



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
08.02.2017 Bulletin 2017/06

(51) Int Cl.:
H01Q 1/12 (2006.01) **H01Q 1/24 (2006.01)**
H01Q 1/42 (2006.01)

(21) Application number: **16182397.6**

(22) Date of filing: **02.08.2016**

(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:
MA MD

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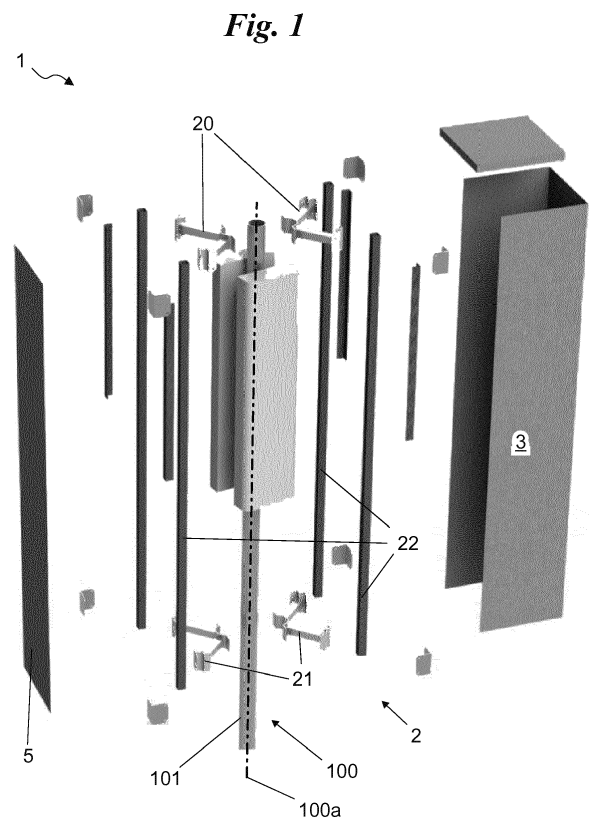
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(30) Priority: **03.08.2015 IT UB20152756**

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(54) **MASKING DEVICE FOR AN ANTENNA OR REPEATER**

(57) A masking device (1) for an antenna or repeater (100), suitable to visually conceal the antenna or repeater (100) without altering its characteristic transmission function, comprising: a rigid lattice support frame (2), defining the load-bearing structure of the masking device (1), a covering membrane (3) forming the outer cover of at least part of the masking device (1) and connected to the rigid support frame (2), tensioning means (4) suitable to tighten and keep taut the covering membrane (3) so that it adheres to the rigid support frame (2) and resists any external forces and events.



Description

[0001] The present invention relates to a masking device for an antenna or repeater of the type as recited in the preamble of Claim 1.

[0002] Masking devices for antennas or repeaters of telecommunications and other similar networks are known in the prior art. They are also known as artificial chimneys.

[0003] Similar structures are described in patent applications US-A-2013/255166 and WO-A-2014/140580.

[0004] Said devices hide the antennas from view by disguising them as chimneys or other structures, so as not to spoil the look of a building or a district.

[0005] They are especially used in old city centres or similar environments.

[0006] At the same time, the covering structures must not interfere with the transmission of electromagnetic waves at the operating frequencies of the antenna or repeater even outside of the masking device.

[0007] Said artificial chimneys are usually made of rigid structures in polymeric material, such as resin or a similar material.

[0008] The prior art solutions described above have several significant drawbacks.

[0009] In particular, said artificial chimneys may be subject to breakage in strong winds or other adverse weather conditions. Such breakages are extremely dangerous as they result in sharp pieces of debris that could fall to the ground and hit someone. Moreover, said artificial chimneys are very expensive and must be custom-built for each type of antenna.

[0010] Lastly, artificial chimneys are not always perfectly transparent to the electromagnetic waves at the operating frequencies of the antenna or repeater.

[0011] In this situation the technical purpose of the present invention is to devise a masking device for an antenna or repeater that substantially overcomes the drawbacks mentioned above.

[0012] Within the sphere of said technical purpose one important aim of the invention is to provide a masking device for an antenna or repeater that is able to withstand adverse weather conditions.

[0013] Another important aim of the invention is to provide a masking device for an antenna or repeater that, even in the event of a breakage, does not pose a risk to people or to the surrounding environment.

[0014] A further important aim of the invention is to provide a masking device for an antenna or repeater that is economical and can be adapted for different antennas. Another no less important aim of the invention is to devise a masking device for an antenna or repeater that is perfectly transparent to the electromagnetic waves at the operating frequencies of the antenna or repeater.

[0015] The technical purpose and specified aims are achieved with a masking device for an antenna or repeater as claimed in the appended Claim 1.

[0016] Preferred embodiments are described in the de-

pendent claims.

[0017] The characteristics and advantages of the invention are clearly evident from the following detailed description of preferred embodiments thereof, with reference to the accompanying drawings, in which:

Fig. 1 is an exploded view of a first embodiment of the device according to the invention;

Fig. 2 shows an axonometric projection of a portion of the device in Fig. 1;

Fig. 3 is an axonometric projection of the device in Fig. 1;

Fig. 4 shows an axonometric projection of the device in Fig. 1 in a first configuration;

Fig. 5 shows an axonometric projection of the device in Fig. 1 in a second configuration;

Fig. 6 is a normal section of the device in Fig. 1;

Fig. 7 shows a diagram of a component of Fig. 6;

Fig. 8 is a side view of the device in Fig. 1;

Fig. 9 shows a cross section of the device in Fig. 10; and

Fig. 10 is an exploded view of a second embodiment of the device according to the invention.

[0018] In this document, measurements, values, forms and geometric data (such as perpendicularity and parallelism), when used with terms such as "about" or other similar terms such as "practically" or "substantially", are to be considered without any measurement errors or inaccuracies due to production and/or manufacturing errors and, above all, without any slight divergence from the value, measurement, form or geometric data with which they are associated. For example, such terms, when associated with a value, preferably indicate a difference of not more than 10% of said value.

[0019] Moreover, terms such as "first", "second", "upper", "lower", "main" and "secondary" do not necessarily indicate an order, priority or respective position, but may simply be used in order to make a clear distinction between the different components. With reference to the Figures, reference numeral **1** globally denotes the masking device according to the invention.

[0020] It is suitable for covering an antenna or repeater **100** to hide it from view without altering its characteristic transmission function.

[0021] The antenna or repeater **100**, of a type known in the prior art, defines a main direction of extension **100a**, and generally comprises a main supporting pole **101**, extending along said main direction of extension **100a**. The latter is also preferably substantially vertical.

[0022] The masking device **1** comprises a rigid lattice support frame **2**, defining the load-bearing structure of the masking device **1**.

[0023] The rigid support frame **2** preferably comprises at least one upper bracket **20** and one lower bracket **21** substantially perpendicular to the main direction of extension **100a** and preferably directly integrally connected to the main supporting pole **101** of the antenna or repeat-

er 100.

[0024] The upper and lower brackets 20 and 21 are preferably made of metal, more preferably of steel, and are connected to the pole 101, or in any case to the structure of the antenna or repeater 100, by means of arms, plates and releasable connecting means, such as screws and bolts.

[0025] The upper and lower brackets 20 and 21 preferably have a same external shape, rectangular in a first example (Figs. 1-8) and in particular circular in a second example (Figs. 9-10).

[0026] The upper bracket 20 and the lower bracket 21 are suitable to define the bottom and the top of said device 1. Furthermore, since the device 1 is preferably substantially cylindrical or prismatic in shape, the upper and lower brackets 20 and 21 are suitable to define the development of said cylinder or prism.

[0027] There may also be intermediate brackets 23, preferably identical to the upper and lower brackets 20 and 21 in terms of their shape, structure and material.

[0028] The rigid support frame may also comprise connecting rods 22, preferably consisting of fibreglass box-shaped elements, more preferably with a square cross-section. Said connecting rods 22 are preferably connected to both the upper bracket 20 and the lower bracket 21 and also preferably to the intermediate brackets 23. Preferably, the connecting rods 22 are present at the top of the rectangular upper and lower brackets 20 and 21 and are not present when the upper and lower brackets 20 and 21 are circular.

[0029] The masking device 1 further comprises a covering membrane 3 which forms the outer cover of the masking device 1 and is connected to the rigid support frame 2. The covering membrane 3 is a membrane in perforated polymeric material, preferably polyester.

[0030] The covering membrane 3 occupies much of the outer surface of the device 1, in particular much of the side surface of the device 1.

[0031] The covering membrane 3 is also preferably associated with a detachable membrane 5, together with which it covers substantially all of the side surface of the device 1. The detachable membrane 5 is preferably very similar or identical, in structure, to the covering membrane 3 and they are also visually substantially continuous. The only difference is that the detachable membrane substantially acts as an opening to permit access to or inspection of the inside of the device 1 and thus the antenna 100. The detachable membrane 5 will be described in detail later on in this document.

[0032] The masking device 1 further comprises tensioning means 4 suitable to tighten and keep taut the covering membrane 3 so that it adheres to the rigid support frame 2 and resists any external forces and events.

[0033] The tensioning means 4 preferably comprise at least one flexible tensioning element 40 connected to the covering membrane 3. In particular there are a plurality of tensioning elements 40 consisting of fabric belts or the like. Furthermore, the tensioning element 40 and the cov-

ering membrane 3 define, along a tensioning plane 40a crossing the masking device 1, a closed path enclosing at least part of the rigid support frame 2.

[0034] In a first example (Figs. 6 and 7) the tensioning planes 40a are normal to the main direction of extension 100a of said antenna or repeater 100. In that case, the covering membrane 3 preferably encloses, in the normal section, a non-complete portion of the perimeter of the side surface of the device 1, for example three sides of the square or $2/3 - 4/5$ of the round angle.

[0035] In any case, all the connecting rods 22, which are preferably perpendicular to the tensioning planes 40a, are preferably comprised in said portion of perimeter. In particular, the tensioning element 40 and the covering membrane 3 enclose two connecting rods 22 and pass on the outside of the remaining connecting rods 22 (Fig. 7).

[0036] The tensioning elements 40 are preferably connected to the covering membrane 3 by means of rigid rods 41, made of fibreglass, housed in slots, for example heat-sealed, in the covering membrane 3 and in the tensioning elements 40. To define said closed path in the tensioning planes 40a, both ends of both the covering membrane 3 and of the tensioning elements 40 are connected to one another or connected to the rigid rods 41.

[0037] Furthermore, there are preferably several tensioning elements 40 along the axial direction 100a, in particular one in correspondence with each bracket 20, 21 and 23.

[0038] Said configuration is preferable especially when the upper and lower brackets 20 and 21 are rectangular.

[0039] In a second example (Figs. 9 and 10) the tensioning planes 40a are a plurality of planes parallel to the main direction of extension of the antenna or repeater 100 and mutually incident. Such planes are thus preferably centred on the main axis or direction of extension 100a and angularly spaced. In said tensioning planes 40a (Fig. 9) the covering membrane 3 and the tensioning elements 40 form a path that passes along the outer side, where the covering membrane 30 is present, around rigid rods 41 or the like present in correspondence with the upper and lower brackets 20 and 21 and twice around the inner side of the device 1, once for each tensioning element 40. Preferably there is one tensioning element 40 every 2 dm - 5 dm, more specifically, one every 3 dm. Tensioning elements 40 may also be arranged in planes 40a horizontal or normal to the direction 100a, in addition to said tensioning planes in the present example. In particular, a tensioning element 40 in a horizontal plane 40a may act as the support for a rigid rod 41 which acts as a connection for the membrane 30 and the vertical tensioning elements 40.

[0040] Lastly, the tensioning elements 40 are preferably tensioned by means of ratchets 42, which, after tensioning, can be kept or, preferably, replaced with metal fastening braces or the like.

[0041] The detachable membrane 5 preferably constitutes an outer portion of the device 1 and is configurable

in a closed position, in which it is connected to the covering membrane 3 and forms part of the outer covering of at least part of said masking device 1 substantially continuously with the covering membrane 3, and in an open position, in which it defines an opening which permits physical access to the antenna or repeater 100.

[0042] Preferably the detachable membrane 5 is wrapped, in the normal section, around a portion of the perimeter of the side surface of the device 1, for example one side of the square or 1/3 - 1/5 of the round angle.

[0043] If the device 1 is circular, the detachable membrane 5 is preferably connected to rigid elements 5a, so that it forms an angular segment of a cylinder.

[0044] The detachable membrane 5 is connected in a sliding manner to two side rails 50 parallel to and integral with the covering membrane 3 and preferably extending in the direction of the main axis of development 100a. The detachable membrane 5 can thus be opened by folding or packing.

[0045] Preferably the rails 50 are polymeric and comprise polymeric tracks 51, integral with the covering membrane 3, and polymeric wedges 52 integral with the detachable membrane 5. In particular there are a plurality of wedges 52 arranged between 2 and 5 dm apart.

[0046] There is also preferably an opening mechanism comprising a rope 53, connected to the lower wedges on the two sides of the covering membrane 3, control mechanisms 54, such as pulleys, suitable to let the rope 53 down to enable simple opening. Lastly, a mass 55 assists automatic closing of the detachable membrane 5.

[0047] Alternatively, the detachable membrane 5 may be comprised between the two side rails 50 (as in Fig. 1) and opened by means of a single hinge arranged within said detachable membrane 5 and substantially parallel to the side rails. In that case, an elastic strip is preferably arranged longitudinally alongside the hinge. Furthermore, preferably, a second portion of detachable membrane 5 is suitable to be arranged over the hinge and to cover the latter and to be connected to another portion of membrane 3 or 5 by means of Velcro.

[0048] Lastly, the top of the device 1 may be covered with an upper membrane or a rigid element.

[0049] The assembly of the masking device 1 described above in a structural sense, is as follows.

[0050] When disassembled, the device 1 is extremely compact and easy to transport.

[0051] It is assembled by connecting the brackets 20, 21 and 23 to the main pole 101 of the antenna 100. Then the connecting rods 22 are connected to complete the assembly of the rigid support frame 2.

[0052] Next the covering membrane 3 is connected to the rigid rods 41 and to the tensioning elements 40. The latter are tightened, along the paths described and illustrated, using ratchets 42 which are then removed and tautness is maintained by means of said metal braces.

[0053] Next the detachable membrane 5 is mounted on the side rails 50, which are preferably pre-assembled. The latter can be opened and closed simply by means

of said rails 50 and the opening mechanism.

[0054] The masking device 1 according to the invention achieves some important advantages.

[0055] Thanks to the configuration described above, the device 1 is able to withstand even very strong gusts of wind. Indeed, when one side or a portion of the membrane 3 moves the entire mechanism is kept taut, since tensioning is performed along closed paths. The system is thus self-tensioning.

[0056] Moreover, even if the membrane 3 tears, for whatever reason, it would not harm people or damage the surrounding environment, because it is light and flexible. The device 1 is also economical, can be adapted during assembly to suit any type of antenna and is easy to transport. With the device 1 there is in fact no need for customisation during production depending on the type antenna 100.

[0057] Lastly, the device 1 is perfectly transparent to the electromagnetic waves at the operating frequencies of the antenna or repeater, since it is mainly made of polymeric elements and in particular of membranes.

[0058] Modifications and variations may be made to the invention described herein without departing from the scope of the inventive concept as defined in the claims.

All details may be replaced with equivalent elements and the scope of the invention includes all other materials, shapes and dimensions.

Claims

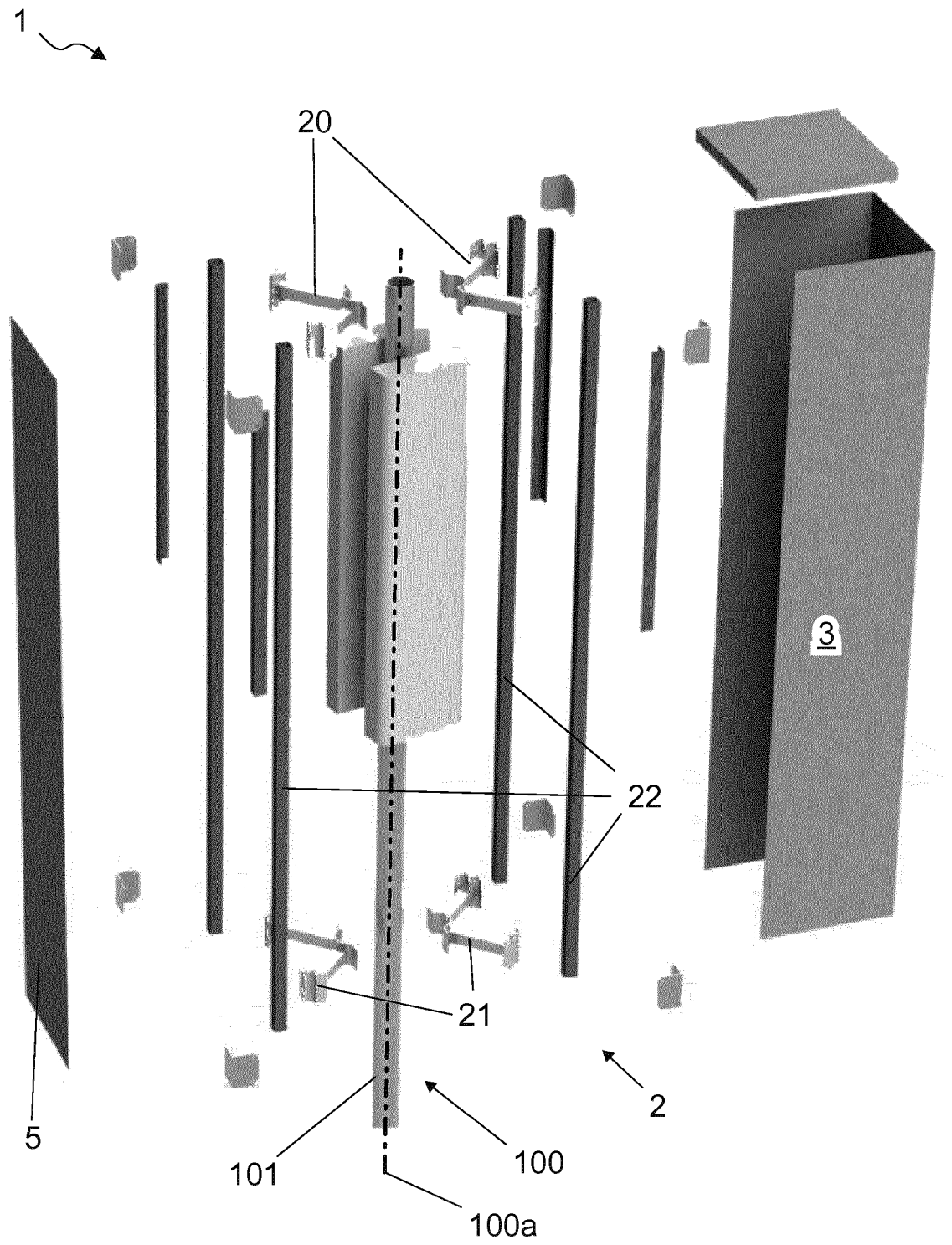
1. Masking device (1) for an antenna or repeater (100) suitable to visually conceal said antenna or repeater (100) without altering its characteristic transmission function,

- a rigid, lattice support frame (2), defining the load-bearing structure of said masking device (1),
- a covering membrane (3) forming the outer cover of at least part of said masking device (1) and connected to said rigid support frame (2),
- tensioning means (4) suitable to tighten and keep taut said covering membrane (3) so that it adheres to said rigid support frame (2),
- said masking device (1) being **characterised in that** it comprises:

- a detachable membrane (5), configurable in a closed position, in which it is connected to said covering membrane (3) and forms part of the outer covering of at least part of said masking device (1) substantially continuously with said covering membrane (3), and in an open position, in which it defines an opening which permits physical access to said antenna or repeater (100).

2. Masking device (1) according to the previous claim, wherein said tensioning means (4) comprise at least one flexible tensioning element (40), connected to said covering membrane (3), wherein said tensioning element (40) and said covering membrane (3) define, along a tensioning plane (40a) crossing said masking device (1), a closed path enclosing at least part of said rigid support frame (2). 5
3. Masking device (1) according to the previous claim, wherein said tensioning elements (40) are flexible belts. 10
4. Masking device (1) according to claim 2 or 3, wherein said tensioning planes (40a) are normal to the main direction of extension of said antenna or repeater (100). 15
5. Masking device (1) according to claim 2 or 3, wherein said tensioning planes (40a) are a plurality of planes parallel to the main direction of extension of said antenna or repeater (100) and mutually incident. 20
6. Masking device (1) according to the previous claim, wherein said tensioning means (4) are suitable to tighten and keep taut said covering membrane (3) so that it adheres to said rigid support frame (2) and resists any external forces and events. 25
7. Masking device (1) according to one or more of the previous claims, wherein said detachable membrane (5) is slidingly connected to two side rails (50) parallel to and integral with said covering membrane (3), and wherein said detachable membrane in said open position is packed. 30
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8. Masking device (1) according to one or more of the previous claims, wherein said rigid support frame (2) comprises at least one upper bracket (20) and one lower bracket (21) perpendicular to the main direction of extension of said antenna or repeater (100) and suitable to define the bottom and the top of said device. 40
9. Masking device (1) according to one or more of the previous claims, wherein said rigid support frame (2) comprises connecting rods (22) of said upper bracket (20) and lower bracket (21), consisting of fibre-glass box-shaped elements. 45
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10. Masking device (1) according to one or more of the previous claims, wherein said covering membrane (3) is a membrane in perforated polyester. 55

Fig. 1



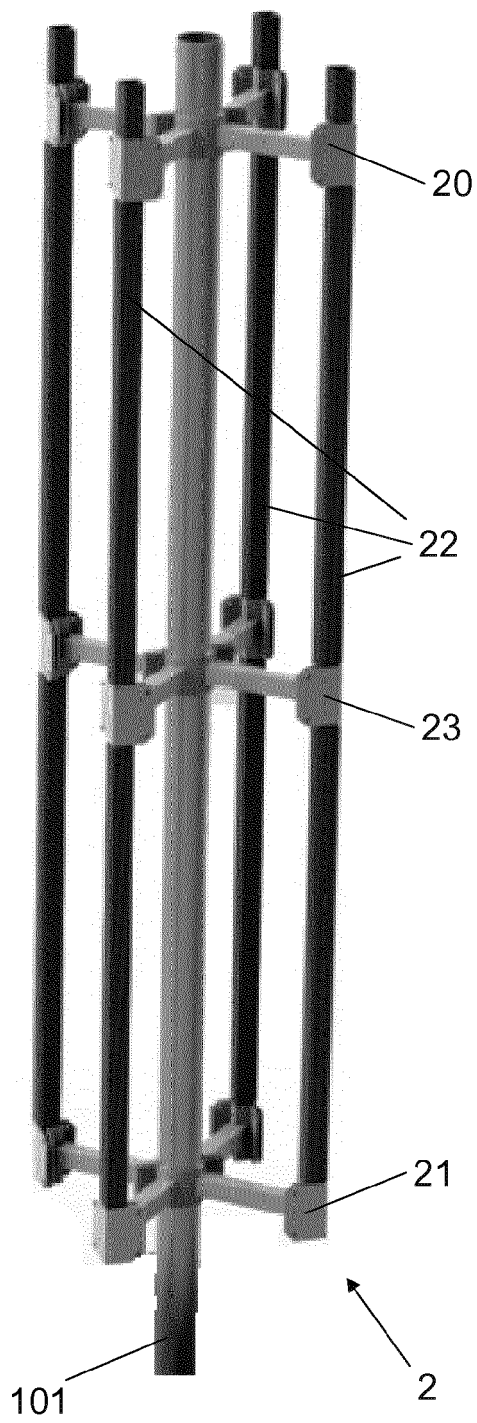


Fig. 2

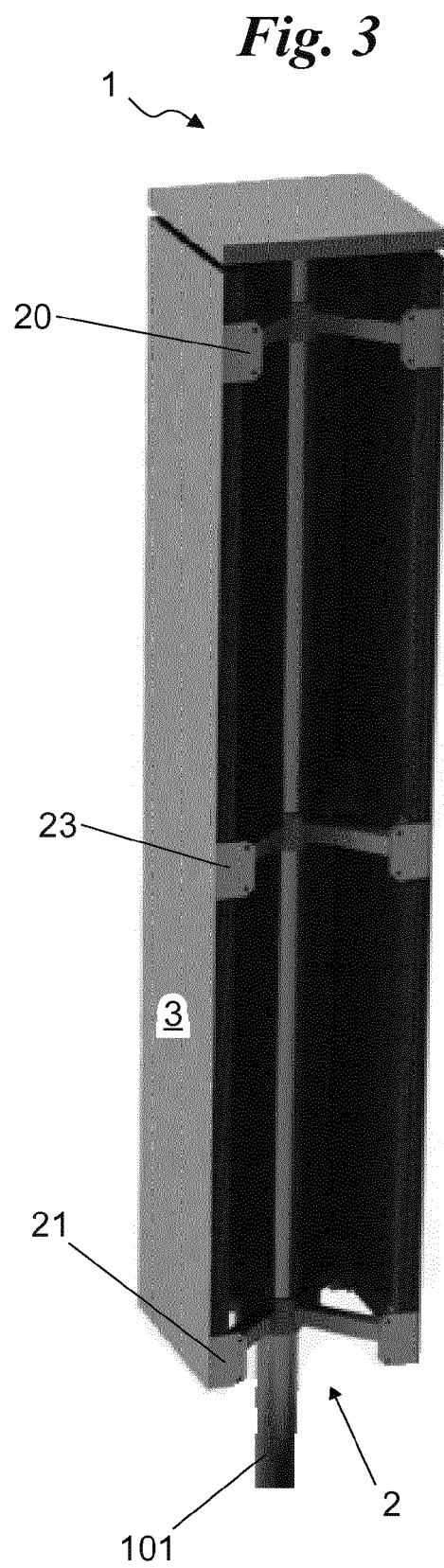


Fig. 3

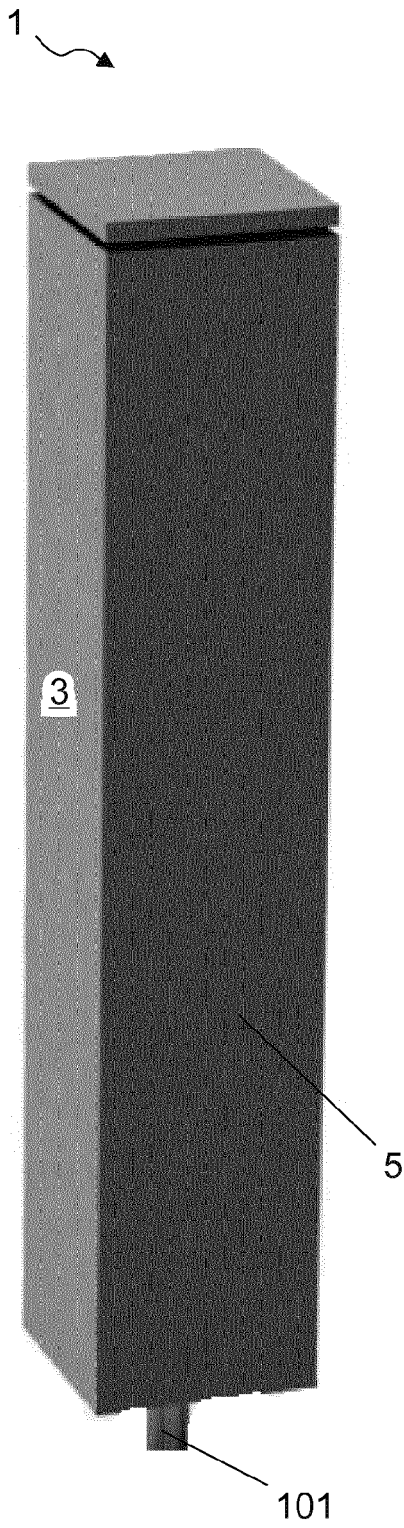


Fig. 4

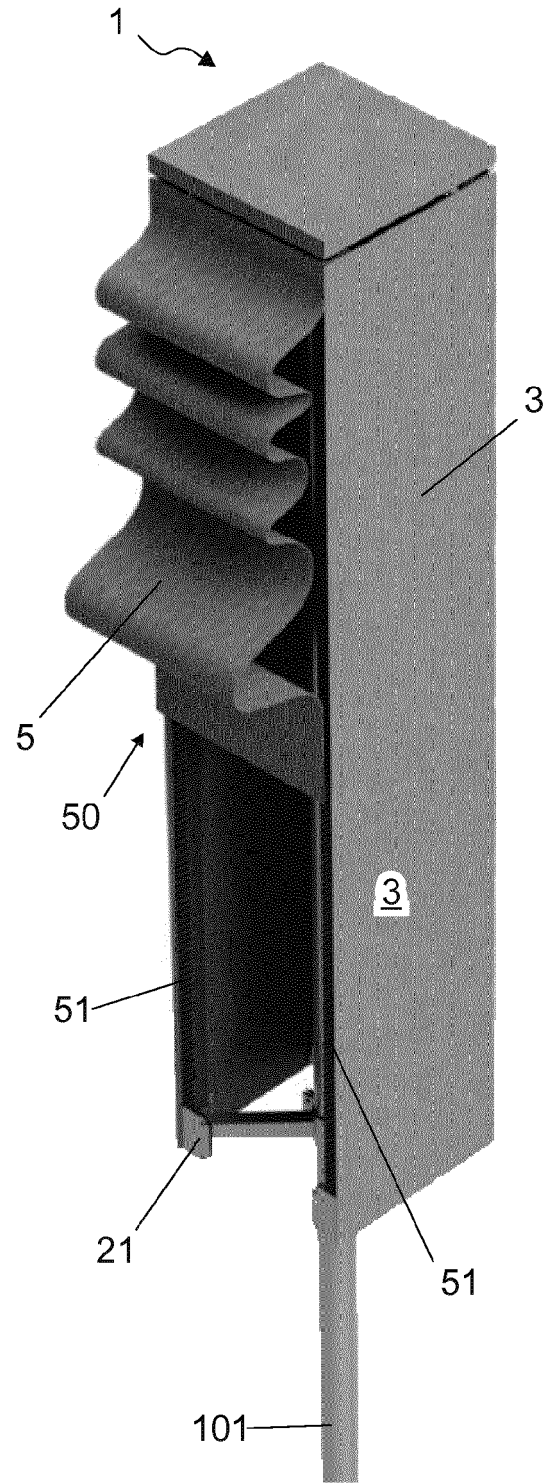


Fig. 5

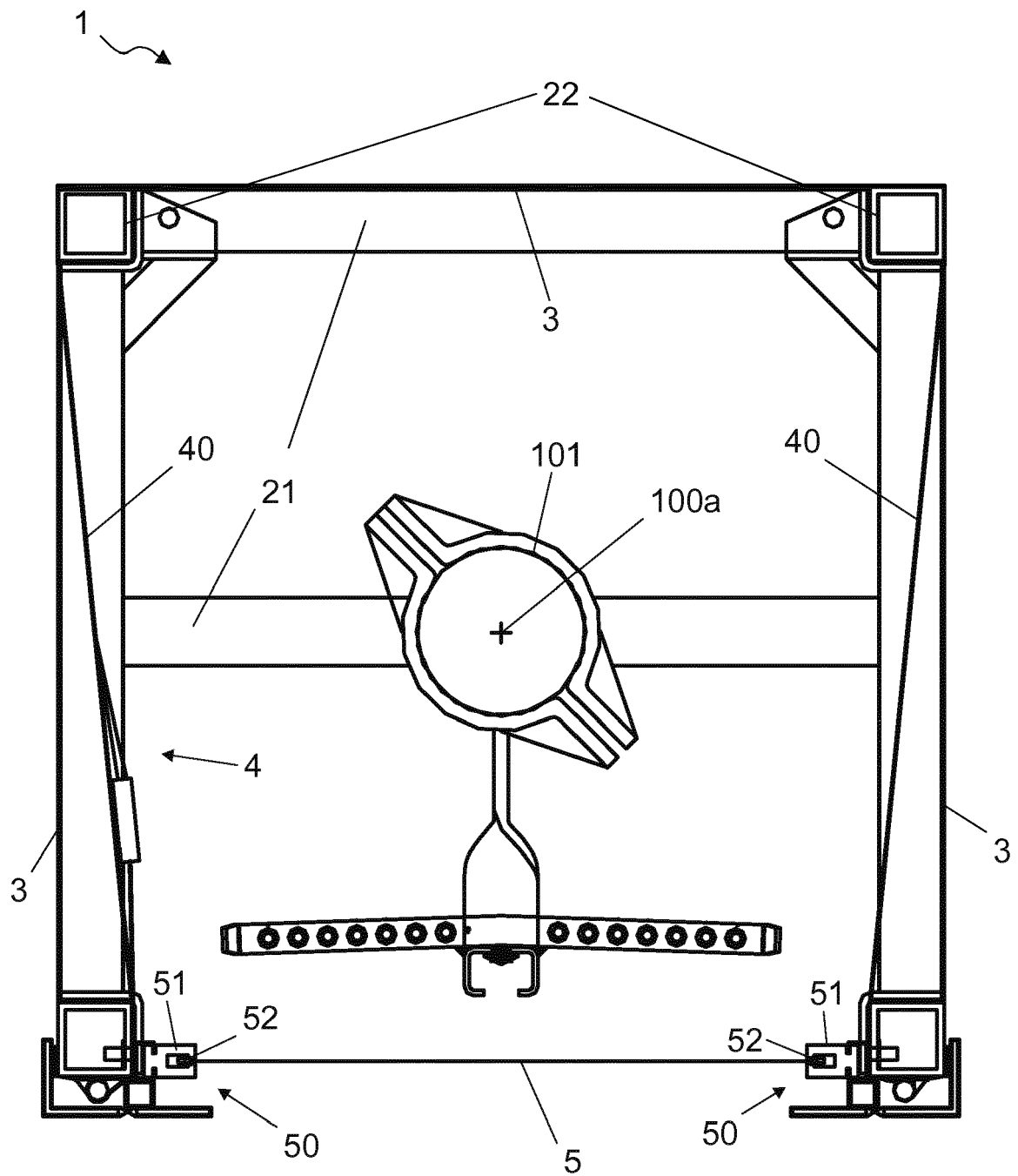


Fig. 6

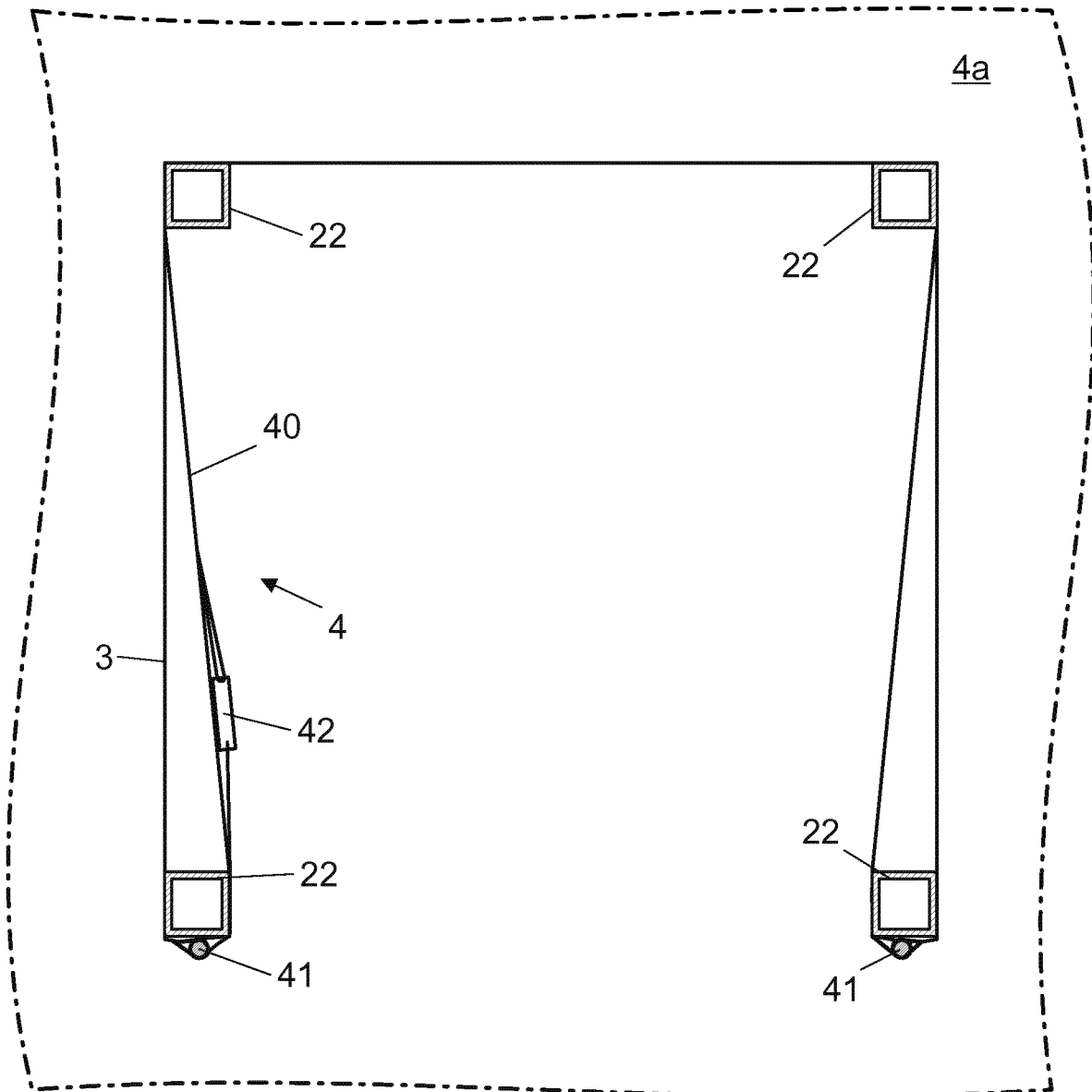


Fig. 7

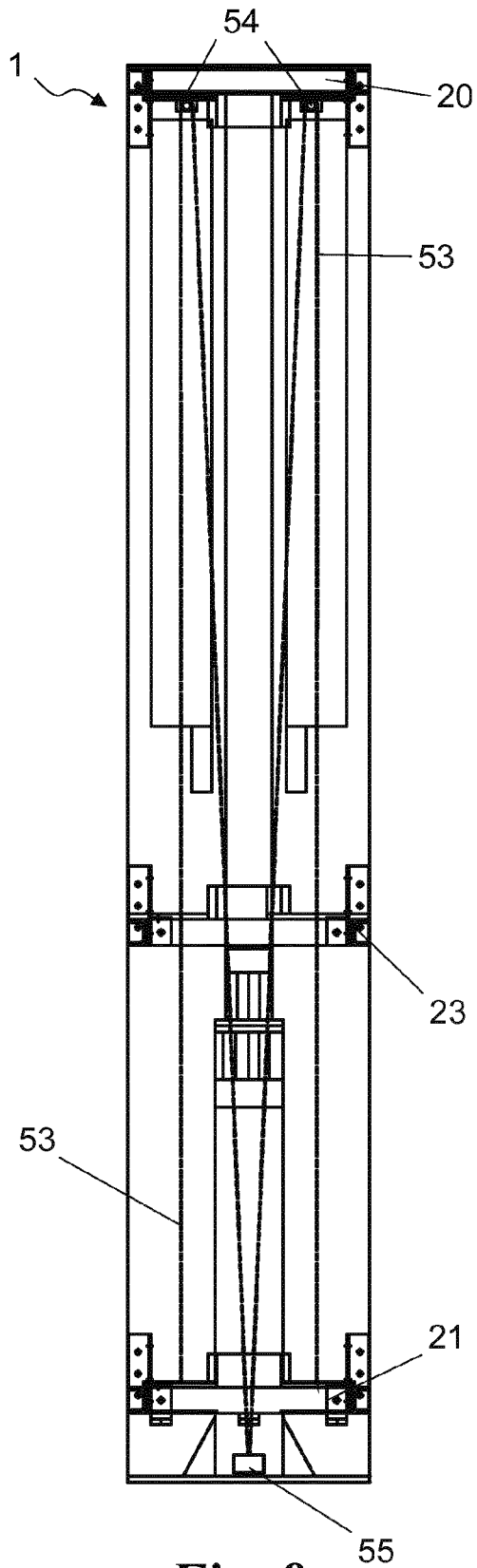


Fig. 8

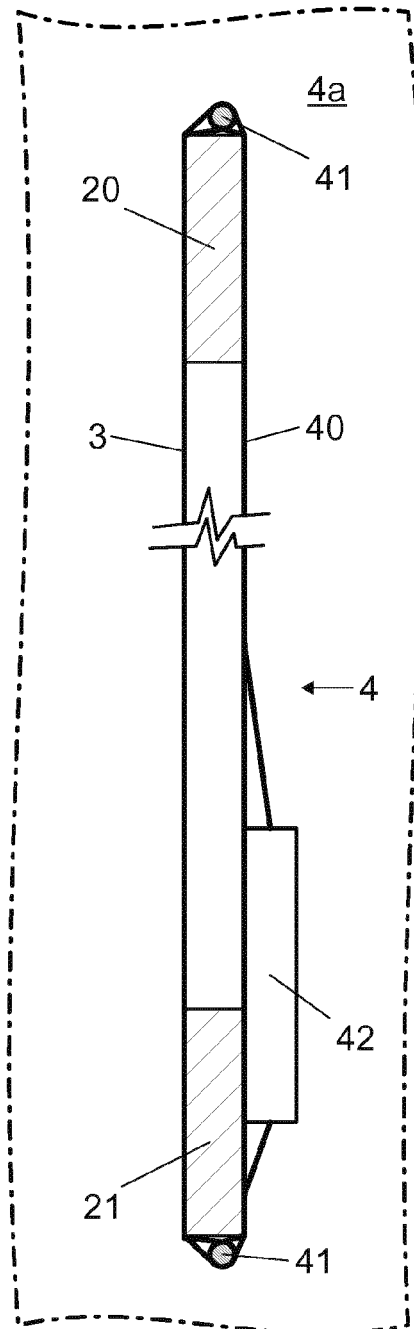


Fig. 9

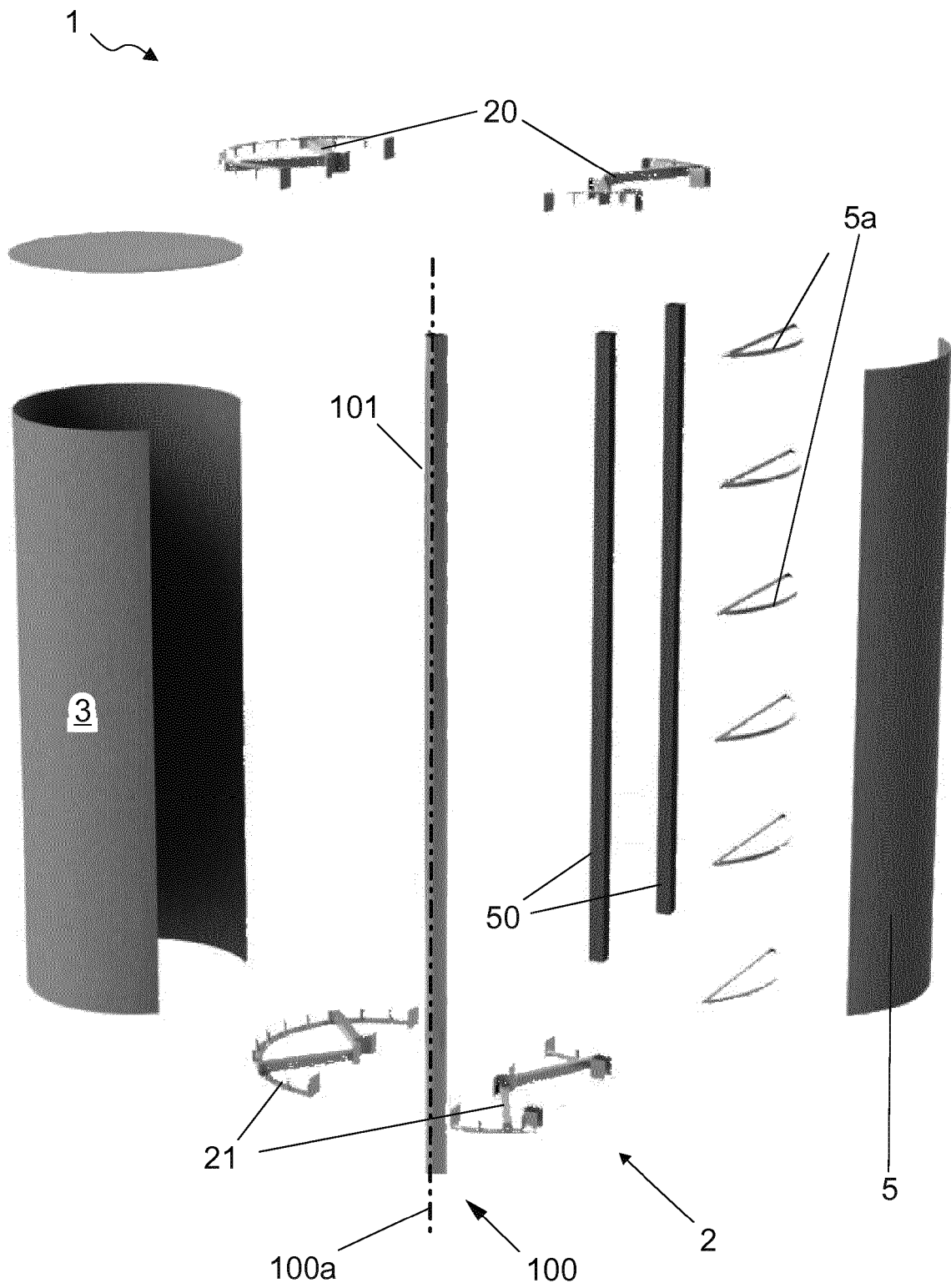


Fig. 10



EUROPEAN SEARCH REPORT

Application Number
EP 16 18 2397

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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	LUCA OLMÍ: "A comparison of radome- and astrodome-enclosed large radio telescopes at millimeter wavelengths: The Large Millimeter Telescope", RADIO SCIENCE, vol. 34, no. 3, May 1999 (1999-05), - June 1999 (1999-06), pages 733-746, XP002765232, * the whole document * -----	1-10	INV. H01Q1/12 H01Q1/24 H01Q1/42
A	US 2013/255166 A1 (JOHANSSON GOERAN [SE]) 3 October 2013 (2013-10-03) * paragraph [0001] - paragraph [0017] * * figure 1 * -----	1-10	
A	WO 2014/140580 A1 (DYNAMIC CONCEPTS INTERNATIONAL LTD [GB]) 18 September 2014 (2014-09-18) * page 8, line 17 - page 11, line 17; figures 1-5 * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01Q
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		15 December 2016	A1-Hazam, Lorens
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 16 18 2397

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013255166 A1	03-10-2013	AR 090514 A1	19-11-2014
		CN 104364967 A	18-02-2015
		EP 2831951 A1	04-02-2015
		HK 1204713 A1	27-11-2015
		SE 1250302 A1	28-09-2013
		TW 201342705 A	16-10-2013
		US 2013255166 A1	03-10-2013
		WO 2013147686 A1	03-10-2013

WO 2014140580 A1	18-09-2014	GB 2513722 A	05-11-2014
		WO 2014140580 A1	18-09-2014

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 2013255166 A [0003]
- WO 2014140580 A [0003]