

PANEL CEILING STRUCTURE

This invention relates generally to the construction and installation of ceiling structures and more particularly to a ceiling structure of the so-called false-ceiling type, in which ceiling surface material units (herein referred to as panels) can be readily and accurately installed, easily adjusted in position, and readily dismantled.

In a typical ceiling structure of similar type known heretofore, each panel has around its outer periphery an outwardly projecting mounting flange. These mounting flanges of adjacent panels are fastened by screws to a common horizontal support member constituting a part of a support grid frame. The panels have vertical side web walls contiguous to the mounting flanges, whereby jointing recesses are formed between adjacent panels. The above mentioned fastening of the panels is carried out in these recesses in which jointing strips are thereafter inserted and fastened by screws as trimming material.

This fastening of the panels with screws at high places from below while the panels are held in place is a difficult and troublesome work. Furthermore, the jointing strips must fill the recesses completely across their width, which is difficult since adjustment of the width of the recesses is

almost impossible. Moreover, the recesses become disadvantageously shallow.

5 This invention seeks to overcome these problems by providing a panel ceiling structure in which the work of installing or dismantling ceiling panels is facilitated, and, moreover, the widths of jointing recesses can be readily adjusted.

10 According to this invention, briefly summarized, there is provided a panel ceiling structure fixed to a rough ceiling and comprising and characterized by: a plurality of support beams of inverted Tee shape in cross section each having a vertical web and a horizontal fixing flange at the lower end thereof; a support structure supported by said rough ceiling and
15 suspendedly supporting the support beams in a state wherein they are mutually spaced apart by a constant distance; a plurality of ceiling panels of shallow box shape each comprising a bottom plate, a plurality of upstanding side web walls around the outer periphery
20 of the bottom plate, and attachment flanges formed by bending inward the upper portions of the web walls; a plurality of holding clamps, which can be readily tightened and loosened by hand, for clamping opposed attachment flanges of each ceiling panel securely
25 against the lower surfaces of fixing flanges of adjacent support beams; and a plurality of plates for spanning between and being secured to

respective pairs of the unclamped attachment flanges of adjacent ceiling panels, downwardly open jointing recesses being formed around each ceiling panel between that ceiling panel and adjacently neighboring ceiling panels.

The nature, utility, and further features of this invention will be more clearly apparent from the following detailed description with respect to one preferred embodiment of the invention when read in conjunction with the accompanying drawings, briefly described below.

In the drawings:-

FIG. 1 is a partial plan view, as viewed upward, showing an example of a ceiling structure according to the invention;

FIG. 2 is an elevational section taken along the plane indicated by line II-II in FIG. 1 as viewed in the arrow direction;

FIG. 3 is an elevational section taken along the plane indicated by line III-III in FIG. 1 as viewed in the arrow direction;

FIG. 4 is a perspective view showing a clip connector; and

FIG. 5 is a view similar to FIG. 2, showing a known ceiling structure of similar character.

Reference notations X-X and Y-Y as shown in FIG. 1 are used herein to designate orthogonal directions

in the horizontal plane to which most parts of the ceiling structure shown are parallel.

In the example of the ceiling structure according to this invention as illustrated in FIGS. 1, 2, and 3, the visible ceiling surface is defined by the lower surfaces of the bottom plates 2 of a plurality of rectangular ceiling panels 1 assembled and supported on a ceiling support structure so that all of the lower surfaces of the bottom plates 2 lie in the same plane. Each panel 1, which in this example is of square shape in plan view, is formed from a sheet material into the shape of a shallow box with upwardly bent side walls 3, 4, 5, and 6 around the periphery of the above mentioned bottom plate 2. The upper parts of opposite side walls 3 and 5 and of opposite side walls 4 and 6 are bent inward at right angles to their respective side walls thereby to form attachment flanges 7, 9, 8, and 10, respectively. In this example, the side walls 3 and 5 and the attachment flanges 7 and 9 of each panel 1 in installed state extend in the Y-Y direction, while the side walls 4 and 6 and the attachment flanges 8 and 10 extend in the X-X direction.

The ceiling panels 1, each of the above described construction, is secured to and supported in suspended state by a ceiling support structure as described below.

This support structure has, as its uppermost structural members, a plurality of channel beams 19 extending parallelly in the X-X direction with suitable spacing therebetween and suspended by adjustable hanger bolts (not shown) from a rough ceiling. These channel beams 19 support in suspended state a plurality of spaced-apart support beams 11 extending parallelly in the Y-Y direction and suspendedly fixed to the channel beams 19 by clip connectors 20. Each support beam 11 has a cross-sectional shape resembling an inverted Tee with a vertical web 12, a horizontal fixing flange 13 formed integrally with the web 12 at the lower part thereof, and an engagement flange 14 formed integrally with the web 12 at the upper part thereof. As shown in FIG. 4 the clip connectors 20 have opposed hook-like lower ends 20a which are engaged with the engagement flanges 14 of the support beams 11.

The support beams 11 are suspendedly supported by the channel beams 19 in the above described manner at specific, equal spacing intervals, each of which is greater by a specific distance than the width of each panel 1 in the X-X direction.

Each ceiling panel 1 in installed state is so positioned that the upper surfaces of its attachment flanges 7 and 9, which are aligned in the Y-Y direction, are in tight contact respectively against the

lower surfaces of the nearest parts of the fixing flanges 13 of adjacent support beams 11. Each of the attachment flanges 7 and 9 is thus held in tight contact by two holding clamps 15 disposed near the ends thereof. Each holding clamp 15 is essentially a Cee-clamp comprising a horizontal upper flange 16, a horizontal lower flange 17 joined integrally to the upper flange 16 by a vertical web, and a vertical wing bolt 21 passed downward through and screw engaged with a tapped hole 18 in the upper flange 16. The lower extremity of the wing bolt 21 is in abutting contact with the upper surface of the above mentioned nearest part of the corresponding fixing flange 13. The upper surface of the lower flange 17 is thereby pressed tightly against the lower surface of the corresponding attachment flange 7 (or 9) of the panel 1. Thus, the attachment flanges 7 and 9 of each panel 1 are tightly clamped in sandwiched state between respective parts of adjacent fixing flanges 13 and the lower flanges 17 of the holding clamps 15.

Since, as mentioned hereinbefore, the spacing distance between adjacent support beams 11 is greater by a specific distance than the overall dimension of the ceiling panel in the X-X direction, a jointing recess 22, defined by the lower surface of the fixing flange 13 of a support beam 11 and the outer surfaces

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of opposed side web walls 3 and 5 of adjacent panels 1, is formed between each pair of adjacent panels 1.

5 The ceiling panels 1 are secured in the above described manner to their respective adjacent support beams 11 at such positions therealong, or in the Y-Y direction, that gaps substantially of the same horizontal width as the recesses 22 are formed between adjacent panels, these gaps extending in the X-X direction. A plate 23 of substantially
10 the same width as the fixing flange 13 of the support beams 11 is placed on the attachment flanges 8 and 10 of each pair of adjacent panels 1 on opposite sides of a respective one of these gaps. The

plate 23 is secured to the attachment flanges 8
15 and 10 by screws. Thus a jointing recess 24 is formed by the lower surface of each plate 23 and the inner surfaces of the corresponding side web walls 4 and 6 of the adjacent panels 1.

In the panel ceiling structure according to this
20 invention as described above, individual ceiling panels 1 can be readily installed or dismantled or the widths of the jointing recesses 22 can be easily adjusted by loosening or tightening the wing bolts 21 to disconnect or connect the holding clamps 15.

25 In the work of mounting and disconnecting the ceiling panels in the ceiling structure of this invention, only a particular panel can be readily

mounted or disconnected, and, at the same time, adjustments of the widths of the jointing recesses can be readily carried out at the installation site. Furthermore, since jointing strips are not used,
5 the jointing recesses can be made deep, whereby, as viewed from below, ceiling panels of three-dimensional appearance with deeply sculptured recesses are obtained.

While this invention has been described above
10 with respect to an example thereof wherein the ceiling panels are substantially square in plan view and, in installed state, lie in a common plane, the invention is not intended to be limited to such construction and arrangement, the teachings of the invention
15 being applicable to those wherein the panels are of other shapes in plan view such as triangles and parallelograms, and the lower exposed surface of the ceiling panels in installed state is a bent surface which is concave, convex, or undulating.

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For reference and as conducive to a full understanding of this invention and its unique features distinguishing it from the prior art, the general nature and limitations of a typical panel ceiling
25 structure of a similar type known heretofore will be briefly described with reference to FIG. 5.

Each of the ceiling panels 1a in this known

ceiling structure has the shape of a tray with vertical upright web side walls around the periphery of a rectangular bottom plate 2a and horizontal mounting flanges 25 projecting outwardly from the upper edges of the web side walls. At the time of installation of the panels 1a, they are brought up so that their mounting flanges 25 contact members 11a of a supporting grid frame suspendedly fixed to a rough ceiling. Then the mounting flanges 25 are fastened to their respective members 11a with screws. The mounting flanges 25 of adjacent panels 1a are in close, opposed relation and are thus fastened to respective sides of a common member 11a. While channel-like members 11a are shown in FIG. 5, these supporting members may be inverted Tee beams, angle beams, or I beams. Jointing recesses are thus formed between adjacent panels 1a. Jointing strips 26 are thereafter inserted into these jointing recesses and fastened as trimming material with screws to the members 11a.

As mentioned hereinbefore, the panels 1a must be installed as described above at high places from below with screws while the panels are held in place. This is difficult, troublesome, and inefficient work. In addition, the jointing strips 26 must fill the jointing recesses completely across their width. This is difficult since adjustment of the recess width, which is not constant, is almost impossible.



CLAIMS.

1. A panel ceiling structure fixed to a rough ceiling and comprising: a plurality of support beams of inverted Tee shape in cross section each having a vertical web and a horizontal fixing flange at the lower end thereof; a support structure supported by said rough ceiling and suspendedly supporting the support beams in a state wherein they are mutually spaced apart by a constant distance; a plurality of ceiling panels of shallow box shape each comprising a bottom plate, a plurality of upstanding side web walls around the outer periphery of the bottom plate, and attachment flanges formed by bending inward the upper portions of the web walls; a plurality of holding clamps, which can be readily tightened and loosened by hand, for clamping opposed attachment flanges of each ceiling panel securely against the lower surfaces of fixing flanges of adjacent support beams; and a plurality of plates for spanning between and being secured to respective pairs of the unclamped attachment flanges of adjacent ceiling panels, downwardly open jointing recesses being formed around each ceiling panel between that ceiling panel and adjacently neighbouring ceiling panels.

2. A panel ceiling structure as claimed in Claim 1 in which each ceiling panel is of rectangular shape



in plan view.

3. A panel ceiling structure as claimed in Claim 1 in which each ceiling panel is of the shape of a parallelogram in plan view.

4. A panel ceiling structure as claimed in Claim 1 in which each ceiling panel is of triangular shape in plan view.

5. A panel ceiling structure as claimed in any one of the preceding Claims in which the lower exposed surface of the ceiling panels in installed state is a bent surface which is concave, convex, or undulating.

6. A panel ceiling structure constructed, arranged, and assembled substantially as herein described and shown in FIGS. 1 through 3 of the accompanying drawings.
