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(54) **A WASHING MACHINE WHEREOF THE ENERGY CONSUMPTION AND WASHING PERFORMANCE IS OPTIMIZED**

WASCHMASCHINE MIT OPTIMIERTEN ENERGIEVERBRAUCH UND WASCHLEISTUNG

MACHINE A LAVER AVEC UNE CONSOMMATION D'ENERGIE ET UN RENDEMENT DU LAVAGE OPTIMISES

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WO-A1-2006/006766 **KR-A- 20030 092 191**

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Description

[0001] The present invention relates to a washing machine whereof the energy consumption and washing performance is brought to the most ideal state.

[0002] 80 % of the electric energy consumption in washing machines is consumed in the stage of heating the water received into the washing machine from the mains. In this stage, the heater is operated and the wash water is raised to the temperature predetermined by the manufacturer for the selected program. When the wash water reaches the adjusted temperature, the heater is turned off with the signal delivered to the control unit from the heat sensor located in the tub in an area close to the heater. Decreasing the energy consumption of the washing machine is directly proportional with decreasing the energy consumption in the heating stage. The amount of electric energy consumed in the heating stage depends on the amount of water heated for a water intake temperature of constant value. Depending on how much more this amount of water is, the heating duration and electric energy consumption in the heating stage will be that much more. At the start of the main washing step, the wash water, received at a level that will saturate the amount of laundry in the drum, is started to be heated after a 10 -15 min. of cold washing step. The water to be received into the washing machine is determined based on the level and not on the amount. Therefore, when the washing machine is loaded at full capacity with the same type of laundry, the amount of received wash water is not always a constant value. Since water intake is determined by performing level measurement with the aid of the pressure sensor, the turbulences in the drum, water absorption characteristics of the laundry, the amount of detergent, water entry temperature and similar factors cause variations in the amount of water that saturates the laundry load. This situation directly results in variability of the heating duration and the energy consumption. As a result of the measurement errors that arise due to the configuration of particularly the pressure sensor, the amount of wash water becomes much more than the required value, therefore the energy consumption can increase considerably and results in nonconformity with the energy consumption declarations. The amount of water can either be more than required or can be less as well. Receiving less than the required amount of wash water affects the washing performance adversely. In this situation, energy saving is provided but this time the washing performance is compromised.

[0003] WO 2006/006766 A1 discloses a method of controlling water supply where the power consumed by the heater and the time for heating the washing water to a target temperature are reduced.

[0004] In the state of the art Korean Patent Application No KR20010084246, a washing machine is explained wherein the amount of washing water is calculated according to the difference between the real heating time and the reference heating time.

[0005] In the state of the art Korean Patent Application No KR20030092191, the amount of washing water is determined according to the temperature of the washing water.

[0006] The aim of the present invention is the realization of a washing machine having the most ideal energy consumption and washing performance.

[0007] The washing machine realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, is a machine wherein the amount of water received is determined by the level measurement and the control unit determines the estimated time period that will elapse for the temperature of the wash water to reach the value determined by the manufacturer. If this estimated time period is longer than the maximum time determined by the manufacturer, it is decided that the amount of wash water is more than the amount of water predetermined by the manufacturer for the selected program, thereby the temperature of the wash water is provided to be decreased. Thus, the same washing performance is provided to be achieved without a change in energy consumption by compensating the excess wash water with low temperature of the wash water.

[0008] If the estimated time period is shorter than the maximum time determined by the manufacturer, it is decided that the amount of wash water is less than the amount of water for the selected program predetermined by the manufacturer, and the temperature of wash water is provided to be increased up to the temperature for each textile type that will not damage that type of textile product. Consequently, the same washing performance is provided to be achieved without a change in washing performance by compensating less wash water in response to high temperature wash water.

[0009] In an embodiment of the present invention, if the estimated time period is longer than the maximum time, the heater is operated for a shorter time period.

[0010] In another embodiment of the present invention, if the estimated time period is longer than the maximum time, the heater is operated with lower power.

[0011] In yet another embodiment of the present invention, if the estimated time period is shorter than the minimum time, the heater is operated for a longer period of time.

[0012] In another embodiment of the present invention, if the estimated time period is shorter than the minimum time, the heater is operated with higher power.

[0013] By means of the present invention, the energy consumption and the washing performance are provided to be optimized in the situation that the received wash water is less or more than the amount determined for the selected washing program.

[0014] A washing machine realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

[0015] Figure 1 - is the perspective view of a washing machine.

[0016] The elements illustrated in the figures are numbered as follows:

1. Washing machine
2. Tub
3. Drum
4. Heater
5. Control unit

[0017] The washing machine (1) of the present invention comprises a tub (2), a drum (3) which is positioned inside the tub (2) and wherein the laundry to be washed is placed, a heater (4) which provides the wash water to be heated by being disposed between the tub (2) and the drum (3), and a control unit (5) which executes the washing program consisting of main washing, rinsing and spinning steps and wherein the wash water target temperature value (T) for each selected washing program predetermined by the manufacturer, the maximum and minimum times (t_{max}, tmin) determined for each target temperature value (T) and the operation time and power of the heater (4) are stored (Figure 1). In the washing machine (1), the amount of wash water received from mains is determined by performing level measurement.

[0018] The control unit (5),

- determines a estimated time period (t_h) that will elapse for reaching the target temperature value (T) when the heater (4) starts operating,
- if the estimated time period (t_h) is longer than the maximum time (t_{max}) determined by the manufactureror each target temperature value (T)
- provides the wash water target temperature value (T) to be decreased,
- if the estimated time period (t_h) is shorter than the minimum time (t_{min}) determined by the manufacturer for each target temperature value (T)
- provides the wash water target temperature value (T) to be increased.

[0019] In the situation that more than desired wash water is received for any amount of load placed in the drum (3), by making savings from the energy to be consumed for heating the excess amount of water, the washing performance intended for the selected program is provided by washing with water received more than the desired amount. Furthermore, when less than the determined amount of water is received for the washing program, the intended washing performance is this time achieved by increasing the wash water temperature even though there is less wash water. Consequently, the variabilities in energy consumption and washing performance are minimized and thus, the most optimum values in between the energy consumption and washing performance are provided to be achieved.

[0020] The washing program starts when the user operates the washing machine (1) and selects the washing program depending on desired parameters such as the type of laundry, dirt level and the like. Upon starting the washing program, water at a certain temperature is received from the mains into the washing machine (1) and the water received into the washing machine (1) starts to be heated by operating the heater (4) preferably after washing with cold water for a certain period of time. While the heater (4) is activated, the estimated time period (t_h) that will elapse for reaching the wash water target temperature value (T) predetermined by the manufacturer for each washing program is determined. If this determined estimated time period (t_h) is between the maximum time (t_{max}) determined by the manufacturer for each target temperature value (T) and the minimum time (t_{min}) determined by the manufacturer for each target temperature value (T), then any other change is not made in the wash water target temperature value (T) or the heater (4) operating time or power. However, if the estimated time period (t_h) is longer than the maximum time (t_{max}) determined by the manufacturer for the target temperature value (T), the wash water target temperature value (T) is decreased to a lower temperature value. In this situation, the washing performance intended for the selected washing program is provided to be achieved with more water by operating the heater (4) for a shorter period of time or with lower power. Consequently, the washing performance intended for the selected washing program is achieved by saving the energy to be consumed for heating the wash water received in excess of the amount determined for the selected washing program.

[0021] If the estimated time period (t_h) is shorter than the minimum time (t_{min}) determined by the manufacturer for the target temperature value (T), the wash water target temperature value (T) is increased to a higher temperature value. In this situation, the washing performance intended for the selected washing program is provided to be achieved with less water by operating the heater (4) for a longer period of time or with higher power. Consequently, the same washing performance intended for the selected washing program is achieved by increasing the temperature of the wash water in response to receiving wash water less than determined for the selected program. The amount of temperature increase is a value for each textile type that will not damage that textile product.

[0022] By means of the present invention, when the amount of wash water received for the selected washing program is in excess, the same washing performance is provided to be achieved by decreasing the target temperature value (T), thereby decreasing the amount of energy that will be consumed for heating the excess water. Furthermore, in the situation when the amount of wash water received is insufficient for the selected washing program, the decrease in washing performance that will arise resulting from washing with less water is compensated by increasing the target temperature value (T), thereby providing the intended washing performance to be achieved.

[0023] It is to be understood that the present invention is not limited to the embodiments disclosed above and a

person skilled in the art can easily introduce different embodiments. These different embodiments should also be considered within the scope of the protection postulated by the claims of the present invention.

Claims

1. A washing machine (1) comprising a tub (2), a drum (3) which is positioned inside the tub (2) and wherein the laundry to be washed is placed, a heater (4) providing the wash water to be heated by being disposed between the tub (2) and the drum (3), and a control unit (5) which executes the washing program consisting of main washing, rinsing and spinning steps and wherein the wash water target temperature value (T) for each selected washing program predetermined by the manufacturer, the maximum and minimum times (t_{max}, t min) determined for each target temperature value (T) and the operation time and power of the heater (4) are stored,
characterized by the control unit (5)

   - which determines a estimated time period (t_h) that will elapse for reaching the target temperature value (T) measured from the time that the heater (4) starts operating,
   - if the estimated time period (t_h) is longer than the maximum time (t_{max}) determined by the manufacturer for the target temperature value (T),
   - the wash water target temperature value (T) is decreased.
   - if the estimated time period (t_h) is shorter than the minimum time (t_{min}) determined by the manufacturer for each target temperature value (T),
   - the wash water target temperature value (T) is increased.

2. A washing machine (1) as in Claim 1, **characterized by** the heater (4) that is operated for a shorter period of time if the estimated time period (t_h) is longer than the maximum time (t_{max}) determined by the manufacturer.

3. A washing machine (1) as in Claim 1, **characterized by** the heater (4) that is operated with lower power value if the estimated time period (t_h) is longer than the maximum time (t_{max}) determined by the manufacturer.

4. A washing machine (1) as in Claim 1, **characterized by** the heater (4) that is operated for a longer period of time if the estimated time period (t_h) is shorter than the minimum time (t_{min}) determined by the manufacturer.

5. A washing machine (1) as in Claim 1, **characterized by** the heater (4) that is operated with a higher power value if the estimated time period (t_h) is shorter than the minimum time (t_{min}) determined by the manufacturer.

Patentansprüche

1. Waschmaschine (1), **umfassend** einen Waschbehälter (2), eine Trommel (3), die im Inneren des Waschbehälters (2) angeordnet ist und in die die zu waschende Wäsche gelegt wird, eine Heizeinrichtung (4), die das Waschwasser erwärmt, indem sie zwischen dem Waschbehälter (2) und der Trommel (3) angeordnet ist, und eine Steuereinheit (5), die das Waschprogramm ausführt, das aus den Schritten Hauptwaschen, Spülen und Schleudern besteht, und wobei der Waschwasserzieltmperaturwert (T), der für jedes gewählte Waschprogramm im Voraus vom Hersteller festgelegt ist, die Maximal- und Minimalzeiten (t_{max}, t_{min}), die für jeden Zieltemperaturwert (T) festgelegt sind, und die Betriebszeit und die Leistung der Heizeinrichtung (4) gespeichert sind,
dadurch gekennzeichnet, dass die Steuereinheit (5)

   • eine geschätzte Zeitperiode (t_h) bestimmt, die bis zum Erreichen der Zieltemperatur (T) verstreichen wird, gemessen ab der Zeit, ab der die Heizeinrichtung (4) den Betrieb beginnt, wobei
   • wenn die geschätzte Zeitperiode (t_h) länger als die vom Hersteller für den Zieltemperaturwert (T) festgelegte Maximalzeit (t_{max}) ist,
   • die Waschwasserzieltemperatur (T) gesenkt wird,
   • wenn die geschätzte Zeitperiode (t_h) kürzer als die vom Hersteller für den Zieltemperaturwert (T) festgelegte Minimalzeit (t_{min}) ist,
   • die Waschwasserzieltemperatur (T) erhöht wird.

2. Waschmaschine (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Heizeinrichtung (4) für eine kürzere Zeitperiode betrieben wird, wenn die geschätzte Zeitperiode (t_h) länger als die vom Hersteller festgelegte Maximalzeit (t_{max}) ist.

3. Waschmaschine (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Heizeinrichtung (4) mit einem geringeren Leistungswert betrieben wird, wenn die geschätzte Zeitperiode (t_h) länger als die vom Hersteller festgelegte Maximalzeit (t_{max}) ist.

4. Waschmaschine (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Heizeinrichtung (4) für eine längere Zeitperiode betrieben wird, wenn die geschätzte Zeitperiode (t_h) kürzer als die vom Hersteller festgelegte Minimalzeit (t_{min}) ist.

5. Waschmaschine (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Heizeinrichtung (4) mit einem höheren Leistungswert betrieben wird, wenn die geschätzte Zeitperiode (t_h) kürzer als die vom Hersteller festgelegte Minimalzeit (t_{min}) ist.

Revendications

1. Une machine à laver (1) **comprenant** une cuve (2), un tambour (3) qui est positionné dans la cuve (2) et où le linge à laver est placé, un dispositif de chauffage (4) qui chauffe l'eau de lavage en étant disposé entre la cuve (2) et le tambour (3), et une unité de commande (5) qui réalise le programme de lavage composant des étapes de lavage principal, rinçage et essorage et où la température de consigne de l'eau de lavage (T) pour chaque programme de lavage sélectionné prédéterminé par le fabricant, les délais maximum et minimum (t_{max}, t_{min}) déterminés pour chaque température de consigne (T) et le délai de fonctionnement et la puissance du dispositif de chauffage (4) sont enregistrés,
caractérisée par l'unité de commande (5)

   • qui détermine un intervalle de temps estimé (t_h) qui doit s'écouler afin d'atteindre la température de consigne (T) mesurée à partir du moment où le dispositif de chauffage (4) commence à fonctionner,
   • si l'intervalle de temps estimé (t_h) est plus long que le délai maximum (t_{max}) déterminé par le fabricant pour la température de consigne (T)
   • la température de consigne de l'eau de lavage (T) est diminuée,
   • si l'intervalle de temps estimé (t_h) est plus court que le délai minimum (t_{min}) déterminé par le fabricant pour chaque température de consigne (T)
   • la température de consigne de l'eau de lavage (T) est augmentée.

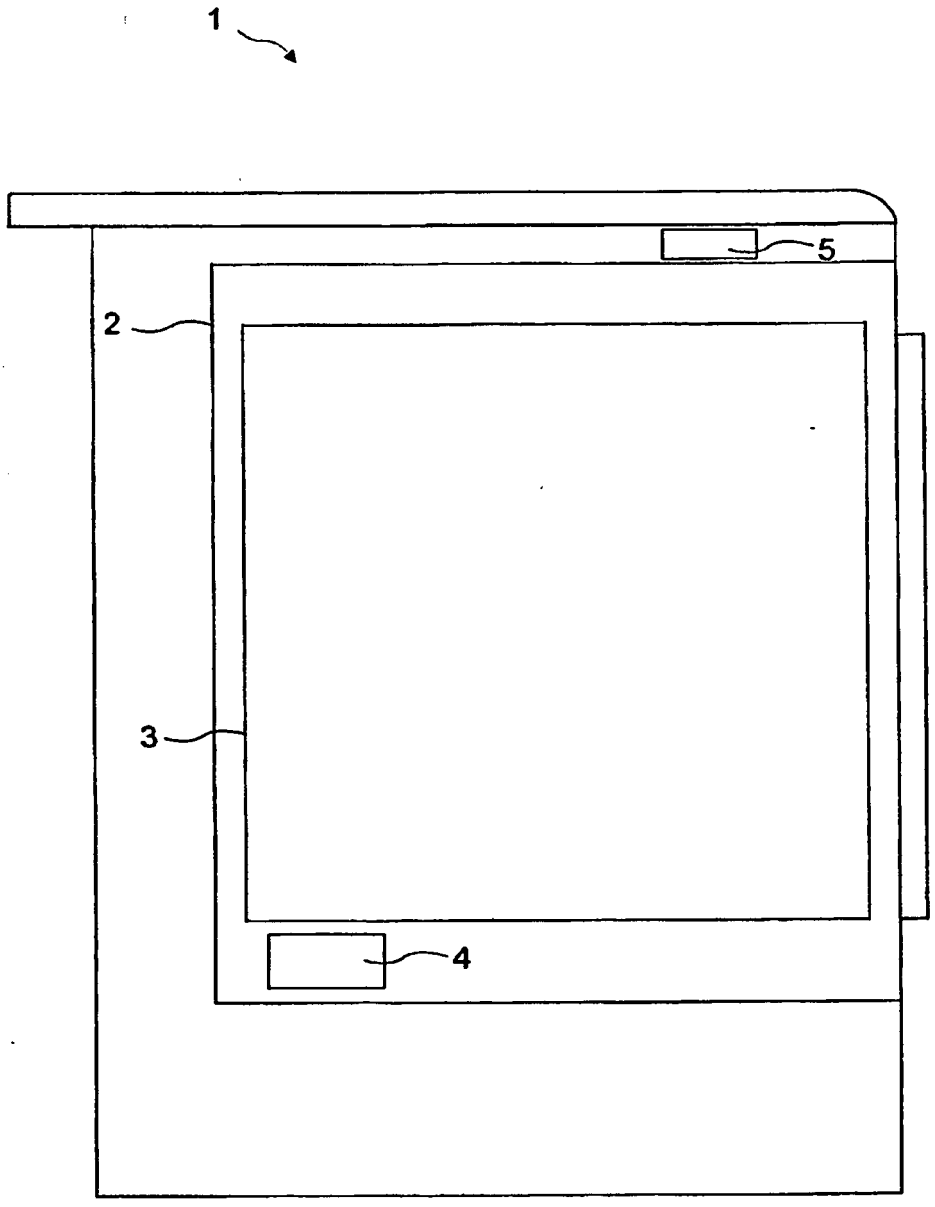
2. Une machine à laver (1) selon la Revendication 1, **caractérisée par** le dispositif de chauffage (4) qui est fonctionné pour un intervalle de temps plus court si l'intervalle de temps estimé (t_h) est plus long que le délai maximum (t_{max}) déterminé par le fabricant.

3. Une machine à laver (1) selon la Revendication 1, **caractérisée par** le dispositif de chauffage (4) qui est fonctionné avec une valeur de puissant plus faible si l'intervalle de temps estimé (t_h) est plus long que le délai maximum (t_{max}) déterminé par le fabricant.

4. Une machine à laver (1) selon la Revendication 1, **caractérisée par** le dispositif de chauffage (4) qui est fonctionné pour un intervalle de temps plus long si l'intervalle de temps estimé (t_h) est plus court que le délai minimum (t_{min}) déterminé par le fabricant.

5. Une machine à laver (1) selon la Revendication 1, **caractérisée par** le dispositif de chauffage (4) qui est fonctionné avec une valeur de puissant plus élevée si l'intervalle de temps estimé (t_h) est plus court que le délai minimum (t_{min}) déterminé par le fabricant.

Figure 1



REFERENCES CITED IN THE DESCRIPTION

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