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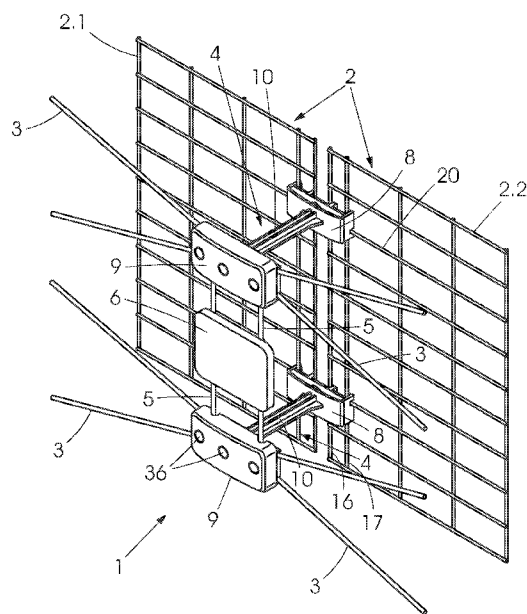


FIGURE 1

(57) Abstract: The invention relates to an ultra-high frequency television antenna (1) having a grid-type reflector (2) and an array of dipole elements (3) mounted onto two spaced apart, insulated supports (4). The reflector comprises at least two separate grid components (2.1; 2.2) that are releasably securable relative to each other to enable an overlapping, packing arrangement of the grid components. In use, the grid components are rigidly secured in an extended condition to provide a working grid assembly of the reflector. Each pair of dipole elements is provided by a dipole assembly comprising a V-shaped rod with a fixed mounting plate and a captive tightening screw.

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## **A GRID ANTENNA**

### **FIELD OF THE INVENTION**

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The invention relates to a grid-type antenna for receiving satellite television transmissions and more specifically to such an antenna which receives ultra-high frequency (UHF) transmission signals.

### **BACKGROUND TO THE INVENTION**

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These antennae are provided with a reflector of grid construction and additional components that are mounted to and/or supported from the reflector to make up an assembled product.

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The assembly includes an arrangement of dipoles supported in spaced apart relationship to the grid of the reflector. These grid-type antennae or aerials commonly use either two or four dipole arrangements positioned in front of the reflector. The dipoles are used to receive the UHF signals.

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Insulated supports are required to avoid electrical contact between the dipoles or with any of the metal antenna components or supporting structure. The dipoles are connected to a printed circuit board (PCB) that will include a balun. An F connector provides the interface between the PCB and a coax cable. The balun is a device that  
25 serves to match the balanced (i.e. symmetrical) dipole to the unbalanced (i.e. asymmetric, signal and earth) coax cable.

The operation of such an antenna will be understood by a person skilled in the art.

These antennae need to be packaged for supply to consumers or end users. The components of the antennae may be supplied in a part-assembled condition to facilitate packing in a reduced size or more compact form of packaging. The packaged product will usually be shipped or transported as container loads. Thereafter, further distribution  
5 may take place as truck/trailer loads.

### **OBJECT OF THE INVENTION**

It is an object of the invention to provide a grid antenna with components that have a  
10 compact packing configuration and/or are convenient to assemble.

### **SUMMARY OF THE INVENTION**

In accordance with the invention there is provided an antenna, preferably a UHF  
15 antenna for satellite television, comprising having a grid-type reflector and including:

- a. an array of dipole elements mounted onto two spaced apart, insulated supports that extend to a front side of the reflector;
- b. a pair of dipole connecting rods extending between the supports;
- c. a housing for a printed circuit board secured between the dipole connecting rods  
20 with an output connection for a coax cable;
- d. the supports each having a foot to engage the reflector;
- e. the reflector comprising (at least) two separate grid components that are releasably securable in relation to each other:
  - i. for release and positioning of the two grid components in an overlapping,  
25 packing arrangement relative to each other; and
  - ii. to rigidly secure the two grid components in an extended condition relative to each other and to the foot of each support, providing a working grid assembly of the reflector.

The invention further provides for an antenna as defined in which at least one of the two grid components is releasably securable to the foot of each support: for release of the at least one grid component and positioning of the two grid components in the overlapping, packing arrangement; and to rigidly secure the at least one grid component to the foot of each support with the two grid components in the extended condition.

The invention further provides for an antenna as defined in which the two separate grid components are both releasably securable to the foot of each support: for release of the two grid components and positioning of the two grid components in the overlapping, packing arrangement; and to rigidly secure the at least one grid component to the foot of each support with the two grid components in the extended condition.

The invention further provides for an antenna as defined in which:

the dipole elements are removably securable to the two spaced apart supports and extend to a first side and to a second side of the two supports and the two grid components are respectively securable to extend to the first side and to the second side of the two supports;

the at least one grid component is hingedly retained to the foot of each support; and/or

the two grid components are releasably securable to the foot of each support with a clamping plate.

The invention further provides for an antenna as defined in which: the foot of each support includes inner and outer spaced apart shoulders, for engagement with one of the grid components, with at least the outer shoulder having a lip; each grid component includes an inner bar at an inner edge of the grid component and a securing bar, with a space between the inner bar and securing bar corresponding substantially to a space between the inner and outer shoulders; and the clamping plate is provided adjacent the inner shoulder to at least partially overlies the inner bar and biases the inner bar and the securing bar against the inner and outer spaced apart shoulders respectively.

The invention further provides for an antenna as defined in which:

the clamping plate has an opening for a biasing screw that engages the foot of the support between two inner shoulders arranged to engage the inner bars of the two  
5 grid components;

the inner and outer shoulders are provided by two mounting flanges on the foot of each support; and/or

the two mounting flanges are each provided with an aligned recess that accommodates a crossbar extending from the inner bar to the securing bar.

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The invention further provides for an antenna as defined in which:

each support includes a connector for engagement with two pairs of removably securable dipole elements;

each pair of dipole elements is provided by a dipole assembly comprising a V-  
15 shaped rod providing two dipole elements with a mounting plate fixed adjacent an apex where the two dipole elements converge, the mounting plate providing a web between the two dipole elements having an opening for a tightening screw;

the mounting plate includes two integral connecting flanges that extend from the web and are pressed into engagement around each of the two dipole elements  
20 respectively and in which the connecting flanges of the mounting plate extend around an outside of the two dipole elements and are folded inwardly to an inside of the two dipole elements;

the tightening screw is rotatably retained within the opening in the web;

a first portion of the tightening screw adjacent a head of the tightening screw is  
25 located inside the opening in the web and the opening in the web is provided with an interference fit to resist passage of a second portion of the tightening screw that carries a screw-thread;

the opening in the web is provided with a toothed or notched profile;

a stop washer is secured onto the tightening screw with the web located between  
30 the stop washer and a head of the tightening screw; and/or

the stop washer is provided by a resiliently deformable O-ring that engages with an interference fit onto the tightening screw.

In accordance with a further, more specific aspect of the invention there is provided an antenna having a grid-type reflector and including:

- a. an array of dipole elements mounted onto two spaced apart, insulated supports that extend to a front side of the reflector;
- b. a pair of dipole connecting rods extending between the supports;
- c. a housing for a printed circuit board secured between the dipole connecting rods with an output connection for a coax cable;
- d. the supports each having a foot to engage the reflector;
- e. the reflector comprising two separate grid components that provide a working grid assembly with the two grid components engaged with the foot of each support;
- f. at least one of the two grid components releasably securable to the foot of each support:
  - i. for release of the at least one grid component and positioning of the two grid components in an overlapping, packing arrangement relative to each other; and
  - ii. to rigidly secure the at least one grid component to the foot of each support with the two grid components in an extended condition providing the working grid assembly of the reflector.

In accordance with another aspect of the invention there is provided a dipole assembly for an antenna having a grid-type reflector, comprising a V-shaped rod providing two dipole elements with a mounting plate fixed adjacent an apex where the two dipole elements converge with the mounting plate providing a web between the two dipole elements having an opening for a tightening screw which is rotatably retained relative to the web.

The invention further provides for a dipole assembly as defined in which:

the mounting plate includes two integral connecting flanges that extend from the web and are pressed into engagement around each of the two dipole elements respectively and in which the connecting flanges of the mounting plate extend around  
5 an outside of the two dipole elements and are folded inwardly to an inside of the two dipole elements;

a first portion of the tightening screw adjacent a head of the tightening screw is located inside the opening in the web and the opening in the web is provided with an interference fit to resist passage of a second portion of the tightening screw that carries  
10 a screw-thread; and/or

a stop washer is secured onto the tightening screw with the web located between the stop washer and a head of the tightening screw.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

15 These and other features of the invention will become more apparent from the following description of a preferred embodiment, made by way of example, with reference to the accompanying drawings, in which:

- 20 Figure 1 shows a perspective view of an assembled antenna having a grid-type reflector;
- Figure 2 shows a rear perspective view of the antenna in Figure 1;
- Figure 3 shows an exploded perspective view of an insulated support;
- Figure 4 shows a rear view of the antenna with one grid component of the reflector  
25 folded across into an overlapping position with the other grid component;
- Figure 5 shows an enlarged perspective view of the section marked by broken lines on Figure 4;
- Figure 6 shows an enlarged rear perspective view of a portion of the antenna with the grid components secured in an extended condition to a foot of a  
30 support;

- Figure 7 shows a front perspective view of a dipole assembly;  
Figure 8 shows a part cross-sectional plan view of the dipole assembly secured to an insulated connector of a support;  
Figure 9 shows a rear view of the components shown in Figure 8.

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## **DETAILED DESCRIPTION OF THE INVENTION**

An antenna (1) in accordance with a preferred embodiment of the invention is described with reference to the drawings. The antenna (1) is of the ultra-high frequency (UHF) signal receiving type that is used for satellite television and has a grid-type reflector (2) and an array of dipole elements (3).

The dipole elements (3) are mounted onto two spaced apart, insulated supports (4) that extend to a front side of the reflector (2). A pair of parallel dipole connecting rods (5) extend between the supports (4) with an insulated housing (6) for a printed circuit board (PCB – not shown) secured between the rods (5). An output connection (7) for a coax cable protrudes from a rear side of the housing (6).

Each support (4) includes a foot (8) to engage the reflector (2) at one (rear) end and a connector (9) for engagement with two pairs of removably securable dipole elements (3) at the other (front) end. A spacer (10) extends between the foot (8) and the connector (9). The foot (8) is moulded integrally with the spacer (10) and a fastening screw (11) secures the connector (9) in place onto the spacer (10).

In accordance with this particular embodiment of the invention, the reflector (2) comprises two separate grid components (2.1; 2.2) that are releasably securable in relation to each other. More specifically, the two separate grid components (2.1; 2.2) are both releasably securable to the foot (8) of each support (4).

The dipole elements (3) are removably securable to the two spaced apart supports (4) and extend to a first side and to a second side of the two supports (4). The two grid components (2.1; 2.2) are also securable to extend to the first side and to the second side of the two supports (4) respectively and thus correspondingly arranged when the reflector (2) is assembled. Where convenient in describing the product, the two grid components (2.1; 2.2) will be referred to as the first grid component (2.1) and the second grid component (2.2) in what follows. It should however be appreciated that the antenna (1) is not limited to an orientation where the first and second sides correspond to the horizontal and may, in use, be mounted in various positions.

The releasable engagement of the two grid components (2.1; 2.2) serves to provide for a compact packing arrangement of the antenna (1) prior to assembly. When the two grid components (2.1; 2.2) are released, they can be position in an overlapping, packing arrangement relative to each other – see Figures 4 and 5. On assembly, the two grid components (2.1; 2.2) are rigidly secured in an extended condition relative to each other and to the foot (8) of each support (4), providing a working grid assembly of the reflector (2). This is shown in Figures 1, 2, 3 and 6.

It will be appreciated, considering also the description of features that follows, that only one of the two grid components may be releasably securable to the foot of each support or relative to the other of the two grid components. In one such version of the antenna, the fixed grid can be riveted or otherwise anchored to the foot of each support while the other may be releasably clamped with a mechanism similar to that described with reference to the drawings.

In Figures 4 and 5, both grid components (2.1; 2.2) are hingedly retained to the foot (8) of each support (4) by a clamping plate (12). The foot (8) of each support (4) includes inwardly disposed and spaced apart inner (13) and outer (14) shoulders, provided by four mounting flanges (13; 14), for engagement with each of the grid components (2.1; 2.2). In this embodiment, a locating groove (15.1) for the inner bar (16) is provided at

the base of the inner shoulder (13) and the outer shoulder (14) has a lip (15.2). Each grid component (2.1; 2.2) includes an inner bar (16) at an inner edge of the grid component (2.1; 2.2) and a securing bar (17). A space between the inner bar (16) and securing bar (17) are provided to correspond substantially to a space between the inner  
5 shoulder (13) and outer shoulder (14).

The clamping plate (12) is located adjacent and between two inner shoulders (13) and provided to partially overlies the two inner bars (16). The clamping plate (12) has an opening (not shown) for a biasing screw (18) that engages the foot (8) of the support (4)  
10 between two inner shoulders (13).

In a pre-assembly condition of the antenna, the biasing screw (18) is used to connect the clamping plate (12) to the foot (8) over the inner bars (16). With edges of the clamping plate (12) supported in close proximity to the inner shoulders (13), the two  
15 grid components (2.1; 2.2) are movably retained in relation to each foot (8). The inner bar (16) can move under the clamping plate (12) towards the biasing screw (18). This allows the securing bar (17) to move past the lip (15.2) on the outer shoulder (14). In this condition, the grid components (2.1; 2.2) can be hinged relative to the supports (4).

20 The biasing screws (18) have a large head that can be gripped with a thumb and forefinger. Alternative, heads that afford ease of tightening may also be used. Screwdriver slots are also included to apply additional torque.

The four mounting flanges (13; 14) are each provided with an aligned recess (19) that  
25 accommodates a crossbar (20) extending from the inner bar (16) to the securing bar (17). The location of the crossbars (20) inside the recesses (19) provides for an accurate alignment of the grid components (2.1; 2.2) and affords additional rigidity.

The eight dipole elements (3) are provided by four dipole assemblies (21) as shown in  
30 Figures 7 and 8. Each dipole assembly (21) comprises a V-shaped rod (22) providing

two dipole elements (3). The dipole assembly (21) includes a mounting plate (23) fixed adjacent an apex where the two dipole elements (3) converge. The mounting plate (23) provides a web (24) between the two dipole elements (3) having an opening (25) for a tightening screw (26) which is rotatably retained relative to the web (24).

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The mounting plate (23) has two integral connecting flanges (27) that extend from the web (24) and are pressed into engagement around each of the two dipole elements (3) respectively. The connecting flanges (27) are arranged to extend around an outside of the V-shaped rod (22) and are folded inwardly, in a curve over and to an inside of the two dipole elements (3).

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Retaining means to hold the tightening screw (26) captive while still affording rotation in the opening (25) of the web (24) may be provided in various forms. In this embodiment, a stop washer (28) is secured onto the tightening screw (26) with the web (24) located between the stop washer (28) and a head (29) of the tightening screw (26). The stop washer is provided by a resiliently deformable O-ring (28) that engages with an interference fit onto the tightening screw (26).

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The heads (29) on the tightening screws (26) have wing formations for ease of tightening. Alternative heads may also be employed.

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Alternatively, a first portion of the tightening screw adjacent the head is located inside the opening which will have an interference fit to resist passage of a second portion of the tightening screw that carries a screw-thread. The opening in the web may, for example, be provided with a toothed or notched profile.

25

The connector (9) has two screw holes (30) which each extend into a bore having a hex profile to retain a nut (31) that receives the tightening screw (26).

A central bore also has a third screw hole (32) that receives the fastening screw (11) from the opposite, front side of the connector (9) for mounting onto the spacer (10). The fastening screw (11) engages into a sleeve (33) that extends from a square profile head (34) that fits into a square socket (35) on the rear side of the connector (9). Three caps (36) are provided with a press fit into the bores to conceal the internal connecting parts.

The connector (9) is also provided with two spaced apart recesses (37) for location of each of the dipole connecting rods (5). The same two moulded components as shown in Figure 3 are used for both supports (4) which are arranged opposite to each other. The opposite arrangement places the recesses (37) and (19) in a required position for engagement with the connecting rods (5) and crossbars (20). The grid components (2.1) and (2.2) are also of the same construction and oppositely arranged. The duplicate use of these corresponding parts reduces the tasks in a manufacture line.

The antenna (1) of the current embodiment provides a desirable degree of rigidity and structural integrity, particularly along a central region of the reflector (2) and given the use of two separate grid components (2.1; 2.2). The parallel dipole connecting rods (5) provide a box-structure in this central region and brace the supports (4) for added rigidity.

In the current example, the antenna is part assembled for packaging as described below:

- The connectors (9) of the insulated supports (4) will be engaged with the spacers (10).
- The two grid components (2.1; 2.2) will be folded in an overlapping, packing arrangement as shown in Figures 4 and 5. In this condition, the two grid components (2.1; 2.2) are hingedly retained by the clamping plates (12) that are secured to each foot (8) by the biasing screws (18).

- The four dipole assemblies (21) will, in this example, be provided loose in the packaging as shown in Figure 7. The benefit of the fixed mounting plate (23) and captive tightening screw (26) as part of the dipole assembly (21) provides for only four parts that are conveniently secured to the connectors (9).
- 5     - The two dipole connecting rods (5) will be pre-fastened to the PCB housing (6), using two clamping nuts that fit onto conductive screws extending from the PCB through the housing (6).

Two steps are required for assembly after unboxing the antenna (1):

- 10     (i)     The dipole connecting rods (5) are clamped to the connectors by each of the four dipole assemblies (21) as shown in Figure 8. The clamping engagement also establishes a conductive connection between these components.
- (ii)    With the dipole assemblies (21) secured in place, the two grid components (2.1; 2.2) can be moved into an extended condition and rigidly secured to the
- 15               foot (8) of each support (4) by tightening of the two biasing screws (18).

To secure the grid components (2.1; 2.2) the extended condition, the inner bar (16) and the securing bar (17) are located against the inner and outer spaced apart shoulders (13; 14) respectively, with the inner bar (16) located in the groove (15.1), and the biasing

20     screw (18) is tightened to close the clamping plate (12) towards the foot (8). The region along underside at edges of the clamping plate (12) is provided with an inclined surface or bevel that biases the inner bar (16) and consequently the outer bar into engagement with the four mounting flanges (13; 14). The inner bar (16) is clamped in the groove (15.1) and the securing bar (17) is locked under the lip (15.2) of the outer shoulder (14)

25     and the grid components (2.1; 2.2) rigidly supported in the extended condition.

The product construction and proposed packaging arrangement simply requires fitment of the dipole elements into the dipole connector assemblies and fixing of the two grid components in the outward, extended condition.

- 5 It will be appreciated that the same antenna components can be packaged in a number of different ways and may only include a minimal amount of pre-assembly. The clamping plates may have rotatably retained/captive biasing screws to reduce the number of loose parts where these are not pre-fitted to the foot of each support.
- 10 The antenna of the current embodiment when assembled provides a desirable degree of rigidity and structural integrity, particularly along a central region of the reflector and given the use of two separate grid components. The parallel dipole connecting rods provide a box-structure in this central region and brace the spacers for added rigidity.
- 15 The invention disclosed serves to provide added convenience in the assembly of the antenna for installation. The grid reflector of the invention can be assembled from its packaged configuration in a relatively easy, convenient and effective manner. Each of the two grid components are about half the size of the working grid assembly of the reflector when secured in an expanded condition.
- 20 The parts of the antenna can be packaged into a much smaller box than those used for an integral grid-type antenna which has a single fixed and rigid reflector grid.
- The space saving benefits of the smaller boxes into which the antenna is packed
- 25 represents a significant reduction in transport costs. It is estimated that a container can be used to transport almost twice as many boxes with antennae in accordance with the invention as compared to an antenna with equivalent size single grid component. Even a 30% improvement in container packing capacity would be significant.

A person skilled in the art will appreciate that a number of variations can be made to the features of the described embodiment. There will be various ways to construct a suitable grid-type reflector from parts that fall within the scope of the invention and are suited for compact packaging as required and demonstrated by the currently disclosed  
5 embodiment.

The reflector in accordance with the invention may accordingly be constructed from different arrangements of grid components which provide a required grid-type reflector body having at least two components that can be packed in an overlapping  
10 arrangement and can be secured in relation to each other in an expanded condition.

A pair of wing components may be hingedly connected to a central grid component. The wing components will provide oppositely disposed extensions of the central component and folded closed in overlapping relationship against the central component.  
15 Alternatively, the reflector may include two grid components that are hingedly connected two components are separate and securable with a fastening mechanism.

The two or three grid components are securable in the expanded condition with a plurality of fastening mechanisms to be braced in a rigid and tightened configuration  
20 before the antenna is installed. Other examples will be within the design competence of a person skilled in the art.

**CLAIMS**

1. An antenna having a grid-type reflector and including:
  - a. an array of dipole elements mounted onto two spaced apart, insulated supports that extend to a front side of the reflector;
  - 5 b. a pair of dipole connecting rods extending between the supports;
  - c. the supports each having a foot to engage the reflector;
  - d. the reflector comprising two separate grid components that are releasably securable in relation to each other:
    - 10 i. for release and positioning of the two grid components in an overlapping, packing arrangement relative to each other; and
    - ii. to rigidly secure the two grid components in an extended condition relative to each other and to the foot of each support, providing a working grid assembly of the reflector.
- 15 2. An antenna as claimed in claim 1 in which at least one of the two grid components is releasably securable to the foot of each support:
  - a. for release of the at least one grid component and positioning of the two grid components in the overlapping, packing arrangement; and
  - b. to rigidly secure the at least one grid component to the foot of each support  
20 with the two grid components in the extended condition.
3. An antenna as claimed in claim 1 in which the two separate grid components are both releasably securable to the foot of each support:
  - 25 a. for release of the two grid components and positioning of the two grid components in the overlapping, packing arrangement; and
  - b. to rigidly secure the at least one grid component to the foot of each support with the two grid components in the extended condition.

4. An antenna as claimed in claim 1 in which the dipole elements are removably securable to the two spaced apart supports and extend to a first side and to a second side of the two supports and the two grid components are respectively securable to extend to the first side and to the second side of the two supports.

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5. An antenna as claimed in claim 2 in which the at least one grid component is hingedly retained to the foot of each support.

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6. An antenna as claimed in claim 3 in which the two grid components are releasably securable to the foot of each support with a clamping plate.

7. An antenna as claimed in claim 6 in which:

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- a. the foot of each support includes inner and outer spaced apart shoulders, for engagement with one of the grid components, with at least the outer shoulder having a lip;

- b. each grid component includes an inner bar at an inner edge of the grid component and a securing bar, with a space between the inner bar and securing bar corresponding substantially to a space between the inner and outer shoulders; and

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- c. the clamping plate is provided adjacent the inner shoulder to at least partially overlie the inner bar and bias the inner bar and the securing bar against the inner and outer spaced apart shoulders respectively.

25

8. An antenna as claimed in claim 7 in which the clamping plate has an opening for a biasing screw that engages the foot of the support between two inner shoulders arranged to engage the inner bars of the two grid components.

9. An antenna as claimed in claim 7 in which the inner and outer shoulders are provided by two mounting flanges on the foot of each support.

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10. An antenna as claimed in claim 9 in which the two mounting flanges are each provided with an aligned recess that accommodates a crossbar extending from the inner bar to the securing bar.

5 11. An antenna as claimed in claim 1 in which each support includes a connector for engagement with two pairs of removably securable dipole elements.

12. An antenna as claimed in claim 1 in which each pair of dipole elements is provided by a dipole assembly comprising a V-shaped rod providing two dipole elements  
10 with a mounting plate fixed adjacent an apex where the two dipole elements converge, the mounting plate providing a web between the two dipole elements having an opening for a tightening screw.

13. An antenna as claimed in claim 12 in which the mounting plate includes two  
15 integral connecting flanges that extend from the web and are pressed into engagement around each of the two dipole elements respectively and in which the connecting flanges of the mounting plate extend around an outside of the two dipole elements and are folded inwardly to an inside of the two dipole elements.

20 14. An antenna as claimed in claim 12 in which the tightening screw is rotatably retained within the opening in the web.

15. An antenna as claimed in claim 14 in which a first portion of the tightening screw adjacent a head of the tightening screw is located inside the opening in the web  
25 and the opening in the web is provided with an interference fit to resist passage of a second portion of the tightening screw that carries a screw-thread.

16. An antenna as claimed in claim 15 in which the opening in the web is provided with a toothed or notched profile.

17. An antenna as claimed in claim 14 in which a stop washer is secured onto the tightening screw with the web located between the stop washer and a head of the tightening screw.
- 5 18. An antenna as claimed in claim 14 in which the stop washer is provided by a resiliently deformable O-ring that engages with an interference fit onto the tightening screw.
- 10 19. An antenna as claimed in claim 1 in which a housing for a printed circuit board is secured between the dipole connecting rods with an output connection for a coax cable.
20. An antenna having a grid-type reflector and including:
- 15 a. an array of dipole elements mounted onto two spaced apart, insulated supports that extend to a front side of the reflector;
- b. a pair of dipole connecting rods extending between the supports;
- c. the supports each having a foot to engage the reflector;
- d. the reflector comprising two separate grid components that provide a working grid assembly with the two grid components engaged with the foot of each support;
- 20 e. at least one of the two grid components releasably securable to the foot of each support:
- i. for release of the at least one grid component and positioning of the two grid components in an overlapping, packing arrangement relative to each other; and
- 25 ii. to rigidly secure the at least one grid component to the foot of each support with the two grid components in an extended condition providing the working grid assembly of the reflector.

21. A dipole assembly for an antenna having a grid-type reflector, comprising a V-shaped rod providing two dipole elements with a mounting plate fixed adjacent an apex where the two dipole elements converge with the mounting plate providing a web between the two dipole elements having an opening for a tightening screw which is rotatably retained relative to the web.
22. A dipole assembly as claimed in claim 21 in which the mounting plate includes two integral connecting flanges that extend from the web and are pressed into engagement around each of the two dipole elements respectively and in which the connecting flanges of the mounting plate extend around an outside of the two dipole elements and are folded inwardly to an inside of the two dipole elements.
23. A dipole assembly as claimed in claim 22 in which a first portion of the tightening screw adjacent a head of the tightening screw is located inside the opening in the web and the opening in the web is provided with an interference fit to resist passage of a second portion of the tightening screw that carries a screw-thread.
24. A dipole assembly as claimed in claim 21 in which a stop washer is secured onto the tightening screw with the web located between the stop washer and a head of the tightening screw.

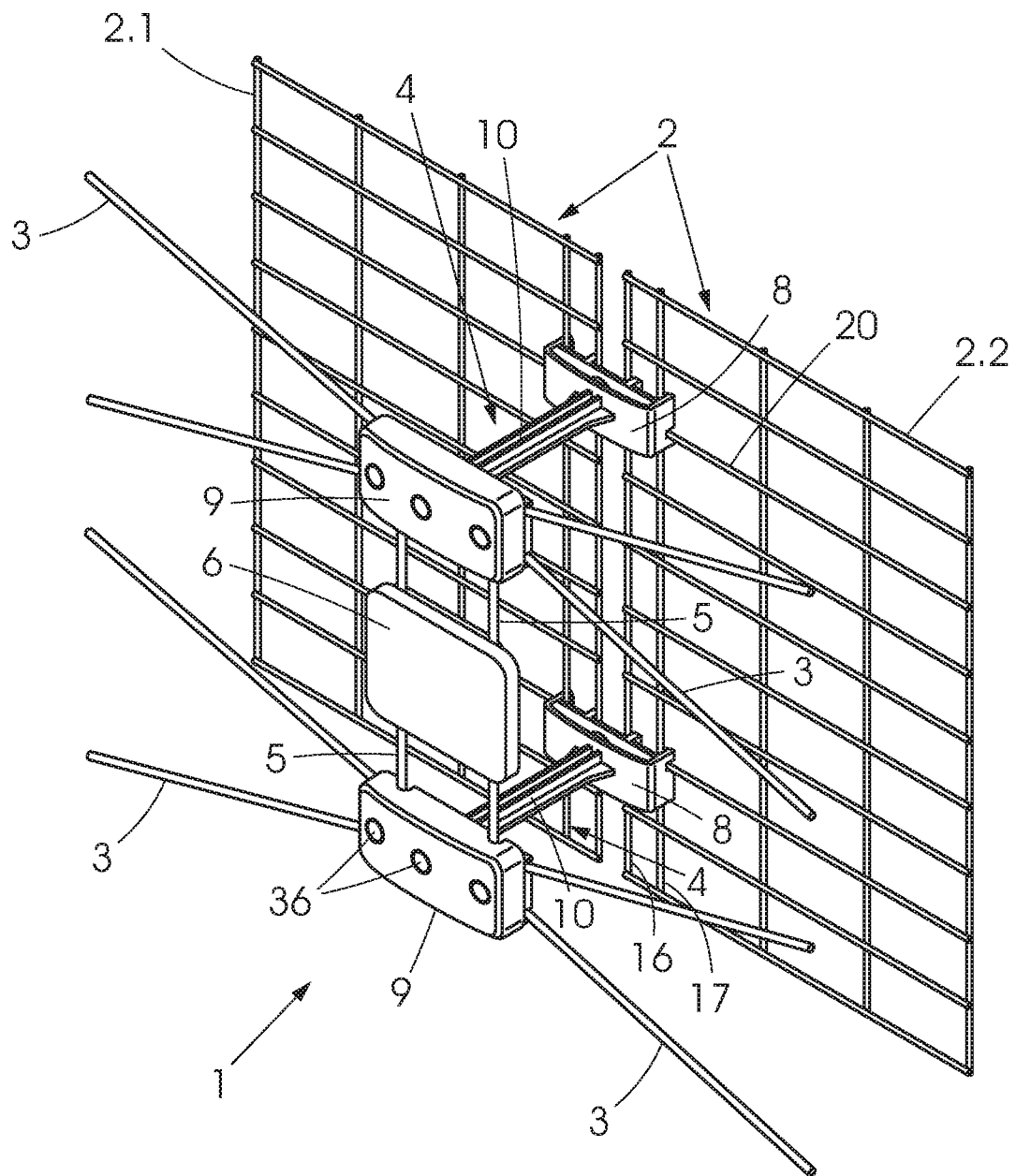
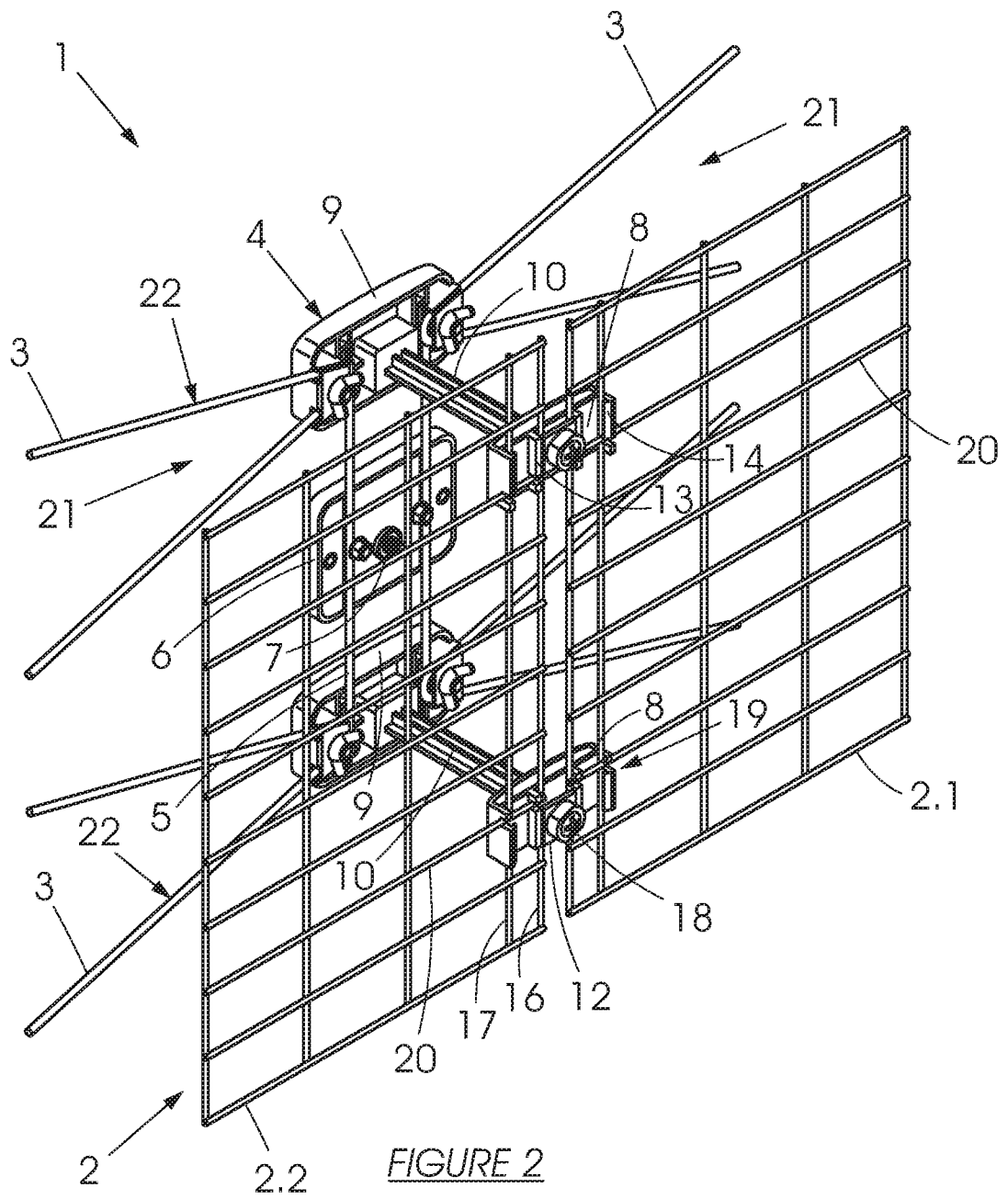


FIGURE 1



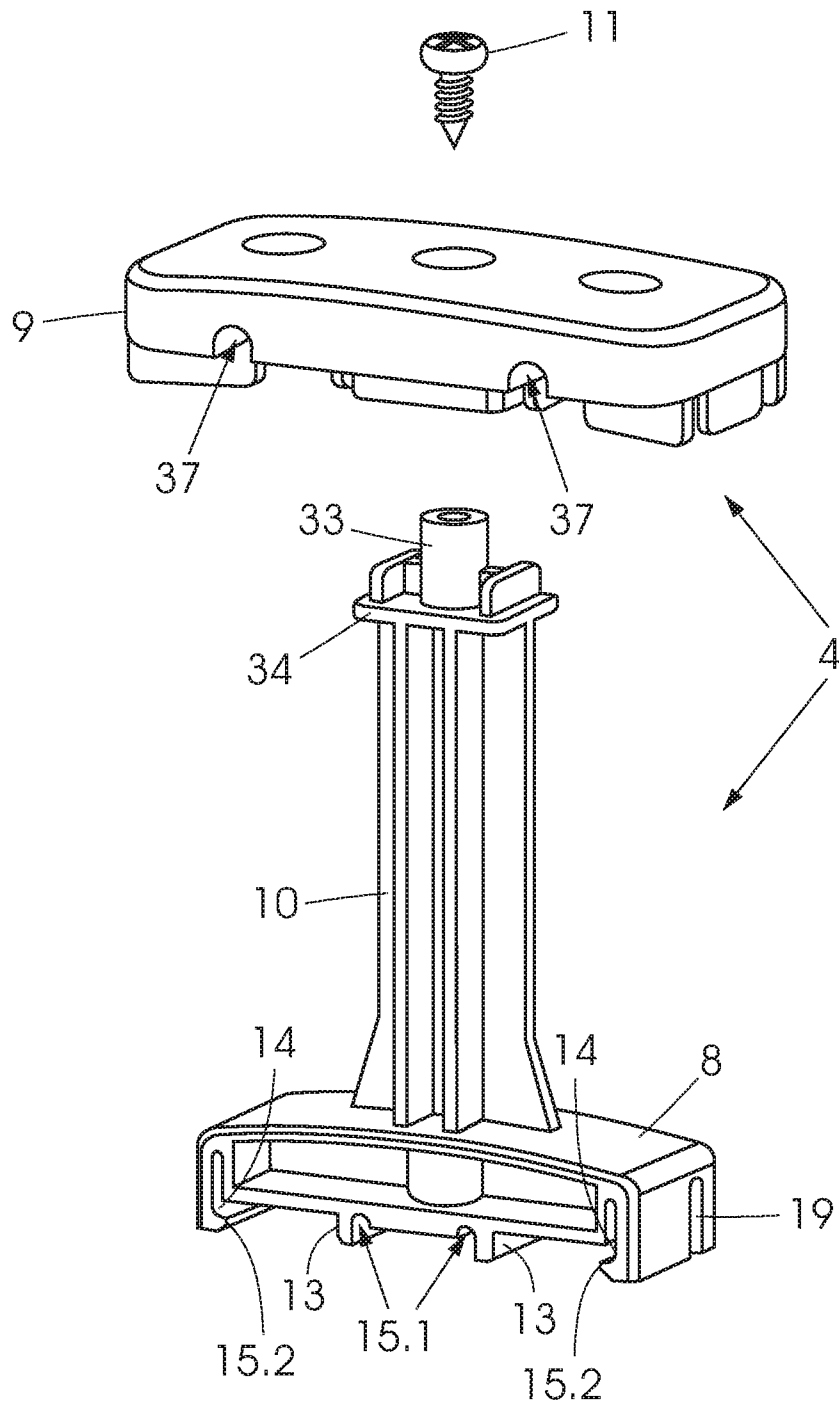
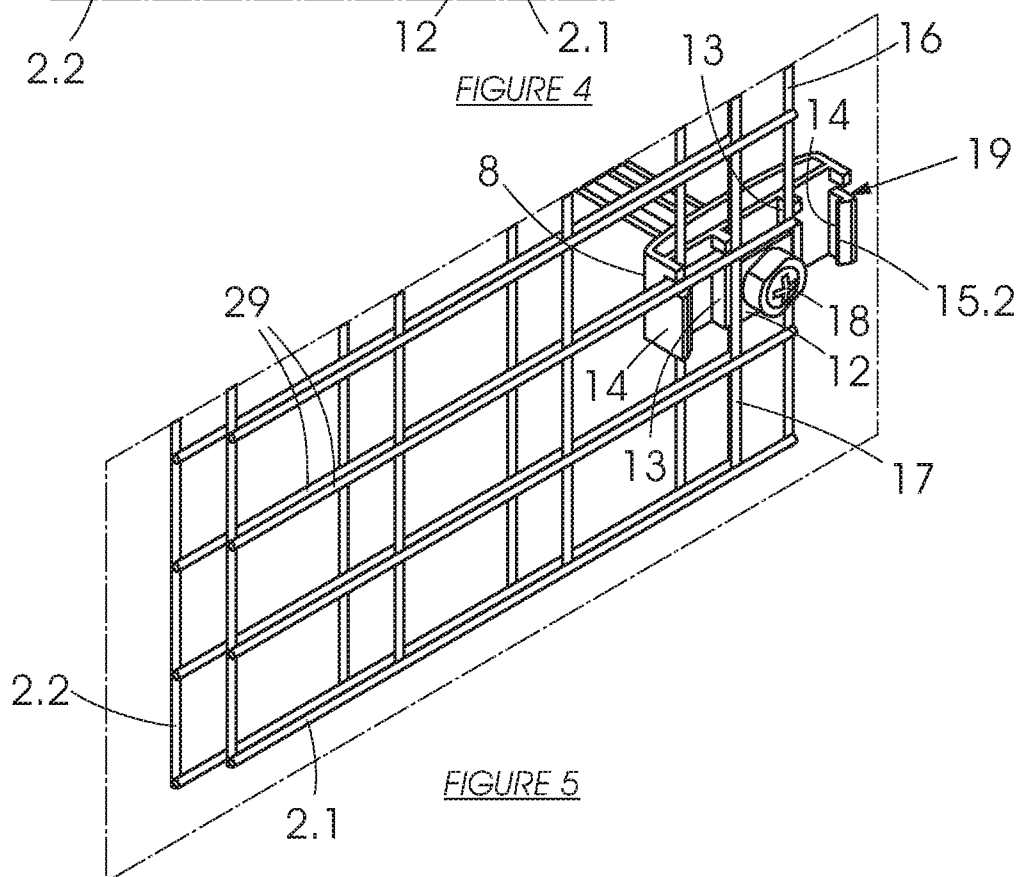
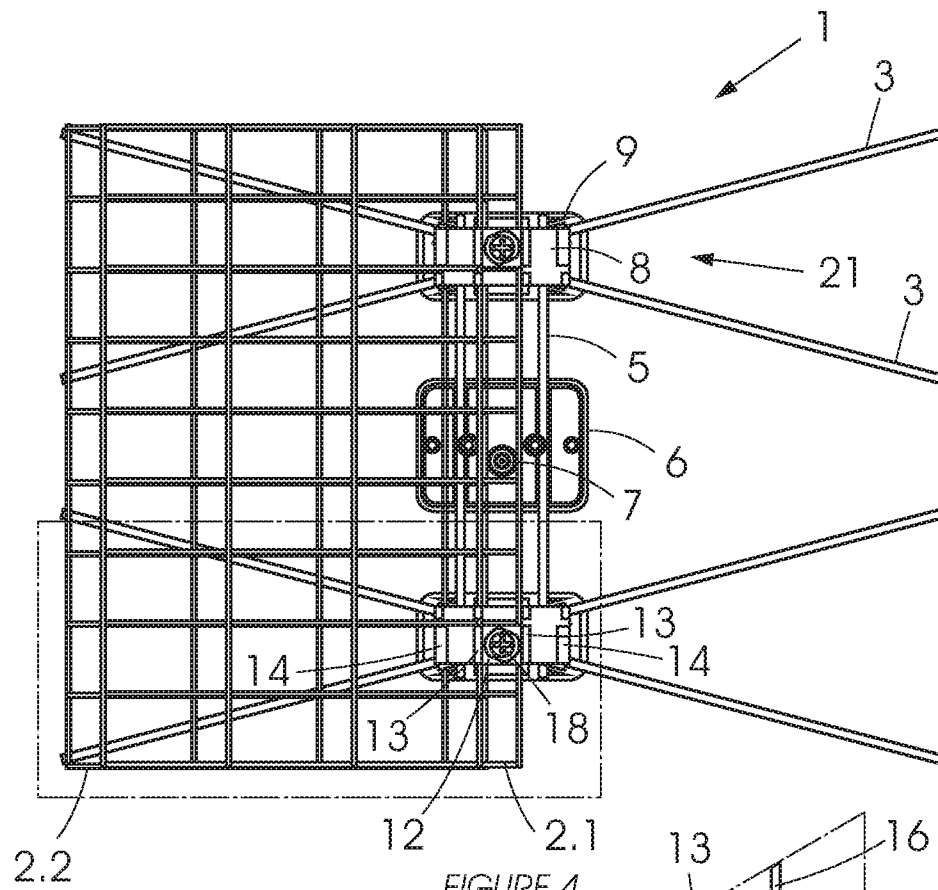


FIGURE 3



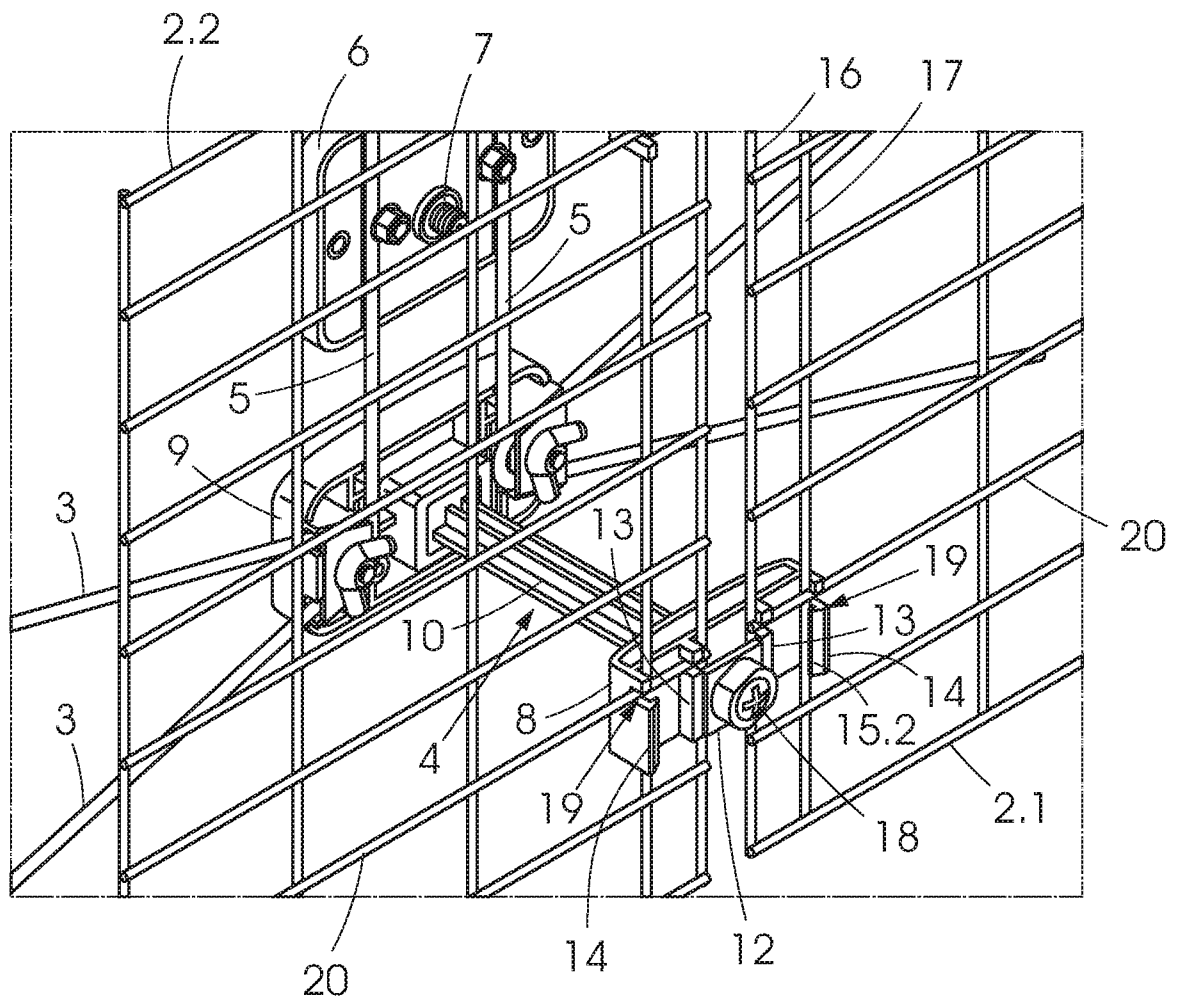
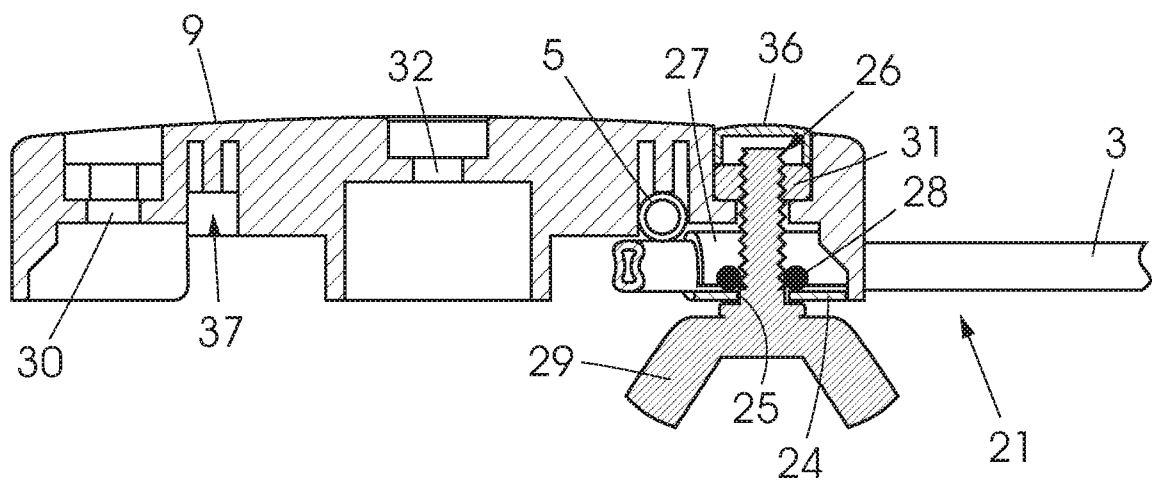
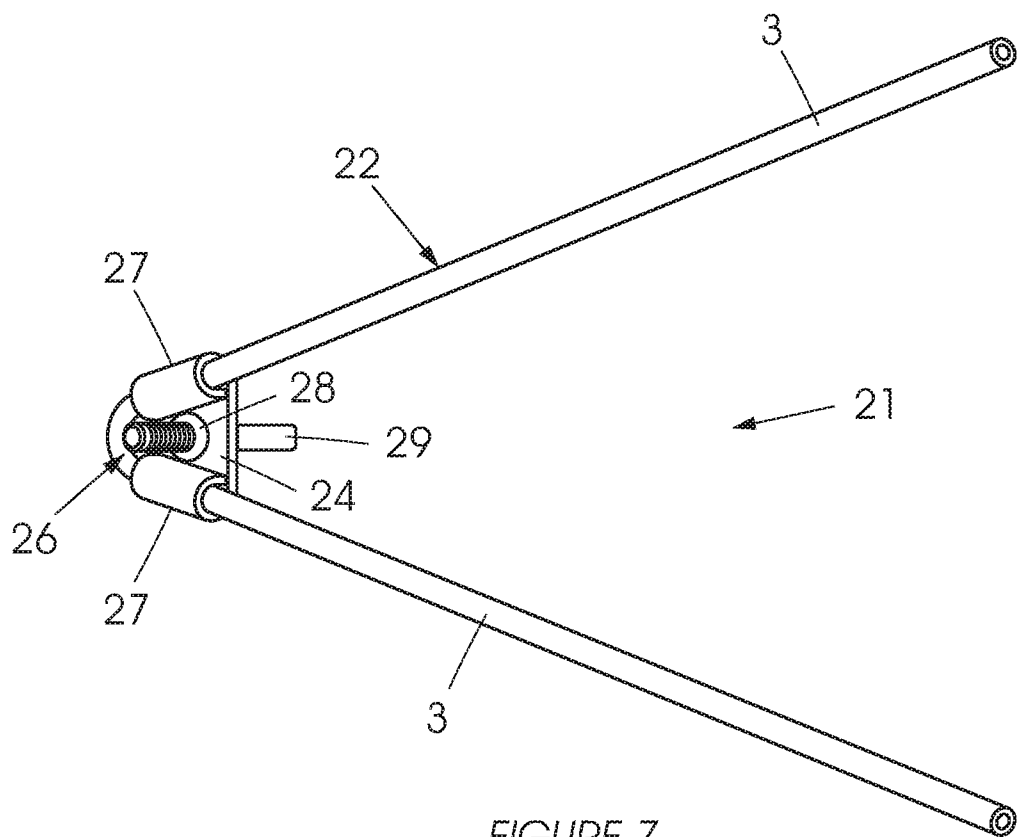
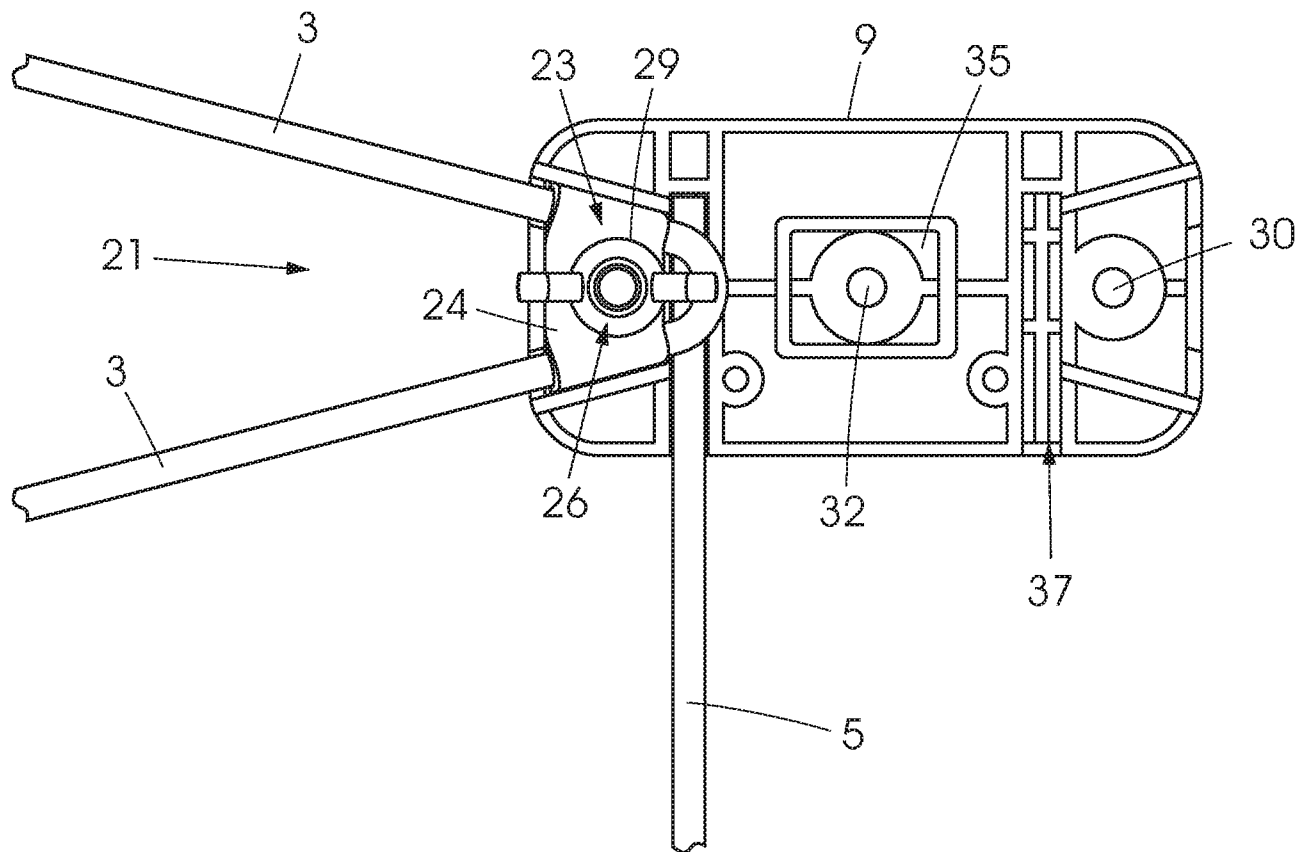


FIGURE 6



FIGURE 9

# INTERNATIONAL SEARCH REPORT

International application No.

PCT / IB 2020/054700

| <b>A. CLASSIFICATION OF SUBJECT MATTER</b><br>IPC: <b>H01Q 1/12</b> (2006.01); <b>H01Q 19/10</b> (2006.01); <b>H01Q 21/06</b> (2006.01)<br>According to International Patent Classification (IPC) or to both national classification and IPC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                            |                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| <b>B. FIELDS SEARCHED</b><br>Minimum documentation searched (classification system followed by classification symbols)<br><b>H01Q</b><br>Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                            |                                                                                    |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)<br><b>EPODOC; WPIAP</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                            |                                                                                    |
| <b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                            |                                                                                    |
| Category*                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Citation of document, with indication, where appropriate, of the relevant passages                                                         | Relevant to claim No.                                                              |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US 2015091772 A1 (Schneider et al.) 02 April 2015 (02.04.2015)<br>Abstract; Figs. 1 - 3 and associated description; Paragraphs [0051] ff   | 1 - 24                                                                             |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | US 3373432 A (Breneman W. E.) 12 March 1968 (12.03.1968)<br>Abstract; Figs. 8 - 14 and associated description.                             | 1 - 24                                                                             |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | EP 2621014 A1 (Angel Inglesias S.A.) 31 July 2013 (31.07.2013)<br>Abstract; Figures 2 - 4 and associated description; Paragraphs [0020] ff | 1 - 24                                                                             |
| <input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                            |                                                                                    |
| * Special categories of cited documents:<br>"A" document defining the general state of the art which is not considered to be of particular relevance<br>"E" earlier application or patent but published on or after the international filing date<br>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)<br>"O" document referring to an oral disclosure, use, exhibition or other means<br>"P" document published prior to the international filing date but later than the priority date claimed<br>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention<br>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone<br>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art<br>"&" document member of the same patent family |                                                                                                                                            |                                                                                    |
| Date of the actual completion of the international search<br>02 October 2020 (02.10.2020)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                            | Date of mailing of the international search report<br>12 October 2020 (12.10.2020) |
| Name and mailing address of the ISA/AT<br>Austrian Patent Office<br>Dresdner Straße 87, A-1200 Vienna<br>Facsimile No. +43 / 1 / 534 24-535                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                            | Authorized officer<br>WALTER P.<br>Telephone No. +43 / 1 / 534 24-569              |

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.

PCT / IB 2020/054700

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