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- (73) Patenthaver: **V-Zug AG, Industriestrasse 66, 6301 Zug, Schweiz**
- (72) Opfinder: **Betschart, Alfred, Husmatt 53, 6443 Morschach, Schweiz**
- (74) Fuldmægtig i Danmark: **Zacco Denmark A/S, Arne Jacobsens Allé 15, 2300 København S, Danmark**
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The invention relates to a household appliance, particularly dish washer, with a heating device for water and with a clocked control device for the heating device for operating the flow heater with different powers.

5 EP 1 738 677 discloses a dish washer for which the water can be transferred by a pump with different flow speeds. A high flow speed is necessary during normal operation of the device and a low flow speed in steam operation. In both operation modes the water has to be
10 heated by a flow heater.

US 3440399 discloses a heating arrangement with a clock switch for a dish washer.

EP 0022879 discloses a dish washer with a heating device consisting of multiple elements which can be
15 arranged either in series or in parallel.

US 3049133 discloses a dish washer with a regulated heating.

For heating the water at low flow speed, the average heating power of the flow heater must be decreased.
20 In case of a clocked heating this is reached by using less or shorter heating pulses. However, the application of shorter heating pulses is undesired for reasons of life span and due to control of the entire system. When using less, longer heating pulses the problem arises that the water
25 starts boiling at the heater due to insufficient cooling caused by the slow water flow, which generates undesired noise and stresses the heating.

In order to solve these problems, the flow heater has to be operated with a zero-cross control or a
30 phase angle control with electronic or electromechanic switches which are precisely controllable in terms of time, which leads however to high costs or to an increased calibration effort.

Therefore, the objective of the invention is to
35 provide a device of the type mentioned at the beginning,

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which allows operation of the heating device across a wide power range, but which is able to avoid the described problems.

5 This objective is reached by the household
appliance according to claim 1. According to it, the heating
device has at least a first and a second resistance heating.
The resistance heatings are operated via a switching device
having at least two switch states. In the first switching
10 state at least the first resistance heating is operated with
the prescribed supply voltage. In the second switching state
the first and the second resistance heating are connected
electrically in series and the series circuit created in
this way is operated with the supply voltage. In the first
15 switching state the first resistance heating is arranged
between a neutral conductor and a first phase and in the
second switching state the first and the second resistance
heating are arranged electrically in series between the
neutral conductor and the first phase and wherein in the
20 first switching state the second resistance heating is
arranged via a toggle switch S2 between the neutral
conductor and a second phase.

In this way it is reached that the heating
device can store less power in the second switching state
than in the first one, thereby allowing even for low
25 required heating power to operate the device with relatively
long clock pulses so that the aforementioned problems don't
occur.

The resistance heatings may be physically
integrated in a common component, however they may also be
30 adapted as separate components.

The solution according to the invention
therefore combines the clocked operation - which would
itself be capable of varying the power of the heating
device, with a variation of the internal resistance of the
35 heating device. By these measures, which appear redundant at

first sight, it is possible to ensure the clocked operation with simple switching components, e.g. relays, across a very large power range and without complex controlling or synchronization.

5 The resistance heatings may be operated in a clocked way in the first as well as in the second switching state of the switching device. The clocking, i.e. the switching on and off of the resistance heatings for generating the desired average power, is created by
10 actuating the switches of the switching device - it is however also conceivable to introduce upstream or downstream of the switching device separate clock switches in order to provide the clocking.

 The present invention is particularly suitable
15 for household appliances in case of which the water is guided through the heating device with different speeds, e.g. for a dish washer of the type mentioned at the beginning.

 Further preferred embodiments of the invention
20 result from the dependent claims and from the now following description by the drawing. It shows a simplified schematics of an embodiment of the invention.

 The device shown in Fig. 1 is e.g. a dish washer of the type described in EP 1 738 677, wherein only the
25 controller 1 of the device, the pump 2 for transferring the water from the sump into the spraying arms, a heating device as a flow heater 3 as well as a switching device 4 are shown.

 The flow heater 3 is arranged at the water
30 circuit before, after or at the pump 2 and serves to heat the water flowing therein. It consists of at least two resistance heatings 5, 6, the connectors of which are connected to the switching device 4.

 The switching device 4 serves to connect the
35 resistance heatings 5, 6 via switch (particularly relay

switch) S0, S1 and S2 with a neutral line N, a first phase L1 and/or (optionally) a second phase L2 of the alternating current supply network.

5 The switch S0, called neutral line switch, is a toggle switch. It is connected to the neutral switch N on the first side. On the second side it is either connected to one connector of each of the two resistance heatings 5, 6, or with one of the branch connectors of the switch S2.

10 The switch S1, called clock switch, is also a switch-on/off switch. On the first side it is connected with the first phase L1 and on the other side with the second connector of the first resistance heating 5.

The switch S2 is a toggle switch connecting a master connector optionally with a first and a second branch connector. The master connector is connected to the second connector of the second resistance heating 6. The first branch connector is connected to the second phase L2. The second branch switch can be connected to the neutral line via the switch S0. Thus, the second connector of the second resistance heating can optionally be connected to the neutral line N (if switch S0 is in the low position of Fig. 1) and with the second phase L2. If an operation of the device is intended without the second phase, the toggle switch S2 can be replaced by a bridge connecting the second switch of the resistance heating 6 permanently with the neutral line.

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The controller 1 controls the operation of the device according to a program provided by the user as well as depending on state parameters of the device. For this, the controller 1 is connected to corresponding sensors, particularly with a temperature sensor 8 for measuring the water temperature after or at the flow heater 3.

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The switching device 4 is operated by the controller 1 in two different switching states:

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First switching state:

In the first switching state, the neutral line switch S0 is in the upper position in Fig. 1 and connects
5 the first connectors of the resistance heatings 5, 6 with the neutral line N. The clock switch S1 is switched on and off in order to operate the first resistance heating 5 in a clocked way. The toggle switch S2 is switched (during
10 operation of the device with two phases) between its two positions in order to operate the second resistance heating 6 in a clocked way. In its upper position of Fig. 1 no current flows through the resistance heating, whereas in the low position it does.

In this switching state the first resistance
15 heating 5 is thus operated between the neutral line N and the first phase L1 with e.g. 230 V. Its power draw is controlled by the controller 1 by switching on and off the clock switch S1. It may, if the clock switch S1 is permanently switched on, draw a maximum power of e.g. 2kW.

20 The second resistance heating 6 is also operated in the first switching state between the neutral line N and the second phase L2, also with e.g. 230 V. Its power draw is controlled by the controller 1 by switching the toggle switch S2, if the device is operated with two phases. The
25 second resistance heating 6 can draw a maximum power of e.g. 1.3 kW, if the toggle switch S2 is permanently in the low position of Fig. 1. If the second phase L2 is not used, no voltage can be applied to the second resistance heating in the first switching state.

30 In the first switching state the flow heater may consequently draw a maximum power of about 3.3 kW in the two-phase operation and 2 kW in the one-phase operation, respectively.

35 Second switching state:

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In the second switching state the neutral line switch S0 is in the low position, i.e. the first connectors of the two resistance heatings are not at neutral line potential. The toggle switch S2 is permanently in the upper position of Fig. 1, where it connects the second connector of the second resistance heating 6 via the switch S0 with the neutral line. The clock switch S1 is either permanently switched on, if an operation with maximum power is desired, or it is switched on and off in order to operate the two resistance heatings in a clocked way.

Thus, in this switching state the first and the second resistance heating are arranged electrically in series between the neutral line N and the first phase L1. The supply voltage of e.g. 230 V is therefore across the entire series connection of the two resistance heatings, such that a low voltage is present across every single resistance heating. The average power drawn by the resistance heatings can be adjusted by the controller according to the respective requirements by switching on and off the clock switch S1.

The maximum power drawn by the flow heater 3 is e.g. 800 W in the second switching state.

Operation of the device:

In an advantageous embodiment, the device may be operated in normal mode with a first pump power and in a steam mode with a second pump power. In both operating modes the water is heated by the flow heater 3, wherein the controller 1 monitors its temperature in or after the flow heater and operates the flow heater clocked in such a way that the measured temperature corresponds to a setpoint temperature. The controller 1 drives the pump such that the water is pumped in normal mode with a first speed and in the steam mode with a second speed, wherein the first speed is

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higher than the second speed. As described in EP 1 738 677, in this way it is reached that in steam mode the water only exits through the bottom spraying arm and doesn't act on the dishes. The two speeds may differ e.g. by a factor 10 or
5 more.

The controller 1 is adapted in such a way that it puts the switching device during pumping with the first speed in the aforementioned first switching state and during pumping with the second speed in the aforementioned second
10 state. This accounts for the fact that during pumping with the second speed a substantially lower heating power is required.

This measure allows that an operation without boiling noise and evaporation processes can be secured in
15 the flow heater even for the lower second transport speed. The clock switch S1 doesn't have to be switched during heating up and after reaching the setpoint temperature only seldom, if the power draw of the series circuit of the two heating resistances is chosen appropriately. The heating
20 resistances are cooled in an optimum way even at lower rotation speeds of the pump 2 due to the low power and no overheating of the heating spiral occurs, which could reduce life span.

A further advantage of this switching type is
25 that the 800W steam heating is usable even when phase L2 is not connected and that this function may therefore be offered in all devices, independently from the number of the phases. This wouldn't be the case if the second heating resistance would be used alone for the heating at low
30 pumping speed.

The technology described herein is also usable for other water guiding household appliances for which heating power from a relatively wide power range has to be supplied to the water.

35 For toggling between the first and the second

switching state, firstly the switch S2 is brought into the upper position of Fig. 1 as long as its upper branch connector is still high-resistance (i.e. as long as the switch S0 is still in the upper position). In this way, an electric arc between the two branch connectors of the switch S2 can be avoided even in case of switches which are not secured in a particular way. The switch S0 is only switched when the switch S2 is securely in the upper position.

If a switch S2 is used, for which there is no danger of an electric arc between the branch connectors, its upper branch connector may also be directly connected to the neutral line and switch S0 may be formed as a simple ON/OFF-switch.

The heating device of the above description is formed as flow heater. It is however also conceivable to arrange e.g. at least a part of the heating device at the sump of the vat, where it heats up the water located there.

Patentkrav

1. Husholdningsapparat, især opvaskemaskine, med en varmeindretning (3) til vand og med en taktet styring (1, 4) til varmeindretningen (3) til drift af varmeindretningen (3) ved forskellige effekter, hvor varmeindretningen (3) omfatter mindst en første og en anden modstandsopvarmning (5, 6), og der endvidere er tilvejebragt en koblingsindretning (4) med to koblingstilstande, hvor mindst den første modstandsopvarmning (5) i en første koblingstilstand kan være i drift med en forudbestemt forsyningsspænding, og hvor den første og anden modstandsopvarmning (6) i en anden koblingstilstand kan være i drift elektrisk i serie med den forudbestemte forsyningsspænding,

kendetegnet ved, at den første modstandsopvarmning (5) i den første koblingstilstand er anbragt mellem en neutralleder (N) og en første fase (L1), og den første og anden modstandsopvarmning (6) i den anden koblingstilstand er anbragt elektrisk i serie mellem neutrallederen (N) og den første fase (L1), og hvor den anden modstandsopvarmning (6) i den første koblingstilstand via en omskifter S2 er anbragt mellem neutrallederen (N) og en anden fase (L2).

2. Husholdningsapparat ifølge krav 1, hvor koblingsindretningen (4) omfatter en neutralleder-kontakt S0, og hvor den første og den anden modstandsopvarmning (5, 6) sammen er forbundet med neutrallederen (N) via neutralleder-kontakten S0.

3. Husholdningsapparat ifølge krav 1, hvor den anden modstandsopvarmning (6) valgfrit kan forbindes med neutrallederen (N) og den anden fase (L2) ved hjælp af omskifteren S2.

4. Husholdningsapparat ifølge krav 1 og 3, hvor neutralleder-kontakten (S0) er en omskifter, der valgfrit forbinder neutrallederen (N) med fælles tilslutninger af den første og anden modstandsopvarmning (5, 6) eller med omskifteren S2.

5. Husholdningsapparat ifølge et af kravene 1 eller 2, hvor den anden modstandsopvarmning (6) ikke kan sættes under spænding i den første koblingstilstand.

- 5 **6.** Husholdningsapparat ifølge et af kravene 1 til 5, hvor der mellem den første modstandsopvarmning (5) og den første fase (L1) er anbragt en takt-kontakt (S1), hvormed den første modstandsopvarmning (5) kan forbindes med den første fase (L1), og hvor husholdningsapparatet er indrettet til at takte varmeindretningen (3) i den første og anden koblingstilstand ved til- og frakobling af takt-kontakten (S1).
- 10 **7.** Husholdningsapparat ifølge et af de foregående krav med en pumpe (2) til at pumpe vandet og med en styreindretning (1) til at styre pumpen (2) og koblingsindretningen (4), hvor styreindretningen (1) er udformet til at pumpe vandet mindst med en første og en anden hastighed, hvor den første hastighed er større end den anden hastighed, og hvor styreindretningen (1) endvidere er udformet til ved pumpning med den første hastighed at sætte koblingsindretningen (4) i den første koblingstilstand og ved pumpning med
15 den anden hastighed at sætte den i den anden koblingstilstand.
- 20 **8.** Husholdningsapparat ifølge et af de foregående krav, hvor modstandsopvarmningen (5, 6) drives taktet i den første og den anden koblingstilstand.
- 20 **9.** Husholdningsapparat ifølge et af de foregående krav, hvor varmeindretningen (3) er en gennemløbsopvarmer.

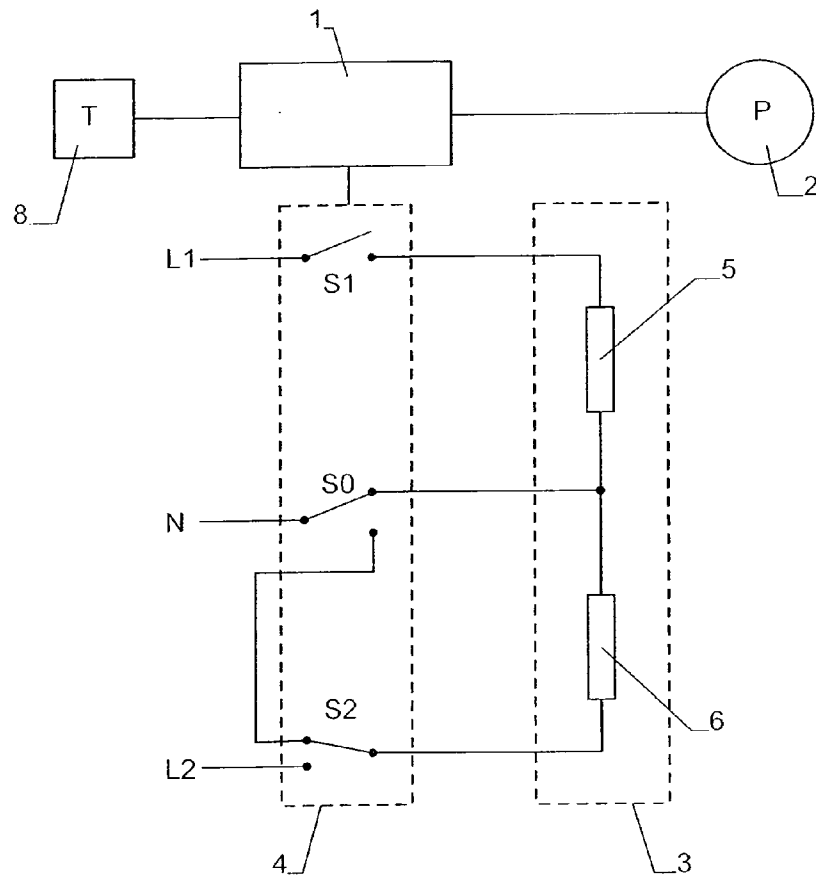


Fig. 1