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(54) **Method of operating a washing machine and washing machine**

(57) The present invention in particular is directed to a washing machine (1), being operable in a recirculation washing mode, wherein a filter clogging state of a wash-

ing liquid filter (13) of a recirculation unit is monitored. If a critical filter clogging state is detected, the recirculation washing mode is deactivated and substituted by a non-recirculation washing mode.

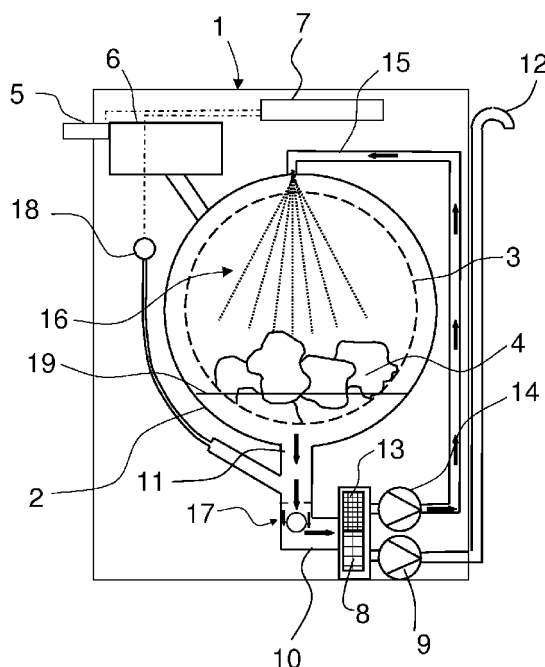


Fig. 1

Description

[0001] The present application is directed to a method of operating a washing machine and to a washing machine.

[0002] In washing machine technology it is well known to recirculate washing liquid in order to reduce consumption of washing liquid, e.g. water. Washing machines operable in such a way are known for example from EP 0 240 911 B1, EP 1 204 792 B1 and EP 0 807 707.

[0003] Recirculation of washing liquid generally involves a recirculation unit with a recirculation pump. The recirculation pump extracts washing liquid from a bottom section of the tub of the washing machine and feeds it back into the tub via a spray or jet system arranged above the filling level of washing liquid.

[0004] In order to prevent fluff and other foreign matter from entering and impairing the function or operation of the pump or jet system, a recirculation filter may be provided upstream the pump.

[0005] If such recirculation filters become clogged the washing efficiency of the washing machine drastically drops.

[0006] By virtue of these facts, it is an object of the invention to provide an improved method of operating a washing machine, in particular avoiding reduced washing efficiency upon recirculation filter clogging. Further, a corresponding washing machine shall be provided.

[0007] This object is achieved by independent claims 1 and 8. Embodiments of the invention result from dependent claims.

[0008] According to independent claim 1, a method of operating a washing machine which is operable in a recirculation washing mode is provided. The washing machine may be a conventional washing machine, i.e. a laundry washer, or a washer dryer, both of front loading and top loading type.

[0009] With the method according to the invention, a filter clogging state of a washing liquid filter of a recirculation unit, or of a recirculation circuit, is monitored or observed, at least from time to time or at certain time intervals. Advantageously, monitoring of the washing liquid filter can be carried out continuously during operation of the washing machine.

[0010] If, in the monitoring action, a critical filter clogging state, or the occurrence of a critical filter clogging state is detected, then the recirculation washing mode is deactivated and substituted by a non-recirculation washing mode.

[0011] A critical filter clogging state shall for example pertain to situations or states in which the washing liquid filter is clogged to such an extent that further operation in recirculation mode would impair washing quality and/or, in particular in the long term, negatively impact the pump of the recirculation unit.

[0012] Deactivation and substitution of the recirculation mode shall mean that execution of the recirculation mode is blocked, and, even if a recirculation mode has

been selected by a user, the recirculation mode is replaced or overruled by a non-recirculation mode. Information about blocked recirculation mode may be made available for future operations. For example the information may be stored in a memory, where a deactivation flag may be set. If a critical filter clogging state has been removed and no critical recirculation filter clogging state can be determined any more, the recirculation washing mode can be activated again, e.g. the deactivation flag may be deleted.

[0013] A non-recirculation mode can for example be a conventional washing mode in which laundry is tumbled in a washing drum, with the tub being filled with washing liquid up to a non-recirculation level (e.g. a level higher than the level in the recirculation mode).

[0014] As can be seen, the method can ensure effective washing quality even in cases with clogged washing liquid filters in the recirculation circuit. Besides from this, severe damages to the washing machine, in particular the pump of the recirculation unit, can be greatly prevented. This is of particular importance, for example, if the pump acting in the recirculation circuit is also used and adapted for draining washing liquid from the washing machine.

[0015] In an embodiment, substitution of the recirculation washing mode by the non-recirculation mode involves increasing or raising, with respect to the recirculation mode, a filling level of washing liquid in the tub of the washing machine.

[0016] Increasing the filling level can involve setting a respective filling level parameter of the washing machine and/or adding additional liquid, for example water, to the tub. Advantageously, the level of the washing liquid being present or to be present in the tub of the washing machine during operation thereof will be raised.

[0017] Setting or providing a respective filling level parameter, for example in a memory of the washing machine, preferably together with deactivation information, may be advantageous, as subsequent washing operations can be based on such information. This means that if a critical recirculation filter clogging state has been detected and recirculation washing is selected again, the machine automatically conducts, preferably after user confirmation, a non-recirculation mode according to respective parameters, until critical recirculation filter clogging state is removed.

[0018] Further, setting and storing respective parameters and making available such kind of information for subsequent operating phases may be advantageous if the critical filter clogging state is determined in an idle or non-operating mode or state of the washing machine. This implies that the filter clogging state may even be monitored in time intervals when the washing machine is carrying out no washing operation or is in an off or standby mode. However, the time window in which a filter clogging state can be determined advantageously depends on the respective method used for detection of filter clogging states.

[0019] In general it may be adequate to monitor the filter clogging state during recirculation washing phases of the washing machine. However, in an advantageous embodiment in which the filter is used both as a recirculation filter, and as a draining filter for washing liquid, monitoring the filter clogging state in non-recirculation phases may be appropriate.

[0020] Increasing the filling level of washing fluid in response to a critical filter clogging state safeguards washing quality and efficiency as recirculation washing modes operate with reduced filling levels as compared to conventional tumble-only washing modes. With reduced filling levels and disabled recirculation, the exposure of laundry to washing liquid is reduced which clearly leads to inferior cleaning efficiency and may result in excessive wear of laundry or other items tumbling in the drum of the washing machine. Therefore, if a critical filter clogging state is observed or detected, which leads to deactivation of the recirculation unit, additional liquid, such as water, can be automatically fed to the tub.

[0021] The filter clogging state can be monitored by measuring or detecting one or more representative parameters. For example, the washing liquid flow of washing liquid in the recirculation circuit and/or the washing liquid pressure or pressure change in the tub effected by recirculation washing operation, in particular a washing liquid pressure drop in an initial phase after activating recirculation washing, and/or at least one optically detectable particular feature of the washing liquid filter, can be used as parameters. In using such parameters, the recirculation mode can be deactivated and substituted, if at least one of the measured washing liquid flow, measured washing liquid pressure or pressure change and optically detected particular feature, is indicative of a critical clogging state.

[0022] Advantageously, it is possible that at least one of the measured washing liquid flow, washing liquid pressure or pressure change, in particular pressure drop, is compared to a reference flow value, or reference pressure value or reference pressure change or drop value, respectively. In such cases, a critical clogging state can be determined to exist if at least one of the following situations occurs: the washing liquid flow is less than or equal the reference flow value, or the washing liquid pressure is higher than or equal the reference pressure value, or the washing liquid pressure change is less than or equal the reference pressure change value.

[0023] In order to improve accuracy, in an advantageous embodiment a critical filter clogging state may only be determined to exist if the above mentioned parameters are indicative of a filter clogging state over a certain, in particular extended, period of time or in several successive measurements.

[0024] In a further embodiment, it is possible, that upon deactivating the recirculation mode during operation of the washing machine, a conduit connecting a bottom section of the tub of the washing machine to a recirculation unit or recirculation circuit is closed via a valve, preferably

a ball valve. In this way, washing liquid can be prevented from entering the recirculation circuit. A synergistic effect of using such a valve may be obtained, if a heating element for heating the washing liquid is arranged upstream the valve. In this case, washing liquid still being present in the deactivated recirculation unit or circuit downstream the valve will not be heated any more, and hence energy can be saved.

[0025] In an advantageous embodiment, at least one of an event of deactivation of the recirculation mode and occurrence of a critical clogging state is made available to a user, preferably by at least one of visual and audible signs. For example, deactivation of the recirculation unit or the occurrence of a critical filter clogging state may be visually indicated on a user interface of the washing machine. Advantageously, a warning or other signals may also be made available to a user if the clogging state of the filter is close to a critical clogging state. In particular with such embodiments, it is possible to consider further parameters suitable for detecting and/or predicting critical clogging states.

[0026] As can be seen from the above description, the proposed method provides an improved method for operating a washing machine, and in particular is effective in avoiding reduced washing efficiency upon recirculation filter clogging.

[0027] According to independent claim 8, a washing machine operable in a recirculation washing mode is provided. The washing machine may for example be a laundry washer or washer dryer and similar as already mentioned beforehand.

[0028] The washing machine advantageously comprises a tub, a recirculation unit for recirculating washing liquid in a recirculation circuit provided with the tub, and at least one recirculation washing liquid filter. The washing machine advantageously further comprises an electronic control unit adapted to operate the washing machine according to the proposed method or any embodiment thereof.

[0029] As to advantages and advantageous effects of the washing machine, reference is made to the description above.

[0030] In order to implement the proposed method or an embodiment thereof, the recirculation unit may comprise at least one pump for pumping washing liquid in a recirculation circuit. The washing liquid filter can advantageously be integrated in the recirculation circuit, and arranged upstream the pump. The washing liquid filter may be adapted to retain lint, loose fibers, dirt particles, impurities and foreign matter from entering the recirculation pump.

[0031] In order to monitor parameters suitable for detecting critical filter clogging states, the washing machine may advantageously comprise at least one of a flow meter for measuring a washing liquid flow in the recirculation circuit, a pressure sensor, for example a pressure switch, for measuring a washing liquid pressure or pressure change in the tub, and an optical sensor for optically de-

tecting at least one particular feature of the washing liquid filter. The respective sensors may advantageously be connected to the electronic control unit in such a way that the measured washing liquid flow, measured washing liquid pressure or pressure change or detected particular feature are available for operating the washing machine accordingly, i.e. for deactivating the recirculation unit if a critical filter clogging state occurs or prevails.

[0032] It shall be mentioned, that if it is determined that a critical clogging state no longer exists or ceased to exist, advantageously the recirculation washing mode may be activated again.

[0033] In an embodiment, in a conduit connecting an opening provided in a bottom section of the tub with an input side of the pump, there may be provided a valve, preferably a ball valve, arranged and adapted to open and close the conduit. Reference is also made to the above discussion.

[0034] The washing machine may advantageously comprise a user messaging or information unit. This user messaging or information unit may be adapted to at least one of visually and audibly indicate to a user at least one of an event of deactivation of the recirculation mode and occurrence of a critical clogging state. It is of particular interest, to provide accurate information about filter clogging, preferably announcing filter clogging in advance. Accurate information may advantageously be obtained by observing one or more parameters and comparing them to at least one respective reference parameter value or reference parameter.

[0035] In a further embodiment, the washing machine may advantageously comprise an integral filter unit having a recirculation filter section and draining filter section, wherein at least one recirculation washing liquid filter is accommodated in the recirculation filter section. In such a configuration, loose fibers or fluff and the like may be rinsed away from the recirculation washing liquid filter during draining washing liquid off the tub of the washing machine. At some instances, it may well be that an announced or an actually occurred critical filter clogging state can be removed in this way. This enables the washing machine to be operated in recirculation mode over extended periods of time.

[0036] In a yet further embodiment, the pump may be operable as a recirculation pump and a draining pump, and a valve, preferably a three way valve, may be provided for connecting the pump either to the recirculation circuit or a draining circuit. In this case, some of the monitored parameters, such as for example a flow of washing liquid through the pump, may be used to identify or forecast also critical draining filter clogging states.

[0037] The washing machine may comprise a liquid inlet adapted to feeding additional or fresh liquid to the tub and cooperating with the electronic control unit such that in the event of deactivation of the recirculation washing mode due to a critical clogging state of the recirculation washing liquid filter, additional or fresh liquid is fed to the tub. In this way, excellent washing results can be

achieved even if the recirculation unit is deactivated.

[0038] Exemplary embodiments of the invention will be described in connection with the annexed figures, in which

FIG 1 shows a schematic representation of a washing machine according to the invention in a first operational state;

FIG 2 shows the washing machine of FIG 1 in a second operational state;

FIG 3 shows a time course of an operational parameter of the washing machine of FIG 1 and 2; and

FIG 4 shows a filter of the washing machine of FIG 1 and 2.

[0039] The following description of embodiments shall not be construed as limiting the scope of the invention. In particular, features jointly shown in any of the figures can be implemented alone or in any other combination as discussed further above.

[0040] If not otherwise stated like elements are denoted by like reference signs throughout the figures. The figures may not be true to scale, and scales of different figures may be different.

[0041] FIG 1 shows a schematic representation of a washing machine 1 in a first operational state.

[0042] The washing machine, which in the present case is a laundry washer (but which could be as well a washer-drier), advantageously comprises a tub 2, in which a drum 3 is rotatably arranged, in order to carry out a washing operation by tumbling items, such as laundry 4, placed in the drum 3.

[0043] The washing machine 1 further comprises an inlet 5 for feeding water into the tub 2, preferably via a drawer 6 adapted to accommodate washing agent or washing powder. By feeding water via the drawer 6, the washing agent accommodated therein is flushed into the tub 2. The inlet 5 comprises an actuatable inlet valve, not illustrated, which, for example by virtue of an electronic controller 7 connected thereto, is operable to feed water in accordance with a preset washing liquid level into the tub 2.

[0044] The washing machine 1 further comprises a draining unit for draining washing liquid from the tub 2. The draining unit comprises a draining filter element 8 arranged upstream a draining pump 9. An inlet side of the draining pump 9 is connected via the draining filter element 8 to a main conduit 10 in turn connected to a bottom opening 11 of the tub 2. An outlet of the draining pump 9 is connected to a draining conduit 12 provided for discharging washing liquid from the tub 2 to an external drainage.

[0045] The washing machine 1 further comprises a recirculation unit for recirculating washing liquid. The recirculation unit comprises a recirculation filter element 13

arranged upstream a recirculation pump 14. An inlet of the recirculation pump 14 is connected via the recirculation filter element 13 to the main conduit 10. An outlet side of the recirculation pump 14 is connected to a recirculation conduit 15. A distal end of the recirculation conduit 15 is connected to an opening, in the present case advantageously a top opening, provided in the tub 2 in such a way that washing liquid can be sprayed or jetted onto laundry present in the tub 2. A jet of recirculated washing liquid is schematically shown in FIG 1 and depicted by reference sign 16.

[0046] The draining filter element 8 and recirculation filter element 13 are preferably accommodated in a filter unit, in which the draining filter element 8 is arranged in a draining section, and the recirculation filter element 13 is arranged in a recirculation section. In a further embodiment, not illustrated, the recirculation filter element 13 and the draining filter element 8 may be two totally independent (i.e. distinct) components and they may be arranged in totally independent (i.e. distinct) filter units or seats.

[0047] In between the bottom opening 11 and the filter unit, a ball valve 17 may be advantageously provided and adapted to enable and block the main conduit 10. In a further embodiment, not illustrated, the ball valve 17 may be replaced by a different kind of valve, for example a butterfly valve, a gate valve, an electronic-controlled valve, etc.; more in general any kind of valve adapted to block the main conduit 10 may be used.

[0048] A branch connecting upstream the ball valve 17 to the main conduit 10, preferably comprises a pressostat 18, i.e. a pressure sensor. The pressostat 18 is adapted and connected to the main conduit 10 such that a washing liquid pressure or pressure change can be determined.

[0049] The operation of the washing machine 1 is now described in more detail. FIG 1 shows the washing machine 1 in a recirculation mode in which washing liquid is taken from the bottom section of the tub 2 and sprayed or jetted onto the laundry 4 contained in the drum 3. The flow of washing liquid through the recirculation unit is indicated by small arrows. As can be seen, washing liquid is circulated with the tub 2, preferably, but not necessarily in a continuous way.

[0050] Circulation of the washing liquid has the advantage that the amount of water needed for conducting a washing programme can be greatly reduced as compared to non-recirculation washing, such as conventional tumble washing. The recirculation washing liquid level, i.e. the level of the washing liquid in the tub 2, is indicated in FIG 1 by reference sign 19. As can be seen, due to reduced amounts of washing liquid, the laundry 4 is not fully immersed in washing liquid. However, spraying washing liquid onto the laundry 4 compensates for this. Therefore, excellent washing results can be obtained even with reduced amounts of washing liquid.

[0051] In particular, as laundry 4 is tumbled by a rotating movement of the drum 3, fluff, loose fibers, dirt and other foreign particles (typically coming from the laundry)

will be present in the washing liquid. Obviously, the recirculation filter element 13 intended for protecting the recirculation pump 14 from fluff, foreign particles and so on is prone to being clogged by respective foreign particles and the like. Already partial clogging of the recirculation filter element 13 will result in a reduced recirculation flow impairing washing quality and efficiency. In order to avoid reduced washing efficiency, the washing machine 1 can monitor the clogging state of the recirculation filter element 13, and, in particular in the event that a critical clogging state occurs, disable or deactivate the recirculation washing unit.

[0052] Upon disabling or deactivating the recirculation mode, the washing machine 1 is set or further operated in a non-recirculation, i.e. tumble-only, mode.

[0053] Preferably, along with switching from recirculation to non-recirculation mode, the inlet valve of the inlet 5 is opened and fresh water is fed into the tub 2 until the predetermined non-recirculation washing liquid level 20 (see FIG 2) is obtained.

[0054] The situation after feeding fresh, i.e. additional, water such that the non-recirculation washing liquid level 20 is obtained, is shown in FIG 2. As can be seen therefrom, and in particular from a comparison of FIG 1 and FIG 2, an enlarged portion of the laundry 4 contained in the drum 3 is immersed with washing liquid, as is usual for non-recirculation washing. Thereby washing quality and efficiency is greatly enhanced as compared to washing results with reduced recirculating washing liquid levels 19.

[0055] Detecting a critical clogging state of the recirculation filter element 13 can be implemented, for example, as follows.

[0056] The pressure of washing liquid is continuously, or at least at certain time intervals, measured by the pressostat 18. The pressure can for example be measured as the height of washing liquid contained in the tub 2.

[0057] Obviously, if the recirculation pump 14 starts to recirculate washing liquid in the recirculation circuit, the height of washing liquid, and therefore the pressure measured by the pressostat 18 will decrease. The pressure decrease or reduction, i.e. the pressure drop, induced by activation or operation of the recirculation pump 14 is maximal, i.e. the pressure in the tub 2 is minimal, if the recirculation filter element 13 is not clogged. If the pressure remains above a threshold value, or the pressure drop is smaller than a respective threshold value, a critical clogging state is reached. Thereupon, the electronic controller 7, which is advantageously connected to the pressostat 18 and monitors the pressure or pressure drop, disables the recirculation washing mode. Then, other operational parameters, such as the washing liquid level, may be advantageously adapted in correspondence with non-recirculation washing mode requirements. For adapting the washing liquid level, the inlet valve can be activated in order to feed additional water.

[0058] As an example, inter alia depending on the type of washing machine used, a pressure drop of 10 - 20

mm, corresponding to 10 - 20 kg/m², may be used to identify a critical clogging state, if a pressure drop of 25 mm can be observed in unclogged states of the recirculation filter element 13. In this connection, FIG 3 shows two diagrams of washing liquid pressure versus time. In an initial time interval, the pressure of the washing liquid has a value of p_1 which corresponds to an idle or to a non-recirculation washing mode of the washing machine 1. At a certain point of time t_R the recirculation unit, and in particular the recirculation pump 14 is activated. Activation of the recirculation pump 14 leads to a pressure drop of the washing liquid pressure in the tub 2. In a first pressure drop graph (numbered 24 in FIG 3), which corresponds to a unclogged state of the recirculation filter element 13, the pressure drop $\Delta p'$, from p_1 to p_2 , as indicated by a double arrow in FIG 3, is for example from 70 mm to 45 mm, i.e. 25 mm, corresponding to a non-clogged recirculation filter state.

[0059] With increasing clogging of the recirculation filter element 13, the flow of washing liquid in the recirculation circuit is increasingly blocked, and hence the drop of washing liquid pressure is increasingly diminished. In FIG 3, a second, pressure drop graph (numbered 25 in FIG 3) is shown, which corresponds to a critical clogging state. Due to filter clogging, a smaller pressure drop $\Delta p''$ from p_1 to p_3 is observed.

[0060] In the present case, the washing liquid pressure is observed or monitored by the electronic controller 7 via pressure values of the pressostat 18. If the pressure drop Δp for example is lower than a respective critical pressure drop value, such as for example lower than 10 - 20 mm, a critical filter clogging state can be assumed. As a consequence, recirculation operation modes of the washing machine 1 can be deactivated or substituted as already described further above.

[0061] Advantageously, other parameters of the washing machine 1, for example of the filter, can be used to identify clogged recirculation filter states. Such parameters may be for example the flow or flow rate in the recirculation circuit or other recirculation filter parameters, optical characteristics of the recirculation filter element 13 and so on. Preferably respective parameters are selected such that automatic inspection is possible.

[0062] In FIG 4 a filter 21 implementing a recirculation filter element 13 is shown. The recirculation filter element 13 and the draining filter element 8 preferably are accommodated in a common filter housing 22; in an advantageous embodiment the recirculation filter element 13 and the draining filter element 8 may be made in a single-piece construction (i.e. they may be obtained as a single component). The respective filter elements are arranged within the housing such that washing liquid passes the recirculation filter element 13 in recirculation operation mode, and passes the draining filter element 8 in non-recirculation operation mode.

[0063] As is indicated in FIG 4, the filter meshwork of the recirculation filter element 13 is preferably somewhat more tight than that the draining filter element 8. Due to

the fact, that both filter elements 8, 13 are arranged and adapted in a common housing, washing liquid of either recirculation mode or non-recirculation mode may flow through the filter 21. The washing liquid will be filtered by filter 21 and foreign particles, dust, fluff or other lint will be retained by either the recirculation filter element 13 in recirculation mode and by the draining filter element 8 in draining mode. Both filter elements 8, 13 shown in FIG 4 are or can be adapted to efficiently remove foreign particles from the washing liquid as is required by respective pumps 9, 14.

[0064] One advantage of the implementation of FIG 4, i.e. arranging the recirculation 13 and draining filter element 8 in a common housing is that washing liquid draining via the draining filter element 8 can advantageously carry away loose fibers, fluff and other foreign substances adhering to the recirculation filter element 13. Here, it shall be considered, that the recirculation filter element 13 is comparatively fine, whereas the draining filter element 8 is comparable coarse. Hence, fibers, fluff and the like retained by the recirculation filter element 13 may probably pass through the draining filter element 8. Therefore, draining washing liquid from the tub 2 may reduce recirculation filter clogging.

[0065] However it is clear that also two completely separated filters and filter housings may be used.

[0066] The filter 21 may advantageously be of exchangeable, preferably of reusable, type. In case of an exchangeable filter 21, a handle 23 may be provided at the filter housing 22, for easing replacement of the filter 21.

[0067] In all, it can be seen, that the proposed method or methods for operating the washing machine 1 lead to improved operation, in particular to enhanced and more efficient washing.

Claims

1. Method of operating a washing machine (1) operable in a recirculation washing mode, wherein a filter clogging state of a washing liquid filter (13) of a recirculation unit is monitored, **characterized in that** if a critical filter clogging state is detected, the recirculation washing mode is deactivated and substituted by a non-recirculation washing mode.
2. Method according to claim 1, wherein substitution of the recirculation washing mode by the non-recirculation mode involves increasing, with respect to the recirculation mode, a filling level (19, 20) of washing liquid in a tub (2) of the washing machine (1).
3. Method according to claim 2, wherein increasing the filling level (19, 20) during operation of the washing machine (1) involves feeding additional liquid to the tub (2).

4. Method according to at least one of claims 1 to 3, wherein monitoring the filter clogging state involves at least one of measuring a washing liquid flow of washing liquid in a recirculation circuit, and/or measuring a washing liquid pressure and/or pressure change in the tub (2) effected by recirculation washing operation and/or optically detecting at least one particular feature of the washing liquid filter (13), and wherein the recirculation mode is deactivated and substituted if at least one of the measured washing liquid flow, and/or measured washing liquid pressure and/or pressure change and/or optically detected particular feature is indicative of a critical filter clogging state.

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5. Method according to claim 4, wherein at least one of the measured washing liquid flow, and/or washing liquid pressure and/or pressure change is compared to a reference flow value, and/or reference pressure value and/or reference pressure change value, respectively, and a critical clogging state is determined to exist if at least one of the washing liquid flow is less than or equal the reference flow value, and/or the washing liquid pressure is higher than or equal the reference pressure value and/or the washing liquid pressure change is less than or equal the reference pressure change value.

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6. Method according to at least one of claims 1 to 5, wherein upon deactivating the recirculation mode during operation of the washing machine (1), a conduit connecting a bottom section of the tub (2) of the washing machine (1) to a recirculation unit is closed via a valve.

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7. Method according to at least one of claims 1 to 6, wherein at least one of an event of deactivation of the recirculation mode and occurrence of a critical filter clogging state is made available to a user.

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8. Washing machine (1) operable in a recirculation washing mode, comprising a tub (2), a recirculation unit for recirculating washing liquid in a recirculation circuit provided with the tub (2), and at least one recirculation washing liquid filter (13), and further comprising an electronic control unit (7) adapted to operate the washing machine (1) according to at least one of claims 1 to 7.

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9. Washing machine (1) according to claim 8, the recirculation unit comprising a pump (14) for pumping washing liquid in a recirculation circuit, wherein at least one recirculation washing liquid filter (13) is comprised in the recirculation circuit and arranged upstream the pump (14), the recirculation washing liquid filter (13) being adapted to retain lint, loose fibers, dirt particles, impurities and foreign matter from entering the pump (14).

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10. Washing machine (1) according to at least one of claims 8 and 9, further comprising at least one of a flow meter for measuring a washing liquid flow in the recirculation circuit, and/or a pressure sensor for measuring a washing liquid pressure or pressure change in the tub (2) and/or an optical sensor for optically detecting at least one particular feature of the recirculation washing liquid filter (13), respectively connected to the electronic control unit (7) in such a way that the measured washing liquid flow, and/or measured washing liquid pressure and/or pressure change and/or optically detected particular feature are available for operating the washing machine (1) accordingly.

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11. Washing machine (1) according to at least one of claims 8 to 10, wherein in a conduit (10) connecting an opening (11) provided in a bottom section of the tub (2) with an input side of the pump (14) there is provided a valve arranged and adapted to open and close the conduit (10).

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12. Washing machine (1) according to at least one of claims 8 to 11, further comprising a user messaging or information unit adapted to visually and/or audibly indicate to a user an event of deactivation of the recirculation mode and/or the occurrence of a critical clogging state.

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13. Washing machine (1) according to at least one of claims 8 to 12, comprising an integral filter unit (21, 22) having a recirculation filter section and draining filter section, wherein at least said recirculation washing liquid filter (13) is accommodated in the recirculation filter section.

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14. Washing machine (1) according to at least one of claims 8 to 13, wherein the pump is operable as a recirculation pump (14) and as a draining pump (9), and wherein a valve, preferably a three way valve, is provided for connecting the pump either to the recirculation circuit (15) or a draining circuit (12).

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15. Washing machine (1) according to at least one of claims 8 to 14, further comprising a liquid inlet (5) adapted for feeding additional or fresh liquid to the tub (2) and cooperating with the electronic control unit (7) such that in the event of deactivation of the recirculation washing mode due to a critical clogging state of the recirculation washing liquid filter (13), additional or fresh liquid is fed to the tub (2).

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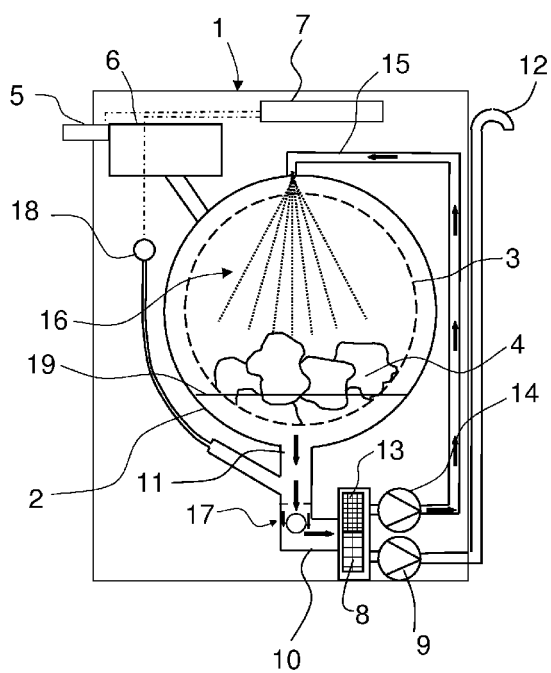


Fig. 1

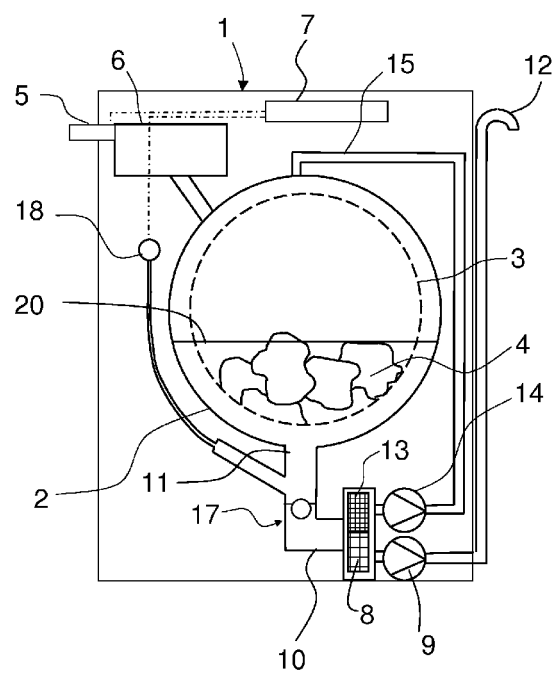


Fig. 2

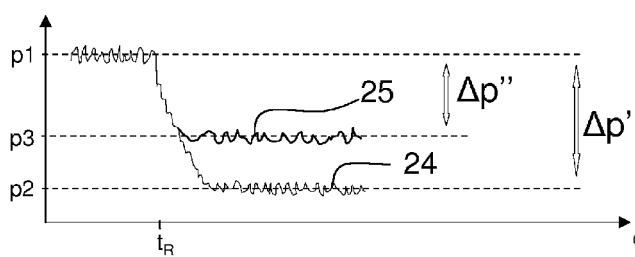


Fig. 3

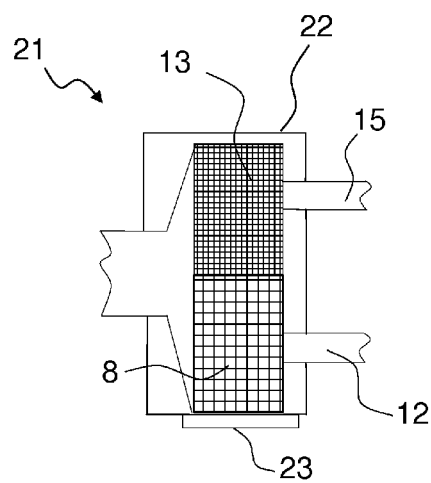


Fig. 4



EUROPEAN SEARCH REPORT

Application Number
EP 10 19 2052

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Place of search Munich		Date of completion of the search 8 June 2011	Examiner Clivio, Eugenio
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