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EXPANSIBLE ACOUSTICAL SYSTEM

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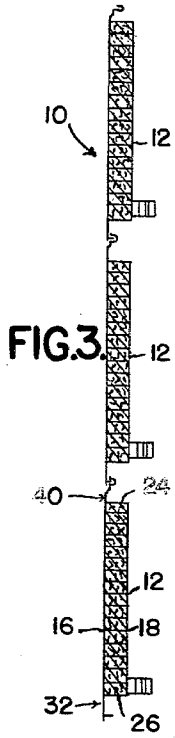


FIG.3.

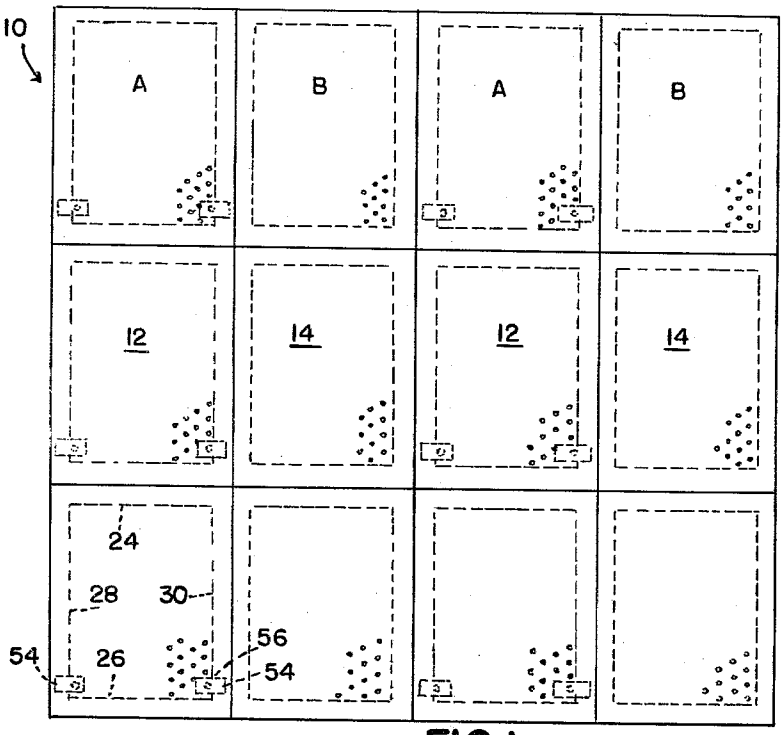


FIG.1.

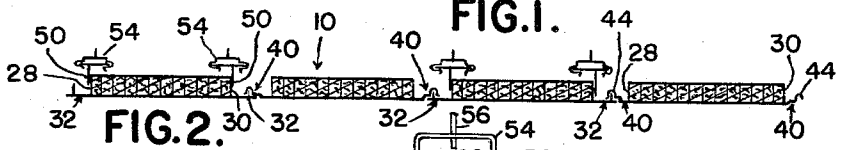


FIG.2.

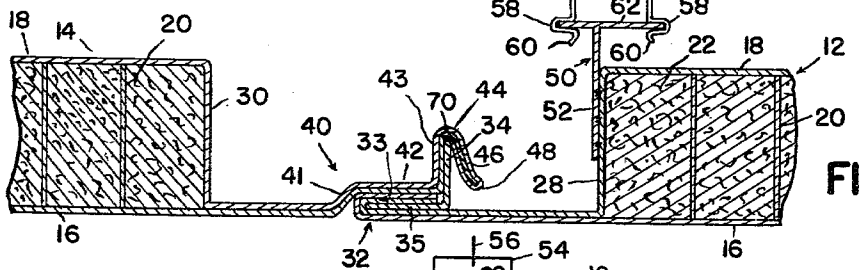


FIG.4.

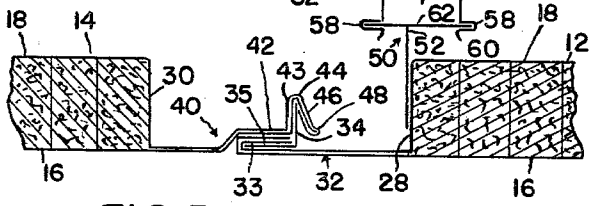


FIG.5.

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EXPANSIBLE ACOUSTICAL SYSTEM

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This invention relates generally to ceiling structure and refers more particularly to an acoustical ceiling structure composed of individual separable panels.

One object of this invention is to provide a ceiling structure composed of individual separable panels arranged edge to edge and in the same plane to form a continuous ceiling, which will also provide an effective fire barrier.

Another object is to provide an expansible joint between adjacent panels to allow for expansion of the individual panels without causing any of the panels to fall out of the ceiling structure. This is an important requirement since obviously if any of the panels were to fall out, the ceiling structure would no longer be an effective fire barrier.

Another object is to provide an expansible connection between the edges of adjacent panels which is composed of slidably engaging parts to permit movement of the adjacent panels toward one another.

Another object is to provide an edge connection between adjacent panels including an upwardly extending flange carried by the edge of one panel and a downwardly opening hook carried by the edge of an adjacent panel engaged over and supported by the flange, and a sliding connection between the flange and the panel edge by which it is carried, with means positively limiting movement of the adjacent panels away from one another.

Another object is to provide a ceiling structure wherein the aforementioned flange has an extension at right angles thereto and the panel edge by which it is carried has a return bent margin defining a channel slidably receiving the flange extension and in tight friction contact therewith to provide the sliding connection.

Other objects and features of the invention will become more apparent as the following description proceeds, especially when considered with the accompanying drawing, wherein:

FIGURE 1 is a bottom plan view of a ceiling structure according to my invention.

FIGURE 2 is a line diagram of the ceiling structure shown in FIGURE 1 in end elevation.

FIGURE 3 is a line diagram in side elevation.

FIGURE 4 is an enlarged sectional view of a portion of FIGURE 2.

FIGURE 5 is a line diagram similar to FIGURE 4.

Referring now more particularly to the drawing, the ceiling structure is generally indicated by the reference numeral 10 and is composed of individual, separable, rectangular, acoustical panels 12 and 14. As viewed in FIGURE 1, the panels 12 are arranged in the alternate rows A and the panels 14 are arranged in the rows B.

The panels 12 are identical and each has a perforated sheet metal front facing 16 and a sheet metal rear facing 18 which is parallel to and spaced behind the front facing. A honeycomb structure 20 is sandwiched between the facings. The honeycomb may be formed of a cardboard material and, together with the facings 16 and 18, provides a strong composite structure which resists bending or twisting. A heat insulating and sound absorbing material 22, which may be formed of glass, wool or wood fibres, fills the cells of the honeycomb 20. The margins of the back facing 18 of each panel 12 are turned at right angles toward the front facing 16 to define the parallel ends 24 and 26 and the parallel sides 28 and 30.

A supporting portion 32 is provided along the opposite

side edges of each panel 12. A similar supporting portion 32 is also provided along one end edge of each panel 12. Supporting portions are formed by surface-to-surface extensions of the front and back facings. Referring to FIGURE 4, the supporting portion 32 there shown is formed by the surface-to-surface integral lateral extensions of the front and back facings 16 and 18 respectively beyond the side 28. These surface-to-surface extensions project laterally outwardly in the plane of the front facing and are return bent to provide a channel 33 opening toward the side 28. The channel is quite strong and rigid because of the two layers of metal. Each supporting portion 32 also includes an upright flange 34 which extends parallel to the adjacent side or end of the panel, in FIG. 4 the side 28. The flange 34 has a lateral extension 35 at right angles thereto which is received in the channel 33. The metal of the channel is pinched down tight on the extension 35 to form a tight friction contact therewith. The supporting portion 32, including flange 34, along the opposite side 30 of each panel 12 is identical to the one shown in FIGURE 4 and projects from said opposite side 30 of the panel, and the end supporting portion 32 of each panel 12 is also identical to that shown in FIGURE 4, projecting outwardly from the end wall 26 thereof.

Although the flange extensions 35 are tightly gripped in the channel to prevent movement thereof, the flange extensions can slide in and out relative to the channel 33 if enough force is applied thereto. The limit of inward slide movement of the extension 35 is determined by the engagement of its free edge with the bottom or base of the channel 33, which is formed from back 18 and front 16.

The remaining end edge of each panel 12 is provided with a marginal extension in the form of a supported portion 40. This is a hook portion, and since identical hook portions 40 are provided on each panel B, one of which is shown in the enlarged view of FIGURE 4, reference will be made to FIGURE 4 to describe this supported portion. As shown in FIGURE 4, the supported portion 40 is formed by integral extensions of the front and back facings 16 and 18 beyond the corresponding end or side of the associated panel 12. These extensions of the front and back facings are in surface-to-surface contacting relation with each other and extend laterally outwardly from the panel in the plane of the front facing 16, then are rolled to form a rounded or inclined shoulder 41 which extends into a further lateral extension 42 parallel to the front facing 16, then are turned at right angles toward the back facing 18 and parallel to the front or end wall of the panel to form an upright flange 43 which is return bent to form a hook 44 the opposite flange of which is indicated at 46 and terminates in a turned-out end 48. It will be noted that the metal of the back facing 18 continues beyond the end 48 and along the opposite surface of the metal formed as an extension of the front facing 16 to provide a triple layer of metal for the flange 46 of the hook. The remainder of the supported portion 40 is in two layers. Preferably, and as shown in FIGURE 4, the flange 46 of the hook is inclined from the base of the hook away from the flange 43.

It will be understood that the supporting portions 32, including the flanges 34, extend for the full length of the side edges and one end edge of each panel 12, and that the supported portion 40 likewise extends for the full length of the opposite end edge thereof.

The panels 14 are identical with the panels 12 except for the margins thereof, each panel 14 having at the side edges and one end edge a supported portion 40, and at the opposite end edge a supporting portion 32, including flange 34.

A T-shaped member 50 is secured to each side edge of

each panel 12 near the end thereof having the supporting portion 32. The stems 52 of the T-shaped members 50 are rigidly secured in surface-to-surface relation to the sides 28 and 30 of each panel 12. A generally channel-shaped resilient clip 54 is associated with each T-shaped member, the clips 54 being suspended from an overhead ceiling structure. The clips 54 are thus suspended by rods 56 which together with the clips form suspension hangers. The legs of the clips are shaped to provide opposed channels 58 and terminate at their lower ends in flanges 60. Hence the cross member 62 of the T may be snapped into the opposed recesses or channels 58 of the associated clip by merely pressing upwardly to cam the legs apart by engagement with the flanges 60. The cross members 62 of the T-shaped members are in off-center relation with respect to the stems in order to clear the hook and flange connection between adjacent panels.

In order to install the acoustical ceiling structure, and assuming the suspension hangers composed of the rods 56 and clips 54 are in place, the row A of panels 12 are first put up. This is accomplished by engaging the hook 44 of the supported portion 40 along one end of each panel 12 over the flange 34 of the supported portion 32 along the adjacent end of the next panel in the row. Then the end of the panel 12 having the flange or supporting portion 32 is engaged with the clip 54 of the adjacent hanger by means of the T-shaped member 50. The next panel in the row is then installed in the same manner, that is, its hook-shaped end is engaged over the flanged end of the installed panel, and its flanged end is then suspended from the associated clip 54. The first panel 12 to be installed in the row A may be supported by laying on a suitable flange provided by a wall angle or channel fixed to the wall of the enclosure.

Alternate rows A are installed in this manner, and then panels 14 of rows B are installed to complete the ceiling structure. The panels 14 are installed in the rows B by turning them edge wise to elevate them above the level of the common horizontal plane established by the installed rows A of panels 12, and then the panels 14 are lowered so that the hooks along their sides engage over and are supported on the flanges 34 of the panels 12 in rows A. As each panel 14 is installed, its end having the hook 44 is engaged over the flange of the end of a B panel previously installed. The first panel 14 to be installed in B rows may be supported by laying on a suitable flange provided by a wall angle or channel fixed to the wall of the enclosure.

By reason of the inclined wall 46 of each hook and the turned-out terminal portion 48 thereof, it will be apparent that the hooks may be readily engaged over the associated flanges. Moreover, a lead-in is thereby provided to firmly engage the flange in the base of the hook. The panels are drawn together by the movement of the flange along the inclined wall 46 to the narrow base of the hook during installation.

Preferably a strip of sealing material 70 fills the base of each hook 44 along the full length thereof to be engaged by the flange received therein to provide a seal against the transmission of air and also to provide a sound barrier.

One man can install this ceiling. When putting up the A rows, the hooked end of one panel is engaged over the flange of another, and the hooked end is thus supported while the flanged end is connected to a clip 54. The B panels can also be installed by one man in the manner described above.

According to this construction, the panels together form a continuous ceiling structure and are disposed in edge to edge relationship in the same horizontal plane. Moreover, the panels in the rows B being supported by the panels in the rows A can be readily removed by simply lifting them from hooked engagement, turning them edgewise and then lowering them through the opening between the other panels to provide access to the area above the ceiling. The panels are very rigid and therefore give a smooth continuous appearance when viewed from below. The panels in the B rows tie together the panels in the A rows in side by side relation, stabilizing and rigidifying the entire ceiling and preventing the panels from spreading apart. The hooked connection between panels also keeps them in straight rows without zig-zag.

In the event of a fire, the ceiling structure provided by the panels in edge to edge relationship provide a complete and continuous barrier. The heat developed by a fire will cause expansion of the individual panels, and unless the connection joining adjacent panels is constructed to take up this expansion, the ceiling structure is apt to buckle and individual panels may fall out, thereby destroying the fire barrier. According to this construction, expansion may take place due to the sliding connection between the extensions 35 of the flanges 34 and the channels 33 receiving the extensions. While the extensions are gripped tightly in friction contact between the surfaces of the channels, nevertheless if sufficient force is imposed, the extensions may slide with respect to the channels. Sufficient force is imposed by the expansion of the individual panels under the influence of heat. Under such circumstances, the hook 44 shown in FIGURE 4 will move toward the panel on the right and with sufficient force to take the flange 34 with it and cause its extension 35 to slide part way out of the receiving channel. The length of the channel and flange extension are such that any normal amount of expansion can be taken care of before the extension actually pulls out of the channel. The rounded or inclined shoulder 41 provides a ramp which will ride up over the end of the channel 33 during expansion. The shoulder 41 is provided so that under normal conditions the panel extensions may lie in the same plane to give a continuous ceiling appearance.

It will be understood that although a degree of expansion is provided by this construction, the panels themselves remain firmly joined together by the hook and flange connection. Hence there is no danger that the panels will fall out of place or drop to the floor. Hence there is complete assurance that the continuous ceiling construction will remain intact though expansion of the individual panel members takes place.

The extreme end edge of the flange extensions 35 engage the base or bottom of the receiving channels 33 to provide a limit of movement of the adjacent panels away from each other. This can also be accomplished by having the free edge of the flange forming the channel engage the flange 34 itself. The FIGURE 5 illustration is made as a line diagram to more easily illustrate the FIGURE 4 construction. Actually the metal thicknesses shown in FIGURE 4 are exaggerated from necessity.

What I claim as my invention is:

1. In a ceiling structure composed of individual separable panels arranged edge to edge to form a continuous ceiling, a connection between the edges of adjacent panels, said connection including an upwardly extending flange carried by the edge of one of said adjacent panels, and a downwardly opening hook carried by the edge of the other of said adjacent panels engaged over and supported by said flange, said flange having an extension at right angles thereto, the panel edge by which said flange is carried having a return bent margin defining a channel slidably receiving said flange extension in tight friction contact, and means positively limiting movement of said adjacent panels away from one another.

2. The structure defined in claim 1 wherein said limiting means comprises the base of said channel and the free edge of said flange extension within said channel and engageable therewith.

3. An acoustical ceiling structure composed of individual separable rectangular acoustical panels arranged in laterally spaced rows and positioned edge to edge and in the same plane to form a continuous ceiling, the panels in alternate rows each having at one end edge an upwardly extending flange and at the opposite edge a down-

wardly opening hook engaged over and supported by the flange of the adjacent panel in the same row, said panels in the alternate rows having upwardly extending flanges at the opposite side edges thereof, and the panels in the remaining rows having downwardly opening hooks at the opposite side edges thereof respectively engaged over and supported by the side flanges of the adjacent panels in said alternate rows, said flanges having extensions at right angles thereto, and the panel edges by which they are carried having return bent margins defining channels slidably receiving said flange extensions permitting movement of adjacent connected panels toward one another.

4. The ceiling structure defined in claim 3 wherein the panels in said remaining rows each have at one end edge an upwardly extending flange and at the opposite edge a downwardly opening hook engaged over and supported by the flange of the adjacent panel in the same row, the hook and flange connection between panels enabling one man installation and being effective to maintain the panels in straight rows.

5. The ceiling structure defined in claim 4 wherein said channels open in a direction such that they positively limit movement of connected panels away from one another.

6. The ceiling structure defined in claim 5 having support means for the flanged ends of the panels in alternate rows.

7. In a ceiling structure, a pair of adjacent panels arranged substantially in edge to edge relation in a common horizontal plane, and a connection between adjacent edges of said panels including a horizontally extending supporting portion projecting from one of said panels and having an open return bent portion, an upright flange having an angular extension slidably engaging said open return bent portion, and a horizontally extending supported portion projecting from the other of said panels and having a downwardly opening hook-shaped portion straddling the upper edge of said upright flange.

8. The ceiling structure defined in claim 7, wherein the adjacent panels have front and back facings, and said supporting and supported portions are formed from extensions of said facings.

9. The ceiling structure defined in claim 8 wherein the extensions of said front and back facings of each panel are arranged in surface to surface relation with each other and project laterally from the respective panels in substantially the horizontal plane of the front facing of each panel.

10. The ceiling structure defined in claim 8, wherein the supported portion is provided opposite an edge of the open return bent portion of the supporting portion with an upwardly extending shoulder, and is provided in substantially parallel relation to the upper surface of said open return bent portion with a lateral extension substantially parallel to said front facing.

11. The ceiling structure defined in claim 10, wherein the lateral extension is provided with an upright flange disposed substantially parallel to one side of the upright flange aforesaid, and wherein the upright flange of the lateral extension is return bent to form the downwardly opening hook-shaped portion.

12. The ceiling structure defined in claim 7, wherein the supporting and supported portions extend throughout the length of the adjacent edges of said panels.

13. The ceiling structure defined in claim 7, wherein a T-shaped member projects above and has the stem thereof secured to a side edge of one of said panels, and wherein a clip suspended by a rod from an overhead ceiling structure is connected to said T-shaped member.

14. The ceiling structure defined in claim 7, wherein a T-shaped member projects above and has the stem thereof secured to an edge of one of said panels, and wherein a hanger suspended from an overhead ceiling structure is connected to said T-shaped member.

15. The ceiling structure defined in claim 13, wherein the cross member of the T-shaped member is in off-center relation with respect to the stem thereof.

16. The ceiling structure defined in claim 7, wherein sealing material fills the bight of each hook, and wherein said sealing material cooperates with the upper edge of said upright flange to provide a seal.

17. In a ceiling structure, a pair of adjacent panels arranged substantially in edge to edge relation in a common horizontal plane, and a connection between adjacent edges of said panels including a supporting portion projecting from one of said panels, a member slidably mounted on said supporting portion for movement toward said one panel or the other, and a supported portion projecting from the said other of said panels and having a portion engaging and supported by said member.

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