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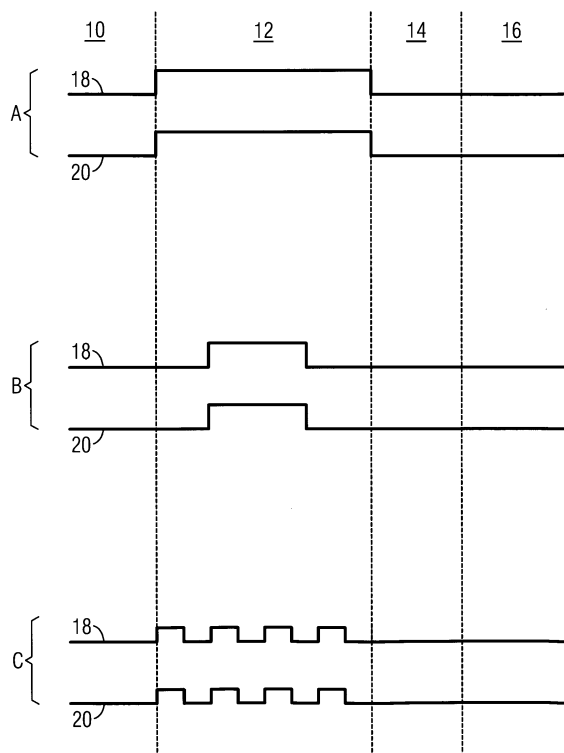
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(54) **A method for performing a rinse cycle during a washing process in a washing machine**

(57) The present invention relates to a method for performing a rinse cycle during a washing process in a washing machine. The rinse cycle comprises the steps of loading water into a washing tub containing laundry, moving the laundry within the washing tub, recirculating the water in a recirculation circuit, and irradiating the water with ultraviolet light within the recirculating circuit and outside the washing tub. Further, the present invention relates to a corresponding washing machine.

FIG 1



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Description

[0001] The present invention relates to a method for performing a rinse cycle during a washing process in a washing machine according to the preamble of claim 1. Further, the present invention relates to a washing machine according to the preamble of claim 12.

[0002] In a conventional washing machine the hygiene is obtained by a relative high temperature, detergent and/or additives, e.g. bleaching agents. Changes in the behaviour of the user and in the washing processes require alternative hygiene solutions. In particular, the washing at a low temperature and/or the use of detergents free of bleaching require special methods for obtaining sufficient hygienic results.

[0003] It is known that the hygiene effect can be obtained by an ultraviolet (UV) lamp. The use of UV light is an effective non-chemical treatment to disinfect water, air and surfaces. It is widely used in commercial and industrial applications.

[0004] DE 43 42 049 A1 discloses a washing machine with an UV light source. The UV light source is arranged within the recirculation circuit. Thus, only the water within the recirculation circuit is irradiated by UV light. The laundry itself is not directly exposed to the UV light.

[0005] It is an object of the present invention to provide an improved method for performing a rinse cycle during a washing process in a washing machine, which allows the application of further operation modes.

[0006] The object of the present invention is achieved by the method according to claim 1.

[0007] According to the present invention during the rinse cycle, the water is irradiated with ultraviolet light within the re-circulating circuit and outside the washing tub.

[0008] Further, the moving of the laundry is interruptible and/or disengageable during the rinse cycle by the user and/or by a washing programme.

[0009] An additional idea of the method according to the present invention is the possibility that the movement of the laundry within the washing tub can be interrupted or switched off, wherein the rinse water in the recirculation circuit is treated by UV light. The present invention allows further operation modes. The laundry can stay soaked within a washing drum, since the rinse water is disinfected by the UV light in the recirculation circuit at the same time. The washing process can be interrupted for a relative long time.

[0010] According to a preferred embodiment of the present invention the rinse cycle is a part of an interruptible washing programme, wherein the movement of the laundry within the washing tub is deactivated and the laundry stays soaked in the water. The washing process can be interrupted without or with reduced reproduction of bacteria.

[0011] In a similar way, the rinse cycle may be a part of a night washing programme, wherein the movement of the laundry within the washing tub is deactivated, the

laundry stays soaked in the water and a spinning phase deactivated. The washing process can be interrupted over night, so that the loud high speed spinning phase can be avoided.

[0012] For example, the laundry is moved by a rotatable washing drum arranged within the washing tub.

[0013] Preferably, the recirculation circuit is driven by at least one recirculation pump. Further, the ultraviolet light is generated by at least one electric ultraviolet light source.

[0014] According to a preferred embodiment of the present invention the ultraviolet light source and the recirculation pump are activated and/or deactivated synchronously. This is an efficient way to save energy.

[0015] For example, the ultraviolet light source and the recirculation pump are activated and/or deactivated periodically.

[0016] In particular, during a rinse cycle of the washing process, a fabric conditioner is dosed at a predetermined time period after the rinse water has been loaded into the tub and before the drain pump is activated to drain the rinse water from the tub so that at least part of the rinse cycle is performed before the fabric conditioner is added. This improves the efficiency of the UV light source, since the fabric conditioner reduces the transparency of the water.

[0017] For said rinse cycle with fabric conditioner addition it is not necessary that the moving of the laundry is interruptible and/or disengageable.

[0018] Preferably the fabric conditioner is added during the last rinse.

[0019] Preferably, the fabric conditioner is dosed between five and fifteen minutes, preferably eight minutes, before the activation of the drain pump. This is the time for flushing a softener from the detergent drawer and mixing in an effective way said softener with the laundry.

[0020] At last, the present invention relates to a washing machine with a recirculation circuit for rinse water and an ultraviolet light source within the recirculating circuit and outside the washing tub, wherein said washing machine is provided for a method as described above.

[0021] The novel and inventive features believed to be the characteristic of the present invention are set forth in the appended claims.

[0022] The invention will be described in further detail with reference to the drawings, in which

FIG 1 illustrates a schematic diagram of three examples of a rinse cycle according to a preferred embodiment of the present invention, and

FIG 2 illustrates a schematic diagram of a last rinse cycle according to the preferred embodiment of the present invention.

[0023] FIG 1 illustrates a schematic diagram of three examples of a rinse cycle according to a preferred embodiment of the present invention. The rinse cycle is a

part of a washing process in a washing machine. Typically the washing process includes an optional pre-washing cycle, a washing cycle and one or more rinse cycles.

[0024] The rinse cycle includes a first phase 10, wherein water is loaded into a washing tub. During a second phase 12 the water is re-circulated into the tub via a recirculation circuit. In a third phase 14 the water is drained off from the washing tub by activating a drain pump. A forth phase is a spinning phase wherein the drain pump remains activated.

[0025] As it well known in the art, the recirculation circuit fluidly connect two different portions of the tub to improve the mixing of the water and laundry.

[0026] The washing machine comprises a recirculation circuit with an UV light source. The UV light source is arranged out of the washing tub. In FIG 1 the recirculation pump and the UV light source are always activated and deactivated synchronously. In general, the recirculation pump and the UV light source may be activated and deactivated at different times.

[0027] According to example A of FIG 1 the recirculation pump and the UV light source are activated during the whole second phase 12.

[0028] According to example B of FIG 1 the recirculation pump and the UV light source are activated during a central third of the second phase 12.

[0029] According to example C of FIG 1 the recirculation pump and the UV light source are activated and deactivated four times in each case during the second phase 12. The activated and deactivated periods have the same lengths.

[0030] At least one of the rinse steps of the washing programme is performed according to FIG. 1. The irradiation of the water with UV light allows a reduction of bacteria and microorganisms from washed laundry through the disinfection of the water passing in the recirculation circuit by the means of a treatment unit provided with a germicidal UV source.

[0031] The inventive method is suitable for low temperature cycles and cold temperature cycles. The corresponding temperatures do not allow a disinfection of the rinse water, but the UV light disinfects the water.

During the second phase 12 the washing tub is always filled with water. In the second phase 12 the laundry is either moved within the washing tub or stays soaked in the water. The motion of the laundry is performed by a washing drum arranged within the washing tub. The motion of the laundry can be activated and deactivated by a washing programme or manually by the user.

[0032] FIG 2 illustrates a schematic diagram of a last rinse cycle according to the preferred embodiment of the present invention. During the last rinse cycle typically a fabric conditioner is dosed.

[0033] The first phase 10 of the last rinse cycle runs without dosing fabric conditioner. In the first phase 10 only an electric valve for water loading is activated. An electric valve for conditioner loading, the recirculating pump and the UV light source are deactivated during the

first phase 10.

[0034] At the beginning of the second phase 12 of the last rinse the recirculating pump and the UV light source are activated so that at least a part of the second phase 12 is performed before the fabric conditioner is added to the water. During the second phase 12 of the last rinse the laundry is moved. At a later time interval of the second phase 12 the electric valve for conditioner loading is activated, so that the conditioner is dosed some minutes before the activation of the drain pump, i.e. some minutes before commencing of draining phase 14.

[0035] Preferably, the valve for conditioner loading is activated about 5-15 minutes before activation of the drain pump. Highly preferably the valve for conditioner loading is activated about eight minutes before activation of the drain pump. This is the time required to flush the conditioner (for example softener) from the detergent drawer, for the softener to reach and effectively mix with laundry and take effect. This improves the efficiency of the UV light source, since the conditioner contributes to reduce water transparency and thus the penetration of the germicidal UV radiation.

[0036] The UV light source can either be activated or deactivated after the conditioner dosage. Preferably, the UV light source is activated at this stage. Preferably the part of the second phase 12 performed without conditioner, i.e. before adding the conditioner to the water, is prolonged to a minimum of 20 minutes.

Also longer durations can be used as well, resulting in an improved bacteria reduction. For example, 20 minutes are intended as the time before supplying the conditioner, i.e. 20 minutes only with water and without any conditioner in order to eliminate bacteria and microorganisms contained in the laundry.

[0037] Preferably to improve the efficiency of the UV light source the washing drum should contain the half load.

[0038] Preferably, the level of water in the washing drum is high during the washing and/or rinsing cycle, when the UV light source is activated. It is to be intended in the sense that the amount of water is greater than the normal amount in the washing tub for the specific cycle selected by the user. Each cycle has its specific amount of rinse water, which depends on the types of textile and the amount. For example, the amount of rinse water for sanitization purpose is from 5% to 15% greater than the amount normally used for same cycle without anti-bacterial UV light treatment.

[0039] An intermediate spinning phase of low intensity may be performed. Alternatively, the spinning phase is omitted. The bacteria behave as solid particles, so that a high centrifugal force sticks the bacteria to the laundry, if the spinning phase of high intensity is performed.

[0040] During the draining phase 14 and the spinning phase 16 the electric valve for water loading, the electric valve for conditioner loading, the recirculating pump and the UV light source are deactivated.

[0041] The rinse cycle described above can be applied

at temperatures equal as or lower than 40 °C. This temperature is used for cotton, delicates, synthetics, wool and for special cycles such as baby, technical and in particular Sensitive and Sensitive Plus cycles.

[0042] Further, the rinse cycle described above can be applied for new cold cycles at a temperature of about 20 °C, preferably in combination with new generation of special detergents.

[0043] A rinse hold cycle or night cycle can be selected by the consumer. During said night cycle the movement of the laundry in interrupted in the second phase 12, so that the laundry remains in the water until next morning. In this case the high speed spinning phase can be skipped for noise reasons. The laundry can stay soaked, since the water is recirculated and treated by UV light.

[0044] 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.

List of reference numerals

[0045]

- 10 water loading
- 12 movement or hold phase
- 14 draining phase
- 16 spinning phase
- 18 status of the recirculating pump
- 20 status of UV light source
- 22 status of the valve for water loading
- 24 status of the valve for conditioner loading

- A first example
- B second example
- C third example

Claims

1. A method for performing a rinse cycle during a washing process in a washing machine comprising a drum rotatably arranged inside a tub, wherein the rinse cycle comprises the following steps:
 - loading water into a washing tub containing laundry,
 - moving the laundry within the washing tub,
 - recirculating the water in a recirculation circuit,
 - **characterized by**
 - irradiating the water with ultraviolet light within the recirculating circuit and outside the washing

tub.

2. The method according to claim 1, wherein the moving of the laundry is interruptible and/or disengageable during the rinse cycle by the user and/or by a washing programme.
3. The method according to claim 1 or 2, **characterized in, that** the rinse cycle is a part of an interruptible washing programme, wherein the movement of the laundry within the washing tub is deactivated and the laundry stays soaked in the water.
4. The method according to claim 2 or 3, **characterized in, that** the rinse cycle is a part of a night washing programme, wherein the movement of the laundry within the washing tub is deactivated, the laundry stays soaked in the water and a spinning phase is deactivated.
5. The method according to any one of the preceding claims, **characterized in, that** the recirculation circuit is driven by at least one recirculation pump.
6. The method according to any one of the preceding claims, **characterized in, that** the ultraviolet light is generated by at least one ultraviolet light source.
7. The method according to claim 5 and 6, **characterized in, that** the ultraviolet light source and the recirculation pump are activated and/or deactivated synchronously.
8. The method according to claim 5 and 6, **characterized in, that** the ultraviolet light source and the recirculation pump are activated and/or deactivated periodically.
9. The method according to any one of the preceding claims, **characterized in, that** a fabric conditioner is dosed during the rinse cycle at a predetermined time period after the rinse water has been loaded into the tub and before the activation of a drain pump to drain the water from the tub so that at least part of the rinse cycle is performed before the fabric conditioner is added to the water.
10. The method according to claim 9, **characterized in, that** the fabric conditioner is dosed during the last rinse cycle of the washing program.

11. The method according to claim 9 or 10,

characterized in, that

the fabric conditioner is dosed between five and fifteen minutes, preferably eight minutes, before the activation of a drain pump.

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12. A washing machine with a recirculation circuit for rinse water and an ultraviolet light source within the recirculating circuit and outside the washing tub,

characterized in, that

the washing machine is provided for a method according to any one of the claims 1 to 11.

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FIG 1

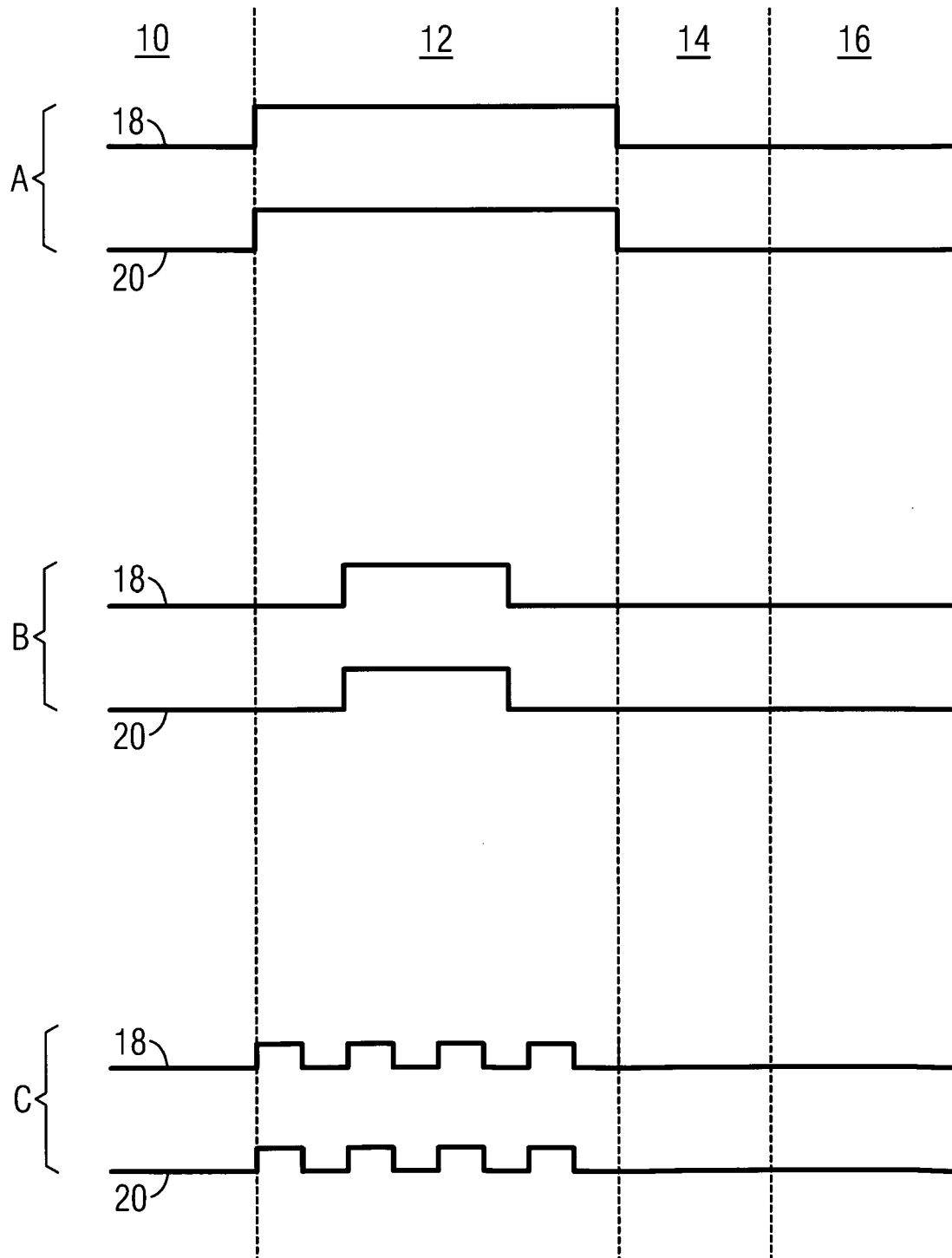
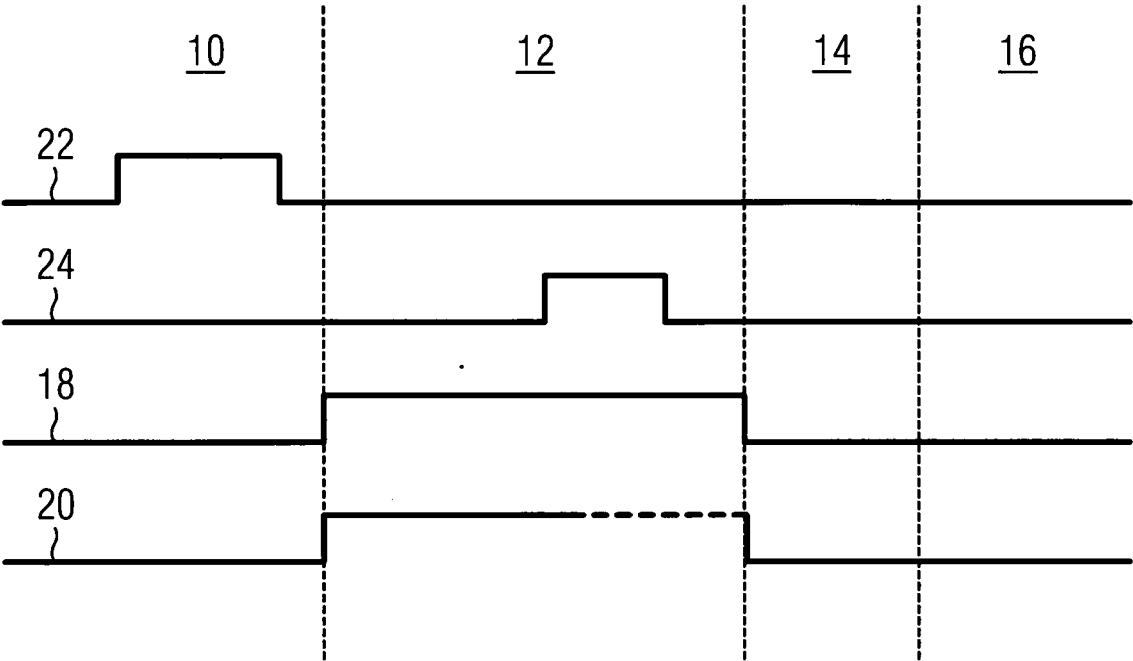


FIG 2





EUROPEAN SEARCH REPORT

Application Number
EP 09 01 3194

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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
Munich		23 April 2010	Kising, Axel
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)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 01 3194

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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23-04-2010

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REFERENCES CITED IN THE DESCRIPTION

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