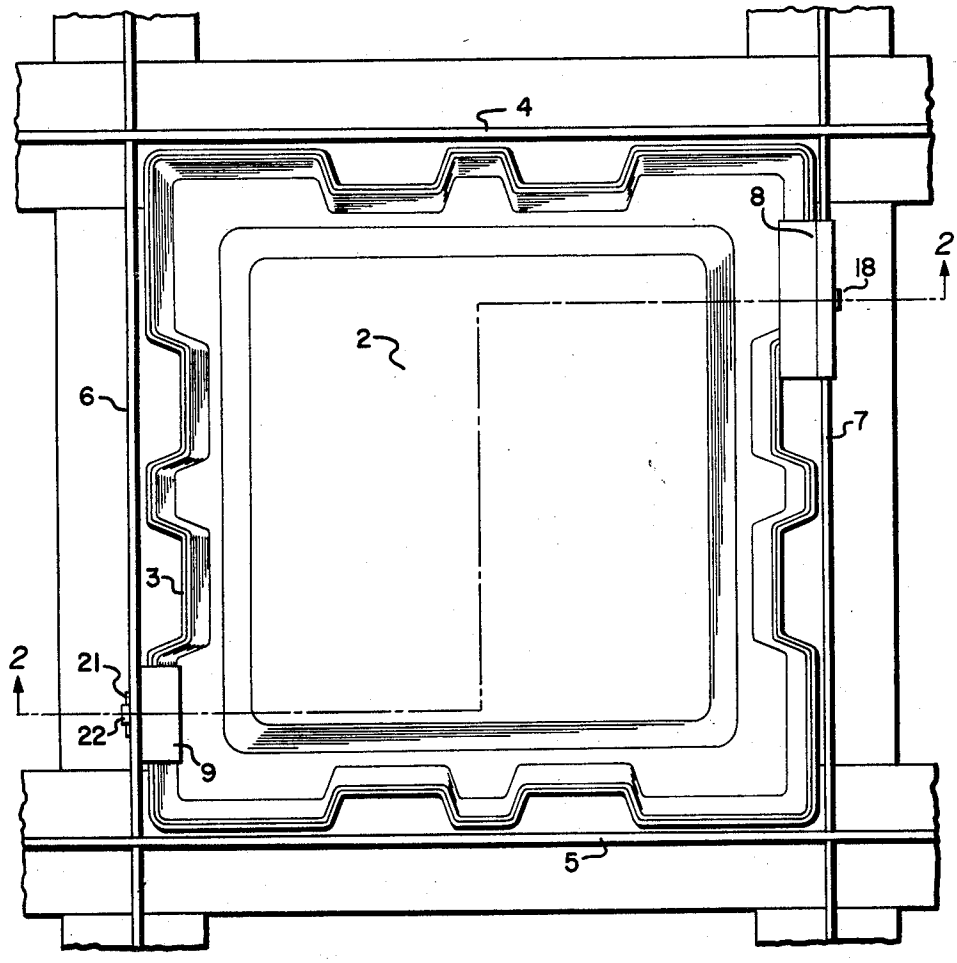
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CEILING STRUCTURE

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Fig. 1



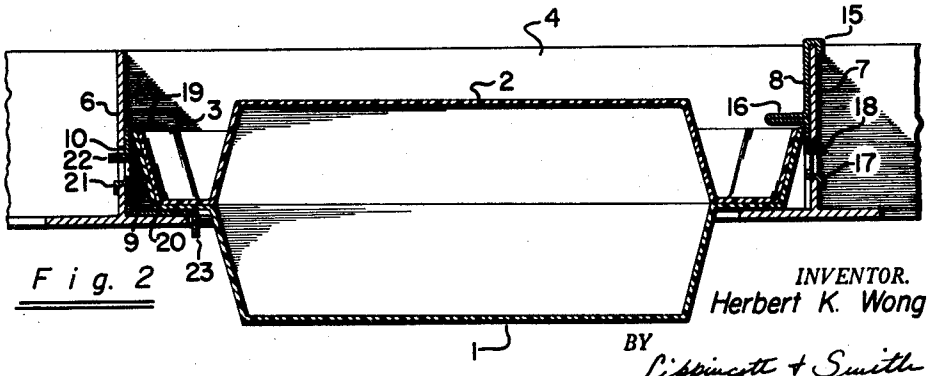


Fig. 2

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Fig. 3

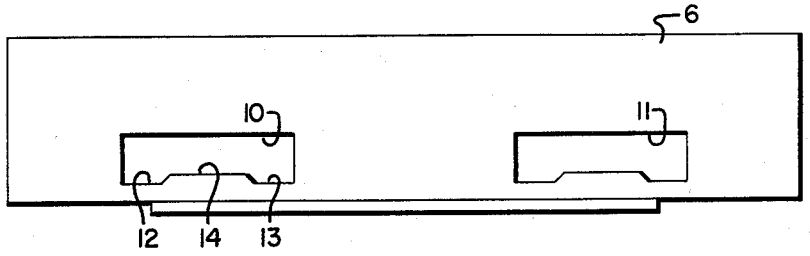


Fig. 4

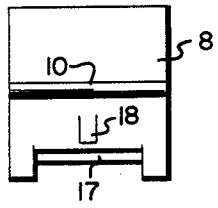


Fig. 5

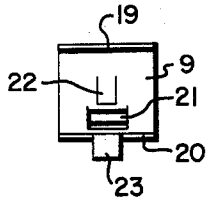
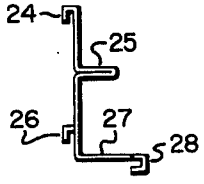


Fig. 6



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CEILING STRUCTURE

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10 Claims. (Cl. 20—4)

This invention relates to ceiling structures consisting of light-weight panels supported by a grid, and in particular to improvements in such structures whereby the panels are securely held in place within the grid but may easily and quickly be removed when desired for cleaning or for other purposes.

In modular ceiling structures, having a plurality of panels arranged side-by-side like tiles to cover a ceiling area, it is often desirable to use light-weight ceiling panels, made from thin embossed sheets of plastic or the like, which may have sound-absorbing properties and which may be translucent for transmitting and diffusing light from lighting fixtures installed above the ceiling. The panels are usually supported by a grid of T-beams or runners having horizontal flanges that underlie and support peripheral portions of the panels.

Because of the light weight of the panels, retaining or "hold-down" means must be provided to prevent upward displacement of the panels by gusts of air or the like. Provisions should be made for releasing or "unlocking" the retaining means to facilitate installation of the panels and to permit quick and easy removal of the panels for cleaning, for replacement of lamps in the lighting fixtures, and for other purposes.

Heretofore, the retaining means in such ceiling structures have been fairly complex and expensive, or have had other disadvantages. Accordingly, a principal object of this invention is to provide an improved modular ceiling structure having panel-retaining members of the utmost simplicity, which are exceptionally inexpensive to manufacture and to install. Other objects and advantages of the invention will appear as the description proceeds.

Briefly stated, in accordance with one aspect of this invention, an improved modular ceiling structure has light-weight panels, each with a periphery containing one or more indentations or notches. The panels are supported by a grid of runners, each having an upstanding web and a horizontal flange that underlies a peripheral portion of a panel for supporting the same. Movable and stationary retaining members are mounted upon the webs of runners located on opposite peripheral sides of the panel, and each of these retaining members has a flange that overlies a peripheral edge of the panel to prevent upward displacement of the panel by air currents and the like. The flange of each movable retaining member can be moved into alinement with a notch in the periphery of a panel, to facilitate installation of the panels and to permit quick and easy removal of the panels when desired.

The invention will be better understood from the following 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 ceiling structure embodying principles of this invention, showing one ceiling panel and the supporting and retaining structure therefor;

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

Fig. 3 is a side elevation of a cross-runner of the same ceiling structure;

Fig. 4 is a side elevation of a stationary retaining member of the same ceiling structure;

Fig. 5 is a side elevation of a movable retaining member of the same ceiling structure; and

Fig. 6 is an end elevation showing an alternative movable retaining member.

Referring now to the drawings, and in particular to Figs. 1 and 2, a ceiling panel consists of two parallel nested embossed sheets, 1 and 2, preferably made of light-weight plastic material. Sheets 1 and 2 may be translucent for transmitting and diffusing light from lighting fixtures (not shown) mounted above the ceiling structure, or, if light transmission is not desired, sheets 1 and 2 may be opaque. Flat peripheral portions of sheets 1 and 2 are in contact, as shown, while central portions thereof are embossed outward to provide an air chamber that enhances the sound-absorbing characteristics of the panel and also improves the light-diffusing properties. If desired, one of the sheets 1 and 2 may be omitted, in which case the panel will consist of a single plastic sheet. Furthermore, within the scope of broader principles of this invention, panels of other materials such as conventional acoustic tile may be employed.

Sheets 1 and 2 have nested upstanding peripheral flanges, as shown, which strengthen the periphery of the panel and have other purposes that will become apparent as the description proceeds. These flanges are indented, as shown, to form one or more notches 3 in the periphery of the panel. Only one notch 3 is essential, but preferably each of the four peripheral sides of the panel has a pair of such notches, positioned symmetrically with respect to the center of that panel side, so that the panel may be installed in any desired position. The periphery of the panel preferably is square, and it may be of any desired size. According to the scale of the drawings, the panel illustrated is about eight inches square, but in practice larger panels are generally used. Most frequently in practice, each panel is about twenty-four inches square, and in some cases the panels may be forty-eight inches square, or larger. Panels that are not square, and in particular rectangular panels that are longer than they are wide, may also be used in some instances.

The panel is supported by a rectangular grid consisting of parallel main runners 4 and 5 and cross-runners 6 and 7 extending perpendicular to the main runners. Consequently, each panel is supported by four runners. Any desired number of panels and runners may be employed to form a modular ceiling structure covering any desired ceiling area. The cross-runners may be attached to the main runners by any suitable means (not shown). The grid of runners is supported by conventional hangers or wires attached to portions of the building.

Each of the runners is an inverted T-beam having an upstanding web and horizontal flanges integral therewith and perpendicular thereto. Flanges of the four runners supporting each panel are in a common plane and underlie and support the periphery of the panel. The panel may be installed from below the grid by inserting it diagonally edgewise through the opening between the four runners, then turning the panel flat so that its periphery lies upon the runner flanges. Although the weight of the panel tends to hold it in place, because the panel is very light it may be displaced upward by a gust or current of air in the room. Consequently, retaining means are required to prevent such upward displacement of the panel after it is installed in place, while permitting easy removal of the panel when such is desired for cleaning the panel or other purposes.

In a preferred embodiment of this invention, the retaining means for the panel consist of a stationary retaining member **8** mounted on cross-runner **7**, and a movable retaining member **9** mounted on cross-runner **6**. Alternatively, both retaining members may be of the movable type. If desired, retaining members **8** and **9** may be mounted on the main runners **4** and **5** instead of on the cross-runners **6** and **7**, or more than two retaining members may be used. The two retaining members have flanges that overlie opposite peripheral side portions of the panel, thereby holding the panel securely in place and preventing upward displacement thereof. Retaining member **9** is movable lengthwise to a certain extent along runner **6**, so that its upper flange, which is smaller than notch **3** in the panel periphery, can be brougth into alinement with notch **3** for easy installation and removal of the panel.

A side elevation of cross-runner **6** is shown in Fig. 3, and cross-runner **7** is identical thereto. The web of each cross-runner contains two horizontal slots **10** and **11** that are used in attaching the retaining members to the cross-runners. Slots **10** and **11** are identical, and preferably are symmetrically placed relative to the center of the cross-runner. Each cross-runner has two slots so that two retaining members may be attached thereto, the two retaining members being generally placed on opposite sides of the web for retaining two panels on opposite sides of the runner. Since each side of the panel has two symmetrically positioned notches, either retaining member may be attached through either of the symmetrically positioned slots **10** and **11**. Slot **10**, which is identical to slot **11**, has a straight horizontal upper edge, and has a lower edge consisting of two flat depressions **12** and **13** at opposite ends of the slot between a higher flat portion or plateau **14**, as shown. Preferably the sides of plateau **14** are slanting or oblique.

The stationary retaining member **8** is best shown in Figs. 1, 2 and 4. The stationary retaining member is punched from a single sheet of metal and is bent into the shape shown. Major portions thereof are flat, coplanar and vertical, and when installed are adjacent to and in contact with a side of the runner web, as is best shown in Fig. 2. A lengthwise portion **15** at the top of the stationary retaining member is folded outward, away from the panel, and when installed extends over the top and down the opposite side of the runner web, as shown. A longitudinal folded portion of the retaining member is bent inward, toward the panel, perpendicular to the vertical portions and forms a horizontal flange **16** that overlies a peripheral portion of the ceiling panel. A tab **17**, offset outward from a vertical portion at the bottom of retaining member **8**, extends through a horizontal slot of the web and down the opposite side of the web. Just above tab **17** in the same vertical portion, there is a U-shaped cut forming another tab **18** that is bent outward through the slot of the web after installation of the retaining member to hold the retaining member securely in place.

Preferably, all portions of retaining member **8** except tab **18** are bent to the shapes shown before the retaining member is mounted on the runner. Installation of the retaining member on the runner is accomplished by inserting tab **17** through one of the horizontal slots **10** and **11** in the runner web, so that the major vertical portions of member **8** are in contact with one side of the web, and then pressing the retaining member downward so that tab **17** and the folded portion **15** firmly engage the opposite side of the web to hold the retaining member in place. Tab **18** is then bent through the horizontal slot in the web, and is adjacent to the upper edge of the slot. This prevents substantial upward movement of the retaining member relative to the web, and thus securely attaches it to the runner.

Tab **17** preferably is substantially equal to length to each of the horizontal slots **10** and **11**, so that retaining member **8** is substantially stationary on the runner after it has been installed, although tab **17** may be somewhat shorter, if desired. Since tab **18** can be bent through the slot simply by pressing upon this tab with a screwdriver or the like, mounting of the retaining member upon the cross-runner is easily accomplished at the construction site. The construction of the retaining member is exceptionally simple and inexpensive, since it is merely punched and bent from a single sheet of metal.

Movable retaining member **9** is best shown in Figs. 1, 2 and 5. This member also is punched from a single sheet of metal and bent to the shape shown. A vertical portion of member **9** is adjacent to and in contact with one side of the web of runner **6**, as is best shown in Fig. 2. The top portion of member **9** is bent inward toward the panel to form an upper horizontal flange **19** that overlies a peripheral side portion of the ceiling panel, while the bottom portion of member **9** is bent inward to form a lower horizontal flange **20** that underlies the peripheral portion of the ceiling panel and lies immediately above the horizontal flange of runner **6**. A tab **21** is offset outward from the vertical portion of member **9** and extends through slot **10** in the runner web and down the opposite side of the web, thereby attaching retainer member **9** to runner **6**. Immediately above tab **21** in the vertical portion there is a U-shaped cut forming a tab **22** that is bent outward through slot **10** when the retaining member is installed on the runner.

To install retaining member **9**, tab **21** is inserted through slot **10**, with the vertical portion of member **9** in contact with a side of the runner web, and the retaining member is pressed downward until tab **21** engages the opposite side of the runner web. Tab **22** is then bent outward through the slot **10**, adjacent to the upper edge of the slot. This prevents substantial upward movement of the retaining member, and thus prevents its accidental removal from the runner. The length of tab **21** is considerably smaller than the slot **10**, so that retaining member **9** can be moved lengthwise along the runner **6**. A depending tab **23**, bent downward from the end of flange **20**, extends below the horizontal runner flange, and thus provides a convenient means for moving retaining member **9** lengthwise along the runner.

The length of tab **21** is substantially equal to the length of flat depressions **12** and **13** at opposite ends of slot **10**. When tab **21** rests in depression **12**, flange **9** overlies a peripheral portion of the ceiling panel and locks the panel in position. When tab **21** rests in depression **13**, flange **9** is alined with notch **3** so that the panel can be pushed upward to remove it from the supporting grid. The plateau **14** between depressions **12** and **13** prevents accidental movement of member **9** from its "locked" position to its "unlocked" position, since the combined weight of member **9** and the ceiling panel resting upon flange **20** tends to hold tab **21** within depression **12**. However, the retaining member can easily be moved to its unlocked position by a slight pressure upon tab **23**, whenever such is desired. This movement is facilitated by the slanting sides of plateau **14**.

An alternative form of the removable retaining member is shown in Fig. 6. This member, also punched from a single sheet of metal, has a folded upper portion **24** that engages the top of the runner web in the same manner as does the folded portion **15** of retaining member **8**. An upper horizontal flange that overlies the peripheral portion of the ceiling panel is formed by a lengthwise fold **25**, as shown. Offset tab **26** extends through the slot **10** in the same manner as the tab **21** of member **9**. Lower flange **27** underlies a peripheral portion of the ceiling panel and lies just above the horizontal flange of the cross-runner. A depending tab **28** may be folded under the horizontal flange of the runner to assist in holding the retaining member in place on the cross-runner.

It should be understood that this invention in its broader aspects is not limited to specific embodiments 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. A ceiling structure comprising a ceiling panel having a periphery containing a notch, a grid of runners having horizontal flanges and upstanding webs, said runner flanges underlying and supporting the periphery of said panel, and a retaining member attached to and movable lengthwise along the web of one of said runners, said retaining member having a flange overlying the periphery of said panel for holding the panel in place, said flange of the retaining member being smaller than said notch so that said panel can be removed when said member is moved to a position where said retaining member flange is alined with said notch.

2. A ceiling structure comprising a panel having a rectangular periphery, said periphery having a first side containing a notch and a second side opposite said first side, a rectangular grid of runners each having a horizontal flange and an upstanding web, said runner flanges underlying and supporting the periphery of said panel, a stationary retaining member mounted on one of said runners, said stationary member having a flange overlying said second peripheral side of the panel, a movable retaining member mounted on another of said runners, said movable member having upper and lower flanges respectively overlying and underlying said first peripheral side of the panel, whereby said panel is held in place, said upper flange being smaller than said notch, said movable member being attached to and movable lengthwise along the web of a runner so that said upper flange can be brought into alinement with said notch, whereby said panel can be removed, said lower flange lying immediately over the runner flange, and a tab depending from said lower flange for moving said movable member.

3. A ceiling panel comprising two parallel nested sheets having flat rectangular peripheral portions in contact with each other and having outwardly embossed central portions, said sheets having nested upstanding peripheral flanges, said flanges being indented to form a notch in a peripheral side of the panel.

4. In a supporting structure for ceiling panels, the combination comprising a runner having a horizontal flange and an upstanding web, said web containing a horizontal slot, and a retaining member having a vertical portion and a horizontal flange, said vertical portion being adjacent to one side of said web and having an offset tab extending through said slot and engaging the other side of said web to attach said retaining member to said runner.

5. In a supporting structure for ceiling panels, the combination comprising a runner having a horizontal flange and an upstanding web, said web containing a horizontal slot, and a retaining member having a vertical portion and a horizontal flange, said vertical portion being adjacent to one side of said web, said vertical portion having upper and lower tabs extending through said slot, said upper tab being adjacent to the upper edge of said slot and said lower tab being bent over the lower edge of said slot and extending downward adjacent to the opposite side of said web.

6. In a supporting structure for ceiling panels, the combination comprising a runner having a horizontal flange and an upstanding web, said web containing a horizontal slot, and a retaining member having upper and lower vertical major portions adjacent to one side of said web, the top of said upper vertical portion being folded over the top of said web into engagement with the opposite side thereof, a tab offset from said lower vertical portion extending through said slot and engaging the opposite side of said web, and a longitudinal folded portion between and bent perpendicular to said vertical portions to form a horizontal flange.

7. In a supporting structure for ceiling panels, the combination comprising a runner having a horizontal flange and an upstanding web, said web containing a horizontal slot, and a retaining member having a vertical portion and a horizontal flange, said vertical portion being adjacent to one side of said web and having an offset tab extending through said slot and engaging the other side of said web to attach said retaining member to said runner, the length of said tab being smaller than the length of said slot, whereby said retaining member is movable lengthwise along said runner.

8. A panel-retaining member for ceiling structures, consisting of a one-piece metal sheet having a flat portion and a horizontal flange bent perpendicularly thereto, having an offset tab bent out from said flat portion on the side thereof opposite said flange, and having a U-shaped cut in said flat portion between said tab and said flange.

9. A panel-retaining member for ceiling structures, consisting of a one-piece metal sheet having two coplanar substantially flat portions, and having a longitudinal folded portion between and bent perpendicular to said flat portions to form a flange, one of said flat portions having a folded edge, the other of said flat portions having an offset tab, said folded edge and said offset tab being bent out from said flat portions on the side thereof opposite said flange.

10. A panel-retaining member for ceiling structures, consisting of a one-piece metal sheet having two parallel flanges bent substantially perpendicular to and on the same side of a flat portion therebetween, said flat portion having an offset tab bent out from the side thereof opposite said flanges, said flat portion having a U-shaped cut between said tab and one of said flanges.

References Cited in the file of this patent

UNITED STATES PATENTS

683,799	Reavis	Oct. 1, 1901
923,156	Downie	June 1, 1909
999,509	Lydon	Aug. 1, 1911
1,161,316	Jones	Nov. 23, 1915
1,644,940	Moyer	Oct. 11, 1927
1,707,008	Havemeyer	Mar. 26, 1929
1,975,002	Heerwagen	Sept. 25, 1934
1,978,632	Hoff	Oct. 30, 1934
1,997,580	Gibson	Apr. 16, 1935
2,009,512	Offutt	July 30, 1935
2,027,004	Stewart	Jan. 7, 1936
2,157,316	Arkus	May 9, 1939
2,569,941	Mastrangelo et al.	Oct. 2, 1951
2,728,595	Wong	Dec. 27, 1955