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(54) **Washing machine with detergent dispenser**

(57) Washing machine (1) comprising a detergent dispenser (3) connected to a water inlet valve means (2), the dispenser comprising a plurality of compartments connected to a rotating drum (5) being accommodated in a tub (6), said machine being adapted to carry out successive operation phases under the control of a programme sequence control unit that is adapted to also

control the water inlet valve means causing an amount of water to flow into the compartment so as to flush off the detergent contained therein and convey it into the tub (6), said washing solution from the drum (5) is circulated by a circulation pump (7) through the detergent dispenser (3) in a cleaning cycle under control of the programme sequence control unit.

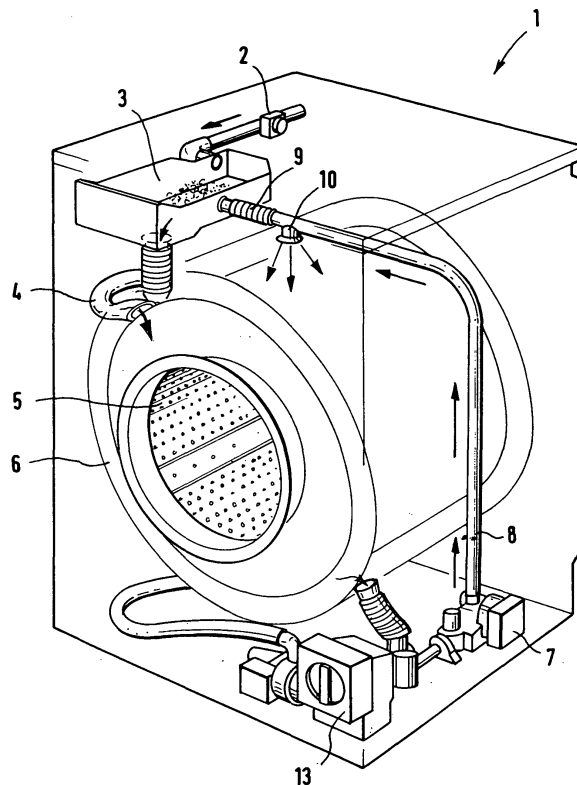


FIG. 2

Description

[0001] The present invention relates to a washing machine comprising a detergent dispenser connected to a water inlet valve means, the dispenser comprising a plurality of compartments connected to a rotating drum being accommodated in a tub, said machine being adapted to carry out successive operation phases under the control of a programme sequence control unit that is adapted to also control the water inlet valve means causing an amount of water to flow into the compartment so as to flush off the detergent contained therein and convey it into the tub.

[0002] Washing machines of the above cited kind usually comprise a tub adapted to hold inside the rotating drum accommodated therein the clothes that can be treated with water in which, in respective operational phases of the washing process, various laundering aids are diluted. Such laundering aids are let into the tub of the machine through the detergent dispenser, which can for example be of the pull-out drawer type, comprising adjacent and separate compartments, e.g. three such compartments for holding the prewash detergent, the main wash detergent and the rinsing aid or fabric softener, respectively, in which respective amounts of various such laundering aids can be filled, according to the selected operation cycle of the machine.

[0003] Mostly this dispenser is placed so that it is accessible by the user and in convenient position for filling with detergent. Its location can be at the top of the machine, above water level in the tub. The washing aid is flushed in by fresh water at the beginning of the appropriate cycle. The duration of the fresh water is controlled by the programme sequence control unit and restricted by the amount of water that is used in the respective programmes steps. Further dosing of washing aids and detergent ingredients can only be done when fresh water can still be added in sufficient amount. However, detergent forms that do not dissolve sufficiently fast may not be added that way.

[0004] The detergent dispenser, in particular a dispenser of the pull-out drawer type is usually shaped in a way to facilitate transport of detergent into the tub by the tap water flow. Although machine manufacturers direct large efforts on the design and surface finish of detergent dispensers, often detergent residues remain anyway inside the dispenser that can accumulate and further act as breeding ground for microbial colonisation and fungal growth. The removal and manual cleaning of the pull out drawer is regarded as severe nuisance by customers.

[0005] It is therefore an object of the present invention to provide a washing machine comprising a detergent dispenser which does not require manual cleaning of the drawer.

[0006] According to the present invention this object is achieved in the above defined washing machine in that washing solution from the drum is circulated by a circulation pump through the detergent dispenser in a cleaning

cycle under control of the programme sequence control unit.

[0007] The specific dispenser cleaning cycle prevents creation and deposition of unwanted detergent residues. Further it is advantageous that a customer does not have to clean the detergent dispenser manually.

[0008] According to one aspect of the present invention the cleaning cycle can be initiated automatically during an operation phase of the washing machine. In this case the washing machine is adapted to carry out the cleaning cycle totally independent from an intervention of the user.

[0009] In accordance with an alternative aspect of the present invention the cleaning cycle can be initiated manually by a user. Thus the user can start a cleaning cycle in case there are detergent residues in the detergent drawer.

[0010] According to the present invention the washing machine can comprise a control means for initiating the cleaning cycle, which enables the user to start the cleaning cycle manually. Preferably the control means can be a button, a push button, a switch or a turn knob. Further the control means can be a menu choice of a display device or a voice command. Additionally it is possible to use any other triggering mechanism or a combination of the aforementioned control means.

[0011] In order to improve the user-friendliness of the washing machine of the present invention a current cleaning cycle can be made visible on a display device. In this way a current cleaning cycle is optically indicated and can be recognised by the user.

[0012] According to yet another aspect of the present invention the compartments of the detergent drawer are flushed individually or simultaneously or sequentially or in groups. Conventional washing machines comprise a flow guide which can be switched in different positions in order to guide the circulating solution through the selected compartment.

[0013] In order to achieve a thorough cleaning of the detergent dispenser the machine comprises a heating means for heating up the solution in the tub to an operating temperature during a cleaning cycle. The operating temperature can be between 10 °C, which is the temperature of cold water from the tap, and 95 °C, preferably between 40 and 85 °C.

[0014] According to the present invention the machine can comprise at least one conductivity sensor sensing the electrical conductivity of the washing solution. This sensor can detect whether the electrical conductivity of the circulating solution is still changing or not.

[0015] According to another alternative of the present invention the washing machine can comprise at least one turbidity sensor sensing the turbidity of the washing solution. This sensor can detect whether the turbidity of the circulating water is still changing.

[0016] It is pointed out that the invention can be implemented in both horizontal and vertical axis washing machines.

[0017] The invention and its underlying principle will be better understood when consideration is given to the following detailed description of a preferred embodiment with reference to the accompanying drawings.

Fig. 1 is a schematic drawing of the water conduits of a washing machine according to the present invention;

Fig. 2 is a perspective view showing the main parts of a washing machine according to the present invention; and

Fig. 3 is a flow chart showing the different phases of a cleaning cycle.

[0018] Fig. 1 a schematic drawing of the water conduits of a washing machine according to the present invention.

[0019] The washing machine 1 has a water intake 2 which is connected to a detergent dispenser or drawer 3. The detergent drawer 3 can be loaded with the required amount of washing powder or other ingredients as bleach or conditioner prior to the start of the washing programme. The detergent drawer 3 or detergent dispenser is placed so that it is easily accessible by the user and in convenient position for filling with detergent. In this embodiment the detergent drawer 3 is placed at the top of the washing machine 1, above water level. The washing powder or washing aid is flushed in by fresh water at the beginning of the appropriate cycle. The fresh water flows from the water intake 2 through the respective compartments of the detergent drawer 3 and further through a conduit 4 into a drum 5. The drum 5 is accommodated in a tub 6 so that the drum 5 can be rotated in the tub 6.

[0020] After normal flush-in the main wash starts with circulation of water from the bottom of the tub 6 to the upper part of the tub 6 where the solution is spread onto the tumbling load. A circulation pump 7 is disposed underneath the tub 6 conveying the solution through a conduit 8 to the top of the tub 6.

[0021] When a dispenser cleaning cycle is carried out the solution is circulated through the conduit 8 and further through a conduit 9 to the detergent drawer 3 in order to clean the detergent drawer 3 with solution from the tub 6. The connection between the conduits 8 and 9 can selectively be opened or closed by a valve 10, which is controlled by the programme sequence control unit.

[0022] A conductivity sensor 11 is disposed in the conduit 4 downstream the detergent drawer 3. Similarly a turbidity sensor 12 is also disposed in conduit 4. The conductivity sensor 11 detects a change in the electrical conductivity of the circulating solution. In case the conductivity is no longer changing this indicates that no more detergent residues are rinsed out of the detergent drawer 3. Similarly a signal from the turbidity sensor 12 which is no longer changing indicates that all residues have been flushed out of the detergent drawer 3.

[0023] Fig. 2 is a perspective view showing the main

components of the washing machine according to the present invention.

[0024] Fresh water is flushed in through the water intake 2 into the detergent drawer 3 and through the conduit 4 into the drum 5. The circulation pump 7 conveys the solution through conduit 8 into the tub 6. When the solution flows from the tub 6 to the pump 7 it passes a filter in which solid residues are retained. Fig. 2 further shows conduit 9 connecting conduit 8 with the detergent drawer 3.

[0025] Fig. 3 is a flow chart showing the different phases of a cleaning cycle.

[0026] The flow chart shows a manual cleaning cycle as well as an automatic cleaning cycle as part of normal washing programmes. After the start 14 a manual cleaning cycle 15 can be initiated by the user without laundry present in the machine 1. Optionally a special dispenser cleaner 16 is added into the detergent drawer 3. The cleaning cycle 15 starts as usual by flushing in this optional detergent in step 17 from the detergent drawer 3 into the tub 6.

[0027] Alternatively an automatic cleaning cycle 18 can be carried out, starting with normal flush-in of tap water.

[0028] The following steps are identical for both the manual cleaning cycle 15 and the automatic cleaning cycle 18. When the water is flushed into the tub a heating step 19 follows in order to heat up the solution to the operating temperature for the cleaning cycle, which is preferably 40 - 85 °C. The heated solution is then circulated by the circulation pump 7 through conduits 8, 9 into the detergent drawer 3. Therefore the valve 10 has to be opened so that the solution is conveyed into the drawer 3. It is also possible to flush only a part of the circulating solution through conduit 9 and to spray the remaining part onto the tumbling load from the upper part of the tub 6.

[0029] All compartments of the detergent drawer can be flushed and cleaned simultaneously, successively, or in groups to dissolve and flush-out any residues that are present. As the heating phase of the solution at the beginning of the cleaning cycle takes some time complete dissolution of the detergent is accomplished at the end of the heating phase. Afterwards the circulation flow is directed through the detergent drawer 3 that has contained the previously flushed in detergent for a sufficient length of time to ensure complete dissolution of the detergent that had been in there. The circulation through the drawer 3 and the flushing of the compartments is carried out in the steps 20 and 21 of the flow chart shown in fig. 3.

[0030] As additional benefit this will allow placing detergent forms that are slowly dissolving or so bulky that they are not normally flushed out of the compartment, e.g. tablets, into the dispenser.

[0031] In step 22 sensor signals from the conductivity sensor 11 and the turbidity sensor 12 are obtained which can be evaluated in order to detect whether the electrical

conductivity or turbidity of the circulated water is still changing. When the sensor signals are not changing any longer this indicates that cleaning of the detergent drawer 3 is complete. Alternatively the cleaning cycle can be stopped after a predetermined period of time has lapsed.

[0032] After the cleaning cycle is complete the cleaning solution is drained in step 23 and one to three rinsing cycles 24 with tap water are conducted, including circulation and possibly heating, to free the tub 6, pump 7, detergent drawer 3 and conduits 8, 9 from any debris and detergent that had been employed or loosened during the cleaning cycle. Finally the programme ends in step 25.

[0033] Alternatively, in particular during an automatic cleaning cycle the compartment can be flushed with fresh water that is part of the amount required in this step. Therefore 1 to 80 % of the water volume of the respective programme step can be used, for a horizontal axis washing machine 0,1 - 5 1, preferably 1 - 2 1. It is also possible to use the fresh water of the next programme step during the intake phase.

[0034] In an automatic cleaning cycle the conditioner, which might be used in the last rinse is flushed in as usual and the last rinse solution is circulated through the rinse aid compartment as described above. As the conditioner is a liquid this time is rather short, 0,1 - 5 minutes, preferably 1 - 2 minutes. A certain amount of water for the last rinsing cycle will be finally introduced through the conditioner compartment, which is a part of the detergent drawer 3. The amount of water can be 1 - 80 % of the water volume of the respective programme step, for a horizontal axis machine preferably 1 - 2 1.

[0035] The washing machine comprises a display device like an LCD or OLED, so that a manual or automatic cleaning cycle is well visible on the display device. The control panel of the washing machine can comprise an extra button or a turn knob or it can be implemented in a menu on the display device.

Claims

1. Washing machine (1) comprising a detergent dispenser (3) connected to a water inlet valve means, the dispenser (3) comprising a plurality of compartments connected to a rotating drum (5) being accommodated in a tub (6), said machine (1) being adapted to carry out successive operation phases under the control of a programme sequence control unit that is adapted to also control the water inlet valve means causing an amount of water to flow into the compartment so as to flush off the detergent contained therein and convey it into the tub (6), **characterised in that** washing solution from the drum (5) is circulated by a circulation pump (7) through the detergent dispenser (3) in a cleaning cycle under control of the programme sequence control unit.

2. Washing machine according to claim 1, **characterised in that** the cleaning cycle is initiated automatically during an operation phase.

3. Washing machine according to claim 1, **characterised in that** the cleaning cycle can be initiated manually by a user.

4. Washing machine according to claim 3, **characterised in that** the machine (1) comprises a control means for initiating the cleaning cycle.

5. Washing machine according to claim 4, **characterised in that** the control means is a button or a switch or a turn knob or a menu choice of a display device or a voice command.

6. Washing machine according to any preceding claim, **characterised in that** a current cleaning cycle is visible on a display device.

7. Washing machine according to any preceding claim, **characterised in that** the compartments are flushed individually or simultaneously or sequentially or in groups.

8. Washing machine according to any preceding claim, **characterised in that** the machine (1) comprises a heating means for heating up the solution in the tub (6) to an operating temperature during a cleaning cycle, the operating temperature being between 10 and 95 °C, preferably between 40 and 85 °C.

9. Washing machine according to any preceding claim, **characterised in that** the machine (1) comprises at least one conductivity sensor (11) sensing the electrical conductivity of the washing solution.

10. Washing machine according to any preceding claim, **characterised in that** the machine (1) comprises at least one turbidity sensor (12) sensing the turbidity of the washing solution.

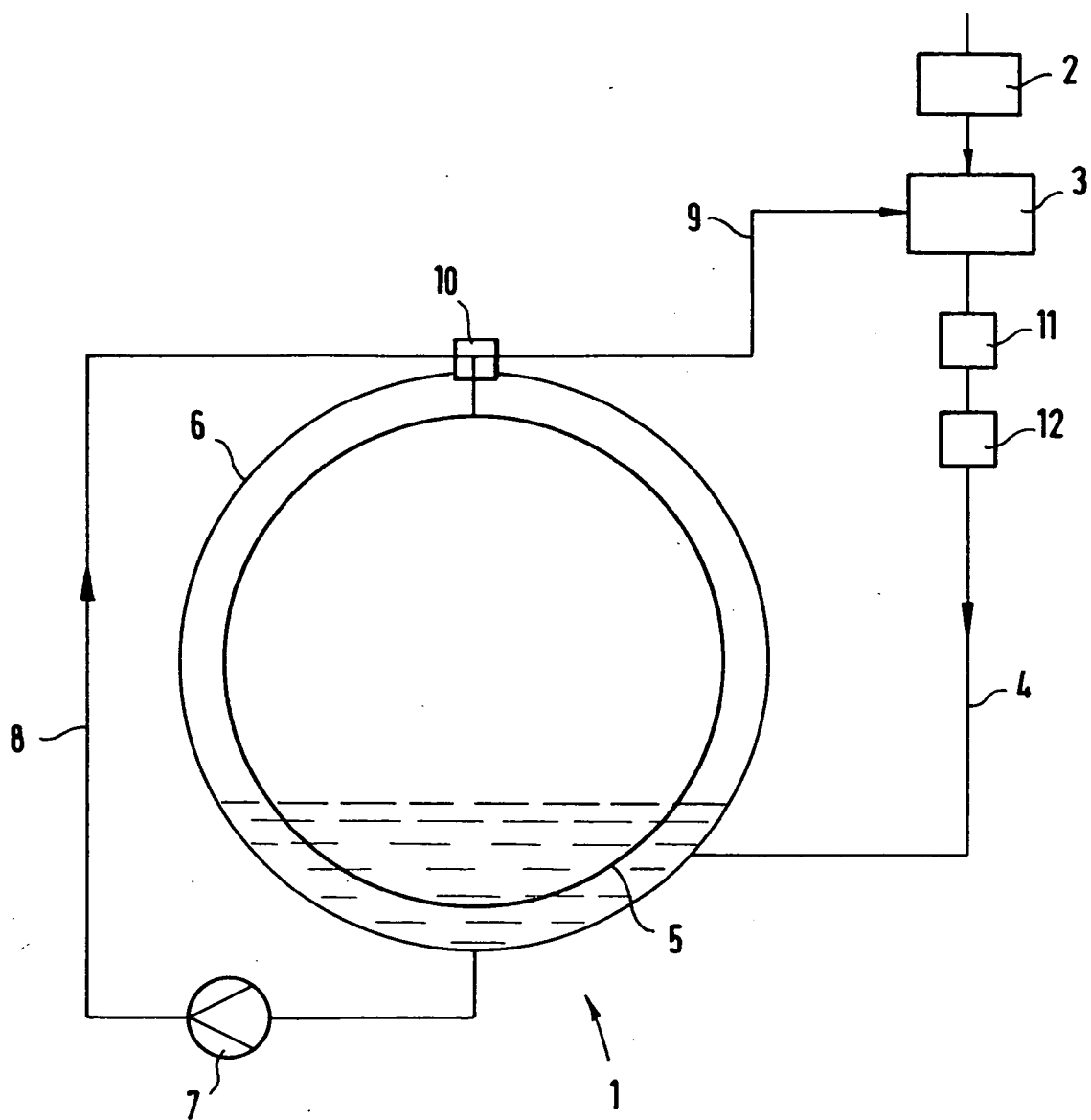


FIG. 1

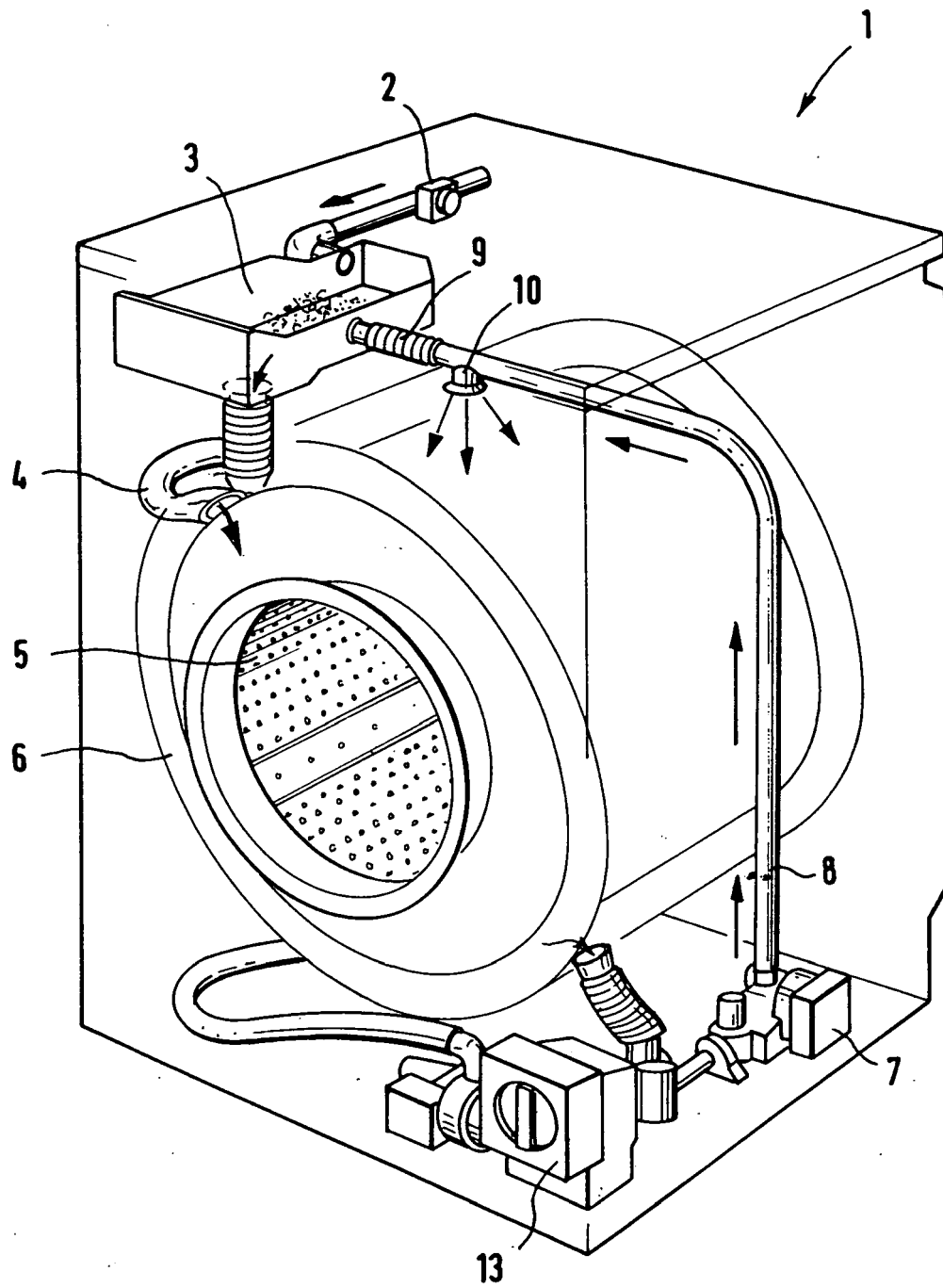


FIG. 2

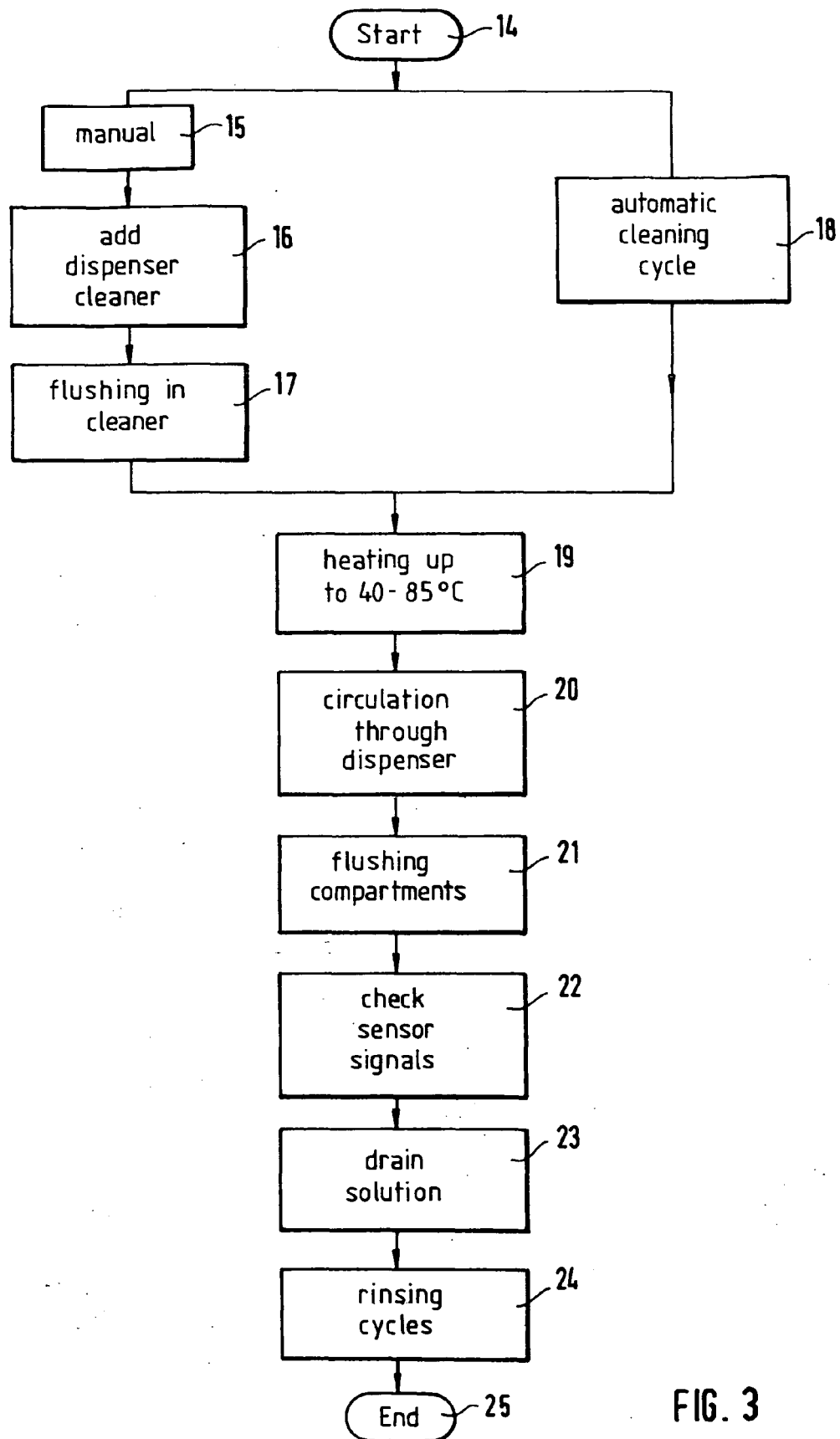


FIG. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 05 00 1763

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Place of search Munich		Date of completion of the search 8 July 2005	Examiner Falkentoft, C
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

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