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AIR DIFFUSER

BACKGROUND OF THE INVENTION

The present invention relates to an air diffuser for blowing out air into a room or chamber which is to be subjected to an air conditioning, particularly provided with means for preventing dewing to a diffuser blowout opening.

In general, a clean air controlled in its temperature or the like is blown out into a room or chamber to be subjected to an air conditioning through an air diffuser, called diffuser hereinafter, disposed to a ceiling or wall of the room. When a cooling air is supplied into the room to carry out the air conditioning therein, a frame member constituting the blowout opening of the diffuser is cooled and the cooled air is dewed to the blowout opening portion of the diffuser in contact to a hot air in the room. Some known air diffusers are provided with means for preventing such dewing.

For example, Figs. 9 and 10 represent structures of known air diffusers, in which Fig. 9 is a side view of a part of a known diffuser, partially broken away, and Fig. 10 is a partial sectional view of another example.

Referring to Fig. 9, an air diffuser is composed

of so-called ceiling-type diffuser, to be mounted to a ceiling of a room or the like, in which a plurality of blades 3 are arranged inside a frame member 12 defining a blowout opening 13 and a heat generating member or element 201 is disposed on the rear side of the frame member 12. Although the frame member 12 is cooled by a blow-out air, since the frame member 12 is heated by the heat generating member 201, the frame member 12 is not cooled to a temperature less than a predetermined value. According to this reason, no dewing is caused even if a hot air in the room contacts the frame member 12 constituting the blowout opening. This heat generating member 201 is controlled to provide a predetermined temperature by means of a power control unit 202.

Referring to Fig. 10, a decoration cover 200 is mounted, through a heat insulating member 300, to the frame member 12 constituting the blowout opening mounted to an outer peripheral portion of the air diffuser blowout opening 13. According to this structure, even if the frame member 12 is cooled by the blow-out cooling air, the hot air in the room is prevented from directly contacting the frame member 12 by the decoration cover 200 which is mounted in the heat insulated manner through the heat insulating member 300, thus causing no dewing on the blowout opening 13 of the diffuser. The direct heat transfer from the frame member 12 to the decoration cover 200 is also prevented,

so that the decoration cover 200 is not cooled, thus also preventing from dewing in contact to the hot air in the room.

However, according to the structures of the known air diffusers shown in Figs. 9 and 10, it is required to arrange the heat generating member 201 and associated power control unit 202, electric wirings etc., resulting in a complicated structure of the diffuser itself and a manufacturing process is also complicated with increased manufacturing cost and running cost, thus providing a problem. Particularly, at a time when the air conditioning is performed by supplying the cooling air, since the frame member 12 is always heated by the heat generating member 201, the cooling function is made worse, also providing a severe problem.

In the structure utilizing the heat insulating member 300, the heat insulating member 300 is mounted to the frame member 12 and the decoration cover 200 is further mounted, so that the number of parts constituting the diffuser increases, thus being complicated in its assembling with increased manufacturing cost.

SUMMARY OF THE INVENTION

The present invention was conceived to eliminate the defects or drawbacks encountered in the prior art described above and to provide an air diffuser having an

improved compact structure capable of preventing dewing on elements constituting the diffuser and providing an improved outer appearance thereof in design.

This and other objects can be achieved according to the present invention by providing an air diffuser in which air is taken into a diffuser body through an air take-in opening formed on one side thereof and the air taken into the diffuser body is blown out through an air blow-out opening formed on another side of the diffuser body, the air diffuser comprising a diffuser body provided with air take-in and air blow-out openings, a frame element defining the air blow-out opening and a frame cover having one end portion abutting against an inner peripheral side portion of the frame element and another end portion abutting against an outer peripheral side portion of the frame element so as to define a closed space between the frame cover and an outer side surface of the frame element, the frame cover being formed with a heat insulating frame member.

In preferred embodiments, the frame cover is provided with at least one projection abutting against the outer side surface of the frame element to support the frame element. The frame cover is provided with a plurality of projections including a projection abutting against the inner peripheral side portion of the frame element, a projection abutting against the outer peripheral side

portion of the frame element and a projection formed on a surface of the frame cover facing the closed space and abutting against the outer surface of the frame element. The projection may have substantially a triangular shape in section.

The frame cover is provided with at least one projection on another surface of the frame cover opposite to the surface facing the closed space to rectify air flow. This projection may be formed so as to provide substantially a triangular shape in section, and the projection may be formed as a protruded portion of the frame cover.

The another surface of the frame cover opposite to the surface facing the closed space is formed as a wave-shaped surface.

A heat insulating packing member is disposed between the diffuser body and the frame element.

The frame cover is formed of a transparent material.

The frame cover is provided with an inner hollow portion extending in a longitudinal direction thereof. The frame cover is composed of a plurality frame cover elements which are connected to each other through connection members each of which is inserted into the hollow portions of the adjacent frame cover elements.

According to the present invention of the

characters and structures described above, since the closed space is defined between the air blow-out opening of the diffuser body and the frame cover formed of the heat insulating material, if the frame element for the blow-out opening is cooled by the blow-out air, the heat transfer to the frame cover can be effectively suppressed, thus preventing the dewing from causing.

Furthermore, since the frame cover is formed of a transparent material, the frame element can be observed through the frame cover, providing a fine design appearance.

The location of the projections to the frame cover can improve the firm support between the frame cover and the frame element to thereby make strong the frame cover structure and prevent the frame cover from being bent or deformed. The projection or protrusion formed on the surface of the frame cover opposite to the closed space side can achieve the air flow rectifying function, thus effectively preventing the dewing from causing.

Furthermore, since the hollow portion is formed to the frame cover, the cooling of the frame cover through the heat transfer can be prevented and the formation of the dew can be further suppressed. The respective frame cover elements can be firmly connected by inserting the connection member in the hollow portions of the adjacent frame cover elements, and the sealed hollow portion can

serve to improve the heat insulation effect.

The nature and further features of the present invention will be further made clear from the following descriptions made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is a sectional view of a line structure type air diffuser according to a first embodiment of the present invention;

Fig. 2A is a sectional view in an enlarged scale of an essential portion of an air diffuser according to a second embodiment of the present invention and Fig. 2B is a view similar to that of Fig. 2A in an alternation thereof;

Fig. 3 is a sectional view and a partial front view of a line structure type air diffuser according to a third embodiment of the present invention;

Fig. 4 is a view similar to that of Fig. 3 in an alternation thereof;

Fig. 5 is a sectional view and a partial front view of a universal grill type air diffuser according to a third embodiment of the present invention;

Fig. 6 is a sectional view in an enlarged scale of an essential portion of an air diffuser according to

an alternation of the third embodiment of the present invention;

Fig. 7 is a sectional view of a line structure type air diffuser according to a fourth embodiment of the present invention in a perpendicularly air blowing condition;

Fig. 8 is a sectional view of the fourth embodiment in a horizontally air blowing condition;

Fig. 9 is a side view, partially broken away, of a known air diffuser; and

Fig. 10 is a partial sectional view of another known air diffuser.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will be described in detail hereunder through preferred embodiments with reference to the accompanying drawings.

(First Embodiment)

The line structure type air diffuser according to the first embodiment of the present invention will be first described hereunder with reference to Fig. 1.

Referring to Fig. 1, an air diffuser, called diffuser hereinafter, is of the type mounted to an opening portion 101 of a ceiling 100 constituting a wall section of a room or chamber, and the diffuser comprises a diffuser body 1 which serves to take in a cooled air supplied through an air conditioner, not shown, and blow out the cooled air through a blow-out opening 13, a frame member 21 formed of a heat insulating material and a frame cover 2. The frame member 21 is provided with an inside projection 22 which tightly contacts an inner peripheral side of a frame element 12 defining the blow-out opening 13 and the frame member 21 is also provided with an outside projection 23 which tightly joined with an outer peripheral side of the frame element 12. The frame cover 2 is disposed to define a sealed space 20 between the frame element 12 and the frame member 21 constituting the frame cover.

The diffuser body 1 is formed with a pair of

opposing side wall plates 11, 11 having end portions from which parts of the frame element 12 project in respective inner and outer directions thereof. The frame cover 2 has at least one, preferably, a plurality of support projections 25 each having approximately triangle sectional shape projecting, upwardly as viewed, in the space 20 and the front end portions of the projections 25 abut against the surfaces of the frame elements 12. The frame cover 2 is formed to be elastically flexible and is mounted to the frame elements 12 through the engagement with the inside and outside projections 22 and 23 and by utilizing the elasticity thereof through one-touch press-in manner.

A air flow rate adjusting unit 203 is disposed in a substantially central portion of the diffuser body 1 in a rotatable manner.

The diffuser according to the first embodiment of the structure described above will carry out air blowing operation in the following manner.

The air flow rate adjusting unit 203 is first rotated to a position shown with two-dots and dash line in Fig. 1, at which the blow-out opening 13 is closed thereby, to a position shown with a solid line, at which the blow-out opening 13 is opened. When the air flow rate adjusting unit 203 is rotated to the position shown with the solid line, cooled air as a primary air A, supplied

through the air conditioner, is blown out into a room or chamber through the blow-out opening 13 formed by the frame element 12, and the respective side wall plates 11, 11 are cooled by the cooled air as the primary air A. When the side wall plates 11, 11 are cooled, the frame element 12, forming the air blow-out opening 13 and integrally formed with the side wall plates, are also cooled through heat transfer.

Although the frame cover 2 is directly supported by the frame element 12, heat transfer from the frame element 12 to the frame cover 2 will be very small because the frame cover 2 contacts the frame element 12 through very small contacting areas, and the sealed air space 20 is formed therebetween.

A hot air in the room is sucked into the diffuser body 1 as a secondary air B in place of the blowing-out of the primary cooled air A. However, the temperature of the frame cover 2, which is not cooled as mentioned above, is maintained to a temperature nearly of a room temperature without being cooled by the primary cooled air A, so that no dew is formed to the frame cover 2 even if the secondary hot air B contacts the frame cover 2.

Furthermore, since the front end portions of the support projections 25 abut against the surface of the blow-out frame element 12, the frame cover 2 can be entirely supported thereby, thus preventing the frame cover 2 from

being deformed or deflected to thereby ensure a firm mounting of the frame cover 2.

(Second Embodiment)

The second embodiment of an air diffuser of the present invention will be described hereunder with reference to Figs. 2A and 2B.

Referring to Fig. 2A, a diffuser of this second embodiment is also mounted as in the first embodiment in a manner such that the diffuser body 1 is mounted to the opening portion 101 of the ceiling 100 of a room or chamber, and in this second embodiment, the structural shape of the frame cover 2 is different from that of the first embodiment. That is, the frame cover 2 of this embodiment is provided with projections 24 and 23 formed to the inside and outside portions of the frame member 21 tightly engaged with the side wall sections of the diffuser body 1, support projections 25a and 25b projecting into the space 20 defined by frame member 21 and the frame element 12 and sealed by the location of the projections 24 and 23, and a rectifying projection 27 having a rectangular shape and projecting outside from a surface side of the frame member 21 on the side opposite to the sealed space 20 as shown in Fig. 2A.

The air diffuser according to the second embodiment of the structure described above will carry out air blowing operation in the following manner.

As mentioned above with reference to the first embodiment, the air flow rate adjusting unit 203 is first rotated to a position shown with two-dots and dash line in Fig. 1, at which the blow-out opening 13 is closed, to a position shown with a solid line, at which the blow-out opening 13 is opened. When the air flow rate adjusting unit 203 is rotated to the position shown with the solid line, cooled air as a primary air A, supplied through the air conditioner, is blown out to a room or chamber through the blow-out opening 13 formed by the frame elements 21, and the respective side wall plates 11, 11 and the frame element 12 are cooled by the cooled air as the primary air A. In this operation, since the frame cover 2 is mounted to the outside portion of the frame element 12 by tightly engaging the inside and outside projections 24 and 23 with the frame element 12 and the sealed air space 20 is defined between the frame element 12 and the frame cover 2, the mounting of the frame cover 2 to the frame element 12 can be done in substantially heat insulated state, thus preventing the heat transfer from the diffuser body 1 and the blow-out frame element 12 to the frame cover 2.

Furthermore, according to the rectifying projection 27 formed in the triangular shape in section to the surface of the frame cover 2, the hot air as secondary air B induced into the diffuser body 1 through the blowing-out of the primary cooled air A is rectified in

the downstream side of the primary cooled air as shown in Fig. 2. According to this rectifying function of the projection 27, the cooled primary air A and the hot secondary air B are combined at a portion apart from the frame cover 2, thus effectively preventing the dewing to the frame cover 2.

In place of the location of the rectifying projection 27 to the frame cover 2 in the embodiment shown in Fig. 2A, a protruded rectifying portion 28, which protrudes toward the blow-out opening 13, may be formed to the frame cover 2 as shown in Fig. 2B. In this modified embodiment, the cooled primary air A and the hot secondary air B are also combined at a portion apart from the frame cover 2, thus completely preventing the dewing to the frame cover 2.

(Third Embodiment)

A line structure type air diffuser according to a third embodiment of the present invention will be described hereunder with reference to Fig. 3 showing an entire sectional view and a partial front view thereof.

Referring to Fig. 3, the diffuser of this third embodiment is provided with the diffuser body 1 and the frame cover 2 as in the first embodiment of Fig. 1. However, in this embodiment, the frame cover 2 is formed of a transparent material for visually observing the blow-out frame element 12 through the transparent frame cover 2

together with an outer edge portion of the support projection 25 formed to the rear surface of the frame cover 2 so as to project into the space 20. The outer edge portion of the support projection 25 appears at an entire inner peripheral portion of the frame cover 2, whereby the frame widths of the frame cover 2 and the frame element 12 is observed to be more fine in appearance, thus presenting a fine spectacle of an outer appearance of the blow-out structure. With reference to Fig. 3, a plurality of rectifying plates 3 are mounted to a support member 21a for the frame member 21 inside the frame member 21 so as to extend downward, as viewed, therefrom, with a predetermined interval from each other. The rectifying plates 3 serve to rectify the downward air flow inside the frame member 21. Furthermore, the frame element 12 can be observed from the outside of the frame cover 2, the outer appearance in design can be made uniform even if the frame element 12 and the rectifying plates 3 are mounted without considering colors or patterns thereof, thus increasing merits in design and manufacture.

Fig. 4 shows a ceiling-type air diffuser according to a modification of the third embodiment and Fig. 5 shows a universal grill type air diffuser also according to another modification thereof. In both the modified embodiments, the frame covers 2 are formed of a heat insulating transparent material, and according to such

structure, the outer appearance in design of the blow-out portion can be improved, and design and manufacturing cost can be reduced even if the frame cover 2 is mounted to prevent the dewing.

In a further modification shown in Fig. 6A, the surface of the frame member 21 constituting the frame cover 2 is formed in irregular shape to provide a plurality of wave shapes, thereby surely preventing the dewing on the frame member 21 of the frame cover 2. In a further modification of Fig. 6B, a heat insulating packing 41 having flexibility may be disposed between the frame member 21 of the frame cover 2 and the frame element 12 of the diffuser body 1. According to the location of such heat insulating packing 41, the heat insulating property of the space 20 defined between the frame member 21 and the frame element 12 can be surely maintained with the sealing function being maintained, thus further surely preventing the dewing.

Furthermore, the surface of the frame cover 2 may be coated or colored with the same color as that of the surface of the frame element 12 of the diffuser body 1 and/or air flow rate adjusting unit 203.

(Fourth Embodiment)

A line structure type air diffuser according to a fourth embodiment of the present invention will be described hereunder with reference to Figs. 7 and 8 which

represent sectional views of perpendicular blow-out and horizontal blow-out conditions of the line structure type air diffuser of this embodiment.

The line structure type air diffuser of this embodiment is of the type, as in the first embodiment, mounted to an opening portion 101 of a ceiling 100 constituting a wall section of a room or chamber, but is different from the first embodiment in the shape of the frame cover 2 mounted to the blow-out opening 13 of the diffuser body 1 and an air flow direction adjusting unit 204 is provided in place of the air flow rate adjusting unit 203.

The frame cover 2 is provided with projections 24 and 23 disposed inside and outside the frame member 21 closely engaging with the inner and outer peripheral sides of the frame element 12, respectively, support projections 25 and 26 each having a triangular section disposed on a back surface side of the frame member 21 in the sealed air space 20 formed between the frame member 21 and the frame element 12, and a hollow portion 28 formed between the front and back surfaces of the frame member 21. The hollow portion 28 is formed so as to provide substantially L-shape gap and acts as a heat insulating layer by the air in the gap. Furthermore, a connection fitting member, not shown, having substantially L-shape is press fitted to the hollow portions 28 of the adjacent two frame cover elements at

the end portion of the frame cover 2 to thereby firmly fixing it to the adjacent frame cover elements constituting the frame cover 2.

The air flow direction adjusting unit 204 has a streamline shape suitable for reducing air flow loss and has a structure capable of changing the air blow-out direction from the blow-out opening 13.

The diffuser of the fourth embodiment of the structure described above will operate in the following manner.

In the manner similar to that of the first embodiment, when the primary air A is blown out in the room through the blow-out opening 13 of the blow-out frame element 12 of the diffuser body 1, the side wall plates 11 and the frame element 12 of the diffuser body 1 are cooled. On the outer side of the frame element 12, the frame cover 2 is supported to the frame element 12 with minimum contact points of the inside and outside projections 24 and 23 to thereby form the sealed air gap 20 between the frame element 12 and frame cover 2. According to such structure, the heat transfer from the frame element 12 to the frame cover 2 can be extremely reduced, and in addition, since the frame cover 2 is provided itself with the hollow portion 28, the surface portion of the frame cover 2 can surely maintain its heat insulated state through the hollow portion 28.

In such state, when the air flow direction

adjusting unit 204 disposed at substantially the central portion of the diffuser body 1 is directed perpendicularly, the cool primary air A is blown out downward from the blow-out opening 13, and according to the flow of this primary air A, the hot air in the room is induced as a secondary air B. In such case, however, since the surface of the frame cover 2 maintains a temperature near the room temperature without being cooled, any dew is not formed even if the hot secondary air B contacts the frame cover 2.

On the other hand, when the air flow direction adjusting unit 204 is directed obliquely, the cool primary air A flows obliquely along the air flow direction adjusting unit 204, collides with the frame element 12 and then changes its flow direction, and is blown out in the room substantially horizontally. In this state, as mentioned above, since the surface of the frame cover 2 maintains a temperature near the room temperature without being cooled, any dew is not formed even if the hot secondary air B contacts the frame cover 2. In addition, since the primary air A flows substantially horizontally, the secondary air B does not contact the frame cover 2, thus completely preventing the formation of the dew.

Further, in the above embodiments, there is adapted a structure that the frame cover 2 is mounted at

the initial stage to the frame element 12 of the diffuser body 1, but there may be adapted a structure that the frame cover 2 is mounted to the frame element 12 after observing the dewing in only the using of the frame element 12 after the frame element 12 is mounted to the diffuser body 1.

As described above, according to the present invention, since the closed space is defined between the air blow-out opening of the diffuser body and the frame cover formed of the heat insulating material, if the frame element for the blow-out opening is cooled by the blow-out air, the heat transfer to the frame cover can be effectively suppressed, thus preventing the dewing from causing.

Furthermore, since the frame cover is formed of a transparent material, the frame element can be observed through the frame cover, providing a fine design appearance.

The location of the projections to the frame cover can improve the firm support between the frame cover and the frame element to thereby make strong the frame cover structure and prevent the frame cover from being bent or deformed. The projection or protrusion formed on the surface of the frame cover opposite to the closed space side can achieve the air flow rectifying function, thus effectively preventing the dewing from causing.

According to the forth embodiment in which the hollow portion is formed to the frame cover, the cooling

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of the frame cover through the heat transfer can be prevented and the formation of the dew can be further suppressed. The respective frame covers can be firmly connected by inserting the connection member in the hollow portions of the adjacent frame covers, and the sealed hollow portion can serve to improve the heat insulation effect.

CLAIMS

1. An air diffuser in which air is taken into a diffuser body through an air take-in opening formed on one side thereof and the air taken into the diffuser body is blown out through an air blow-out opening formed on another side of the diffuser body, said air diffuser comprising a diffuser body provided with air take-in and air blow-out openings, a frame element defining the air blow-out opening and a frame cover having one end portion abutting against an inner peripheral side portion of the frame element and another end portion abutting against an outer peripheral side portion of the frame element so as to define a closed space between the frame cover and an outer side surface of the frame element, said frame cover being formed with a heat insulating frame member.
2. An air diffuser according to claim 1, wherein said frame cover is provided with at least one projection abutting against the outer side surface of the frame element to support the frame element.
3. An air diffuser according to claim 2, wherein said frame cover is provided with a plurality of projections including a projection abutting against the inner

peripheral side portion of the frame element, a projection abutting against the outer peripheral side portion of the frame element and a projection formed on a surface of the frame cover facing said closed space and abutting against the outer surface of the frame element.

4. An air diffuser according to claim 2, wherein said projection has substantially a triangular shape in section.

5. An air diffuser according to claim 1, wherein said frame cover is provided with at least one projection on another surface of the frame cover opposite to the surface facing said closed space to rectify air flow.

6. An air diffuser according to claim 5, wherein said projection has substantially a triangular shape in section.

7. An air diffuser according to claim 5, wherein said projection is formed as a protruded portion of the frame cover.

8. An air diffuser according to claim 1, wherein said another surface of the frame cover opposite to the surface facing the closed space is formed as a wave-shaped surface.

9. An air diffuser according to claim 1, wherein a heat insulating packing member is disposed between the diffuser body and the frame element.
10. An air diffuser according to claim 1, wherein said frame cover is formed of a transparent material.
11. An air diffuser according to claim 1, wherein said frame cover is provided with an inner hollow portion extending in a longitudinal direction thereof.
12. An air diffuser according to claim 11, wherein said frame cover is composed of a plurality frame cover elements which are connected to each other through connection members each of which is inserted into the hollow portions of the adjacent frame cover elements.