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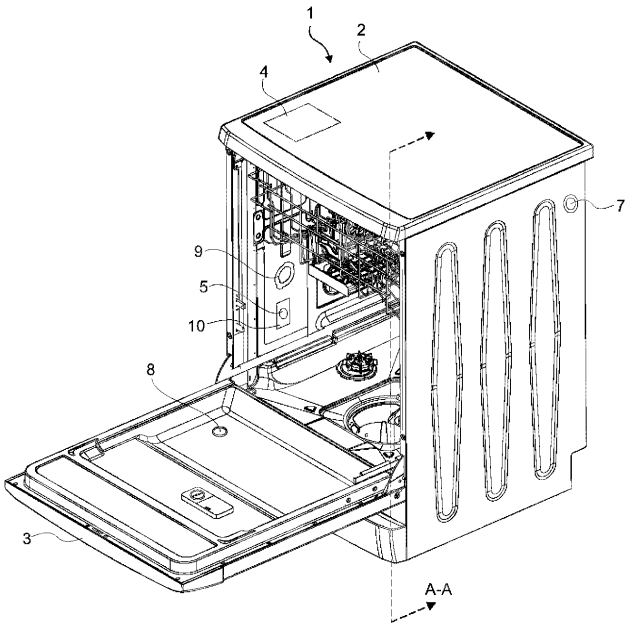
(54) A DISHWASHER WITH A HUMIDITY SENSOR

(57) The present invention relates to a dishwasher (1) comprising a body (2) having an inner volume wherein the articles to be washed are placed, a door (3) having an open position and a closed position, a control unit (4) configured to execute the steps of washing, rinsing, and drying, a first sensor (5) in communication with the control unit (4) to detect the relative humidity of the air inside the inner volume, an actuator (6) configured to open or close the door (3) upon activation, wherein the control unit (4) is configured to activate the actuator (6) to open the door (3) during the drying step if the relative humidity of the inner volume exceeds a first value, activate the actuator (6) to close the door (3) if the relative humidity of the inner volume falls under a second value.

Figure 1



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Description

[0001] The present invention relates to a dishwasher, in particular to a dishwasher having improved drying step.

[0002] Dishwashers are widely used in our daily life. The dishwashers follow the steps of washing, rinsing and drying during their cleaning procedure. During drying, the water residue on the dishes are evaporated by means of heating the interior of the dishwasher. In dishwashers, the dishes are left for dripping of the water at the end of the rinsing step. After the rinsing step, many dishwashers utilize the method of opening the door at least partly to increase the efficiency of the drying step. By means of this, the air trapped inside the body that has a high relative humidity is transferred to the outer environment. As a result, vaporization inside the body is accelerated. A problem with the state of the art is that the door is opened independent of the humidity conditions inside the body of the dishwasher. Another problem is that the door after being opened remains open longer than necessary thereby causing thermal energy loss.

[0003] A prior art publication in the technical field of the present invention may be referred to as WO2019015966 among others, the document disclosing a dishwasher having at least one air drying device.

[0004] A prior art publication in the technical field of the present invention may be referred to as WO2019015966 among others, the document disclosing a dishwasher having at least one air drying device.

[0005] A prior art publication in the technical field of the present invention may be referred to as CN109700408 among others, the document disclosing a dishwasher and method for controlling the dishwasher.

[0006] An objective of the present invention is to improve drying performance of the dishwashers meanwhile minimizing the energy used.

[0007] Another objective of the present invention is to accelerate the drying step of the dishwasher.

[0008] The method realized to achieve the aim of the present invention and disclosed in the first claim and the dependent claims comprises a dishwasher. The dishwasher has a body and a door pivotably attached to the body between an open position and a closed position. During the open position door allows access inside the body. During the closed position the door blocks access inside the body. The dishwasher comprises a control unit controlling the operational functions of the dishwasher including but not limited to washing, rinsing and drying. The Dishwasher comprises a first sensor wherein the first sensor is in communication with the control unit. The first sensor measures the relative humidity of the air inside the inner volume of the dishwasher. An actuator is provided inside the dishwasher wherein the actuator is controlled by the control unit. The actuator upon being activated pushes the door away from the body thereby opening the door. Similarly, the actuator is configured to close the door open being activated by the control unit. During drying step, the relative humidity of the inner volume increases. As the relative humidity of the air inside the inner volume reaches a predetermined value, the control unit activates the actuator ad opens the door. The predetermined relative humidity value is between %95 and %100. The air at that high of a relative humidity value is saturated by water molecules. By means of the control unit opening the door, the air that has a very high humidity is removed from the inner volume of the dishwasher. As a result, evaporation inside the inner volume is increased. Meanwhile, the first sensor continues to measure the relative humidity of the air inside the inner volume. The control unit activates the actuator a second time and closes the door when and if the relative humidity of the air inside the body of the dishwasher falls under a second value. The second relative humidity value is between %40 and %70. By means of the control unit, controlling the door, evaporation of the water drops on the dishes is accelerated meanwhile minimizing the time interval during which the door remains open thereby reducing energy consumption.

[0009] In an embodiment of the invention, the dishwasher comprises a second sensor. The second sensor is in direct communication with the control unit and measures the relative humidity of the air surrounding the dishwasher, meaning that the relative humidity of the air of the environment. The second relative humidity value is adjusted according to the relative humidity read by the second sensor. The value read by the second sensor is used for adjusting the second relative humidity value. For instance, if the relative humidity of the environment is %50, the control unit allows the door to remain open till the relative humidity of the air inside the inner volume of the dishwasher reaches %50. By this means, the dishwasher becomes responsive to the outer environment conditions, further improving energy consumption of the dishwasher.

[0010] In an embodiment of the invention, the dishwasher comprises a temperature sensor, measuring the temperature of the air inside the dishwasher. The control unit forms a decision matrix by the relative humidity readings provided by the first sensor, the second sensor and the temperature reading provided by the temperature sensor. The control unit adjusts the first and second values according to the decision matrix. By this means, the energy consumption of dishwasher is further reduced.

[0011] In an embodiment of the invention, the dishwasher comprises a fan inside the inner volume directing the air towards the first sensor. The fan accelerates the air transfer to the outer environment. Another advantageous effect provided by means of the fan is that the first sensor responds to changes in the relative humidity faster. By means of this, the control unit closes the door via the actuator faster.

[0012] In an embodiment of the invention, the dishwasher comprises a cover covering the first sensor. The cover keeps the water away from the first sensor improving the accuracy of the relative humidity readings.

[0013] By means of the present invention, optimization

in drying of the dishes is achieved by means of the first sensor and the control unit activating the actuator accordin to the readings provided by the first sensor.

[0014] Another advantageous effect provided by means of this invention is that the energy consumption of the dishwasher is decreased.

[0015] The drawings are not meant to delimit the scope of protection as identified in the claims nor should they be referred to alone in an effort to interpret the scope identified in the claims without recourse to the technical disclosure in the description of the present invention.

[0016] Figure 1 - is a perspective view of the dishwasher

[0017] Figure 2 - is a side view of the dishwasher along the dashed A-A lines in Figure 1

[0018] Figure 3 - is an enlarged view of the dishwasher along the dashed B-B lines in Figure 2

[0019] The following numerals are assigned to different parts demonstrated in the drawings and referred to in the present detailed description of the invention:

1. Dishwasher
2. Body
3. Door
4. Control Unit
5. First sensor
6. Actuator
7. Second sensor
8. Temperature sensor
9. Fan
10. Cover

[0020] The present invention relates to a dishwasher (1) comprising; a body (2) having an inner volume wherein the articles to be washed are placed, a door (3) having an open position and a closed position, a control unit (4) configured to execute the steps of washing, rinsing, drying, a first sensor (5) in communication with the control unit (4) to detect the relative humidity of the air inside the inner volume, an actuator (6) configured to open or close the door (3) upon activation.

[0021] The present invention relates to a dishwasher (1) comprising; the control unit (4) that is configured to; activate the actuator (6) to open the door (3) during the drying step if the relative humidity of the inner volume exceeds a first value and activate the actuator (6) to close the door (3) if the relative humidity of the inner volume falls under a second value. The dishwasher (1) encloses the inner volume wherein the articles to be washes are placed. The inner volume is separated from the outer environment by means of the door (3). The door (3) is attached to the body (2) by means of hinges in a pivotable manner between an open position and a closed position. The dishwasher (1) comprises the control unit (4). The control unit (4) controls the operational functions of the dishwasher including but not limited to washing, rinsing and drying. The first sensor (5) is inside the inner volume of the dishwasher (1) and measures the relative humidity of the air inside the dishwasher (1). The first sensor (5) is in communication with the control unit (4) and transmits the relative humidity data to the control unit (4) on regular intervals. The dishwasher (1) comprises the actuator (6). The actuator (6) is in communication with the control unit (4) and opens/closes the door (3) upon activation. The control unit (4), according to the relative humidity reading coming from the first sensor (5) activates the actuator (6). The control unit (4), in the closed position of the door (3) and during drying step, activates the actuator (6) and the actuator (6) forces the door (3) to open. Opening of the door (3) depends on the relative humidity value of the air inside the inner volume. The door (3) is opened when and if the relative humidity value of the air inside the inner volume exceeds a first value predetermined by the manufacturer. In a preferred embodiment, the control unit (4) opens the door (3) by means of the actuator (6) if the relative humidity value of the air inside the inner volume exceeds %95. By means of this, the air having high relative humidity is removed from the inner volume. After the relative humidity value of the air inside the inner volume falls under a second value predetermined by the manufacturer. The control unit (4) activates the actuator (6) to close the door (3). By means of the control unit (4) closing and opening the door (4) via the actuator (6), humid air is expelled from the inner volume. By means of this, drying of the dishes inside the inner volume is hastened which in turn improves drying efficiency. Another advantageous effect provided by means of this invention is that the energy consumption of the dishwasher (1) is improved as the door (3) is opened only for a very limited time.

[0022] In another embodiment, the dishwasher (1) comprises a second sensor (7) in communication with the control unit (4) to detect the relative humidity of the surrounding environment wherein the control unit (4) is configured to adjust the first and second value depending on the relative humidity of the surrounding environment. The second sensor (7) is used for detecting the humidity of the environment. The second sensor (7) is in communication with the control unit (4) and transmits the relative humidity data of the environment to the control unit (4) on regular intervals. The control unit (4) according to the relative humidity data adjust the second value. Especially in humid regions, the second value is hard to reach by keeping the door open for a very long time. By means of the second sensor (7), the second value is adjusted therefore optimizing time interval during which the door (3) remains open. This helps reduce the energy consumption and also improves the drying capability of the dishwasher (1).

[0023] In another embodiment, the dishwasher (1) comprises a temperature sensor (8) in communication with the control unit (4) to measure the temperature of the air inside the inner volume wherein the control unit (4) is configured to form a decision matrix to adjust the first and second values depending on the temperature. According to the data provided by the first sensor (5), the

second sensor (7) and the temperature sensor (8) the control unit creates a decision matrix. This helps improve energy consumption and drying capability of the dishwasher (1).

[0024] In another embodiment, the dishwasher (1) comprises a fan (9) to direct the air inside the inner volume towards the first sensor. The fan (9) circulates the air inside the inner volume improving precision of the first sensor (5).

[0025] In another embodiment, the dishwasher (1) comprises a cover (10) enclosing the first sensor (5) in a water-tight manner. It is vital for the first sensor (5) to be dry in order to achieve a correct relative humidity measurement.

[0026] In the dishwasher (1) of the present invention, drying step is improved by means of the first sensor (5), the second sensor (7) and the control unit (4) in communication with said sensors (5,7). The control unit (4) according to the readings coming from the first sensor (5) and the second sensor (7) activates the actuator (6) to open the door (3) which in turn helps remove the air that has a high relative humidity from the inner volume. As a result, the dishes are dried in an efficient manner.

Claims

1. A dishwasher (1) comprising;

a body (2) having an inner volume wherein the articles to be washed are placed,
a door (3) having an open position and a closed position,
a control unit (4) configured to execute the steps of washing, rinsing, drying,
a first sensor (5) in communication with the control unit (4) to detect the relative humidity of the air inside the inner volume,
an actuator (6) configured to open or close the door (3) upon activation,
characterized in that
the control unit (4) is configured to;
activate the actuator (6) to open the door (3) during the drying step if the relative humidity of the inner volume exceeds a first value,
activate the actuator (6) to close the door (3) if the relative humidity of the inner volume falls under a second value.

2. A dishwasher (1) according to claim 1, **characterized by** a second sensor (7) in communication with the control unit (4) to detect the relative humidity of the surrounding environment wherein the control unit (4) is configured to adjust the first and second value depending on the relative humidity of the surrounding environment.

3. A dishwasher (1) according to claim 2, **characterized by** a temperature sensor (8) in communication with the control unit (4) to measure the temperature of the air inside the inner volume wherein the control unit (4) is configured to form a decision matrix to adjust the first and second values depending on the temperature.

4. A dishwasher (1) according to any of the preceeding claims, **characterized by** a fan (9) to direct the air inside the inner volume towards the first sensor.

5. A dishwasher (1) according to claim 1, **characterized by** a cover (10) enclosing the first sensor (5) in a water-tight manner.

Figure 1

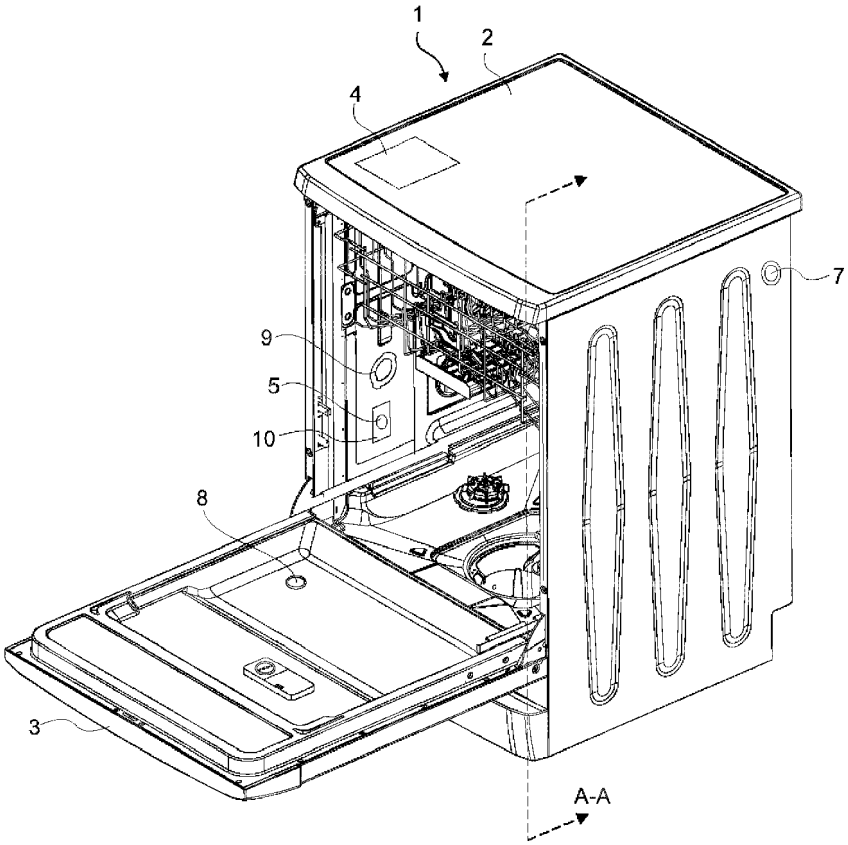


Figure 2

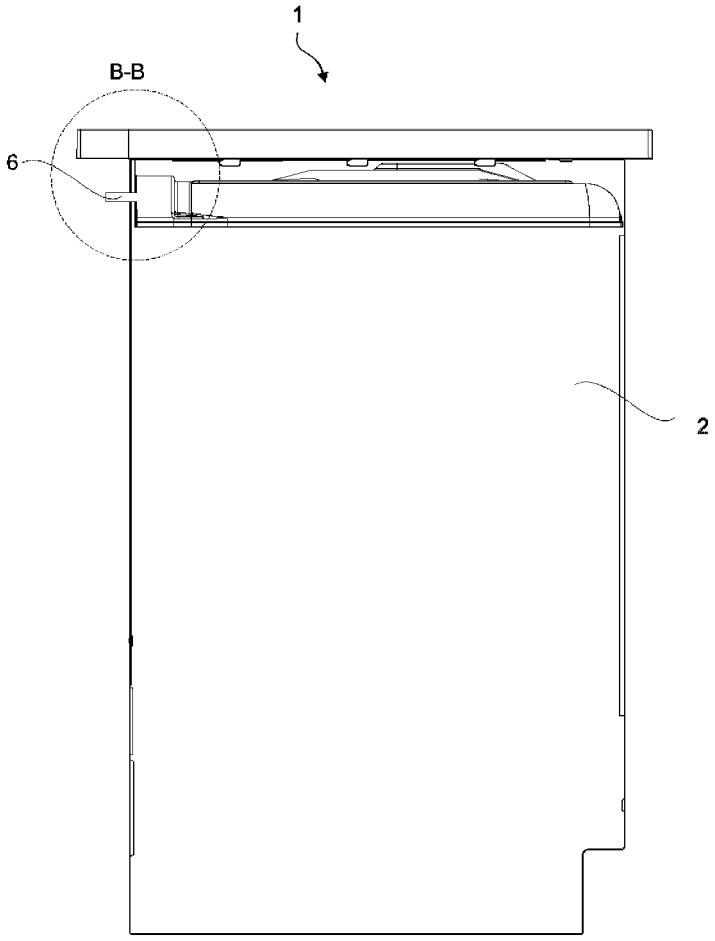
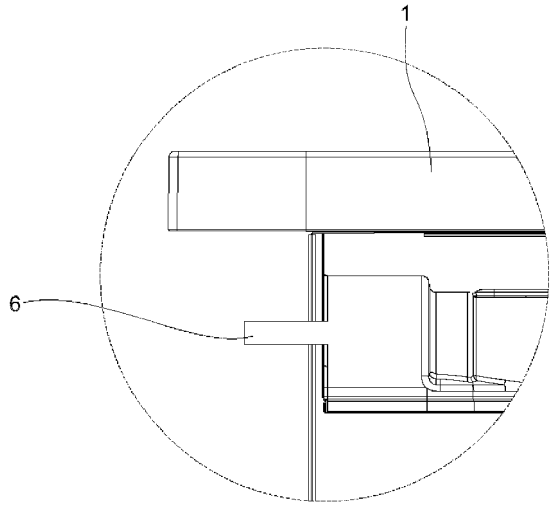


Figure 3



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EUROPEAN SEARCH REPORT

Application Number
EP 20 21 6655

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 April 2021	Weidner, Maximilian

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

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

REFERENCES CITED IN THE DESCRIPTION

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- CN 109700408 **[0005]**