Dec. 17, 1957 HERBERT K. WONG 2,816,623

MODULAR CEILING

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Fig. 1

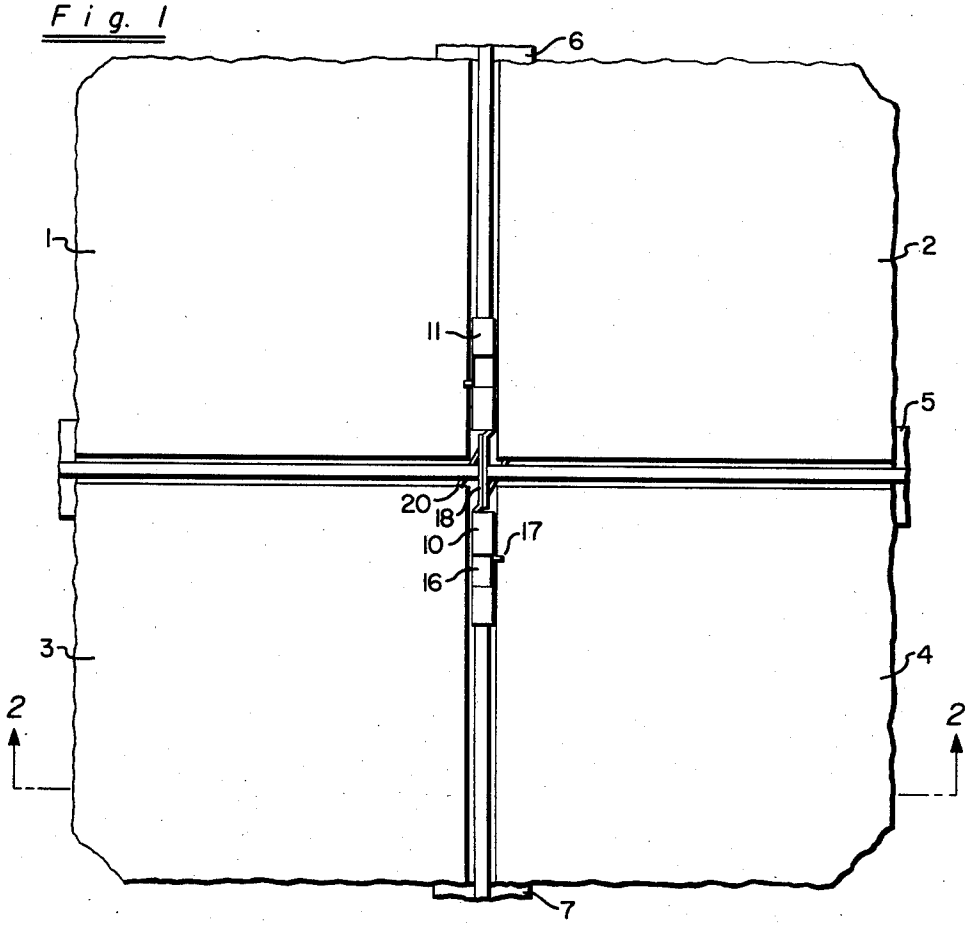
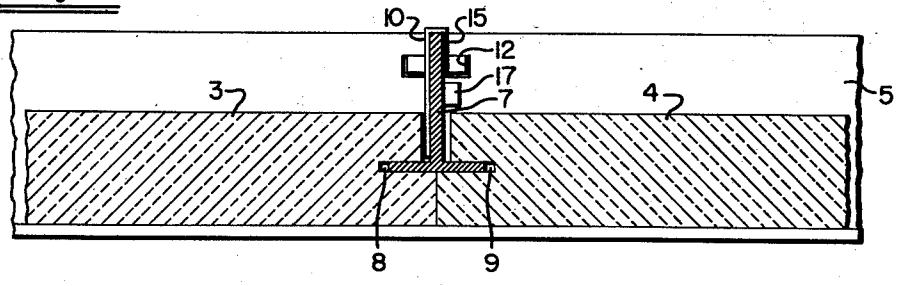


Fig. 2



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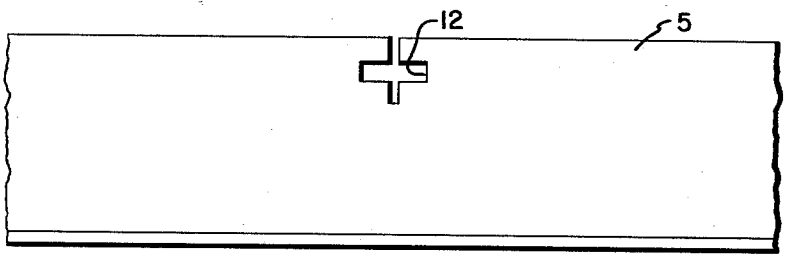

Fig. 3

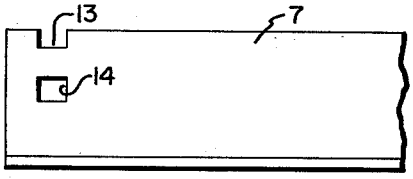

Fig. 4

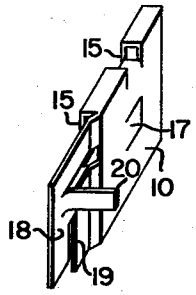

Fig. 5

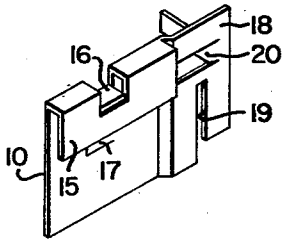

Fig. 6

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United States Patent Office 2,816,623 Patented Dec. 17, 1957

2,816,623

MODULAR CEILING

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Application December 13, 1955, Serial No. 552,875

2 Claims. (Cl. 183—36)

This invention relates to modular ceilings or sub-ceilings formed by a coplanar horizontal array of side-by-side rectangular ceiling panels, generally acoustic tiles or the like, and in particular to an improved supporting structure for such ceiling panels.

In modular ceilings that consist essentially of a horizontal coplanar array of rectangular ceiling panels, such as rectangular acoustic tiles, a supporting structure is required for holding the ceiling panels in place. It is desirable that this supporting structure be light in weight, inexpensive to manufacture, and easy to assemble at the construction site. An object of this invention is to provide a modular ceiling or sub-ceiling having an improved supporting structure that meets the aforesaid requirements.

The supporting structure may be a rectangular grid of intersecting T-beams. To make the supporting structure adequately strong and rigid, connecting means must be provided for fastening together the intersecting beams. The connecting means should be simple, inexpensive, and easy to install without special tools or equiment. Accordingly, another object of this invention is to provide improved connecting means for securely fastening together the intersecting beams of a ceiling supporting structure.

Small structural connectors may be used for fastening the intersecting beams together. The connectors should be inexpensive to manufacture, and should be adapted for quick and easy installation, without bolts, screws or welded joints, and without the use of special tools or equipment. After installation, the connectors should be securely locked in place, and they should securely fasten the beams together. The connectors should be strong enough to hold the intersecting beams securely in place, and should be capable of transmitting considerable stress in the lengthwise direction of the beam. Accordingly, another object of this invention is to provide an improved structural connector for fastening beams together that meets the aforesaid requirements.

Other objects and advantages of the invention will appear as the description proceeds.

Briefly stated, in accordance with certain aspects of this invention, a modular ceiling or sub-ceiling consists essentially of a horizontal coplanar array of side-by-side rectangular ceiling panels, and a supporting structure therefor. The supporting structure includes a first plurality of horizontal parallel inverted T-beams and a second plurality of horizontal inverted T-beams extending between and perpendicular to said first plurality of T-beams. The first plurality of T-beams have horizontal flanges that underlie and support portions of the rectangular ceiling panels. Sides of the ceiling panels that are perpendicular to the first plurality of beams contain horizontal grooves, and the second plurality of T-beams have horizontal flanges that fit within these horizontal grooves. All of the T-beams have upstanding webs that extend upward between adjacent ones of the ceiling panels. The upstanding webs of the intersecting T-beams are securely fastened together by improved structural connectors herein described.

The first plurality of T-beams have cruciform slots extending downward from the tops of their webs. The connectors have vertical edgewise tongues that extend through vertical portions of these cruciform slots and web portions of the beam below the cruciform slots pass through vertical slots in the tongue. The tongues have tabs that are bent through horizontal portions of the cruciform slots when the structure is assembled, which thereafter securely lock the connectors to the first plurality of T-beams.

The second plurality of T-beams have slots extending downward from the tops of their webs, and have holes through their webs below these slots. The connectors have horizontal folds that straddle the webs of the second plurality of T-beams, have horizontal edgewise tabs that extend through the slots in the same web, and have vertical edgewise tabs that are bent through the holes in the webs when the structure is assembled, thereafter securely locking the connectors to the second plurality of T-beams.

The supporting structure thus provided is inexpensive to manufacture, exceptionally easy to install, and has considerable strength.

The invention will be better understood from the following detailed description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims. In the drawings:

Fig. 1 is a fragmentary top view of a modular ceiling embodying principles of this invention;

Fig. 2 is a vertical section taken along the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary side elevation of a T-beam used in the supporting structure of the same ceiling;

Fig. 4 is a fragmentary side elevation of another T-beam used in the same structure;

Fig. 5 is a left side perspective view of a structural connector for fastening the aforesaid T-beams together; and

Fig. 6 is a right side perspective view of the same connector.

Referring now to the drawings, a modular ceiling or sub-ceiling includes a horizontal coplanar array of side-by-side rectangular ceiling panels, including the panels 1, 2, 3 and 4. Each panel may be an acoustic tile or the like, and may be about two feet square. The panels are held in place by a supporting structure that includes a first plurality of horizontal parallel inverted T-beams including beam 5 and other like beams parallel thereto. The beams of this first plurality are spaced apart by a distance substantially equal to the width of a ceiling panel, and each of these beams has a length several times greater than the length of a ceiling panel. Extending between and perpendicular to the first plurality of beams, there is a second plurality of horizontal inverted T-beams including beams 6 and 7 and other beams substantially identical thereto. The beams of this second plurality are spaced apart by a distance substantially equal to the length of a ceiling panel, and each of these beams has a length substantially equal to the width of a ceiling panel. The first and second pluralities of T-beams form a grid of intersecting beams for supporting the ceiling panel.

Beam 5, and the other beams of the first plurality, has horizontal flanges that underlie and support portions of the ceiling panels, and has an upstanding web that extends upward between adjacent ones of the panels, as shown. The panels have grooves 8 and 9 in the sides thereof that are perpendicular to beam 5. Beam 7, and the other beams of the second plurality, has horizontal flanges that fit within grooves 8 and 9, and has an upstanding web that extends upward between adjacent ones of the panels, as shown. The top edges of the webs of beams 5 and 7

are coplanar, and since the flanges of beam **7** are not coplanar with the flanges of beam **5**, the depth of beam **7** from the top of its web to the bottom of its flanges, is less than the depth of beam **5**. The web of beam **7** is securely fastened to the web of beam **5** by a structural connector **10**, and the web of beam **6** is securely fastened to the web of beam **5** by an identical structural connector **11**. Thus the webs of the intersecting T-beams are securely fastened together to form an adequately strong and rigid grid for supporting the ceiling panels.

Beam **5** has a cruciform slot **12** extending downward from the top of its web, as shown. Slot **12** has a vertical portion and a horizontal portion. Beam **7** has a rectangular slot **13** extending downward from the top of its web, and has a rectangular hole **14** through its web below slot **13**.

Connector **10** is made from a metal sheet cut and bent to the shape shown. The connector has a flat vertical major portion, and has a horizontally folded upper portion **15**. A horizontal edgewise tab **16** is bent over from the flat major portion transverse to the folded portion of the connector. A U-shaped cut in the flat major portion of the connector below tab **16** forms a vertical edgewise tab **17**.

Integral with and extending outward lengthwise from one end of the connector, offset inward from the flat major portion, there is a vertical edgewise tongue **18** having a vertical slot **19** extending upward from its lower edge. A vertical edgewise tab **20** is bent outward from tongue **18**, and, before installation of the connector, tab **20** preferably is substantially perpendicular to the tongue.

Connector **10** is installed on and fastened to beam **7** by sliding the connector over the top of the web of beam **7** so that folded portion **15** of the connector straddles the web of the beam and tab **16** extends through slot **13**. Then tab **17** is bent through hole **14**, which may be accomplished simply by pressing inward upon tab **17** with the end of a screwdriver or the like. After tab **17** has been bent through hole **14**, connector **10** is securely attached to the web of beam **7**. Any lengthwise stress on beam **7** is transmitted to the connector through an edge of horizontal edgewise tab **16**, and any vertical stress applied to the beam is transmitted to the connector through an edge of vertical edgewise tab **17**. Consequently, the connector is securely fastened to the beam, and there is no appreciable tendency for applied stresses to bend the locking tabs and thus loosen the connector from the beam.

To fasten the connector **10** to beam **5**, tongue **18** is inserted into the vertical portion of cruciform slot **12** and the connector is pressed downward until the portion of the web below slot **12** passes through vertical slot **19** in the tongue of the connector. Tab **20** is then bent backward through the horizontal portion of cruciform slot **12**, as shown in Fig. 1, for locking the connector securely to the web of beam **5**. Thereafter any vertical stress applied to the connector by beam **7** is transmitted to beam **5** through an edge of tab **20**, and any lengthwise stress applied to the connector by beam **7** is transmitted to beam **5** by the edges of slot **19**. Furthermore, even if such lengthwise stresses are so great that some bending of the connector must occur, the bending will usually take place at the offset between the major portion of the connector and tongue **18**, which will not affect the locking tabs of the connector and therefore will not loosen the connector from either of the beams which it fastens together.

The vertical portion of slot **12** preferably is substantially twice as wide as the thickness of tongue **18**, so that the tongues of two connectors, **10** and **11** for example, can be placed side-by-side within the same slot **12** for fastening two beams **6** and **7** to opposite sides of beam **5**. Because of the offset of the tongues from the major vertical portions of the connectors, connectors **10** and **11**, and therefore beams **6** and **7**, are positioned in linear alinement when the two connector tongues are inserted side-by-side through the same slot **12**.

It should be understood that this invention in its broader aspects is not limited to the specific embodiment herein illustrated and described, and that the following claims are intended to cover all changes and modifications that do not depart from the true spirit and scope of the invention.

What is claimed is:

1. In a supporting structure for ceiling panels, the combination comprising first and second horizontal beams each having an upstanding web, said second beam being perpendicular to said first beam, said first beam having a cruciform slot extending downward from the top of its web, said second beam having a rectangular slot extending downward from the top of its web and a rectangular hole through its web below said rectangular slot, and a connector having at its top a horizontal fold that straddles the web of said second beam, said connector having a horizontal edgewise tab that extends through said rectangular slot and a vertical edgewise tab that extends through said rectangular hole, said connector having a vertical edgewise tongue extending outward lengthwise from an end thereof and through said cruciform slot, said tongue having a vertical slot extending upward from a lower edge thereof, said web of the first beam passing through said vertical slot of the tongue, said tongue having a vertical edgewise tab bent through said cruciform slot.

2. A structural connector for fastening beams together, comprising a metal sheet having a flat vertical major portion with a horizontally folded upper portion, a horizontal edgewise tab bent from said flat portion transverse to said folded portion, a U-shaped cut in said flat portion forming a vertical edgewise tab below said horizontal edgewise tab, a tongue integral with and offset from an end of said flat portion, said tongue having a vertical slot extending upward from a lower edge thereof, and a vertical edgewise tab bent out from and substantially perpendicular to said tongue.

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