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Lambert

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[54] **CEILING TILE PLENUM BOUNDARY SUSPENDED CEILING CONSTRUCTION**

[75] Inventor: **Robert R. Lambert,** Glendora, Calif.

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

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[58] **Field of Search** ..... 52/288; 55/502, 484, 55/483; 98/40 D, 40 DL

[56] **References Cited**

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Primary Examiner—William E. Wayner

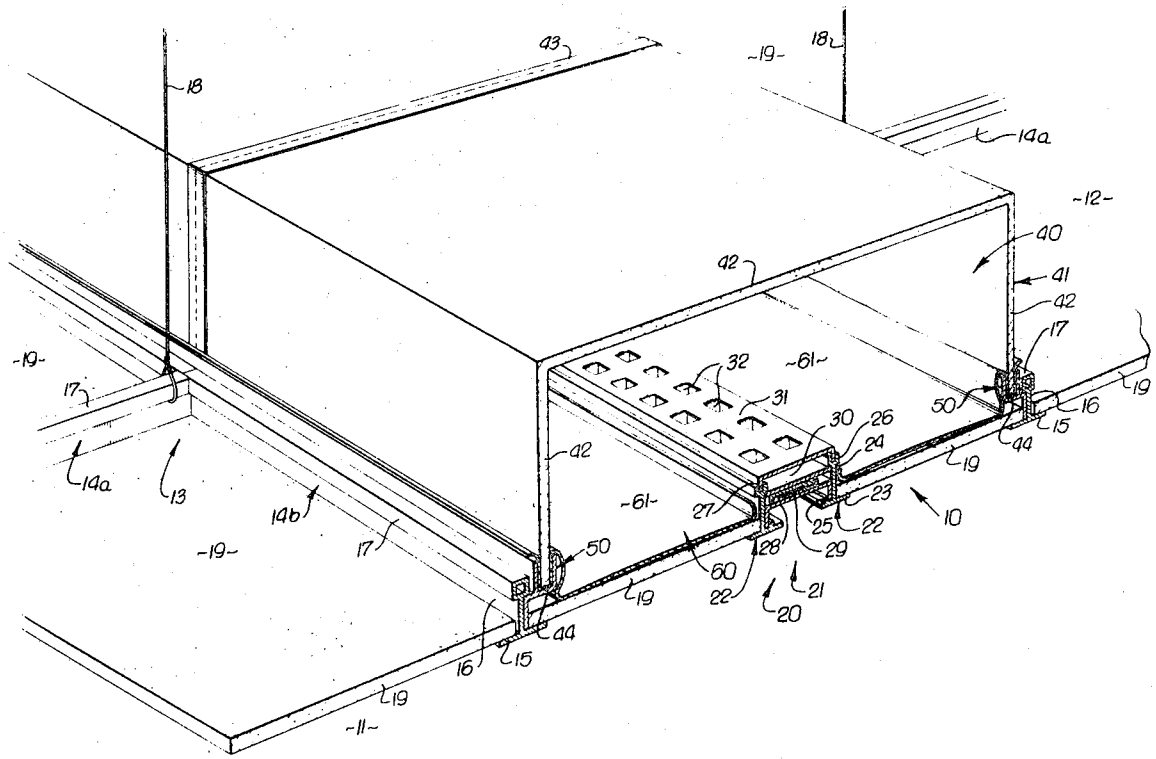
Assistant Examiner—William E. Tapolcai, Jr.

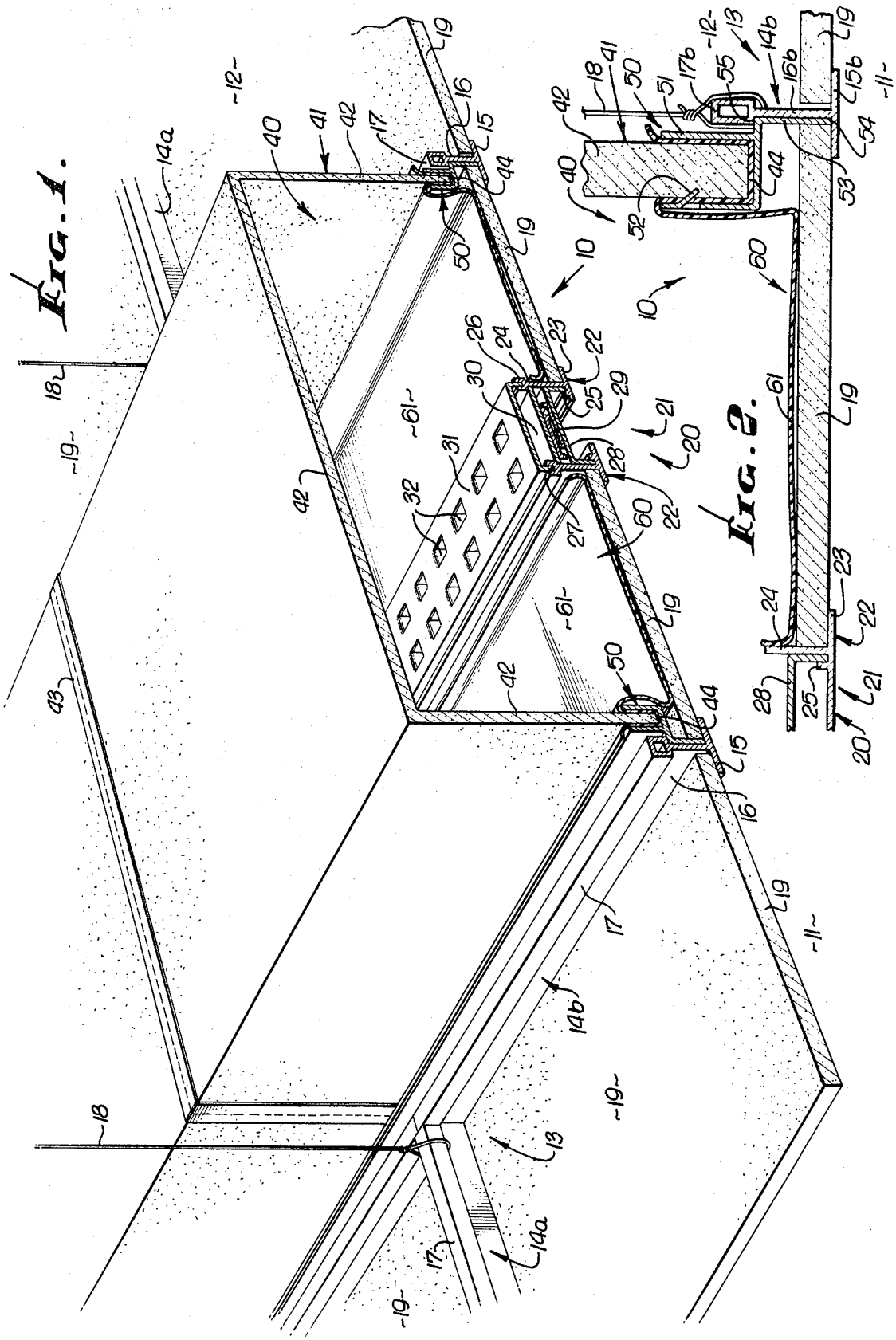
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[57] **ABSTRACT**

An air troffer has an imperforate flexible membrane sheet with the outer marginal edge located between the edge of an inverted channel section and the feet of the troffer. Upon the air troffer being mounted on the gridwork of a suspended ceiling over an air bar and over the ceiling tile, between the air bar and the gridwork, the sheet drapes from the troffer over the gridwork, over the ceiling tile and over a portion of the air bar to provide a boundary for an air plenum which does not leak air.

7 Claims, 2 Drawing Figures




FIG. 1.
FIG. 2.

CEILING TILE PLENUM BOUNDARY SUSPENDED CEILING CONSTRUCTION

BACKGROUND OF THE INVENTION

This invention relates to air distribution systems and more particularly to such air distribution systems integrated into a suspended ceiling wherein the ceiling forms a boundary for an air plenum above the ceiling.

The use of air troffers to form air plenums with the suspended ceiling tiles was previously disclosed in my copending application for United States Letters Patent, Ser. No. 133,284 filed Apr. 2, 1971, now U.S. Pat. No. 3,690,243 and entitled "Suspended Ceiling Framework Supported Troffer Air Distribution System."

In that application, a system is disclosed which has effectively continuous arrays or rows of resilient inverted channel members, each having lower feet thereon for insertion on and between the runners of a suspended ceiling framework over an air control means extending between the runners. Ceiling tiles are inserted between the runners and the air control means to close the inverted channel members for conducting air therealong for delivery to the air control means.

In using the air troffer, it was discovered that air losses occurred due to the lack of an effective seal between the ceiling tile and the supporting structure of the ceiling tile, i.e., the runners and the air control means. For many uses, this air leakage is not objectional and in fact adds to the ventilating of the system. However, for other uses, any air leakage is objectionable. For these other uses, the system of air troffers closed by ceiling tile is not suitable.

It would seem a simple matter to seal the junctures of the ceiling tile with the runners and with the air control means, but it is not. The ceiling tiles, for example, could be caulked about their peripheral edge but there is no simple way to apply pressure to the caulking when the tile is positioned on its supporting structure. Also the use of caulking would prevent the raising of the ceiling tile to gain access to the air control means of the troffer. Other conventional methods of sealing the ceiling tile to the runners and the air control means also present these or similar disadvantages which makes them unsuited for this purpose.

BRIEF DESCRIPTION OF THE INVENTION

Therefore it is the primary object of this invention to provide a novel air distribution system wherein the suspended ceiling forms a boundary for an air plenum above the ceiling without the loss of air through the ceiling.

Other and additional objects of this invention are to provide such a system wherein the junctures between the ceiling tiles, the gridwork and the air distribution components are sealed against the passage of air therethrough; to provide such a system wherein the ceiling tiles can be raised and returned to their position on the gridwork without destroying the seal; to provide such a system wherein sealing occurs automatically upon pressurization of the air plenum; to provide such a system wherein the sealing means drapes across the ceiling tile, the ceiling gridwork and the ceiling air distribution components; to provide such a system in which the sealing means is secured to the walls defining the plenum chamber; and to provide such a system which is inexpensive to manufacture, to install, and to maintain to effectively prevent air leakage from the air plenum through the ceiling tiles and their junctures with the ceiling gridwork and the air distribution components.

Generally, stated, the suspended ceiling construction has a ceiling gridwork, air distribution components integrated into the gridwork, and ceiling tiles closing the spaces between the gridwork and the air distribution components, with some of the tiles forming a boundary for an air plenum above said gridwork, the improvement, according to this invention, including the provision of sealing membrane means overlaying at least some of the tiles for sealing the boundary of the plenum formed by the tiles against leakage of air therethrough. The sealing membrane means may be a sheet of flexible imperforate material draped upon the upper side of the ceiling. The air distribution components may include an air troffer to which the outer edge of the sheet is sealingly attached between the feet and the channel section thereof and may include air control means against a portion of which the sheet drapes.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a suspended ceiling having the improved ceiling tile plenum boundary construction, according to this invention.

FIG. 2 is an enlarged, fragmentary, end cross-sectional view of the suspended ceiling of FIG. 1 showing the sealing membrane sheet carried by the air troffer and draped across the ceiling tile, to the air diffuser assembly to prevent air leakage.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing and particularly to FIG. 1, the suspended ceiling construction is generally denoted by the number **10**. The suspended ceiling **10** is shown mounted in a room **11** to provide an attic space **12**, above the suspended ceiling **10** and below the real ceiling of the room, in which heating and air conditioning ducts, utility ducts, etc., are mounted.

The illustrated suspended ceiling has a ceiling grid work **13** dividing the ceiling space into smaller generally rectangular spaces. The gridwork **13** includes main runners **14***a* and cross runners **14***b* of inverted T-bar members. The inverted T-bar members each have a horizontal flange **15**, a vertical web **16** and a head ridge **17**. The gridwork **13** is hung from the real ceiling of soffet wires **18**. Ceiling tile **19** of suitable rectangular shape and size are inserted into the rectangular spaces to rest upon and extend between the horizontal flanges **15** of the runners **14**.

The illustrated suspended ceiling **10** also has air distribution components **20** located therein to be supported thereby. The air distribution components **20** illustratively include air control means such as an air diffuser assembly **21** as is taught in my copending application for U.S. Letters Patent Ser. No. 815,838, filed Apr. 14, 1969, now U.S. Pat. No. 3,598,283 and entitled "Suspended Ceiling Integrated Air Distribution System."

The air diffuser assembly **21** is constructed of spaced inverted T-bar members **22**; each having a horizontal flange **23**; a vertical web **24**; an inside, upwardly extending rib **25** in the flange **23** and spaced from the web **24**; and a head ridge **26** with an upwardly opening longitudinal groove **27**. Weir-supporting inverted channels **28** have the lower edges thereof inserted into the space between the ribs **25** and the vertical webs **24** to seat on

the horizontal flanges 23 of the inverted T-bar members 22. The webs of the channels 28 space the members 22, and support a nested pair of weir members 29 as is taught by my U.S. Pat. No. 3,411,425. Plates 30 extend under the head ridges 26 to abut the vertical webs 24 and space them apart while retaining the nested weir members 29 on the channels 28. The air diffuser assembly 21 is completed by the provision of an extractor channel 31 with the lower edges located in the grooves 27 of the head ridges 26 while the perforated web thereof, having extractor vanes 32, is centrally located over and between the spaced inverted T-bar members 22.

Illustratively, the air diffuser is shown extending between main runners 14*a* and centrally located between cross runners 14*b*. The spaces between the inverted T-bar members 22 of the air diffuser assembly 21 and the adjacent inverted T-bar members of the runners 14 are closed by specially sized ceiling tile 19 extending between the flanges 23 and 15 to rest thereon and close the space therebetween ready for forming an air plenum 40.

The air plenum 40 is provided for carrying conditioned air to the attic place 12 over the air diffuser assembly 21 to pass through the air diffuser assembly 21 and be diffused throughout the room 11. The exemplary air plenum 40 includes an inverted channel member or troffer 41 as is taught by my copending application for U.S. Letters Patent, Ser. No. 132,284, filed Apr. 2, 1971, and entitled "Suspended Ceiling Framework Supported Troffer Air Distribution System." The troffer includes the provision of an originally generally flat rectangular ductboard section 42. The ductboard section has been longitudinally notched to be folded into an inverted channel member 41. The individual sections, may be taped at 43 to be joined together, ready to receive feet means 50 on the lower edges 44 thereof.

Feet means 50 are provided for mounting the inverted channel members to the adjacent runners 14. The feet means 50 include an upwardly opening channel portion 51 sized to receive the lower edges 44 of the sections 42 therein, with an interference fit. The side walls of the channel portion 51 have downwardly pointing teeth 52 therein, which extend into the ductboard section 42 adjacent the lower edges 44 to hold the lower edges 44 within the foot channels 50. The foot channels 50, each also have offset foot portion 53 with a lower edge 54 for resting on the flange 15*b* adjacent the web 16*b* of the cross runners 14*b*. An upper edge 55 is provided on the foot portion 53 for extending under the head ridge 17*b* of the cross runner 14*b*. The upper and lower edges 55 and 54 vertically hold the feet means 50 to the cross runners 14*b*. The insertion of the ceiling tile 19 holds the foot portions 53 against the vertical webs 16*b* while closing the lower open side of the inverted channel members or troffers 41 for carrying air.

As the air passes down the troffers 41, the junctures of the ceiling tile 19 with the runners 14 and with the air diffuser assembly 21 may present gaps through which the air can leak through the suspended ceiling 10 and into the room 11 therebelow, without being properly diffused by the air diffuser assembly 21. In order to prevent such leakage of air, sealing membrane means 60, according to this invention, are provided for sealing the boundary of the plenum, formed by the tiles 19, against the leakage of air.

In the preferred embodiment the sealing membrane means 60 includes a sheet 61 of flexible imperforate material, preferably a thin plastic sheet. The sheet 61 is generally rectangular in shape and, as best seen in FIG. 2, has its peripheral outer edge inserted into the channel portion 51 of the feet means 50 under the lower edge 44 of the ductboard section 42 to be sealingly held thereby to the air troffer 41. The teeth 52 will extend through the sheets 61 to hold the sheet 61 in the channel portion 51 of the feet means 40 while the walls of the channel portion 51 press the sheet sealingly against the section 42. The sheet 61 will drape or overlay from the feet means 50 along the ceiling tile 19 and along one side of the web 24 of the air diffuser assembly 21, to provide a boundary which is unbroken and so can not leak air. Upon pressurization of the plenum, the air therein will press the sheet 61 against the ceiling tile 10 to conform the sheet 61 the upper surface of the runners 14, ceiling tile 19 and a portion of the air diffuser 21 to provide a sealed upper surface which acts as the boundary of the air troffer 41.

If for any reason, access is needed into air troffer 41 or into the attic space 12 above the suspended ceiling 10, the ceiling tile 19 may be raised, raising the sheet 61 to provide such access. Upon lowering of the ceiling tile 19 and repressurization of the troffer 41, the sheet 61 will reseal against the upper surface as before to prevent any air leakage.

Thus the improvement, according to this invention, in a suspended ceiling construction provides sealing membrane means to close the junctures between the ceiling tile and the runners and the air distribution components to provide a boundary for an air plenum which is sealed against air leakage therethrough.

I claim:

1. In a suspended ceiling construction having a ceiling gridwork, air distribution components integrated into the gridwork, and ceiling tile closing the spaces between the gridwork and the air distribution components, with at least some of said tiles forming a boundary for an air plenum above said gridwork, the improvement comprising the provision of

sealing membrane means overlaying all of said tiles for sealing the boundary of the plenum formed by said tiles against the leakage of air therethrough.

2. The improvement as in claim **1** wherein the sealing membrane means comprises a sheet of flexible, imperforate material draped upon the upper side of the tiles within the plenum.

3. In a suspended ceiling construction having a ceiling gridwork, air distribution components integrated into the gridwork, wherein the air distribution components include air control means mounted to and between the gridwork and include an inverted channel member mounted to and between the gridwork over the air control means, and ceiling tile closing the spaces between the gridwork and the air distribution components with the tile closing the space between the channel member and the air control means with at least some of said tiles forming a boundary for an air plenum above said gridwork, the improvement comprising the provision of:

sealing membrane means overlaying at least some of said tiles for sealing the boundary of the plenum formed by said tiles against the leakage of air there-

through, said sealing membrane means comprising a sheet of flexible, imperforate material draped upon the upper side of the tiles within the plenum; and

means for sealingly holding the peripheral outer edge portion of said sheet of material against the channel member.

4. The improvement as in claim **3** wherein the inverted channel member includes as inverted channel section, and feet means for mounting the channel section to the gridwork, and wherein the holding means includes the provision of a wall on the feet means and against the channel section, said sheet having its peripheral outer edge received between the channel section and the wall of the feet means to sealingly engage the channel section.

5. An improved air troffer for use with a suspended ceiling gridwork of main and cross runners having air control means mounted to and between a first pair of runners, and extending parallel to but spaced from an adjacent second pair of runners, and having ceiling tile extending between and supported by the runners and the air control means, said air troffer comprising

an inverted channel section,

feet means for mounting the inverted channel section to the adjacent pair of runners over the air control means, and

sealing membrane means sealingly attached to the section for draping across the tile and against the air control means to sealingly close the opening of the channel section around the air control means.

6. The invention as in claim **5** wherein the sealing membrane means includes a sheet of flexible imperforate material suitably sized to drape across the ceiling tile and against the air control means, and means for sealingly attaching the sheet to the inverted channel section.

7. The invention as in claim **6** wherein the means for sealingly attaching the sheet includes the provision of walls on the feet means for receiving thereagainst the section and the outer edge portion of the sheet, said walls pressing the outer edge portion of the sheet into sealing engagement with the section.

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