A method and apparatus for creating and installing a curved ceiling support system and associated panels. The invention includes a ceiling support system, a ceiling panel, and a clip or fastener that holds the ceiling panel to the ceiling support system. The ceiling panel may include an upset taking one of two basic shapes: a C-shaped upset or a Z-shaped upset. The C-shaped upset has an inwardly directed flange while the Z-shaped upset has an outwardly directed flange. Further, the edges perpendicular to the upset may be extruded or shaped in three dimensions. Panel locks couple the ceiling panel to a curved support member suspended from the ceiling. Once inserted, the ceiling panel conforms to the curve of the support member. An installation tool aids in fitting the ceiling panel to a support beam.
well edge trim

hanger ledge

abutment wall

abutment base

internal upstand

adjustable support

FIG. 53
FIG. 60

- Panel end of wall split
- Inwardly directed ledge
- Upwardly directed wall
- Sheet portion of panel
short edge floating wall treatment

upper prong

tip
tip

lower prong

base

interior downwardly pointy teeth

FIG. 61

FIG. 62
alternative brace
alternative blade
alternative support procket assembly
support bar

FIG. 72
CEILING PANEL AND SUPPORT SYSTEM

[0001] CROSS-REFERENCE TO RELATED APPLICATIONS

[0002] This application claims priority to U.S. Provisional Application No. 60/269,141, filed Feb. 15, 2001 (the '141 application) and U.S. Provisional Application No. _______, filed Feb. 14, 2002 (the '______application). The application filed Feb. 14, 2002 corresponds to Dorsey & Whitney Docket No. 10030US.01. The '141 application and the '______application are both hereby incorporated by reference as though fully set forth herein.

BACKGROUND OF THE INVENTION

[0003] a. Field of the Invention

[0004] The present invention relates to the field of curved ceilings and support systems for curved ceilings. In particular, the present invention relates to a support system that may be pre-curved or curved at a job site and to panels fabricated from metal or other materials that are suspended by the support system and that obscure the support system.

[0005] b. Background Art

[0006] Metal ceilings are known in the art. There are two types of metal ceilings: a linear ceiling and a tile ceiling. A typical linear ceiling is formed at the job site into long, longitudinally-extending panels with no predetermined length, and hung with perpendicular supports connected to the back of the panels. A typical tile ceiling is made of ceiling tiles of a predetermined size manufactured off of the job site and suspended by a T-grid suspension system. The T-grid system is first suspended from the rough ceiling and then the ceiling tile is mounted to the grid. Typically there will be both longitudinal and latitudinal supports. This support grid is necessary to suspend the panels.

[0007] When using metal ceilings, it is preferable to have upstands positioned at the interface of the panels to hide any supporting grid work. This is usually more of an issue with tile panels than with linear ceilings, because the tile panel uses a support grid, whereas the longitudinal panel has perpendicular supports suspending the panel. The upstands are shaped and subsequently positioned in a manner that substantially hides the grid support system. Hiding the grid is one method of hiding a metal ceiling panel.

[0008] The tile ceiling system with upstands that hide the support system requires that both the T-grid supports and the panels be curved at the factory prior to shipping to the job site. Shipping this type of panel can be difficult and expensive. The curve of the panel must be supported, and much air is shipped. To alleviate this problem with a curved T-grid support system, an alternate ceiling panel system is available. This ceiling panel system uses a flat piece of metal with no upstands on its edges. This metal panel does not hide the T-grid, but instead is supported by the up face of the “T” of the T-grid support. The metal panel can be shipped flat to the job site and takes the curve of the T-grid support, which still must be curved off of the job site at a manufacturing facility. Since the T-grid is not hidden by this system, this ceiling is not as aesthetically pleasing as the ceiling with upstands that hide the support system.

[0009] The T-grid support used to support known metal tile ceilings is comprised of four independent pieces of metal roll formed together to create a single piece. Because of the complexity of curving an individual piece of metal created from four pieces of metal, any curving has to be done off site.

BRIEF SUMMARY OF THE INVENTION

[0010] The above discussed and other problems with the prior art are addressed by the ceiling panels and ceiling support system of the present invention. The ceiling system of the present invention includes a ceiling support system, a ceiling panel, and a panel locking device that holds the ceiling panel to the ceiling support system. The ceiling panel has at least a longitudinal three-dimensional edge and may include three-dimensional edges perpendicular to the longitudinal edge. The ceiling panel remains flat until placed onto a curved longitudinal support. The ceiling support system can be curved at the job site with a radius ranging from one foot to flat, and more preferably from four feet to flat, and most preferably from about eight feet to flat. The panel locking device holds the adjoining ceiling panels to the ceiling support system.

[0011] The ceiling panel is preferably made from a sheet of metal with longitudinally extending, upstanding edges. The upstanding edges provide both structural support and aesthetics. By using an upstanding edge, the panel can be coupled to the support system in a manner that hides the support system, thus providing a more aesthetically pleasing ceiling. An important element of a metal ceiling panel is the ratio of the height of the upstanding edge to the thickness of the sheet metal for the type of metal being used. This ratio determines if a flat panel with upstanding edges will follow the curve of a curved support system. In one embodiment this ratio is, for a 1063 T5 Aluminum sheet metal, 0.400 inches upstand height to 0.032 inches sheet metal thickness. For other types of metals and thicknesses the ratio may be different. Generally, the panel has an edge that can be coupled to the support system to hide the support system and will first lay flat, and then follow the curve of the longitudinal supports.

[0012] The upstand has two basic shapes, though many other shapes could be used. One of the two shapes is a C-shape in which the upstand is created by an outwardly facing ninety degree turns to create essentially a C-shape at the edge of the panel. The other shape is a Z-shape in which the upstand is created by an outwardly facing ninety degree angle to create a Z-shape at the edge of the panel, with the Z being formed with ninety degree angles. Essentially the C-shape creates an upstand with a flange directed inwardly toward the panel and the Z-shape creates and upstand with a flange directed outwardly from the panel.

[0013] The support system in the present invention is a unique design. In the present embodiment the support member is a robust extruded aluminum rail having a shape resembling a T or I. The design includes a longitudinally extending slot at the bottom of the T that allows for the capture of a panel lock clip that locks in the upstand of the panel. Once locked into place the panel cannot move. The T of the support member flanges out in both directions from the center leg of the T. Small hooks then, basically, curl back toward the T to help support or capture the upstand. The shape of the T-support member may be different if a C-shaped flange or upstand is formed on the ceiling panel instead of a Z-shaped flange or upstand.
[0014] Being made of a single extrusion, the support member can be easily shaped in the field with the proper tool. The radius of the curve can change over length or remain the same. Multiple curves can be added to a support member, and the curve from one longitudinal support member to the next adjacent longitudinal support member can change a small amount and on and on. This change creates a dome like appearance for the ceiling when the ceiling tile is ultimately applied. A typical curve would be about an eight-foot radius to flat. Support members with curves having radii as small as three feet have been shaped. It is conceivable that a support member could be shaped to a curve with a radius of one foot. It should be noted that the support member may comprise multiple smaller segments rather than a single segment where ease of storage, shipping, or assembly so dictate.

[0015] Panel locks couple the ceiling panel to the support member. These may include a support lock that slides into a channel or channels extruded into the support member and are captured by the support member. The locks may then place the upstand of the panel into contact with the boles of the support member, thus securing the panel. The panel locks may be an integral portion of the panel itself, such as a groove or extrusion, a separate lock, button, or clip, or may simply be the unadorned panel edge capable of interlocking with the aforementioned support members.

[0016] The C-panel lock or clip is either spring operated in one embodiment or alternatively screw driven operated in a second embodiment. Each system will be discussed in more detail below. The Z-panel clip or lock may be spring loaded.

[0017] The invention also involves an installation tool for use in assembling a ceiling panel to a support beam. The installation tools includes a support bar having a first end portion and a second end portion. A first support bracket assembly is connected with the first end portion and a second support bracket assembly is connected with the second end portion. Each support bracket assembly includes a brace and a blade. Each support bracket assemblies may also include a first separator rotatably connected with each end portion of the support bar. The separator defines a finger portion adapted to engage a strike plate on the brace to bias the brace away from the first blade. The installation tool may be suspended between two support beams. In one embodiment, the support bracket assemblies are each secured to a support beam. When suspended, the support bar portion of the installation tool extends between and below the two support beams to provide a support upon which a panel may be rested to assist an installer in the installation of the panel.

[0018] A unique method of supporting the panel for installation also exists. This support tool provides for an installation support to be positioned under the panel and coupled to the support beams. When two installation supports are in place, the flat panel can be slid into place by a single person and then subsequently coupled to the support beams, again by a single person or installer. This feature allows installation of a curved or flat metal ceiling panel by a single person.

[0019] Other objects and advantages of the present invention will become apparent as the following specification progresses, reference being had to the accompanying drawings for an illustration of one example of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] FIG. 1 is an isometric view of the curved ceiling system of the present invention;

[0021] FIG. 2 depicts a curved support beam section forming a concave arc depicting a possible notch and hole configuration;

[0022] FIG. 3 is an enlarged, detailed view of the end portion of the curved support beam section depicted in FIG. 2 and labeled with the number 3;

[0023] FIG. 4 is an enlarged, detailed view showing a mid portion of the curved support beam depicted in FIG. 2;

[0024] FIG. 5 is an isometric view of a clip-in beam joiner that may be used to connect abutting support beam sections like the one depicted in FIG. 2;

[0025] FIG. 6 is a cross sectional view taken through the center support of the clip-in beam joiner depicted in FIG. 5, the cross section taken along line 6-6;

[0026] FIG. 7 is a top planed view of the clip-in beam joiner depicted in FIGS. 5 and 6, showing the lazy H-shaped cross section;

[0027] FIG. 8 is a metal beam joiner that may be used as a substitute for the clip-in beam joiner depicted in FIGS. 5-7;

[0028] FIG. 9 is an isometric view of a metal beam joiner that is being positioned to join to support beam sections in an end-to-end abutting relationship;

[0029] FIG. 10 is similar to FIG. 9, but shows that the metal beam joiner has been fully installed by folding the punched tabs inwardly toward the main webs of the adjacent support beam sections;

[0030] FIG. 11 is an exploded, isometric view of an optional cross brace that may be temporarily or permanently used to maintain the relative position of a first support beam section to an adjacent, parallel support beam section;

[0031] FIG. 12 is an enlarged, fragmentary view of one end of the cross brace depicted in FIG. 11, showing in more detail the notching of the cross brace;

[0032] FIG. 13 is a fragmentary planed view looking downwardly on a C-panel having inwardly-directed ledges for returns along the long edges of the panel;

[0033] FIG. 14 is a view taken along line 14-14 of FIG. 13, depicting an end view of a panel short edge;

[0034] FIG. 15 is an enlarged, fragmentary view of the C-panel portion within the dashed circle numeral 15 of FIG. 14, depicting a C-panel upstand;

[0035] FIG. 16 is a schematic, fragmentary, isometric view of the C-panel depicted in FIGS. 13-15;

[0036] FIG. 17 is an isometric view of an asymmetric panel lock button that may be installed in the field;

[0037] FIG. 18 is a cross sectional view taken along line 18-18 of FIG. 17 and clearly depicting the screw driver slot;

[0038] FIG. 19 is an isometric view similar to FIG. 17 but depicting an asymmetric panel lock button that is installed in a support beam before the support beam is transported to the installation site;
FIG. 20 is a cross sectional view taken along line 20-20 of FIG. 19 and clearly depicting the screw driver slot;

FIG. 21 is an end view of a square head support beam supporting two C-panels with the asymmetric panel lock button of FIGS. 19 and 20 installed and oriented to permit installation or removal of the left and C-panel depicted in FIG. 21;

FIG. 22 is an isometric view looking downwardly at a leaf spring panel lock that may be used as an alternative to the asymmetric panel lock buttons depicted in FIGS. 17-20;

FIG. 23 is a fragmentary isometric view looking upwardly at two C-panels that are installed on a square head support beam with a leaf spring panel lock in place;

FIG. 24 is an end view of the combination depicted in FIG. 23, clearly depicting the staggered nature of the panel locking humps that are also visible in FIGS. 22 and 23;

FIG. 25 depicts a spline panel lock being used in combination with a square head support beam to keep two C-panels in their mounted configuration;

FIG. 26 is an isometric view looking downwardly at the spline panel lock depicted in FIG. 25;

FIG. 27 is an end view of a threaded groove support beam that may be used to mount two C-panels and depicts the hex set locking screw just prior to installation in the lower portion of the threaded groove support beam to lock the panels in position;

FIG. 28 is an enlarged isometric view of the hex set locking screw depicted in FIG. 27;

FIG. 29 depicts a top-down view of a Z-panel in accordance with an embodiment of the present invention.

FIG. 30 depicts a cross-sectional view taken along line H-H of the Z-panel of FIG. 29.

FIG. 31 depicts an expanded view of the panel long edge as shown in FIG. 30.

FIG. 32 depicts an isometric view of the Z-panel of FIGS. 29-31, more clearly displaying the outwardly-directed ledge and Z-panel upstand running along the first and second panel long edges.

FIG. 33 depicts a cross-sectional view of a Z-panel support beam and an installed Z-panel.

FIG. 34 depicts an isometric view of a panel locking strip.

FIG. 35 depicts a top-down view of a C-panel with altered first and second panel short edges.

FIG. 36 depicts a cross-sectional view taken along line I-I of the wall-flange C panel of FIG. 35.

FIG. 37 depicts a detail view of the notch of the wall-flange C panel shown in FIGS. 35 and 36.

FIG. 38 depicts a cross-sectional side view taken along line K-K of FIG. 35, showing the flange end form in greater detail.

FIG. 39 depicts a detailed view of the wall end form taken along line J-J of FIG. 35.

FIG. 40 depicts an isometric view of the wall-flange C panel.

FIG. 41 depicts a cross-sectional side view of two installed wall-flange C panels resting on a support beam, taken along the panel long edge.

FIG. 42 depicts a top-down view of a wall-flange Z panel.

FIG. 43 depicts a front view along the long axis of the wall-flange Z panel of FIG. 42.

FIG. 44 depicts a detail view of the Z-panel upstand of the wall-flange Z panel shown in FIGS. 42 and 43.

FIG. 45 depicts a detail view of the wall end form of the wall-flange Z panel shown in FIG. 42.

FIG. 46 depicts a detail view of the flange end form of the wall-flange Z panel shown in FIG. 42.

FIG. 47 depicts an isometric view of the wall-flange Z panel.

FIG. 48 depicts one embodiment of a wall treatment for a C-shaped ceiling panel.

FIG. 49 depicts a three-quarter view of an installed wall treatment including the adjustable support and wall edge trim.

FIG. 50 depicts a wall treatment for use with such a partial panel.

FIG. 51 depicts an interval upstand extending from a ceiling panel.

FIG. 52 depicts an isometric view of the wall treatment of FIG. 50 showing the hanger ledge and the interval upstand in their installed positions.

FIG. 53 depicts yet another embodiment of a wall treatment for use with a partial panel.

FIG. 54 depicts an isometric view of the wall treatment shown in FIG. 53.

FIG. 55 depicts a cross-sectional view of a floating beam corner capable of hiding a floating ceiling edge created by a partial panel.

FIG. 56 depicts an isometric view of the floating beam corner of FIG. 55.

FIG. 57 depicts floating beam corner capable of hiding a floating ceiling edge created by a full C-panel.

FIG. 58 depicts a panel splice.

FIG. 59 depicts the panel splice of FIG. 58 being used as a long edge end treatment.

FIG. 60 depicts a cross-sectional view taken along the long axis of a pair of C-panels showing the panel splice of FIG. 58 mating two panels along their respective short edges.

FIG. 61 depicts a floating wall treatment for a ceiling panel short edge.

FIG. 62 depicts a cross-section of the short edge floating wall treatment of FIG. 61 affixed to a C-panel.
FIG. 63 depicts an isometric view of an alternate embodiment of a short edge floating wall treatment in use.

FIG. 64 depicts a cross-sectional view of the short edge floating wall treatment of FIG. 63 when used adjacent a support beam.

FIG. 65 is a perspective view of an installation tool according to one embodiment of the invention.

FIG. 66 is an exploded perspective view of the installation tool illustrated in FIG. 65.

FIG. 67 is a side view of a support bracket assembly of the installation tool according to one embodiment of the invention.

FIG. 68 is a perspective view of a blade support bracket of the support bracket assembly according to one embodiment of the invention.

FIG. 69 is a perspective view of a brace support bracket of the support bracket assembly according to one embodiment of the invention.

FIG. 70 is a perspective view of a separator support bracket of the support bracket assembly according to one embodiment of the invention.

FIG. 71 is a side view of the installation tool in engagement with a support beam and supporting a panel according to one embodiment of the invention and an alternative embodiment of the support bracket assembly.

FIG. 72 is an exploded perspective view of one side of the installation tool with an alternative embodiment of the support bracket assembly.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to FIG. 1, the ceiling system of the present invention is shown generally at 10. Ceiling system 10 includes a plurality of panels 12 mounted between parallel support beams 14. Each panel has a panel long edge 16 and a panel short edge 18. The support beams are attached to the actual ceiling structure of a room (not shown) by a plurality of strategically placed suspension wires 20. A number of metal beam joiners 22 are depicted in the embodiment of FIG. 1, each metal beam joiner being used to connect two curved support beams positioned in an abutting end-to-end relationship. This technique for joining longitudinally abutting support beams is described further below in connection with FIGS. 8-10. Details concerning how the panels are connected to the support beams are provided below.

FIG. 1 is merely a sample configuration that may be obtained using the present invention. The curvature seen in the support beams 14 and panels 12 of FIG. 1 may be accomplished on the actual job site where the ceiling is being installed.

In general, the panels 12 depicted in FIG. 1 are shipped flat and only become curved when the panels are installed and thus take on the shape of the support beams 14. Also, the ceiling panels can be transitioned across a ceiling from a curved section to a flat section. As shown in FIG. 1, the support beams are hung by typical ceiling suspension wires 20 that are known in the art. The suspension wires are fixedly attached to the actual ceiling structure of a room on one end and are attached to suspension wire mounting holes (see, e.g., FIG. 9) on their opposite ends as described further below.

As also shown in FIG. 1, the ceiling panels 12 are typically longer than they are wide. In the embodiment depicted in FIG. 1, the panel short edges 18 extend between adjacent support beams, and the panel long edges 16 extend along a support beam 14. Adjacent panels may be arranged end-to-end as shown in FIG. 1 so that the panel short edge of one panel abuts the panel short edge of an adjacent panel.

FIG. 2 depicts a curved support beam 14 in the shape of a concave arc. The support beam may be any desired length. For example, the support beam shown in FIG. 2 may be a single twelve foot piece of metal curving to follow a portion of an eight foot radius circle. FIG. 3 is a detailed view of the region encircled at the left hand portion of FIG. 2. Similarly, FIG. 4 is a detailed view of the region encircled at the mid portion of the curved support beam 14 of FIG. 2. As may be seen in each of FIGS. 2-4, rectangular holes 24 may be notched at regular or irregular intervals along the support beam. These notches may serve a variety of purposes. For example, as explained below in connection with FIGS. 5-10, these notches may be used to connect end-to-end abutting support beams. Also, as will be described further in connection with FIGS. 11 and 12, a cross brace, which may optionally be placed between a pair of support beams, locks into a notch at each end of the cross brace. Also visible in FIGS. 2-4 are mounting or clearance holes 26. In the embodiment depicted in FIGS. 2-4, a pair of mounting holes straddles each rectangular hole. As will be described further below, these mounting holes may receive a bolt or screw used to attach a support beam to a wall or other surface.

Referring next to FIGS. 5-7, a clip-in beam joiner 28, which may be used to join or tie together two support beams 14 that are positioned in an end-to-end abutting relationship, is described next. FIG. 5 is an isometric view looking downwardly at the clip-in beam joiner having an H-shaped cross section. FIG. 6 is a cross-sectional view taken along line 6-6 of FIG. 5 through the center support web 30 of the clip-in beam joiner. FIG. 7 is an end view which clearly depicts the internal, ramp-shaped barbs 32 or catches comprising part of the clip-in beam joiner. The clip-in beam joiner comprises four plates 34 that extend outwardly from the center support web. The two plates (34a, 34b) that extend outwardly away from one side of the center support web define a first gap 36 between them, and a similar second gap 38 is formed between the remaining two plates (34c, 34d) that extend outwardly from the opposite side of the center support web.

The ramp shaped retention barbs 32 depicted to best advantage in FIG. 7 are mounted within these two gaps (36, 38)—two in each gap. Referring most specifically to FIG. 6, each internal barb comprises a plurality of surfaces. For example, each barb comprises a lead in surface 40, a ramp surface 42, a ramp apex 44, a locking ledge 46 (FIG. 7), and a rear surface 48.

To install the clip-in beam joiner 28, two support beams 14 would be arranged as depicted in, for example, FIG. 9. The clip-in beam joiner has a height 50 (FIG. 6) that may be accommodated by the main beam web 52 (FIG. 9) of a support beam 14. The clip-in beam joiner is first
attached to the main beam web of one support beam by sliding the main beam web into one of the two gaps (36, 38) defined between the outwardly extending plates 34 of the clip-in beam joiner. Once the clip-in beam joiner is pushed longitudinally along the support beam a sufficient distance, the ramp shaped barbs 32 snap into the rectangular notch 24 or hole closest to the end of that support beam. The clip-in beam joiner is then locked onto the first support beam to be joined. The main beam web 52 of the second support beam to be clipped is then slid into the opposing gap of the clip-in beam joiner until the ramp shaped barbs 52 in this opposite gap snap into the corresponding rectangular notch 24 adjacent to the abutting edge of the second support beam. Once the clip-in beam joiner is properly locked in position, thereby holding the two support beams in abutting end-to-end relationship, the clip-in beam joiner would rest in a position similar to the position of the metal beam joiner 54 depicted in FIG. 10.

[0100] Referring most particularly to FIGS. 8-10, installation of a metal beam joinder 54, which would be used as an alternative to the clip-in beam joiner of FIGS. 5-7, is described next. As shown in FIG. 8, the metal beam joiner comprises a pair of punched tabs 56. Before the metal beam joiner is installed to join a pair of support beams 14, the punched tabs extend substantially perpendicularly away from the metal beam joiner main body. During installation of the metal beam joiner, two support beams are again placed in abutting, end-to-end relationship. FIG. 9 shows two support beams just prior to being in such abutting, end-to-end relationship, and the metal beam joiner as depicted in FIG. 9 is exploded away from its installed position.

[0101] Once the two support beams 14 to be joined are slid together as shown in FIG. 10, the metal beam joiner 54 can be installed. Installation of the metal beam joiner requires sliding the punched tabs 56 through appropriate notched holes 24 at the longitudinal ends of the adjacent support beams to be joined. Once the punched tabs are slid through these notched holes, the punched tabs are folded inwardly as depicted by the arrows in FIG. 10, or, alternatively, the punch tabs could be folded outwardly against the main beam web 52, 180 degrees from the folded positions depicted in FIG. 10.

[0102] Referring most specifically to FIGS. 9 and 10, additional support beam details are described next. FIGS. 9 and 10 depict one possible embodiment for a support beam 14. In this embodiment, working upwardly from the lower portion of the support beam, a panel support portion 58 may first be seen. This panel support portion comprises a series of channels and ledges that are described in greater detail in connection with FIG. 21. The panel support portion is connected to an intermediate wall 60 by the main beam web. It is the main beam web that was just described as having rectangular notches and mounting holes therethrough. The intermediate wall is connected to a beam cap 62 by a suspension web 64. The suspension web has a plurality of suspension wire mounting holes 66 through it. The suspension wires 20 depicted in FIG. 1 extend between these suspension wire mounting holes and the actual ceiling structure (not shown).

[0103] FIGS. 11 and 12 depict a cross brace 68 that may optionally be used in connection with the ceiling system 10 of the invention. These cross braces help, for example, keep the support beams 14 in the correct relative position until ceiling panels 12 have been installed. Following installation of the ceiling panels in the support beams, the cross braces may or may not be removed. The cross brace depicted in FIG. 11 is based upon an existing design. It includes a main body 70, a base 72, and a clip 74 installed at each longitudinal end of the main body. FIG. 12 is an enlarged, fragmentary view of one end of the cross brace and clip. The clip includes a barbed end piece 76. When a cross brace is placed substantially perpendicularly between two adjacent support beams, the barbed end piece at each end of the cross brace locks into one of the rectangular notches 24 in the main beam webs 52 of the adjacent support beams. The notched region 78 of the cross brace main body accommodates any portion of the support beam that might otherwise interfere with proper placement of the cross brace.

[0104] FIGS. 13-16 depict a C-panel 80 that may be used in connection with, for example, the support beam 14 depicted in FIGS. 9 and 10. The C-panel includes a sheet portion 82 covering an area defined within panel short edges 18 and panel long edges 16. FIG. 14 is an edge view taken along line 14-14 on FIG. 13 and shows the C-panel upstands 84 formed along each panel long edge 16. FIG. 15 is an enlarged, fragmentary view of the region encircled by dashed circle 15 in FIG. 14.

[0105] It may be seen in FIG. 15 that the C-panel upstand 84 comprises an upwardly-directed wall 86 and an inwardly-directed ledge 88 or return. When a panel is formed into a curved configuration like that depicted in FIG. 1, the panel long edges and thus the upstands become curved. When the panel long edges are curved, the C-panel upstand depicted to best advantage in FIGS. 14 and 15 is curved or arched. The ratio of the height of the upwardly-directed wall of the C-panel upstand to the panel thickness, when considered in view of the material from which the C-panel is made, influences how much the C-panel upstands may be curved during attachment of the C-panels to the support beams before undesirable buckling occurs. It is apparent that, if the C-panel were being curved upwardly like the two panels in the left-hand side of FIG. 1 are curved, the upper portion of the upwardly directed wall, adjacent to the inwardly-directed ledge, would be placed in compression and the lower portion of the upwardly-directed wall, adjacent to where it intersects the sheet portion of the C-panel, would be placed in tension. Conversely, if the C-panel is curved the opposite way (see, e.g., similar to the right-hand most two panels in FIG. 1), the upper portion of the upwardly-directed wall would be placed in tension and the lower portion of the upwardly-directed wall would be placed in tension. At some point, the upwardly-directed wall of the C-panel upstands buckle.

[0106] The following table provides dimensions "A", "B", and "G" (See FIG. 15) that work satisfactorily when the panel 12 is made from aluminum.

<table>
<thead>
<tr>
<th>Dim &quot;A&quot;</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>.010</td>
<td>.015</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dim &quot;B&quot;</th>
<th>No Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>.040</td>
<td>.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dim &quot;G&quot;</th>
<th>Each &quot;A&quot; &amp; &quot;B&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>.015</td>
<td>.020</td>
</tr>
</tbody>
</table>

Each "A" & "G"
FIGS. 17-21 depict two different asymmetric panel lock buttons 90. FIGS. 17 and 18 depict an asymmetric panel lock button 90d that may be installed by pressing it into a panel lock channel defined or formed in an upper portion of the panel support portion of a support beam and FIGS. 19-21 depict an asymmetric panel lock button 90b that is installed by sliding it into the panel lock channel from a longitudinal end of a support beam. These panel lock buttons 90 hold installed C-panels 80 in position as shown in, for example, FIG. 21. In FIG. 21, a support beam 14 is depicted with two C-shaped panels 80 installed. The panel lock button 90b of FIGS. 19 and 20 includes a lock button suspension head 94 that slides easily into the panel lock channel 92 defined above a pair of lock channel ledges 96. The panel lock button shown in FIGS. 19-21 is slid into the panel lock channel from a longitudinal end of the support beam either before or after the support beams are installed. As long as a support beam has at least one open longitudinal end, one can install panel lock buttons like the one depicted in FIGS. 19-21. Once in position in the panel lock channel, the asymmetric panel lock button may be rotated in the panel lock channel using for, example, a screwdriver (shown in phantom in FIG. 21).

When the asymmetric panel lock button 90 is oriented as depicted in FIG. 21, the left hand C-panel 80 depicted in that figure can be removed from or installed above the left hand panel support ledge 98. Once the left hand C-panel is in position, the screwdriver could be used to rotate the panel lock button 180°, placing the panel locking leg 98 against the upstand 84 of the left hand C-panel, thereby making it possible to remove or install the right hand C-panel in FIG. 21. Once the C-panels are positioned as desired, the asymmetric panel lock button would be rotated into its performance position, which is 90° in either direction from the orientation depicted in FIG. 21. When the asymmetric panel lock button is in the performance position, the panel locking leg (i.e., the long leg) spans the gap between the upstands of the left and right C-panels, thereby locking the two C-panels in position above the panel support ledges 96 comprising part of the panel support portion 88 of the support beam.

The asymmetric panel lock button 90d depicted in FIGS. 17 and 18 is specially configured to permit installation from below the support beam 14 and upwardly into the panel lock channel 92 depicted in FIG. 21 (e.g., it need not be slid into the panel lock channel from a longitudinal end of the support beam like the panel lock of FIGS. 19-21). The lock button suspension head 100 includes various features to facilitate this installation. In particular, the lock button suspension head has sloped sides 102.

These sloped sides may be pressed upwardly against the lock channel ledges 96 and help to guide the asymmetric panel lock button of FIGS. 17 and 18 past these lock channel ledges and into the panel lock channel 92. In particular, when a enough upward force is placed on this asymmetric panel lock button, the two halves of the split lock panel suspension head flex 100 slightly toward each other, thereby reducing the U-shaped channel 104 slightly as each half of the split lock button suspension head flexes slightly towards each other under the influence of the lock channel ledges pressing against the sloped sides of the split lock panel suspension head. Once the sides of the split channel suspension head clear the lock channel ledges, the split lock channel suspension head substantially returns to its uncompressed configuration depicted in FIG. 17. Once the asymmetric panel lock button of FIGS. 17 and 18 is thus installed, it too may be rotated using, for example, a screwdriver in the same fashion that the asymmetric panel lock button depicted in FIGS. 19-21 can be rotated.

FIGS. 22-23 depict a leaf-spring panel lock 106, which is an alternative means for locking the C-panels 80 in position in a support beam 14. In particular, FIG. 22 is an isometric view looking downwardly at the leaf-spring panel lock. As depicted in FIG. 22, the leaf-spring panel lock includes three mounting plates 108 and two staggered, panel-locking humps 110, each of these two humps extending between and terminating at a pair of the mounting plates. FIG. 23 is an isometric view looking upwardly at a support beam with two C-panels installed and with the leaf-spring panel lock 106 in place. The configuration depicted in FIG. 23 is achieved by sliding the three mounting plates 108 of the leaf-spring panel lock into the panel-lock channel 92 of the support beam. The leaf-spring panel lock is thus inserted into the panel-lock channel from one longitudinal end of the support beam.

In their relaxed position, the staggered panel-locking humps 110 of the leaf-spring panel lock extend downwardly. One of these panel-locking humps abuts an upstand 84 from a first C-panel, and the other panel-locking hump abuts the upstand of the adjacent C-panel. This abutting relationship between each hump and its respective C-panel is depicted to good advantage in FIG. 24, which is an end view of the leaf-spring panel lock 106 in position with its mounting plates slippingly mounted in the panel lock channel 92, and each staggered hump positioned against one of the C-panel upstands.

Once the leaf-spring panel lock 106 is installed as depicted in FIG. 23, it is unnecessary to slide the mounting plates 108 longitudinally out of the panel-lock channel 92 in order to be able to remove one or both of the C-panels 80. Rather, it is possible to press upwardly in the direction of the arrows depicted in FIG. 23 on one or both of the staggered, panel-locking humps 110, thereby flattening out the corresponding staggered, panel-locking hump or humps of the leaf-spring panel lock and increasing the distance between adjacent mounting plates. In other words, as an upward force along lines H in FIG. 23 is applied to the base of each panel-locking hump, the leaf-spring panel lock flattens out, until the lowest edges of the panel-locking humps are positioned above the inwardly-directed ledge 88 of the C-panel upstands. Once in that configuration, one or both of the C-panels may be removed from the panel-support ledges at the lower end of the support beam. After one or both of the C-panels is thus removed, upward pressure on the bottom surface of the staggered, panel-locking humps may be released allowing the humps to return to their natural, downwardly projecting configurations, where each of the panel-locking humps rest against an upwardly-directed wall of a C-panel upstand.

FIGS. 25 and 26 depict yet another alternative for locking C-panels in position over the panel support ledges. According to this particular C-panel locking technique, a spline panel lock 112 is inserted into the gap between the upstands 84 of adjacent C-panels 80. In particular, the spline panel lock, an isometric view of which is depicted in FIG.
is pressed upwardly into the gap between the upwardly-directed walls of the adjacent C-panel upstands until the spline panel lock ledges 114 snap onto the lock channel ledges 96 at the lower portion of the panel-lock channel 92. As the spline panel lock is pressed upwardly between the upstands of adjacent C-panels, the longitudinally-extending legs of the spline panel lock flex toward each other until the spline panel lock ledges can snap above the respective lock-channel ledges. Once the spline panel lock is thus positioned, the lower width of the spline panel lock extends between and may abut the two upwardly-directed walls 86 of the adjacent C-panel upstands.

[0115] FIGS. 27 and 28 depict another alternative for holding adjacent C-panels 80 in position in a support beam 14. The support beam depicted in FIG. 27 includes a special panel support portion 116. In this configuration, the panel-lock channel has been altered from that depicted in, for example, FIGS. 21 and 23-25. The lock-channel ledges have been removed and threaded grooves 118 have been added to select lock edges along the downward-facing vertical walls of the panel-lock channel 92 as depicted to good advantage in FIG. 27. Once the C-panels are in position and supported by the panel-support ledges 120, as depicted in FIG. 27, a locking screw 122 may be inserted from the bottom of the panels and threaded into a selected threaded groove in the panel-lock channel. Once the locking screw is threaded into the threaded grooves lining at least a portion of the panel-lock channel, the head of the locking screw comes to rest adjacent to the upwardly directed wall of the adjacent C-panel upstands, thereby preventing each C-panel from dislodging from its respective panel-support ledge and falling from the panel-support channel. FIG. 28 is an isometric view depicting the locking screw as a boxset screw.

[0116] FIGS. 29 through 32 generally depict an alternate embodiment of a panel 12 suitable for use with the present invention. Turning now to FIG. 29, a top-down view of a Z-panel 124 may be seen, as opposed to the C-panel displayed in FIGS. 13-16. The Z-panel includes a generally rectangular sheet portion 126 defined by a first and second panel short edge 128 and first and second panel long edge 130, as does the C-panel. The Z-panel long edges, however, each has an outwardly-directed edge 132 instead of the inwardly-directed edge 88 of the C-panel. The outwardly-directed edge or return may be more clearly seen in FIG. 30, which is a cross-sectional view taken along line 30-30 of the Z-panel shown in FIG. 29.

[0117] FIG. 31 is an expanded view of the panel long edge 130 encircled by a dashed line in FIG. 30. As may be seen, the present panel has a Z-panel upstand 134 rather than the C-panel upstand characterizing the C-panel. The Z-panel upstand is formed by an upwardly-directed wall 136 perpendicular to the sheet portion 126 and an outwardly-directed ledge 132 set at a ninety degree angle from the upwardly directed wall. Thus, the outwardly-directed return is parallel to the sheet portion, although it extends away from the terminus of the sheet portion instead of overlapping the sheet portion.

[0118] An isometric view of a Z-panel 124 is shown in FIG. 32, more clearly displaying the outwardly-directed ledge 132 and Z-panel upstand 134 running along the first and second panel long edges 130. It should be noted that, although the present embodiment generally employs Z-panels measuring approximately four feet by eight feet, alternate embodiments may use panels of varying sizes, areas, dimensions, thicknesses, and so forth. Further, although the Z-panel is typically manufactured from 1063 T5 aluminum, the Z-panel may be created from different gauges of aluminum, different metals, plastics, polymers, resins, and so forth.

[0119] Due to its outwardly-directed ledge 132, the Z-panel 124 typically requires a support beam 14 that is different from the support beam used to suspend C-panels when hung from a ceiling. The Z-panel support beam and an installed Z-panel are shown in cross-section in FIG. 33. The Z-panel support beam 138 includes a beam cap at the top of the support, a suspension web connecting the beam cap to an intermediate wall, a main beam web extending downwardly from the intermediate wall, and a panel support portion suspended from the lower edge of the main beam web. The panel support portion comprises a pair of panel lock channels and a pair of panel support ledges.

[0120] When installed, the Z-panel 124 is suspended from the Z-panel support beam 138 on the panel support ledges and held in place by a panel locking strip 154. In particular, outwardly-directed ledge 132 of the Z-panel upstand 134 sits atop the panel support ledge. The panel support channel 150 is slightly wider than the outwardly-directed ledge’s thickness, so the outwardly-directed ledge may be easily placed into the panel support channel atop the panel support ledge.

[0121] A panel locking strip 154 secures the Z-panel 124 to the Z-panel support beam 138. The panel locking strip comprises a mounting plate 156, spring arm 158, and lever arm 160. The mounting plate lodges in the panel lock channel 150 and is wider than the opening in the top of the Z-panel lock channel. The mounting plate places tension on the mounting plate and lever arm. The lever arm, in turn, presses against the upwardly-directed wall 236 of the Z-panel upstand 134, thus holding the Z-panel 124 firmly in place. The panel locking strip 154 may be inserted into the panel lock channel by pulling on the lever arm while pressing the mounting plate into the channel at an angle. Because the mounting plate’s thickness is less than the width of the side of the mounting plate channel, the mounting plate may slide into the channel relatively easily. Alternatively, the locking plate of the panel locking strip may be inserted into the panel lock channel from a longitudinal end of the Z-panel support beam. Once the panel locking strip is in place, the lock channel ledges overlap the front and back of the mounting plate, securing it in the panel lock channel as shown in FIG. 33. This, in turn, prevents the Z-panel from substantially shifting. An isometric view of the panel locking strip, which may be a plastic extrusion, may be seen in FIG. 34.

[0122] Another embodiment of a panel according to the present invention is shown in FIGS. 35-40. FIG. 35 displays a top-down view of a C-panel with end forms, which are altered first and second panel short edges (a “wall-flange C-panel”). Specifically, one panel short edge terminates in a wall end form, while the other panel short edge terminates in a flange end form. The wall-flange C-panel may be hung from a ceiling where a different aesthetic is desired. Generally, when a series of wall-flange C-panels are installed, the flange of one panel abuts the wall of the next adjacent
Turning now to FIG. 36, a cross-sectional view taken along line 36-36 of the wall-flange C-panel of FIG. 35 is shown. The wall end form is notched at each upper corner. This notch is shown in greater detail in FIG. 37, which is an enlarged view of the portion encircled by a dashed line in FIG. 36. The notch permits the panel to hang from a support beam, such as those more fully described in the above discussion of FIGS. 21 and 25. The notch ensures that sufficient space exists to permit a panel support ledge to fit underneath the inwardly-directed return and above the wall end form. Were the wall end form not notched so that the form extended to the bottom of the inwardly-directed return of the upstand, the panel could not be hung. It should be noted that the wall-flange C-panel may use any support beam or fastening means used with the earlier-described C-panel.

FIG. 38 displays a cross-sectional view taken along line 38-38 of FIG. 35, showing the flange end form in greater detail. Generally, the flange end form comprises an outwardly-extending flange set at a right angle to an upwardly-extending portion, which is in turn perpendicular to the sheet portion of the panel. The upwardly-extending portion of the flange end form abuts the upwardly-directed wall of the C-panel upstand.

By contrast, the wall end form has no outwardly extending flange. FIG. 39 depicts a detailed view of the wall end form taken along line 37-37 of FIG. 35. The wall end form extends substantially directly upwardly from the sheet portion and lies adjacent to the upwardly-directed wall of the C-panel upstand.

FIG. 40 is an isometric view of the wall-flange C-panel. As shown, the height of the top of the outwardly-extending flange is approximately equal to the height of the top of the notch in the wall end form. This permits the wall-flange C-panel to slide along the support rails and into position as necessary.

FIG. 41 is a cross-sectional side view of two installed wall-flange C-panels resting on a support beam, taken along the panel long edge. The cross-section is taken through the full-height wall end form, and thus the notch is not shown. Generally, it may be seen that the outwardly-extending flange of the first panel substantially abuts the wall end form of the second panel. Because the outwardly-extending flange lies below the support beam, when an installed ceiling comprising of wall-flange C-panels is viewed from below continuous depressions or grooves may be seen between panels. The flange, however, prevents the viewer from seeing the support beam. This creates an alternate aesthetic effect when compared to the standard C- and Z-panels described above.

FIGS. 42-47 depict a wall-flange Z-panel. The wall-flange Z-panel differs from the wall-flange C-panel in that the panel long edges form Z-panel upstands as shown in FIGS. 43 and 44, rather than C-panel upstands. The Z-panel upstand was discussed above with respect to FIGS. 29-32. Accordingly, the wall-flange Z-panel may be hung from a Z-panel support beam, as discussed with respect to FIG. 33. The wall-flange Z-panel is generally secured via the panel locking strip of FIG. 34. As may be seen in FIGS. 45 and 46, the wall end form and flange end form are substantially similar in appearance and construction to those of the wall-flange C-panel. Similarly, when installed, a surface made of wall-flange Z-panels looks substantially identical from below the ceiling to a surface comprising installed wall-flange C-panels. FIG. 47 is an isometric view of the wall-flange Z-panel.

FIGS. 48-49 generally show one embodiment of a wall treatment for a full C-panel (i.e., a panel having an upstand adjacent to the wall). The wall treatment is comprised of a support beam, an adjustable support, a screw, and a wall trim. This structure conceals the edges of the panel via the adjustable support, thus creating a more uniform and pleasing appearance.

The support beam may be secured to the structural ceiling of the room (not shown) by one or more suspension wires (FIG. 1). The support beam may be a square, head support beam (see, e.g., FIG. 21), a threaded groove support beam (see, e.g., FIG. 27), or a pointed head support beam (see, e.g., FIG. 50). Alternate embodiments employing a different support beam to secure a C-panel may use the same support beam herewith.

The support beam is affixed to the wall via a screw having an integral spring between the wall side of the support beam and the wall. In an alternate embodiment, the spring and screw may be separate. The spring allows the distance between the support beam and wall to be easily varied in order to account for irregularities in the surface of the wall (i.e., non-plumb walls) and still line up with other support beams accepting the C-panel. For example, a slightly curved or otherwise irregular wall would force multiple support beams into different vertical planes, depending on the magnitude of the irregularity, and a standard fastener providing a fixed distance between the wall and the beam used. In other words, each support beam would be offset from the next by the depth of the wall irregularity or the difference in curvature. By using the aforementioned spring-screw arrangement, the support beam may be securely fastened to the wall while still allowing the distance between the beam and wall to be varied as necessary. Where practicable, however, alternate embodiments may use standard screws or fasteners in place of the screw-spring arrangement.

As depicted in FIG. 48, the inwardly-directed return of the C-panel upstand is placed in the panel support channel on the panel support ledge. An abutment wall of the wall edge trim abuts the C-panel upstand’s upwardly-directed wall, applying pressure to maintain the C-panel’s position. The wall edge trim has a serrated extension with an upwardly-facing serrated surface. The upwardly-facing serrated surface mates with a downwardly-facing serrated surface of the adjustable support. The adjustable support, in turn, directs abuts the wall. The serrations on the upwardly-facing and downwardly-facing serrated surfaces not only help to immobilize the wall edge trim when it is in place, but also permit the distance between the wall and the wall edge trim’s abutment wall to vary as necessary to ensure steady pressure on the C-panel upstand. By allowing the serrated surfaces back and forth, the distance between the wall and the wall edge trim’s abutment wall is adjustable. The wall edge trim also includes a pair of hanger ledges, one of which
fits into the panel support channel and the other of which fits in the panel lock channel as shown. These hanger ledges provide additional security for the wall treatment, as well as additional stability holding the C-panel in the panel support channel. Finally, the base of the adjustable support extends from the wall, beyond the beam between the wall edge trim’s abutment wall and the C-panel upstand, and partially along the lower surface of the sheet portion of the C-panel. This not only hides the seam or discontinuity between the wall edge trim and C-panel, thus creating a more pleasing aesthetic, but also serves to further stabilize the C-panel.

FIG. 49 shows a fragmentary view of an installed wall treatment, including the adjustable support and wall edge trim.

[0133] Oftentimes, a wall may be less than a full panel width from the nearest suspended support beam. In such a case, a full panel will not fit between the suspended support beam and the wall. Thus, the panel must be cut to size. FIG. 50 displays a wall treatment for use with such a partial panel. One or more interval upstands are formed along the cut long edge of the partial panel by periodically turning up part of the sheet portion as shown in FIG. 51. The interval upstands lack any projection or flange permitting them to be secured in the support beam’s panel support channel. Accordingly, the wall edge trim used in this embodiment has two hanger ledges, one of which fits into each side of the panel support channel. One hanger ledge abuts both the outer surface and top edge of the interval upstands as with the embodiment discussed with respect to FIG. 48, both the adjustable support and wall edge trim have mating serrated surfaces. By adjusting the length of the overlap between the wall edge trim’s upwardly-facing serrated surface and the adjustable support’s downwardly-facing serrated surface, the distance between the abutment wall and the wall may be varied. In turn, this adjusts the pressure placed against the interval upstands. The adjustable support again extends beyond the meeting of the abutment wall and interval upstands, continuing some distance along the bottom of the panel’s sheet portion. Thus, the adjustable support provides a resting surface for the cut ceiling panel. It should be noted that the present embodiment may work with either C- or Z-panels. Further, although the embodiment shown in FIG. 50 is depicted as attached to the wall with a standard screw, the spring-screw apparatus described with respect to FIG. 48 may also be employed.

[0134] FIG. 52 is a fragmentary isometric view of an installed wall treatment in accordance with the embodiment of FIGS. 50 and 51, showing the hanger ledges and an interval upstand in their installed positions.

[0135] FIGS. 53 and 54 show yet another embodiment of a wall treatment for use with a partial panel. Although the partial panel shown is a C-panel, the embodiment works equally well with a Z-panel. In this embodiment, the support beam is again affixed to the wall with a spring-screw apparatus, although a standard screw or other fastener may be used. The support beam is substantially similar to that described with respect to FIG. 48. The wall edge trim generally includes two hanger ledges, each of which fits into a side of the panel support channel and rests on a respective panel support ledge. Unlike the previous embodiment, here the abutment wall is located beneath the wall edge trim’s upwardly-facing serrated surface. Instead of being located between the abutment wall and a panel support ledge, the panel’s interval upstand is positioned between the abutment wall and an abutment vise. In the present embodiment, neither the abutment wall nor vise are in direct contact with the interval upstand. Instead, they define a narrow channel which may receive the upstand and permit a minimal amount of back and forth movement necessary to position the upstand. Further, the downwardly-facing serrated surface of the adjustable support and the upwardly-facing serrated surface of the wall edge trim are substantially longer, thus permitting more adjustability between surfaces. Once again, the base of the adjustable support extends a distance along the bottom of the sheet portion of the ceiling panel. Generally, the ceiling panel simply rests on the adjustable support base while its movement is minimized via the abutment wall and abutment vise. No direct pressure is used in this embodiment to maintain the panel’s position.

FIG. 54 is an isometric view of the FIG. 53 embodiment.

[0136] Occasionally, ceilings may vary in height. For example, a loft, skylight, or atrium may cause an abrupt termination of the ceiling wall away from any wall. This is generally referred to as a “floating edge.” In such cases, a casual viewer looking at the ceiling from an angle may be able to perceive the edges of any ceiling panel. In order to preserve design principles, it may be desirable to conceal these edges. Since a ceiling may conceivably require a floating edge at any distance from a wall, the floating edge may occur either at the natural terminus of a ceiling panel or may require the panel to be cut.

[0137] FIGS. 55 and 56 shows a floating beam cover capable of hiding a floating ceiling edge created by a partial panel. The floating beam cover connects to a support beam via a top clamp and a side clamp, which are connected to one another via an elongate body. The top clamp comprises a first and second angled ledge, each of which fits snugly over the T-shaped beam cap at the top of the suspension web. The T-shaped beam cap rests on these angled ledges. The support beam is further connected to the floating beam cover via a side clamp having a blunt projection and a tine. The blunt projection is positioned above the top of the panel support portion and may or may not be in direct contact therewith. The tine sits below the bottom of the panel support portion, and generally is in sufficiently tight contact with the panel support portion to exert stabilizing pressure on the panel support portion. The tine presses the panel support portion fairly tightly against the sidewall of the side clamp. The side clamp further includes a panel guide and a bottom portion, both projecting inwardly from the side clamp sidewall. Typically, the panel guide is located above the bottom portion of the side clamp. The distance between the bottom portion and panel guide is generally slightly greater than the thickness of a ceiling panel. The sheet portion of the partial panel sits on the bottom portion of the side clamp and partially beneath the panel guide. Generally, the partial panel’s cut edge is substantially snug against the side clamp’s sidewalls. Thus, the bottom portion of the side clamp (and by extension, the floating beam cover) supports the partial panel. Typically, the support beam is attached to the ceiling with a suspension wire (FIG. 1), which may be connected to the support beam at any convenient location. Alternately, the suspension wire may be connected to some portion of the floating beam cover, such as the top clamp or elongate body. Insofar as the floating beam cover and support beam are tightly coupled and the partial panel rests on the bottom portion of the floating beam cover, the
embodiment as a whole is suspended from the ceiling by the wire regardless of where it is attached.

[0138] FIG. 57 displays a floating beam cover capable of hiding a floating ceiling edge created by a full C-panel. In this embodiment, the general configuration of the floating beam cover is the same as that shown in FIGS. 55 and 56. Further, the floating beam cover is affixed to the support beam in the same manner as previously described. However, because the C-panel includes a C-panel upstand (discussed more thoroughly with respect to FIGS. 13 through 15), the panel may not lie flat between the panel guide and bottom portion of the beam cover. Instead, the inwardly-directed return is placed within the panel support channel, as generally discussed with respect to FIG. 21. A panel locking device secures the C-panel upstand in the panel support channel. Again, the bottom of the sheet portion of the panel rests on the bottom portion of the floating beam cover. Thus, the floating beam cover not only shields the outer edge of the floating ceiling panel, but also provide aesthetic continuity to the bottom of the ceiling by extending some distance along the sheet portion of the ceiling panel.

[0139] Sometimes, it may prove useful to mount a wall treatment flush to the outer surface of a wall, rather than offsetting the treatment from the wall by the length of a screw or spring, as detailed above. Other times, it may be necessary to join two adjacent panels together along abutting panel short edged. This may, for example, provide additional longitudinal support when the short edges of two adjacent panels are affixed. In such situations, a panel splice as shown in FIG. 58 may be useful.

[0140] The panel splice is generally C-shaped, with a T-shaped member protruding downwardly from the bottom of the C. The C-shaped portion of the panel splice consists of an upper flange (the top of the C), a vertical web section (the side of the C), and a V-shaped intermediate wall (the bottom of the C). The V-shaped intermediate wall includes an obtuse approximately 150 degree interior angle placed slightly closer to the vertical web section than the end of the V-shaped intermediate wall. The exact placement of the angle, however, may vary in alternate embodiments. Similarly, the angle measurement may differ in different embodiments. Generally, the V-shaped intermediate wall extends further than the upper flange, although this too may change in alternate embodiments.

[0141] Depending down from the obtuse interior angle is an upside down T-shaped member. The T-shaped member comprises a divider web connecting the member to the V-shaped intermediate wall (the base of the T), and a bottom wall approximately paralleling the upper flange (the branches of the T). The bottom wall, divider web, and outer portion of the V-shaped intermediate wall define a first opposing channel. Similarly, the bottom wall, divider web, and inner portion of the V-shaped intermediate wall define a second opposing channel. Generally speaking, the height of the first and second opposing channels is slightly greater than the thickness of the sheet portion of a ceiling panel. Thus, the edge of a partial or cut panel may be placed in either the first or second opposing channel.

[0142] For example, FIG. 59 shows the panel splice being used as a long edge end treatment. Specifically, the panel splice is connected to a wall via a screw or other fastener in such a manner that the vertical web section lies flat against the wall with the first opposing channel and upper flange projecting away from the wall. When a C- or Z-panel is cut to length, the cut long edge may rest in the first opposing channel. This hides the end of the panel from casual inspection from below, as well as providing stability to the panel.

[0143] The panel splice may also be used as a butt joint assembly to mate two panels along their respective short edges. FIG. 60 displays a cross-sectional view taken along the long axis of a pair of C-panels showing the panel splice serving this purpose. As can be seen, the panel splice is located between a first and second panel, with the short edges of the panels’ sheet portions resting in the first and second opposing channels, respectively. The upwardly-directed wall and inwardly-directed ledge comprising the C-shaped upstand are positioned behind the panel splice in the view of FIG. 60. Generally, the width of the panel splice is less than the width of a panel in order to avoid interfering with either the C- or Z-shaped upstands located long the long edges of the panels, as described above. The panel splice may be suspended from the ceiling by a support wire (not shown) in order to partially support the weight of the ceiling panels contacted by the splice.

[0144] Referring back to FIG. 1 briefly, the curved nature of an installed ceiling system making use of an embodiment of the present invention may be seen. Sometimes, the ceiling panel curvature dictates that the formed ceiling terminates on a downward curve near a wall. For example, the ceiling panel shown in FIG. 1 may terminate next to a wall (not shown) on the right edge of the figure. Because the rightmost ceiling panel slopes downward, a portion of the panel interior may be visible to an observer standing under the panel. To prevent this unsightly problem, a floating wall treatment may be used on the short edge of the panel to block an observer’s view.

[0145] FIG. 61 displays a floating wall treatment for a ceiling panel short edge. The short edge floating wall treatment is generally clip-shaped, with an upper and lower prong connected at one end by a base. The upper prong may have one or more interior downwardly-pointing teeth. Typically, the space between the teeth and the lower prong of the short edge floating wall treatment is slightly smaller than the thickness of a ceiling panel. By contrast, the space between the lower prong and upper prong as measured across the floating wall treatment base is slightly greater than the ceiling panel thickness. In the present embodiment, this distance remains constant along the length of the prongs. Alternate embodiments may have decreasing distance from the base to the prong tips, so that the upper and lower prongs slant towards one another. Typically, although not necessarily, the lower prong protrudes further than the upper prong.

[0146] FIG. 62 shows a cross-section of the short edge floating wall treatment affixed to a C-panel. The C-panel extends at a downward angle until the top of the panel (that is, the C-panel upstand and inwardly-directed return) contact the wall surface. Because of the panel angle, however, a slight gap exists between the lower panel edge (the sheet portion) and the wall. The short edge floating wall treatment is affixed to the sheet portion of the C-panel along the short edge. The upper prong rests above the sheet portion, while the lower prong sits below. The teeth anchor the short edge floating wall treatment to the panel. It should be noted that the short edge floating wall treatment works equally well with a Z-panel as described above.
FIG. 63 displays an isometric view of an alternate embodiment of a short edge floating wall treatment in use. This embodiment includes an L-shaped extrusion extending upwardly from the base which generally parallels and rests against the wall while the treatment is in use. The L-shaped extrusion aids in stabilizing the ceiling panel. Otherwise, the means of connection and general function of the short edge floating wall treatment is similar to that discussed immediately above.

FIG. 64 displays a cross-sectional view of the short edge floating wall treatment of FIG. 63 when used adjacent a support beam.

Now referring to FIG. 65, one embodiment of an installation tool for use in hanging ceiling panels of the invention is depicted generally as ____. Installation tool ____ includes a support bracket assembly at each end of a support bar to secure the support bar between two support beams. When secured between two adjacent support beams, in one example, the support bar extends between each support beam and the support bar hangs below the support beams so that a ceiling panel may be placed on the support bar. One or more installation tools may be used to assist in the installation of ceiling panels. For example, one installation tool may be secured between two support beams at one end of the support beams and a second installation tool secured between two support beams at the opposite end of the support beams. Once the tools are in place, one end of a panel is suspended by the installation tool at one end of the support beams and the other end of the panel is suspended by the second installation tool at the opposite end of the support beams. After the panel is suspended on the installation tools, the installer can more easily secure the panel to the support beams. With the use of one or more installation tools, one person can install an entire ceiling by him or herself.

FIG. 66 illustrates an exploded perspective view of the installation tool according to one embodiment of the invention. In one example, at each end of the support bar, the support assembly bracket includes a blade support bracket, a brace support bracket, and separator, each extending generally transversely to the bar. Each pair of brace and blade is secured to an end of the support bar by a screw adapted to engage a threaded aperture (not shown) in the support bar. One of ordinary skill in the art will recognize that the blades and the braces may be secured to the support bar by other means, such as a weld, a rivet, a snap tab, and the like. FIG. 67 illustrates a side view of the support bracket assembly of an uninstalled installation tool.

FIG. 68 illustrates a perspective view of one embodiment of the blade. In one example, the blade is rigid, and is fabricated from steel, stainless steel, or any other suitable rigid material. The blade defines a widening trapezoidal blade with a wide portion and a narrow portion. A blade tab extends at about a right angle to the blade at the narrow end of the blade. The blade tab defines an aperture adapted to receive the screw so that the blade may be secured to the support bar. The blade also defines a pivot screw aperture in its narrow portion adjacent the tab adapted to receive a pivot screw, which is discussed in more detail below.

FIG. 69 illustrates one embodiment of the brace. In one example, the brace is flexible, and is fabricated from spring steel, or any other suitable flexible material. The brace defines a widening trapezoidal central body portion with a wide section and a narrow section. A brace tab extends at about a right angle to the central body portion at the narrow end of the brace. The brace tab defines an aperture adapted to receive the screw so that the brace may be secured to the support bar. In one example, the blade is sandwiched between the brace and the support bar. Accordingly, the brace tab fits over the blade tab so that the aperture in the blade tab aligns with the aperture in the brace tab so that a single screw secures both the blade and the brace to the support bar. In the narrow section of the central body portion of the brace adjacent the tab, the brace also defines a pivot aperture, which when assembled with the blade aligns with the pivot aperture in the narrow portion of the blade.

A retaining tab extends at an angle from the wide section end of the central body portion of the brace. As shown in FIG. 67, before attaching the installation tool to the support beam, the retaining tab extends away from the blade. Extending away from the blade, the retaining tab is also flared away from the support bar. As the retaining tab is fabricated from spring steel or the like, when the installation tool is secured to the support beam and the retaining tab is deflected inwardly toward the blade, a bias force is created which helps to secure the installation tool to the support bar as discussed in more detail below. A retaining flange, which also helps to secure the installation tool to the support beam, is defined on the top of the retaining flange opposite the central body portion of the brace.

Referring to FIG. 70, a separator plate is shown according to one embodiment of the present invention. The separator plate is rotatably secured to the support bar with the pivot screw. The pivot screws engage threaded apertures defined at each end of the support bar. In one example, the separator plate defines a pivot aperture that may be aligned with the pivot apertures in the blade and the brace, which pivot apertures are adapted to receive the pivot screw so that the separator plate may rotate with respect to the blade and the brace. The blade and the brace are also secured by the screw so that the blade and the brace will not rotate.

In one example, the separator plate defines a generally U-shape with the pivot aperture defined along one prong of the U and an offset finger defined along the other prong of the U. A handle is defined along the radius of the U. The handle extends generally transversely to the separator plate and may be used to insert or remove the finger from between the blade and the brace.

The wide section of the central body portion of the brace defines a first separator strike plate and a second separator strike plate. Each separator strike plate defines a ramp, in one example. Referring to FIG. 65, the separator is shown not engaged with the brace and the blade. In the unengaged position, the separator is rotated at an angle to the blade so that the finger is pointing toward the ramp surface of the separator strike plate. It will be recognized by one of ordinary skill in the art that the blade defines a first and a second separator strike plate so that the blade may be used at either end of the support bar. For example, still referring to FIG. 66, at the left side of the installation tool, in the unengaged position the separator is rotated forwardly from the brace and the blade, and the finger is aligned to engage
the forwardly facing first separator strike plate. At the right side of the installation tool, in the unengaged position the separator is rotated rearwardly from the brace and the blade, and the finger is aligned to engage the rearwardly facing second separator strike plate.

0157] FIG. 71 illustrates a cross section of the installation tool secured to the support beam. Generally speaking, the installation tool is hung from the support beam. As shown in FIG. 71, when the installation tool is hung from the support beam, a panel may be laid on the support bar to position the panel adjacent the support beams so that an installer can work on securing the panel to the support beam while the panel is held in place by the installation tool.

0158] The installation tool is generally secured to the panel lock channel. In one example, the brace is snapped into place so that the retaining flange engages the top surface of the lock channel ledge. The generally outward orientation of the retaining tab and the flexibility of the retaining tab provide the bias force which helps to secure the installation tool to the support beam. When the installation tool is snapped into place and the brace has engaged the panel lock channel, using the handle, the separator is rotated so that the finger contacts the strike plate of the brace. The finger may then be inserted between the brace and the blade to firmly engage the brace within the lock channel. To insert the finger between the brace and the blade, the finger is pressed against the ramp which forces the brace away from the blade and opens up a space between the brace and the blade. The finger rides along the face of the ramp and then inserts into the space created between the brace and the blade. When the finger is inserted between the brace and the blade, the blade is biased outwardly from the support bar against the lock channel ledge to further secure the installation tool to the support beam.

0159] To remove the installation tool after the panel is secured to the support beams, the separators are rotated away from the brace and the blade to that the finger is no longer between the brace and the blade. De-insertion of the finger reduces the overall bias force securing the installation tool to the support beams, but does not eliminate the bias force altogether as some portion of the bias force is provided by the outwardly biased engaging tab. After the finger is removed, the installation tool may be pulled downward firmly to disengage the retaining tab and the retaining flange from the lock channel and thus disconnect the installation tool from the support beam.

0160] FIG. 72 is an exploded perspective view of an alternative embodiment of the installation tool which includes an alternative embodiment of the brace and the blade, and does not use a separator. The brace shown in FIG. 72 is similar to the brace shown in FIG. 70, with the difference being that the brace shown in FIG. 72 does not define an aperture adapted to receive the pivot screw and does not define separator strike plates. The blade shown in FIG. 72 is similar to the blade shown in FIG. 68, with the difference being that the blade shown in FIG. 72 does not define an aperture adapted to receive the pivot screw. The alternative embodiment of the installation tool shown in FIG. 72 is held to the support brace primarily by the bias force of the engagement tab and does not utilize the additional bias force created by insertion of the separator. In other respects, the alternative embodiment shown in FIG. 72 operates substantially similarly to the embodiment illustrated in FIGS. 65-71.

We claim:
1. A ceiling system for a building comprising:
   at least two support members that can be curved and that are suspended from a rough ceiling with suspension members;
   a ceiling panel with upstands along the longitudinal edge of said panel; and a plurality of panel locks;
   wherein said panel locks couple said ceiling panel to said support member and said ceiling panel follows the shape of said support member.
2. The ceiling system of claim 1 wherein said support member is made from a single extrusion of metal.
3. The ceiling system of claim 2 wherein said metal is aluminum.
4. The ceiling system of claim 2 wherein said support member can be curved to a radius of at least one foot.
5. The ceiling system of claim 1 wherein said ceiling panel is flat and can be flexed to a radius of at least three feet.
6. The ceiling system of claim 1 wherein said ceiling panel is made of metal.
7. The ceiling system of claim 6 wherein said metal is aluminum.
8. The ceiling system of claim 6 wherein said ceiling panel has a thickness of about 0.020 to 0.050 inches, and said upstand has a height of about 100 to 600 inches.
9. The ceiling system of claim 1 wherein said support member has a panel lock channel that captures said panel lock.
10. The ceiling system of claim 9 wherein said panel locks comprise a continuous strip.
11. The ceiling system of claim 1 further including an installation tool that couples to said support member.
12. The installation tool of claim 11 that supports said ceiling panel prior to coupling to said support member.
13. The ceiling system of claim 1 further including a wall treatment comprising:
   a wall treatment support and a wall edge trim, wherein said wall edge trim couples to a support member fixedly attached to a wall, and said wall treatment support couples to said wall edge trim and supports a ceiling panel, said wall treatment support can be adjusted relative to said wall edge trim to mask irregularities on the surface of said wall.
14. The ceiling system of claim 1 further including a cross brace positioned between said support members.
15. An installation tool for use in assembling a ceiling panel to a support beam comprising:
   a support bar having a first end portion and a second end portion;
   a first support bracket assembly connected with the first end portion, the first support bracket assembly including a first brace and a first blade; and
   a second support bracket assembly connected with the second end portion, the second support bracket assembly including a second brace and a second blade.
16. The installation tool of claim 15 wherein the first brace defines at least one strike plate and the second brace defines at least one second strike plate, and further comprising:

a first separator rotatably connected with the first end portion of the support bar, the first separator defining a finger portion adapted to engage the at least one strike plate of the first brace to bias the first brace away from the first blade; and

a second separator rotatably connected with the second end portion of the support bar, the second separator defining a second finger portion adapted to engage the at least one strike second strike plate of the second brace to bias the second brace away from the second blade.

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