

(12) **EUROPEAN PATENT APPLICATION**

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

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

(21) Application number: **12182235.7**

(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

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(54) **Laundry washing machine and method for washing laundry in a laundry washing machine**

(57) The present invention relates to a laundry washing machine (1) 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 into the washing tub (3) and a water outlet circuit (25) from draining liquid from the washing tub (3) to the outside. The machine (1) further comprises a first recirculation circuit (30) suitable for with-

drawing liquid from the washing tub (3) and to re-admit such a liquid into the washing tub (3) so as to improve the dissolution of the washing/rinsing products (D) therein and a second recirculation circuit (40) suitable for withdrawing liquid from the washing tub (3) and conveying such a liquid into said washing/rinsing products supplier (6), and then re-admitting such a liquid into said washing tub (3) so as to further improve the dissolution of the washing/rinsing products (D).

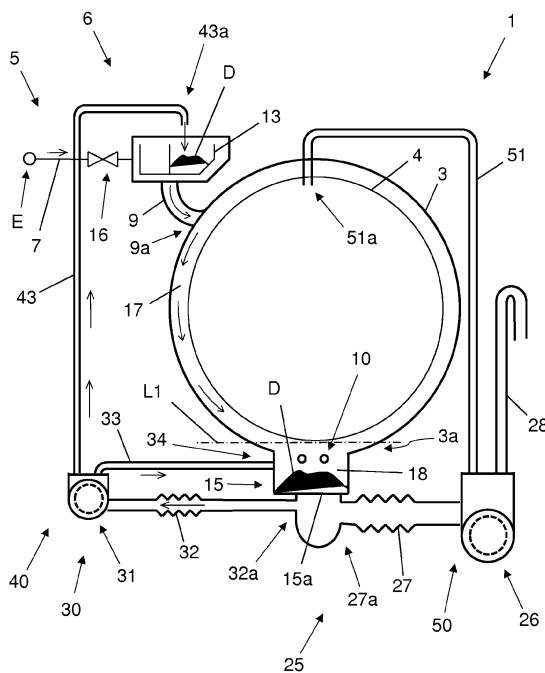


FIG. 2

Description

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

[0002] In particular, the present invention refers to a laundry washing machine capable of performing a more efficient washing cycle.

[0003] The invention refers also to a new method for washing laundry 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 drum.

[0007] 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.

[0008] The products supply unit typically comprises, for example, a removable drawer comprising adjacent and separate compartments (e.g. three compartments for holding the prewash detergent, the main wash detergent and the rinsing aid or fabric softener, respectively) in which respective amounts of various washing/rinsing products can be filled, according to the selected operation cycle of the machine.

[0009] Typically the drawer is placed so that it is accessible by the user and in convenient position for filling with the products. Its location can be at the top of the machine, preferably above the tub. The washing detergent is typically conveyed into the tub by fresh water flowing through the respective compartment at the beginning of the appropriate cycle. The duration of the phase is properly controlled by a program control unit so that the detergent is conveyed into the tub by means of a sufficient quantity of fresh water.

[0010] 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.

[0011] According to the known technique, a complete washing cycle typically includes different phases during which the laundry to be washed is subjected to adequate treatments.

[0012] A known washing cycle usually comprises a laundry wetting phase with addition of a washing deter-

gent, preferably according to the above mentioned technique, 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.

[0013] 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, the drum is then rotated to extract dirty water from the laundry and finally the dirty water extracted is drained from the tub to the outside.

[0014] After the rinsing phase, a final spinning phase allows the extraction of the residual water contained in the wet laundry.

[0015] The water extracted during the spinning phase is then drained towards the outside by means of the water draining devices.

[0016] A laundry washing machine performing a washing cycle is disclosed in document EP464776B1.

[0017] Such a laundry washing machine, compared to the typical washing machine of the type above mentioned, further comprises a recirculating circuit, or mixing circuit, provided with a recirculating pump which withdraws liquid from the bottom of the tub and conveys it again in a bottom region of the tub. In such region, the turbulent movement created during the recirculation of the liquid through the recirculating circuit promotes the dissolution of the detergent introduced into the tub.

[0018] In fact, it is well known that a fast and/or complete dissolution of the detergent has a positive impact on the washing performance.

[0019] 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 mixing circuit does not guarantee a fast and/or complete dissolution of the washing products which are introduced into the washing tub.

[0020] In the machines of known type, therefore, the washing efficiency can be compromised by a not complete dissolution of the washing products. Furthermore, the washing product which is not completely dissolved and mixed within the water may cause halos of washing product in the laundry, especially in dark-colored laundry.

[0021] Another drawback posed by the laundry washing machines of the known art lies in that a quantity of detergent may settle in the compartment of the drawer without being conveyed to the tub. This has a negative impact on the washing performance since the detergent filling the drawer is not completely used in the washing phase.

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

[0023] It is a first object of the invention to provide a laundry washing machine that makes it possible to improve the washing efficiency of the machine itself.

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

a uniform effect of the washing product on the laundry.

DISCLOSURE OF INVENTION

[0025] The applicant has found that by providing a laundry washing machine comprising a washing tub external to a rotatable washing drum adapted to receive laundry, a water supply circuit to supply water into the washing tub, a washing/rinsing products supplier to supply washing/rinsing products into the washing tub, and by providing a step of withdrawing liquid from the washing tub and re-admitting such a liquid into the washing tub so as to improve the dissolution of the washing/rinsing products therein, and a step of withdrawing liquid from the washing tub and conveying such a liquid into the washing/rinsing products supplier and then re-admitting such a liquid into the washing tub, it is possible to obtain a laundry drying machine having a better washing efficiency compared to the known technique.

[0026] In a first aspect, the present invention relates, therefore, to a laundry washing machine 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 water outlet circuit for draining liquid from said washing tub to the outside;
- a first recirculation circuit suitable for withdrawing liquid from said washing tub and to re-admit such a liquid into said washing tub so as to improve the dissolution of said washing/rinsing products therein;

wherein the machine further comprises a second recirculation circuit suitable for withdrawing liquid from said washing tub and conveying such a liquid into said washing/rinsing products supplier, and then re-admitting such a liquid into said washing tub so as to further improve the dissolution of said washing/rinsing products.

[0027] In a preferred embodiment of the invention, the washing/rinsing products supplier is configured for conveying liquid inside the washing tub in such a way that, during such conveying, the liquid does not enter the washing drum. Preferably, the washing/rinsing products supplier comprises a supply pipe which extends towards the washing tub, wherein the supply pipe is configured so that the liquid flowing through it is conveyed along a direction which does not intersect the washing drum.

[0028] Preferably, the machine comprises a control unit suitable for activating/deactivating the first recirculation circuit and the second recirculation circuit simultaneously.

[0029] Advantageously, the first recirculation circuit creates a first flow of recirculated liquid into the washing tub which improves the dissolution of the washing/rinsing products therein and the second recirculation circuit cre-

ates a second flow of recirculated liquid into the washing tub which further improves the dissolution of the washing/rinsing products.

[0030] More advantageously, the dissolution of the washing/rinsing products is improved by the synergy achieved by merging the two flows of recirculated liquid at the bottom of the tub when the two recirculation circuits are activated simultaneously.

[0031] In a preferred embodiment of the invention, the first recirculation circuit comprises a first recirculation pump, a first pipe connecting the washing tub to the first recirculation pump and a first recirculation pipe connecting the first recirculation pump to the washing tub.

[0032] Preferably, the first recirculation pipe ends in a bottom region of the washing tub. In a preferred embodiment of the invention, the second recirculation circuit comprises a second recirculation pump, a second pipe connecting the washing tub to the second recirculation pump, and a second recirculation pipe connecting the second recirculation pump to the washing/rinsing products supplier.

[0033] In a further preferred embodiment of the invention, the first recirculation circuit comprises a first recirculation pump, a first pipe connecting the washing tub to the first recirculation pump and a first recirculation pipe connecting the first recirculation pump to the washing tub, and the second recirculation circuit comprises the first recirculation pump, the first pipe connecting the washing tub to said first recirculation pump and a second recirculation pipe connecting the first recirculation pump to the washing/rinsing products supplier.

[0034] In a further preferred embodiment of the invention, the machine further comprises a two-way controlled valve having an input and two outputs, the input being connected to the first recirculation pump, a first output being connected to the first recirculation pipe and a second output being connected to the second recirculation pipe.

[0035] Preferably, the washing/rinsing products supplier comprises a drawer having one or more compartments suitable for receiving the washing/rinsing products. Opportunely, the second recirculation circuit recirculates liquid from the washing tub and conveys such a liquid into one of the compartments of the washing/rinsing products supplier.

[0036] In a preferred embodiment of the invention, the machine further comprises a circulation circuit suitable for withdrawing liquid from a bottom region of the washing tub and for re-admitting such a liquid into the washing tub in such a way that the re-admitted liquid wets the laundry.

[0037] Opportunely, the circulation circuit re-admits the liquid into an upper region of the washing tub.

[0038] In a further aspect the present invention relates 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;

the method comprising the steps of:

- providing a quantity of water into said washing tub;
- providing a quantity of said washing/rinsing products into said washing tub; wherein the method further comprises the steps of:
- withdrawing liquid from said washing tub and re-admitting such a liquid into said washing tub so as to improve the dissolution of said washing/rinsing products therein;
- withdrawing liquid from said washing tub and conveying such a liquid into said washing/rinsing products supplier and then re-admitting such a liquid into said washing tub so as to further improve the dissolution of said washing/rinsing products.

[0039] Preferably, the step of withdrawing liquid from the washing tub and conveying such a liquid into the washing/rinsing products supplier and then re-admitting such a liquid into the washing tub is carried out in such a way that, during such re-admitting, the liquid re-admitted into the washing tub does not enter the washing drum.

[0040] In a preferred embodiment of the invention, the step of withdrawing liquid from the washing tub and re-admitting such a liquid into the washing tub and the step of withdrawing liquid from the washing tub and conveying such a liquid into the washing/rinsing products supplier take place simultaneously.

[0041] In a further preferred embodiment of the invention, the step of withdrawing liquid from the washing tub and re-admitting such a liquid into the washing tub and the step of withdrawing liquid from the washing tub and conveying such a liquid into the washing/rinsing products supplier take place alternatively.

[0042] In a preferred embodiment of the invention, the quantity of washing/rinsing products is provided into the washing tub by means of said quantity of water which comes from said water supply circuit and passes through the washing/rinsing products supplier.

[0043] In a further preferred embodiment of the invention, the quantity of washing/rinsing products is provided into the washing tub by means of recirculated liquid passing through the washing/rinsing products supplier, said recirculated liquid being the liquid recirculated in the step of withdrawing liquid from the washing tub and conveying such a liquid into the washing/rinsing products supplier.

[0044] Preferably, during the step of withdrawing liquid from the washing tub and re-admitting such a liquid into the washing tub and the step of withdrawing liquid from the washing tub and conveying such a liquid into the washing/rinsing products supplier, the liquid level inside the washing tub is maintained at a level at which the liquid

does not go inside the washing drum.

[0045] More preferably, during the step of withdrawing liquid from the washing tub and re-admitting such a liquid into the washing tub and the step of withdrawing liquid from the washing tub and conveying such a liquid into the washing/rinsing products supplier, the liquid level inside the washing tub is maintained at a level which is below the bottom of the washing drum.

[0046] Advantageously, between the step of providing a quantity of water into the washing tub from the water supply circuit and the step of providing a quantity of washing/rinsing products into the washing tub, the method further comprises a step of completely wetting the laundry and/or a step of draining exceeding water from the washing tub which is not absorbed by the laundry.

[0047] Preferably, the steps of withdrawing liquid from the washing tub take place for a pre-determined period of time.

[0048] More preferably, the first recirculation circuit and/or the second recirculation circuit are activated for a pre-determined period of time until the washing/rinsing products and the water form a homogeneous solution.

[0049] In a further aspect the present invention relates 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 first recirculation circuit suitable for withdrawing liquid from said washing tub and to re-admit such a liquid into said washing tub;
- a second recirculation circuit suitable for withdrawing liquid from said washing tub and conveying such a liquid into said washing/rinsing products supplier and then re-admitting such a liquid into said washing tub;

the method comprising the steps of:

- providing a quantity of water into said washing tub from said water supply circuit;
- providing a quantity of said washing/rinsing products into said washing tub; wherein the method further comprises the steps of:
- activating said first recirculation circuit for withdrawing liquid from said washing tub and re-admitting such a liquid into said washing tub so as to improve the dissolution of said washing/rinsing products therein;
- activating said second recirculation circuit for withdrawing liquid from said washing tub and conveying such a liquid into said washing/rinsing products supplier and then re-admitting such a liquid into said washing tub so as to further improve the dissolution of said washing/rinsing products;

- deactivating said first recirculation circuit;
- deactivating said second recirculation circuit.

[0050] Preferably, the step of activating the second recirculation circuit for withdrawing liquid from the washing tub and conveying such a liquid into the washing/rinsing products supplier and then re-admitting such a liquid into the washing tub is carried out in such a way that, during such re-admitting, the liquid re-admitted into the washing tub does not enter the washing drum.

[0051] In a preferred embodiment of the invention, the step of activating the first recirculation circuit and the step of activating the second recirculation circuit take place simultaneously.

[0052] In a further preferred embodiment of the invention, the step of activating the first recirculation circuit and the step of activating the second recirculation circuit take place alternatively.

[0053] In a preferred embodiment of the invention, the quantity of washing/rinsing products is provided into the washing tub by means of the quantity of water coming from the water supply circuit which passes through the washing/rinsing products supplier.

[0054] In a further preferred embodiment of the invention, the quantity of washing/rinsing products is provided into the washing tub by means of liquid coming from the second recirculation circuit which passes through the washing/rinsing products supplier.

[0055] Preferably, during the step of activating the first recirculation circuit and the step of activating the second recirculation circuit, the liquid level inside the washing tub is maintained at a level at which the liquid does not go inside the washing drum.

[0056] More preferably, during the step of activating the first recirculation circuit and the step of activating the second recirculation circuit, the liquid level inside the washing tub is maintained at a level which is below the bottom of the washing drum.

[0057] Advantageously, between the step of providing a quantity of water into said washing tub from the water supply circuit and the step of providing a quantity of washing/rinsing products into the washing tub, the method further comprises a step of completely wetting the laundry and/or a step of draining exceeding water from the washing tub which is not absorbed by the laundry.

[0058] Preferably, the first recirculation circuit and/or the second recirculation circuit are activated for a pre-determined period of time.

[0059] More preferably, the first recirculation circuit and/or the second recirculation circuit are activated for a pre-determined period of time until the washing/rinsing products and the water form a homogeneous solution.

[0060] In a preferred embodiment of the invention, the machine of the invention is a laundry washing-drying machine.

BRIEF DESCRIPTION OF THE DRAWINGS

[0061] 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 according to a preferred embodiment of the invention;
- Figure 2 shows a schematic front view of the laundry washing machine of Figure 1, with the casing and other components removed for more clarity;
- Figure 3 shows a construction variant of the laundry washing machine shown in Figure 2;
- Figure 4 is a simplified flow chart of the basic operations of a method for washing laundry in the laundry washing machine of Figures 1 and 2;
- Figure 5 is a simplified flow chart of the basic operations of a further embodiment of the method for washing laundry in the laundry washing machine of Figures 1 and 2;
- Figures 6 and 7 show two successive steps of the method for washing laundry according to the flow chart of Figure 5 in the laundry washing machine of Figure 2;
- Figure 8 is a simplified flow chart of the basic operations of a further method for washing laundry in the laundry washing machine of Figures 1 and 2;
- Figures from 9 to 13 show successive steps of the method for washing laundry according to the flow chart of Figure 8 in the laundry washing machine of Figure 2;
- Figure 14 shows an enlarged detail of the rear part of the washing tub of a laundry washing machine according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0062] 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).

[0063] In the present description, therefore, the term "laundry washing machine" will refer to both simple laundry washing machines and laundry washing-drying machines.

[0064] Figures 1 and 2 show a laundry washing machine 1 according to a preferred embodiment of the invention.

[0065] The laundry washing machine 1 comprises an external casing or housing 2, in which a washing tub 3 is provided that contains a rotatable perforated drum 4,

visible in Figure 2, where the laundry to be treated, not illustrated, can be loaded. The tub 3 and the drum 4 both preferably have a substantially cylindrical shape. A gap 17 between the tub 3 and the drum 4 is therefore advantageously defined. The housing 2 is provided with a loading/unloading door 8 which allows access to the washing drum 4.

[0066] 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.

[0067] 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.

[0068] The tub 3 is preferably connected to the casing 2 by means of an elastic bellows, or gasket, not illustrated.

[0069] The lower portion 3a of the tub 3 preferably comprises a seat 15 suitable for receiving a heater device 10.

[0070] The heater device 10 preferably comprises an electrical resistor of serpentine type. The heater device 10 is advantageously horizontally placed in the seat 15. Between the heater 10 and the bottom surface 15a of the seat 15 a gap 18 is defined, as illustrated in Figure 2.

[0071] A water supply circuit 5 is preferably arranged in the upper part of the laundry washing machine 1 and is suited to supply water W into the tub 3.

[0072] A washing/rinsing products supply system 6 is preferably arranged in the upper part of the laundry washing machine 1 and is suited to supply washing/rinsing products (i.e. detergent D, softener, etc.) into the tub 3.

[0073] The washing/rinsing products supply system 6 advantageously comprises a drawer 13, preferably removable, provided with various compartments suited to be filled with said washing and/or rinsing products.

[0074] In the embodiment herein described, the water W flowing through the water supply circuit 5 is advantageously supplied into the tub 3 by making it flow through the drawer 13 and then through a supply pipe 9 which extends toward the tub 3.

[0075] The supply pipe output 9a of the supply pipe 9 ends in correspondence of the tub 3. Preferably the supply pipe output 9a ends in correspondence of a lateral side of the tub 3, more preferably in correspondence of the rear side 3b of the tub 3, as will be described with reference to Figure 14.

[0076] Figure 14 shows the rear portion of the tub 3 where the supply pipe, not illustrated, is connected. In the advantageous embodiment illustrated in Figure 14, the tub 3 comprises an aperture 3c at which the supply pipe output 9a of the supply pipe 9 is connected. The liquid coming from the supply pipe 9, therefore, enters the tub 3 through the aperture 3c. The liquid is preferably directed towards and against the rear side 3b of the tub 3. The rear side 3b of the tub 3 preferably comprises a

convex draining portion 3d which directs the liquid towards the bottom of the tub 3.

[0077] The liquid advantageously falls down towards the bottom of the tub 3 and does not enter the washing drum 4 during its way towards the bottom of the tub 3.

[0078] In different embodiments, the supply pipe may be opportunely configured so that the liquid flowing through it, i.e. the liquid flowing from the drawer 13 to the tub 3, is conveyed along a direction which does not intersect the drum 4.

[0079] For example, the supply pipe may end at the lower portion 3a of the tub 3.

[0080] More generally, the washing/rinsing products supplier is configured for conveying liquid inside the washing tub so that the liquid does not enter the washing drum 4 during the conveying.

[0081] The water supply circuit 5 preferably comprises a main pipe 7 which opportunely connects the drawer 13 to an external water supply line E by means of a controlled supply valve 16.

[0082] 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 13, or such water W can be clean (i.e. without products). This may depend on the phase of the washing program which is actually performed; in the initial phases of the washing program, for example, detergent D is conveyed into the tub 3 by the incoming water W, as better explained later. In other phases, for example during the rinsing phase, only water W may be conveyed into the tub 3.

[0083] 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 laundry washing machine 1 advantageously comprises a water outlet circuit 25.

[0084] The water outlet circuit 25 advantageously comprises a drain pump 26, a draining pipe 27 connecting the tub 3 to the drain pump 26 and an outlet pipe 28 ending outside the casing 2.

[0085] The draining pipe 27 preferably connects the lower portion 3a of the tub 3 to the drain pump 26. A first input end 27a of the draining pipe 27 is advantageously positioned at the lower point of the tub 3, more preferably at the lower point of the seat 15, and communicates with the internal of the tub 3, for example via a draining opening, not illustrated, obtained in the lower portion 3a of the tub 3. The water outlet circuit 25 is suited to drain the liquid, i.e. water or dirty water or water mixed with washing and/or rinsing products, from the tub 3 to the outside. Drainage of the liquid from the tub 3 towards the outside takes place activating the drain pump 26.

[0086] The water outlet circuit 25 preferably comprises a filtering device, not illustrated, 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.).

[0087] This filtering device can preferably be removed, and then cleaned, advantageously through a gate 40

placed advantageously on the front wall of the housing 2 of the laundry washing machine 1, as illustrated in Figure 1. According to the invention, the laundry washing machine 1 advantageously comprises a first recirculation circuit 30 adapted to drain liquid from the lower portion 3a of the tub 3 and to re-admit such a liquid (recirculated liquid) into the same lower portion 3a of the tub 3.

[0088] The first recirculation circuit 30 preferably comprises a first recirculation pump 31, a first pipe 32 connecting the tub 3 to the first recirculation pump 31 and a first recirculation pipe 33 provided with a terminal portion 34.

[0089] The first pipe 32 preferably connects the lower portion 3a of the tub 3 to the first recirculation pump 31. A first input end 32a of the first pipe 32 is advantageously positioned at the lower point of the tub 3, more preferably at the lower point of the seat 15.

[0090] The liquid from the lower portion 3a of the tub 3 is conveyed again towards the lower portion 3a of the tub 3 by activation of the first recirculation circuit 30, in particular by activation of the first recirculation pump 31. Activation of the first recirculation circuit 30 is advantageously carried out when mixing and/or dissolution of the washing products is needed, as better described below. According to the invention, the laundry washing machine 1 advantageously further comprises a second recirculation circuit 40 adapted to drain liquid from the lower portion 3a of the tub 3 and to convey advantageously such a liquid (recirculated liquid) into the washing/rinsing products supply system 6, preferably into the drawer 13. More preferably, the recirculated liquid is conveyed into one or more of the compartments of the drawer 13.

[0091] From the drawer 13 the liquid then flows through the supply pipe 9 towards the tub 3, as said above.

[0092] The second recirculation circuit 40 preferably comprises the first recirculation pump 31, the first pipe 32 connecting the tub 3 to the first recirculation pump 31 and a second recirculation pipe 43.

[0093] The second recirculation pipe 43 preferably comprises a terminal portion 43a arranged in correspondence of the drawer 13. More preferably, the terminal portion 43a ends in the compartment of the drawer 13 which receives the detergent D.

[0094] The liquid from the lower portion 3a of the tub 3 is conveyed towards the drawer 13 by activation of the second recirculation circuit 40, in particular by activation of the first recirculation pump 31. Activation of the second recirculation circuit 40 is advantageously carried out when further mixing and/or dissolution of the washing products is needed, as better described below.

[0095] In the preferred embodiment of the invention here illustrated, activation of the first recirculation pump 31 activates both the first recirculation circuit 30 and the second recirculation circuit 40.

[0096] In a further preferred embodiment of the invention, the first recirculation pump 31 may be properly controlled in order to allow selective recirculation towards the bottom 3a of the tub 3 through the first recirculation

pipe 33 or towards the drawer through the second recirculation pipe 43.

[0097] In a further embodiment, as illustrated in the example of Figure 3, a two-way valve 48 may be advantageously interposed between the first recirculation pump 31, the first recirculation pipe 33 and the second recirculation pipe 43.

[0098] The two-way valve 48 may be properly controlled in order to allow selective recirculation towards the bottom 3a of the tub 3 through the first recirculation pipe 33 or towards the drawer 13 through the second recirculation pipe 43 while the common first recirculation pump 31 is activated.

[0099] In a further embodiment, not illustrated, the second recirculation circuit may be completely separated from the first recirculation circuit; in this case the second recirculation circuit advantageously comprises a second controlled recirculation pump.

[0100] The water outlet circuit 25 may be advantageously provided with a circulation circuit 50 adapted to drain liquid from a bottom region of the tub 3 and to re-admit such a liquid into an upper region of the tub 3 for improving the wetting of the laundry with such recirculated liquid.

[0101] The circulation circuit 50 preferably comprises the drain pump 26 and a circulation pipe 51. The circulation pipe 51 may advantageously end with an injection nozzle 51a, placed preferably in an upper region of the tub 3. In further preferred embodiments other injection nozzles in different locations along the tub 3 may be preferably provided.

[0102] The drain pump 26 is properly controlled in order to allow selective drainage towards the outside through the outlet pipe 28 or towards the upper region of the tub 3 through the circulation pipe 51.

[0103] In a further embodiment, a two-way valve may be advantageously interposed between the drain pump 26, the outlet pipe 28 and the circulation pipe 51. This two-way valve may be properly controlled in order to allow selective drainage towards the outside through the outlet pipe or towards the upper region of the tub through the circulation pipe while the common drain pump is activated.

[0104] In a further embodiment, not illustrated, the circulation circuit may comprise a dedicated circulation 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 circulation circuit is advantageously completely separated from the water outlet circuit.

[0105] In general, the circulation 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.

[0106] Advantageously, laundry washing machine 1 comprises a device, not illustrated, suited to sense (or detect) the liquid level inside the tub 3.

[0107] The sensor device preferably comprises a pressure sensor which senses the pressure in the tub 3. From

the values sensed by the sensor device it is possible to determine the liquid level of the liquid inside the tub 3. In another embodiment, not illustrated, laundry 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.

[0108] 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 first and the second recirculation circuit 30, 40, 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.

[0109] Preferably the control unit is connected to the first recirculation pump 31. Therefore the control unit may advantageously activate/deactivate the first recirculation pump 31 and, in turn, activate/deactivate both the first and the second recirculation circuit 30, 40.

[0110] 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..

[0111] Based on the parameters acquired by said interface 12, the control unit may advantageously set and control the various parts of the laundry washing machine 1 in order to carry out the desired washing program.

[0112] 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 4.

[0113] The laundry to be washed is first placed inside the drum 4 (step 100 of Figure 4). 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.

[0114] 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.

[0115] 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).

[0116] 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.

[0117] 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 13 by the first quantity Q1_w of water W coming from the external water supply line E when the controlled supply valve 16 is switched on.

[0118] The first quantity Q1_w of water W flows through the drawer 13 and then, together with the detergent D, through the supply pipe 9 up to the tub 3.

[0119] In different embodiments, the quantity Qd of detergent D and the first quantity Q1_w of water W may be advantageously introduced singularly into the tub 3 in different times.

[0120] Advantageously, 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 to the lower portion 3a of the tub 3.

[0121] Therefore, substantially all the detergent D and the water W reach the lower portion 3a of the tub 3 without any absorption from the laundry.

[0122] That is guaranteed, in particular, by the advantageous arrangement of the supply pipe 9 with respect to the tub 3, as illustrated above. The detergent D and the water W, in fact, fall down to the lower portion 3a of the tub 3 by flowing inside the gap 17 between the tub 3 and the drum 4, as schematically illustrated in Figure 2.

[0123] Nevertheless, a minimum quantity of the detergent D and/or of water W (e.g. some spurts of water) may accidentally reach the laundry inside the drum 4.

[0124] In further embodiments, the supply pipe 9 may be opportunely configured so that all the detergent D and/or all water W from the drawer 13 reaches the lower portion 3a of the tub 3 without going inside the drum 4 during the conveying, as mentioned above.

[0125] 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. The detergent D tends to accumulate in such lower portion 3a of the tub 3, particularly in the seat 15 and more particularly in the gap 18 below the heater device 10.

[0126] At the same time, the water W inside the tub 3 reaches a first level L1. In a preferred embodiment, the first level L1 is advantageously a level at which the water W does not go inside the drum 4, more preferably a level which is below the bottom of the drum 4, as illustrated in Figure 2.

[0127] Advantageously, said first level L1 guarantees that wetting of the laundry with a liquid wherein the detergent D is not yet completely dissolved in the water W, i.e. a solution S, is avoided.

[0128] According to the invention, the method provides for the activation of the first recirculation circuit 30 and the second recirculation circuit 40 (step 130).

[0129] In the preferred embodiment here described, the two recirculation circuits 30, 40 are activated simultaneously by activating the first recirculation pump 31.

[0130] The two recirculation circuits 30, 40 are preferably activated for a pre-determined time T_m , for example 6 min.

[0131] Activation of the first recirculation circuit 30 advantageously mixes with water and/or dissolves into water the washing products D accumulated in the seat 15. Advantageously, the terminal portion 34 of the first recirculation pipe 33 is arranged in such a way to emit a jet of liquid pointed to the gap 18 so as to remove washing/rinsing products collected therein.

[0132] The liquid forced in the gap 18 collides with the product accumulated in the gap 18 and enhances its mixing and/or dissolution in the liquid in which it is immersed.

[0133] Advantageously, the forced jet of recirculated liquid according to the invention avoids accumulation of products at the bottom of the tub 3 and enhances a complete and/or a fast dissolution of the products themselves in the water. Hence, the first recirculation circuit 30 creates a first flow of recirculated liquid into the washing tub 3 which improves the dissolution into water of the washing/rinsing products therein.

[0134] The washing performance of the washing cycle and the efficiency of the machine 1 are therefore increased.

[0135] Still advantageously, the first recirculation circuit 30 according to the invention performs a cleaning effect since no products accumulate at the bottom of the tub 3.

[0136] Activation of the second recirculation circuit 40 advantageously mixes with water and/or dissolves into water the washing products residues (detergent D) which, in particular when powder detergent is used, may settle inside the drawer 13.

[0137] Advantageously, the terminal portion 43a of the second recirculation pipe 43 is arranged in such a way to emit a jet of liquid in the proper compartment of the drawer which receives the detergent D, so as to remove possible detergent residues.

[0138] The liquid forced in the drawer 13 collides with the detergent residuals and enhances their removal. At the same time, the detergent residues are mixed and/or dissolved in the recirculated liquid.

[0139] The recirculated liquid together with the removed detergent residues then flow through the supply pipe 9 to the tub 3.

[0140] The recirculated liquid together with the removed detergent residues fall down to the lower portion 3a of the tub 3. Therefore, substantially all the liquid and the removed detergent residues reach the lower portion 3a of the tub 3 without any absorption from the laundry.

[0141] That is guaranteed, as said above, by the advantageous arrangement of the supply pipe 9 with respect to the tub 3.

[0142] Advantageously, the liquid recirculated by the second recirculation circuit 40 according to the invention, avoids accumulation of products in the drawer 13 and enhances a complete and/or a fast dissolution of the products themselves in the water.

[0143] Still advantageously, the fact that all the liquid and the removed detergent residues reach the lower portion 3a of the tub 3 without any absorption from the laundry guarantees that in this phase the detergent does not reach the laundry before its complete dissolution in the water. In this way accumulation of detergent on the laundry is avoided and an advantageous uniform detergent effect is obtained. In particular, halos of detergent in the dark-colored laundry are avoided.

[0144] Furthermore, the second recirculation circuit 40 creates a second flow of recirculated liquid into the lower portion 3a of the tub 3 which further improves the dissolution of the washing/rinsing products.

[0145] The dissolution into washing water of the washing/rinsing products D is advantageously improved by the combined effect of the first flow of recirculated liquid and of the second flow of recirculated liquid the at the lower portion 3a of the tub 3, in particular when the two recirculation circuits 30, 40 are activated simultaneously.

[0146] The dissolution of the washing/rinsing products D is therefore improved by the synergy achieved by merging the two flows of recirculated liquid at the bottom of the tub 3.

[0147] The washing performance of the washing cycle and the efficiency of the machine 1 are therefore increased.

[0148] Furthermore, all the products introduced by the user in the drawer 13 are used in the washing cycle, substantially without any losses.

[0149] Still advantageously, the second recirculation circuit 40 according to the invention performs a cleaning effect since no products accumulate in the drawer 13.

[0150] Furthermore, activation of the two recirculation circuits 30, 40 allows the complete and/or a fast dissolution of the products in the water thus creating a solution S used successively to wet the laundry. Advantageously, when the detergent reaches the laundry, it is properly dissolved and mixed within the water. In this way, as already mentioned above, accumulation of detergent on the laundry is avoided and an advantageous uniform detergent effect is obtained. In particular, halos of detergent in the dark-colored laundry are avoided.

[0151] The two recirculation circuits 30, 40 are preferably activated for a pre-determined time T_m until the washing/rinsing products and the water form a homogeneous solution S.

[0152] In a further preferred embodiment, such as in the embodiment of Figure 3, the first recirculation circuit 30 and the second recirculation circuit 40 may be activated separately. According to this embodiment, the method of the invention may provide for a first pre-determined time T_1 of activation for the first recirculation circuit 30 and a second pre-determined time T_2 of activation for the second recirculation circuit 40.

[0153] In a further preferred embodiment, the method may provide for an intermittent activation of the first and/or of the second recirculation circuit 30, 40 and/or may provide for alternating the activation of the two re-

circulation circuits 30, 40.

[0154] In the preferred embodiment of the method, activation of the two recirculation circuits 30, 40 (step 130) is performed after the quantity Q_d of detergent D and the first quantity Q_{1w} of water W are introduced into the tub 3 (step 120). Nevertheless, in a further embodiment, the activation of the two recirculation circuits 30, 40 (step 130) may be performed at the same time, or even before, the phase of introducing detergent D and the water W into the tub 3 (step 120). In this case, the mixing and/or dissolution effect inside the tub 3 and in the drawer 13 according to the invention starts from the very beginning, thus speeding the mixing phase.

[0155] Once the phase of mixing and/or dissolving the detergent inside the tub 3 and in the drawer 13 has been completed, the first recirculation circuit 30 and the second recirculation circuit 40 are de-activated (step 140) and the washing program may continue with the following programmed phases, until the washing program ends (step 150). For example, the washing program may continue with a phase in which the washing liquid (i.e. water mixed with washing product/s) is conveyed into the laundry, for example by activating the circulation circuit 50, and/or by increasing the liquid level in the tub 3, for example by loading further clean water through the water inlet circuit 5. Then the washing program may continue with the following programmed phases, until the washing program ends (step 150).

[0156] Figure 5 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 the flow chart of Figure 4 substantially for the fact that the phase of introducing the detergent D into the tub 3 takes place preferably through the activation of the second recirculation circuit 40 instead of through the water inlet circuit 5, as better described below with reference also to Figures 6 and 7.

[0157] The laundry to be washed is first placed inside the drum 4 (step 100 of Figure 5). 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.

[0158] 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.

[0159] 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).

[0160] In a successive phase (step 220) a quantity Q_{1w} of water W is introduced directly into the tub 3, as illustrated in Figure 6. The water W may be introduced directly into the tub 3 bypassing the compartments of the drawer

13 or, in an alternative embodiment of the invention, through a further separate water supply pipe which supplies exclusively clean water into the tub 3.

[0161] Advantageously, the first quantity Q_{1w} of water W introduced into the tub 3 in said phase (step 220) falls down to the lower portion 3a of the tub 3.

[0162] Therefore the water W reaches the lower portion 3a of the tub 3 without any absorption from the laundry.

[0163] That is guaranteed, advantageously, by the advantageous arrangement of the supply pipe 9 with respect to the tub 3.

[0164] The water W inside the tub 3 reaches a first level L1. In a preferred embodiment, the first level L1 is advantageously a level at which the water W does not go inside the drum 4, more preferably a level which is below the bottom of the drum 4, as illustrated in Figure 6.

[0165] Advantageously, said first level L1 guarantees that wetting of the laundry with a liquid wherein the detergent D is not yet completely dissolved in the water W, i.e. a solution S, is avoided.

[0166] According to the invention, the method provides for the activation of the first and the second recirculation circuit 30, 40 (step 230), as illustrated in Figure 7.

[0167] The two recirculation circuits 30, 40 are preferably activated for a pre-determined time T_m, for example 6 min.

[0168] Advantageously, the terminal portion 43a of the second recirculation pipe 43 is arranged in such a way to emit a jet of recirculated liquid in the proper compartment of the drawer 13 which receives the detergent D.

[0169] Therefore, a quantity Q_d of detergent D, be it powder or liquid, is preferably brought out of the apposite compartment of the drawer 13 by the recirculated liquid coming from the second recirculation circuit 40.

[0170] The recirculated liquid flows through the drawer 13 and then, together with the detergent D, through the supply pipe 9 up to the tub 3.

[0171] Advantageously, the quantity Q_d of detergent D and the recirculated liquid introduced into the tub 3 in said phase (step 230) falls down to the lower portion 3a of the tub 3.

[0172] Therefore substantially all the detergent D and the liquid reach the lower portion 3a of the tub 3 without any absorption from the laundry.

[0173] That is guaranteed, in particular, by the advantageous arrangement of the supply pipe 9 with respect to the tub 3, as illustrated above.

[0174] 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. The detergent D tends to accumulate in such lower portion 3a of the tub 3, particularly in the seat 15, and more particularly in the gap 18 below the heater device 10.

[0175] According to the invention, the first recirculation circuit 30 is also activated (step 230).

[0176] Activation of the first recirculation circuit 30 advantageously mixes and/or dissolves the washing prod-

ucts accumulated in the seat 15.

[0177] Advantageously, the terminal portion 34 of the first recirculation pipe 33 is arranged in such a way to emit a jet of liquid pointed to the gap 18 so as to remove washing/rinsing products collected therein.

[0178] The liquid forced in the gap 18 collides with the product accumulated in the gap 18 and enhances its mixing and/or dissolution in the liquid in which it is immersed.

[0179] Advantageously, the forced jet of recirculated liquid according to the invention avoids accumulation of products at the bottom of the tub 4 and enhances a complete and/or a fast dissolution of the products themselves in the water. Hence, the first recirculation circuit 30 creates a first flow of recirculated liquid into the washing tub 3 which improves the dissolution of the washing/rinsing products therein.

[0180] The washing performance of the washing cycle and the efficiency of the machine 1 are therefore increased.

[0181] Still advantageously, the first recirculation circuit 30 according to the invention performs a cleaning effect since no products accumulate at the bottom of the tub 3.

[0182] Furthermore, at the same time, the second recirculation circuit 40 advantageously mixes and/or dissolves all the washing products (detergent D) inside the drawer 13. In this way, detergent residues do not remain inside the compartment of the drawer 13 and do not accumulate therein.

[0183] Advantageously, the liquid recirculated by the second recirculation circuit 40 according to the invention avoids accumulation of products in the drawer 13 and enhances a complete and/or a fast dissolution of the products themselves in the water.

[0184] Still advantageously, the fact that all the liquid and the removed detergent residues reach the lower portion 3a of the tub 3 without any absorption from the laundry during the conveying, guarantees that in this phase the detergent does not reach the laundry before its complete dissolution in the water. In this way accumulation of detergent on the laundry is avoided and an advantageous uniform detergent effect is obtained. In particular, halos of detergent in the dark-colored laundry are avoided.

[0185] The two recirculation circuits 30, 40 are preferably activated for a pre-determined time T_m until the washing/rinsing products and the water form a homogeneous solution S.

[0186] All the advantages above-mentioned with reference to the first embodiment are therefore achieved.

[0187] In particular, the dissolution of the washing/rinsing products D is advantageously improved by the combined effect of the first flow of recirculated liquid and of the second flow of recirculated liquid the at the lower portion 3a of the tub 3, in particular when the two recirculation circuits 30, 40 are activated simultaneously. The dissolution into water of the washing/rinsing products D is therefore improved by the synergy achieved by merg-

ing the two flows at the bottom of the tub 3.

[0188] Once the phase of mixing and/or dissolving the detergent inside the tub 3 and in the drawer 13 has been completed (step 230), the first and the second recirculation circuits 30, 40 are de-activated (step 240) and the washing program may continue with the following programmed phases, until the washing program ends (step 150). Also in this case, the washing program may advantageously continue with a phase in which the washing liquid is conveyed into the laundry for example by activating the circulation circuit 50, and/or by increasing the liquid level in the tub 3, for example by loading further clean water through the water inlet circuit 5. Then the washing program may continue with the following programmed phases, until the washing program ends (step 150).

[0189] In the preferred embodiment here described, the first recirculation circuit 30 and the second recirculation circuit 40 are activated simultaneously.

[0190] Nevertheless, in further embodiments the first recirculation circuit 30 may be activated after the second recirculation circuit 40 or, vice-versa, the second recirculation circuit 40 may be activated after the first recirculation circuit 30. Still, in different embodiments of the invention, between the phase of introducing water into the tub 3 (step 220) and the phase of activating one or both the recirculation circuits 30, 40 (step 230), further phase of the washing cycle may be performed.

[0191] An example of such a method is given herein-after with reference to the flow chart of Figure 8 and with reference to Figures from 9 to 12.

[0192] The laundry to be washed is first placed inside the drum 4 (step 100 of Figure 8). 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.

[0193] 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.

[0194] 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).

[0195] In a successive phase (step 220) a first quantity $Q_{1w'}$ of clean water is introduced in the tub 3 up to a wetting level $L1'$, as illustrated in Figure 9. The quantity $Q_{1w'}$ of clean water is preferably defined before its introduction in the tub 3. The introduction of clean water takes place through the water inlet circuit 5 that will provide for feeding clean water into the tub 3. The water W may be introduced directly into the tub 3 bypassing the compartments of the drawer 13 or, in an alternative embodiment of the invention, through a further separate water supply pipe which supplies exclusively clean water into the tub 3.

[0196] The wetting level $L1'$ reached by the water is a level that guarantees complete wetting of the laundry.

[0197] Preferably, the first quantity $Q1_w'$ will at least be equal to quantity of water necessary to wet the laundry completely.

[0198] Advantageously, the first quantity $Q1_w'$ is greater than the quantity of water necessary to wet the laundry completely.

[0199] In order to favour the wetting operation, the drum 4 advantageously is set rotating and the circulation circuit 50 is activated so as to obtain better and more homogeneous wetting of the laundry (step 224), as illustrated in Figure 10.

[0200] At the end of this phase described (step 224), the laundry inside the drum 4 is completely wet and the water inside the tub 3 reaches a new lower level $L1''$. Therefore, the gap 17 between the tub 3 and the drum 4 is filled with water up to level $L1''$, as shown in Figure 10.

[0201] The quantity of water occupying the gap 17 constitutes a quantity of clean water that exceeds the quantity of water necessary to wet the laundry completely.

[0202] In the successive phase of the cycle (step 226) said exceeding water will be removed from the tub 3, as illustrated in Figure 11.

[0203] The removal operation preferably includes the drainage of the water from the tub 3 by means of the drain pump 16 that takes the water from the bottom of the tub 3 and conveys it towards the outside through the outlet duct 18.

[0204] This phase ends when the water reaches a first level $L1$. In a preferred embodiment, the first level $L1$ is advantageously a level at which the water W does not go inside the drum 4, more preferably a level which is below the bottom of the drum 4, as illustrated in Figure 11.

[0205] Advantageously, said first level $L1$ guarantees that wetting of the laundry with a liquid wherein the detergent D is not yet completely dissolved in the water W , i.e. a solution S , is avoided.

[0206] At the end of the draining phase (step 226), the laundry inside the drum 4 is completely wetted and water in the tub at level $L1$.

[0207] Successively, the method continues by providing for the activation of first and the second recirculation circuit 30, 40 (step 230), as illustrated in Figure 12. Advantageously, the terminal portion 43a of the second recirculation pipe 43 is arranged in such a way to emit a jet of recirculated liquid in the proper compartment of the drawer 13 which receives the detergent D .

[0208] Therefore, a quantity Qd of detergent D , be it powder or liquid, is preferably brought out of the apposite compartment of the drawer 13 by the recirculated liquid coming from the second recirculation circuit 40 (as illustrated in Figure 12).

[0209] The recirculated liquid flows through the drawer 13 and then, together with the detergent D , through the supply pipe 9 up to the tub 3.

[0210] Advantageously, the quantity Qd of detergent D and the recirculated liquid introduced into the tub 3 in

said phase (step 230) falls down to the lower portion 3a of the tub 3.

[0211] Therefore substantially all the detergent D and the liquid reach the lower portion 3a of the tub 3 without any absorption from the laundry.

[0212] That is guaranteed, in particular, by the advantageous arrangement of the supply pipe 9 with respect to the tub 3, as illustrated above.

[0213] 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 . The detergent D tends to accumulate in such lower portion 3a of the tub 3, particularly in the seat 15 and more particularly in the gap 18 below the heater device 10.

[0214] According to the invention, the first recirculation circuit 30 is also activated (step 230).

[0215] Activation of the first recirculation circuit 30 advantageously mixes and/or dissolves the washing products accumulated in the seat 15.

[0216] Advantageously, the terminal portion 34 of the first recirculation pipe 33 is arranged in such a way to emit a jet of liquid pointed to the gap 18 so as to remove washing/rinsing products collected therein.

[0217] The liquid forced in the main flowing direction collides with the product accumulated in the gap 18 and enhances its mixing and/or dissolution in the liquid in which it is immersed.

[0218] Advantageously, the forced jet of recirculated liquid according to the invention avoids accumulation of products at the bottom of the tub 4 and enhances a complete and/or a fast dissolution of the products themselves in the water.

[0219] Hence, the first recirculation circuit 30 creates a first flow of recirculated liquid into the washing tub 3 which improves the dissolution of the washing/rinsing products therein.

[0220] The washing performance of the washing cycle and the efficiency of the machine 1 are therefore increased.

[0221] Still advantageously, the first recirculation circuit 30 according to the invention performs a cleaning effect since no products accumulate at the bottom of the tub 3.

[0222] Furthermore, at the same time, the second recirculation circuit 40 advantageously mixes and/or dissolves all the washing products (detergent D) inside the drawer 13. In this way, detergent residues do not remain inside the compartment of the drawer 13 and do not accumulate therein.

[0223] Advantageously, the recirculated liquid by the second recirculation circuit 40 according to the invention avoids accumulation of products in the drawer 13 and enhances a complete and/or a fast dissolution of the products themselves in the water.

[0224] Still advantageously, the fact that all the liquid and the removed detergent residues reach the lower portion 3a of the tub 3 without any absorption from the laundry during the conveying, guarantees that in this phase

the detergent does not reach the laundry before its complete dissolution in the water. In this way accumulation of detergent on the laundry is avoided and an advantageous uniform detergent effect is obtained. In particular, halos of detergent in the dark-colored laundry are avoided.

[0225] The two recirculation circuits 30, 40 are preferably activated for a pre-determined time T_m until the washing/rinsing products and the water form a homogeneous solution S. All the advantages above-mentioned with reference to the first embodiment are therefore achieved.

[0226] In particular, the dissolution of the washing/rinsing products D is advantageously improved by the combined effect of the first flow of recirculated liquid and of the second flow of recirculated liquid at the lower portion 3a of the tub 3, in particular when the two recirculation circuits 30, 40 are activated simultaneously. The dissolution of the washing/rinsing products D is therefore improved by the synergy achieved by merging the two flows at the bottom of the tub 3.

[0227] Once the phase of mixing and/or dissolving the detergent inside the tub 3 and in the drawer 13 has been completed (step 230), the first and the second recirculation circuit 30, 40 are de-activated (step 240).

[0228] At the bottom of the tub 3 a highly concentrated detergent solution S is present. In a successive phase (step 250), the solution S is distributed over the laundry by activating the circulation circuit 50, as illustrated in figure 13.

[0229] Advantageously also during this phase the heater device 10 is activated.

[0230] The washing program may then continue with the following programmed phases, until the washing program ends (step 150).

[0231] 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.

[0232] 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. A laundry washing machine (1) 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 into said washing tub (3);
- a water outlet circuit (25) for draining liquid from said washing tub (3) to the outside;
- a first recirculation circuit (30) suitable for withdrawing liquid from said washing tub (3) and to re-admit such a liquid into said washing tub (3) so as to improve the dissolution of said washing/rinsing products (D) therein; **characterized in that** it further comprises a second recirculation circuit (40) suitable for withdrawing liquid from said washing tub (3) and conveying such a liquid into said washing/rinsing products supplier (6), and then re-admitting such a liquid into said washing tub (3) so as to further improve the dissolution of said washing/rinsing products (D).

2. A machine (1) according to claim 1, wherein said washing/rinsing products supplier (6) is configured for conveying liquid inside said washing tub (3) in such a way that, during such conveying, the liquid does not enter said washing drum (4).

3. A machine (1), according to claim 1 or 2, comprising a control unit suitable for activating/deactivating said first recirculation circuit (30) and said second recirculation circuit (40) simultaneously.

4. A machine (1) according to any of the preceding claims, wherein said first recirculation circuit (30) comprises a first recirculation pump (31), a first pipe (32) connecting said washing tub (3) to said first recirculation pump (31) and a first recirculation pipe (33) connecting said first recirculation pump (31) to said washing tub (3).

5. A machine (1) according to claim 4, wherein said first recirculation pipe (33) ends in a bottom region (3a) of said washing tub (3).

6. A machine (1) according to any of the preceding claims, wherein said second recirculation circuit comprises a second recirculation pump, a second pipe connecting said washing tub (3) to said second recirculation pump and a second recirculation pipe connecting said second recirculation pump to said washing/rinsing products supplier (6).

7. A machine (1) according to any claims from 1 to 3, wherein said first recirculation circuit (30) comprises a first recirculation pump (31), a first pipe (32) connecting said washing tub (3) to said first recirculation pump (31) and a first recirculation pipe (33) connecting said first recirculation pump (31) to said washing tub (3) and wherein said second recirculation circuit (40) comprises said first recirculation pump (31), said first pipe (32) connecting said washing tub (3) to said first recirculation pump (31) and a second recirculation pipe (43) connecting said first recirculation pump (31) to said washing/rinsing products supplier (6).
8. A machine (1) according to claim 7, further comprising a two-way controlled valve (48) having an input and two outputs, said input being connected to said first recirculation pump (31), a first output being connected to said first recirculation pipe (33) and a second output being connected to said second recirculation pipe (43).
9. A machine (1) according to any of the preceding claims, wherein said washing/rinsing products supplier (6) comprises a drawer (13) having one or more compartments suitable for receiving said washing/rinsing products (D).
10. Method for washing laundry in a laundry washing machine (1) 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);
- the method comprising the steps of:
- providing (120; 230) a quantity (Q_{1_w} ; Q_{1_w}') of water (W) into said washing tub (3);
 - providing (120; 230) a quantity (Qd) of said washing/rinsing products (D) into said washing tub (3);
- characterized in that** the method further comprises the steps of:
- withdrawing liquid from said washing tub (3) and re-admitting such a liquid into said washing tub (3) so as to improve the dissolution of said washing/rinsing products (D) therein;
 - withdrawing liquid from said washing tub (3) and conveying such a liquid into said washing/rinsing products supplier (6), and then re-admitting such a liquid into said washing tub (3) so as to further improve the dissolution of said wash-
- ing/rinsing products (D).
11. Method according to claim 10, wherein said step of withdrawing liquid from said washing tub (3) and conveying such a liquid into said washing/rinsing products supplier (6) and then re-admitting such a liquid into said washing tub (3) is carried out in such a way that, during such re-admitting, the liquid re-admitted into said washing tub (3) does not enter said washing drum (4).
12. Method according to claim 10 or 11, wherein said step of withdrawing liquid from said washing tub (3) and re-admitting such a liquid into said washing tub (3) and said step of withdrawing liquid from said washing tub (3) and conveying such a liquid into said washing/rinsing products supplier (6) take place simultaneously.
13. Method according to any claims from 10 to 12, wherein said quantity (Qd) of washing/rinsing products (D) is provided into said washing tub (3) by means of said quantity (Q_{1_w} ; Q_{1_w}') of water (W) which comes from said water supply circuit (5) and passes through said washing/rinsing products supplier (6).
14. Method according to any claims from 10 to 12, wherein said quantity (Qd) of washing/rinsing products (D) is provided into said washing tub (3) by means of recirculated liquid passing through said washing/rinsing products supplier (6), said recirculated liquid being the liquid recirculated in said step of withdrawing liquid from said washing tub (3) and conveying such a liquid into said washing/rinsing products supplier (6).
15. Method according to any claims from 10 to 14, wherein during said step of withdrawing liquid from said washing tub (3) and re-admitting such a liquid into said washing tub (3) and said step of withdrawing liquid from said washing tub (3) and conveying such a liquid into said washing/rinsing products supplier (6), the liquid level inside said washing tub (3) is maintained at a level (L1) at which the liquid does not go inside said washing drum (4).

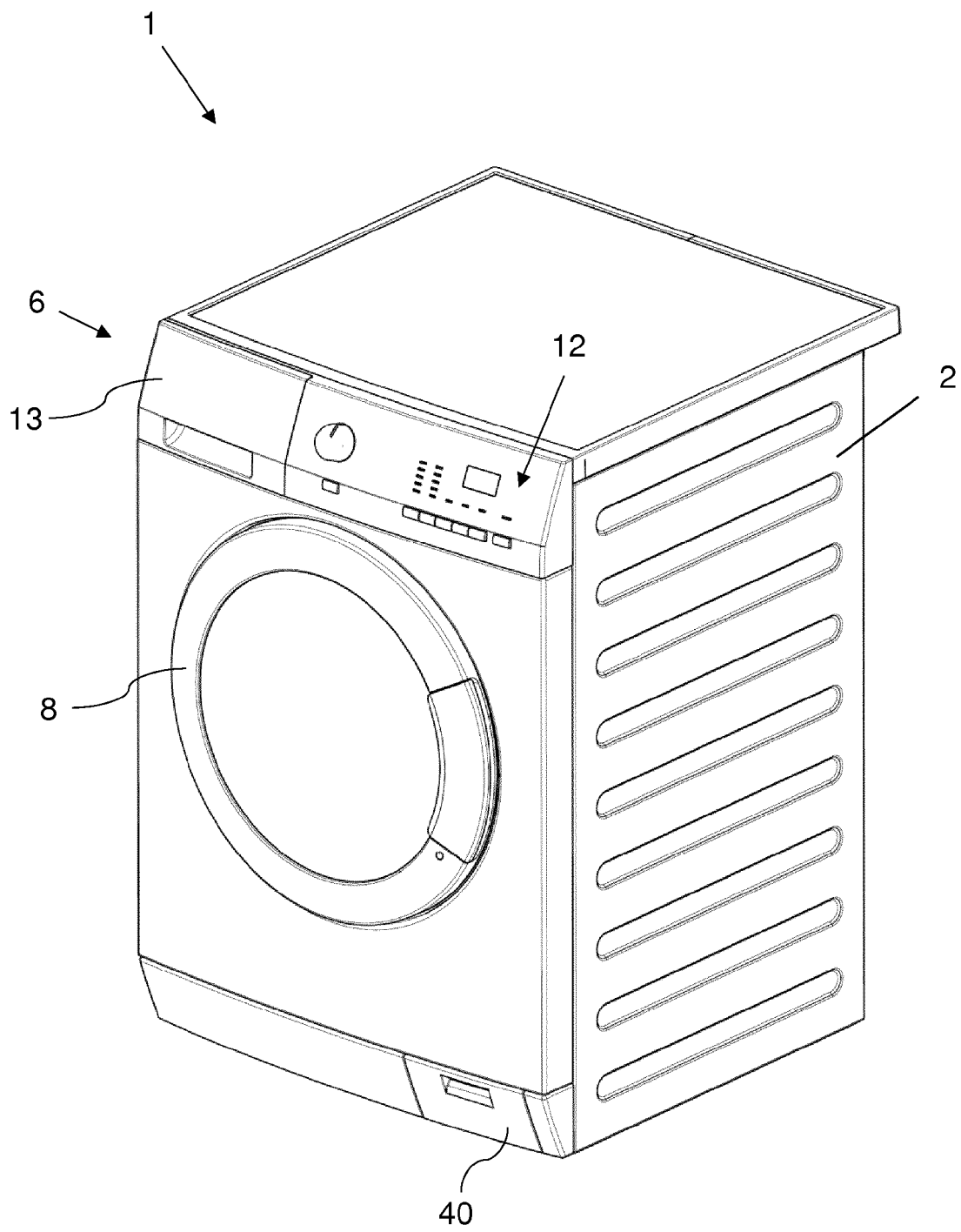


FIG. 1

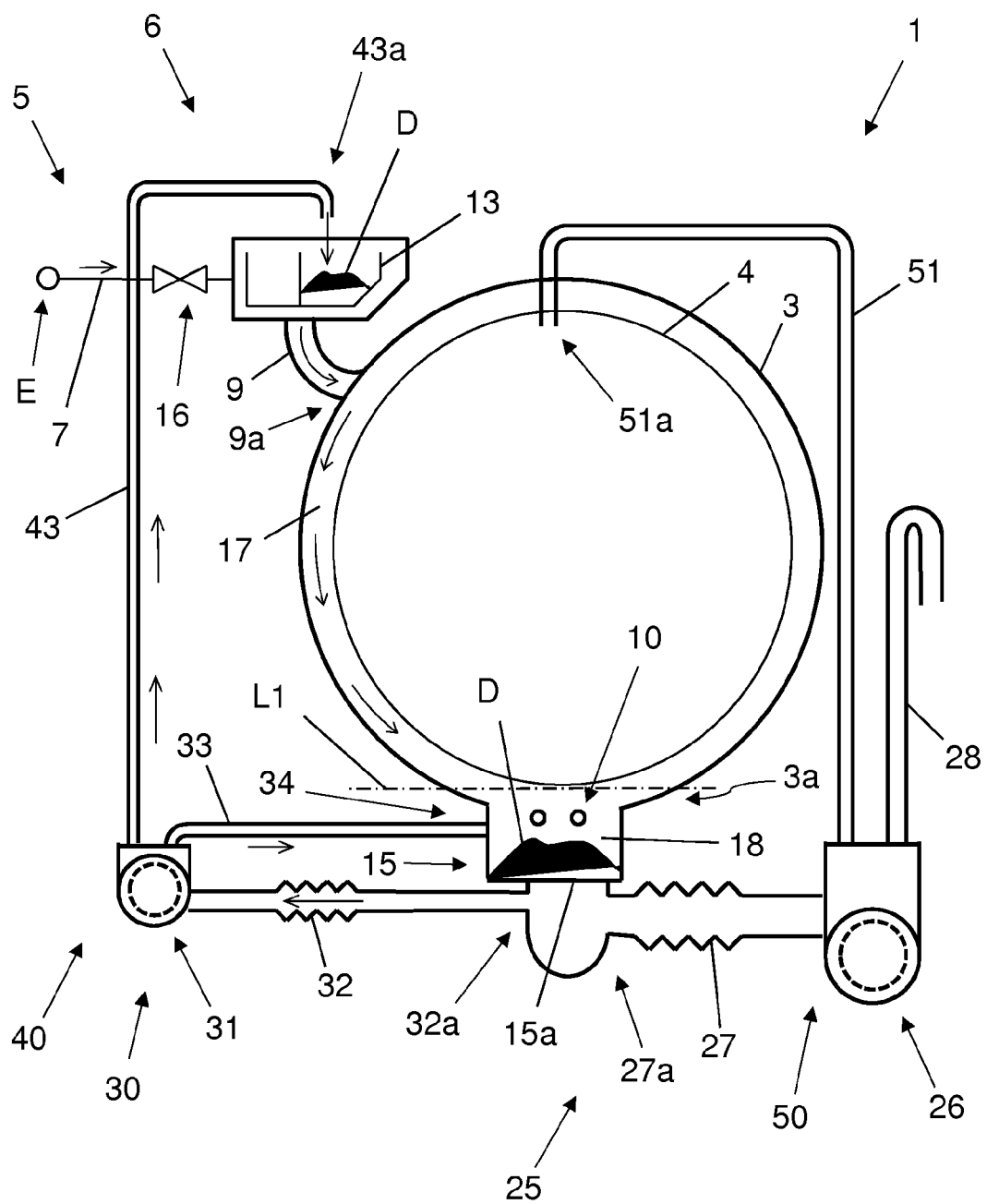


FIG. 2

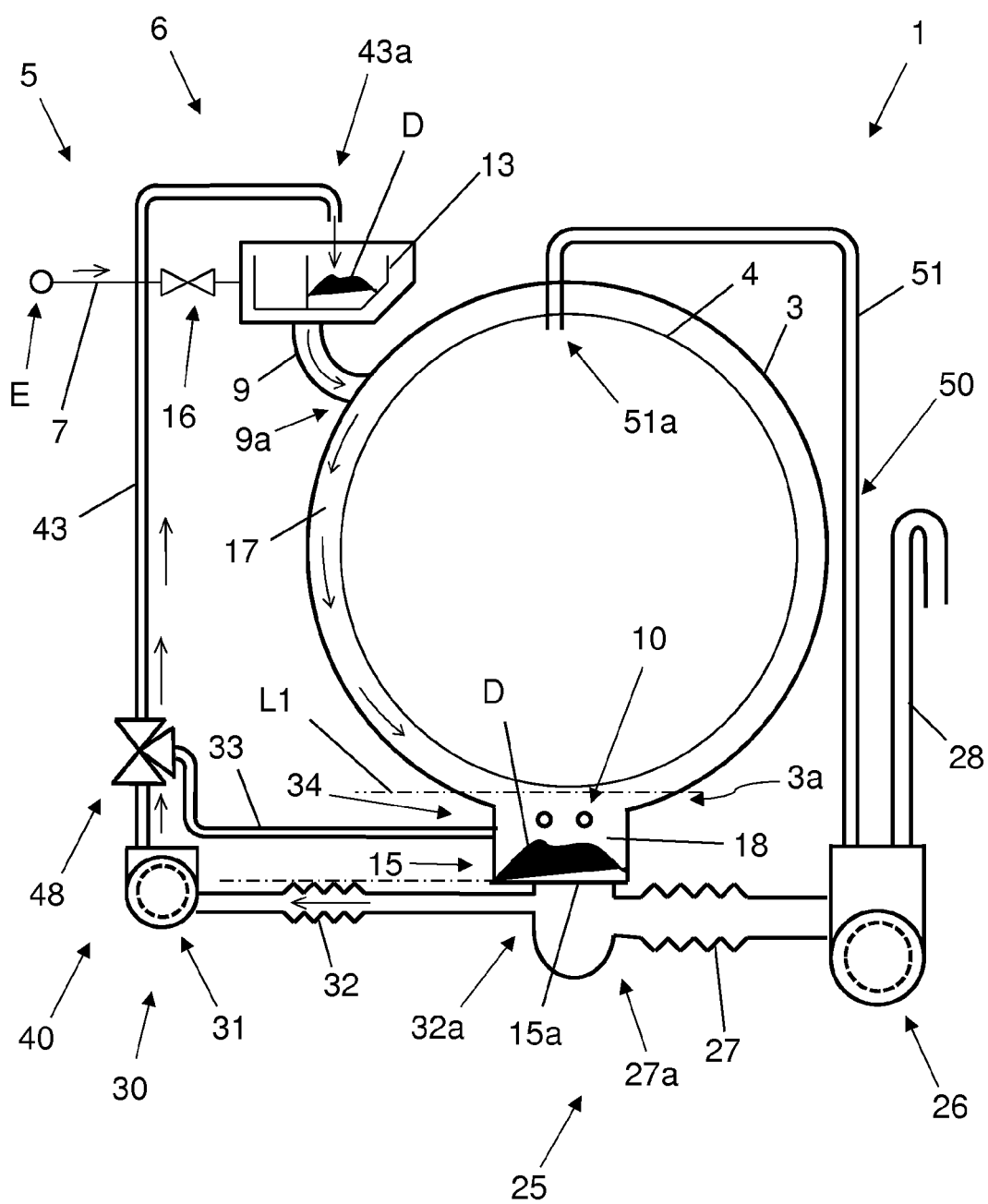


FIG. 3

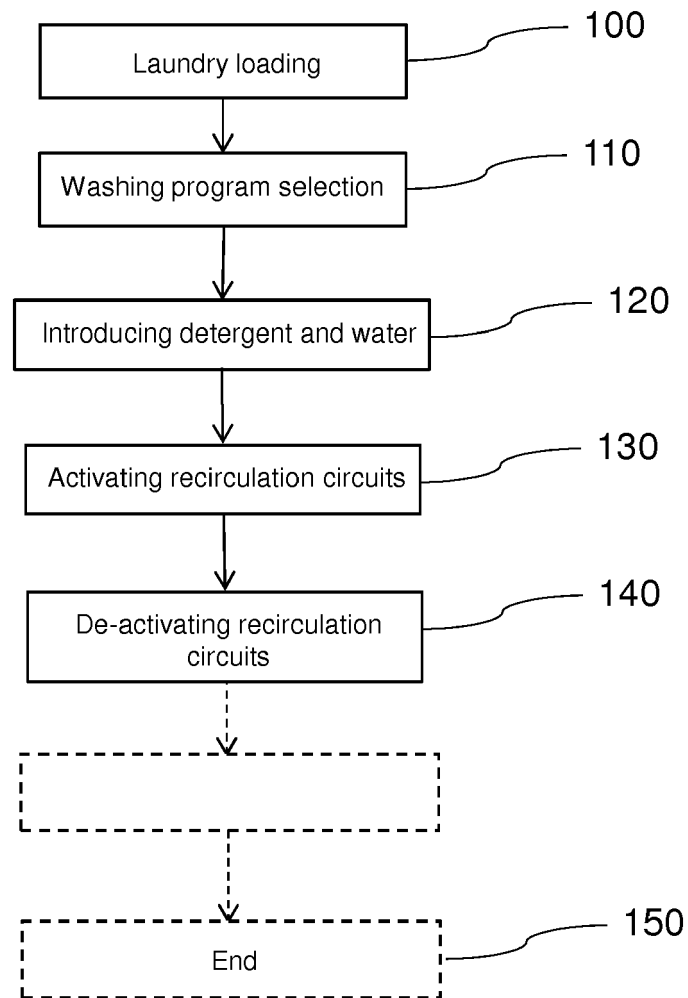


FIG. 4

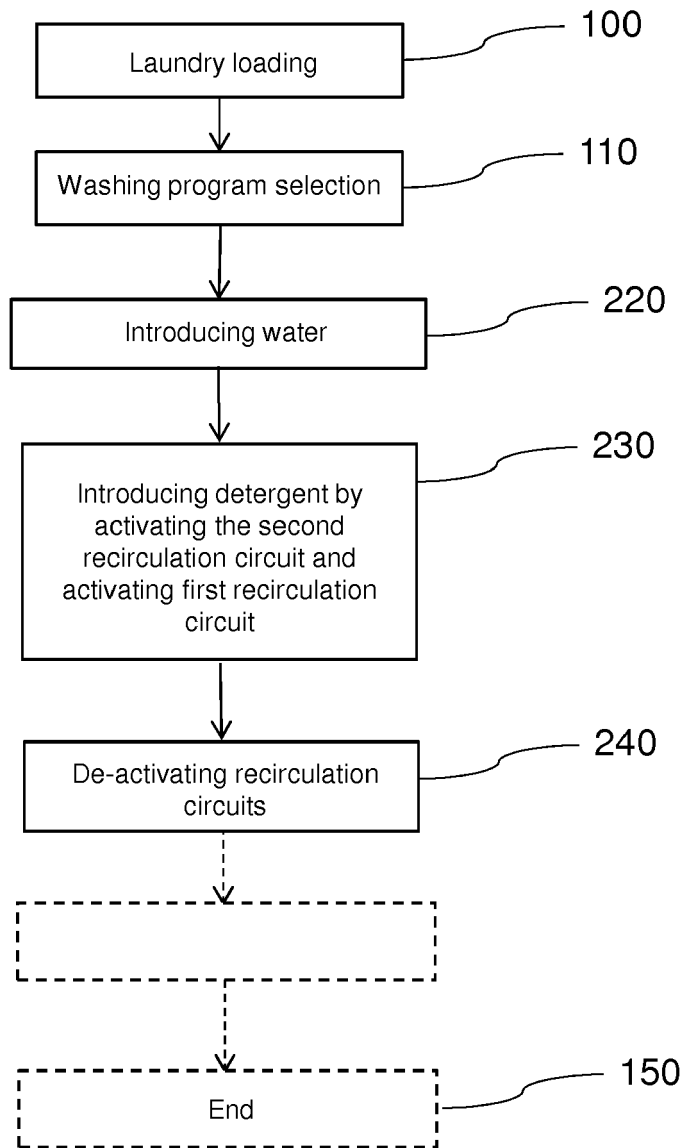


FIG. 5

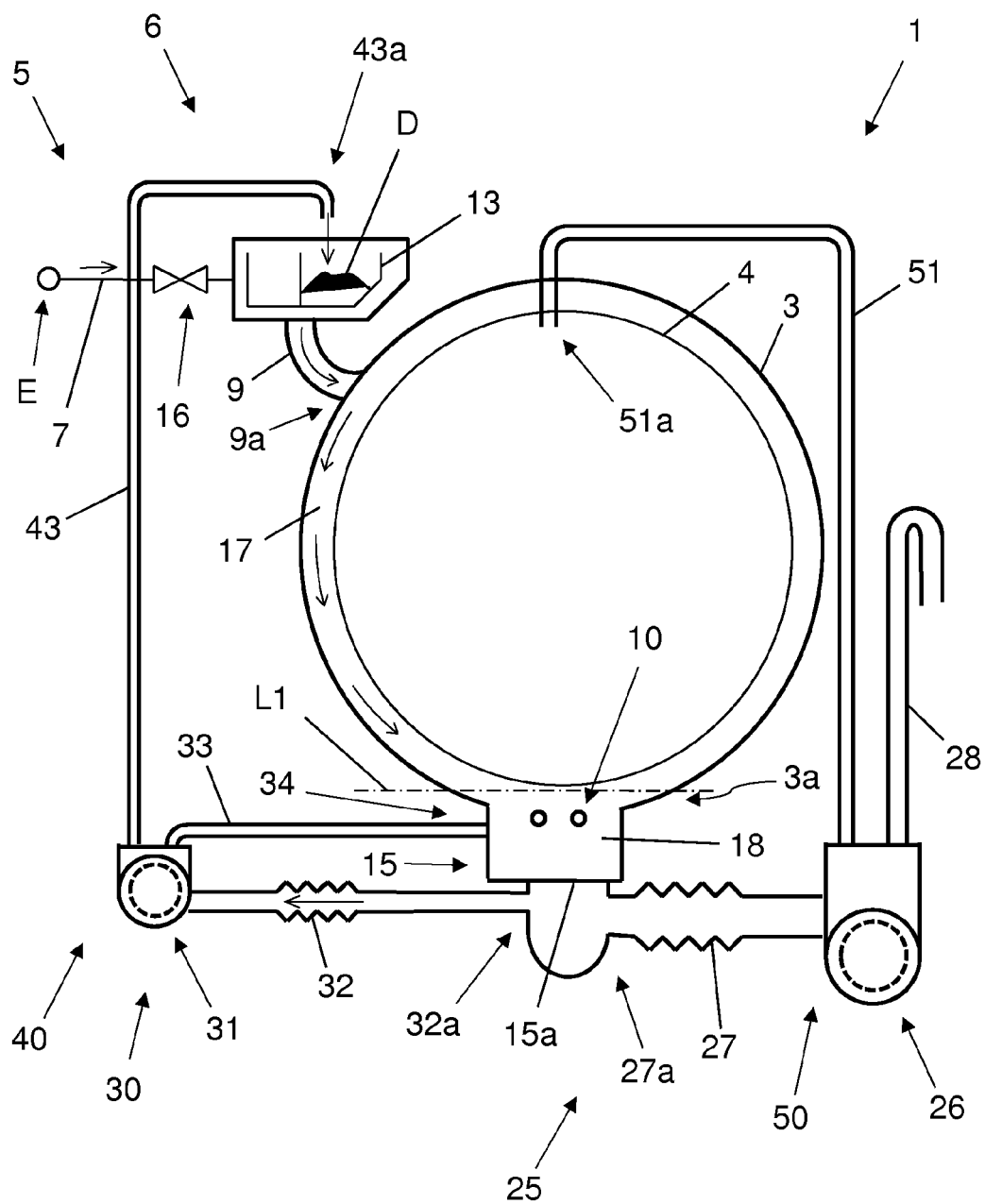


FIG. 6

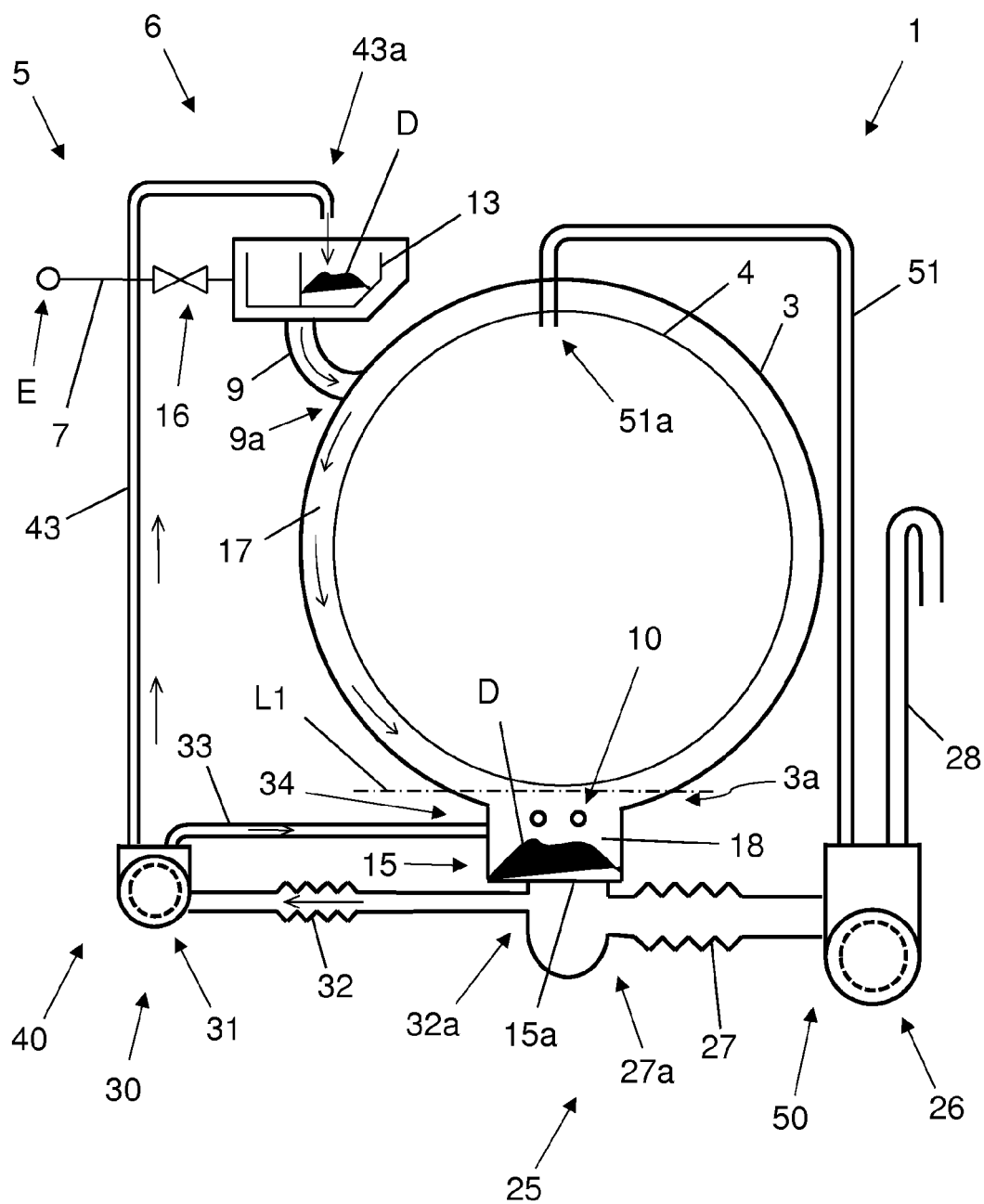


FIG. 7

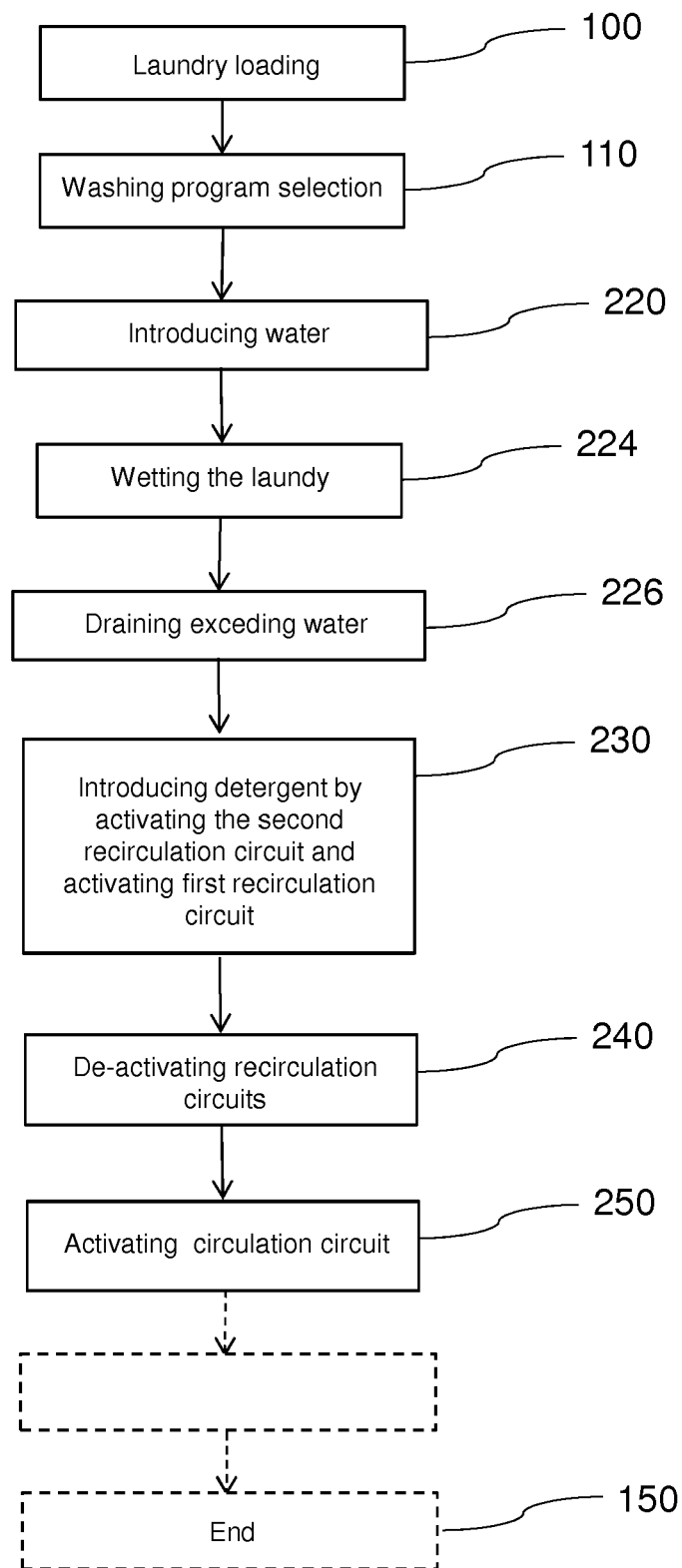


FIG. 8

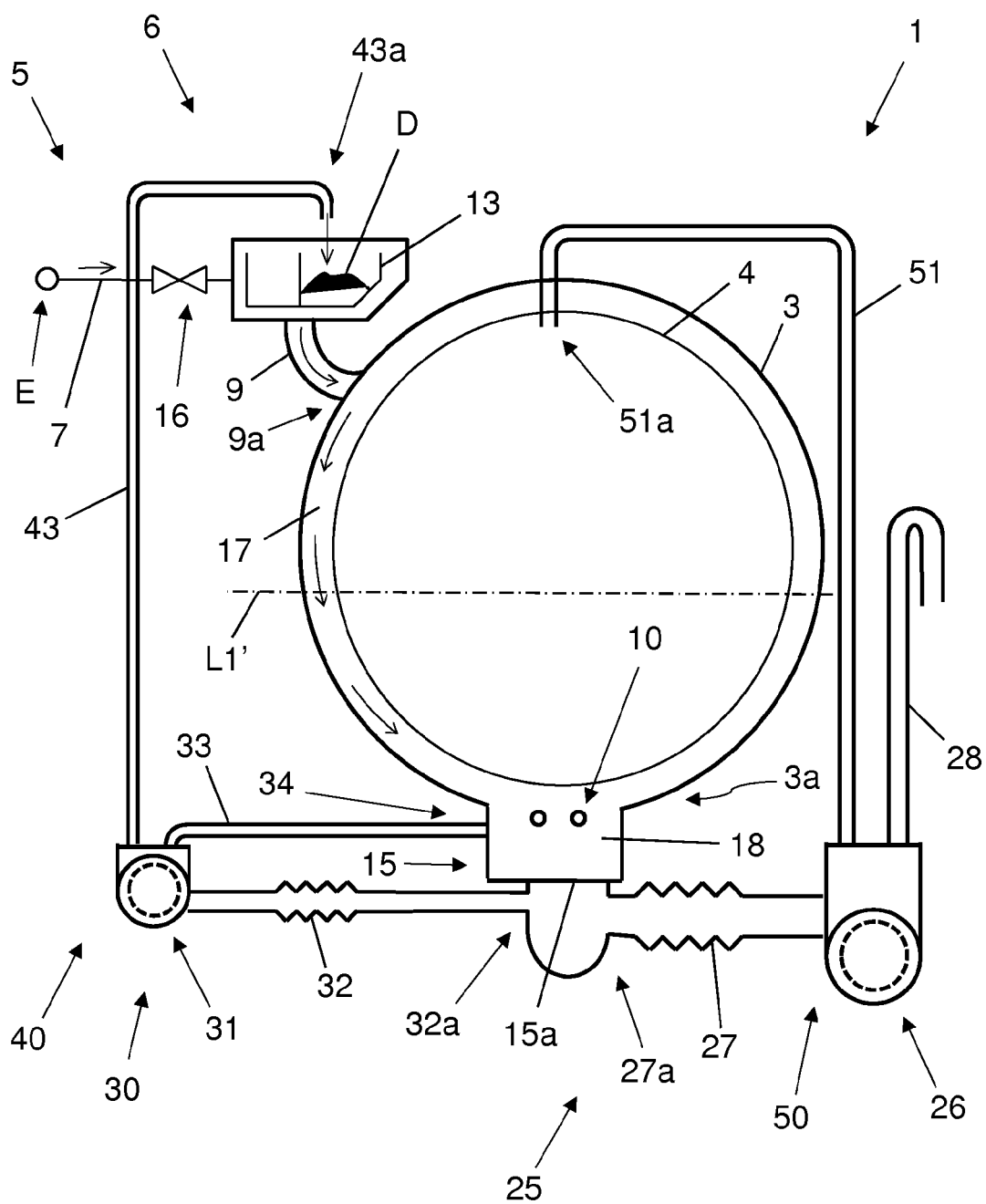


FIG. 9

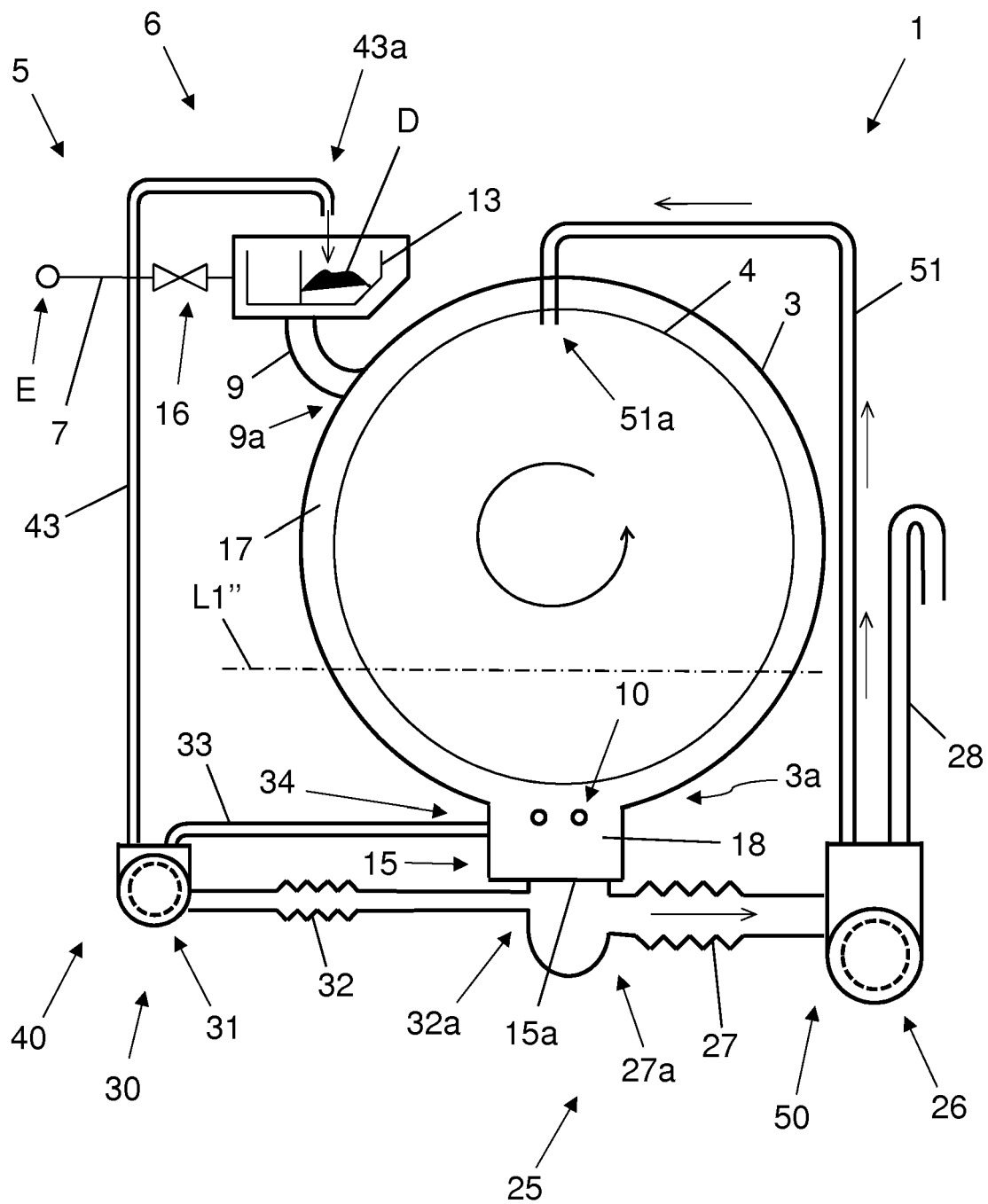


FIG. 10

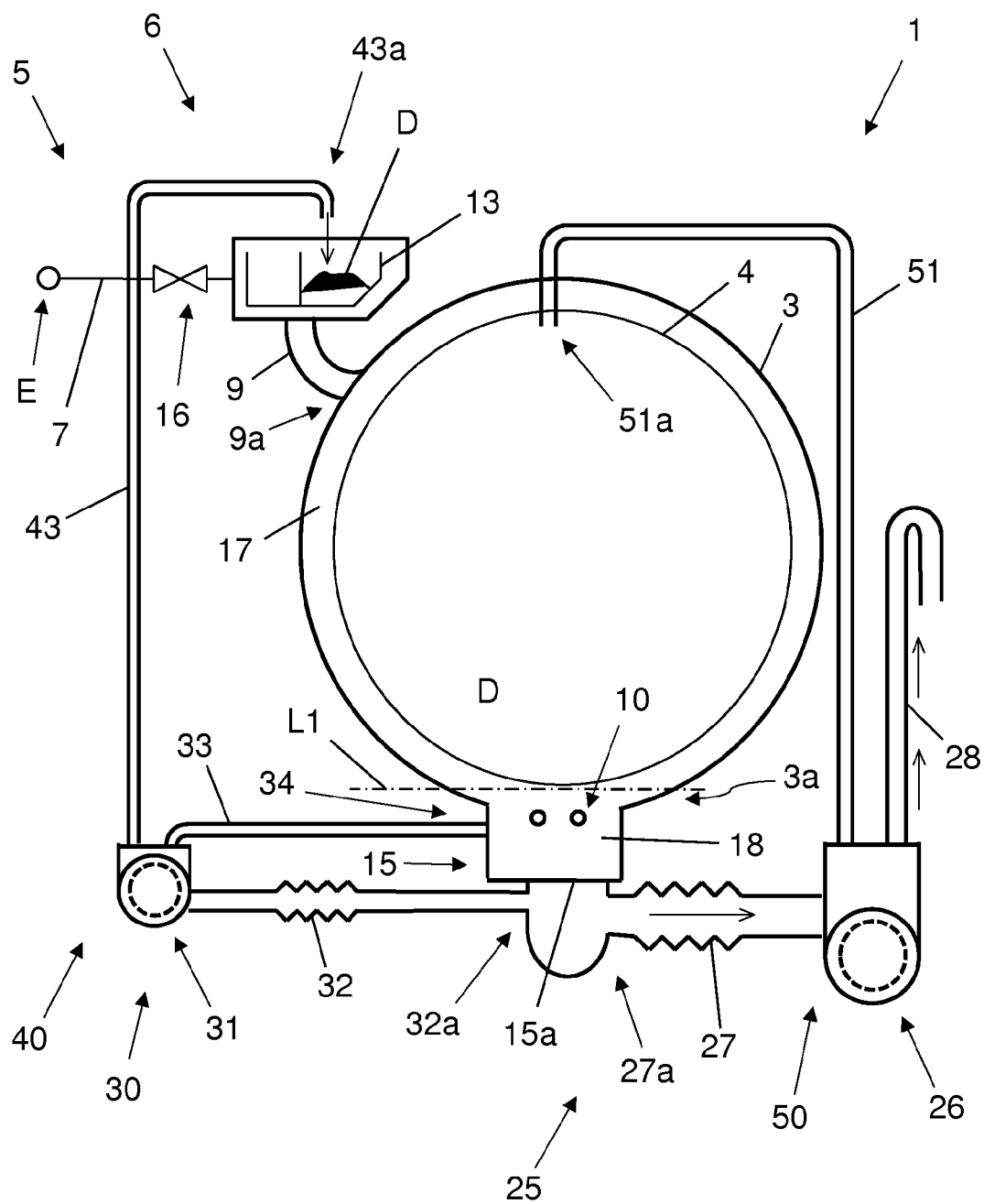


FIG. 11

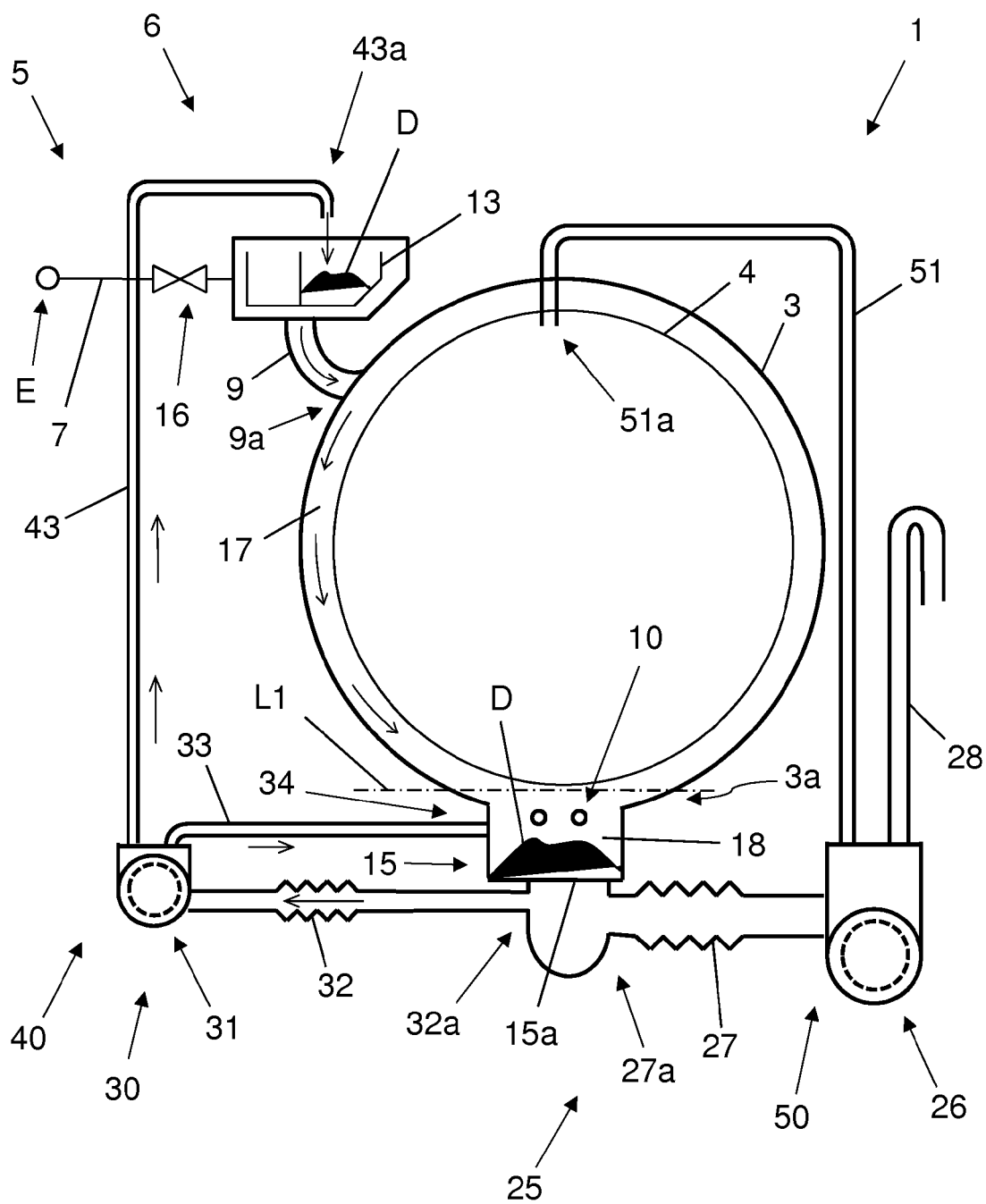


FIG. 12

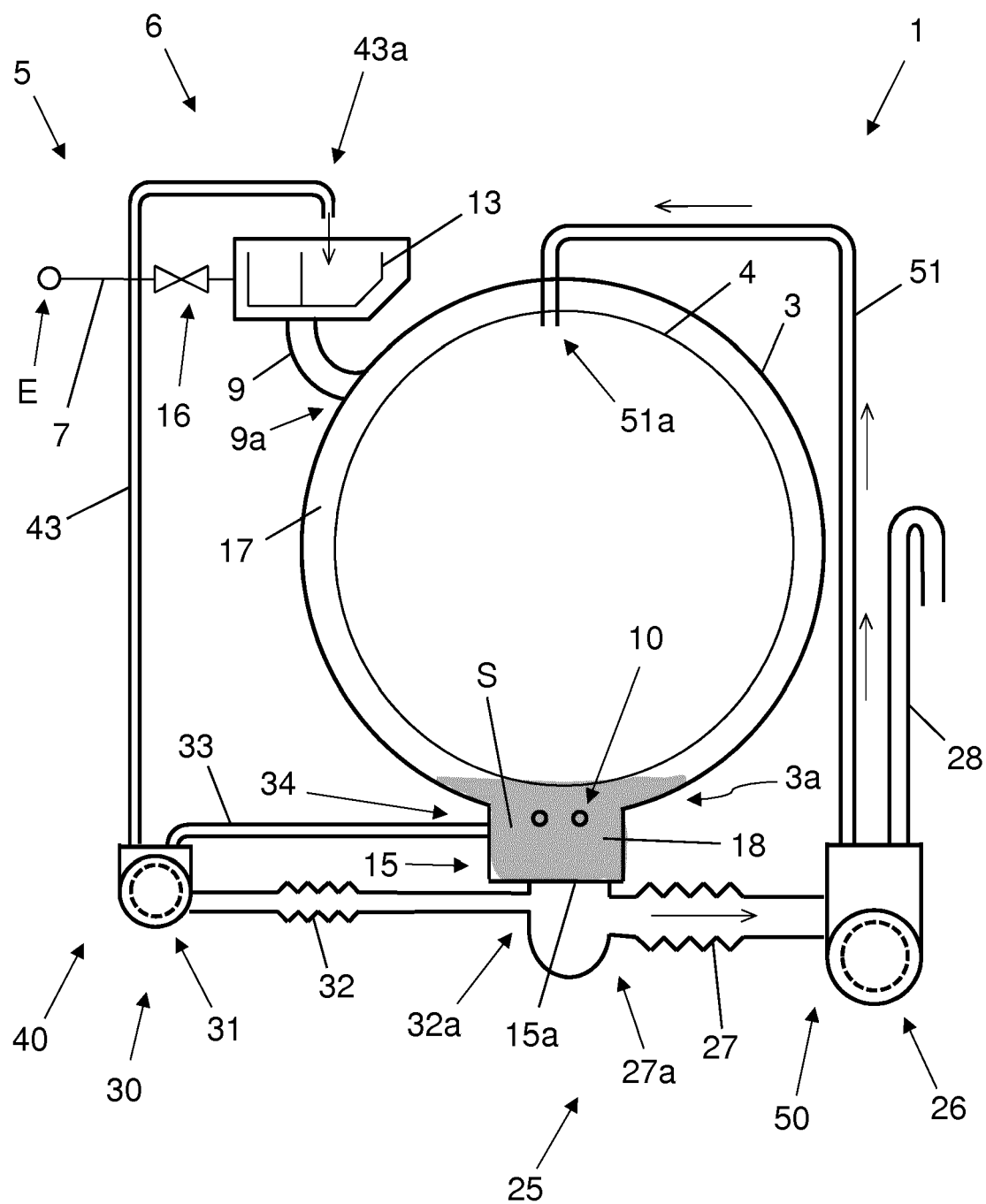


FIG. 13

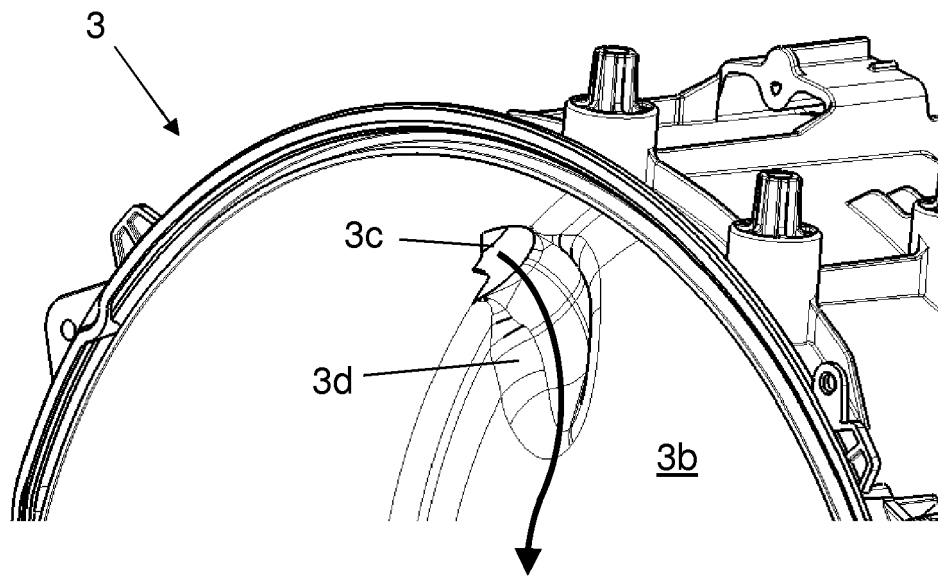


FIG. 14



EUROPEAN SEARCH REPORT

Application Number
EP 12 18 2235

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Y,D	----- EP 0 464 776 B1 (ZANUSSI ELETTRODOMESTICI [IT]) 14 June 1995 (1995-06-14) * column 2, line 15 - line 21; figure 1 *	3-5,7,9, 12,13	
Y	----- EP 0 736 626 A2 (CANDY SPA [IT]) 9 October 1996 (1996-10-09) * column 1, line 8 - line 24 *	6,8	
A	----- DE 78 13 695 U1 (ZANUSSI S.P.A.) 31 August 1978 (1978-08-31) * figure 1 *	2	
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			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 9 January 2013	Examiner Engelhardt, Helmut
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