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(54) **CONNECTING DEVICE FOR A POLE OF THE SUPPORT STRUCTURE FOR ROAD EQUIPMENT, AND SUPPORT STRUCTURE FOR ROAD EQUIPMENT INCLUDING SAID CONNECTING DEVICE**

(57) The invention relates to a connecting device for a pole of the support structure for road equipment, including a hollow drum, having a circular, elliptical, or polygonal section, comprising a first end for anchoring to the foundation, a second end for fixing to a lower end of the pole, and a central part with a wall portion configured for deforming in a controlled manner when an impact force acts on the pole, such that the lower end of the pole is displaced upwards and twisted in the direction of the impact force. A support structure for road equipment including the connecting device is also an object of the invention.

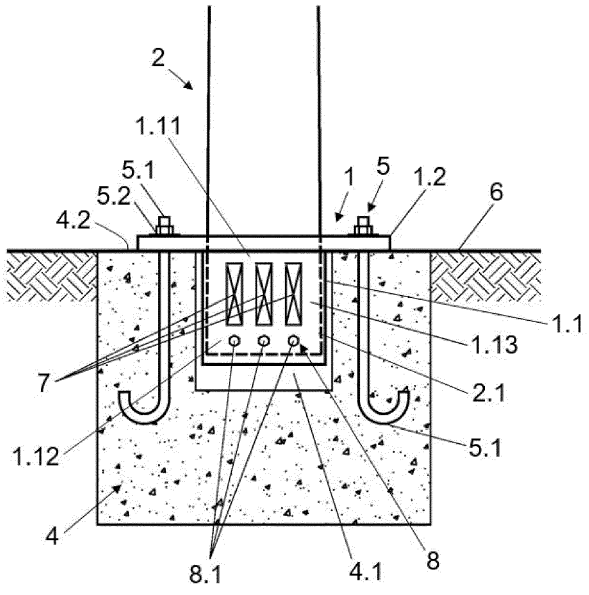

Fig.1

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention is encompassed in the field of support structures for road equipment on public or private roads such as, freeways, highways, streets, parking, etc. For example, these support structures may include columns, lampposts or poles, found in the vicinity of road traffic, which are usually fixed at their lower end to the terrain by means of a foundation, and at their upper end there is fixed, either directly or indirectly through an extension arm, at least one item of road equipment, such as lighting means or a luminaire, a sign panel or board, a traffic signal, a support bracket for overhead lines, whether these are utility and/or telephone lines, etc.

[0002] The invention specifically relates to an anchoring or connecting device for anchoring or connecting the pole of a support structure for road equipment to the foundation, where the connecting device acts or behaves like a structural fuse capable of absorbing an impact of a vehicle against the pole, with said device collapsing in a manner that is controlled and safe for the occupants of the vehicle impacting against said pole, as well as for third parties, whether other users of the road or pedestrians. Another object of the invention relates to a support structure for road equipment comprising said connecting device.

BACKGROUND OF THE INVENTION

[0003] As is known, means are required in the immediate vicinity of traffic which provide information, light, limitations and restrictions necessary for road traffic. These means or any other element in the vicinity of a road, street or highway are usually supported by support structures made of metal or another material. In that sense, there are support structures based on columns, masts, poles, lampposts, etc., which support road equipment such as lamps, information boards, traffic signs, street signs, traffic signals, public telephones, support brackets for overhead lines, etc., or any combination thereof. Said equipment may even be supported by more than one support structure, if required.

[0004] Poles of support structures for road equipment have traditionally been designed and sized as rigid structures capable of withstanding mechanical service demands, such as wind loads, their own weight, snow, etc., but they have not been specifically designed to behave in a safe manner in the case of vehicle impacts. The more rigid the pole, the more it will resist against the aforementioned mechanical demands, but the more dangerous it will also be in the case of a vehicle impact against same.

[0005] Therefore, work is being done at present to find solutions to improve the safety of both vehicle occupants and pedestrians, as well as the public or private property located in the vicinity of the road, street, highway, parking, or the like. As will be understood, these poles may constitute a rigid obstacle for vehicles that come off the road out of control and impact against said poles, and the consequences of the direct impact against said poles usually lead to a series of sometimes fatal physical damage and injuries to the occupants of the vehicle, and even for third parties, whether other users of the road and/or pedestrians.

[0006] In this sense, the invention seeks to find advantages that can be obtained by improving behavior in the case of possible impacts against poles forming support structures for road, street, or similar equipment, for example, by reducing the effects of a vehicle impact against the pole, column, or the like, lessening the severity of the injuries or damages sustained by the occupants of the vehicle as well as third parties, whether other users of the road and/or pedestrians.

[0007] To that end, various pole types have been developed and manufactured such that in the case of a vehicle impact, said pole types deform or break in a more or less controlled manner.

[0008] For example, detachable poles comprising one or more "frangible" sections at different heights of the pole are known, for example, as shown in patent document EP 3143210, such that given the weight and wind load demands, the "frangible" section transmits bending stresses and the pole resists, keeping its shape intact; however, when a vehicle impacts against said pole, the "frangible" section breaks due to shear stresses, and the upper part of said pole detaches and, therefore, reduces the level of severity of the impact for the occupants of the vehicle, because there is a low deceleration level in the vehicle when the upper part of the support pole detaches very easily without putting up significant resistance. However, the main drawback of these known solutions is that they have a low energy absorbing capacity and, therefore, present a high vehicle exit velocity after impacting against the pole (fast and uncontrolled vehicle); they furthermore involve the detachment of a body having a large mass that may compromise the safety of third parties, whether other users of the road and/or pedestrians.

[0009] Additionally, collapsible or fusible poles are also known, such as those shown in patent documents WO 2008/151862 and WO 2006/093415, having a mechanism or a particular form of manufacture making the pole capable of withstanding weight and wind load demands, however, in the case of an impact of a vehicle, it loses its initial rigidity and collapses, being caused to collapse by the vehicle without detaching from the foundation. Upon impact, the pole collapses as if it were "molted snakeskin". While this type of pole does not produce a detachment of masses and allows higher energy absorption during impact and, therefore, a considerable reduction of vehicle exit velocity (there is greater control over said vehicle), it may, in principle, produce a higher impact severity for the vehicle and its occupants because of the higher resistance.

[0010] It is difficult to achieve for a pole maximum en-

ergy absorption with a minimum level of severity because in principle, the more the velocity is reduced during the impact of a vehicle against the pole, the more severe it is for the occupants of said vehicle.

[0011] It is precisely this compromise between energy absorption and severity that requires implementing specific and innovative pole operating mechanisms, while further maintaining the normal aesthetic features of said pole in relation to its own weight and wind load.

[0012] Therefore, an alternative solution needs to be designed so that it can be applied in the anchoring of the poles of the support structures for road equipment which allows improvements in relation to the aforementioned drawbacks of the known solutions.

DESCRIPTION OF THE INVENTION

[0013] The present invention is established and characterized in the independent claims, while the dependent claims describe other features thereof.

[0014] One object of the invention relates to a connecting device, with deformation-induced absorption capacity for a pole of support structures for road equipment.

[0015] The device comprises a hollow drum, formed by a perimetral wall having a circular, elliptical, or polygonal cross-section, i.e., it is a cylindrical, elliptical, or prismatic body which is adapted for being arranged with its longitudinal axis parallel to the longitudinal axis of the pole to which it is coupled.

[0016] The hollow drum comprises a first end, a second end, and a central part arranged between said ends, where the first end of the hollow drum is adapted for being fixed directly or indirectly to a fixing foundation, and its second end is adapted for being fixed to a lower end of the pole.

[0017] "Direct" fixing is understood to mean when the fixing of the first end of the hollow drum to the foundation is achieved when said first end of the hollow drum is embedded in the foundation, and "indirect" fixing is understood to mean when the fixing of the first end of the hollow drum to the foundation is achieved by means of an anchoring piece which is connected, preferably welded, to said first end of the hollow drum.

[0018] In turn, the central part of the hollow drum comprises a wall portion, weakened with respect to the ends of the hollow drum, which is configured for deforming in a controlled manner when an impact force acts against the pole. Deformation of the wall portion of the central part of the hollow drum in a controlled manner means that in the case of a vehicle impact against the pole, said wall portion collapses progressively, successfully absorbing the impact force and progressively reducing the velocity of the vehicle by at least 50% upon impact.

[0019] With the controlled deformation of the wall portion of the central part of the hollow drum, the lower end of the pole is adapted for being displaced upwards or being raised and twisted in the direction of the impact force, while the lower end of the pole remains fixed to the second end of the hollow drum.

[0020] The connecting device thus constitutes the connecting element between the pole of the support structure for road equipment and the foundation, such that it allows the pole to be fixed to the terrain, conferring a rigid structure to said pole assuring an encasing sufficient for withstanding its own weight and static wind loads in the same way a conventional pole would. However, when a vehicle comes off the road out of control and impacts against the pole, applying an impact force at a certain height of said pole, as a result of the invention, there is a controlled deformation of the wall portion of the hollow drum which absorbs part of the energy from the impact and, in turn, controls the collapsing movement of the pole by the lower end of said pole being displaced upwards or raised and twisted in the direction of the impact force, with the rigidity of the casing and, therefore, the contour limitation which conferred rigidity to the pole being lost.

[0021] Likewise, another object of the present invention also relates precisely to a support structure for road equipment comprising a pole formed by a hollow cylindrical, elliptical, prismatic, polygonal, truncated pyramid-shaped, or truncated cone-shaped mast, comprising a lower end adapted for being fixed to a terrain by means of a foundation, where said support structure additionally comprises the connecting device object of the present invention arranged between the lower end of the pole and the foundation.

[0022] With the pole manufactured from a material or materials with an elastic limit within a certain predetermined range, upon losing rigidity at its lower end as a result of the connecting device as described above, said pole is easily deformable by the vehicle, such that it deforms rapidly, with its contour crumpling up as if it were "snakeskin", and is caused to collapse by the vehicle without putting up major resistance.

[0023] The deformation and collapsing of the pole, once removed from its encasing, also contributes to absorbing part of the energy from the impact and furthermore allows a much more gradual deceleration of the vehicle to be achieved, and therefore the severity of said impact is largely reduced for the occupants of the vehicle.

[0024] Therefore, the combination of the controlled deformation of the wall portion of the central part of the hollow drum of the connecting device connecting the pole to the foundation, and the likewise controlled deformation sustained by the walls of the pole during their collapse, after the raising and twisting of its lower end, allows the absorption of the energy from the impact to be improved and a smooth deceleration of the vehicle to be achieved, reducing the severity of the impact for the occupants of the vehicle.

BRIEF DESCRIPTION OF THE FIGURES

[0025] A set of figures illustrating a non-limiting, preferred embodiment of the invention is attached to the present specification.

Figure 1 depicts a schematic front view of a first embodiment of the connecting device for being connected to the pole of the support structure for road equipment, where the second end of the hollow drum, which is fixed to the lower end of the pole, is arranged below an anchoring piece to the foundation which is welded to the first end of said hollow drum.

Figures 2a-2b depict a sequence of the assembly of the lower end of the pole on the connecting device according to the embodiment of Figure 1.

Figures 3a-3c depict a sequence of the behavior of the connecting device and of the pole according to the embodiment of Figure 1 during a vehicle impact (represented by the horizontal impact force (F)) against the pole.

Figure 4 depicts a schematic front view of a second embodiment of the connecting device for being connected to the pole of the support structure for road equipment, where the second end of the hollow drum which is fixed to the lower end of the pole is arranged above the first end of the hollow drum which is fixed to the foundation by means of an anchoring piece welded to said first end of the hollow drum.

Figure 5 depicts a perspective view of the connecting device of Figure 1 or 4, including a first embodiment of the wall portion of the central part of its hollow drum.

Figure 6 depicts a perspective view of the connecting device of Figure 1 or 4, including a second embodiment of the wall portion of the central part of its hollow drum.

Figures 7a-7d depict front views of the connecting device of Figure 1 or 4, including other possible embodiments of the wall portion of the central part of its hollow drum.

Figure 8a depicts a section view of an enlarged detail of the hollow drum of the connecting device of Figure 1 or 4, showing another embodiment of the wall portion of the central part of the hollow drum based on a reduction of the wall thickness of said weakened wall portion.

Figure 8b depicts a section view of an enlarged detail of the hollow drum of the connecting device of Figure 1 or 4, showing another embodiment of the wall portion of the central part of the hollow drum based on a non-constant longitudinal section of said wall portion in the form of a "diabolo" or "hourglass".

Figures 9a-9b depict top and bottom views of the connecting device of Figure 1 or 4 fixed to the lower end of the pole, using screwed connections, in relation to orthogonal and circular sections of the pole, respectively.

Figure 10 depicts a schematic front view of a third embodiment of the connecting device for being connected to the pole of the support structure for road equipment, where the second end of the hollow drum which is fixed to the lower end of the pole is arranged above the first end of the hollow drum which is fixed directly to the foundation.

Figures 11a-11d depict examples of road equipment which can be fixed to the upper end of the pole comprising the connecting device of Figure 1, 4 or 10.

DETAILED DISCLOSURE OF THE INVENTION

[0026] The present invention relates to a connecting device for a pole of the support structure for road equipment on either public or private roads such as freeways, roads, streets, parking, etc.

[0027] As shown in Figures 1, 4 and 10, the connecting device (1) basically comprises a hollow drum (1.1), having a circular, elliptical, or polygonal cross-section, preferably made of metal or a metal alloy, which is adapted for being arranged with its longitudinal axis parallel to a longitudinal axis of the pole (2) of a support structure for road equipment (3).

[0028] In turn, the hollow drum (1.1) comprises a first end (1.11) and a second end (1.12), where the first end (1.11) is adapted for being fixed directly or indirectly to the foundation (4), and the second end (1.12) is adapted for being fixed to a lower end (2.1) of the pole (2).

[0029] In a first preferred embodiment of the connecting device (1) shown in Figures 1, 2a, and 2b, the first end (1.11) of the hollow drum (1.1) is fixed indirectly to the foundation (4) by means of an anchoring piece (1.2), where the hollow drum (1.1) is adapted for fitting onto the outside of the lower end (2.1) of the pole (2), such that in use, the second end (1.12) of the hollow drum (1.1) which is fixed to the lower end (2.1) of the pole (2) is arranged below (at a lower height than) the anchoring piece (1.2) for anchoring to the foundation (4), for example, a base plate, which is fixed, preferably by welding, to the first end (1.11) of the hollow drum (1.1), and the hollow drum (1.1) and the lower end (2.1) of the pole (2) are arranged inside a hollow space (4.1) formed in the foundation (4).

[0030] In a second embodiment of the device of anchoring (1) shown in Figure 4, the first end (1.11) of the hollow drum (1.1) is likewise fixed indirectly to the foundation (4) by means of the anchoring piece (1.2), where in this case the hollow drum (1.1) is adapted for fitting onto the inside or onto the outside (not shown in Figure 4) of the lower end (2.1) of the pole (2), such that in use, the second end (1.12) of the hollow drum (1.1) which is fixed to the lower end (2.1) of the pole (2) is arranged

above (at a greater height than) the first end (1.11) of the hollow drum (1.1) which is fixed to the foundation (4) through the anchoring piece (1.2); for example, said anchoring piece (1.2) could likewise be a base plate which is fixed, preferably by welding, to said first end (1.11) of the hollow drum (1.1).

[0031] In both embodiments mentioned above, the anchoring piece (1.2) is preferably fixed to the foundation (4) through first fixing means (5), for example, anchor bolts (5.1), partially embedded in the foundation (4) on the upper surface (4.2) thereof, and respective washer and nut assemblies (5.2) adapted for being inserted and threaded respectively into said anchor bolts (5.1), after the latter traverse respective openings (1.21) formed in the anchoring piece (1.2). The upper surface (4.2) of the foundation (4) can be located on the surface of the terrain (6) or can be buried a certain depth from said surface.

[0032] Likewise, in a third embodiment of the connecting device (1), the hollow drum (1.1) is adapted for fitting onto the inside, as shown in Figure 10, or onto the outside of the lower end (2.1) of the pole (2), such that in use, the second end (1.12) of the hollow drum (1.1) which is fixed to the lower end (2.1) of the pole (2) is arranged above (at a greater height) the first end (1.11) of the hollow drum (1.1) which is fixed directly to the foundation (4), i.e., without the use of an anchoring piece (1.2), as occurs in the embodiments described above. For example, the fixing of the first end (1.11) of the hollow drum (1.1) to the foundation (4) can be achieved if said first end (1.11) of the hollow drum (1.1) is embedded in the foundation (4) through the upper surface (4.2) thereof due to the formation and setting of said foundation (4) with the first end (1.11) of hollow drum (1.1) inserted therein. In order to reinforce the fixing of the first end (1.11) of the hollow drum (1.1) to the foundation (4), said first end (1.11) of the hollow drum (1.1) may be provided with screws, pins, or a similar element (not shown in the figures) fixed thereto in a manner transverse to its longitudinal axis.

[0033] Moreover, in all the embodiments of the connecting device (1), the second end (1.12) of the hollow drum (1.1) preferably comprises first openings (1.121) which match up with respective second openings (2.11) formed in the lower end (2.1) of the pole (2), where each first opening (1.121) and the corresponding second opening (2.11) are configured for being traversed by second fixing means (8) adapted for keeping said second end (1.12) of the hollow drum (1.1) fixed to the lower end (2.1) of the pole (2), for example by means of the screwed attachments (8.1) (screw and nut) shown in Figures 9a-9b. However, the fixing of the second end (1.12) of the hollow drum (1.1) to the lower end (2.1) of the pole (2) could also be achieved by means of welding.

[0034] Additionally, the hollow drum (1.1) comprises a central part (1.13) arranged between its first and second ends (1.11, 1.12), where said central part (1.13) in turn comprises a wall portion (7), weakened with respect to the ends (1.11, 1.12), which is configured for deforming in a controlled manner when for example a substantially perpendicular impact force (F), see Figures 3a-3c, acts on the pole (2), such that the lower end (2.1) of the pole (2) is suitable for being displaced upwards or raised, i.e., towards the road equipment (3) supported by the pole (2), and twisted in the direction of the impact force (F), the lower end (2.1) of the pole (2) remaining fixed to the second end (1.12) of the hollow drum (1.2).

[0035] Although the connection of the anchoring (1) and the pole (2) depicted in Figures 3a-3c, correspond to the first embodiment of the anchoring device (1) of Figure 1, said behavior is essentially the same for the second and third embodiments of Figures 4 and 10. For these latter embodiments, it can be understood that instead of a controlled deformation under compression of the wall portion (7), the latter likewise deforms in a controlled manner but under tension, when the impact force (F) acts on the pole (2), and the lower end (2.1) of the pole (2) is also suitable for being displaced upwards or being raised and twisted in the direction of the impact force (F), while the lower end (2.1) of the pole (2) remains fixed to the second end (1.12) of the hollow drum (1.2).

[0036] In any case, a first embodiment of the wall portion (7) formed in the central part (1.3) of the hollow drum (1.1) shown in Figure 5 preferably comprises a plurality of longitudinal notches (7.1), i.e., oriented in the same direction of the longitudinal axis of the hollow drum (1.1), formed and distributed along the perimeter in said wall portion (7). "Notch" can be understood to mean a cut made, for example, by means of a die, without any loss of material.

[0037] In a second embodiment shown in Figures 6 and 7d, the wall portion (7) may comprise a plurality of longitudinal slots (7.2), i.e., cuts involving a loss of material, oriented in the same direction of the longitudinal axis of the hollow drum (1.1), likewise formed and distributed along the perimeter in said wall portion (7). In this embodiment, when the hollow drum (1.1) has a polygonal cross-section, as shown in Figure 6, the longitudinal slots (7.2) of the wall portion (7) are preferably formed on some or on all of the edges (1.131) of the central part (1.13) corresponding to the wall portion (7).

[0038] In another possible embodiment shown in Figure 7a, the wall portion (7) may comprise a plurality of transverse creases (7.3), i.e., extending in a direction perpendicular to the longitudinal axis of the hollow drum (1.1), formed along the perimeter in said wall portion (7), forming alternating "ridges" and "valleys", such as the shape of a "bellows" or "accordion".

[0039] In two other possible embodiments shown in Figures 7b and 7c, respectively, the wall portion (7) may comprise transverse notches or slots (7.4, 7.5) formed along the perimeter forming rows and columns in said wall portion (7).

[0040] In another possible embodiment as shown in Figure 8a, the wall portion (7) may be formed by a wall thickness (e1) of the central part (1.13) of the hollow drum (1.1) less than a wall thickness (e2) of the first and second

ends (1.11, 1.12) of said hollow drum (1.1).

[0041] In another possible embodiment shown in Figure 8b, the wall portion (7) may comprise a non-constant longitudinal section, which includes a segment of a cross-section (s1) of the central part (1.13) having smaller dimensions than a cross-section (s2) of the first and second ends (1.11, 1.12) of the hollow drum (1.1), for example, in the form of a "diabolo" or "hourglass".

[0042] In any case, as will be understood, the central part (1.13) of the hollow drum (1.1) is intended to be suitable for deforming with respect to the ends (1.11, 1.12) for being fixed to the foundation (4) and to the lower end (2.1) of the pole (2), respectively, such that in the case of a possible vehicle impact (not shown in the figures) against the pole (2), there is a controlled deformation of the wall portion (7) formed in said central part (1.13) of the hollow drum (1.1), absorbing part of the energy from said impact, and the collapsing movement of the pole (2) is in turn controlled by completely or partially raising its lower end (2.1) above the connecting device (1), such that the pole (2) loses rigidity of its lower end (2.1), in order to then twist it in the direction of the impact force (F) of the vehicle, without the pole (2) losing its link to the foundation (4), thereby contributing to progressively reducing the velocity of the vehicle and therefore, reducing damages to the occupants of said vehicle.

[0043] Another object of the invention also relates to a support structure for road equipment (3) comprising a pole (2), for example, made of metal or a metal alloy, formed by a hollow cylindrical, elliptical, prismatic, polygonal, truncated pyramid-shaped, or truncated cone-shaped mast, comprising a lower end (2.1) adapted for being fixed to a terrain (6) by means of a foundation (4).

[0044] Additionally, as shown in Figures 11a-11d, the pole (2) preferably comprises an upper end (2.2) adapted for being fixed directly or by means of an extension element (9) to at least one item of road equipment (3) selected from the group consisting of a lighting means (3.1), a sign panel (3.2), a traffic signal (3.3), and a support bracket (3.4) for overhead lines (3.41).

[0045] The support structure further comprises the connecting device (1) according to any of the embodiments described above, which is arranged between the lower end (2.1) of the pole (2) and the foundation (4).

[0046] Thus, preferably using a pole (2) manufactured from a material or materials with an elastic limit within a certain predetermined range, such as known fusible or collapsible poles, upon losing rigidity at its lower end (2.1) as a result of the connecting device (1), the pole (2) is easily deformable by the vehicle impacting against it, such that said pole (2) deforms rapidly, with its contour crumpling up as if it were "snakeskin", said pole (2) being caused to collapse by the vehicle without putting up major resistance. This deformation and collapsing of the pole (2), once removed from its encasing by the connecting device (1), also contributes to absorbing part of the energy from the impact (impact force (F)), as well as the energy already absorbed in the controlled deformation of the weakened wall portion (7) formed in the central part (1.13) of the hollow drum (1.1) of the connecting device (1) and furthermore allows a much more gradual deceleration of the vehicle to be achieved, and therefore the severity of the impact is largely reduced for the occupants of the vehicle.

[0047] In other words, the combination of the controlled deformation of the wall portion (7) of the central part (1.13) of the hollow drum (1.1) of the connecting device (1) connecting the pole (2) to the foundation (4), and the subsequent also controlled deformation sustained by the walls of the pole (2) during their collapse, after the raising and twisting of its lower end (2.1), allows the absorption of energy from the impact to be improved and a smooth deceleration of the vehicle to be achieved, reducing the severity of the impact for the occupants of the vehicle.

Claims

1. A connecting device (1) for a pole (2) of the support structure for road equipment (3), **characterized in that** it comprises a hollow drum (1.1), having a circular, elliptical, or polygonal cross-section, adapted for being arranged with its longitudinal axis parallel to a longitudinal axis of the pole (2), the hollow drum (1.1) comprising a first end (1.11), a second end (1.12), and a central part (1.13) arranged between said ends (1.11, 1.12), where the first end (1.11) is adapted for being fixed directly or indirectly to a foundation (4), the second end (1.12) is adapted for being fixed to a lower end (2.1) of the pole (2), and the central part (1.13) comprises a wall portion (7) configured for deforming in a controlled manner when an impact force (F) acts on the pole (2), such that the lower end (2.1) of the pole (2) is adapted for being displaced upwards or being raised and twisted in the direction of the impact force (F), the lower end (2.1) of the pole (2) remaining fixed to the second end (1.12) of the hollow drum (1.1).

2. The device according to claim 1, wherein the wall portion (7) comprises a plurality of longitudinal notches (7.1) formed and distributed along the perimeter in said wall portion (7).

3. The device according to claim 1, wherein the wall portion (7) comprises a plurality of longitudinal slots (7.2) formed and distributed along the perimeter in said wall portion (7).

4. The device according to claim 3, wherein when the hollow drum (1.1) has a polygonal cross-section, the longitudinal slots (7.2) of the weakened wall portion (7) are formed on some or on all of the edges (1.131) of the central part (1.13) corresponding to the wall portion (7).

5. The device according to claim 1, wherein the wall portion (7) comprises transverse creases (7.3) formed along the perimeter in said wall portion (7).

6. The device according to claim 1, wherein the wall portion (7) comprises transverse notches or slots (7.4, 7.5) formed along the perimeter forming rows and columns in said wall portion (7).

7. The device according to claim 1, wherein the wall portion (7) comprises a wall thickness (e1) of the central part (1.13) less than a wall thickness (e2) of the first and second ends (1.11, 1.12) of the hollow drum (1.1).

8. The device according to claim 1, wherein the wall portion (7) comprises a non-constant longitudinal section, including a segment of a cross-section (s1) of the central part (1.13) having smaller dimensions than a cross-section (s2) of the first and second ends (1.11, 1.12) of the hollow drum (1.1).

9. The device according to claim 1, wherein the first end (1.11) of the hollow drum (1.1) is fixed indirectly to the foundation (4) by means of an anchoring piece (1.2) which is connected to said first end (1.11) of the hollow drum (1.1), and the hollow drum (1.1) is adapted for fitting onto the outside of the lower end (2.1) of the pole (2), such that in use, the second end (1.12) of the hollow drum (1.1) which is fixed to the lower end (2.1) of the pole (2) is arranged below the anchoring piece (1.2) for anchoring to the foundation (4), and the hollow drum (1.1) and the lower end (2.1) of the pole (2) are arranged inside a hollow space (4.1) formed in the foundation (4).

10. The device according to claim 1, wherein the first end (1.11) of the hollow drum (1.1) is fixed indirectly to the foundation (4) by means of an anchoring piece (1.2) which is connected to said first end (1.11) of the hollow drum (1.1), and the hollow drum (1.1) is adapted for fitting onto the outside or onto the inside of the lower end (2.1) of the pole (2), such that in use, the second end (1.12) of the hollow drum (1.1) which is fixed to the lower end (2.1) of the pole (2) is arranged above the anchoring piece (1.2) for anchoring to the foundation (4).

11. The device according to claim 9 or 10, wherein the anchoring piece (1.2) is connected to the first end (1.11) of the hollow drum (1.1) by means of welding.

12. The device according to claim 1, wherein the first end (1.11) of the hollow drum (1.1) is fixed directly to the foundation (4), and the hollow drum (1.1) is adapted for fitting onto the outside or onto the inside of the lower end (2.1) of the pole (2), such that in use, the second end (1.12) of the hollow drum (1.1) which is fixed to the lower end (2.1) of the pole (2) is arranged above the first end (1.11) of the hollow drum (1.1) which is embedded in the foundation (4).

13. The device according to any of claims 1, 9, 10, or 12, wherein the second end (1.12) of the hollow drum (1.1) comprises first openings (1.121) which match up with respective second openings (2.11) formed in the lower end (2.1) of the pole (2), where each first opening (1.121) and the corresponding second opening (2.11) are configured for being traversed by second fixing means (8) adapted for keeping said second end (1.12) of the hollow drum (1.1) fixed to the lower end (2.1) of the pole (2).

14. The device according to any of claims 1, 9, 10, or 12, wherein the second end (1.12) of the hollow drum (1.1) is fixed to the lower end (2.1) of the pole (2) by means of welding.

15. A support structure for road equipment (3), comprising a pole (2) formed by a hollow cylindrical, elliptical, prismatic, polygonal, truncated pyramid-shaped, or truncated cone-shaped mast, comprising a lower end (2.1) adapted for being fixed to a terrain (6) by means of a foundation (4), **characterized in that** it comprises a connecting device (1) according to any of the preceding claims which is arranged between the lower end (2.1) of the pole (2) and the foundation (4).

16. The support structure according to claim 15, wherein the pole (2) comprises an upper end (2.2) adapted for being fixed directly or by means of an extension element (9) to at least one item of road equipment (3) selected from the group consisting of a lighting means (3.1), a sign panel (3.2), a traffic signal (3.3), and a support bracket (3.4) for overhead lines (3.41).

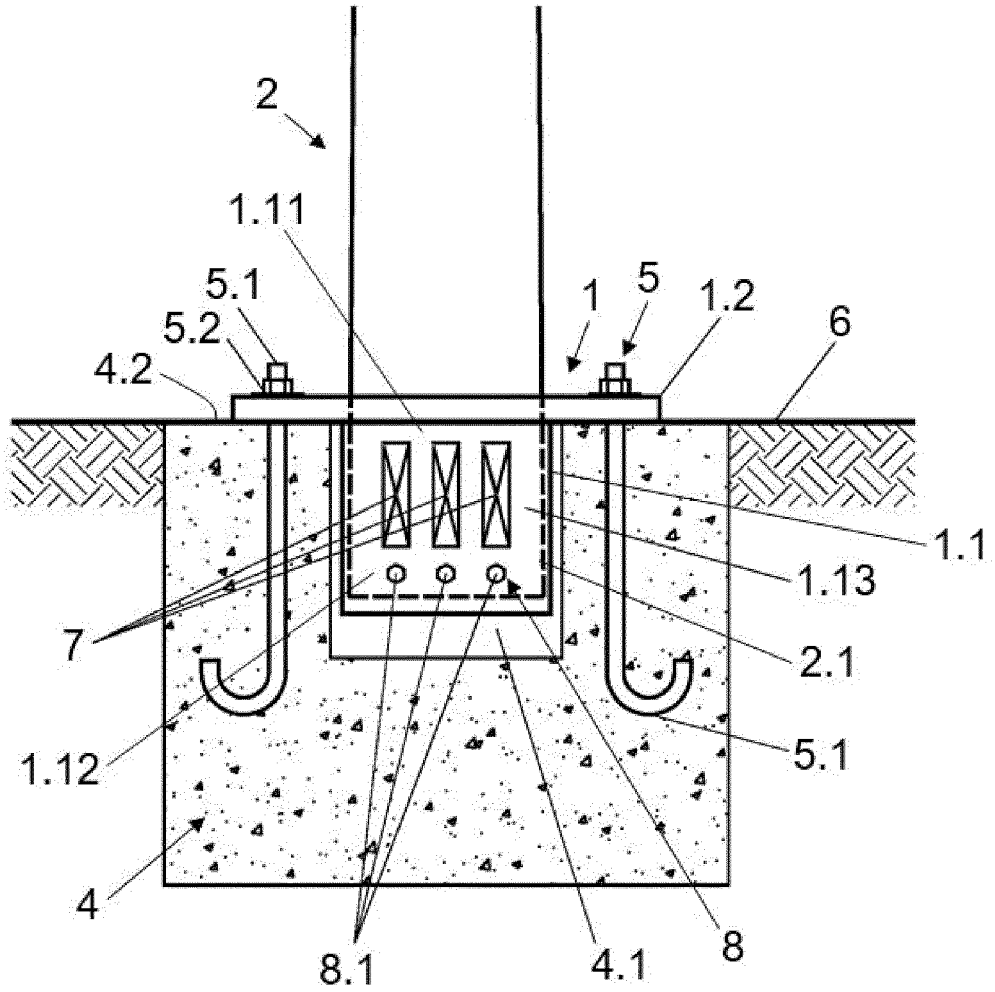


Fig.1

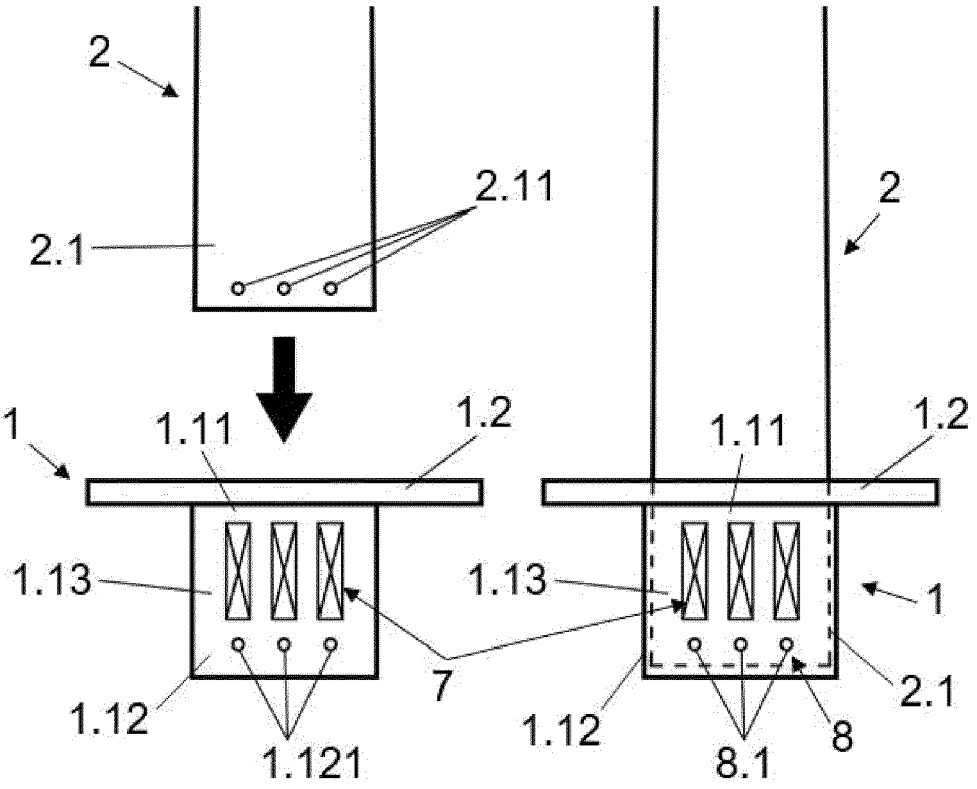


Fig.2a Fig.2b

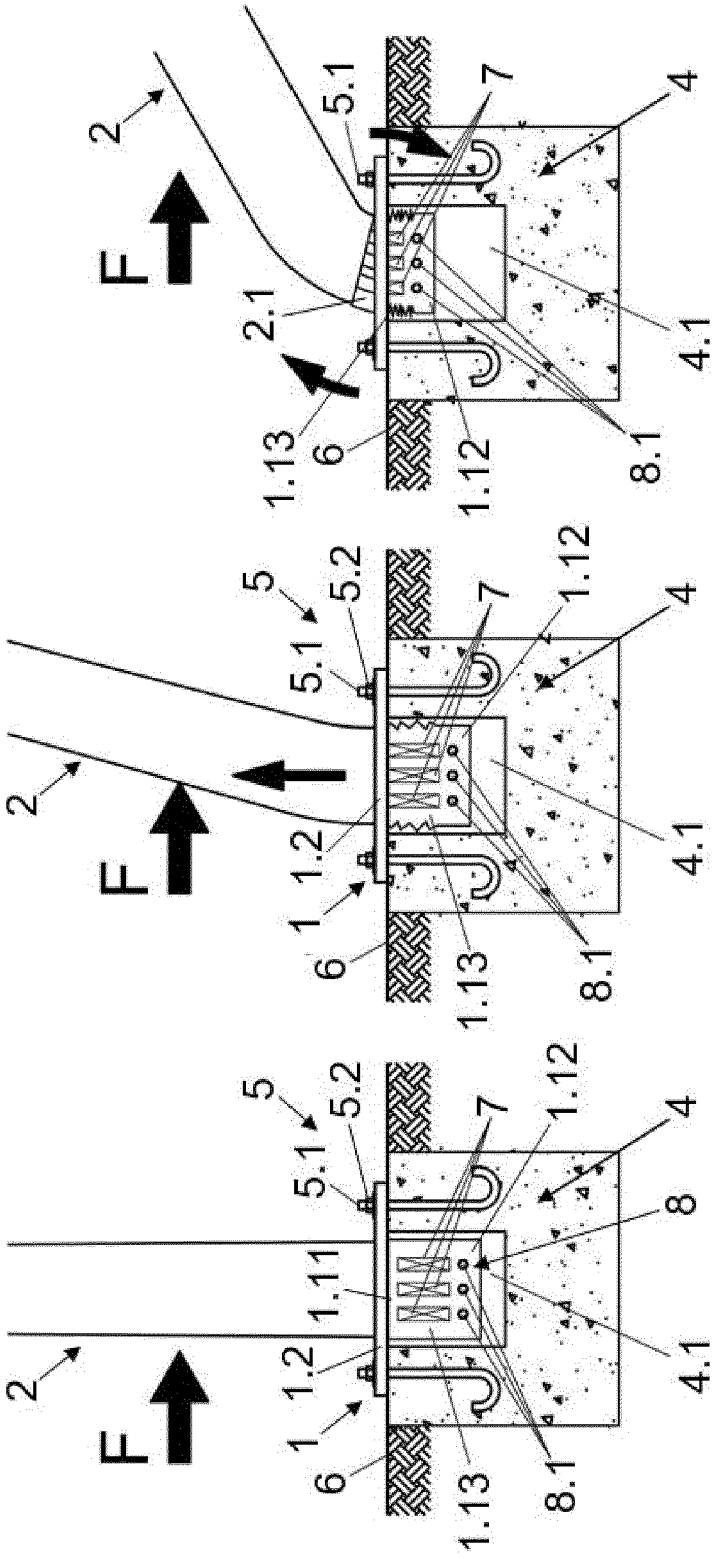


Fig.3c

Fig.3b

Fig.3a

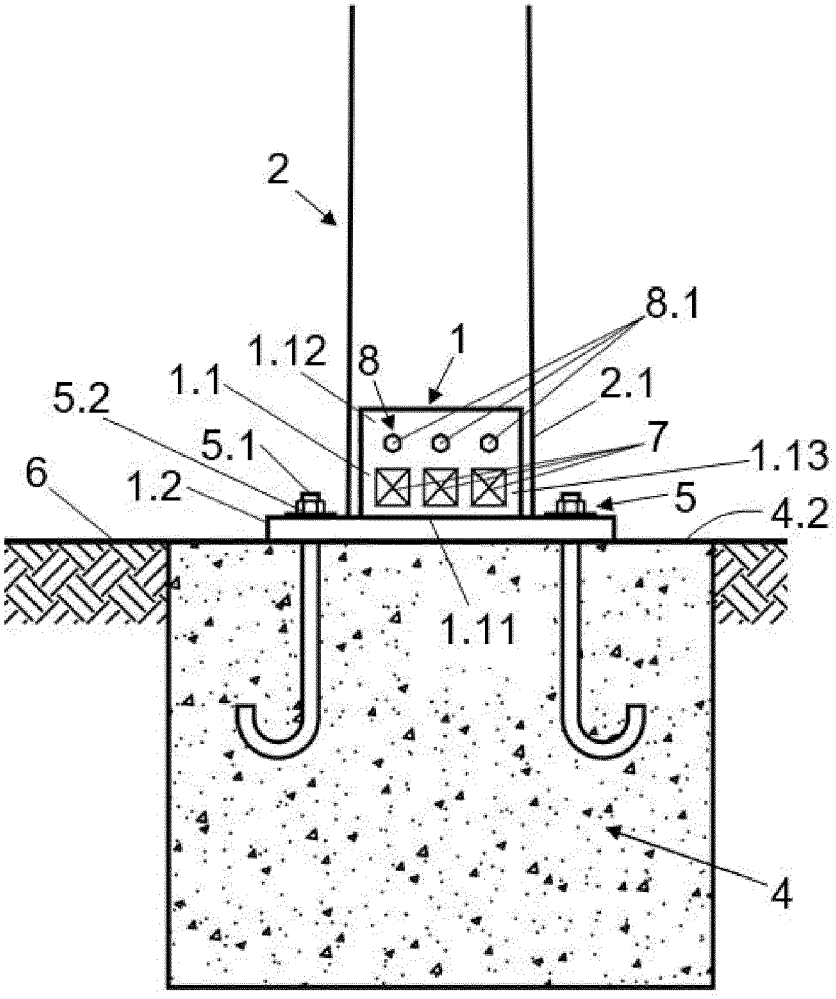
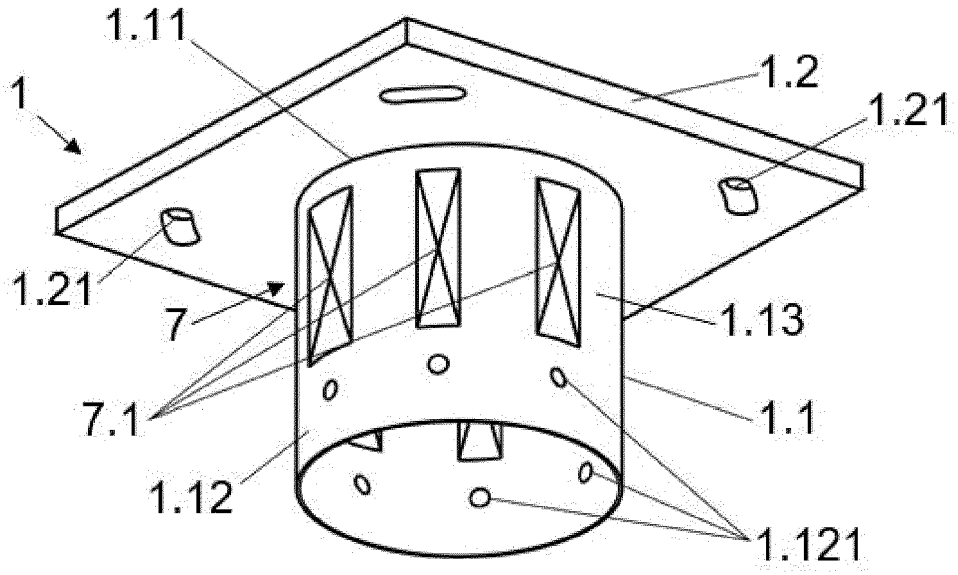


Fig.4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1
1.2
1.21
1.21
7
1.13
7.1
1.1
1.12
1.121

Fig.5

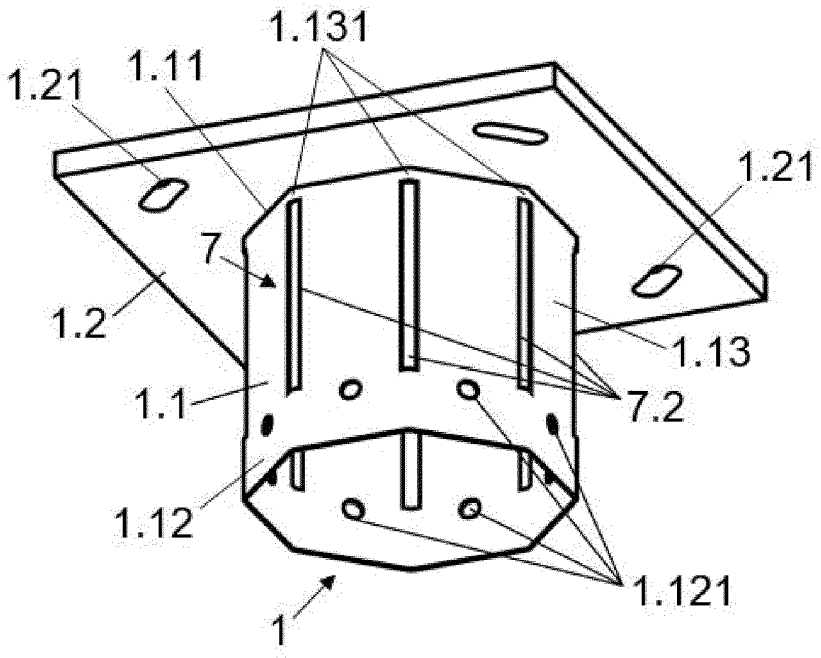
1.131
1.21
1.11
1.21
7
1.2
1.13
1.1
7.2
1.12
1.121
1

Fig.6

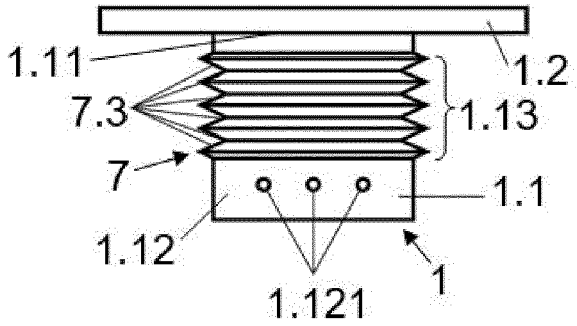

Fig.7a

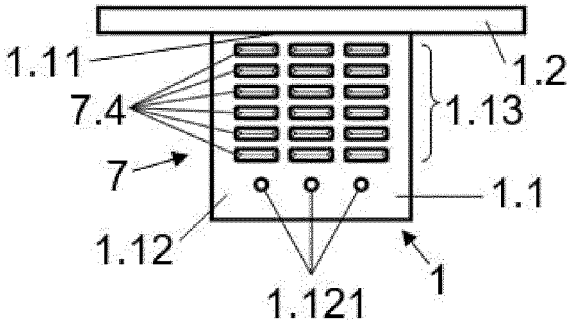

Fig.7b

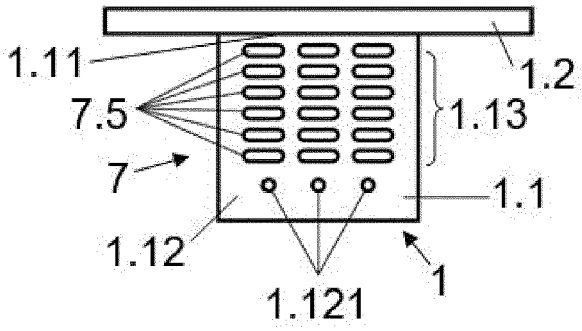

Fig.7c

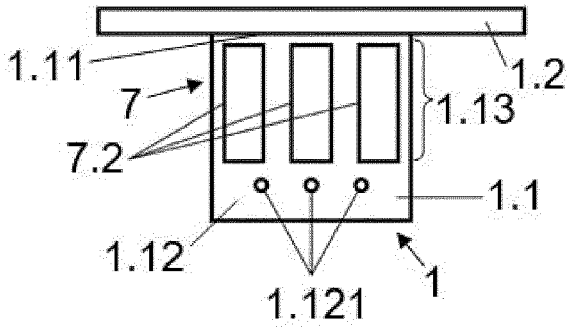

Fig.7d

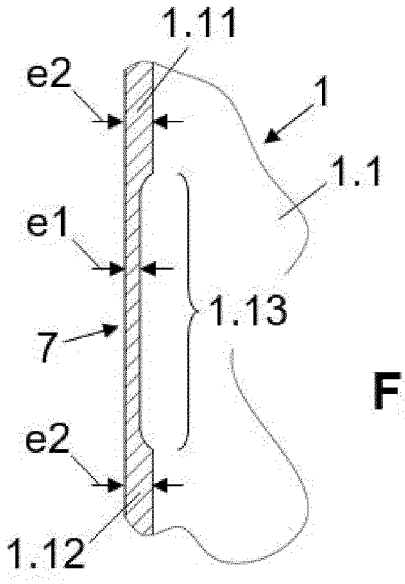

Fig.8a

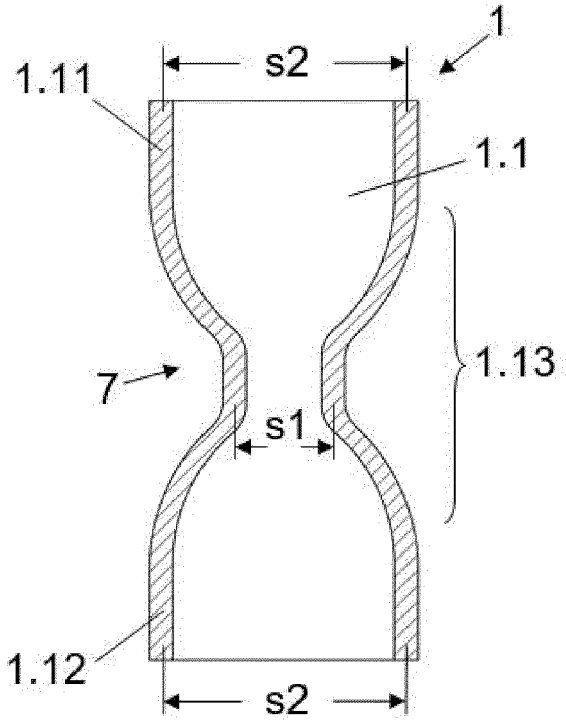

Fig.8b

Fig.9a

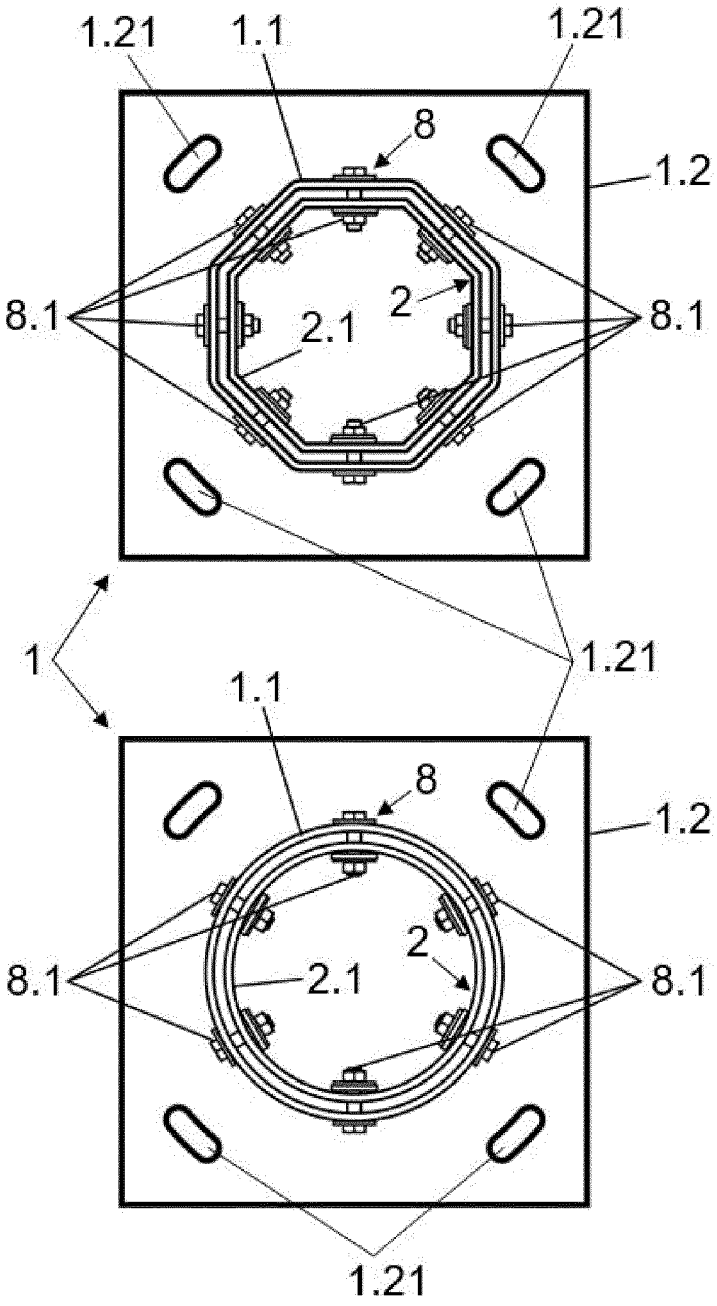

Fig.9b

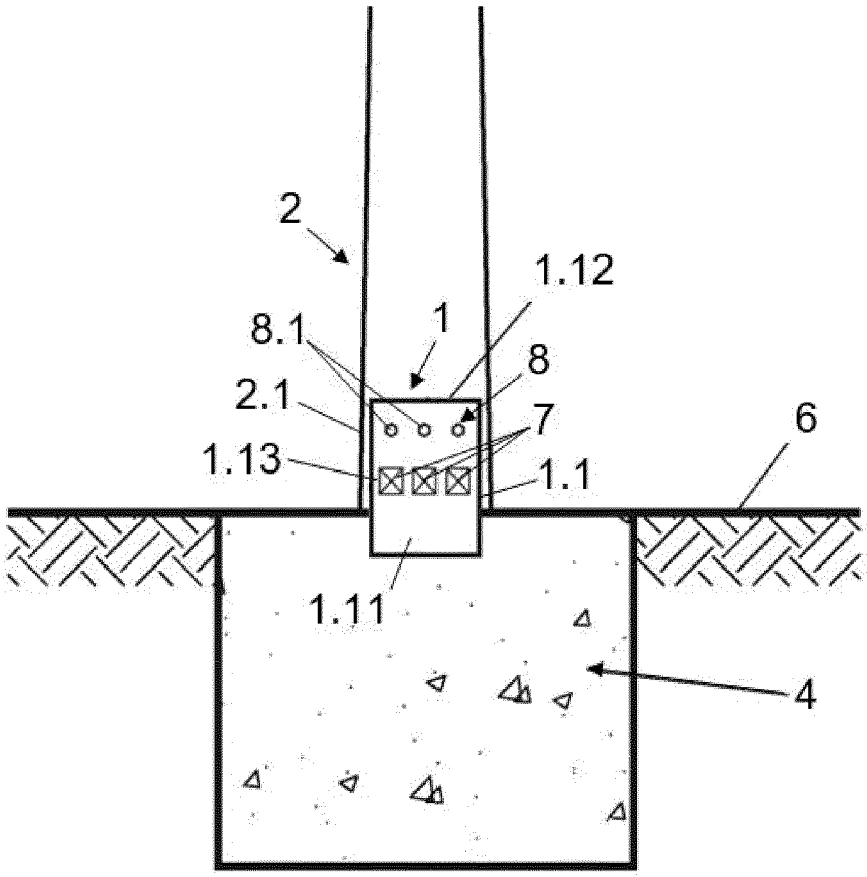

Fig.10

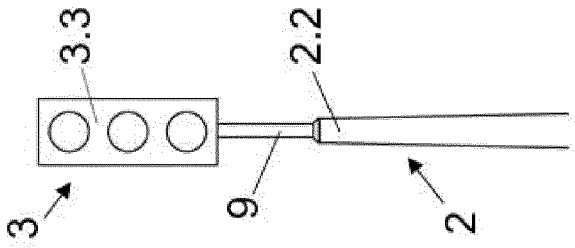

Fig.11d

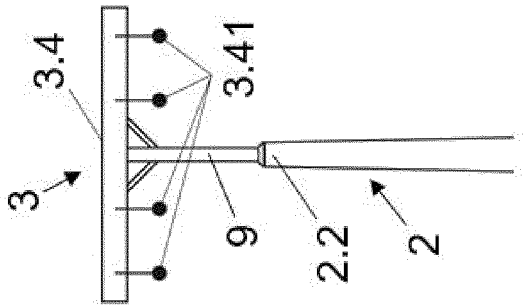

Fig.11c

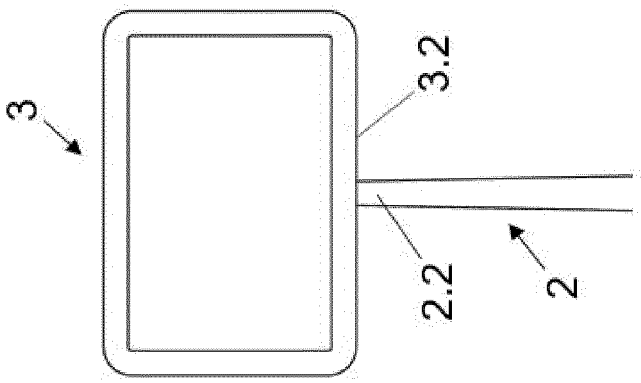

Fig.11b

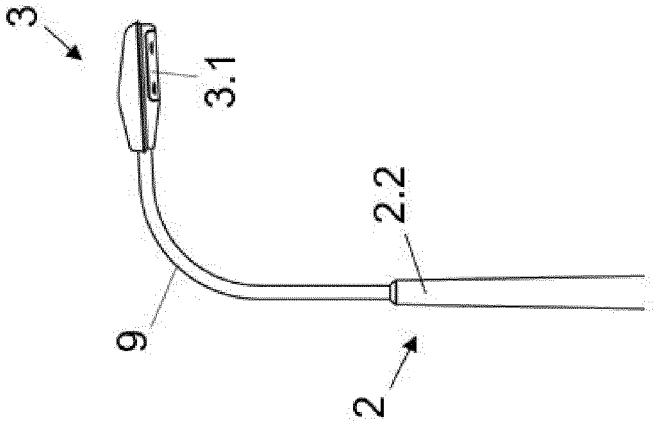

Fig.11a

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EUROPEAN SEARCH REPORT

Application Number
EP 22 38 2282

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 156 158 A1 (HOECKLE EBERHARD) 2 October 1985 (1985-10-02) * the whole document *	1,2,4,5, 7-12, 14-16	INV. E01F9/635 E01F9/685 E01F9/631
X	SE 0 901 068 A1 (ODEHAAG ARNE [SE]) 11 February 2011 (2011-02-11) * the whole document *	1,3,4,6, 9-16	
A	US 5 060 437 A (PARSONS JAMES H [US] ET AL) 29 October 1991 (1991-10-29) * column 5, line 18 - column 6, line 40; figures 10-15 *	1-16	

TECHNICAL FIELDS SEARCHED (IPC)

E01F
E04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 August 2022	Flores Hokkanen, P

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EPO FORM 1503 03.82 (P04C01)

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26-08-2022

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		EP 0156158 A1	02-10-1985
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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- WO 2008151862 A **[0009]**
- WO 2006093415 A **[0009]**