United States Patent [19]

Dean, Jr.

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[54] **T-BAR MOUNTED AIR DIFFUSER**

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[73] Assignee: **Tempmaster Corporation**, Kansas City, Mo.

[22] Filed: **Feb. 12, 1973**

[21] Appl. No.: **331,495**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 89,747, Nov. 16, 1970, abandoned.

[52] **U.S. Cl.** ..... **98/40 D**

[51] **Int. Cl.** **F24f 13/06**

[58] **Field of Search** ..... 98/40 D, 40 DL, 114

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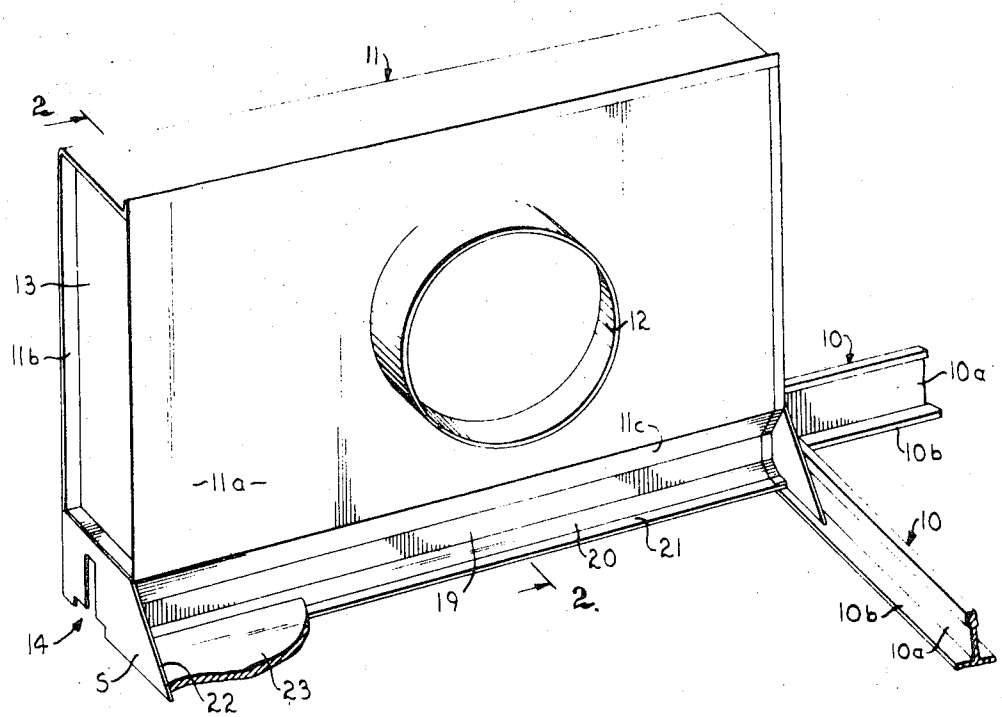
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Attorney—Claude W. Lowe, William B. Kircher et al.

[57] **ABSTRACT**

An air diffuser device is attachable to T-bar supports which hang or are otherwise supported from a ceiling structure. The diffuser device terminates in an integrally formed longitudinal single or double directional outlet slot with one side of the slot being shaped to facilitate directing the air flow from the diffuser device along the underside of the ceiling adjacent the shape side. The side of the device opposite the shaped side cooperates to divert the air in the aforesaid direction and does so independently of the T-bar parallel to the outlet slot. Supporting gussets (or end support plates) facilitate the mounting of the device on transverse T-bars (T-bars which are located in the supporting grid in a direction that is transverse to the outlet slot of said diffuser device). The diffuser device can also be utilized as return air inlets for return air ducts.

5 Claims, 7 Drawing Figures



2 Sheets-Sheet 1

Fig. 1.

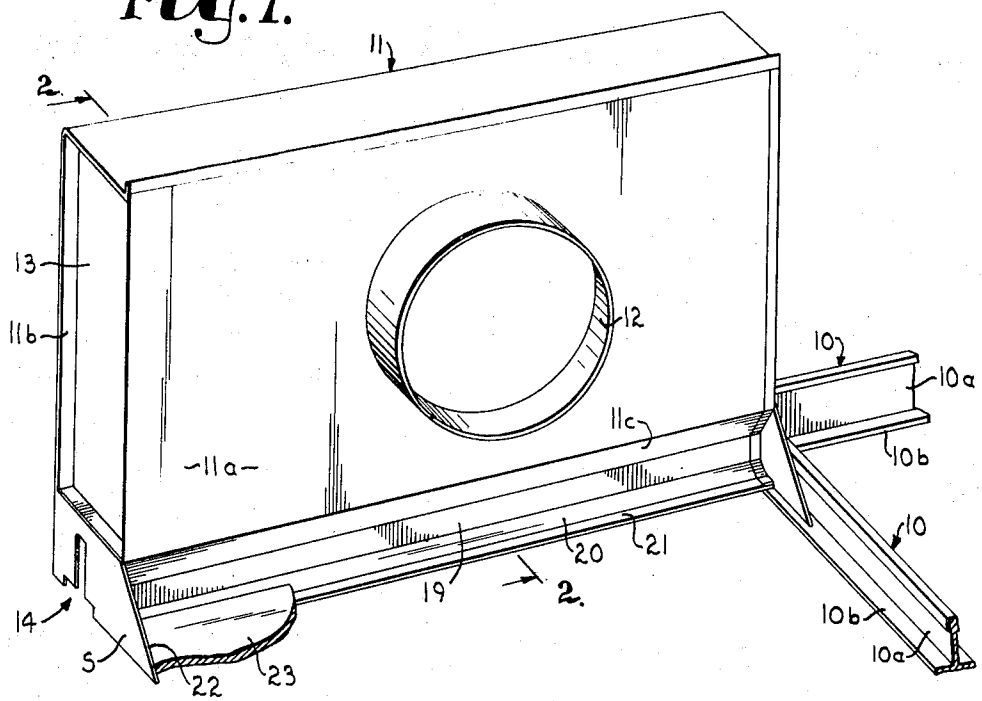


Fig. 3.

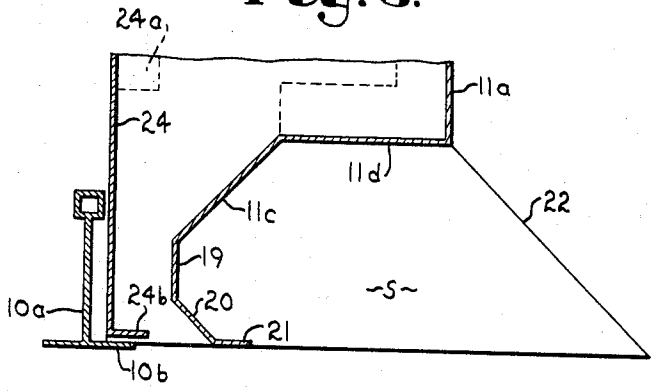


Fig. 4.

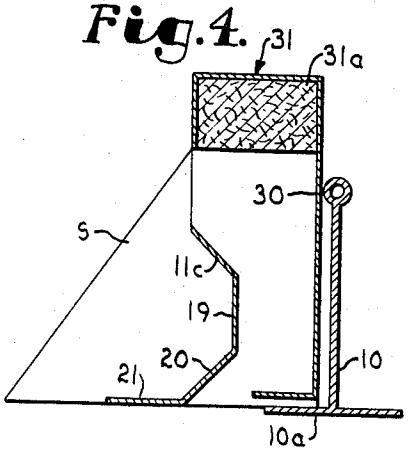


Fig. 2.

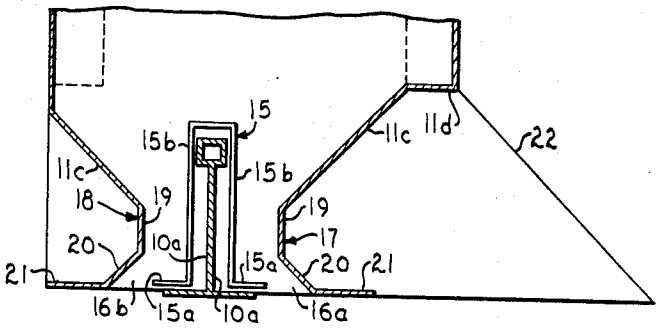


Fig. 5.

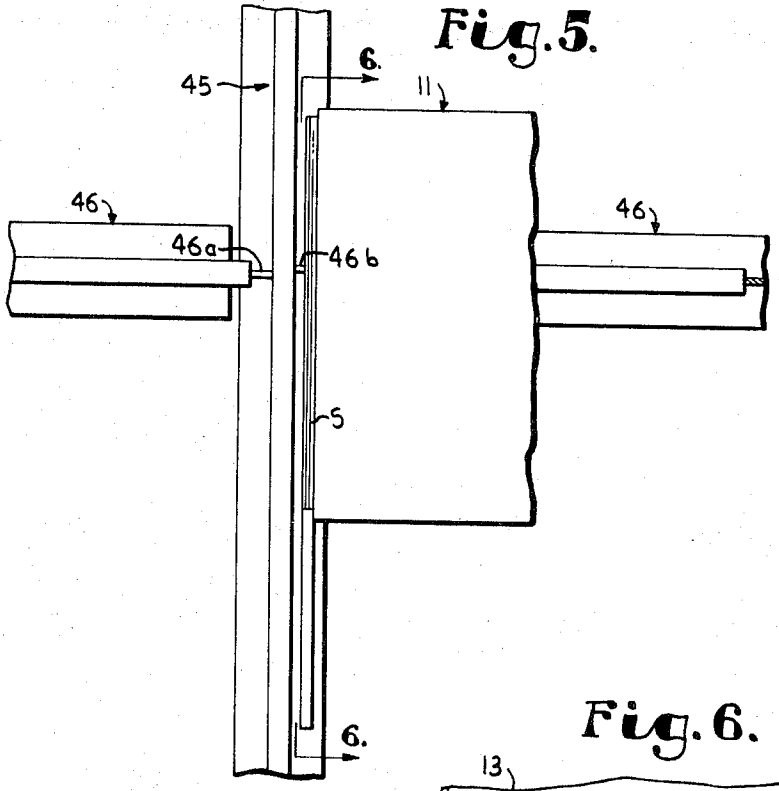


Fig. 6.

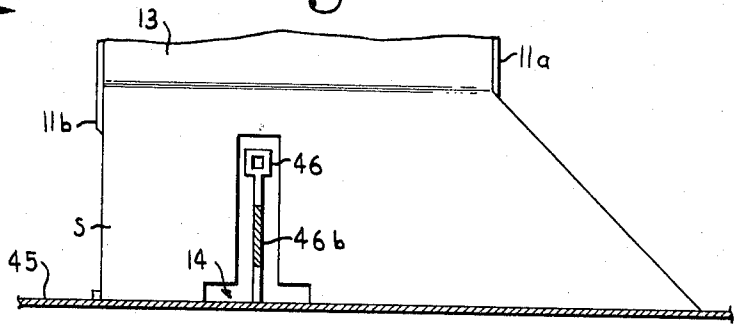
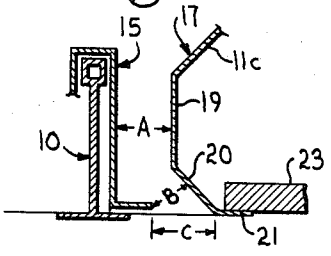


Fig. 7.



T-BAR MOUNTED AIR DIFFUSER

BACKGROUND AND BRIEF DESCRIPTION OF THE INVENTION

This application is a continuation-in-part of the co-pending application Ser. No. 89,747 filed Nov. 16, 1970 now abandoned.

Ceiling air diffusers and air distribution systems which diffuse conditioned air into rooms or compartments for heating, cooling and/or ventilating have been incorporated with subceiling structures and systems for some time. Many techniques include various combinations of devices for ventilating and heating; illuminating and ventilating; illuminating and cooling; and illuminating, heating/cooling and ventilating.

My invention relates to air diffuser devices which cooperate with T-bars conventionally hung from a true ceiling to form the structural support for a false ceiling. My diffuser device is adapted to be supported on the horizontal flange surfaces of T-bars which are transverse to the T-bar immediately adjacent and extending parallel to the elongated outlet slot of the diffuser device.

One side of the outlet slot is angled outwardly away from the parallel T-bar and is substantially arcuately shaped. This angled or shaped side is comprised of three angled surfaces integrally formed to cooperate with the L-shaped opposite side in order to direct the air flow through the diffuser device along the underside of the false ceiling immediately adjacent the flared side of the outlet slot. Supporting gussets (or end support plates generally) enclose the lower end portions of the diffuser device and extend from a location adjacent the rear wall of same part the flared side to thereby terminate in a horizontal plane which is matingly supportable on a corresponding horizontal flange surface of a transverse T-bar. Since the T-bar supporting structure is generally in the form of suspended grid, the air diffuser device will be supported entirely by the end gussets. Due to the manufacturing and installation irregularities of the T-bars generally, the inner or L-shaped side of the outlet slot is deliberately raised above the upper surface of the corresponding parallel T-bar flange. Furthermore, the leading edge of the L-shaped portion of the duct is extended to or beyond the horizontal surface of the corresponding transverse T-bar flange to cooperate with the flared side in producing an outlet slot whose dimensions are fixed and completely independent of the adjacent T-bar flange. In this manner, the air flow through the outlet slot depends exclusively on the manufactured shape of the diffuser and not on the T-bar. Accordingly, with the flared side being integrally formed and fixedly connected in a spaced relationship with the L-shaped rear wall, the critical spacing therebetween may not be inadvertently changed or altered. It should be noted that the cross section area of the outlet slot and the dimensional spacing of the throat surfaces must be closely regulated to achieve the desired Coanda or ceiling effect.

One embodiment of my air diffuser device will include two parallel outlet slots and has a housing structure which straddles a parallel T-bar but which is supported on the T-bars running transverse to same. The two outlet slot T-bars will have two divergingly flared slot side portions arranged to direct the flow of air in opposite directions away from the longitudinal center line of the parallel but nonsupporting T-bar. The ends

of the housing which are integrally formed with the supporting gussets are appropriately vertically slotted to span the parallel T-bar and distribute the weight of the device on the transverse T-bars. It is further contemplated that a channel structure will extend the length of the diffuser device and will be appropriately sized to fit over the web portion of the parallel T-bars so as to not touch same or impart any weight thereupon. This structure likewise insures proper orientation of the outlet slots with respect to the parallel T-bar.

As suggested above, another embodiment of the diffuser device utilizes the horizontal upper surface of each of the two transverse T-bars to position the supporting gussets of the diffuser thereon and includes only one flared slot side portion which cooperates with the L-shaped rear wall portion to direct the air in only one direction away from the subject slot.

In either embodiment the deflection of the air flow through and out of the diffuser is caused by the main air stream impinging on the L-shaped rear surface of the diffuser which is spaced above and is extended beyond the horizontal flange of the parallel T-bar and which then cooperates with the arcuate shaped or flared opposite side of the longitudinal slot to produce an outlet slot of fixed cross section area. The air flow tends to attach primarily to the under-surface of the ceiling immediately adjacent the flared side of the longitudinal slot. This wall attachment principle, sometimes known as the Coanda or ceiling effect, has been utilized in the science of fluidics or fluid logic, however, it has particular utility in and with air-conditioning systems in that good circulation and secondary indirect air flow is insured and the adverse effects of down drafts and wall drafts are minimized.

In either embodiment, the diffuser structure may be utilized as inlets for return air ducts or plenum areas.

A primary object of my invention is to provide a uniquely constructed air diffuser device which directs air along a ceiling surface.

Another primary object of my invention is to provide a uniquely constructed air diffuser device which is conveniently used with conventional T-bar supports.

Another object of my invention is to provide a uniquely constructed air diffuser device which may be integrated with a ceiling system using T-bar supports and the like and which may provide additional supporting surfaces for ceiling board or panels and lighting fixtures. It is a feature of my invention that the diffuser device is self-supporting on the T-bars and may be laid in place without benefit of supporting wire or cable attachments.

A further object of my invention is to provide a unique air diffuser that requires no manual adjustment for operation and which is inexpensive and easily installed in conventional ceiling systems.

It is a feature of my invention that the diffuser may have either single or multiple outlet slots and effectively utilize existing and conventional T-bar supports for mounting and installation purposes.

A still further object of my invention is to provide an air diffuser device for conditioned air which is easily and inexpensively integrated into the ceiling system and which permits the room area below same to be optimally conditioned in accordance with the location of the subject diffuser.

Another object of my invention is to provide a uniquely constructed air diffuser device of the charac-

ter described immediately above which directs the diffused air from outlet slots located adjacent conventional T-bar supports buy which are functionally independent of the T-bar support parallel and adjacent to the corresponding outlet slot.

Other and further objects of the invention, together with the features of novelty appurtenant thereto, will appear in the course of the following description.

DETAILED DESCRIPTION OF THE INVENTION

In the accompanying drawings, which form a part of the specification and are to be read in conjunction therewith and in which like reference numerals are employed to indicate like parts in the various views:

FIG. 1 is a perspective view of my diffuser device shown with a conventional T-bar grid support and with portions of the ceiling board and said T-bars broken away to show how the device is mounted thereon;

FIG. 2 is an end sectional view taken generally along the line 2—2 of FIG. 1 in the direction of the arrows and showing the air diffuser units straddling a T-bar that is oriented parallel to the longitudinal outlet slots associated therewith;

FIG. 3 is an end sectional view similar to that shown in FIG. 2, however showing an alternative embodiment of the diffuser unit having a single outlet slot associated therewith;

FIG. 4 is an end sectional view similar to that shown in FIG. 3 however showing a diffuser device which may alternately be utilized for return air purposes either to appropriate ducts or to the ceiling plenum;

FIG. 5 is a top plan view of a T-bar supporting grid in combination with a partial view of the diffuser device. The vertical T-bar shown therein indicates a single T-bar located transverse to the T-bars which are oriented parallel to the longitudinal outlet slot (or slots) of said diffuser device;

FIG. 6 is an end sectional view of a portion of the transverse T-bar and showing the end supporting gusset of the diffuser device in elevation; and

FIG. 7 is an end sectional view of an alternative structure for the diffuser device which shows the general spacing arrangement of the three angled surfaces which cooperate with an adjacent side portion to define the throat and outlet slot.

Turning now more particularly to the drawings, reference numeral **10** generally designates the conventional T-bar supports which are designed to be hung from a true ceiling by hangers (not shown) in a conventional manner. Each T-bar is comprised of a central web **10***a* with horizontal flanges **10***b* extending perpendicular thereto on either side thereof to form the suggested inverted T. The diffuser is generally indicated by the numeral **11** and is comprised of an elongated housing or enclosure having a suitable inlet opening **12** for receiving the conditioned air from the overhead supply duct (not shown). The upper portion of the diffuser **11** may take any convenient shape. The configuration shown in FIGS. **1** and **2** is constructed to straddle a parallel T-bar and to effect the forming of two outlet slots as will be discussed later.

In most false ceiling systems, T-bars **10** hang from the true ceiling in a grid pattern. When utilized with my air diffuser, the T-bars may be easily spaced apart to accommodate the longitudinal dimension of the air diffuser device with the device supported on the two transversely extending T-bars. For instance, FIG. **5** shows a partial top plan view of the diffuser being supported on transverse T-bars **45** and straddling or parallel to T-bars **46.** It should be noted that ceiling bar having other than a T shape could be used without causing any radical change in the structure of diffuser **11.**

As shown in FIGS. **1** and **2,** the elongate housing of the device is generally indicated by the numeral **11** and includes the single inlet opening **12.** The ends of the housing are enclosed by end portions **13** which may be fabricated by the welding of inwardly turned end flanged peripheral edges to the inner surface of the housing. The lower end portion includes a supporting partially triangular shaped gusset (or end plate) generally indicated by the letter S. These supporting gussets extend forwardly past the front wall **11***a* of the diffuser unit and terminate in a horizontal plane that is coincident with the lower end of the diffuser unit and lower surface of the later described slot or slots. The rear edges of the support S are substantially vertical and coincident with the rear wall **11***b* of diffuser unit **11.** It should be pointed out that each of the end supporting gussets S has an inverted T-shaped slot generally identified by the numeral **14** therein. This inverted T-shaped slot facilitates the mounting of the diffuser over the parallel T-bar but causes substantially all of the weight of the diffuser unit to be supported on the transverse T-bars. As shown in FIG. **2,** an inverted U-shaped channel constructed from two spaced apart back-to-back "Ls" spans the length of the diffuser unit between the support gussets S. This channel, generally designated by the number **15,** is appropriately sized and spaced relative to support gussets S so that the lower horizontal portions of the "LS" (**15***a*) are spaced and extended above and beyond the upper horizontal flanged surface of the parallel T-bar. Further, the upper portion of the channel is dimensioned so as to clear the upper end extremity of the T-bar vertical web thereby affording only a side contact with the upper portion of the vertical web **10***a* of the T-bar in order to preclude inadvertent skewing of the diffuser relative to same. The vertical walls **15***b* of the channel **15** form the inner surface of the diffuser slot and cooperate with the lower horizontally turned portion **15***a* to deflect the air through the outlet slot and along the underside of the ceiling as will be described in more detail later.

As suggested above, the embodiment shown in FIGS. **1** and **2** provides for two longitudinal outlet air slots which are generally designated by the numerals **16***a* and **16***b* in FIG. **2.** The lateral boundary of each slot is determined by the distance between the end extremity of the horizontal portion **15***a* of the channel member **15** and the arcuately shaped or flared outer side represented by the numeral **17** and **18** (right and left, respectively).

It should be noted, however, that the housing structure above each arcuate or flared side portion includes a sloped or inclined surface generally designated by the numeral **11***c*. This inclined surface is then terminated by a substantially vertical section **19** in each slot forming the initial throat portion of same. The vertical section is then flared outwardly at **20** to diverge from the throat and to form a continuation of the arcuate outer side portion. Finally, the flared section is eventually terminated with the substantially horizontal section **21** whose lower surface lies in substantially the same plane as the lower plane of the associated supporting gussets S. It should be pointed out that while the flared side

portion is described with reference to three (3) angled and interconnected surfaces, same could have a curved arcuate shape (in section) with equal effectiveness.

With respect to the supporting gusset S on each end portion of the diffuser unit, it is contemplated that each gusset will be weldedly interconnected with the flared side portion as well as with the middle channel member 15 and that each supporting gusset S will include a substantially triangular forwardly extending section which is angled downwardly from the horizontally turned tab T. In the construction of same, the horizontally turned tab T interconnects between the forward wall 11*a* and the rearward wall 11*b* of the diffuser and contacts the vertical end wall 13 in a manner as shown in FIG. 1. The downwardly angled edge 22 terminates substantially forwardly of the forward wall 11*a* in a horizontal plane which runs from the forward termination to a rearward horizontal position that is coextensive with the lower end extremity of the rear wall 11*b* and the horizontal section 21 of the associated flared side 18. Accordingly, the weight of the diffuser unit is supported on the transverse T-bars via the supporting gussets S. Likewise, the parallel T-bar cooperates with the channel menber to preclude any disorienting of same relative to the slots and the parallel T-bar. This construction permits conventional ceiling panel, tile or light fixtures 23 (see FIG. 1) to be supported on the upper horizontal surface of the horizontal section 21 on either or both of the sides 17 or 18 and on a corresponding transverse horizontal flange of both of the transverse T-bars 10. Also the parallel T-bar is not required for the functioning of the diffuser and may be eliminated if the underside of the diffuser is appropriately aesthetically designed.

Turning now more particularly to the embodiment shown in FIG. 3, the single outlet slot air diffuser device has an essentially vertical rearward wall 24 with a layer of glass fiber or other insulated material (24*a*) extending down to the lower portion of the diffuser unit on the interior thereof. Accordingly, the inner effective rear wall of the diffuser occupies and includes more than one vertical plane. The lower end of the rearward wall 24 terminates in an L-shaped lower end portion generally designated by the numeral 24*b*.

The forward wall 11*a* is substantially similar to that described with reference to FIGS. 1 and 2 and includes the inclined section 11*c*, the vertical throat section of the outer side 19, outwardly diverging section 20 and the horizontally turned ceiling panel supporting section 21. Likewise, the supporting gusset S will be weldedly attached to the lower portion of the rear wall 24 and the flared outer side portion of the slot as well as the horizontal lower diffuser housing portion 11*d*. Accordingly, the supporting gusset S and cooperating spring clips maintain the diffuser unit in its appropriate position relative to the parallel T-bar by supporting the diffuser unit on the transverse T-bars with the lower surface of the L-shaped rear wall 24*b* being located above the upper surface of the parallel T-bar horizontal flange.

The embodiment in FIG. 4 is similar to that shown with respect to FIG. 3 in that the diffuser includes only a single side. The unit includes the supporting gusset S and the flared outer side comprised of the sections 11*c*, 19, 20 and 21. The rear wall is generally indicated by the numeral 30 and is an extension of a channel member 31. The upper portion of the channel member is suitably contoured to facilitate the location of an insulating material 31*a*, and interconnection with the upper portion of conventional duct work mounted above the false ceiling. It is contemplated that the supporting gussets S are weldedly interconnected with the end portions of the channel member and its vertical side 30 along with the flared outer side described above. It should be pointed out, however, that the vertical side 30 terminates above the upper surface of the horizontal flange of the T-bar 10 so that the supporting weight of the diffuser is once again carried by the supporting gussets S.

In operation, air diffusers described above with respect to FIGS. 1–4 are easily incorporated with the overhead duct work normally associated with an air-conditioning system. The inlet 12 will be in communicating relationship with the normal air-conditioning duct (not shown). The air diffuser is positioned with respect to the T-bar grid support structure so that the air is deflected through the diffuser unit in a preselected direction depending upon the positioning of the diffuser. Furthermore, the air flows through the diffuser unit (into a restricted area device) and out the outlet slot so that it will "hug" the lower surface of the ceiling and eliminate drafts or the direct blowing of air downwardly into the room on either objects or people located below. When the device is combined with the T-bar grids, the placement of ceiling tile and/or lighting fixtures operate to substantially reduce the effort heretofore associated with the installation of an integrated ceiling system including a light source, air-conditioning system and the ceiling tile or decorative panels. The view in FIG. 7 is typical of either embodiment and is shown to depict the critical spacing arrangement of the three angled sections 19, 20, and 21 in relation to the L-shaped opposite side portion 15. Space A represents the perpendicular distance between section 19 and section 15*a*; space B represents the perpendicular distance between the extremis of section 15a and section 20; space C represents the distance between the extremis of section 15*a* and the intersection of section 20 and section 21. With this arrangement, the adjacent ceiling bars will not adversely effect the air flow through the diffuser outlet slots.

As stated above, the views shown in FIGS. 5 and 6 exemplify the orientation of the diffuser device with respect to a conventional T-bar grid. In FIG. 5, it may be seen that the transverse T-bar (the T-bar that is transverse to the longitudinal outlet slot or slots in the diffuser device) is generally indicated by the numeral 45. It is well known in the art that the parallel T-bars (such as that indicated by the numeral 46) have connecting projections 46*a* and 46*b* which extend through suitable openings in the vertical web of the transverse T-bar 45 thereby permitting their respective T-bar to have its transverse end horizontal surface abut against the longitudinal horizontal surface of the transverse T-bar. Likewise, the end portions of the transverse T-bar 45 may be provided with similar connecting projections which will extend through openings in the oppositely oriented T-bars at other locations.

With the supporting T-bars being supported from the true ceiling in any conventional manner, the diffuser 11 is supported on the upper surface of the horizontal flanges of the transverse T-bars 45 by resting the supporting gussets S thereon. Of course, as shown in FIG. 1, the supporting gussets have the inverted T-shaped

opening 14 defined therein so that the diffuser's weight is carried by the transverse T-bar and is not arranged to rest or otherwise be supported on the T-bar parallel to the outlet slots.

From the foregoing, it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. An air diffuser or return air device for use in ceiling systems utilizing T-bar supports therein, said T-bar supports having an inverted T-shaped cross section, said device comprising:

a housing;

an inlet to said housing, said inlet suitable for interconnection with air ducts so that conditioned air may be transferred from said ducts interiorly of said housing,

at least one longitudinal outlet slot integrally formed with said device, said slot being formed in part by first and second elongated side portions and operable to direct the flow of air therethrough onto the lower surface of said ceiling adjacent said second slot side portion, said first side portion being located adjacent and parallel to a T-bar support and whereby said first side portion being located adjacent and parallel to a T-bar support and whereby said first side portion has a lowermost air turning surface substantially parallel to and spaced from the upper horizontal surface of the adjacent T-bar support raised above and has an edge extending beyond said T-bar support, said second slot side portion having an angled surface and cooperating with the first side portion to define an outlet slot of fixed cross section independent of said adjacent T-bar support, said air turning surface contacting and turning the air flow direction through said slot independently of the T-bar support located adjacent and parallel to said longitudinal outlet slot; and

means associated with the ends of said housing for supporting substantially the entire weight of said device on T-bar supports that are transversely oriented with respect to the longitudinal center line of said outlet slot.

2. The combination as in claim 1 wherein said second side portion has at least three longitudinal surfaces lying in different planes and integrally connected with said housing.

3. The combination as in claim 2 wherein said diffuser has at least two longitudinal outlet slots, each outlet slot having said three surfaced side portion, said slots being oriented to direct the flow of air therethrough and in opposite directions.

4. The combination as in claim 3 wherein slots having a preselected shape are defined in side portions of said housing, said side portion slots permitting a portion of said device to straddle a T-bar support parallel to the longitudinal center line of said outlet slots.

5. The combination as in claim 4 wherein each side portion has a supporting gusset fixedly attached thereto, said side slot being located in each one of said supporting gussets, said supporting gussets operable to support the weight of said air diffuser on T-bar supports transversely oriented with respect to said longitudinal center line of said outlet slots.

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