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(54) Performance-enhanced electric appliance and related manufacturing method

(57) An electric appliance **(100)** for treating items is proposed. The electric appliance comprises at least one functional component **(105)** having an associated operative physical quantity having a nominal value affected by a tolerance, and a control unit **(125)** for controlling the operation of the appliance. The control unit comprises a memory **(310).** In the solution according to the present invention the memory is configured to store a working parameter **(320)** corresponding to an actual value of said operative physical quantity. Furthermore, the control unit is configured to exploit, for controlling the operation of the electric appliance, the working parameter corresponding to the actual value of said operative physical quantity associated with the functional component. Thereby, the operation of the electric appliance is based on the actual value of the operative physical quantity of the functional component instead of on said nominal value.

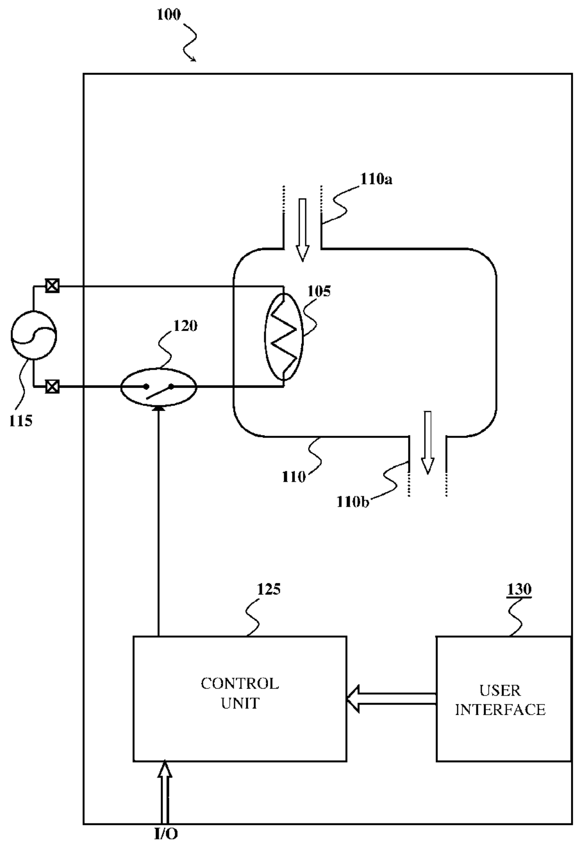

FIG.1

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Description

[0001] The present invention generally relates to the field of electric appliances, for example, although not limitatively, household electric appliances, and to a manufacturing method for manufacturing such appliances.

[0002] Manufacturers of electric appliances, such as laundry washing machines, laundry driers, laundry washing/drying machines and dishwashers, devote much effort in improving performances, and at the same time reducing energy/ resources consumption (particularly, electric energy consumption and/or water consumption).

[0003] Fine control of the amount of water loaded by a washing appliance and/or of the activation time of the treatment fluid heaters (washing heaters, i.e. heaters for heating water or water mixed with washing/rinsing products, or drying heaters, e.g. heaters for heating drying air) are probably the most common measures to keep the consumptions low, while ensuring good performance (both for passing quality tests and for the users' satisfaction).

[0004] For example, significant design efforts are devoted to achieve a finer control of the amount of water loaded by a laundry washing machine and/or the activation time of the washing heater for any different selectable laundry washing cycle.

[0005] However, the effectiveness of this solutions is reduced by the unavoidable manufacturing tolerances of the appliance components, like washing or drying heaters, which cause actual physical parameter values of these components (e.g., actual resistance values) to vary with respect to the nominal values used in the appliance design phase to find the best consumption-performance trade-off.

[0006] For example, the resistance of a washing-heating resistor in a laundry washing machine has a nominal resistance of $27\Omega \pm 5\%$, thus, the actual resistance of a specific heating resistor exemplar may fall in the range from 25.65Ω to 28.35Ω.

[0007] When the washing heater is kept energized for a predetermined time, a certain amount of heat is generated by Joule effect, that is transferred to the washing liquid; the energizing time of the heater depends on the specific washing cycle set by the user: for example, if the user sets a washing cycle at 90°C, the washing heater energizing time will be longer than that of a washing cycle at 60°C or 30°C. The energizing time of the washing heater for each washing cycle is decided by the appliance manufacturer in the design phase, based on the knowledge of the resistor nominal value, for the different washing cycles. However, the actual washing heater that is mounted on a specific laundry washing machine will have an actual resistance that differs from the nominal resistance value. Since the heat generated by Joule effect (and transferred to the washing liquid) depends on the actual resistance of the heater, the heat actually transferred to the washing liquid when the heater is kept energized for a predetermined time will be different from the forecasted one, and as a consequence the washing liquid temperature will differ from that expected by the designer. This means that the electric energy consumption and the washing performance usually differ from what expected, which is undesirable: either the washing performance may be penalized (e.g. if a washing heater having an actual value higher than the nominal value is kept energized at constant voltage for a time insufficient to heat the washing liquid up to the expected temperature), or the electric energy consumption may be unnecessarily high (e.g. if a washing heater having an actual value lower than its nominal value is kept energized at a constant voltage for a longer time than needed to heat the washing liquid up to the expected temperature).

[0008] The Applicant has handled the problem of how to overcome the problems and drawbacks outlined in the foregoing.

[0009] One aspect of the present invention relates to an electric appliance for treating items. The electric appliance comprises at least one functional component having an associated operative physical quantity having a nominal value affected by a tolerance, and a control unit for controlling the operation of the appliance. The control unit comprises a memory. In the solution according to the present invention the memory is configured to store a working parameter corresponding to an actual value of said operative physical quantity. Furthermore, the control unit is configured to exploit, for controlling the operation of the electric appliance, the working parameter corresponding to the actual value of said operative physical quantity associated with the functional component. Thereby, the operation of the electric appliance is based on the actual value of the operative physical quantity of the functional component instead of on said nominal value.

[0010] Preferred features of the method are set in the dependent claims.

[0011] In an embodiment of the invention, the working parameter may be equal to a measured actual value of said operative physical quantity value of the functional component.

[0012] In an embodiment of the invention, the working parameter may be equal to a measured value of a physical quantity that is related to said actual value of the operative physical quantity of the functional component.

[0013] In an embodiment of the invention, the functional component may comprise a Joule-effect heater of a treatment fluid used in operation by the electric appliance for treating the items.

[0014] In an embodiment of the invention, the operative physical quantity may be a resistance of the heater, and the working parameter may be a measured actual resistance value of said heater.

[0015] In an embodiment of the invention, the operative physical quantity may be a resistance of the heater, and the working parameter may be a measured absorbed electric power absorbed by the heater.

[0016] In an embodiment of the invention, the memory may be configured to store instructions to be used by the control unit for controlling the operation of the electric appliance, said instructions being parameterized to said working parameter.

[0017] In an embodiment of the invention, the electric appliance may further comprise a measurement arrangement operable to measure the actual value of said operative physical quantity of the functional component, or to measure a value of a physical quantity that is related to said actual value of the operative physical quantity of the functional component, and to store the measured value in said memory as the working parameter.

[0018] Another aspect of the present invention provides a method of manufacturing an electric appliance for treating items. The electric appliance comprises at least one functional component having an associated operative physical quantity having a nominal value affected by a tolerance, and a control unit for controlling the operation of the appliance, the control unit comprising a memory. The method comprises the step of measuring an actual value of the operative physical quantity of said functional component or a value of a physical quantity that is related to said actual value of the operative physical quantity of the functional component. The method further comprises the step of storing in the memory a working parameter corresponding to the measured actual value, and the step of configuring the control unit to exploit, for controlling the operation of the electric appliance, the working parameter corresponding to the actual value of said operative physical quantity associated with the functional component. Thereby the operation of the electric appliance is based on the actual value of the operative physical quantity of the functional component instead of on said nominal value.

[0019] In an embodiment of the invention, the step of measuring may be performed before installing said functional component in the appliance.

[0020] In an embodiment of the invention, the step of measuring may be performed after installing said functional component in the appliance.

[0021] In an embodiment of the invention, the step of measuring may be performed during a test phase of the electric appliance.

[0022] In an embodiment of the invention, the step of measuring may be performed during the operation of the electric appliance.

[0023] These, and others, features and advantages of the solution according to the present invention will be better understood by reading the following detailed description of some embodiments thereof, provided merely by way of exemplary and non-limitative examples, to be read in conjunction with the attached drawings, wherein:

> **Figure 1** schematically depicts an electric appliance in which an embodiment of the present invention can be applied;
>
> **Figure 2** shows a plot on a Cartesian plane of a curve of electric power absorption by a heating resistor of the electric appliance of **Figure 1,** powered at constant voltage, as a function of an actual resistance value of the heating resistor;
>
> **Figure 3** conceptually illustrates a control unit of the electric appliance of **Figure 1** according to an embodiment of the present invention; and
>
> **Figure 4** shows a plot on a Cartesian plane of an actual electric power absorbed by the heating resistor of the electric appliance according to an embodiment of the present invention versus a duration of an energizing time of the heating resistor.

[0024] Referring to **Figure 1,** an electric appliance **100** wherein an embodiment of the present invention can be applied is schematically illustrated. The electric appliance **100** may be a laundry washing machine, a laundry drier, a laundry washer/dryer, a dishwasher, and more generally an electric appliance comprising at least one functional component that has an associated operative physical quantity whose nominal value is affected by a tolerance. Just for the sake of explanation, and not at all limitatively, such functional component may be a heating resistor (heater) **105,** provided for heating a treatment fluid (such as a washing liquid in washing machines, laundry washing/drying machines and dishwashing machines, or drying air in laundry drying machines and laundry washing/drying machines) during the operation of the electric appliance **100.** The treatment fluid flows (possibly compelled by a fan or a pump, not shown in the drawing) through a treatment fluid circuit - of which only a heating chamber **110** (e.g., the washing tub of a laundry washer or dishwasher, or part of the drying air circuit of a laundry washing/drying machine or laundry drying machine) is shown in **Figure 1** in order to reach and treat items (not shown) to be treated (such as laundry to be washed and/or dried in a laundry washing machine or a laundry drier machine and/or a laundry washer/drier machine, or dishware in a dishwasher machine).

[0025] The heating chamber **110** has an inlet port **110a** that allows the treatment fluid entering the heating chamber **110,** and an outlet port **110b** that allows the treatment fluid exiting the heating chamber **110;** the heater **105** is located in the heating chamber **110** (e.g. in the washing tub of a washing machine or washing/drying machine, in the hot air duct of a tumble dryer, *etc.*).

[0026] The heater **105** is selectively energizable by selective coupling thereof to power mains **115** (*e.g.* AC power mains); for example, an electronic or electromechanical switch **120** (such as a power transistor, a thyristor or a relay) is provided for selectively coupling one of the two heater's **105** terminals to the power mains **115;** a further switch (not shown in the figure; for example, equal to the switch **120)** may be provided for selectively coupling the other heater's

105 terminal to the power mains **115.** The switch **120** is controlled by a control unit 125 (*e.g.* an electronic control unit, *e.g.,* a microcontroller), which controls the operation of the whole electric appliance **100.**

[0027] In operation, the electronic control unit **125** maintains the switch **120** closed for a predetermined time period Δt whose duration depends on an appliance operating cycle selected by a user (as will be discussed in greater detail in the following). The operating cycle of the electric appliance **100** may for example be selected by means of a user interface **130** accessible to the user from outside the electric appliance **100.** Each selectable operating cycle provides a different type of treatment to the items to be treated. For example, in laundry washing machines and laundry washing/drying machines, different operating cycles may be provided, each of which is optimized for specific textiles (*e.g.*, cotton, wool, synthetic textiles, in laundry washing, washing/drying and drying machines) or for different degrees of dirt. Each operating cycle of the electric appliance **100** may correspond to a specific temperature Top of the treatment fluid (for example, a temperature which may fall in a range of 30-90°C).

[0028] According to the operating cycle selected by the user, the electronic control unit **125** energizes the heater **105** by closing the switch **120** for the corresponding time period Δt, which in the appliance design phase has been determined to be adequate for heating the treatment fluid up to the proper temperature T_{op}. When energized, the heater **105** absorbs electric power from the mains and converts it into heat (by Joule effect) according to the following relation:

$$P_{ABS} = \frac{{V_{AC}}^2}{R}, \qquad (1)$$

wherein P_{ABS} is the nominal electric power absorbed from the mains (measured in Watts), V_{AC} is the nominal AC voltage value of the mains (for example, the U.S.A. standard value is 120 V @ 60 Hz, whereas the European standard value is 230 V @ 50 Hz), and R is the resistance of the heater **105.**

[0029] The heat generated by the heater **105** is transferred to the treatment fluid in the heating chamber **110.** The treatment fluid is then heated up to an actual temperature T'_{op}:

$$T'_{op} = T_0 + \alpha \cdot P_{ABS} \cdot \Delta t \cdot m, \qquad (2)$$

where T_0 is an initial temperature of the treatment fluid (*e.g.,* the ambient temperature), α is an adjustment factor that takes into account for the thermal capacity of the specific treatment fluid (for example, the adjustment factor is equal to 4,1855 for water), and m is the mass (*i.e.*, amount) of the treatment fluid to be heated.

[0030] Due to unavoidable manufacturing tolerances an actual value R' of the resistance R of the heater **105** always differs from the nominal value R_0 of the resistance R declared by the heater manufacturers, and upon which the appliance is based. Therefore, even assuming that the AC voltage value V_{AC} does not change in time, an actually-absorbed electric power P'_{ABS} (and, consequently, the generated heat) by the heater **105** is almost always different in value from the expected nominal absorbed power P_{ABS} considered by the appliance's designer.

[0031] Looking at the plot of **Figure 2,** wherein the actually-absorbed electric power P'_{ABS} absorbed from the mains by the heater **105** (powered at a constant voltage, *e.g.,* the nominal AC voltage value) as a function of the actual value R' of the heater resistance R is shown, it can be seen that when the actual heater resistance value R' is higher than the nominal resistance value R_0 (*i.e.,* $R' > R_0$) the actually-absorbed electric power P'_{ABS} is lower than the expected (nominal) one; conversely, when the actual heater resistance value R' is lower than the nominal resistance value R_0 (*i.e.,* $R' < R_0$) the actually-absorbed electric power P'_{ABS} is higher than the expected (nominal) one.

[0032] This, according to equation 2, results in the treatment fluid being heated up to an actual temperature T'_{op} that is different from an expected operative temperature T_{op0}, which was intended for the selected operating cycle. Particularly, the actual operative temperature T'_{op} will be higher than the desired operative temperature T_{op0} in case the actual heater resistance is lower than the nominal resistance, whereas the actual temperature T'_{op} will be lower than the desired operative temperature T_{op0} in case the actual heater resistance value is higher than the nominal resistance value. In the former case, the electric power consumption of the appliance is unnecessarily increased, whereas in the latter case the washing or drying performance of the appliance are jeopardized.

[0033] In an embodiment of the present invention, these drawbacks are prevented by providing an electric appliance **100** adapted to take into account the tolerance of the nominal value R_0 of the heater resistance *R*, and thus, at the same time, adapted to ensure a proper heating of the treatment fluid and a more performant operation of the electric appliance **100** as a whole.

[0034] Referring to **Figure 3** jointly with **Figure 1,** a control unit **125** of an appliance **100** according to an embodiment of the present invention will be described.

[0035] The control unit **125** advantageously comprises at least an operative block **305** (possibly implemented in firmware and/or software), for controlling the operation of the electric appliance **100,** and a memory **310** (e.g., an EEPROM or Flash EPROM), for storing operative data. The operative block **305** can access the memory **310** for retrieving instructions sets **315_1, 315_2, ... 315_N** stored in a first memory sector **310a** of the memory **310;** each of such instructions sets **315_1, 315_2,...315_N** comprises sets of instructions for actuating a corresponding operating cycle of the electric appliance **100** selected by the user through the user interface **130.** Such instructions sets **315_1, 315_2, ... 315_N** depends on at least one working parameter **320** that is stored in a second memory sector **310b** of the memory **310** (as will be discussed in the following).

[0036] In operation, the operative block **305** detects the selected electric appliance operating cycle selected by the user through the user interface **130.** In response, the operative block **305** retrieves a corresponding instruction set **315i** for the selected operating cycle from the first memory sector **310a.** Analogously, the operative block **305** retrieves the working parameter **320** from the second memory sector **310b,** to be used for processing the instruction set **315i** and actuating the selected operating cycle. Let for example the processing of a portion of the instruction set **315i** be considered, which determines the time period Δt during which the heater **105** is to be kept energized in order to heat the treatment fluid up to the desired temperature, i.e. the duration of the time period during which the control unit **125** keeps the switch **120** closed. Such time period Δt is determined by the operative block **305** by processing the corresponding portion of the instruction set **315i** using as a variable a corresponding working parameter **320** retrieved from the second memory sector **310b.**

[0037] The working parameter **320** (stored in the second memory sector **310b)** may not merely be the nominal value of the operative physical quantity corresponding to the considered component (e.g., the nominal resistance value R_0 of the heater **105,** or the nominal absorbed electric power P_{ABS}), nor a worst-case-design value (like, for example, the nominal resistance nominal R_0 of the heater **105** *plus* - or less - its maximum tolerance). Conversely, according to an embodiment of the present invention, the working parameter **320** stored in the second memory sector **310b** and used to determine the time period Δt is the actual value (*e.g.,* the actual resistance value R' of the heater element **105)** of the operative physical quantity corresponding to the considered component of the electric appliance **100.**

[0038] Such actual value (e.g., the actual resistance value R'), stored as the working parameter **320** in the second memory sector **310b,** may be determined by a preliminary measure, performed during the appliance manufacturing, and thus when the functional component (*e.g*., the heater **105)** that will be installed in the appliance is available, without the statistical uncertainties of the manufacturing tolerances.

[0039] Alternatively, it is possible to carry out a measure of another physical quantity, which is related to and depends on such actual value of the considered functional component, to be used as working parameter **320.** For example, it is possible to measure the actually-absorbed electric power P'_{ABS} absorbed by the heater **105,** instead of measuring the actual resistance value R' thereof. Such actually-absorbed electric power P'_{ABS} is a function of the actual resistance value R ' (as previously shown in equation 2).

[0040] The measure of the actual resistance value R' of the heater **105,** or of the actually-absorbed electric power P'_{ABS} absorbed by the heater **105** may be easily performed, in any known way.

[0041] As mentioned above, the measurement of the actual value R' of the heater resistance R (or of the actually-absorbed electric power P'_{ABS}) may be performed during the manufacturing of the electric appliance **100** (and stored as the working parameter **320** in the second memory sector **310b).**

[0042] Alternatively, the measurement may be performed during a post-manufacturing test phase of the electric appliance **100.**

[0043] The measurement of the actual value of the operative physical quantity of the functional component may be performed either manually, by a technician, or automatically, by a properly arranged measure apparatus. The measured actual value is then stored in the second memory sector **310b** of the memory **310** as the working parameter **320 -** for example, by interfacing to the control unit **125** *via* an input/output interface **325.**

[0044] Consequently, the working parameter **320** (*e.g.,* the actual resistance value R' and/or the actually-absorbed electric power P'_{ABS}) stored in the memory **310** of each manufactured electric appliance **100** is the actual value referred to the specific exemplar of that functional component - e.g., the heater element **105 -** that is actually mounted in the electric appliance **100.** This allows more accurate and precise operating cycles for the electric appliance **100;** in other words, the performance of the electric appliance **100** results substantially enhanced.

[0045] Referring now to **Figure 4,** where a plot on a Cartesian plane of an actually-absorbed electric power P'_{ABS} absorbed from the AC mains *versus* the time period Δt of energization of the heater **105** is depicted, it can be appreciated that the actual energizing time period Δt depends on the actually-absorbed electric power P'_{ABS}, and thus on the actual resistance value R' of the heater **105.**

[0046] The working parameter **320,** *e.g.* the actually-absorbed electric power P'_{ABS}, is used by the control unit **125** of the electric appliance **100** for processing the portion of the instruction set **315i** that determines the time period Δt, during which the control unit **125** keeps the switch **120** closed (so as to heat the treatment fluid to the desired temperature T_{op} associated with the selected cycle).

[0047] As can be seen from **Figure 4,** the higher the actually-absorbed electric power P'_{ABS} (*i.e.,* the lower the actual resistance value R'), measured during the appliance manufacturing, the shorter the time period Δt during which the heater **105** is kept energized to heat the treatment fluid up to reach the desired operative temperature T_{op0}, and, *vice versa,* the lower the measured actually-absorbed electric power P'_{ABS} (*i.e.,* the higher the actual resistance value R'), the longer the time period Δt.

[0048] According to an embodiment of the present invention, each specific manufactured exemplar of electric appliance **100** implements operating cycles that are based on the actual value of the heater **105** mounted on such exemplar of electric appliance **100.** Therefore, each specific manufactured exemplar of electric appliance **100** is not affected by the tolerance of the values of its components. In the considered example, during an operating cycle the desired temperature Top for the treatment fluid is reached even if the actual value of the resistance of the heater differs from the nominal one, while in the prior art such desired temperature was reached only in the unlikely case that the heater had a resistance having an actual value equal to the nominal one.

[0049] In embodiments of the invention, the electric appliance may be equipped with a measurement arrangement adapted to measure, from time to time during the appliance operation, (*e.g.*, at each startup of the electric appliance) the actual values of the physical quantities of the functional components, measured actual values that are then stored as working parameters in the memory. In this way, it is possible, for example, to take into account variations of the actual values of the functional components due, for example, to the aging of the functional component, or variations due to changed environmental conditions (e.g., ambient temperature), thereby ensuring still more precise operating cycles.

[0050] The electric appliance according to the present invention is also effective in the case of substitution of the functional component (for example, due to malfunction or wearing) with a replacement functional component. Indeed, the actual value of the physical parameter associated with the replacement component may be measured before the substitution of the functional component; thus a technician, substituting the functional component, may overwrite the working parameter in the memory, storing the measured actual value of the new physical parameter therein. Alternatively, if the electric appliance is equipped with the abovementioned measurement arrangement, the actual value of the physical parameter associated to the replacement functional component will be measured by the measurement arrangement in the startup of the electric appliance and, consequently, the working parameter will be updated with the measured actual value of the new physical parameter.

[0051] Although the foregoing description has been referred to an embodiment of the present invention in which the tolerance of the resistance value of the heater is considered, the present invention may be applied to other functional components comprised in the electric appliance as well. Generally, the present invention may be applied to any functional component that has an associated operative physical quantity, which, at least partly, determines a consumption of resources (electric energy, water, etc.) of the electric appliance, and whose nominal value may be affected by a tolerance. For example, the functional component may be an electric motor (comprised in the electric appliance for moving mechanical parts thereof) and the physical parameter of which the actual value is measured may be an electric power absorbed by the electric motor in operation. As a further example, such other functional component may be a flow meter or a pressure switch comprised in the electric appliance (such as washing machines and washing/drying machines) for, *e.g.*, determining an amount of treatment fluid (e.g., water) used for treating items. For example, considering a flow meter used for a metered intake of water in a washing machine, it is possible to measure an actual water flow trough the flow meter and use such measures value as working parameter. In the case of a pressure switch, it is possible to measure an actual pressure threshold for which the pressure switch switches, and use such measured value as working parameter. In both cases, it is possible to obtain a more precise and accurate control on the amount of treatment fluid in the electric appliance and, therefore, a more precise control of the treatment fluid heating. In this way, similar advantages as those mentioned above are achieved.

[0052] Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many logical and/or physical modifications and alterations. More specifically, although this solution has been described with a certain degree of particularity with reference to one or more embodiments thereof, it should be understood that various omissions, substitutions and changes in the form and details as well as other embodiments are possible. Particularly, different embodiments of the invention may even be practiced without the specific details (such as the numerical examples) set forth in the preceding description to provide a more thorough understanding thereof; conversely, well-known features may have been omitted or simplified in order not to obscure the description with unnecessary particulars. Moreover, it is expressly intended that specific elements and/or method steps described in connection with any embodiment of the disclosed solution may be incorporated in any other embodiment as a matter of general design choice.

Claims

1. An electric appliance **(100)** for treating items, comprising:

at least one functional component **(105)** having an associated operative physical quantity having a nominal value affected by a tolerance,
a control unit **(125)** for controlling the operation of the appliance, the control unit comprising a memory **(310),**
characterized in that
the memory is configured to store a working parameter **(320)** corresponding to an actual value of said operative physical quantity,
and in that
the control unit is configured to exploit, for controlling the operation of the electric appliance, the working parameter corresponding to the actual value of said operative physical quantity associated with the functional component, thereby the operation of the electric appliance is based on the actual value of the operative physical quantity of the functional component instead of on said nominal value.

2. The electric appliance according to claim 1, wherein the working parameter is equal to a measured actual value of said operative physical quantity value of the functional component.

3. The electric appliance according to claim 1, wherein the working parameter is equal to a measured value of a physical quantity that is related to said actual value of the operative physical quantity of the functional component.

4. The electric appliance according to any one of claims 1-3, wherein the functional component comprises a Joule-effect heater **(105)** of a treatment fluid used in operation by the electric appliance for treating the items.

5. The electric appliance according to claim 2, wherein the functional component comprises a Joule-effect heater **(105)** of a treatment fluid used in operation by the electric appliance for treating the items, wherein the operative physical quantity is a resistance of the heater, and wherein the working parameter is a measured actual resistance value of said heater.

6. The electric appliance according to claim 3, wherein the working parameter is equal to a measured value of a physical quantity that is related to said actual value of the operative physical quantity of the functional component, wherein the operative physical quantity is a resistance of the heater, and wherein the working parameter is a measured absorbed electric power absorbed by the heater.

7. The electric appliance according to any of the preceding claims, wherein the memory is configured to store **(310a)** instructions **(315)** to be used by the control unit for controlling the operation of the electric appliance, said instructions depending on said working parameter.

8. The electric appliance according to any one of the preceding claims, further comprising a measurement arrangement operable to measure the actual value of said operative physical quantity of the functional component, or to measure a value of a physical quantity that is related to said actual value of the operative physical quantity of the functional component, and to store the measured value in said memory as the working parameter.

9. A method of manufacturing an electric appliance **(100)** for treating items, the electric appliance comprising at least one functional component **(105)** having an associated operative physical quantity having a nominal value affected by a tolerance, and a control unit **(125)** for controlling the operation of the appliance, the control unit comprising a memory **(310),**
characterized by comprising
measuring an actual value of the operative physical quantity of said functional component or a value of a physical quantity that is related to said actual value of the operative physical quantity of the functional component,
storing in the memory a working parameter **(320)** corresponding to the measured actual value, and
configuring the control unit to exploit, for controlling the operation of the electric appliance, the working parameter corresponding to the actual value of said operative physical quantity associated with the functional component, thereby the operation of the electric appliance is based on the actual value of the operative physical quantity of the functional component instead of on said nominal value.

10. The method of claim 9, wherein the step of measuring is performed before installing said functional component in the appliance.

11. The method of claim 9, wherein the step of measuring is performed after installing said functional component in the appliance.

12. The method of claim 11, wherein the step of measuring is performed during a test phase of the electric appliance.

13. The method of any one of claims 10-12, wherein the step of measuring is performed during the operation of the electric appliance.

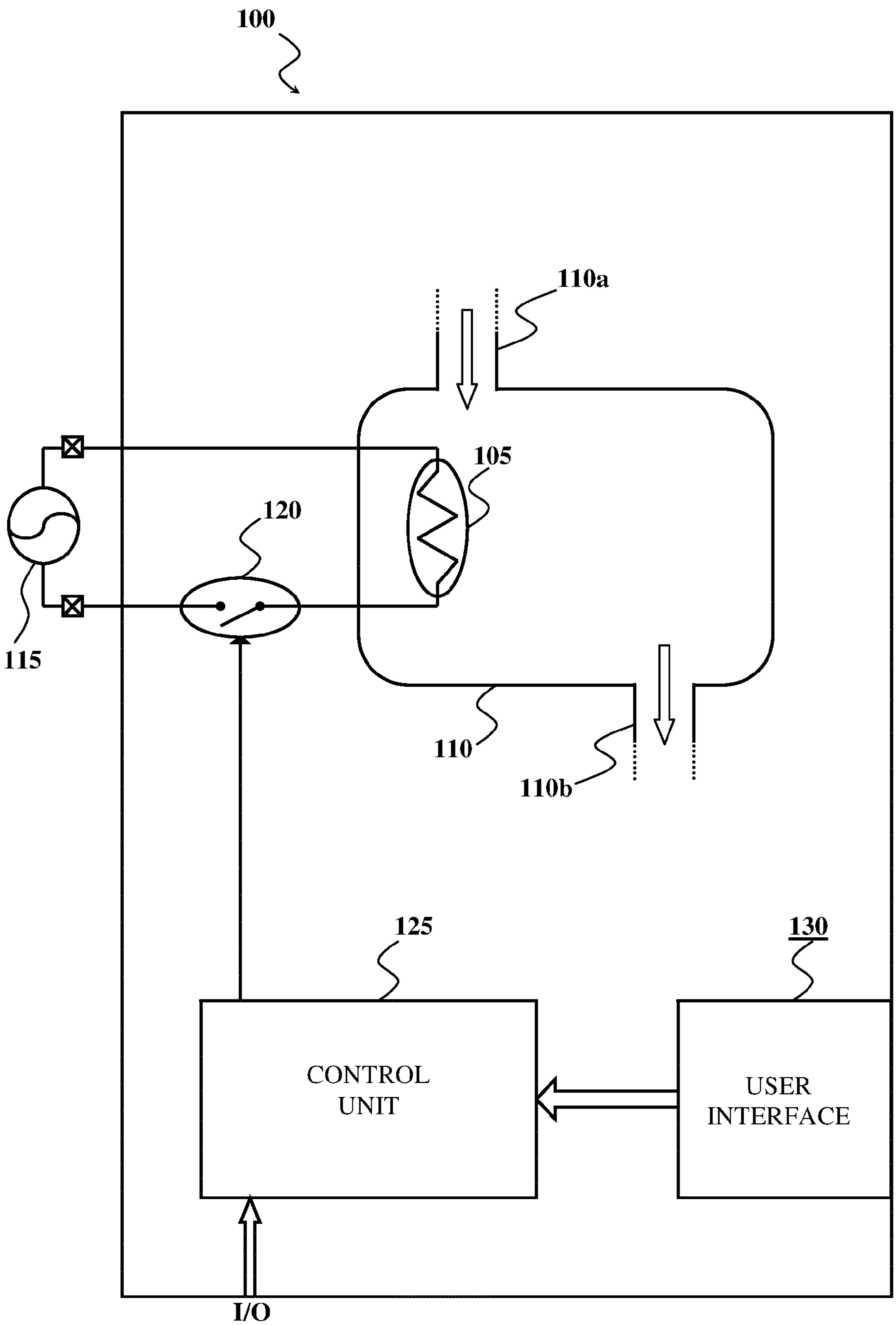
100
110a
105
120
115
110
110b
125
130
CONTROL
UNIT
USER
INTERFACE
I/O

FIG.1

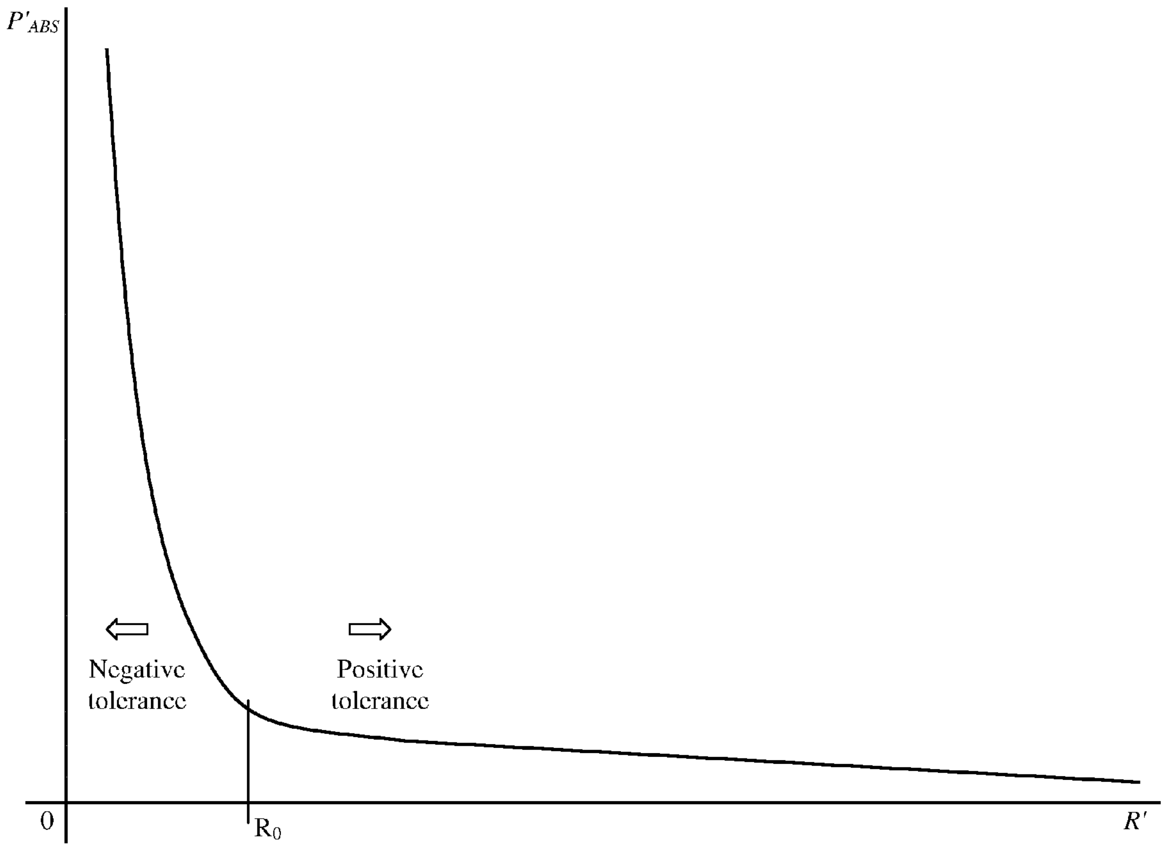

FIG.2

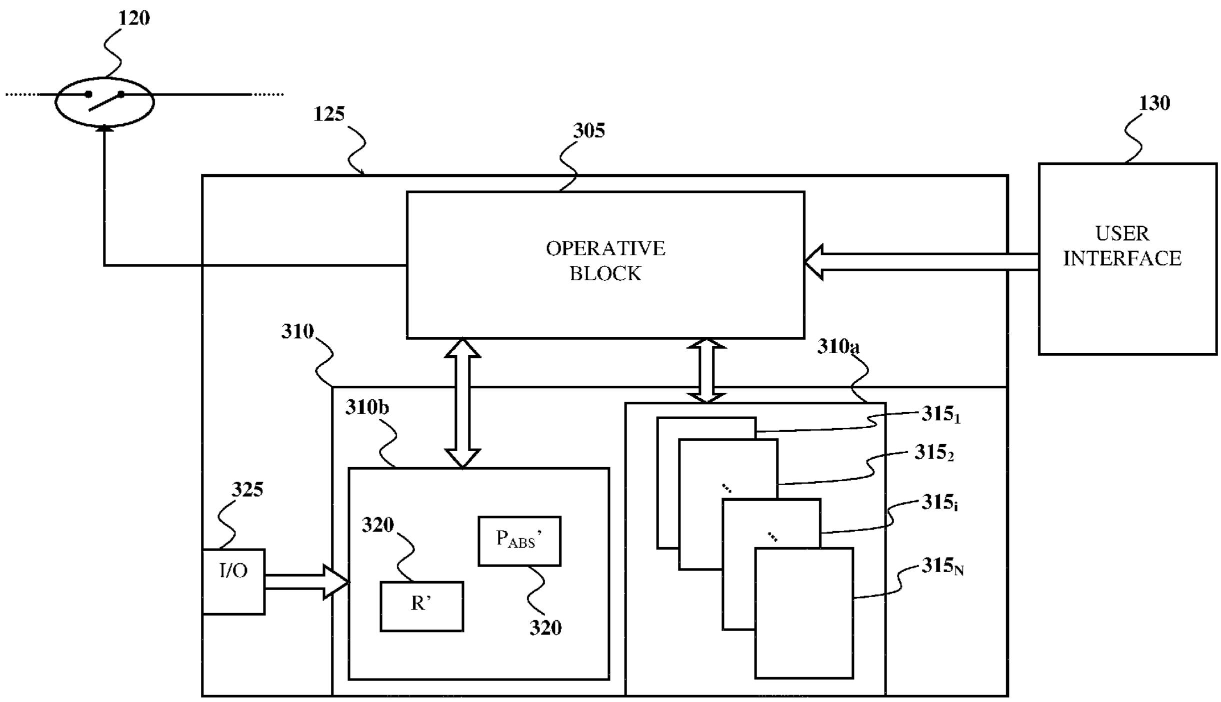
120
125
305
130
OPERATIVE BLOCK
USER INTERFACE
310
310a
310b
315_1
315_2
315_i
315_N
325
320
I/O
P_{ABS}'
R'
320

FIG.3

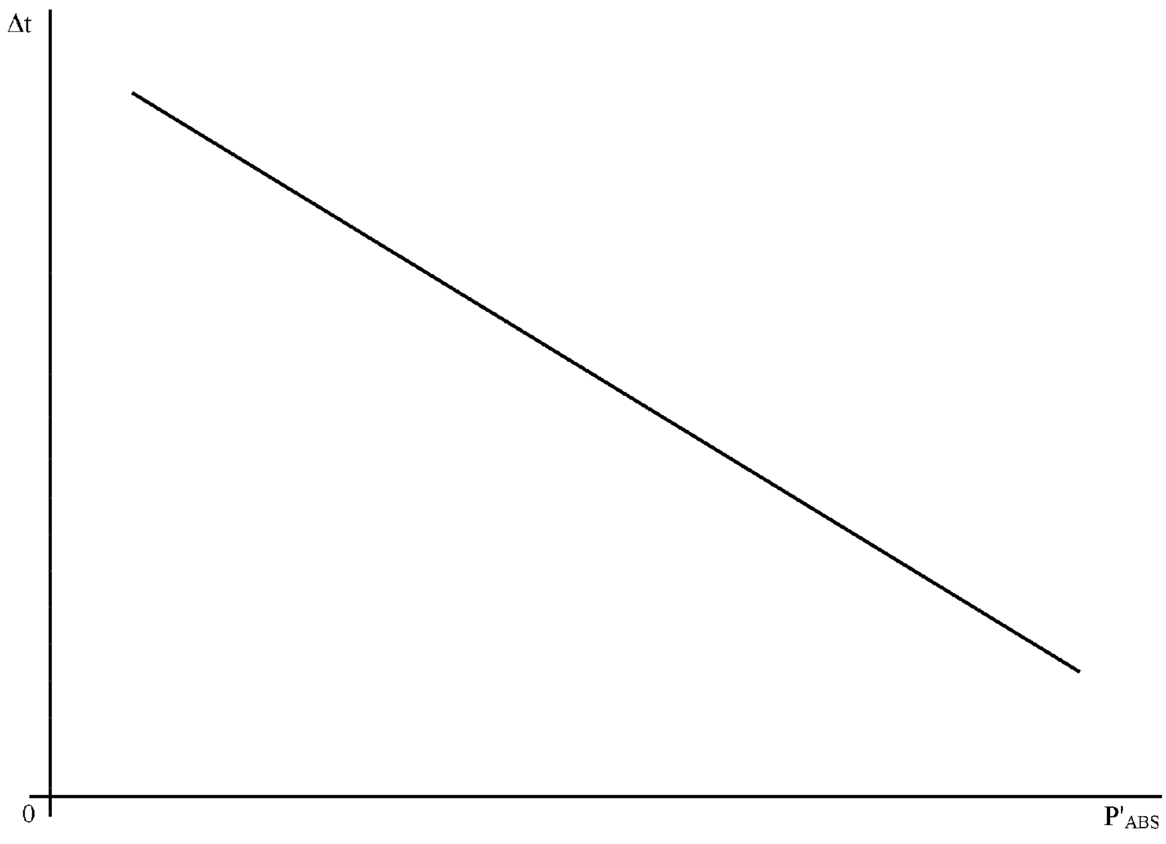

FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 11 18 5164

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 0 579 947 A1 (ZANUSSI ELETTRODOMESTICI [IT]) 26 January 1994 (1994-01-26) * columns 3-4; figure 1 * -----	1	INV. D06F33/00 D06F33/02 D06F39/04
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TECHNICAL FIELDS SEARCHED (IPC)
D06F

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
Munich	26 April 2012	Stroppa, Giovanni

CATEGORY OF CITED DOCUMENTS

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26-04-2012

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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