

[54] AIR CONDITIONING TERMINAL

[75] Inventors: August W. Gutheim, Chittenango;
Carl C. Herb, Camillus, both of
N.Y.

[73] Assignee: Carrier Corporation, Syracuse, N.Y.

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[58] Field of Search 138/108; 239/552,
239/590; 98/40 D, 40 C, 40 N; 251/153

[56] References Cited

UNITED STATES PATENTS

3,591,076 7/1971 Bryans 98/40 D
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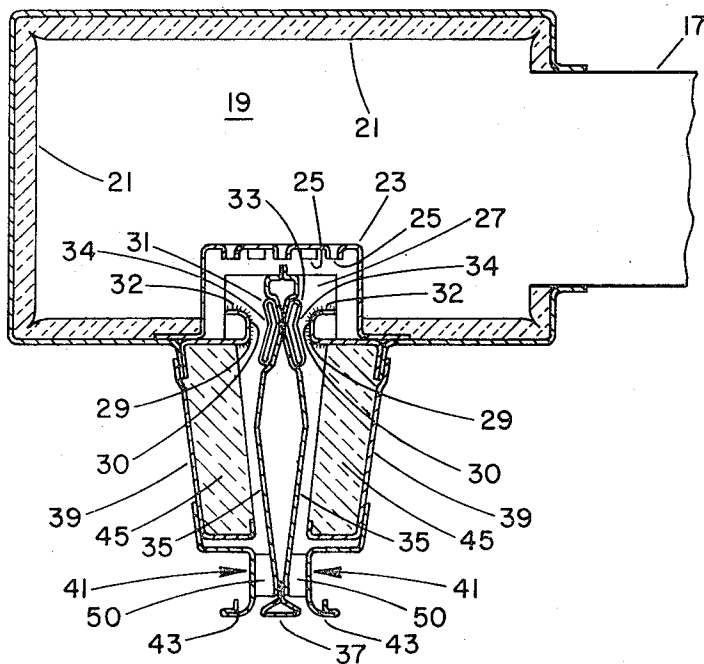
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Primary Examiner—William E. Wayner
Attorney—Harry G. Martin, Jr. et al.

[57] ABSTRACT

An air conditioning terminal for use in an air conditioning system for discharging conditioned air into a space which includes a diffuser spaced from opposed parallel walls; the opposed parallel walls and diffuser cooperate to define therebetween two discharge air streams. Spacers are provided between opposed surfaces of the diffuser and the parallel walls. The sides of the spacers are in intimate contact with the opposed surfaces of the diffuser and parallel walls. The spacer acts to maintain a predetermined distance between the diffuser surface and the opposed terminal wall.

1 Claim, 3 Drawing Figures



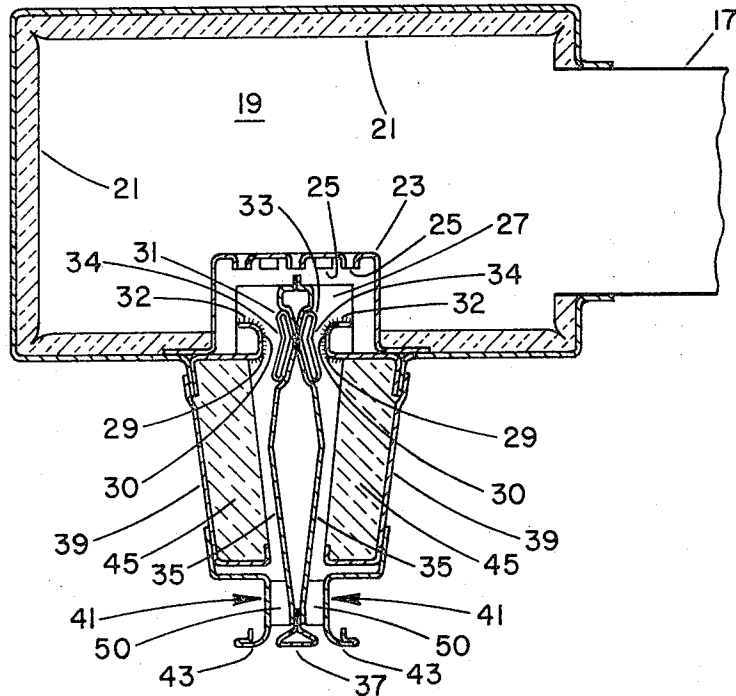


FIG. 1

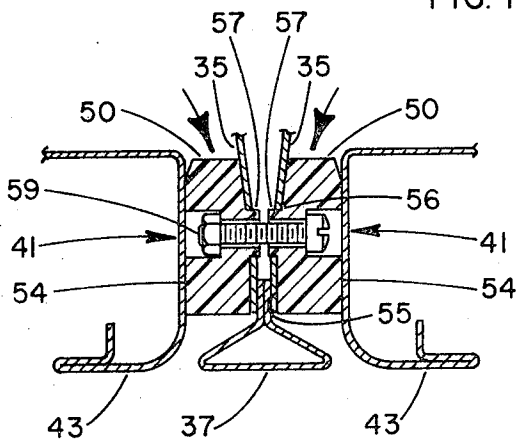


FIG. 2

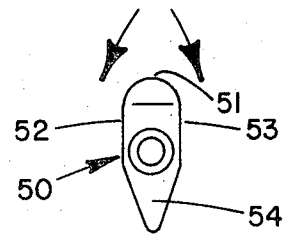


FIG. 3

INVENTOR.
AUGUST W. GUTHEIM
BY CARL C. HERB
Barry E. Dutch
ATTORNEY

AIR CONDITIONING TERMINAL

BACKGROUND OF THE INVENTION

In air conditioning systems utilizing ceiling air terminals, a problem is encountered in evenly distributing the conditioned air throughout the area being served by a terminal. When cool air is being discharged from the terminal, there is a tendency for the air to drop rapidly before there is a complete mixture of the conditioned air with the room air. To assure that conditioned air is provided to the portions of the area farthest from the terminal, the air may have to be discharged at a considerable velocity which can create excessive noise.

A terminal or unit which has proven highly satisfactory in overcoming the above described problems is disclosed in U.S. Pat. No. 3,554,111, issued Jan. 12, 1971 in the names of Darwin G. Traver and Fred V. Honnold, Jr. In the above cited patent, it was indicated that the width of the air discharge slot from the unit is a critical dimension. In order to achieve the desired "throw" for the air discharged from the unit, it is essential that the width of the slot be maintained substantially constant at a predetermined dimension for its entire length. The length of such unit may be about 4 feet.

To check the width of the slot for its entire length is both time consuming and expensive when manufacturing units on a mass production basis. It is, therefore, an object of this invention to provide an air conditioning unit having a constant width discharge slot that may be produced in an economical manner when manufacturing such a unit in large quantities.

SUMMARY OF THE INVENTION

This invention relates to a ceiling air terminal for use in an air conditioning system to provide treated air to a space within an enclosure. The terminal includes a conduit section adapted for connection to a source of conditioned air. Opposed parallel walls provide an air passage in communication with the conduit section. A diffuser is disposed within the air passage and is held in spaced-apart relation from the opposed parallel walls. The diffuser and parallel walls define therebetween two discharge air slots for discharging the conditioned air from the terminal into the space being served. The width of each of the slots is a highly critical dimension.

Spacers are disposed in fixed positions between the opposed surfaces of the diffuser and parallel walls. The sides of each spacer are in intimate contact with a surface of the diffuser and a side wall. The spacer is designed to maintain noise generation at an absolute minimum.

In a preferred embodiment, the spacer is shaped in the form of a "teardrop." The top surface thereof is defined by an arcuate portion. The sides thereof extend from the arcuate portion and taper inwardly so they almost converge at their lower ends. By providing a smooth, rounded top surface against which the air stream impinges, and by causing the air stream to reconverge at the bottom of the spacer before it is discharged into the space, turbulence and thus noise generation is maintained at a minimum.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view of an air terminal embodying the present invention;

FIG. 2 is an enlarged fragmentary view of a portion of the air terminal illustrated in FIG. 1; and
FIG. 3 is a frontal elevation of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more particularly to the drawings, there is illustrated an air conditioning terminal having conditioned air supplied thereto. The air is treated in a central station (not shown) which may include a filter, precooling coil, spray means, cooling coil, heating coil, and a fan, for heating, cooling, humidifying and filtering the air as desired, to provide conditioned air for passage to the terminals located in the areas being served.

A supply air duct 17 is illustrative of the plurality of ducts provided to supply conditioned air to ceiling air terminals throughout a building or other common enclosure. The ceiling terminal includes a primary chamber 19 lined with a sound absorbing material 21, such as a glass fiber blanket. The primary chamber is ordinarily open at both ends for connecting a series of terminals end to end to provide a complete air discharge system. Suitable end pieces (not shown) are utilized to cap the end terminals in the series.

An air supply distribution plate 23 having a plurality of collared openings 25 therein is provided to evenly distribute the supply air from primary chamber 19 into the distribution chamber 27 which is defined by the top and side walls of distribution plate 23. To provide an optimum air discharge pattern, the air supplied to the distribution chamber from the primary chamber should have minimal non-vertical velocity components. Since the air supplied to the ceiling terminal is ordinarily introduced horizontally into the end or side of the terminal, there is a large horizontal velocity component to the air stream within the conduit section. The distribution plate employing a large number of collared openings is very effective in providing an efficient, non-turbulent vertical diversion of the air stream from primary chamber 19 into distribution chamber 27. This minimizes noise generation within the terminal. The collars divert the horizontal velocity component of the air stream so the velocity components of the air stream within distribution chamber 27 are vertical.

For an optimum air discharge pattern from the plate, the depth of a collar should approximate the diameter of a collared opening. The depth of each collar is constant throughout the entire circumference thereof to provide a discharge opening parallel to the plane of the distribution plate. In discharging air from an opening, the geometry of the opening itself may have a tendency to effect an attachment of the air stream to a portion of the wall forming the opening. This attachment can cause the air stream to be diverted in a direction away from the axis of the opening. By providing a collar having a constant depth throughout its circumference, an abrupt detachment of the air stream therefrom is obtained which minimizes the tendency of the air stream to flow in a non-vertical direction within the distribution chamber.

The bottom of distribution chamber 27 includes aligned cutoff plates 29 which are provided with a curved surface 30 for engagement by bladders 31 and 33 to form a damper. The curved surfaces smooth the

flow of air throughout the damper to minimize the pressure drop therethrough when the bladder is fully deflated and provide a low noise level over the entire operating range of the terminal as bladder inflation is varied between a fully deflated position and a fully inflated position. The surface 30 is preferably covered with felt 32 to further minimize noise.

By varying the inflation of the bladders, the area of the openings between the bladders and the cutoff plates may be varied. This feature can be utilized to provide a variety of modes of terminal operation. If it is desired to maintain a constant discharge of air from the terminal, a pressure responsive control may be employed to selectively inflate or deflate the bladders in response to supplied air pressure to reduce the area between the bladders and cutoff plates as duct pressure increases and to increase the area therebetween as duct pressure decreases.

If it is desired to control the terminal to provide a constant room temperature under varying cooling loads, the bladder inflation may be controlled by a thermostat responsive to room temperature to provide an increased quantity of air flow from the terminal as the cooling load increases and a decreased quantity of air flow from the terminal as the cooling load decreases.

Bladders 31 and 33 are adhesively mounted on a central partition assembly comprised of opposed, generally convex plates 35 and diffuser triangle 37. The plates have a suitably-shaped recess therein so the bladders are completely recessed within the plates when deflated. This provides a large area between active walls 34 of the bladders and the cutoff plates for maximum air flow therebetween. Further, the recessed bladder provides a smooth surface along plate 35 to minimize air turbulence.

By reference to the drawings, it may be seen walls 34 of the bladder are concave. When the bladders are fully deflated, the active walls of the bladders are withdrawn from the air stream to minimize a possibility of bladder flutter. By recessing the bladders within plates 35 and providing the bladders with concave walls 34, the distance between the cutoff plate and wall 34 of the bladders is increased. This provides a greater opening between the bladder and cutoff plate when the bladder is fully deflated for maximum air flow therebetween. Further, a large movement of wall 34 from a concave to a convex position may be obtained without stretching the bladder material.

The damper mechanism is disposed a substantial distance upstream from the discharge openings in the terminal to provide sufficient space therebetween to absorb any noise generated by the damper mechanism. For maximum sound absorption, downwardly extending walls 39 which form air passages in conjunction with plates 35, are lined with a sound absorbing material such as glass fiber blankets 45. Outlet members 41 having outwardly flared lower portions 43 are affixed, as by welding, to walls 39.

The convex plates prevent direct, straight line passage of sound energy waves from the damper into the area being conditioned. The sound waves generated at the damper strike sound-absorbing blankets 45 where they are absorbed to prevent passage of noise from the terminal. The lower portion of the passageways formed between plates 35 and walls 39

has a constantly increasing cross-sectional area in the direction of air flow which also aids in the dissipation of sound energy.

As noted hereinbefore, for proper air distribution within the area being served, the discharged air stream should remain attached to the ceiling during its passage to portions of the area remote from the terminal. This assures a supply of conditioned air to such remote portions. Another advantage is room air will thus be induced by the discharged air stream and will mix therewith to temper the stream so the air stream temperature is not disproportionate to room temperature, thereby providing even temperatures throughout the area being conditioned. The terminal described in the previously cited U.S. Pat. No. 3,554,111 discloses a terminal that satisfactorily discharges the conditioned air into an area to obtain the results described hereinabove.

As noted in the abovementioned patent, the width of the air discharge slot from the terminal is critical throughout its length. The slot is defined by the opposed surfaces of outlet member 41 and diffuser 37. It is extremely important that, in order to obtain the desired air discharge characteristics, the width of the slot be maintained uniform for the entire length of the terminal, which is typically about four feet.

In order to obtain the desired uniformity, spacers 50 are provided between the opposed surfaces of outlet 41 and diffuser 37.

The front and rear faces, respectively 54, and 55 of each spacer 50 are in intimate contact with the opposed surfaces of the outlet and diffuser. A hole 56 is provided in each contacting surface of the diffuser to receive mating portion 57 of spacer 50. Hole 56 and mating portion 57 preferably have a particular configuration so the spacer may only be inserted and thus installed in the air passage in a predetermined manner. Joining means 59, such as a bolt and nut, is provided to firmly affix the spacer in its desired location within the air passage.

By placing an object, such as spacer 50, within the flow path of the conditioned air through the terminal, the generation of undesirable noise may occur. To minimize the generation of such noise, the spacer is formed in a particular manner, as shown in FIG. 3.

The top surface of spacer 50 is defined by arcuate portions 51. Side walls 52 and 53 extend downwardly therefrom and gradually taper so as to substantially converge at the bottom portion thereof. By providing a smooth rounded top surface for the spacer, noise generation is maintained at a minimum. In addition, by providing a gradual downstream taper the air stream is permitted to reconverge before passing through the discharge slot. This reduces turbulence which is a source of noise generation. It should be understood that although only one spacer is shown in each air passage, additional spacers may be provided if required.

By providing a spacer of the type described hereinabove, a uniform air discharge slot may be obtained, without creating any undesirable problems. Thus, an air terminal may be economically manufactured and still provide desired characteristics for the air discharged into the area being served by the terminal.

While we have described and illustrated a preferred embodiment of our invention, our invention should not be limited thereto, but may be otherwise embodied within the scope of the following claims.

We claim:

1. A ceiling air terminal for use in an air conditioning and distribution system for discharging conditioned air into a space served by said terminal comprising:

A. means defining a primary chamber adapted for connection to a source of conditioned air;

B. at least one downwardly extending wall associated with said primary chamber to define a first portion of an air passage;

C. diffuser means held in spaced-apart relation from said downwardly extending wall to define therebetween an air discharge slot for the passage of conditioned air from said terminal into said

space; and

D. a spacer member disposed in a fixed position between opposed surfaces of said diffuser means and said downwardly extending wall, said spacer member being in substantially intimate contact with said opposed surfaces of said diffuser means and said downwardly extending wall, said spacer member comprising an arcuate portion defining the upper surface thereof, and wall means extending downwardly from said arcuate portion, said wall means substantially converging at the lower ends thereof, said spacer member maintaining a predetermined distance between said diffuser means and said downwardly extending wall to maintain the width of said air slot uniformly constant at a predetermined dimension.

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