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(54) **FAR-INFRARED HEATING CLOTHES DRYING MACHINE AND CONTROLLING MEANS FOR DRYING CLOTHES THEREOF**

(57) Provided are a clothes dryer using far-infrared heating and a clothes-drying control method thereof. The clothes dryer using far-infrared heating includes a clothes-drying drum, and further includes at least one far-infrared heater (1), a humidity sensor (6) for detecting exhaust humidity of the clothes-drying drum, a relay (3) and a controller (2) having an output end connected with the relay (3); where all the far-infrared heaters (1) are connected with a power supply (4) through the relay (3); a first temperature sensor (5) is mounted inside one of the far-infrared heaters (1); the first temperature sensor (5) and the humidity sensor (6) are connected with an input end of the controller (2); and the controller (2) controls on and off of the relay (3) according to a received temperature signal or humidity signal. A control system described above simplifies a circuit, and also saves cost.

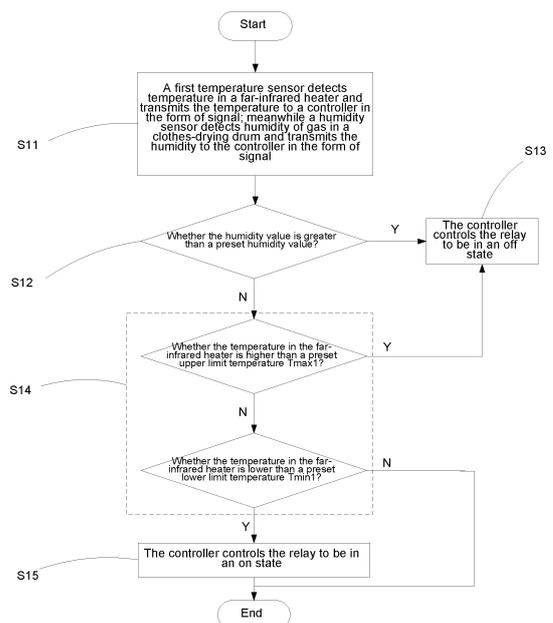


FIG.2

## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to the field of clothes dryers, and in particular to a clothes dryer using far-infrared heating and a clothes-drying control method thereof.

### BACKGROUND

**[0002]** In the existing art, some clothes dryers or washing-drying integrated machines use a far-infrared heating technology to dry clothes. Specifically, far-infrared heaters are arranged on or outside drying drums of the clothes dryers or the washing-drying integrated machines; the far-infrared heaters can emit far-infrared rays; the far-infrared rays have an energy characteristic of being absorbed by water but not absorbed by air; therefore, the far-infrared rays are radiated to interiors of the drying drums, are absorbed by water in heated objects, and are directly converted into a heat energy for converting the water in the heated objects into water vapor to be drained out.

**[0003]** However, the existing clothes dryers or washing-drying integrated machines use the far-infrared heating technology; on and off of a group of far-infrared heaters are usually controlled by a relay arranged on a PCB (Printed Circuit Board); a temperature controller is mounted near each of the far-infrared heaters to prevent that the temperature of the far-infrared heater is too high; and a temperature sensor is arranged in the drying drum to control that the temperature inside the drum is not excessive. As a result, if an existing far-infrared heating control mode is used, one relay and one temperature controller need to be configured for each far-infrared heater, and multiple groups of relays and temperature controllers need to be arranged in the entire clothes dryer or washing-drying integrated machine, to result in complicated circuits and waste of cost.

**[0004]** The far-infrared heaters are made of TCM (Tin Ceramic Membrane) materials; the TCM is a novel functional ceramic composite electric heating material, has characteristics of converting electric energy into the heat energy and then converting the heat energy into the far-infrared rays, can be made into low-temperature and middle-temperature high-efficiency far-infrared components, can produce rich long-wavelength far-infrared rays, is a pioneering, energy-saving and most advanced high-technology novel product, has thermal efficiency up to 92%, saves electricity by 20%-30% compared with conventional electric heating components, and fully complies with environmental protection requirements as a clean energy. When the far-infrared heaters are used in the clothes dryers or washing-drying integrated machines for drying the clothes, since a power density of the far-infrared heaters is relatively low and large heating areas are required, single-piece power of the existing far-

infrared heaters is 200-400 W generally, e.g., an ordinary 5 kg clothes dryer at least needs 3-6 far-infrared heaters; and if the existing heating control mode is used, one relay and one temperature controller need to be configured for each far-infrared heater, i.e., 3-6 groups of relays and temperature controllers are required, to result in complicated circuits and waste of cost.

**[0005]** Based on the above descriptions, there is an urgent need for a novel far-infrared clothes-drying control system, to solve problems of complicated circuits of the control system and waste of cost in the existing art.

### SUMMARY

**[0006]** In view of this, an objective of the present invention is to provide a clothes dryer using far-infrared heating; and the clothes dryer only needs to be configured with one relay and one temperature controller to monitor all far-infrared heaters, thereby simplifying circuits and saving cost.

**[0007]** Another objective of the present invention is to provide a clothes-drying control method using far-infrared heating; the method is applied to the above clothes dryer using far-infrared heating; and the control method is simple and easy to operate.

**[0008]** Embodiments of the present invention adopt following technical solutions.

**[0009]** A clothes dryer using far-infrared heating includes a clothes-drying drum, and further includes at least one far-infrared heater, a humidity sensor for detecting exhaust humidity of the clothes-drying drum, a relay and a controller having an output end connected with the relay; where all the far-infrared heaters are connected with a power supply through the relay; a first temperature sensor is mounted inside one of the far-infrared heaters; the first temperature sensor and the humidity sensor are connected with an input end of the controller; and the controller controls on and off of the relay according to a received temperature signal or humidity signal.

**[0010]** Preferably, the clothes dryer using far-infrared heating further includes at least one second temperature sensor for detecting temperature inside the clothes-drying drum; and the second temperature sensor is connected with the input end of the controller.

**[0011]** Preferably, the second temperature sensor is arranged at an air outlet of the clothes dryer.

**[0012]** Preferably, the humidity sensor is arranged at the air outlet of the clothes dryer.

**[0013]** Preferably, a fan is arranged at an air inlet of the clothes dryer; power of the fan is 10-20 W; and the fan is connected with the controller.

**[0014]** Preferably, mounting holes are arranged in the clothes-drying drum; and the far-infrared heaters are mounted in the mounting holes for heating interior of the clothes-drying drum.

**[0015]** Preferably, at least one group of hole arrays are arranged on the clothes-drying drum; each group of the hole arrays is composed of a plurality of holes; and the

far-infrared heaters are arranged outside the hole arrays, and can heat interior of the clothes-drying drum through the hole arrays.

**[0016]** A clothes-drying control method using far-infrared heating, applied to the clothes dryer using far-infrared heating according to a first item and includes the following steps:

in S11, detecting, by a first temperature sensor, temperature in a far-infrared heater and transmitting the temperature to a controller in the form of signal; meanwhile detecting, by a humidity sensor, humidity of gas in a clothes-drying drum and transmitting the humidity to the controller in the form of signal;

in S12, comparing, by the controller, the received humidity value with a preset humidity value; executing a step S14 when the humidity value is greater than the preset humidity value; and executing a step S13 when the humidity value is less than or equal to the preset humidity value;

in S13, controlling a relay to be in an off state by the controller;

in S14, comparing, by the controller, the received temperature in the far-infrared heater with a preset upper limit temperature Tmax1 and a preset lower limit temperature Tmin1; executing the step S13 when the temperature in the far-infrared heater is higher than the preset upper limit temperature Tmax1; and executing a step S15 when the temperature in the far-infrared heater is lower than the preset lower limit temperature Tmin1; and

in S15, controlling the relay to be in an on state by the controller.

**[0017]** A clothes-drying control method using far-infrared heating, applied to the clothes dryer using far-infrared heating according to a second item and includes the following steps:

in S21, detecting, by a first temperature sensor, temperature in a far-infrared heater and transmitting the temperature to a controller in the form of signal; detecting, by a humidity sensor, humidity of gas in a clothes-drying drum and transmitting the humidity to the controller in the form of signal; meanwhile detecting, by a second temperature sensor, the temperature in the clothes-drying drum and transmitting the temperature to the controller in the form of signal;

in S22, comparing, by the controller, the received humidity value with a preset humidity value; executing a step S24 when the humidity value is greater than the preset humidity value; and executing a step S23 when the humidity value is less than or equal to

the preset humidity value;

in S23, controlling a relay to be in an off state by the controller;

in S24, comparing, by the controller, the received temperature in the far-infrared heater with a preset upper limit temperature Tmax1 and a preset lower limit temperature Tmin1, and comparing the received temperature in the clothes-drying drum with a preset upper limit temperature Tmax2 and a preset lower limit temperature Tmin2; executing the step S23 when at least one of conditions that the temperature in the far-infrared heater is higher than the preset upper limit temperature Tmax1, and the temperature in the clothes-drying drum is higher than the preset upper limit temperature Tmax2 is satisfied; and executing a step S15 when at least one of conditions that the temperature in the far-infrared heater is lower than the preset lower limit temperature Tmin1, and the temperature in the clothes-drying drum is lower than the preset lower limit temperature Tmin2 is satisfied; and

in S25, controlling the relay to be in an on state by the controller.

**[0018]** The technical solutions proposed by embodiments of the present invention have beneficial effects that: all the far-infrared heaters are connected with the power supply through one relay, i.e., the on and off of all relays are controlled by one relay; one first temperature sensor is mounted inside one of the far-infrared heaters; the first temperature sensor and the humidity sensor for detecting the exhaust humidity of the clothes-drying drum are connected with the controller; the controller controls the on and off of the relay according to the received temperature signal or humidity signal; therefore, a control system described above simplifies circuits and saves cost.

## BRIEF DESCRIPTION OF DRAWINGS

**[0019]** In order to more clearly illustrate the technical solutions in embodiments of the present invention, drawings which are required to be used in the descriptions of embodiments of the present invention are briefly introduced hereinafter. It is apparent that the drawings described below are only some embodiments of the present invention; for those ordinary skilled in the art, other drawings can also be obtained in accordance with contents and these drawings of embodiments of the present invention without paying creative efforts.

Fig. 1 is a schematic structural diagram illustrating a far-infrared clothes-drying control system provided by device embodiments of the present invention;

Fig. 2 is a flow chart illustrating a clothes-drying control method provided by method embodiments of the present invention; and

Fig. 3 is a flow chart illustrating a preferred mode of a clothes-drying control method provided by method embodiments of the present invention.

In the figures:

**[0020]** 1: Far-infrared heater; 2: Controller; 3: Relay; 4: Power supply; 5: First temperature sensor; 6: Humidity sensor; 7: Second temperature sensor; 8: Fan.

## DETAILED DESCRIPTION

**[0021]** In order to make solved technical problems, adopted technical solutions and achieved technical effects of the present invention clearer, the technical solutions of embodiments of the present invention are further described in detail in combination with the drawings below. Apparently, the described embodiments are merely some embodiments of the present invention, rather than all embodiments. All other embodiments obtained by those skilled in the art without paying creative efforts fall within a protection scope of the present invention, based on embodiments of the present invention.

Embodiments of device

**[0022]** The far-infrared heater provided by the present application can be applied to a washing-drying integrated machine and can also be applied to a clothes dryer; and the clothes dryer is introduced below as an example. The clothes dryer includes a tank body and a far-infrared clothes-drying control system; the far-infrared clothes-drying control system includes a clothes-drying drum, which is rotatably arranged inside the tank body. Fig. 1 is a schematic structural diagram illustrating the far-infrared clothes-drying control system provided by device embodiments of the present invention. As shown in Fig. 1, the far-infrared clothes-drying control system further includes at least one far-infrared heater 1, a humidity sensor 6 for detecting exhaust humidity of the clothes-drying drum, a relay 3 and a controller 2 having an output end connected with the relay 3; the controller 2 is connected with a power supply 4; all the infrared heaters 1 are connected with the power supply 4 through the relay 3; a first temperature sensor 5 is mounted inside one of the far-infrared heaters 1; the first temperature sensor 5 and the humidity sensor 6 are connected with an input end of the controller 2; and the controller 2 controls on and off of the relay 3 according to a received temperature signal or humidity signal.

**[0023]** During operation, the first temperature sensor 5 detects temperature in the far-infrared heaters 1 and transmits the temperature to the controller 2 in the form of signal; meanwhile, the humidity sensor 6 detects hu-

midity of gas discharged from the clothes-drying drum and transmits the humidity to the controller 2 in the form of signal.

**[0024]** The controller 2 compares the received temperature in the far-infrared heaters with a preset upper limit temperature  $T_{max1}$  and a preset lower limit temperature  $T_{min1}$ , controls the relay 3 to be turned off when the temperature in the far-infrared heaters is higher than the preset upper limit temperature  $T_{max1}$ , and controls the relay 3 to be turned on when the temperature in the far-infrared heaters is lower than the preset lower limit temperature  $T_{min1}$ ; and meanwhile, the controller 2 compares the received humidity value with a preset humidity value, and controls the relay 3 to be turned off and terminates a drying process when the humidity value is less than the preset humidity value.

**[0025]** Since the far-infrared heater 1 itself has a temperature limiting characteristic (temperatures are different according to different TCM systems, generally 200-400°C) and a high degree of consistency; the control system no longer adopts a mechanical temperature controller, but only one first temperature sensor 5 is mounted on one far-infrared heater 1 for detecting and controlling temperature. Specifically, the first temperature sensor 5 is mounted inside the far-infrared heater 1; current of the far-infrared heaters 1 has a characteristic of increasing gradually; all the far-infrared heaters 1 are controlled by only one relay 3, rather than respectively controlled by a plurality of relays 3. In this way, the system can control all the far-infrared heaters 1 by using only one first temperature sensor 5 and one relay 3, to simplify circuits and also save cost.

**[0026]** In the present embodiment, the far-infrared heaters 1 can be mounted on the clothes-drying drum or mounted between the clothes-drying drum and the tank body. When the far-infrared heaters 1 are mounted on the clothes-drying drum, mounting holes are arranged in the clothes-drying drum; and the far-infrared heaters 1 are mounted in the mounting holes so as to heat interior of the clothes-drying drum.

**[0027]** In the present embodiment, as another preferred solution, when the far-infrared heaters 1 are mounted between the clothes-drying drum and the tank body, at least one group of hole arrays is arranged on the clothes-drying drum; each group of the hole arrays is composed of a plurality of holes; and the far-infrared heaters 1 are arranged outside the hole arrays, and can heat interior of the clothes-drying drum through the hole arrays.

**[0028]** Since normal operation temperature of the far-infrared heaters used in the clothes-drying system in the existing art is 600 °C and may reach to 1000 °C under abnormal conditions, control of the temperature is particularly important; besides the above-mentioned temperature detection and protection for the far-infrared heaters, a temperature sensor is further arranged in the clothes-drying drum; the temperature sensor is configured to detect the temperature in the clothes-drying drum

and prevent clothes from being damaged due to excessively high temperature in the clothes-drying drum, which requires the whole machine to be equipped with a high-power fan, so as to make the temperature in the drum as even as possible, so that security problems may occur when an air speed is slightly lower, or an air duct is slightly blocked.

**[0029]** In the control system, the far-infrared heaters 1 are configured to heat clothes; the temperature of the far-infrared heaters 1 is locked, e.g., the temperature of a 200 membrane system is not higher than 200°C, and the far-infrared heaters are automatically powered off when the temperature exceeds 200°C; furthermore, the clothes are not heated by an air medium, but water of the clothes is directly heated by emitted far-infrared radiation; these two aspects ensure use security firstly, so the temperature sensor arranged in the clothes-drying drum in a traditional clothes-drying system is no longer so important, and temperature detection accuracy in the clothes-drying drum is no longer dependent on the air speed. However, for the clothes to be dried, if the clothes are made of chemical fibers, wools and other fabrics with high temperature requirements, the requirements for the temperature in the clothes-drying drum are also relatively high.

**[0030]** Therefore, in the present embodiment, as a preferred solution, at least one second temperature sensor 7 is further arranged on the clothes dryer; the second temperature sensor 7 is connected with the input end of the controller 2, for detecting the temperature in the clothes-drying drum and transmitting the temperature to the controller 2; the controller 2 compares the received temperature in the clothes-drying drum with a preset upper limit temperature  $T_{max2}$  and a preset lower limit temperature  $T_{min2}$ , controls the relay 3 to be turned off when the temperature in the clothes-drying drum is higher than the preset upper limit temperature  $T_{max2}$ , and controls the relay 3 to be turned on when the temperature inside the clothes-drying drum is lower than the preset lower limit temperature  $T_{min2}$ .

**[0031]** In the present embodiment, as a preferred solution, the second temperature sensor 7 is arranged at an air outlet of the clothes dryer.

**[0032]** In the present embodiment, the number of the second temperature sensors 7 is at least one; when the number of the second temperature sensors 7 is plural, after all the second temperature sensors 7 transmit the detected temperatures in the clothes-drying drum to the controller 2; the controller 2 averages all the received temperatures in the clothes-drying drum, and then compares an average value with the preset upper limit temperature  $T_{max2}$  and the preset lower limit temperature  $T_{min2}$ .

**[0033]** In the present embodiment, as a preferred solution, a fan 8 is arranged at an air inlet of the clothes dryer; power of the fan 8 is 10-20 W; the fan 8 is connected with the controller 2; and the controller 2 controls rotation of the fan 8. Since the control system avoids dependence

on air speed, the use of the high-power fan is avoided, and only one smaller fan is required for auxiliary dehumidification; and therefore, noise of such clothes dryer is low.

5 **[0034]** In the present embodiment, since a low-power fan is used in the control system, hot and humid gas may be aggregated toward the air outlet at the top of the clothes dryer; and therefore, as a preferred solution, the humidity sensor 6 is placed at the air outlet of the clothes dryer in order to more accurately measure the humidity.

10 **[0035]** In the present embodiment, as a preferred solution, the controller 2 is made into a PCB integrated circuit board.

15 Embodiments of method

**[0036]** The present application also provides a clothes-drying control method using far-infrared heating; the clothes-drying control method is applied to a clothes dryer using far-infrared heating in which a first temperature sensor 5 and a humidity sensor 6 are arranged but the second temperature sensor 7 is not arranged; Fig. 2 is a flow chart illustrating a clothes-drying control method provided by method embodiments of the present invention; and as shown in Fig. 2, the control method includes the following steps.

20 **[0037]** In S11, after a drying process is started, the first temperature sensor 5 detects temperature in a far-infrared heater 1 and transmits the temperature to a controller 2 in the form of signal; meanwhile the humidity sensor 6 detects humidity of gas in a clothes-drying drum and transmits the humidity to the controller 2 in the form of signal;

25 in S12, the controller 2 compares a received humidity value with a preset humidity value; when the humidity value is less than or equal to the preset humidity value, it is indicated that clothes in the clothes-drying drum are dried, a step S 13 is executed; and when the humidity value is greater than the preset humidity value, a step S 14 is executed;

30 in S13, the controller 2 judges whether the relay 3 is in an off state, and controls the relay 3 to be in the off state and terminates the entire drying process if the relay 3 is not in the off state;

35 in S14, the controller 3 compares the received temperature in the far-infrared heater with a preset upper limit temperature  $T_{max1}$  and a preset lower limit temperature  $T_{min1}$ ; the step S13 is executed when the temperature in the far-infrared heater is higher than the preset upper limit temperature  $T_{max1}$ ; and a step S15 is executed when the temperature in the far-infrared heater is lower than the preset lower limit temperature  $T_{min1}$ ; and the controller 2 makes no response when the temperature in the far-infrared heater is lower than or equal to the preset upper limit temperature  $T_{max1}$  and higher than or equal to the preset upper limit temperature  $T_{max1}$ ; and in S15, the controller 2 judges whether the relay 3 is in an on state; and if the relay 3 is not turned on, the con-

troller 2 controls the relay 3 to be turned on, and the far-infrared heater 1 re-emits infrared rays.

**[0038]** In the present embodiment, the preset upper limit temperature  $T_{max1}$  is preferably in a range of  $190^{\circ}\text{C}$ - $210^{\circ}\text{C}$ , but is not limited thereto and can be determined according to specific conditions; and the preset lower limit temperature  $T_{min1}$  is preferably in the range of  $140^{\circ}\text{C}$  - $160^{\circ}\text{C}$ , but is not limited thereto and can be determined according to specific conditions.

**[0039]** The present application also provides another clothes-drying control method using far-infrared heating; the control method is applied to a clothes dryer using far-infrared heating in which a first temperature sensor 5 and a humidity sensor 6 are arranged and a second temperature sensor 7 is arranged in the drum; and Fig. 3 is a flow chart illustrating a preferred mode of a clothes-drying control method provided by method embodiments of the present invention; and as shown in Fig. 3, the control method includes the following steps.

**[0040]** In S21, after a drying process is started, the first temperature sensor 5 detects temperature in a far-infrared heater 1 and transmits the temperature to a controller 2 in the form of signal; the humidity sensor 5 detects humidity of gas in a clothes-drying drum and transmits the humidity to the controller 2 in the form of signal; meanwhile the second temperature sensor 7 detects temperature in the clothes-drying drum and transmits the temperature to the controller 2 in the form of signal;

in S22, the controller 2 compares the received humidity value with a preset humidity value; when the humidity value is greater than the preset humidity value, a step S24 is executed; and when the humidity value is less than or equal to the preset humidity value, it is indicated that clothes in the clothes-drying drum are dried, a step S23 is executed;

in S23, the controller 2 judges whether the relay 3 is in an off state, and controls the relay 3 to be in the off state and terminates the entire drying process if the relay 3 is not in the off state;

in S24, the controller 2 compares the received temperature in the far-infrared heater with a preset upper limit temperature  $T_{max1}$  and a preset lower limit temperature  $T_{min1}$ , and compares the received temperature in the clothes-drying drum with a preset upper limit temperature  $T_{max2}$  and a preset lower limit temperature  $T_{min2}$ ; when at least one of conditions that the temperature in the far-infrared heater is higher than the preset upper limit temperature  $T_{max1}$  and the temperature in the clothes-drying drum is higher than the preset upper limit temperature  $T_{max2}$  is satisfied, it is indicated that the temperature in the clothes-drying drum and/or the temperature in the far-infrared heater 1 is too high, the step S23 is executed to prevent clothes and/or the far-infrared heater 1 from being burnt out; when at least one of conditions that the temperature in the far-infrared heater is lower than the preset lower limit temperature  $T_{min1}$  and the temperature in the clothes-drying drum is lower than the preset lower limit temperature  $T_{min2}$  is satisfied, it is indicated

that the temperature in the clothes-drying drum and/or the temperature in the far-infrared heater 1 is too low, the step S25 is executed; or else, the controller 2 makes no response.

5 **[0041]** in S25, the controller 2 judges whether the relay 3 is in an on state; and if the relay 3 is not in the on state, the controller 2 controls the relay 3 to be turned on, and the far-infrared heater 1 re-emits infrared rays to continue to heat the clothes in the clothes-drying drum.

10 **[0042]** It should be noted that the above is only preferred embodiments and applied technical principles of the present invention. Those skilled in the art should understand that the present invention is not limited to specific embodiments described herein. For those skilled in the art, the present invention may be subjected to various apparent changes, re-adjustments and substitutions without departing from a protection scope of the present invention. Thus, although the present invention is described in detail through the above embodiments, the present invention is not only limited to the above embodiments, but may include many other equivalent embodiments without departing from conceptions of the present invention; and the scope of the present invention is determined by the scope of appended claims.

## Claims

1. A clothes dryer using far-infrared heating, comprising a clothes-drying drum, and further comprising at least one far-infrared heater, a humidity sensor for detecting exhaust humidity of the clothes-drying drum, a relay and a controller having an output end connected with the relay; wherein all the far-infrared heaters are connected with a power supply through the relay; a first temperature sensor is mounted inside one of the far-infrared heaters; the first temperature sensor and the humidity sensor are connected with an input end of the controller; and the controller controls on and off of the relay according to a received temperature signal or humidity signal.
2. The clothes dryer using far-infrared heating according to claim 1, further comprising at least one second temperature sensor for detecting temperature inside the clothes-drying drum, wherein the second temperature sensor is connected with the input end of the controller.
3. The clothes dryer using far-infrared heating according to claim 2, wherein the second temperature sensor is arranged at an air outlet of the clothes dryer.
4. The clothes dryer using far-infrared heating according to claim 1, wherein the humidity sensor is arranged at the air outlet of the clothes dryer.
5. The clothes dryer using far-infrared heating accord-

ing to claim 1, wherein a fan is arranged at an air inlet of the clothes dryer; power of the fan is 10-20 W; and the fan is connected with the controller.

- 6. The clothes dryer using far-infrared heating according to claim 1, wherein mounting holes are arranged in the clothes-drying drum; and the far-infrared heaters are mounted in the mounting holes for heating interior of the clothes-drying drum.
- 7. The clothes dryer using far-infrared heating according to claim 1, wherein at least one group of hole arrays are arranged on the clothes-drying drum; each group of the hole arrays is composed of a plurality of holes; and the far-infrared heaters are arranged outside the hole arrays, and can heat interior of the clothes-drying drum through the hole arrays.
- 8. A clothes-drying control method using far-infrared heating, applied to the clothes dryer using far-infrared heating according to claim 1, comprising following steps:

in S11, detecting, by a first temperature sensor, temperature in a far-infrared heater and transmitting the temperature to a controller in the form of signal; meanwhile detecting, by a humidity sensor, humidity of gas in a clothes-drying drum and transmitting the humidity to the controller in the form of signal;

in S12, comparing, by the controller, the received humidity value with a preset humidity value; executing a step S14 when the humidity value is greater than the preset humidity value; and executing a step S 13 when the humidity value is less than or equal to the preset humidity value;

in S 13, controlling a relay to be in an off state by the controller;

in S14, comparing, by the controller, the received temperature in the far-infrared heater with a preset upper limit temperature Tmax1 and a preset lower limit temperature Tmin1; executing the step S13 when the temperature in the far-infrared heater is higher than the preset upper limit temperature Tmax1; and executing a step S15 when the temperature in the far-infrared heater is lower than the preset lower limit temperature Tmin1; and

in S15, controlling the relay to be in an on state by the controller.

- 9. A clothes-drying control method using far-infrared heating, applied to the clothes dryer using far-infrared heating according to claim 2, comprising following steps:

in S21, detecting, by a first temperature sensor, temperature in a far-infrared heater and trans-

mitting the temperature to a controller in the form of signal; detecting, by a humidity sensor, humidity of gas in a clothes-drying drum and transmitting the humidity to the controller in the form of signal; meanwhile detecting, by a second temperature sensor, the temperature in the clothes-drying drum and transmitting the temperature to the controller in the form of signal;

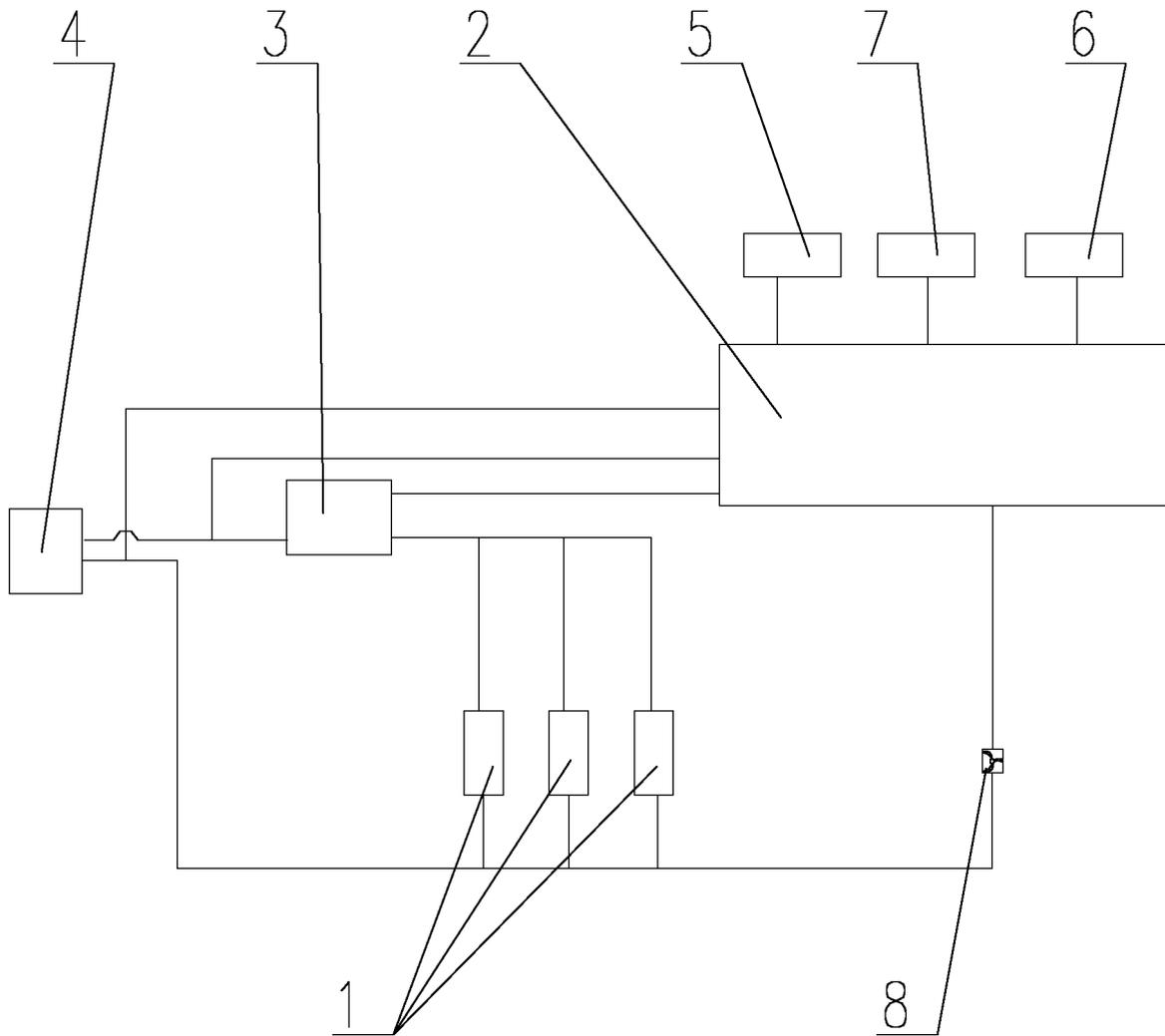
in S22, comparing, by the controller, the received humidity value with a preset humidity value; executing a step S24 when the humidity value is greater than the preset humidity value; and executing a step S23 when the humidity value is less than or equal to the preset humidity value;

in S23, controlling a relay to be in an off state by the controller;

in S24, comparing, by the controller, the received temperature in the far-infrared heater with a preset upper limit temperature Tmax1 and a preset lower limit temperature Tmin1, and comparing the received temperature in the clothes-drying drum with a preset upper limit temperature Tmax2 and a preset lower limit temperature Tmin2; executing the step S23 when at least one of conditions that the temperature in the far-infrared heater is higher than the preset upper limit temperature Tmax1, and the temperature in the clothes-drying drum is higher than the preset upper limit temperature Tmax2 is satisfied; and executing a step S25 when at least one of conditions that the temperature in the far-infrared heater is lower than the preset lower limit temperature Tmin1, and the temperature in the clothes-drying drum is lower than the preset lower limit temperature Tmin2 is satisfied; and

in S25, controlling the relay to be in an on state by the controller.

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**FIG.1**

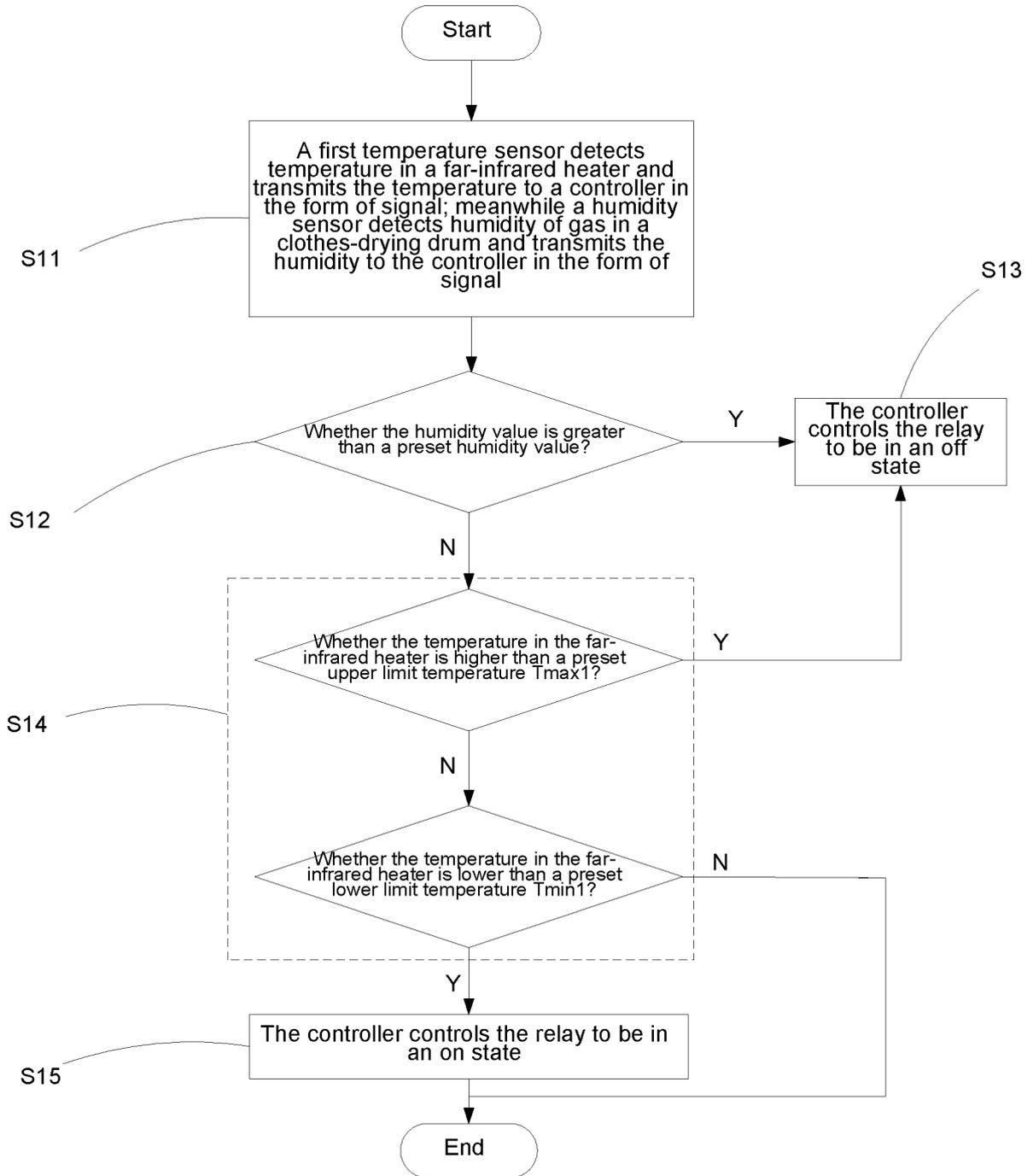


FIG.2

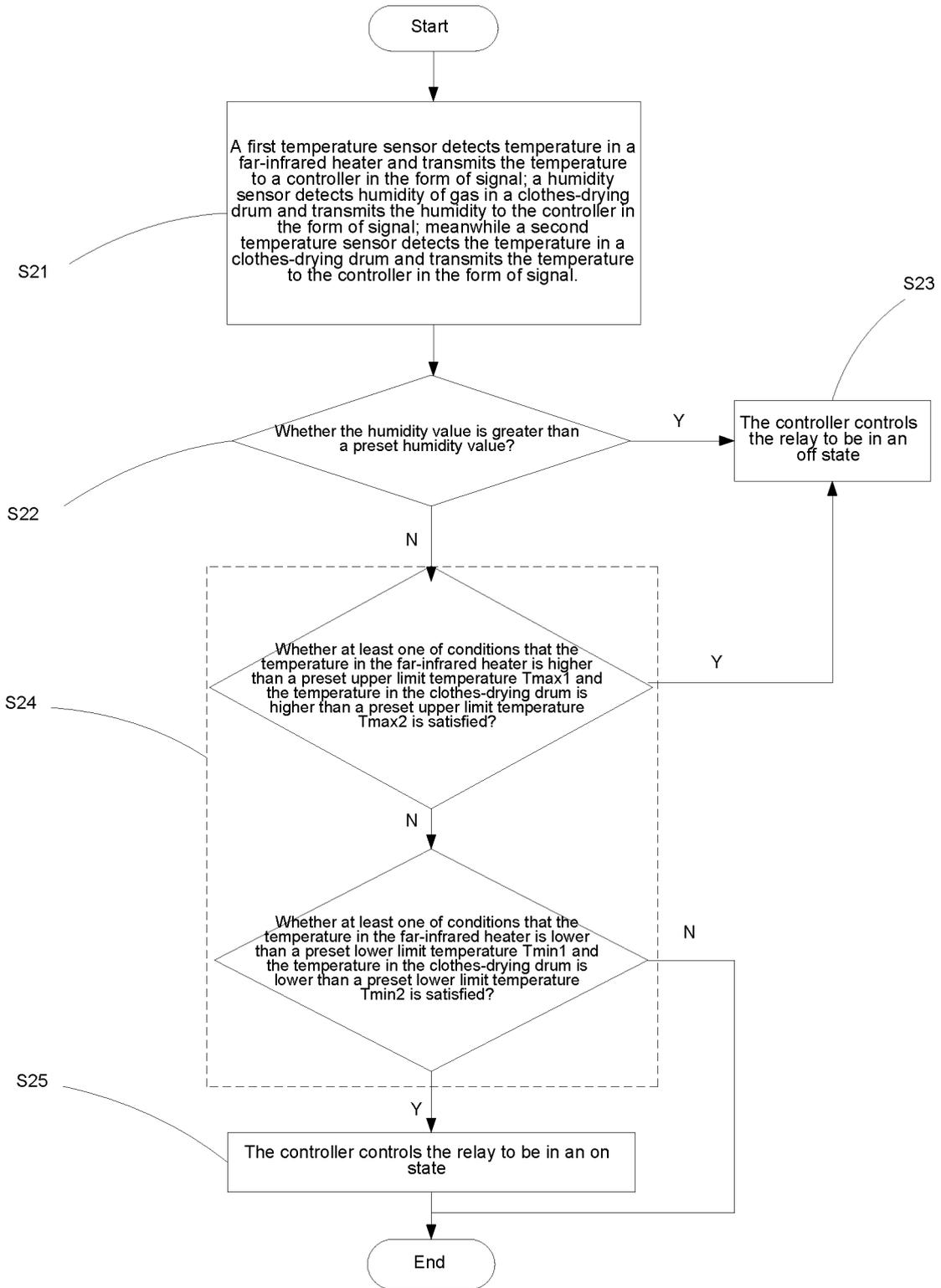


FIG.3

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CN2014/091312

<b>A. CLASSIFICATION OF SUBJECT MATTER</b>		
D06F 58/00 (2006.01) i		
According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b>		
Minimum documentation searched (classification system followed by classification symbols)		
D06F		
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: clothes drying, dry, dry, temperature, humidity, infrared		
Infrared, temperature, humidity, dry		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 2635709 Y (LIU, Zhiqiang) 25 August 2004 (25.08.2004) description, page 2, the 1 <sup>st</sup> to the 4 <sup>th</sup> paragraphs, and figure 1	1-6, 8, 9
X	CN 203741624 U (FOSHAN SHUNDE HAIER ELECTRIC CO LTD et al.) 30 July 2014 (30.07.2014) description, paragraphs [0032]-[0036]	1-6, 8, 9
X	KR 2010003022 A (ASTONE TECHNOLOGY) 07 January 2010 (07.01.2010) description, paragraphs [0010]-[0025]	1-6, 8, 9
A	CN 2628567 Y (HUANG, Mingguang) 28 July 2004 (28.07.2004) the whole document	1-9
A	CN 201313997 Y (YAN, Yaping) 23 September 2009 (23.09.2009) the whole document	1-9
E	CN 204138970 U (QINGDAO HAIER WASHING MACH CO) 04 February 2015 (04.02.2015) claims 1-7, description, paragraphs [0039]-[0051]	1-9
<input type="checkbox"/> Further documents are listed in the continuation of Box C.		<input checked="" type="checkbox"/> See patent family annex.
* Special categories of cited documents:	<p>“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>“A” document defining the general state of the art which is not considered to be of particular relevance</p> <p>“E” earlier application or patent but published on or after the international filing date</p> <p>“L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>“O” document referring to an oral disclosure, use, exhibition or other means</p> <p>“P” document published prior to the international filing date but later than the priority date claimed</p> <p>“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>“&amp;” document member of the same patent family</p>	
Date of the actual completion of the international search	Date of mailing of the international search report	
15 May 2015	21 May 2015	
Name and mailing address of the ISA 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  CHEN, Pengfei Telephone No. (86-10) 62084627	

Form PCT/ISA/210 (second sheet) (July 2009)

**INTERNATIONAL SEARCH REPORT**  
 Information on patent family members

International application No.  
 PCT/CN2014/091312

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 25  
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 35  
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Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 2635709 Y	25 August 2004	None	
CN 203741624 U	30 July 2014	None	
KR 20100003022 A	07 January 2010	None	
CN 2628567 Y	28 July 2004	None	
CN 201313997 Y	23 September 2009	None	
CN 204138970 U	04 February 2015	None	