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(54) **Improved structural support**

(57) A structural support (100) to support a column (200), the structural support (100) comprising:
a frame (300) configured to be insertable into a hole in the ground;
wherein the frame (300) comprises a connecting portion (400) configured to be rigidly connected to a lower end of the column (200), the frame (300) being configured to retain a portion of filler material such that the frame (300), when at least partially filled with filler material, provides a substantially rigid support for the column (200).

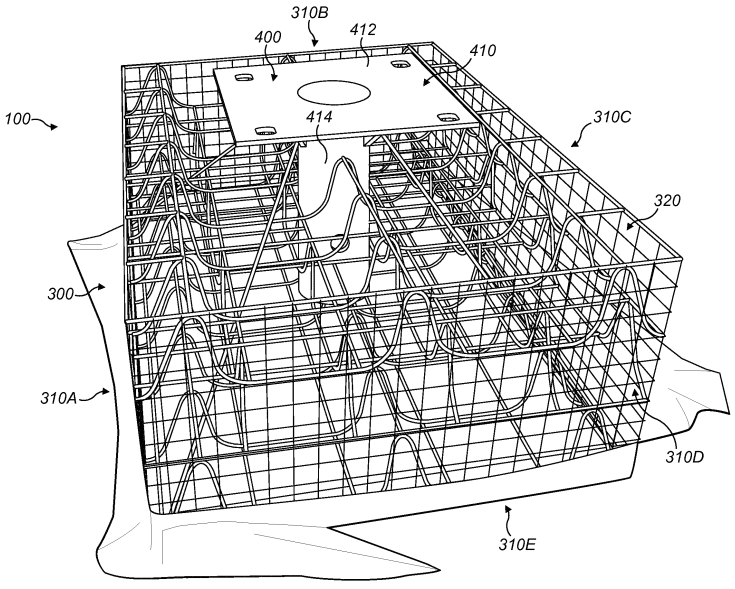


FIG. 1

EP 2 740 847 A2

Description

FIELD OF INVENTION

[0001] The present invention relates to a device and method for supporting a column of a structure. In particular, the present invention relates to a device to support a column of a railway signal, or a column of a traffic signal or the like.

BACKGROUND OF INVENTION

[0002] It is necessary to provide a structural support in the ground for a column which, for instance, supports a signalling system for use in the rail industry, road or other aspect of the transport / construction industry.

[0003] In the rail industry, columns are currently supported by a concrete foundation. In more detail, the concrete foundation is applied at a worksite by firstly digging a sufficiently large hole by removing rail ballast (or other material) from the railway bed. Generally the digging is done by hand or worksite machinery. The removed material is then transported away and disposed of. The hole is filled by concrete which is mixed by worksite machinery. The concrete is then allowed to set with a plurality of bolts extending therethough, such that an upper section of the bolt is left exposed. The column is then attached to the exposed section of the bolt, by means of a flanged connection.

[0004] A disadvantage of the above process is that a large quantity of concrete has to be mixed and transported to the work site. Yet further, a large quantity of excavated material has to be transported away from site and properly disposed of. Both of the above are time consuming and expensive. Furthermore, the concrete takes a substantial amount of time to set before the column can be connected to it. Yet further these processes are not suited to meet current sustainability and environmental, government legislation criteria.

[0005] It is an object of aspects of the invention to provide a solution to the above mentioned or other problems.

SUMMARY OF THE INVENTION

[0006] According to a first aspect of the invention there is provided a structural support to support a column, the structural support comprising:

> a frame configured to be insertable into a hole in the ground;
>
> wherein the frame comprises a connecting portion configured to be rigidly connected to a lower end of the column, the frame being configured to retain a portion of filler material such that the frame, when at least partially filled with filler material, provides a substantially rigid support for the column.

[0007] Preferably, the filler material is ballast or other excavated material which is preferably removed by excavation of the hole.

[0008] Preferably, the structural support is to support a column used in the transport or construction industry.

[0009] Preferably, the column is part of a railway signal. Preferably, the column is part of a road traffic signal.

[0010] Preferably, the column is about 1 - 5 metres in height, more preferably it is about 3 metres in height.

[0011] Preferably, the connecting portion comprises a movable member, the movable member being operable to move relative the frame such that the orientation of the column, once received, can be adjusted by moving the movable member.

[0012] Preferably, the frame is configured to retain filler material within its interior. Preferably, the weight of the filler material acting through the frame restrains the frame such that the substantially rigid support is provided.

[0013] Preferably, the movable member is movable by means of one or more position adjustment members. Preferably, the position adjustment members are configured to adjust the distance between a point on the movable member and the frame. Preferably, the position adjustment members are operable to tilt the movable member substantially about at least one axis of rotation, more preferably, about 6 axes of rotation.

[0014] Preferably, the movable member comprises a flange for receiving the column, and the or each position adjustment members are operatively connected to the flange, such that they can adjust a position of the flange.

[0015] Preferably, the or each position adjustment members comprise an axially adjustable tie which is adjustable in length along an elongate axis. Preferably, the ties are adjustable in length at one or both ends.

[0016] Preferably, the movable member further comprises an arm which is connected to the flange at a first end and which is connected to the frame at a second end. Preferably, the second end of the arm is flexibly connected to the frame, such that movement of the flexible connection effects movement of the movable member.

[0017] Preferably, the or each adjustment member is attached to the flange and / or the first end of the arm. Preferably, there are four adjustment members which are preferably arranged at the movable member to define a square, although it will be appreciated that other arrangements are possible.

[0018] Preferably, the arm comprises a substantially hollow sleeve, preferably through which one or more cables, to operate electronic equipment which is preferably supported by part of the column, can extend. Preferably, an insert is insertable into the sleeve to protect the cables. Preferably, the sleeve and / or insert are substantially circular in cross-section, and one or more fixing means are arranged to extend through the sleeve and into the insert to prevent rotation of the insert relative the sleeve.

[0019] Preferably, the arm comprises a first part and a second part, wherein the first part is connected to the

flange and the second part is connected to the frame, wherein the first and second part are removably attached to each other.

[0020] Preferably, the frame comprises a plurality of grills configured to retain filler material within the interior of the frame. Preferably, the grills comprise a plurality of bars which extend in first and second directions, which are preferably orthogonal to each other to define a grid, which is preferably a regular grid, more preferably a Cartesian grid. In a preferred embodiment, the grid has generally square apertures.

[0021] Preferably, the grills are arranged around the sides of the frame, preferably the side grills are arranged such that the bars extend in horizontal and vertical directions.

[0022] Preferably, the frame comprises a grill at its lower surface, wherein the lower grill preferably comprises a plurality of bars which extend in first and second directions, which are preferably orthogonal to each other.

[0023] Preferably, the frame at an upper surface comprises an opening through which the filler material can be transferred into the interior of the frame.

[0024] Preferably, the frame is comprised of a plurality of interior grills, which are preferably layered on top of each other and in use are preferably arranged substantially orthogonal to the column, such that they are substantially horizontal.

[0025] Preferably, the apertures in the grid of the interior grills are greater than those in the side grills and/or the lower grill. More preferably, the apertures in the interior grills are about 200mm x 200mm. More preferably, the apertures in the side grills and lower grill are about 50mm x 50mm.

[0026] Since the apertures in side grills are smaller a substantial portion of the filler material is retained with in the interior of the frame. The larger apertures in the interior grills enable the filler material to diffuse through the interior of the frame such that a uniform distribution of filler material occupies the interior of the frame. Furthermore, the interior grills uniformly extend through the interior of the frame, such that load from the filler material is uniformly transferred to the frame.

[0027] Preferably, the interior grills are at least partially undulating. Preferably, the lowest and highest points of undulation are connected on adjacent grills. Preferably, the grills are arranged such that the undulations extend in a transverse direction in a first layer and in a lateral direction in an adjacent second layer. Advantageously, the undulations increase the rigidity of the frame.

[0028] Preferably, the undulation is formed from a substantially flat grill. Optionally, the undulation comprises a series of substantially triangular portions. Optionally, the undulation comprises a series of arcuated portions. Optionally, the undulation comprises a series of sine wave shaped portions. Preferably, the undulations are interconnected by substantially flat portions.

[0029] Preferably, the undulated interior grills are configured such that the apertures in the grill allow movement of the filler material through the interior of the frame in the horizontal or vertical directions or a combination thereof. Since the undulations are formed from a flat grill, the apertures in the grill are displaced when forming the undulations such that they allow movement of filler material in a vertical and horizontal direction though the interior of the frame. Such an arrangement enables the frame to be more uniformly filled with filler material.

[0030] Preferably, the side grills and/or lower grill are connected around the edges or abutting portions of the interior grills.

[0031] Optionally, the lower grill is the lowest interior grill. Preferably, the arm is flexibly connected to one or more of the grills, more preferably it is connected to the lower grill. Preferably, the lower grill does not comprise any undulations.

[0032] Preferably, the adjustment members are connected to a periphery of the frame. More preferably, the adjustment members are connected to the periphery of the lower grill, and/or an undulation of an interior grill.

[0033] Preferably, the arm is arranged to extend through the interior grills.

[0034] Optionally, the frame is substantially square or rectangular in section. Preferably, the frame is approximately 50 - 150 cm in width, 50 - 200cm in length and 200 - 600 cm in height. More preferably it is about 140 x 100 x 500 cm. Although, it will be appreciated that the particular size of the frame is selected to be sufficient to provide adequate structural support for the typical columns of the rail / road industry it is intended for use with.

[0035] Preferably, the grills of the frame are composed of steel wire which is about 8 mm thick, although it will be appreciated that other thicknesses may be used depending on the required size of the frame, for instance, smaller frames may be made of wire which is 5 mm thick. Preferably, the flange, sleeve and insert are also made of steel.

[0036] Preferably, the grills and / or associated components are connected to each other by means of spot welding or other suitable means.

[0037] According to a second aspect of the invention there is provided a structural support and a column, the structural support comprising:

a frame which is at least partially inserted into a hole in the ground;

wherein the frame comprises a connecting portion which is rigidly connected to a lower end of the column, the frame retaining a portion of filler material such that the frame provides a substantially rigid support for the column.

[0038] It will be appreciated that the frame when filled can provide a support for the column when positioned above the ground, partially inserted into a hole in the ground or fully inserted into a hole in the ground. However, in a preferred example it is fully inserted into the

ground.

[0039] According to a third aspect of the invention there is provided a method of supporting a column by means of a structural support, the method comprising:

digging a hole to fit a frame of the structural support;

at least partially inserting the frame of the structural support into the hole;

at least partially filling the frame with filler material to weight the frame in the ground;

attaching a lower end of the column to a connecting portion of the frame.

[0040] Preferably, the method comprises a step of filling the frame with filler material which comprises the material removed from the hole.

[0041] Preferably, the method comprises a step of changing the orientation of the column by moving a movable member of the connecting portion, the movable member being movable relative the frame.

[0042] According to a fourth aspect of the invention there is provided a method of manufacturing a structural support of a column, the structural support comprising:

a frame configured to be insertable into a hole in the ground;

wherein the frame comprises a connecting portion configured to be rigidly connected to a lower end of the column, the frame being configured to retain a portion of filler material such that the frame, when at least partially filled with filler material, provides a substantially rigid support for the column,

wherein the method comprises forming the frame from a plurality of grills,

the method further comprising a step of forming one or more undulations in the grills from a substantially flat sheet of grill material.

[0043] Preferably, the method further comprises a step of connecting adjacent grills to the lowest and highest points of undulation.

[0044] Preferably, the method further comprises a step of connecting adjacent grills together such that the undulations on adjacent gills are substantially orthogonal to each other.

[0045] All of the features contained herein may be combined with any of the above aspects and in any combination.

BRIEF DESCRIPTION OF THE DRAWINGS

[0046] For a better understanding of the invention, and to show how embodiments of the same may be carried into effect, reference will now be made, by way of example, to the accompanying diagrammatic drawings in which:

Figure 1 shows a perspective view of a support structure according to an exemplary embodiment of the invention;

Figure 2 shows a side perspective view of part of the support structure of figure 1;

Figure 3 shows a side exploded view of the structure of figure 2;

Figure 4 shows a perspective view of part of the support structure of figure 1;

Figure 5 shows a method of forming part of the structure of figure 1;

Figure 6 shows a perspective view of part of the support structure of figure 1.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0047] Figures 1 - 3 show an example of a structural support 100 for a column 200 of a signalling system (both of which are not shown). The structural support 100 comprises a frame 300, which is designed to be inserted into a hole (not shown) in the ground. The frame 300 comprises a connection portion 400 which is designed to be connected to a lower end of the column 200. The frame 300 is designed to be filled with filler material (not shown) such that the filler material weights the frame down to provide a rigid support for the column, as will be discussed in more detail in the following.

[0048] Firstly considering the connecting portion 400 in more detail: In this particular embodiment the connecting portion comprises a movable member 410, in the form of a flange 412 and arm 414, as will be discussed in more detail below. The movable member 410 is operable to move relative the frame 300 such that the orientation of the column 200 supported thereon is adjustable. This is particularly advantageous as following installation of the column 200 on the filled frame 300, the orientation of the column can be fine-tuned by changing the position of the movable member rather than the entire frame.

[0049] It will be appreciated that in other embodiments the flange 412 and arm 414 may be fixed to the frame such that they are not movable relative to the frame 300. In such an embodiment the column 200 may comprise its own position adjustment means.

[0050] Referring back to the present embodiment: as best seen in figures 1 and 2, the movable member 410 comprises a flange 412 in the form of a flat square steel plate, which, in use, is arranged to abut a further flange

(not shown) of the base of the column 200. Proximate each vertex of the flange 412 there is a hole through which a bolt can be inserted to removably join the flange 412 to the flange of the column. Although a square flange 412 with four holes has been shown, it will be appreciated that other shapes of flange and hole arrangements can be used.

[0051] The moveable member 410 further comprises an arm 414 which is connected to the flange at a first end 416A and which is flexibly connected to a lower portion of the frame 300 at a second end 416B, as will be discussed in more detail below.

[0052] In this embodiment the arm 414 is in the form of a substantially hollow tubular sleeve through which one or more cables can be inserted (not shown), which operate the signalling system. The sleeve of the arm is made from steel and is of sufficient compressive strength to support the weight of the column.

[0053] As best shown in figure 4, the arm 414 is in two parts: an upper part 414A and lower part 414B. The upper part 414A and lower part 414B are connected together by fixing means, which in this example comprises a plurality of lugs 418. In more detail there are two lugs 418A, 418B which are connected to the lower part 414B (although it will be appreciated that the lugs 418 can alternatively be connected to the upper part 414A). The lugs 418 are connected to an inner surface of the lower part 414B, and protrude from an upper end of the lower part, such that when the upper and lower part 414A, B are mated, the lugs 418 extend into the upper part via a lower end of the upper part. Each lug 418 comprises an aperture 420A, which is arranged to align with apertures 420B in the side wall of the upper part 414A. Accordingly, to fix the upper and lower parts 414A, B together a bolt 422 (not shown) is inserted though the apertures 420A, B. There may be two bolts, one for each set of apertures 420A, B, or a single bolt which extends through both sets of apertures 420A, B. It will be appreciated that in the case of the latter the aperture sets 420A, B are positioned such that they are diametrically opposed to each other. One or both apertures 420A, B may have a threaded surface to mate with a thread of the bolt 422. The bolt 422 abuts the apertures 420A, B to prevent rotation and axial displacement of the upper part 414A relative the lower part 414B.

[0054] The upper or lower part 414A, B may also comprise a further aperture 424 for passage of cabling into the interior of the arm 412. In figure 4, the aperture 424 is shown extending into the lower part 414B.

[0055] As best seen in figures 1 and 2, four position adjustment members 430 in the form of axially adjustable ties extend between the flange 412 and the corners of the lower grill. The ties are adjustable in length along an elongate axis. Such adjustment may be achieved, as shown in figure 6B, by having the ties with a threaded end 431. A nut 433 is positioned relative to a plate 460 such that rotation of the nut adjusts the axial length of the tie between the plate 460 and the other point of connection of the tie which is discussed in more detail below. An advantage of this arrangement is that since the tie is adjusted at its end, this portion of the tie remains exposed once the frame 300 is filled or part filled in the ground, and hence is still adjustable.

[0056] In the example embodiment there are four adjustment members 430 A, B, C, D which are connected to the movable member to define a square. Although it will be appreciated that other arrangements and numbers of position adjustment members 430 are possible. It will also be appreciated that the position adjustment members may alternatively be connected to the arm 414.

[0057] As discussed above, changing the axial length of the adjustment members 430 adjusts the distance between a point on the movable member 410 and the frame 300, which enables adjustment of the tilt of the movable member. In more detail, and as shown in figure 2:

Equal axial adjustment of adjustment members 430 A, B and equal axial adjustment of adjustment members 430 C, D enables adjustment of the movable member about axis 432A;

Equal axial adjustment of adjustment members 430 D, A and equal axial adjustment of adjustment members 430 B, C enables adjustment of the movable member about axis 432B;

Axial adjustment of adjustment members 430 A, C enables adjustment of the movable member about axis 432C;

Axial adjustment of adjustment members 430 B, D, enables adjustment of the movable member about axis 432C.

[0058] Accordingly, by having four adjustment members tilt is adjustable in four axis. It will be appreciated that other combinations of adjustment members can be used to provide adjustment along other axes.

[0059] In an embodiment wherein the arm 414 and flange 412 are fixed with respect to the frame 300 the ties of the position adjustment members 430 are replaced with ties which are welded at a first end to the frame 300 and welded at a second end to the flange 412 and / or the arm 414.

[0060] Now considering the frame 300: the frame 300 is substantially square in section and is formed predominantly from a plurality of grills which extend around the periphery and through the interior of the frame 300 to retain filler material within the interior of the frame. The grills are composed of a plurality of bars which extend in first and second directions, which are generally orthogonal to each other to define a grid which is regular with square or rectangular apertures. There are a range of grills with different sized apertures and different arrangements, as will now be described:

As best seen in figure 1, along the sides of the frame 300 side grills 310 A, B, C and D extend, which are formed from bars that are arranged to extend in a horizontal and vertical direction. Along a lower surface of the frame 300 a bottom grill 310 E extends, which is formed from bars that are arranged to extend in a lateral and transverse direction. The grills 310A - E have the same sized apertures, which are smaller than the apertures found on the interior grills 330, as will be discussed in more detail below. In this way the peripheries of the frame help to retain a greater range of particulate size of filler material within the interior of the frame. In this example the size of the apertures is 5 cm x 5 cm although it will be appreciated that this size will vary depending on the overall size of the frame.

[0061] An upper surface of the frame 300 comprises an opening 320 through which the filler material can be transferred into the interior of the frame. As best seen in figure 3, a strengthening member 322 optionally extends around the periphery of the frame at the upper surface to strengthen the opening. The strengthening member comprises a wire shaped to form a square.

[0062] The interior of the frame 300 comprises a plurality of horizontally arranged grills 330, which are layered on top of each other, as best seen in figure 3. In this example there are 3 horizontal grills 330 A, B, C, although it will be appreciated that there may be more or less depending on the size of the frame and the load which it is required to support.

[0063] The horizontal grills 330 are configured such that a portion of them is undulating 332 and a portion is regular 334, as best seen on grill 330B. In more detail the undulation 332 is formed from a flat grill as illustrated in figure 5.

[0064] As shown in figure 5a, initially a flat grill 330A is formed from a grid of bars that are arranged to extend in a lateral 'L' and transverse 'T' direction, such that the grid has transversely extending rows of apertures, and laterally extending columns 336 of apertures.

[0065] In this example a sequence of two undulating columns 336A is followed by a regular column 336B. The undulating columns 336A are formed into the undulation 332, as will be discussed in more detail below. The transverse width t_u of the sum of the undulating columns 336A is selected such that, when the column is deformed to provide the undulation 332, the undulation has the same transverse width t_r as the regular columns 336B. In this example two undulating columns 336A comprise the undulation 332, however it will be appreciated that other numbers of undulating columns 336A can be used to form the undulation 332.

[0066] As shown in figure 5b, the flat grill 330B is manipulated to form the undulations 332. The undulations 332 may be formed by any known means. One such example is by using a bending machine to bend across lines 340 A, B, C which extend in the lateral direction. The undulations may be formed into a range of shapes: for instance a symmetrically arcuate shape that resembles a Gaussian curve; a triangular shape; a square/square tapered shape; a sine wave shape.

[0067] In this example since the undulation 332 is formed from an even number (two) of undulating columns 336A, the highest point of the undulation 332 comprises a laterally extending bar 342. Advantageously, the bar 342 enables convenient fixing between the interior grills 330 when layered.

[0068] Accordingly, the horizontal grill 330 comprises a sequence of regular sections 334 which comprises horizontally arranged apertures, and undulations 332, which comprise apertures that extend around the undulation 332.

[0069] Referring now to figures 2 and 3 in particular, it can be seen that the lowest horizontal grill 330A is connected at its highest vertical point (which in this example is the bar 342) of the undulation 332 to the lowest point (which comprises the bars 345 of the regular section 334) of the adjacent grill 330B.

[0070] The undulations 332 between adjacent horizontal grills are orthogonal to each other. For example, the undulations 332 in the horizontal grill 330A extend in a transverse direction, and the undulations 332 in the horizontal grill 330B extend in a lateral direction. In this way the undulations enhance the flexural rigidity of the frame 300 in several planes.

[0071] The apertures in the grid of the horizontally arranged grills 330 are greater than those in the side and bottom grills 310 A - E. In this example the apertures of the regular section 334 and undulated section 332 of the horizontal grills 330 are 200mm x 200mm and for the side grills 310 A - D and bottom grill 310E are 50mm x 50mm. Although it will be appreciated that this size will vary depending on the overall size of the frame which is selected for the particular site and column it is intended for use with. The larger apertures in the horizontally arranged grills 330, as opposed to the side and bottom grills 310 A - E, enable the filler material to diffuse through the interior of the frame such that a uniform distribution of filler material occupies the interior of the frame.

[0072] Moreover, since the undulations are formed from a flat grill, the apertures are horizontally arranged in the regular section 334, and are vertically inclined in the undulated section 332. In this way they allow movement of filler material in a vertical and horizontal direction throughout the interior of the frame 300. Such an arrangement enables the frame 300 to be more uniformly and conveniently filled with filler material.

[0073] Furthermore, the horizontally arranged grills uniformly cover the interior of the frame. In this way load from the filler material is uniformly transferred to the frame. Accordingly, the frame is highly structurally efficient, such that less material can be used.

[0074] As best seen in figure 1, the side and bottom grills 310 A - E are connected around the edges of the horizontally arranged grills. They are also connected to

each other along adjoining edges.

[0075] As best seen in figures 1 - 3, the arm 414 as described in the above extends through the horizontal grills 330 and is arranged at the centre of the frame 300. In the example, this is achieved by positioning the arm 414 to extend though a central aperture 346 (not shown). However, if a larger arm is required it will be appreciated that a portion of the horizontal grills 330 can alternatively be removed.

[0076] The lower part 414B of the arm 414 is connected to the bottom grill 330A. It may also be connected to adjacent parts of the horizontal grills 330. Since the bottom grill 330A and horizontal grills 330 are made of relatively compliant steel wire a flexible connection between the arm and frame is achieved. This enables adjustment of the position of the arm 414 and flange 412 as part of the movable member 410, as described in the above.

[0077] Referring now to figure 6A, an example of the connection between the adjustment members 430 and the frame 300 is shown. A plate 450 is connected between orthogonal bars 452, 454 which form part of the peripheral undulation of the lower horizontal layer 330A. The adjustment member 430 is then attached to a hole 458 in the plate 450.

[0078] The equivalent connection at the other end of the adjustment member 430 is shown in figure 6B; wherein a plate 460, which comprises a front portion 462, and two side portions 464 are connected to the flange 412. The side portions have an angled edge which when attached to the underside of the flange 412, causes the front plate 462 to be inclined to the flange such that the adjustment member 430 is substantially orthogonal to it.

[0079] In the example, the frame is approximately 50 - 150 cm in width, 50 - 200 cm in length and 200 - 600 cm in height. The specific size is selected to suit the particular loading requirement of the column. Although, it will be appreciated that the particular size of the frame is selected to be sufficient to provide adequate structural support for the typical columns of the rail / road industry it is intended for use with.

[0080] The grills of the frame are composed of steel wire which is about 8 mm thick, although it will be appreciated that other thicknesses may be used depending on the required size of the frame, for instance, smaller frames may be made of wire which is 5 mm thick.

[0081] The connections between the above grills and associated components are achieved by spot welding; however it will be appreciated that other forms of connection may be used, such as an eyelet which loops around the connection points.

[0082] A method of supporting a column 200 using the support structure 100 will now be described:

Initially a hole is dug at the worksite, by hand or industrial digging apparatus. Thereafter the frame 300 is inserted in to the hole, such that it is below or partially above the level of the ground. The ballast & excavated material which is removed from the ground to form the hole is then used as filler material to uniformly fill the frame. It will be appreciated that the frame 300 may be fully filled or part filled with this material. Accordingly, the weight of the filler material is sufficient to weight the frame down such that it provides a rigid support for the column.

[0083] The column is then attached to the flange 412. If the position of the attached column requires adjustment the position adjustment members are used to adjust the tilt of the flange 412.

[0084] In the instance when the frame 300 is required to contain cabling for the column 200, cables are inserted through the side bottom or top of the frame and into the arm 414 via the aperture 424 prior to filling the frame with material.

[0085] Although, in the example the frame is filled with filler material that comprises the ballast removed from the hole it will be appreciated that other material may be used in addition or as an alternative to the ballast.

[0086] Attention is directed to all papers and documents which are filed concurrently with or previous to this specification in connection with this application and which are open to public inspection with this specification, and the contents of all such papers and documents are incorporated herein by reference.

[0087] All of the features disclosed in this specification (including any accompanying claims, abstract and drawings), and/or all of the steps of any method or process so disclosed, may be combined in any combination, except combinations where at least some of such features and/or steps are mutually exclusive.

[0088] Each feature disclosed in this specification (including any accompanying claims, abstract and drawings) may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0089] The invention is not restricted to the details of the foregoing embodiment(s). The invention extends to any novel one, or any novel combination, of the features disclosed in this specification (including any accompanying claims, abstract and drawings), or to any novel one, or any novel combination, of the steps of any method or process so disclosed.

Claims

1. A structural support to support a column, the structural support comprising:

   a frame configured to be insertable into a hole in the ground;

   wherein the frame comprises a connecting portion configured to be rigidly connected to a lower end of the column, the frame being configured

to retain a portion of filler material such that the frame, when at least partially filled with filler material, provides a substantially rigid support for the column.

2. The structural support to support a column as claimed in claim 1, which is a structural support to support a column used in the transport or construction industry.

3. The structural support to support a column as claimed in claim 1 or claim 2, in which the connecting portion comprises a movable member operable to move relative to the frame such that the orientation of the column, once received, can be adjusted by moving the movable member.

4. The structural support to support a column as claimed in any preceding claim, in which the movable member is movable by means of one or more position adjustment members.

5. The structural support to support a column as claimed in claim 4, in which the or each position adjustment member comprises an axially adjustable tie which is adjustable in length along an elongate axis.

6. The structural support to support a column as claimed in claim 5, in which, the movable member comprises a flange for receiving the column, and the or each position adjustment members are operatively connected to the flange, such that they can adjust a position of the flange.

7. The structural support to support a column as claimed in claim 6, in which, the movable member further comprises an arm which is connected to the flange at a first end and which is connected to the frame at a second end.

8. The structural support to support a column as claimed claim 7, in which the arm comprises a substantially hollow sleeve, through which one or more cables, to operate electronic equipment supported by part of the column, can extend.

9. The structural support to support a column as claimed in claim 7 or claim 8, in which the arm comprises a first part and a second part, wherein the first part is connected to the flange and the second part is connected to the frame, wherein the first and second part are removably attached to each other.

10. The structural support to support a column as claimed in any preceding claim, in which the frame comprises a plurality of grills configured to retain filler material within the interior of the frame.

11. The structural support to support a column as claimed in any preceding claim, in which the frame is comprised of a plurality of interior grills, which are layered on top of each other and in use are arranged substantially orthogonal to the column, such that they are substantially horizontal.

12. The structural support to support a column as claimed in claim 11, in which apertures in a grid of the interior grills are larger than those in the side grills.

13. The structural support to support a column as claimed in claim 12, in which the interior grills are at least partially undulating.

14. A method of supporting a column by means of a structural support, the method comprising:

digging a hole to fit a frame of the structural support;
at least partially inserting the frame of the structural support into the hole;
at least partially filling the frame with filler material to weight the frame in the ground;
attaching a lower end of the column to a connecting portion of the frame.

15. The method of claim 14, which comprises a step of changing the orientation of the column by moving a movable member of the connecting portion, the movable member being movable relative the frame.

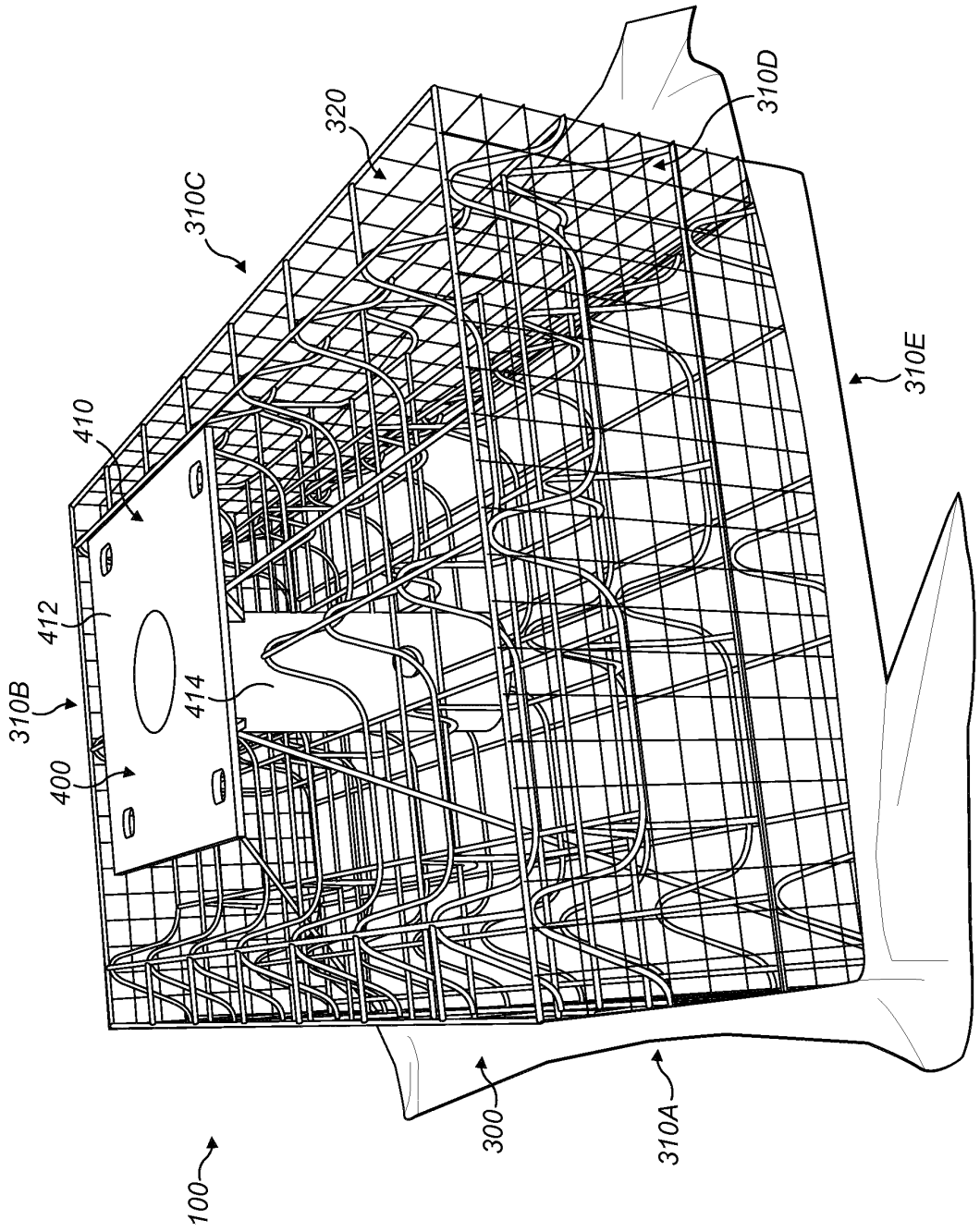


FIG. 1

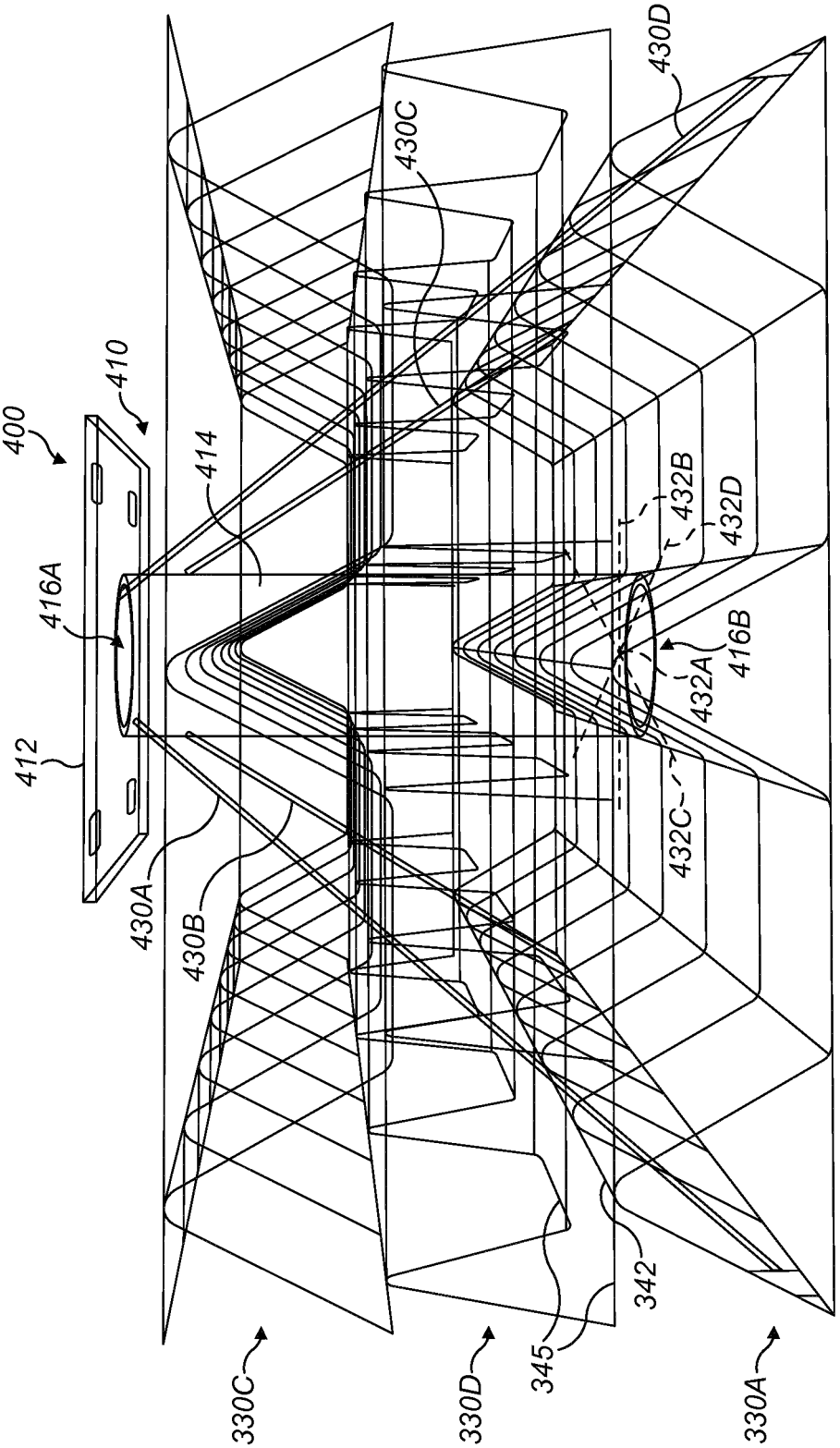

400
410
414
416A
412
430A
430B
430C
430D
432B
432D
432A
416B
432C
342
345
330C
330D
330A

FIG. 2

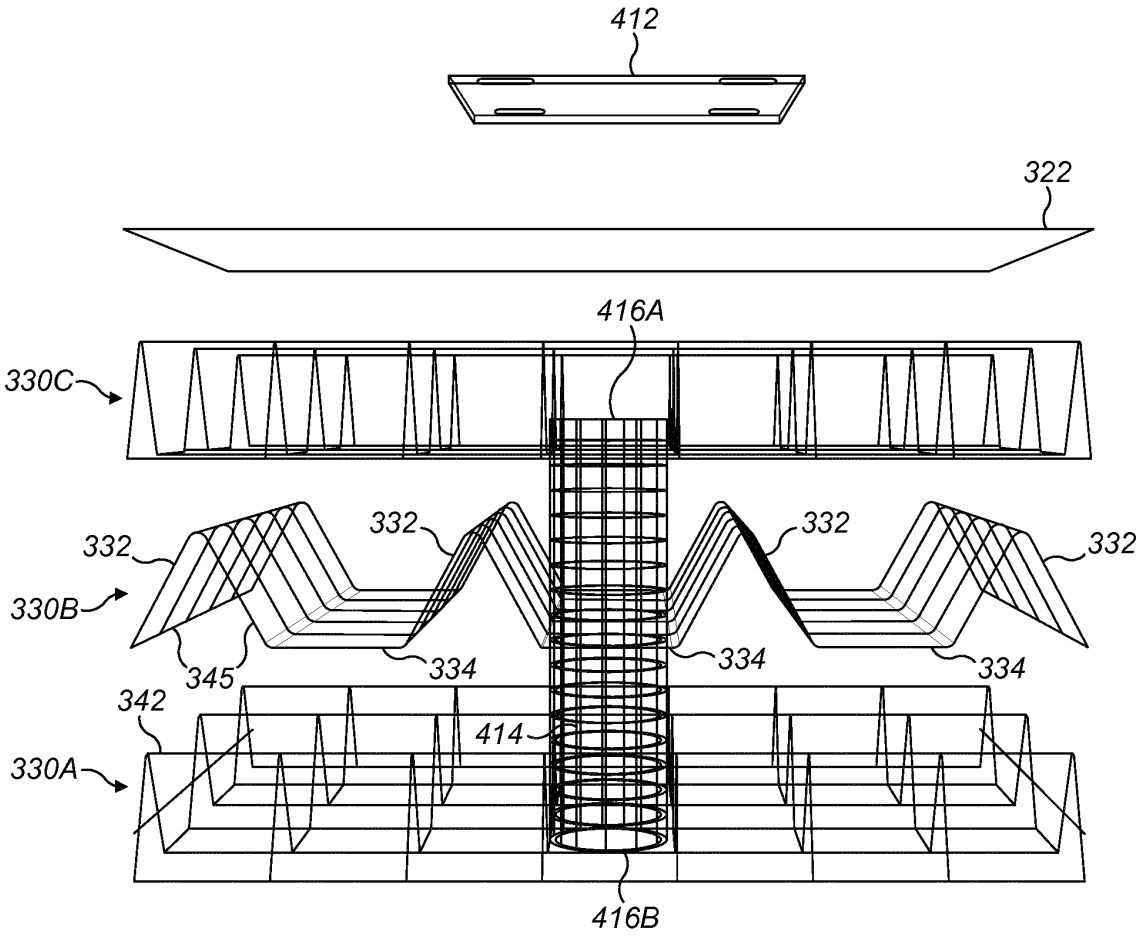

412
322
416A
330C
332
332
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332
330B
345
334
334
334
342
414
330A
416B

FIG. 3

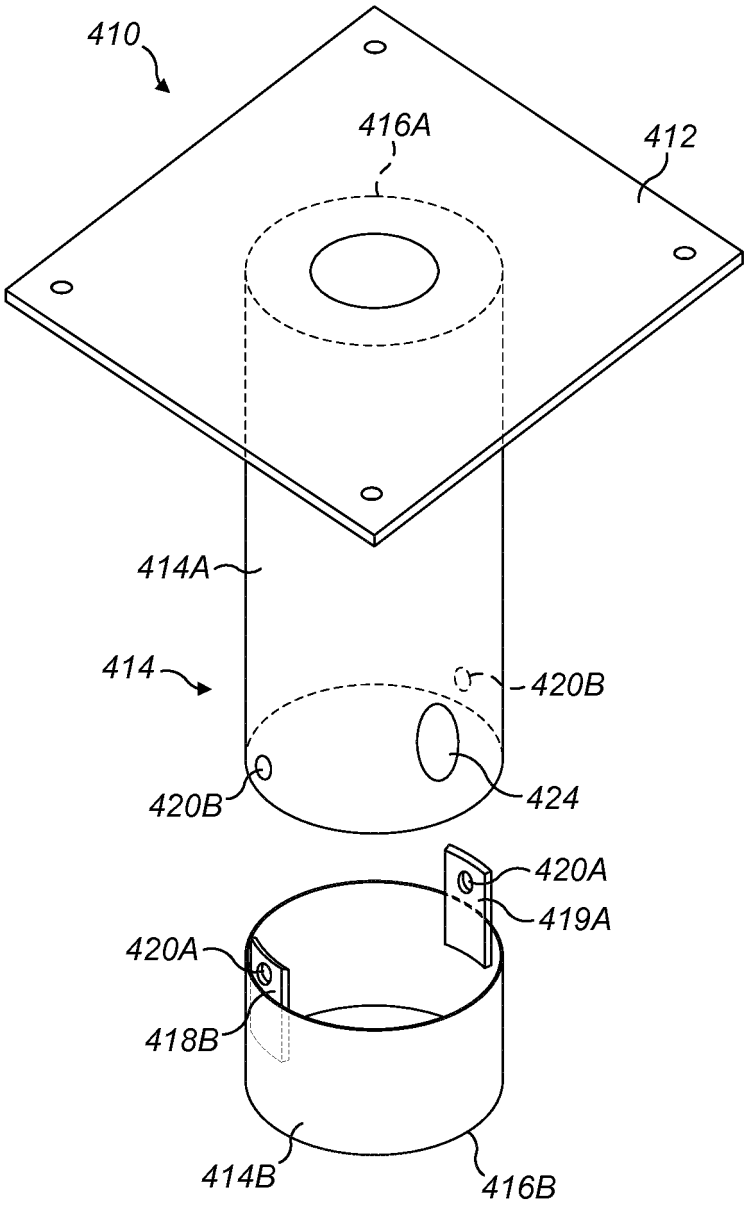

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420B
420B
424
420A
419A
420A
418B
414B
416B

FIG. 4

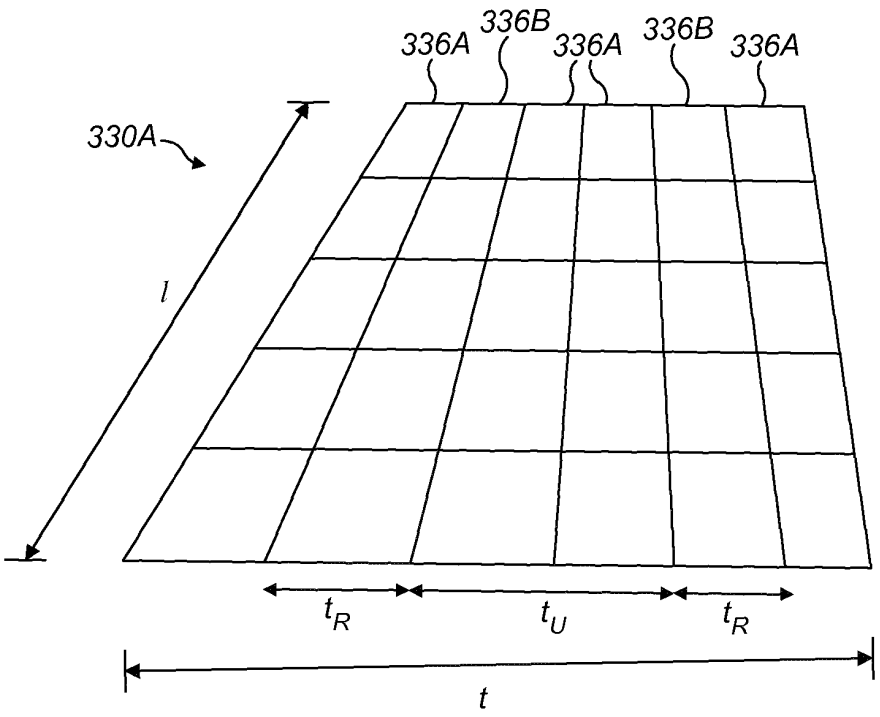

336A
336B
336A
336B
336A
330A
l
t_R
t_U
t_R
t

FIG. 5A

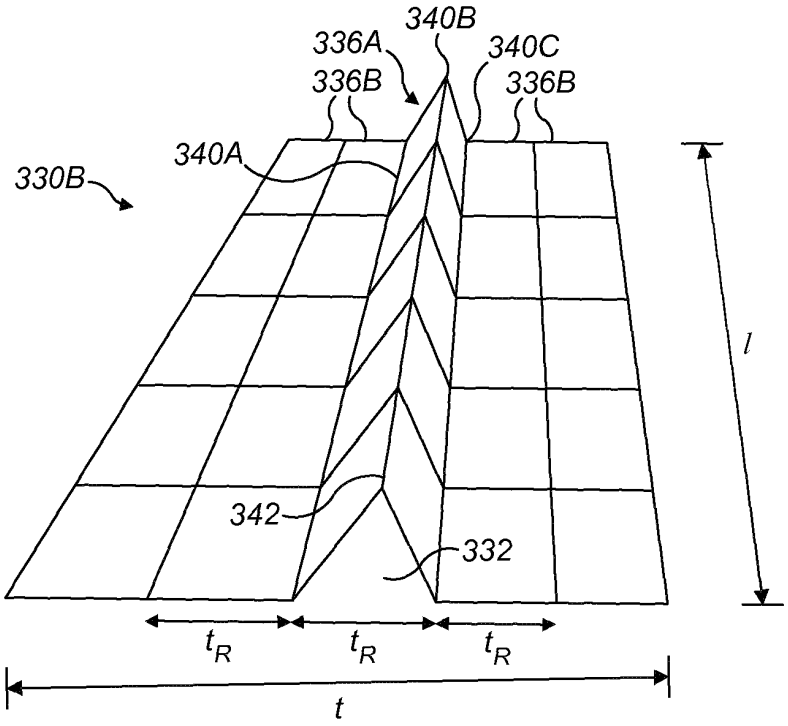

340B
336A
340C
336B
336B
340A
330B
l
342
332
t_R
t_R
t_R
t

FIG. 5B

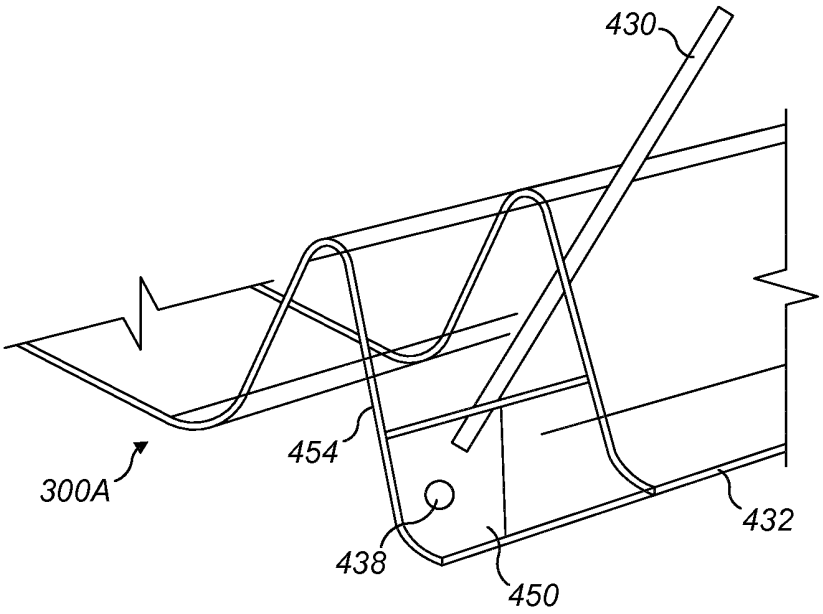


FIG. 6A

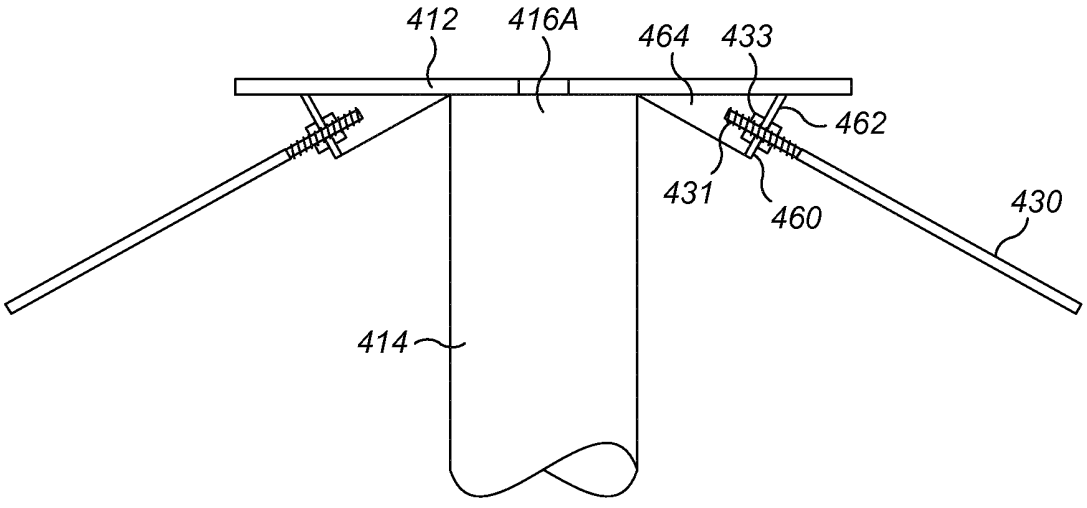


FIG. 6B