

INDOOR DEVICE OF AIR CONDITIONER

Field of the Invention

The present invention relates to an indoor device of an air conditioner, and more specifically, relates to an indoor device of an air conditioner for realizing efficient heat transfer by promoting the convection of indoor air with a chimney effect and realizing uniformity of indoor air conditioning by effectively utilizing radiant heat.

Background of the Invention

For example, there are various types of air conditioners for conditioning indoor air, e.g. an air conditioner disclosed in Patent Document 1 proposed by the present inventor, wherein a tube for circulating a heat medium is arranged indoors as a heat exchange element, and good heat exchange may be performed between the heat exchange element and the indoor air by heat radiation from the heat exchange element and air convection along the heat exchange element.

The existing air-conditioning device is provided with a heat tube <1> and a heat accumulator <2> having a heat emission function of heating using the heat energy of the heat tube <1> or a heat absorption function of cooling using the heat energy of the heat tube <1>. The heat tube <1> and the heat accumulator <2> are alternately arranged and spaced at a desired interval, and exposed to the environment. The heat tube <1> and the heat accumulator <2> are arranged horizontally in length and parallel to each other in a vertical direction, thereby obtaining a high heat exchange efficiency by using radiation and convection and an excellent energy-saving effect.

Prior Art Document

Patent Document

Patent Document 1: Japanese Patent No. 2007-303727

Problems to be solved by the invention

The existing air-conditioning device is very useful as a device for effectively conditioning the indoor air by using heat radiation and convection. However, the

air-conditioning device is of an exposed heating body, so the efficiency of indoor cooling and heating with the radiant heat is excellent, e.g. under the heating condition, it is warm nearby the heating body. However, the heating effect easily declines far away from the heating body, and an improvement may be made in view of transferring heat by convection of indoor air to realize indoor cooling and heating.

However, a natural air cooling mechanism using the so-called chimney effect is known (e.g. referring to <http://www.pref.okayama.jp/sangyo/kougi/publishment/report/pdf/2010/H23-13.pdf>). The present inventor focuses on the chimney effect for promoting the convection of indoor air to realize heat transfer.

Thus, rectifying plates are arranged on the front surface side and the back surface side of the heating body of the existing upright air-conditioning device. It can be known that, although the convection of indoor air is promoted by the chimney effect and the heat transfer may be well performed, the heating body is shielded by the rectifying plates at this time, so that the heat radiation efficiency of the heating body declines. Therefore, it is difficult to expect the uniformity of indoor air conditioning.

Summary of the Invention

(Object of the Invention)

The object of the present invention is to provide an indoor device of an air conditioner. Rectifying plates are arranged at the front surface side and the back surface side of a heating body of the air conditioner, convection of indoor air is promoted by a chimney effect so that heat is efficiently transferred. Moreover, heat radiated from the heating body may be efficiently radiated to a room for use. By heat transfer realized by the convection of indoor air in combination with air conditioning realized by the radiant heat, the indoor air conditioning may be uniform.

Technical solutions for solving the problems

(1) The present invention provides an indoor device of an air conditioner for conditioning indoor air, comprising:

a heating body having a heating or cooling function and arranged vertically; and
rectifying plates, arranged in a manner of wrapping the heating body therein or sandwiching the heating body therebetween, and arranged vertically and spaced from the surface of the heating body,

wherein each rectifying plate is provided with a plurality of radiant heat-transmission holes penetrating through its inner and outer faces.

(2) The present invention provides an indoor device of an air conditioner for conditioning indoor air, comprising:

a heating body having a heating or cooling function and arranged vertically; and
rectifying plates arranged in a manner of wrapping the heating body therein or sandwiching the heating body therebetween and arranged vertically and spaced from the surface of the heating body,

wherein the periphery of each rectifying plate extends beyond the periphery of the heating body, thereby having a surface wider than the heating body, each rectifying plate is provided with a plurality of radiant heat-transmission holes penetrating through its inner and outer faces, and the inner face is formed as a reflective surface for reflecting radiant heat radiated from the heating body; and

wherein when arranged indoors, the lower end of each rectifying plate is positioned above a ground surface, the upper end of each rectifying plate is positioned below a ceiling surface, and gaps for air flow are formed between each rectifying plate and the ground surface and between each rectifying plate and the ceiling surface.

(3) The indoor device of the air conditioner as mentioned in (1) or (2) in the present invention, wherein both sides of each rectifying plate are blocked by blocking components, and the rectifying plates and the blocking components surround the heating body to form a cylinder that is open at its upper lower ends.

(4) The indoor device of the air conditioner as mentioned in (1), (2) or (3) in the present invention, wherein the heating body consists of a plurality of tubular bodies.

(5) The indoor device of the air conditioner as mentioned in (1), (2), (3) or (4) in the present invention, wherein guiding components for guiding convected air at the

inner side of each rectifying plate in a smooth flow manner are arranged at the upper side or/and lower side of the heating body.

(6) The indoor device of the air conditioner as mentioned in (1), (2), (3), (4) or (5), wherein the rectifying plates are made of aluminum or a composite material containing aluminum.

(7) The indoor device of the air conditioner as mentioned in (1), (2), (3), (4), (5) or (6), wherein an advertisement, a logo, a graph or a photo is displayed on the surfaces of the rectifying plates.

The term “heating” in the specification and claims includes the meaning of cooling besides warming.

The term “rectifying plate” in the specification and claims indicates a plate-like object for exerting the chimney effect.

(Effects)

The effects of the indoor device of the air conditioner of the present invention will be described.

Firstly, under the condition that the indoor device of the air conditioner is utilized for indoor heating, air nearby the heating body is heated by radiant heat, and natural convection of air from bottom to top is produced along the heating body.

Thus, external air flows in from the gap at the lower part of the indoor device through the lower opening between the rectifying plates, and is heated by the heating body while ascending between the rectifying plates, thus continuing the convection. In addition, the flow rate of the convection air is improved through the chimney effect realized by the rectifying plates arranged on the front surface side and the back surface side of the heating body.

The heated air ascending between the rectifying plates is discharged to the outside from the gap at the upper part of the indoor device through the upper opening between the rectifying plates. The flow rate of the discharged air is also improved due to the chimney effect, and thereby the discharged air arrives at a position far away from the indoor device along the ceiling surface. In addition, the air is cooled along

with the movement and descends. In this way, the indoor air is circulated in the whole room while being heated by the heating body.

On the other hand, a part of radiant heat radiated by the heating body is released to the room through the radiant heat-transmission holes formed in the rectifying plates. The proportion of the radiant heat penetrating through the radiant heat-transmission holes depends on the aperture ratio of the radiant heat-transmission holes. Thus, the radiant heat raises the temperature of the indoor air and thus may be directly and effectively utilized.

In addition, the radiant heat which cannot pass through the radiant heat-transmission holes in the radiant heat is reflected by the reflective surface at the inner surface side of each rectifying plate, and then diffuse reflection is produced between the heating body and the reflective surfaces of the rectifying plates.

Thus, a part of the radiant heat is released to the room through the radiant heat-transmission holes, and the other part of the radiant heat is released to the room from the upper and lower openings between the rectifying plates. Then, a part of the radiant heat heats the rectifying plates to raise the temperature, and the outward radiant heat from the rectifying plates is released to the room.

In this way, according to the indoor device of the air conditioner of the present invention, when reflection and release of the radiant heat are repeated, the room is well heated by the radiant heat and the heat transferred due to the convection of air, so that the air conditioning in the whole room may be efficiently performed.

In addition, the indoor cooling condition is different from the heating condition. Since the air is cooled by the heating body, the air along the heating body and the rectifying plates is convected from top to bottom, and the cooled air is basically in the opposite direction relative to the heating condition.

Moreover, liquid such as water, anti-freezing liquid, oil, liquid phase coolant in a freezing loop and the like or gas such as coolant gas and the like may be used as a heat medium in the heating body.

Further, the indoor air may be convected through heat energy of heating due to

circulation of the heat medium, radiant heat released through the radiant heat-transmission holes of the rectifying plates, heat energy on the surface of the heating body, radiant heat and convection heat released by heating of the surfaces of the rectifying plates and the heat energy on the surface of the heating body, and cooling and heating are realized through natural convection of the air and the radiant heat.

In addition, air appropriately enters the inner side of each rectifying plate by using the natural convection produced by the heat energy from the heating body inside each rectifying plate, to promote the convection in the space inside each rectifying plate and also promote heat transfer realized by the convection and heat exchange with air realized thereby, so that the indoor ambient air may be well conditioned.

In addition, in the present invention, the heating body is arranged inside the rectifying plates, so that the heating body may not be directly touched by hand. Accordingly, when the gas coolant and the like are used for heating, the heating body is at a high temperature sometimes, but the heating body will not be mistakenly touched, so the heating body is safe for a user.

In addition, dew condensed on the surface of the heating body will not be touched by hand during cooling, so the heating body is relatively sanitary and the user will not be casually wetted by the dew. In addition, as mentioned above, the heating body itself does not bear an external force, so the heating body may be prevented from being deformed or damaged due to pressure or impact from the outside.

Accordingly, the heating body almost does not need the strength of resisting the external force but only needs to have the strength of tolerating fluid pressure at least, so the raw material for the heating body may have low strength and be light and thereby the range of choice is broadened. In addition, the risk of being hurt caused by mistakenly touching the heating part may also be reduced.

Accordingly, raw material having good heat conductivity and achieving high heat emission rate on the surface of the heating body may be utilized, and raw material with low pressure and low pressure tolerance may also be adopted when liquid such

as water, anti-freezing liquid or the like is utilized. In addition, synthetic resin tubes or carbon fiber tubes with high heat emission on the surface and excellent water tightness may also be adopted.

In addition, it is a high-pressure situation under the condition that a liquid layer coolant and a coolant gas are utilized, so materials with high pressure tolerance and good conductivity may also be utilized, e.g. aluminum coolant tubes or precision flat tubes with processed materials having high heat emission rate applied on the surfaces.

The heating body of synthetic resin tubes or carbon fiber tubes is relatively light respectively, so light weight of the device may be realized.

Accordingly, the burden of carrying operation and assembly operation of assets during the setting of a project may be reduced, and the cost of setting the project may be reduced. In addition, for realizing light weight of the device so as to reduce deformation stress and the like during earthquake, an enhancement project and the like for supporting such a condition may also be minimized. In this way, various constraints in the setting may be reduced, and the risk of rolling of the device due to the earthquake is reduced. Thus, safety and ease of the user may be ensured.

Moreover, the heat medium used in the heating body may also not be specially constrained, and may be high-temperature and high-pressure heat or high-pressure cold obtained by refrigerating cycle of an efficient heat pump heat source machine or unused energy of discharged heat and the like. In addition, if the synthetic resin tubes with excellent corrosion resistance are utilized, underground water (warm water or cold water) of a geothermal source serving as natural energy may be directly introduced to the heating body, to achieve the cooling and heating effect.

In addition, the heating body, which is made of a raw material with high far infrared emission capability or is subjected to surface processing to promote transfer of the radiant heat, as mentioned above, is used as an efficient radiant cooling and heating device having a radiation effect realized by the heating body with the radiant heat-transmission holes and a radiation effect from the surfaces of the rectifying plates with the radiant heat-transmission holes to exert effects.

In the structure that the two side of each rectifying plate are blocked by the blocking components and that the rectifying plates and the blocking components surround the heating body to form a cylinder of which the upper end and the lower end are open, the blocking components are arranged on the two sides of the rectifying plates, so that convection air between the rectifying plates flows more smoothly and the chimney effect is exerted more effectively.

The guiding components for guiding convected air inside the rectifying plates in the smooth flowing manner are arranged on the upper side or/and lower side of the heating body, so that the air convection produced by the chimney effect of the rectifying plates may be implemented more efficiently.

The rectifying plates are made of the aluminum or the aluminum-containing composite material, so that the heat transfer effect is excellent, and the heat exchange efficiency with air is further improved.

Advertisements, logos, graphs or photos are displayed on the surfaces of the rectifying plates, so that the rectifying plates with a protective cover function may be used as advertising panels or logos besides the function of producing the chimney effect promoting air convection.

Effects of the Invention

In the present invention, the rectifying plates are arranged at the front surface side and the back surface side of the heating body of the air conditioner, and convection of indoor air is promoted by the chimney effect, so that heat is efficiently transferred. Moreover, heat radiated by the heating body may be efficiently radiated to a room for use, and heat transfer realized by the convection of indoor air supplements air conditioning realized by the radiant heat, so that the indoor air conditioning may be uniform.

Brief Description of the Drawings

Fig. 1 is a perspective view of a first embodiment of an indoor device of an air conditioner of the present invention;

Fig. 2 is a decomposed perspective view indicating that rectifying plates on the front surface side of the indoor device of the air conditioner shown in Fig. 1 are disassembled;

Fig. 3 is a front view of an inner structure indicating the installation state of the indoor device of the air conditioner shown in Fig. 1 and omitting the rectifying plates on the front surface side;

Fig. 4 is a section view of A-A in Fig. 1;

Fig. 5 is a section view of B-B in Fig. 1;

Fig. 6 shows a second embodiment of the indoor device of the air conditioner of the present invention, indicating air flow under the condition that guiding components are arranged at the upper and lower ends of the heating body, wherein (a) is an illustration diagram during heating, and (b) is an illustration diagram during cooling;

Fig. 7 is an illustration diagram indicating an example of rectifying plates displaying an advertising word on the surface, wherein (a) is an illustration diagram displaying the advertising word in the longitudinal direction, and (b) is an illustration diagram displaying the advertising word in the transverse direction.

Reference Symbol

R1 indoor device of air conditioner

1 heating body

10, 10a upper horizontal tube

11, 11a lower horizontal tube

12, 12a vertical tube

13 communicating tube

14 supply tube

15 discharge tube

16 water collecting component

160 water release tube

161 drain pipe

2 framework

20, 21 longitudinal frame
22, 23 decorative strut
24, 25 lower fixing component
26, 27 upper fixing component
28 upper opening
29 lower opening
3, 3a rectifying plate
30 radiant heat-transmission hole
31 reflective surface
39 gap
4, 4a rectifying plate
40 radiant heat-transmission hole
41 reflective surface
49 gap
5 ground surface
50 lower gap
6 ceiling surface
60 upper gap
7a, 7b advertising word
R2 indoor device of air conditioner
17 lower guiding component
18 upper guiding component
8 wall

Detailed Description of the Embodiments

(Embodiments)

The present invention will be described in detail based on the embodiments shown in the accompanying drawings.

Refer to Fig. 1 to Fig. 5.

An indoor device R1 of an air conditioner has a heating or cooling function and includes: a heating body 1 arranged vertically; a framework 2 supporting the heating body 1; and rectifying plates 3 and 3a arranged vertically and one above another at the front surface side (front side in Fig. 3 and left side in Fig. 5) of the heating body 1 and rectifying plates 4 and 4a arranged vertically and one above another at the back surface side of the heating body 1, wherein desired gaps are formed between the rectifying plates and the front surface and the back surface of the heating body 1.

The heating body 1 is fixed inside the metallic framework 2. The framework 2 is provided with longitudinal frames 20 and 21 which are spaced laterally at a desired interval and parallel to each other and are arranged along the vertical direction. Wooden and elongated plate-like decorative struts 22 and 23 are fixed on and integrated with the outer surface sides of the longitudinal frames 20 and 21. The longitudinal frames 20 and 21 and the decorative struts 22 and 23 have the same length and are fixed so that the upper ends are in a same plane and the lower ends are in a same plane.

Lower fixing components 24 and 25 of L-shaped plate for being fixed onto the ground surface 5 are fixed on the inner surface sides of the lower ends of the longitudinal frames 20 and 21. In addition, upper fixing components 26 and 27 of L-shaped plate for being fixed onto the ceiling surface 6 are fixed on the inner surface sides of the upper ends of the longitudinal frames 20 and 21. The horizontal portions (symbols are omitted) of the lower fixing components 24 and 25 connected with the ground surface 5 are in the same plane with the lower ends of the longitudinal frames 20 and 21, and the horizontal portions (symbols are omitted) of the upper fixing components 26 and 27 connected with the ceiling surface 6 are slightly higher than the upper ends of the longitudinal frames 20 and 21.

Two ends of the heating body 1 made of synthetic resin such as polypropylene resin are fixed onto the inner surfaces of the longitudinal frames 20 and 21 so that the heating body 1 is installed between the longitudinal frames 20 and 21 of the framework 2. Moreover, a beam component may be formed at the upper part, lower

part or middle part between the longitudinal frames 20 and 21 to strengthen the framework 2.

The heating body 1 is provided with upper horizontal tubes 10 and 10a and lower horizontal tubes 11 and 11a arranged in parallel to and spaced at a desired interval downwards from the upper horizontal tubes 10 and 10a. Two ends of each of the upper horizontal tubes 10 and 10a and the lower horizontal tubes 11 and 11a are respectively blocked in a liquid-tight manner.

The upper horizontal tubes 10 and 10a are slightly lower than the upper ends of the longitudinal frames 20 and 21. In addition, the lower horizontal tubes 11 and 11a are slightly higher than the lower ends of the longitudinal frames 20 and 21.

The upper horizontal tube 10 and the lower horizontal tube 11 on the front surface side are connected with each other by a plurality of vertical tubes 12 arranged in parallel at desired intervals, and are communicated with each vertical tube 12. In addition, the upper horizontal tube 10a and the lower horizontal tube 11a on the back surface side are connected with each other likewise by a plurality of vertical tubes 12a arranged in parallel at desired intervals, and are communicated with each vertical tube 12a.

In addition, the lower horizontal tubes 11 and 11a adjacent to the front surface side and the back surface side are connected and communicated with each other through communicating tubes 13 at three positions. A gutter-shaped water collecting component 16, which is open upward, is arranged below the lower horizontal tubes 11 and 11a so that the lower horizontal tubes 11 and 11a enter the opening. The water collecting component 16 is horizontally fixed at a height relative to the longitudinal frames 20 and 21 so that its bottom is not in contact with the lower horizontal tubes 11 and 11a, and an end side of the water collecting component 16 is connected with a water release tube 160.

Further, a supply tube 14 for supplying heat medium is connected and communicated with the upper horizontal tube 10 at the right side end of the upper horizontal tube 10 in Fig. 3. Likewise, a discharge tube 15 for discharging the heat

medium is connected and communicated with the upper horizontal tube 10a at the end of the same side of the upper horizontal tube 10a adjacent to the back surface side of the upper horizontal tube 10.

The supply tube 14 and the discharge tube 15 are formed vertically to penetrate the horizontal portion of the upper fixing component 27 in the vertical direction. The supply tube 14 and the discharge tube 15 are connected with a heat medium circulating device (e.g. a device using a heat pump) not shown in the figures, and in this embodiment, the heat medium circulating device enables warm water or cold water to be circulated in the heating body 1.

Moreover, in this embodiment, the heating body 1 is formed by tubular bodies made of synthetic resin, but not limited thereto, e.g. may be formed by tubes of metal such as aluminum in other well-known structures.

The rectifying plates 3 and 3a are installed on the front surface side of the longitudinal frames 20 and 21 of the framework 2 in a easily disassemble and assemble manner, and the rectifying plates 4 and 4a are installed on the back surface side of the longitudinal frames 20 and 21 of the framework 2 in a easily disassemble and assemble manner. The rectifying plates 3 and 3a and the rectifying plates 4 and 4a are constructed in such a manner that a plurality of grooves formed in bent portions at two side edges are hooked on pins on the inner surfaces at the front surface side and the back surface side of the longitudinal frames 20 and 21.

The rectifying plates 3 and 3a and the rectifying plates 4 and 4a are respectively installed in two-section manner, i.e. upper and lower sections, to form a shape of rectangle that can substantially cover the overall width and overall height of the framework 2. Gaps 39 and 49 for air flow are formed between the heating body 1 and the rectifying plates 3 and 3a as well as the rectifying plates 4 and 4a.

The rectifying plates 3 and 3a and the rectifying plates 4 and 4a are made of an aluminum-containing composite material, a remaining portion of periphery of which is formed into a perforated metal (or perforated plate) with a plurality of radiant heat-transmission holes 30 and 40 penetrating through the front and back surfaces

over almost the entire surface. In addition, the inner faces of the rectifying plates 3 and 3a and the rectifying plates 4 and 4a are reflective surfaces 31 and 41 for reflecting radiant heat. The aperture ratio of radiant heat-transmission holes 30 of the rectifying plates 3 and 3a and radiant heat-transmission holes 40 of the rectifying plates 4 and 4a is set to- 50%.

The arrangement, quantity, shape and aperture ratio of the radiant heat-transmission holes 30 and 40 are not specially limited, and may be set appropriately in various designs. In this embodiment, for promoting diffuse reflection of radiant heat, the reflective surface 31 and the reflective surface 41 are embossed to form multiple fine bumps.

The rectifying plates 3 and 3a and the rectifying plates 4 and 4a are made of aluminum, so the heat transfer effect is excellent, and the heat exchange efficiency with air is further improved. Moreover, the material for the rectifying plates 3, 3a, 4 and 4a, besides the aluminum-containing composite material and the aluminum, may also adopt metal plates such as stainless steel plates, glass plates or synthetic resin plates when focusing on designs.

In addition, the rectifying plates 3 and 3a and the rectifying plates 4 and 4a are provided with surfaces of which the peripheries extend beyond the periphery of the heating body 1 and which are wider than the heating body 1 when viewing from the front side. The upper ends of the rectifying plates 3 and 3a and the rectifying plates 4 and 4a are set on a same plane with the upper ends of the longitudinal frames 20 and 21 of the framework 2, and the lower ends of the rectifying plates 3 and 3a and the rectifying plates 4 and 4a are slightly higher than the lower ends of the longitudinal frames 20 and 21 of the framework 2.

The rectifying plates 3 and 3a on the front surface side, the rectifying plates 4 and 4a on the back surface side and the longitudinal frames 20 and 21 at two end sides in the width direction of the rectifying plates are integrated so as to form a roughly flat rectangular cylinder with an upper opening 28 at the upper end and a lower opening 29 at the lower end. In this way, since the structure surrounding the heating

body 1 is set as a cylinder, the chimney effect promoting convection is more excellent.

Moreover, through setting the size and installation position of the rectifying plates 3 and 3a and the rectifying plates 4 and 4a as mentioned above, when the indoor device R1 of the air conditioner is fixed on the ground surface 5 and the ceiling surface 6 as shown in Fig. 3, a lower gap 50 is formed between the ground surface 5 and the lower ends of the rectifying plates 3a and 4a, and an upper gap 60 is formed between the ceiling surface 6 and the upper ends of the rectifying plates 3 and 4.

(Effects)

The effects of the indoor device R1 of the air conditioner will be described with reference to Fig. 1 to Fig. 7.

Firstly, as shown in Fig. 3, at a position slightly far away from the wall 8, the indoor device R1 of the air conditioner is arranged indoors, and fixed onto the ground surface 5 by using the lower fixing components 24 and 25 and onto the ceiling surface 6 by using the upper fixing components 26 and 27.

Under the condition that the indoor device R1 of the air conditioner is utilized for indoor heating, a high-temperature heat medium is supplied from the supply tube 14 to the heating body 1 for circulating, and the heating body 1 is heated to produce heat. Thus, air nearby the heating body 1 is heated by radiant heat, and natural convection (in the following description of air flow, for the purpose of describing conveniently, reference is made to Fig. 6(a)) of air from bottom to top is produced along the heating body 1.

Thus, external air flows in from the gap 50 at the lower ground surface 5 through the lower opening 29 between the rectifying plates 3 and 3a and the rectifying plates 4 and 4a. The inflow air is heated by the heating body 1 while ascending in the gaps 39 and 49 inside the rectifying plates, thus continuing the convection. In addition, sufficient flow rate of the convection air is ensured through the chimney effect realized by the rectifying plates 3 and 3a and the rectifying plates 4 and 4a arranged on the front surface side and the back surface side of the heating body 1.

The heated air ascending in the gaps 39 and 49 is discharged to the outside from

the gap 60 at the upper ceiling surface 6 through the upper opening 28 between the rectifying plates 3 and 3a and the rectifying plates 4 and 4a. The flow rate of the discharged air is also improved through the chimney effect, and thus the discharged air arrives at a position far away from the indoor device R1 of the air conditioner along the ceiling surface 6. In addition, the air is cooled through heat exchange along with the movement. In this way, the indoor air is circulated in the whole room while being heated by the heating body 1.

On the other hand, a part of radiant heat radiated by the heating body 1 (in this embodiment, because the aperture ratio of the radiant heat-transmission holes 30 and 40 is 50%, when further considering the lower opening 29 and the upper opening 28, the transmission proportion is about 50% of the whole radiant heat) is released to the room through the radiant heat-transmission holes 30 and 40 formed in the rectifying plates 3 and 3a and the rectifying plates 4 and 4a. Thus, the radiant heat raises the temperature of the indoor air and thus is directly and effectively utilized.

In addition, the radiant heat which cannot pass through the radiant heat-transmission holes 30 and 40 in the radiant heat radiated by the heating body 1 is reflected by the reflective surfaces 31 and 41 at the inner surface sides of the rectifying plates 3 and 3a and the rectifying plates 4 and 4a, and then diffuse reflection is produced between the heating body 1 and the reflective surfaces 31 and 41 of opposite rectifying plates. Thus, a part of the radiant heat is released to the room through the radiant heat-transmission holes 30 and 40, and the other part of the radiant heat is released to the room from the lower opening 29 and the upper opening 28 between the rectifying plates 3 and 3a and the rectifying plates 4 and 4a. Further, a part of the radiant heat heats the rectifying plates 3 and 3a and the rectifying plates 4 and 4a to raise their temperature, and the radiant heat from the rectifying plates is released outwards to the room.

In this way, according to the indoor device R2 of the air conditioner of this embodiment, when above reflection and release of the radiant heat are repeated, the room is well heated by the heat transferred through the convection of air and the

radiant heat, so that the air conditioning in the whole room may be effectively performed, and the temperature and the humidity may be uniform.

The indoor cooling condition is different from the above-mentioned heating condition. Since air is cooled by the heating body 1 to produce cold, the air along the heating body 1 and the rectifying plates 3 and 3a and the rectifying plates 4 and 4a is cooled and convected from top to bottom, and the cooled air is basically in the opposite direction relative to the heating condition (for describing conveniently, reference is made to Fig. 6 (b) below for air flow).

Moreover, during heating and cooling, as mentioned above, when air is convected at the desired flow rate along the rectifying plates 3 and 3a and the rectifying plates 4 and 4a, external air enters from the radiant heat-transmission holes 30 and 40 by the Venturi effect, so the movement of air also promotes the convection, and the air conditioning in the whole room may be performed more effectively.

In addition, as mentioned above, under the condition of indoor heating and cooling, the heating body 1, the framework 2, the rectifying plates 3 and 3a and the rectifying plates 4 and 4a are expanded and contracted, the length in the vertical direction varies substantially. Then, as shown in Fig. 6(a) and Fig. 6(b) below, the height of the water collecting component 16 varies therewith, but because the water release tube 160 is inserted into a drain pipe 161 and can move in and out freely during the installation, the variation may be absorbed.

Refer to Fig. 6.

The indoor device R2 of the air conditioner is provided with a lower guiding component 17 for guiding convected air at the lower part of the heating body 1 and an upper guiding component 18 at the upper part of the heating body 1. The lower guiding component 17 is composed of two bent plates (symbols are omitted) having widths substantially as same as the lengths of the lower horizontal tubes 11 and 11a of the heating body 1 and having desired lengths in the vertical direction, and the bent plates are fixed opposite to the front surface side and back surface side of the water collecting component 16.

In addition, the upper guiding component 18 is composed of two bent plates (symbols are omitted) having widths substantially as same as the lengths of the upper horizontal tubes 10 and 10a of the heating body 1 and having desired lengths in the vertical direction, and the bent plates are fixed opposite to the front surface side and back surface side of the upper horizontal tubes 10 and 10a. Moreover, the lower guiding component 17 and the upper guiding component 18 are made of various metals or synthetic resin, but not limited thereto.

The indoor device R2 of the air conditioner is provided with the lower guiding component 17 and the upper guiding component 18, so that air flows smoothly, and air convection realized by the chimney effect using the rectifying plates 3 and 3a and the rectifying plates 4 and 4a may be performed more efficiently.

Refer to Fig. 7.

Fig. 7 shows the surface of the rectifying plates 3 and 3a at the front surface side, and an advertising word 7a presenting a logo “ecowin” is printed longitudinally from the lower rectifying plate 3a to the upper rectifying plate 3 in Fig. 7(a). In addition, an advertising word 7b presenting a logo “ecowin” is printed transversely on the surface of the upper rectifying plate 3 in Fig. 7(b). In addition, an advertising word may also be printed likewise on the rectifying plates 4 and 4a at the back surface sides. The word presented on the rectifying plates is not limited to advertisements or logos (signs or advertising boards) or various designs, and may also adopt graphs, photos and other artistic presentations.

Thus, the rectifying plates 3, 3a, 4 and 4a having a protective cover function may also be used as advertising panels or logos besides the function of producing the chimney effect promoting air convection. That is, the indoor device R1 or R2 of the air conditioner may also be largely exposed to the indoor space to achieve a sense of presence, so the indoor device R1 or R2 may have a more effective advertising function in the exposure manner.

Moreover, the terms and presentations used in the present specification are merely illustrative, but are not limited thereto. It is not intended to exclude the terms

and presentations equivalent to features recorded in the present specification. In addition, obviously, various variations may be made within the scope of technical idea of the present invention.

CLAIMS

WHAT IS CLAIMED IS:

1. An indoor device of an air conditioner, arranged between the ground surface and the ceiling surface, promoting the convection of indoor air with a chimney effect in order to realize the indoor air conditioning, wherein, comprising:

a framework being provided with the longitudinal frames which are spaced laterally at a desired interval and parallel to each other and are arranged along the vertical direction;

a heating body being supported by the framework and having a heating or cooling function and arranged vertically;

rectifying plates arranged in a manner of sandwiching the heating body therebetween, and arranged vertically and spaced from the surface of the heating body, and the different inner face is formed as a reflective surface for reflecting radiant heat radiated from the heating body;

the heating body is provided with upper horizontal tubes and lower horizontal tubes arranged in parallel to and spaced at a desired interval downwards from the upper horizontal tubes; and the upper horizontal tube and the lower horizontal tube are connected with each other by a plurality of vertical tubes arranged in parallel at desired intervals, and are communicated with each vertical tube;

the periphery of each rectifying plate extends beyond the periphery of the heating body, and both sides of each rectifying plate are blocked by blocking components, and the rectifying plates and the blocking components surround the heating body to form a cylinder that is open at its upper lower ends and arranged in a manner of wrapping the heating body therein;

and are provided with a plurality of radiant heat-transmission holes penetrating through the inner and outer faces; when air is convected along the rectifying plates, the indoor air enters from the radiant heat-transmission holes;

when the indoor device is arranged indoors, the lower end of each rectifying plate is positioned above a ground surface, the upper end of each rectifying plate is positioned below a ceiling surface, and gaps for air flow are formed between each rectifying plate and the ground surface and between each rectifying plate and the ceiling surface.

2. The indoor device of an air conditioner in accordance with claim 1, wherein, a water collecting component is arranged below the lower horizontal tube; there is provided with the water collecting component being open upward and having a water release tube being inserted into a drain pipe to move in and out freely when the indoor device being arranged.
3. The indoor device of an air conditioner in accordance with claim 1 or 2, wherein, guiding components for guiding convected air at the inner side of each rectifying plate in a smooth flow manner are arranged at the upper side or/and lower side of the heating body.
4. The indoor device of an air conditioner in accordance with claim 1, 2 or 3, wherein, the rectifying plates are made of aluminum or a composite material containing aluminum.
5. The indoor device of an air conditioner in accordance with claim 1, 2, 3 or 4, wherein, an advertisement, a logo, a graph or a photo is displayed on the surface of the rectifying plates.