

[54] **SUSPENDED CEILING SYSTEM INCLUDING
A GRID NETWORK**

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Related U.S. Application Data

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1970, Pat. No. 3,685,235.

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52/484, 52/488, 98/29

[51] Int. Cl. **E04b 5/55**

[58] Field of Search 52/39, 666, 27, 29,
52/173, 488, 484, 487, 474, 220, 221; 98/29

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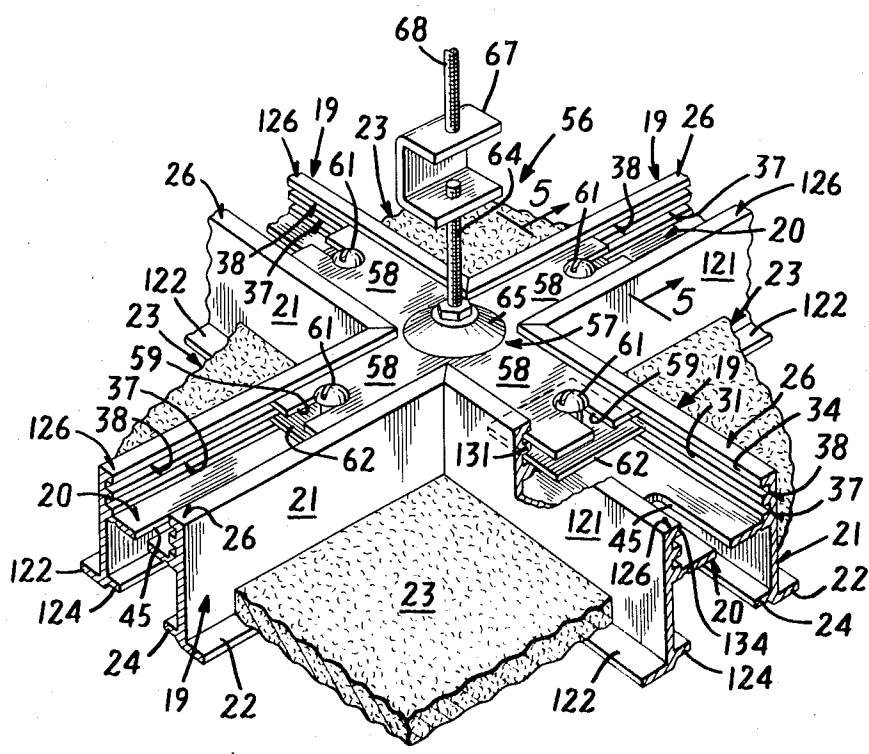
[57] **ABSTRACT**

A suspended ceiling system which includes a grid network for supporting a plurality of ceiling panels with this network being made up of a plurality of generally like grid modules. Each grid module is an elongated integrator member in the form of an inverted channel of suitable stiff material, such as aluminum. This inverted channel is defined by a cross web and a pair of transversely spaced, depending sidewall flanges that are integral with the web and between which supplemental equipment, such as selected utility units, may be mounted at any chosen location by anchoring means, such as screws, snap-in fasteners, interfitting parts or anchoring elements, e.g., bolts, extending through the web. The bottom edge of at least one of these channel sidewall flanges carries an integral, outwardly extending, panel-supporting flange, and both thereof may be

so equipped when demanded. A pair of elongated, transversely spaced, upstanding and opposed flanges are permanently connected, such as by being made integral with the web at the junctions thereof with the depending sidewall flanges. Each of these upstanding flanges is provided on the inner side thereof with two upwardly spaced and laterally extending track flanges with these substantially aligned transversely to form two opposed pairs thereof. The inner opposed edges of each of these pair of track flanges are spaced apart to provide an intervening longitudinal access slot. The space defined by the lower pair of these track flanges and the web constitutes a first longitudinal, equipment-receiving track with both pairs defining therebetween a second upper, longitudinal, equipment-receiving track. The inner faces of the depending channel sidewall flanges are provided with transversely spaced and generally aligned, opposed abutment flanges with a wide intervening access slot defined therebetween. The resulting grid module has the general appearance of an H-shaped channel having the side flanges on opposite sides of the cross web equipped with a plurality of pairs of lateral flanges.

A trim strip is provided removably to cover, where desired, the lower space of such inverted channel defined between the cross web, the sidewall flanges and the abutment flanges. A snap-in flow-diverting air supply insert is also provided for this space which is anchored to the cross web and one of these abutment flanges; and tempering air delivery is effected by an inverted, U-shaped, overhead duct section which has flexible bottom lip flanges snapped beneath a pair of the opposed track flanges with openings in the cross web allowing flow downward into this lower space. Such openings may be in the form of a longitudinal series of localized, longitudinally spaced and generally aligned, elongated slots which may also serve selectively to receive therethrough anchor members, such as bolts or screws. A partition post cap structure is also provided for seating against the abutment flanges and anchored through such lower space by a suitable hanger member, such as a screw, depending from the cross web, or other suitable means such as a spring-biased member which pushes up against the post cap structure to hold the post and cap structure assembly in free standing position of the post.

7 Claims, 16 Drawing Figures



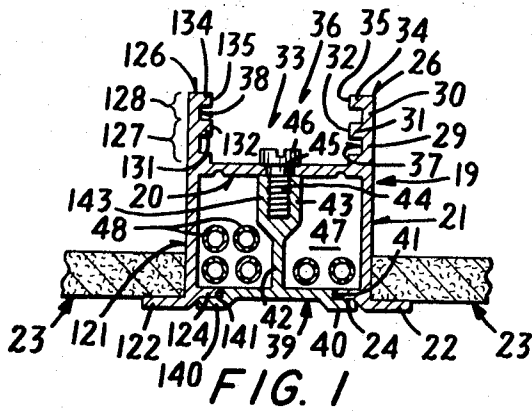
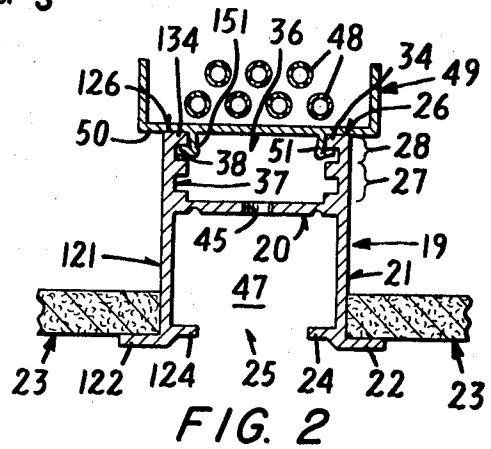
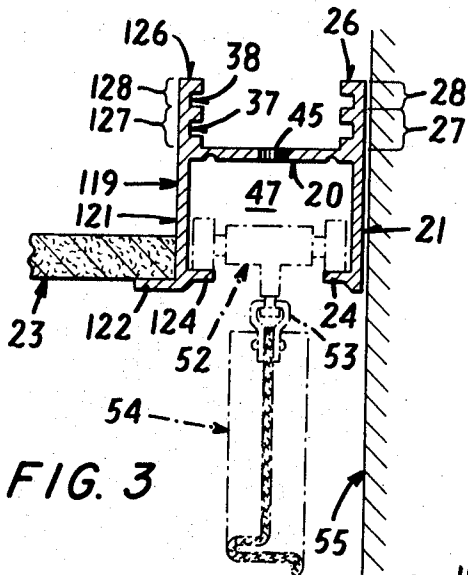
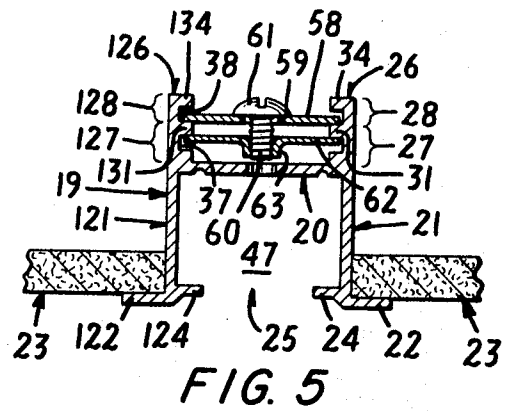
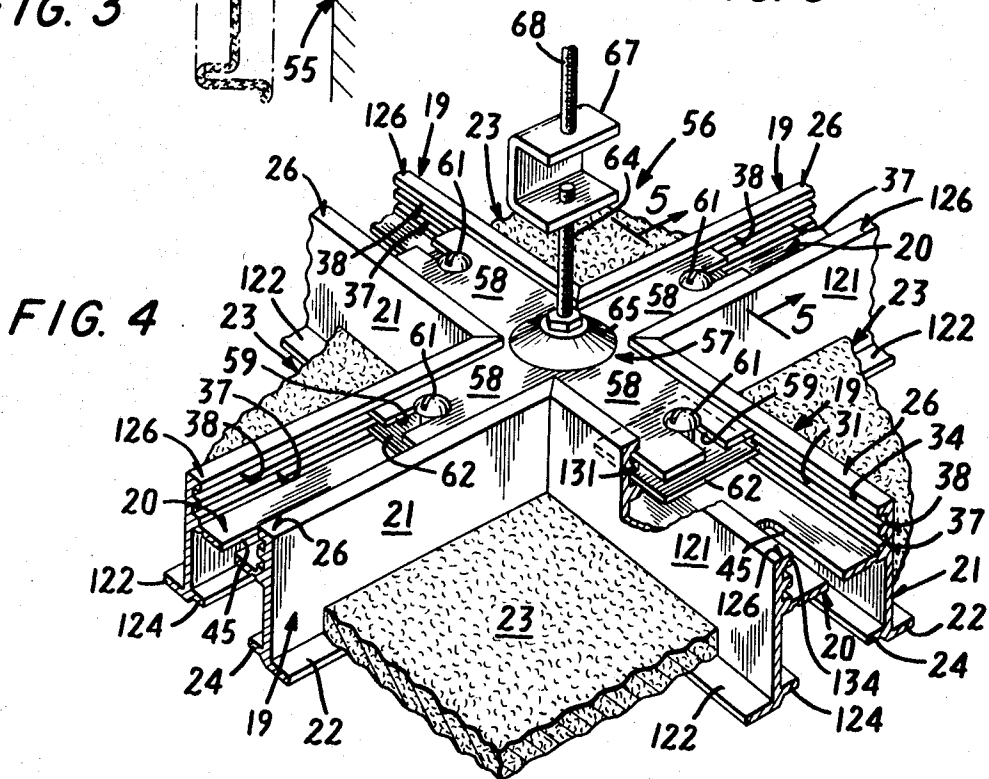


FIG. 6

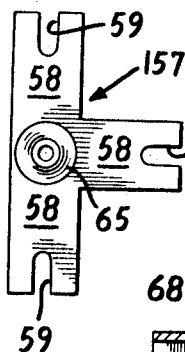


FIG. 7

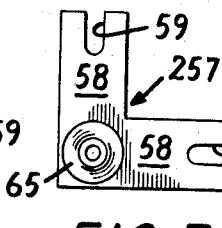
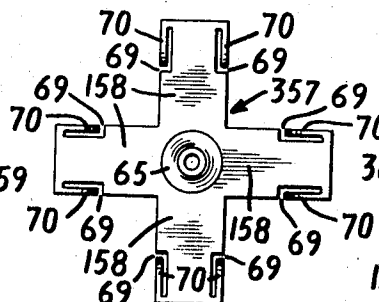


FIG. 8

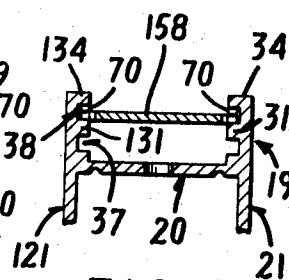


FIG. 9

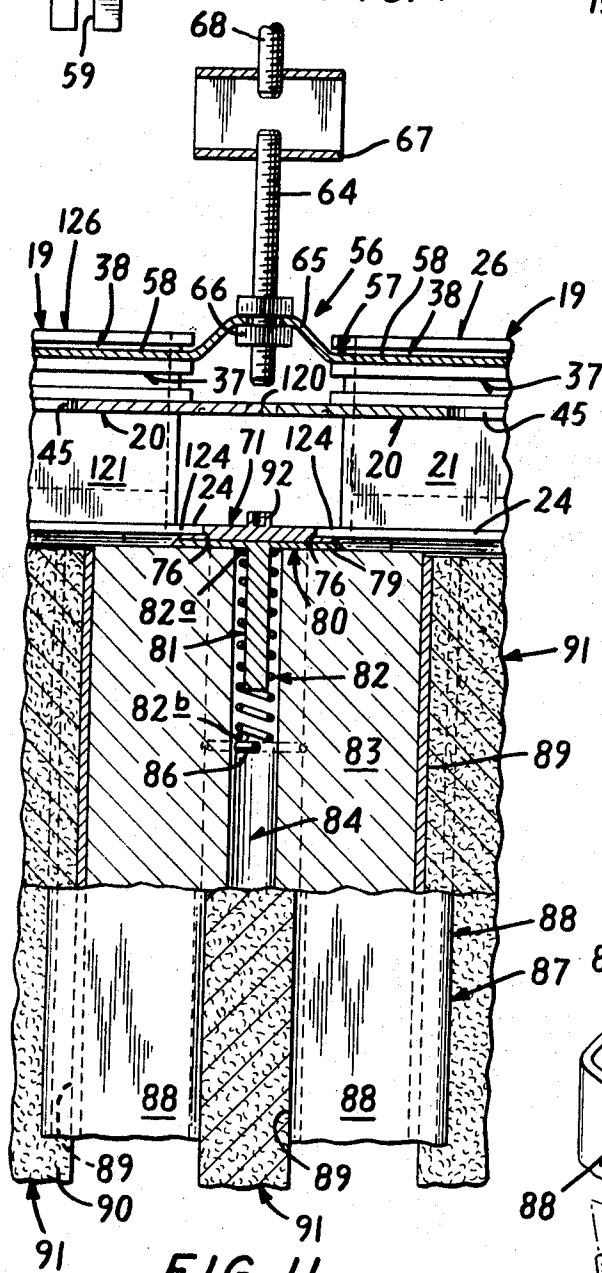


FIG. 11

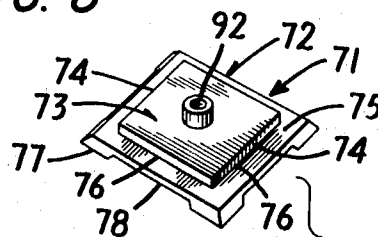
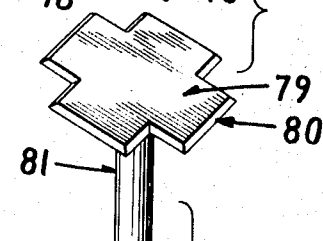
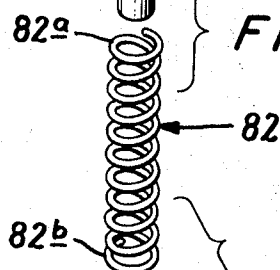
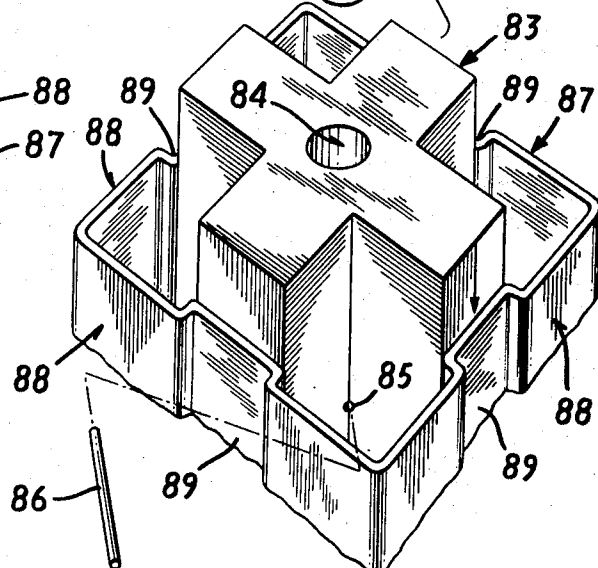


FIG. 10



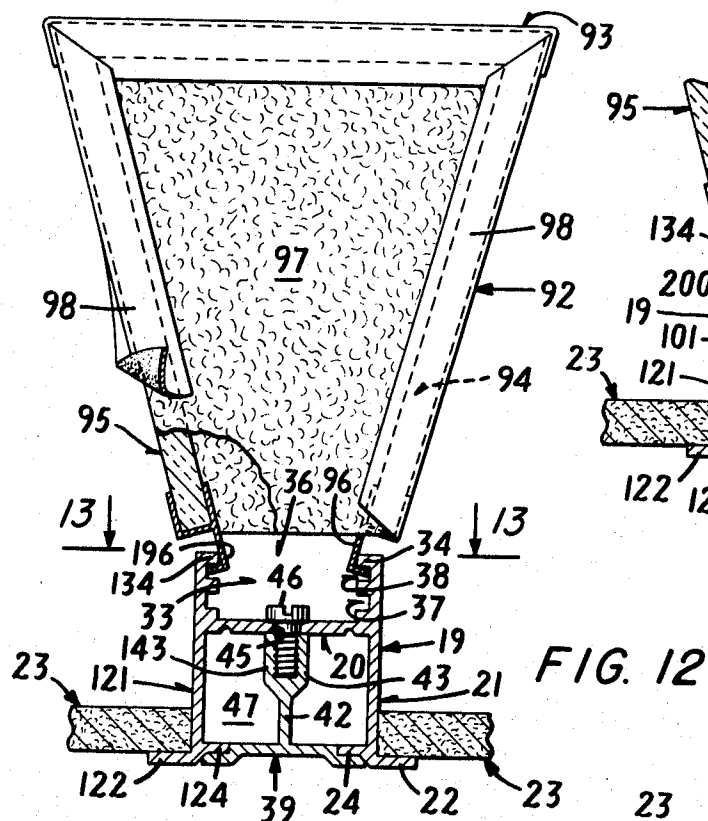


FIG. 14

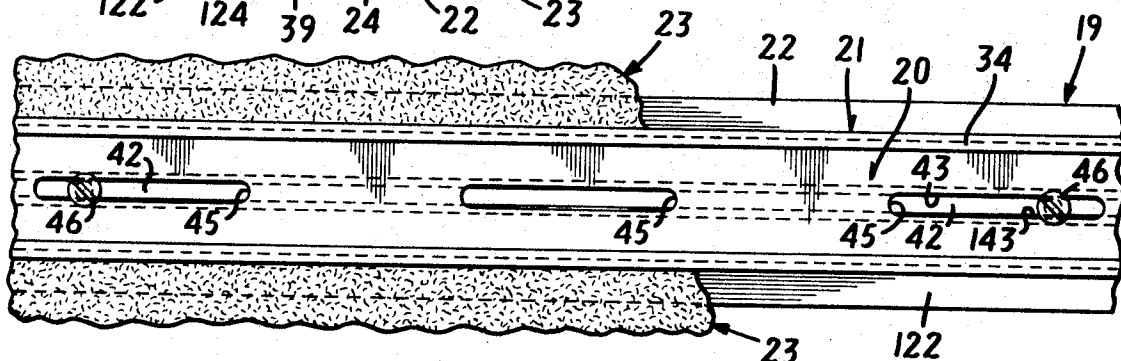
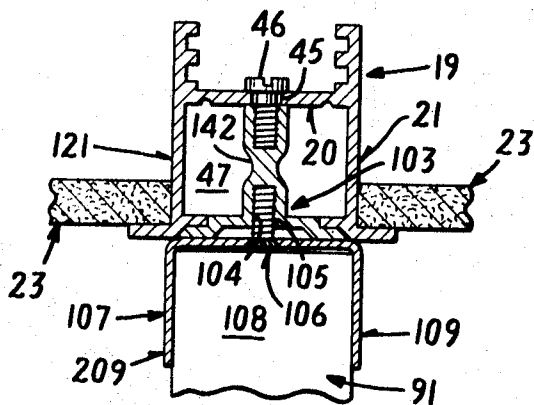


FIG. 13



SUSPENDED CEILING SYSTEM INCLUDING A GRID NETWORK

BACKGROUND OF THE INVENTION

This application is a continuation-in-part of my pending application of the same title Ser. No. 73,806 filed Sept. 21, 1970, now U.S. Pat. No. 3,685,235.

The present invention relates to suspended ceiling systems which include grid networks for supporting ceiling panels and a variety of types of supplemental equipment such as a variety of utility units, at selected positions.

Prior to my identified pending application and the present invention such grid networks have been proposed which embody a variety of types of grid members, in the form of I-beams, T-beams, open side and upright channels, hollow beams, guy interconnected hangers and other variations differing materially from the grid modules of the present invention. However, such prior proposals are chiefly characterized by structures which expensively require supplemental connectors, fasteners, hangers and housings to adapt them to limited services. By contrast, the grid network and module of the present invention effectively and economically eliminate the need for such supplemental equipment while assuring a sturdy system construction well adapted to perform a large variety of services, some of which the various prior proposals are incapable of performing without further provision of additional costly and complicating equipment that require more labor to install.

Cooper U.S. Pat. No. 3,327,438 proposes another variant of such grid networks specially designed for associating therewith specific complementary structures of complicated design to mount partition panels and for retention of a doorjamb channel. The grid module thereof lacks features of the present grid module which provides for the latter a much greater versatility of desirable uses. Among such additional features are the equipment of the top of the inverted grid module channel with a pair of stacked longitudinal tracks having generally aligned, longitudinal access slots; the provision of transversely aligned and spaced interior abutment flanges integral with the bottom zones of the depending channel sidewall flanges which extend away from the vertical inner faces of these sidewall flanges, and the provision of a longitudinal series of multipurpose localized elongated slots which are longitudinally spaced in general alignment.

SUMMARY OF THE INVENTION

Embodiments of the present grid network include a plurality of similar, adequately load-bearing, grid modules which may be elongated integrator members produced as sections that are easily cut from a relatively stiff, elongated integrator stock member, with these sections having ends that may be simply fitted and connected together to define the grid network. This elongated integrator stock member may be, for example, desirably formed as a unity structure from extruded stiff or relatively rigid material, such as aluminum compositions or certain well-known plastics. Such stock member has an inverted channel defined by a cross web and a pair of transversely spaced, depending sidewall flanges that are adapted to receive therebetween any selected one of a large variety of utility units or other

structural equipment. The inverted channel is provided, either on or in its cross web and depending channel sidewall flanges with means to anchor any such utility unit or units and other equipment at any chosen locations.

At least one of the depending sidewall flanges of such inverted channel is also provided with a lateral and outwardly extending, panel-supporting flange permanently connected or integrated with the outer side of this depending sidewall flange at or in the vicinity of the bottom edge of the latter. In one form of this inverted channel both of its depending sidewall flanges may be so equipped. It is further provided with a first pair of elongated, transversely spaced, upstanding and opposed, inverted L-shaped flanges with their upstanding legs permanently connected or integrated directly with the channel cross web. The opposed lateral edges of these L-shaped flanges are laterally spaced apart to define an intervening longitudinal access slot, with the space intervening these flanges and the web constituting a first, lower, equipment-receiving elongated track for receiving and holding at any selected point anchoring means, such as heads or nuts of hanger rods or bolts, or clipping lips of conduit members and other equipment. A second pair of such opposed inverted L-shaped flanges are also provided above the first pair thereof, with their upstanding legs permanently connected to or integrated with the cross web by way of the upstanding legs of the first pair thereof. The opposed lateral edges of this second pair of inverted L-shaped flanges are similarly spaced transversely apart to define a similar intervening longitudinal access slot. The resulting pair of access slots are generally aligned upwardly for access therethrough to the cross web. The second pair of L-shaped flanges and the opposed lateral edges of the first pair together define a second, upper, equipment-receiving elongated track which extends longitudinally, substantially parallel to the first lower track. The integrated legs of the two pairs of inverted L-shaped flanges thus constitute together a pair of transversely spaced, continuous, upstanding flange structures which are integrated with the cross web in the vicinity of the junctions of the latter with the depending channel sidewall flanges, and each of their opposed inner faces has at least two upwardly spaced and laterally extending track flanges with those on one of the upstanding flanges being substantially aligned transversely with those on the other to form two opposed pairs thereof.

Each of the opposed inner faces of the inverted channel sidewall flanges is also provided in a lower zone thereof with a laterally extending abutment flange with the resulting pair thereof having their opposed inner edges spaced laterally apart appreciably to define an intervening access slot. These abutment flanges serve as anchorage structures to aid in the mount the inverted channel of various types of supplemental equipment, such as trim strip inserts, partition anchorage inserts, tempering air flow diverting devices, etc., and also to serve as trolley tracks when desired.

The resulting grid module in its preferred form has the general appearance of an H-shaped channel having the side flanges on opposite sides of the cross web equipped with a plurality of pairs of lateral flanges that extend in transverse planes substantially parallel to the transverse plane of the cross web.

The cross web is desirably provided with a longitudinal series of localized, longitudinally-spaced and generally aligned, elongated slots accessibly exposed between the generally aligned and longitudinal access slots intervening the pairs of opposed lateral track flanges above this web. Such elongated slots are adapted for selective use as air flow openings and insertion of equipment-anchoring members to extend down into the space defined between the cross web and depending channel sidewall flanges.

The present grid network includes a plurality of junctions where four of the inverted channel integrator modules are joined together in cruciform pattern with their abutted, opposed ends being angularly shaped to points which closely interfit. Each junction preferably includes a cruciform connector plate having each of its four arms respectively located in the upper second track and overlaying the lower first track of one of these inverted channel modules and anchored thereto by an anchorage, such as a bolt carrying a nut member that is slidably mounted through the access slot of and into the lower track. In order to keep each cruciform connector plate arm substantially aligned with the lower first elongated track that underlays it the channel integrator module has a pair of transversely spaced, upstanding, guide flanges flanking opposite sides of the top of this first lower track with the connector plate arm being slidably fitted between these guide flanges. These transversely-spaced and upstanding guide flanges are provided by the legs of the second upper track flanges with the cruciform arm slidably inserted in this second upper track. Along marginal edges of such a ceiling grid network such a connector plate may be T-shaped with its three arms so mounted in the upper tracks of three such grid modules that are there joined together in a junction. At the corners of a normally rectangular grid network of this type such connector plate may be L-shaped with each of its two arms so mounted in the upper tracks of a pair of such grid modules that are there brought together in a right angular junction thereof. One or more of such cruciform connector plates also may serve conveniently as an anchor for an overhead hanger to suspend the grid network, and the tracks of the modules may also slidably receive anchors of other overhead suspending hangers.

The space within the inverted channel module, intervening the depending sidewall flanges thereof, and the inside abutment flanges provided on the inner opposed faces of such depending flanges is well adapted to receive in any desired adjusted positions and to mount in simple manner a variety of types of utility units, such as automatic sprinklers, lighting fixtures, insulative electrical supply cable trackways, air supply and return outlets and intakes, tracks for sliding or bellows folding partitions and curtain walls, anchorages for the tops of posts and panels of room partitions, and also intervening blank filler or trim strip sections where needed for decorative appearance. The inwardly directed and opposed lateral flanges of the elongated top track or tracks also provide means readily available for anchoring thereto various types of anchorages, such as laterally spaced and outwardly directed lips, of conduit sections for embodying where needed fluid or tempering air flow passages, such anchorage lips also being useful for overhead mounting of open top pans in which power cables and other electrical wiring may be laid. When trim strips close the bottom access slots between

the opposed pairs of lateral inside flanges that are carried by the opposed inner faces of the depending sidewall flanges of such inverted channel integrator members when interconnected, so that the spaces between these depending sidewall flanges, the cross webs and such trim strips are closed off, electrical cables or wiring and other equipment, such as pipes, may be housed to advantage in such closed elongated spaces. The opposed pair of such lateral, inside abutment flanges of any particular inverted channel grid module may also serve effectively as transversely spaced tracks which together may constitute a raceway for support of a plurality of trolleys to glide therealong. Any depending type of structure, such as a curtain wall, may be supported from such trolleys through the access space intervening these opposed and transversely spaced inside lateral flanges. Such opposed and lateral inside abutment flanges also effectively serve as portions of anchorages for such a trim strip and also for other equipment, such as flow diverters or other outlets, as well as for structure to engage and hold the top edges of partition structure, such as panels. Such an anchorage may be a partition strip similar to a trim strip, but having in its bottom face an inverted gripping channel into which may be fixedly inserted suitable partition unit mounting means. This mounting means may be an inverted U-shaped channel into which the top edges of partition units may be tightly received and with its web having an upstanding flange which may be forced upwardly into the strip gripping channel.

At junctions of a plurality of the grid modules, such as where four thereof are brought together, provision may be made for effectively anchoring by the aid of their inside lateral abutment flanges free standing posts to which the side edges of partition units may be anchored. Such a post may carry on its top end an element, such as a headed pin, which is upwardly biased by a spring mounted on or in the post. A juncture cap may be provided which has a top side so shaped as to fit complementally against and between the inside abutment flanges of the grid modules brought together in this junction, and a bottom side shaped complementary to a patterned head of the upwardly biased pin. The post is jammed into position beneath this juncture cap to hold the assembly in position. Such a post support may be provided at any selected position along one of the grid modules rather than at junctions of a plurality of such modules.

Other objects of the invention will in part be obvious and will in part appear from reference to the following detailed description taken in connection with the accompanying drawings, wherein like numerals identify similar parts throughout, and in which:

FIG. 1 is a transverse sectional view, with parts broken away, of one form of the grid module or integrator channel member of the present invention, illustrating the depending support from the cross web of this channel member of a bottom space-closing trim strip, and a housing in this closed bottom space of electrical cables, edges of portions of lateral ceiling panels being shown supported on the lateral outside flanges of the channel depending sidewall flanges;

FIG. 2 is a transverse sectional view similar to FIG. 1, showing the support of the electrical cables in a shallow open-top tray superposed on the integrator channel member and with the trim strip omitted;

FIG. 3 is a transverse sectional view, with parts broken away, of a perimeter variant of the integrator channel member illustrated in FIGS. 1 and 2 and which is adapted to location along the marginal side of a room or building space, a portion of a wall of which is indicated, which dictates omission of one of the outside lateral flanges for ceiling panel support, and depicting use of the opposed inside abutment flanges as tracks for movable trolleys which are employed to suspend a belows type partition that are shown in broken lines;

FIG. 4 is a perspective view, with parts in section and broken away, of a junction of four of the channel integrator members and the suspension support thereof by a cruciform connecting plate and suspending member, with parts of ceiling tile supported by these integrator members being shown;

FIG. 5 is a transverse sectional view, with parts broken away, taken substantially on line 5—5 of FIG. 4;

FIGS. 6 and 7 are plan views to smaller scale respectively of T-shaped and L-shaped variants of the cruciform connecting plate that is illustrated in FIG. 4;

FIG. 8 is a plan view to smaller scale of another embodiment of the cruciform connecting plate depicted in FIG. 4;

FIG. 9 is a transverse sectional view, with parts broken away, of a channel integrator member of the present invention showing in cross-section one of the four arms of the cruciform connecting plate of FIG. 8 as anchored in the upper longitudinal track of this integrator member;

FIG. 10 is an exploded perspective view, with parts broken away, of the top end of a sheathed post, equipment thereof and a juncture cap designed to support this post in free standing position for anchorage thereto of partition paneling units radiating from a junction of four of the channel integrator members of this invention;

FIG. 11 is an elevational section, with parts broken away, of such a FIG. 10 junction employing the parts of the the latter;

FIG. 12 is a transverse sectional view, with parts broken away and others shown in elevation, of the structure shown in FIG. 1 with the cables omitted, illustrating mount thereby of an air supply conduit structure or duct;

FIG. 13 is a transverse sectional view, with parts broken away, taken substantially on line 13—13 of FIG. 12;

FIG. 14 is a transverse sectional view, with parts broken away, of structure shown in FIG. 12 with a flow directing air delivery unit substituted at a desired location for the trim strip for delivery of tempering air from the overhead air supply duct, or a "boot" or head unit of similar construction;

FIG. 15 is a transverse sectional view, with parts broken away, of structure similar to that illustrated in FIG. 1, but with a partition insert substituted for the trim strip, this partition insert supporting an inverted U-shaped channel for receiving the top edges of partition panel units; and

FIG. 16 is a view similar to FIG. 15 showing the partition insert supporting another embodiment of the inverted U-shaped channel for engagement over the top edges of partition panel units.

Reference should be made to FIG. 1 of my above-identified pending patent application Ser. No. 73,806 for an illustration of a portion of a room which has been

equipped with an embodiment of the suspended ceiling system. It is to be understood that for the construction of this suspended ceiling system the grid module integrator members of the present invention may have been employed to advantage. The grid modules which are employed therein that do not margin the borders of the room would be of the type illustrated in FIG. 4 and those which do would be of the type shown in FIG. 3.

As will be seen from FIGS. 1 and 2 a grid module of the present invention, in the form of an extruded, elongated, channel integrator member, is characterized by an inverted U-shaped channel structure 19 having a cross web 20 from the side edges of which depend sidewall flanges 21 and 121. The bottom zones of these sidewall flanges are equipped with outside lateral flanges 22 and 122, each of which forms a ledge on which may be supported or rested the edge of a suitable ceiling tile 23. The inner faces of the depending sidewall flanges 21 and 121 are provided with opposed, lateral abutment flanges 24 and 124, with their opposed edges appreciably spaced apart to provide an intervening access slot 25 for ready access to the bottom space 47 of this inverted channel as defined by the cross web 20, the depending sidewall flanges 21 and 121 and the lateral abutment flanges.

The cross web 20 has permanently connected thereto or integrated therewith a pair of laterally spaced, upstanding flanges 26 and 126, which are respectively formed of a pair of inverted L-shaped portions or flanges 27 and 28, and 127 and 128. The leg 29 of the inverted L-shaped flange 27 is directly connected or integrated with the junction between one edge zone of the cross web 20 and the depending sidewall flange 21 thereat. The depending leg 30 of the upper, inverted L-shaped flange 28 is integrated with the depending leg 29 of the lower, inverted L-shaped flange 27, so that they together form the upstanding side flange 26. This integrated assembly of flanges is allochirally duplicated in the opposed upstanding flange 126. The L-shaped flange 27 has its lateral flange 31 opposed to and appreciably spaced from the similar lateral flange 131 of the inverted L-shaped flange 127, so that their opposed edges 32 and 132 define therebetween an elongated access slot 33. In like fashion the lateral flanges 34 and 134 of the upper inverted L-shaped flanges 28 and 128 have their opposed inside edges 35 and 135 substantially aligned with each other so as to define therebetween an upper access slot 36. The access slots 33 and 36 are generally aligned upwardly so as to provide ready accessibility to the cross web 20 down there-through.

The cross web 20 and the lower, inverted L-shaped flanges 27 and 127 together define therebetween a first, lower, elongated track 37. Likewise, the opposed lateral flanges 31 and 131 of the lower inverted L-shaped flanges 27 and 127, and the opposed lateral flanges 34 and 134 of the upper inverted L-shaped flanges 28 and 128 define therebetween a second, upper, elongated track 38. It will thus be seen that the two opposed pairs of inverted L-shaped flanges 27 and 28 define above the cross web 20 a stack of a pair of the elongated lateral tracks 37 and 38.

It will be noted that the structure on one lateral side of the cross web 20 of the inverted U-shaped channel integrated member 19 is like that on the opposite side thereof in an allochiral sense, and it is to be understood that this elongated member may be provided as a sec-

tion of a continuous extrusion of any suitable, substantially rigid material, such as an aluminum composition or a suitable plastic. Such continuous elongated extrusions may be cut up into suitably selected lengths for use as a grid modules in the construction of suspended ceiling structures.

An elongated, extruded trim strip 39, which may be of similar material, is provided with lateral side flanges which have outer side lips 40 and 140 that are rabbeted longitudinally to provide longitudinal notches or grooves 41 and 141 into which the abutment flanges 24 and 124 nest or seat. Medially, the top side of the trim strip 39 is provided with a longitudinally extending, upstanding rib or hanger flange 42 which is forked along its upper edge to provide a pair of laterally spaced, elongated, upstanding flanges 43 and 143. The opposed inside faces of the flanges 43 and 143 are provided with a series of longitudinal grooves and intervening ridges which may anchor therebetween the threaded shank of one or more screws or bolts, such as that indicated at 44, at any desired locations therealong. A suitable aperture 45 in the cross web 20 permits this bolt shank to extend down therethrough to such threaded engagement with the bolt head 46 located in the lower elongated track 37. If desired, the cross web 20 may be provided with a longitudinally extending series of localized, longitudinally spaced and generally aligned holes of this nature which may be in the form of elongated slots, as will be made more apparent hereinafter. The lower space 47 which is defined between the cross web 20, the depending sidewall flanges 21 and 121 and the trim strip 39, may be employed for housing any suitable service equipment or wires, such as, for example, a plurality of electrical cables 48.

It will also be seen from FIG. 2 that, in lieu of housing such electrical cables 48 in the closed lower space 47, provision therefor may be made by superposing above this integrator member an open-top elongated pan 49, as is proposed in FIG. 2, which will be located between the suspended ceiling structure and the permanent ceiling thereabove, from which this suspended ceiling system depends. For this purpose, the transverse bottom 50 of the shallow pan 49 may be equipped with a pair of laterally spaced, depending, elongated, springy clip lips 51 and 151 having their hooked bottom edges extending outwardly in opposite directions, to be engaged beneath the lateral, inwardly extending, opposed flanges 34 and 134 by virtue of the springiness of these clip lips. For this engagement the hook terminating edges of these depending clip lips 51 and 151 may be forced downwardly through the elongated access slot 36, past the opposed lateral track flanges 34 and 134, to snap into the upper track 38.

It will be noted from FIG. 3 that the opposed, interior abutment flanges 24 and 124 desirably may serve as rails of a track or raceway. As is therein indicated in broken lines, each of a plurality of trolleys 52 may be inserted into the interior space 47 with wheels thereof riding upon the rails 24 and 124. Each such trolley 52 may support by any suitable means, such as a suspending clip 53, a section of the top of a folding bellows-type curtain wall or partition 53. In the event that the grid module, therein illustrated at 119, is of a type to be located along the perimeter of a ceiling grid network for flanking a building structural wall, a portion of which is indicated at 55, this grid module has omitted therefrom the longitudinal, outside lateral flange 22

which would otherwise extend from the bottom edge of the depending channel sidewall 21, for support thereby of the edge of a ceiling tile.

FIGS. 4 and 5 illustrate structural parts of a junction assembly 56 in a suspended ceiling grid network, where four of the grid modules 19 are brought together in cruciform pattern by tapering the opposed ends thereof in abutted interfitting fashion, and with a cruciform connector plate 57 being embodied therein to connect them together. This cruciform connector plate 57 has four like radiating arms 58, with each arranged at right angles to those on opposite sides of it and with all of them being respectively anchored in like fashion to the four grid modules 19 brought together in this junction assembly 56. For example, the outer end of each cruciform connector plate arm 58 has a longitudinal slot 59 therein which receives the shank 60 of a headed screw 61 with a nut plate 62 threadably mounted upon this shank being slidably received in the lower track 37, beneath its lateral flanges 31 and 131. This cruciform connector plate arm 58 is of a width so as to be snugly slidable within the upper track 38, beneath its lateral flanges 34 and 134 and above the lateral flanges 31 and 131 of the lower track 37. Tightening of the screw shank 60 into the nut plate 62 securely clamps this cruciform connector plate arm 58 to the shaped end of the grid module 19 into which it is so seated. Preferably, the internally threaded hole in the nut plate 62, which threadably receives the screw shank 60, is formed by an extrusion or boss 63 to provide a greater number of the internal threads therein for secure anchorage of the screw shank. This same clamping connection is effected with respect to the remaining three cruciform connector plate arms 58 and the grid modules into which they are so fitted and anchored.

A variant of the cruciform connector plate 57 may be provided which may be a cast unit with each of the four arms provided with wedge-shaped catches and adapted to be jammed respectively for self-anchorage into the lower tracks 37 of the four module channels 19 brought and anchored together in the junction 56. This will leave free the upper tracks 38 thereof for other purposes. Conveniently, the suspending hanger may have its bottom end headed for quickly anchoring to such a cast cruciform connector by engagement into a key-hole slot provided centrally in the latter.

It will be understood that the cruciform connector plate 57 may be provided with a central hole to receive the threaded shank of a reach bolt 64 which may be anchored into the junction assembly 56 by any suitable means, such as a nut 66 (FIG. 11). For this purpose the central hole in the cruciform connector plate 57 may be formed in a boss 65 that is raised in the central portion of this connector plate, into the concave underside of which such a nut 66 may be nested. The reach bolt 64 may be threaded into a connector or turnbuckle 67 which, in turn, threadably engages a suspension stem 68 that is anchored to a ceiling joist, together to constitute the suspension assembly.

In perimeter junction assemblies margining such a suspended ceiling network variants of such a cruciform connector plate 57 are to be employed. In such junction assemblies which intervene room corners T-shaped connector plates 157 (FIG. 6) may be used to advantage, having three such arms 58 adapted respectively to be received in and anchored in like fashion to the three grid modules there brought together in an

abutted T-shaped pattern. In corner junction assemblies, where two obliquely shaped ends of the grid modules are brought together in L-shaped pattern, L-shaped connector plates 257 (FIG. 7) are used to advantage, for similar anchorage thereto.

A frictional engagement variant of the anchorage of each of the connector plate arms 58 is proposed in FIGS. 8 and 9. It is therein illustrated, by way of example, that the cruciform connector plate 357 has the side edges of each of its arms 158 provided with L-shaped notches or slots 69, each of which defines a spring finger 70 when the plate is formed from suitable resilient metallic sheet, such as tempered steel. Such a connector plate 357 may be die shaped and cut from the resilient metallic sheet to provide the medial perforated boss 65 therein, the radiating arms 158, the L-shaped slots 69 in these arms and curved deflection of the resulting spring fingers 70 out of the plane of these arms. The top side of the tip of each of these spring fingers 70 will be located by such deflection a distance from the bottom face of such arm 158 a greater distance than the width of the receiving and opposed, upper track grooves 38, so as to require such fingers to be flexed back to a degree when the side edges of the arm are slidably forced into these opposed track grooves. This forced sliding action and resulting partial return flexure of these deflected spring fingers 70 stores recovery force therein which causes the side edge zones of the arm 158 and the tip ends of these fingers to jam in these track grooves for secure retention. Other forms of spring biasing may be employed for this purpose, such as spring-biased detents carried either by edge zones of the connector plate arm or the walls of the receptive track grooves 38, which are in direct opposition with respect to each other. The arms 158 of such cruciform connector plate 357 may also be jammed into the lower tracks 37 of the four module units 19 to leave free the upper tracks 38 thereof for other purposes.

In FIGS. 10 and 11 are illustrated structural equipment which may be employed to advantage for anchoring partitioning post structure to such suspended ceiling grid network. This structural equipment includes a rectangular juncture cap 71 which has a rectangular, preferably square, base 72 surmounted by a rectangular or square raised land 73 of smaller lateral dimensions. The side edges 74 of the land and the top edge zones 75 flanking these edges together define rabbet grooves 76 in which the channel abutment flanges 24 and 124 will seat or nest. The bottom face 77 of the juncture cap 71 is provided with a cruciform-shaped recess 78 into which a cruciform-shaped head 79 of a detent pin 80 will fit in nestable fashion, as is indicated in FIG. 11. The shank 81 of the detent pin 80 is slidably receivable in a longer helical compression spring 82 for permitting the pinhead 79 to rest upon the spring top end 82a, so that this pinhead will be biased upwardly by this spring when the bottom end 82b of the latter is seated upon a suitable abutment. A vertical partition post 83 is provided, preferably as a section of an extruded bar of suitable rigid material, such as an aluminum composition. As is best understood from FIG. 10 this post 83 preferably is of cruciform cross-section and is of hollow core construction by virtue of a cylindrical central hole 84 provided therein by the extruding procedure. The diameter of the hole 84 is slightly larger than the outside diameter of the compression spring 82 for free sliding action therein. A simple way of provid-

ing a seating abutment within the core hole 84 is to drill a transverse pinhole 85 into a side of the post 83 for extending across the core hole 84 and driving a drift pin 86 therein for bridging across this hole.

When it is desired to subdivide by partitions a building space that has been equipped with a suspended ceiling grid network made up of grid modules of the present invention and ceiling tiles supported thereby such a partition post structure 83 and juncture cap 71 may be employed to advantage. If a plurality of such partitions, such as four, are to radiate from a grid network junction 56, such as that which is illustrated in FIG. 4, a post section 83 will be selected which may be of proper length initially or the bottom end thereof may be cut off to reach up from the building floor substantially to the bottoms of the grid modules in this junction. A suitable sheathing casing 87 of the proper length will be selected or prepared as to length, and the proper length post 83 will be telescoped therinto, as is indicated in FIGS. 10 and 11. The juncture cap 71 will be seated on the cruciform pinhead 79 and the pin 80 retracted against the upward biasing of the spring 82 until this entire post assembly can be jammed to beneath the bottom of the grid network junction 56, with this cap guided into position below this junction for nesting the grid module abutment flanges 24 and 124 into the cap rabbets 76. This will provide a freestanding partition post structure at this grid network junction, to which ends of partition structures may be suitably anchored.

For this purpose it will be noted that the sheathing casing 87 has four side panels 88, each of which is shaped to provide therein a vertical groove or channel 89. The vertical edge 90 of a partition panel 91 will be jammed into one of the receiving channels 89 and its top edge may be jammed into a suitable inverted U-shaped clip channel suspended from the grid module beneath which such partition is being constructed, as will be more fully explained in connection with FIGS. 15 and 16. If desired, the juncture cap 71 may be more positively anchored to the grid modules 19 which are brought together at 120 in interfitting fashion in the suspended ceiling grid network junction 56. For this purpose the juncture cap land 73 may be provided with an upwardly extending, internally threaded, extrusion or boss socket 92, into which may be threaded the externally threaded shank of a screw, such as 46, which extends down through an opening defined in the meeting tapered tips of the grid module cross webs 20 where they are brought together at 120 in the junction. Such a boss socket 92 and anchorage screw assembly may also be desirable when a partition structure is to begin or terminate at a point which is not at a location of a junction of the ceiling grid network. In the latter case one of the slot openings 45 in the grid module cross web 20 may be at a proper location for such anchorage screw use and, if not, a suitable hole may be drilled therethrough at the required point. In such case the post sheath 87 may be varied to provide only such panel edge receiving, vertical channels 89 as may be required.

As will be seen from FIGS. 12 and 13 selected ones or aligned pluralities of the grid modules 19 embodied in the suspended ceiling grid network may have associated therewith air ducts for supplying therethrough pressurized tempering air to desired locations of a room space covered by the suspended ceiling system.

Such ducts may be located in the overhead space intervening the suspended ceiling system and the permanent building ceiling thereabove, and connected in any desired manner to a remote point of supply of the pressurized tempering air. For example, air supply duct 92 which may be constructed of compacted fiber glass or aluminum sheeting, may be of generally triangular cross-section and have a substantially flat top panel 93 from which depend oblique and converging sidewall panels 94 and 95. The lower edges of the sidewall panels 94 and 95 are equipped with elongated clip lips 96 and 196 which are turned outwardly in opposite directions to be sprung toward each other and inserted down through the elongated access slot 36, into the upper track 38, below the lateral flanges 34 and 134 thereof. Springiness of the duct sidewalls 94 and 95 as well as that of the junctions of these sidewalls with the top panel 93, and flexibility of such clip lips 96 and 196, permit the turned out bottom edges of the latter to spring out laterally away from each other, when released, so that they will engage firmly beneath the in turned lateral flanges 34 and 134. With the bottom of the triangular duct 92 open between the clip lips 96 and 196 the interior of such duct is in communication through the aligned access slots 36 and 33 to the lower track area 37 immediately above the cross web 20. Cooling or heating air is supplied through the interior of the duct 92 from a suitable remote pressurized source to the lower elongated space 47 of the grid module by way of the elongated slot openings 45 in the cross web 20 (FIG. 13). Wherever delivery of such tempering air into the room space is desired a portion of the lower space closing trim strip 39 is omitted to be replaced by a suitable delivery or outlet utility unit, which may be localized or extend a considerable distance along aligned runs of the grid modules 19. The terminal ends of such air supply ducts 92 may be determined by the locations of such utility air delivery units and may simply be provided by cutting off each such duct at a suitable point and blocking the open end by a trapezoidally shaped panel 97 secured thereto by strips of tape 98. If it is desired to employ other types of air delivery ducts, sections of such triangular duct 92 may be provided in standard lengths of 30 to 40 inches long which are closed off at both ends by such trapezoidally shaped end panels 97 to form localized supply heads or "boots," for mount to and support by a grid module 19 in the described manner. It is to be understood that by making the hooked edge zones 96 and 196 longer they can be hooked into the lower track 37, if desired.

A simple and readily mounted outlet utility unit is illustrated in FIG. 14, which may be a generally curved or C-shaped section 99 of desirable length which is cut from an elongated extrusion of suitable material. For the purpose of so mounting the C-shaped outlet unit 99 within the grid module lower space 47 the extrusion production of the grid module sections 19 desirably includes the formation of a pair of longitudinal shallow grooves 100 and 200 in the side edge zones of the bottom face of the cross web 20. The top edge zone of the C-shaped section 99 has a longitudinal bead 101 which fits into one of these longitudinal grooves 100 and 200, such as the latter, and the bottom edge zone of this C-shaped section is provided with a lateral channel 102 into which the lateral, interior abutment flange 124 fits. It is a simple matter to insert the C-shaped, flow-

directing section 99 up through the bottom access slot 25, into the lower space 47 and then slide it laterally outward toward the depending sidewall 121 with engagement of the abutment flange 124 into the channel 102. By making the vertical distance between the crown of the bead 101 and channel 102 slightly greater than the vertical distance between the deepest portion of the groove 200 and the abutment flange 124 such lateral sliding of the C-shaped section requires a stressing of the latter in a vertical direction with this bead sliding along the bottom face of the cross web 20 until it can snap into the groove 200 for a resulting secure anchorage of this outlet utility unit 99. It will be noted from FIG. 14 that pressurized air flows down from the supply duct or "boot" 92 through one or more of the cross web openings or slots 45 into the portion of the lower space 47 which is not filled by the C-shaped section 99, so as to be directed obliquely down by the lateral, interior abutment flange 24 with some desired lateral deflection as is indicated by the flow path arrows.

FIGS. 15 and 16 illustrate the use of an extruded, elongated partition insert 103. It may be quite similar to the cover insert or trim strip 39 except that the upstanding Y-shaped rib 142 has an elongated inverted channel 104 defined in its base between laterally opposed and spaced, corrugated channel sidewalls with which the threaded shank 105 of a screw 106 threadably may engage at any desired point along this channel. An inverted clip channel 107 may be anchored by a plurality of such screws 106 along the bottom of the partition insert 103, and the top edge zone 108 of a partition panel 91 may be securely mounted therein by jamming it between the depending side flanges 109 and 209 of this inverted clip channel. A variant of the panel-anchoring clip channel 107 is illustrated at 207 in FIG. 16, which may be formed of spring sheet metal. Its lateral top end 110 includes a reverse fold to define an upstanding rib 111 which may be jammed into the partition insert channel 104 for secure anchorage, with depending sidewall flanges 109 and 209 being adapted to grip therebetween the top edge zone 108 of the partition panel unit 91.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent is the novel subject matter defined in the following claims:

1. In a suspended ceiling system which includes a grid network for supporting a plurality of ceiling panels, a grid module comprising

1. an elongated integrator member which is adapted to have its ends connected to those of other like integrator members together to define the grid network, with said member having
 - a. an inverted channel defined by a cross web and a pair of transversely spaced, depending sidewall flanges adapted to receive therebetween another structure,
 - b. means provided on said inverted channel to effect anchorage therein at any chosen location of such other structure, and

- c. at least one lateral and outwardly extending panel-supporting flange permanently connected to the outer side of one of said depending channel sidewall flanges in the vicinity of the bottom edge of the latter, characterized by
 - d. a pair of elongated, transversely spaced, upstanding and opposed flanges permanently connected to said channel web at the junctions thereof with said depending sidewall flanges
 - e. each of which is provided on the inner side thereof with at least two upwardly spaced and laterally-extending track flanges with those on one of said upstanding flanges being substantially aligned transversely with those on the other to form two opposed pairs thereof,
 - f. the inner edges of each of said pair of opposed lateral track flanges being spaced apart laterally to define an intervening longitudinal access slot with the resulting pair of longitudinal access slots being generally aligned upwardly,
 - g. the pair of said opposed lateral track flanges nearest said cross web defining with the latter a first lower, longitudinal, equipment-receiving track and with both pairs of said opposed lateral track flanges defining therebetween a second upper, longitudinal, equipment-receiving track.
2. The grid module as defined in claim 1 characterized by each of the opposed inner faces of said channel sidewall flanges being provided with a laterally-extending abutment flange with the resulting pair thereof having their opposed inner edges spaced laterally apart appreciably to define an intervening access slot.
3. The grid module as defined in claim 2 characterized by the provision of a cover insert in the form of a longitudinally-extending and lateral trim strip having an upstanding, longitudinally-extending, generally medial hanger flange insertable up into the space defined between said channel cross web and depending sidewalls, said hanger flange being provided on its upper edge with means engageable by anchoring members depending from said inverted channel cross web and a pair of lateral and longitudinally extending side flanges extending from opposite sides of said hanger flange, said trim strip side flanges having longitudinal grooves in which said channel abutment flanges seat.
4. The grid module as defined in claim 2 characterized by the provision of a flow-diverting air supply in-

sert in the form of an elongated member insertable up into the space defined between said channel cross web and depending sidewall flanges, said member being C-shaped in cross-section and having on its upper edge zone anchoring means engaging the lower side of said cross web in the vicinity of the junction of the latter with one of said depending sidewall flanges and additional anchoring means on its lower edge zone engaging the lateral abutment flange which projects inward from the inner face of this depending sidewall flange, openings being provided in said channel cross web for passage of air flow from thereabove down into said space between said cross web and depending sidewall flanges.

5. The grid module as defined in claim 2 characterized by a partition post cap structure having a top provided with grooves in which said channel abutment flanges are seated with the bottom of said cap structure shaped complementary to the shape of top end structure of an upright partition post for interfitting engagement between the latter and said cap structure.

6. The grid module as defined in claim 1 characterized by said cross web thereof being provided with a longitudinal series of localized, longitudinally spaced and generally aligned, elongated slots accessibly exposed between the generally aligned and longitudinal access slots intervening said pairs of opposed lateral track flanges, these slots being adaptable for selective use as air flow openings and insertion of equipment-anchoring members to extend down into the space defined between said channel cross web and depending sidewall flanges.

7. The grid module as defined in claim 1 characterized by said channel cross web being provided with openings for passage of tempering air flow from thereabove down into the space defined therebelow between said channel depending sidewall flanges; and an inverted U-shaped, tempering air supply duct having sidewall panels with bottom longitudinal portions thereof equipped with elongated, flexible clip lips having longitudinally extending lateral flanges turned outwardly away from each other and inserted down through said upper longitudinal track access slot, said clip lips being sprung outwardly away from each other with their lateral flanges engaged below the opposed and inwardly extending track flanges of one of the opposed pair thereof.

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Disclaimer

3,742,674.—*Marshall Ira Lang*, Wayne, N.J. SUSPENDED CEILING SYSTEM INCLUDING A GRID NETWORK. Patent dated July 3, 1973. Disclaimer filed Feb. 1, 1973, by the assignee, *Bayer Industries Incorporated*.

Hereby disclaims the portion of the term of the patent subsequent to Aug. 22, 1989.

[*Official Gazette February 19, 1974.*]