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(54) **STRUCTURALLY INTEGRATED ACCESSIBLE FLOOR SYSTEM**

KONSTRUKTIV INTEGRIERTES, ZUGÄNGLICHES BODENSYSTEM

PLANCHER ACCESSIBLE A STRUCTURE INTEGREE

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EP 1 407 089 B1

Description

TECHNICAL FIELD

[0001] The present invention relates to floor structures, and more specifically to a floor assembly having removable access panels supported on a grid that is supported on a plurality of primary and secondary structural supports.

BACKGROUND OF THE INVENTION

[0002] The increase in the use of computers, communication devices, and other electronic hardware has placed new demands on building designers. Users desire a large number of outlets for access to electrical power and communication signals, and they need the ability to change the location of such outlets on a regular, sometimes weekly basis. Power and data outlets have been located in, or under, a floor, typically in removable floor sections elevated above the original floor by supports. Two typical types of elevated floors are the pedestal floor and the low-profile floor.

[0003] The pedestal access floor has pedestals that consist of metal rods with a base plate at one end and a supporting plate on the other that supports removable horizontal panels, thus forming a raised floor structure. The metal rods are height adjustable and rest on a conventional solid floor deck. The solid floor deck may be made of wood, concrete, or a combination of metal deck and a concrete topping slab. The rods are arranged in a grid, typically square. The rods and plates support removable floor sections. The height of the rods is typically about 18 inches (1 inch = 2,54 cm) and can be adjusted to a desired height prior to installing the floor sections. Electrical power and data cables are laid between the solid floor deck and the underside of the floor sections. The cables penetrate the floor sections at a desired location to suit the user's needs. The penetrations may consist only of cables, or may be a junction box, similar to a common electrical wall outlet. The penetrations may accommodate power wires, or signal cables such as cable television, speaker wire, computer networks, etc. In some designs, the space between the floor deck and the elevated floor sections is enough to enable the distribution of conditioned air through grilles and/or registers located in selected floor sections. Because it is relatively expensive, this system is generally used where accommodation must be made for changes in elevation of the floor. US 3396501 describes an elevated floor system of grounded metal panels.

[0004] There is a labor premium involved in having to locate and install the foregoing pedestal system. The pedestals must be braced to meet seismic code, further increasing labor and cost. Moreover, the pedestals increase ceiling height requirements, and ultimately the height of the building, which increases the area of the exterior envelope, thereby increasing not only construction costs but also operating costs due to heat loss. If the pedestal access floor is only used in parts of a building, ramps or structural accommodations must be made for the changes in floor elevation. As users re-route electrical cables below the access floor, the pedestals may present an impediment in pulling cables to a new location. The access floor also represents another step in the construction schedule. The acoustical properties of this system are poor. The floor sections are usually relatively thin and rigid and transmit sound both horizontally and vertically.

[0005] The second type of elevated floor is a low-profile design, which may be roughly 2% inches to 4 inches high. This design does not use pedestals to raise and support the floor sections, but rather relies on "feet" at the corners of the sections to create the space above the solid floor deck and below the underside of the panel. The panels, with low "feet," rest directly on the floor deck. This low-profile design is less costly than the pedestal floor, but still impacts the cost of a traditionally designed floor in a building because it requires the use of a solid floor deck. The problem of elevation changes between the existing conventional floor and accessible floor also remains.

[0006] There are also disadvantages to the low-profile floor compared to the pedestal floor. The space below the low-profile sections is not deep enough to be used to supply pair. The resulting floor is not as stable, in either the horizontal or vertical dimension, as the pedestal access floor described above. Since the sections are not fastened to the floor deck, they can move when cable is being pulled and re-routed. It also increases the floor-to-floor height of the building, and thus the construction and operating costs. In general, the smaller distance between the solid floor deck and the surface of the floor sections decreases the flexibility of the low-profile floor. Both types require an underlying solid floor deck for support and to provide structural stability to the exterior building.

[0007] In addition, the acoustical characteristics of both common types of elevated floors are typically very poor. They tend to transmit noise to a degree that makes them impractical for use in many environments.

[0008] US 3583121 describes a rigid reticulated bar joist system for supporting a floor.

SUMMARY OF THE INVENTION

[0009] The present invention provides a floor system according to claim 1.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Figure 1 shows an isometric view of a section of the floor system formed in accordance with one embodiment of the present invention;

Figure 2 shows a detail of an example of a structural support grid element of the floor system;

Figure 3 is a cross-sectional view taken along line III-III of a portion of the floor system of Figure 1;

Figure 4 is a cross-sectional illustration of an example of a removable panel;

Figure 5 is a plan view of one arrangement of the structural support grid;

Figure 6 is a plan view of another arrangement of the structural support grid;

Figure 7 is an isometric view of the use of repositionable walls as part of the floor system;

DETAILED DESCRIPTION OF THE INVENTION

[0011] The structurally integrated accessible floor system, hereinafter referred to as the floor system, is designated generally as 100, and is shown isometrically in Figure 1.

[0012] Primary framing members 102 are provided, which can be formed as integral parts of metal frame type buildings. Secondary framing members, such as joists 104 are connected to the primary framing members 102. According to one embodiment of the invention, a structural support grid 106 is then formed over the secondary framing members 104. The grid 106 is configured to receive removable floor panels 108 in the openings 110 formed by the grid 106. The removable floor panels 108 are of a uniform size to allow interchangeability, and they may be provided with terminals or hookups 112 for electrical power and communication access, and with vents or registers 114 for ventilation.

[0013] For the sake of convenience and clarity, one type of power terminal 112 is shown in Figure 1. However, it will be obvious to those skilled in the art that a wide variety of terminals may be used, including standard 110 volt sockets, coaxial cable terminals, fiber optical connections, heavy duty power terminals, T2 connectors, etc. A user may further choose to provide an opening in the panel to enable the passage of cable without the use of a terminal. These and other options are considered to be within the scope of the invention.

[0014] By the same token, a wide variety of means to transmit air and gas may be used in place of the vent 114, including compressed air hookups, vacuum lines, fans, directionally adjustable vents, filters, emergency gas evacuation systems, compressed oxygen, CO_2, propane, nitrogen, etc.

[0015] Figure 1 also shows optional panels 116 attached to metal channels 118, which are in turn affixed to the underside of the secondary framing members. These panels 116 are ideally constructed of material that resists fire, thus forming a fire block. The panels 116 isolate one story of a building from the next, establishing fire protection, which may required by many building codes. The panels 116 attached to the underside of the secondary framing members enclose the space between the secondary framing members. This enclosed space may be employed as a plenum for HVAC. This can result in a financial savings, because ductwork is reduced or eliminated. Partitions may be used within this space to permit discreet sections of the floor system to pressurize for use as a plenum.

[0016] Referring next to Figure 2, shown therein is a section of one embodiment of the structural support grid 106. According to this embodiment, the structural support grid comprises L-shaped rail members 202 affixed in back-to-back relationship to T-shaped joint nodes 200 to form supports for the removable floor panels. The nodes and rail members are standardized to permit interchangeability.

[0017] It is to be understood that the rail members may have many different cross-sectional shapes and node configurations. For example, some alternative cross-sectional shapes include channel, "T", and square.

[0018] Figure 3 shows the floor system 100 in cross-section taken along lines III-III in Figure 1. The removable floor panel 108 has a plurality of layers, including a top layer 300, which is configured according to the requirements of the particular application and may have a carpeted surface or a tile surface. Alternatively, the top layer may be formed using chemically resistive materials for use in a lab or other caustic environments. The top layer 300 and a bottom layer 306 are designed to provide structural stiffness to the panel 108 and are configured according to the structural and weight bearing requirements of the particular application. Fire retardant layers 304 are composed of fire resistant materials such as gypsum, or other appropriate material, and serve to inhibit the passage of fire from one side of the panel 108 to the other. An insulation layer 302 provides thermal and acoustic insulation, as well as additional stiffness.

[0019] It will be understood that the composition of the removable floor panels will vary according to the requirements of a particular application and will in part be dictated by the anticipated environment, the required load carrying capacity, the desired appearance, the anticipated degree of noise control, local building and fire codes, and other factors.

[0020] Although the removable floor panels 108 bear against the structural support grid 106, panel fasteners 310 may be used to positively attach the panels 108 to the structural support grid 106. In the embodiment shown in Figure 3, the panel fasteners 310 comprise threaded fasteners that pass from a lower surface of the structural support grid 106 into an opening in a lower surface of the removable panel 108 via an opening 311 in the rail member 202 of the structural support grid 106. The opening 311 is oversized in relation to the threaded fastener 310 to enable adjustment in the position of the removable panel 108 relative to the structural support grid 106. The threads of the threaded fastener 310 engage the removable panel and a hexagonal head of the fastener 310 bears against the lower surface 324 of the support grid

106, drawing the removable panel tight against the structural support grid 106. Thus, in this embodiment access to the panel fasteners 310 is from beneath the structural support grid 106.

[0021] A leveling unit 308 is provided to control a vertical distance 320 between the structural support grid 106 and the secondary framing members 104. Figure 3 shows one of a plurality of similar units that comprise the leveling system, which functions as described below.

[0022] As shown in figure 3, the leveling unit 308 includes a threaded rod 312 attached to a support plate 314 that bears against an upper surface 322 of the secondary framing member 104. The threaded rod 312 passes through a lift plate 316 via an opening in the lift plate 316, with the lift plate 316 bearing upward against the lower surface 324 of the structural support grid 106. The rod 312 is slideably received in an opening 307 formed in the grid 106. A pair of jam nuts 318 on the threaded rod supports the lift plate 316. The position of the jam nuts 318 on the threaded rod determines the distance 320 between the upper surface 322 of the secondary framing member 104 and the lower surface 324 of the structural support grid 106.

[0023] By adjusting each of the plurality of units of the leveling system, the bearing surface 326 of the floor system 100 can be leveled, even if the upper surfaces 322 of the secondary framing members are not level.

[0024] In one variation, leveling devices that are functionally similar to the leveling unit 308 described above may be employed between an upper surface 120 (shown in figure 1) of the primary framing members 102 and the part 105 of the secondary framing members 104 that bears against the primary framing members. By adjusting the vertical distance between the primary and secondary framing members, the level of the structural support grid 106 can be controlled.

[0025] Other methods of controlling the vertical distance (not shown) between the primary and secondary framing members 102, 104, or between the structural support grid 106 and the secondary framing members 104 will be obvious to those skilled in the art. These methods include the use of wedges, shims, threaded devices that are accessed from above the floor system, automatic or remotely adjustable devices, etc., all of which are deemed to be within the scope of the invention.

[0026] Figure 4 shows a removable panel 108 including a flexible gasket 400 affixed to the top edge 412 of each panel 108, 109. The gaskets 400 of adjoining panels 108, 109 press against each other, providing a seal between the removable panels 108, 109. The seal may be employed to prevent spills from leaving through the floor system. In applications where spills of caustic or dangerous fluids might be anticipated, the composition of the gasket 400 is chosen to be resistant to the particular classes of substances in use. Multiple or interlocking gaskets may also be employed to provide a more secure seal. Alternatively, a single gasket may be wedged between the adjoining panels 108, 109 after they are installed on the structural support grid 106. The gasket 400 may also be used in applications where it is desirable to control the movement of air or other gasses from one side of the floor system to the other.

[0027] Figure 4 also shows another example of a panel fastener. Here, the panel fastener 410 is accessed with a tool (not shown) that is inserted from above the surface of the floor system into the center of the joint node 200. The panel fastener 410 is rotated approximately 45°. Fastener blades 408 rotate from positions in slots (not shown) in the joint node 200 into slots in the corners of the removable panels 406, locking them in place.

[0028] Other locking devices and systems will be evident to those skilled in the art and are considered to be within the scope of the invention. Such devices include those employing cam-type fasteners, devices that are accessible from the surface of the removable floor panels, devices that latch automatically when the removable floor panels are emplaced, etc.

[0029] Depending upon the height and local requirements, some buildings include devices or methods of construction that provide earthquake resistance. In conventional construction methods a solid floor deck functions as a diaphragm, which is resistant to dimensional stresses.

[0030] As illustrated in Figure 5, the structural support grid 106 can be attached orthogonally, relative to the primary 102 and secondary 104 framing members. Diagonal stays 500 are employed to brace and provide the requisite stability to the structure. The stays 500 are attached directly to the primary columns 502 of a building and pass underneath the floor structure 100.

[0031] Figure 6 shows an alternative variation, in which the structural support grid 106 is oriented diagonally, relative to the primary 102 and secondary 104 framing members. In this variation, the structural support grid 106 itself forms the diagonal bracing that reinforces the building structure.

[0032] As shown in Figure 7, repositionable walls 700 may be employed as part of the structurally integrated accessible floor system. These repositionable walls may consist of floor to ceiling room dividers, which may be assembled on site, as shown in Figure 7, or prefabricated and installed as individual units, or alternatively they may be prefabricated cubicle dividers of the type common in office environments. The repositionable walls 700 are affixed directly to the structural support grid 104. Partial floor panels 108a may be cut to the necessary size at the site, using conventional methods, or may be manufactured in common dimensions. By affixing the walls 700 to the grid 106 and employing partial floor panels, acoustical isolation is enhanced and the structural stability of the walls 700 is improved.

[0033] Electrical components in the walls 700, such as light switches, thermostats, power connections etc, may be wired directly through the bottom of the walls via harnesses (not shown) that can be connected to cables and connectors underneath the floor panels 108. This is a

significant advantage, especially in the case of cubicle dividers, over the methods currency in use, because conventional cubicle dividers must bring power into open areas and may involve complex interconnections between the dividers, and power drops from ceilings. Other methods include the use of wireless technology for switches and controls. Such technology has the advantage that it doesn't require any wiring connections in the walls.

[0034] Figure 8 illustrates the use of structural support rails 800. The rails 800 span the secondary framing members 104 and support the removable floor panels 108 on two sides. The floor panels 108 of this embodiment are configured to span the structural support rails 800.

[0035] In a conventional building, an elevated floor system of the type described in the background section of this document is installed on top of an existing floor. The elevated floor occupies a space above the floor, and is not part of the building structure. The accessible space provided by such an elevated, floor is that space between the panels that form the surface of the elevated floor and the upper surface of the solid floor deck. In the structurally integrated accessible floor system of the embodiments of the invention described herein the solid floor deck is not needed. The removable panels provide access to the space beneath the grid and between the individual secondary framing members. In prior floor structures, this space is inaccessible and wasted. Because the structural support grid of the present invention spans the secondary framing members, the space beneath is unobstructed, providing simplified access for pulling cables, laying conduit, ducting, and pipe.

[0036] The cost of the floor system disclosed herein is significantly mitigated by several factors. A conventional structural floor is not required, and the floor system is essentially the same height as a conventional structural floor, obviating the need for ramps in areas where conventional floors adjoin the floor system. Because the floor system does not add height per story to the final building structure, there will be a savings in building materials, and a savings in operating costs over those of a similar building using accessible floors according to the prior art. Also, because the space under the floor system is unencumbered by pedestals, feet, or other support devices, the floor system has improved flexibility and changeability. Pulling cable, laying conduit and pipe, and installing ducting are all simplified. The labor costs and down time costs are reduced during changeovers.

[0037] From the foregoing it will be appreciated that, although specific embodiments of the invention have been described herein for purposes of illustration, various modifications may be made without deviating from the scope of the claims.

Claims

1. A floor structure (100), comprising:

a plurality of horizontal structural members (104) held in a spaced-apart relationship;

a grid assembly (106), attached to the plurality of horizontal structural members (104), and having a plurality of first and second intersecting grid members (202) defining a plurality of openings (110);

a plurality of panels (108), each sized and shaped to be individually and removably engaged with the grid assembly (106) to cover the plurality of openings (110), each of the plurality of panels (108) being removable to provide access to a space beneath the plurality of panels (108) and between the plurality of horizontal structural members (104); and

an attachment system (308) configured to attach the grid assembly (106) to the plurality of structural members (104) and to maintain an adjustable gap between the grid assembly (106) and each of the plurality of structural members (104) to provide for leveling of the grid assembly (106).

2. The structure of claim 1 wherein each of the plurality of panels (108) is configured to fit within a respective opening (110), and each panel (108) includes an upper surface configured to extend over a portion of those of the plurality of grid members (202) that form the respective opening (110).

3. The structure of claim 2 wherein each the plurality of panels (108) is provided with a flexible gasket (400) surrounding the upper surface, such that when the plurality of panels are placed within contiguous ones of the plurality of openings (110), adjacent flexible gaskets (400) engage one another.

4. The structure of claim 2 wherein the plurality of panels (108) comprises at least one panel (108) configured to enable gas to pass from a first side to a second side.

5. The structure of claim 2 wherein the plurality of panels (108) comprises at least one panel (108) configured to distribute power via an electrical outlet.

6. The structure of claim 2 wherein each of the plurality of panels (108) is configured to dampen sound transmission from one of the plurality of panels (108) to a contiguous one of the plurality of panels (108).

7. The structure of claim 2 wherein each of the plurality of panels (108) is configured to be removably attached to the grid assembly (106).

8. The structure of claim 1, further comprising walls (700) removably attached to the grid assembly (106).

Patentansprüche

1. Fußbodenstruktur (100), die Folgendes umfasst:

   mehrere horizontale Strukturelemente (104), die in einer voneinander beabstandeten Beziehung gehalten werden;
   eine Gitteranordnung (106), die an den mehreren horizontalen Strukturelementen (104) befestigt ist und mehrere erste und zweite sich überkreuzenden Gitterelemente (202) hat, die mehrere Öffnungen (110) definieren;
   mehrere Platten (108), die jeweils so bemessen und geformt sind, dass sie einzeln und entfernbar mit der Gitteranordnung (106) in Eingriff gebracht werden, um die mehreren Öffnungen (110) abzudecken, wobei jede der mehreren Platten (108) entfernbar ist, um Zugriff auf einen Raum unter den mehreren Platten (108) und zwischen den mehreren horizontalen Strukturelementen (104) bereitzustellen; und
   ein Befestigungssystem (308), das dazu konfiguriert ist, die Gitteranordnung (106) an den mehreren Strukturelementen (104) zu befestigen und einen einstellbaren Zwischenraum zwischen der Gitteranordnung (106) und jedem der mehreren Strukturelemente (104) aufrechtzuerhalten, um für ein Planieren der Gitteranordnung (106) zu sorgen.

2. Struktur nach Anspruch 1, wobei jede der mehreren Platten (108) dazu konfiguriert ist, in eine jeweilige Öffnung (110) zu passen und jede Platte (108) eine obere Fläche aufweist, die dazu konfiguriert ist, sich über einen Teil derjenigen der mehreren Gitterelemente (202) zu erstrecken, die die jeweilige Öffnung (110) bilden.

3. Struktur nach Anspruch 2, wobei jede der mehreren Platten (108) mit einer flexiblen Dichtung (400) versehen ist, die die obere Fläche umgibt, so dass, wenn die mehreren Platten in benachbarte der mehreren Öffnungen (110) gesetzt werden, angrenzende flexible Dichtungen (400) ineinander eingreifen.

4. Struktur nach Anspruch 2, wobei die mehreren Platten (108) mindestens eine Platte (108) umfassen, die dazu konfiguriert ist zu ermöglichen, dass Gas von einer ersten Seite zu einer zweiten Seite strömt.

5. Struktur nach Anspruch 2, wobei die mehreren Platten (108) mindestens eine Platte (108) umfassen, die dazu konfiguriert ist, Strom mittels eines Stromanschlusses zu verteilen.

6. Struktur nach Anspruch 2, wobei jede der mehreren Platten (108) dazu konfiguriert ist, die Schallübertragung von einer der mehreren Platten (108) zu einer benachbarten der mehreren Platten (108) zu dämmen.

7. Struktur nach Anspruch 2, wobei jede der mehreren Platten (108) dazu konfiguriert ist, entfernbar an der Gitteranordnung (106) befestigt zu werden.

8. Struktur nach Anspruch 1, die weiterhin Wände (700) umfasst, die entfernbar an der Gitteranordnung (106) befestigt sind.

Revendications

1. Une structure de plancher (100), comprenant :

   une pluralité d'éléments porteurs horizontaux (104) maintenus dans une relation espacée ;
   un ensemble grille (106), attaché à la pluralité d'éléments porteurs horizontaux (104), et ayant une pluralité de premiers et seconds éléments de grille entrecroisés (202) définissant une pluralité d'ouvertures (110) ;
   une pluralité de panneaux (108), chacun dimensionné et formé pour s'engager de façon individuelle et amovible avec l'ensemble grille (106) pour couvrir la pluralité d'ouvertures (110), chacun de la pluralité de panneaux (108) étant amovible pour fournir un accès à un espace sous la pluralité de panneaux (108) et entre la pluralité des éléments porteurs horizontaux (104) ; et
   un système de fixation (308) configuré pour attacher l'ensemble grille (106) à la pluralité d'éléments porteurs (104) et pour maintenir un écartement ajustable entre l'ensemble grille (106) et chacun de la pluralité d'éléments porteurs (104) pour assurer la mise à niveau de l'ensemble grille (106).

2. La structure selon la revendication 1 où chacun de la pluralité de panneaux (108) est configuré pour s'encastrer dans une ouverture respective (110), et chaque panneau (108) inclut une surface supérieure configurée pour s'étendre au-dessus d'une partie des éléments de la pluralité d'éléments de grille (202) qui forment l'ouverture respective (110).

3. La structure selon la revendication 2 où chacun de la pluralité de panneaux (108) est muni d'un joint plat flexible (400) entourant la surface supérieure, de telle sorte que lorsque la pluralité de panneaux sont placés dans des ouvertures contigües de la pluralité d'ouvertures (110), des joints plats flexibles adjacents (400) s'engagent les uns dans les autres.

4. La structure selon la revendication 2 où la pluralité de panneaux (108) comprennent au moins un panneau (108) configuré pour permettre à du gaz de

passer d'un premier côté à un second côté.

5. La structure selon la revendication 2 où la pluralité de panneaux (108) comprend au moins un panneau (108) configuré pour amener le courant électrique par une prise électrique.

6. La structure selon la revendication 2 où chacun de la pluralité de panneaux (108) est configuré pour atténuer la transmission du son d'un de la pluralité de panneaux (108) à un panneau contigu de la pluralité de panneaux (108).

7. La structure selon la revendication 2 où chacun de la pluralité de panneaux (108) est configuré pour être attaché de façon amovible à l'ensemble grille (106).

8. La structure selon la revendication 1, comprenant en plus des parois (700) attachées de façon amovible à l'ensemble grille (106).

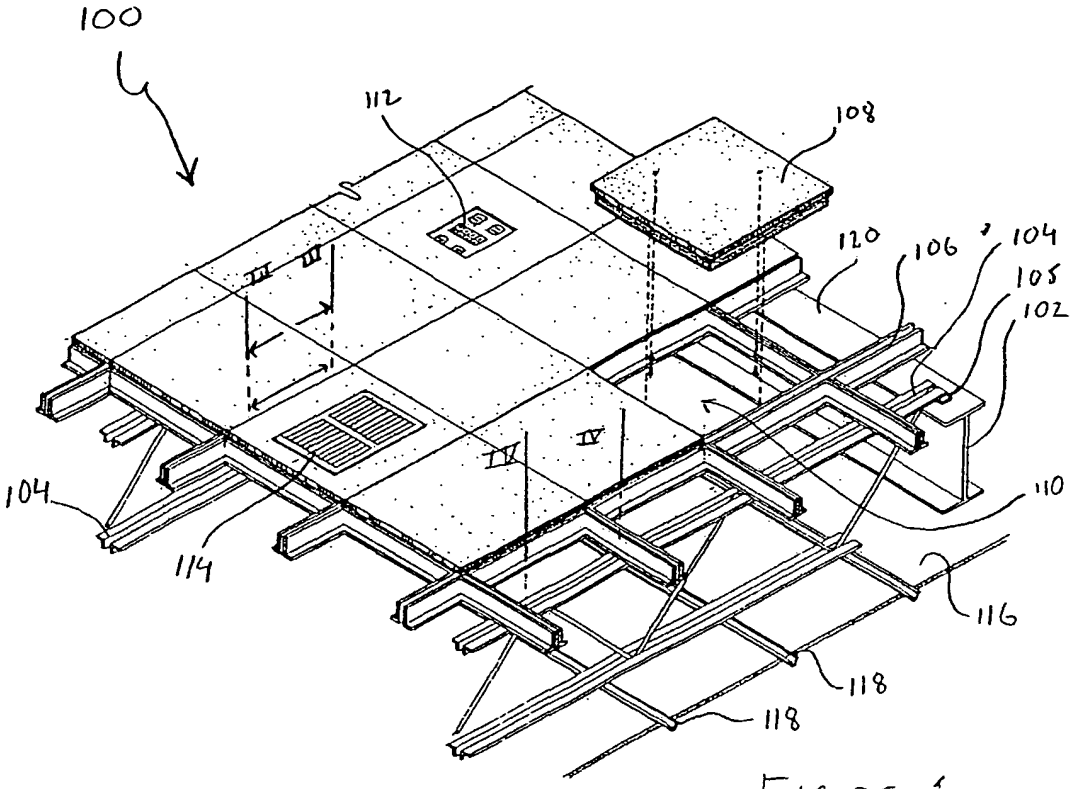

FIGURE 1

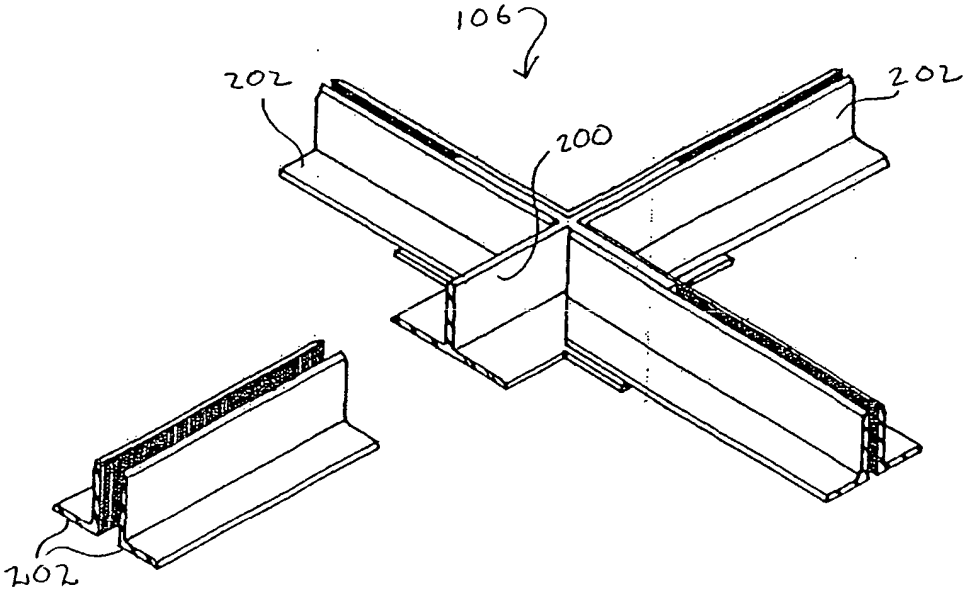

FIGURE 2

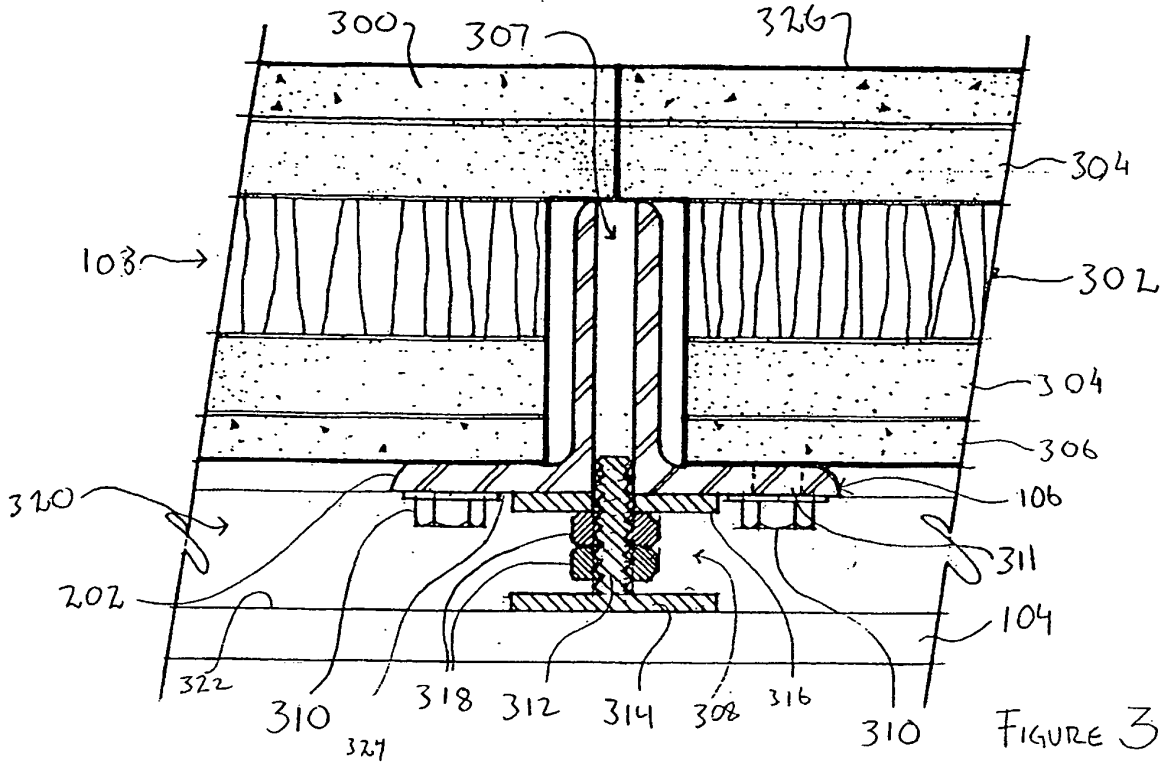

FIGURE 3

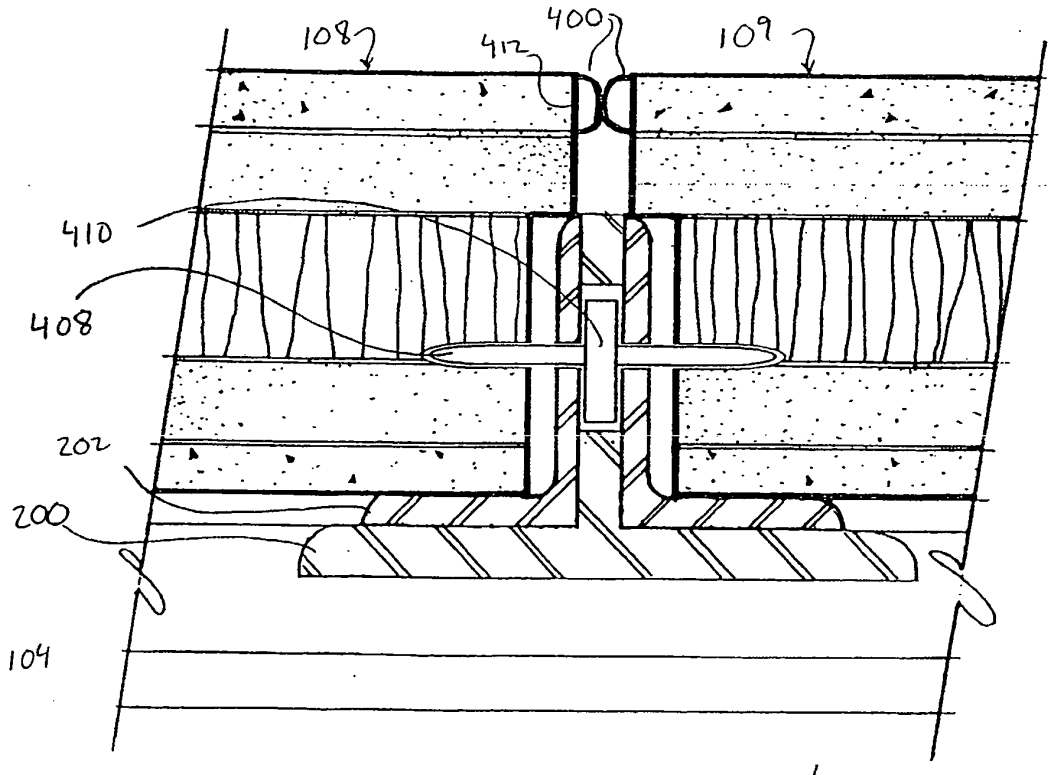

FIGURE 4

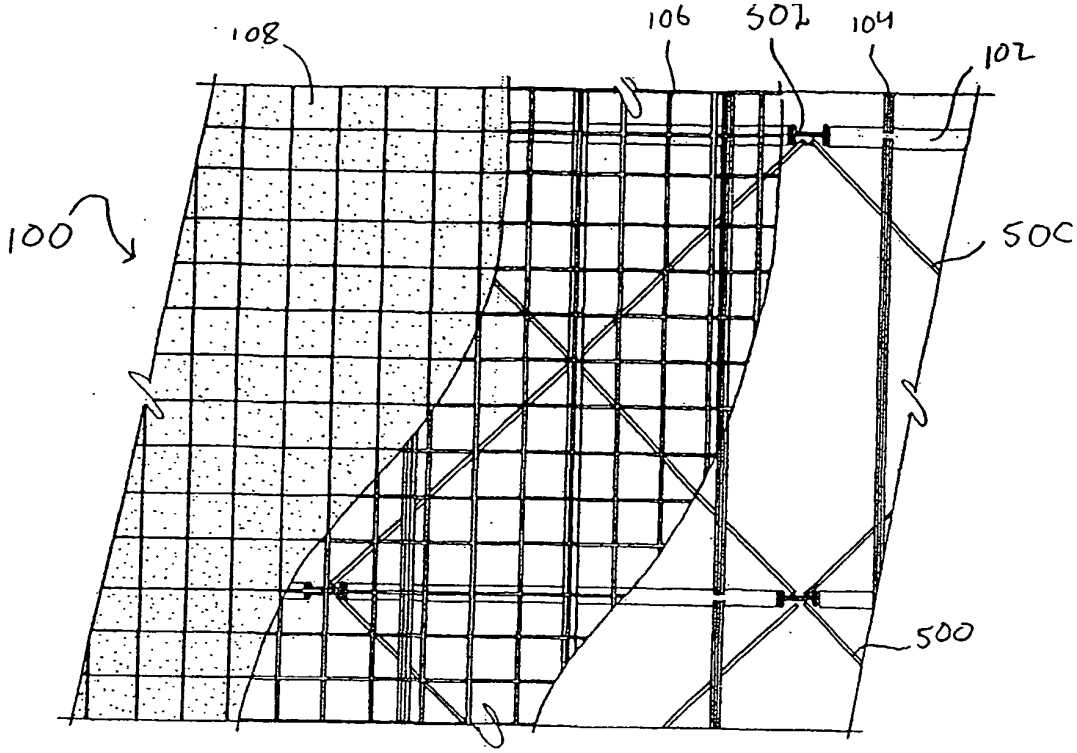

FIGURE 5

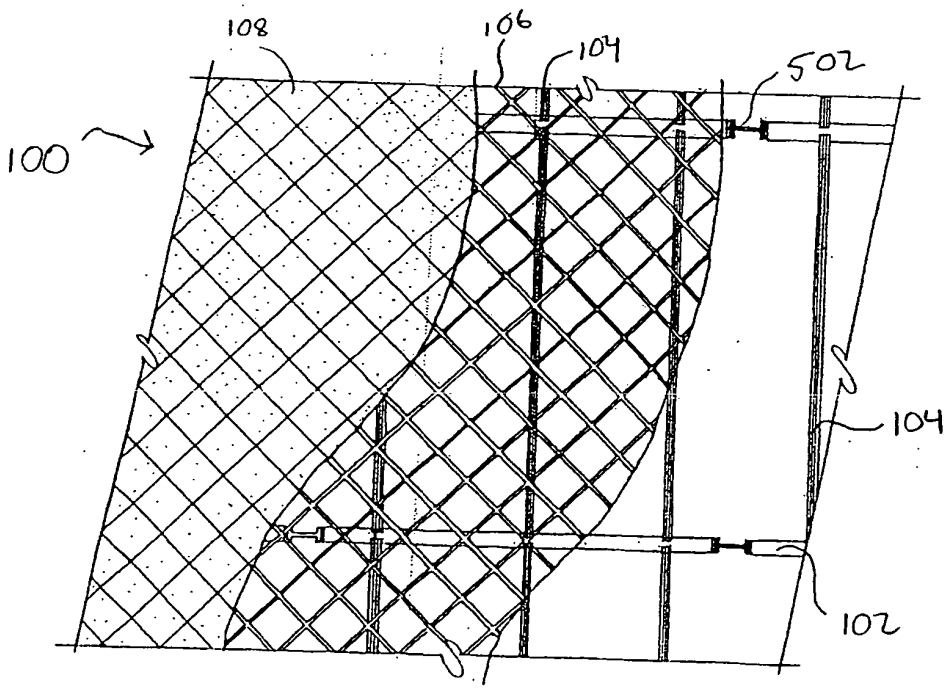

FIGURE 6

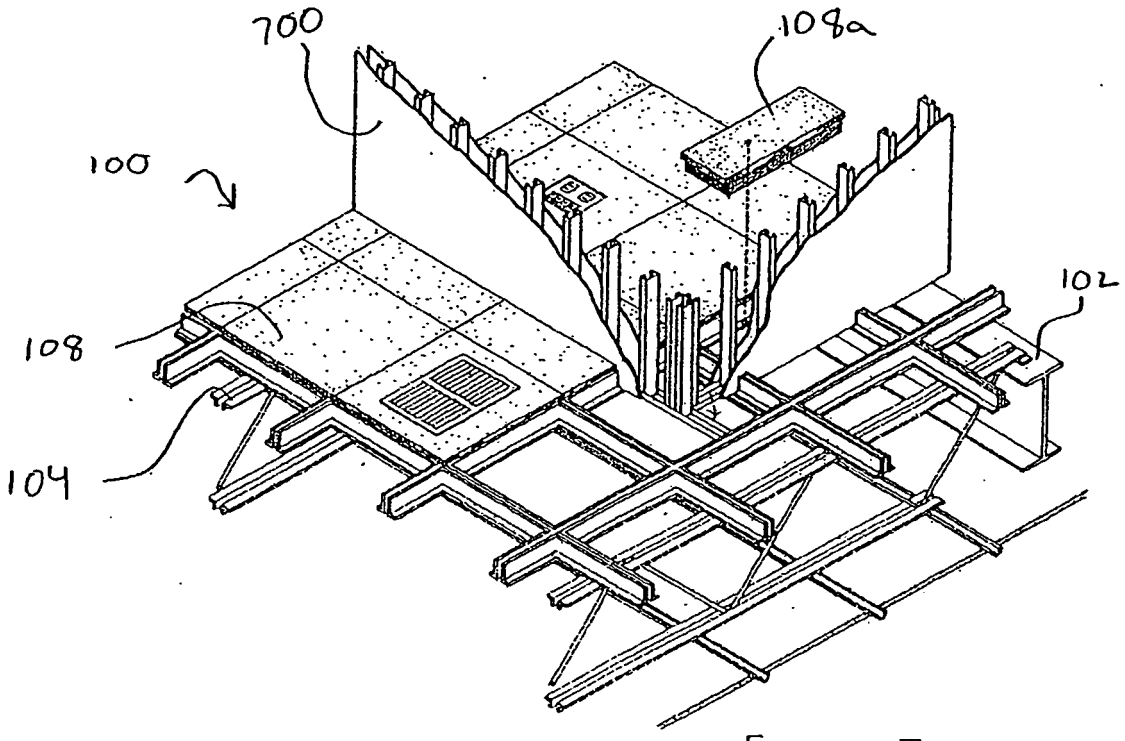

FIGURE 7

REFERENCES CITED IN THE DESCRIPTION

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