(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 772 772 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
10.02.2021 Bulletin 2021/06

(21) Application number: **20189743.6**

(22) Date of filing: **06.08.2020**

(51) Int Cl.:
H01Q 1/12 *(2006.01)* ***E04H 12/08*** *(2006.01)*
E04H 12/20 *(2006.01)* ***E04H 12/22*** *(2006.01)*

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **06.08.2019 IT 201900014160**

(71) Applicant: **Towerlend S.R.L.S.**
53045 Montepulciano (SI) (IT)

(72) Inventor: **GJECI, Alvaro**
53045 Montepulciano (SI) (IT)

(74) Representative: **Ercolani, Simone Pietro**
Marietti, Gislon e Trupiano S.r.l.
Via XX settembre, 80
06121 Perugia (PG) (IT)

(54) **STRUCTURE FOR SUPPORTING TELECOMMUNICATIONS STATIONS**

(57) Structure (1) for supporting at least one telecommunications station comprising a supporting pole (100) that can be anchored to a foundation (101), said structure (1) comprising at least one collar (2) provided with at least one plate-shaped projection (3) and reversibly constrainable to said supporting pole (100) and at least one upright (4) directly or indirectly constrained to said foundation (101) and integrally combinable with said at least one collar (2) at said at least one plate-shaped projection (3), characterized in that said at least one upright (4) comprises a T-section, and in that it comprises reversible connecting means (5) for reversibly connecting said at least one T-shaped upright (4) and said at least one collar (2) at said at least one plate-shaped projection (3).

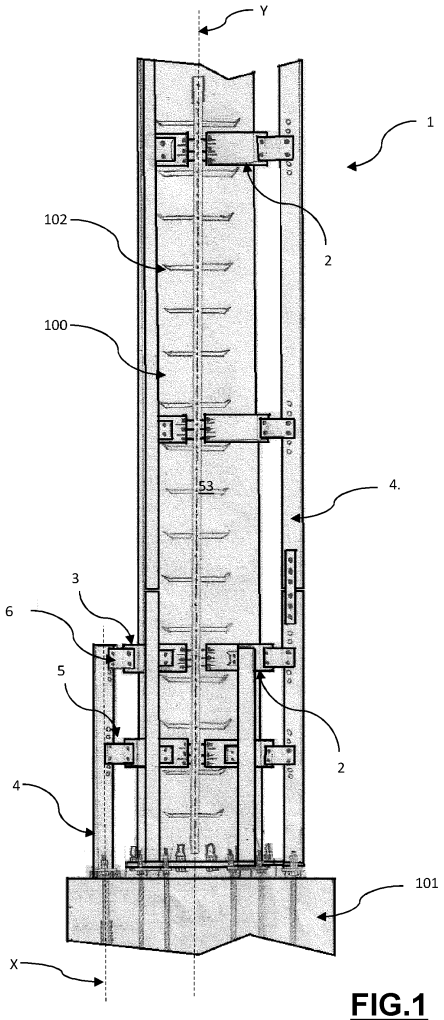

FIG.1

EP 3 772 772 A1

Description

FIELD OF THE INVENTION

[0001] The present invention concerns a structure for supporting telecommunications stations comprising at least one supporting pole. In particular, the structure in question herein is able to ensure the verticality of the supporting pole that can be anchored to the foundation.

KNOWN PRIOR ART

[0002] According to the known art, the telecommunications stations comprise a pole of the polygonal or truncated cone type, whose height can reach and exceed twenty-five meters and a support structure for supporting the supporting pole. Afterwards, the antennas and/or satellite dishes or other electrical/electronic device are installed on the supporting pole anchored to a foundation made of reinforced concrete to allow the communications between mobile telephony devices. Clearly, such support structure is able to support the generic telecommunications station also whenever subjected to strong stresses and is thus able to keep the perfect verticality of the supporting pole supporting the antennas and/or satellite dishes or other electrical/electronic device to allow the communications between mobile telephony devices.

[0003] According to the known art, the structure for supporting a telecommunications station of the type described above comprises a collar provided with plate-shaped projections, also named plates, generally six in number, welded to the collar angularly spaced in a uniform manner and reversibly constrainable to the supporting pole. The structure further comprises a plurality of uprights, identical in number to the number of the plate-shaped projections or plates, directly or indirectly constrained below to the foundation, and integrally constrainable above to the collar at the respective plate-shaped projection, or plate. Still according to the known art, the upright comprises two L-sections which are removably constrained to the respective plate. The coupling is achieved by prearranging the two profiles on the longer side and by coupling such sides on each of the two faces of the respective plate, or plate-shaped projection. The upright thus assumes the shape of a double L.

[0004] However, such solution is not without drawbacks. In fact, the coupling between the upright, consisting of two L-sections, and the collar is not simple and often leads to alignment issues between the final upright and the plate of the collar to which the upright is reversibly coupled. This leads to delays in the assembling of the structure and to a strong increase of the final costs of making the structure itself.

[0005] The document US 1702165 concerns a pole for fixing electric cables. Such pole is anchored to the ground by means of a foundation comprising a plate-shaped base which envelops the pole, and a series of vertical T-shaped beams which are contemporaneously fixed to the soil and plate-shaped base. Anyhow, the solution described in such patent does not allow to ensure the perfect verticality of the pole in question. In practice, although such solution comprises a light foundation, i.e. not made of cement or concrete, it is nonetheless devoid of a structure for supporting the pole itself and for perfectly holding it vertical under any atmospheric condition.

[0006] US2007256388 describes a structure for reinforcing a longitudinal section of a pole. Such structure comprises at least two load transferring rings formed by sleeve segments with diametrically opposite coupling ends. The rings are sized for adapting themselves to the outer surface of the pole such as to enclose it circumferentially. The sleeve segments are connected at their ends by a nut and bolt set, wherein the tightening of the nut and bolt set creates a radial locking force to squeeze the load transferring rings on the outer surface of the pole and to hold the rings thereon in a fixed condition. The elongated stiffening elements are constrained in a fixed manner to the load transferring rings by means of a nut and bolt set or by welding. The load transferring rings can also be partially welded outside the pole whenever the structural load requirements require additional capacity.

[0007] US2012/023859 describes a wind turbine having a base at the top of which the shell of the turbine is mounted and with a support system configured around a portion of the base of the tower. The support system comprises a plurality of supporting wings radially spaced around the base portion. Each of the supporting wings has a continuous beam fastened to the tower and a continuous head element radially extending outside and below towards the earth starting from the beam. The supporting wings comprise a lattice structure extending between the beam and the head element. The supporting wings extend from the tower for a length and with an acute extension angle with respect to a longitudinal axis of the tower such as to provide vertical and lateral support around the circumference of the tower.

[0008] US2004020158 describes an apparatus for reinforcing towers, which is designed to increase the load capacity and stability of a tower and to allow the tower to support the weight of additional communications equipment as well as the environmental forces exerted on the tower.

[0009] The patent ITMI20130900 describes a reinforcement structure for a telecommunications tower. In particular, the invention is applied to telecommunications towers of mobile telephony networks and especially, although not exclusively, to towers of the "raw land" type for base transceiver stations.

[0010] Thus, object of the present invention is to implement a structure for supporting telecommunications stations which is simple to assemble and allows a quick and precise centering between the upright and plate-shaped projection of the collar.

[0011] Further object of the present invention is to implement a structure which allows to ensure the perfect

verticality of the supporting pole of the telecommunications station. Finally, object of the present invention is to implement a structure which also consists of a limited number of elements, and which can be thus implemented in a simple, quick and economically convenient manner.

SUMMARY OF THE INVENTION

[0012] These and other objects are achieved by means of a structure for supporting at least one telecommunications station comprising a supporting pole that can be anchored to a foundation and for ensuring the verticality of said supporting pole, said structure comprising at least one collar provided with at least one plate-shaped projection and reversibly constrainable to said supporting pole and at least one upright directly or indirectly constrained to said foundation and integrally combinable with said at least one collar at said at least one plate-shaped projection, characterized in that said at least one upright comprises a T-section, and in that it comprises reversible connecting means for reversibly connecting said at least one T-shaped upright and said at least one collar at said at least one plate-shaped projection.

[0013] In particular, the structure in question herein is able to ensure the verticality of the supporting pole that can be anchored to the foundation.

[0014] Such solution allows to make the coupling between the upright and collar more quickly and precisely. In fact, the upright must not be assembled on site before then being coupled to the respective plate-shaped projection, as occurs in the structures of the known art, but already arrives ready in a single T-shaped piece and is immediately couplable to the collar by means of the aforementioned connecting means, thus ensuring a perfect centering with such plate-shaped projection.

[0015] It should be observed that said at least one upright is arranged above ground.

[0016] Moreover, said at least one upright advantageously has a longitudinal axis parallel to the axis of said supporting pole and extends for part of the length of said pole.

[0017] Said at least one upright is sized to ensure the verticality of said supporting pole in cooperation with said at least one collar and said reversible connecting means.

[0018] Advantageously, said reversible connecting means comprise at least one connecting element provided with a plate-shaped portion; said plate-shaped portion comprises a first end that can be reversibly connected to said T-section and a second end that can be reversibly connected to said at least one plate-shaped projection.

[0019] Moreover, said at least one connecting element comprises a C-section, wherein said plate-shaped portion is comprised between the two legs of said C-section. Such connecting element thus has greater structural rigidity.

[0020] Said at least one T-shaped upright comprises a first plate-shaped section orthogonal to a second plate-shaped section and arranged at a median area of said second plate-shaped section. Advantageously, said first plate-shaped section comprises a first planar face and a second planar face opposite said first planar face, wherein said first end of said connecting element can be reversibly connected to said first plate-shaped section of said T-section, on said first planar face.

[0021] It should be observed that first end, or second end, of the connecting element shall henceforth also mean first end of the plate-shaped portion of the connecting element. Moreover, said plate-shaped projection comprises a first planar face and a second planar face opposite said first planar face, wherein said second end can be reversibly connected to said first planar face of said plate-shaped projection.

[0022] In specific, the connecting means further comprise a second connecting element, wherein said first end of said second connecting element can be reversibly connected to said first plate-shaped section of said T-section, on said second planar face, and said second end of said second connecting element can be reversibly connected to said second planar face of said plate-shaped projection. In practice, said at least one first connecting element and said second connecting element are mounted opposite with respect to the projecting portion of the collar.

[0023] It should be observed that second end of the connecting element (or of the second connecting element) shall henceforth also means second end of the plate-shaped portion of the connecting element (or of the second connecting element).

[0024] Advantageously, said first plate-shaped section and said plate-shaped projection substantially lie on the same vertical plane, at least when said structure is assembled. This way, the first connecting element and the second connecting element are arranged symmetrical with respect to the aforementioned vertical plane of alignment for said plate-shaped projection and said first section of said T-shaped upright.

[0025] Always according to the solution suggested, said at least one upright comprises at least one bearing foot to said foundation.

[0026] In particular, said pole is of the polygonal or truncated cone type.

[0027] Moreover, said uprights are six in number and are arranged angularly in a uniform manner around said supporting pole.

[0028] Anyway, in the event of a number of uprights anyhow greater than two, at least one of said at least two uprights has height distinct from the other upright of said at least two uprights. Also in this case, said uprights greater than two in number are arranged angularly to said supporting pole in a uniform manner.

[0029] Specifically, three uprights of said six T-shaped uprights have height distinct from the remaining three uprights of said six T-shaped uprights.

[0030] Moreover, the structure comprises at least two collars arranged at different heights along said pole, and further comprises at least one reinforcing rod that can be

reversibly connected between at least two connecting elements combined with said T-shaped upright and with the respective collar of said two collars arranged at different heights.

[0031] Moreover, said at least one collar comprises two semicircle elements and approaching and tightening means for approaching towards each other and firmly tightening said two semicircle elements to said supporting pole.

[0032] Finally, said at least one plate-shaped projection is connected to said collar by welding.

DESCRIPTION OF THE FIGURES

[0033] These and other aspects of the present invention will become clearer in the following detailed description of a preferred embodiment provided herein, by way of example only and without limitations, with reference to the accompanying figures, in which:

figure 1 is a partial side view of a structure for supporting a telecommunications station;
figure 2A is a top view of a collar used in the structure according to the invention;
figure 2B is a top view of the collar of figure 2A to which a T-shaped upright according to the invention was coupled;
figure 2C is a top view of the collar of figure 2A to which a T-shaped upright according to the invention and two connecting elements were coupled;
figure 3A is a top view of the T-shaped upright according to the invention;
figure 3B is a side view of the T-shaped upright according to the invention;
figure 3C is a front view of the T-shaped upright according to the invention;
figure 4A is a front view of the connecting element according to the invention;
figure 4B is a side view of the connecting element according to the invention;
figure 5 shows a partial view of a structure comprising a reinforcing rod combined with two connecting elements arranged at two collars in turn arranged at different heights along the supporting pole.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE PRESENT INVENTION

[0034] With particular reference to such figures, 1 denotes a structure according to the invention.

[0035] A structure 1 for supporting a telecommunications stations, which in turn comprises a supporting pole 100 that can be anchored to a foundation 101, wherein such structure 1 is able to also ensure the verticality of the supporting pole 100, is partially shown in figure 1. The supporting pole 100 in turn comprises a ladder 102 for reaching the telecommunications devices not shown herein, but well known to the technician of the sector. The structure 1 comprises several collars 2 mounted at different heights and each provided with a plurality of plate-shaped projections 3 (refer to figure 2A). It should be observed that the plate-shaped projections 3 shown in the accompanying figures are six in number, however, in other embodiments, this number of projections 3 can also be different, for example, four or three plate-shaped projections 3, without thereby departing from the protection scope of the present invention. The plate-shaped projections 3 are arranged in a uniform manner along the collar 2 and each plate-shaped projection 3 is connected to the collar 2 by welding.

[0036] When the collar 2 is mounted on the supporting pole 100, the plate-shaped projections 3 are arranged on a vertical plane.

[0037] Each collar 2 is in turn reversibly constrainable to the supporting pole 100. Moreover, the structure 1 comprises several uprights 4 directly or indirectly constrained to the foundation 101 and integrally combinable with one or more collars 2 at each plate-shaped projection 3. In practice, each plate-shaped projection 3 of each collar 2 is combined with an upright 4, thus, if the plate-shaped projections 3 are six in number, the uprights 4 combinable with that given collar 2 will also be six in number. Moreover, two distinct collars 2 placed at different heights along the pole 100 can have identical uprights 4 for each of their plate-shaped projections 3. Advantageously, the generic upright 4 comprises a T-section. Moreover, the structure 1 comprises reversible connecting means 5 for reversibly connecting each T-shaped upright 4 and the collar 2 at the respective plate-shaped projection 3.

[0038] The T-shaped upright 4 allows to solve the problems of the known art by making the installation of the structure 1 simpler and easier and also by reducing the final cost of the work. Moreover, such T-shaped upright 4 makes the alignment between the T-shaped upright 4 and the generic plate-shaped projection 3 to which it will be combined extremely easy and simple.

[0039] Each T-shaped upright 4 is arranged above ground. Moreover, each upright 4 advantageously has a longitudinal axis X parallel to the longitudinal axis Y of the supporting pole 100 and extends for part of the length of the supporting pole 100 such as to be able to ensure the verticality of said supporting pole 100 in cooperation with said at least one collar 2 and said reversible connecting means 5.

[0040] As shown in figures 2A and 2B, each collar 2 comprises two semicircle elements 31 and 32 and approaching and tightening means 33 for approaching towards each other and firmly tightening such two semicircle elements 31 and 32 to the supporting pole 100. Such approaching and tightening means 33 are two in number and each comprise a screw 33a and two bolts 33b combined with the two ends of the screw 33a and with the two flanges 31a, 32a integral with the two respective semicircle elements 31 and 32.

[0041] According to an embodiment shown herein, the

reversible connecting means 5 comprise, for each plate-shaped projection 3, a connecting element 6 provided with a plate-shaped portion 6a. Such plate-shaped portion 6a comprises a first end 60a that can be reversibly connected to the T-section 4 to which it is coupled and a second end 60b that can be reversibly connected to the plate-shaped projections 3 to which it is coupled.

[0042] Preferably, each connecting element 6 comprises a C-section, wherein the plate-shaped portion 6a is comprised between the two legs 6b of the C-section.

[0043] Advantageously, each T-shaped upright 4 comprises a first plate-shaped section 4a orthogonal to a second plate-shaped section 4b and arranged at a median area 4c of the second plate-shaped section 4b. The first plate-shaped section 4a comprises a first planar face 41a and a second planar face 42a opposite the first planar face 41a. This way, the first end 60a of the connecting element 6 can be reversibly connected to the first plate-shaped section 4a of the T-section 4, at the first planar face 41a.

[0044] As mentioned above, the first end 60a of the connecting element 6 coincides with the first end 60a of the plate-shaped portion 6a of the same connecting element 6.

[0045] The reversible connection is achieved through a plurality of bolts 50 which are housed in holes 51, 52 made on the first plate-shaped section 4a and on the first end 60a of the connecting element 6.

[0046] Moreover, each plate-shaped projection 3 comprises a first planar face 3a and a second planar face 3b opposite the first planar face 3a. The second end 60b of the connecting element 6 can thus be reversibly connected to the first planar face 3a of the plate-shaped projection 3 to which that connecting element 6 is combined. As mentioned above, the second end 60b of the connecting element 6 coincides with the second end 60b of the plate-shaped portion 6a of the same connecting element 6. The reversible connection is achieved through a plurality of bolts 70 which are housed in holes 71, 72 made on the plate-shaped projection 3 and on the second end 60b of the connecting element 6.

[0047] Moreover, according to the preferred solution, the reversible connecting means 5 further comprise a second connecting element 6'. Such second connecting element 6' is identical to the connecting element 6, but for reasons of clarity, the characteristics associated with such second connecting element 6' will henceforth have a number identical to the one used for the connecting element 6, but with the addition of a single quote mark. The first end 60a' of the second connecting element 6' can be reversibly connected to the first plate-shaped section 4a of the T-section 4, at the second planar face 42a of the latter, whereas the second end 60b' of the second connecting element 6' can be reversibly connected to the second planar face 3b of the plate-shaped projection 3. This way, the two connecting elements 6 and 6' are reversibly mounted to the T-shaped upright 4 and to the collar 2, but oppositely with respect to the projection 3. Clearly, the second connecting element 6' also comprises a plate-shaped portion 6a' which in turn comprises the aforementioned first end 60a' and the aforementioned second end 60b'. In practice, as also mentioned above, first end 60a' and second end 60b' of the second connecting element 6' will also mean first end 60a' and second end 60b' of the plate-shaped portion 6a' of the second connecting element 6'.

[0048] The reversible connection of the second connecting element 6' with the T-shaped upright 4 and the plate-shaped projection 3 is achieved through the same plurality of bolts 50 and 70.

[0049] In particular, as better shown in figure 2C, the first plate-shaped section 4a and the plate-shaped projection 3 substantially lie on the same vertical plane V, at least when the T-shaped upright is assembled with the plate-shaped projection 3. This way, the two connecting elements 6 and 6' will be mounted in a symmetric position with respect to the vertical plane V. This occurs for each T-shaped upright 4 and each plate-shaped projection 3.

[0050] According to the embodiment shown herein, each T-shaped upright 4 comprises a bearing foot 20 to the foundation 101.

[0051] In the figures shown, the pole 100 is of the polygonal type, however, in other embodiments, such pole 100 can also be truncated cone shaped without thereby departing from the protection scope of the present invention. In the latter case, the collar 2 will not be cylindrical but will have a truncated cone shape of the same angle as the pole 100 to which it will be coupled.

[0052] In the embodiment described herein, three uprights 4 of the six T-shaped uprights 4 described above have height distinct from the remaining three T-shaped uprights 4.

[0053] Anyway, in the event of a number of uprights anyhow greater than two, at least one of said at least two uprights has height distinct from the other upright of said at least two uprights.

[0054] Finally, as shown in figure 5, the structure 1 comprises a reinforcing rod 30 that can be reversibly connected to two connecting elements 6 combined with two distinct collars 2, 2' arranged at different heights and in turn combined with the same T-shaped upright 4.

Claims

1. Structure (1) for supporting at least one telecommunications station comprising a supporting pole (100) that can be anchored to a foundation (101), said structure (1) comprising at least one collar (2) provided with at least one plate-shaped projection (3) and reversibly constrainable to said supporting pole (100) and at least one upright (4) directly or indirectly constrained to said foundation (101) and integrally combinable with said at least one collar (2) at said at least one plate-shaped projection (3), **characterized in that** said at least one upright (4) comprises

a T-section, and **in that** it comprises reversible connecting means (5) for reversibly connecting said at least one T-shaped upright (4) and said at least one collar (2) at said at least one plate-shaped projection (3).

2. Structure according to claim 1, **characterized in that** said reversible connecting means (5) comprises at least one connecting element (6) provided with a plate-shaped portion (6a), said plate-shaped portion (6a) comprising a first end (60a) that can be reversibly connected to said T-section (4) and a second end (60b) that can be reversibly connected to said at least one plate-shaped projection (3).

3. Structure according to claim 2, **characterized in that** said at least one connecting element (6) comprises a C-section, wherein said plate-shaped portion (6a) is comprised between two legs (6b) of said C-section.

4. Structure according to claim 2 or 3, **characterized in that** said at least one T-shaped upright (4) comprises a first plate-shaped section (4a) orthogonal to a second plate-shaped section (4b) and arranged at a median area (4c) of said second plate-shaped section (4b), said first plate-shaped section (4a) comprising a first planar face (41a) and a second planar face (42a) opposite said first planar face, wherein said first end (60a) of said at least one connecting element (6) can be reversibly connected to said first plate-shaped section (4a) of said T-section (4), on said first planar face (41a).

5. Structure according to claim 4, **characterized in that** said plate-shaped projection (3) comprises a first planar face (3a) and a second planar face (3b) opposite said fist planar face (3a), said second end (60b) of said at least one connecting element (6) can be reversibly connected to said first planar face (3a) of said plate-shaped projection (3).

6. Structure according to claims 4 and 5, **characterized in that** said reversible connecting means (5) further comprise a second connecting element (6'), wherein said first end (60a') of said at least one second connecting element (6') can be reversibly connected to said first plate-shaped section (4a) of said T-section (4), on said second planar face (42a), and said second end (60b') of said second connecting element (6') can be reversibly connected to said second planar face (3b) of said plate-shaped projection (3).

7. Structure according to one or more of claims 4 to 6, **characterized in that** said first plate-shaped section (4b) of said at least one T-shaped upright (4) and said plate-shaped projection (3) of said at least one collar (2) substantially lie on a same vertical plane (V), at least when said structure is assembled.

8. Structure according to one or more of the preceding claims, **characterized in that** said at least one upright comprises at least one bearing foot to said foundation (101).

9. Structure according to one or more of the preceding claims, **characterized in that** said pole is of the polygonal or truncated cone type.

10. Structure according to one or more of the preceding claims, **characterized in that** the uprights are at least two in number, preferably six in number, and are arranged angularly in a uniform manner around said supporting pole.

11. Structure according to claim 10, **characterized in that** at least one of said at least two uprights has height distinct from the other upright of said at least two uprights.

12. Structure according to claim 11, **characterized in that** three uprights of said six T-shaped uprights have height distinct from the remaining three uprights of said six T-shaped uprights.

13. Structure according to one or more of claims 2 to 12, **characterized by** comprising at least two collars (2, 2') arranged at different heights along said at least one pole (100), and by comprising at least one reinforcing rod (30) that can be reversibly connected between two connecting elements (6) combined with said at least one T-shaped upright and said two collars (2, 2') arranged at different heights.

14. Structure according to one or more of the preceding claims, **characterized in that** said at least one collar (2) comprises two semicircle elements (31, 32) and approaching and tightening means (33) for approaching towards each other and firmly tightening said two semicircle elements (31, 32) to said supporting pole (100).

15. Support according to one or more of the preceding claims, **characterized in that** said at least one plate-shaped projection (3) is connected to said at least one collar (2) by welding.

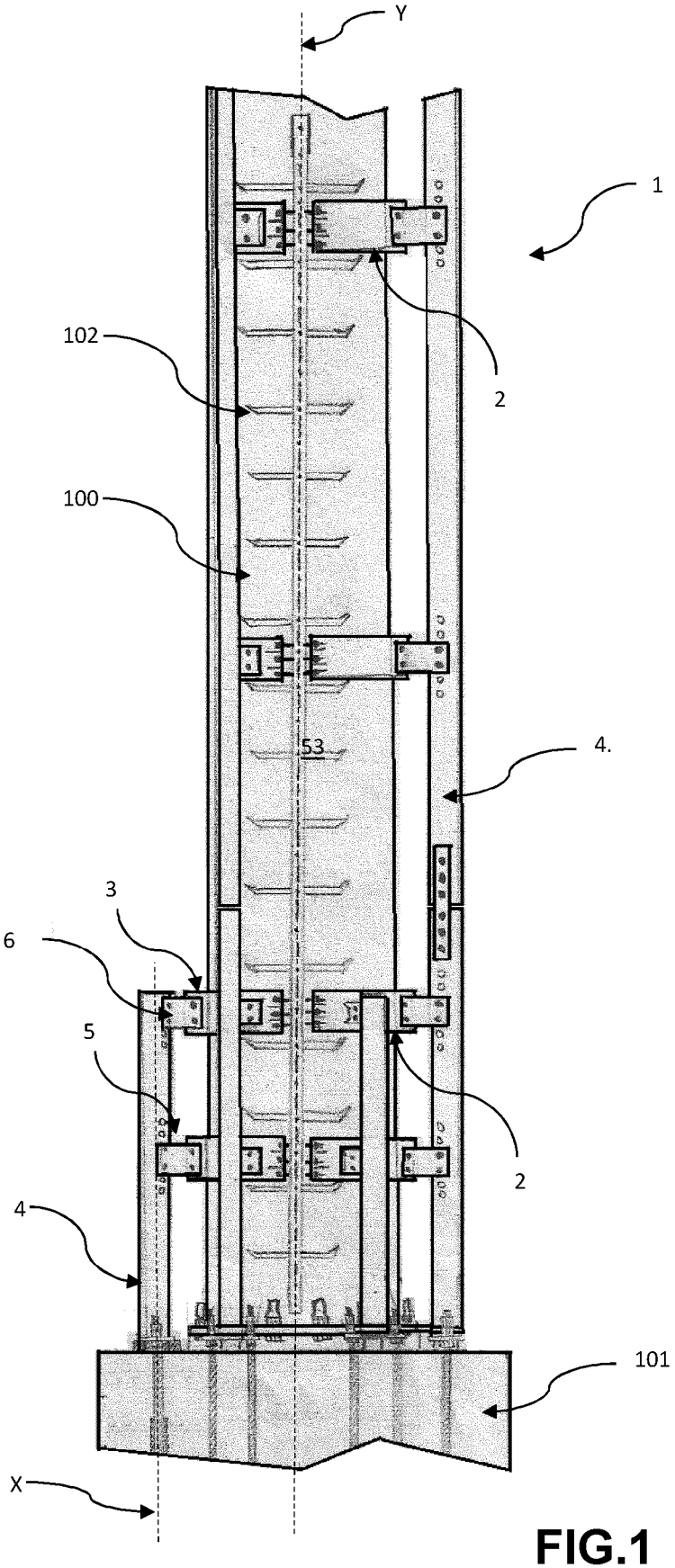

FIG.1

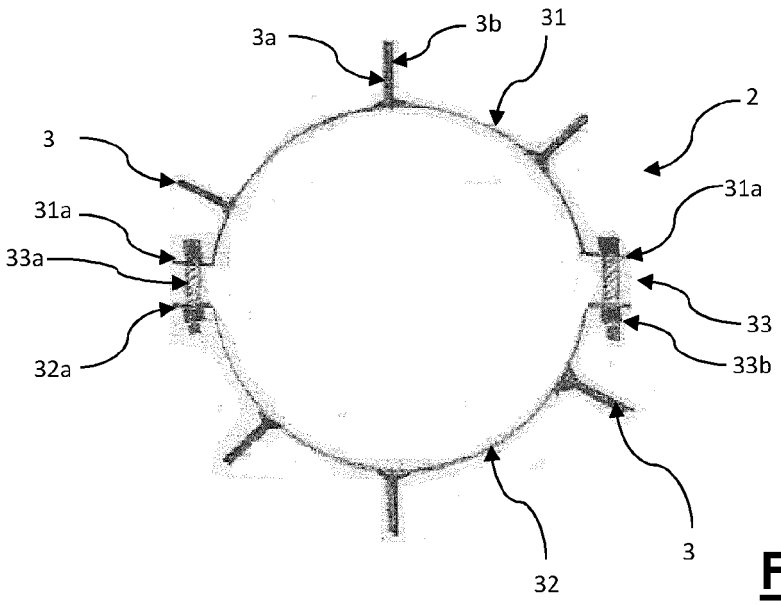

FIG.2A

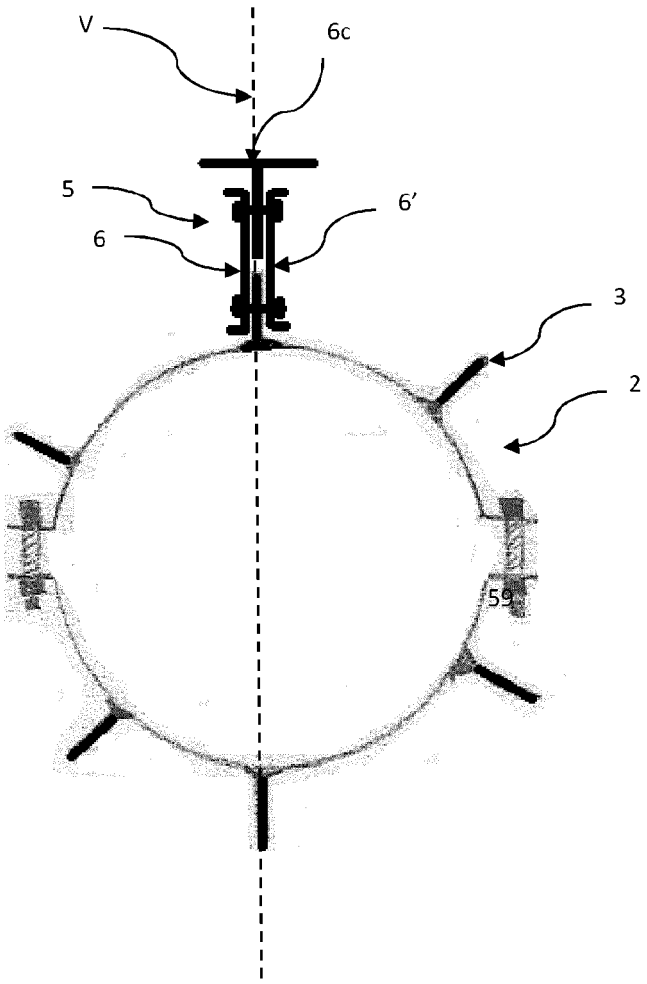

FIG.2B

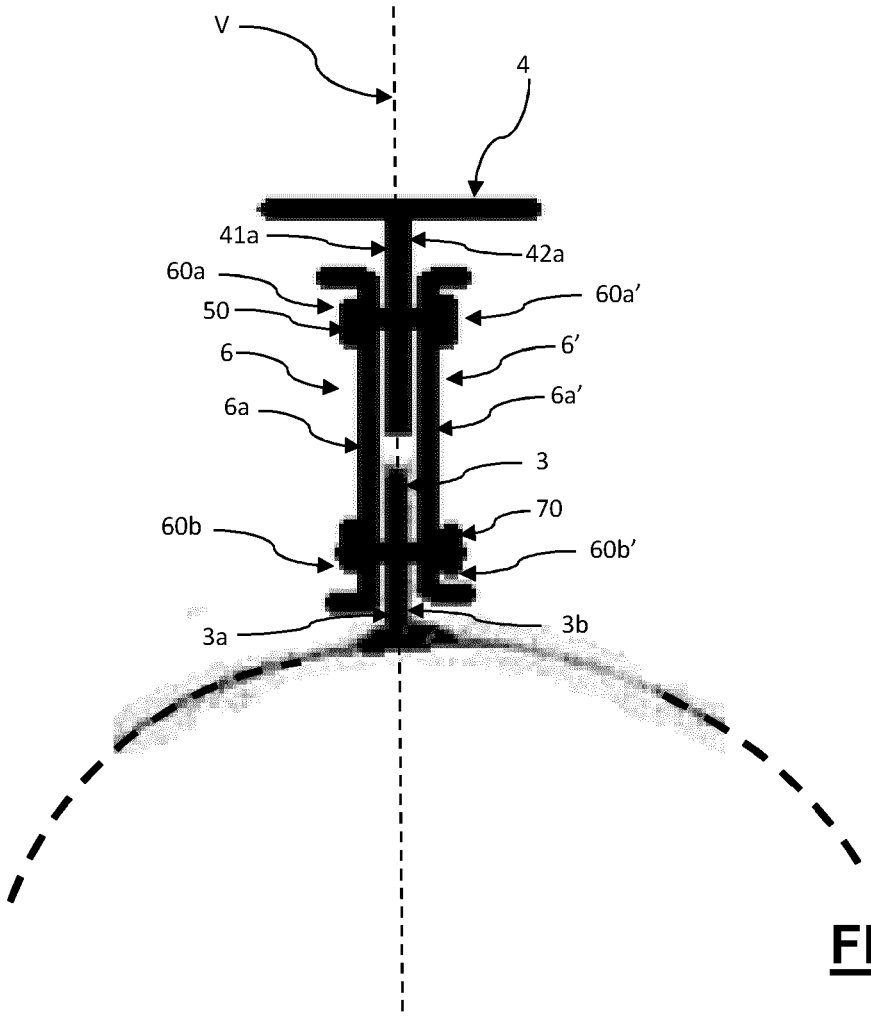

FIG.2C

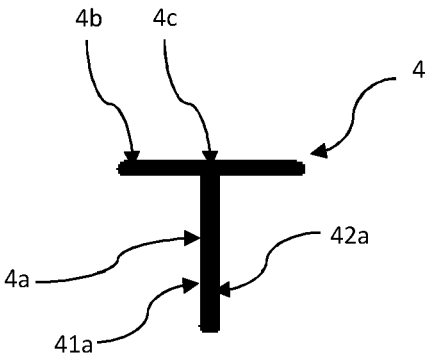

FIG.3A

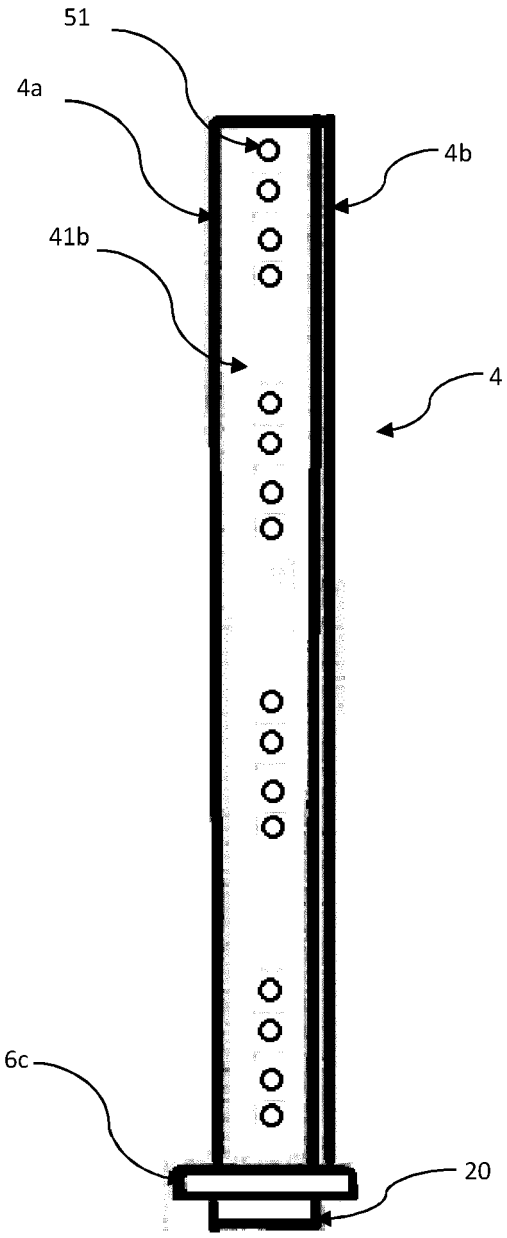

FIG.3B

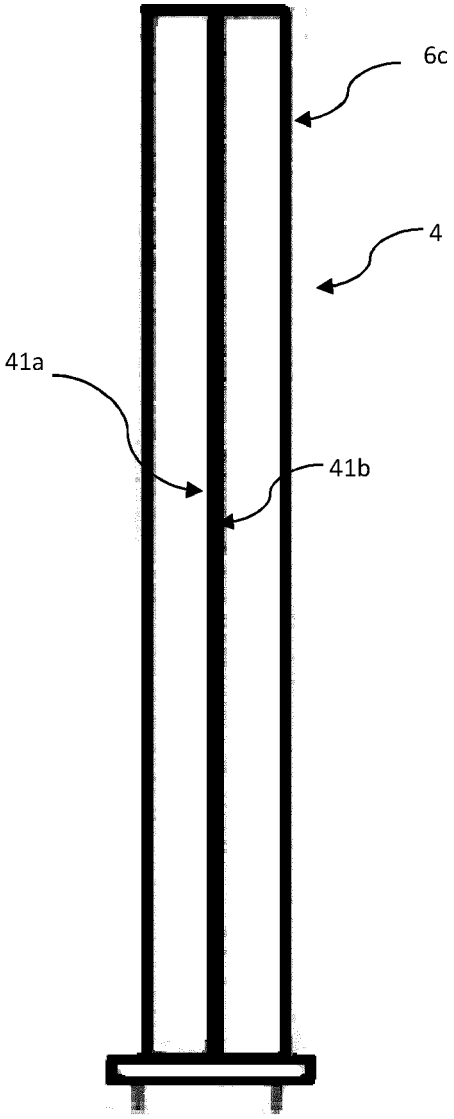

FIG.3C

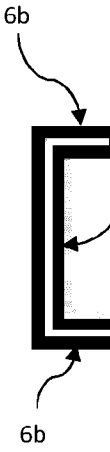

FIG.4A

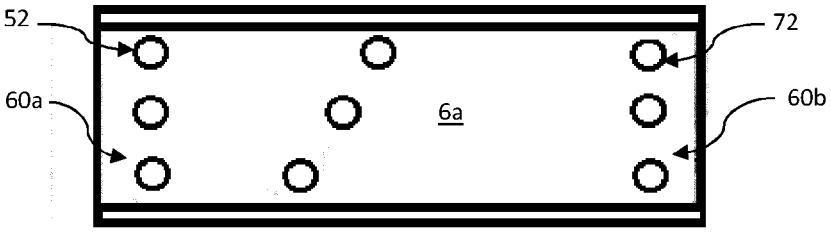

FIG.4B

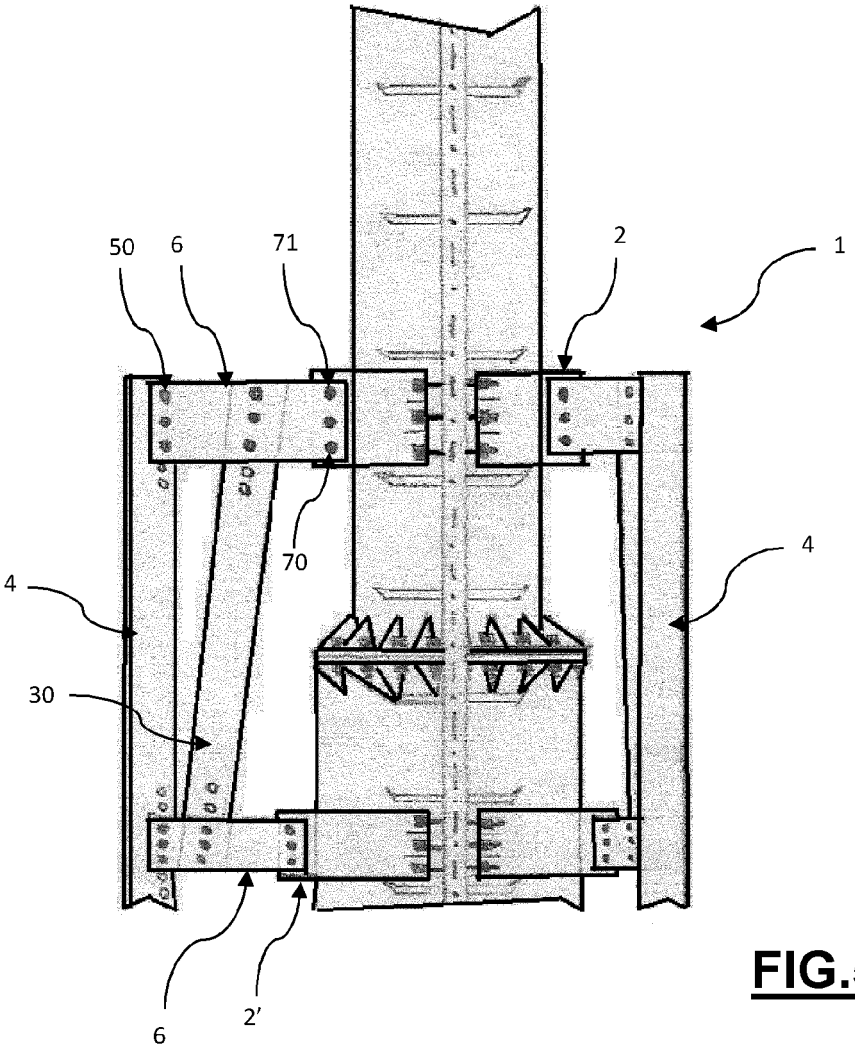

FIG.5

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 20 18 9743

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	US 1 702 165 A (FRANK LANE) 12 February 1929 (1929-02-12)	1-11	INV. H01Q1/12
A	* right-hand column, lines 87-98; figures 1,2,4 *	12	E04H12/08 E04H12/20 E04H12/22

X	US 2007/256388 A1 (IANELLO DANIEL J [US] ET AL) 8 November 2007 (2007-11-08)	1-11,13, 14	
A	* the whole document *	12	

X	US 2012/023859 A1 (JOHNSON STEPHEN BERTRAM [US] ET AL) 2 February 2012 (2012-02-02)	1-11, 13-15	
A	* the whole document *	12	

X	US 2004/020158 A1 (KOPSHEVER MICHAEL J [US]) 5 February 2004 (2004-02-05) * the whole document *	1-11, 13-15	

X	IT MI20 130 900 A1 (IRTE SPA) 1 December 2014 (2014-12-01) * the whole document *	1-11, 13-15	

TECHNICAL FIELDS SEARCHED (IPC)
H01Q
E04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 November 2020	Valenta, Ivar

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 20 18 9743

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-11-2020

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 1702165 A	12-02-1929	NONE	
US 2007256388 A1	08-11-2007	NONE	
US 2012023859 A1	02-02-2012	CA 2776020 A1	17-11-2012
		CN 102787987 A	21-11-2012
		DK 2525093 T3	07-10-2019
		EP 2525093 A2	21-11-2012
		US 2012023859 A1	02-02-2012
US 2004020158 A1	05-02-2004	NONE	
IT MI20130900 A1	01-12-2014	----------	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 1702165 A **[0005]**
- US 2007256388 A **[0006]**
- US 2012023859 A **[0007]**
- US 2004020158 A **[0008]**