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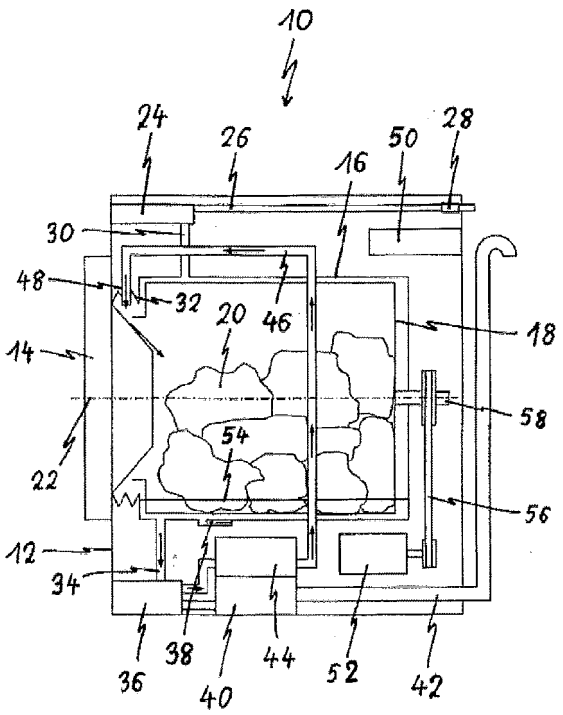
(54) A method for performing a washing cycle of sensitive laundry in a washing machine or in a washer-dryer

(57) The present invention relates to a method for performing a washing cycle of sensitive laundry (20) in a washing machine (10) or in a washer-dryer, which washing machine (10) or washer-dryer, respectively, comprises a washing tub (16), a rotatable laundry drum (18) within the washing tub (16), a recirculation circuit for circulating a washing liquid from a bottom region of the washing tub (16) to a higher region of the latter, and a heating device (38). The method comprises the following steps: one or more filling steps in which a washing liquid is filled into the washing tub (16); a main heating step in which the washing liquid contained in the washing tub (16) is heated from an inlet-temperature to an operating-temperature adapted for washing the laundry (20); a washing step in which the laundry (20) loaded in the washing tub (16) is washed with said washing liquid; a rinsing step in which said loaded laundry (20) is rinsed. During the main heating step the rotation of the laundry drum (18) is not activated, and the recirculation of the washing liquid from the bottom region of the washing tub (16) to a higher region of the latter is activated. Further, the present invention relates to a corresponding washing machine (10) or a corresponding washer-dryer.

FIG 1



EP 2 503 044 A1

Description

[0001] The present invention relates to a method for performing a washing cycle of sensitive laundry in a washing machine or in a washer-dryer. Further, the present invention relates to a corresponding washing machine or a corresponding washer-dryer.

[0002] The washing of special fabrics like wool needs some special precautions, in particular, if said special fabrics are washed in washing machines or washer-dryers with horizontal rotation axes. For example, the rotation of the laundry drum causes a mechanical stress to the sensitive laundry. A gentle handling of the sensitive laundry is desired.

[0003] WO 2008/09124 A2 discloses a washing machine with a steam supply unit. The washing temperature is set to about 30°C.

[0004] EP 1 975 298 A1 discloses a washing machine. The structure of said washing machine prevents an overheating of the heating device. A circulation hole is formed at a height same as or greater than the mounting height of a heating device in order to allow water flow into a circulation unit. This prevents the height of water from becoming less than the mounting height of the heating device even when the circulation unit is in operation, so that an overheating of the water is prevented.

[0005] EP 0 740 010 B1 discloses a washing machine. The concept of said washing machine prevents the formation of suds. For this purpose the flow of the mixture of water and detergent is controlled according to a predetermined scheme.

[0006] EP 0 279 483 B1 discloses a method of washing woollens in a washing machine. The laundry drum of said washing machine performs only a part of one revolution during every movement interval. The circumferential speed of the laundry drum is limited, when the laundry begins to contact the inner drum walls.

[0007] DE 38 41 551 A1 discloses a method of washing woollens in a washing machine. The laundry drum of said washing machine performs only a part of one revolution during every movement interval, wherein the rotation angle of the laundry drum is controlled by an evaluation of the pulses from a tachometer generator connected to the motor.

[0008] It is an object of the present invention to provide a method for performing a washing cycle of sensitive laundry in a washing machine or in a washer-dryer and a corresponding washing machine or in a washer-dryer, respectively, which allows a gentle handling of the sensitive laundry.

[0009] The object of the present invention is achieved by a method for performing a washing cycle of sensitive laundry in a washing machine or in a washer-dryer, which washing machine or washer-dryer, respectively, comprises a washing tub, a rotatable laundry drum within the washing tub, a recirculation circuit for circulating a washing liquid from a bottom region of the washing tub to a higher region of the latter, and a heating device. The method comprises the following steps: one or more filling steps in which a washing liquid is filled into the washing tub; a main heating step in which the washing liquid contained in the washing tub is heated from an inlet-temperature (i.e. the temperature of the washing liquid before the activation of the heating element of the washing machine) to an operating-temperature adapted for washing the laundry; a washing step in which the laundry loaded in the washing tub is washed with the washing liquid; a rinsing step in which the loaded laundry is rinsed; during the main heating step the rotation of the laundry drum is not activated, and the recirculation of the washing liquid from the bottom region of the washing tub to a higher region of the latter is activated.

[0010] According to the present invention, during the main heating step in which the washing liquid (for example water or water mixed with detergent and/or additives) contained in the washing tub is heated from the inlet-temperature to the operating-temperature, the rotation of the laundry drum is not activated, and the recirculation of washing liquid from the bottom region of the washing tub to a higher region of the latter is activated; since the laundry drum doesn't rotate, the laundry is not subjected to mechanical stress. This is particularly effective in the case of laundry made of wool, since it allows avoiding the felting of the wool. The recirculation of the washing liquid during the main heating step, while the laundry drum is not rotating, allows that all the laundry within the laundry drum is wetted by the heated washing liquid. Otherwise, since the drum is not rotating, only the laundry on the bottom of the laundry drum would be wetted. The complete wetting of the laundry with the heated washing liquid is advantageous for the following washing step. Further, the complete wetting of the laundry with the heated washing liquid, allows a uniform heating of the laundry. Moreover, the recirculation during the main heating step reduces the time for obtaining a suitable heating and wetting of the laundry. The inventive method ensures that all the laundry inside the washing tub is completely wetted and heated before the start of the proper washing step, and without any risk of felting said laundry.

[0011] According to a further embodiment of the present invention, the recirculation of the washing liquid from the bottom region of the washing tub to a higher region of the latter is not activated during the one or more steps of filling water, or water mixed with detergent (more generally during each step of filling a washing liquid) into the washing tub. In this case, the recirculation of the washing liquid from the bottom region of the washing tub to a higher region of the latter may be advantageously activated during at least part of the steps of heating the washing liquid, washing the laundry, rinsing the laundry.

[0012] Further, before the main heating step the rotation of the laundry drum is activated for at least a first predetermined time interval followed by a second predetermined time interval in which the rotation of the laundry drum is not activated.

[0013] Preferably, also during the washing step the ro-

tation of the laundry drum is activated for at least a first predetermined time interval followed by a second predetermined time interval in which the rotation of the laundry drum is not activated.

[0014] Advantageously, also during the rinsing step the rotation of the laundry drum is activated for at least a first predetermined time interval followed by a second predetermined time interval in which the rotation of the laundry drum is not activated.

[0015] This behaviour of the rotation of the laundry drum has been proved to be very effective in ensuring a good washing of the laundry, avoiding at the same time the felting of the latter.

[0016] Preferably the first predetermined time interval is shorter than the second predetermined time interval. This feature has been proved to be very effective in avoiding the felting of the laundry.

[0017] Preferably, in the first predetermined time interval the rotation of the laundry drum is activated at a rotation speed lower than 60 rounds per minute, which reduces the risk of felting of the laundry.

[0018] Advantageously the first predetermined time interval is shorter than 30 seconds. Preferably the second predetermined time interval is comprised between 30 seconds and 180 seconds. These particular lengths of the first and second time interval have been proved to be very effective in ensuring a good washing of the laundry, avoiding at the same time the felting of the latter.

[0019] Advantageously the method comprises two or more filling steps.

[0020] Advantageously the method according to the invention may comprise, after the rinsing step, a spinning step, in which the drum is rotated at a high rotational speed, for example comprise between 400 and 800 rounds per minutes, so as to extract the water from the laundry by effect of the centrifugal force; however the spinning phase can also be avoided.

[0021] Advantageously the method according to the invention may comprise, after the rinsing step, and, if present, after or contemporaneously with the spinning step, a draining step, in which the washing liquid present in the tub is drained from the washing machine or washer-drier.

[0022] The object of the present invention is achieved also by a washing machine or washer-dryer.

[0023] Preferably the washing machine or washer-dryer comprises a washing tub, a rotatable laundry drum within the washing tub for washing the laundry, a recirculation circuit for circulating a washing liquid from a bottom region of the washing tub to a higher region of the latter, a heating device for heating up washing liquid (e.g. water or water mixed with detergent and/or additives) in the washing tub, a control unit for controlling the electrical and electronic components of the washing machine or washer dryer. The control unit is configured for operating the washing machine or washer-dryer according to the method according to the invention.

[0024] At last, the washing machine or washer-dryer, respectively, is of the front-loading type or of the top-loading type.

[0025] The invention will be described in further detail with reference to the drawings, in which:

FIG 1 illustrates a schematic sectional side view of a washing machine according to a preferred embodiment of the present invention, and

FIG 2 illustrates four schematic diagrams of some characteristic parameters of the washing cycle as a function of the time.

[0026] FIG 1 illustrates a schematic sectional side view of a washing machine 10 according to a preferred embodiment of the present invention. This embodiment relates to a washing machine 10, but the present invention may also relate to a washer-dryer.

[0027] The washing machine 10 advantageously includes a casing 12 with a door 14 at preferably a front side of the casing 12. A washing tub 16 is arranged in central portion of the casing 12. A rotatable laundry drum 18 is arranged inside the washing tub 16. In the embodiment of FIG 1, the laundry drum 18 is loaded with sensitive laundry 20, for example made of wool. The laundry drum 18 is rotatable around a preferably horizontal rotation axis 22. Advantageously, the principal plane of the door 14 extends preferably perpendicular to the rotation axis 22. In this example, the washing machine 10 is of the front-loading type, but the present invention may also relate to a top-loading type.

[0028] A detergent drawer 24 is advantageously arranged above the door 14 and the washing tub 16. The detergent drawer 24 is preferably connected via a first duct 26 to an electric valve 28. The electric valve 28 is connectable to water supply mains. Supply water runs through the electric valve 28 and the first duct 26 to the detergent drawer 24. Further, the detergent drawer 24 is advantageously connected via a second duct 30 to the washing tub 16. The supply water or supply water mixed with detergent or softener preferably runs from the detergent drawer 24 through the second duct 30 to the washing tub 16. The outlet of the second duct 30 is preferably on the washing tub 16, as shown in FIG 1. Alternatively, the outlet of the second duct 30 may be in a bellows 32 arranged between the door 14 and the washing tub 16.

[0029] According to a further embodiment, there may be two ducts instead of the second duct 30. In this case, the one duct may be provided for clean water and the other duct may be provided for the water mixed with the detergent or the softener.

[0030] A sump (or a draining duct) 34 is preferably arranged below the washing tub 16. The sump (or draining duct) 34 takes out the water or the water mixed with the detergent or the softener from the washing tub 16.

[0031] An electric heating device 38 is preferably arranged in the bottom of the washing tub 16. Alternatively, other heating devices like for example a microwave gen-

erator, a steam generator or a hot air generator may be used. In particular a hot air generator may be advantageously provided in the case of a washer-dryer.

[0032] A draining pump 40 is advantageously interconnected between the sump 34 and a draining duct 42.

[0033] A filter 36 may be advantageously provided, preferably between the sump 34 and the draining pump 40, for collecting foreign particles and impeding that the latter can obstruct the draining pump 40.

[0034] The washing machine 10 advantageously comprises a recirculation circuit for circulating water from a bottom region of the washing tub 16 to a higher region of the latter; the recirculation circuit advantageously comprises a recirculation pump 44, preferably interconnected downstream the filter 36 (i.e. the filter is placed between the recirculation pump 44 and the washing tub 16), and a recirculation duct 46.

[0035] In another embodiment, not illustrated, a single pump may be provided, which acts alternatively as draining pump and as recirculation pump. In the latter case the recirculation circuit advantageously comprises a three-way valve interconnected between the outlet of said single pump, the draining duct 42 and the recirculation duct 46.

[0036] Additionally, a valve, for example a ball valve, may be advantageously arranged between the washing tub 16 and the sump 34. Said valve may be open when the recirculation pump is operating. In contrast, said valve may be closed, when the recirculation pump is not operating.

[0037] In a further embodiment, two ducts may be provided instead of the sump 34, wherein one of said ducts would be connected to the draining pump 40 and the other one would be connected to the recirculation pump 44.

[0038] An outlet 48 of the recirculation duct 46 is preferably placed in correspondence of the bellows 32, so that the jets of the circulated water are directed to the rear sloped surface of the door 14 and are sprayed onto the laundry 20 from a frontal portion of the laundry drum 18. However, there are alternative possible positions for the outlet 48 of the recirculation duct 46 (for example the outlet 48 can be positioned in correspondence of a suitable opening provided in the tub 16). If the washing machine 10 is of the top-loading type, then the outlet 48 of the recirculation duct 46 may be placed for example in correspondence of a hole arranged in one of the two shafts, wherein said shafts support the rotatable laundry drum 18. In this case the jets of circulated water are sprayed directly inside the laundry drum 18.

[0039] Further, the washing machine 10 preferably comprises a control unit 50 and a motor 52. The control unit 50 is provided for controlling the electrical and electronic components of the washing machine 10. The motor 52 is provided for driving the rotation of the laundry drum 18.

[0040] A water level 54 inside the washing tub 16 is defined during a main heating step, when the water is heated by heating device 38. The water level 54 guarantees that the heating device 38 is completely underwater.

[0041] Moreover, the washing machine 10 advantageously comprises a belt drive 56 between the motor 52 and a shaft 58 of the laundry drum 18. Alternatively, the motor 52 may be directly connected to the shaft 58 of the laundry drum 18.

[0042] If the washing machine 10 is of the top-loading type, then the laundry drum 18 is a closed cylinder, which is internal accessible via a suitable porthole arranged in its lateral surface. In this case, there are two shafts which support the bases of said cylinder.

[0043] FIG 2 illustrates four schematic diagrams of some characteristic parameters of the washing cycle as a function of the time t.

[0044] A first diagram V shows the amount of water loaded in the washing tub 16 during a washing cycle. In the embodiment represented in these diagrams the washing cycle advantageously comprises five filling steps, numbered F1 to F5. The first two, F1 and F2, correspond to an initial loading of water and detergent into the washing tub, during a wetting step, while the last three filling steps F3, F4 and F5 correspond to the filling of clean rinsing water into the washing tub; it is underlined that the first diagram (V) doesn't represent the level of liquid into the washing tub, but the amount of liquid admitted in the latter.

[0045] The second diagram T of FIG 2 shows the temperature inside the washing tub 16.

[0046] The third diagram D of FIG 2 shows the rotation speed of the laundry drum 18.

[0047] The fourth diagram RP of FIG 2shows the ON and OFF states of the recirculation pump 44.

[0048] It is underlined that the recirculation pump 44 is not active during the filling steps.

[0049] In this example the washing cycle advantageously starts with a wetting step, in which a washing liquid, e.g. water mixed with a detergent, is loaded into the tub 18, so as to wet the laundry 20 loaded therein.

[0050] The wetting step comprises one or more filling steps in which the washing liquid is loaded into the tub 18. In this example the wetting step advantageously comprises two filling steps F1 and F2. In the third diagram D and in the fourth diagram RP, it can be seen that during the filling steps F1 and F2 the rotation of the laundry drum 18 is not activated and the recirculation of the washing liquid from the bottom region of the washing tub 16 to a higher region of the latter is not activated.

[0051] In the second diagram T it can be seen that in this example, during the wetting step, after the start of the first filling step F1 (i.e. after washing liquid starts filling the tub 16), the temperature inside the tub 16 decreases; this is due to the fact that in this example the fresh water filled in the tub 16 has a temperature (e.g. 15°C), which is lower than the temperature inside the tub 16 before the filling of water (which is typically substantially equal to the ambient temperature, e.g. 23°C), and therefore the temperature inside the tub 16 decreases after starting

the filling of water.

[0052] In the example of FIG 2, during the wetting step, after a certain time interval (in this example after a small time interval after the end of the second filling step F2) the temperature inside the tub 16 starts to slowly increase, because the drum has been rotated (as shown in third diagram D), and therefore there has been a thermal exchange between the water and the laundry 20 (which has in this example a temperature higher than the temperature of the water) which has caused an increase of the temperature inside the tub 16. After this slow increase of the temperature, the main heating steps starts; in this step there is a rapid increase of the temperature inside the tub 16, due to the activation of the heating device: Therefore, during the main heating step the temperature inside the tub 16 rapidly increases from the inlet-temperature (i.e. the temperature before starting the main heating step), up to reach an operating-temperature adapted for washing the laundry 20. The operating temperature reached at the end of the main heating step preferably depends on the washing program selected by the user, and is advantageously a temperature which ensures a good washing of the particular type of textile of the loaded laundry (for example it may be around 40°C for delicate laundry).

[0053] During the main heating step the rotation of the laundry drum 18 is not activated (third diagram D) and the recirculation of the washing liquid from the bottom region of the washing tub 16 to a higher region of the latter is activated (fourth diagram RP).

[0054] The fact that the laundry drum 18 is motionless during the main heating step, allows that the laundry 20 is not subjected to mechanical stress. If the laundry 20 is made of wool, it is not felted. The recirculation of the washing liquid (water or water mixed with detergent and/or additives) during the main heating step, while the laundry drum 18 is not rotating, allows that all the laundry 20 within the laundry drum 18 is wetted by the heated washing liquid. Otherwise, only the laundry 20 on the bottom of the laundry drum 18 would be wetted by the heated washing liquid. The complete wetting of the laundry 20 with heated washing liquid is advantageous for the following washing step. Further, the complete wetting of the laundry 20 allows a uniform heating of said laundry 20. Moreover, the recirculation of the washing liquid during the main heating step reduces the time for obtaining a suitable heating and wetting of the laundry 20. The inventive method ensures that all laundry 20 inside the washing tub 16 is completely wetted and heated before the start of the proper washing step. If the laundry 20 is made of wool, there is no risk of felting said laundry 20.

[0055] After the main heating step the heating device is deactivated, and the washing step starts; in the washing step, since the heating device is not activated, the temperature in the tub may decrease (second diagram T).

[0056] During the washing step the heating device may advantageously be activated, preferably for one or more short time intervals, in order to avoid a high decrease of the temperature of the washing liquid, so as to keep this temperature close to the operative temperature (e.g. close to 40°C).

[0057] During the washing step (as shown in the third diagram D) the rotation of the laundry drum 18 is advantageously activated for at least a first predetermined time interval followed by a second predetermined time interval in which the rotation of the laundry drum 18 is not activated. Advantageously the first predetermined time interval is shorter than the second predetermined time interval. Preferably during the first predetermined time interval the rotation of the laundry drum 18 is activated at a rotation speed lower than 60 rounds per minute. Advantageously the first predetermined time interval is shorter than 30 seconds, and the second predetermined time interval is comprised between 30 seconds and 180 seconds. In the example shown in FIG 2, in the washing step the drum 18 is advantageously rotated three times for a first predetermined time interval followed by a second predetermined time interval in which the drum 18 is not rotated.

[0058] At the end of the washing step, the washing water is drained from the tub, and then a rinsing step is performed, advantageously comprising one or more filling steps, in this example three F3, F4 and F5, in which the tub 16 is filled with clean water; after each filling step of the rinsing step, the drum 18 is advantageously rotated for at least a first predetermined time interval followed by a second predetermined time interval in which the rotation of the laundry drum 18 is not activated. Preferably, during the first predetermined time interval, the rotation of the laundry drum 18 is activated at a rotation speed lower than 60 rounds per minute. Advantageously the first predetermined time interval is shorter than 30 seconds, and the second predetermined time interval is comprised between 30 seconds and 180 seconds.

[0059] Preferably, during each filling step F3, F4, F5 of the rinsing step, the drum 18 is not rotated, and the recirculation pump is not activated.

[0060] Before each filling step F3, F4, F5 of the rinsing step, the rinsing liquid is advantageously drained from the washing machine.

[0061] Preferably, during the rinsing step, after each filling step F3, F4, F5, the heating device may advantageously be activated for one or more short time intervals, in order to heat the loaded rinsing water.

[0062] The washing cycle preferably comprises, after the end of the rinsing step, a draining phase, in which the water is drained from the washing machine, preferably actuated together with a spinning phase, in which the drum 18 is rotated at a relatively high speed (e.g. 800 rpm), so as to extract the water from the laundry 20. The spinning phase is advantageously optional.

[0063] Although an illustrative embodiment of the present invention has been described herein with reference to the accompanying drawings, it is to be understood that the present invention is not limited to those

precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

Claims

1. A method for performing a washing cycle of sensitive laundry (20) in a washing machine (10) or in a washer-dryer, which washing machine (10) or washer-dryer, respectively, comprises a washing tub (16), a rotatable laundry drum (18) within said washing tub (16), a recirculation circuit for circulating a washing liquid from a bottom region of the washing tub (16) to a higher region of the latter, and a heating device (38), wherein the method comprises the following steps:

   - one or more filling steps in which a washing liquid is loaded into the washing tub (16),
   - a main heating step in which the washing liquid loaded in the washing tub (16) is heated from an inlet-temperature to an operating-temperature adapted for washing the laundry (20),
   - a washing step in which the loaded laundry (20) is washed with said washing liquid,
   - a rinsing step in which said loaded laundry (20) is rinsed,

   characterized in that
   during said main heating step the rotation of the laundry drum (18) is not activated, and the recirculation of said washing liquid from the bottom region of the washing tub (16) to a higher region of the latter is activated.

2. The method according to claim 1, wherein during said one or more filling steps the recirculation of said washing liquid from the bottom region of the washing tub (16) to a higher region of the latter is not activated.

3. The method according to claim 2, wherein the recirculation of said washing liquid from the bottom region of the washing tub (16) to a higher region of the latter is activated during at least part of said washing step and said rinsing step.

4. The method according to any one of the preceding claims, wherein before said main heating step the rotation of said laundry drum (18) is activated for at least a first predetermined time interval followed by a second predetermined time interval in which said rotation of said laundry drum (18) is not activated.

5. The method according to any one of the preceding claims, wherein during said washing step the rotation of said laundry drum (18) is activated for at least a first predetermined time interval followed by a second predetermined time interval in which said rotation of said laundry drum (18) is not activated.

6. The method according to any one of the preceding claims, wherein during said rinsing step the rotation of said laundry drum (18) is activated for at least a first predetermined time interval followed by a second predetermined time interval in which said rotation of said laundry drum (18) is not activated.

7. The method according to claim 4 or 5 or 6, wherein said first predetermined time interval is shorter than said second predetermined time interval.

8. The method according to claim 4 or 5 or 6, or 7, wherein during said first predetermined time interval the rotation of the laundry drum (18) is activated at a rotation speed lower than 60 rounds per minute.

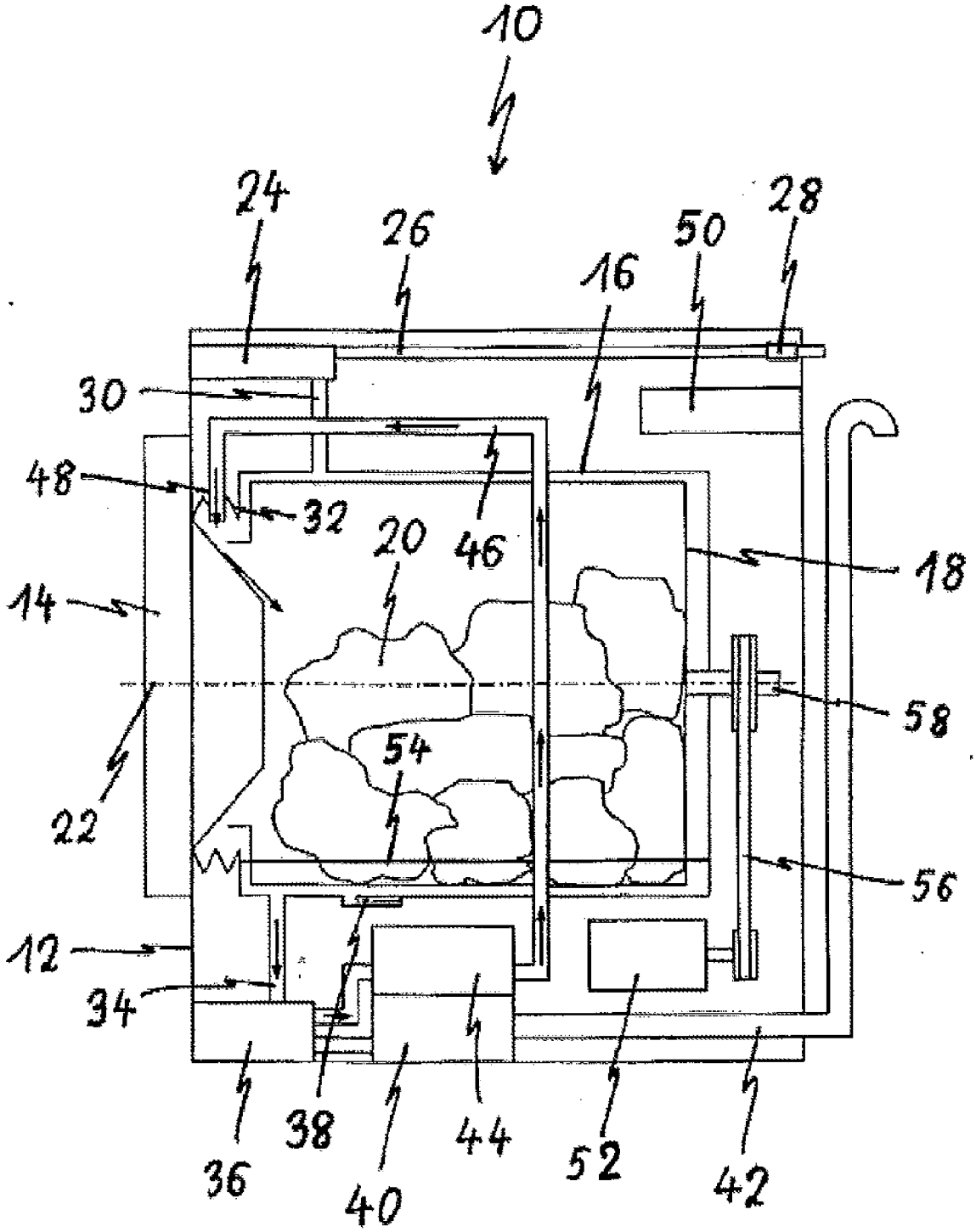
9. The method according to claim 4 or 5 or 6 or 7 or 8, wherein said first predetermined time interval is shorter than 30 seconds.

10. The method according to claim 4 or 5 or 6 or 7 or 8 or 9, wherein said second predetermined time interval is comprised between 30 seconds and 180 seconds.

11. The method according to one or more of the preceding claims, comprising two or more of said filling steps.

12. A washing machine (10) or washer-dryer, comprising a washing tub (16), a rotatable laundry drum (18) within said washing tub (16) for washing the laundry (20), a recirculation circuit for circulating a washing liquid from a bottom region of the washing tub (16) to a higher region of the latter, a heating device (38) for heating up washing liquid in the washing tub (16), a control unit (50) for controlling the electrical and electronic components of said washing machine (10) or washer dryer,
    characterized in that
    said control unit (50) is configured for operating said washing machine or washer-dryer according to the method of one or more of the preceding claims.

FIG 1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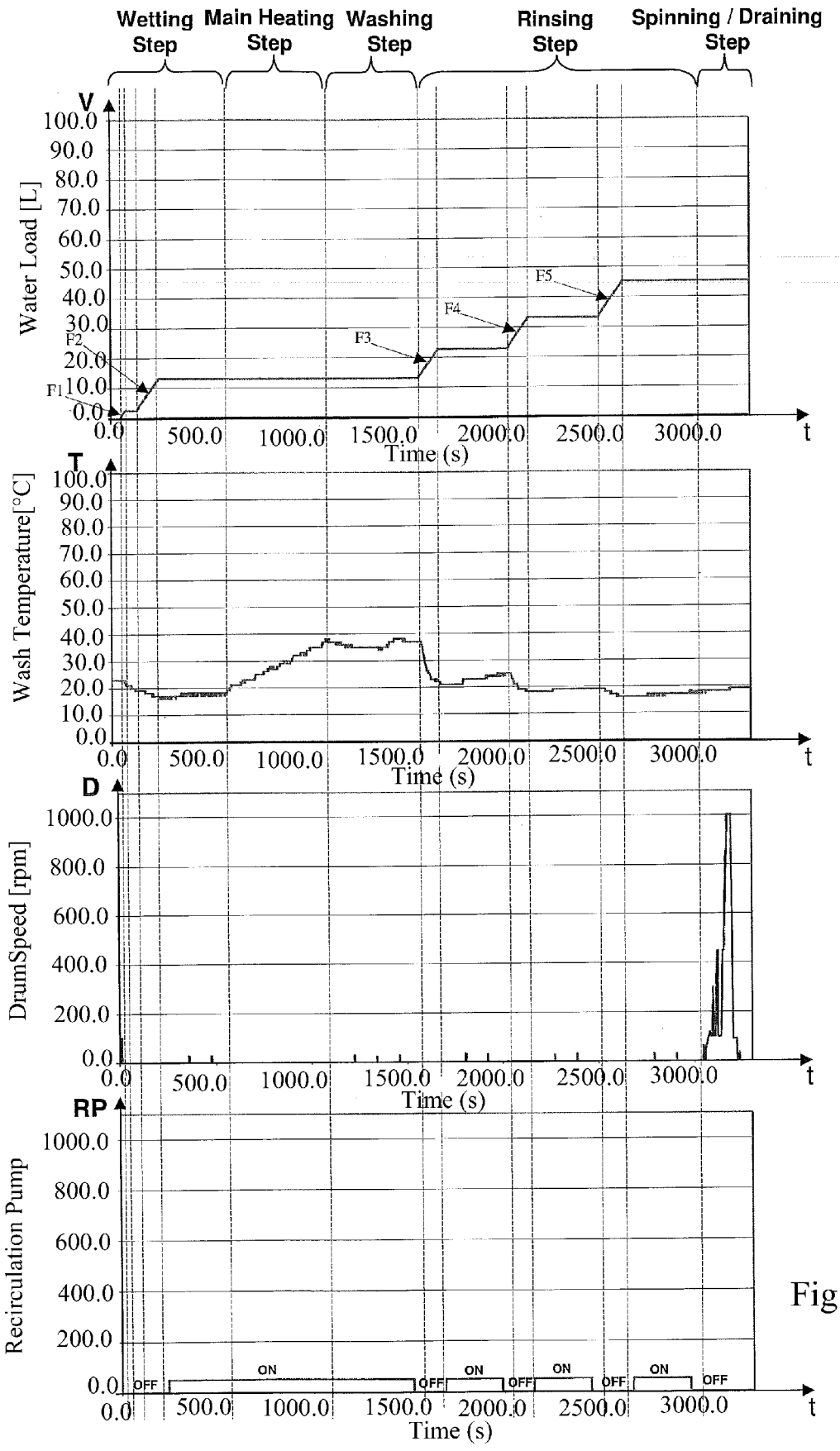
Wetting Step
Main Heating Step
Washing Step
Rinsing Step
Spinning / Draining Step
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Fig. 2

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European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 11 15 9614

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 025 795 A2 (LG ELECTRONICS INC [KR]) 18 February 2009 (2009-02-18) * the whole document *	1-12	INV. D06F33/02 D06F35/00
A	US 6 032 494 A (TANIGAWA MASANOBU [JP] ET AL) 7 March 2000 (2000-03-07) * figure 4 *	1-12	
A,D	EP 0 279 483 A2 (BAUKNECHT HAUSGERAETE [DE]; PHILIPS NV [NL]) 24 August 1988 (1988-08-24) * the whole document *	1-12	

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	27 October 2011	Diaz y Diaz-Caneja

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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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 11 15 9614

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27-10-2011

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