United States Patent [19]

Halfaker

[11] **3,743,826**

[45] **July 3, 1973**

[54] **CEILING MODULES**

[75] Inventor: **Thomas C. Halfaker**, St. Louis, Mo.

[73] Assignee: **Emerson Electric Co.**, St. Louis, Mo.

[22] Filed: **Nov. 12, 1970**

[21] Appl. No.: **88,952**

[52] **U.S. Cl.** ..... **240/9 A**, 98/40 DL, 240/51.11

[51] **Int. Cl.** **F21s**

[58] **Field of Search** ..... 240/9 R, 47, 51.11, 240/70, 78, 9 A; 98/40, 40 DL; 52/126, 470, 508

[56] **References Cited**

UNITED STATES PATENTS

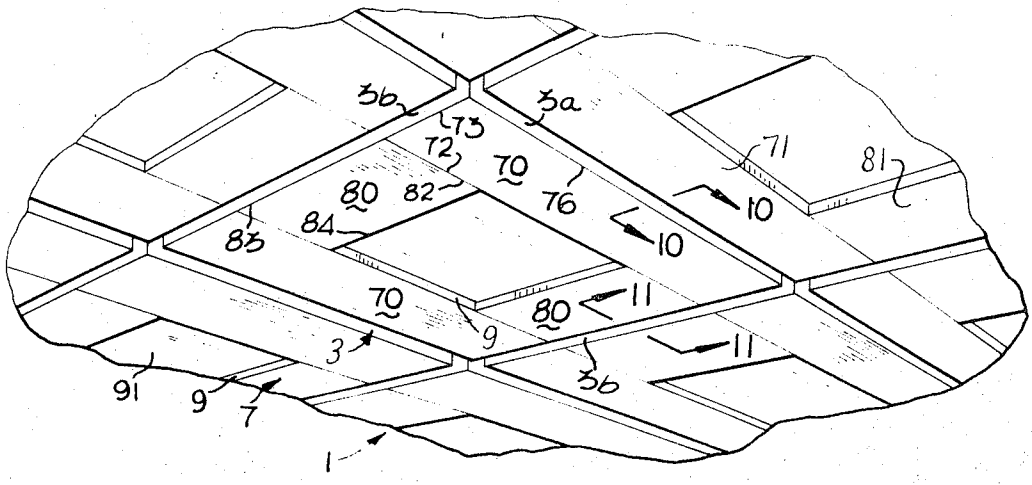
2,845,854	8/1958	Kurek	98/40 DL
3,103,157	9/1963	Quin	240/9 A
3,108,529	10/1963	Sweetser	240/9 A
3,181,450	5/1965	Kruger	98/40 DL
3,193,001	7/1965	Meckler	240/9 A X
3,308,288	3/1967	Ades	240/9
3,312,160	4/1967	Rackley	98/40 DL
3,372,270	3/1968	Quin et al.	240/9 R
3,402,517	9/1968	Halfaker	52/126
3,514,593	5/1970	Halfaker	240/78 R

Primary Examiner—Louis J. Capozi
Attorney—Polster and Polster

[57] **ABSTRACT**

A ceiling module and a ceiling composed of a plurality of the ceiling modules. The modules have a planar ceiling-defining area comprising four rectangular panels arranged about an open seat and supported by a frame above the planar area. The frame consists of an H-shaped structure including a pair of end beams and a bridging member which may also act as an enclosure and reflector for a light source mounted above the open seat. The light source may be a U-shaped or linear fluorescent tube having a novel ballast support. The ceiling system composed of modules of this invention may have a novel air flow system having outlets entirely between edges of modules in one direction and returns entirely between the edges of modules orthogonal to the outlets. The ceiling also may provide fixture mounting tracks between modules.

11 Claims, 14 Drawing Figures



5 Sheets-Sheet 1

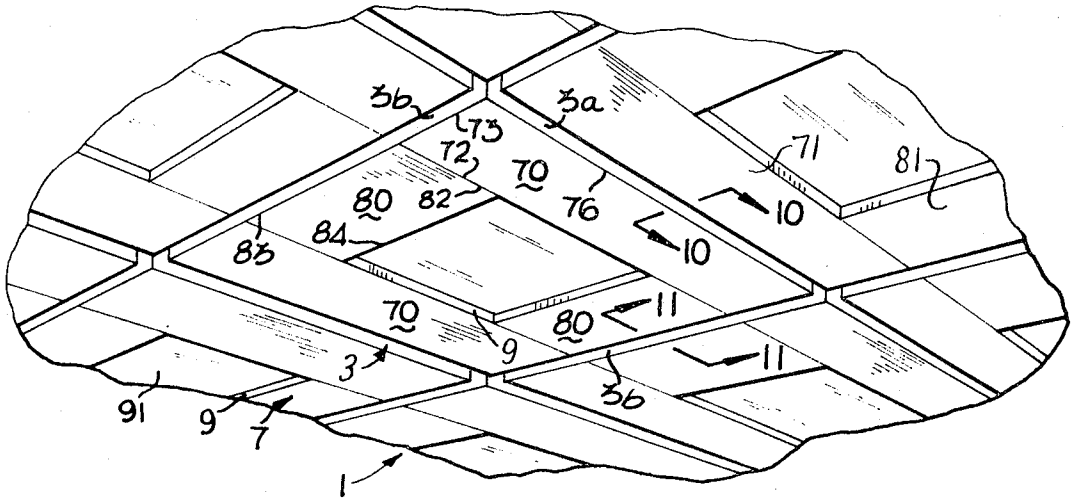


FIG. 1

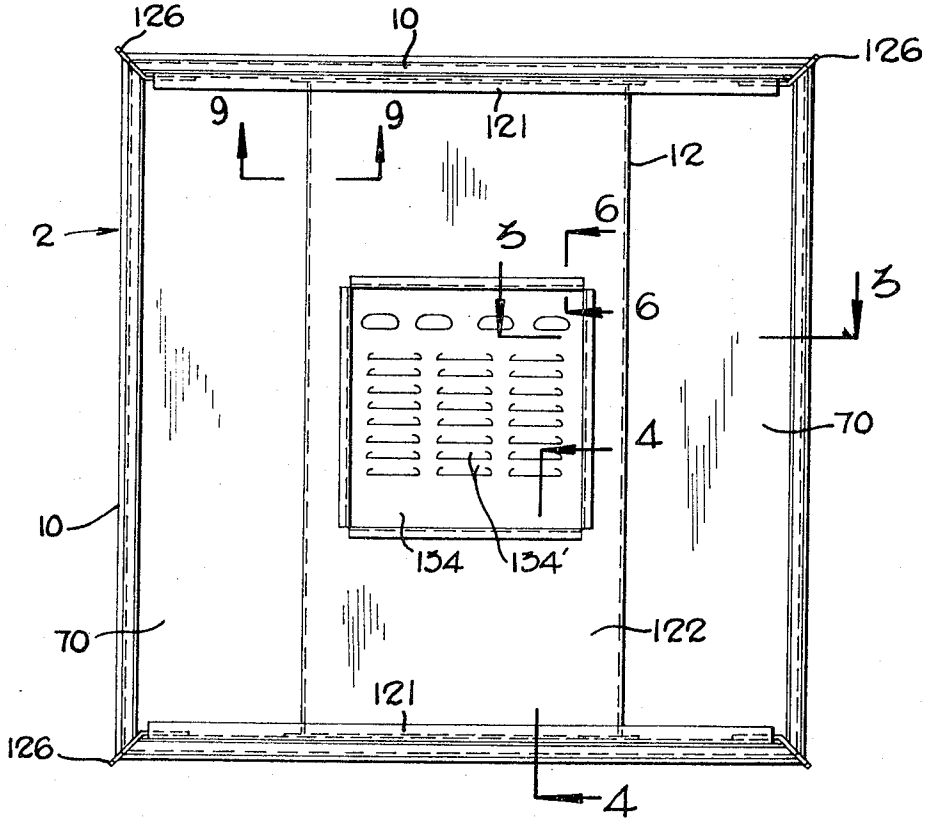


FIG. 2

Inventor
THOMAS C. HALFAKER

By Polster and Polster
Attorneys

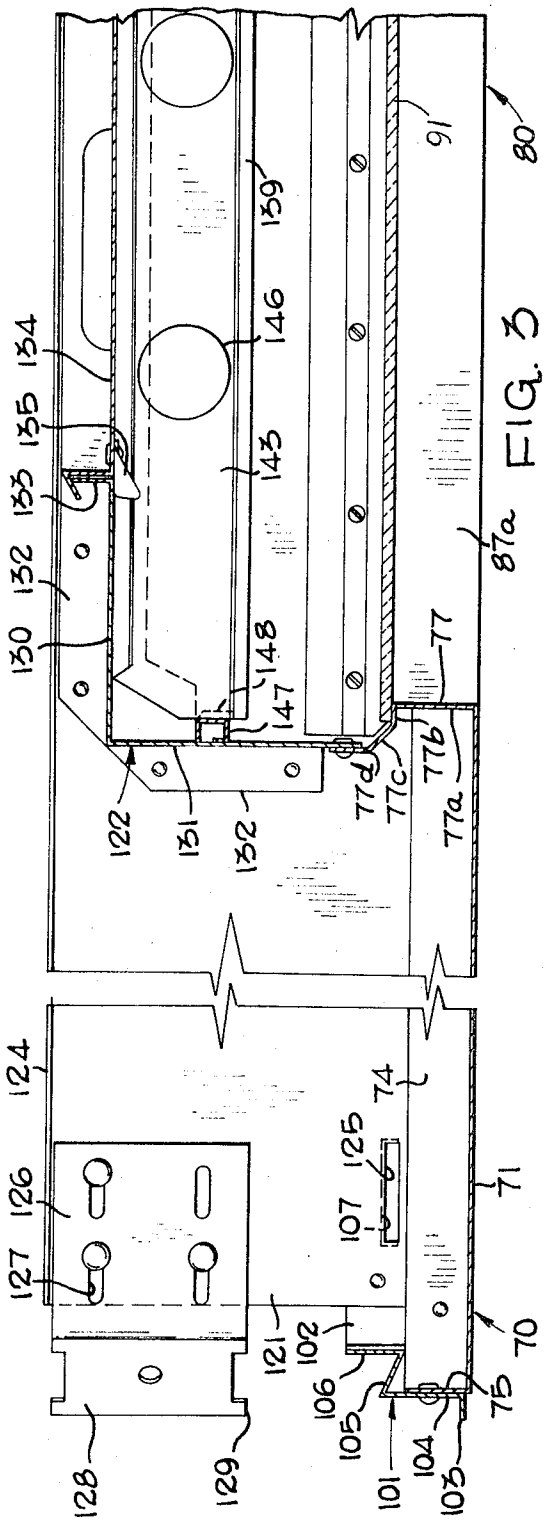


FIG. 3

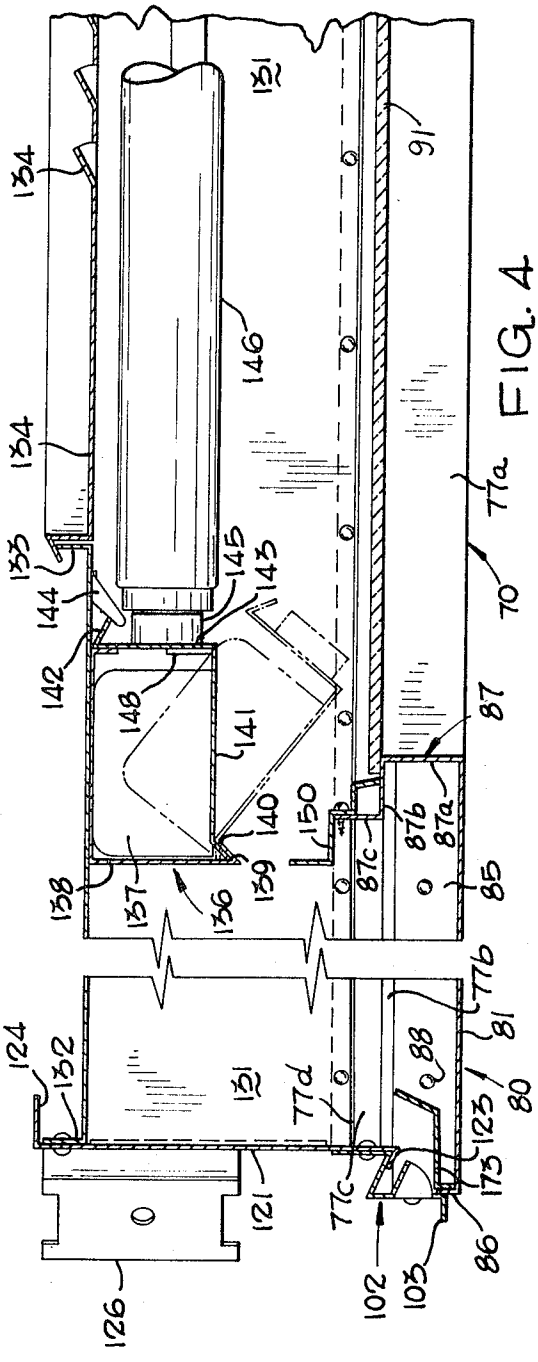


FIG. 4

Inventor
THOMAS C. HALFAKER

By Polster and Polster
Attorneys

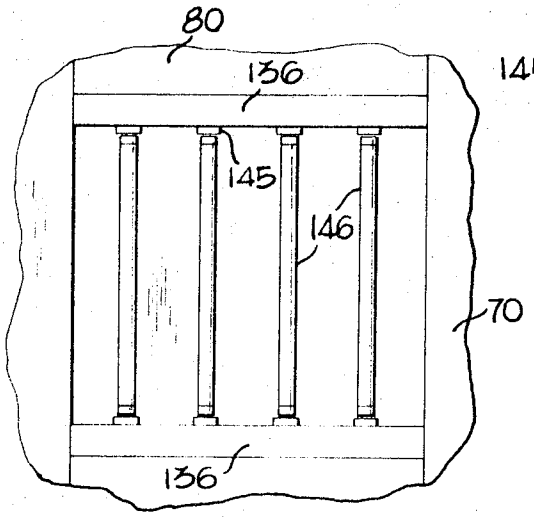


FIG. 5

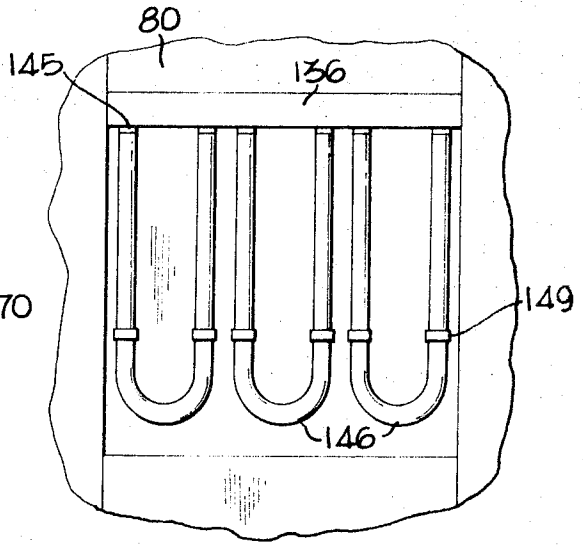


FIG. 7

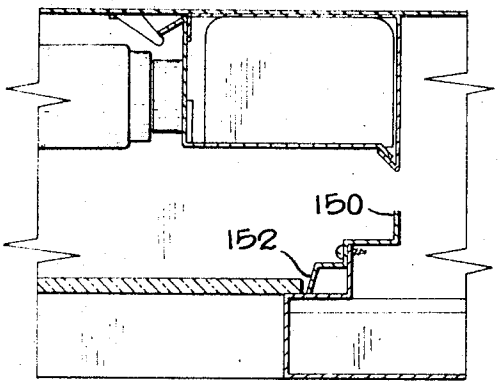


FIG. 6

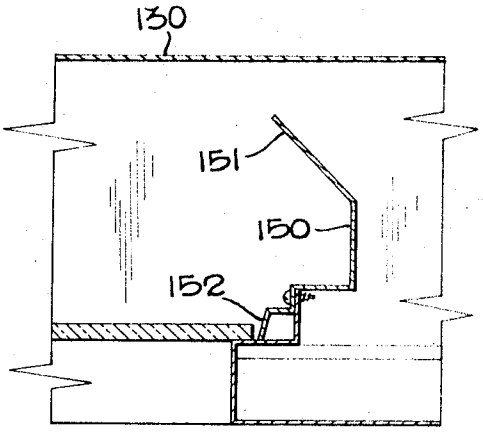


FIG. 8

Inventor
THOMAS C. HALFAKER

By Polster, and Polster
Attorneys

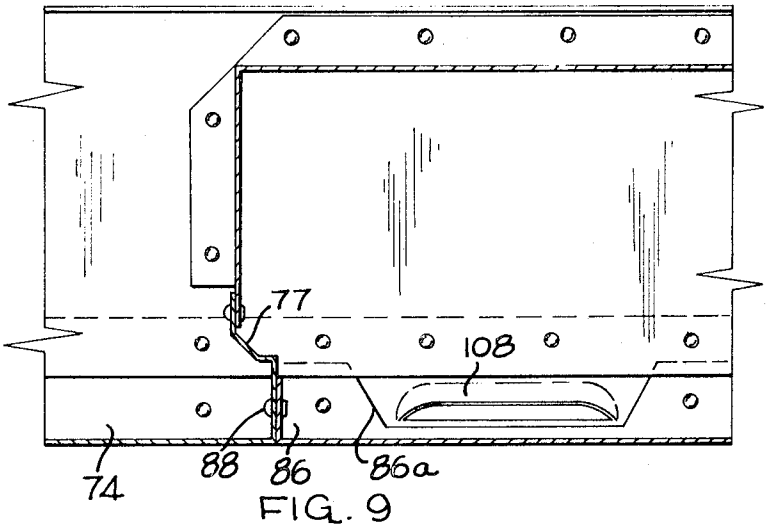


FIG. 9

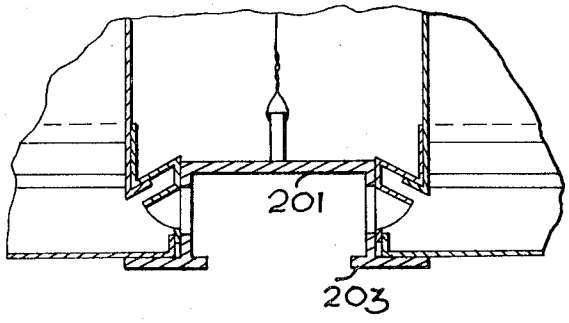


FIG. 13

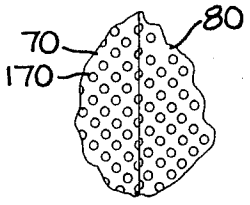


FIG. 12

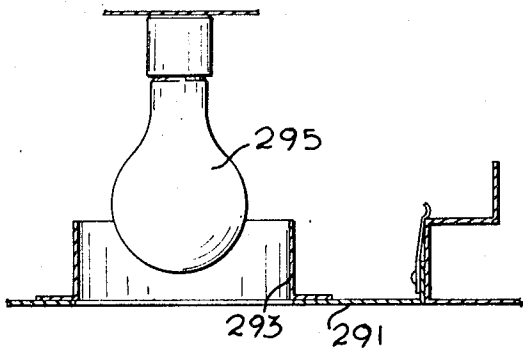


FIG. 14

Inventor
THOMAS C. HALFAKER

By Polster and Polster
Attorneys

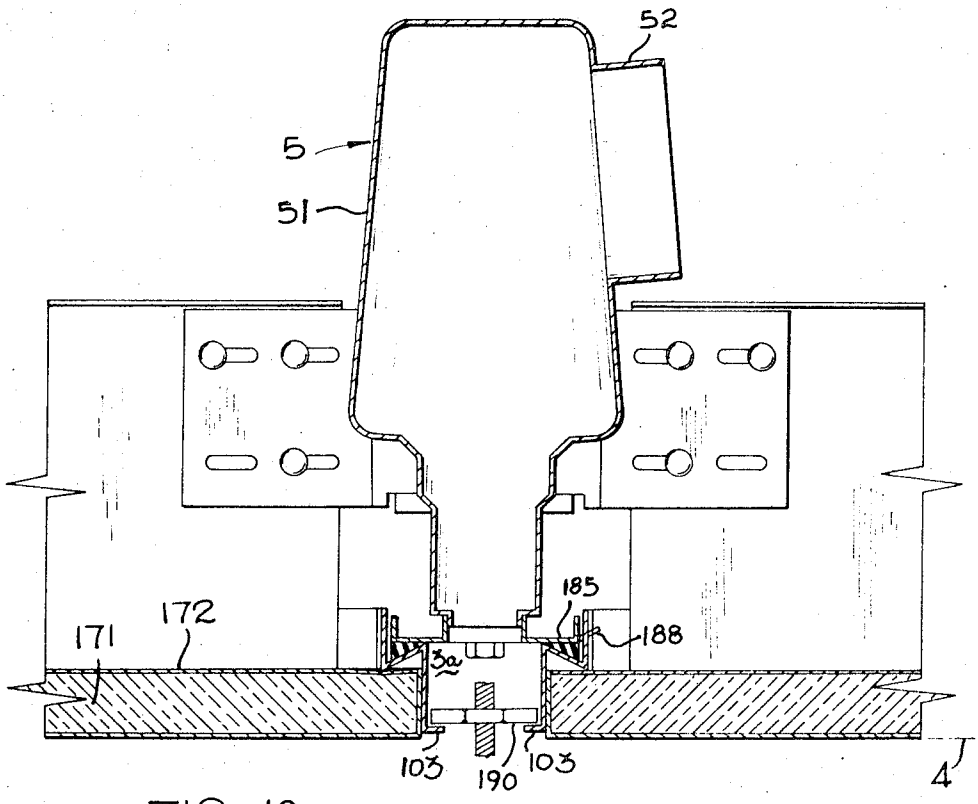


FIG. 10

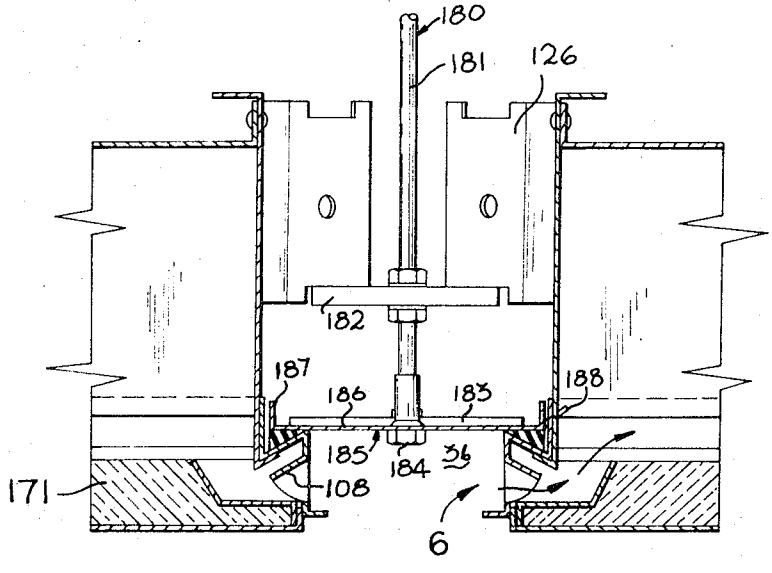


FIG. 11

Inventor
THOMAS C. HALFAKER

By Polster and Polster
Attorneys

CEILING MODULES

BACKGROUND OF THE INVENTION

This invention relates to ceiling modules and ceilings composed of a plurality of modules placed in edge to edge relationship. The use of ceiling modules, as disclosed and described more fully in Quin et al U.S. Pat. No. 3,372,270, to provide fully engineered environmental control through a highly flexible ceiling system has revolutionized attitudes toward the function and nature of ceiling components. The use of modules, that is ceiling components of substantial size in the range of about 16 square feet to about 36 square feet, as repeating ceiling components to provide not only a ceiling-defining area but also lighting and other environmental control elements such as air distribution, sound attenuation and spatial division elements has allowed an unparalleled freedom in providing truly effective and attractive environmental control, while simplifying the effectuation of each type of control in an easily installed package.

Although the ceiling modules and system described in Quin et al. No. 3,372,270 have in practice provided all of the advantages foreseen for them, they nonetheless have had certain drawbacks. Both the strength and the beauty of the modules depend largely on their pyramidal form. Therefore, the embodiment shown in FIG. 7 of Quin et al. has not proven commercially successful, and the commercial embodiment of the modules have had an effective depth which is somewhat greater than is required by an ordinary suspended ceiling. The effective ceiling height is therefore somewhat lower for a given height of its support structure than with an ordinary suspended ceiling. Further, the pyramidal form, to draw attention to itself and is therefore sometimes felt unsuitable when the eye of the beholder should be drawn elsewhere. Another disadvantage is that in order to utilize a lighted module as a heat transfer device to dissipate or transfer the heat of the lamps to an area below the ceiling or elsewhere, special provision such as special framing of the lighting panel or special construction of the seat on which the lighting panel rests must be provided. Also, the only practical mountings for partitions and the like have been at the corners of the modules. Also, the cost of these modules has been higher than the cost of a conventional ceiling, although this cost is generally completely offset by savings in the installation cost.

One of the objects of this invention is to provide a ceiling module and ceiling system which have all of the functional advantages of those described in Quin et al., No. 3,372,270, but which provide flat ceiling-defining areas and are shallower than those known heretofore.

Another object is to provide such modules which are extremely rigid and attractive.

Another object is to provide such modules and ceilings which do not require any special seat or framing for the lens to provide air flow through the lamp housing.

Another object is to provide such modules and ceilings which are relatively inexpensive to manufacture and which are easy to install and maintain.

Other objects will become obvious to those skilled in the art in the light of the following description and accompanying drawing.

SUMMARY OF THE INVENTION

In accordance with one aspect of this invention, generally stated, a ceiling module is provided having a planar ceiling-defining area comprising four rectangular panels arranged about an open seat and supported by a frame above the planar area. The module has an area of from about 16 square feet to about 36 square feet. The frame preferably consists of an H-shaped structure comprising a pair of end beams connected to each other by a bridging member, and the bridging member is an enclosure and reflector for a light source mounted above the open seat. Also in the preferred embodiment mounting brackets are slidably secured to the end portions of the end beam to permit the modules to be supported from their corners. Also in the preferred embodiment the light source is a U-shaped fluorescent tube mechanically and electrically connected to a ballast box mounted in the lamp housing adjacent one edge of the open seat. In another embodiment, straight fluorescent tubes are mounted between ballast boxes adjacent opposite edges of the open seat. The ballast boxes extend generally perpendicuar to long axes of the tubes, and a novel wireway is provided between the ends of the tubes. Also in the preferred embodiment, the panels are turned at their inboard edges to form a riser, a shelf and a sloped part which centers a light diffuser on the shelf. Trim rails around the periphery of the module give the module dimensional stability and may form mounting channels both above and below the module. Louvered openings in vetical walls of the end trim rails form completely hidden air inlets into the lamp housing, and an exhaust vent is provided in the top wall of the lamp housing.

In accordance with another aspect of the invention, a ceiling is provided which is made up of a plurality of rectangular modules arranged in edge-spaced relation to define orthogonal channels between them, an air distribution system is arranged above one set of parallel channels and an air return system is provided including an inlet through a set of parallel channels orthogonal to the first set. Preferably, the air return system is through a lamp housing on each module extending across the module from one of the second set of parallel channels to an adjacent one of the second set, so that the air return is through the lamp housing. Also preferably a ballast is mounted on the lower face of an upper wall of the housing between the air inlet and an exhaust vent in the upper wall of the housing. Also preferably the modules are suspended by their corners by brackets above the lower margins of the modules. The modules are preferably between about 16 square feet and about 36 square feet in area and include a flat planar ceiling-defining area surrounding a rectangular seat, and the area defined by the margin of the module is at least twice the area of the rectangular seat. Also preferably, a light-transmitting panel is supported by the seat of at least some modules and other modules are provided with a closure piece in the seat, and partition mountings are carried in the channel between modules.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, FIG. 1 is a fragmentary view in perspective from below of a ceiling system of this invention made up of modules of this invention;

FIG. 2 is a top plan view of one embodiment of ceiling module of this invention, showing the hidden side of one of the modules shown in FIG. 1;

FIG. 3 is a sectional view taken along the line 3—3 of FIG. 2;

FIG. 4 is a sectional view taken along the line 4—4 of FIG. 2;

FIG. 5 is a somewhat diagrammatic bottom plan view of one lighting configuration of the module of FIGS. 1–4;

FIG. 6 is a sectional detail of the configuration of FIG. 5, taken along the line 6—6 of FIG. 2;

FIG. 7 is a somewhat diagrammatic bottom plan view of another lighting configuration of the module of FIGS. 1–4;

FIG. 8 is a sectional detail of the configuration of FIG. 7, corresponding to FIG. 6;

FIG. 9 is a sectional detail taken along the line 9—9 of FIG. 2;

FIG. 10 is a sectional detail taken along the line 10—10 of FIG. 1;

FIG. 11 is a sectional detail taken along the line 11—11 of FIG. 1;

FIG. 12 is a detail of the surface of the module of FIGS. 1–11;

FIG. 13 is a detail corresponding to FIG. 11 of another embodiment of ceiling of this invention; and

FIG. 14 is a sectional detail corresponding to FIGS. 6 and 8 of still another lighting configuration of the module of FIGS. 1–4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, reference numeral 1 indicates a ceiling made up of a multiplicity of modules 2. The modules are arranged in edge-spaced relation to form orthogonal channels 3 between them and to define a ceiling plane 4 (see FIG. 10). In the preferred embodiment shown in FIGS. 1–4, the modules are suspended from above the ceiling plane 4 and the channels 3 are completely open below the ceiling plane 4. Above one set of parallel channels 3*a* is mounted an air distribution system (see FIG. 10) 5. The orthogonal set of parallel channels 3*b* forms the inlet of an air return system (see FIG. 11) 6. The ceiling 1 will be described more fully hereinafter in terms of the preferred embodiments of modules which make up the ceiling 1.

The preferred embodiments of modules for use in the improved ceiling of this invention comprise a planar rectangular ceiling-defining border 7 surrounding a rectangular open seat 9, the area of the module being at least twice the area of the open seat. A lighting panel or diffuser 91 is usually carried by the seat 9.

In the preferred embodiment of module shown in FIGS. 1–4, each module includes a planar ceiling-defining border 7 made up of the broad faces 71 of two long rectangular "side" panels 70 and the broad faces 81 of two short rectangular "end" panels 80. The short panels 80 are arranged with one end 82 of each short panel 80 contiguous an inboard side 72 of one of the long panels 70 and the other end 82 of each short panel 80 contiguous an inboard side 72 of the other long panel 70, and with outboard sides 83 of the short panels 80 aligned with ends 73 of the long panels 70 to form a square module having a square, open, central seat 9 defined by the inboard sides 72 of the long panels 70 and inboard sides 84 of the short panels 80. Thus in the illustrative square module with a square seat 9, the width of each of the broad faces 71 and 81 is equal to the width of the border 7, the length of each broad face 81 is equal to the side of the seat 9, and the length of each broad face 71 is equal to the sum of the length of the face 81 and twice the width of the face 71 or 81.

It has been found that this arrangement of panels produces a far more attractive planar ceiling than do trapezoidal panels forming a flat ceiling as in FIG. 7 of the aforesaid Quin et al. patent No. 3,372,270. In particular, a flat module made of trapezoidal panels gives the illusion that it sags toward its center whereas the present arrangement does not.

Around the periphery of the module 2 trim rails 10 are secured to the panels 70 and 80. The trim rails 10 include side trim rails 101 and end trim rails 102. The trim rails serve not only the aesthetic function of setting off the modules, but give the module additional rigidity and dimensional stability and also perform numerous functions when the modules are assembled into a ceiling.

The panels 70 and 80 are supported from above by a framework 12 consisting of a pair of end beams 121 connected or bridged by a lamp housing 122 to form an H-shaped structure. The end beams 121 extend along the aligned ends 73 of the side panels 70 and outboard sides 83 of the end panels 80, and are secured to the end trim rails 102. The lamp housing 122, in cross-section, is formed as an inverted U, with the ends of the lamp housing attached to the end beams 121 and the sides of the lamp housing attached to the inboard sides of the side panels 70. The lamp housing 122 serves not only as a structural element of the framework 12 but also as a reflector and an air duct.

The panels 70 and 80 are made of sheet steel in the form of pans having upwardly turned flaps or flanges on all four sides. The end flaps 74 and 85 at the ends 73 and 82 of the side panels 70 and end panels 80 respectively are flat vertical parts used only for connection to other parts as will be described hereinafter. The flap 75 at the outboard side 76 of each long panel 70 is likewise merely a vertical attachment part. The flap 86 on the outboard side 83 of each end panel 80 is scalloped as at 86*a* to provide an air inlet as described hereinafter. The inboard side 72 of each long panel 70 is provided with a flap 77 having a vertical riser part 77*a*, a horizontal shelf 77*b*, an upwardly outboard sloping surface 77*c* and a vertical attachment part 77*d*. The flap 87 at the inboard side 84 of each end panel 80 includes a vertical riser part 87*a*, horizontal shelf 87*b* and a vertical attachment part 87*c*.

The broad faces 71 and 81 of the panels 70 and 80 are perforated in a small square pattern running at 45° to the formed edges of the panels. It has been found that if the holes 170 have a diameter of about 0.050 inch and are spaced on 0.100 inch diagonal centers (resulting in about 9.5 percent open area), not only are the individual panels attractive, but the lines of abutment between the panels are attractive and give the illusion that the holes are aligned across the line of abutment. When the panels are backed with acoustic insulation such as mineral wool batts 171, this pattern of perforations 170 provides excellent acoustic absorption. The further provision of sound attenuation panels 172 over the wool batts 171 on the panels 70 provides excellent sound attenuation. The lamp housing 122 has

been found to provide satisfactory sound attenuation across the end panels **80.**

It has also been found that by forming the panels with the burr side upward, the stretching action of perforating is taken advantage of and the panels resist deflection and sagging substantially better than unperforated panels.

Only the broad faces **71** and **81** of the panels **70** and **80** are perforated. The unperforated riser parts **77***a* and **87***a* around the seat **9** provide a more attractive appearance than would perforated surfaces, and also prevent light leaks around the seat **9.**

The trim rails **10** include a lower outboardly turned horizontal lip **103,** a lower vertical attachment part **104,** a downwardly inboardly sloping shoulder **105** and an upper vertical attachment part **106.** The upper attachment part **106** of each end rail **101** and **102** is provided with hinge slots **107.** The central reaches of the end rails **102** are provided with inwardly struck louvers **108** in their lower vertical parts **104.** The louvers **108** provide an air inlet into the lamp housing **122.**

The lower, visible, portions of the module **2** may be assembled by placing the panels **70** and **80** and the trim rails **101** and **102** in their proper positions on a flat surface and riveting the parts together. Thus, the end flaps **85** of the end panels **80** are riveted to the vertical riser parts **77***a* on the inboard sides of the long panels **70,** as at **88.** The side trim rails **101** are riveted to the outboard flaps **75** of the long panels **70.** The end trim rails **102** are riveted to the end flaps **74** of the side panels **70** and the outbaord side flaps **86** of the end panels **80** with the trim rail louvers **108** aligned with the end panel scallops **86***a.*

The end beams **121** are formed of sheet steel and have an outboardly turned shelf **123** at their lower end and an inboardly turned flange **124** at their upper end. Hinge slots **125** in the end beam **121** are aligned with the hinge slots **107** in the end trim rail **102.** Mounting brackets **126** are loose riveted through horizontal slots **127** to the end beams **121.** Free ends **128** of the mounting brackets **126** are bent outwardly at an angle of 45° and include mounting hooks **129** on their lower edges. The end beams **121** are riveted to the upper vertical attachment parts **106** of the end trim rails **122,** with the trim rail shoulder **105** seated on the shelf **123** of the end rail **121.**

The lamp housing **122** is also made of sheet metal and includes a flat upper face **130** and flat side faces **131.** Mounting flaps **132** on the ends of the lamp housing **122** are riveted to the end beams **121.** The side faces **131** of the lamp housing are riveted to the attachment part **77***d* of the inboard flap **77** of the long panel **70.**

A peripheral flange **133** defines a central opening in the upper face **130** of the lamp housing **122.** A louvered access pan **134** is mounted in the opening and is secured by thumb latches **135.** The louvers **134'** provide an exhaust duct from the lamp housing **122.**

Mounted across the upper face **130** of the lamp housing **122,** parallel with and adjacent the inboard side **84** of one of the end panels **80,** is a ballast box **136** for a fluorescent ballast **137.** The ballast box **136** includes a sheet metal fixed part **138** riveted at its upper turned face to the upper wall **130** of the lamp housing **122.** An inboardly upwardly turned flap **139** on the rear wall of the part **138** forms a hinge with a downwardly turned flap **140** on a sheet metal socket and ballast mounting saddle **141.** An inboardly turned flange **142** on the upper edge of a vertical face **143** of the saddle **141** is held by another thumb latch **144.** Fluorescent lamp sockets **145** are mounted on the vertical face **143,** so that long axes of fluorescent lamps **146** are perpendicular to the long axis of the ballast box **136.** The ballast box **136** is so proportioned that fastening the thumb latch **144** clamps the ballast **137** to the ballast box walls. This provides good heat dissipation from the ballast to the enclosing sheet metal and thence to the moving air within the lamp housing and to the air in the plenum of a completed ceiling. As is well known in the art, good heat dissipation is important to ballast life and lamp performance.

In the illustrative lamp configuration shown in FIGS. **3–6,** identical ballast boxes **136** and two-lamp ballasts **137** are provided at each end of the seat **9,** and four standard linear fluorescent lamps **146** are mounted between sockets **145.** Necessary wiring between opposite ends of the lamps **146** is provided through sheet metal wireways **147.** Mounting tabs **148** at the ends of the wireways **147** are trapped by the vertical faces **143** of the saddles **141** and the wireways **147** are held against the sides **131** of the lamp housing **122** by the saddle **141.** Therefore, removal of the ballasts **137** by releasing the saddle **141** as shown in broken lines in FIG. **4** will also release the wireway **147.**

An alternative lamp configuration is shown in FIGS. **7** and **8.** In this configuration, U-shaped fluorescent lamps **146** are all plugged into a single ballast **137** at one end of the seat **9** and are stabilized by clips **149.** In this configuration, no wireway **147** is needed.

The open seat **9** is defined by the riser parts **77***a* and **87***a* and the horizontal shelves **77***b* and **87***b* of the side and end panels **70** and **80** respectively. Air baffles **150** at opposite ends of the seat **9** are secured by sheet metal screws to the vertical attachment parts **87***c* on the end panels **80.** Below the ballast box **136** the upper edges of the baffles **150** are aligned with and spaced from the hinge parts **139.** At the open end of the housing in the configuration shown in FIGS. **7** and **8,** the air baffle **150** is provided with an inboardly sloping part **151** spaced from the upper wall **130** of the lamp housing **122.** It will be seen that the air baffles **150** also act as light baffles. The sloping surfaces **77***c* of the side panels **70** and sloping inboard faces **152** on the air baffles **150** make the diffuser **91** self aligning. The diffuser may be simply an unframed prismatic panel of glass or plastic and may be inserted skewed into the seat **9** and allowed to center itself.

The diffuser **91** may be virtually any known type. For example, it may be a plastic or metal egg-crate louver or it may be a framed panel designed to hinge downwardly from the seat. Likewise, the seat may be provided with an air and light baffling arrangement which may form an air passage into or out of the lamp housing.

The recessed seat serves to define the apparent thickness of the border **7,** thereby giving the modules a monolithic appearance when they are assembled into a ceiling. The recessed seat also provides excellent high angle light cut off and thus reduces direct glare. However, the seat or diffuser may be modified to provide a sloped riser part on the seat or to provide a dependent diffuser which is flush with the ceiling plane **4** defined by the border **7.**

Baffles **173** are mounted across the end panels **80** adjacent the air return inlet louvers **108.** These baffles direct air into the lamp housing **122** and prevent the batts **171** from blocking the louvers **108.** The batts **171,** sound attenuation panels **172** and baffles **173** are parts of the illustrative preferred embodiment of module **2,** but are omitted from some of the drawings to provide clearer views of the construction of the modules.

By way of example, the module **2** may be 58-7/8 inches square including a 5/16 inch lip **103.** The open seat may be 28 inches square. The risers may be 1-1/4 inches high, and the top wall of the lamp housing may be 5 ¼ inches above the ceiling-defining plane **4.**

The panels **70** and **80,** the end beams **121** and the lamp housing **122** may all be made of **22** gauge sheet steel, the trim rails **10** may be made of **18** gauge sheet steel, and the mounting brackets **126** may be made of **14** gauge sheet steel.

The panels **70** and **80,** the lamp housing **122** and the ballast box **136** may be finished with baked white enamel and the trim rails **10** may be finished with baked black enamel.

The ceiling **1** may be formed of the modules **2** in a manner similar to that described in the aforesaid Quin et al. patent No. 3,372,270 and in my patent 3,402,517. Hangers **180,** which may be identical with those described in my aforesaid patent 3,402,517, are mounted on the ceiling support structure on 60 inch square centers and are adjusted to the proper height. Each hanger includes a stem **181,** a cruciform hook-receiving rest **182,** a closure plate **183** and a polygonal head **184.** The modules are mounted on the hangers, with the hooks **129** on the mounting brackets **126** resting in slots in the cruciform rests **182.** The hangers and mounting brackets may be so proportioned that the channels **3** between modules **2** are 1 ¾ inches wide, with a clearance between lips **103** of 1 ⅛ inches. The channels **3** are bridged adjacent the meeting corners of the modules by closure strips **185,** including a central web **186** and side walls **187.** One side wall of each closure strip is lanced out at one or more places to form a hinge finger **188,** which fits into the aligned hinge slots **107** nd **125** in the end trim rails and end beams respectively. Strips of foam rubber gasketing **189** extend along the outer edges of the lower face of the closure strips **185.** The gasketing **189** rests on the shoulders **105** of the trim rails **10** and is compressed against the shoulders when the closure plate **183** is tightened.

The closure strip **185***a* bridging the channel **3***a* between modules is struck out upwardly in its web part **186** to form an open seat for an air connector **51.** The air connector **51** extends about 48 inches along the channel **3***a* and distributes air from an air distribution duct **52** through the channel **3***a.* The lips **103** on the trim rails **10** act as kickers for air control, and are especially effective when used in conjunction with an air controller device within the channel **3***a.* The volume of air passing through the air distribution system **5** may be controlled by dampers either within the channel **3***a* or within the air distribution system above the air diffuser **51.**

The closure strip **185***b* bridging the channel **3***b* orthogonal to the channels **3***a* closes the entire length of the channel **3***b.* Return air flow, caused by lower pressure in the plenum above the modules than in the room below the modules, is therefore through an air return system **6** including the inlet louvers **108,** the lamp housing **122,** and the exhaust louvers **134'** in the access pan **134.** The inlet louvers **108** are positioned and baffled to be virtually hidden when the ceiling is installed. Return air may be regulated by the use of a damper plate, not shown, slidably secured to the access pan **134.** Ducted return of the exhaust air for use at other locations may be provided by replacing the illustrative access pan with an access pan having a circular punching for attachment of a flexible duct.

The ceiling of this invention also provides far more spatial flexibility than known ceilings because the channels **3** form lipped mounting channels or partition tracks for a variety of partition systems utilizing channel nuts as fastening means. Thus, partitions, clocks, signs, smoke and fire detectors or other accessories and building elements may be attached not only at the module corners and removed without damage to the ceiling, but by use of channel nuts such as shown at **190** in FIG. **10,** they may be attached and removed anywhere along the channel **3.** Partitions may thus be secured across the module anywhere desired. When partitions are moved, the air distribution system is easily adjusted, since even removal or addition of air diffusers **51** is easily accomplished through the access pans **134.**

The ceiling **1** may also be constructed in other ways and still retain many of the advantages of the embodiment just described. As shown in FIG. **13,** rather than supporting the modules from above the ceiling plane at the corners of the modules, the modules may be supported by a grid system which carries the entire periphery of the modules. The supporting grid **201** may be provided with air inlet and outlet passages through the channels **3** between modules and may be provided with lips **203** which form partition tracks.

It is frequently desirable not to provide completely lighted areas within the open seat **9,** particularly when a partition is to be placed across a module **2.** Therefore, the light diffuser **91** may be replaced by a sheet metal pan **291.** The pan **291** may be plain or perforated and may contain one or more circular or polygonal punchings **293.** As shown in FIG. **14,** a circular punching **293** may be placed adjacent one edge of the pan **291** to allow the punching and an incandescent lamp **295** to be spaced from a partition or from a wall adjacent the module **2.**

Numerous variations in the modules and ceiling of this invention, within the scope of the appendd claims, will occur to those skilled in the art in the light of the foregoing description. For example, although the module and the seat have been described as square, either or both may be made rectangular, by the simple expedient of changing the dimensions of the side panels **70** or the end panels **80.** Thus, the open seat may be made to match the length of three or four foot lamps simply by reducing the width of the end panels **80.** Moving the ballast boxes and using longer wireways are the only other adjustments needed other than using narrower sound absorbing batts and sound attenuation panels over the panels **80.** Covers may be secured below some or all of the channels **3** to make them into wireways, and mountings may be provided through the covers for partitions or accessories. Entirely different modules or suspension systems may be utilized to realize some of the advantages of the ceiling. These variations are merely illustrative.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. A rectangular ceiling module comprising

a. panel means for defining a rectangular, planar ceiling area including a flat border around an open seat, the ceiling area defined by said panel means (including the area defined by said open seat) being from about 16 square feet to about 36 square feet and the area defined by said open seat being no more than about half the ceiling area defined by said panel means; and

b. an H-shaped framework means above said planar ceiling area for supporting said panel means, said frame-work means comprising a pair of parallel end beams extending along opposed sides of said rectangular ceiling area and a bridging member extending between said end beams perpendicular to said end beams, said bridging member being secured at its ends to said end beams intermediate the ends of said end beams, at least a part of said bridging member being generally an inverted U in cross-section to form a lamp housing, an inner face of said lamp housing forming a reflector, and mounting means for positioning an electric light source in said lamp housing above said open seat in said panel means.

2. The module of claim 1 wherein the bridging member is an inverted U in cross-section throughout its length, said module including an air inlet in at least one end of said module above said ceiling-defining area, said air inlet communicating with said bridging member, and an air outlet in an upper surfuce of said bridging member, said bridging member forming an air passage from said air inlet to said air outlet.

3. The module of claim 2 including a ballast mounted in said bridging member between said air inlet and said air outlet.

4. The module of claim 1 including mounting brackets slidably secured to ends of said end beams.

5. In a ceiling comprising a plurality of rectangular modules and support means for supporting said modules in edge-spaced relation to define orthogonal channels between them, the improvement comprising

means for distributing air through a first of said channels into a space below said ceiling, said means for distributing air comprising a duct positioned above said first channel, said duct having an opening into said first channel, and

means for returning air through a second of said channels, orthogonal to said first channel, into a space above said ceiling, said means for returning air comprising closure means above said second channel for restricting air flow through the upper margin of said second channel and a return passage through a first module adjacent said second channel, said first module comprising a lamp housing and an electric light source mounted in the lamp housing, said return passage comprising means in said first module adjacent said second channel for defining an inlet opening from said second channel into said first module, means in said lamp housing for defining an outlet opening from said lamp housing into said space above said ceiling, and means for defining an air return duct between said inlet opening and said outlet opening.

6. The improvement of claim 5 wherein each module comprises a ceiling-defining border surrounding an open seat, the area of said modules being at least twice the area defined by said open seat.

7. In a ceiling comprising a plurality of rectangular modules, each of said modules comprising panel means for defining a rectangular ceiling area of from about 16 square feet to about 36 square feet, at least some of said modules comprising an electric light source, and support means for supporting said modules in edge-spaced relation to define orthogonal channels between them, the improvement comprising accessory mounting means in at least some of said channels for mounting a structure below said ceiling defining area at a point intermediate the corners of said modules, said accessory mounting means comprising

a pair of spaced apart lips extending into said channel on opposite sides of said channel, said lips lying in a common horizontal plane, and at least one piece of mounting hardware supported by said lips.

8. The improvement of claim 7 wherein the modules each comprise a planar border surrounding an open seat, at least some of said modules comprising a light diffuser in sald open seat at least some others of said modules comprising a closure piece in said open seat, said closure piece having a broad surface lying substantially in the same plane as said planar border.

9. The improvement of claim 7 wherein said support means comprise hanger means for supporting corners of said modules and said pair of lips comprises an outwardly extending lip on the edge of each of two adjacent edge-spaced modules.

10. The improvement of claim 9 including a peripheral trim rail on each of said modules, said outwardly extending lip being provided on said trim rail.

11. The improvement of claim 7 wherein the piece of mounting hardware is a channel nut.

* * * * *