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Lambert

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[54] **SUSPENDED CEILING AND AIR DISTRIBUTION ARRANGEMENT**

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[73] Assignee: **Wehr Corporation,** Milwaukee, Wis.

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[21] Appl. No.: **428,424**

[52] **U.S. Cl.** ..... **98/40 D;** 98/114

[51] **Int. Cl.**[2] **F24F 13/02;** F24F 7/00

[58] **Field of Search** ..... 98/40 R, 40 D, 40 DL, 114, 98/40 C; 52/303, 484, 731, 732; 138/106, 107, 37, 39

[56] **References Cited**

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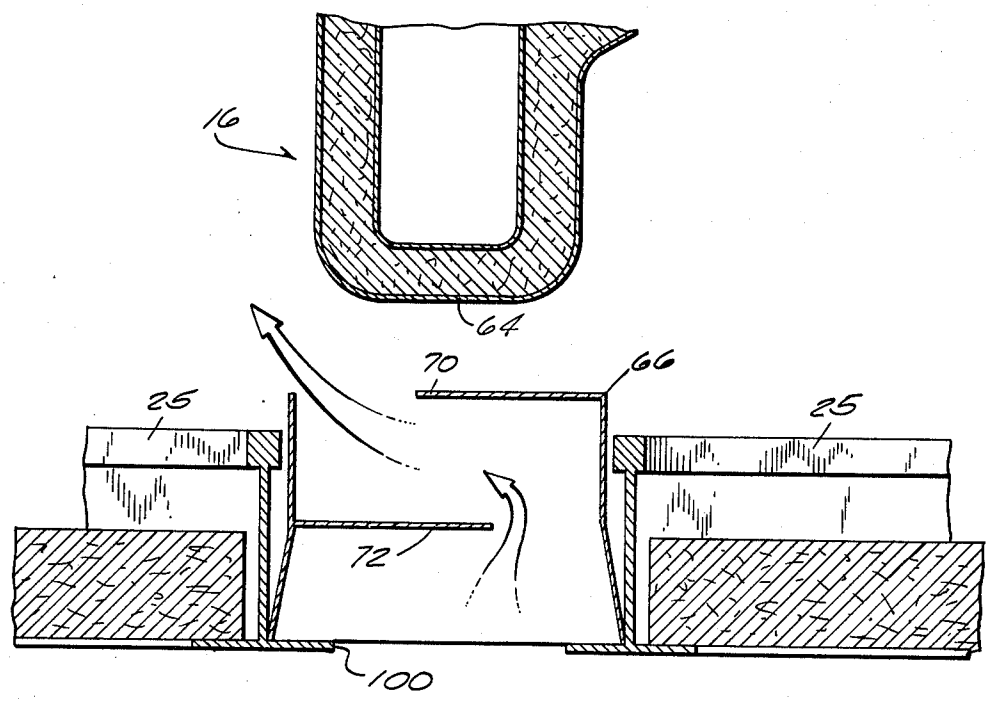
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Primary Examiner—John J. Camby
Assistant Examiner—Henry C. Yuen

[57] **ABSTRACT**

A linear air plenum formed of duct board (generally a thickness of fiber glass) carries a linear diffuser. The air plenum-diffuser assembly is used with a ceiling having a series of main and cross-runner T-bars, or similar ceiling support members. With the diffuser carried by the linear plenum, a slot is provided in the ceiling by an air track; alternatively the slot may be defined by an air bar, which includes the diffuser elements in which case the air plenum is provided with an air outlet collar which registers with the air bar. A number of these assemblies are connected end-to-end and arranged parallel to one of the cross or main runners and at right angles to the others. The lengths of the air plenum and the attached diffuser, or air outlet collar, are related to the module upon which the ceiling is designed and the diffuser, or outlet collar, length is less than the overall length of the air plenum. The areas of the air plenums between adjacent diffusers, or air outlet collars, are closed and spaced above the runners to be capable of functioning as air return areas.

8 Claims, 5 Drawing Figures



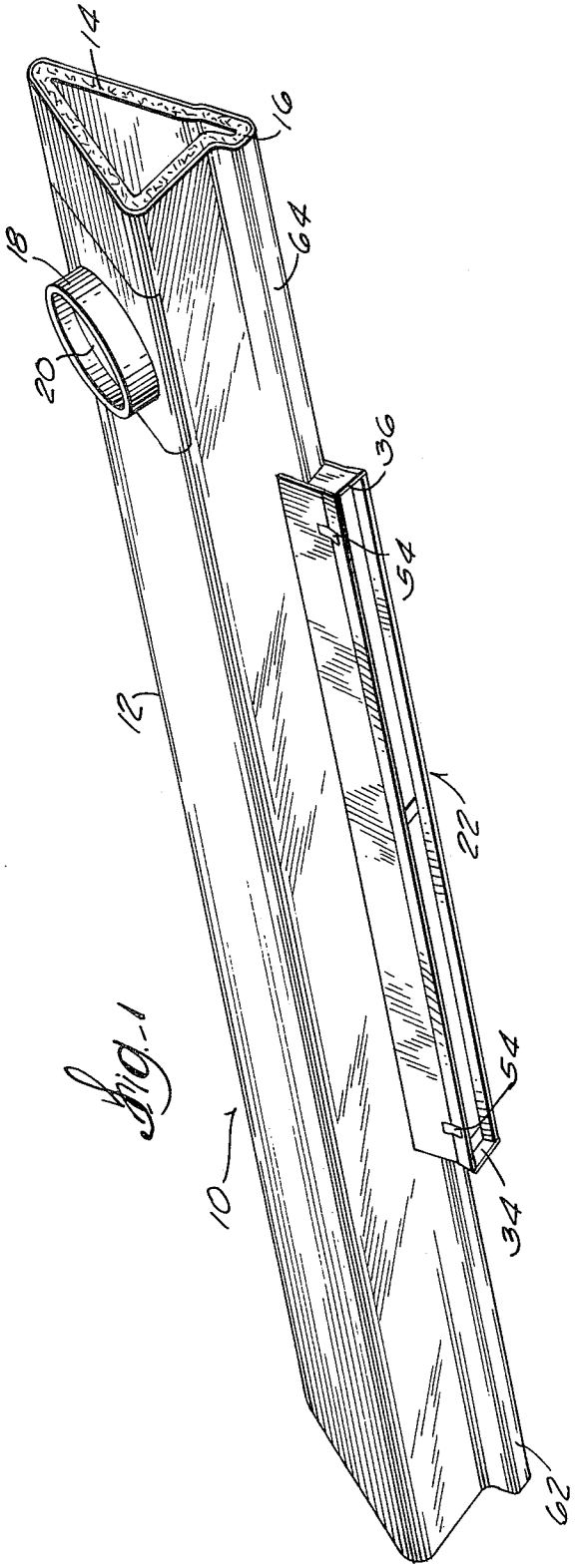


Fig. 1

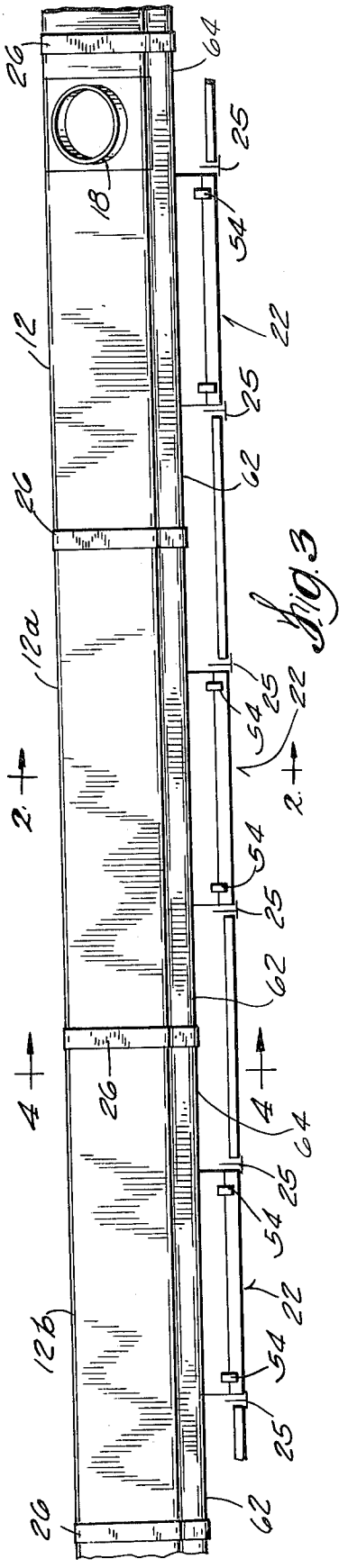


Fig. 3

Fig. 2.

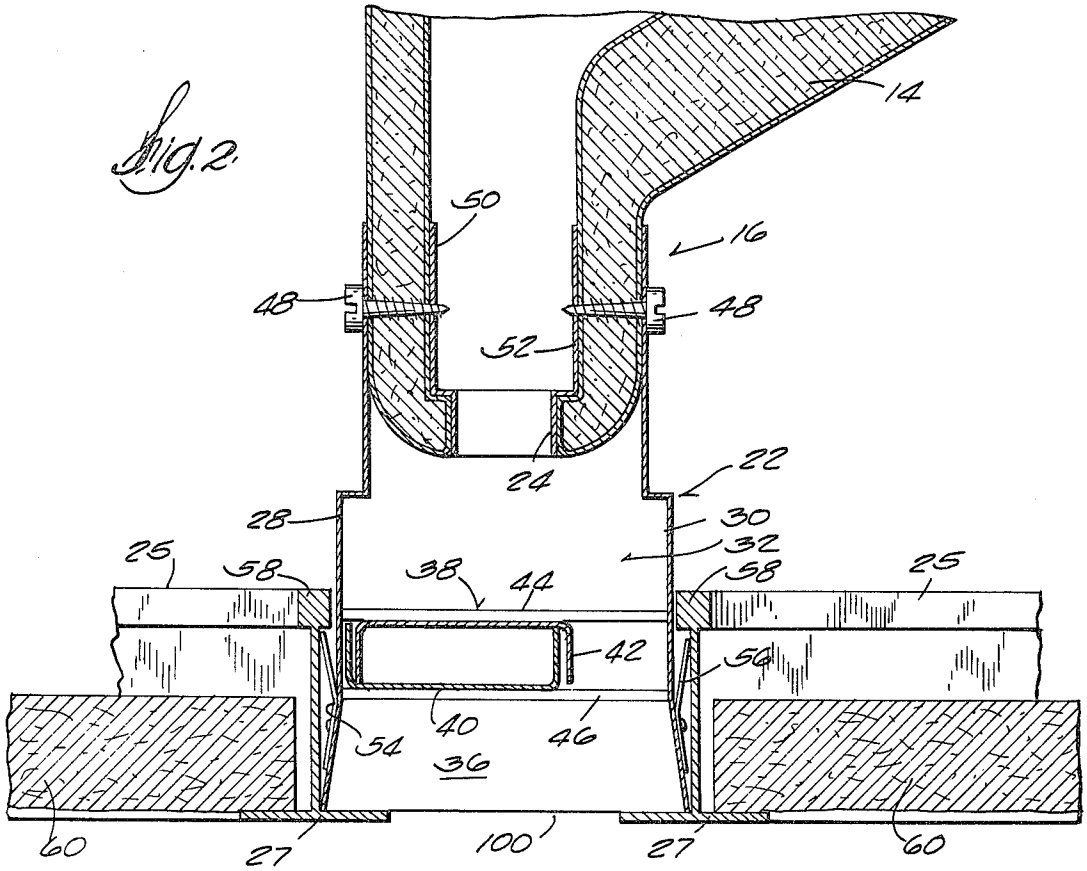

14
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16
48
48
52
24
22
28
30
32
25
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38
44
58
25
42
54
40
46
54
36
60
27
100
27
60

Fig. 4

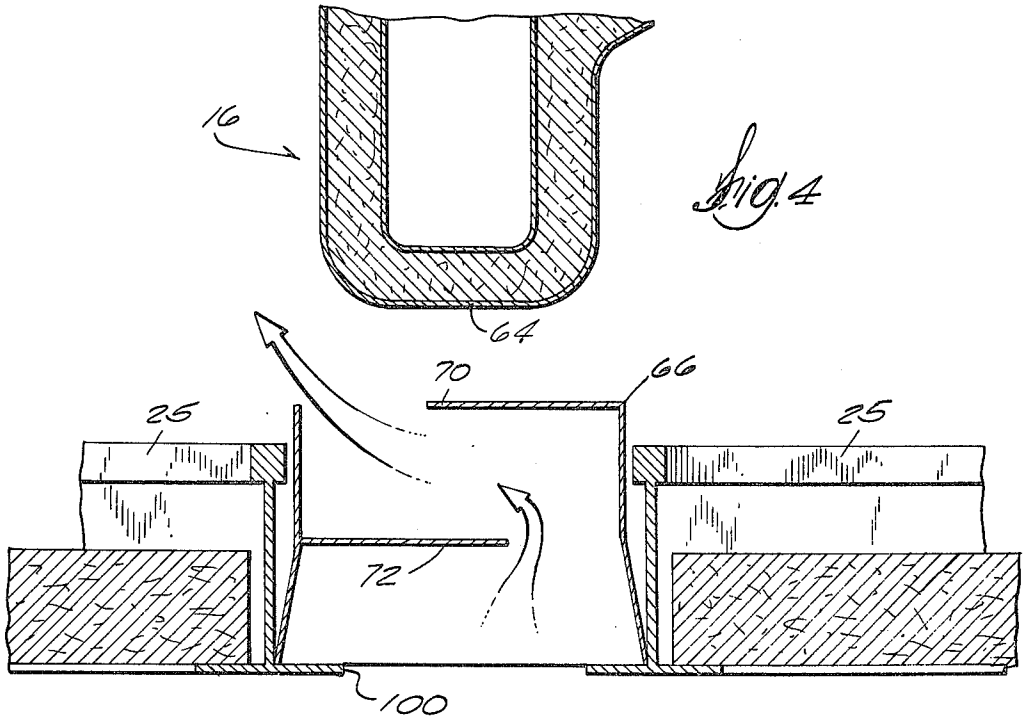
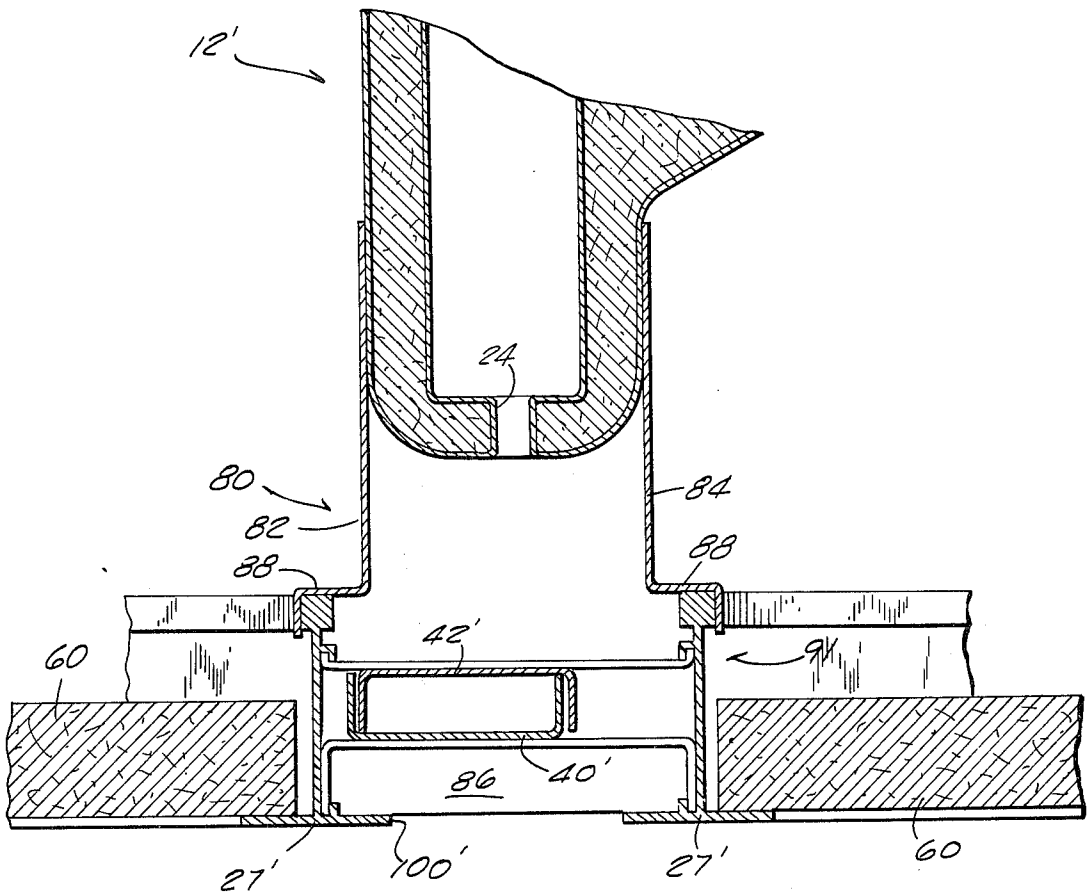

16
64
70
66
25
25
72
100

Fig. 5



SUSPENDED CEILING AND AIR DISTRIBUTION ARRANGEMENT

BACKGROUND OF INVENTION

This invention relates to ceiling type air distribution arrangements and, more particularly, to an improved construction for delivering air through a ceiling slot defined by either an air tract or an air bar.

In discussing this invention reference has been, and will be, made to a slot, an air bar, and an air track. A slot is an elongated, linear opening, generally 1 inch or 2 inch wide, in a suspended ceiling defined between, for example, the horizontal flanges of spaced inverted T-bars. An air bar is a linear air diffuser incorporating a means of pattern control and including a part of its assembly the basic ceiling support members (e.g. inverted T-bars) forming the slot. An air track is the same as the air bar but does not include the pattern control, a separate diffuser being used in association with the air track to provide pattern control.

Various air plenum constructions, diffuser constructions, and combinations thereof have been provided in the past. Examples of such prior constructions can be found in various U.S. patents issued to Robert R. Lambert, namely U.S. Pat. Nos. 3,227,063, 3,577,904, 3,601,032, 3,601,033, 3,690,243, 3,748,998, and 3,757,667.

This invention is concerned with such constructions and the problems presented thereby.

SUMMARY OF INVENTION

Among the general objects of this invention is to provide a combination air plenum and air outlet which achieves air delivery and return in a suspended ceiling with a minimum of subassemblies and on-site installation steps while improving air delivery charcteristics.

For the achievement of such objects, this invention proposes an elongated, linear air plenum having a passage defining wall which is closed except for an elongated, linear outlet opening. The length of the outlet opening is less than the overall length of the air plenum. An outlet assembly, e.g. a diffuser or a collar, is attached to the wall at the outlet opening and is adapted to register with an assembly defining an elongated, linear slot in a suspended ceiling. The air delivery arrangement so constructed is supported in the ceiling with the plenum being spaced from the ceiling support members so that air delivery is provided through outlet assembly and the slot with a return being provided through the portion of the slot adjacent to that portion of the slot receiving air from the outlet assembly.

A number of linear plenum-outlet assemblies can be arranged end-to-end with open communication therebetween to increase the overall length of the air plenum. The increase in length can be such as to extend completely across a particular room being serviced or across an entire building floor in which case it may span more than one room. The ceiling slot will also have the same basic extension. Outlet openings are provided on a plurality of the plenums and are arranged to maintain the relationship necessary to achieve alternate supply and return areas at the slot.

It will be appreciated that when the plenums are described as being closed allowance is still made for connection to a central air supply through a flexible duct.

With this arrangement, a simple assembly is provided which can be used in a suspended ceiling to provide

supply and return areas at a ceiling slot. A minimum of subassemblies have to be handled by the contractor doing the actual assembly and the pattern of supply and return can be readily varied using the same basic components and without disrupting the overall ceiling. Where a plurality of end-to-end arranged plenum-outlet assembly combinations are used and span a number of rooms or areas, the size of the rooms or areas can be varied as desired and the air supply adjusted to accommodate the change by cutting the plenum and inserting a dam at the appropriate joint or joints.

Other objects and advantages will be pointed out in, or be apparent from, the specification and claims, as will obvious modifications of the embodiments shown in the drawings, in which:

FIG. **1** is a perspective view of an air plenum-diffuser assembly;

FIG. **2** is a section view taken generally along lines **2—2** in FIG. **3;**

FIG. **3** is a side elevation of a plurality of the air plenum-diffuser assemblies of FIG. **1** arranged end-to-end in a suspended ceiling;

FIG. **4** is a section view taken generally along lines **4—4** in FIG. **3;** and

FIG. **5** is an end view, in section similar to FIG. **2,** of an alternative embodiment.

DESCRIPTION OF PREFERRED EMBODIMENTS

With particular reference to the drawings, an air plenum-diffuser assembly **10** is illustrated as including an air plenum **12** which is formed of conventional foil covered duct board. The air plenum has a generally triangular section **14** and a projecting portion **16.** The triangular section forms a linear, elongated principal air passage and projection **16,** which extends the length of the principal air passage, forms an extension off of that principal air passage.

A sheet metal collar **18** is attached to triangular section **14** and registered with an air entry opening **20** to provide for connection of the air plenum to a central supply of air. Diffuser assembly **22** is connected to projection **16** adjacent an elongated opening **24** (see FIG. **2**) provided at the terminal end of projection **16.** The construction of the diffuser and the arrangement thereof relative to the air plenum will be described in more detail hereinafter.

In FIG. **3** a plurality of the air plenum-diffuser assemblies **12, 12***a*, and **12***b* are illustrated as they would be assembled end-to-end in a suspended ceiling. More particularly, the joints between the adjacent air plenum-diffuser assemblies are connected by means of tape **26** and diffusers **22** extend between adjacent pairs of cross-runner T-bars **25.** In a conventional manner, cross-runner T-bars **25** extend at right angles to the main runner T-bars. The main runners are parallel to the two T-bars **27** visible in FIG. **2** which are virtually identical to the main runners but are closer spaced than normal because they form an air track. Before describing the relationship of the air plenum-diffuser assemblies in the suspended ceiling, a specific description of a diffuser assembly and its connection to the air plenum will be made.

Referring to FIG. **2,** diffuser assembly **22** includes side walls **28** and **30** spaced apart to provide an air supply passage **32** therebetween. The opposite ends of the air passage are closed by end plates **34** and **36,** see also FIG. **1.** Pattern control means **38** is provided within the air supply passage **32.** The air pattern control includes

nesting channel shaped weir members **40** and **42.** These weir members are mounted for sliding movement relative to each other in the air supply passage to provide pattern control as well as to control the volume of flow, or completely close a passage to flow if desired. The operation and connection of the weir members in the diffuser are more completely described in Robert R. Lambert's U.S. Pat. Nos. 3,411,425, 3,444,801 assigned to the assignee of this application, and reliance is placed on those prior patents for a more complete description of the weir mounting and function should it become necessary. For purposes of this invention it should be sufficient to explain that nesting weir members **40** and **42** extend the entire length of the linear diffuser **22** and are supported a their opposite ends between mounting members **44** and **46.** Members **44** and **46** (provided at both of the opposite ends of the diffuser but only one illustrated in FIG. **3**) are connected to the side walls **28** and **30** and hold the weir members against vertical movement while permitting generally unrestricted motion of the weirs between the two diffuser side walls.

The actual connection of the diffuser to the air plenum is made by machine screws **48** which extend through the upper portions of diffuser walls **28** and **30,** the duct board forming the opposed walls of projection **16** of the air plenum and through backing plates **50** and **52** provided on the interior walls of projection **16.** The lower ends of walls **28** and **30** rest on the flanges of T-bars **27.** Retaining springs **54** and **56** are provided at space points on the walls of the diffuser and engage the vertical leg of the T-bars. These springs **54** and **56** hold the diffuser rigid between the T-bars minimizing vibration and also will engae the enlarged upper heads **58** of the T-bars to prevent accidental withdrawal of the air plenum-diffuser from between the two T-bars.

As mentioned above T-bars **27** are in the nature of main T-bars runners, but are closely associated so as to form the air track described previously. In other words, the horizontal flanges of the T-bars are spaced apart to provide a slot **100** in the ceiling, the regular ceiling tile **60** being supported on the outer flanges of the T-bars.

With this arrangement, air delivered to the air plenum through opening **20** will flow through opening **24** in the plenum to passage **32** and will discharge through slot **100** into the room or other area being serviced.

The suspended ceiling in which the air plenum-diffuser assembly is utilized is of conventional construction and therefore will not be described in specific detail. It should be sufficient for the purpose of understanding this invention to point out that cross runners **25** are all parallel to each other and extend at right angles to the main runners **27,** the main runners in turn being all parallel to each other. The cross and main runner T-bas are generally supported by wire hangers and on a specific dimension module, i.e. defining 2 by 2 feet squares, 4 by 4 squares, etc. When one or more air plenum-diffuser assemblies are utilized such as illustrated in FIG. **3,** the length of the air plenum, the length of the diffuser attached thereto, and the position of the diffuser on the air plenum are all related to the ceiling module.

As illustrated, the end-to-end arranged air plenums **10** are positioned parallel to the main runners and the length of the air plenum is selected such that it is greater than the distance between two adjacent cross runners (the plenums could be parallel to the cross runners). Specifically, as illustrated, the length of the air plenum is approximately twice the distance between adjacent cross runners and the length of diffuser assembly **22** is approximately equal to the spacing between a pair of adjacent cross runners. With this arrangement, diffuser **22** extends between the cross runners **25** virtually completely filling that area of the slot **100** which is commensurate with the distance between those two cross runners while the extensions of the air plenum beyond the diffusers extend over the cross runners to approximately the midpoint of the adjacent pair of cross runners at which point it engages the next adjacent plenum.

In the specific illustrated embodiment the diffusers, being shorter than the air plenum, are centered on the plenums and areas **62** and **64** of projection **16** on either side of the plenum are closed. Slot **100** extends the entire length of the air plenum assembly, or assemblies as illustrated in part of FIG. **3.** Thus, there will be a slot extending across the cross runners and not only those which have diffusers **22** associated therewith. With the air plenum arrangement described, the spaces between, or adjacent the diffusers, can be utilized effectively and without undue involvement to provide an air return.

More specifically, the portions of slot **100** which are immediately adjacent the slot portions registering with diffusers **22** will be positioned below the closed areas **62** and **64** of the air plenum and the air plenum is spaced above the cross and main runners as is illustrated in the drawings. This arrangement is partly illustrated in FIG. **4** wherein it can be seen that return air can flow upwardly through slot **100** into the attic between the suspended ceiling and the actual structural ceiling. Although no additional elements are necessary to provide the return air path, a baffle insert **66** is provided in the air track mainly for aesthetic reasons. More specifically, overlapping horizontal walls **70** and **72** block the line of sight through slot **100** into the attic so that one in the room being serviced cannot see into the attic through the return air slot.

FIG. **5** illustrates an alternative embodiment wherein the slot **100'** is formed in the ceiling by an air bar assembly **91.** The air bar assembly includes main runners **27'** and weirs **40'** and **42'** supported identical to that described in connection with the embodiment of FIGS. **1–4** and also functioning in the same manner. With this embodiment, a collar **80** is provided at opening **24',** the collar being provided by longitudinal side walls **82** and **84** and end walls **86,** only one end wall is illustrated in the drawing. The collar has shoulders **88** which rest atop the air bar T-bars **27'** so that the air outlet of plenum **12'** registers with the air bar for discharge of air through slot **100'** and air is discharged in the same manner as in the previously described embodiment. The remainder of the air plenum-collar assembly is identical to that described in connection with FIGS. **1–4,** returns, etc.

The longitudinal position of the diffuser or collar on the plenums can be varied as desired. Also, the plenum cross section illustrated is the type which would be used at a room perimeter or adjacent a light fixture. It can have other cross-sectional shapes and the outlet need not be at one side but can be centered or otherwise positioned between the sides of the plenum.

The ends of a single plenum can be closed in a conventional manner, i.e. end plates taped to the plenum body, where one plenum is used or the otherwise open ends of end-to-end arranged plenums can be similarly closed.

Although this invention has been illustrated and described in connection with particular embodiments thereof, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. In combination in a suspended ceiling including a plurality of ceiling members, a plurality of ceiling support members and means defining an elongated slot in said ceiling the improvement of an air delivery arrangement comprising, in combination,

means including a generally closed tubular wall portion defining an elongated, linear plenum air passage,

means defining an elongated, linear opening in said wall portion and extending parallel to the longitudinal axis of said plenum air passage,

the length of said opening being less than the overall length of said linear plenum air passage,

means for delivering air to said plenum air passage for discharge through said opening,

means having a length generally equal to the length of said opening and connected to said wall portion along said opening for connecting said opening to said means defining said slot only along a length of said slot corresponding generally to the length of said opening so that air delivered to said plenum air passage is discharged through a limited length of said slot generally equal to the length of said opening,

and said linear plenum being spaced from said ceiling support members so that air is delivered through said slot from said opening while the length of said slot adjacent that through which air is delivered is in alignment with a closed extension of said tubular wall portion and provides an air return.

2. The apparatus of claim **1** wherein said means connected to said wall portion at said opening comprises a diffuser assembly including, spaced walls projecting laterally from said wall portion and defining a passage therebetween, and pattern control means in said passage to deflect flow through said passage prior to discharge through said slot.

3. The apparatus of claim **1** wherein said means connected to said wall portion at said opening comprises a collar having spaced side and end walls and projecting laterally from said wall portion to define a passage therebetween.

4. The combination of claim **1**

wherein said ceiling support members comprise a first set of mutually parallel ceiling support members and a second set of mutually parallel ceiling support members arranged generally perpendicular to said first set,

including a plurality of said linear plenums all generally identical in construction and each having a length greater than the spacing between adjacent ones of said first set of ceiling support members,

wherein said linear plenums are connected end-to-end parallel to said second set of ceiling support members,

and wherein at least two of said linear plenums include said opening and said means connected to said wall portions at said opening,

so that air is delivered through portions of said slot from said openings while the lengths of said slot adjacent those slot portions through which air is delivered are in alignment with closed extensions of said linear plenums and provide air returns.

5. The apparatus of claim **4**

wherein said means connected to said wall portions at said openings comprise diffuser assemblies including spaced walls projecting laterally from said wall portions and defining a passage therebetween, and pattern control means in said passages to deflect through said passage prior to discharge through said slot,

and wherein said diffusers are centered relative to the length of said linear plenums.

6. The apparatus of claim **4**

wherein said means connected to each of said wall portions at said openings comprises a collar having spaced side and end walls and projecting laterally from said wall portions to define a passage therebetween,

and wherein each of said collars are centered relative to the length of said linear plenums.

7. The apparatus of claim **5**

wherein the ceiling support members of said first set are equally spaced,

wherein said linear plenums each have a length substantially twice the spacing between adjacent ceiling support members of said first set,

and wherein said diffusers have a length substantially equal to the spacing between adjacent ceiling support members of said first set.

8. The apparatus of claim **6**

wherein the ceiling support members of said first set are equally spaced,

wherein said linear plenums each have a length substantially twice the spacing between adjacent ceiling support members of said first set,

and wherein said diffusers have a length substantially equal to the spacing between adjacent ceiling support members of said first set.

* * * * *