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(54) **Suspended ceiling comprising a system for supporting a load**

Abgehängte Decke mit einem System zum Tragen einer Last

Plafond suspendu comprenant un système pour supporter une charge

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The invention relates to prior art suspended ceilings that use beams roll-formed of sheet metal in a grid that supports relatively light weight loads, such as panels. The beams have an inverted T-cross section with a vertical web, horizontal flanges extending opposite from one-another at the bottom of the web, and a bulb at the top, and optionally along, the web. Such beams are interconnected into a grid having rectangular openings that support panels on the flanges of the beams. The grid is supported from an overhead structure by hang wires. In some instances, the grid supports other light loads, such as signs, or other visual decorative elements.

2. Description of Related Art

[0002] Relatively light roll-formed sheet metal beams of the type described above and used in the present invention are shown, for instance, in U.S. Patents 5,979,055 and 6,138,416. Such light beams are arranged into a grid, as shown, for instance, in U.S. Patent 6,763,642.

[0003] Such suspended ceilings, with such relatively light sheet steel roll-formed metal grid beams that support panels, provide a pleasing cover over a room, with a minimum use of metal in the grid beams, since such a suspended ceiling structurally is designed to support only itself.

[0004] In some instances, however, light weight loads, for instance light fixtures, are hung below a suspended ceiling from the suspended ceiling grid by a clip on the ceiling grid, as shown for instance, in U.S. Patent 3,612,461. In U.S. Patent 4,073,458, there is shown a hanger clip for displaying light weight articles, such as sale signs, from a suspended ceiling. However, where it is necessary to support relatively heavy loads, such as data banks, below a suspended ceiling, heavy forged metal beams are used in the prior art in the ceiling grid of the suspended ceiling, instead of the light roll-formed sheet metal beams described above. The prior art forged steel beams have threads in channels in the beams, that receive threaded rods, as seen for instance in U.S. Patent Publication 2012/0240495A1 published September 27, 2012.

[0005] US 4,189,893 discloses a suspended ceiling according to the preamble of claim 1.

SUMMARY OF THE PRESENT INVENTION

[0006] In the present invention, a prior art suspended ceiling having a grid of roll-formed sheet metal grid beams, as described above, is adapted to transmit relatively heavy loads from below the suspended ceiling to a structural support above the suspended ceiling.

[0007] Threaded load and hang rods, are secured to the suspended ceiling grid formed of prior art roll-formed sheet metal grid beams by clips shaped to transmit loads vertically through the webs of the grid beams, without twisting or bending the beams in the grid. The load and hang clips are spaced on the suspended ceiling at locations that maintain a level and balanced suspended ceiling, notwithstanding the relatively heavy loads that are being supported through the suspended ceiling by means of the clips, and the threaded rods secured to the clips.

[0008] The invention uses a prior art grid of beams of sheet metal that are roll-formed into an inverted T cross section. The suspended ceiling grid formed from these roll-formed sheet metal grid beams is suspended from a structural support, such as a structural ceiling, by hang wires. Panels are placed in rectangular grid openings formed by the grid, in the suspended ceiling.

[0009] In the present invention, relatively heavy loads, such as data banks, are suspended through such prior art suspended ceilings formed of roll-formed sheet metal beams described above, without the need to use heavy forged metal beams in the grid as described above. Lower threaded load rods are secured to the grid beams with grid beam load clips in a manner that passes the loads solely vertically upward through the webs of the grid beams to grid beam hang clips, at selected ceiling locations on the grid, above the suspended ceiling. The grid beam hang clips receive and pass the load through the suspended ceiling to upper threaded rods, above the suspended ceiling, that are secured into the upper structural support, such as a structural ceiling.

[0010] In this way, the load hung below the suspended ceiling passes upwardly only through the webs of the grid beams, without twisting or bending the beams. The grid beam hang clips above the ceiling are spaced on the web to balance the load from the grid beam load clips below the ceiling, and are designed to avoid any twisting or bending of the relatively fragile roll-formed sheet metal grid beams.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011]

Figure 1 is an isometric view of a suspended ceiling of the invention using grid beam load clips below the suspended ceiling, and grid beam hang clips above the suspended ceiling, to transmit loads through the suspended ceiling to a structural support.

Figure 2 is a view downward showing the spacing of the grid beam load clips and grid beam hang clips of the invention on the grid beams, to secure a balanced load through the ceiling.

Figure 3 is a downward isometric view of a grid beam load clip of the invention that is secured to a grid beam from below the suspended ceiling.

Figure 4 is an exploded view of the grid beam load

clip of Figure 3.

Figure 5 is a cross-section view of the grid beam load clip of Figures 3 and 4 secured to the flanges of a grid beam in a suspended ceiling grid, which is shown in phantom.

Figure 6 is a view downward showing the grid beam load clip of Figure 3 secured to a grid beam, shown in phantom, in a suspended ceiling grid.

Figure 7 is an isometric view of a grid beam hang clip of the invention used to secure an upper threaded rod to the grid beam in a way that receives the load vertically solely through the web of the grid beam.

Figure 8 is a sectional view taken on the line 8-8 of the grid beam hang clip of Figure 7, showing the grid beam hang clip attached to a grid beam in the grid, to pass the load through the web of the grid beam, without bending or twisting the beams.

Figure 9 is an isometric view of a grid beam intersection hang clip of the invention straddling a grid main beam from above, and secured to grid cross beams, at an intersection of a grid main beam and grid cross beams.

Figure 10 is a sectional side view of the grid beam intersection hang clip of Figure 9 taken on the line 10-10 of Figure 9, secured to a grid main beam, which is shown in phantom.

Figure 11 is a sectional view of the grid beam intersection hang clip of Figure 9, taken on the line 11-11, showing the intersection hang clip straddling a main beam, and attached to cross beams.

Figure 12 is a partial perspective view of a basket supported from a structural support through a suspended ceiling.

DETAILED DESCRIPTION OF THE INVENTION

[0012] In Figure 1, there is shown a well-known type of prior art suspended ceiling grid 20 formed of interlocking main beams 21 and cross beams 22 suspended from a structural support by hang wires 23. Both the main beam 21, and the cross beams 22 have the same cross section, which includes a web 25, horizontal flanges 26, 27 extending in opposite directions from the bottom of the web 25, and bulbs 30, 31 at the top of, and along, the web 25. Suitable connectors, as seen for instance in prior art U.S. Patents 6,523,313, and 7,614,195, connect the grid cross beams 22, and the main beams 21, to form a suspended ceiling grid 24 with rectangular openings 32. Panels 33 are supported in the suspended ceiling grid openings 32 to cover the space below the suspended ceiling 20. The space above the suspended ceiling 20 may be used for air ducts, electrical conduits, sprinkler systems, and other structures, that are supported from the structural support above the suspended ceiling 20.

[0013] Examples of such prior art ceiling grids are shown in detail, for instance, in the above cited '642 U. S. Patent, incorporated herein by reference.

[0014] The suspended ceilings 20 of the present invention have lower threaded load rods 35 and upper threaded hang rods 34 that are connected to the suspended ceiling grid beams 21, 22 below and above the suspended ceiling 20. The upper threaded hang rods 34 are located at places in the ceiling grid 24 that counterbalance the loads imparted to the grid 24 by the lower threaded load rods 35, which are located above the loads below the suspended ceiling 20 being supported in basket 61. Such placement of the upper threaded hang rods 34 avoids any bending, twisting, or unbalancing of the suspended ceiling grid 24 when such a load below the suspended ceiling 20 is supported through the suspended ceiling 20 from a structural support.

[0015] The lower threaded load rods 35 and upper threaded hang rods 34 are attached to the grid beams 21, 22 with clips 40, 41, and 42.

[0016] A grid beam intersection hang clip 40 is placed above grid 24 at a desired location, based on the location of the grid beam load clips 42 described below, at an intersection of a main beam 21 and a pair of cross beams 22. The grid beam intersection hang clip 40, as seen particularly in Figure 9, has a first lower portion 46 that has a cutout 47 that straddles a grid main beam 21 cross section 48, and a second lower portion 50 that is secured to the adjoining grid cross beams 22, by rivets 51, as seen in Figure 11. The grid beam intersection hang clip 40 has an offset at the top 52 so that the line of support from a threaded rod 34 passes downward through the cutout 47 that straddles the main beam 21, thus preventing any torsion stresses on the main beam 21.

[0017] As seen particularly in Figure 11, the wings 56, 57 at the bottom of the grid beam intersection hang clip 40 are secured by rivets 51 to the cross beams 53, 54, to increase load carrying capabilities of both clip 40 and cross beams 53,54.

[0018] Also connected to the suspended ceiling grid 24 from the structural support, are upper threaded hang rods 34 connected at their lower end to either a main beam 21 or cross beams 22, at a desired location, by the grid beam hang clip 41 shown in Figures 7 and 8. Such grid beam hang clip 41, used to suspend the grid 24 by upper threaded hang rod 34 above the suspended ceiling 20, has a contour in cross section that includes a top arm 63 that receives the upper threaded hang rod 34, a side profile 66 that follows that of a grid beam 21, 22, and anchoring holes 67 that permit the grid beam hang clip 41 to be secured to grid beams 21,22. The profiles of the clips 40, 41, are such that all vertical tensile forces pass through the web 25 of a grid beam 21, 22 without any torsion or twisting forces being created.

[0019] Below ceiling grid 24, grid beam load clips 42, as shown in Figures 1, 3 through 5, and 12, are used to pass the load upward through the webs of grid beams 21, 22, through grid beam intersection hang clips 40, and grid beam hang clips 41, to threaded load rods 35, without the beams 21, 22, of the grid 24, bending or twisting

[0020] Grid beam load clips 42 are formed of two iden-

tical halves 68,69 that slide together to lock onto the flanges 26, 27 of a grid beam 21, 22. In the exploded view of Figure 4, the threaded load rod 35 is intended to be clamped between the identical halves 68, 69 and then locked in position with nut 58, so that loads, such as from the basket 61 pass upwards through the threaded load rods 35, and on through the webs 25 of the beams 22, 23, in grid 24 without creating twisting or torsion forces in the beams 22, 23, nor creating unbalance in grid 25 that would cause the grid to distort or fail.

[0021] The lower grid beam load clips 42 are spaced above the basket 61, as seen in Figures 2 and 12, which carries the load below the suspended ceiling 20. The upper grid beam intersection hang clips 40, and the grid beam hang clips 41, are spaced, for instance, as shown in Figures 1 and 2. Such a clip 40,41,42 arrangement as shown in Figure 2 is for illustrative purposes only, since the positioning of the upper grid beam hang clips 40, grid beam hang clips 41 will generally first be determined by the location of the load supported in basket 61 shown in Figure 12. The upper grid beam intersection hang clips 40, and grid beam hang clips 41, are positioned at the grid beam intersections and along the beams 21, 22, at the appropriate places, as described above, to create a balanced suspended ceiling 20 wherein the load below the suspended ceiling 20 is passed through the webs 25 of the grid beams 21,22 of the suspended ceiling 20 without creating distortions in, or collapse of, the suspended ceiling grid 24, whereby the suspended ceiling 20 remains level, balanced and intact.

[0022] Initially, the positioning of the lower grid beam load clips 42 will be determined by the position of the load supported in basket 61.

[0023] Then, the positioning of the upper grid beam intersection hang clips 40 and upper grid hang clips 41, may be determined with respect to the positions of the lower grid beam load clips 42, both in number and location, so that there will be no twisting or unbalancing loads on the relatively fragile grid beams 21, 22 of the suspended ceiling 20, when the load in basket 61 is being supported. Foremost in such positioning of clips 40, 41, 42, is that such positioning results in the loads being transmitted through the webs 25 in the grid beams 21, 22 of the suspended ceiling grid 24, without creating twisting or torsion loads on such beams 21, 22, thus unbalancing the suspended ceiling 20.

[0024] As seen, for example, in the partial view of a suspended ceiling 20 in Figure 2, grid beam intersection hang clips 40 and grid beam hang clips 41 balance out the load on the suspended ceiling 20 from grid beam load clips 42, so that the suspended ceiling 20 remains level, balanced, and intact, with a minimum of twisting or torsion loads on the grid beams 21, 22.

Claims

1. Suspended ceiling (20) having a grid (24) of beams (21, 22) roll-formed of sheet metal into an inverted T cross section having a vertical web (25), horizontal flanges (26, 27) extending opposite from one another at the bottom of the web (25), and at least one bulb (30) at the top of the web (25),
wherein the grid (24)

(a) is suspended from a structural support above the suspended ceiling (20) by hang elements (23);
(b) forms a support for panels (33) resting on the flanges (26, 27) of the grid beams (21, 22); and
(c) is balanced;

characterized by
a system for supporting a load that hangs below such suspended ceiling (20), having upper threaded hang rods (34) above and lower threaded load rods (35) below the grid (24) that connect to the beams (21, 22) of the grid (24) with clips (40, 41, 42) at locations on the grid (24) that enable the load to pass vertically through the webs (25) of the beams (21, 22), whereby the suspended ceiling (20) remains balanced, level, and intact.

2. Suspended ceiling according to claim 1, wherein the upper threaded hang rods (34) are spaced on the grid (24) at locations relative to the locations of the lower threaded load rods (35) that result in primarily vertical forces being transmitted through the webs (25) of the grid beams (21, 22), with bending and twisting forces being cancelled out by the design of the clips (40, 41, 42), and by the location of such clips (40, 41, 42), whereby the suspended ceiling (20) remains balanced, level, and intact.

3. Suspended ceiling according to claim 1 or 2, wherein the suspended ceiling (20) remains balanced, level, and intact under a load below the suspended ceiling (20) that is not spread evenly over the suspended ceiling (20).

4. Suspended ceiling according to any of the preceding claims,
wherein the clips include:

a) a grid beam intersection hang clip (40) for attachment from above the suspended ceiling (20) to the grid (24) of the suspended ceiling (20), at the intersection of a grid main beam (21) and a grid cross beam (22),
b) a grid beam hang clip (41) for attachment from above the suspended ceiling (20) to the grid (24) along a grid beam (21, 22), and
c) a grid beam load clip (42) for attachment from below the suspended ceiling (20) to a grid beam (21, 22).

5. Suspended ceiling according to any of the preceding claims, wherein the clips (40, 41, 42) transmit the load to and from the grid beams (21, 22) without bending or twisting.

6. Suspended ceiling according to any of the preceding claims, wherein the clips (40, 41, 42) grip the grid beams (21, 22) without weakening the beams (21, 22).

7. Suspended ceiling according to any of the claims 4 to 6, wherein the grid beam load clip (42), is formed of two identical halves (68, 69), that slide together, to lock to the flanges of a grid beam (21, 22), and are held locked by a threaded rod secured in place by nuts (58).

Patentansprüche

1. Abgehängte Decke (20) mit einem Gitter (24) aus Balken (21, 22), die aus Blech durch Walzen zu einem umgekehrten T-Querschnitt geformt sind und einen vertikalen Steg (25), horizontale Flansche (26, 27), die sich am Fuß des Stegs (25) einander gegenüberliegend erstrecken, und wenigstens einen Wulst (30) an der Spitze des Stegs (25) aufweisen, wobei das Gitter (24)

   a) mittels Hängeelementen (23) an einer Tragkonstruktion über der abgehängten Decke (20) aufgehängt ist;
   b) eine Stütze für Platten (33) bildet, die auf den Flanschen (26, 27) der Gitterbalken (21, 22) aufliegen; und
   c) im Gleichgewicht ist;

   gekennzeichnet durch
   ein System zum Tragen einer Last, die unter einer derartig abgehängten Decke (20) hängt, welches obere mit einem Gewinde versehene Hängestäbe (34) oberhalb sowie untere mit einem Gewinde versehene Laststäbe (35) unterhalb des Gitters (24) aufweist, die mittels Klemmen (40, 41, 42) mit den Balken (21, 22) des Gitters (24) an Stellen des Gitters (24) verbunden sind, die die Last vertikal **durch** die Stege (25) der Balken (21, 22) hindurchgehen lassen, wodurch die abgehängte Decke (20) im Gleichgewicht, auf einer Ebene und intakt bleibt.

2. Abgehängte Decke nach Anspruch 1, wobei die oberen mit einem Gewinde versehenen Hängestäbe (34) am Gitter (24) an Stellen bezüglich zu den Stellen der unteren mit einem Gewinde versehenen Laststäbe (35) verteilt sind, so dass im Ergebnis hauptsächlich vertikale Kräfte durch die Stege (25) der Gitterbalken (21, 22) übertragen werden, wobei Biege- und Torsionskräfte durch die Konstruktion der Klemmen (40, 41, 42) und die Anordnung dieser Klemmen (40, 41, 42) ausgeglichen werden, wodurch die abgehängte Decke (20) im Gleichgewicht, auf einer Ebene und intakt bleibt.

3. Abgehängte Decke nach Anspruch 1 oder 2, wobei die abgehängte Decke (20) unter einer Last unterhalb der abgehängten Decke (20), die nicht gleichmäßig über die abgehängte Decke (20) verteilt ist, im Gleichgewicht, auf einer Ebene und intakt bleibt.

4. Abgehängte Decke nach einem der vorigen Ansprüche, wobei die Klemmen umfassen:

   a) eine Hängeklemme (40) für Gitterbalken-Kreuzungspunkte zur Befestigung am Gitter (24) der abgehängten Decke (20) an dem Kreuzungspunkt eines Gitterhauptbalkens (21) und eines Gitterquerbalkens (22) von oberhalb der abgehängten Decke (20),
   b) eine Gitterbalken-Hängeklemme (41) zur Befestigung am Gitter (24) entlang einem Gitterbalken (21, 22) von oberhalb der abgehängten Decke (20), sowie
   c) eine Gitterbalken-Lastklemme (42) zur Befestigung an einem Gitterbalken (21, 22) von unterhalb der abgehängten Decke (20).

5. Abgehängte Decke nach einem der vorigen Ansprüche, wobei die Klemmen (40, 41, 42) die Last auf die Gitterbalken (21, 22) und von ihnen weg ohne Biegung oder Torsion übertragen.

6. Abgehängte Decke nach einem der vorigen Ansprüche, wobei die Klemmen (40, 41, 42) an den Gitterbalken (21, 22) angreifen, ohne die Balken (21, 22) zu schwächen.

7. Abgehängte Decke nach einem der Ansprüche 4 bis 6, wobei die Gitterbalken-Lastklemme (42) aus zwei gleichen Hälften (68, 69) ausgebildet ist, die zusammengleiten, um mit den Flanschen eines Gitterbalkens (21, 22) zu verriegeln und durch einen Gewindestab, der mit Muttern (58) fixiert ist, in Verriegelung gehalten zu werden.

Revendications

1. Plafond suspendu (20) comprenant une grille (24) constituée de poutres (21, 22) formées par laminage de tôles de manière à obtenir une section transversale en T inversé comprenant une âme verticale (25), des brides horizontales (26, 27) s'étendant de manière opposée l'une à l'autre à la base de l'âme (25) et au moins un bourrelet (30) au sommet de l'âme (25), la grille (24)

(a) étant suspendue par des éléments d'accrochage (23) à un support structurel situé au-dessus du plafond suspendu (20) ;
(b) formant un support pour des panneaux (33) reposant sur les brides (26, 27) des poutres (21, 22) de la grille ; et
(c) étant équilibrée ;

caractérisé par
un système destiné à supporter une charge accrochée sous ledit plafond suspendu (20), comprenant des tiges d'accrochage filetées supérieures (34) au-dessus et des tiges de charge filetées inférieures (35) au-dessous de la grille (24), lesquelles tiges sont reliées aux poutres (21, 22) de la grille (24) par des attaches (40, 41, 42) à des emplacements sur la grille (24) qui permettent à la charge d'être transmise verticalement à travers les âmes (25) des poutres (21, 22), grâce à quoi le plafond suspendu (20) reste équilibré, de niveau et intact.

2. Plafond suspendu selon la revendication 1, les tiges d'accrochage filetées supérieures (34) étant situées à distance les unes des autres sur la grille (24), à des emplacements par rapport aux emplacements des tiges de charge filetées inférieures (35) qui ont pour résultat la transmission de forces essentiellement verticales à travers les âmes (25) des poutres de grille (21, 22), les forces de flexion et de torsion étant éliminées par la conception des attaches (40, 41, 42) et par l'emplacement de ces attaches (40, 41, 42), grâce à quoi le plafond suspendu (20) reste équilibré, de niveau et intact.

3. Plafond suspendu selon la revendication 1 ou 2, le plafond suspendu (20) restant équilibré, de niveau et intact sous une charge située au-dessous du plafond suspendu (20) qui n'est pas uniformément répartie sur le plafond suspendu (20).

4. Plafond suspendu selon l'une quelconque des revendications précédentes, les attaches comprenant :

a) une attache d'accrochage d'intersection de poutres de grille (40) destinée à être fixée, par le dessus du plafond suspendu (20), à la grille (24) du plafond suspendu (20), à l'intersection d'une poutre principale de grille (21) et d'une poutre transversale de grille (22),
b) une attache d'accrochage de poutre de grille (41) destinée à être fixée, par le dessus du plafond suspendu (20), à la grille (24) le long d'une poutre de grille (21, 22) et
c) une attache de charge de poutre de grille (42) destinée à être fixée, par le dessous du plafond suspendu (20), à une poutre de grille (21, 22).

5. Plafond suspendu selon l'une quelconque des revendications précédentes, les attaches (40, 41, 42) transmettant la charge aux poutres de grille (21, 2) et la recevant de celles-ci sans plier ni se tordre.

6. Plafond suspendu selon l'une quelconque des revendications précédentes, les attaches (40, 41, 42) saisissant les poutres de grille (21, 22) sans affaiblir les poutres (21, 22).

7. Plafond suspendu selon l'une quelconque des revendications 4 à 6, l'attache de charge de poutre de grille (42) étant formée de deux moitiés identiques (68, 69) qui glissent ensemble pour se bloquer sur les brides d'une poutre de grille (21, 22) et qui sont maintenues bloquées par une tige filetée maintenue en place par des écrous (58).

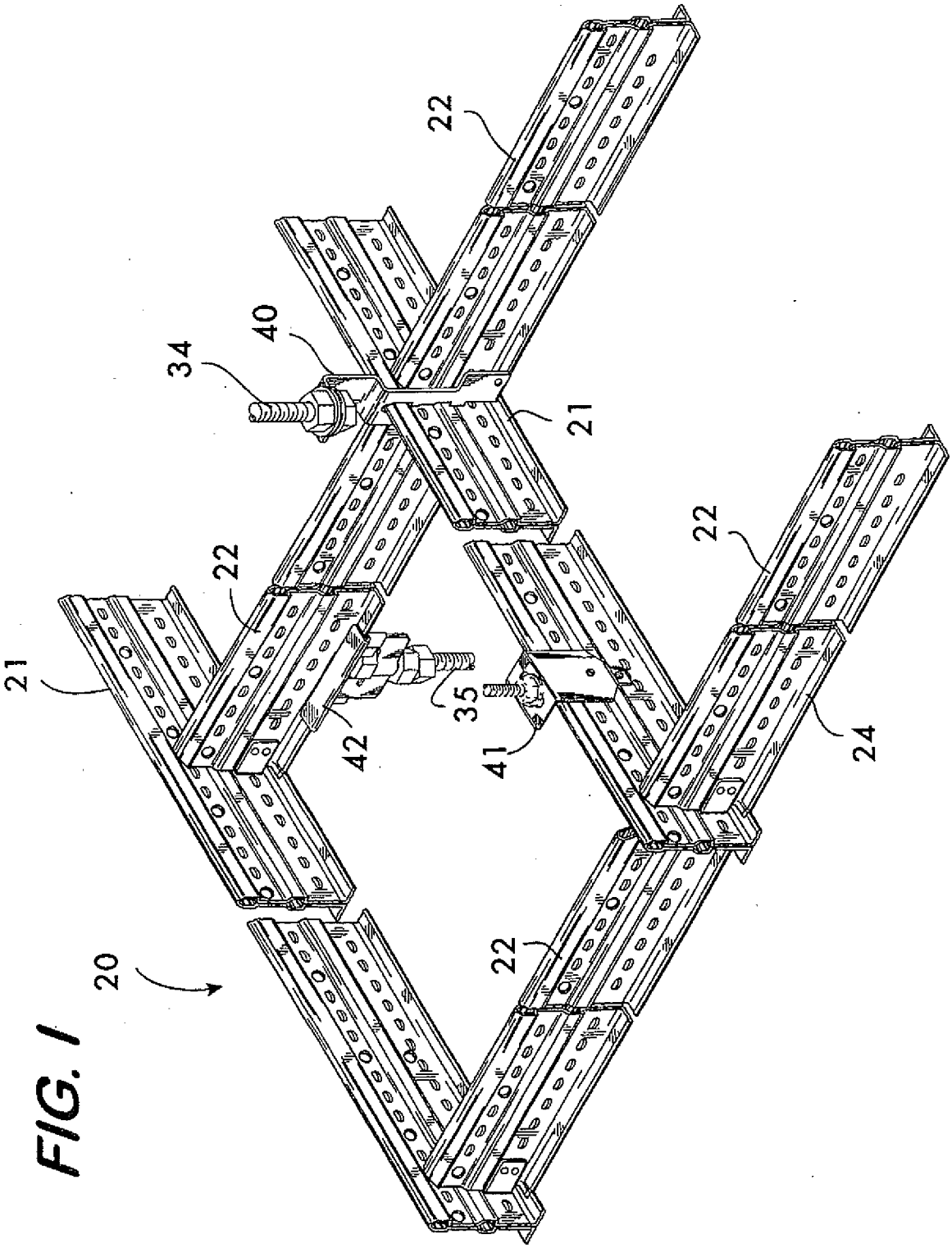


FIG. 1

FIG. 2

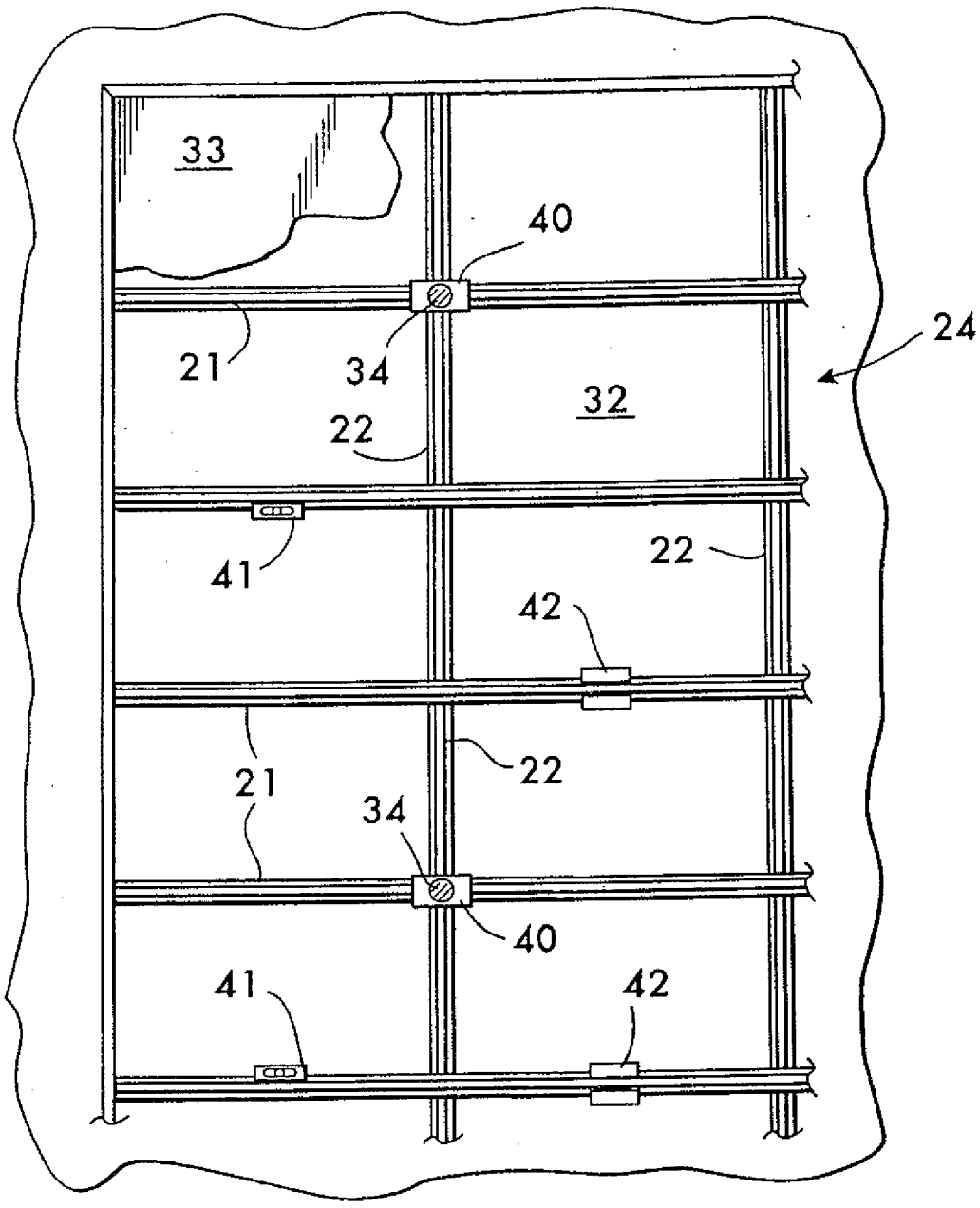


FIG. 3

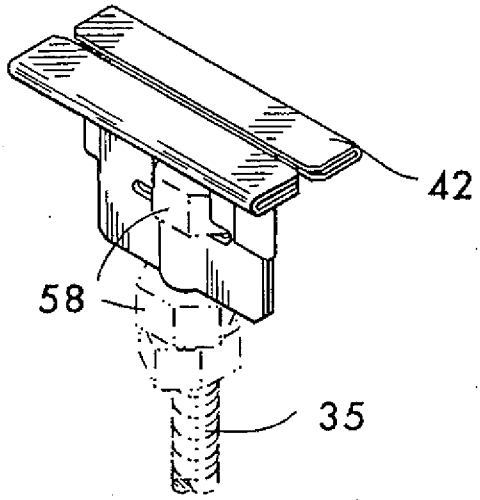


FIG. 5

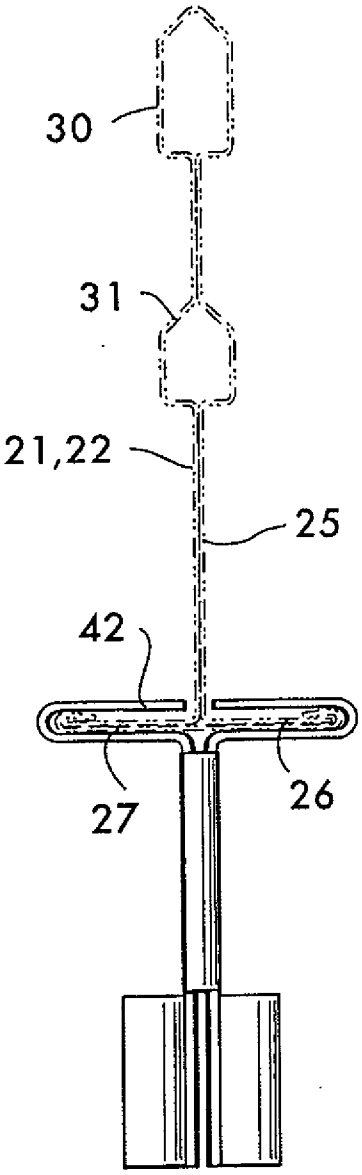


FIG. 4

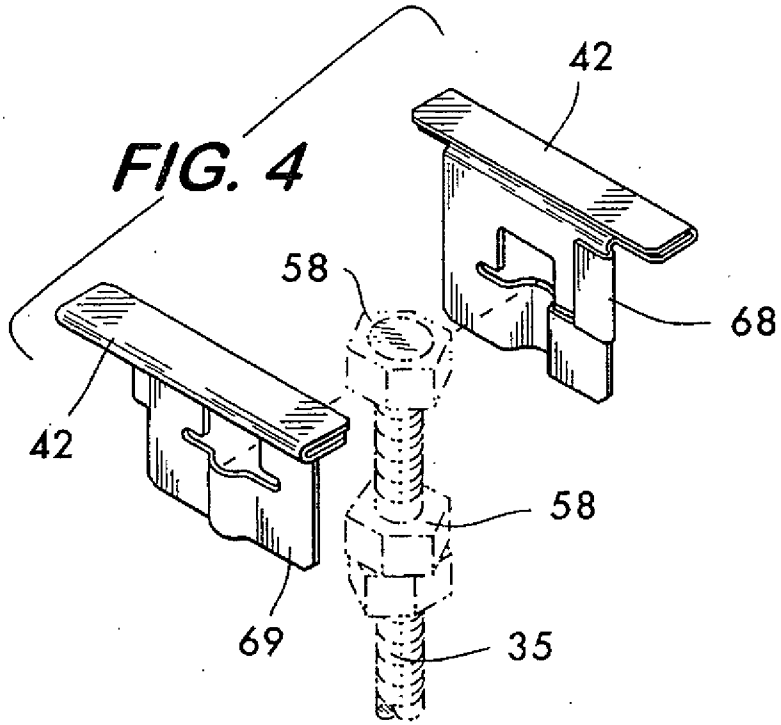


FIG. 6

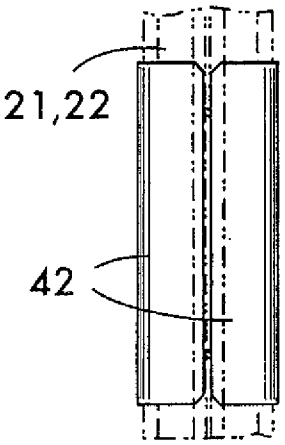


FIG. 7

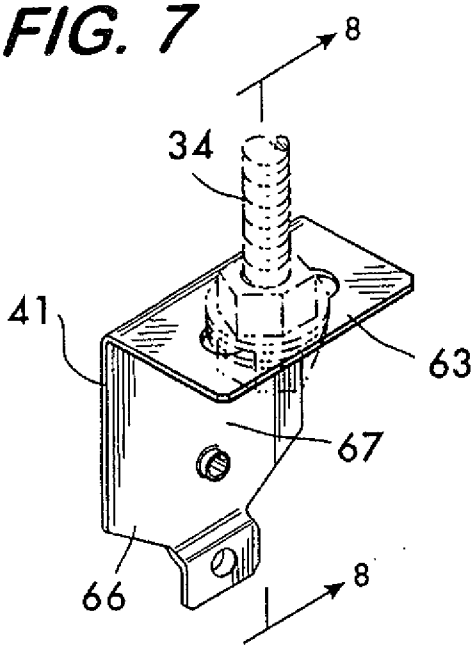


FIG. 8

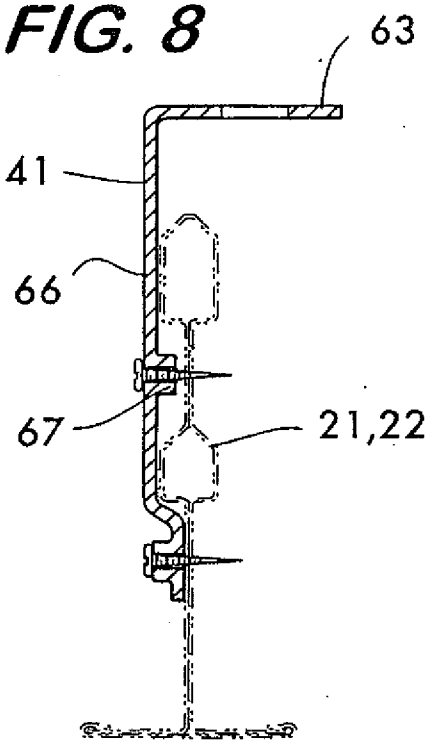


FIG. 9

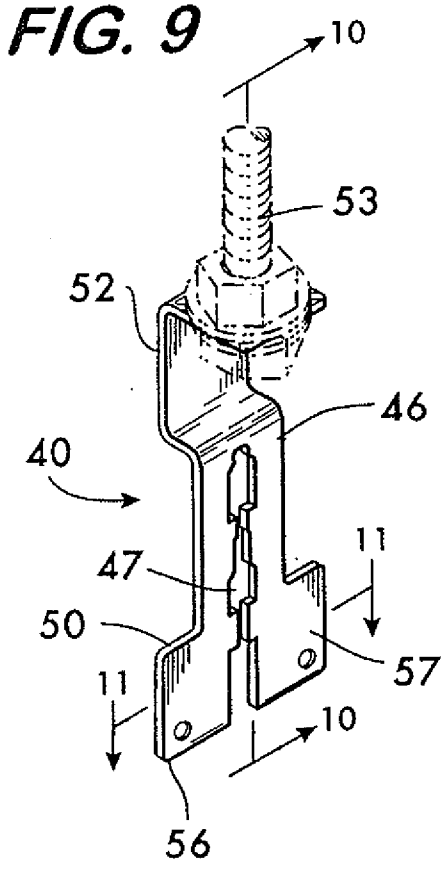


FIG. 10

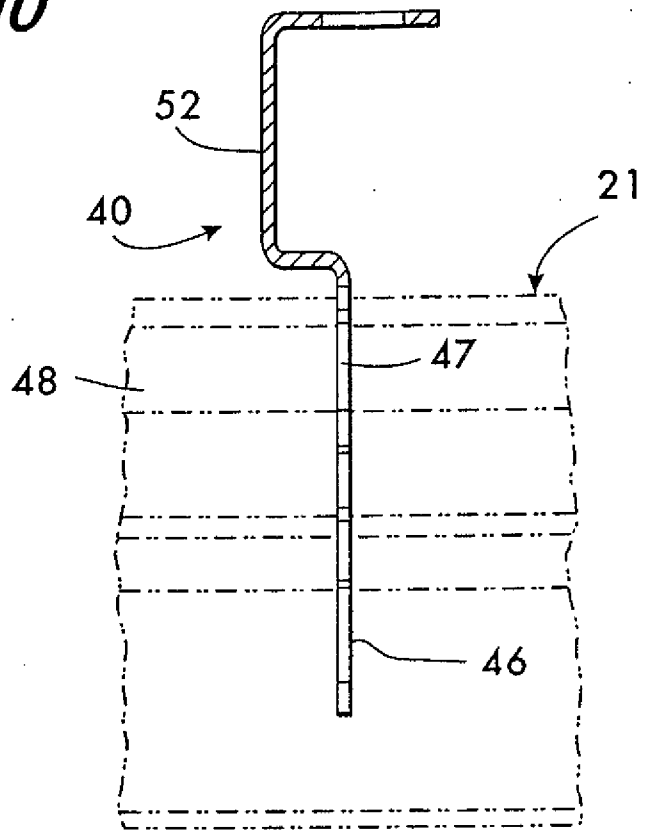


FIG. 11

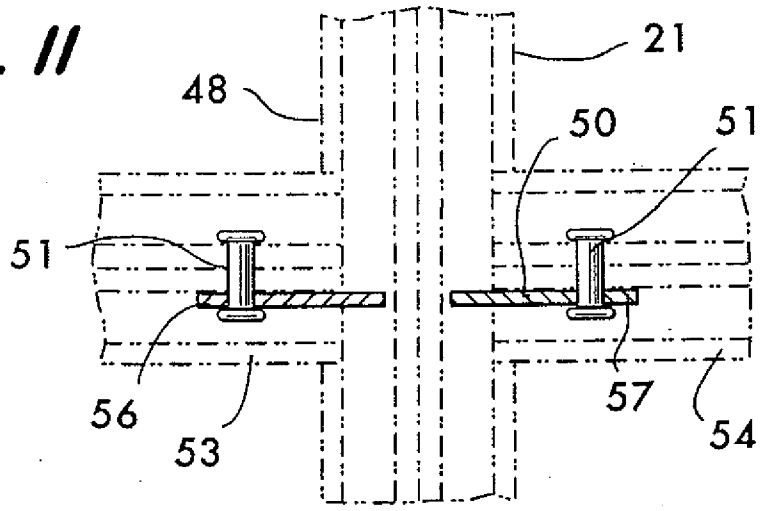
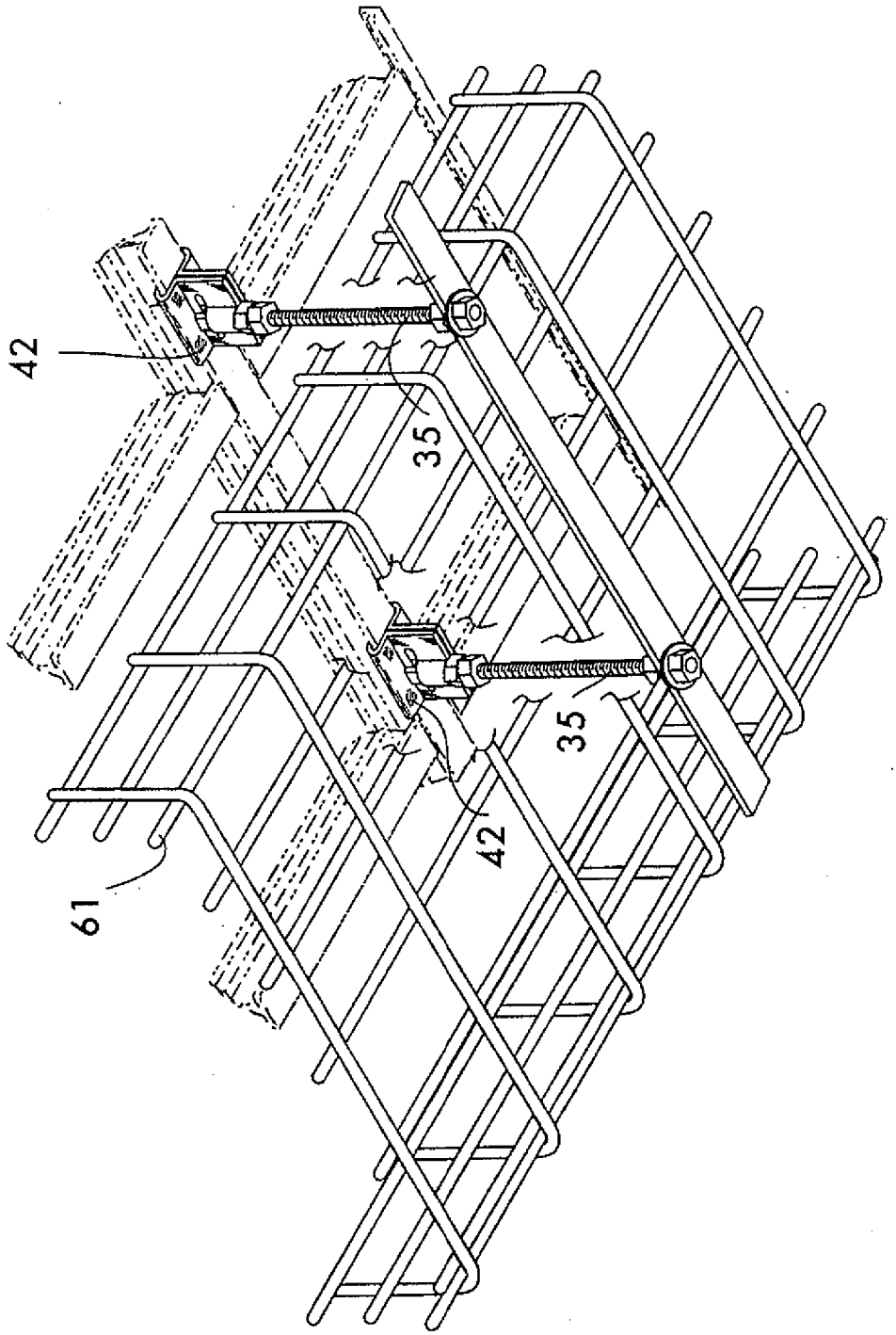


FIG. 12



REFERENCES CITED IN THE DESCRIPTION

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ÁLMENNYEZET TEHERHORDÓ RENDSZERREL

Szabadalmi igénypontok

1. Álmennyezet (20) gerendákból (21, 22) álló ráccsal (24), a gerendák fémlemezből hengerléssel fordított T keresztmetszetűre vannak alakítva, a keresztmetszetet függőleges gerinc (25), a gerinc (25) alján egymással ellenkező irányban kiálló vízszintes peremek (26, 27), és a gerinc (25) tetején legalább egy vastagabb rész (30) alkotja,
ahol a rács (24)

a) függesztő elemek (23) segítségével az álmennyezet (20) felett levő tartószerkezetre van függesztve;

b) tartót alkot a rácsgerendák (21, 22) peremein (26, 27) felfekvő panelek (33) számára; és

c) ki van egyensúlyozva;

azzal jellemezve, hogy
az álmennyezet (20) alatt függő terhet hordozó rendszer van, amely a rács (24) felett felső menetes függesztő rudakat (34), és a rács alatt alsó menetes teherhordó rudakat (35) tartalmaz, a rudak kapcsokkal (40, 41, 42) kapcsolódnak a rács (24) gerendáihoz (21, 22) a rács (24) olyan helyein, amelyek lehetővé teszik a terhelés átadását a gerendák (21, 22) gerincén (25) át függőlegesen, úgyhogy az álmennyezet (20) kiegyensúlyozott, sík és sértetlen marad.

2. Az 1. igénypont szerinti álmennyezet, amelynél a felső menetes függesztő rudak (34) a rácson (24) az alsó menetes teherhordó rudak (35) helyeihez viszonyítva úgy vannak kiosztva, hogy a rácsgerendák (21, 22) gerince (25) főként függőleges erőket visz át, a hajlító- és csavaróerőket a kapcsok (40, 41, 42) konstrukciója és a kapcsok (40, 41, 42) elrendezése kiegyenlíti, úgyhogy az álmennyezet

(20) kiegyensúlyozott, sík és sértetlen marad.

3. Az 1. vagy 2. igénypont szerinti álmennyezet, amelynél az álmennyezet (20) kiegyensúlyozott, sík és sértetlen marad az álmennyezetre (20) alulról ható olyan terhelés alatt, amely nem oszlik el egyenletesen az álmennyezet (20) mentén.

4. Az előző igénypontok bármelyike szerinti álmennyezet, amelynél a kapcsok a következők:

a) rácsgerenda-kereszteződési függesztő kapocs (40), amely az álmennyezeten (20) felülről kapcsolható az álmennyezet (20) rácsához (24) a rács egy főgerendájának (21) és a rács egy keresztgerendájának (22) kereszteződésénél,

b) rácsgerenda-függesztő kapocs (41), amely az álmennyezeten (20) felülről kapcsolható a rácshoz (24) egy rácsgerenda (21, 22) mentén, és

c) rácsgerenda-teherkapocs (42), amely az álmennyezeten (20) alulról kapcsolható egy rácsgerendához (21, 22).

5. Az előző igénypontok bármelyike szerinti álmennyezet, amelynél a kapcsok (40, 41, 42) hajlítás vagy csavarás nélkül viszik át a terhelést a rácsgerendákra és a rácsgerendákról (21, 22).

6. Az előző igénypontok bármelyike szerinti álmennyezet, amelynél a kapcsok (40, 41, 42) a gerendák (21, 22) gyengítése nélkül fogják be a rácsgerendákat (21, 22).

7. A 4.-6. igénypontok bármelyike szerinti álmennyezet, amelynél a rácsgerenda-teherkapocs (42) két azonos félből (68, 69) van kialakítva, amelyek összecsúsztatva a rácsgerenda (21, 22) peremeihez kapcsolódnak, és anyákkal (58) biztosított helyzetű menetes rúddal vannak rögzítve.