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CEILING INSTALLATION

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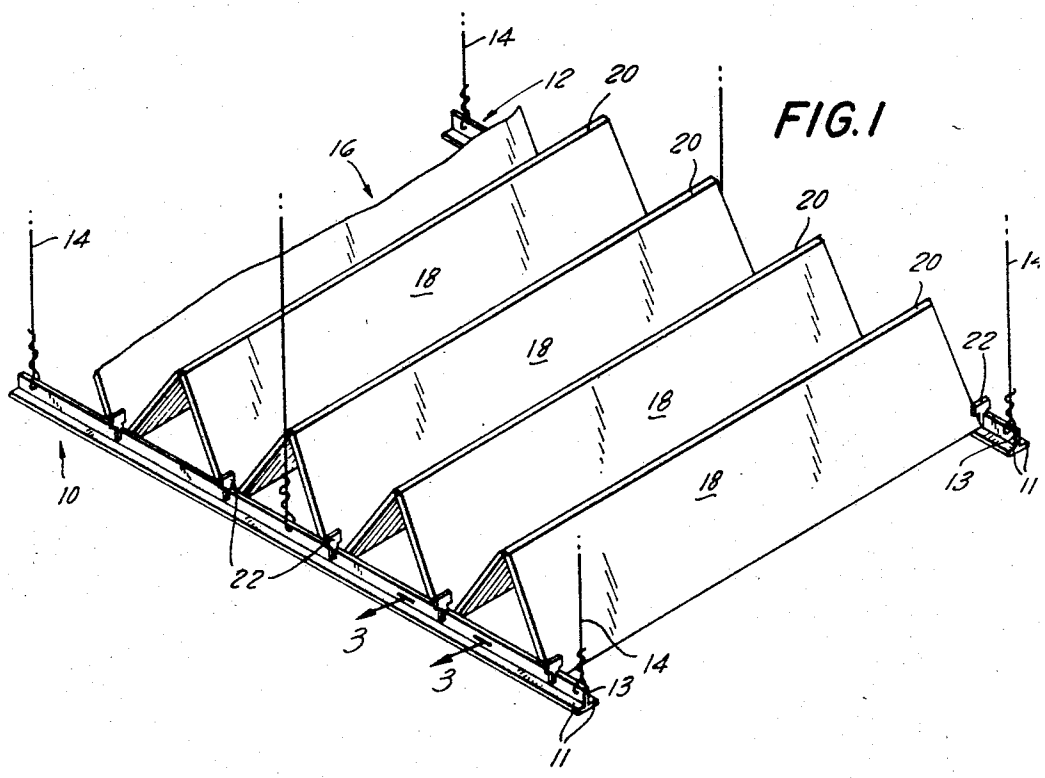


FIG. 1

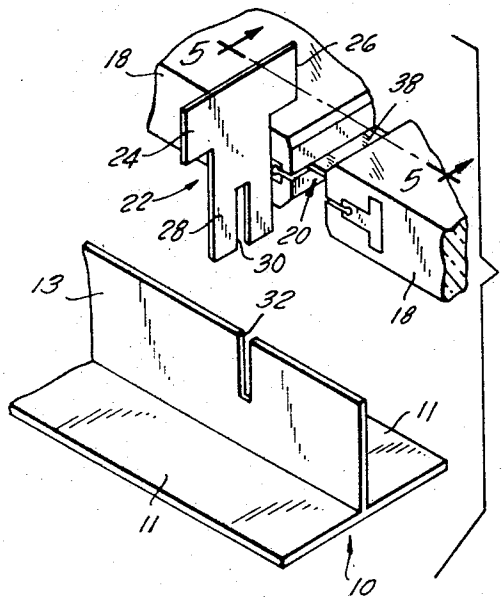


FIG. 2

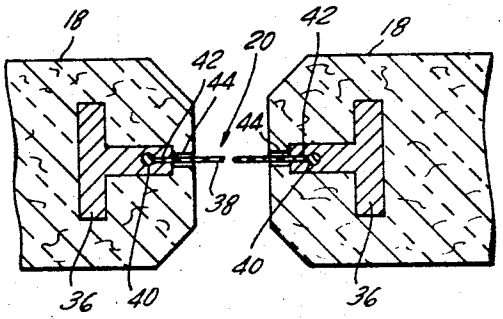


FIG. 5

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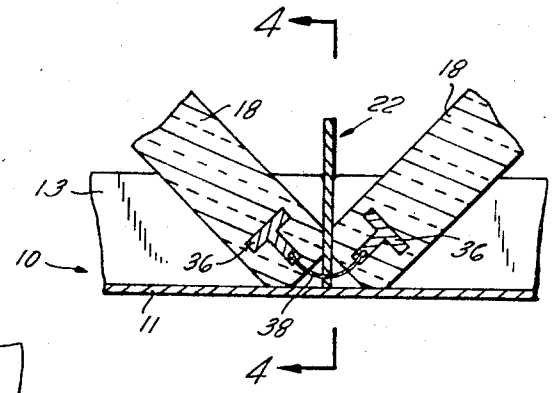


FIG. 3

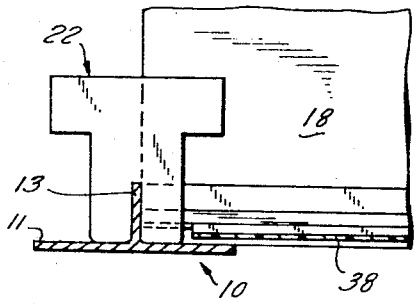


FIG. 4

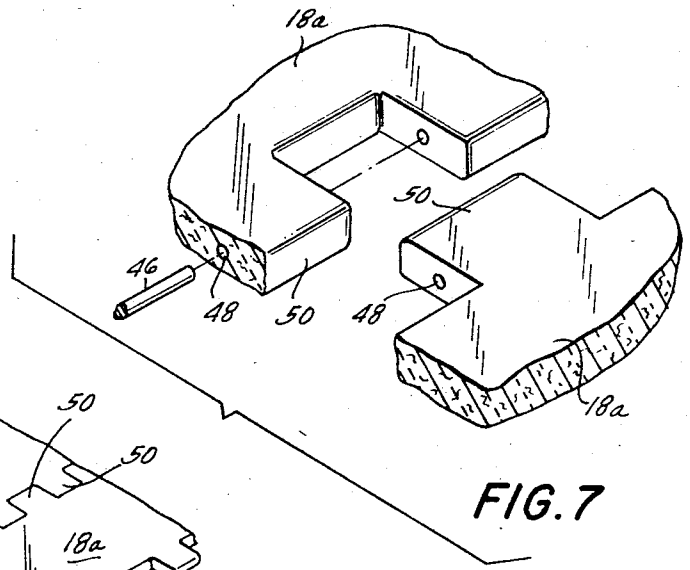


FIG. 7

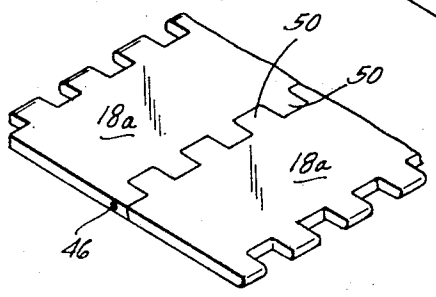


FIG. 6

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FIG.8

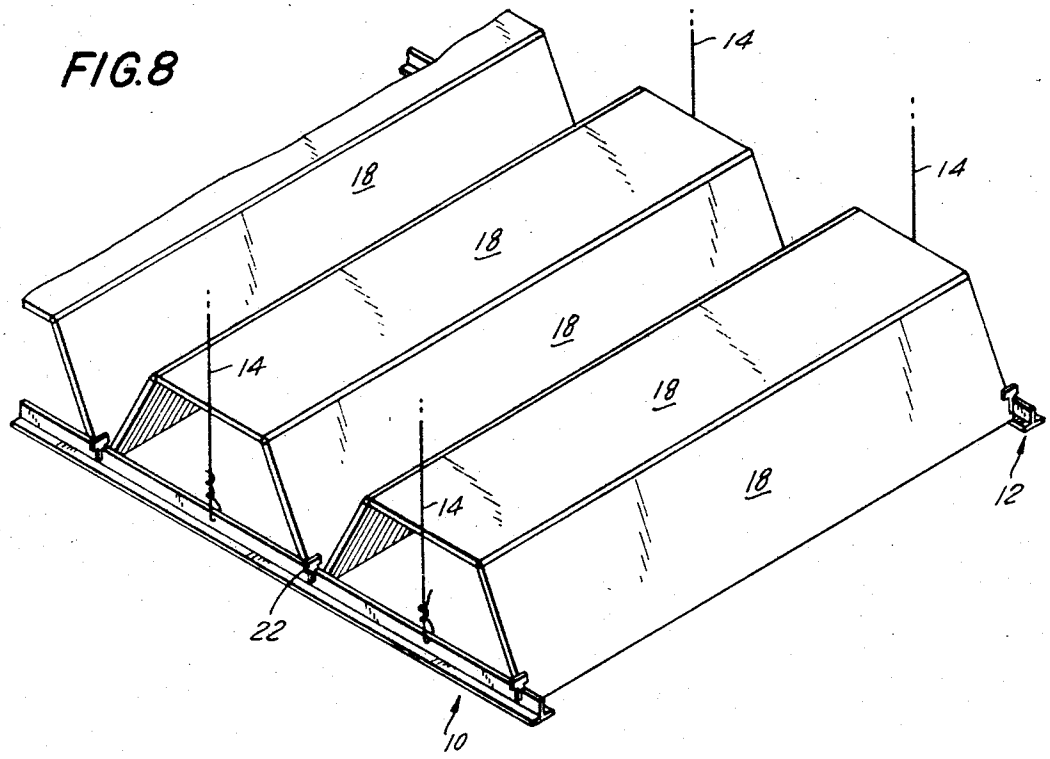
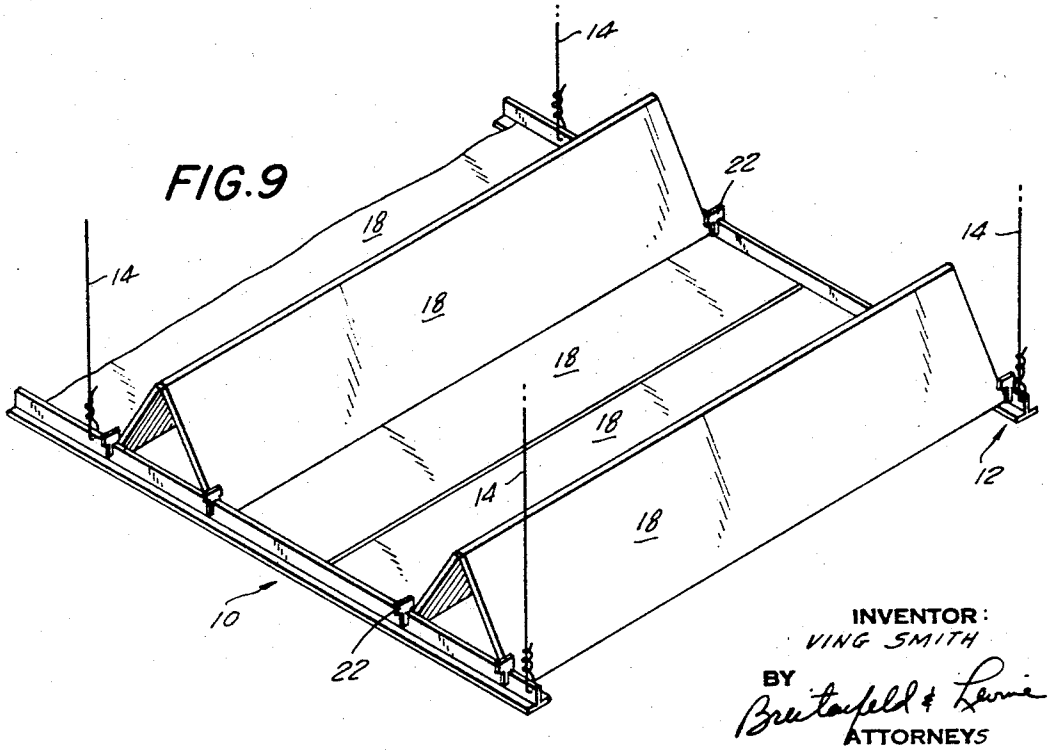


FIG.9



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FIG. 10

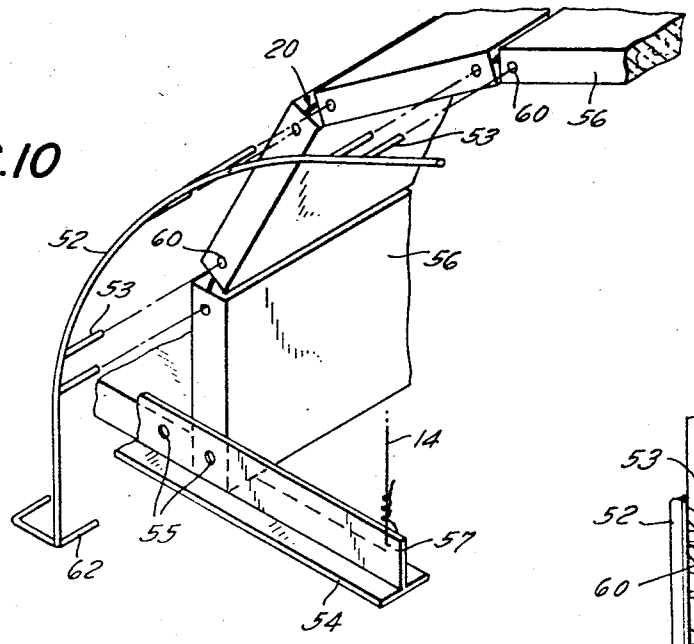


FIG. 11

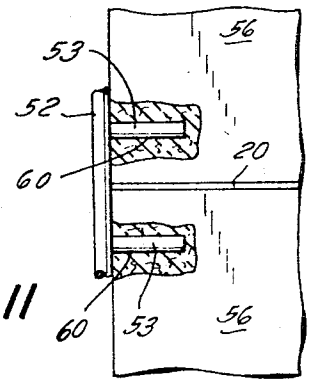
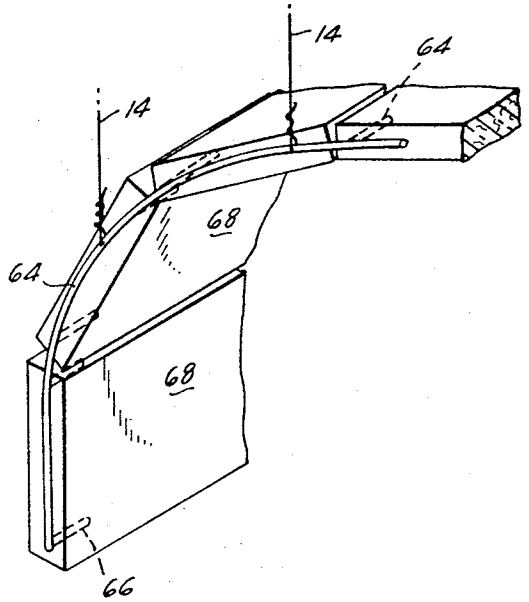


FIG. 12



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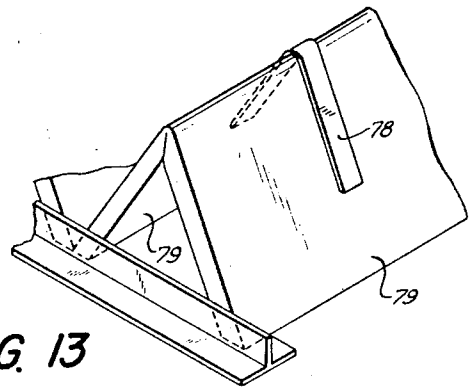


FIG. 13

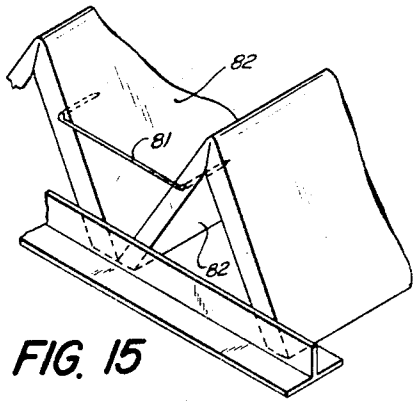


FIG. 15

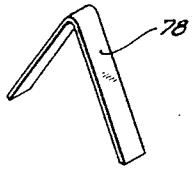


FIG. 14

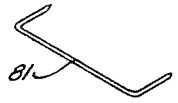


FIG. 16

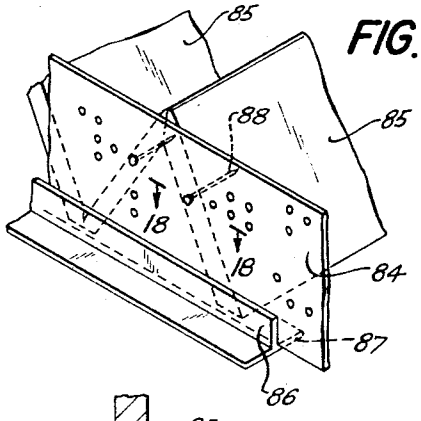


FIG. 17

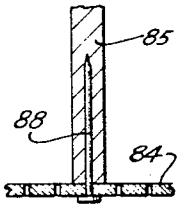


FIG. 18

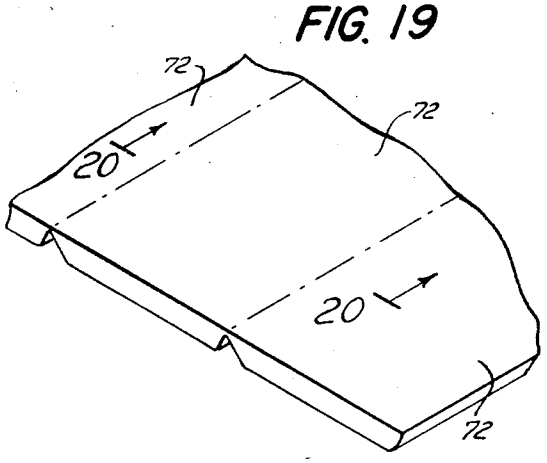


FIG. 19

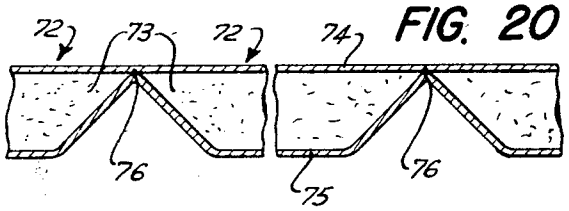


FIG. 20

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FIG. 21

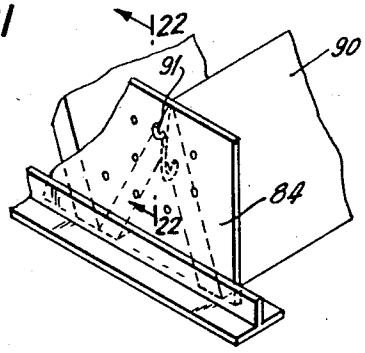


FIG. 22

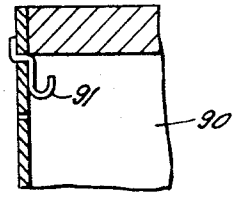


FIG. 23

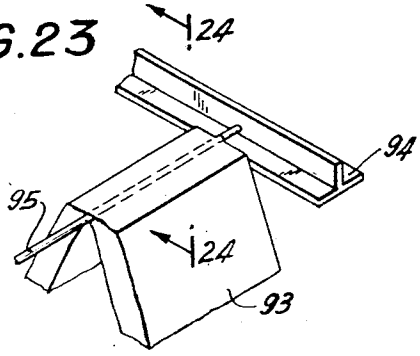


FIG. 24

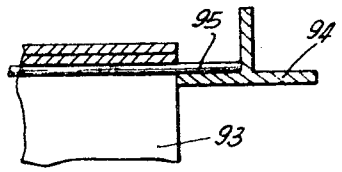


FIG. 25

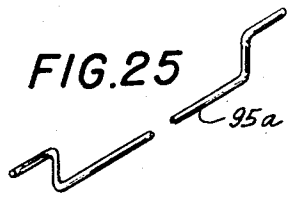


FIG. 26

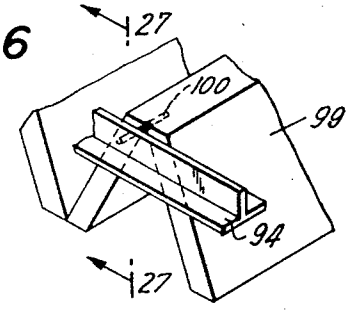
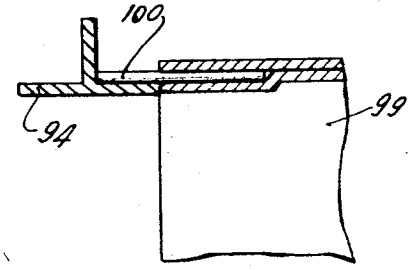


FIG. 27



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United States Patent Office 3,466,830 Patented Sept. 16, 1969

3,466,830

CEILING INSTALLATION

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Continuation-in-part of application Ser. No. 620,026, Mar. 2, 1967. This application Mar. 28, 1968, Ser. No. 722,521

Int. Cl. E04b 5/57, 1/343

U.S. Cl. 52—495 8 Claims

ABSTRACT OF THE DISCLOSURE

A plurality of side-by-side panels are hingedly joined along opposed edges to form a panel assembly. The panel assembly is supported at its ends by support means, such as T-shaped rails, carried by the building structure. Retaining means provided to maintain the panel members at selected angular positions. Retaining means may be clips engaging support rails, non-linear braces, rigid elements engaging the faces or ends of the panels but not the rails, rods extending between successive rails, or pins projecting past end edges of panels, the latter two means permitting the panel assembly to hang below the support rails.

This application is a continuation-in-part of copending application Ser. No. 620,026, filed Mar. 2, 1967, now abandoned.

This invention relates to a ceiling installation, and more particularly to a so-called "suspended" ceiling installation.

Known ceiling installations of this type include support rails, which may have inverted T-shaped cross-sections, suspended from an existing ceiling, or roof, of a building. Individual panels, or tiles, are supported on the lateral flanges of the rails to define the ceiling. Installation of this type of ceiling is time-consuming, because each individual tile must be handled separately, and there is no provision for flexibility in the shape of the ceiling, i.e., in ceilings of this type all the tiles lie in a single plane.

It is an object of the presnt invention to alleviate these disadvantages by providing panel assemblies which permit a number of panels to be installed simultaneously, and which can be installed in a variety of orientations to produce shaped or sculptured ceilings.

To achieve this objective, the invention provides a plurality of panels hinged together along opposed edges to form a folding-screen-type of panel assembly. Each panel assembly may be supported at its free edges upon supporting rails similar to those of a conventional installation. As a result of the hinged connection between the panels, they may be folded into a compact unit and in this condition lifted above the support rails. Thereafter, the panel assembly is unfolded and placed on the rails. Consequently, a plurality of panels, representing a relatively large ceiling area, are installed simultaneously.

In conventional suspended ceiling installations, all the panels or tiles are usually arranged in a single plane. Consequently, the height of the suspended ceiling is limited to the height of the lowest obstruction, e.g., air ducts, and plumbing, projecting below the existing ceiling. However, due to their hinged relationship, the panels of this invention need not necessarily all be arranged in a single plane. Instead, the panel assemblies can be supported on the rails with the panels arranged at selected angles to one another. Thus, panels in the vicinity of an obstruction can be caused to converge downwardly to provide a trough-like ceiling portion for accommodating the obstruction, and the particular arrangement of such panels does not prevent other panels of the installation from being arranged at a higher level. To facilitate the initial placement of the panels at angles to one another, and maintain such a relationship, retaining means are provided of at least one hinge line between the panels which prevent movement of the panels with respect to the support rails. By the use of non-linear braces of special character, which may be supported upon the rails, or themselves suspended from the building, the panel assembly can be given any desired sculptured shape.

The invention will be more fully described below with reference to the accompanying drawings.

FIG. 1 is a fragmentary perspective view of a ceiling installation according to this invention;

FIG. 2 is an exploded perspective view showing a portion of the support rail and the ceiling panels along with a retaining clip adapted to engage the rail to position the ceiling panels;

FIG. 3 is a sectional view, on an enlarged scale, along line 3—3 of FIG. 1;

FIG. 4 is a sectional view along line 4—4 of FIG. 3;

FIG. 5 is a sectional view, on an enlarged scale, through the ceiling panels and connecting hinge looking along the line 5—5 of FIG. 2;

FIG. 6 is a partial perspective view of an alternative embodiment in which the ceiling panels are hinged by means of a pin;

FIG. 7 is an exploded view showing further details of the hinge arrangement of FIG. 6;

FIG. 8 is a fragmentary perspective view of a ceiling installation similar to that shown in FIG. 1, but wherein the ceiling panels are arranged in still a different configuration;

FIG. 9 is a fragmentary perspective view of a ceiling installation similar to that shown in FIG. 1, but wherein the ceiling panels are arranged in still a different configuration;

FIG. 10 is a fragmentary perspective view of another embodiment of a ceiling installation according to this invention;

FIG. 11 is a fragmentary view, partially in section, of the ceiling panel and support rods of the FIG. 10 embodiment;

FIG. 12 is a fragmentary perspective view of another alternative construction, in which the arcuate support rods are suspended directly from the building;

FIG. 13 is a fragmentary perspective view of a ceiling installation showing an alternative means for retaining the panels in a desired configuration;

FIG. 14 is a perspective view of the retaining means of FIG. 13;

FIG. 15 is a view similar to FIG. 13 showing another alternative retaining member;

FIG. 16 is a perspective view of the retaining means of FIG. 15;

FIG. 17 is a fragmentary perspective view of an alternative ceiling installation;

FIG. 18 is a horizontal cross-sectional view along line 18—18 of FIG. 17;

FIG. 19 is a fragmentary perspective view of an alternative ceiling panel arrangement;

FIG. 20 is a cross-sectional view along line 20—20 of FIG. 19;

FIG. 21 is a fragmentary perspective view of a ceiling installation showing still another alternative means for retaining the panels in a desired configuration;

FIG. 22 is a vertical cross-sectional view along line 22—22 of FIG. 21;

FIG. 23 is a fragmentary perspective view of an alternative ceiling installation in which portions of the panels are suspended below the support rails;

FIG. 24 is a vertical cross-sectional view along line 24—24 of FIG. 23;

FIG. 25 is a perspective view of an alternative form of support element;

FIG. 26 is a fragmentary perspective view of an alternative ceiling installation; and

FIG. 27 is a vertical cross-sectional view along line 27—27 of FIG. 26.

Referring to the drawings, the fragmentary view of the ceiling shown in FIG. 1 includes support means in the form of two parallel support rails 10 and 12 suspended from a building structure (not shown) by the suspension wires 14. Each rail 10 and 12 has the general cross-sectional shape of an inverted "T," whereby in each rail two lateral flanges 11 project from each side of a common upright flange 13. The parallel support rails 10 and 12 are suitably spaced apart so that the opposed flanges 11 can support the ends of a ceiling panel assembly indicated generally at 16.

The panel assembly 16 comprises a plurality of flat, side-by-side panels 18 joined by hinge means indicated generally at 20 along their opposed longitudinal edges in a manner to be further described.

Although the panels are shown as being rectangular, they may be square, or may have some other suitable shape. In order to provide for various angular relationships between the individual panels 18 of the panel assembly 16, retaining means are provided on the rails 10 and 12. These retaining means may comprise retaining clips 22 mounted on the rails 10 and 12 and adapted to engage individual panels 18 to prevent longitudinal displacement of the latter along the rails. As shown in FIG. 2, each clip 22 may comprise a flat, T-shaped member having wings 24 and 26, and including within its upright section 28 a slot 30 having a width approximately or just slightly wider than the thickness of the upright flange 13 of the rail with which it is used. The upright flanges 13 of the rails 10 and 12 are also provided with slots 32 spaced apart along the length of the flange 13 at regular intervals. Each slot 32 has a width approximating or slightly greater than the thickness of the retaining clip 22. As will be apparent from FIG. 2, the depth of the slots 30 and 32 are such that the clip 22 may be placed on the rail 10 or 12 with one slot in the other so that the clip 22 is supported in an upright position on the rail 10 and locked thereon against longitudinal movement.

A plurality of clips 22 may be placed on the rails 10 and 12 in this manner. The clips 22 will engage the inverted apex defined by two adjacent panels 18, as shown in FIGS. 3 and 4, and support the panels in selected positions, for example as shown in FIG. 1.

The individual panels 18 may be made of any desirable material suitable for the purpose intended. The physical properties of the panel material will, of course, be a factor to be considered in determining the type of hinge means 20 to be used between the individual panels 18. By way of example, FIG. 5 illustrates a pair of panel members 18 made of fiberglass. Embedded along longitudinal marginal regions of the fiberglass panels 18 are reinforcing members 36 made of a rigid material, e.g., metal. These reinforcing members 36 may extend for the entire length of the panels 18. A flexible web of material 38, e.g., plastic or nylon, having beads 40 along the longitudinal edges thereof, is secured to these reinforcing members 36 to form the aforementioned hinge means 20. As shown in FIG. 5, the reinforcing members 36 have a groove 42 aligned with another groove 44 in the longitudinal margins of the panel members 18. The grooves 42 in the reinforcing members 36 are enlarged at their inner ends to receive the bead 40 on the flexible web 38, to thereby firmly secure the web 38 to the reinforcing members 36 and to the panels 18. The flexible web 38 may terminate just short of the free ends of the panels 18 so as not to interfere with the engagement between the retaining clips 22 and the end portions of the panels 18.

An alternative hinge arrangement is shown in FIGS. 6 and 7, wherein a pin 46 is adapted to be inserted into aligned openings 48 formed in interlocking finger-like projecting portions 50 extending from the longitudinal edges of panels 18a. It will be apparent that the individual panel members 18a may be pivoted about the axis defined by the pivot pin 46.

To install the arrangement shown in FIG. 1, the panel assembly 16 is positioned between the two support rails 10 and 12 with the free ends of the panels over the opposed flanges 11. Thereafter, individual panels 18 may be placed in the position shown, one or two at a time, and the retaining clips 22 placed in position on the rails 10 and 12 to maintain the panels in position. Depending on the type of ceiling desired, the panels 18 may be pivoted into different positions and the clips 22 may be located in various locations. For example, the panels 18 and clips 22 may be arranged to provide the ceiling shown in FIG. 8 or 9. It will be apparent, therefore, that greater flexibility of ceiling shape may be attained by means of the present invention than with comparable ceiling arrangements heretofore known. Furthermore, the panel assemblies will remain fixed in the position selected, since the clips 22 prevent movement of the individual panels. It will of course be understood that the means for anchoring or securing the clips 22 in a particular position on the rails 10 and 12 may include alternative arrangements. For example, the rails 10 and 12 may be provided with serrations adapted to be engaged by spring biased detents on the clips, thereby providing virtually unlimited possible locations for the clips.

Under certain circumstances, the arrangement shown in FIGS. 1, 8, and 9 may leave undesirable openings in the ceiling installation. For example, in FIG. 1, a series of triangular shaped openings would be seen when the installation is viewed at an angle from beneath. To avoid this problem, it is contemplated that the flange 13 may be increased in height, e.g., so that its upper edge reaches the apices of the triangular openings in FIG. 1, to thereby close the openings and give the installation a finished appearance. Another way of closing these openings will be described below with reference to FIG. 17. Furthermore, it may be mentioned that means other than the clips 22 may serve to maintain the panels 18 against sliding on the rails. For example, the flange 13 may be provided with a series of holes, rather than the slots 32, and pins fitted through the holes could serve the function of the clips 22. In the alternative, the flanges 13 need not necessarily have the slots 32, and in place of the clips 22, spring biased clips of the clothes-pin type (not shown) may be employed to frictionally grip the upright flange 13 and retain the panels 18 in selected positions.

FIG. 10 shows a further alternative embodiment of the invention, which permits ceiling arrangements of sculptured appearance, for example, a generally arcuate shape as shown. In this embodiment, retaining means in the form of rods 52 (only one being shown) having a plurality of lateral peg-like projections 53 may be bent to the particular shape or configuration desired. The rods 52 may be mounted on the support rails 54 (only one being shown) and the panels 56, which are joined by the hinge means 20, mounted on the rods 52. As shown in greater detail in FIG. 11, the projections 53 are inserted into the openings 60 in the end edges of the panels 56 to effect the mounting. Similar peg-like projections 62, adapted to fit into holes 55 in the upright flange 57 of a rail 54, may be employed to mount the rod 52 on the support rail 54. The parts may be arranged so that each projection 62 passes through a hole 60 in the lowermost panel 56, as well as a hole 55 in the rail, to connect the panel assembly to the rail. Although only one rod 52 and support rail 54 are shown in FIG. 10, it will be understood that the opposite ends of the panels 56 are supported by a similar rod and rail. The particular arrangement shown in FIG. 10 is merely representative of various configurations which may be obtained.

As a further alternative embodiment a support means in the form of a rod 64 (somewhat like the rod 52 in

FIG. 10), instead of being mounted on rails, may be suspended directly from the ceiling or roof by the suspension wires **14**, as shown in FIG. 12. In this arrangement, retaining means in the form of lateral peg-like projections **66** are employed to support the panel members **68**. This construction has the advantage of eliminating the requirement for support rails, and provides for greater flexibility in design arrangements in that provision need not be made for incorporating support rails into the design.

Another embodiment of the hinged ceiling panels is shown in FIGS. 19 and 20. These panels **72** are each formed of a core **73** of suitable self-sustaining material, such as fiberglass, having a trapezoidal cross-sectional shape. The cores **73** are arranged in parallel relation with the longitudinal edges of each two adjacent cores spaced slightly apart. The cores of each panel unit, which may comprise for example four hinged-together panels **72**, are covered on each face by a continuous sheet of suitable flexible material, such as vinyl. Thus, a single sheet **74** is secured, such as by adhesive, to the wider faces of all the panel cores **73** of the unit, and another sheet **75**, which could be a continuation of the sheet **74**, is secured to the narrower and slanted faces of the cores **73**. At the spaces between the cores **73**, the sheets **74** and **75** meet to define hinge lines, and are secured together by adhesive **76** along these lines. If desired, one of the sheets **74** or **75** may be eliminated entirely, or made discontinuous so that only narrow strips of sheet material are present along the hinge lines to give the hinges strength.

Alternative means for retaining the panels, or some of them, in a non-planar relationship are illustrated in FIGS. 13–18. It should be understood that these retaining means may be employed with any of the types of panels described above. FIGS. 13 and 14 illustrate a rigid V-shaped strap **78** adapted to straddle two adjacent upwardly converging panels **79** and thereby prevent rotation of these panels about their mutual hinge in a direction tending to bring the panels **79** into the same plane.

FIGS. 15 and 16 show a U-shaped pin or staple **81** having attenuated ends. After two panels **82** have been arranged as shown in FIG. 15, the ends of the pin may be pushed into the ends of the panels to prevent relative rotation between the panels. If the pin is used as shown, it cannot be seen from beneath the ceiling, and a single pin holds four panels in the non-planar condition shown.

To close the openings remaining at the ends of the panels when they are arranged at angles to one another, a thin strip **84** (FIGS. 17 and 18) of for example aluminum or plastic, may be inserted between the ends of the panels **85** and the upright flanges **86** of the respective rail, the lower longitudinal edge of the strip **84** resting on the horizontal flange **87**. Such a strip may be used when the retaining means of FIGS. 14 and 16 are used, or separate retaining means may be eliminated and the strip employed to help hold the panels in a desired orientation. In the example shown, the strip is provided with a pattern of small perforations, such as are provided in well known pegboard, and ordinary nails or tacks **88** having sufficiently large heads are pushed through perforations which happen to be in registry with the edges of the panels. In this way, the strip **94** and nails **88** define a rigid cap for the ends of the panels which retains them in any desired orientation. If the strip **84** is formed of readily pierceable material, it need not ncessarily have any preformed perforations, since the nails could be pushed through it at the time of installation.

FIGS. 21 and 22 show another way of using the perforated strip **84** to retain the hinged-together panels **90** in a desired orientation. In this example, an ordinary "pegboard" hook **91** of well known character is inserted, as shown, through one of the holes in the strip **84**. The hook **91** is located precisely at the apex of the inclined lower edges of two adjacent panels **90**, and thereby prevents movement of these panels longitudinally along the rails.

FIGS. 23 and 24 illustrate a manner in which panels **93** according to this invention may be suspended from support rails **94** (only one shown in FIGS. 23 and 24) so that portions of the panels hang below the level of the rails. In this arrangement, the rails **94** are spaced apart a distance slightly greater than in previous embodiments so that the panels **93** can fit between them, instead of the ends of the panels resting on the rails. Rigid rods **95** (only one being shown) are provided extending between two successive rails **94**, each end of each rod resting on the upper face of one horizontal flange of a rail **94**. Two adjacent panels **93**, which converge upwardly, are arranged on opposite sides of the rod **95**, and the hinge region **96** between the panels engages the rod along its length, whereby the panels are supported.

If it is desired to hang the panels **93** even lower than as shown in FIGS. 23 and 24, a rod **95***a*, illustrated in FIG. 25, may be employed. This rod differs from rod **95** in that each end is formed with an L-shaped bend so that the body of the rod which is engaged by the panels projects downwardly from the rail upon which it is seated.

Another way of suspending hinged-together panels **99** according to this invention below the level of the support rails **94** is shown in FIGS 26 and 27. In this embodiment a support pin **100** is secured within the hinge between each two adjacent panels **99**, a portion of the pin projecting beyond the ends of the panels. For example, the pins **100** could be secured between the sheets **74** and **75** (FIG. 20) at the point where these sheets are joined by adhesive **76**. The pin **100** rests upon the upper face of one horizontal flange of the rail **94** and supports the panels **99** on either side of it, as shown.

In conventional suspended ceiling installations, the rails **94** are usually mounted below the level of obstacles, such as pipes, extending along the original ceiling. With the arrangement of FIGS. 23–27, the rails **94** may be arranged above and perpendicular to a pipe, and two downwardly converging panels **93** or **99** may extend below the rails and enclose the pipe.

The invention has been disclosed herein in connection with certain specific constructions and arrangements, but it will be understood that this is intended by way of example only, and that numerous changes can be made in the structure and arrangement of the parts within the spirit of the invention.

What is claimed is:

1. A ceiling installation for use with a room having a main ceiling from which said ceiling installation is to be suspended, comprising a plurality of panels arranged in side-by-side relation, means hingedly joining opposed edges of said panels along at least one hinge line to form a panel assembly, spaced apart rails suspended from the main ceiling, said rails having lateral flanges, said panel assembly extending between two of said rails and being exposed to view from beneath said ceiling installation, the ends of said panel assembly resting on said flanges, whereby said rails carry said panel assembly, and retaining means engaging said panel assembly on opposite sides of said hinge line to maintain the panels in selected relative angular positions.

2. A ceiling installation according to claim **1** wherein said rails have upright flanges, and said retaining means comprise a plurality of clips adapted to engage said upright flanges to maintain said panels in the selected angular positions.

3. A ceiling installation for a building, comprising a plurality of panels arranged in side-by-side relation, means hingedly joining opposed edges of said panels to form a panel assembly, spaced support means carried by the building, said panel assembly extending between said support means and being carried thereby, and retaining means engaging said panel assembly to

maintain the panels in selected relative angular positions, said support means comprising a non-linear rod, said rod carrying lateral projections, the free edges of said panels having means for accommodating said projections.

4. A ceiling installation for a building, comprising a plurality of panels arranged in side-by-side relation, means hingedly joining opposed edges of said panels to form a panel assembly, spaced support means having upright flanges carried by the building, said panel assembly extending between said support means and being carried thereby, and retaining means engaging said panel assembly to maintain the panels in selected relative angular positions, said retaining means including a non-linear rod carrying lateral projections which cooperate with the free edges of said panel, the ends of said rod having means for securing it to said upright flanges.

5. A ceiling installation for a building comprising a plurality of panels arranged in side-by-side relation, means hingedly joining opposed edges of said panels to form a panel assembly, spaced support means carried by the building, said panel assembly extending between said support means and being carried thereby, a strip arranged in a vertical plane at one end of said panel assembly, and retaining means engaging said panel assembly to maintain the panels in selected relative angular positions, said retaining means including fasteners extending through said strip and into the ends of at least some of the panels of said assembly.

6. A ceiling installation for a building, comprising a plurality of panels arranged in side-by-side relation, means hingedly joining opposed edges of said panels to form a panel assembly, spaced support means carried by the building, said panel assembly extending between said support means and being carried thereby, a perforated strip arranged in a vertical plane at one end of said panel assembly, and retaining means engaging said panel assembly to maintain the panels in selected relative angular positions, said retaining means including distorted wire-like elements fitted within the holes of said strip and projecting from said strip into the apex between two upwardly converging adjacent panels.

7. A ceiling installation for a building, comprising a plurality of panels arranged in side-by-side relation, means hingedly joining opposed edges of said panels to form a panel assembly in which the panels are connected to each other, spaced apart rails carried by the building, said rails having lateral flanges, said panel assembly extending between said rails and being carried thereby, and retaining means engaging said panel assembly to maintain the panels in selected relative angular positions, said retaining means including rods extending laterally between two successive rails, the ends of said rods resting on the flanges of said rails, two adjacent and connected panels being arranged on opposite sides of said rod, the hinge means between said panels resting on said rod.

8. A ceiling installation for a building, comprising a plurality of panels arranged in side-by-side relation, means hingedly joining opposed edges of said panels to form a panel assembly, spaced support means carried by the building, said panel assembly extending between said support means and being carried thereby, and retaining means engaging said panel assembly to maintain the panels in selected relative angular positions, said retaining means including pins carried by said panel assembly and projecting beyond the end edges of said panels, said pins being supported by said support means.

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