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(54) **Air conditioner controller.**

(57) An air conditioner controller characterized in that it comprises : a plurality of auxiliary heating elements (8a, 8b) which are arranged in an air conditioner ; desired temperature input means (11) for inputting desired temperatures ; and auxiliary heating element control means (14) for separately controlling the auxiliary heating elements (8a, 8b) based on the desired temperatures which have been inputted in the desired temperature input means (11).

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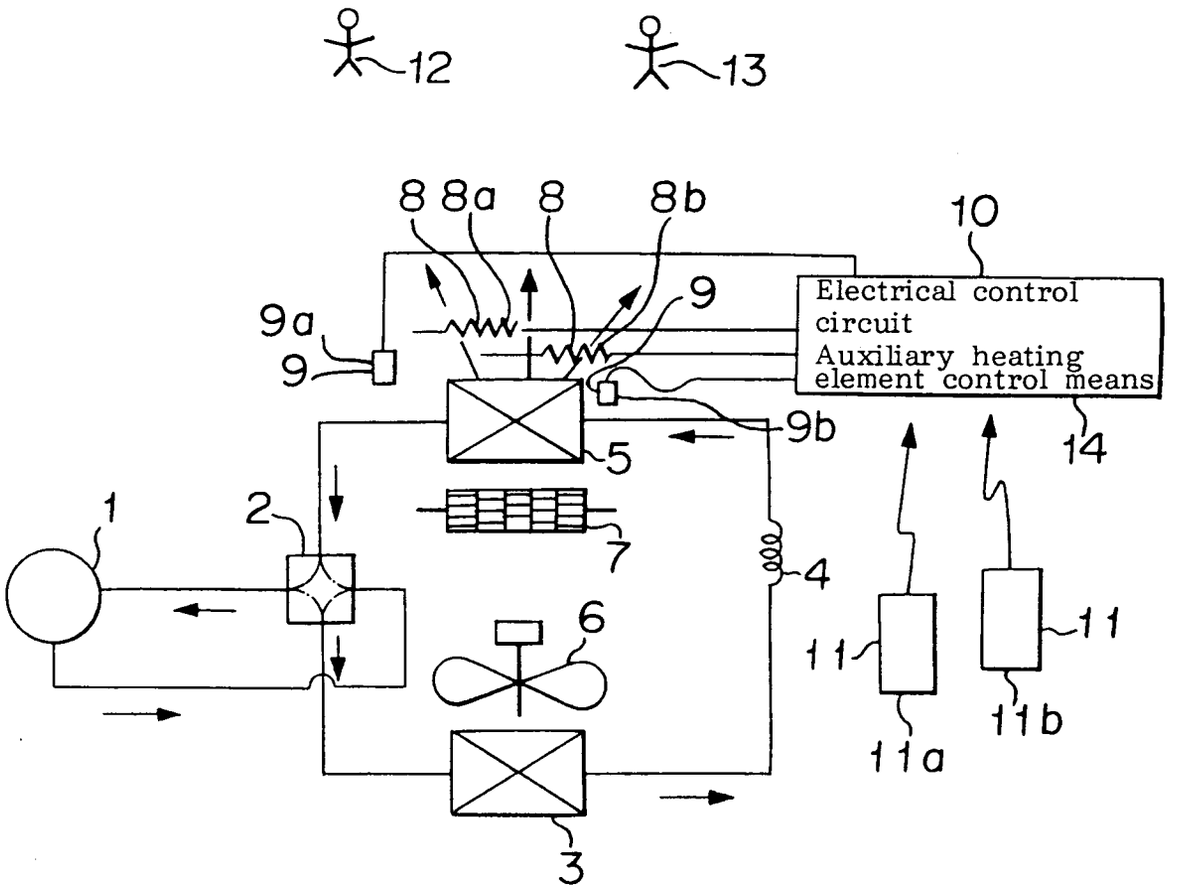
FIGURE 1


12
13
8
8a
8
8b
10
Electrical control circuit
Auxiliary heating element control means
9a
9
9
9b
14
5
1
2
7
4
6
11
11
11a
11b
3

The present invention relates to a controller which is capable of preventing a user from being cooled too much when an air conditioner is under cooling mode, in particular while he or she is asleep.

Referring to Figure 6, there is shown a conventional air conditioner controller. In Figure 6, reference numeral 1 designates a compressor. Reference numeral 2 designates a four port reversing valve. Reference numeral 3 designates an outdoor heat exchanger. Reference numeral 4 designates a throttle expansion device. Reference numeral 5 designates an indoor heat exchanger. Reference numeral 6 designates an outdoor fan. Reference numeral 7 designates an indoor fan. These devices 1-7 are arranged in that order.

Reference numeral 8 designates an auxiliary heater.

Near to the indoor heat exchanger 5 is arranged a thermistor 9 which detects a room temperature, and which is connected to an electrical control circuit 10 together with the auxiliary heater 8.

Reference numeral 11 designates a desired temperature input device, through which a desired room temperature can inputted. Reference numerals 12 and 13 designate a user A and a user B, respectively.

The operation of the conventional controller will be explained.

During cooling, a high temperature and high pressure refrigerant gas which has been discharged from the compressor 1 passes through the four port reversing valve 2, and enters the outdoor heat exchanger 3.

In the outdoor heat exchanger 3, the refrigerant gas is heat exchanged by the outdoor fan 6. Then the refrigerant gas enters the indoor heat exchanger 5 through the throttle expansion device 4, is heat exchanged by the indoor fan 7, flows into the four port reversing valve 2 again, and returns to the compressor 1.

Now, a room temperature control in the refrigeration cycle will be explained referring to the flowchart of Figure 7.

When the cooling operation is turned on at Step 20, the program proceeds to Step 21, where a desired temperature t_1 is inputted into the electrical control circuit 10 through the desired temperature input device 11.

At next Step 22, an actual room temperature t_2 is read into the electrical control circuit 10 through the room temperature detecting thermistor 9.

At next Step 23, it is determined whether the inequality $t_1 > t_2$ is satisfied or not. If affirmative, or if the actual room temperature is the desired room temperature or less (which means that it is too cool), the heater 8 is turned on to increase the room temperature at Step 24. If negative, the heater 8 is turned off at Step 25.

Then the program proceeds to Step 26, where it is determined whether the cooling operation should be continued or not. If affirmative, the program returns to Step 21.

An air conditioner which is provided with such auxiliary heater 8 has been known in e.g. Japanese Examined Patent Publication No. 25049/1986.

Because the conventional air conditioner controller is constructed as mentioned above, the actual room temperature can be equally maintained. However, the conventional controller involves a problem in that when there are a plurality of persons in a room to be air conditioned, a desired temperature which is comfortable to one of them may be a temperature which the other person(s) feels cold or uncomfortable. This is because a desired comfortable temperature varies depending on persons.

It is an object of the present invention to solve the problem, and to provide an air conditioner controller which allows a plurality of persons in a room to obtain their comfortable temperatures simultaneously.

The foregoing and other objects of the present invention have been attained by providing an air conditioner controller comprising a plurality of auxiliary heating elements which are arranged in an air conditioner; desired temperature input means for inputting desired temperatures; and auxiliary heating element control means for separately controlling the auxiliary heating elements based on the desired temperatures which have been inputted in the desired temperature input means.

In accordance with the air conditioner of the present invention, the plural auxiliary heating elements can be separately controlled by the auxiliary heating element control means to feed conditioned air in such manner that the control temperatures of the conditioned air are different depending on portions thereof so as to be suitable to the inputted desired temperatures. This arrangement allows the plural persons in the room to receive their own comfortable air, thereby offering an advantage in that comfortable air conditioning can be obtained in such manner that the persons can not feel too cool during cooling operation.

In a preferred embodiment, the auxiliary heating elements are arranged to separately heat different portions of conditioned air fed by a fan of the air conditioner.

In another preferred embodiment, the auxiliary heating elements are arranged to be opposite to different portions of a fan of the air conditioner.

In another preferred embodiment, the air conditioner controller further comprises a fan of the air conditioner for simultaneously feeling conditioned air, the controlled temperatures of which are different depending on portions thereof.

In another preferred embodiment, the desired temperature input means is capable of separately setting desired temperatures of the auxiliary heating elements.

In another preferred embodiment, the desired temperature input means is constituted by a plurality of desired temperature input units to separately control the auxiliary heating elements.

In another preferred embodiment, the auxiliary heating element control means controls the auxiliary heating elements separately in turn.

In another preferred embodiment, the auxiliary heating element control means separately controls the auxiliary heating elements based on conditioned air temperatures which are detected by a plurality of temperature sensors located near to an outlet port of the air conditioner.

In another preferred embodiment, the auxiliary heating element control means can carry out either one of a separate control and a collective control, the separate control for separately controlling the auxiliary heating elements, and the collective control for collectively controlling the auxiliary heating elements.

In drawing:

Figure 1 is a schematic diagram showing the air conditioner controller according to an embodiment of the present invention;

Figure 2 is a flowchart to help explain the operation of the embodiment;

Figures 3 and 4 are an exploded perspective view and a cross sectional view of an air conditioner which has auxiliary heating elements arranged behind an indoor heat exchanger in accordance with the embodiment;

Figure 5 is a cross sectional view of an air conditioner which has auxiliary heating elements arranged in an outlet port in accordance with the embodiment;

Figure 6 is a schematic diagram showing a conventional air conditioner controller; and

Figure 7 is a flowchart to help explain the operation of the conventional air conditioner controller.

Preferred embodiments of the present invention will be described with reference to the drawings.

Referring now to Figures 1 and 2, there is shown the air conditioner controller according to an embodiment of the present invention. In Figure 1, reference numeral 1 designates a compressor. Reference numeral 2 designates a four port reversing valve. Reference numeral 3 designates an outdoor heat exchanger. Reference numeral 4 designates a throttle expansion device. Reference numeral 5 designates an indoor heat exchanger. Reference numeral 6 designates an outdoor fan. Reference numeral 7 designates an indoor fan. Reference numeral 8 designates auxiliary heating means which heats conditioned air to be blown off from an air conditioner (not shown), and which is divided into two parts across the width of the indoor heat exchanger 5 to form a first auxiliary heating element 8a and a second auxiliary heating element 8b.

Reference numeral 9 designates room temperature detecting means which detects room temperatures at locations near to an outlet port (not shown), which is arranged to correspond to the first and second auxiliary heating elements 8a and 8b across the width of the indoor heat exchanger 5, and which is constituted by a first room temperature detecting thermistor 9a and a second room temperature detecting thermistor 9b.

Reference numeral 10 designates an electrical control circuit which controls the operation of the air conditioner (not shown), and to which the first and second auxiliary heating elements 8a and 8b, the first room and second temperature detecting thermistors 9a and 9b and the like are connected.

Reference numeral 11 designates desired temperature input means through which desired temperatures can be inputted, and which is constituted by a first desired room temperature input unit 11a and a second desired room temperature input unit 11b. The input units can transmit signals indicative of the desired temperatures to the electrical control circuit 10 by use of e.g. remote control system (not shown).

Reference numerals 12 and 13 designate a first user and a second user, respectively, who are in a room to be air conditioned. The first user 12 is at the side of the first auxiliary heating element 8a, and the second user 13 is at the side of the second auxiliary heating element 8b.

Reference numeral 14 designates auxiliary heating element control means which can be constituted by a microcomputer (not shown) and so on in the electrical control circuit 10. Based on the desired room temperatures which have been inputted through the input units 11a and 11b, the desired room temperatures are compared to corresponding detection temperatures which are detected by the first and second thermistors 9a and 9b. An on and off control is separately carried out in energisation of the first and second auxiliary heating elements 8a and 8b to adjust the temperatures of conditioned air, thereby to bring the detected room temperatures near the corresponding desired temperatures.

The auxiliary heating element control means 14 may carry out a collective control wherein the on and off operations of the auxiliary heating elements (8b, 8b) are collectively controlled. The present invention is applicable to a case wherein the separate control and the collective control can be selected.

The operation of the embodiment will be explained referring to the flow chart of Figure 2.

If a cooling operation is turned on at Step 30, the program proceeds to Step 31.

At Step 31, it is determined whether the users 12 and 13 of the air conditioner have turned on a "separate air conditioning mode" switch (not shown) which means that the auxiliary heating elements are sepa-

rately controlled. If affirmative, the program proceeds to Step 32, where the first user 12 uses the first input unit 11a to input a desired temperature t_1a into the auxiliary heating elements control means 14 of the electrical control circuit 10.

Likewise, the second user 13 uses the second input unit 11b to input a desired temperature t_1b into the auxiliary heating element control means 14 of the electrical control circuit 10.

At next Step 33, the first and second thermistors 9a and 9b detect actual room temperatures t_2a and t_2b, and transmit signals indicative of the detected actual room temperatures to the auxiliary heating element control means 14.

At next Step 34, the actual room temperature t_2a is compared to the desired room temperature t_1a of the first user 12. If $t_1a > t_2a$ (which means that it is too cool) the first auxiliary heating element 8a is turned on at Step 35 to increase the temperature of the conditioned air at the side of the first user 12, thereby raising the room temperature at the side of the first user 12.

If $t_1a < t_2a$ (which means that it is warm), the first auxiliary heating element 8a is turned off to decrease the room temperature at the side of the first user 12, thereby carrying out such temperature control that the first user 12 can obtain a comfortable temperature.

At Steps 37 through Steps 39 as well, a similar temperature control is carried out to control the second auxiliary heating element 8b to give the second user 13 to a comfortable temperature.

At Step 40, it is determined whether the operation should be continued or not. If affirmative, the program returns to Step 30.

Although the explanation on the embodiment as stated earlier has been made for the case wherein the first user 12 is at the side of the first auxiliary heating element 8a and the second user 13 is at the side of the second auxiliary heating element 8b, the present invention is applicable to the case wherein the location of the first user 12 and the location of the second user 13 with respect to the air conditioner are automatically detected by use of a sensor or the like, and the on and off control is accordingly carried out for the first and second heating elements 8a and 8b, thereby offering an advantage in that the operation can be made in an easy and precise manner.

In order to carry out the room temperature control, a finer voltage control for energisation of the auxiliary heating means 8, which has for example a strong mode, an intermediate mode, a weak mode and an off mode, may be done instead of the on and off control.

Although the explanation on the embodiment stated earlier has been made for the case wherein the cooling operation is carried out, the present invention is applicable to a case wherein during heating as well the auxiliary heating means 8 is used to adjust partly the temperature of heated air, thereby offering an advantage in that heating can be carried out to match with comfortable temperatures of a plurality of users.

The auxiliary heating elements can be arranged behind the indoor heat exchanger as shown in Figures 3 and 4.

The auxiliary heating elements may be arranged in the outlet port in the air conditioner.

Claims

1. An air conditioner controller characterized in that it comprises:
   a plurality of auxiliary heating elements (8a, 8b) which are arranged in an air conditioner;
   desired temperature input means (11) for inputting desired temperatures; and
   auxiliary heating element control means (14) for separately controlling the auxiliary heating elements (8a, 8b) based on the desired temperatures which have been inputted in the desired temperature input means (11).

2. An air conditioner controller according to Claim 1, characterized in that the auxiliary heating elements (8a, 8b) are arranged to separately heat different portions of conditioned air fed by a fan (7) of the air conditioner.

3. An air conditioner controller according to Claim 1, characterized in that the auxiliary heating elements (8a, 8b) are arranged to be opposite to different portions of a fan (7) of the air conditioner.

4. An air conditioner controller according to Claim 1, characterized in that it further comprises a fan (7) of the air conditioner for simultaneously feeding conditioned air, the controlled temperatures of which are different depending on portions thereof.

5. An air conditioner controller according to Claim 1, characterized in that the desired temperature input means (11) is capable of separately setting desired temperatures of the auxiliary heating elements (8a, 8b).

6. An air conditioner controller according to Claim 1, characterized in that the desired temperature input means (11) is constituted by a plurality of desired temperature input units (11a, 11b) to separately control the auxiliary heating elements (8a, 8b).

7. An air conditioner controller according to Claim 1, characterized in that the auxiliary heating element control means (14) controls the auxiliary heating elements (8a, 8b) separately in turn.

8. An air conditioner controller according to Claim 1, characterized in that the auxiliary heating element control means (14) separately controls the auxiliary heating elements (8a, 8b) based on conditioned air temperatures which are detected by a plurality of temperature sensors (9a, 9b) located near to an outlet port of the air conditioner.

9. An air conditioner controller according to Claim 1, characterized in that the auxiliary heating element control means (14) can carry out either one of a separate control and a collective control, the separate control for separately controlling the auxiliary heating elements (8a, 8b), and the collective control for collectively controlling the auxiliary heating elements (8b, 8b).

10. An air conditioner controller substantially as described with reference to Figures 1 to 5 of the drawings.

FIGURE 1

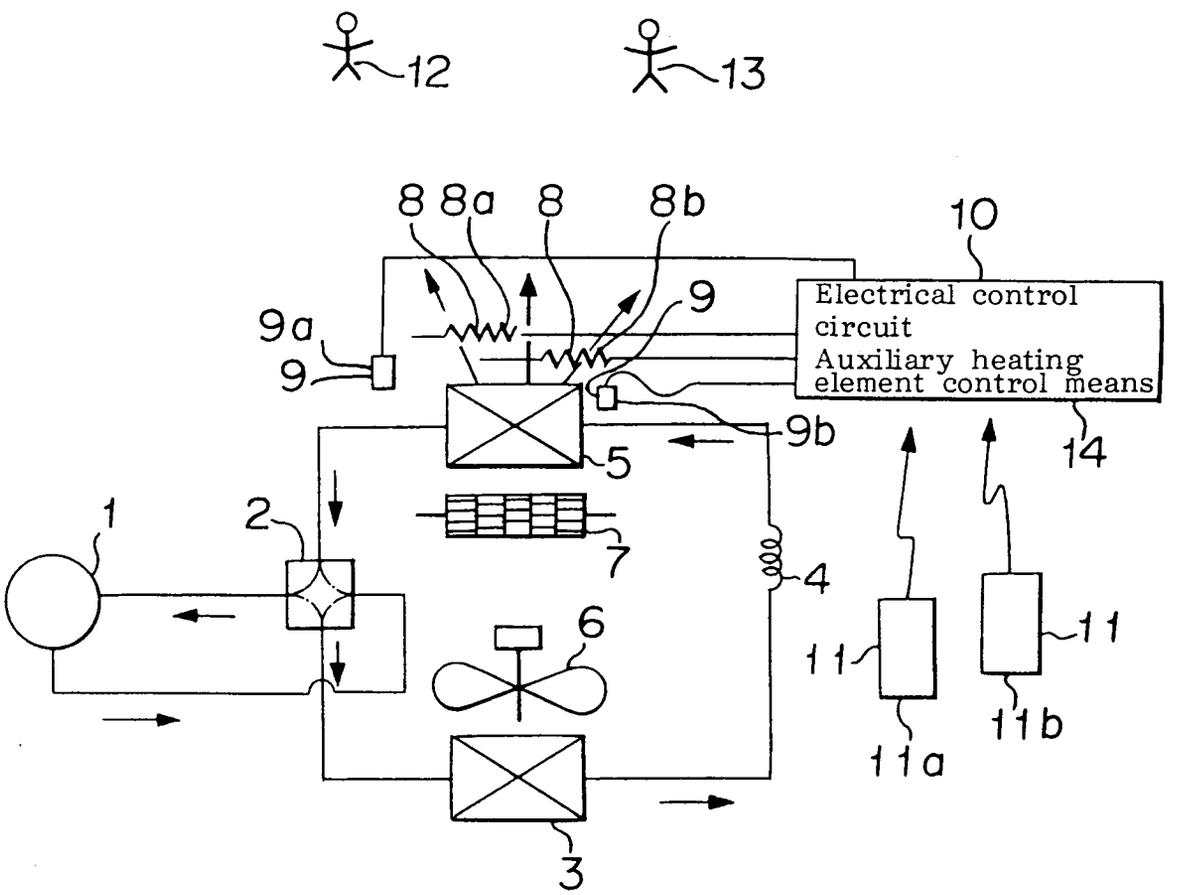

12
13
8
8a
8
8b
10
9
9a
9
Electrical control circuit
Auxiliary heating element control means
9b
14
5
1
2
7
4
6
11
11
11b
11a
3

FIGURE 2

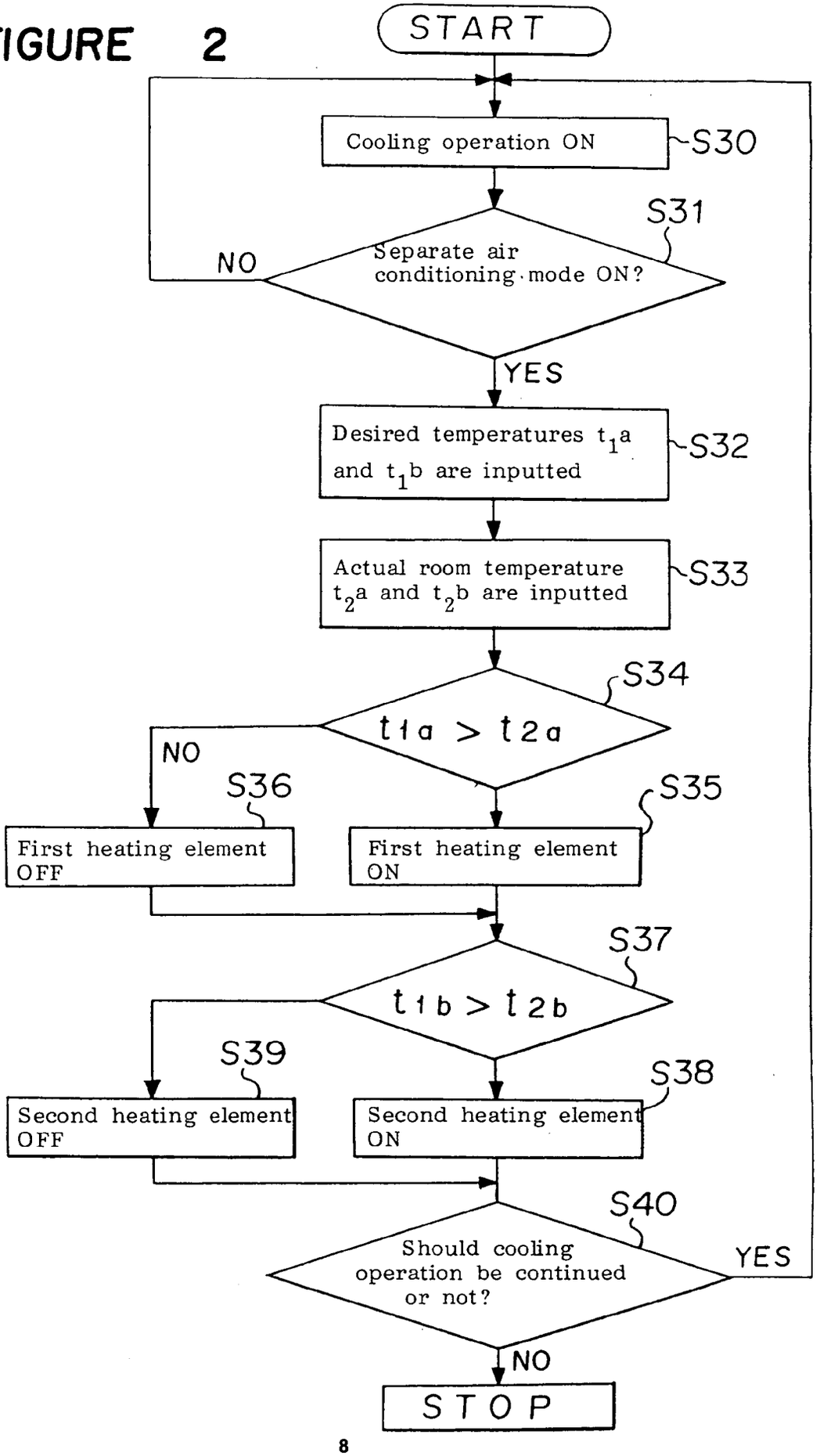

START
Cooling operation ON
S30
S31
Separate air conditioning mode ON?
NO
YES
Desired temperatures t_1a and t_1b are inputted
S32
Actual room temperature t_2a and t_2b are inputted
S33
S34
$t_{1a} > t_{2a}$
NO
S36
First heating element OFF
S35
First heating element ON
S37
$t_{1b} > t_{2b}$
S39
Second heating element OFF
S38
Second heating element ON
S40
Should cooling operation be continued or not?
YES
NO
STOP

FIGURE 3

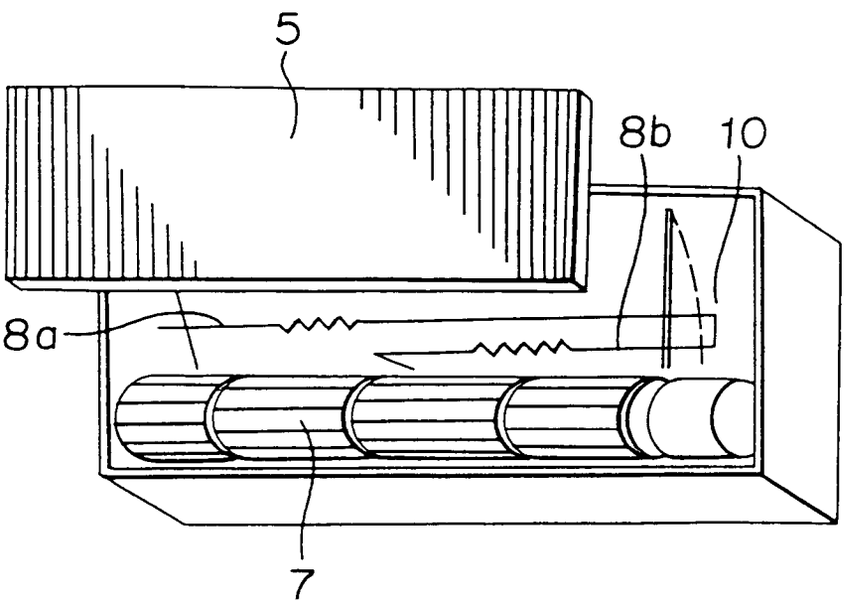


FIGURE 4

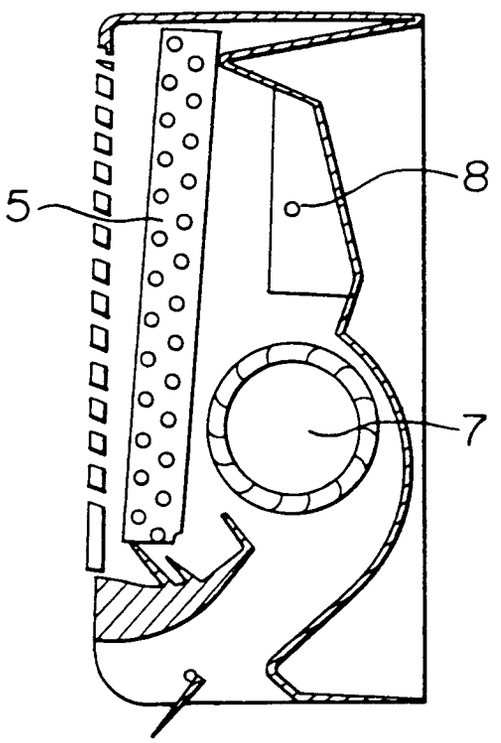


FIGURE 5

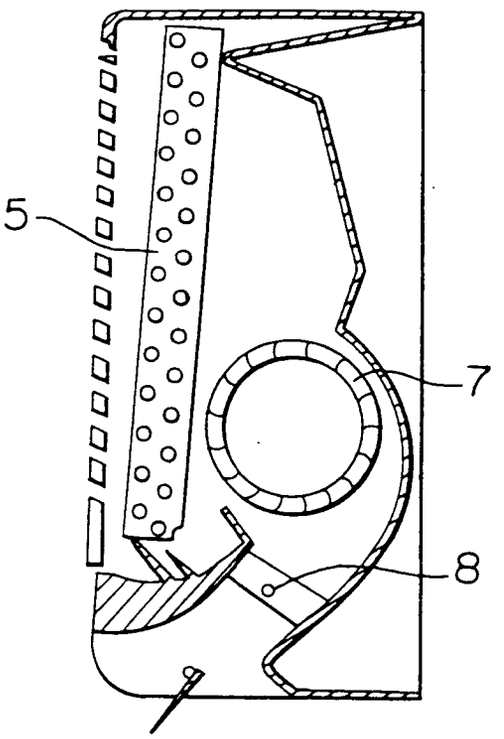


FIGURE 6

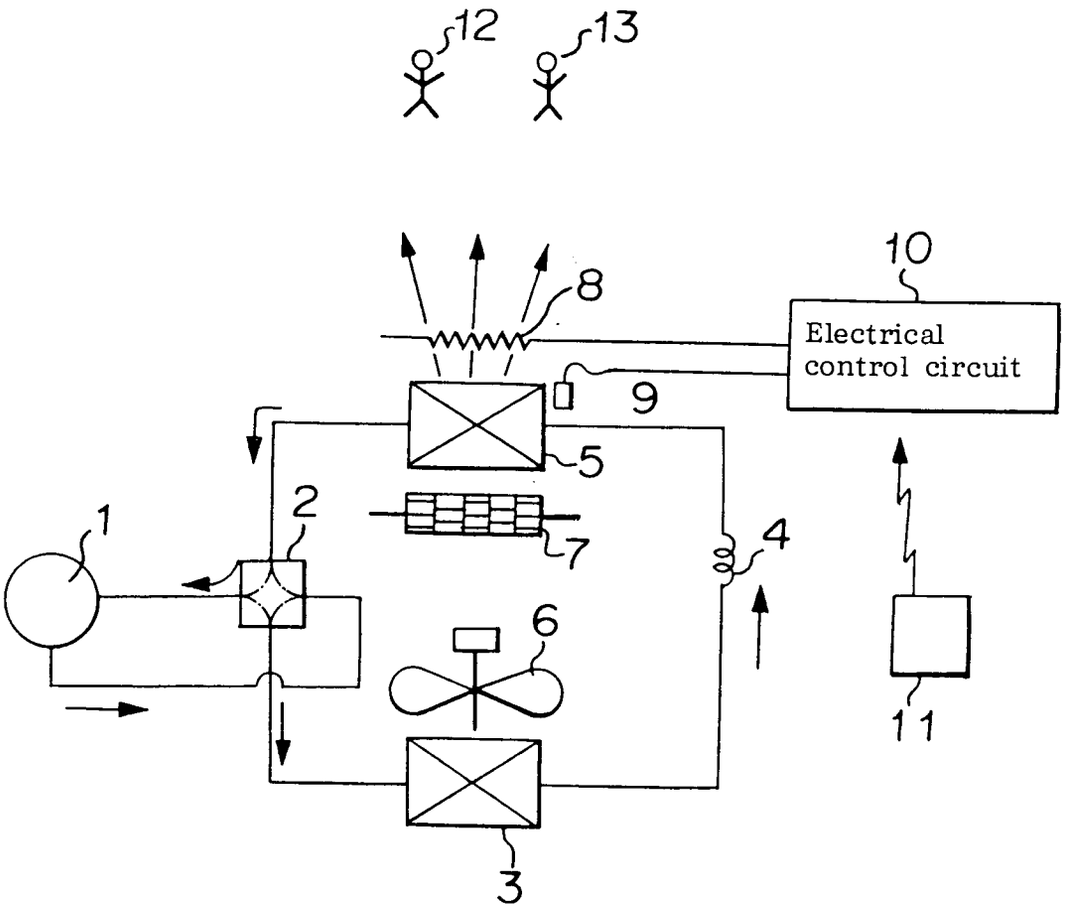
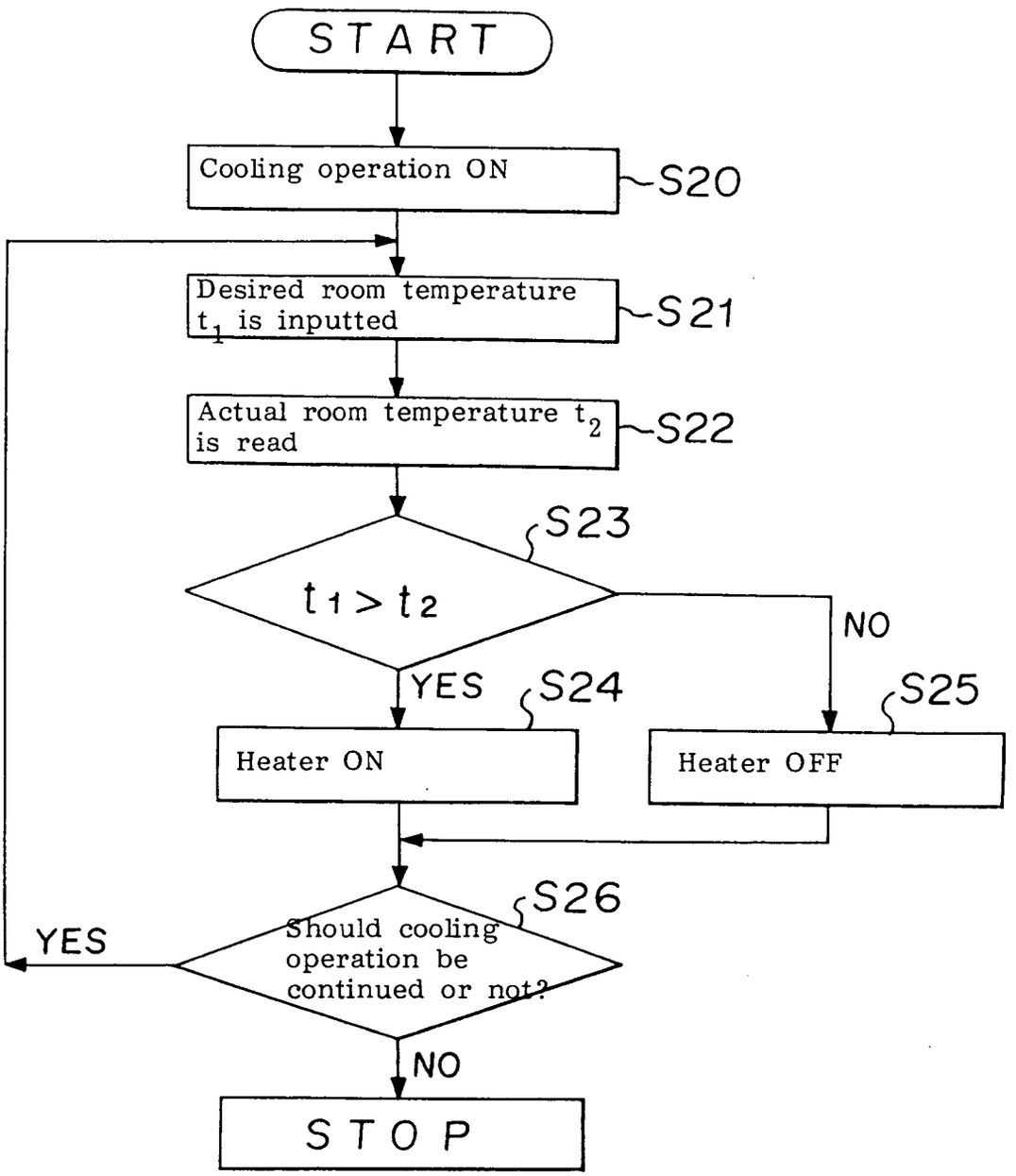


FIGURE 7


START
Cooling operation ON
S20
Desired room temperature t_1 is inputted
S21
Actual room temperature t_2 is read
S22
S23
$t_1 > t_2$
NO
YES
S24
S25
Heater ON
Heater OFF
S26
YES
Should cooling operation be continued or not?
NO
STOP

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91306170.1

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	DE - A1 - 3 224 635 (MITSUBISHI) * Claims; pages 3-8; fig. 1, 2,9 *	1-5	F 24 F 11/053 F 24 F 7/00
A	--	6-10	
Y	DE - A1 - 3 439 139 (HITACHI LTD.) * Pages 3-6; fig. 1,4-6; claims *	1-5	
A	--	6,8	
Y	US - A - 4 543 796 (HAN et al.) * Abstract; columns 1-3; claims; fig. 1,2 *	1-5	
A	--	6,8	
A	GB - A - 2 199 935 (MITSUBISHI) * Abstract; fig. 9,13; claims *	1-6,8	TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A	--		
A	US - A - 4 925 089 (CHAPARRO et al.) * Abstract; claims 1-4; fig. 1,3 *	1,5,8	F 24 F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	18-10-1991	LANG

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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