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(54) HEATING APPARATUS FOR HEATING LIQUID

(57) A heating apparatus (100) for heating liquid comprises a sealed frame (1), a heating body (10), a water inlet (14), and a water outlet (11). The sealed frame (1) and the heating body (10) are sealedly connected, and the two enclose and form a cavity within. The cavity is provided with a sealed body (2), and the sealed body (2) and the heating body (10) enclose and form a sealed water passage (8) having a certain degree of capacity. The sealed water passage (8) is connected to the exterior separately by means of the water inlet (14) and the water outlet (11). Liquid that enters from the water inlet (14) is limited and sealed within the sealed water passage (8), and flows along the sealed water passage (8) and, at the end, out of the water outlet (11). The heating apparatus (100) reduces the pre-heating time in start-up, continuously discharges water at a stable temperature. Additionally, the present invention avoids the problem of gasification and non-continuous water discharge as a result of water leakage caused by the gap between a liquid passage and a heater having a thick stainless steel film.

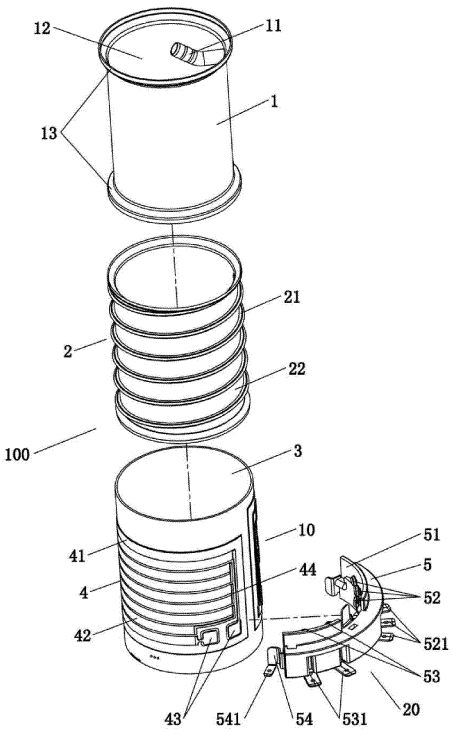

FIG.1

EP 3 412 986 A1

Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a heating apparatus, particularly to a heating apparatus for heating liquid.

Description of the Prior Art

[0002] In an ordinary electric heating device, a heating resistor is encapsulated with an insulator and then embedded in cast aluminum having higher thermal conductivity, and a stainless tube is curved to form a continuous liquid passageway and embedded in the cast aluminum.

[0003] Heat generated by the heating resistor cannot directly enter the liquid inside the stainless tube but heats the cast aluminum to a given temperature beforehand. Then, heat exchange undertakes between the cast aluminum and the liquid through the stainless tube. Because aluminum has a higher thermal inertia, the following problems may take place: 1. A longer period of time (about 15-305 seconds) is spent in preheating the cast aluminum to the required temperature while starting up the device. 2. If the rate that the heating resistor generates heat is lower than the rate that the liquid absorbs heat in the case requiring continuous liquid supply, the temperature of the cast aluminum is decreased; if the temperature of the output liquid is not allowed to be lowered, more time would be spent in preheating. 3. If the heating device is demanded to be in a standby state, some energy would be spent in keeping the temperature at a constant temperature. 4. The heating device using cast aluminum with high thermal inertia needs preheating to supply liquid of a constant temperature; if the heating device is required to supply liquid continuously, the temperature of the output liquid is hard to keep constant; further, because of high thermal inertia of cast aluminum, it is unlikely to realize continuous variation of liquid temperature; besides, cast aluminum is heavy and bulky, and the fabrication technology is very complicated.

[0004] There are some existing schemes for solving the abovementioned problems. For example, a plastic runner is arranged inside a thick-film stainless tube to avoid the influence of thermal inertia. Plastic material has a given hardness. In order to let the plastic runner be thrusted into the stainless outer tube, the outer diameter of the plastic runner must be reduced and is not fully fit to the inner diameter of the stainless outer tube. Although the scheme solves the problem of installation, it brings about the problem of sealing. The liquid would not always flow along the runner but may partially run through the gaps where sealing is incomplete. A portion of water running into the gaps may become stagnant water, and the stagnant water would be persistently heated in situ and finally vaporized to jet out. Thus, the output water become intermittent. Because the sealing between the plastic and metal can only be realized by sealing rings, it is unlikely to achieve the requirement of keeping a pressure of 8-10 Bar. Even at ambient pressure, the sealing rings, which are deteriorated by long-term usage at high temperature, may lead to liquid leakage.

[0005] At present, the traditional water purification machine normally has only a filtration section and a temperature modification section. In usage, water is filtered, next chilled or heated, and then supplied to users. However, the traditional water purification machine still has the following problems: the input water has different temperatures in different environments, and thus the output water also has different temperatures; for example, even though water is heated/chilled for an identical period of time, the output water has different temperatures in winter and summer because the input water has different temperatures in winter and summer. Therefore, some water purification machines have a function of adjusting the time of heating or chilling water to solve the problems of different input water temperatures. Although the measure can satisfy the users in the output water temperature, it also brings about some inconveniences. For example, it cannot meet the demand by some hi-end users for the speed of supplying water. Therefore, how to guarantee the temperature of output water without varying the time of heating or chilling water has become a problem the manufacturers desire to overcome.

SUMMARY OF THE INVENTION

[0006] The primary objective of the present invention is to overcome the deficiencies of the existing technologies and provide a heating apparatus for heating liquid, which is characterized in simple and rational structure, small thermal inertia, and superior heating effect.

[0007] In order to achieve the objectives of the present invention, the present invention proposes a heating apparatus for heating liquid, which comprises a sealed frame, a heating body, a water outlet, and a water inlet. The sealed frame and the heating body are connected with each other sealedly and enclose a room sealedly to form a cavity. The present invention is characterized in that a sealed body is disposed inside the cavity, and that the sealed body and the heating body enclose a room to form a sealed water passage having a given capacity, and that the sealed water passage interconnects with the exterior through the water inlet and the water outlet, and that the liquid from the water inlet is constrained by the sealed water passage, flows along the sealed water passage, and then runs out of the water outlet.

[0008] The objectives of the present invention may be further realized by the technical measures involved in the embodiments described below.

[0009] In one embodiment, the sealed body has a sealing rib along the path interconnecting the water inlet and the water outlet. The sealing rib contacts the heating body in a sealed state. Thereby, the sealed water passage

between the water inlet and the water outlet is longer than the linear distance between the water inlet and the water outlet. Thus is increased the efficiency of heat exchange between the heating body and the heated liquid.

[0010] In one embodiment, the sealing rib and the sealed body are fabricated into a one-piece component. The area where the sealing rib contacts the sealed body is larger than the area where the sealing rib contacts the heating body in a sealed state. Thereby, more heat is conducted from the heating body to the heated liquid, and less energy is wasted.

[0011] In one embodiment, a material is cast outside the sealed frame to form the sealed body. Thereby is enhanced the tightness of the bonding between the sealed body and the sealed frame.

[0012] In one embodiment, the surface of the sealed frame has positioning elements for positioning the sealed body. Thereby, the sealed body is fixed to the sealed frame relatively securely. Thus, the sealed water passage would not move, or the movement thereof may be neglected.

[0013] In one embodiment, each of the sealed frame and the heating body is in form of a hollow pipe structure. The sealed body tightly sleeves the outer surface of the sealed frame. The sealing rib rises upward spirally along the outer surface of the sealed body. The pitch of the sealing rib forms a spiral water trench. The heating body sleeves the sealed frame and the sealed body. Two ends of the heating body are respectively fit to two ends of the sealed frame in a sealed state. The spiral water trench and the heating body jointly enclose a room to form the sealed water passage in a spiral form. The water inlet and the water outlet are respectively at two ends of the sealed water passage. The liquid flowing into the sealed water passage via the water inlet can only run along the entire sealed water passage before it runs out of the water outlet. Thus, the flowing path is longer, and the liquid can fully contact the heating body. Hence, less energy is wasted.

[0014] The sealed frame has a hollow chamber in the center thereof. The water inlet and the water outlet are disposed on the wall of the hollow chamber. The sealed frame is substantially a pipe structure with two ends thereof opened. The pipe structure has a circular or circle-like cross section. The spiral sealed water passage is free of blind spots and thus accumulates less water scale. The hollow structure of the sealed frame favors reducing weight, decreasing thermal inertia, and increasing time of heating liquid.

[0015] The surface of the heating body, which faces the sealed body, is a smooth surface, whereby to prevent from formation of water scale that impairs heat conduction.

[0016] The heating body includes a heat transfer component and a heating component. The heat transfer component is in form of a pipe structure. The heating component is a thick-film heating circuit. The thick-film heating circuit is sintered onto the outer surface of the heat transfer component. The position of the thick-film heating circuit is between the altitudes corresponding to the water inlet and the water outlet. The surface of the sealed water passage is larger than the surface area of the thick-film heating circuit, whereby to guarantee that only the sealed water passage is heated by the thick-film heating circuit and prevent from temperature rising too fast, which is caused by that the thick-film heating circuit cannot undertake heat exchange with the heated liquid timely. Thus is prolonged the service life of the thick-film heating circuit and enhanced the safety of using the product.

[0017] The heating apparatus for heating liquid of the present invention further comprises an electric connector. The electric connector includes a connector seat, elastic contacts and contact leads. The connector seat is disposed in the heating body. The elastic contacts are disposed in the connector seat and respectively electrically connected with the contact leads and the thick-film heating circuit. The contact leads extend out of the connector seat. The outer surface of the heating body is a cylindrical surface where cables are hard to solder. The present invention disposes the electric connector on the outer surface of the heating body, whereby the contacts of the electric connector can electrically contact the electric-conduction points of the heating body, wherefore the difficulty of electric connection is greatly reduced. Besides, the contacts have leads extending out of the electric connector to convenience electric connection.

[0018] The present invention has the following advantages:

(1) The heating apparatus can decrease the preheating time in start-up and output water with stable temperature. In standby, the cast aluminum needn't be heated to maintain the temperature thereof.
(2) The heating apparatus is exempted from the gaps between the liquid runner and the stainless thick-film heater, which may cause liquid vaporization, generate steam, and induce intermittent water supply.
(3) The heating apparatus has simple structure and low fabrication cost.
(4) The heating apparatus can fast output water with a temperature of 60-98°C, applicable to electric coffee makers, espresso makers, beverage heaters, etc., and satisfying the requirements for mouth feels and nutrient extraction.
(5) The heating apparatus can output water with stable temperature continuously or output temperature-varying water anytime, even at beginning.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

Fig.1 is an exploded view schematically showing the structure of a heating apparatus according to one embodiment of the present invention;
Fig.2 is a diagram schematically showing the struc-

ture of an assemblage of a heating apparatus according to one embodiment of the present invention;

Fig.3 is a diagram schematically showing the structure of the heating apparatus in Fig.2, which is viewed from another viewing angle;

Fig.4 is a sectional view schematically showing the structure of a heating apparatus according to one embodiment of the present invention;

Fig.5 is an enlarged view schematically showing the structure of a heating apparatus in the area labelled by A according to one embodiment of the present invention;

Fig.6 is a diagram schematically showing the structure of a sealed frame of a heating apparatus according to another embodiment of the present invention;

Fig.7 is a diagram schematically showing the operation of a heating apparatus according to one embodiment of the present invention; and

Fig.8 is a block diagram schematically showing the operation of a heating apparatus in Fig.7 according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0020] Below, embodiments are described in detail in cooperation with the attached drawings to further demonstrate the present invention.

[0021] Refer to Fig.1 for a first embodiment. The heating apparatus 100 for heating liquid of the present invention comprises a sealed frame 1, a heating body 10, a water inlet 14 and a water outlet 11. The sealed frame 1 and the heating body 10 are sealedly connected with each other, and the sealed frame 1 and the heating body 10 enclose a room to form a cavity therebetween. A sealed body 2 is disposed inside the cavity. The sealed body 2 and the heating body 10 enclose a room to form a sealed water passage 8 having a given capacity. The sealed water passage 8 interconnects with the exterior through the water inlet 14 and the water outlet 11. The water from the water inlet 14 is constrained by the sealed water passage 8, flows along the sealed water passage 8, and then runs out of the water outlet 11.

[0022] The sealed body 2 has a sealing rib 21 along the path interconnecting the water inlet 14 and the water outlet 11. The sealing rib 21 contacts the heating body 10 in a sealed state. In one embodiment, the sealing rib 21 and the sealed body 2 are fabricated into a one-piece component. The area where the sealing rib 21 contacts the sealed body 2 is larger than the area where the sealing rib 21 contacts the heating body 10 in a sealed state. One edge of the sealing rib 21, which contacts a heat transfer component 3 in a sealed state, has a shape of a sharp angle.

[0023] A silicone or a rubber is cast outside the sealed frame 1 to form the sealed body 2.

[0024] Each of the sealed frame 1 and the heating body 10 is in form of a hollow pipe structure. The sealed body 2 tightly sleeves the outer surface of the sealed frame 1. The sealing rib 21 rises upward spirally along the outer surface of the sealed body 2. The pitch of the sealing rib 21 forms a spiral water trench 22. The heating body 10 sleeves the sealed frame 1 and the sealed body 2. Two ends of the heating body 10 are respectively fit to two ends of the sealed frame 1 in a sealed state. The spiral water trench 22 and the heating body 10 jointly enclose a room to form the sealed water passage 8 in a spiral form. The water inlet 14 and the water outlet 11 are respectively at two ends of the sealed water passage 8.

[0025] The sealed frame 1 has a hollow chamber 12 in the center thereof. The water inlet 14 and the water outlet 11 are disposed on the wall of the hollow chamber 12. The sealed frame 1 has two everted edges 13 on two rims thereof. The everted edges 13 and two rims of the heat transfer component 3 are welded in a sealed way. Each of the water inlet 14 and the water outlet 11 is welded to the sealed frame 1 in a sealed way. Each of the water inlet 14 and the water outlet 11 interconnects with the sealed water passage 8. The sealed frame 1 is in form of a pipe structure, having the hollow chamber 12 thereinside, and the hollow chamber 12 has two open ends. The water inlet 14 and the water outlet 11 are disposed on the wall of the hollow chamber 12, respectively curved upward and downward.

[0026] One surface of the heating body 10, which faces the sealed body 2, is a smooth surface.

[0027] The heating body 10 includes a heat transfer component 3 and a heating component 4. The heat transfer component 3 is in form of a pipe structure. The heating component 4 is a thick-film heating circuit. The thick-film heating circuit is sintered onto the outer surface of the heat transfer component 3. The position of the thick-film heating circuit is between the altitudes corresponding to the water inlet 14 and the water outlet 11. The surface area of the sealed water passage 8 is larger than the surface area of the thick-film heating circuit.

[0028] The thick-film heating circuit include bottom insulation layers 41, heating resistor layers 42 and outer insulation layers, which are sintered onto the outer surface of the heat transfer component 3 in sequence. The bottom insulation layer 41 has power-supply terminals 43, which will electrically contact the heating resistor layer 42. The heating resistor layer 42 is fabricated via sintering at least one layer of resistance paste. A plurality of heating resistor layers 42 is arranged to be parallel to each other from top to bottom. Two adjacent heating resistor layers 42 are connected in series through an electric-conduction bridge 44. The heating resistor layer 42 on the upper region of the heat transfer component 3 and the heating resistor layer 42 on the lower region of the heat transfer component 3 are respectively electrically connected with the power-supply terminals 43.

[0029] At least one output water temperature sensor 6 is disposed at a region of the heat transfer component 3, which neighbors the water outlet 11. The output water

temperature sensors 6 are arranged along the direction that the liquid flows from the water inlet 14 to the water outlet 11. The output water temperature sensors 6 are positioned between the water inlet 14 and the water outlet 11. Therefore, the liquid flowing into the sealed water passage 8 from the water inlet 14 will pass the detection areas of the output water temperature sensors 6 before it flows out of the water outlet 11.

[0030] The water inlet 14 and the water outlet 11 are respectively disposed at the regions near the bottom and the top of the heating body 10. Therefore, the output water temperature sensor 6 is near the top of the heating body 10.

[0031] The heat transfer component 3 further includes an over-temperature sensor 7.

[0032] Each of the output water temperature sensors 6 and the over-temperature sensor 7 is attached to the outer surface of thick-film heating circuit. The bottom insulation layers 41 of the thick-film heating circuit has data-receiving electrodes connected with the output water temperature sensors 6 and the over-temperature sensor 7.

[0033] The heating apparatus 100 for heating liquid of the present invention further comprises an electric connector 20. The electric connector 20 includes a connector seat 5, heavy-electricity contacts 53 and light-electricity contacts 52. The connector seat 5 is disposed in the heating body 10. The heavy-electricity contacts 53 and the light-electricity contacts 52 are disposed in the connector seat 5 and respectively electrically contact the power-supply terminals 43 and the data-receiving electrodes on the heating body 10. The connector seat 5 further includes heavy-electricity leads 531 and light-electricity leads 521, which are respectively electrically connected with the heavy-electricity contacts 53 and the light-electricity contacts 52.

[0034] The heat transfer component 3 is fabricated with metallic laminates. The heat transfer component 3 has fixing braces 54 on the surface thereof. The connector seat 5 and the fixing braces 54 are fixedly connected with the heat transfer component 3. The fixing braces 54 are also electrically connected with a grounding lead 541.

[0035] The heat transfer component 3 is a circular-tube structure or a flat-tube structure. The thick-film heating circuit is in form of an opened ring and arranged around the outer surface of the heat transfer component 3.The power-supply terminals 43 and the data-receiving electrodes are respectively disposed at the head end and the tail end of the thick-film heating circuit. The connector seat 5 is in form of an arc and disposed outside the heating component 4. The heavy-electricity contacts 53 and the light-electricity contacts 52 are disposed at two ends of one side surface of the connector seat 5, which faces the heat transfer component 3.

[0036] Protection plates 51 are disposed on the upper regions of the connector seat 5, which are corresponding to the backsides of the heavy-electricity contacts 53 and the light-electricity contacts 52.

[0037] The bottom of the connector seat 5 has snap-fit hooks 55, which are to be snap-fitted to the lower edge of the heat transfer component 3.

[0038] Refer to Fig.6 for a second embodiment of the present invention. The second embodiment is different from the first embodiment in that the surface of the sealed frame 1 has positioning elements 15 for positioning the sealed body 2. The positioning elements 15 are more than two bumps or protrudent ribs.

[0039] The present invention also discloses a water purification system using the abovementioned heating apparatus 100. Refer to Fig.7. The water purification system of the present invention comprises a filtration unit 9, a flowrate regulating device 30 and a heating apparatus 100. The heating apparatus 100 has a water inlet 14 and a water outlet 11. The filtration unit 9, the flowrate regulating device 30 and the heating apparatus 100 are connected in series through water channels. The filtration unit 9 is disposed in the water channel before the water inlet 14.

[0040] The water purification system further comprises an input water temperature sensing device (input water temperature sensor 40). The filtration unit 9 includes an original water region 91, a water purification device 92 and a purified water region 93. The original water region 91 interconnects with the water inlet 14 of the heating apparatus 100 through the filtration device 92 and the purified water region 93.

[0041] The flowrate regulating device 30 is a water pump or a flowrate adjusting valve, disposed between the filtration unit 9 and the water inlet 14.

[0042] The input water temperature sensing device is disposed in the water channel before the water inlet 14. A unidirectional valve 50 is disposed between the input water temperature sensing device and the water inlet 14.

[0043] Refer to Fig.8 for the operational principle. After tap water enters the original water region (the user may pour tap water into the original water region manually), the tap water passes the filtration device via the outlet in the bottom of the original water region to the purified water region. The purified water passes the flowrate regulating device and the unidirectional valve to the heating apparatus 100, wherein the flowrate regulating device automatically adjusts the flowrate according to the current output water temperature, the current input water temperature, and the preset output water temperature. The purified water is heated in the heating apparatus 100 and then output from the water outlet. Thus, the user can enjoy the purified water whose temperature meets his/her requirement.

Claims

1. A heating apparatus for heating liquid, comprising a sealed frame (1), a heating body (10), a water outlet (11), and a water inlet (14), wherein the sealed frame (1) and the heating body (10) are

connected with each other sealedly and enclosing a room sealedly to form a cavity;
characterized in that a sealed body (2) is disposed inside the cavity, and that the sealed body (2) and the heating body (10) enclose a room to form a sealed water passage (8) having a given capacity, and that the sealed water passage (8) interconnects with exterior through the water inlet (14) and the water outlet (11), and that liquid from the water inlet (14) is constrained by the sealed water passage (8), flows along the sealed water passage (8), and then runs out of the water outlet (11).

2. The heating apparatus for heating liquid according to claim 1, **characterized in that** the sealed body (2) has a sealing rib (21) along the path interconnecting the water inlet (14) and the water outlet (11), and that the sealing rib (21) contacts the heating body (10) in a sealed state.

3. The heating apparatus for heating liquid according to claim 2, **characterized in that** the sealing rib (21) and the sealed body (2) are fabricated into a one-piece component, and that an area where the sealing rib (21) contacts the sealed body (2) is larger than an area where the sealing rib (21) contacts the heating body (10) in a sealed state.

4. The heating apparatus for heating liquid according to claim 1, **characterized in that** a material is cast outside the sealed frame (1) to form the sealed body (2).

5. The heating apparatus for heating liquid according to claim 1, **characterized in that** a surface of the sealed frame (1) has positioning elements (15) for positioning the sealed body (2).

6. The heating apparatus for heating liquid according to claim 2 or claim 3, **characterized in that** each of the sealed frame (1) and the heating body (10) is in form of a hollow pipe structure, and that the sealed body (2) tightly sleeves an outer surface of the sealed frame (1), and that the sealing rib (21) rises upward spirally along an outer surface of the sealed body (2), and that a pitch of the sealing ribs (21) forms a spiral water trench (22), and that the heating body (10) sleeves the sealed frame (1) and the sealed body (2), and that two ends of the heating body (10) are respectively fit to two ends of the sealed frame (1) in a sealed state, and that the spiral water trench (22) and the heating body (10) jointly enclose a room to form the sealed water passage (8) in a spiral form, and that the water inlet (14) and the water outlet (11) are respectively at two ends of the sealed water passage (8).

7. The heating apparatus for heating liquid according to claim 6, **characterized in that** the sealed frame (1) has a hollow chamber (12) in a center thereof, and that the water inlet (14) and the water outlet (11) are disposed on a wall of the hollow chamber (12).

8. The heating apparatus for heating liquid according to claim 1, **characterized in that** a surface of the heating body (10), which faces the sealed body (2), is a smooth surface.

9. The heating apparatus for heating liquid according to claim 1, **characterized in that** the heating body (10) includes a heat transfer component (3) and a heating component (4), and that the heat transfer component (3) is in form of a pipe structure, and that the heating component (4) is a thick-film heating circuit, and that the thick-film heating circuit is sintered onto an outer surface of the heat transfer component (3), and that a position of the thick-film heating circuit is between altitudes corresponding to the water inlet (14) and the water outlet (11), and that a surface of the sealed water passage (8) is larger than a surface area of the thick-film heating circuit.

10. The heating apparatus for heating liquid according to claim 1, **characterized in** further comprising an electric connector (20), and that the electric connector (20) includes a connector seat (5), elastic contacts and contact leads, and that the connector seat (5) is disposed in the heating body (10), and that the elastic contacts are disposed in the connector seat (5) and respectively electrically connected with the contact leads and the thick-film heating circuit, and that the contact leads extend out of the connector seat (5).

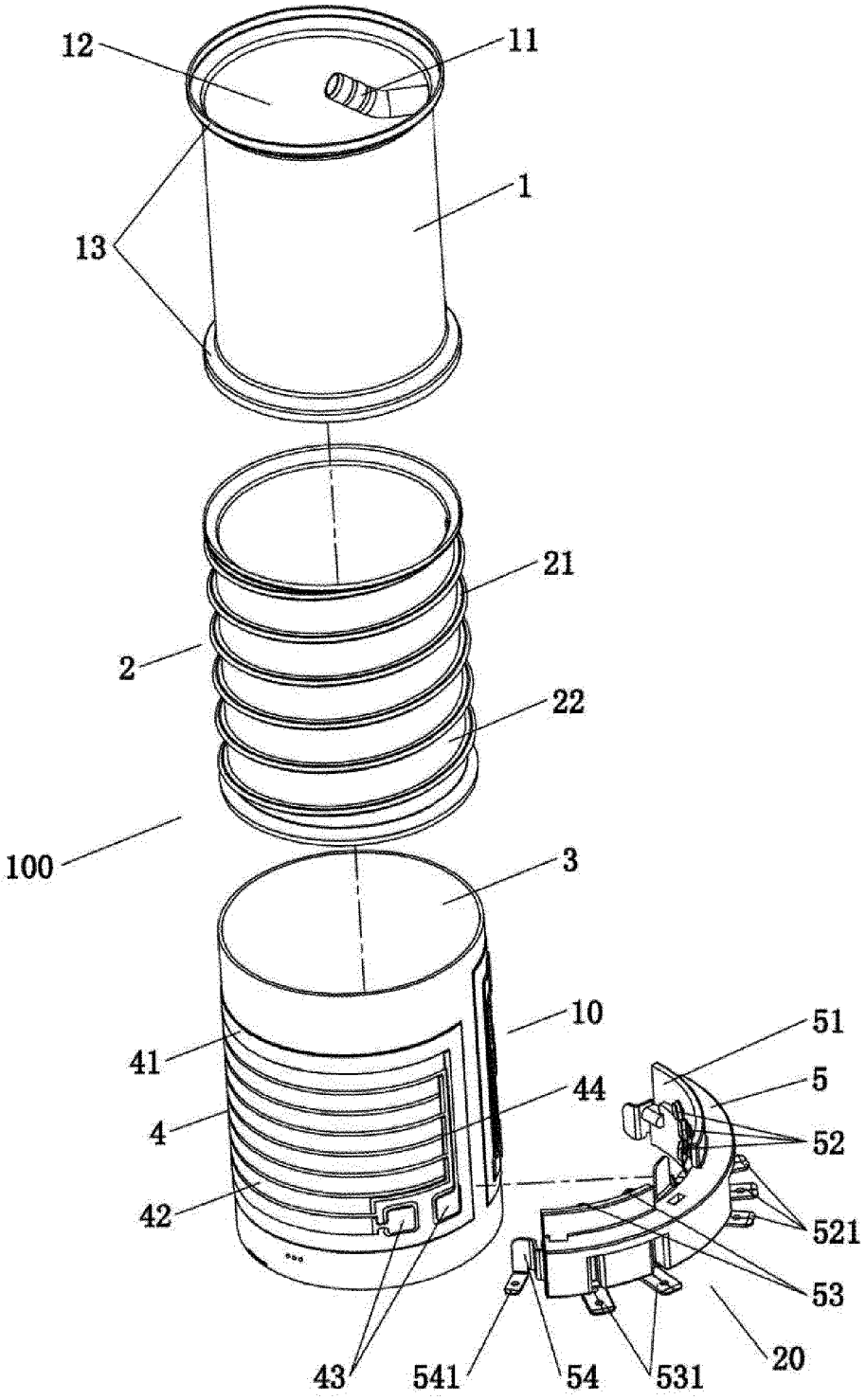

FIG.1

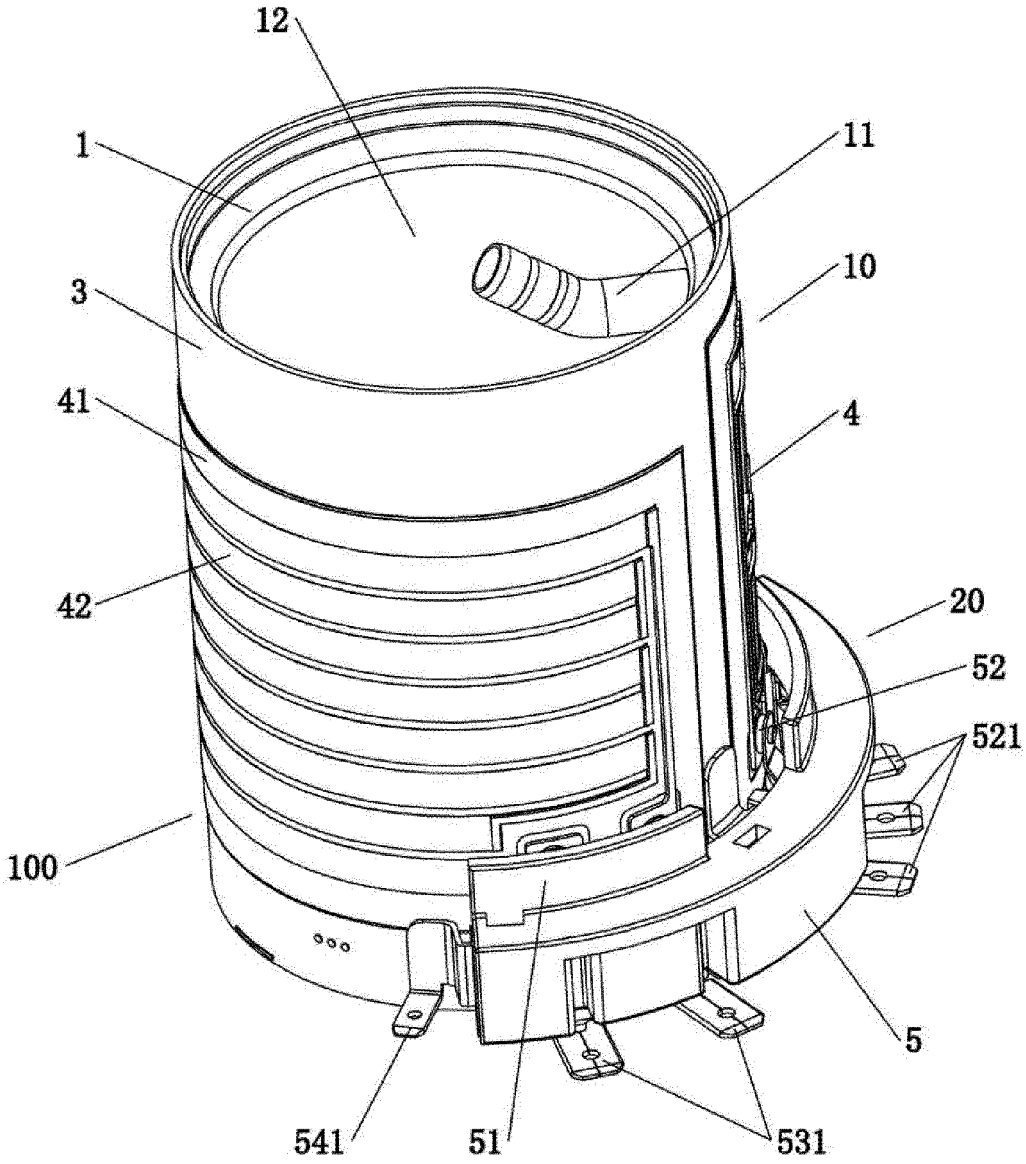

FIG.2

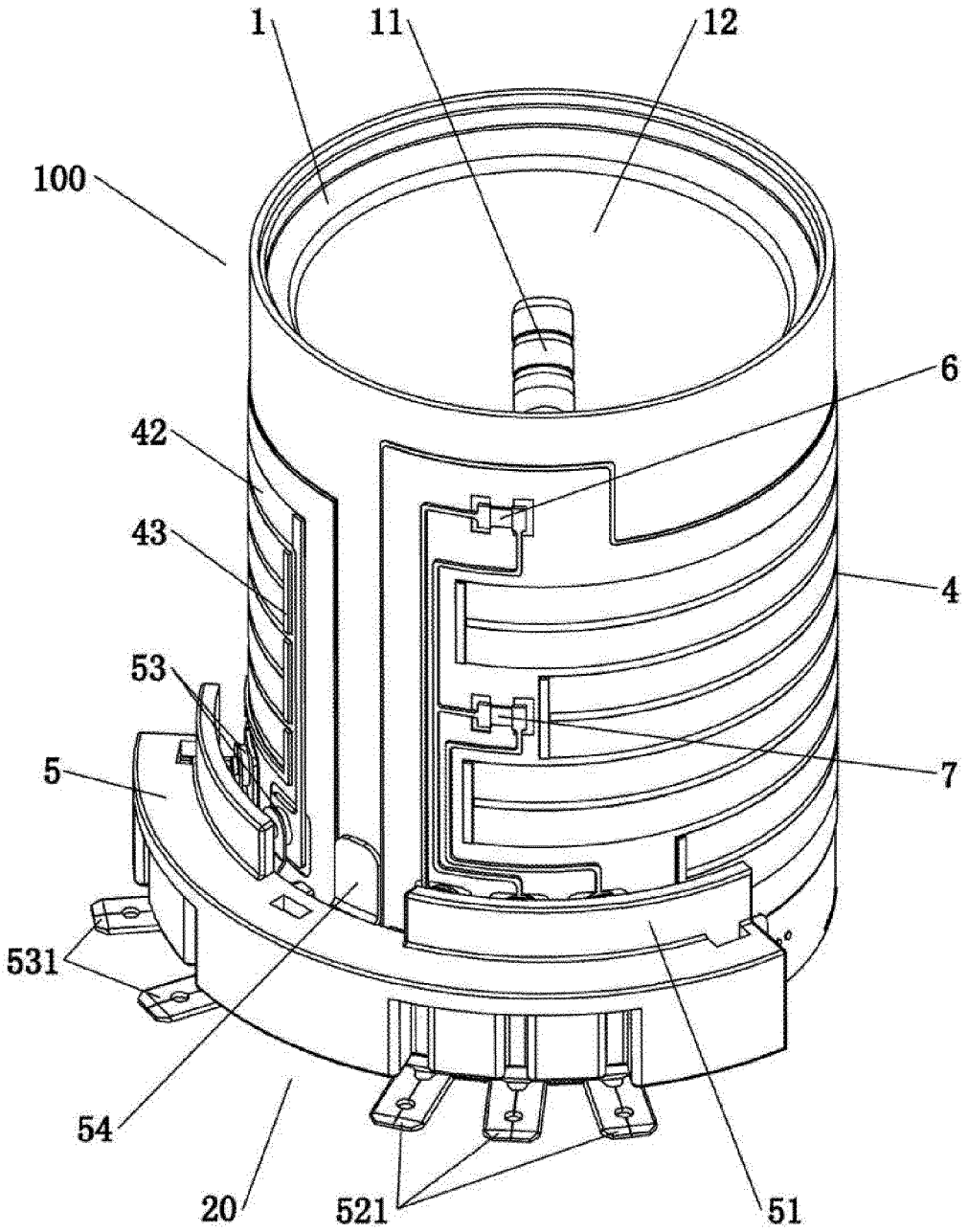

FIG.3

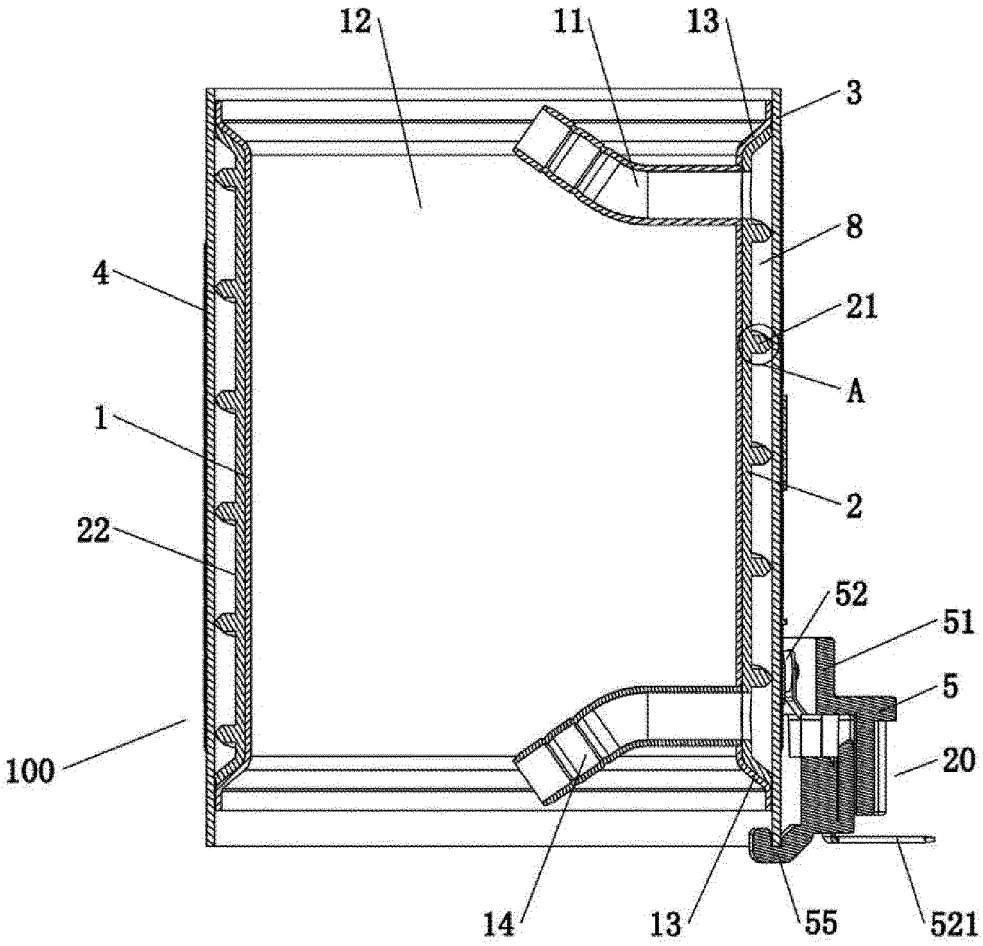

FIG.4

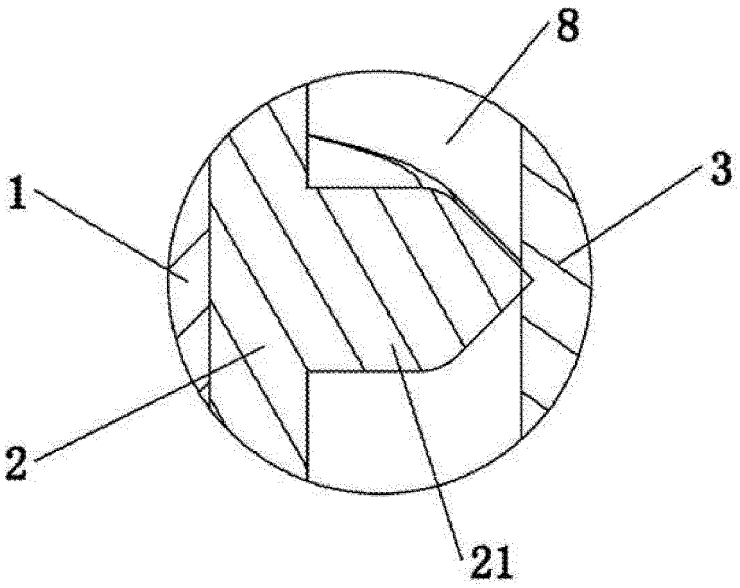

FIG.5

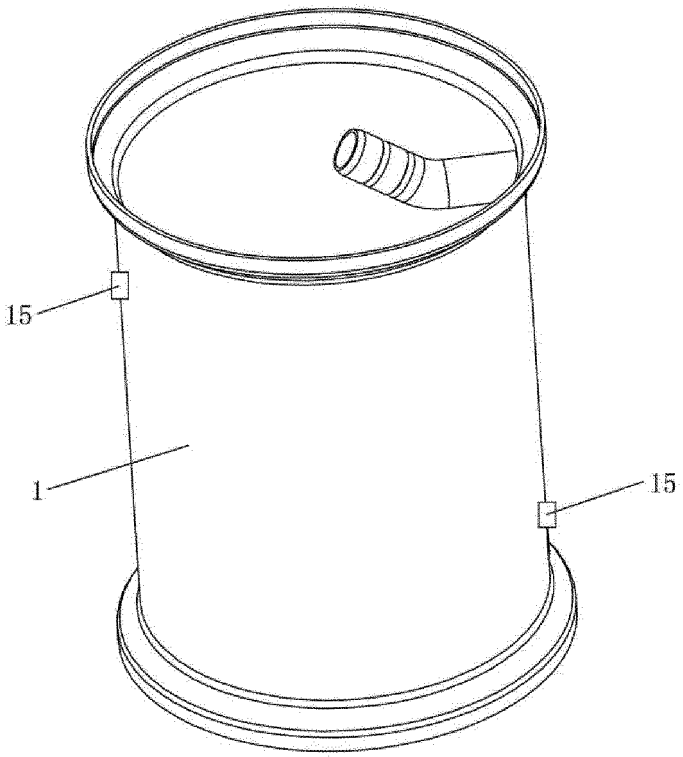

FIG.6

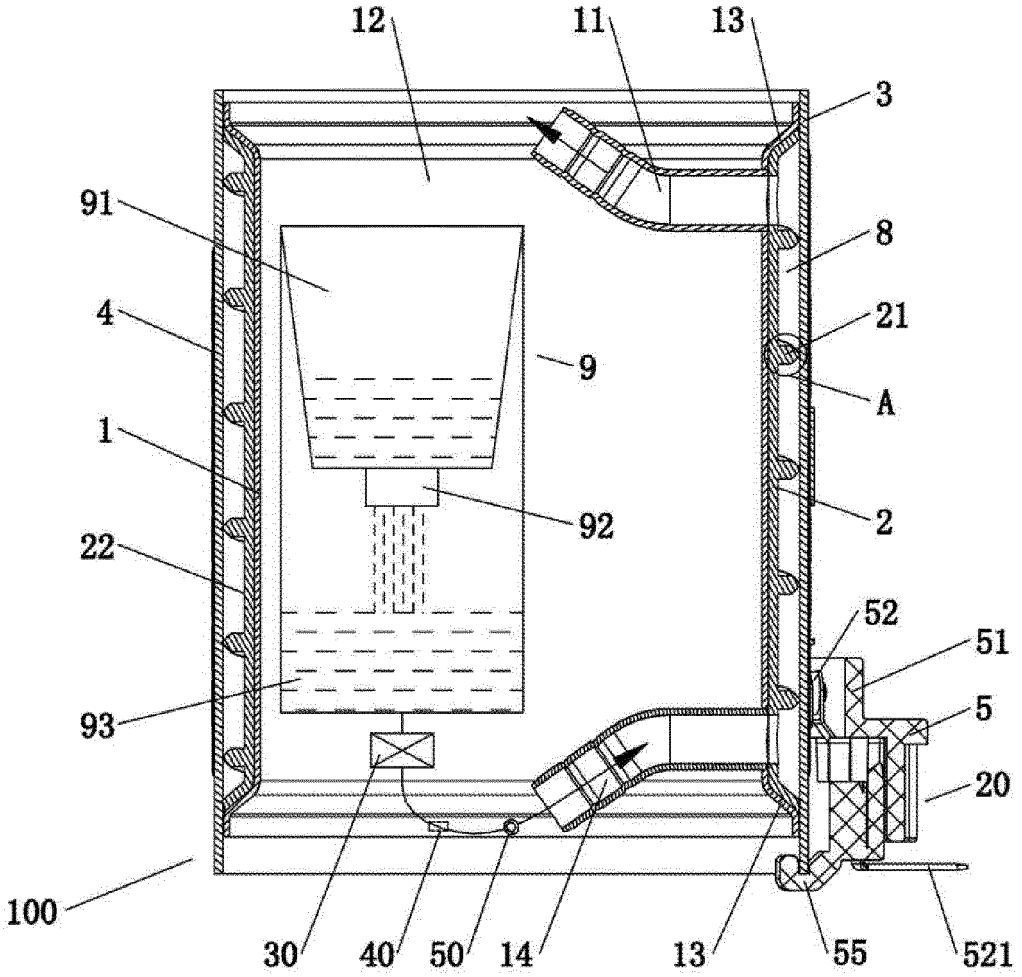

FIG.7

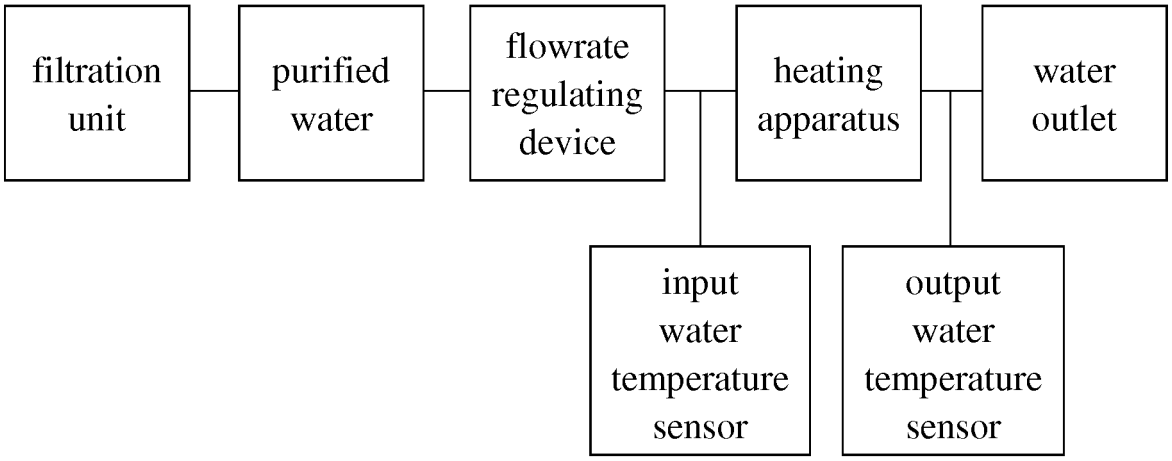
filtration unit
purified water
flowrate regulating device
heating apparatus
water outlet
input water temperature sensor
output water temperature sensor

FIG.8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2017/076446

A. CLASSIFICATION OF SUBJECT MATTER

F24H 1/10 (2006.01) i; F24H 9/18 (2006.01) i
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNABS, SIPOABS, CNTXT, VEN: water channel, flow channel, heat+, seal+, water, flow, channel, passage, path, rib, bar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 202177210 U (JOYOUNG CO., LTD.), 28 March 2012 (28.03.2012), description, paragraphs [0038]-[0042] and [0061]-[0066], and figure 4	1-10
Y	CN 101929730 A (WUXI XIZHOU MACHINERY CO., LTD.), 29 December 2010 (29.12.2010), description, paragraphs [0012]-[0020], and figures 1-3	1-10
PX	CN 105546804 A (FOSHAN VIOMI ELECTRICAL TECHNOLOGY CO., LTD. et al.), 04 May 2016 (04.05.2016), claims 1-10	1-10
PX	CN 205481683 U (FOSHAN VIOMI ELECTRICAL TECHNOLOGY CO., LTD. et al.), 17 August 2016 (17.08.2016), claims 1-10	1-10
PX	CN 205481684 U (FOSHAN VIOMI ELECTRICAL TECHNOLOGY CO., LTD. et al.), 17 August 2016 (17.08.2016), claims 1-10	1-10
PX	CN 205481783 U (FOSHAN VIOMI ELECTRICAL TECHNOLOGY CO., LTD. et al.), 17 August 2016 (17.08.2016), claims 1-10, description, paragraphs [0030]-[0053], and figures 1-7	1-10

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 May 2017 (17.05.2017)	**05 June 2017 (05.06.2017)**
Name and mailing address of the ISA/CN: State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No.: (86-10) 62019451	Authorized officer **LI, Yuhong** Telephone No.: (86-10) **62084836**

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 101832646 A (RUAN, Youming), 15 September 2010 (15.09.2010), the whole document	1-10
A	CN 102252413 A (NINGBO WANHONG ELECTRICAL & TECHNOLOGIES CO., LTD.), 23 November 2011 (23.11.2011), the whole document	1-10
A	CN 101660835 A (HANGZHOU HEATWELL M & E CO., LTD.), 03 March 2010 (03.03.2010), the whole document	1-10

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2017/076446

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 202177210 U	28 March 2012	None	
CN 101929730 A	29 December 2010	CN 101929730 B	03 October 2012
CN 105546804 A	04 May 2016	None	
CN 205481683 U	17 August 2016	None	
CN 205481684 U	17 August 2016	None	
CN 205481783 U	17 August 2016	None	
CN 101832646 A	15 September 2010	None	
CN 102252413 A	23 November 2011	CN 102252413 B	27 March 2013
CN 101660835 A	03 March 2010	None	

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