A concealed suspension ceiling assembly with simplified support structure for closely spaced ceiling tiles is described. The ceiling tiles are kerfed and mounted on framing members suspended from a supporting grid. V shaped torsion springs engage hooks on the framing members and extend upwardly through slots in main tees in an intersecting grid of main tees and cross tees. A tool is inserted in the reveal between adjacent tiles to raise and lower a selected tile. Tiles are lowered in predetermined sections to permit access to the space above the suspended ceiling and also to permit repair or replacement of individual tiles.
FIG. 8A
ACOUSTICAL PANEL CEILING SYSTEM

FIELD OF THE INVENTION

[0001] This invention generally relates to a suspended acoustic ceiling assembly with removable tile sections and more particularly to a suspended acoustic ceiling structure wherein sections of the acoustic tiles are selectively removable for enlarged access to a plenum area above the ceiling. The supporting structure for the acoustic tile sections is hidden from view of the persons in the room below.

BACKGROUND OF THE INVENTION

[0002] Suspended ceilings have been utilized in building installations for many years. They are typically provided as a grid work of main-runners and cross-runners suspended from the building structure and supporting suitable infill material such as ceiling tiles, light fixtures, air handling devices, etc. In most suspended ceilings the runners have a form of an inverted “T”, and thus, are sometimes called main tees and cross tees. The grid tees are usually formed from a strip of material which has been bent to form a bulb or bead along the top edge of a central web with opposed outwardly extending flanges located at the bottom edge of the web.

[0003] Suspended ceilings are generally formed by hanging main tees along one dimension of a room, the main tees being spaced apart a distance equal to the length of a cross tee which is typically four feet. The main tees are provided with apertures at a regular spacing along the length of the main tee, the apertures receive a strap extending between adjacent cross tees for connecting the cross tees to each other and to the main tee. Typically opposed cross tees are interconnected within the opening, the opposed cross tees extending to either side of the web of the main tee. The connection between the cross tee and the main tee and between interconnected cross tees must, according to many present building code standards, be able to support the ceiling in an emergency situation, such as fire and seismic conditions. Thus the suspended ceiling must provide sufficient integrity such that the connectors will not disengage when exposed to a fire, and also should have sufficient integrity so that in a seismic occurrence, such as an earthquake, the connections will be maintained to enable the infill material of the ceiling to be supported.

SUMMARY OF THE INVENTION

[0004] The invention includes a main tee and cross tee suspended from wires attached to a structural ceiling. The main tees have slots for receiving the free end of arms on the upper end of torsion springs. The wound bottom end of the torsion springs engage hooks located at spaced intervals along acoustical panel framing members. These panel framing members are joined at the corners by various means such as pop rivets and bayonet fittings. The framing members are structured with an inwardly extending lip or flange along the length of the member at the bottom thereof. The lip engages a kerf in the acoustic ceiling panels. The kerf extends around the periphery of the panel and provides a mechanism for engaging the lip and holding the panels in place.

[0005] Among the advantages of this invention are those resulting from the fact that it facilitates the ceiling sections that may conveniently be removed from a suspended ceiling structure utilizing the aforementioned structure to provide large clearance access into the plenum space above the ceiling for maintenance personnel and for enabling infill materials such as ceiling tiles and light fixtures to be supported directly from the structural ceiling. The resultant appearance is a aesthetically pleasing ceiling appearance with extremely small reveals between adjacent ceiling tiles.

[0006] It is a further advantage of the invention to provide a hidden supporting structure for a suspended ceiling wherein large ceiling sections are removably supported without sagging.

[0007] Further advantages of the present invention result from the fact that it enables the selectively shaped horizontal panel framing members to be held rigidly parallel in predetermined spaced relationship so that these assemblies can be suspended on wires directly from the building structure above. The main tees, cross tees and panel framing members provide a rigid grid without the necessity of applying heavy structural channels which are conventionally installed in prior art ceiling structures.

[0008] The ceiling produced by this invention is durable, rigid and good looking while hiding the acoustic tile support elements from the viewers located below the ceiling.

[0009] In practicing the invention, the ceiling supporting main tees and cross tees are horizontally aligned and supported on wires directly from the building structure. The tees in turn support framing panels by means of v-shaped torsion springs which engage hooks on the panels and extend upwards to engage slots in the main tees. Each of the panel frames has at its lower end, an acoustic tile (panel) supporting flange extending transversely, i.e., horizontally inwardly from one side of the framing member. The flanges on the framing members on opposite sides of a ceiling panel are inserted into the kerf (slot) extending along the edge of the tile. Panel framing members on the remaining two sides of the enclosure then engage kerfs on the corresponding sides of the tile and the four framing members are connected to each other at the corners to complete the assembly.

[0010] The invention provides an acoustic panel ceiling system comprising a plurality of ceiling panel framing members with ends interconnected to form a four-sided enclosure, with each panel member having a flange at the bottom thereof extending into the interior of the enclosure. A plurality of notches are formed at spaced intervals along the top edges of each framing member comprising a hook-shaped element.

[0011] A plurality of v-shaped torsion springs having a wound end at the bottom engage the hooks on the framing members and have a pair of arms extending upwardly and outwardly from the wound end, each arm having a hook formed in the free end thereof. A grid suspended from the structure in which the ceiling system is to be mounted is provided comprising main tees and intersecting cross tees. A plurality of pairs of slots are located at spaced intervals along the main tees, the slots being adapted to receive the free ends of the torsion spring arms. A ceiling tile has a kerf formed around the periphery thereof, is engaged with the flanges on the framing members and adapted to abut adjacent tiles with a minimal space between adjacent tiles.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The various features, aspects and advantages of the present invention will be more fully understood from a
consideration of the following detailed description in conjunction with the accompanying drawings in which:

[0013] FIG. 1 is a perspective view of a typical portion of the ceiling system showing the ceiling panel, the frame for receiving the panel, the cross tees and main tees for supporting the panel frames and panels and hanger wires for attaching the system to a structure;

[0014] FIG. 2 is a perspective view of a portion of the system according to the present invention showing main tees, cross tees and hanger wires;

[0015] FIG. 3 is a perspective view of a typical perforated wood ceiling panel attached to panel framing members for use in the system according the present invention;

[0016] FIG. 4 is a perspective view of the panel assembly in FIG. 3 attached to the supporting tee assembly;

[0017] FIG. 5 is a sectional view in elevation showing a kerfed acoustical ceiling panel and framing assembly attached to a main tee and two cross tees;

[0018] FIG. 6 is a sectional view in elevation showing the panel and framing assembly attached to main tees and cross tees with a metal or vinyl ceiling panel attached thereto;

[0019] FIG. 7 is a detailed perspective view of a notch and hook or clip construction on a typical panel framing member with the torsion spring attached thereto.

[0020] FIG. 8A is a sectional view of the assembly of FIG. 6 prior to insertion of a pull down tool into the reveal between adjacent tiles.

[0021] FIG. 8B is a sectional view of the assembly in FIG. 6 with the pull down tool engaged with a ledge on the panel member, and;

[0022] FIG. 8C is a sectional view of the assembly of FIG. 6 with one panel pulled down to enable disengagement of the ceiling tile from the panel member.

DETAILED DESCRIPTION OF THE INVENTION

[0023] The invention 10 is shown in perspective view in FIG. 1. As shown therein, the invention includes a plurality of main tees 12 and cross tees 14. The main tees 12 are provided with a plurality of torsion spring slots 16 which are located at spaced intervals along the length of the main tees in the flanges extending inwardly from the bottom of the main tees. The main tees and the cross tees provide support for the ceiling panel framing assembly which are attached to the main tees by means of torsion springs 18 which are connected to panel framing members 20 and extend upwardly from torsion spring notches 22 to the torsion spring slots 16. The main tee and cross tee assembly are supported by hanger wires 23 which are connected to the tee assembly and extend upwardly to be connected to the structure from which the ceiling system is to be hung.

[0024] As shown in FIG. 1, a ceiling panel 24 is positioned below the panel framing members 20. The ceiling panel 24 has a framing slot or kerf 26 extending along the peripheral edge of the ceiling panel. Flange 28 is formed at the bottom of the framing panel members 20 and this flange is adapted and positioned to be engaged in the framing slot 26 of the ceiling panel to hold the ceiling panel in place. In assembly the ceiling panel is mounted to the framing assembly by attaching two panel framing members on opposite sides to the ceiling panel and engaging the same with the kerf extending along the perimeter of the ceiling panel. Subsequently, the pair of framing panels on the remaining two sides of the ceiling panel are engaged at the corners with the first pair of panel framing members and are secured at the corners by means of pop rivets or a connector tab and connector slot configuration. As can be seen from FIG. 1 torsion spring notches 22 are located at spaced intervals along each panel framing member to provide flexibility in terms of the way in which panel framing members to which the torsion springs are attached to the tee assembly. Also, as shown in FIG. 1, the torsion springs 18 are attached to two sides of the four sided panel assembly.

[0025] The illustration in FIG. 2 shows the assembly of main tees 12 and cross tees 14 supported by hanger wires 23 in greater detail. As shown therein, the main tees 12 are connected to cross tees 14 by means of straps 32 which extend through vertical slots 34 in the main tees and fastened to the cross tees at the intersections. Torsion spring slots 16 are located at spaced intervals along the main tees. The vertical slots 34 are provided at spaced intervals along the length of the main tees to provide flexibility for mounting cross tees to accommodate different sizes of ceiling tiles.

[0026] Referring now to FIG. 3, shown therein is a ceiling panel assembly 35 comprising the panel framing members 20 joined by brackets 36 and pop rivet fasteners 38 which join the adjacent panel framing members at the corners. The ceiling panel member is attached to the panel framing members, either by means of a flange extending around the panel framing members (see FIG. 1) and engaging a kerf in the ceiling panel or, in the alternative, by securing the ceiling panel to the underside of the flange by means of adhesives or the like. As shown therein, the ceiling panel 40 is a typical perforated wood panel 40 and attached thereto is a layer of acoustic insulating material 41 such as Soundtex. The torsion springs 18 are likewise depicted in FIG. 3 and are attached at the torsion spring notches 22. The torsion springs 22 comprise arms 43 extending upwardly from a hinge or wound end 42 which engages a folded-down tab or clip 44.

[0027] The ceiling panel assembly 35 of FIG. 3 is then attached to the main tee and cross tee subassembly 46 as shown in FIG. 4. The torsion spring arms 43 are inserted upwardly through torsion spring slots 16 and the ceiling panel assembly 35 is raised until the panel framing members are flush against the bottom side of the main tees and cross tees. As will be discussed in more detail, the ceiling panel frame assemblies 35 can be easily lowered by the use of a stock tool which is inserted in the reveal between adjacent ceiling panels 40 to engage the edge of a ceiling panel and pull it downwardly causing the torsion springs 18 to slide downwardly through the slots until hooks 48 at the end of the torsion spring arms 43 engage flanges 50 in the main tees.

[0028] A sectional view in FIG. 5 shows a detail of the assembly of the ceiling panel system supporting a typical acoustical fiberglass panel 52. As shown therein, the main tee 12 is supported by hanger wire 22. The main tee is shown in cross section and connected to the main tee are two cross tees 14. The cross tees are connected to the main tee by strap 32. Two torsion springs 40 are shown extending
upwardly through the flanges of main tee 12. As shown therein, the ceiling panels are in their raised position and the panel framing members bear directly against the bottom of the main tees and the cross tees. The torsion spring notches 30 on adjacent panel members 52 are shown in opposed position and comprise folded-down tabs or clips 44 to define hooks which are engaged with hinges 42 at the bottom of each of the torsion springs. The flanges 28 of the panel framing members are shown engaged with the kerfs 26 of adjacent ceiling panels 24. The ceiling panel assembly of the present invention features the close spacing of adjacent ceiling panels with typically a \( \frac{1}{4} \)th of an inch reveal between adjacent acoustical fiberglas panels.

A sectional view similar to the view shown in FIG. 5 is shown in FIG. 6, with main tee 12 being supported by hangar wire 22 and cross tees 14 joined to the main tee. In this figure the acoustic panels with kerfed edges are replaced by a metal panels 53 which are secured to the flange of the panel framing member by means of adhesives or similar fastening material. The ceiling panel in this instance can be selected from a number of different choices and in certain instances the visible side is covered with a veneer 55 to suit the particular requirements, application and location of the ceiling system being installed. The reveal between metal panels is typically \( \frac{1}{4} \)th of an inch.

FIG. 7 shows a detail of a torsion spring notch 30 and torsion spring 18. As shown therein, the notch 30 is formed in the side of a panel framing member and a strap of material in the form of a tab 51 in the center of the notch is bent and folded down to define a hook or clip 54. The wound end or hinge 42 of the torsion spring is engaged with the hook or clip and secured to the panel member. The arms 43 of the torsion spring extend upwardly and are terminated in hooks 48. The hooks limit the travel of the torsion spring when the ceiling panel is lowered for purposes of gaining access to the space above the ceiling panel system or for purposes of changing ceiling panels.

Hook or clip 54 is oversize and provides ample space for engagement with hinge 42. In assembly hinge 42 is engaged by tab 51 at the notch configuration at the factory as the tab is folded down into its closed position to form the hook or clip. The oversize dimensions of hook 54 provide space for torsion springs 18 to be rotated 90° forward to lie flat with the panel framing assemblies for shipping to a job site. Assembly of the torsion springs and hooks at the place of fabrication eliminates a number of assembly steps at the job site thereby speeding the process of installation and reducing the labor cost at installation.

FIGS. 8A, 8B and 8C illustrate the manner in which a ceiling panel is lowered and then restored to its normal position. As shown therein, a tool 56 having a long blade 57 with a plate 58 affixed thereto, is inserted in the reveal between adjacent panels to engage a ledge 60 formed into the edge of the panel member. The plate 58 engages the ledge as shown in FIG. 8B preparatory to pulling the ceiling panel downwardly. As shown in FIG. 8C, the ceiling panel 24 is lowered and the torsion spring 18 is slid downwardly through the torsion spring slots until the hooks 48 on the torsion springs engage the flanges of the main tee and the ceiling panel is thereby positioned at its lowest limit. After work is done to either replace the panels or to work in the space above the ceiling, the ceiling panel is then manually pressed upwardly until it is flush with the adjacent ceiling panel and the assembly is restored to its normal position.

What is claimed is:

1. An acoustic panel ceiling system comprising:
   a plurality of ceiling panel framing members interconnected end to end to form a four sided enclosure, each member having a flange at the bottom thereof extending into the interior of the enclosure;
   a plurality of notches formed along the top edge of each framing member comprising a hook shaped element;
   a plurality of V shaped torsion springs having a wound end engaged with a respective one of the elements on the framing members and a pair of arms extending upwardly and outwardly from the wound end, each arm having a hook formed in the free end thereof;
   a grid for suspension from a structure comprising main tees and intersecting cross tees;
   a plurality of pairs of slots located at spaced intervals along the main tees, the slots being adapted to receive the free ends of the torsion spring arms; and
   a ceiling tile having a kerf formed around the periphery thereof, the kerf being engaged with the flanges on the framing members and adapted to abut adjacent ceiling tiles with a minimal space between adjacent tiles.

2. A system according to claim 1 wherein the ends of the framing members are connected by corner angles secured by pop rivets.

3. A system according to claim 1 wherein the ends of the framing members are connected by bayonet clips.

4. A system according to claim 1 wherein each framing member has at least two notches formed into the top edge of the member.

5. A system according to claim 1 wherein an alignment guide is provided at a predetermined location on the outer face of each framing member.

6. A system according to claim 4 wherein the alignment guides on each facing framing member engage the guide on the adjacent framing member.

7. A system according to claim 1 wherein a shelf is provided on the outer face of each framing member.

8. A system according to claim 6 wherein the shelf is adapted to be engaged by a mating shelf on a hand tool for raising and lowering a selected ceiling tile.

9. A system according to claim 1 wherein the framing members are fabricated of extruded aluminum.

10. A system according to claim 1 wherein the ceiling tiles are acoustic tiles.

11. An acoustic panel ceiling system comprising:
   a plurality of ceiling panel framing members interconnected end to end to form a four sided enclosure, each member having a flange at the bottom thereof extending into the interior of the enclosure;
   a plurality of notches formed along the top edge of each framing member comprising a hook shaped element;
   a plurality of V shaped torsion springs having a wound end engaged with a respective one of the elements on the framing members and a pair of arms extending upwardly and outwardly from the wound end, each arm having a hook formed in the free end thereof;
a grid for suspension from a structure comprising main tees and intersecting cross tees;
a plurality of pairs of slots located at spaced intervals along the main tees, the slots being adapted to receive the free ends of the torsion spring arms; and
a ceiling tile secured to the framing members and adapted to abut adjacent ceiling tiles with a minimal space between adjacent tiles.

12. A system according to claim 11 wherein the ceiling tile is a flat panel adhesively secured to the bottom edges of the framing members.

13. A system according to claim 12 wherein the panel has a wood veneer on the exterior face.

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