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(54) A WASHING MACHINE COMPRISING A FILTRATION UNIT

WASCHMASCHINE MIT EINER FILTEREINRICHTUNG

LAVE-LINGE COMPRENANT UNE UNITÉ DE FILTRATION

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Description

[0001] The present invention relates to a washing machine that comprises a sterilization unit.

In washing machines, Ca^{++} and Mg^{++} ions that increase the hardness of water are present in the water received from the water mains and used in the washing process. The ions that increase water hardness join with the surfactants present in the detergent and decrease the cleaning properties of these agents thus the laundry cannot be cleaned in a desired manner. The ions that increase water hardness furthermore cause lime accumulation on components like the heater by generating deposits in hot water. In the state of the art, utilization of cross-flow filtration systems is known for decreasing the hardness of water. In the embodiment of cross-flow filtration, water is passed tangentially over a membrane and water is separated into two as soft and hard water. In order to prevent the membrane used in this type of filtration units from drying and cracking, sufficient amount of water must be present in the filtration unit to keep the membrane in a humid state. However, keeping the water inside the filtration unit creates an environment suitable for microorganism growth.

In the European Patent Application No. EP2012062156, a washing machine is described, wherein the hard water separated from the filtration unit in the water softening process is not discharged outside but used in the laundry rinsing processes thus providing water savings.

[0002] German Patent DE 199 64 292 B4 describes a washing machine in which wash water is circulated via a filtering device in order to remove dirt by centrifugal forces. An ultraviolet lamp is arranged at the outlet of the filter for sterilization of the circulated wash water.

[0003] International Patent Application WO 2013/000839 A1 discloses a washing machine comprising a cross-flow type filtration unit that provides the removal of the hardness of water by passing the mains water through a filter.

[0004] The aim of the present invention is the realization of a washing machine wherein the laundry is washed in a hygienic manner.

The washing machine realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a tub wherein the washing process is realized, a water inlet valve that supplies water from the water mains to the tub to be used in the washing program, a reservoir connected to the water inlet valve, a supply line that provides the circulation of the water between the reservoir and the filtration unit and that delivers the water from the reservoir to the filtration unit, a soft water line that enables the water removed of hardness by being filtered in the filtration unit to be delivered to the tub, and a return line that enables the hard water running down from the filter by flowing together with the substances trapped on the surface of the filter in the filtration unit to be transferred to the reservoir. By means of the return line, the hard water is collected in the reservoir to be used in the rinsing steps, thus providing water savings.

[0005] The washing machine of the present invention comprises a sterilization unit wherein the sterilization unit is situated on the supply line and is situated on the inlet of the filtration unit and/or wherein the sterilization unit is situated on the soft water line and is situated on the outlet of the filtration unit. The sterilization unit enables the water kept in the filtration unit to be sterilized. In order to prevent the membrane-shaped filtration unit from being damaged, the membrane surface must be kept in a humid state. The accumulation of the water inside the filtration unit causes microorganism growth. By means of the sterilization unit situated on the soft water line, the water, of which the microbiological load increases as it is kept in the filtration unit, is sterilized. Thus, the water is cleansed of the microorganisms before being taken into the tub.

[0006] In case the sterilization unit is situated on the soft water line, the washing machine comprises a control unit that activates the sterilization unit for a predetermined sterilization time if the time the water is kept inside the filtration unit is longer than a predetermined water waiting time. If the water is kept inside the filtration unit for a time longer than the water waiting time predetermined by the producer or the user, the control unit activates the sterilization unit. Thus, the sterilization unit is operated in a controlled manner, providing energy savings.

[0007] In an embodiment of the present invention, the sterilization unit is an ultraviolet lamp. The ultraviolet lamp emits ultraviolet rays with wavelengths between 240 nm and 280 nm. Since the wavelength range between 240 nm and 280 nm is the ray range with the highest effect on microorganisms, the microbiological load of the water is effectively reduced before being sent to the tub. In an embodiment of the present invention, the sterilization unit is an ultrasonic transducer.

[0008] In an embodiment of the present invention, the washing machine comprises a circulation pump that is situated on the supply line and that enables the water to be circulated between the reservoir and the filtration unit. The sterilization unit is disposed between the circulation pump and the filtration unit.

[0009] In an embodiment of the present invention, the washing machine comprises a rinsing water line that transfers hard water from the reservoir to the tub. Thus, receiving additional water from the water mains is not necessary for the laundry rinsing process and water saving is provided.

[0010] In the washing machine of the present invention, microorganisms grow in the water that is accumulated and kept inside the filtration unit and the reservoir. By means of the sterilization unit, microorganisms in the water leaving the filtration unit and the reservoir are killed and the washing process is realized in a hygienic manner.

[0011] The washing machine realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 - is the schematic view of a washing machine.

[0012] The elements illustrated in the figures are numbered as follows:

1. Washing machine
2. Tub
3. Water inlet valve
4. Filtration unit
5. Soft water line
6. Reservoir
7. Supply line
8. Return line
9. Sterilization unit
10. Control unit
11. Circulation pump
12. Rinsing water line

[0013] The following symbols are used for explicating the washing machine (1) of the present invention:

t_{bset} : a predetermined water waiting time
t_b : the time the water is kept inside the filtration unit (4)
t_s : a predetermined sterilization time
F : Filter
S : Water mains

[0014] The washing machine (1) comprises a tub (2) wherein the washing process is performed, at least one water inlet valve (3) that enables water intake into the tub (2) from the water mains (S) to be used in the washing program, a cross-flow type filtration unit (4), functioning as "water softening device", that separates ions like Ca^{++}, Mg^{++} by passing water through a filter (F) thus providing the removal of the hardness of water, a soft water line (5) that provides delivering of the water removed of hardness by being filtered in the filtration unit (4) to the tub (2), a reservoir (6) that is connected to the water inlet valve (3), a supply line (7) that enables the water to be circulated between the reservoir (6) and the filtration unit (4) and that delivers water from the reservoir (6) to the filtration unit (4), and a return line (8) that enables the hard water running down from the filter (F) by flowing together with the substances trapped on the surface of the filter (F) in the filtration unit (4) to be transferred to the reservoir (6). The hard water collected in the reservoir (6) is not discharged outside, but delivered to the tub (2) in the rinsing steps and used for rinsing the laundry. The washing machine (1) of the present invention comprises a sterilization unit (9) that is situated on the supply line (7) and/or on the soft water line (5) and that enables the water kept in the filtration unit (4) to be sterilized. In order to prevent the membrane-shaped filtration unit (4) from being damaged, the membrane surface must be kept in a humid state. By means of the sterilization unit (9) situated on the soft water line (5), the water, wherein bacteria growth is observed as it is kept in the filtration unit (4), is sterilized. Thus, the water is cleansed of the microorganisms before being taken into the tub (2). By means of the sterilization unit (9) situated on the supply line (7) and/or the soft water line (5), the microorganisms growing in the water kept in the filtration unit (4) are killed.

[0015] In an embodiment of the present invention, the sterilization unit (9) is situated at the outlet of the filtration unit (4). Thus, the sterilization process is realized when the water is transferred from the filtration unit (4) to the tub (2).

[0016] In an embodiment of the present invention, the sterilization unit (9) is situated at the inlet of the filtration unit (4).

[0017] In an embodiment of the present invention, the washing machine (1) comprises a control unit (10) that activates the sterilization unit (9) for a predetermined sterilization time (t_s) if the time the water is kept inside the filtration unit (4) (t_b) is longer than a predetermined water waiting time (t_{bset}). If the water is kept inside the filtration unit (4) for a time longer than the water waiting time (t_{bset}) predetermined by the producer or the user, the control unit (10) activates the sterilization unit (9). Thus, the sterilization unit (9) is operated in a controlled manner, providing energy savings.

[0018] In an embodiment of the present invention, the sterilization unit (9) is an ultraviolet lamp. The ultraviolet lamp emits ultraviolet rays with wavelengths between 240 nm and 280 nm. Since the wavelength range between 240 nm and 280 nm is the ray range with the highest effect on microorganisms, the microbiological load of the water is effectively reduced before being sent to the tub (2).

[0019] In an embodiment of the present invention, the sterilization unit (9) is an ultrasonic transducer.

[0020] In an embodiment of the present invention, the washing machine (1) comprises a circulation pump (11) that is situated on the supply line (7) and that enables the water to be circulated between the reservoir (6) and the filtration unit (4), and the sterilization unit (9) is disposed between the circulation pump (11) and the filtration unit (4).

[0021] In an embodiment of the present invention, the washing machine (1) comprises a rinsing water line (12) that transfers hard water from the reservoir (6) to the tub (2). Thus, receiving additional water from the water mains is not necessary for the laundry rinsing process and water saving is provided.

[0022] In the washing machine (1) of the present invention, water must be kept inside the filtration unit (4) in order to prevent the occurrence of capillary cracks on the surface of the membrane-shaped filtration unit (4) due to humidity deficiency. Moreover, water may stay inside the filtration unit (4) during a power shortage or washing steps. By means of the sterilization unit (9), the water kept inside the filtration unit (4) is sterilized before being taken into the tub (2), the laundry is enabled to be efficiently cleaned and generation of microorganism-based bad odor is prevented.

Claims

1. A washing machine (1) comprising a tub (2), at least one water inlet valve (3) that enables water intake into the tub (2) from the water mains (S), a cross-flow type filtration unit (4) that provides the removal of the hardness of water by passing the mains water through a filter (F), a soft water line (5) that provides delivering of the water removed of hardness in the filtration unit (4) to the tub (2), a reservoir (6) that is connected to the water inlet valve (3), a supply line (7) that enables the water to be circulated between the reservoir (6) and the filtration unit (4) and that delivers water from the reservoir (6) to the filtration unit (4), and a return line (8) that enables the hard water running down from the filter (F) by flowing together with the substances trapped on the surface of the filter (F) in the filtration unit (4) to be transferred to the reservoir (6),
characterized by at least one sterilization unit (9) that enables the water kept in the filtration unit (4) to be sterilized and
wherein the sterilization unit (9) is situated on the supply line (7) and is disposed at the inlet of the filtration unit (4) and/or
wherein the sterilization unit (9) is situated on the soft water line (5) and is disposed at the outlet of the filtration unit (4),
and in case that the sterilization unit (9) is situated on the soft water line (5), the washing machine (1) is further **characterized by** a control unit (10) that activates the sterilization unit (9) for a predetermined sterilization time (t_s) if the time the water is kept inside the filtration unit (4) (t_b) is longer than a predetermined water waiting time (t_{bset}).

2. A washing machine (1) as in any one of the above claims, **characterized by** the sterilization unit (9) which is an ultraviolet lamp.

3. A washing machine (1) as in any one of the above claims, **characterized by** the sterilization unit (9) which is an ultrasonic transducer.

4. A washing machine (1) as in any one of the above claims, **characterized by** a circulation pump (11) that is situated on the supply line (7) and that enables the water to be circulated between the reservoir (6) and the filtration unit (4), and the sterilization unit (9) that is disposed between the circulation pump (11) and the filtration unit (4).

5. A washing machine (1) as in any one of the above claims, **characterized by** a rinsing water line (12) that transfers hard water from the reservoir (6) to the tub (2).

Patentansprüche

1. Waschmaschine (1) umfassend eine Wanne (2), mindestens ein Wassereinlassventil (3), das die Wasseraufnahme aus der Wasserleitung (S) in die Wanne (2) ermöglicht, eine Querstromtyp-Filtrationseinheit (4), die das Entfernen der Wasserhärte durch das Leiten des Leitungswassers durch einen Filter (F) ermöglicht, eine Weichwasser-Leitung (5), die das Abgeben des Wassers, das von dessen Härte in der Filtrationseinheit (4) entfernt ist, an die Wanne (2) vorsieht, ein Reservoir (6), das mit dem Wassereinlassventil (3) verbunden ist, eine Versorgungsleitung (7), die es ermöglicht, dass das Wasser zwischen dem Reservoir (6) und der Filtrationseinheit (4) zirkuliert und Wasser von dem Reservoir (6) zu der Filtrationseinheit (4) liefert, und eine Rückführleitung (8), die es ermöglicht, dass das von dem Filter (F) herabfließende harte Wasser zusammen mit den auf der Oberfläche des Filters (F) in der Filtrationseinheit (4) eingeschlossenen Substanzen in das Reservoir (6) übertragen wird,
gekennzeichnet durch eine Sterilisationseinheit (9), die es ermöglicht, dass das in der Filtrationseinheit (4) gehaltene Wasser sterilisiert wird und
wobei die Sterilisationseinheit (9) sich auf der Versorgunsleitung (7) befindet und am Einlass der Filtrationseinheit (4) angeordnet ist und/oder
wobei die Sterilisationseinheit (9) sich auf der Weichwasser- Leitung (5) befindet und am Auslass der Filtrationseinheit (4) angeordnet ist,
und für den Fall, dass sich die Sterilisationseinheit (9) in der Weichwasser-Leitung (5) befindet, ist die Waschmaschine (1) weiterhin **gekennzeichnet durch** eine Steuereinheit (10), die die Sterilisationseinheit (9) für eine vorbestimmte Sterilisationszeit aktiviert (t_s) wenn die Zeit, in der das Wasser in der Filtrationseinheit (4) (t_b) gehalten wird, länger als eine vorbestimmte Wasserwartezeit (t_{bset}) ist.

2. Waschmaschine (1) nach einem der vorangehenden Ansprüche, **gekennzeichnet durch** eine Sterilasitionseinheit (9), die eine Ultravioletlampe ist.

3. Waschmaschine (1) nach einem der vorangehenden Ansprüche, **gekennzeichnet durch** eine Sterilasitionseinheit (9), die ein Ultraschallwandler ist.

4. Waschmaschine (1) nach einem der vorangehenden Ansprüche, **gekennzeichnet durch** eine Umwälzpumpe (11), die sich auf der Versorgungsleitung (7) befindet und die Zirkulation des Wassers zwischen dem Reservoir (6) und der Filtration ermöglicht und eine Filtrationseinheit (4), und eine Sterilisationseinheit (9), die zwischen der Umwälzpumpe (11) und der Filtrationseinheit (4) angeordnet ist.

5. Waschmaschine (1) nach einem der vorangehenden

Ansprüche, **gekennzeichnet durch** eine Spülwasserleitung (12), das hartes Wasser aus dem Reservoir (6) in die Wanne (2) überträgt.

Revendications

1. Machine à laver (1) comprenant une cuve (2), au moins une soupape d'admission d'eau (3) permettant l'entrée d'eau dans la cuve (2) depuis le réseau d'eau (S), une unité de filtration à flux transversal (4) cela permet d'éliminer la dureté de l'eau en faisant passer l'eau du réseau à travers un filtre (F), une conduite d'eau douce (5) qui fournit l'eau enlevée de dureté dans l'unité de filtration (4) à la cuve (2), un réservoir (6) relié à la soupape d'admission d'eau (3), une conduite d'alimentation (7) qui permet à l'eau de circuler entre le réservoir (6) et l'unité de filtration (4) et qui fournit de l'eau du réservoir (6) à l'unité de filtration (4), et une conduite de retour (8) permettant à l'eau dure qui s'écoule du filtre (F) de s'écouler avec les substances piégées sur la surface du filtre (F) dans l'unité de filtration (4) à transférer dans le réservoir (6),
caractérisé par au moins une unité de stérilisation (9) permettant de stériliser l'eau conservée dans l'unité de filtration (4) et
dans lequel l'unité de stérilisation (9) est située sur la conduite d'alimentation (7) et est disposée à l'entrée de l'unité de filtration (4) et / ou
dans lequel l'unité de stérilisation (9) est située sur la conduite d'eau douce (5) et est disposée à la sortie de l'unité de filtration (4),
et dans le cas où l'unité de stérilisation (9) est située sur la conduite d'eau douce (5), la machine à laver (1) est en outre **caractérisée par** une unité de commande (10) qui active l'unité de stérilisation (9) pendant un temps de stérilisation prédéterminé (t_s) si le temps que l'eau est maintenue à l'intérieur de l'unité de filtration (4) (t_b) est plus long qu'un temps d'attente d'eau prédéterminé (t_{bset}).

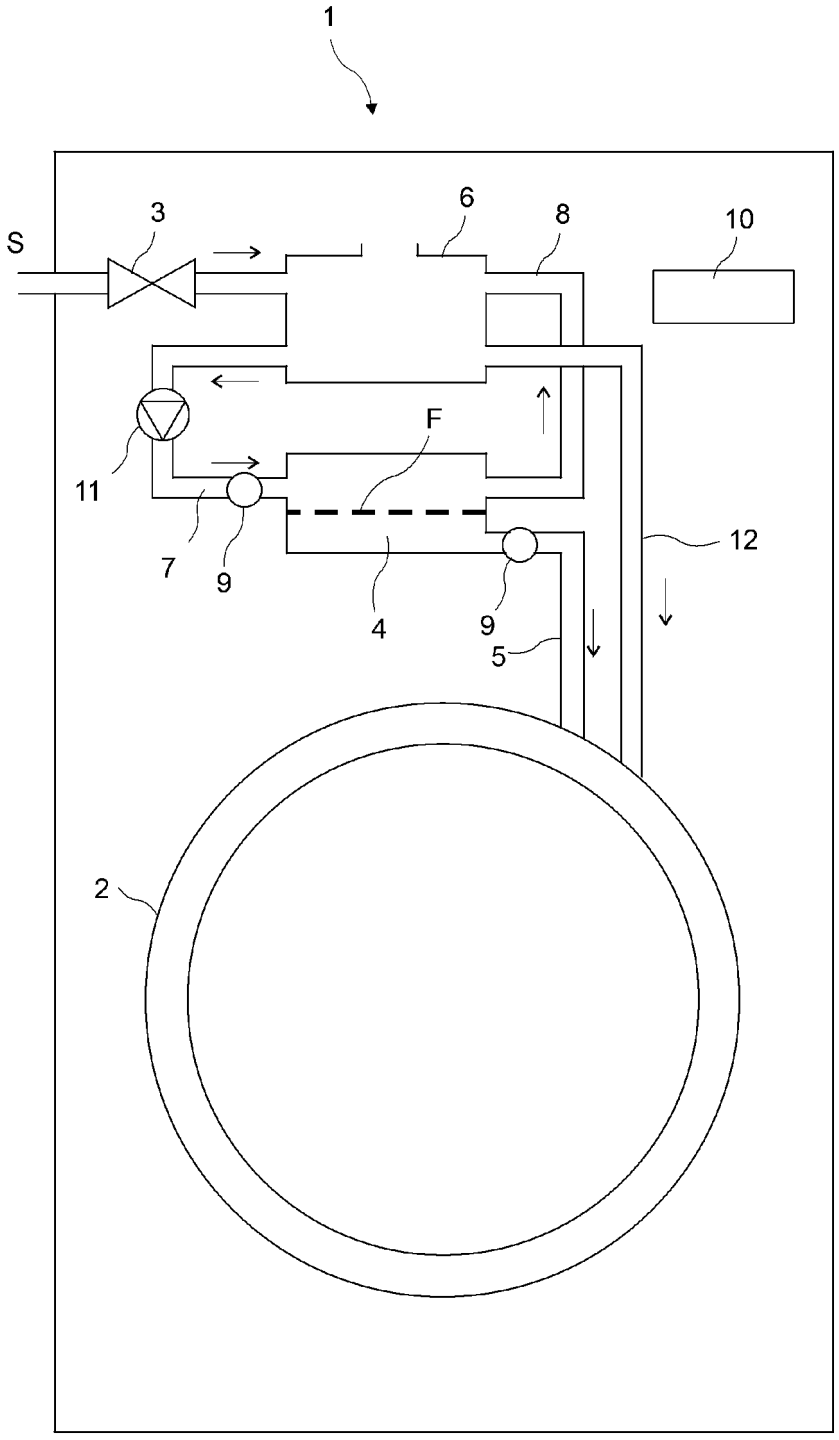
2. Machine à laver (1) selon l'une quelconque des revendications précédentes, **caractérisée par** l'unité de stérilisation (9) qui est une lampe à ultraviolets.

3. Machine à laver (1) selon l'une quelconque des revendications précédentes, **caractérisée par** l'unité de stérilisation (9) qui est un transducteur à ultrasons.

4. Machine à laver (1) selon l'une quelconque des revendications précédentes, **caractérisée par** une pompe de circulation (11) située sur la conduite d'alimentation (7) et permettant la circulation de l'eau entre le réservoir (6) et l'unité de filtration (4), et l'unité de stérilisation (9) qui est disposée entre la pompe de circulation (11) et l'unité de filtration (4).

5. Machine à laver (1) selon l'une quelconque des revendications précédentes, **caractérisée par** une conduite d'eau de rinçage (12) qui transfère l'eau dure du réservoir (6) à la cuve (2).

Figure 1



REFERENCES CITED IN THE DESCRIPTION

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- WO 2013000839 A1 **[0003]**