United States Patent [19]

Lambert

[11] **3,748,998**

[45] **July 31, 1973**

[54] **AIR BAR CONSTRUCTION FOR FIRE RESISTANT SUSPENDED CEILING**

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[22] Filed: **Dec. 20, 1971**

[21] Appl. No.: **210,186**

Related U.S. Application Data

[63] Continuation of Ser. No. 58,251, July 27, 1970, abandoned.

[52] **U.S. Cl.** ..... **98/40 D,** 52/732

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

[58] **Field of Search** ..... 98/114, 40 D, 40 DL; 52/732, 303, 731

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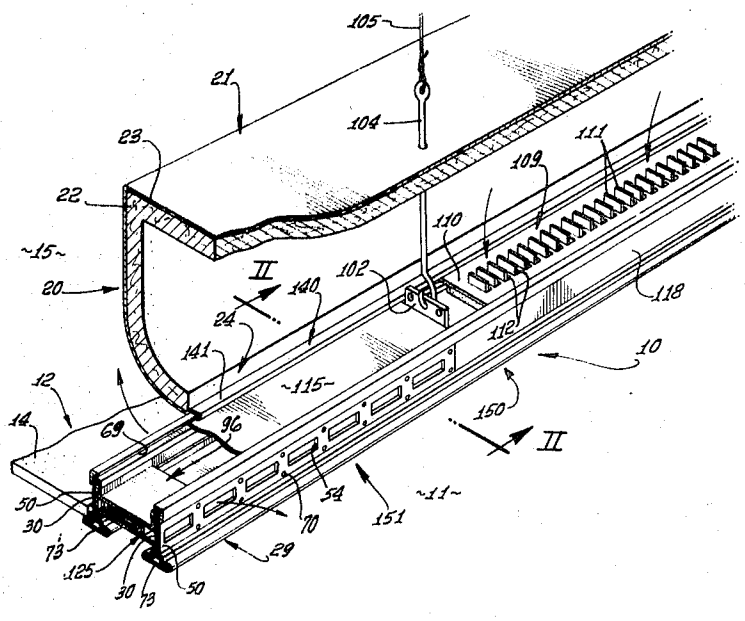
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[57] **ABSTRACT**

Inner and outer members of an inverted T-bar assembly are rolled from sheet metal, each including a vertical web with a horizontal flange extending from the lower edge and a side facing elongated opening in a head portion along the upper edge. The members are riveted together with the horizontal flanges aligned and oppositely extending with a cap therearound to give an inverted T-shape with the upper wall of the inner member extending into the opening of the outer member to engage the upper wall thereof while the upper wall of the outer member is spaced thereabove to form an inwardly opening elongated cavity. Pairs of spacer channels have tongues extending into slots in the lower wall of the inner members to space pairs of inverted T-bar assemblies to form an air bar. The lip of an air plenum chamber flange extends into the opposed T-bar assembly head cavities to mount the chamber over the air bar. In an alternative embodiment, the cooperating slots and tongues are replaced by troughs receiving the edges of the spacer channels.

14 Claims, 8 Drawing Figures



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SHEET 1 OF 2

FIG. 1.

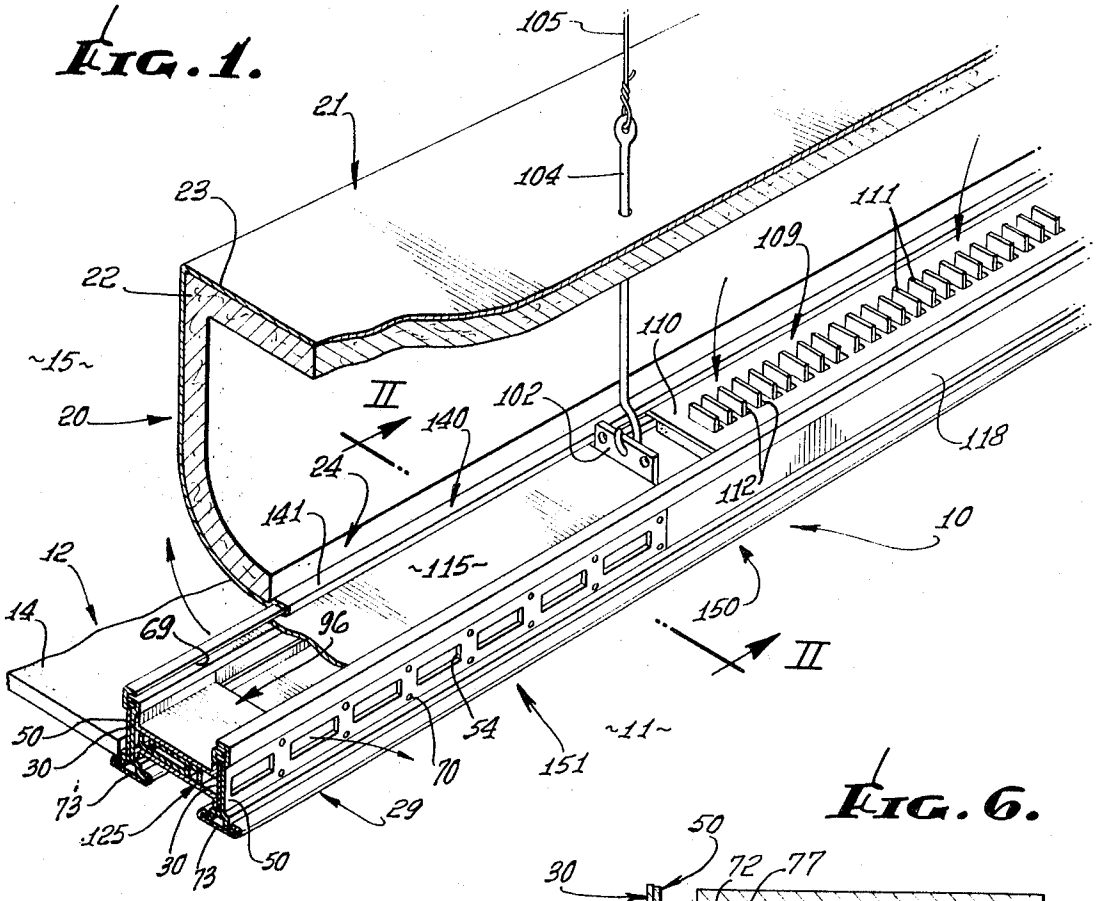


FIG. 6.

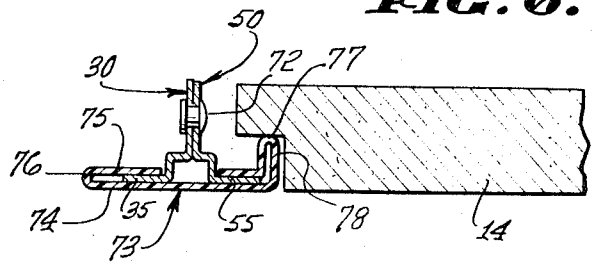


FIG. 8.

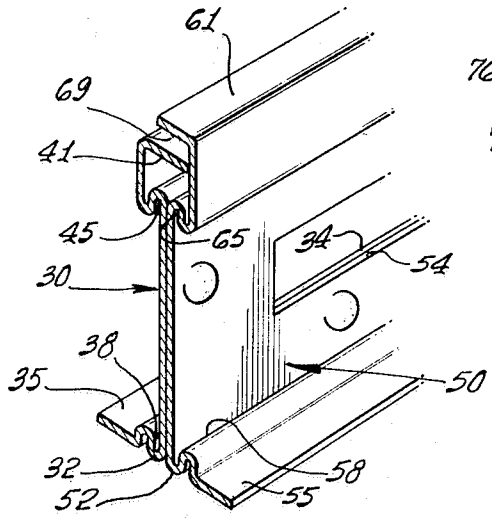
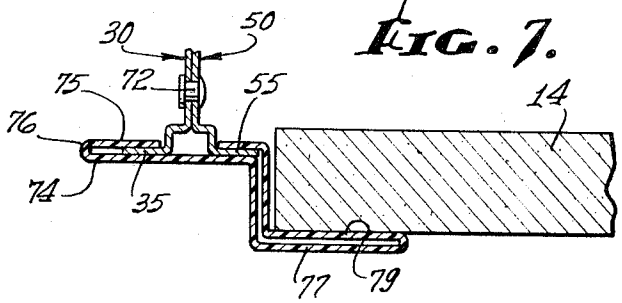


FIG. 7.



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FIG. 2.

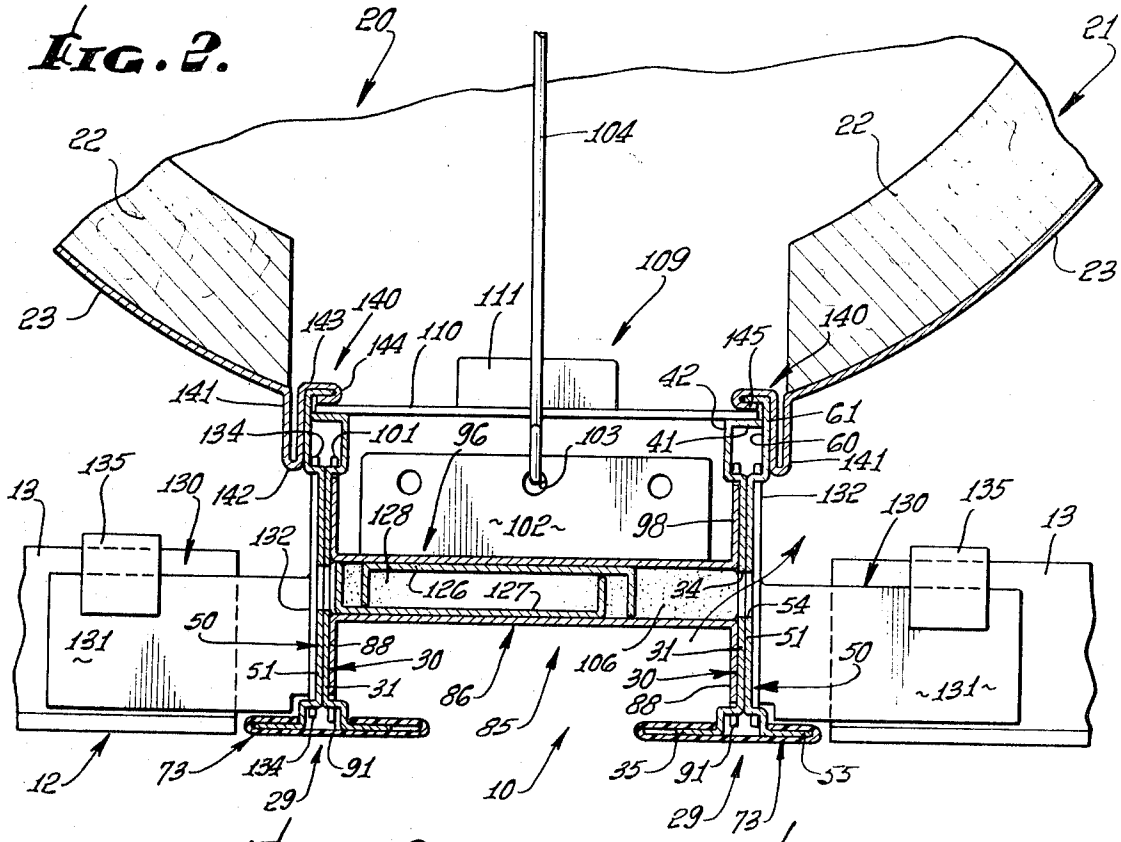


FIG. 3.

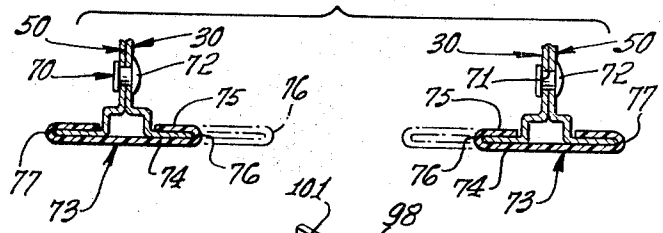


FIG. 4.

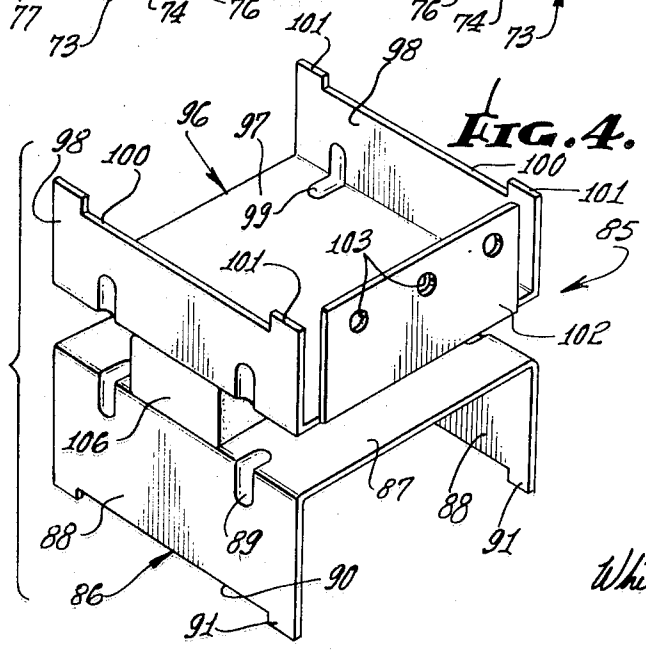
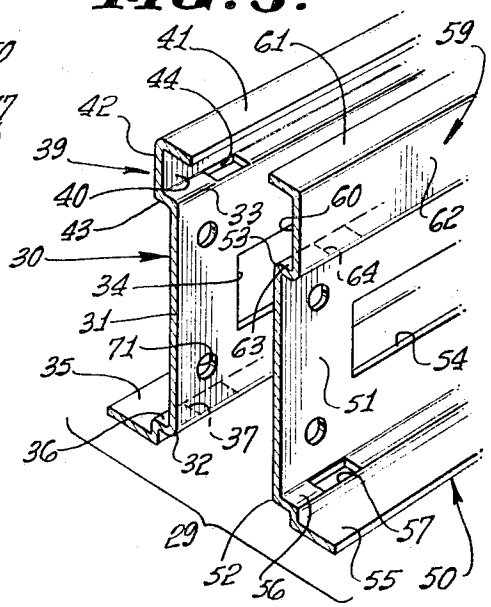


FIG. 5.



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AIR BAR CONSTRUCTION FOR FIRE RESISTANT SUSPENDED CEILING

This application is a continuation of Ser. No. 58,251, filed 7/27/70, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to air diffuser systems, and more particularly to an air bar construction of sheet metal for fire resistant suspended ceilings.

Air bars are provided in suspended ceilings to mount air plenum chambers above the ceiling with the air supplied from therein passing through the air bars to be diffused throughout the room. A very successful design of air bar is assembled from two inverted T-bar members spaced apart by spacer channels having nested weirs therebetween to control the flow of air. These inverted T-bar members also support the adjacent ceiling tile of the suspended ceiling. Heretofore the inverted T-bar members have been extruded from ductile aluminum to be assembled with sheet metal parts into an air bar which is suitably heat resistant for most room installations.

However, extruded aluminum has a low melting point, and for room installations where a fire would burn articles therein producing very high temperatures, i.e., chemicals and certain metals, aluminum T-bar members may melt. The melting of the aluminum T-bar members drops the fire resistant ceiling tile, exposing the heretofore protected real ceiling to the flames, and spreading the fire. If the T-bar members were made of a metal with a higher melting point, they would continue to support the fire resistant ceiling tile in spite of the fire to protect the real ceiling and confine the fire below the suspended ceiling. The higher melting point metals are not easily extruded in desired shapes but are readily available in sheet form. But the desired thickness for such sheets prevents the use of overly complicated bends normally required to form an integral inverted T-bar member. What is needed then is a design of an inverted T-bar member and air bar assemblies which can be easily fabricated out of sheet metal for use with a highly fire resistant suspended ceiling.

BRIEF DESCRIPTION OF THE INVENTION

It is the principal object of this invention to provide a novel air bar assembly easily fabricated out of sheet metal parts for use in a fire resistant suspended ceiling.

Other and additional objects of this invention are to provide such an air bar which is made of a metal having a high melting point, to provide such an air bar made from sheet metal, to provide such an air bar having inverted T-bar assembly with inner and outer members, to provide such an air bar with such assemblies with an inwardly facing elongated cavity along the upper edge thereof, to provide such an air bar with such assemblies having troughs to receive the edges of spacer channels, to provide such an air bar with such assemblies having slots adjacent the vertical web thereof to receive the tongues on the spacer channels, to provide such an air bar with such spacer channels with apertured end plates, to provide such an air bar which is inexpensive to produce and easily assembled.

Further and additional objects of this invention are to provide a method of making the inner and outer members of the inverted T-bar assemblies, and to provide a method of making these members from high melting point sheet metal.

Generally the improved air bar according to this invention for use in a suspended ceiling integrated air diffuser having an air plenum chamber includes inner and outer members, each having a vertical web, a lower horizontal flange, and an upper wall, the upper walls defining an opening therebetween when the members are secured together by means provided therefor for securing the halves together with the horizontal flanges aligned to form an inverted T-bar assembly. Spacer means are also provided for spacing a pair of inverted T-bar assemblies to provide an air bar and for receiving therebetween air control means for controlling the flow of air out of the outlet of the plenum chamber between the inverted T-bar assemblies of the air bar thus formed. The air bar T-bar assemblies thus provided each have an elongated head cavity defined by the space between the upper walls of the inner and outer members for receiving an end lip of an air plenum chamber and edge portions of an air extractor means. The T-bar assemblies have continuous troughs or grooves to receive the edges of spacer channels or spaced slots to receive spaced tongues on the spacer channels to facilitate the assembly of the T-bar assemblies into an operative air bar.

Other and additional objects and advantages of this invention will become more apparent from the detailed description taken in conjunction with the drawing in which;

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view, partially in section, of an air diffuser system in the suspended ceiling structure of a room, with the system including an air bar according to this invention;

FIG. 2 is a sectional view taken along the plane II—II of FIG. 1 showing the construction of the system including the air bar thereof and the preferred embodiment of T-bar assemblies according to the present invention;

FIG. 3 is a view of a portion of FIG. 2 showing a preferred embodiment of flange caps for the T-bar assemblies according to this invention, an alternative embodiment thereof being shown in phantom lines;

FIG. 4 is a perspective view of upper and lower spacer channels and a resilient pad therebetween for the air bar of FIGS. 1 and 2;

FIG. 5 is a perspective exploded view of the inner and outer members of the inverted T-bar assembly of the air bar of FIGS. 1 and 2;

FIG. 6 is a sectional view of the preferred embodiment of T-bar assemblies of FIGS. 2 and 3 showing a third embodiment of flange cap;

FIG. 7 is a sectional view as in FIG. 6 showing a fourth embodiment of the flange cap; and

FIG. 8 is a perspective view of an alternative embodiment of inverted T-bar assembly for the air bar.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

Referring now to the drawings and particularly to FIG. 1, the air bar according to this invention is generally denoted by the numeral 10. The air bar 10 is shown located in a room 11 with a suspended ceiling structure 12. The suspended ceiling structure 12 includes a framework of inverted T-bars 13 for receiving therebetween plaques 14 of the ceiling tile. The suspended ceiling structure 12 defines an attic space 15 there-

above in which is mounted a suspended ceiling integrated air diffuser 20.

The air diffuser 20 includes an air plenum chamber 21 constructed of formed ductboard 22 with a sheet metal cover 23. A downwardly opening longitudinal outlet 24 is provided for passing conditioned air from the plenum chamber 21 through the associated air bar 10. For the particular installation shown, it is contemplated that the suspended ceiling structure will be fire resistant, that is the plaques will be made of a suitable fire resistant material, and the framework 13 will be made of a metal having a high melting point. The air bar 10 for such a suspended ceiling structure 12 must also be made of a material having a high melting point.

Air bar 10, according to this invention, generally includes an inverted T-bar assembly 29 of inner and outer generally L-shaped members 30 and 50 which may be assembled together by securing means 70. Spacer means 85 are also provided for spacing the inverted T-bar assemblies 29 to form air bar 10 and to receive air control means 109 between the assemblies. Bracket or angle means 130 are provided in association with air bar 10, as seen in FIG. 2, for securing the framework 13 thereto. The individual constituent parts are formed of high temperature, low ductility metal, preferably in sheets, and assembled as part of the ceiling structure 12.

As best seen in FIGS. 2 and 5, the inverted T-bar assembly 29 includes an inner generally L-shaped member 30 and an outer generally L-shaped member 50. The inner generally L-shaped member 30 has a vertical web 31 between a lower edge 32 and upper edge 33 with a multiplicity of spaced slots 34 through the vertical web 31. A horizontal flange 35 extends outwardly from the lower edge 32 of the vertical web 31. The horizontal flange 35 has a ridge 36 at the juncture of the flange 35 with the web 31. The ridge 36 in one embodiment has slots 37 therethrough and in a second embodiment, as seen in FIG. 8, forms an upwardly opening trough 38 adjacent the vertical web 31 for a purpose which will appear later.

Wall means 39 are provided at the upper edge 33 of the web 31 forming a head portion with an opening 40 facing oppositely from the direction the horizontal flange 35 extends. Wall means 39 includes an upper horizontal wall 41 joining a vertical wall 42 which extends to a lower wall 43 joined to the upper edge 33 of the vertical web 31. The lower wall 43 is provided with spaced slots 44 similar to the slots 37 in the ridge 36 of the horizontal flange or, in a second embodiment as seen in FIG. 8, a downwardly opening trough 45 opposite the trough 38 of the horizontal flange 35.

The outer generally L-shaped member 50 for the inverted T-bar assembly 29 is generally a mirror image of the member 30. The outer member 50 has a vertical web 51 between a lower edge 52 and upper edge 53 with spaced slots 54 through the vertical web 51. A horizontal flange 55 extends outwardly from the lower edge 52 of the vertical web 51 and has a ridge 56 with slots 57 therein or as seen in FIG. 8 the alternative embodiment has an upwardly opening trough 58 along the vertical web 51.

At upper edge 53 of the vertical web 51 are wall means 59 forming a head portion with an opening 60 facing oppositely from the direction the horizontal flange 55 extends. The wall means 59 includes a upper wall 61 joining a vertical wall 62 which extends to a lower wall 63 joined to the upper edge 53 of the vertical web 51. The lower wall 63 is provided with spaced slots 64 similar to the slots 57 or in an alternative embodiment as seen in FIG. 8, a downwardly opening trough 65 opposite the upward opening trough 58.

It is contemplated that the members 30 and 50 will be formed out of a suitable high melting point sheet metal such as sheet steel. The members 30 and 50 are preferably rolled through roller dies to bend the flat sheet metal into generally L-shapes of the members 30 and 50. The members 30 and 50 may be rolled through the same roller dies as the cross-sectional shape of the members 30 and 50 is identical except for the position of the upper walls 41 and 61. The upper wall 61 of the outer member 50 is spaced further from the horizontal flange 55 than the upper wall 41 of the inner member 30 is spaced from the horizontal flange 35. To accommodate this difference in spacing, the roller die forming the upper walls 41 and 61 must be movable between two positions to form the two walls 41 and 61.

If the same width of sheet metal is used to form both the inner and outer members 30 and 50, the difference in the spacing of the upper walls 61 and 41 and corresponding difference in the spacing of the upper walls 61 and 41 and corresponding difference in length of vertical walls 62 and 42 will cause the width of the upper wall 61 to be less than the width of the upper wall 41. The difference in width of the upper walls 61 and 41 is not objectionable and can be used advantageously as will be explained later.

As best seen by comparing FIGS. 5 and 2, the inner and outer members 30 and 50 are assembled by placing the vertical webs 31 and 51 thereof together with the horizontal flanges 35 and 55 thereof extending oppositely and horizontally aligned. In this position, the slots 54 of the vertical web 51 are aligned with the slots 34 in the vertical web 31. In assembling the members 30 and 50, the upper wall 41 of the inner member 30 extends into the opening 60 to engage the vertical wall 62. The engagement of the upper wall 41 with the vertical wall 62 spaces the outer member 50 being spaced from the horizontal flange 55 a greater distance than the upper wall 41 is spaced from the horizontal flange 35, causes the upper wall 61 to be positioned over the upper wall 41. It is contemplated that there will be suitable spacing between the upper wall 61 and the upper wall 41 to form a cavity 69 therebetween.

The means 70 for securing the members 30 and 50 together include holes 71 in the vertical webs 31 and 51 with rivets 72 passing therethrough. The securing means 70 also includes flange caps 73 partially around the aligned horizontal flanges 35 and 55. The flange caps 73 have a lower panel 74 with return bent ends 75 forming an air deflector border 76 and a tile supporting border 77. The air deflector border 76 as best seen in FIG. 3 can be adjacent the free edge of the flange 35 or as shown in phantom lines can be inwardly extended for purposes which will appear later. The tile supporting border 77 may have a straight edge as shown in FIG. 3, may have an upturned edge 78 as shown in FIG. 6 or may have a stepped edge 79 as is shown in FIG. 7. Each of the different embodiments of the tile supporting border are for different shapes of plaques 14 to give different ceiling effects to the suspended ceiling structure 12.

The air bar 10 in the preferred embodiment is also supplied with means 85 for spacing pairs of inverted

T-bar assemblies 29. As best seen in FIG. 4 the means 85 includes lower spacer channels 86, each having a horizontal web 87 with vertical sides 88 joined at the upper edges thereof. Reinforcing notches 89 are provided therein to strengthen the junction. The vertical sides 88 have lower edges 90 with spaced tongues 91 extending downwardly therefrom. The tongues 91 are adapted to mate with the slots 37 and 57 in the horizontal flanges 35 and 55.

The means 85 also includes upper spacer channels 96 which are quite similar to the lower spacer channels 86. Each upper spacer channel 96 includes a horizontal web 97 with vertical sides 98 joined at the lower edges thereof to the vertical web. Reinforcing notches 99 are provided to strengthen the junction. The vertical sides 98 have vertical edges 100 from which spaced tongues 101 extend upwardly. Each upper spacer channel 96 also has a hanger plate 102 extending upwardly from the horizontal web 97 between the vertical sides 98. The hanger plate 102 has holes 103 therethrough for receiving hanger hooks 104 suspended on wires 105 from the ceiling of the room 11. The upper and lower spacer channels 86 and 96 have therebetween a resilient block 106 to space the horizontal webs 97 and 87 thereof apart and bias the spacer channels 86 and 96 apart.

The air bar 10 according to the preferred embodiment is provided with conventional air control means 109 for controlling the flow of air therethrough. The air control means 109 includes extractor plates 110, each having a row of upwardly protruding air vanes 111 to direct the air through openings 112 in the extractor plate 110. The air control means 109 also includes blank-off plates 115 for preventing the flow of air through the air bar 10.

The air control means 109 also includes knock-out plates 117 initially provided in the slots 34 and 54 of the vertical webs 31 and 51 of the inner and outer members 30 and 50. Additionally, closing plates 118 are provided to close the slots 34 and 54 once the knock-out plates have been removed. The closing plates 118 will have suitable spaced tongues or upper and lower edges as needed.

The air control means 109 also includes a weir set 125 having upper and lower U-shaped channels 126 and 127 nested together with a resilient pad 128 therebetween. The weir set 125 is laterally spreadable or contractable as described in U.S. Pat. No. 3,411,425 to control direction, velocity and volume of air discharge when mounted in an air diffuser system 20.

The splicing means 130 shown includes angle plates 131 with vertical webs 132, one of which webs has edges from which upper and lower tongues 134 extend as needed. The securing means 130 is provided with clips 135 to attach the angle plates 131 to the framework 13 as required.

The mounting means 140 for mounting the plenum chamber 21 to the air bar 10 includes a pair of flanges formed in the metal cover 23 surrounding the duct board 22 of the chamber 21. The flanges 141 as seen in FIG. 2, each has a vertical return bent portion 142 joined to a horizontal portion 143 with a vertical portion 144 terminating in a lip 145. The lip 145 will extend into cavities 69 for mounting the plenum chamber 21 to the air bar 10.

The air bar 10 is assembled by joining the inverted T-bar assemblies 29 as has been previously explained, inserting the tongues 91 of the lower spacer channels 86 in the slots 37 and 57, placing the resilient block 106 on the horizontal web 87 thereof, laying the nested weirs 125 with the channels 126 and 127 contracted along the web 31 of one of the assemblies 29, inserting the tongues 101 of one side 98 of the upper spacer channel 96 into the slot 34, and bending the upper spacer channel 96 over the nested weirs to insert the other tongues 101 into the other slots 34. If the alternative embodiment of the inverted T-bar assembly 29 as shown in FIG. 8 is provided the tongues 91 and 101 will be eliminated and the edges 90 and 100 will be inserted into the troughs 38 and 45.

The extractor plates 110 and blank-off plates 115 may be inserted between the spaced pair of inverted T-bar assemblies 29 with the edges thereof in the cavities 69 to divide the air bar 10 into supply sections 150 and return sections 151. The knock-out plates adjacent the supply sections 150 will be left in or if they have already been removed, closing plates 118 will be provided at the supply sections 150 to close the slots 34 and 54. The closing plates 118 will have the spaced tongues 19 inserted into the slots 57 and 64 in the preferred embodiment or the upper and lower edges 120 into the troughs 58 and 65 of the alternative embodiment. For the return sections 151 under the blank-off plates 115, the knock-out plates will be removed to open the slots 34 and 54 to permit air to return to the attic space outside of the air plenum chamber 21. The lips 145 of the flange 141 are located in the cavities 69 along with the edges of the plates 110 and 115 to mount the air plenum chamber 21 over the air bar 10. The angle plates 131 and clips 135 will secure the air bar 10 into the suspended ceiling structure 12. The plaques 14 of the fire resistant material will be suitably mounted by the tile support border 77 of the flange cap 73.

When the suspended ceiling structure 12 is all asembled, the conditioned air from the air plenum chamber 21 passes through the outlet 24 thereof, through the openings 112 in the extractor plate 110 to pass around the nested weirs 125 to be deflected by the air deflector borders 76 of the flange caps 73 to be diffused throughout the room 11. It should be noted that the smaller width of the upper wall 61 permits the vertical portion 144, to pass along the inner edge thereof without restricting the flow of air through the air bar 10. Also, it should be noted by comparing FIGS. 2 and 3, that the adjacent air deflector borders 76 determine the area of the opening between the pair of inverted T-bar assemblies 29 and therefore the volume of air at a given pressure that passes therethrough to be diffused throughout the room. The provision of different caps 73 with different air deflector borders 76 permits the air bar 10 to be assembled for the desired air flow.

The air after having been diffused throughout the room 11 passes through the return sections 151 of the inverted T-bar assemblies 29. The air moves through the aligned slots 34 and 54 into the attic space 15 with the blank-off plates 115 preventing the conditioned air from the outlet 24 of the plenum chamber 21 from moving through the slots 34 and 54, without having been diffused throughout the room 11.

The construction of the inverted T-bar assembly 29 from inner and outer members 30 and 50 formed from high temperature sheet metal makes the air bar 10 fire resistant. The balance of the air bar 10 constituent

parts may also be formed of the same sheet metal enabling the ceiling structure **12** containing the air bar **10** according to this invention, to support the fire resistant plaques **14** during a fire of much hotter temperature than a conventional air bar would support.

I claim:

1. An air diffuser bar for use in a suspended ceiling integrated air diffuser having the combination of an air plenum chamber in the attic over a suspended ceiling, with the outlet thereof directing air downwardly through the air bar, and air control means for controlling the flow of air through the air bar, the improvement in the air bar comprising :

inner and outer elongated, generally L-shaped members, each of said members including a vertical web, a horizontal flange at the lower edge of said web extending in one direction away from said web and wall means at the upper edge of said web for defining an elongated head portion having an elongated opening therein facing in the other direction away from said web, said wall means being suitably spaced to provide an inwardly opening elongated cavity for receiving portions of the air control means when the members are secured together;

means securing said members together with the horizontal flanges of each of the member aligned and oppositely extending to form an inverted T-bar assembly; and

means for spacing pairs of inverted T-bar assemblies apart to provide an air bar for receiving the air plenum chamber thereover whereby air from the outlet thereof is directed between the spaced pairs of inverted T-bar assebmlies, to pass therethrough and to diffuse into the room.

2. The invention as in claim **1** wherein the head portion includes an upper wall, the upper wall of one of said members being spaced a greater distance from the horizontal flange of the one of said members than the upper wall of the other said members is spaced from the horizontal flange of the other of said members, said upper wall of the other of said members being received in the opening hollow said upper wall of the one of said members when the members are assembled to provide the inwardly opening elongated cavity.

3. The invention as in claim **2** wherein the head portion includes a vertical wall, said upper wall of the other of said members engaging the vertical wall of the one of said members to space the vertical wall of the other of said members therefrom.

4. The invention as in claim **1** wherein air plenum chamber mounting means is provided, said mounting means including an elongated lip for being inserted into the elongated cavity of the air bar to secure the air plenum chamber to the air bar.

5. The invention as in claim **4** wherein said upper wall of the one said members extends in the other direction less than the distance the upper wall of the other of said members extends, said upper wall of the one of said members being spaced from the plane of the vertical wall of the other of said members when the members are together, said mounting means have a vertical section with the lip extending from the lower edge thereof, said vertical section passing between the edge of the upper of the one of said members and the plane of the vertical wall of the other of said members.

6. The invention as in claim **1** wherein the means spacing the pairs of inverted T-bar assemblies includes U-shaped spacer channels, each with an horizontal web flanked by vertical sides, said channels extending between vertical webs of the inner members of the pairs of inverted T-bar assemblies, and the wall means at the upper edge of said web include a lower wall extending in the one direction of the web, said wall having a downwardly opening trough formed therein at the upper edge of the vertical web, the edges of said vertical sides of said spacer channels being received in the troughs of the air of inverted T-bar assemblies.

7. The invention as in claim **1** wherein the means spacing the pairs of inverted T-bar assemblies includes U-shaped spacer channels, each with an horizontal web flanked by vertical sides, said channels extending between vertical webs of the inner members of the pairs of inverted T-bar assemblies and

wherein a raised ridge is formed in the horizontal flange at the lower edge of the vertical web, said ridge having a multiplicity of spaced slots therein along the web, and the vertical sides of the spacer channels have a like number of spaced tongue means for being received in the spaced slots, said tongue means and said slots cooperating to hold the spacer channels between the pair of inverted T-bar assemblies.

8. The invention as in claim **1** wherein the means spacing the pairs of inverted T-bar assemblies includes U-shaped spacer channels, each with an horizontal web flanked by vertical sides, said channels extending between vertical webs of the inner members of the pairs of inverted T-bar assemblies, and

wherein the head portion includes a lower wall extending in the one direction from the web, said wall having a multiplicity of spaced slots therein along the vertical web, and the vertical sides of the spacer channels have spaced tongue means for being received in the spaced slots , said tongue means and said slots cooperating to hole the spacer channels between the pair of inverted T-bar assemblies.

9. The invention as in claim **8** wherein some of the spacer channels have an apertured vertical plate between the vertical sides for closing the spaced thereof and for receiving hooks attached to the room ceiling.

10. In a suspended ceiling integrated air diffuser having an air plenum chamber opening through an air control means mounted in an air bar of inverted T-bar members spaced apart by spacer channels, the improvement in the inverted T-bar members for use in an air bar, comprising:

inner and outer elongated generally L-shaped members said members each including a vertical web, a horizontal flange at the lower edge of said web extending in one direction away from said web and wall means at the upper edge of said web for defining an elongated head portion having an opening therein facing in the other direction away from said web, said wall means of each of said members being suitably spaced apart from one another to provide an inwardly opening elongated cavity for receiving portions of the air control means when the members are secured together, and

means securing the members together with the horizontal flanges thereof aligned and oppositely extending to form the inverted T-bar assembly.

11. The invention as in claim **10** wherein the head portion includes an upper wall, said upper wall of said outer member being a greater distance above the hori-

zontal flange thereof than the upper wall of said inner member, when said members are assembled, the upper wall of the outer member being spaced above the upper wall of said inner member to define an elongate cavity therebetween to provide the inwardly opening elongated cavity.

12. The assembly as in claim 11 wherein the head portion includes a vertical wall, and the upper wall of the inner member extends into the opening of the outer member to engage the vertical wall thereof and space the vertical walls of the members apart.

13. The assembly as in claim 10 wherein the members have a ridge formed in the horizontal flange adjacent the vertical web, said ridge having a multiplicity of spaced slots therethrough adopted to receive tongues of spacer channels.

14. The member as in claim 10 wherein the head portion includes a horizontal wall extending in the one direction from said web, said wall having a multiplicity of spaced slots therethrough adjacent the vertical web, adopted to receive the tongues of spacer channels.

* * * * *