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(71) Applicant: **Rohde & Schwarz GmbH & Co. KG**
81671 München (DE)

(72) Inventor: **Barnert, Daniel**
81671 München (DE)

(74) Representative: **Prinz & Partner mbB**
Patent- und Rechtsanwälte
Rundfunkplatz 2
80335 München (DE)

(54) MOUNTING GAUGE, SYSTEM FOR ASSEMBLING AN ANTENNA AND METHOD OF ASSEMBLING AN ANTENNA

(57) The invention provides a mounting gauge (10) for assembling at least two radiators (24) of an antenna (26), particularly a log-periodic dipole antenna. The mounting gauge (10) comprises a base body (12) and at least two alignment pins (14) distanced from each other by a defined distance (D). The alignment pins (14) are shaped and distanced from each other such that they fit into corresponding openings (30, 32) of the radiators (24), thereby aligning the radiators (24) with respect to each other so as to minimize a misalignment of the radiators (24). Moreover, the invention provides a method of assembling an antenna (26). In addition, a system (40) for assembling an antenna (26) is described.

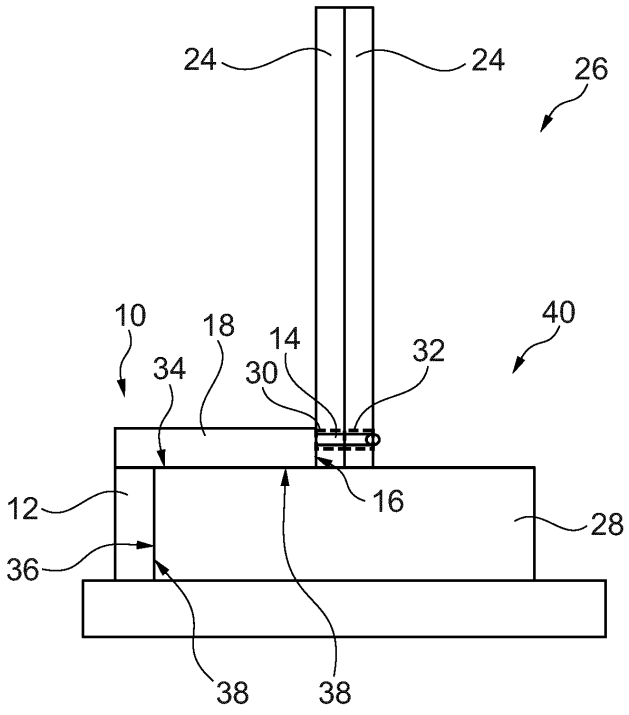

Fig. 4

EP 3 955 381 A1

Description

[0001] The invention relates to a mounting gauge for assembling at least two radiators of an antenna, particularly a log-periodic dipole antenna. Further, the invention relates to a system for assembling an antenna as well as a method of assembling an antenna that comprises at least two radiators.

[0002] In the state of the art, radiators of an antenna are typically assembled in an iterative process according to which the radiators are placed in relation to each other, for instance on top of each other or rather next to each other. Then, the alignment of the radiators is verified by an electrical measurement, for instance a measurement of the voltage standing wave ratio (VSWR). Depending on the outcome of the VSWR measurement, the radiators are moved with respect to each other more or less. Then, the VSWR is measured again wherein the radiators are moved with respect to each other again. This iterative procedure is repeated several times until the VSWR is within a predefined range.

[0003] However, the assembling of the antenna takes time due to the iterative process. In addition, experience in assembling the antenna is required in order to understand how the radiators have to be moved with respect to each other depending on the results of the VSWR measurements.

[0004] Accordingly, there is a need for a simpler assembling of an antenna.

[0005] The invention provides a mounting gauge for assembling at least two radiators of an antenna, particularly a log-periodic dipole antenna. The mounting gauge comprises a base body and at least two alignment pins distanced from each other by a defined distance. The alignment pins are shaped and distanced from each other such that they fit into corresponding openings of the radiators, thereby aligning the radiators with respect to each other so as to minimize a misalignment of the radiators.

[0006] Furthermore, the invention provides a method of assembling an antenna that comprises at least two radiators, wherein the method comprises the steps of:

- Providing at least two radiators with openings,
- Providing a mounting gauge as mentioned above,
- Moving the mounting gauge towards the radiators in order to insert the alignments pins into the openings, thereby aligning the radiators with respect to each other such that a misalignment of the radiators is minimized,
- Fixing the radiators in their aligned positions, and
- Removing the mounting gauge from the radiators in order to extract the alignments pins from the openings.

[0007] The main idea is to provide a mounting gauge that is used to assemble the components of the antenna in a defined manner, thereby minimizing the risk of misalignment of the radiators while accelerating the assembling of the antenna in total. The mounting gauge has at least two alignment pins that interact with the radiators having corresponding openings such that the radiators are orientated in a defined relation with respect to each other when the alignment pins are inserted into the openings as the radiators are aligned. Therefore, the alignments pins are shaped and distanced to each other in a defined manner, which depends on the respective antenna (design) to be assembled. The alignment pins and the corresponding openings together provide an engineering fit, as they relate to a "shaft and hole" pairing.

[0008] With the mounting gauge, the assembling of the antenna can be performed in a fast manner, as no iterative procedure is necessary to align the radiators correctly, which takes time.

[0009] Accordingly, a system is provided that comprises the mounting gauge and the two radiators. The respective radiators have to be assembled in order to obtain the antenna, wherein the mounting gauge is used for assembling the antenna, which interacts with the radiators. In fact, the radiators have the openings into which the alignment pins of the mounting gauge are inserted for aligning the radiators with respect to each other.

[0010] An aspect provides that the at least two alignment pins are located at a contact surface, wherein the at least two alignment pins extend outwardly from the contact surface. The contact surface of the mounting gauge is the one that gets in contact with the antenna to be assembled, namely at least one component of the antenna. Particularly, the contact surface contacts that component of the antenna, which comprises the openings into which the alignment pins are inserted.

[0011] Generally, the alignment pins have a length that corresponds to the distance from the contact surface to the tip of the respective alignment pin.

[0012] Another aspect provides that each of the at least two alignment pins has a tapering tip. The tip tapers towards its free end. Generally, this facilitates the inserting of the alignment pins into the openings of the radiators. In fact, it is not necessary that the radiators are already aligned when the alignments pints are inserted due to the tapering tip, as the radiators get aligned when the alignment pins are moved into the openings since the size of the alignment pins increase with increasing depth of penetration.

[0013] According to a further aspect, the at least two alignment pins are cylindrically shaped. The manufacturing of the mounting gauge, particularly the alignment pins, is simplified. Furthermore, the openings in the radiators can be made easier such that the overall costs for providing the engineering fit are reduced.

[0014] The base body may be made of a metal. The alignment pins may also be made of metal. This ensures stability of the base body, the alignment pins and, there-

fore, the entire mounting gauge.

[0015] Particularly, the base body is made in an integral manner. Hence, the base body may be established as a monolith. Accordingly, a precisely manufactured mounting gauge can be ensured such that the alignment pins are orientated in the defined manner while having the respective shape, namely length and width.

[0016] A further aspect provides that, in a side view on the mounting gauge, the base body has an L-shaped profile. This particular shape ensures that the radiators can be aligned appropriately since the alignment pins may be provided at a projecting portion of the base body.

[0017] The L-shaped base body may establish two contact areas that are orientated in a perpendicular manner with respect to each other. For instance, the contact areas may contact a flange of the antenna. In other words, the flange of the antenna is accommodated by a space partly limited by the L-shaped base body.

[0018] Therefore, the radiators are aligned with respect to each other and with respect to the flange of the antenna by using the mounting gauge. Hence, the flange and the radiators are aligned with respect to each other simultaneously.

[0019] According to another aspect, the base body has an accommodation slot for accommodating a component of the antenna, wherein the accommodation slot runs between the at least two alignment pins, particularly centered between the at least two alignment pins. The accommodation slot may accommodate at least one part of at least one radiator, particularly parts of both radiators, thereby aligning the radiators additionally.

[0020] In a front view on the mounting gauge, the mounting gauge may be symmetrical, in particular wherein the accommodation slot coincides with the symmetry axis. The symmetry simplifies the alignment of the components of the antenna.

[0021] An aspect provides that the radiators are fixed before the mounting gauge is removed. A later misalignment can be prevented accordingly. The radiators may be fixed mechanically and/or chemically. For instance, the radiators may be welded, screwed, riveted and/or glued with each other.

[0022] According to a further aspect, the radiators are also aligned with respect to a flange of the antenna. The flange of the antenna may comprise the interface via which a cable is connected with the antenna.

[0023] The base body of the mounting gauge may contact the flange at two different sides, particularly perpendicularly orientated sides. As mentioned above, the L-shaped base body may interact with the flange of the antenna during the assembling of the antenna such that the radiators and the flange are aligned with respect to each other simultaneously without the need of a subsequent alignment of the respective components.

[0024] Another aspect provides that the radiators are connected to the flange in a mechanical manner, in particular before the mounting gauge is removed. The mechanical connection of the radiators with the flange may be established by screws or bolts. When the radiators are fixed and connected with the flange, it is ensured that no misalignment among the radiators and between the radiators and the flange may occur anymore. Thus, the mounting gauge can be removed.

[0025] Generally, the fixing of the radiators may be ensured by connecting the radiators with the flange. Accordingly, the relative orientation of the radiators with respect to each other is ensured, as they are fixedly connected with the flange of the antenna.

[0026] Furthermore, the alignment of the radiators may be verified by performing a voltage standing wave ratio measurement of the antenna before the radiators are fixed. If necessary, the alignment can be verified in order to check whether the openings in the radiators correspond to the alignment pins at the mounting gauge in order to verify whether the right mounting gauge is used for the specific antenna (design), namely its components.

[0027] Generally, the mounting gauge used in the method of assembling an antenna may comprise the respective features mentioned above.

[0028] The system may comprise the mounting gauge as defined above. Moreover, the system is used to perform the method of assembling the antenna as described above.

[0029] Accordingly, the system may also comprise the flange of the antenna, which is connected with the radiators of the antenna.

[0030] The foregoing aspects and many of the attendant advantages of the claimed subject matter will become more readily appreciated as the same become better understood by reference to the following detailed description, when taken in conjunction with the accompanying drawings. In the drawings,

- Figure 1 shows a perspective view on a mounting gauge according to the invention,
- Figure 2 shows a schematic front view on the mounting gauge shown in Figure 1,
- Figure 3 shows a schematic side view on the mounting gauge shown in Figures 1 and 2, and
- Figure 4 shows a schematically illustrated sectional view on the assembling of the antenna by using the mounting gauge shown in Figures 1 to 3.

[0031] The detailed description set forth below in connection with the appended drawings, where like numerals reference like elements, is intended as a description of various embodiments of the disclosed subject matter and is not intended to represent the only embodiments. Each embodiment described in this disclosure is provided merely as an example or illustration and should not be construed as preferred or advantageous over other embodiments. The illustrative examples provided herein are not intended to be exhaustive or to limit the claimed sub-

ject matter to the precise forms disclosed.

[0032] For the purposes of the present disclosure, the phrase "at least one of A, B, and C", for example, means (A), (B), (C), (A and B), (A and C), (B and C), or (A, B, and C), including all further possible permutations when greater than three elements are listed. In other words, the term "at least one of A and B" generally means "A and/or B", namely "A" alone, "B" alone or "A and B".

[0033] In Figures 1 to 3, a mounting gauge 10 is shown that is used for assembling an antenna.

[0034] The mounting gauge 10 has a base body 12 that, in a side view on the mounting gauge 10, has an L-shaped profile as inter alia shown in Figures 1 and 3. The base body 12 may be made of metal, particularly in an integral manner such that the base body 12 is a monolith.

[0035] In addition, the mounting gauge 10 comprises at least two alignments pins 14 that are located at a contact surface 16 of the base body 12, particularly a protruding portion 18 of the base body 12.

[0036] The alignment pins 14 extend from the contact surface 16 outwardly, thereby forming tips 20. The tips 20 correspond to tapering tips 20 as they taper towards the respective free ends of the alignment pins 14 such that their size or rather width gets smaller.

[0037] In the shown embodiment, the alignment pins 14 are cylindrically shaped. Accordingly, the diameter of the alignment pins 14 reduces towards the free ends due to the tapering tips 20.

[0038] However, the alignment pins 14 may also have any other shape, for instance a rectangular or square one.

[0039] In any case, the alignment pins 14 are distanced from each other by a defined distance D that depends on the respective antenna to be assembled by the mounting gauge 10, which will be explained in more detail later when referring to Figure 4.

[0040] In addition, the mounting gauge 10 has an accommodation slot 22 for accommodating a component of the antenna to be assembled. As shown in Figures 1 to 3, the accommodation slot 22 runs between the at least two alignment pins 14 in a centered manner, namely on the contact surface 16. Thus, the accommodation slot 22 coincides with an axis of symmetry S of the mounting gauge 10 in a front view on the mounting gauge 10 that is shown in Figure 2.

[0041] Accordingly, in a front view on the mounting gauge 10, the mounting gauge 10 is symmetrically shaped.

[0042] In general, the mounting gauge 10 is used for assembling at least two radiators 24 of an antenna 26 which is shown in Figure 4 schematically.

[0043] Two radiators 24 are provided that are positioned on top of each other or rather next to each other.

[0044] Furthermore, a flange 28 is provided that is a component of the antenna 26 as it provides the interface for the antenna 26 via which radio frequency (RF) signals to be transmitted or rather received are exchanged with a cable connected to the antenna 26.

[0045] In general, the radiators 24 have openings 30, 32 illustrated by the dashed lines that are used for aligning the radiators 24 with respect to each other.

[0046] Generally, the alignment pins 14 are shaped and distanced from each other such that they fit into the corresponding openings 30, 32 of the radiators 24, thereby aligning the radiators 24 with respect to each other so as to minimize a misalignment of the radiators 24.

[0047] Put differently, the radiators 24 are put onto the alignment pins 14 that are inserted into the corresponding openings 30, 32.

[0048] Due to the tapering tips 20, it is not necessary that the radiators 24 are already aligned from the beginning since they get aligned when the alignment pins 14 penetrate deeper into the openings 30, 32. In fact, the dimensions of the alignment pins 14, particularly the dimensions of the main bodies adjacent to the tips 20, equals the dimensions of the openings 30, 32 such that an engineering fit is established which aligns the radiators 24 with respect to the mounting gauge 10 and, therefore, among each other.

[0049] In addition, the flange 28 is contacted by the base body 12 of the mounting gauge 10 via at least two different sides 34, 36 which are orientated perpendicularly with respect to each other.

[0050] The mounting gauge 10, particularly the L-shaped base body 12, has two contact areas 38 that are orientated perpendicularly to each other which contact the sides 34, 36 of the flange 28 appropriately.

[0051] Therefore, the mounting gauge 10 contacting the flange 18 via the contact areas 38 has a pre-defined orientation with respect to the components of the antenna 26, namely the flange 18 and the radiators 24. As the mounting gauge 10 simultaneously align the radiators 24 with respect to each other and the flange 18, it is ensured that all components of the antenna 26 are aligned with respect to each other.

[0052] The antenna 26 is assembled by fixing the radiators 24 and the flange 28 while using the mounting gauge 10 establishing the aligned state of the components.

[0053] Particularly, the radiators 24 are fixed to the flange 28 in the aligned positions illustrated in Figure 4, thereby assembling the antenna 26.

[0054] For assembling the antenna 26, the radiators 24 may be placed with respect to each other in a preliminary aligned relationship.

[0055] Then, the mounting gauge 10 is moved towards the radiators 24 in order to insert the alignments pins 14 into the openings 30, 32 of the radiators 24, thereby aligning the radiators 24 with respect to each other such that a misalignment of the radiators 24 is minimized. Usually, the radiators 24 have been positioned at the flange 28 previously, particularly in a pre-aligned manner.

[0056] Accordingly, the mounting gauge 10 is moved with respect to the radiators 24 and the flange 28 such that the alignments pins 14 protrude through the openings 30, 32 of the radiators 24, wherein the L-shaped

base body 12 simultaneously contacts the flange 28 via its contact areas 38.

[0057] Once the radiators 24 are aligned with respect to each other and with respect to the flange 28, the radiators 24 are fixed in their aligned positions, for instance in a mechanical and/or chemical manner.

[0058] Accordingly, the radiators 24 are fixed to the flange 28 in a mechanical manner, for instance by screws and/or bolts, thereby fixing the radiators 24 in their aligned positions.

[0059] Afterwards, the mounting gauge 10 is removed from the radiators 24 in order to extract the alignments pins 14 from the openings 30, 32.

[0060] Hence, the antenna 26 is assembled.

[0061] The respective antenna 26 assembled may correspond to a log-periodic dipole antenna.

[0062] Accordingly, the radiators 24 each comprise several antenna elements, for instance dipoles. Moreover, the radiators 24 each comprise an antenna carrier at which the individual antenna elements are connected.

[0063] During the assembling, the alignment of the radiators 24 may be verified by performing a voltage standing wave ratio (VSWR) measurement of the antenna 26 before the radiators 24 are fixed. Thus, corrective measures are still possible at this stage such that any misalignment could be compensated. In addition, this test may check whether the correct mounting gauge 10 has been used for aligning the radiators 24 of the antenna 26. As mentioned above, the mounting gauge 10, particularly the shape and distance of the alignment pins 14, depends on the antenna 26 to be assembled.

[0064] Accordingly, the antenna 26 is assembled in precise and easy manner by using the mounting gauge 10.

[0065] Generally, the mounting gauge 10, the radiators 24 as well as the flange 28 together establish a system 40 for assembling the antenna 26.

Claims

1. A mounting gauge for assembling at least two radiators (24) of an antenna (26), particularly a log-periodic dipole antenna, wherein the mounting gauge (10) comprises a base body (12) and at least two alignment pins (14) distanced from each other by a defined distance (D), wherein the alignment pins (14) are shaped and distanced from each other such that they fit into corresponding openings (30, 32) of the radiators (24), thereby aligning the radiators (24) with respect to each other so as to minimize a misalignment of the radiators (24).

2. The mounting gauge according to claim 1, wherein the at least two alignment pins (14) are located at a contact surface (16), wherein the at least two alignment pins (14) extend outwardly from the contact surface (16).

3. The mounting gauge according to claim 1 or 2, wherein each of the at least two alignment pins (14) has a tapering tip (20).

4. The mounting gauge according to any of the preceding claims, wherein the at least two alignment pins (14) are cylindrically shaped.

5. The mounting gauge according to any of the preceding claims, wherein the base body (12) is made of a metal and/or in an integral manner.

6. The mounting gauge according to any of the preceding claims, wherein, in a side view on the mounting gauge (10), the base body (12) has an L-shaped profile.

7. The mounting gauge according to any of the preceding claims, wherein the base body (12) has an accommodation slot (22) for accommodating a component of the antenna, wherein the accommodation slot (22) runs between the at least two alignment pins (14), particularly centered between the at least two alignment pins (14).

8. The mounting gauge according to any of the preceding claims, wherein, in a front view on the mounting gauge (10), the mounting gauge (10) is symmetrical, in particular wherein the accommodation slot (22) coincides with the axis of symmetry (S).

9. A system for assembling an antenna (26), wherein the system (40) comprises at least two radiators (24) and the mounting gauge (10) according to any of the preceding claims.

10. A method of assembling an antenna (26) that comprises at least two radiators (24), wherein the method comprises the steps of:

    - Providing at least two radiators (24) with openings (30, 32),
    - Providing a mounting gauge (10) according to any of the claims 1 to 8,
    - Moving the mounting gauge towards the radiators (24) in order to insert the alignments pins (14) into the openings (30, 32), thereby aligning the radiators (24) with respect to each other such that a misalignment of the radiators (24) is minimized,
    - Fixing the radiators (24) in their aligned positions, and
    - Removing the mounting gauge (10) from the radiators (24) in order to extract the alignments pins (14) from the openings (30, 32).

11. The method according to claim 10, wherein the radiators (24) are fixed before the mounting gauge (10)

is removed.

12. The method according to claim 10 or 11, wherein the radiators (24) are also aligned with respect to a flange (28) of the antenna (26).

13. The method according to claim 12, wherein the base body (12) of the mounting gauge (10) contacts the flange (28) at two different sides, particularly perpendicularly orientated sides.

14. The method according to claim 12 or 13, wherein the radiators (24) are connected to the flange (28) in a mechanical manner, in particular before the mounting gauge (10) is removed.

15. The method according to any of claims 10 to 14, wherein the alignment of the radiators (24) is verified by performing a voltage standing wave ratio measurement of the antenna (26) before the radiators (24) are fixed.

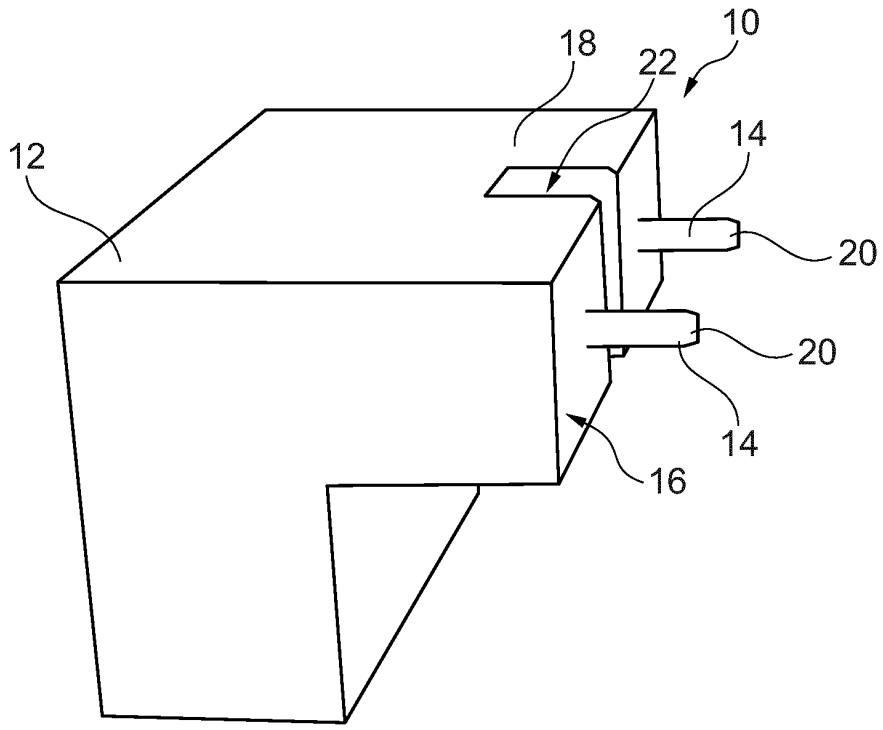

Fig. 1

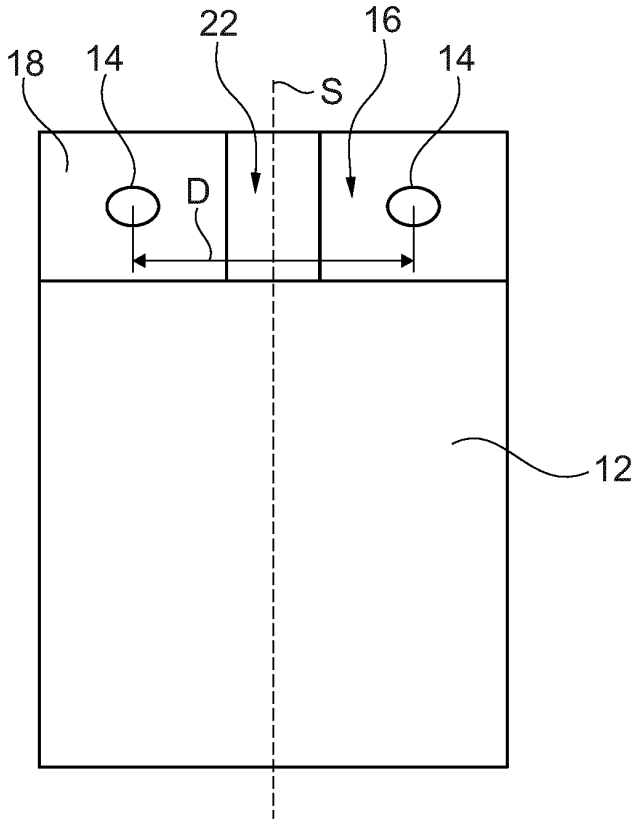

Fig. 2

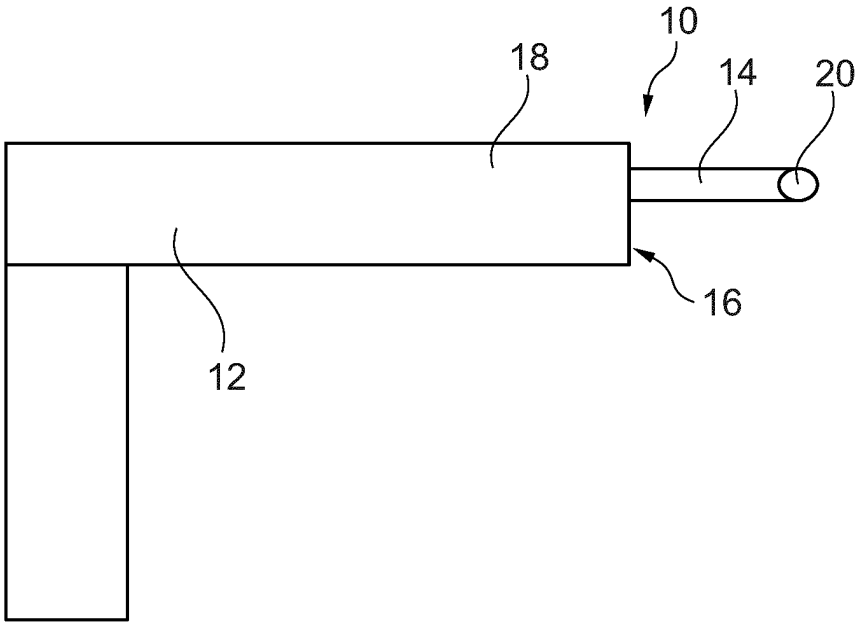

Fig. 3

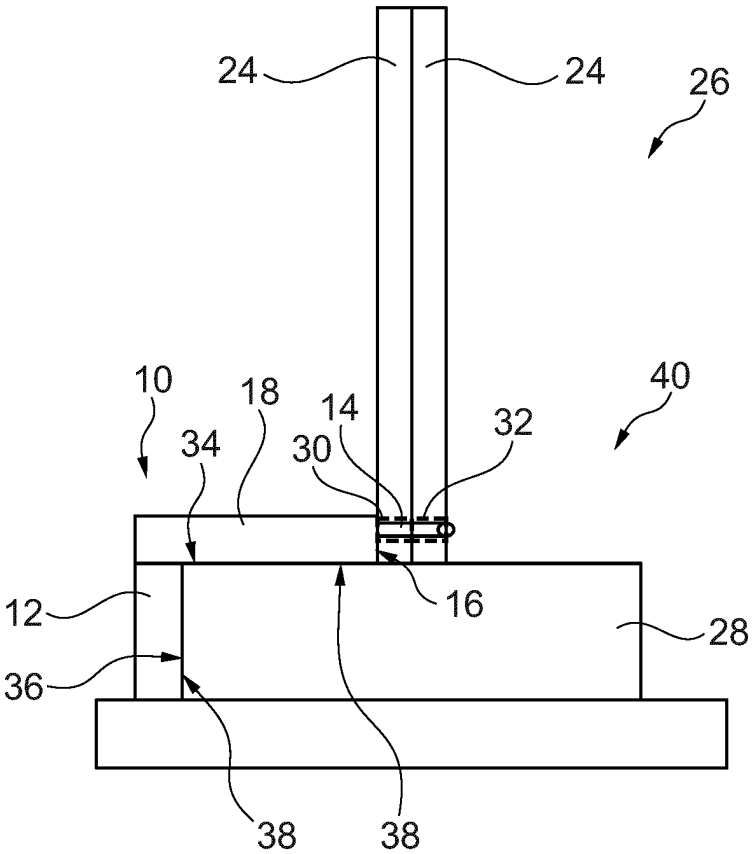

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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