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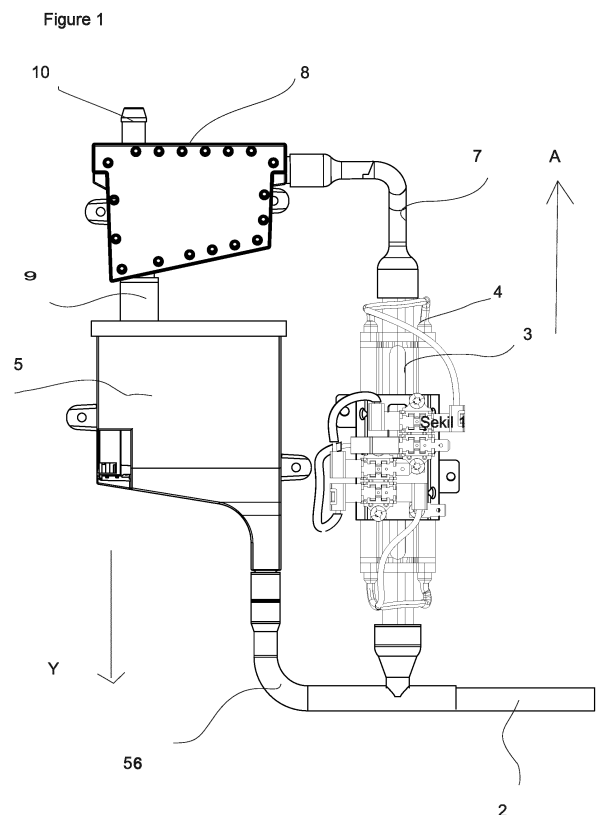
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AN OVEN WITH STEAM COOKING FUNCTION

(57) The present invention relates to an oven (1) comprising at least one supply line (2) which ensures the delivery of water in a top to bottom direction (Y); a steam generator (3) which is positioned longitudinally and vertically; a tank (5) which is positioned longitudinally and vertically so as to be parallel to the steam generator (3); a first connection member (6) which connects the steam generator (3) and the tank (5) to each other, wherein the water delivered from the supply line (4) is delivered to the steam generator (3) and/or the tank (5) in a bottom to top direction (A); and at least one temperature sensor (4) which is configured to detect a predetermined value lower than the boiling point of water.



Description

Technical Field

[0001] The present invention relates to a household oven with steam cooking function. The present invention further relates to a method for controlling a steam generation system for a household oven with steam cooking function.

State of the Art

[0002] Today, steam cooking has become very important as the technique of using steam in household ovens ensures the cooking of very tasty foodstuffs and preserves the nutrients naturally present in foodstuffs. The number of household ovens which has steam cooking function increases day by day. In the state of the art ovens, a steam generation system is arranged outside the oven cavity and the steam is injected into the oven cavity through one or more nozzles. Therefore, in the household ovens, it became necessary to control and deliver the steam to be sent into the oven.

[0003] Various methods are used in the state of the art to control a steam generation system of a household oven with steam cooking function. One of these is to activate the steam generator, and then detect the temperature in the steam generator. If there is no water in the steam generator, the steam generator remains active and the temperature peaks. In this scenario, the pumps are required to draw water from the beginning each time, which causes the cooking quality to decrease. Moreover, running out of water in the system causes problems such as the thermal relay breaking contact.

[0004] After detecting the temperature in the steam generator, it is checked whether this temperature is higher than a predetermined threshold temperature value. If the detected temperature is higher than the set threshold temperature value, the system is deactivated by means of a control valve. If the detected temperature is lower than the predetermined temperature value, then the system continues to control the temperature. However, with these techniques used, if the steam generator is not cooled down, the control valve is opened again. Therefore, the steam generator heater is turned on and off very frequently, which causes condensation in the hose when the steam is cut off. All of these situations prevent the steam control system from operating correctly, create a danger in the oven and cause an increase in the energy consumption.

[0005] One of the technical problems encountered in the state of the art is that it is required to wait for the water to bubble or boil in order to generate steam. As a result, the first steam formed while the water is heated pushes the hot water, which is not yet heated enough, causing a double phase flow. Therefore, the water cannot be heated homogeneously and the steam flow rate cannot be adjusted in the current system. As a result, the different

steam flow rates required for different foodstuffs or the continuous operation of the system cannot be obtained.

[0006] In the state of the art Patent Application No. US2010054717A1, a steam generator for an oven with steam cooking function is disclosed, which simplifies the configuration of a device required for generating steam and which can be detachably attached.

Brief Description of the Invention

[0007] The aim of the present invention is the realization of an oven which provides the homogeneous heating of the water for the steam to be delivered into the body.

[0008] Another aim of the present invention is the realization of an oven which enables the steam flow rate to be delivered into the body to be adjusted.

[0009] Another aim of the present invention is the realization of an oven which provides energy efficiency and operates safely by preventing the steam generation system from being constantly turned on and off.

[0010] The oven realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a body wherein the foodstuffs to be cooked are placed; a water container which is disposed on the body; at least one supply line which enables the water taken from the water container to be delivered in a top to bottom direction; a steam generator which is positioned longitudinally and vertically; a tank which is positioned longitudinally and vertically so as to be parallel to the steam generator; a first connection member which connects the steam generator and the tank to each other, wherein the water delivered through the supply line is filled into the steam generator and/or the tank in a bottom to top direction; and a separation receptacle which is positioned at a level upper than that of the steam generator and the tank, which is connected to the steam generator by at least one second connection member and connected to the tank by at least one third connection member and which separates the water and the steam coming from the steam generator.

[0011] The oven of the present invention comprises at least one temperature sensor which is configured to measure a predetermined temperature value which is lower than the boiling temperature of water, preferably above 85°C and below 100°C.

[0012] The oven of the present invention comprises a control unit which is positioned on the body, which is in communication with the temperature sensor, the supply line and the steam generator, which receives the temperature information of the water in the steam generator measured by the temperature sensor, and which ensures that the water-steam mixture in the steam generator is delivered to the separation receptacle when the temperature of the water reaches a value above 85°C and below 100°C.

[0013] The oven of the present invention comprises at least one delivery line which enables the steam leaving the separation receptacle to be delivered into the body.

[0014] The oven of the present invention comprises the supply line which provides connection to the body at one end and to the steam generator or the tank or the separation receptacle at the other end, and which enables the water taken from the water container to be delivered to the steam generator and/or the tank from top to bottom with the effect of gravity.

[0015] The oven of the present invention comprises the steam generator and the tank, which are connected to each other through the first connecting member and form a U-shaped structure.

[0016] The oven of the present invention comprises at least one second sensor which is positioned at any point in or on the tank and which controls the water level in the tank.

[0017] In the oven of the present invention, the temperature sensor is a negative temperature coefficient (NTC) sensor.

[0018] An oven realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1: is the front perspective view of the steam generator, the tank and the separation receptacle of the present invention.

Figure 2: is the top perspective view of the oven of the present invention.

[0019] The following numerals are referred to in the description of the present invention:

G: Body

C: Control unit

1. Oven
2. Supply line
3. Steam generator
4. Temperature sensor
5. Tank
6. First connection member
7. Second connection member
8. Separation receptacle
9. Third connection member
10. Delivery line
11. Second sensor

100. Steam generation method

Y: Water delivery direction

A: Water filling direction

Detailed Description of the Invention

[0020] The oven (1) comprises a body (G) wherein the foodstuffs to be cooked are placed; and said steam generation system comprises at least one supply line (2) which enables the water to be delivered in a top to bottom direction (Y); a steam generator (3) which is positioned longitudinally and vertically; a tank (5) which is positioned longitudinally and vertically so as to be parallel to the steam generator (3); a first connection member (6) which connects the steam generator (3) and the tank (5) to each other, wherein the water delivered through the supply line (2) is filled into the steam generator (3) and/or the tank (5) in a bottom to top direction (A); and a separation receptacle (8) which is positioned at a level upper than that of the steam generator (3) and the tank (5), which is connected to the steam generator (3) by at least one second connection member (7) and connected to the tank (5) by at least one third connection member (9) and which separates the water and the steam coming from the steam generator (3).

[0021] In an embodiment of the present invention, the oven (1) further comprises at least one temperature sensor (4) which is configured to measure a predetermined temperature value which is lower than the boiling temperature of water, preferably above 85°C and below 100°C.

[0022] In an embodiment of the present invention, the oven (1) further comprises a control unit (C) which is positioned on the body (G) and which is configured to receive the temperature information of the water in the steam generator (3) measured by the temperature sensor (4) and to ensure that the water-steam mixture in the steam generator (3) is delivered to the separation receptacle (8) when the temperature of the water reaches a value above 85°C and below 100°C.

[0023] In an embodiment of the present invention, the steam generation system further comprises at least one delivery line (10) which provides the delivery of the steam leaving the separation receptacle (8).

[0024] In an embodiment of the present invention, the temperature sensor (4) can be positioned in the steam generator (3) in direct contact with water so as to measure the temperature of the water in the steam generator (3) and to measure a temperature value from 85°C to 100°C before the water reaches the boiling temperature. Thus, the water-steam mixture at these temperatures is delivered to the separation receptacle (8) through a second connection member (7) in a form just before reaching the boiling temperature. In another embodiment of the present invention, the temperature sensor (4) can be positioned anywhere on the outer surface of the steam gen-

erator (3).

[0025] In an embodiment of the present invention, the temperature sensor (4) can be any suitable type of sensor including but not limited to negative temperature coefficient (NTC) sensors, thermocouples, ceramic thermistors, metallic resistance temperature detectors (RTD), and infrared temperature measurement devices.

[0026] In an embodiment of the present invention, the temperature sensor (4) is a negative temperature coefficient (NTC) sensor.

[0027] Since the NTC sensor set temperature is set to temperatures lower than the boiling point of water, preferably above 85°C and below 100°C, instead of the boiling point, different steam flow rates of water and steam in this temperature range where water begins to boil are obtained. Thus, as the water bubbles and the water particles rise with the steam as a double phase flow, the steam is delivered at different flow rates from the steam generator (3) to the separation receptacle (8) and from there into the body (G). Thus, homogeneous and effective humidification of the foodstuffs to be cooked is provided.

[0028] In an embodiment of the present invention, the supply line (2) provides connection with the body (G) at one end and with the steam generator (3) or the tank (5) or the separation receptacle (8) at the other end so as to ensure that the water is taken from the water container and delivered to the steam generator (3) and/or the tank (5) in a top to bottom direction (Y) with the effect of gravity.

[0029] In an embodiment of the present invention, the second connection member (7) is connected to the steam generator (3) at one end and the separation receptacle (8) at the other end so as to provide the connection between the steam generator (3) and the separation receptacle (8), and delivers the water and the steam leaving the steam generator (3) together to the separation receptacle (8).

[0030] In an embodiment of the present invention, the third connection member (9) is connected to the separation receptacle (8) at one end and the tank (5) at the other end so as to provide the connection between the separation receptacle (8) and the tank (5), and delivers the water separated in the separation receptacle (8) to the tank (5).

[0031] In an embodiment of the present invention, the delivery line (10) is connected to the separation receptacle (8) at one end and the body (G) at the other end so as to provide the connection between the separation receptacle (8) and the body (G), and delivers the steam separated in the separation receptacle (8) to the body (G).

[0032] In an embodiment of the present invention, the water is delivered to the steam generator (3) or the tank (5) or the separation receptacle (8) in the direction Y through the supply line (2). Thus, the water is delivered to the steam generator (3) and/or the tank (5) with the effect of gravity through the supply line (2). Afterwards, the water is pumped in the direction A into the steam

generator (3) and the tank (5), which are positioned in a vertical position so as to be parallel to each other. The steam generator (3) and the tank (5), which are connected to each other by means of the first connection member (6) and form a U-shaped structure, operate on the principle of communicating vessels. The water in the steam generator (3) and the tank (5) always remains at the same level. Due to its structure, the steam generator (3) is a generator with a small water volume. The large volume tank (5) positioned parallel to the steam generator (3) can store a volume of water sufficient to meet the needs of the system. As the water in the steam generator (3) decreases, continuous water flow is ensured from the tank (5) to the steam generator (3) with the principle of communicating vessels. Thus, the need for the supply line (2) to constantly pump the water or for the system to be constantly turned on and off is eliminated. Thus, energy efficiency and safe operation of the system are provided.

[0033] In another embodiment of the present invention, the supply line (2) provides connection with the separation receptacle (8), and takes the water from the water container and delivers the same to the separation receptacle (8) in a top to bottom direction (Y) with the effect of gravity. Then, the water is delivered from the separation receptacle (8) to the tank (5) through the third connection member (9). Afterwards, the water is pumped in the direction A into the steam generator (3) and the tank (5), which are positioned in a vertical position so as to be parallel to each other.

[0034] In the steam generator (3) and the tank (5), which are connected to each other through the first connection member (6) and form a U-shaped structure, with the principle of communicating vessels, the water is delivered from the tank (5) to the steam generator (3) through the first connection member (6) such that the water in the steam generator (3) and the tank (5) always remains at the same level.

[0035] In an embodiment of the present invention, the supply line (2) comprises at least one pump or valve.

[0036] In an embodiment of the present invention, the water level control in the tank (5) is performed by means of a second sensor (11). The second sensor (11) can be positioned at any point in and/or on the tank (5). The information that the water has reached a certain level in the tank (5) is transmitted to the motherboard by the second sensor (11), and a stop instruction is given to the motherboard and the pump.

[0037] In another embodiment of the present invention, the water level control in the tank (5) is monitored by means of an algorithm on the motherboard. The operation of the pump within a certain time interval is calculated through the algorithm, and when the operating time of the pump reaches said measured value, water delivery from the pump is stopped.

[0038] In an embodiment of the present invention, the temperature sensor (4) provided in the oven (1) is positioned on at least one of the steam generator (3), the tank

(5) or the separation receptacle (8).

[0039] In an embodiment of the present invention, the temperature sensor (4) is positioned on the steam generator (3). The temperature sensor (4) is set to a temperature value below the predetermined boiling point of water. Thus, different steam flow rates and regimes are obtained. Below this boiling point, water begins to evaporate. Since the flow rate of the steam and the flow rate of the water at the stage of being converted into steam are different from each other, the steam-water mixture is delivered from the steam generator (3) to the separation receptacle (8) at different flow rates.

[0040] In the preferred embodiment of the present invention, the steam generator (3) is a tube-type steam generator (3). The steam generator (3) is connected to the first connection member (6) from the lower part thereof and to the second connection member (7) from the upper part thereof. The evaporation of the water is performed in said steam generator (3). The water is delivered to the steam generator (3) through the supply line (2). The steam generated in the steam generator (3) is delivered from said steam generator (3) to the separation receptacle (8) through the second connection member (7). In said separation receptacle (8), the steam is separated from double phase to single phase. Then, the water is delivered to the tank (5) through a third connection member (8). The steam in the separation receptacle (8) is delivered into the body (G) through a delivery line (10). The steam delivered into the body (G) is separated from the water and directed at different flow rates.

[0041] In an embodiment of the present invention, the steam generator (3) and the tank (5) are positioned at a level lower than the level at which the water enters the supply line (2).

[0042] In an embodiment of the present invention, the steam generator (3) and the tank (5) are positioned parallel to each other and in a vertical position, under the separation receptacle (8).

[0043] The oven (1) of the present invention comprises at least one supply line (2) which enables the water to be delivered in a top to bottom direction (Y); a steam generator (3) which is positioned longitudinally and vertically; a tank (5) which is positioned longitudinally and vertically so as to be parallel to the steam generator (3); a first connection member (6) which connects the steam generator (3) and the tank (5) to each other, wherein the water delivered through the supply line (2) is filled into the steam generator (3) and/or the tank (5) in a bottom to top direction (A); at least one temperature sensor (4) which is set at a predetermined value lower than the boiling point of water; a separation receptacle (8) which is positioned at a level upper than that of the steam generator (3) and the tank (5) and which separates the water and the steam; at least one second connection member (7) which provides the connection between the steam generator (3) and the separation receptacle (8); at least one third connection member (9) which provides the connection between the tank (5) and the separation recep-

tacle (8); and at least one delivery line (10) which provides the delivery of the steam leaving the separation receptacle (8).

[0044] In an embodiment of the present invention, the oven (1) is a household oven (1) with steam cooking function.

[0045] In an embodiment of the present invention, a steam generation method (100) for the oven (1) comprises the operational steps of

- taking the water from the water container (3) by the supply line (2) which provides the connection with the body (2) at one end and with the steam generator (3) or the tank (5) or the separation receptacle (8) at the other end to be delivered to the steam generator (3) and/or the tank (5) in a top to bottom direction (Y) with the effect of gravity,
- setting the temperature sensor (4) threshold value to a predetermined value below the boiling temperature of water,
- reacting by the temperature sensor (4) to a temperature in and/or on at least one of the steam generator (3), the tank (5) or the separation receptacle (8),
- delivering the water-steam mixture to the separation receptacle (8) through a second connection member (7) when the temperature in and/or on at least one of the steam generator (3), the tank (5) or the separation receptacle (8) reaches the predetermined value, and
- delivering the steam in the separation receptacle (8) into the body (G) through a delivery line (10).

[0046] In an embodiment of the present invention, the threshold value of the temperature sensor (4) is adjusted to a temperature value between 85°C and 100°C.

[0047] In an embodiment of the present invention, a steam generation method (100) for the oven (1) also comprises the operational step of separating the double-phase water and steam in the separation receptacle (8) into a single phase.

[0048] In an embodiment of the present invention, a steam generation method (100) for the oven (1) also comprises the operational step of delivering the water to the tank (5) through a third connection member (9).

Claims

1. An oven (1) **comprising** a body (G) wherein the foodstuffs to be cooked are placed and a water container which is provided on the body (G), **characterized by** at least one supply line (2) which enables the water taken from the water container to be delivered in a top to bottom direction (Y); a steam gen-

- erator (3) which is positioned longitudinally and vertically; a tank (5) which is positioned longitudinally and vertically so as to be parallel to the steam generator (3); a first connection member (6) which connects the steam generator (3) and the tank (5) to each other and which enables the water delivered through the supply line (2) to be filled into the steam generator (3) and/or the tank (5) in a bottom to top direction (A); and a separation receptacle (8) which is positioned at a level upper than that of the steam generator (3) and the tank (5), which is connected to the steam generator (3) by at least one second connection member (7) and connected to the tank (5) by at least one third connection member (9) and which separates the water and the steam coming from the steam generator (3).
2. An oven (1) as in Claim 1, **characterized by** at least one temperature sensor (4) which is configured to measure a predetermined temperature value which is lower than the boiling temperature of water, preferably above 85°C and below 100°C.
 3. An oven (1) as in Claim 2, **characterized by** a control unit (C) which is positioned on the body (G), which is in communication with the temperature sensor (4), the supply line (2) and the steam generator (3), which receives the temperature information of the water in the steam generator (3) measured by the temperature sensor (4), and which ensures that the water-steam mixture in the steam generator (3) is delivered to the separation receptacle (8) when the temperature of the water reaches a value above 85°C and below 100°C.
 4. An oven (1) as in any one of the above claims, **characterized by** at least one delivery line (10) which provides the delivery of the steam leaving the separation receptacle (8) into the body (G).
 5. An oven (1) as in any one of the above claims, **characterized by** the supply line (2) which is connected to the body (G) at one end and with the steam generator (3) or the tank (5) or the separation receptacle (8) at the other end so as to ensure that the water is taken from the water container and delivered to the steam generator (3) and/or the tank (5) in a top to bottom direction (Y) with the effect of gravity.
 6. An oven (1) as in any one of the above claims, **characterized by** the steam generator (3) and the tank (5) which are connected to each other by means of the first connection member (6) and form a U-shaped structure.
 7. An oven (1) as in any one of the above claims, **characterized by** at least one second sensor (11) which is positioned at any point in or on the tank (5) and which controls the water level in the tank (5).
 8. An oven (1) as in any one of the above claims, **characterized in that** the temperature sensor (4) is a negative temperature coefficient (NTC) sensor.
 9. A steam generation method (100) for the oven (1) comprising the steps of:
 - taking the water from the water container (3) by the supply line (2) which provides the connection with the body (2) at one end and with the steam generator (3) or the tank (5) or the separation receptacle (8) at the other end to be delivered to the steam generator (3) and/or the tank (5) in a top to bottom direction (Y) with the effect of gravity,
 - setting the temperature sensor (4) threshold value to a predetermined value below the boiling temperature of water,
 - reacting by the temperature sensor (4) to a temperature in and/or on at least one of the steam generator (3), the tank (5) or the separation receptacle (8),
 - delivering the water-steam mixture to the separation receptacle (8) through a second connection member (7) when the temperature in and/or on at least one of the steam generator (3), the tank (5) or the separation receptacle (8) reaches the predetermined value, and
 - delivering the steam in the separation receptacle (8) into the body (G) through a delivery line (10).
 10. A method (100) as in Claim 9, **characterized in that** the threshold value of the temperature sensor (4) is adjusted to a temperature value between 85°C and 100°C.
 11. A method (100) as in Claim 9 or 10, **characterized by** the operational step of separating the double-phase water and steam in the separation receptacle (8) into a single phase.
 12. A method (100) as in Claim 9, **characterized by** the operational step of delivering the water to the tank (5) through a third connection member (9).

Figure 1

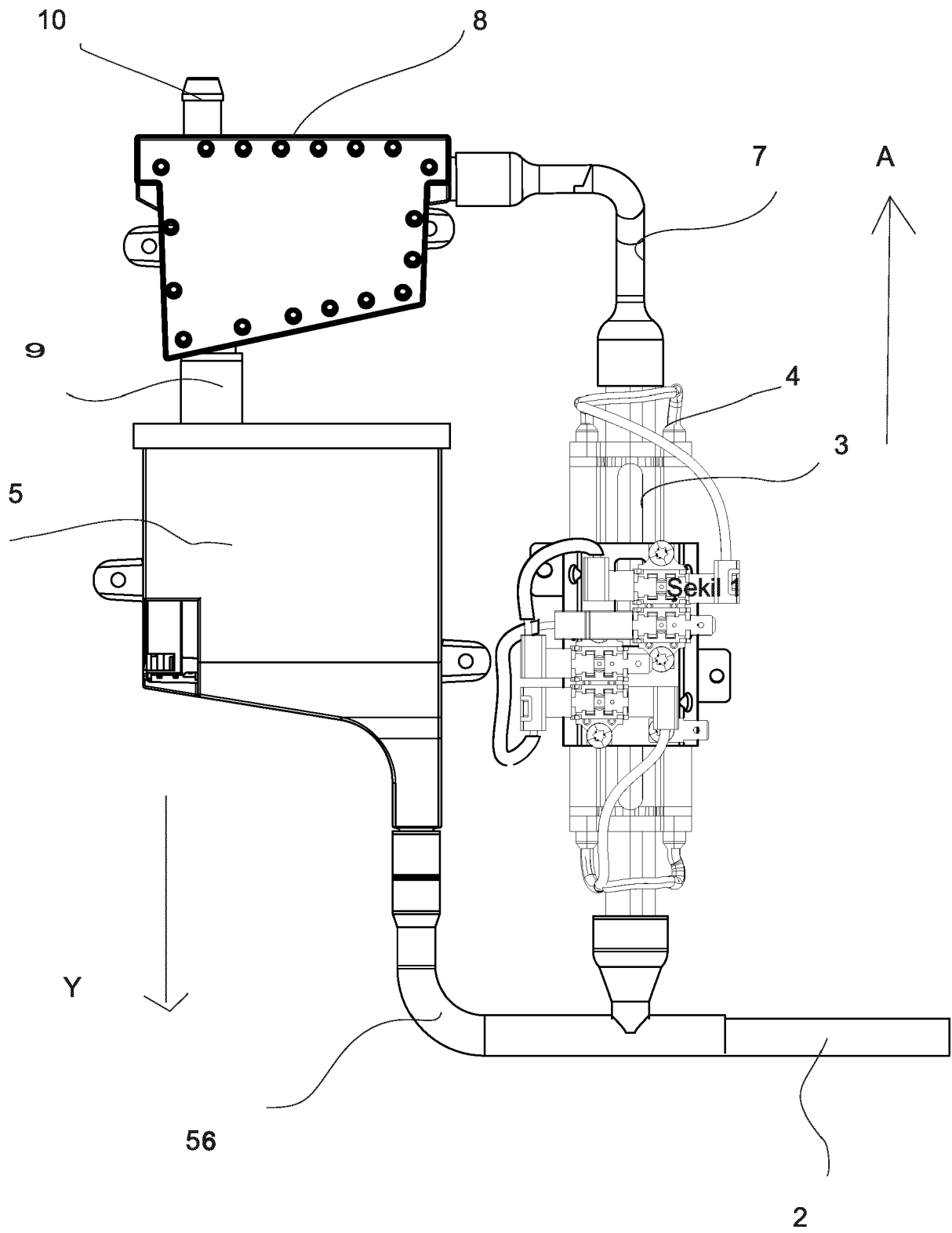
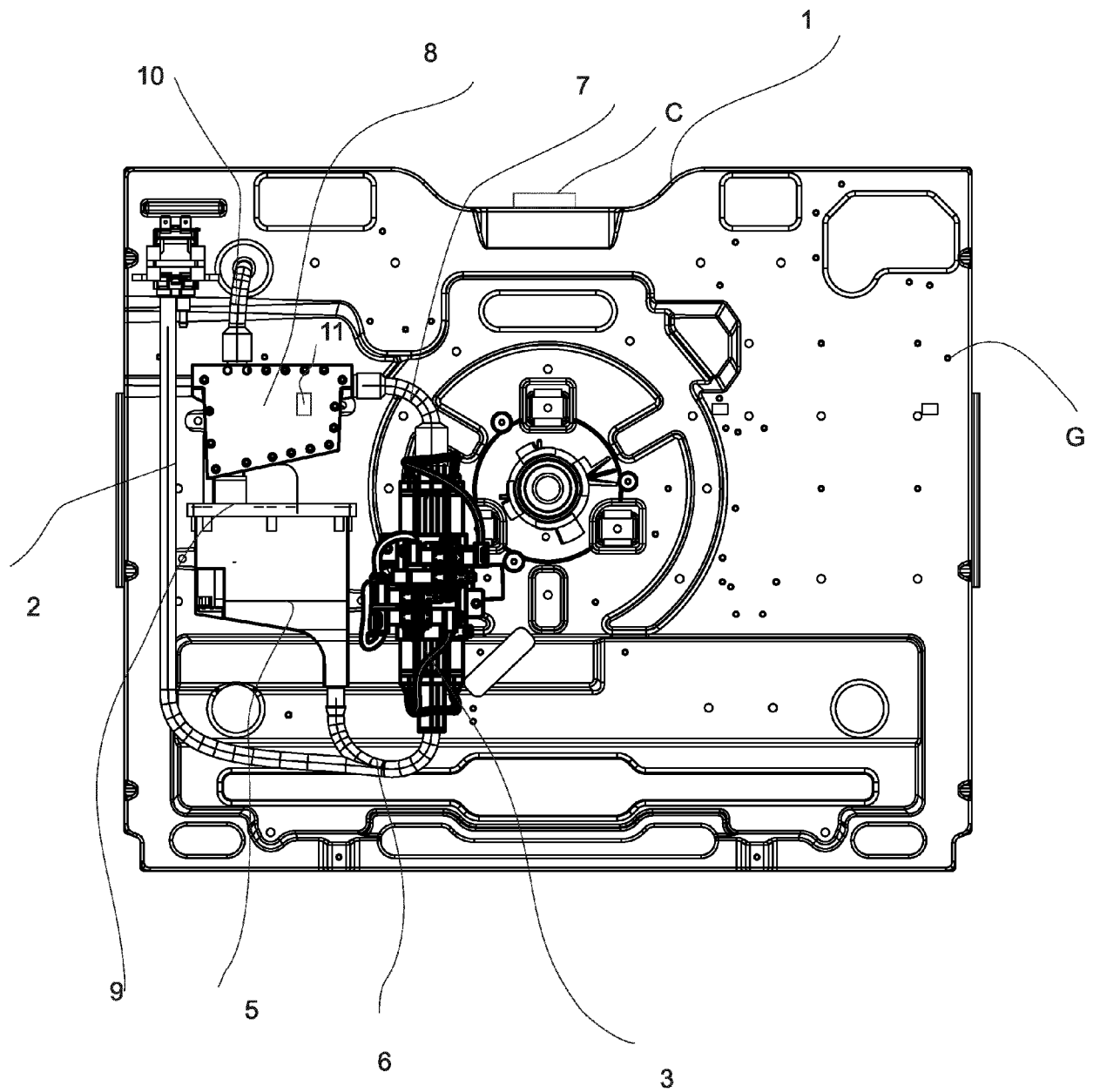


Figure 2





EUROPEAN SEARCH REPORT

Application Number

EP 23 21 3000

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP S53 26364 A (MATSUSHITA ELECTRIC IND CO LTD) 11 March 1978 (1978-03-11)	1, 4-6	INV. F24C15/32
Y	* the whole document *	2, 7, 8	
A	-----	3, 9-12	
X	JP S53 23805 U (N.N.) 28 February 1978 (1978-02-28) * figures *	1, 4-6	
Y	----- CN 210 446 670 U (HANGZHOU ROBAM APPLIANCES CO LTD) 5 May 2020 (2020-05-05) * figure 5 *	2, 7, 8	

The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			F24C
Place of search		Date of completion of the search	Examiner
The Hague		24 April 2024	Verdoodt, Luk
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 23 21 3000

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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24-04-2024

10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
	JP S5326364 A	11-03-1978	NONE	
15	JP S5323805 U	28-02-1978	NONE	
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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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