United States Patent [19]

Englund et al.

[11] **3,911,638**

[45] **Oct. 14, 1975**

[54] **VERTICAL CEILING ASSEMBLY AND CLIP ELEMENTS THEREFOR**

[75] Inventors: **James A. Englund,** Middlesex; **Stephen Popek,** Roselle, both of N.J.

[73] Assignee: **Alcan Aluminum Corporation,** Cleveland, Ohio

[22] Filed: **Apr. 22, 1974**

[21] Appl. No.: **462,625**

[52] **U.S. Cl.** **52/489;** 52/484; 52/665

[51] **Int. Cl.²** **E04B 5/52**

[58] **Field of Search** ..... 52/484, 485, 488, 489, 52/633, 483, 486, 493, 665, 758 A, 760, 144, 145, 39; 240/78 R, 78 LD, 9 R, 108 R; 248/343

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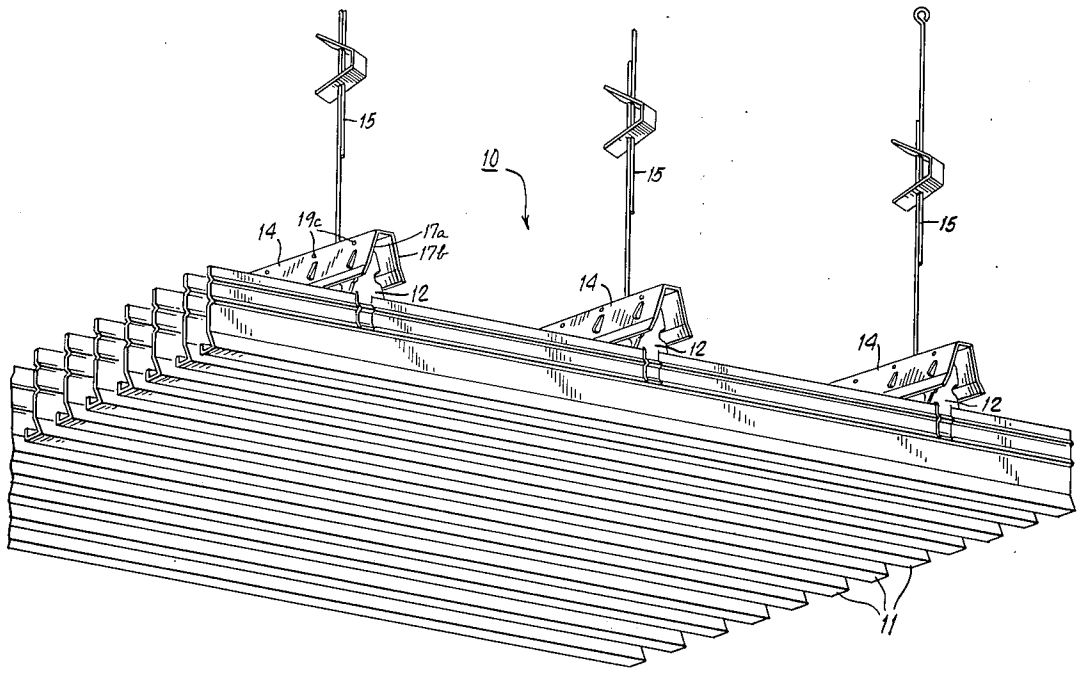
Primary Examiner—John E. Murtagh

Attorney, Agent, or Firm—Cooper, Dunham, Clark, Griffin & Moran

[57] **ABSTRACT**

A ceiling assembly including a plurality of suspended stringers parallel to each other and an array of horizontally elongated panels extending beneath and transversely of the stringers in spaced parallel relation to each other with major surfaces of the panels oriented vertically, wherein the panels are suspended from the stringers by means of clip elements each having an upper portion received in slots in a stringer and a lower, spring clip portion gripping an upper marginal portion of a panel. Each stringer is a downwardly-opening channel member having paired opposed slots formed therein. The upper portion of each clip element has a pair of opposed tabs respectively received in an opposed pair of such slots, and shaped so as to be readily insertable but to be effectively locked in place after insertion in the stringer slots. The clip elements can be bent intermediate their upper and lower portions for orienting the major surface planes of the panels at a desired angle to the stringers, so that the panel major surface planes are vertical when the stringers are pitched at an angle to the horizontal, as over a stairway.

13 Claims, 11 Drawing Figures



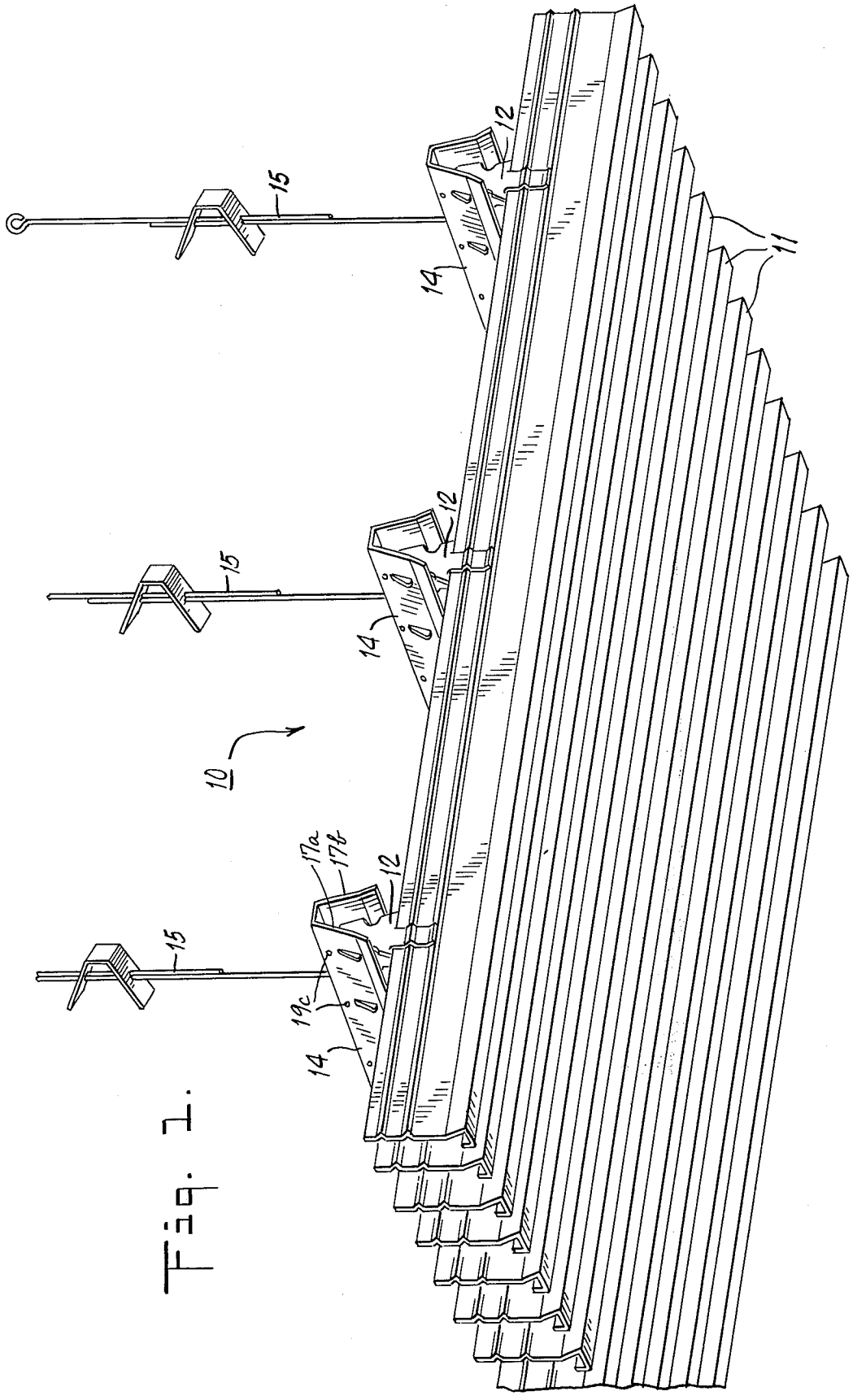


Fig. 1.

Fig. 2.

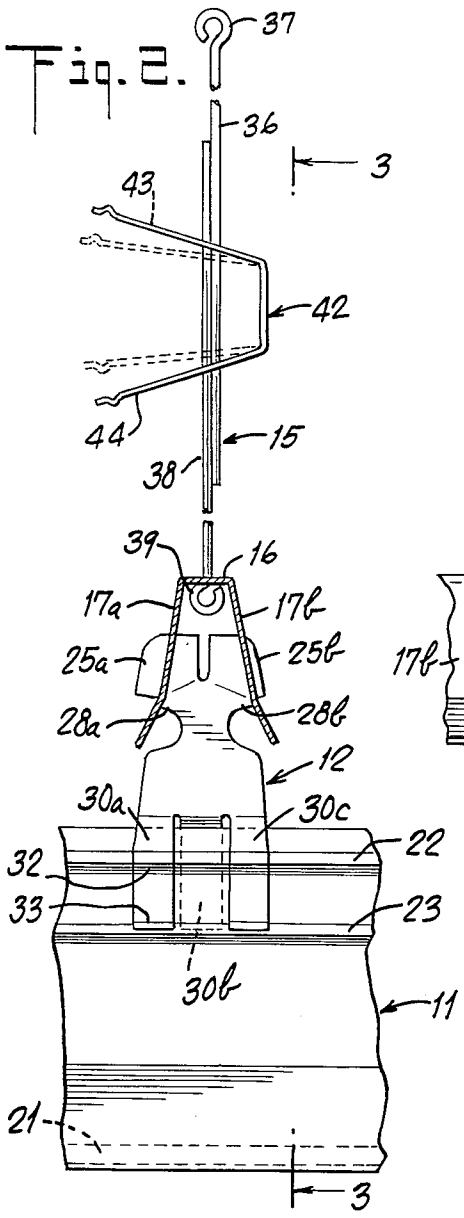


Fig. 3.

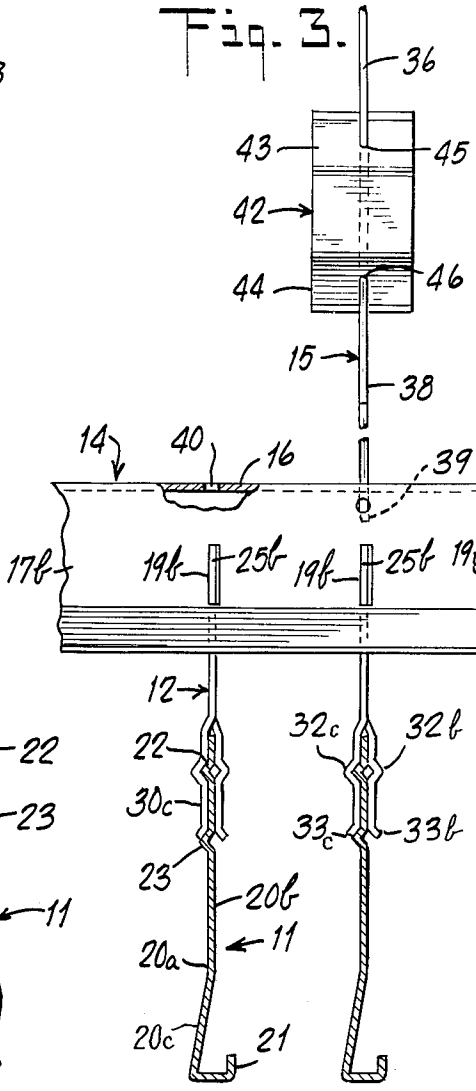


Fig. 4.

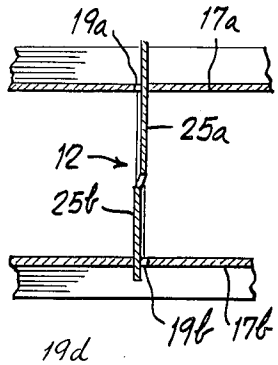


Fig. 5.

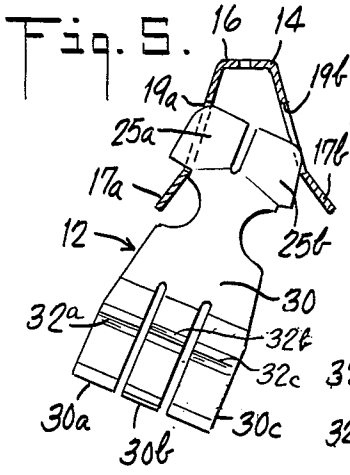


Fig. 6.

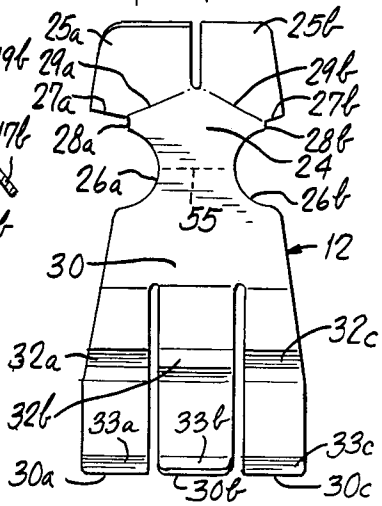


Fig. 7.

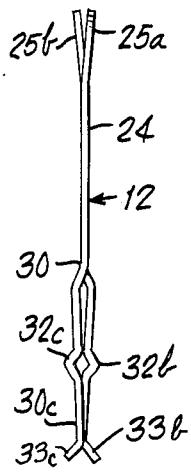


Fig. 8.

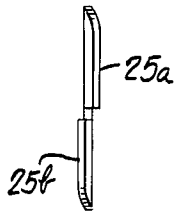


Fig. 11.

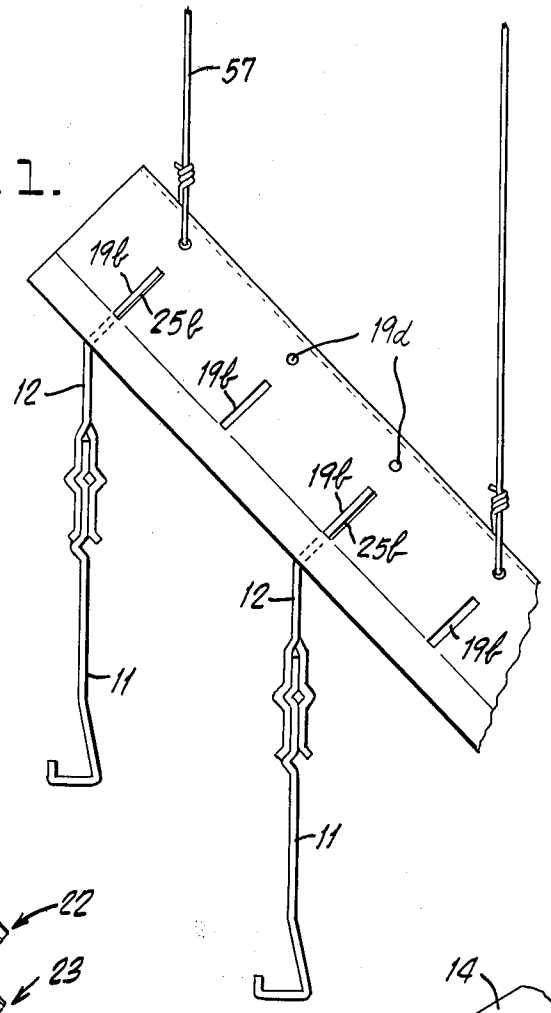
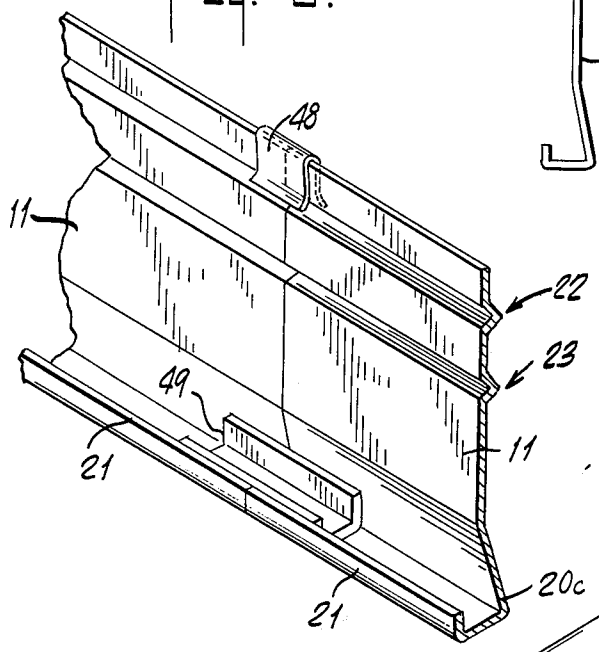


Fig. 9.



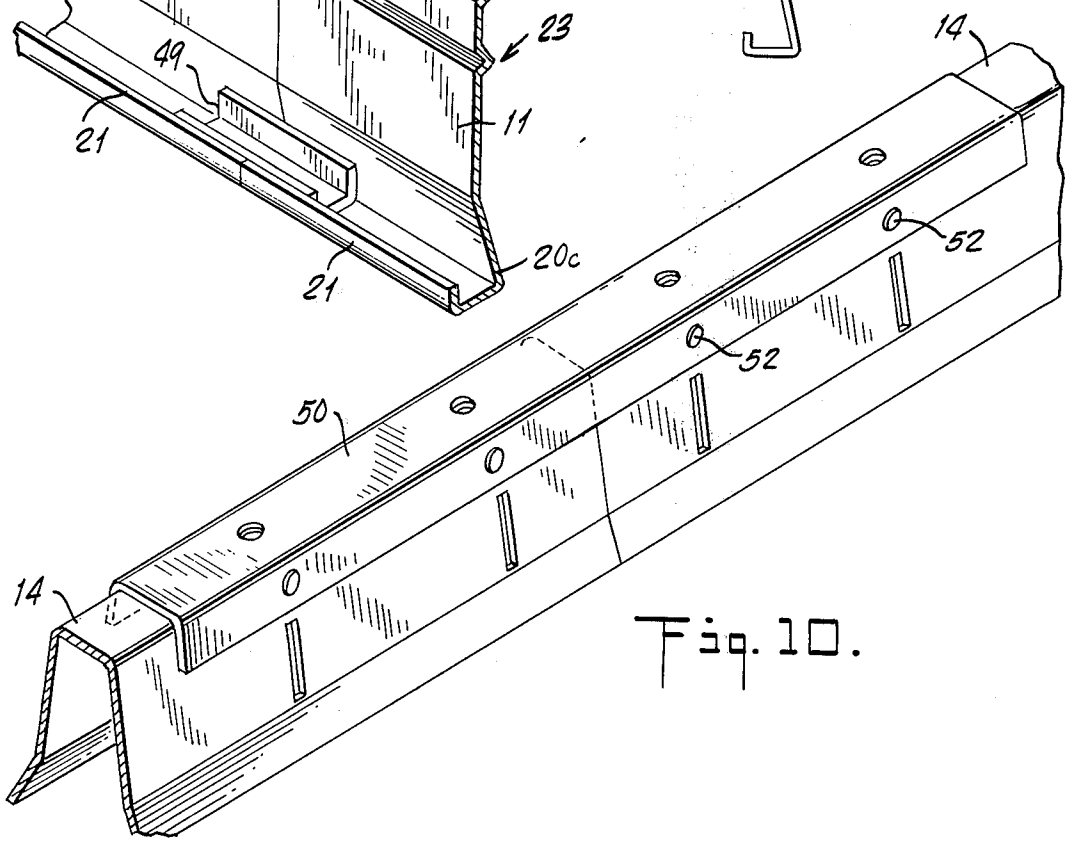


Fig. 10.

VERTICAL CEILING ASSEMBLY AND CLIP ELEMENTS THEREFOR

BACKGROUND OF THE INVENTION

This invention relates to suspended ceiling systems, and more particularly to so-called vertical ceiling systems.

Suspended ceilings are widely used in interior constructions for aesthetic and other reasons. A typical suspended ceiling comprises an assembly of panels spaced below the true or structural ceiling of a room, and carried by horizontal stringers or like members which are themselves suspended from the true ceiling.

One form of suspended ceiling employs elongated metal panels extending horizontally in spaced parallel relation to each other with their major surfaces lying in vertical planes. Such a ceiling, herein for convenience termed a vertical ceiling (because of the vertical orientation of the panel major surfaces), has an unusual and attractive decorative appearance, and may also serve to conceal structures such as lights, sprinklers, speakers, ventilation equipment, etc., mounted in the space or plenum above the suspended ceiling, while permitting passage of illumination, water, sound or air between the panels.

Owing to the vertical orientation of the panels, the types of structures commonly employed to mount a conventional suspended ceiling of horizontal panels are inappropriate for use in a vertical ceiling system. It is therefore necessary to provide a special mounting or support arrangement for a vertical ceiling. Desirable criteria for such an arrangement include low cost, ease of installation, and variability of design, as well as security and stability of support for the panels.

Particular problems are encountered in providing a vertical ceiling (or portion thereof) that is pitched, i.e., at an angle to the horizontal, as over a stairway. In such case, the lower edges of successive panels must lie in a sloping rather than horizontal plane, but the major surface planes of the individual panels must still be vertically oriented. It would be especially desirable to provide panel-mounting structures capable of use in either horizontally extending or pitched vertical ceiling assemblies.

SUMMARY OF THE INVENTION

The present invention broadly contemplates the provision of a ceiling assembly comprising a plurality of suspended, parallel, elongated carriers or stringers each having a plurality of slots provided at spaced intervals along its length; means for suspending the stringers from above; an array of horizontally elongated panels each having vertically oriented major surfaces, extending in spaced parallel relation to each other beneath and transversely of the stringers; and a plurality of clip elements, each having an upper portion seated in a slot or slots of one of the stringers and a lower spring-clip portion grippingly engaging an upper marginal portion of one of the panels, for suspending the panels from the stringers, each panel being suspended by plural clip elements respectively seated in plural stringers.

The invention further contemplates the use of clip elements each initially essentially flat but bendable about a horizontal line intermediate its upper and lower portions. The interengagement of the clip upper portion and stringer slots is such that, when the clip is flat, it extends perpendicularly from the stringer, for suspending a panel with vertically oriented major surfaces from a horizontally oriented stringer, i.e., to provide a ceiling assembly wherein all the panels are at a common level. By bending the clips, however, the major surface planes of the suspended panels may be oriented at an acute angle to the long dimension of the stringers, to provide the desired vertical panel surface orientation when the stringers are pitched at an angle to the horizontal in a pitched or sloping vertical ceiling assembly. Thus the same assembly elements — stringers, clips, and panels — may be used to produce either a level or a pitched vertical ceiling.

As a particular feature of the invention, each of the stringers may be a downwardly opening channel member having diverging legs with slots formed in opposed pairs in the two legs; and the upper portion of each clip element may comprise a pair of opposed tabs respectively insertable in an opposed pair of slots provided in the two legs of a stringer. The two tabs of each clip element may be respectively bent in opposed directions for engagement with edges on respectively different sides of the slots in which they are respectively inserted. Also, the lower edge of each tab may have its outer portion offset to form a shoulder for engaging the lower edge of the slot in which the tab is inserted. To facilitate insertion of the tabs in the slots, one of the tabs of each clip element may be longer than the other tab, and the lower edges of both tabs may slope upwardly and outwardly. This described tab structure permits ready assembly of the clip elements with the stringers, yet effectively locks the clip elements in the stringers once they are inserted.

The lower or spring clip portion of each tab element may comprise a plurality of depending spring fingers for gripping the upper marginal portion of a vertical ceiling panel, these fingers being so shaped that alternate ones of them respectively bear against opposite major surfaces of the gripped panel. One or more longitudinal ribs may be formed in the upper marginal portion of each panel, and the spring fingers of each clip element may correspondingly have one or more horizontal grooves positioned for register with such rib or ribs to aid in securely holding the panels.

Preferably, the supports for the stringers may be adjustable in length to facilitate location of the suspended ceiling assembly at a desired distance below the true or permanent ceiling below which it is mounted.

The foregoing combination of features provides a suspended vertical ceiling assembly of single construction, easy to install, yet secure and stable after installation, and affording desired variability in such design features as ceiling height and pitch, and spacing of panels.

Further features and advantages of the invention will be apparent from the detailed description hereinbelow set forth, together with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a level vertical ceiling assembly embodying the present invention in a particular form;

FIG. 2 is a fragmentary elevational view, partly in section, of the ceiling of FIG. 1;

FIG. 3 is a fragmentary sectional elevational view of the same ceiling assembly, taken along the line 3—3 of FIG. 2;

FIG. 4 is an enlarged detail sectional view taken along the line 4—4 of FIG. 3;

FIG. 5 is an elevational view illustrating insertion of a clip element in a stringer;

FIG. 6 is an enlarged side elevational view of one of the clip elements of the assembly of FIG. 1;

FIG. 7 is an end elevational view of the clip element of FIG. 6;

FIG. 8 is a top plan view of the same clip element;

FIG. 9 is a fragmentary perspective view illustrating an arrangement for splicing two aligned panels;

FIG. 10 is a fragmentary perspective view illustrating an arrangement for splicing two aligned stringers; and

FIG. 11 is a fragmentary elevational view of a pitched ceiling assembly embodying the invention, wherein the panels are oriented with their major surfaces vertical but at an acute angle to the long dimension of the stringers.

DETAILED DESCRIPTION

Referring first to FIG. 1, the embodiment of the invention there illustrated is a suspended level vertical ceiling assembly 10 comprising an array of horizontally elongated ceiling panels 11 having vertically oriented major surfaces, and extending in spaced parallel relation to each other at a common level spaced below a permanent ceiling (not shown). In accordance with the invention, and as a particular feature thereof, the panels 11 are individually suspended by means of hangers or clip elements 12 from a plurality of horizontally elongated carriers or stringers 14 which extend, in spaced parallel relation to each other, above and at right angles to the panels 11. Each panel thus extends beneath plural stringers and is connected to each of them by a separate clip element 12, while each stringer overlies plural panels each connected to it by a separate clip element. Further, each stringer is suspended from the superjacent permanent ceiling by a plurality of supports 15 spaced along the length of the stringer. The suspended vertical ceiling thereby provided may, for example, serve to mask equipment such as a sprinkler system disposed in the plenum or space between it and the permanent ceiling, while permitting downflow of water from the sprinkler system, and may be designed to present an attractive, decorative appearance.

Each of the stringers 14 is a downwardly opening metal channel member having a central web 16 and diverging legs 17*a* and 17*b* that flare outwardly along their respective lower margins 18*a* and 18*b* (FIGS. 2 and 3). A plurality of vertical slots 19*a* (i.e., slots extending transversely of the long dimension of the stringer, with their axes lying in vertical planes) are provided in and spaced equidistantly (e.g. 2 inches apart) along the length of the leg 17*a* of each stringer, while a corresponding plurality of identical slots 19*b* are provided in the opposite leg 17*b* of each stringer, in register with the slots 19*a* so as to constitute therewith a succession of pairs of opposed slots distributed along the stringer length. In addition, small holes 19*c* and 19*d* are provided in the legs 17*a* and 17*b*, respectively, directly above the slots, to facilitate connection of splicing elements and/or some forms of stringer-suspending means to the stringers, as hereinafter further explained. The plural stringers of the assembly 10 are suspended in such positions that the slots of each stringer are aligned with the slots of each other stringer in the assembly. The stringers may be spaced apart by any convenient distance, e.g. up to about 7 feet.

The panels 11 are formed e.g. from aluminum or other metal strip, and have opposed vertical flat major surfaces 20*a* and 20*b*. In its lower portion, each panel may be formed as shown in FIGS. 3 and 9 with an outward bend 20*c* and a marginal channel flange 21. In the upper portion of each panel are formed two spaced longitudinal ribs 22 and 23 parallel to the upper edge of the panel. For purposes of protection and appearance, the panels may be painted or otherwise coated on all surfaces.

Each of the hangers or clip elements 12 (FIGS. 4 – 8) is formed from a single, initially flat piece of metal. The upper portion 24 of each clip element is vertically bifurcated to provide two tabs 25*a* and 25*b* respectively projecting horizontally in opposite directions from the vertical center line of the clip element. These two tabs are shaped for insertion, respectively, into an opposed pair of slots 19*a* and 19*b* in a stringer 14. Below the tabs the sides of the clip element are cut away, as indicated at 26*a* and 26*b*, to provide clearance for insertion of the tabs in stringer slots.

To facilitate insertion of the tabs in a stringer, the tab 25*a* is somewhat longer than the tab 25*b*, and the respective lower edges 27*a* and 27*b* of the two tabs slope upwardly and outwardly, while the outer upper corners of the tabs are rounded. Each of the tab lower edges is offset in its outer portion to provide a shoulder (28*a* or 28*b*) for engaging the lower edge of the slot in which the tab is inserted. As shown in FIG. 5, for assembly with a stringer 14, the upper portion of the clip element 12 is placed within the stringer channel and the longer tab 25*a* is first inserted in slot 19*a* in stringer leg 17*a* (or in slot 19*b* of leg 17*b*); then the shorter tab 25*b* is snapped into place in the opposite slot 19*b* in stringer leg 17*b* (or in slot 19*a* of leg 17*a*). The engagement of shoulders 28*a* and 28*b* with the lower edges of the slots then retains the clip element effectively locked in place in the stringer.

As best seen in FIGS. 4, 7 and 8, the two tabs are bent slightly (along downwardly diverging lines 29*a* and 29*b*, respectively) in opposite directions out of the initial major surface plane of the clip element. When the tabs are fully inserted in the slots 19*a* and 19*b*, tab 25*a* bears against one of the two vertical side edges of the slot 19*a*, and tab 25*b* bears against the other of the two vertical side edges of the slot 19*b* (i.e., the two tabs respectively bear against diagonally opposite side edges of their respective slots), owing to the described oppositely bent arrangement of the tabs, thereby enhancing the positional stability of the clip element relative to the stringer.

In its lower portion 30, each clip element is divided into three parallel depending spring fingers 30*a*, 30*b*, and 30*c*, each having a free lower end. The upper part of each finger is bent first outwardly away from the major plane of the clip element and then back toward the major plane of the clip element, so as to form a spring; as shown, the central finger 30*b* is bent in directions opposite to the directions of the bends of the outer two fingers 30*a* and 30*c*, so that when the upper portion of a panel 11 is inserted between the fingers, alternate ones of the fingers respectively bear against opposite major surfaces of the panel, thus clamping and holding the panel between them by spring action.

The spring fingers respectively have central horizontal grooves **32***a*, 32*b* and **32***c* positioned for register with the upper longitudinal rib **22** of a panel **11** when the upper portion of the panel is inserted between the fingers. Also, the lower ends of the fingers are respectively bent outwardly at **33***a*, 33*b*, and **33***c* to conform to the lower rib **23** of the panel. Consequently, rib **22** is received in grooves **32***a*, 32*b* and **32***c* and finger portions **33***a*, 33*b* and **33***c* bear against rib **23,** for assured positionally stable retention of the panel by the fingers **30***a*, 30*b*, and **30***c*, which together constitute a spring clip for gripping the panel.

Any of various kinds of elements may be used as supports for suspending the stringers from a permanent ceiling. One presently preferred form of support, shown at **15** in FIGS. **2** and **3,** includes a first vertical rod **36** having an eye **37** at its upper end for engaging a hook (not shown) mounted in a permanent ceiling; a second, lower vertical rod **38** having an eye **39** at its lower end for supporting a stringer **14** when rod **38** is inserted upwardly through a hole **40** in the stringer web **16** from within the stringer channel; and a spring clamp **42** for adjustably holding the rods **36** and **38** together. Clamp **42** is a resilient. C-shaped metal member having upper and lower legs **43** and **44** with aligned holes **45** and **46** respectively provided therein. Rods **36** and **38** pass through these holes in contiguous, overlapping relation. The legs **43** and **44** have a resilient divergent bias which causes the edges of holes **45** and **46** to bear against, and clamp together, the overlapping rods **36** and **38** extending therethrough; i.e., legs **43** and **44,** when unstressed, tend to spring open to the diverging, clamping position shown in solid lines in FIG. **2,** thereby holding the rods by spring forces. When the legs are compressed together manually into substantial parallelism (dotted lines in FIG. 2), rod **43** and **44** are released for relative axial movement to vary the overall length of the support **15.** A plurality of these supports **15** are connected to each stringer, spaced at intervals along its length; if the permanent ceiling varies in elevation, different supports **15** may be adjusted to different lengths so as to suspend the stringers at a common horizontal level.

If the dimension of the assembly **10** longitudinally of the panels is greater than the length of a single panel, two panels **11** may be spliced together endwise as shown in FIG. **9,** by means of a spring clip **48** fitted over the top edge of the two panels at the joint between them, and a short channel section **49** press-fitted into the lower marginal channel flanges **21** of the two panels to bridge the joint. Similarly, as shown in FIG. **10,** two stringers **14** may be spliced endwise by bridging the joint between them with a channel section **50** fitted over the tops of the stringers and secured thereto as by blind rivets **52** or other suitable fasteners, inserted through the aforementioned stringer holes **19***c* and **19***d* and through corresponding holes in channel section **50.**

In assembling the vertical ceiling of FIG. **1,** clip elements **12** are inserted (in the manner already described) in the slots **19***a* and **19***b* of the stringers **14,** at positions along the stringers corresponding to the desired spacing between adjacent panels **11.** For instance, assuming that the slots **19** are spaced at intervals of **2** inches, a clip element **12** is inserted in each opposed pair of slots in each stringer if it is desired to space the panels two inches apart (FIG. **3**); or a clip element is inserted only in every second pair of slots, if **4**-inch spacing between panels is desired (FIG. **11**). The stringers are then connected by supports **15** to the permanent ceiling, the supports being adjusted in length as necessary to position the stringers at a common horizontal level of desired height.

With the stringers thus suspended, the lower spring-clip portions of the elements **12** extend therefrom; the stringers are so disposed that corresponding clip elements on all the stringers are aligned in horizontal rows perpendicular to the long dimension of the stringers. A panel **11** is now mounted on the clip elements constituting one such row (i.e., one clip element on each stringer) by snap-fitting the upper marginal portion of the panel into the spring fingers of each clip element, and this step is repeated until all the panels are mounted in place.

If it is desired that the stringers be horizontal to provide a level ceiling assembly as shown in FIGS. **1** and **3,** the upper and lower portions of each clip element are maintained in a common vertical plane. To provide a pitched or sloping assembly of panels progressively differing in level but still having their major surfaces oriented vertically as shown in FIG. **11,** each clip element **12** is bent about a horizontal line intermediate its upper and lower portions such that the lower portion remains in a vertical plane but the upper portion lies in a plane pitched at an angle thereto; to this end, the physical properties and thickness of the clip metal are such as to permit bending about the aforementioned horizontal line and to rigidly retain the bent shape when a panel is suspended from the clip. A bend line **55** may, if desired, be pre-scored in each clip element (FIG. **6**). The stringer **14** are suspended at an angle to the horizontal, i.e., at the desired pitch of the ceiling assembly; as will be understood, the angle at which the clips are bent is determined by this desired pitch angle, so that the major surfaces of the panels remain vertical while the overall assembly is pitched with successive panels positioned at progressively different levels, for example over a stairway or the like. Thus the same components — stringers, clips, and panels, — may be used to produce either a level ceiling or a pitched ceiling.

Also, in FIG. **11,** the stringers are shown as suspended from a fixed ceiling by means of hanger wires **57** inserted through the holes **19***c* and **19***d* and anchored by twisting of their ends, rather than by means of the above-described supports **15.** The hanger wires may also be used to support a level ceiling assembly, and indeed, if desired, the stringers may be fastened directly to a fixed ceiling or portion thereof, with suitable fasteners (not shown) e.g. inserted through holes **40** and/or **19***c* and **19***d.*

The described ceiling assembly is quickly and easily installed, with relatively few and simple manipulations requiring no specialized skills or tools, and is constituted of readily fabricated, mechanically simple parts with advantageous economy of material; yet it is advantageously stable and secure owing in particular to the structure of the clip elements and their cooperation with the panels and stringers. A special advantage of the assembly is the design flexibility affords, e.g. with respect to ceiling height, panel spacing, and pitch, using the same standardized parts.

It is to be understood that the invention is not limited to the features and embodiments hereinabove specifi-

cally set forth but may be carried out in other ways without departure from its spirit.

We claim:

1. A ceiling assembly comprising

a. a plurality of spaced, parallel, elongated stringers each having a plurality of slots provided at spaced intervals along its length;

b. means for suspending said stringers, substantially in a common plane, from superjacent structure;

c. an array of horizontally elongated panels, each having opposed major surfaces oriented vertically, extending in spaced parallel relation to each other beneath and transversely of said stringers; and

d. a plurality of clip elements, each having an upper portion seated in a slot of one of said stringers so as to be held thereby and a lower spring-clip portion grippingly engaging an upper marginal portion of one of said panels, for suspending said panels from said stringers, each said panel being suspended by plural clip elements respectively seated in plural ones of said stringers;

each of said stringers being a downwardly opening channel member having two downwardly diverging legs, said slots being provided in opposed pairs in said legs and extending transversely of the length of said stringers; and

f. the upper portion of each said clip element comprising a pair of opposed tabs respectively inserted in opposed slots formed respectively in the two legs of one of said stringers.

2. An assembly as defined in claim **1,** wherein

a. each of said slots has opposite side edges lying in parallel planes; and

b. the tabs of each said clip element are respectively bent in opposed directions out of parallelism with the side edges of the slots in which they are inserted, for engagement with edges on respectively different sides of the slots in which they are inserted, thereby to stabilize the position of the clip element.

3. An assembly as defined in claim **2,** wherein one of the tab members of each said clip element has a greater horizontal extent than the other tab member of the same clip element, to facilitate insertion of the tabs into opposed slots of a stringer.

4. An assembly as defined in claim **2,** wherein each tab of each said clip element has an upwardly and outwardly sloping lower edge with a shoulder provided therein to engage the lower edge of a slot in which the tab is inserted.

5. An assembly as defined in claim **1,** wherein the spring clip portion of each said clip element comprises a plurality of depending spring fingers alternately resiliently biased in opposite directions for gripping the upper marginal portion of a panel inserted between them.

6. An assembly as defined in claim **5,** wherein

a. the upper marginal portion of each of said panels has at least one longitudinal rib formed therein, and

b. the spring fingers of each said clip elements have at least one groove formed therein for register with said one rib of a panel gripped by the spring fingers.

7. An assembly as defined in claim **6,** wherein

a. the upper marginal portion of each of said panels has a second longitudinal rib formed therein below and parallel to said one rib, and

b. the lower extremity of each spring finger of each said clip element is bent to conform to said second rib of a panel gripped by the spring fingers.

8. An assembly as defined in claim **1,** wherein said stringers extend horizontally at a common level, and wherein the upper and lower portions of each said clip element are formed integrally and lie substantially in a common vertical plane, for suspending panels with major surfaces of the panels oriented vertically.

9. An assembly as defined in claim **1,** wherein said stringers are pitched with their long dimensions at a common angle to the horizontal, and wherein the upper and lower portions of each said clip element are formed integrally, with the lower portion lying substantially in a vertical plane and the upper portion bent at an angle thereto, for suspending panels from the pitched stringers with major surfaces of the panels oriented vertically.

10. A ceiling assembly comprising

a. a plurality of spaced, parallel, elongated stringers each having a plurality of slots provided at spaced intervals along its length;

b. means for suspending said stringers, substantially in a common plane, from superjacent structure;

c. an array of horizontally elongated panels, each having opposed major surfaces oriented vertically, extending in spaced parallel relation to each other beneath and transversely of said stringers; and

d. a plurality of clip elements, each having an upper portion seated in a slot of one of said stringers so as to be held thereby and a lower spring-clip portion grippingly engaging an upper marginal portion of one of said panels, for suspending said panels from said stringers, each said panel being suspended by plural clip elements respectively seated in plural ones of said stringers;

e. the spring clip portion of each said clip element comprising a plurality of depending spring fingers alternately resiliently biased in opposite directions for gripping the upper marginal portion of a panel inserted between them.

11. An assembly as defined in claim **10,** wherein

a. the upper marginal portion of each of said panels has at least one longitudinal rib formed therein, and

b. the spring fingers of each said clip element having at least one groove formed therein for register with said one rib of a panel gripped by the spring fingers.

12. An assembly as defined in claim **11,** wherein

a. the upper marginal portion of each of said panels has a second longitudinal rib formed therein below and parallel to said one rib, and

b. the lower extremity of each spring finger of each said clip element is bent to conform to said second rib of a panel gripped by the spring fingers.

13. A ceiling assembly comrising

a. a plurality of spaced, parallel, elongated stringers each having a plurality of slots provided at spaced intervals along its length;

b. means for suspending said stringers, substantially in a common plane, from superjacent structure;

c. an array of horizontally elongated panels, each having opposed major surfaces oriented vertically, extending in spaced parallel relation to each other beneath and transversely of said stringers; and

d. a plurality of clip elements, each having an upper portion seated in a slot of one of said stringers so

as to be held thereby and a lower spring-clip portion grippingly engaging an upper marginal portion of one of said panels, for suspending said panels from said stringers, each said panel being suspended by plural clip elements respectively seated in plural ones of said stringers;

e. said stringers being pitched with their long dimensions at a common angle to the horizontal; and

f. the upper and lower portions of each said clip element being formed integrally, with the lower portion lying substantially in a vertical plane and the upper portion bent at an angle thereto, for suspending panels from the pitched stringers with major surfaces of the panels oriented vertically.

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