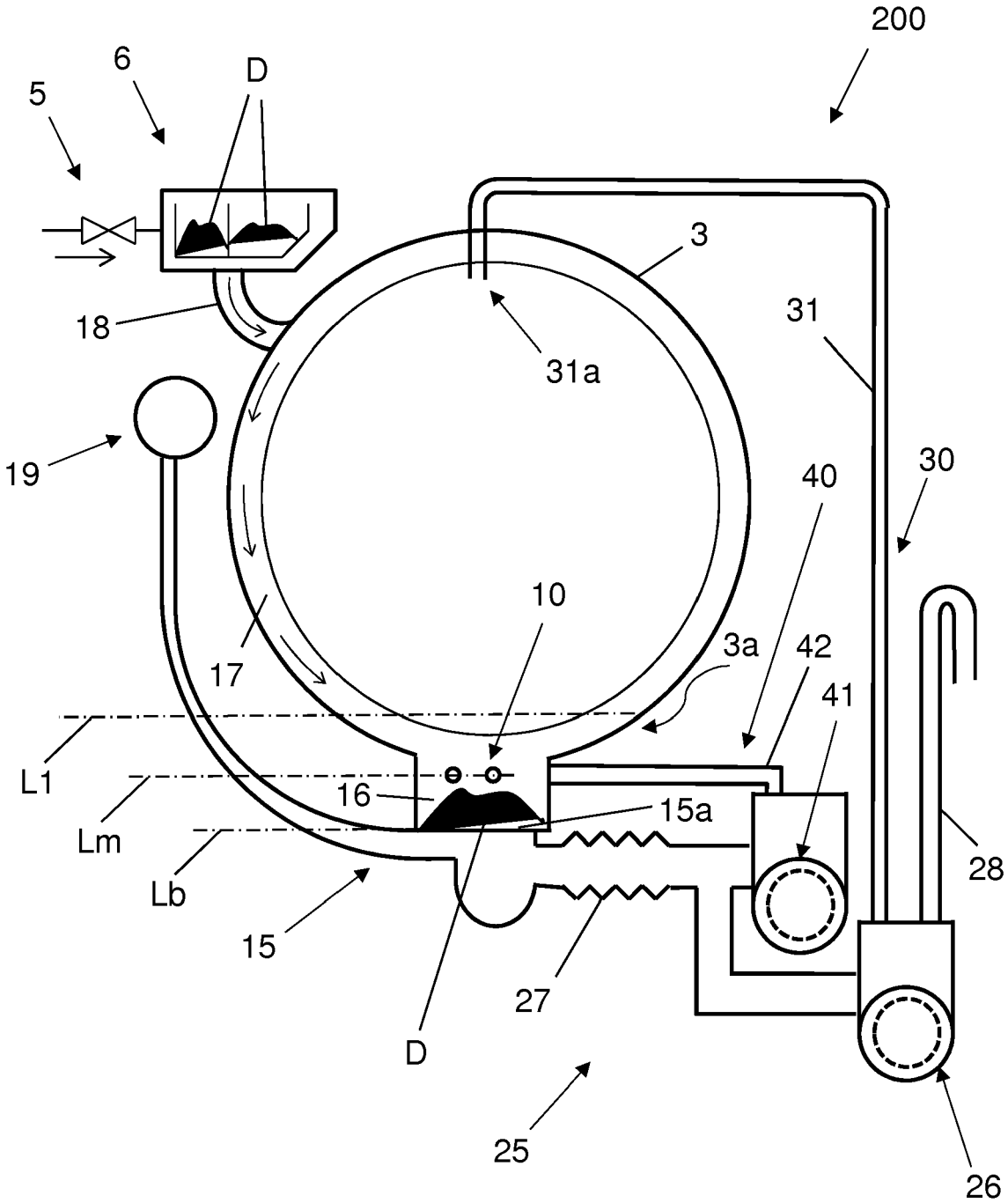
200
6
D
5
3
18
31
31a
19
30
40
10
3a
42
17
41
L1
16
15a
Lm
28
Lb
15
27
D
25
26

FIG. 5

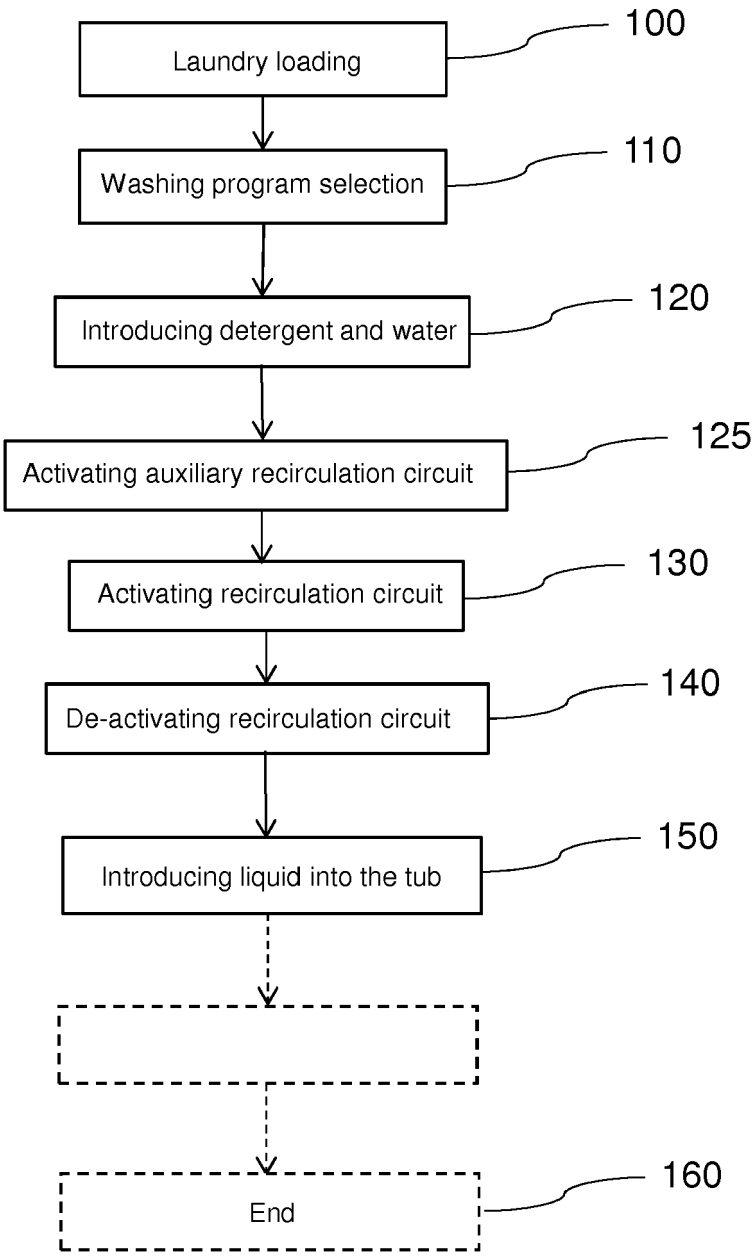
Laundry loading
100
Washing program selection
110
Introducing detergent and water
120
Activating auxiliary recirculation circuit
125
Activating recirculation circuit
130
De-activating recirculation circuit
140
Introducing liquid into the tub
150
End
160

FIG. 6

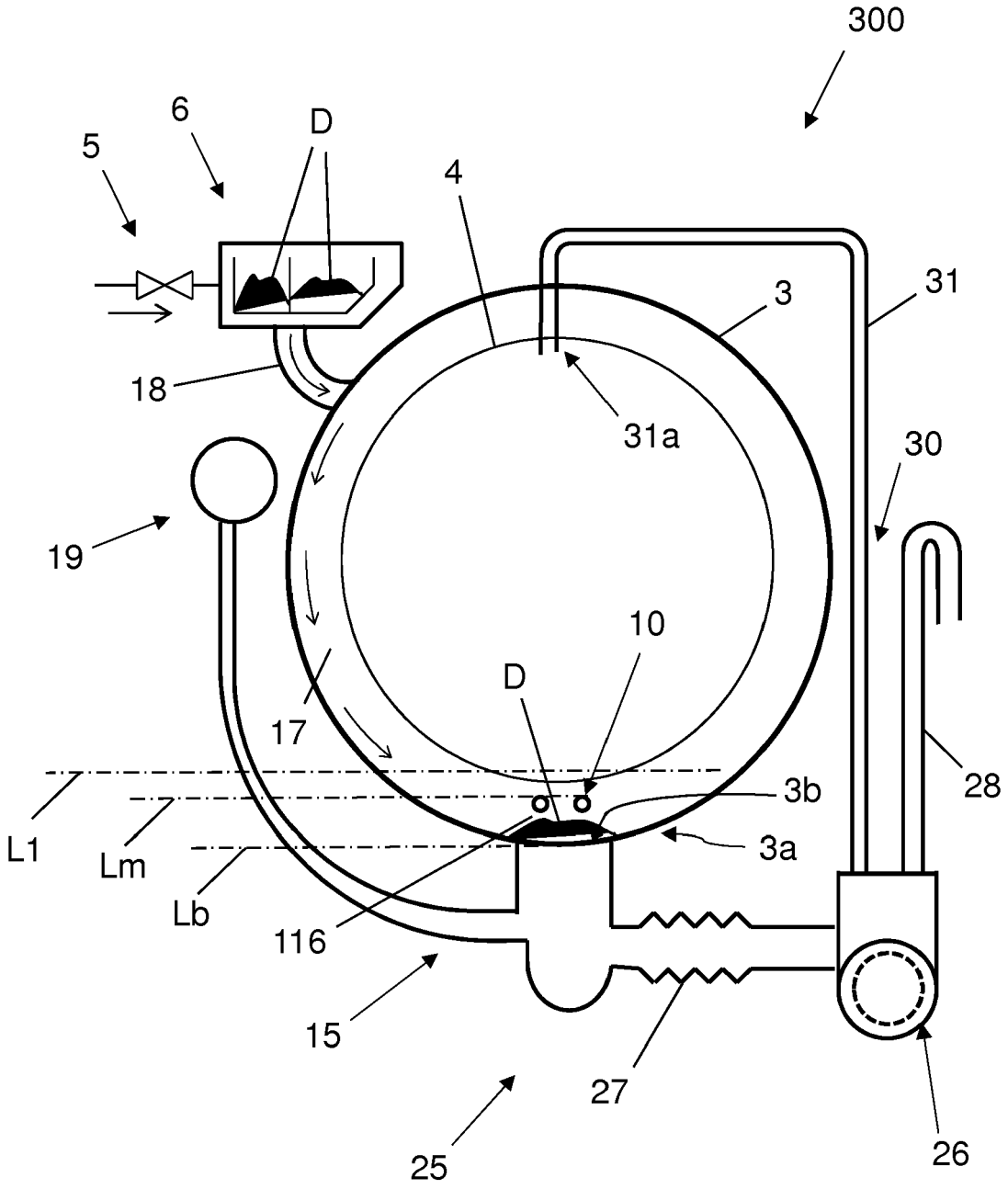

FIG. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 12 18 2198

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 Y	US 2005/028295 A1 (JEON SI MOON [KR] ET AL) 10 February 2005 (2005-02-10) * page 1, paragraph 2 - page 5, paragraph 94; figures 4,6 *	1,2,4-8, 10,11 3,9	INV. D06F33/02 D06F39/08
Y	EP 2 228 483 A1 (PANASONIC CORP [JP]) 15 September 2010 (2010-09-15) * column 4, paragraph 15; figure 1 *	3	
Y	EP 0 386 724 A1 (INDESIT [IT] MERLONI ELETTRODOMESTICI SPA [IT]) 12 September 1990 (1990-09-12) * column 2, line 8 - line 34; figure 1 *	9	
X	EP 1 505 194 A2 (SAMSUNG ELECTRONICS CO LTD [KR]) 9 February 2005 (2005-02-09) * column 3, paragraph 21 - column 4, paragraph 25; figure 1 *	11	

TECHNICAL FIELDS SEARCHED (IPC)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	29 November 2012	Engelhardt, Helmut

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 18 2198

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-11-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005028295 A1	10-02-2005	CN 1580357 A	16-02-2005
		EP 1505190 A2	09-02-2005
		JP 2005052632 A	03-03-2005
		KR 20050015691 A	21-02-2005
		US 2005028295 A1	10-02-2005
EP 2228483 A1	15-09-2010	AT 542946 T	15-02-2012
		CN 101831776 A	15-09-2010
		EP 2228483 A1	15-09-2010
		JP 4831188 B2	07-12-2011
		JP 2010207311 A	24-09-2010
EP 0386724 A1	12-09-1990	DE 69010936 D1	01-09-1994
		DE 69010936 T2	17-11-1994
		EP 0386724 A1	12-09-1990
		ES 2057220 T3	16-10-1994
		IT 1234975 B	09-06-1992
EP 1505194 A2	09-02-2005	CN 1580368 A	16-02-2005
		EP 1505194 A2	09-02-2005
		KR 20050017655 A	22-02-2005
		US 2005028297 A1	10-02-2005

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 0464776 A **[0013]**