United States Patent [19]

Donato

[11] **3,898,782**

[45] **Aug. 12, 1975**

[54] **INTEGRATED CEILING SYSTEM**

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[73] Assignee: **Lightolier Incorporated**, Jersey City, N.J.

[22] Filed: **Jan. 4, 1974**

[21] Appl. No.: **430,913**

[52] **U.S. Cl.** ..... **52/488**; 52/496; 52/664; 52/758 A

[51] **Int. Cl.**[2] **E04B 5/52**; E04C 2/42

[58] **Field of Search** ..... 52/484, 488, 496, 656, 52/664, 665, 669, 666, 668, 660, 758 A, 667

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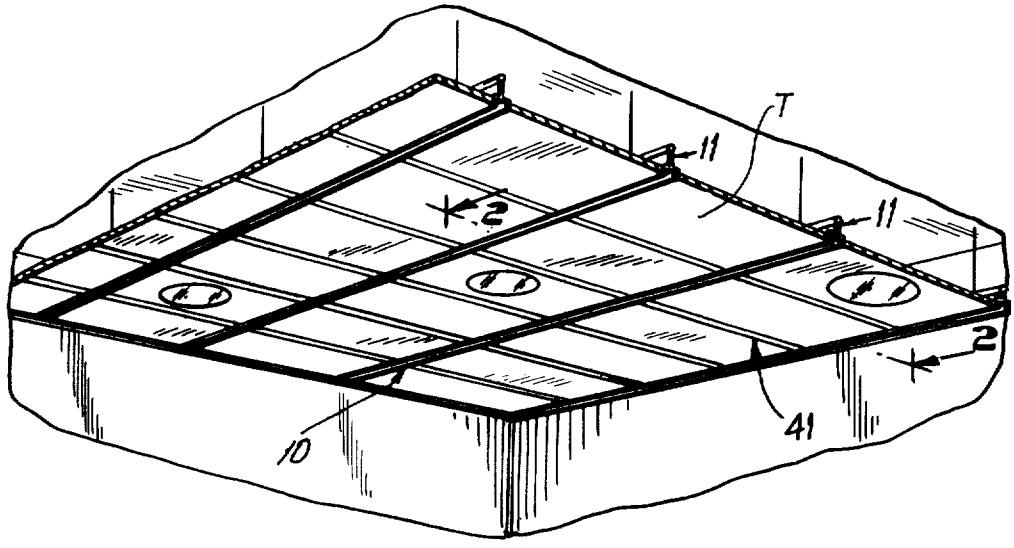
Primary Examiner—Price C. Faw, Jr.

Attorney, Agent, or Firm—Arthur B. Colvin

[57] **ABSTRACT**

The present invention is directed to an integrated ceiling system of the electrified hung ceiling type, characterized by ease of installation, flexibility, structural rigidity and aesthetic appearance. The ceiling includes longitudinally extending runners, transversely extending tile supports and locking struts which interfit between adjacent runners, rigidly coupling the same. A characterizing feature of the structure lies in the novel attachment elements which enable the parts to be accurately and easily integrated.

3 Claims, 14 Drawing Figures



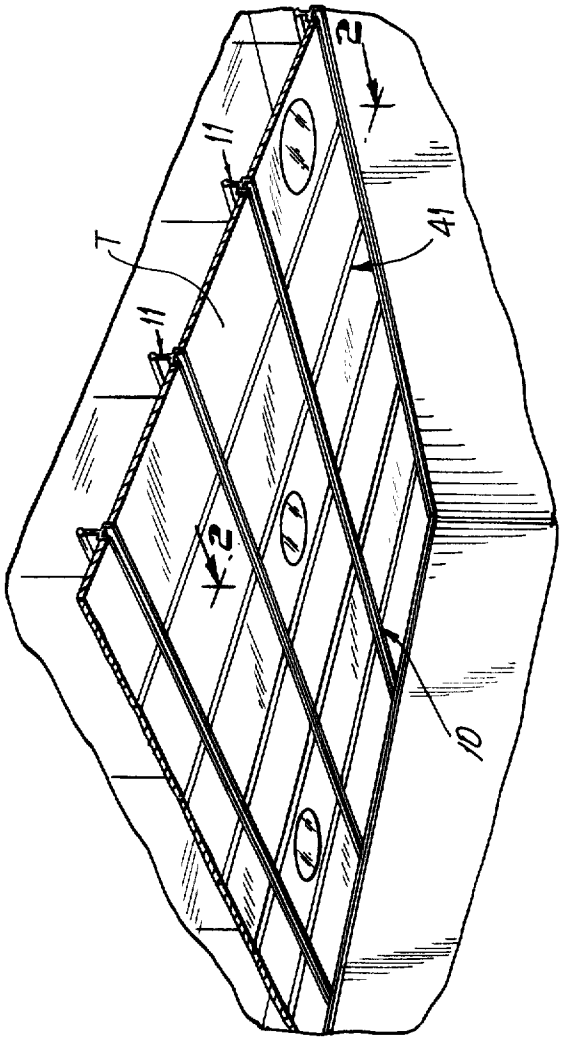

2
11
T
41
11
2
10

FIG. 1

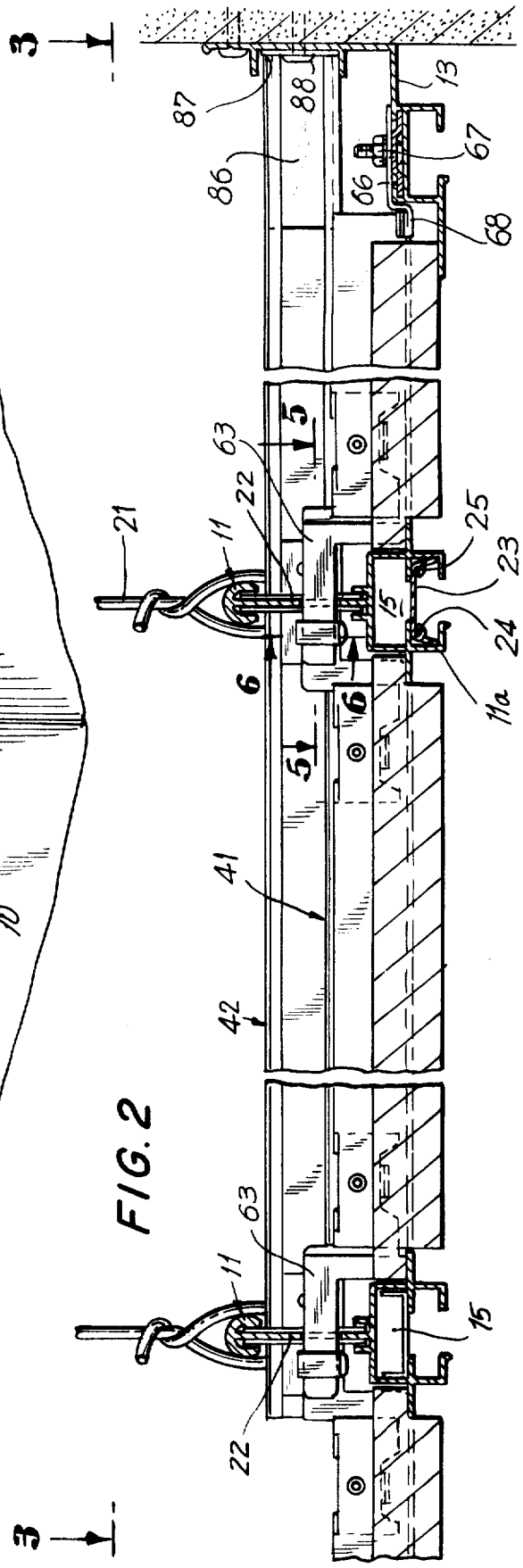

3
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87
88
13
86
67
66
68
5
63
22
21
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24
6
11a
6
5
41
42
63
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3
1

FIG. 2

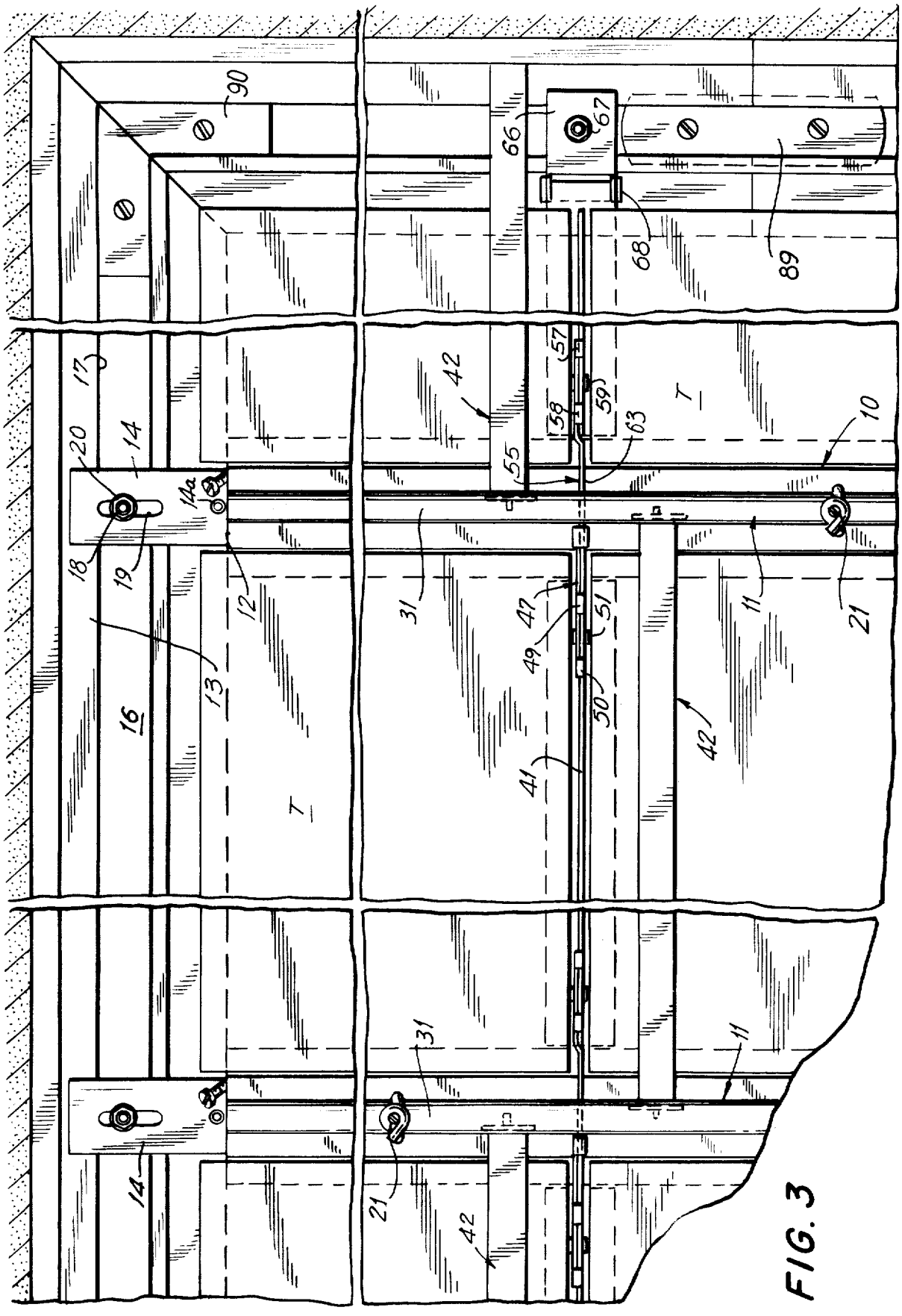

90
66
67
68
89
17
42
57
58
59
63
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14
14a
55
18
19
12
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47
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49
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16
7
41
42
14
21
31
11
42

FIG. 3

FIG. 4

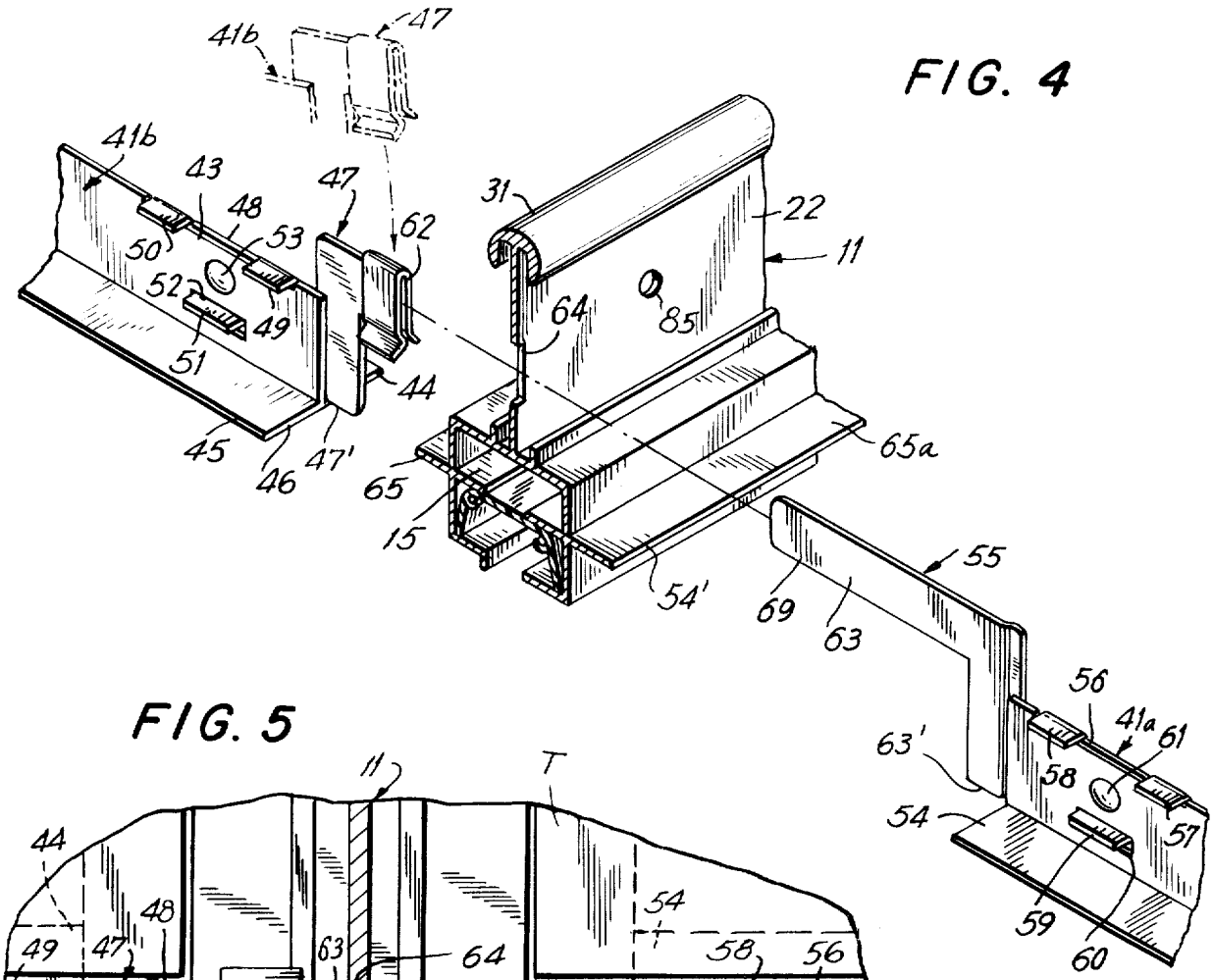


FIG. 5

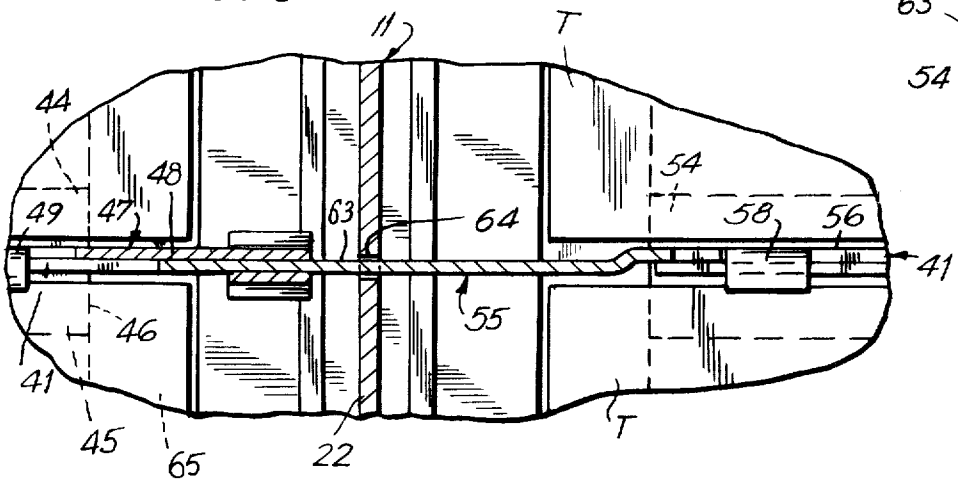


FIG. 6

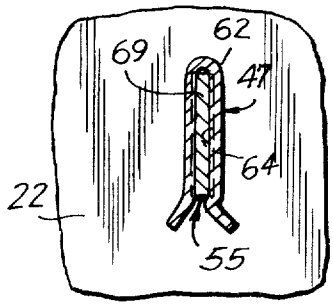


FIG. 7

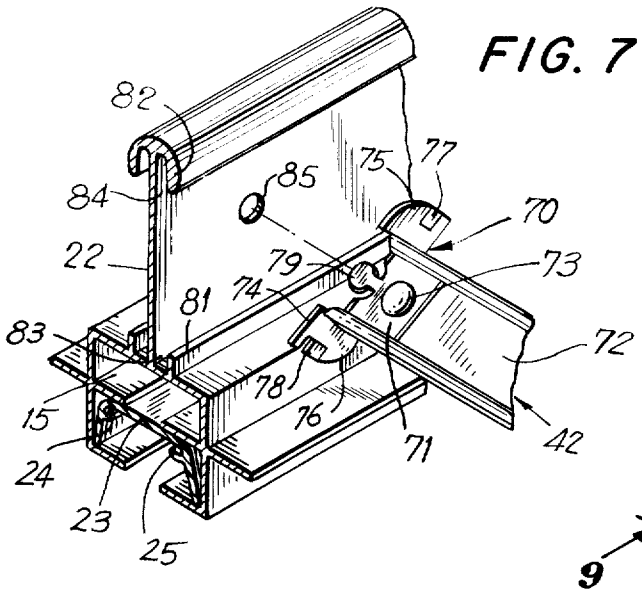


FIG. 8

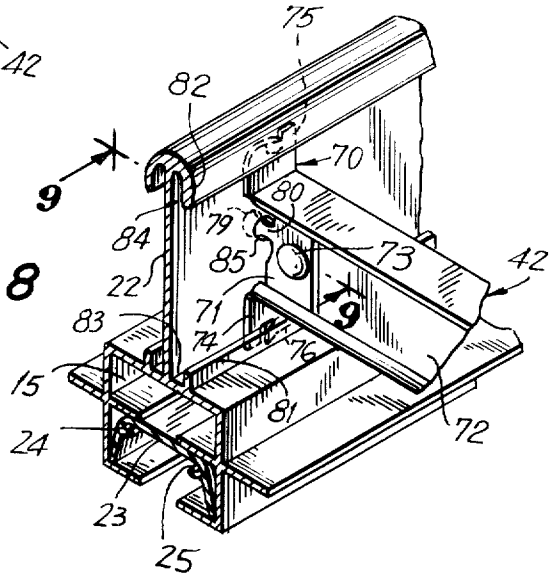


FIG. 9

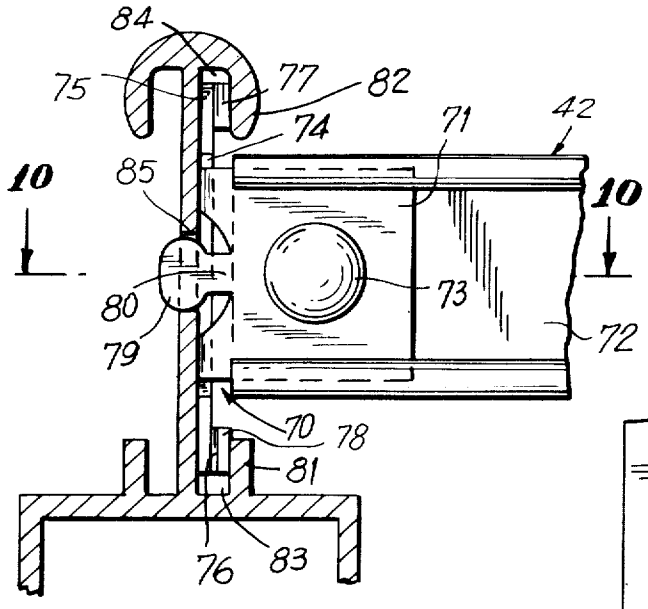


FIG. 10

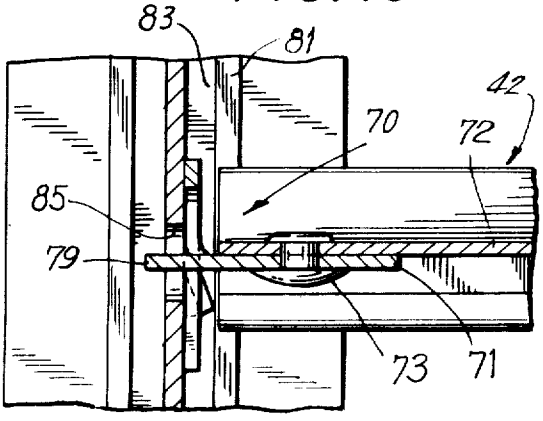


FIG. 11

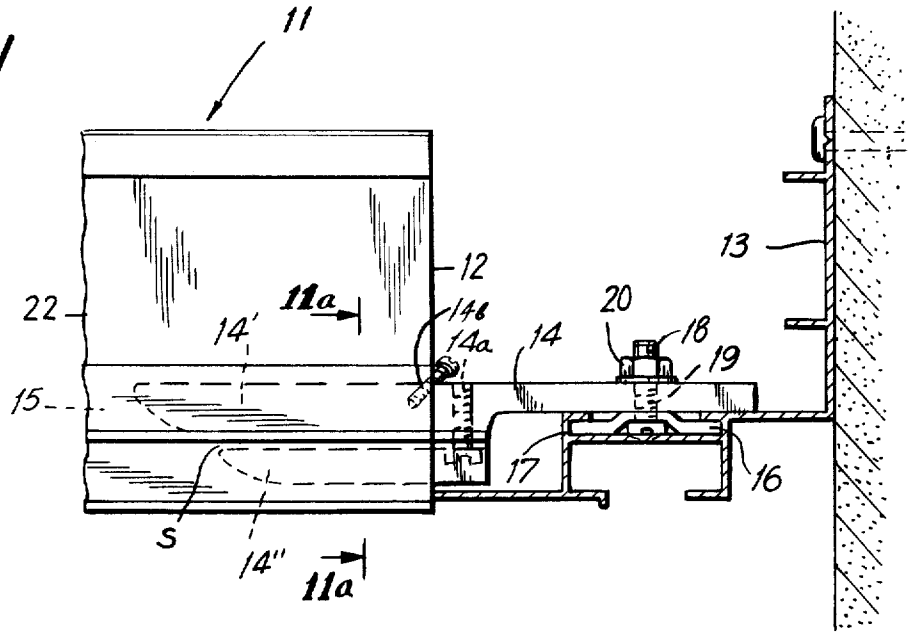


FIG. 11a

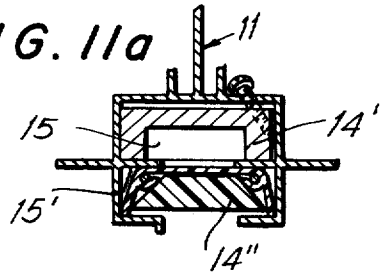


FIG. 12

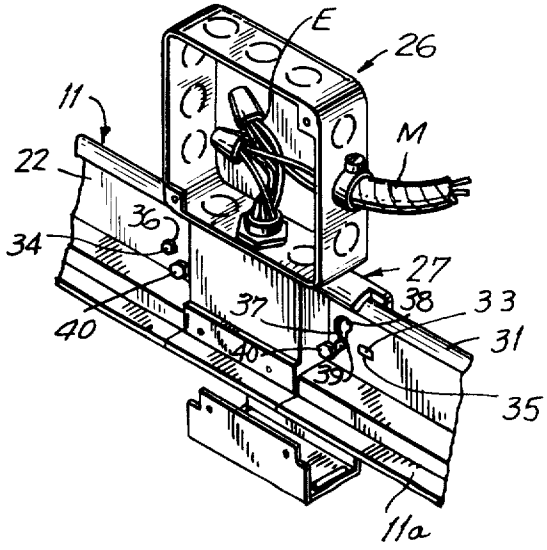
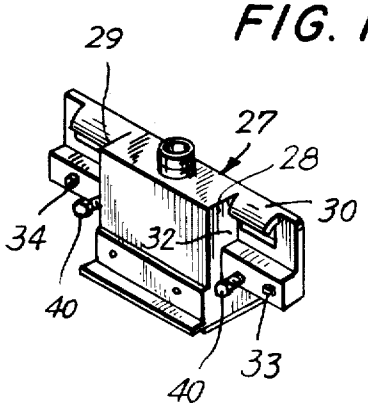


FIG. 13



INTEGRATED CEILING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is in the field of so-called "hung" ceilings, referring to a grid work depending from the structural components of the building, the grid work being of the electrified type, and being adapted to support ceiling tiles as well as lighting fixtures and like devices which may derive power from the electrified components carried by the ceiling grid.

2. The Prior Art

It is known to provide metallic structures which depend from the ceiling of a room, which structures form the mounting means for lighting fixtures and ceiling tiles, such that the ceiling of the room presents an attractive appearance.

It is likewise known to incorporate within the tile supporting gridwork electrical conductors which are accessible from below the ceiling, the conductors permitting various electrical appliances, such as spotlights, for example, to be clamped to the ceiling structure, affording both a mechanical and electrical connection without the necessity for independent wiring.

A drawback of such known electrified ceiling constructions is that their installation requires the presence of highly skilled workers since a substantial amount of on site cutting and fitting of components is required.

SUMMARY

The present invention is directed to an improved electrified ceiling grid system wherein a minimum number of stock parts is required, the parts being readily interconnected into a rigid, durable, versatile and attractive ceiling system.

The ceiling structure is comprised of a perimeter which is first affixed to the vertical wall structures of a room within which the ceiling is to be applied. Longitudinal runners are thereafter secured in position, the ends of the runners adjacent the perimeter being secured thereto. The runners are additionally provided along their length with the usual wire support hangers. Abutting ends of runners may be mechanically and electrically interconnected by novel mechanical connector elements which may carry an electrical junction box, the connectors being insertible into position by a sidewise or rolling action, whereby the spreading or canting of longitudinal elements, as required in installations heretofore known, may be obviated.

Additionally, a novel system of transverse tile support and rigidifying strut components is provided whereby the transverse tile supporting members may be inserted into position to define a flexible temporary gridwork before adjacent longitudinal runners are locked against transverse movement, by the application of transverse locking struts.

The tile support hangers include novel coupling means which permit relative movement between abutting hangers, until the final or locking positioning of the parts is established by application of the transverse support struts.

The runners include prepunched slots and apertures which establish the spacing of the support ledges and struts in accordance with the size of the tiles to be employed, whereupon accurate positioning of the parts is assured with a minimum of on site measurements or adaptation.

Accordingly, it is an object of the present invention to provide an improved ceiling grid construction for a hung ceiling installation.

It is a further object of the invention to provide a grid structure of the type described wherein installation is facilitated by reason of the fact that a substantial number of the installing steps may be carried out after the main structural components, namely, the longitudinal runners, have been mounted in position, the runners being relatively movable until the final grid structure is assembled, such final assembly being effected without the necessity of using tools, tightening of bolts, screws, etc., the assembly merely requiring insertion of transverse support struts and rotation of the struts into locking position.

A further object of the invention is the provision of a ceiling grid structure of the type described having sufficient rigidity to permit the ceiling structure to be used as an anchoring point for vertically extending columns, display rods or the like.

It is still a further object of the invention to provide a ceiling grid construction of the type described wherein the transverse tile support members incorporate novel interconnection means, greatly facilitating assembly of the members in a manner permitting relative movement of the members until the components are locked into position.

It is still a further object of the invention to provide an assembly of the type described wherein certain of the longitudinally extending runners may include polarized electrical conductors, the apparatus including means for securing a junction box between the ends of adjacent runners, the junction box including coded connector means permitting the junction box to be inserted between adjacent runners only if the runners are properly aligned.

To attain these objects and such further objects as may appear herein or be hereinafter pointed out, reference is made to the accompanying drawings, forming a part hereof, in which:

FIG. 1 is a fragmentary perspective view of a ceiling structure in accordance with the invention;

FIG. 2 is a fragmentary magnified sectional view taken on the line 2—2 of FIG. 1;

FIG. 3 is a top plan view taken in the direction of the arrow 3—3 of FIG. 2;

FIG. 4 is a magnified perspective view showing details of the connection between adjacent tile support hangers with the longitudinally extending runner;

FIG. 5 is a section taken on the line 5—5 of FIG. 2;

FIG. 6 is a vertical section taken on the line 6—6 of FIG. 2.

FIGS. 7 and 8 are perspective views of the connection between the transverse cross struts and longitudinal runners, showing the components respectively in the pre-assembled and post-assembled condition;

FIG. 9 is a vertical section taken on the line 9—9 of FIG. 8;

FIG. 10 is a horizontal section taken on the line 10—10 of FIG. 9;

FIG. 11 is a detail view showing the means of anchoring the end of a runner to the perimeter;

FIG. 11*a* is a sectional view taken along line 11*a*—11*a* of FIG. 11;

FIG. 12 is a perspective view of a mechanical connection between adjacent runner sections including a

junction box installed between the ends of adjacent longitudinal runners; and

FIG. 13 is a view of the mechanical connector with the runner sections and junction box removed.

Turning now to the drawings, there is shown in FIG. 1 a hung ceiling structure in which a plurality of tiles T are supported from a gridwork assembly **10.** The grid assembly includes a plurality of spaced, longitudinally extending runners **11,** preferably of extruded aluminum. The terminal ends **12** of the runners **11** are secured to a perimeter member or bracket **13** fixed to the wall structure of a building. The connection of the runner **11** to the perimeter is effected by an end cap member **14** comprising a rigid, metallic element having an inwardly directed tongue **14'** matching the cross sectional shape of the internal partial box channel **15** of the runner **11** having inwardly extending flanges **15'.**

A lower tongue **14''** of insulating material having a boss at its inner end is secured to the upper tongue **14'** by machine screw **14*a*** which extends through such boss. Thus, a space S is provided between the adjacent surfaces of the juxtaposed tongues, so that when the tongues are inserted into the box channel **15** as shown in FIG. **11,** the flanges **15'** will be accommodated in such space S.

In order releasably to lock the end cap member to the channel of runner **11,** a screw **14b** is provided which extends through an angled threaded hole in tongue **14'** as shown in FIGS. **11** and **11*a*** and abuts against the side wall of the channel when screw **14*b*** is tightened.

The end cap member includes a locking flange **16,** slidably supported within channel **17** formed in the perimeter member by a vertically directed locking bolt **18** passing upwardly through the flange **16** and aperture **19** in the end cap member. A lock nut **20** threaded over the bolt **18** may be tightened to clamp the end cap **14** and, hence, the runner, in an adjusted position along the perimeter member **13.**

The runners **11,** as is conventional may be supported from the ceiling by a series of hanger wires **21** depending from the ceiling, the wire being passed through apertures formed for the purpose through web **22** of the runner **11.**

Optionally, but preferably, one or more of the runners, e.g., the runner **11*a***, FIG. **2,** may include an insulator structure **23** carrying electrical conductors **24, 25.**

Provision is made, as shown in FIG. **12,** to connect a junction box **26** to the conductors **24, 25.** In order to provide access to the conductors, it is necessary to provide split sections of the runner **11a,** the free ends of the runners being clamped to a mechanical connector assembly **27** to which the junction box is secured.

The connector assembly **27** may be formed of cast metal including opposed side faces **28, 29** against which the ends of the respective runner sections may be butted. The connector **27** includes an arcuate upper attachment component **30,** the curvature of which intimately fits against the arcuate uppermost portion **31** of the runner. The connector includes a lock shoulder **32** which, in the attached positions, abuts against the vertical face of the web **22** of the runner.

The connector **27** is provided with coded locking projections **33** and **34** adjacent opposite ends thereof, it being observed that the projection **33** is essentially rectangular in vertical section whereas the projection **34** is essentially cylindrical. As previously noted, the runners are pre-punched with various slots and apertures to be hereinafter described. In the course of the pre-punching operation one end (denominated the lead end) of the adjacent runner is provided with a circular aperture **36** adapted to receive the circular projection **34** of the element **27.**

The punching of the runners is factory coordinated with the polarity of the conductors **24, 25** and with the connector **27** in such manner that a connector **27** can only couple the adjacent ends of runner sections if the rectangular projectionand circular projections **33, 34** are aligned with comparably shaped apertures **35, 36,** respectively. By thus coordinating the punching of the runners and loading of the conductors carried in insulator **23,** it is assured that a mechanical connection between adjacent runner sections can be made only if the runners are properly aligned. Otherwise put, if one of the two runner sections were inadvertently rotated through **180°** in the horizontal plane, and the conductors carried by the two sections were electrically connected, it would be evident that the conductor **25** of one section would be in alignment with the conductor **24** of the other section. The construction in accordance with the present invention obviates such possibility since, in the event of the reversal of a runner section, as previously described, the abutting ends would have the same shaped apertures, either rectangular or round. In such case, the coded projections **33, 34** would not interfit within the apertures in the runners, whereupon it would be impossible mechanically to interlock the two runners, thus graphically calling to the attention of the installer the error in the positioning of one of the runner sections.

Installation of the connector **27** between adjacent runner sections may be effected without the necessity for spreading the runners, such installation requiring the connector **27** merely to be pivoted about the conforming arcuate configurations of the elements **30** and **31** and simultaneously moved laterally into the position shown in FIG. **12.** Thus, the installation of a connector between adjacent runner ends involves a simple pivoting into position of the connector.

The runner ends are provided with locking apertures **37,** such apertures preferably including an enlarged clearance portion **38** and a reduced locking portion **39.** A machine screw **40** effects the final locking connection with the parts, the machine screw being threadedly received within a complemental aperture formed in the connector **27.** It will be appreciated that tightening of the machine screws **40** clamps the components into the desired attached position, and that lateral spreading of the components is resisted not merely by the clamping forces of the screws but by the coded projections **33,** 34 which lie in their respective apertures on the runner. Screws **40** also enhance continuity of electrical ground from one runner to the other.

It will be understood that the junction box **26** forms the receptacle for suitable electrical connections E between the main wire M and the conductor in a manner well known in the art.

It will be further understood that connectors **27** are used without junction boxes where it is desired to connect runner ends which do not carry electrical conductors.

After attachment and positioning of the longitudinal runners **11** and **11*a*** in the manner hereinabove set forth, the transverse components forming the integrated gridwork are secured in position. The transverse

components are of two basic types, namely, cross tees or tile support hangers **41** which function as mounting supports for the lateral edges of the tiles T, and cross struts **42** which function to lock the cross tees or tile support hangers **41** into position.

The tile support hangers **41** are essentially of inverted T-shape in vertical section (see FIG. **4**), including a vertically directed central branch **43** and laterally extending tile support legs **44, 45.** The trailing ends **46** of the hangers **41** are provided with female receiver clips **47,** the clips **47** including a mounting leg **48** affixed to the branch portion **43** of the hanger.

The mounting leg **48** includes projecting tabs **49, 50,** 51, the tabs **49** and **50** overlapping the upper edge of the hangers, the tab **51** extending through a transverse slot **52** formed in the adjacent end of the hanger or tee. A rivet member **53** secures the female clip **47** in position, the interconnection of the tabs **49, 50** and **51** and the adjacent components of the cross thus precluding any substantial pivotal movement of the clips.

The leading edges **54** of the cross Tees or hangers are provided with a male clip component **55,** including an attachment leg **56** carrying locator tabs **57, 58, 59.** The tab **59** extends through a locator slot **60** adjacent the end **54** of the hanger, the tabs **57, 58, 59** functioning in the manner described in connection with tabs **49, 50,** 51 to prevent relative pivotal movement between the male clip component, which component is held in position on the hanger by the rivet **61.**

The female clip component **47** includes a receiver socket **62** generally in the form of an inverted U. The clip **55** includes an elongated alignment finger **63** adapted to be intimately received within the socket **62** of the female clip.

The runners **11** are, as previously noted, pre-punched through the web **22** to define spaced vertical slots **64,** the spacing of the slots being calculated to equal the width of the tiles T. As best understood from a consideration of FIGS. **4, 5** and **6,** the elongated finger **63** of cross T **41***a* is passed through the slot **64** of the runner **11** until edge **54** abuts against edge **54'** of flange **65***a* of runner **11** and the edge **63'** of member **55** rests on flange **65***a.*

At this time, the adjacent cross T **41***b* is positioned at an angle as shown in broken lines in FIG. **4** and after finger **63** has been inserted into the associated slot **64** of its adjacent runner **11,** T **41**b then is pivoted downwardly as shown by the arrow in FIG. **4** until the slot **62** of the clip **47** functionally engages the associated finger **63.** At this time the support legs **44, 45** of cross T **41***b* will be adjacent the tile support legs **65** of runner **11** and the edge **47'** of clip **47** will rest on flange **65.**

It will be understood that nothwithstanding the interconnection between adjacent hangers through the runners in the manner heretofore set forth, a significant degree of movement of the runners away from each other may be effected, due to the relative movement possible between the finger **63** and the socket **62.**

The ability thus to move the components during installation of the hangers materially expedites the installation thereof since to provide additional clearance for the mounting of subsequent hangers or cross T's it is merely necessary to modify the spacing between adjacent runners by exerting transverse pressure, and after the desired clearance is obtained, to insert the subsequent hanger, obviating the necessity for tilting, canting and prying encountered in the installation of grid structures heretofore known.

As best shown in FIG. **2,** bracket **66** may be bolted, as by bolt **67,** to the perimeter track **13,** bracket **66** including a horizontal support surface **68,** on which surface may be rested the end of the bottom portions of the cross T.

The grid structure, completed to the extent heretofore noted, has limited rigidity, due to the relative movability between the longitudinally directed runners **11** and the transversely extending cross Tees or hangers. Rigidity is provided by the cross struts **42** which will next be described.

Referring particularly to FIGS. **7** to **10,** the cross struts **42,** at their distal ends, are provided with locking clips which may be engaged with the runners **11,** the connection between the cross struts and runners being effected without the use of tools, tightening of screws, etc. Since the locking clips **70** at each end of the cross struts are identical, a description of one will suffice.

The locking clips **70** preferably are formed of bent metal including attachment tab **71** fitting against web **72** of the cross struts, tab **71** being secured in position against the web **72** as by rivet **73.** The clip includes a body portion **74,** bent at right angles to the tab **71,** the body portion **74** including upper and lower locking ears **75, 76** projecting above and below the surfaces of the struts.

The ears **75, 76** preferably include inwardly deflected frictional wedging elements **77, 78.** A removable locator tab **79** extends from the attachment tab **71** a distance beyond the strut, the locator tab **79** being connected to the attachment tab **71** by a weakened neck **80.**

The runners **11** along each side thereof include an upwardly extending lower locking flange **81** paralleling the web **22** adjacent the lower end of the web, and a downwardly extending upper locking flange **82** directed toward the flange **81.** It will be observed that between the flange **81** and web **22** there is defined a vertically directed, upwardly opening slot **83.** In similar fashion, there is defined between the web **22** and flange **82** a downwardly opening vertically directed slot **84.** The pre-punched web portions **22** of the runners **11** are provided with a series of apertures **85,** the apertures **85** being spaced in accordance with the desired spacing of the cross struts **42.**

In order to attach a cross strut in position between adjacent runners, locator tabs **79** are passed through the spaced locator apertures **85** in the pair of runners to be connected, with the ears **75, 76** offset from the locking ledges **81, 82.** With the cross strut in the desired position, final attachment is made merely by rotating the cross strut about a horizontal axis through an arc sufficient to cause the ears **75, 76** to enter into the slots **83** and **84,** respectively, the ears being frictionally rotated within the slots by the locking wedge portions **77, 78** thereof.

As previously noted, the rotary movement is effective to engage a locking clip **70** at each end of the cross strut into interlocked relation with an opposed pair of runners. The length of the cross struts is calculated to maintain the precise desired spacing between adjacent longitudinal runners to accommodate the lengthwise dimension of the tiles T between adjacent runners.

Where additional rigidity is desired, an extra cross strut may be added at any point along the length of ad-

jacent runners by merely breaking off the locator tab **79** at the weakened neck portion **80** thereof, whereupon it will be observed the attachment between a cross strut and runner may be effected without the necessity for the cross strut to be aligned with an aperture, such as an aperture **85** in the runner.

The ends of the cross struts adjacent the perimeter **13** may be connected thereto by sawing the strut to the approximate desired length, sleeving a right angle cross strut anchor **86** into the channel defined interiorly of the cross strut, the anchor including a right angular portion **87** which may be mechanically connected as by machine screw **88** to the perimeter track.

As is known, the perimeter track components or sections may be connected together by a series of connector splines **89** where longitudinal components of the tracks are to be secured together, the corners being coupled by right angle splines **90** (see FIG. 3).

It will be observed that following connection of the cross struts with the runners, the theretofore relatively flexible ceiling grid structure becomes extremely rigid. By this means it is possible to provide a temporary grid structure wherein the parts are disposed in the approximate desired ultimate position, with fine adjustments being accomplished, particularly in the connection to the perimeter, after the structure is essentially in position. Thereafter, the temporary and flexible grid structure is, by the insertion of the cross strut members, converted to a rigid, permanent structure, the final step of inserting the cross strut members being accomplished without the necessity for using tools, tightening bolts, etc.

By pre-punching locating slots along the length of the runners, arcuate positioning of the cross Tees supporting the tile edges is assured.

Similarly, since the cross Tees and support struts are factory formed to coordinate with the size of the tiles, the interconnection of the grid structure automatically results in an assemblage in which the tile support components define therebetween tile receiving apertures of the precise size desired.

It will be readily recognized from the foregoing description that the grid, with minor modifications, may be rendered suitable for tiles other than those having the rabbetted edge configuration shown in the accompanying drawings.

Similarly, sectional details of the various components may be modified without departing from the spirit of the invention. Accordingly, the invention is to be broadly construed within the scope of the appended claims.

Having thus described my invention, what I claim as new and desire to secure by letters patent of the United States is:

1. An electrified hung ceiling grid construction comprising, in combination, a plurality of horizontally disposed parallel runner members supported in coplanar alignment from a building structure, said runner members including a vertically directed mounting web and horizontally disposed tile support flanges, upper and lower spaced locking flanges in proximate spaced relation to and disposed on either side of said mounting web, said locking flanges and web defining vertically directed locking channels, a plurality of longitudinally spaced, transversely extending locator apertures formed in said mounting webs, cross strut means extending between adjacent runners and locking the same against relative transverse movement, said strut means including at their ends projecting tab members adapted to be inserted through said locator apertures, and adjacent the ends of said struts locking clip members including resilient locking means projecting beyond the upper and lower surfaces of said struts, said locking means being insertible into the space between said locking flanges and being extended into tightly wedged position within said locking channels responsive to rotation of said struts about their longitudinal axes, a plurality of tile support hangers extending between adjacent parallel runners, said support hangers including horizontally extending tile support ledges disposed in coplanar alignment with the tile support flanges of said runners, a plurality of alignment slots formed in said mounting webs of said runners, said slots being regularly spaced apart in accordance with the desired spacing of said hangers, complemental connector means on said hangers extending through said alignment slots and linking the distal ends of adjacent support hangers, said connector means including a finger on one said hanger slidably engaging a finger socket on the other said hanger, thus to permit relative horizontal movement between said adjacent hangers, the spacing between the clip members at opposite ends of said struts being coordinated with the length of said support hangers whereby, upon rotation of said struts into locking position, the ends of said ledges of said struts are tightly abutted against said flanges of said runners.

2. An electrified hung ceiling grid construction comprising, in combination, a plurality of horizontally disposed parallel runner members supported in coplanar alignment from a building structure, said runner members including a vertically directed mounting web and horizontally disposed tile support flanges, a plurality of regularly spaced apart alignment slots formed in said web, a plurality of tile support hangers extending between adjacent parallel runners, said support hangers including horizontally extending tile support ledges disposed in coplanar alignment with the tile support flanges of said runners, complemental connector means linking the distal ends of adjacent tile support hangers, said connector means extending through said alignment slots and providing a sliding connection between said adjacent hangers, and cross strut means extending between adjacent runners and locking the same against transverse movement, said cross strut means being insertible between adjacent runners and rotated into locking engagement with said runners, the length of said cross strut means and said hangers being coordinated to urge said ledges of said struts into tightly abutted engagement with said flanges of said runners responsive to rotation of said struts to said locking position.

3. A device in accordance with claim **2** wherein said web includes spaced, transversely extending locator apertures and the ends of said cross strut means include projecting tabs adapted to be inserted through said apertures prior to rotation of said struts into said locking position.

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