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(54) Process for washing with a washing machine, or the like and washing machine for implementing the said process

(57) A process for washing with a washing machine or the like comprises alternating phases of agitation and stoppage of agitation of the laundry in the washing mixture and a contemporaneous phase of heating of the washing mixture (M). The process provides to vary the ratio between the agitation phases (A) and the stoppage of agitation phases (S) in correspondence with the variation in the time required to heat the washing mixture (M) to the pre-set temperature. According to the invention the above ratio is varied alternately or in combination on the basis of the variations of the supply voltage from the rated voltage and on the basis of the variation of the temperature in the wash tub (1), in the unit of time, i.e. on the basis of the temperature gradient with respect to time.

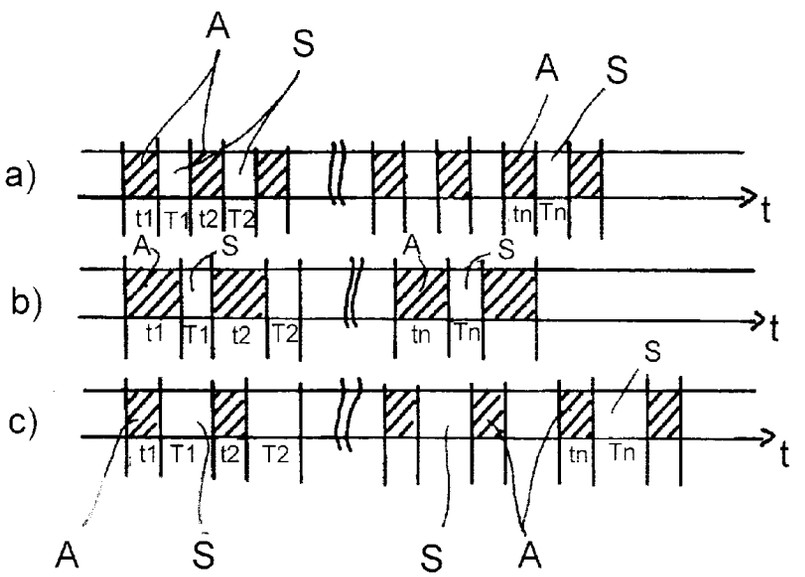

Fig. 4

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Description

The invention relates to a process for washing with a washing machine comprising alternating phases of agitation and of stoppage of agitation of the laundry in the washing mixture and a contemporaneous phase of heating the washing mixture and in which the ratio between the agitation phases and the stoppage of agitation phases is varied in correspondence with the variation in the time required to heat the washing mixture to the pre-set temperature.

Processes of this type are currently known in which the ratio between the duration of the agitation phases and the duration of the stoppage phases is varied by shortening and lengthening the said stoppage phases and keeping the duration of the agitation phases unchanged.

In the known processes, the variation in the duration of the heating phase is detected thanks to the measurement of the variation of the actual mains voltage with respect to the rated voltage.

Although variations in supply voltage constitute the main cause of the variations in the duration of the heating phase, there are other effects, also relatively frequent, which may cause variations in the duration of the heating phase even where the supply voltage corresponds to the rated voltage.

The object of the invention is to provide a process of the type described above in such a way as to remedy the disadvantages of the known processes, by enabling a constant washing efficiency and a correct stressing of the components, particularly the motor of washing machines and a consequent improved utilization of the energy consumed by the said process, to be obtained.

The invention achieves these objects with a process of the type described above, in which the ratio between the duration of the agitation phases and the duration of the stoppage of agitation phases is varied alternately or in combination on the basis of the variations of the supply voltage from the rated voltage and on the basis of the variation in the temperature of the washing mixture in the unit of time, i.e. on the basis of the gradient of the temperature of the washing mixture with respect to time.

This arrangement allows account to be taken of effects which influence the duration of the heating phase and which are independent of the variations in the supply voltage, such as, for example and in particular, a reduction in the heating efficiency of the heating means due, for example, to the deposit thereon of encrustations such as limescale or the like or such as tolerances and differences in the resistance of the heating means.

A reduction of the rated value of the supply voltage thus has the same effect as a loss of efficiency of resistance and in the known washing machines both these effects cause an extension of the washing time with a consequent greater outlay of energy, overheating of the motor's windings and reduced washing efficiency.

An increase in the supply voltage is equivalent to electrical heating means with a resistance of a value lower than the rated one [which] cause a reduction of the heating times with a consequent reduction of the washing times and with a reduced washing efficiency.

The process according to the invention enables the deviations from which the known processes suffer to be compensated, in particular by detecting both the rated supply voltage and the variation per unit of time of the temperature of the washing mixture it is possible to determine the variation in the duration of the heating phase and hence appropriately correct the ratio between the duration of the agitation phases and the duration of the stoppage of agitation phases, all in such a way that the washing efficiency remains constant.

According to an embodiment the process provides to increase the duration of the agitation phase, i.e. the duration of the condition of rotation of the motor, with respect to the duration of the stoppage phase when the temperature rises more rapidly than provided for by the design and/or when the actual supply voltage is higher than the rated supply voltage, whereas when the temperature of the washing mixture, i.e. the temperature in the wash tub, rises less rapidly than provided for by the design and/or when the actual supply voltage is lower than the rated voltage, the duration of the stoppage of agitation phases between two successive agitation phases is increased in correspondence with the longer duration of the wash cycle.

The above advantages thus consist of the fact that it is possible to use motors of lower power than that which would be required if account had to be taken of extensions of the duration of the washing process with respect to a rated duration set by the design, to obtain a constant washing efficiency, with less wear on the fabrics washed and less energy consumption in anomalous operating conditions.

The invention also relates to a device for implementing the above process, i.e. a washing machine which provides means for programming the wash cycles, particularly the operation of the motor and the starting of the heater, means for detecting the actual supply voltage and for comparing it with a pre-set rated voltage value and means for detecting the actual temperature gradient, or the variation over time of the temperature in combination with means for comparing the said actual gradient with a rated gradient which is also pre-settable.

The above-mentioned means may be of any type. In particular, the device according to the invention can easily be produced when the means for operating the motor are constituted by motor speed control means of the type with microprocessor, in that such means may be directly used by connecting the means for detecting the actual voltage and the temperature gradient to them.

The sub-claims relate to further improvements.

The characteristics of the invention and the advantages deriving therefrom will emerge from the description which follows of a non-exhaustive embodiment

shown in the accompanying drawings, in which:

Fig. 1 shows a block diagram of the device for implementing the method according to the prsent invention.

Figs. 2 and 3 show two variants of the means for detecting the actual supply voltage.

Fig. 4 shows a diagram of the duration of the phases of operation and stoppage of the motor in conditions in which the actual voltage is identical to, higher than and lower than the rated voltage.

With reference to Fig. 1, a washing machine capable of carrying out a laundry washing process of the type according to the invention and corresponding to that of Fig. 4 has a rotary basket 1 in a container 2 for the washing mixture M. The basket 1 is provided with holes for the passage of the washing mixture inside it and is set in rotation by an electric motor 3 thanks to a transmission 4, for example. Associated with the container 2 for the washing mixture M are a supply union 5 for the water or the washing mixture, provided with an on/off solenoid valve 6, a discharge union 7 for the washing mixture M and for the rinse water, also with an on/off solenoid valve 8; means for heating the washing mixture, for example and generally a coil 9; at least one temperature sensor 10 of the washing mixture M in the container 2 and at least one level sensor 11 of the washing mixture M in the container 2.

The above-mentioned means are connected to a control unit which is produced in such a way as to permit the performance of pre-set wash programmes. The control unit 12 may be of the electromechanical type, or electronic, or the like. The outputs of the temperature and level sensors 10, 11 and the control or supply lines of the motor 3, the heating coil 9 and the solenoid valves 6, 8 are connected to it.

The control unit 12 is supplied from the mains voltage and also has means for setting and/or selecting the programmes and for displaying the options to be selected or preselected which are denoted overall by 13 in Fig. 5.

In order to take account of the variations in supply voltage which cause the extensions and reductions of the heating time of the washing mixture M, means 14 for measuring the said mains voltage are associated with the control unit 12, the so-called programmer.

The said means may be of any type. Preferably they are of electronic type, as is the control unit 12, i.e. the programmer, also. In particular the said measuring means are constituted by or comprise a microprocessor which verifies the variation in supply voltage with respect to a pre-set rated value and with reference to which the wash programmes have been calibrated. Preferably the microprocessor is constituted by the control microprocessor with speed control of the motor 3.

A memory 15 in which is loaded a program for processing and transforming the variations of the heating time into variations in the stoppage of agitation phases of the wash cycle may be associated with the microprocessor 14. This may take place thanks to a specific algorithm, or also on the basis of a table empirically determined and stored in the memory 15 of the microprocessor.

Furthermore, means 16 for setting, modifying, updating and/or displaying protocols of correlation between variations in the heating time and variations in the duration of the stoppage of agitation phases or in the rated voltage value provided may be associated with the microprocessor 14.

The microprocessor 14 connected to the programmer 12 modifies its control parameters so as to obtain the variations in the duration of the stoppage of agitation phases caused by the variations in the heating times, i. e. in the supply voltage.

To allow account to be taken of the variations in the duration of the phases of heating to the pre-set working temperature, the assembly made up of microprocessor 14 or programmer 12 and the temperature sensor 10 constitute a detector of the temperature gradient of the washing mixture with respect to time, or of the speed at which the said mixture heats up. This detector is useful also for taking account of extensions or reductions of the wash cycle which are independent of the variations in the supply voltage.

In this case, the rate of heating, or the temperature gradient with respect to time, is determined by measuring the temperature of the washing mixture at regular time intervals and using at least two measurements to determine the temperature variation per unit of time. The frequency of measurement may be varied in the context of suitable values so that a temperature difference may be introduced in the said system.

The rate of heating of the washing mixture is then compared in the programmer 12 or optionally also in the microprocessor 14, both of which can be suitably programmed with a rated value and in the event of deviations therefrom, the ratio between the duration of the agitation phase and the duration of the stoppage phase is varied.

Figs. 2 and 3 show two practical variants of the means for detecting the mains voltage.

In the case of Fig. 2 the circuit comprises means for dividing the supply voltage which are constituted by resistors R1 and R2 for the purpose of reducing the voltage to a value which can be read by the microprocessor. In particular, the voltage value is supplied to the microprocessor by means of an analogue digital converter. The altered mains voltage is rectified and stabilized thanks to the diode D1, the resistor R3 and the capacitor C1.

In the embodiment of Fig. 3, the diode D1 provides to cut the negative half-wave whereas the voltage divider constituted by the resistors R1, R2 provides to divide

and reduce the amplitude of the positive half-wave. In this case, the microprocessor carries out the reading of the peak value by synchronizing on the crossing point 0.

Other types of sensors of the variation in the supply voltage of the washing machine are obviously also possible.

Fig. 4 shows the process according to the invention in the form of an operating diagram of the device described above.

When the temperature rises at a rate identical to the pre-set rate and when the supply voltage detected is substantially identical to the rated voltage provided for by the design, the agitation phases A are intercalated in stoppage phases (S) according to diagrams of pre-set distribution and duration.

When either the supply voltage drops or the heating rate, i.e. the increase in the temperature of the washing mixture over time, is less rapid, the duration of the phases of agitation, or of movement of the motor, is kept constant whereas the stoppage of agitation phases are extended. This can be seen in Fig. 4 c in which t1 to tn denote the durations of the agitation phases and T1 to Tn the durations of the stoppage of agitation phases.

When, on the other hand, the supply voltage is higher than the rated voltage and/or the temperature of the washing mixture rises more rapidly than the increase per unit of time provided for by the design, the durations of the phases of agitation, i.e. of operation of the motor, are extended whereas the durations of the stoppage of agitation phases are kept constant as shown in Fig. 4b.

Finally, Fig. 4c shows the operating condition in the condition in which the supply voltage is identical to the rated voltage and the increase in the temperature of the washing mixture over time is identical to the value set by the design.

In all three cases, the total motor operation time t1lt2l...ltn remains constant, in that in the case of Fig. 4b, the overall duration of the wash cycle would be shorter than that provided for in optimum conditions, the pre-set temperature being reached first, so that the shortening of the total agitation time is compensated with an extension of the duration of the agitation phases, whereas in the case of Fig. 4c, the pre-set temperature is reached later and so the wash cycle is extended and this longer duration and the consequent longer duration of the overall time of operation of the motor, i.e. of agitation, is compensated by an increase in the duration of the stoppage of agitation phases in the context of the said wash cycle.

The invention is not, of course, limited to the embodiments described and illustrated but may be widely varied, above all structurally, without thereby abandoning the guiding principle described above and claimed below.

Claims

1. Process for washing with a washing machine or the like comprising alternating phases of agitation and stoppage of agitation of the laundry in the washing mixture and a contemporaneous phase of heating of the washing mixture (M) and in which the ratio between the agitation phases (A) and the stoppage of agitation phases (S) is varied in correspondence with the variation in the time required to heat the washing mixture (M) to the pre-set temperature, characterized in that the ratio between the duration (t1, t2, tn) of the agitation phases (A) and the duration (T1, T2, Tn) of the stoppage of agitation phases (S) is varied alternately or in combination on the basis of the variations of the supply voltage from the rated voltage and on the basis of the variation of the temperature of the washing mixture (M), or of the temperature in the wash tub (1), in the unit of time, i.e. on the basis of the temperature gradient with respect to time.

2. Process according to Claim 1, characterized in that it provides to vary the duration (t1, t2, tn) of the agitation phase (A) and/or the duration (T1, T2, Tn) of the stoppage of agitation phase (S) in relation respectively to the duration (T1, T2, Tn) of the stoppage of agitation phase (S) or to the duration (t1, t2, tn) of the agitation phase (A), keeping these latter preferably constant, all in such a way that the number of revolutions performed by the motor (3) in the wash cycle remains constant, or the sum of the durations (t1, t2, tn) of the agitation phases (A) remains constant with equal speed of rotation of the motor in the overall duration of the wash cycle which is correlated to the duration of the phase of heating the washing mixture, i.e. to the time required to reach a pre-set temperature in the wash tub (1).

3. Process according to Claims 1 or 2, characterized in that it provides to increase the duration (t1, t2, tn) of the agitation phase (A), i.e. the duration of the condition of rotation of the motor (3), with respect to the duration (T1, T2, Tn) of the stoppage phase (S) which is kept constant when the temperature rises more rapidly than provided for by the design and/or when the actual supply voltage is higher than the rated supply voltage, whereas when the temperature of the washing mixture (M), i.e. the temperature in the wash tub (1) rises less rapidly than provided for by the design and/or when the actual supply voltage is lower than the rated voltage, the duration (T1, T2, Tn) of the stoppage of agitation phases (S) intercalated between the agitation phases (A) is increased in correspondence with the longer duration of the wash cycle.

4. Device for implementing the process according to

one or more of the preceding Claims, i.e. a washing machine which comprises means (12, 14) for programming the wash cycles, particularly for operating the motor and starting the heater, means (18) for detecting the actual supply voltage and for comparing it with a pre-set rated voltage value (15, 16), characterized in that it further comprises means (10, 12, 14, 15, 16) for detecting the actual temperature gradient, or the variation in the temperature over time in combination with means for comparing the said actual gradient with a rated gradient which is also pre-settable.

5. Device according to Claim 4, characterized in that the means for programming and/or for operating the motor and the means for comparing the actual supply voltage and the actual temperature gradient with respect to the rated values provided for by the design are constituted by means of the type with microprocessor.

6. Device according to Claims 4 or 5, characterized in that a voltage divider circuit (18) is connected by means of an optional analogue digital converter to an input of the motor control microprocessor (14) or the wash programming microprocessor (12).

7. Device according to Claim 6, characterized in that the divider circuit comprises means for suppressing the negative half-wave of the supply voltage and means for dividing the peak voltage of the positive half-wave, the reading of the voltage on the part of the control microprocessor (14) of the motor (3) and/or programming microprocessor (12) being synchronized with the peak of the positive half-wave with reference to the passage from zero of the supply voltage or alternatively rectifying and/or stabilizing means.

8. Device according to one or more of the preceding Claims, characterized in that the means for detecting the temperature gradient with respect to time in the wash tub (1) are constituted by a temperature sensor (10) the reading of which is carried out (12, 14) at pre-set time intervals, i.e. with a pre-set frequency.

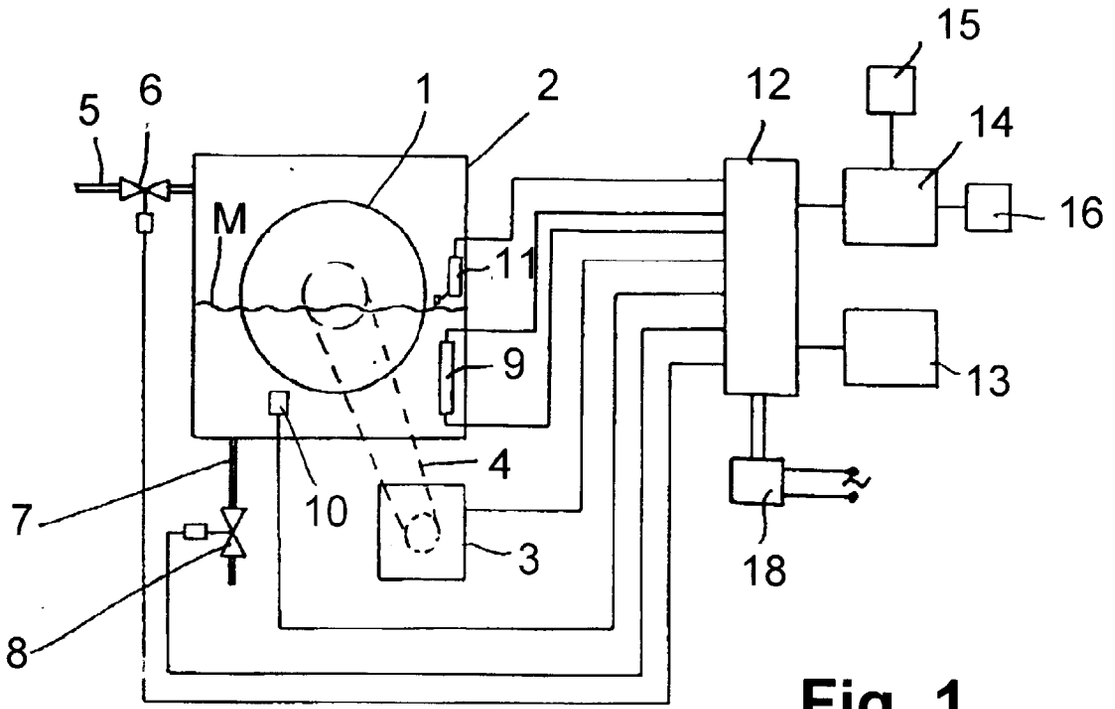


Fig. 1

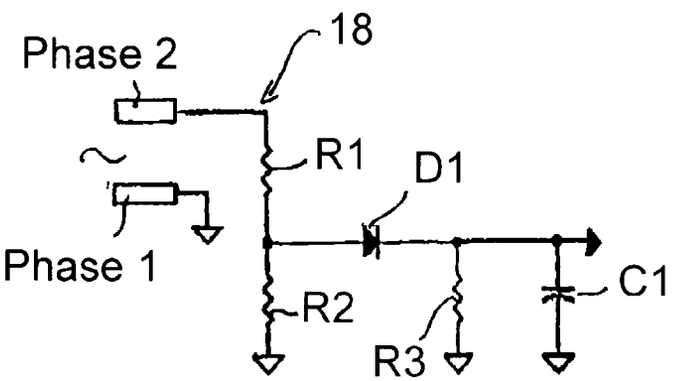


Fig. 2

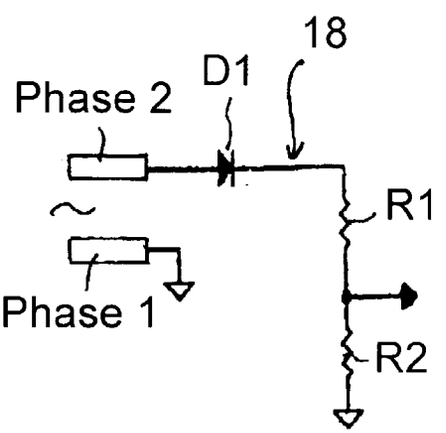
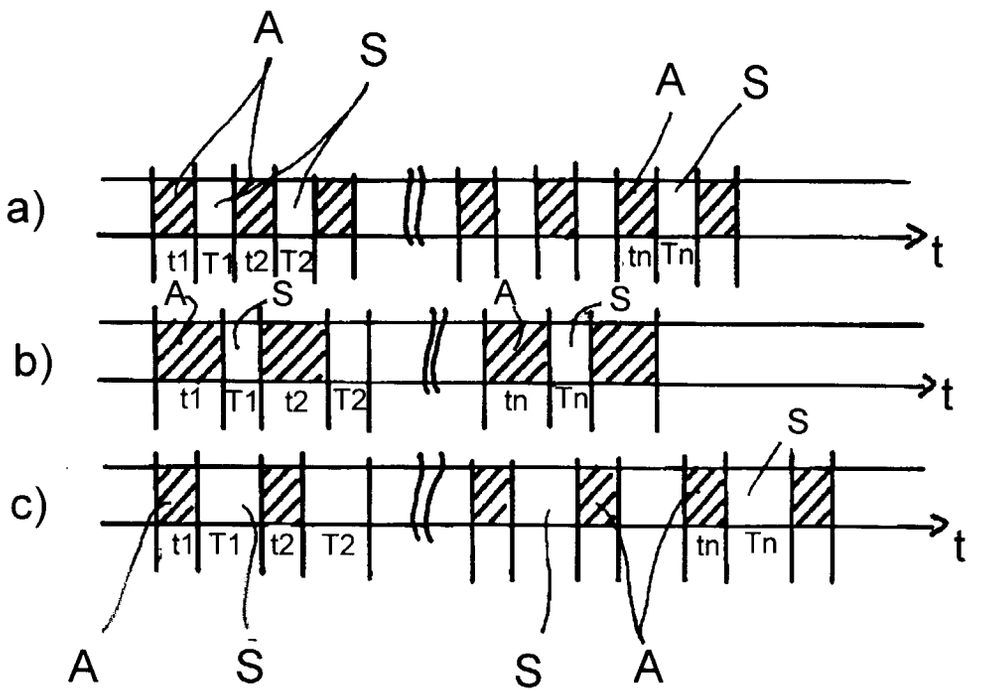


Fig. 3


A
S
A
S
a)
t1
T1
t2
T2
tn
Tn
t
A
S
A
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b)
t1
T1
t2
T2
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Tn
t
S
c)
t1
T1
t2
T2
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t
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Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 97 83 0538

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 542 599 A (CIAPEM) * the whole document * ---	1,5	D06F35/00
A	DE 14 10 157 A (KIENINGER & OBERGFELL KG) * claims; figures * ---	1	
A	DE 14 10 174 A (CONSTRUCTA-WERKE GMBH) * claims; figures * ---	1	
A	GB 2 269 825 A (KABUSHIKI KAISHA TOSHIBA) ---		
A	PATENT ABSTRACTS OF JAPAN vol. 015, no. 080 (C-0810), 25 February 1991 & JP 02 302296 A (SANYO ELECTRIC CO LTD), 14 December 1990, * abstract * -----		

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	9 February 1998	Courrier, G

CATEGORY OF CITED DOCUMENTS

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