Sept. 24, 1968 T. C. HALFAKER 3,402,517

CEILING AND SUSPENSION AND LEVELING MEANS THEREFOR

Filed Oct. 3, 1967 2 Sheets-Sheet 1

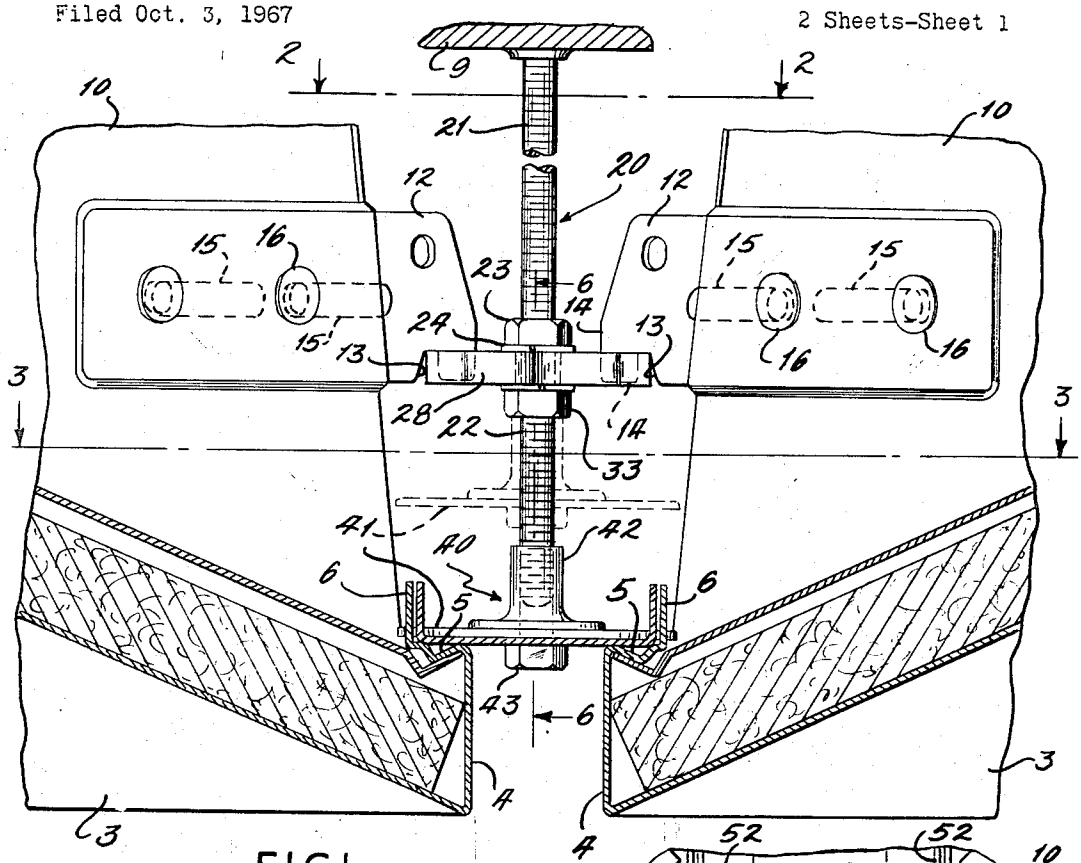

FIG. 1

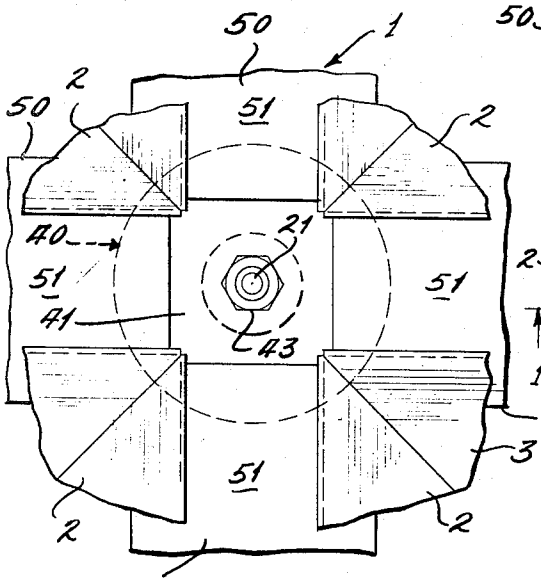

FIG. 5

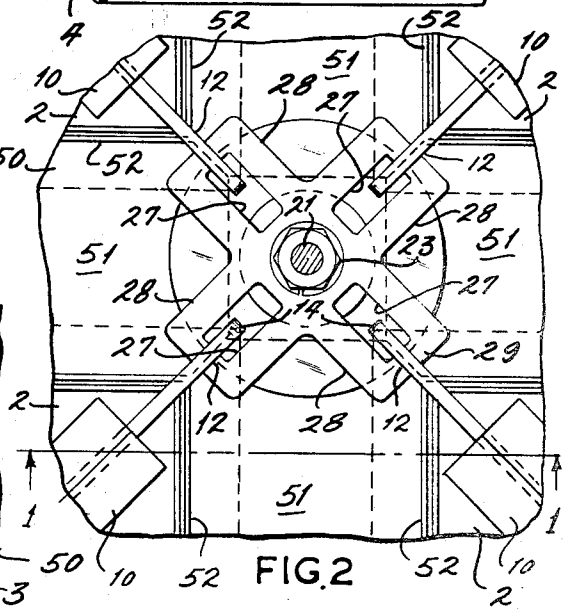

FIG. 2

INVENTOR:
THOMAS C. HALFAKER
BY
ATTORNEY.

Sept. 24, 1968 T. C. HALFAKER 3,402,517

CEILING AND SUSPENSION AND LEVELING MEANS THEREFOR

Filed Oct. 3, 1967 2 Sheets-Sheet 2

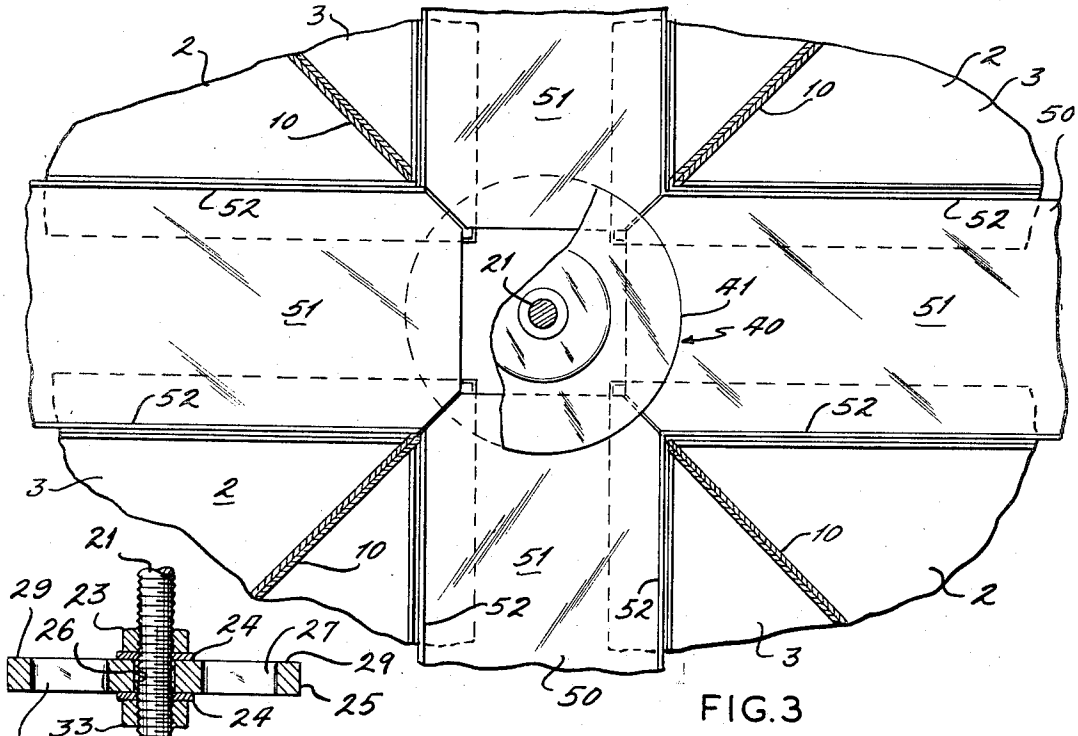

FIG.3

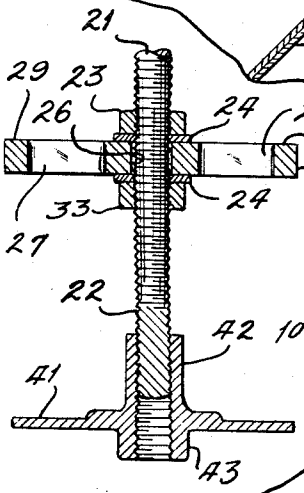

FIG.6

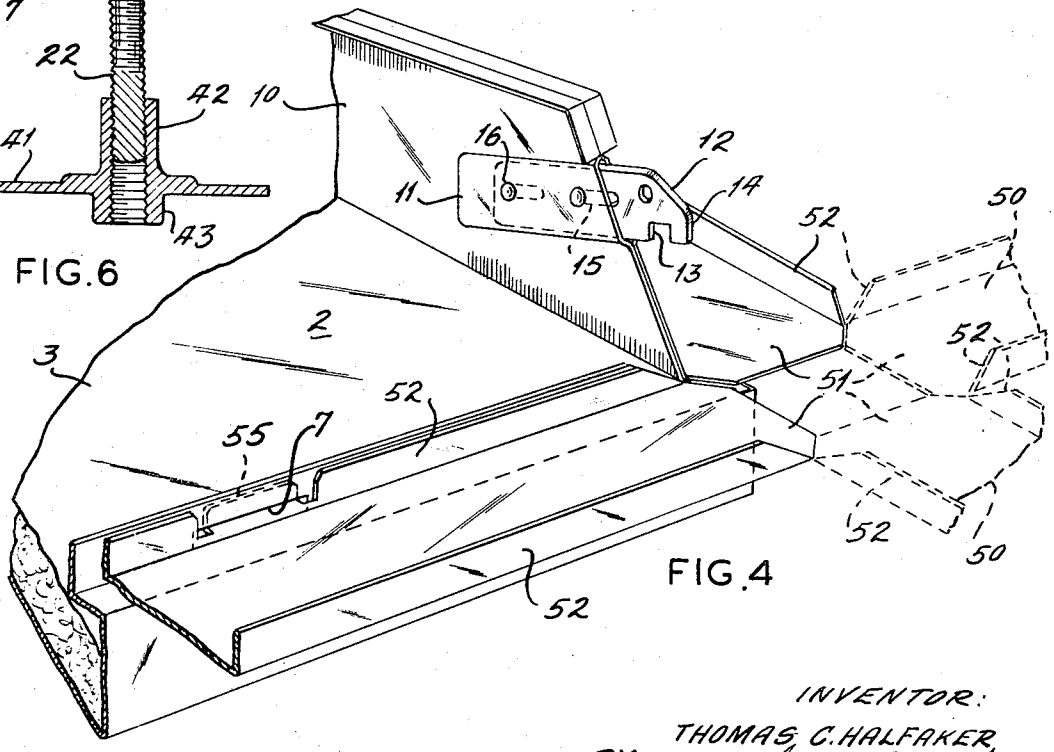

FIG.4

INVENTOR:
THOMAS C. HALFAKER
BY
ATTORNEY.

United States Patent Office 3,402,517 Patented Sept. 24, 1968

3,402,517

CEILING AND SUSPENSION AND LEVELING MEANS THEREFOR

Thomas C. Halfaker, St. Louis County, Mo., assignor to Emerson Electric Co., St. Louis, Mo., a corporation of Missouri

Filed Oct. 3, 1967, Ser. No. 672,510
5 Claims. (Cl. 52—126)

ABSTRACT OF THE DISCLOSURE

In a ceiling made up of a multiplicity of ceiling modules each with hook shaped mounting brackets above a shoulder, the hook shaped brackets being slidably mounted on the module, a threaded hanger rod supported at its upper end on a permanent structure has mounted on it a mounting bracket of cruciform shape with a seat in each of four arms and a clearance hole at its center, a hook of each of four modules seating in the bracket seats, the bracket serving to space the four modules from one another. A plate threadedly mounted on the hanger rod by means of a long internally threaded hub below the bracket and adapted to be screwed down to the level of the modules' shoulders, a part of the internally threaded plate hub extending below the lower end of the threaded rod to provide a downwardly opening threaded socket. Closure strips bridging between shoulders of adjacent modules, the bridging web of closure strips between different pairs of modules projecting beneath and being engaged by the plate.

Background of the invention

In suspending ceilings in modern commercial buildings, it is common to hang T rails with wires, straps or rods depending from a permanent supporting structure and to support lighting fixtures either on the T rails, or independently of the T rails, by means of similar rods or straps, each fixture being mounted independently of every other fixture.

In a new type of ceiling, made up of largely self-contained module units, sometimes called prefabricated ceiling sections, an example of both ceiling and units being described in a U.S. patent application of Quin and Garnet, Ser. No. 489,312, now Patent No. 3,372,270, several new problems have arisen. Such a ceiling is made up of a multiplicity of separate modular units with a space between each of the units. This requires some kind of spacing means, and makes it important to provide some simple means for leveling modular units with respect to one another. It also provides a problem of bridging the space between modules in those areas in which the space does not serve as a part of the air system, and of masking the opening at the meeting corners of four modular units.

It provides a problem of accommodating expansion and contraction of relatively large metal units.

Such a construction also makes desirable some means for preventing upward displacement of the modular units in response to a change of pressure, or, in those instances where the space between modular units is utilized as a partition channel, during the installation and removal of partitions.

One of the objects of this invention is to provide, in a ceiling made up of modular units, a hanger assembly which serves to maintain the modular units in spaced relation, to mask an opening at meeting corners of the modular units, and to provide a simple means for leveling the modules with respect to one another.

Another object is to provide a ceiling and hanger assembly which accommodates expansion and contraction of the units of which it is composed.

Still another object is to provide a simple, readily available supportive system for suspending or steadying objects in the work space below the ceiling.

Other objects will become apparent to those skilled in the art in the light of the following description and accompanying drawings.

Summary of the invention

In a ceiling made up of modules each having a hook member spaced above a shelf-defining flange at a corner of the module, the present invention comprises a hanger assembly including a rod or shank adapted to be mounted at an upper end on a supporting structure, a module hook-engaging member, adapted to receive the hooks of a plurality of modules, mounted intermediate the ends of the shank, and a plate vertically adjustably mounted on the shank below the hook-engaging member and above the flanges of the modules when the modules' hooks engage the hook-engaging members. Preferably, the shank is threaded, and the hook-engaging member is threadedly mounted for adjustment vertically. The plate is preferably provided with a relatively long, internally threaded hub, with a part extending a substantial distance above the upper surface of the plate, so that a substantial section of the hub is threadedly engaged with the shank while a substantial axial length of the hub is below and out of treaded engagement with the shank, to provide a downwardly opening threaded socket in the hub. This socket can be utilized in installing partitions or suspending any sort of object below the ceiling defined by the modules.

The hook engaging member is preferably cruciform in plan, with hook-receiving seats or apertures so arranged as to hold the modules in predeterminedly spaced relationship to one another, and has a clearance hole in its center to permit some lateral accommodation during installation of the modules.

Bridging pieces or closure strips are preferably provided, in the form of a channel with a central, bridging web, each of the closure strips of four modules supported at one corner by a single hanger terminating to leave an opening at the meeting corners of the modules, which opening is closed by the plate. The plate is so arranged as to engage the projecting bridging web of all of the bridging pieces. The module hook members are slidably mounted on the modules to accommodate limited movement in one degree of freedom, to accommodate expansion and contraction.

Brief description of the drawing

In the drawing,

FIGURE 1 is a sectional view, taken along the line 1—1 of FIGURE 2, showing one illustrative embodiment of ceiling and hanger system of this invention;

FIGURE 2 is a sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a sectional view, partly broken away, taken along the line 3—3 of FIGURE 1;

FIGURE 4 is a fragmentary view in perspective showing a corner of a single module with closure strips;

FIGURE 5 is a fragmentary bottom plan view corresponding to the view shown in FIGURE 3; and

FIGURE 6 is a sectional view taken along the line 6—6 of FIGURE 1.

Description of the preferred embodiment

Referring now to the drawing for one illustrative embodiment of ceiling and suspending and leveling assembly of this invention, reference numeral 1 indicates a ceiling

of indeterminate extent, made up of ceiling modules 2 spaced from one another and suspended from a permanent structure 9 by a hanger assembly 20.

Each of the modules 2 which, in the present commercial embodiment, are approximately five feet square, is framed with panels 3. An upstanding marginal flange 4 is integral with each panel 3 along the lower edge of the panel. The upper edge of the flange 4 is bent re-entrantly to define a recessed shelf 5 and an upwardly extending lip 6. The panels 3 of each module meet at four corners. A spine 10 extends along the meeting edges of the panels at each corner.

In this embodiment, each spine is made up of two pieces, each integral with one panel, and welded or otherwise secured to form the unitary spine. Near their outer edges, about midway in their height, the two pieces making up the spine are embossed outwardly with respect to one another to form an outwardly opening pocket 11 which receives a part of the body of a mounting hook 12. The mounting hook 12 is an elongated flat piece of sturdy metal, with a notch 13 in its lower edge, near its outer edge. The notch 13 is defined at its outer side by a nose 14. The notch 13 and nose 14 are positioned outside the pocket 11. Within the pocket 11, the hook 12 is provided with elongated slots 15, through which rivets 16, headed on the two sides of the pocket 11, extended.

The hook 12 is slidable within the pocket 11, the extent of the movement of the hook being limited by the length of the slots 15.

The hanger assembly 20, upon which the modules 2 are suspended, includes a hanger rod 21 adapted in any conventional way to be suspended at its upper end, from the permanent structure 9 and having through a substantial distance beginning at its lower end, a threaded section 22. In the illustrative embodiment, the rod is threaded throughout its length, and its upper end is screwed into an internally threaded boss of a fixed plug 11. An upper bracket nut 23 is threaded on the section 22 above a cruciform hook-receiving rest 25. The rest 25 has a clearance hole 26 in its center, through which the rod 21 passes, and four slots 27, one in each of arms 28. The arms 28 lie in quadrants, so that the long axes of successive slots lie at right angles to one another.

A lower mounting bracket nut 33 is threaded on the section 22 below the rest 25. The nuts 23 and 33 have lock washers 24 between them and the rest 25, and are screwed tight to hold the rest 25 between them. Below the rest 25, a closure assembly 40 is threadedly mounted upon the threaded section 22. The closure assembly 40 includes a closure plate 41, an elongated heavy hub section 42 and a polygonal head 43. The hub section 42 and head 43 have an axially extending passage through them which is internally threaded complementarily to the threaded section 22. The hub, plate and head can be made in one piece, or fabricated of separate parts, but they form a unitary assembly. The plate is preferably circular, and has a clearance hole in its center concentric with the passage through the hub and head.

As shown particularly in FIGURES 1 and 2, a corner of each of four modules is suspended on a single hanger assembly. The nose 14 of each hook member 12 projects into a slot 27 of the rest 25, the notch 13 receiving a crossbar 29 of the rest.

The dimensions of the rest and hook members are such as to insure that the modules are spaced from one another. The space between adjacent modules is bridged adjacent the meeting corners of the modules by channel-shaped closure strips 50. Each of the closure strips 50 has a central web 51 and side walls 52. At the outer end of each strip, the side walls are cut away, to permit the web 51 to project a short distance beyond the side walls. The projecting end of the web 51 is mitered at its corners complementarily to contiguous closure strips, as shown in FIGURE 4.

The outer edges of the closure strips 50 rest on parallel

shelves 5 of adjacent modules. In the embodiment shown, one of the side walls 52 is lanced out to form a hinge finger 55, which extends through a slot 7 in one lip 6 of a module. The lips 6 of all of the modules may be provided with finger-receiving slots 7, but the closure strip should be lanced to form hinge fingers 55 on only one side.

The closure strips can be made of any desired length, from the full length of one panel of the module to a short section adapted to serve as an air passage end defining wall or a seat for one edge of an air diffuser, for example. In any event, it is preferable to have a hinge finger and hinge finger receiving slot within the reach of the closure strip, no matter how short it is. In the case of a long closure strip, this will permit the use of two such hinge arrangements, one at each end, but both on one side.

As shown particularly in FIGURE 1, the rod 22, the shelf 5 and the hook members 12 are so proportioned and arranged as to permit the plate 41 to be screwed down on top of the projecting ends of the webs 51 of the closure strips 50. As can be seen in FIGURE 1, the elongated hub section permits the hub to engage the end of the rod at its screwed down position, while the head 43 and a portion of the hub passage lie well below the lower end of the rod. This provides in effect, a threaded, downwardly opening socket.

In the installation of a ceiling incorporating this invention, the positions of the hangers 20 are determined in the usual manner, laid out on five foot centers in the case of the present commercial embodiment. The rods 21 are then installed, and the rests 25 mounted level with one another. The level of the rest is determined by the position of the upper nut 23. The lower nut 33 is preferably not yet tightened, though it is run up to hold the rest lightly against the upper nut lock washer. The closure assemblies 40 are then threaded on to the free ends of the rods 21, and run up to the position shown in broken lines in FIGURE 1, immediately below the lower mounting bracket nut 33. This provides sufficient clearance for the hooks to be put into position on the rest 25. Preferably, two, diagonally opposite modules are hung first, orienting the rest and permitting the rest to shift to accommodate to any slight misplacement of the rods. The lower nut 33 is then tightened. The closure strip 50 can be hinged to the lip 6 of one of the modules of each adjacent pair before the modules are hooked to the rest. When all four of the modules have been mounted on the rest, the closure strips 50 are laid flat on the edges of the shelves 5 if they are not already there, and the closure assembly 40 is screwed down the threaded section 22 to the position shown in full lines in FIGURE 1, either by hand or by means of a deep throated socket wrench or the like. The plate 41 bears on the upper surface of the webs of all four closure strips, holding the closure strips in position, closing the opening defined by the ends of the closure strips, clamping the modules firmly between the shelves and the hooks, so as to prevent any upward displacement of the modules in response to a sudden decrease in pressure above the modules, for example, and providing an internally downwardly opening socket for the reception of partition stabilizing studs, hanger rods or hooks or the like.

Under any one set of stable conditions, the relative positions of the modules, and their orientation with respect to the hangers is fixed. However, with metal structures of the size of the modules, change in temperature, for example, such as may be generated by the heat of lighting fixtures, will cause a substantial change in the dimensions of the modules. The sliding arrangement of the hooks 12 in the pockets 11, and the flat and snug but not distortingly tight engagements of the plates 41 and webs 51, permits the modules to accommodate themselves without buckling or tearing.

Numerous variations in the construction of the ceiling and suspension assembly of this invention, within the scope of the appended claims, will occur to those skilled

in the art in the light of the foregoing disclosure. For example, the external configuration of the rest can be changed, and the slots which, in the present embodiment run all the way through, can be given the form of wells. The plate **41** could be made polygonal rather than circular. The slots could be provided in the walls of the pocket **11** rather than in the hooks, and the configuration of the shelves and closure strips can be varied. These are merely illustrative.

Having thus described the invention, what is claimed and desired to be secured by Letters Patent is:

1. In a ceiling comprising modules having hook members spaced above shelf-defining flanges, the improvement comprising a hanger comprising a shank adapted to be mounted at its upper end on a supporting structure, a module hook-engaging member mounted intermediate the ends of said shank, and a plate, vertically adjustably mounted on the shank below the hook-engaging member and above the said flanges when the module hooks engage the hook-engaging members.

2. In a ceiling comprising four square modules arranged to define a square ceiling area, parallel sides of adjacent modules spaced from one another to define a gap between them, each of said molules having hook members and shelf-defining flanges below said hook members, the improvement comprising bridging pieces extending between and projecting laterally over the shelf-defining flanges and ending short of end-to-end abutment with one another, and a hanger comprising a shank adapted to be mounted at its upper end on a supporting structure, a module hook-engaging member, upon which hooks of all four modules are supported, mounted intermediate the ends of said shank, and a plate, vertically adjustably mounted on the shank below the hook-engaging member and above the ends of the bridging pieces, said plate bearing upon the ends of said bridging piece.

3. The improvement of claim **1** wherein the shank of the hanger is threaded between the module-hook engaging member and its lower end, and the plate has an internally threaded, axially elongated hub extending a substantial distance above the upper surface of the plate, whereby a supportive section of the hub is threadedly engaged with the shank while a substantial axial length of hub is below and out of threaded engagement with said shank, whereby a downwardly opening threaded socket is provided in said hub.

4. In a ceiling comprising ceiling module units each having a hook member at each of four corners, spaced above shelf-defining flanges, the improvement comprising means for mounting said hook members on said module slidably in one degree of freedom through a limited distance, and a hanger comprising a shank adapted to be mounted at its upper end on a supporting structure, a module hook-engaging member mounted intermediate the ends of said shank, and a plate, vertically adjustably mounted on the shank below the hook-engaging member and above the said flanges when the module hooks engage the hook-engaging members.

5. The improvement of claim **4** wherein bridging means are provided, extending between and projecting laterally over the shelf-defining flanges and ending short of end-to-end abutment so as to leave a space between their ends, and said plate being proportioned and arranged to be adjustable downwardly on said shank to bear upon the ends of all of said bridging means.

References Cited

UNITED STATES PATENTS

2,725,126	11/1955	Ely	52—508
3,014,564	12/1961	Thomsen	52—484 X
3,372,270	3/1968	Quin et al.	240—9

FOREIGN PATENTS

1,206,967	1960	France.

JOHN E. MURTAGH, *Primary Examiner.*