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(54) **Air conditioner controller**

Klimageräteeinrichtung

Système de contrôle à conditionnement d'air

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12, Dec. 1984, pp 909-915**

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Description

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 be 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 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.

With the conventional air conditioner controller 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.

US-A-4543796 describes an air conditioner which comprises: a plurality of heating elements; -desired temperature input means for inputting a desired temperature; 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.

The air conditioning system has a temperature sensor at the air outlet into the room, which ensures that the air discharged into the room can never be excessively cold. This is achieved by overriding the normal control system for the entire volume of air discharged. It is not possible to provide air streams of different temperature selectively during cooling operation.

The system can also be operated in a heating mode. For use in this mode, auxiliary electric heating elements are provided. These heating elements can be energized selectively in order to provide a desired outlet temperature, but each heating element heats the entire volume of air discharged into the room. It is not possible to produce different discharge air temperatures in different regions of the room.

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

The present invention provides an air conditioner according to claim 1.

The plural auxiliary heating elements are 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 from one portion thereof to another, so as to be suitable to the inputted desired temperatures. This arrangement allows different persons in the room to receive their own comfortable air, thereby offering the advantage that comfortable air conditioning can be obtained in such manner that individual persons will 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.

The auxiliary heating elements may be arranged to be opposite to different portions of a fan of the air conditioner.

In another preferred embodiment, the air condition-

er comprises a fan for simultaneously feeding conditioned air, the controlled temperatures of which are different depending on portions thereof.

The desired temperature input means is preferably constituted by a plurality of desired temperature input units to separately control the auxiliary heating elements.

The auxiliary heating element control means may control the auxiliary heating elements separately one after another.

Preferably, the auxiliary heating element control means further 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.

The auxiliary heating element control means may have a separate control mode and a collective control mode, which are selectable by a user, the separate control mode for separately controlling the auxiliary heating elements (as aforesaid, and the collective control mode for collectively controlling the auxiliary heating elements.

In the accompanying drawings: -

Figure 1 is a schematic diagram showing the air conditioner 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 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 soon 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 (8a, 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 separately con-

trolled. 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 comforta-

ble 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, as shown in fig 5.

Claims

1. A room air conditioner comprising a housing, air-cooling means in the housing, means (7) for discharging cooled air from the housing through an outlet port into the room to be air-conditioned, means (9, 10, 11) for controlling the temperature of the discharged air, and auxiliary heating means (8) placed in the air discharge stream in the housing, characterized in that

the auxiliary heating means comprises a plurality of independently controllable additional auxiliary heating elements (8a, 8b) which are arranged to heat different portions of the air discharge stream; and in that

it comprises user-operable desired temperature input means (11) for inputting a plurality of desired discharge air 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) whereby the air conditioner can discharge simultaneously through the outlet port air stream portions of different temperatures.

2. An air conditioner according to Claim 1, characterized in that the means for discharging cooled air into the room is a fan (7) and the auxiliary heating elements (8a, 8b) are arranged to be opposite to different portions of the fan (7).
3. An air conditioner according to Claim 1, characterized in that the means for discharging cooled air into the room is a fan (7) for simultaneously feeding conditioned air, the controlled temperatures of which are different depending on portions thereof.
4. An air conditioner according to Claim 1, 2 or 3 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).
5. An air conditioner according to Claim 1, 2 or 3 characterized in that the auxiliary heating element control means (14) controls the auxiliary heating elements (8a, 8b) separately one after another.

6. An air conditioner according to any preceding Claim, characterized in that the auxiliary heating element control means (14) further 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 outlet port of the air conditioner.
7. An air conditioner according to any preceding Claim, characterized in that the auxiliary heating element control means (14) has a separate control mode and a collective control mode, which are selectable by a user, the separate control mode for separately controlling the auxiliary heating elements (8a, 8b) as aforesaid, and the collective control mode for collectively controlling the auxiliary heating elements (8a, 8b)

Patentansprüche

1. Raumklimaanlage mit einem Gehäuse, einer Luftkühleinrichtung (5) im Gehäuse, einer Einrichtung (7) zum Ausgeben gekühlter Luft durch eine Auslassöffnung aus dem Gehäuse in den zu klimatisierenden Raum, einer Einrichtung (9, 10, 11) zum Regeln der Temperatur der ausgegebenen Luft, und mit einer im Auslassstrom im Gehäuse angeordneten Hilfsheizeinrichtung (8);

dadurch gekennzeichnet, dass:

- die Hilfsheizeinrichtung mehrere unabhängig regelbare zusätzliche Hilfsheizelemente (8a, 8b) aufweist, die so ausgebildet sind, dass sie verschiedene Teile des Luftauslassstroms beheizen, und dass sie eine vom Benutzer betätigbare Solltemperatur-Eingabeeinrichtung (11) zum Eingeben mehrerer gewünschter Temperaturen für die Ausgabeluft aufweist; und
- eine Hilfsheizelement-Regelungseinrichtung (14) zum getrennten Regeln der Hilfsheizelemente (8a, 8b) auf Grundlage der gewünschten Temperaturen, die in die Solltemperatur-Eingabeeinrichtung (11) eingegeben wurden, vorhanden ist, wodurch die Klimaanlage gleichzeitig durch die Auslassöffnungen Teilluftströme mit verschiedenen Temperaturen ausgeben kann.

2. Klimaanlage nach Anspruch 1, **dadurch gekennzeichnet, dass** die Einrichtung zum Ausgeben gekühlter Luft in den Raum ein Lüfter (7) ist und die Hilfsheizelemente (8a, 8b) so angeordnet sind, dass sie verschiedenen Abschnitten des Lüfters (7) gegenüberstehen.
3. Klimaanlage nach Anspruch 1, **dadurch gekennzeichnet, dass** die Einrichtung zum Ausgeben ge-

kühlter Luft einen Lüfter (7) zum gleichzeitigen Zuführen klimatisierter Luft aufweist, die bereichsabhängig verschiedene geregelte Temperaturen aufweist.

4. Klimaanlage nach einem der Ansprüche 1, 2 oder 3, **dadurch gekennzeichnet, dass** die Solltemperatur-Eingabeeinrichtung (11) durch mehrere Solltemperatur-Eingabeeinheiten (11a, 11b) gebildet wird, um die Hilfsheizelemente (8b) getrennt zu regeln.

5. Klimaanlage nach einem der Ansprüche 1, 2 oder 3, **dadurch gekennzeichnet, dass** die Hilfsheizelement-Regelungseinrichtung (14) die Hilfsheizelemente (8a, 8b) getrennt nacheinander regelt.

6. Klimaanlage nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Hilfsheizelement-Regelungseinrichtung (14) ferner die Hilfsheizelemente (8a, 8b) getrennt auf Grundlage der Temperaturen der klimatisierten Luft regelt, die durch mehrere Temperatursensoren (9a, 9b) erfasst werden, die nahe bei der Auslassöffnung der Klimaanlage angeordnet sind.

7. Klimaanlage nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, dass** die Hilfsheizelement-Regelungseinrichtung (14) einen Getrenntregelungsmodus und einen Sammelregelungsmodus aufweist, die von einem Benutzer wählbar sind, wobei der Getrenntregelungsmodus dazu dient, die Hilfsheizelemente (8a, 8b) wie vorstehend genannt getrennt zu regeln, und der Sammelregelungsmodus dazu dient, die Hilfsheizelemente (8a, 8b) gemeinsam zu regeln.

Revendications

1. Conditionneur d'air pour une pièce comprenant, une enceinte, des moyens de refroidissement d'air (5) situés dans l'enceinte, des moyens (7) pour décharger l'air refroidi de l'enceinte à travers un orifice de décharge dans la pièce dont l'air doit être conditionné, des moyens (9, 10, 11) pour commander la température de l'air déchargé, et des moyens de chauffage auxiliaires (8) placés dans le courant de décharge d'air dans l'enceinte, caractérisé en ce que

les moyens de chauffage auxiliaires comprennent une multiplicité d'éléments de chauffage auxiliaires supplémentaires (8a, 8b), aptes à être commandés indépendamment, qui sont disposés de façon à chauffer différentes parties du courant de décharge d'air; et en ce qu'il comprend des moyens d'entrée de température voulue

(11), actionnables par l'utilisateur, pour introduire une multiplicité de températures d'air de décharge voulues; et des moyens de commande d'éléments de chauffage auxiliaires (14) pour commander séparément les éléments de chauffage auxiliaires (8a, 8b) sur la base des températures voulues qui ont été introduites dans les moyens d'entrée de température voulue (11), si bien que le conditionneur d'air peut décharger simultanément à travers l'orifice de décharge des parties de courants d'air dont les températures sont différentes.

peuvent être sélectionnés par un utilisateur, le mode de commande séparée servant à commander séparément les éléments de chauffage auxiliaires (8a, 8b) comme il est dit précédemment, et le mode de commande collective servant à commander collectivement les éléments de chauffage auxiliaires (8a, 8b).

2. Conditionneur d'air selon la revendication 1, caractérisé en ce que les moyens pour décharger l'air refroidi dans la pièce sont constitués par un ventilateur (7) et les éléments de chauffage auxiliaires (8a, 8b) sont disposés de façon à être en regard de différentes parties du ventilateur (7). 15 20
3. Conditionneur d'air selon la revendication 1, caractérisé en ce que les moyens pour décharger l'air refroidi dans la pièce sont constitués par un ventilateur (7) pour envoyer simultanément de l'air conditionné, dont les températures commandées diffèrent suivant ses parties. 25
4. Conditionneur d'air selon l'une quelconque des revendications 1, 2 et 3, caractérisé en ce que les moyens d'entrée de température voulue (11) sont constitués par une multiplicité d'unités d'entrée de température voulue (IIa, IIb) pour commander séparément les éléments de chauffage auxiliaires (8a, 8b). 30 35
5. Conditionneur d'air selon l'une quelconque des revendications 1, 2 et 3, caractérisé en ce que les moyens de commande d'éléments de chauffage auxiliaires (14) commandent les éléments de chauffage auxiliaires (8a, 8b) séparément, l'un après l'autre. 40
6. Conditionneur d'air selon l'une quelconque des revendications précédentes, caractérisé en ce que, en outre, les moyens de commande d'éléments de chauffage auxiliaires (14) commandent séparément les éléments de chauffage auxiliaires (8a, 8b) sur la base des températures de l'air conditionné qui sont détectées par une multiplicité de détecteurs de température (9a, 9b) situés au voisinage de l'orifice de décharge du conditionneur d'air. 45 50
7. Conditionneur d'air selon l'une quelconque des revendications précédentes, caractérisé en ce que les moyens de commande d'éléments de chauffage auxiliaires (14) comportent un mode de commande séparée et un mode de commande collective, qui 55

FIGURE 1

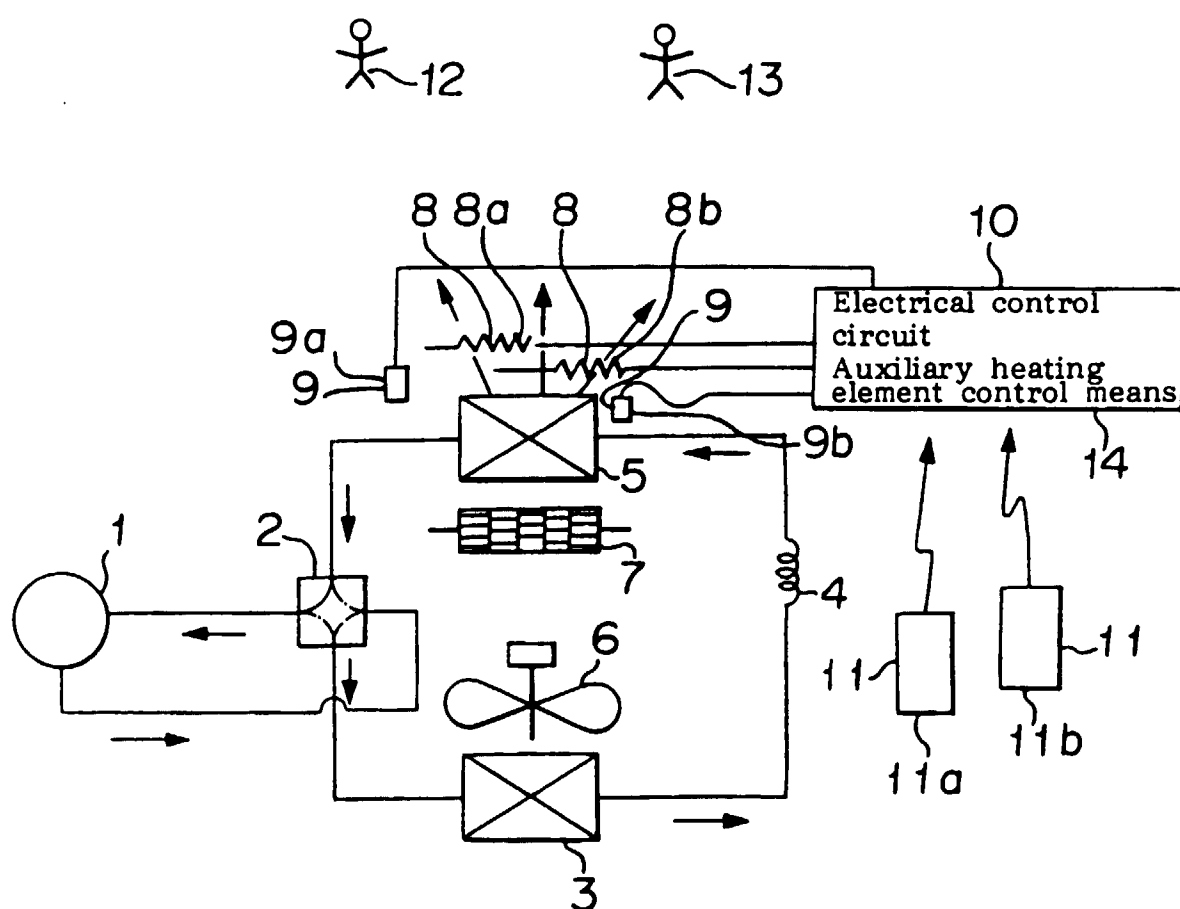


FIGURE 2

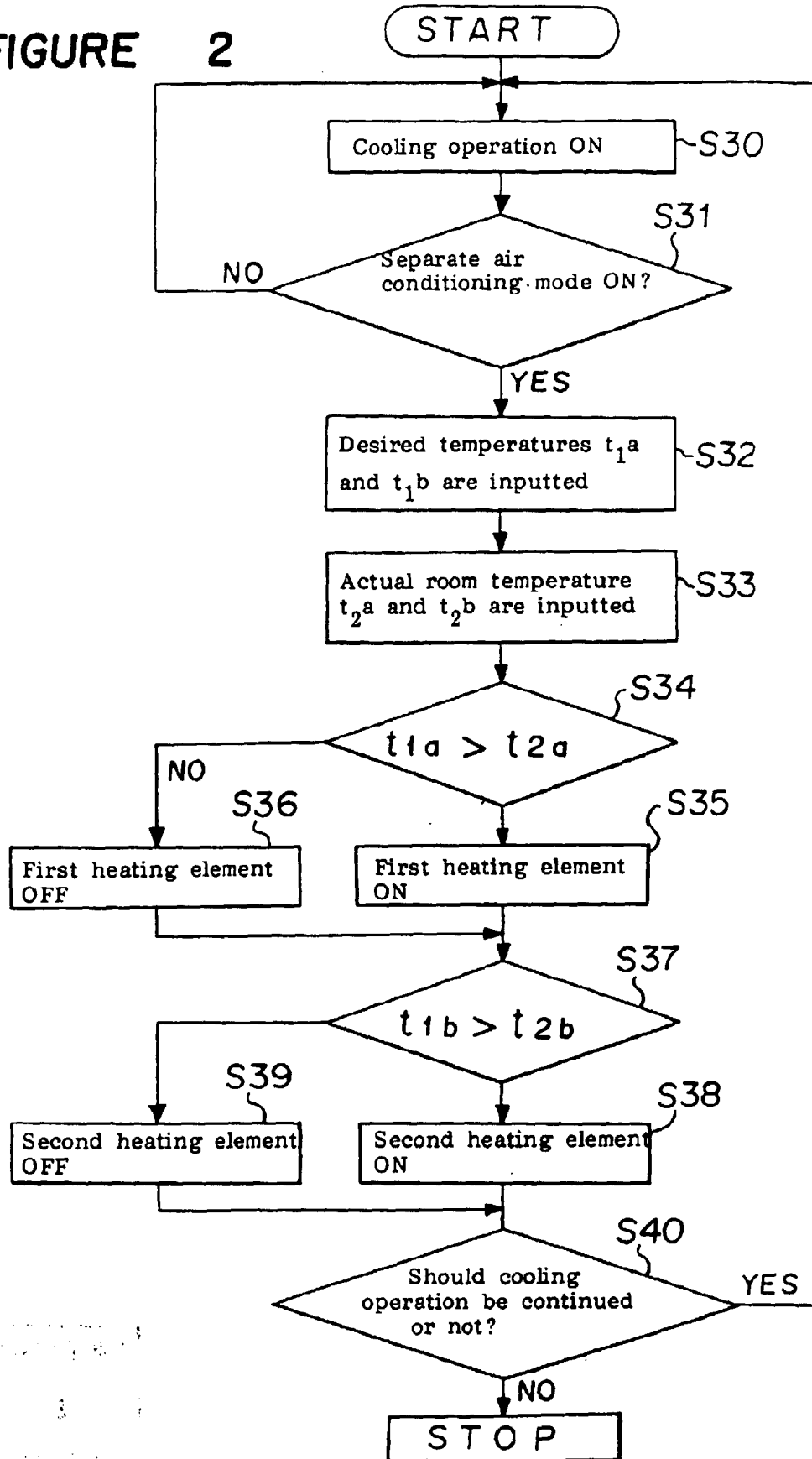


FIGURE 3

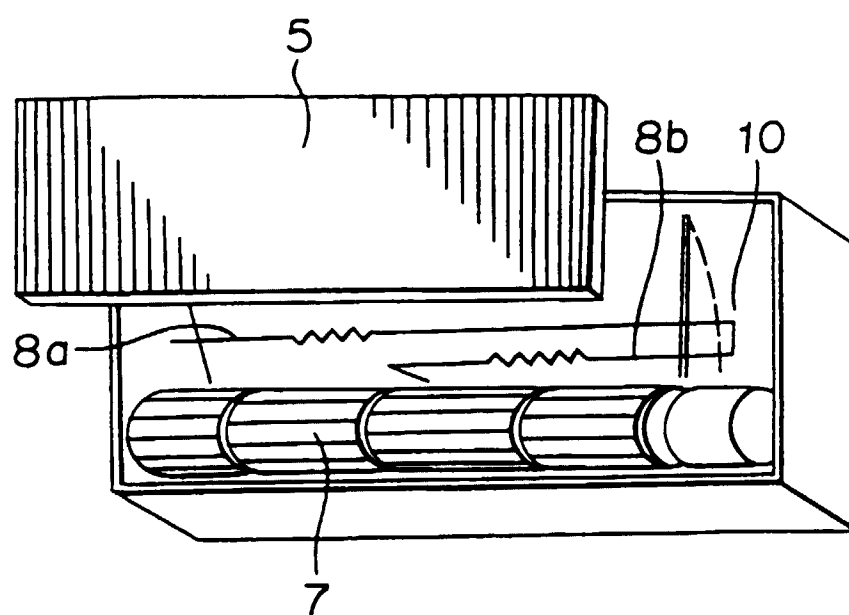


FIGURE 4

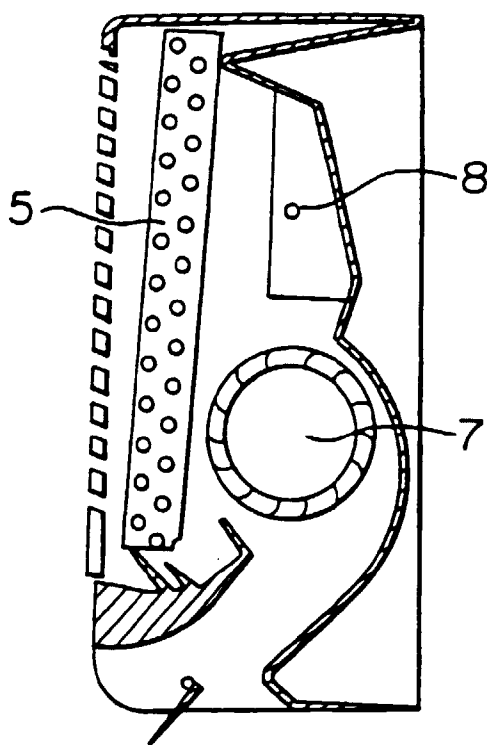


FIGURE 5

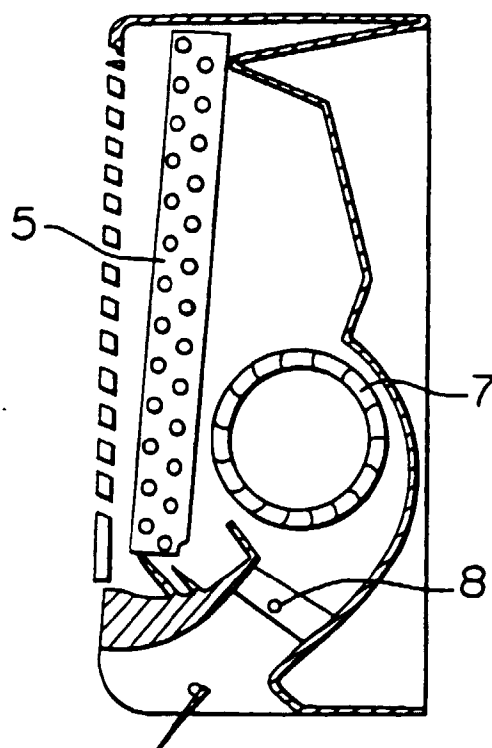


FIGURE 6

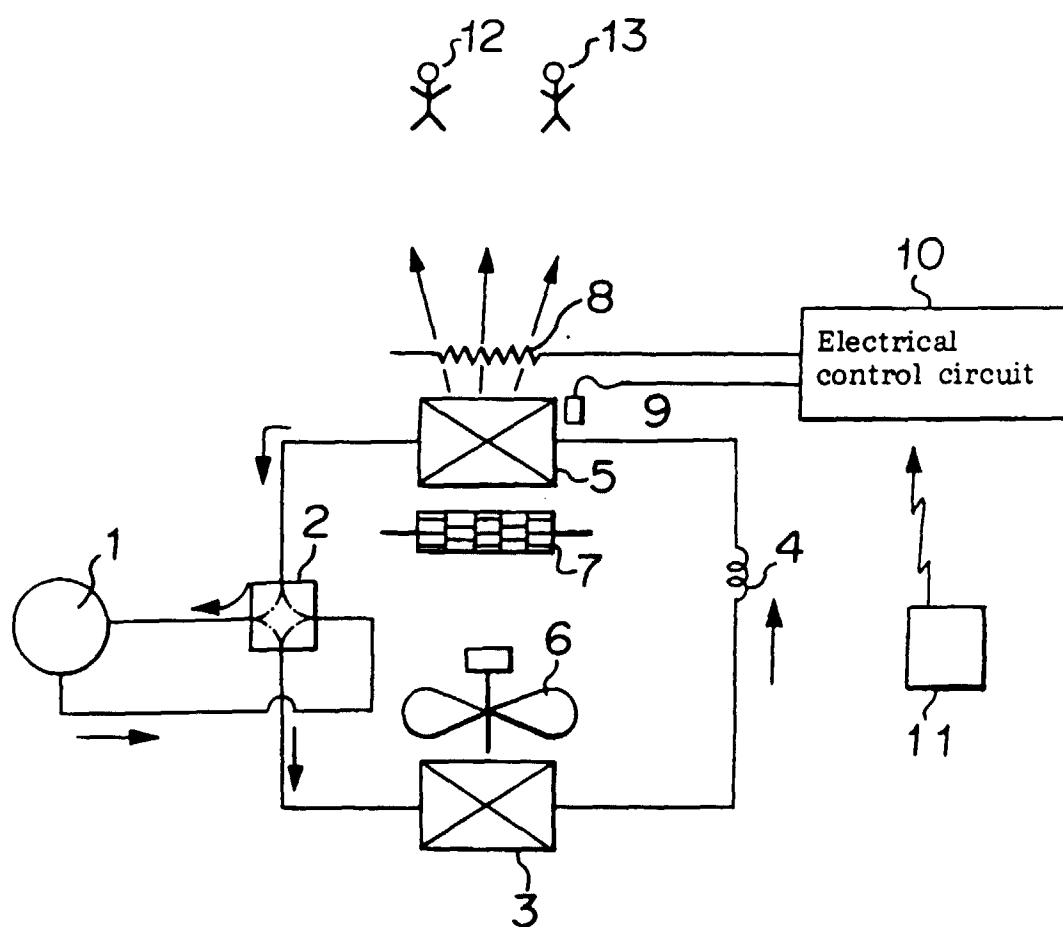


FIGURE 7

