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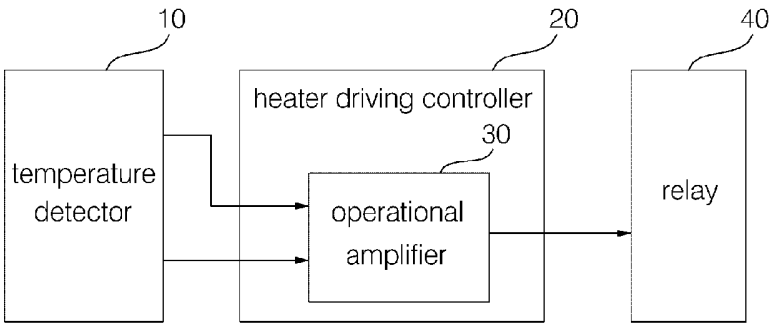
(54) Title: CONTROL CIRCUIT FOR RUNNING A HEATER OF ELECTRIC HOME APPLIANCES



(57) Abstract: Provided is a heater driving circuit of electric home appliances. The heater driving circuit uses an analog circuit including an operational amplifier to output a driving control signal for a heater installed in the electric home appliances by receiving and comparing voltage outputted by detecting changes of outdoor temperature and indoor temperature with a reference voltage. The heater driving circuit controls the heater according to the temperature change without an expensive microcomputer, time for developing a circuit can be reduced, the circuit is simple, and costs are remarkably saved because of cheap components.

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Description

CONTROL CIRCUIT FOR RUNNING A HEATER OF ELECTRIC HOME APPLIANCES

Technical Field

[1] The present invention relates to a heater-driving circuit of electric home appliances, and more particularly, to a heater-driving circuit of electric home appliances equipped with a circuit including an operational amplifier.

Background Art

[2] Generally, electric home appliances include various kinds of heater turned on or off according to temperature change.

[3] For example, an air conditioner, as shown in FIG. 1, includes an outdoor unit 1 and an indoor unit 2, wherein respective heaters (not shown) are installed in the outdoor unit 1 and the indoor unit 2.

[4] A heater installed in the outdoor unit 1 is used as a defrosting heater to remove frost on an outdoor heat-exchanger, and a heater installed in the indoor unit 2 is used to heat indoor air in a change of season or in a winter.

[5] A conventional heater driving circuit of electric home appliances such as an air conditioner, as shown in FIG. 2, includes a temperature detector 3 for detecting a change of indoor temperature or outdoor temperature and for outputting a voltage Vth changed according to the change of the temperatures, a microcomputer 4 for receiving the voltage Vth outputted from the temperature sensor 3 and for outputting a control signal to control a heater H, and a relay 5 for applying a driving voltage VAC of the heater H to the heater H or interrupting the same according to the control signal outputted from the microcomputer 4.

[6] The microcomputer 4 generates outdoor temperature data by converting the voltage Vth received from the temperature detector 3 into actual temperature, and outputs a heater driving signal when a value of the outdoor temperature data is smaller than that of a reference temperature data by comparing the generated outdoor temperature data with the reference temperature data stored in the microcomputer 4.

[7] However, when controlling the heater H using the comparison between the outdoor temperature data and the reference temperature data, since the heater driving circuit structured and driven as described above uses an expensive microcomputer, costs for the controls increase and the microcomputer must be always supplied with a driving electric power to measure temperature.

Disclosure of Invention

Technical Problem

[8] Therefore, the present invention has been made in an effort to provide a heater driving circuit of electric home appliances employing an analog circuit using cheap component instead of an expensive microcomputer to easily design the heater driving circuit and costs for the maintenance can be saved.

Technical Solution

[9] In accordance with the present invention, there is provided a heater driving circuit of electric home appliances including a temperature detector for outputting a detecting voltage corresponding to at least one temperature change of an outdoor temperature and an indoor temperature, a heater driving controller including an operational amplifier for outputting a driving control signal for a heater that is installed in the electric home appliance according to the detecting voltage, and a relay for applying a driving power to the heater or interrupting the driving power according to the driving control signal.

[10] The temperature detector includes a first resistor having an end connected to a primary voltage applied from the exterior, and a thermistor connected to another end of the first resistor and having resistance changed with a temperature change to output the detecting voltage from the primary voltage.

[11] The heater driving controller includes a second resistor having an end connected to the primary voltage and a variable resistor connected to another end of the second resistor in serial. The negative (-) input terminal of the operational amplifier is connected to a connecting point between the second resistor and the variable resistor.

[12] The detecting voltage is inputted to a positive (+) input terminal of the operational amplifier, and a reference voltage divided from the primary voltage is inputted to a negative (-) input terminal of the operational amplifier, and the operational amplifier compares the reference voltage inputted to the negative (-) input terminal with the detecting voltage applied to the positive (+) input terminal to output the driving control signal.

[13] The relay is turned on or off according to the driving control signal outputted from the operational amplifier. At this time, the relay applies a driving power to the heater when being turned on, and the relay interrupts a driving power applied to the heater when being turned off.

Advantageous Effects

[14] According to the present invention described above, instead of the high expensive microcomputer installed in the heater driving circuit of electric home appliances, a circuit including a cheap component such as an operational amplifier is utilized so that costs for manufacturing can be saved. Moreover, since the analog circuit includes resistor and an operational amplifier, the configuration thereof is simple and costs and

time for designing and producing can be reduced.

Brief Description of the Drawings

[15] FIG. 1 shows an example of a conventional air conditioner;

[16] FIG. 2 is a block diagram illustrating a conventional heater driving circuit;

[17] FIG. 3 is a block diagram illustrating a heater driving circuit according to a preferred embodiment of the present invention;

[18] FIG. 4 is a circuit diagram illustrating the heater driving circuit according to the preferred embodiment of the present invention;

[19] FIG. 5 shows an example of the heater driving circuit according to the preferred embodiment of the present invention; and

[20] FIG. 6 shows another example of the heater driving circuit according to the preferred embodiment of the present invention.

Best Mode for Carrying Out the Invention

[21] Hereinafter, a heater driving circuit of electric home appliances according to the preferred embodiment of the present invention will be described with reference to the accompanying drawings. FIG. 3 is a block diagram illustrating a heater driving circuit according to a preferred embodiment of the present invention, FIG. 4 is a circuit diagram illustrating the heater driving circuit according to the preferred embodiment of the present invention, and FIGS. 5 and 6 show examples of the heater driving circuit according to the preferred embodiment of the present invention. The heater driving circuit of electric home appliances according to the preferred embodiment of the present invention will be described as follows.

[22] The heater driving circuit of electric home appliances according to the preferred embodiment of the present invention, as shown in FIG. 3, includes a temperature detector 10 for outputting a detecting voltage corresponding to at least one temperature change of an outdoor temperature and an indoor temperature, a heater driving controller 20 including an operational amplifier 30 for outputting a driving signal for a heater that is installed in the electric home appliance according to the detecting voltage, and a relay 40 for applying a driving power to the heater or interrupting the driving power according to the driving signal.

[23] FIG. 4 is a circuit diagram illustrating the heater driving circuit according to the preferred embodiment of the present invention. The heater driving circuit of electric home appliances according to the preferred embodiment of the present invention will be described in detail with reference to FIG. 4.

[24] The temperature detector 10 includes a primary voltage Vcc applied from the exterior, a first resistor R1 having an end connected to the primary voltage Vcc, and a thermistor T connected to another end of the first resistor R1. The thermistor T is a

device whose resistance is changed with a temperature change and is grouped into a positive temperature coefficient thermistor (PTC) whose resistance increases as temperature increases and a negative temperature coefficient thermistor (NTC) whose resistance decreases as temperature increases. Hereinafter, the thermistor T will be described as the positive temperature coefficient thermistor, but can be substituted with the negative temperature coefficient thermistor in other embodiments.

[25] In this case, the temperature detector 10 outputs a detecting voltage Vth from the primary voltage Vcc with respect to a temperature change of outdoor temperature or indoor temperature by the thermistor T whose resistance increases as the outdoor temperature or the indoor temperature increases. The detecting voltage Vth is expressed by Math Figure 1.

[26] MathFigure 1

$$V_{th} = V_{CC} \cdot \frac{R_{th}}{R_1 + R_{th}}$$

[27] where Vcc is the primary voltage, Rth is a resistor of the thermistor T, R1 is a first resistor whose end is connected to the primary voltage Vcc and another end is connected to the resistor Rth, and Vth is a detecting voltage Vth divided from the primary voltage Vcc by the resistor Rth of the thermistor and the first resistor R1 and is inputted to the operational amplifier 30 of the heater driving controller 20. Thus, as one of outdoor temperature and indoor temperature increases and as the resistor Rth of the thermistor T increases, the detecting voltage Vth increases.

[28] The heater driving controller 20 includes a second resistor R2 having an end connected to the end of the first resistor R1, a variable resistor R3 connected to another end of the second resistor R2 in serial to output a reference voltage VR divided from the primary voltage Vcc when the resistance is changed by a setting condition, and the operational amplifier 30 connected to connecting points of the second resistor R2 and the variable resistor R3 to output the driving control signal.

[29] A positive (+) input terminal of the operational amplifier 30 is connected to any one point between the first resistor R1 and the thermistor T such that the detecting voltage Vth divided by the first resistor R1 and the thermistor T is inputted, and the reference voltage VR divided from the primary voltage Vcc is inputted to a negative (-) input terminal of the operational amplifier 30.

[30] Here, the variable resistor R3 is set such that resistance thereof varies according to a predetermined temperature. The reference voltage VR that is divided by the second resistor R2 and the variable resistor R3 and inputted to the negative (-) input terminal of the operational amplifier 30 is expressed by the following Math Figure 2.

[31] MathFigure 2

$$V_R = V_{CC} \cdot \frac{R_3}{R_2 + R_3}$$

[32] where Vcc is the primary voltage, R2 is the second resistor, R3 is the variable resistor, and VR is the reference voltage inputted to the negative (-) input terminal of the operational amplifier 30.

[33] In other words, the operational amplifier 30 of the heater driving controller 20 receives the detecting voltage Vth divided from the primary voltage Vcc by the first resistor R1 and the resistor of the thermistor T through the positive (+) input terminal and the reference voltage VR divided from the primary voltage Vcc by the second resistor R2 and the variable R3 through the negative (-) input terminal and outputs the driving control signal by comparing the input voltage Vth with the reference voltage VR.

[34] At this time, the operational amplifier 3 outputs a first driving control voltage through an output terminal thereof when the detecting voltage Vth is less than the reference voltage VR, and outputs a second driving control voltage through the output terminal when the detecting voltage Vth is greater than the reference voltage VR. However, when the amplitude of the first driving control voltage is equal to that of the second driving voltage but the polarity of the first driving voltage is different from that of the second driving control voltage, the polarity of the first driving control voltage is positive (+) and the polarity of the second control voltage is negative in the preferred embodiment of the present invention.

[35] In other words, the operational amplifier 30 outputs the first driving voltage +Vee through the output terminal when the measured temperature by the temperature detector 10 is less than a predetermined reference temperature (detecting voltage Vth > reference voltage VR), and outputs the second driving voltage Vee through the output terminal when the measured temperature by the temperature detector 10 is greater than the predetermined reference temperature (detecting voltage Vth < reference voltage VR).

[36] The relay 40 controls ON/OFF according to the driving control signal outputted from the operational amplifier 30 such that the driving power VAC is applied to the heater H or the driving power VAC applied to the heater H is interrupted.

[37] At this time, the relay 40 is switched on when the driving control signal outputted from the operational amplifier 30 is the first driving control voltage +Vee such that the power VAC is applied to the heater H. Thus, the heater H is operated by the applied power VAC.

[38] Meanwhile, the relay 40 is switched off when the driving control signal outputted

from the operational amplifier 30 is the second driving control voltage -Vee such that the power VAC applied to the heater H is interrupted. Thus, the heater H is stopped by the interruption of the power VAC.

[39] FIG. 5 shows an example of the heater driving circuit according to the preferred embodiment of the present invention as a table illustrating operation state of the heater driving circuit when the resistor Rth of the thermistor T varies according to the temperature change of any one of the outdoor temperature and the indoor temperature.

[40] As shown in FIG. 5, when the variable R3 is set to 3K, the primary voltage Vcc is 100, the first resistor R1 is 1K, the second resistor R2 is 1K, and the reference voltage VR becomes 75 by the Math Figure 2. At this time, a voltage (driving control voltage) outputted from the operational amplifier 30 and operations of the relay 40 and the heater H when the resistor Rth of the thermistor T varies to 1K, 2K, 3K, an 4K, will be described as follows.

[41] When the resistor Rth of the thermistor T is 1K and 2K, the detecting voltages Vth applied to the positive (+) input terminal of the operational amplifier 30 are respectively 50.0 and 66.7 by the Math Figure 1. Since the inputted voltages are less than 75 of the reference voltage VR applied to the negative (-) input terminal, the first driving control voltage +Vee is outputted from the operational amplifier 30. At this time, the relay 40 is switched on by the first driving control voltage +Vee and the power VAC is supplied and the heater H is turned on by the supplied power VAC.

[42] Meanwhile, when the resistor Rth of the thermistor T is 4K, the detecting voltage Vth applied to the positive (+) input terminal of the operational amplifier 30 is 80.0 by the Math Figure 1. Since the applied detecting voltage is greater than 75 of the reference voltage VR applied to the negative (-) input terminal, the second driving control voltage -Vee is outputted from the operational amplifier 30. At this time, the relay 40 is switched off by the second driving control voltage -Vee and the power VAC is interrupted, and thus the heater H is stopped.

[43] Here, since the detecting voltage Vth is 75 equal to 75 of the reference voltage VR when the resistor Rth of the thermistor T is 3K, the driving control signal is not outputted from the operational amplifier 30 and the heater H maintains the present operational state.

[44] FIG. 6 shows another example of the heater driving circuit according to the preferred embodiment of the present invention, and shows a polarity of a voltage outputted from the operational amplifier 30 when the resistor Rth of the thermistor T varies according to temperature.

[45] As shown in FIG. 6, the resistance of the positive temperature coefficient thermistor (PTC) increases as temperature increases. At this time, when the reference temperature is set to 0 degrees, on a basis of a resistance X at a point where the detected

temperature is o degrees, +Vee is outputted with respect to the resistance less than X to operate the heater H, and Vee is outputted with respect to the resistance greater than X to stop the heater H.

[46] Although a case that the thermistor T is the positive temperature coefficient thermistor (PTC) is described, the heater driving circuit in which the thermistor T is the negative temperature coefficient thermistor (NTC) may be operated vice versa.

[47] According to the heater driving circuit of the present invention, the expensive microcomputer that is provided in the heater driving circuit of electric home appliances is eliminated, and a heater driving circuit using a cheap component such as an operational amplifier instead of the microcomputer is used so that costs for manufacturing can be saved. Moreover, by using an analog circuit including a resistor and an operational amplifier, the configuration is simple so that time required to design and manufacture the products can be reduced.

[48] Although the preferred embodiments of the present invention have been disclosed for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Industrial Applicability

[49] According to the heater driving circuit of electric home appliances of the present invention, the expensive microcomputer that is provided in the heater driving circuit of electric home appliances is eliminated, and a heater driving circuit using a cheap component such as an operational amplifier instead of the microcomputer is used so that costs for manufacturing can be saved. Moreover, since the configuration is simple, time required to design and manufacture the products can be reduced.

[50]

[51]

Claims

[1] A heater driving circuit of electric home appliances comprising:
a temperature detector for outputting a detecting voltage corresponding to at least one temperature change of an outdoor temperature and an indoor temperature;
a heater driving controller including an operational amplifier for outputting a driving control signal for a heater that is installed in the electric home appliance according to the detecting voltage; and
a relay for applying a driving power to the heater or interrupting the driving power according to the driving control signal.

[2] The heater driving circuit of electric home appliances according to claim 1, wherein the temperature detector comprises:
a first resistor having an end connected to a primary voltage applied from the exterior; and
a thermistor connected to another end of the first resistor and having resistance changed with a temperature change to output the detecting voltage from the primary voltage.

[3] The heater driving circuit of electric home appliances according to claim 1, wherein the detecting voltage is inputted to a positive (+) input terminal of the operational amplifier, and a reference voltage divided from the primary voltage is inputted to a negative (-) input terminal of the operational amplifier.

[4] The heater driving circuit of electric home appliances according to claim 3, wherein the heater driving controller comprises:
a second resistor having an end connected to the primary voltage;
a variable resistor connected to another end of the second resistor in serial;
the negative (-) input terminal of the operational amplifier is connected to a connecting point between the second resistor and the variable resistor.

[5] The heater driving circuit of electric home appliances according to claim 3, wherein the operational amplifier compares the reference voltage inputted to the negative (-) input terminal with the detecting voltage applied to the positive (+) input terminal to output the driving control signal.

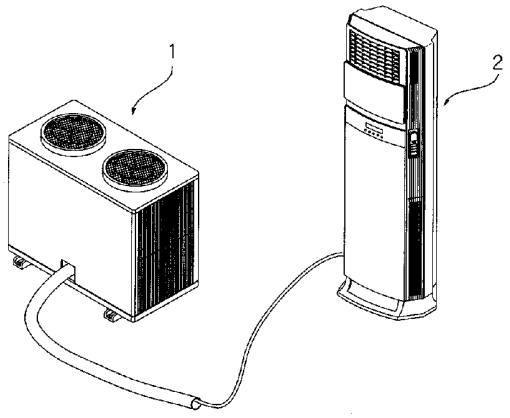
[6] The heater driving circuit of electric home appliances according to claim 1, wherein the relay is turned on or off according to the driving control signal outputted from the operational amplifier.

[7] The heater driving circuit of electric home appliances according to claim 6, wherein the relay applies a driving power to the heater when being turned on.

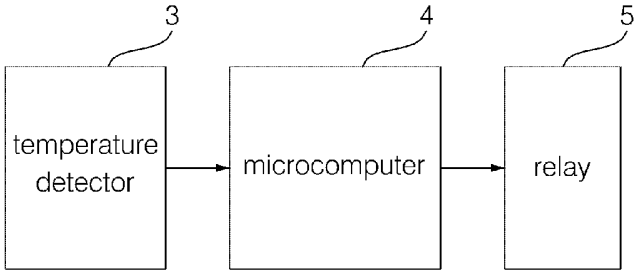
[8] The heater driving circuit of electric home appliances according to claim 6, wherein the relay interrupts a driving power applied to the heater when being

turned off.

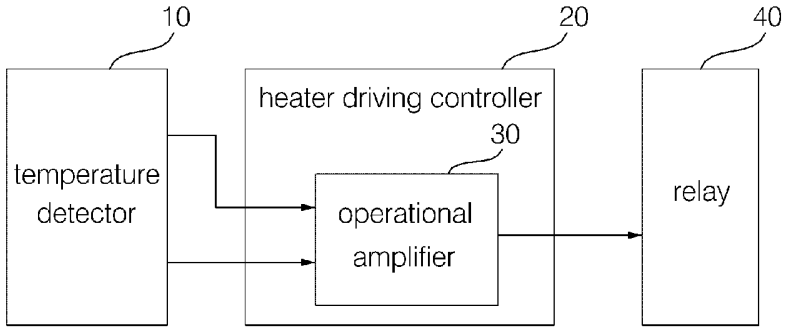
[Fig. 1]



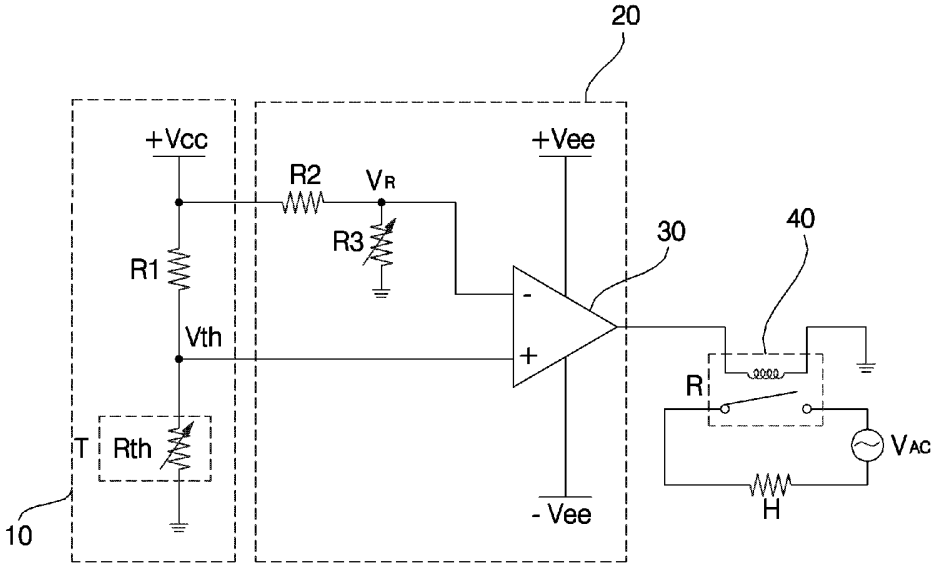
[Fig. 2]



[Fig. 3]



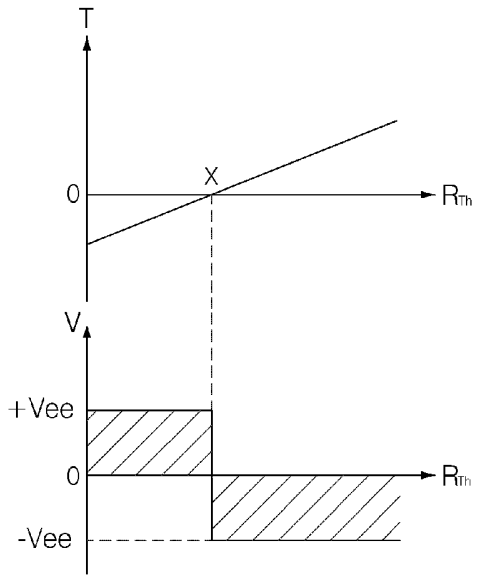
[Fig. 4]



[Fig. 5]

Vcc	100			
R_1	1K	R_2		1K
R_2	3K			
V_R	75			
R_{Th}	1K	2K	3K	4K
V_{Th}	50.0	66.7	75.0	80.0
output voltage of operational amplifier	+Vee	+Vee	—	-Vee
relay	ON	ON	—	OFF
heater	ON	ON	—	OFF

[Fig. 6]



INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

H02N 2/06(2006.01)i, H02N 2/14(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)

IPC 8 : H02N 2/06, B60H 1/02, H05B 3/00, G01F 1/68

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

KR IPC as above

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

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	KR 1997-0028702 U(HYUNDAI Motors) Jul. 24, 1997 see Fig. 2	1-8
Y	KR 1999-0019470 U(DAEWOO Electronics) Jun. 15, 1999 see Fig. 2	1-8
Y	KR 1999-0069972 A(SHINSUNG Electronics) Sep. 6, 1999 see Fig. 1 and abstract	1-8
A	JP 2000-018991 A(YAZAKI Co.) Jan. 21, 2000 see Fig. 1	1-8

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☐ See patent family annex.

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10 AUGUST 2006 (10.08.2006)	**10 AUGUST 2006 (10.08.2006)**

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