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AIR CONDITIONER

BACKGROUND OF THE INVENTION

This invention relates to an air-conditioner which blows air sucked from a suction port of a front panel from a blow port of the front panel through an air inversion course.

In the shape and structure of a casing of an air-conditioner according to the prior art shown in Fig. 10, air sucked by a Silocco fan 2 through a suction port 1 is blown from a blow port 4 through an air inversion course 3.

According to the conventional structure, however, sucked air flows along a wall 5 of the air inversion course 3. Therefore, as represented by the distribution of arrows in Fig. 10 of the drawing, the flow of air is stronger on the wall (5) side and is weaker at portions far from the wall 5, and there involves the problem that the flow of air does not expand. Unless the flow of air is substantially uniform throughout the whole of the blow port 4, it becomes difficult to blow air into the entire portion of a room, and effective utilization of heat cannot be accomplished.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an air-conditioner which can solve the problems of the conventional air-conditioner described above, and which can uniform the flow of air blown from a blow port

substantially throughout the whole of the blow port.

In a first aspect of the invention, there is provided an air-conditioner for blowing air sucked from a suction port of a front panel from a blow port of the front panel through an air inversion course, in which air direction changing means is disposed in the air inversion course so that the flow of air blown from the blow port of the front panel becomes substantially uniform throughout the whole of the blow port.

According to this structure, the flow of air blown from the blow port of the front panel becomes substantially uniform due to the provision of the air direction changing means disposed in the air inversion course. Accordingly, air can be dispersedly blown into the whole room, and the air flow can be uniformed and expanded.

In a second aspect of the invention, there is provided an air-conditioner for blowing air sucked from a suction port of a front panel from a blow port of the front panel through an air inversion course, in which an air direction changing means is disposed in the air inversion course so that the flow of air blown from the blow port of the front panel becomes substantially uniform, the air inversion course is bent substantially at a right angle, and the air direction changing means protrudes into the air inversion course so as to change the inversion angle of air.

In this structure of the second aspect of the invention,

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the flow of air blown from the blow port of the front panel is bent substantially at a right angle by the air inversion course and moreover, the air direction changing means changes the inversion angle of air. Therefore, the flow of air becomes substantially uniform, and hence, the air can be dispersedly blown into the whole room, and the air flow can be uniformed and expanded.

In a third aspect of the invention, there is provided an air-conditioner for blowing air sucked from a suction port of a front panel from a blow port of the front panel through an air inversion course, in which the air inversion course is divided into a plurality of sections so that the flow of air blown from the blow port of the front panel becomes substantially uniform, an air direction changing means having a different angle is disposed in each of the sections of the course so divided, and the air whose direction is inverted by each air direction changing means is guided to the blow port of the front panel.

According to this structure, air flowing through each of a plurality of upper and lower divided sections of the air inversion course is inverted by each air direction changing means and is then guided to the blow port. Therefore, the flow of air becomes substantially uniform, and hence, the air can be dispersedly blown into the whole room, the air flow can be uniformed and expanded.

The fourth aspect of the invention provides an air-

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conditioner including a heat exchanger on the outdoor side, a fan on the room side, a compressor, an expansion device, a heat exchanger on the indoor side, a fan on the indoor side and a motor for driving both of the fans, all those being accommodated in a single casing equipped with a front panel having a suction port and a blow port, in which an inner casing for subjecting air sucked from the suction port of the front panel to heat-exchange by the operation of the fan on the room side through the heat exchanger on the room side, inverting the direction of air flow so subjected to heat exchange through an air inversion course and guiding the air to the blow port of the front panel, is disposed inside the casing; an air direction changing means is disposed in the air inversion course of the inner casing; and the air direction changing means is so constituted as to change the direction of air flow so that the flow of air blown from the blow port becomes substantially uniform.

In the structure of the fourth aspect of the invention described above, the air inversion course can be bent substantially at a right angle, and the air direction changing means can protrude into the air inversion course so as to change the inversion angle of air.

Further the fourth aspect of the invention described above can have the structure wherein the air inversion course is divided into a plurality of sections, an air direction changing means having a different angle is

disposed in each of the sections of the air inversion course so divided, and each air direction changing means changes the direction of flow of air at a different angle.

In any aspects of the invention described above, the air direction changing means can be a protuberance having a triangular pyramid shape.

According to the fourth aspect of the invention and its modifications, the flow of air blown from the blow port of the front panel becomes substantially uniform due to the provision of the air direction changing means disposed in the air inversion course. Accordingly, the air can be dispersedly blown into the whole room, the air flow can be uniformed and can be expanded.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view showing an air-conditioner of an embodiment according to the present invention.

Fig. 2 is transverse sectional view showing the inside of the air-conditioner.

Fig. 3 is a longitudinal sectional view.

Fig. 4 is a cooling medium circuit diagram of the air conditioner.

Fig. 5 is a perspective view showing an example of an inner casing of the air-conditioner.

Fig. 6 is a perspective view showing the accommodation state of a Silocco fan in the inner casing shown in Fig. 5.

Fig. 7 is a transverse sectional view of the inner casing.

Fig. 8 is a longitudinal sectional view of the inner casing.

Fig. 9 is an electric circuit diagram of the air-conditioner.

Fig. 10 is a view showing an example of a conventional casing of an air-conditioner according to the prior art.

PREFERRED EMBODIMENTS OF THE INVENTION

Hereinafter, an embodiment of the present invention will be explained with reference to the accompanying drawings.

Fig. 1 shows an air-conditioner of an embodiment of the present invention, and this air-conditioner is of the type which can be installed in a window, for example.

The portion of this air-conditioner represented by two-dot-chain lines is fitted to a hole of a window frame 10, and is equipped with a casing 12 and a front panel 14. A suction port 16, a blow port 18 and an operation portion 20 are provided to this front panel 14. The front panel 14 is disposed on the room side, while the casing 12 is disposed outside the window frame 10.

Figs. 2 and 3 show the inside of the air-conditioner shown in Fig. 1.

A heat exchanger 30 on the room side, a heat exchanger 32 on the outdoor side, a compressor 34, a fan motor 36, an

outdoor fan 38 connected to one of the ends of the fan motor 36, an room fan (hereinafter referred to as a "Silocco fan") 40 connected to the other end of the fan motor 36, an inner casing 42, etc., are disposed below a board inside the casing 12. The heat exchanger 32 on the outdoor side is disposed at the rear end portion of the casing 12 and the heat exchanger 30 on the room side is so disposed as to correspond to the suction port 16 of the front panel 14. The Silocco fan 40 is disposed at the back of the heat exchanger 30 on the room side. By the operation of this Silocco fan 40, air inside a room R is sucked from the suction port 16 of the front panel 14 into a later-described air inversion course 52.

The compressor 34 and the fan motor 36 are disposed at the substantial center inside the casing 12. The fan motor 36 rotates the outdoor fan 38.

Referring to Fig. 4, the heat exchanger 30 on the outdoor side, the heat exchanger 32 on the outdoor side, the compressor 34 and an expansion device 35 are connected by a predetermined refrigeration piping and constitute a refrigeration cycle.

The inner casing 42 shown in Figs. 5 through 8 is made of a synthetic resin, for example, and is equipped with an accommodation portion 50 for the Silocco fan 40, the air inversion course 52 and protuberance-like air direction changing members 54 and 56. Referring to Fig. 6, the

Silocco fan 40 is accommodated in the accommodation portion 50 of the inner casing 42 as shown in the drawings.

Air sucked from the suction port 16 of the front panel 14 is blown from the blow port 18 of the front panel 14 through the air inversion course 52 as represented by the flows of air A, B and C (Figs. 2 and 5). The air direction changing members 54 and 56 described above are disposed in such a manner that the flows of air A, B and C blown from the blow port 18 of the front panel 14 become substantially uniform throughout the whole of the blow port 18.

As is obvious from Figs. 7 and 8, the air direction changing member 54 has a substantially triangular pyramid shape and is disposed at the upper section formed by dividing the air inversion course 52 into the upper and lower sections, and the air direction changing member 56 likewise has a substantially triangular pyramid shape and is disposed at the lower section formed by dividing the air inversion course 52 into the upper and lower sections.

Referring to Fig. 7, the air direction changing members 54 and 56 are so formed as to be spaced apart from each other at a distance $d_a = 90$ mm with respect to the direction of flow of air when the length D of the air inversion course 52 is, for example, $D = 162$ mm, and the width d_b of each of the air direction changing members 54 and 56 is $d_b = 55$ mm. Referring to Fig. 8, when the height H of the air inversion course 52 is $H = 160$ mm, the air direction changing member

54 protrudes into the course 52 by a length $L_a = 85$ mm, and the other air direction changing member 56 likewise protrudes into the course 52 by a length $L_b = 75$ mm, for example. In other words, each air direction changing member 54, 56 is separated at a suitable dimensional interval in the vertical direction of the air inversion course 52 so that the flows of air A, B and C blown from the blow port 18 become substantially uniform throughout the whole of the blow port 18. As is obvious from Fig. 7, too, the air inversion course 52 is the course which is bent substantially at a right angle, and each of the air direction changing members 54 and 56 protrudes into the air inversion course 52 so as to change the inversion angle of air.

In this embodiment, when the air inside the room R is air-conditioned, the Silocco fan 40 is rotated and air inside the room R is sucked from the suction port 16 of the front panel 14. The flows of air A, B and C so sucked pass through the heat exchanger 30 on the room side, then flow through the respective courses and are blown from the blow port 18 of the front panel 14. In other words, the flow of air A sucked from the suction port 16 passes through the heat exchanger 30 on the room side and through the Silocco fan 40, strikes the changing surface 54a of the air direction changing member 54 having a protuberance-like shape, is then guided obliquely downward, and blown to the

left side of the blow port 18 in the drawing after its direction is so changed, as shown in Figs. 2 and 5.

The flow of air B passes through the heat exchanger 30 on the room side and through the Silocco fan 40, strikes the changing surface 56a of the air direction changing member 56 having a protuberance-like shape, and is blown from the blow port 18 after its direction is so changed. The flow of air C passes through the heat exchanger 30 on the room side and through the Silocco fan 40, is guided along the air course surface 53 of the air inversion course 52 without striking the protuberance-like air direction changing members 54 and 56, and is blown from the right side of the blow port 18 in the drawing after its direction is so changed.

In this embodiment, the direction of the flows of air A, B and C blown from the blow port 18 of the front panel 14 is changed by the protuberance-like air direction changing members 54 and 56 disposed in the air inversion course 52, and the flows are made substantially uniform throughout the whole of the blow port 18 as shown in Fig. 5, for example.

Fig. 9 shows an example of a driving electrical circuit for driving the compressor motor 34a of the compressor 34 and the fan motor 36.

In Fig. 9, A.C. power from the power supply plug 60 is supplied to the compressor motor 34a and to the fan motor 36 through the operation section 20. In other words, power is supplied to the compressor motor 34a through a wiring route

comprising the power supply plug 60, cables L1, L2, L3, L4, L5 and L6 and the power supply plug 60. Power is supplied to the fan motor 36 through a wiring route comprising the power supply plug 60, L1, L7, L8 or L9, L10, L6 and the power supply plug 60. A thermostat 61 using a bimetal as a temperature detection/protection device and an overcurrent relay 62 as an overcurrent protection device are inserted into the wiring route between the operation section 20 and the compressor motor 34a. Through the operation section 20 power supply OFF, the flow rate adjustment of the fan motor 36 (high and low two-stage switching) and the high and low two-stage switching of the cooling operation can be set. Incidentally, reference numerals 63 and 64 denote capacitors for improving the power factor and for preventing the noise, respectively.

Referring to Fig. 9, when the blow rate is adjusted, the blow rate is set to "HIGH" through the operation section 20 in the case of strong (high) blow. Then, the power supply is switched to the "HIGH" rotation side through the terminal number 3 of the operation section 20 and power is supplied to the fan motor 36 through the wiring L8, so that the fan motor 36 rotates at a high speed. In the case of the weak (low) blow, on the other hand, the blow rate is set to "LOW" through the operation section 20. Then, the power supply is switched to the "LOW" circuit side through the terminal number 1 of the operation section 20, and power is supplied

to the fan motor 36 through the wiring L9, so that the fan motor 36 rotates at a low speed.

Next, when cooling is set to "HIGH" through the operation section 20, power is supplied to the terminals C and R of the compressor motor 34a through the terminal number 1 of the operation section 20, the wiring L2, the thermostat 61, the wiring L3, the overcurrent relay 62 and the wiring L4 and through the wiring L5 and L6, and the compressor motor 34a is driven. At this time, the power supply is switched to the "HIGH" rotation side through the terminal number 3 of the operation section 20 and power is supplied also to the fan motor 36 through the wiring L8, so that the fan motor 36 rotates at a high speed. On the other hand, when cooling is set to the "LOW" through the operation section 20, power is supplied to the terminals C and R of the compressor motor 34a through the terminal number 1 of the operation portion 20, the wiring L2, the thermostat 61, the wiring L3, the overcurrent relay 62 and the wiring L4 and through the wirings L5 and L6, so that the compressor motor 34a is driven. At this time, the power supply is switched to the "LOW" circuit side through the terminal number 3 of the operation portion 20 and power is supplied to the fan motor 36, too, through the wiring L9, so that the fan motor 36 rotates at a low speed. In this way, HIGH/LOW switching of cooling is effected by switching of HIGH/LOW of the blow rate by the fan motor 36 while the compressor motor 34a is

kept rotated at a constant speed.

When the temperature of the compressor motor 34a reaches an overheat set temperature, the contact of the thermostat 61 opens, the supply of power to the compressor motor 34a is cut off, the rotation of the compressor 34a is stopped, and the air-conditioner is protected. When the overcurrent flows through the winding of the compressor motor 34a, the overcurrent relay 62 is tripped, the supply of power to the compressor motor 34a is similarly cut off, the rotation of the compressor motor 34a is stopped, and the air-conditioner is protected.

Though the present invention has thus been described by way of the embodiment thereof, it is obvious that the present invention is not particularly limited thereto.

For example, though two protuberance-like air direction changing members 54 and 56 are disposed in the air inversion course 52 in the foregoing embodiment, three or more protuberance-like air direction changing members may be disposed, as well. Further, the shape of the air direction changing member is not limited to the substantial triangular pyramid shape, and other shapes may be employed, too. Though the air-conditioner of the foregoing embodiment is of a window installation type, the present invention can be applied to other types.

As can be understood clearly from the foregoing explanation, according to the first aspect of the invention,

when the air sucked from the suction port of the front panel is blown from the blow port of the front panel through the air inversion course, the flows of air can be substantially uniformed throughout the whole of the blow port due to the provision of the air direction changing members in the air inversion course. Therefore, the air can be dispersedly blown into the room as a whole, and can be uniformed in the room.

According to the second aspect of the invention, when the air sucked from the suction port of the front panel is blown from the blow port of the front panel through the air inversion course, it is bent substantially orthogonally by the air inversion course and its inversion angle is changed by the air direction changing members. Therefore, the flows of air can be substantially uniformed throughout the whole of the blow port, and the air can be dispersedly blown into the room as a whole, and can be uniformed in the room.

According to the third aspect of the invention, when the air sucked from the suction port of the front panel is blown from the blow port of the front panel through the air inversion course, the direction of flow of air flowing through a plurality of upper and lower sections of the air inversion course is inversed by the air direction changing member having a mutually different angle and disposed in each section and is then guided to the blow port. Therefore, the flows of air can be substantially uniformed

throughout the whole of the blow port, and the air can be dispersedly blown into the room as a whole and can be uniformed.

According to the fourth aspect of the invention and its modifications, further, the flows of air blown from the blow port of the front panel are substantially uniformed due to the provision of the air direction changing members disposed in the air inversion course. Therefore, the air can be dispersedly blown into the room as a whole, and the air flow can be uniformed and expanded extensively in the room.



What is claimed is:

1. An air-conditioner for blowing air sucked through a suction port of a front panel from a blow port of said front panel through an air inversion course, wherein an air direction changing means is disposed in said air inversion course so that the flow of air blown from said blow port of said front panel becomes substantially uniform throughout the whole of said blow port.

2. An air-conditioner for blowing air sucked from a suction port of a front panel from a blow port of said front panel through an air inversion course, wherein an air direction changing means is disposed in said air inversion course so that the flow of air blown from said blow port of said front panel becomes substantially uniform, said air inversion course is bent substantially at a right angle, and said air direction changing means protrudes into said air inversion course so as to change the inversion angle of air.

3. An air-conditioner for blowing air sucked from a suction port of a front panel from a blow port of said front panel through an air inversion course, wherein air inversion course is divided into a plurality of upper and lower sections, an air direction changing means having a different

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angle is disposed in each of said sections so divided, and the air whose direction is inverted by each of said air direction changing means is guided to said blow port of said front panel so that the flow of air blown from said blow port of said front panel becomes substantially uniform.

4. An air-conditioner including a heat exchanger on the outdoor side, a fan on the outdoor side, a compressor, an expansion device, a heat exchanger on the room side, a fan on the room side and a motor for driving both of said fans, all those being accommodated in a single casing equipped with a front panel having a suction port and a blow port, wherein:

an inner casing for subjecting air sucked from said suction port of said front panel to heat-exchange by the operation of said fan on the room side through said heat exchanger on the room side, inverting said air so subjected to heat-exchange through an air inversion course and guiding said air to said blow port of said front panel, is disposed inside said casing;

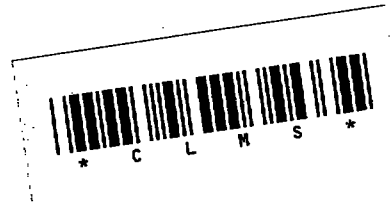
an air direction changing means is disposed in said air inversion course of said inner casing; and

said air direction changing means is so constituted as to change the flow of air so that the flow of air blown from said blow port becomes substantially uniform.



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5. An air-conditioner according to claim 4, wherein said air inversion course is bent substantially at a right angle, and said air direction changing means protrudes into said air inversion course so as to change the inversion angle of air.

6. An air-conditioner according to claim 4, wherein said air inversion course is divided into a plurality of sections, said air direction changing means having a different angle is disposed in each of said sections so that each of said air direction changing means changes the flow of air at a different angle.

7. An air-conditioner according to any of claims 1 through 6, wherein said air direction changing means is a protuberance of triangular pyramid shape.