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(54) Title: PORTABLE SATELLITE ANTENNA

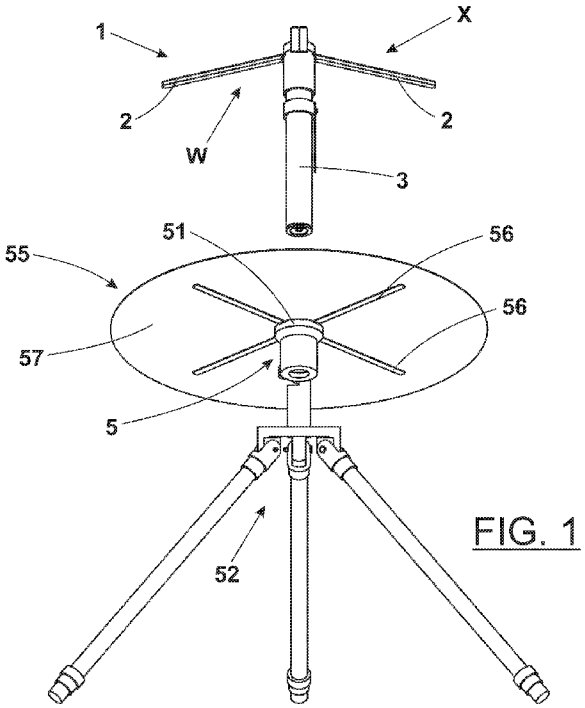

FIG. 1

(57) Abstract: The improved portable satellite antenna (1) consists of radiating elements (2), made of flexible shape memory material, attached to a main body (3) acting as a handle. In operating condition (W) of the antenna (1) the radiating elements (2) are arranged in a fan-like radial pattern (X), while in non-use condition (H) they are folded in a position (R) in which they adhere to the main body (3). For the definition and maintenance of the above mentioned radiating elements (2) in the above mentioned folded position (R), means of stabilization (4) are provided, such as a cap (40) or a band (41), or even a collar (42) or a sleeve (43), to be associated, in a fixed or removable way, to said main body (3) and radiating elements (2), which are capable of spontaneously returning to said fan-like radial configuration (X), corresponding to said operating condition (W) of said satellite antenna (1), as a result of the removal/opening of said means of stabilization (4).

WO 2020/031049 A1

[Continued on next page]

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PORTABLE SATELLITE ANTENNA

TECHNICAL FIELD

The present invention relates to the technical field of RF telecommunications.

In particular, the invention concerns a handheld satellite antenna, suitable for portable or transportable radio transmitters.

BACKGROUND ART

As is well known, satellite communications, both civil and military, exploit the availability of "bridge" or link satellites to extend the range of mobile radio communication systems, or in any case distributed over the territory.

For this purpose, the above mentioned radio communication systems are provided, according to known techniques, with satellite transceivers ("SATCOM") suitably piloted and connected to other transceiver equipment, served by dedicated antennas.

Satellite radio communications equipment includes antennas normally having an omnidirectional radiation pattern in the horizontal plane and a circular polarisation coordinated with the direction of rotation of that of the antenna on board the satellite.

Satellite antennas of this type are often of the crossed dipole type, i.e. including two crossed rods, arranged on the same horizontal plane, and electrically connected in such a way as to result in a 90 electrical degrees phase offset, and in this way they obtain the necessary circular polarization.

In particular, there are well-known portable satellite antennas, built in such a way as to be able to be gripped and oriented manually, for greater immediacy and convenience of use.

Such handheld antennas are structurally made up of a main body

that acts as a handle, from which radially extend, in a plane substantially perpendicular to the axis of said stem, the radiating elements of the antenna, like the ribs of an umbrella.

TECHNICAL PROBLEM

As can be intuitively understood, folding the above mentioned radiating elements close to the main body can be very useful when the antenna is not used, both to reduce its dimensions and to safeguard the integrity of the radiating elements themselves.

A known technical solution requires that the radiating elements are articulated to the main body by means of hinged joints, so as to be able to fold them adherent to the latter in a condition of non-use.

In order to obtain stability in the open position, suitable parts must be associated to the hinged joints, for example clutch or screw, that prevent the reclosing of one or more elements during the use of the antenna, with possible interruptions of the connection.

Apart from the relative mechanical complication, the unfolding and folding manoeuvres must be done for each individual radiating element, with an obvious loss of time which, particularly if one considers a military deployment, becomes unacceptable, for obvious reasons of timeliness.

Since these antennas are to be used while being handheld, it is reasonable to expect that they will be carried substantially "on the shoulder" together with other equipment, or that they will be housed in vehicles, either military or civilian, in which taking up a minimum space is an important requirement; therefore, in such devices, higher weights and larger encumbrances are more disadvantageous.

OBJECTS OF THE INVENTION

The main object of this invention is therefore to propose an

improved portable satellite radio communications antenna that allows to overcome the inconvenience complained of with the known technique, making it much easier and faster to switch the antenna from the inoperative position, with the radiating elements adhering to the stem, to the operational one, with the radiating elements in the fan-like arrangement, and vice versa.

Another object of the invention is to obtain the above mentioned best functionality with a simple and low cost technical solution.

Yet another object of the invention is to adopt technical solutions that allow the maximum compactness and lightness of the antenna, so as to make it easy for the operator to transport it.

A further object of the invention is to produce an antenna in which the radiating elements, when folded in the closed position are as much as possible protected from damages.

SUMMARY OF THE INVENTION

These and other objects are wholly obtained by an improved satellite radio communications antenna of the type including radiating elements fastened to a main body acting as a handle, fan-like extended from the latter in an operating condition and foldable so as to adhere to the same main body in the condition of non-use of said satellite antenna, the latter including:

–

– means of stabilisation associated, whether fixed or removable, with said radiating elements for the definition and maintenance of the same elements in the said folded position adhering to that main body, and with said radiating elements intended to return spontaneously to said fan-like radial configuration, corresponding to the said operating condition of said satellite antenna, as a result of the removal/opening of

said means of stabilisation.

BRIEF DESCRIPTION OF THE DRAWINGS

The characteristics of the invention in question will be evident from the following description of preferred embodiments of the inventive improved antenna for satellite radio communications, in accordance with what is proposed in the claims and with the help of the attached drawings, in which:

- Fig. 1 shows, in axonometric view, an antenna according to the invention, in condition of use;
- Fig. 2A shows a top view of the antenna of Fig. 1;
- Fig. 2B shows a view similar to Fig. 2A of a different embodiment of the antenna; Figs. 3 to 7 illustrate different embodiments of means of stabilization that keep the antenna in non-operating condition.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

In the above figures, reference numeral 1 has been used to indicate, as a whole, an improved portable satellite radio communications antenna of the cross dipole type, which is the subject of the present invention.

Antenna 1 includes, in a way that is *per se* known, radiating elements 2, for example four elements angularly spaced (Figs. 1 and 2A), fixed in a fan-like arrangement to a main body 3 acting as a handle, since the antenna 1 is of the type intended to be held by hand.

The main body 3 also contains all the electronics needed to operate the antenna 1, and the connector(s) needed to connect it to an external SATCOM transceiver.

In a constructive variant of antenna 1, each of said radiating

elements 2 includes a pair 2a, 2b, with each pair 2a, 2b angularly equidistanced from the others, when arranged in the fan-like radial configuration; preferably, the two radiating elements 2a, 2b of each pair are substantially parallel and aligned on the same plane (Fig. 2B).

The radiating elements 2, in operating condition W of the antenna 1, are extended in a fan-like fashion from the main body 3 (Figs. 1 and 2A) and are suitable to be folded to adhere to the latter in condition of non-use H of the same satellite antenna 1.

According to the invention, the radiating elements 2 are made of flexible memory shaped material, consisting for example of metal such as harmonic steel, coated with silicone or other plastic material.

In the absence of external stress, the radiating elements 2 are arranged in the fan-like configuration X, in which the antenna 1 is in operating condition W.

In order to move and hold these radiating elements 2 into the above mentioned folded position R adhering to said main body 3, means of stabilisation 4 are provided which are associated, in a fixed or removable way, with the same radiating elements 2 and main body 3.

In a first embodiment, the means of stabilization 4 are made up of a tubular cap 40 intended to be fitted on the aforementioned main body 3, with movement from top to bottom.

Cap 40 can be made of semi-rigid material and with an axial length such as to partially cover the folded radiating elements 2 (Fig. 3), or of floppy material with a greater axial length, so as to completely cover, or almost cover, the same radiating elements (Fig. 4).

In a second embodiment, the stabilization means 4 are made up of at least a band 41 of flexible material, such as fabric, plastic, leather or the like, intended to wrap from the outside, in the form of a ring, the said radiant elements 2 near their end portions (Fig. 5).

Band 41 is equipped with joining devices (not shown in detail),

designed to secure the edges in the said ring configuration, consisting for example of Velcro strips, snap buttons or the like.

The band 41 is preferably fixed to the main body 3, for example, at or near one of its ends, by means of a screw, or other fastening means, so as to be captive.

Fig. 6 shows both a third and a fourth embodiments of the stabilization means 4.

In the third embodiment, they consist of a rigid collar ring 42, fitted on said main body 3 and sliding axially with respect to the latter, with movement from top to bottom, so as to close the radiating elements 2, and in the opposite direction to release them.

In the fourth embodiment, the means of stabilization 4 are constituted by a sleeve 43 of elastic material, that can be worn on the main body 3 to close the radiating elements 2, or is removed therefrom to free them.

Fig. 7 shows a further possible embodiment of the means of stabilization 4, including the cap 40 shown in Fig. 3 in combination with the band 41 of Fig. 4.

In addition to the examples described and illustrated, other technical solutions are naturally possible for said means of stabilization 4, the removal of which, anyway, allows the radiating elements 2 to return spontaneously from the aforementioned folded position R, adhering to the main body 3, to the fan-like configuration X, thanks to the shape memory of their material.

According to a further embodiment of antenna 1 (see Figure 1), the latter includes a base 5, adapted to fit the antenna into the ground and, in essence, the use as a stationary antenna.

In the above mentioned embodiment, the base 5 includes a hollow cylindrical body 51, so high and with internal diameter sufficient to accommodate the lower part of the main body 3, and an anchorage

52, fixed to the lower part of the cylindrical body and capable of fitting the base 5 to the ground or to another supporting surface of antenna 1.

In particolar, by way of example and not limited thereto, an anchorage 52 consisting of a tripod is shown, intended to be placed on the ground. Another example of anchorage 52, not shown because it is easy to understand, may be a stake, intended to be fitted into the ground.

According to the invention, the base 5 also includes a ground set of radial ribs 55, comprising a plurality of ribs 56 arranged in a fan-like fashion and fixed to the outer lateral surface of the cylindrical body 51. The ground set of radial ribs 55 if provided for acting as a reflective plane of antenna 1.

The ribs 56 that make up the ground set of radial ribs 55, in turn, are conveniently made of shape memory material, for example the same material with which the radiating elements 2 are made, so as to allow easy folding on the cylindrical body 51.

A shaped sheet 57 of non-rigid conductive material is preferably joined to the ground set of radial ribs 55. which designed to operate as the most efficient ground plane for antenna 1.

From the above the peculiar and advantageous characteristics of the proposed improved satellite antenna are self-evident, as it can be set in operational position quickly and spontaneously, with the simple removal of the means of stabilization.

This important advantageous aspect is achieved with a simple technical solution and low cost, which allows, moreover, to obtain an antenna more compact and lighter than those made in accordance with the known technique, so that transport in the military field is made easier.

In particular, it should be noted that, when the embodiments of the means of stabilization including the cap are used, greater protection

of the radiating elements, when placed in the closed position, can be obtained, thus avoiding possible damage to them.

Another advantage is given by the presence of the base 50 and the ground plane consisting of the ribs 55 and the sheet 56, which give the antenna 1 greater versatility of use and allow better definition of the characteristics of directionality.

It is understood, however, that what is described above is illustrative and not limiting, therefore any variations in detail that may be necessary for technical and/or functional reasons, both in the method and in the system, are considered from now on within the protective scope defined by the claims below.

CLAIMS

1. Improved portable satellite antenna, of the type including a main body (3), capable of containing electronics for adapting the same antenna (1) and means of connection to a SATCOM transceiver, and a plurality of radiating elements (2) fastened at one end of said main body (3) acting as a handle, fan-like extended from the latter in an operating condition (W) and foldable so as to adhere to the same main body (3) in the condition of non-use (H) of said satellite antenna (1), the latter being characterised in that:
   - said radiating elements (2) are made of flexible shape memory material; and they extend radially from said main body (3) when arranged in an operational configuration (W), and foldable so as to adhere to the same main body (3) in the condition of non-use (H) of said satellite antenna (1);
   - means of stabilisation (4) associated, either fixed or removable, with the said radiating elements (2) for their definition and maintenance in said folded position (R) adhering to said main body (3),and with said radiating elements (2) intended to return spontaneously to said fan-like radial configuration (X), corresponding to the said operating condition (W) of said satellite antenna (1), as a result of the removal/opening of said means of stabilisation (4).
2. Antenna according to claim. 1, characterised in that said radiating elements (2) are made of elastic metal, coated externally with plastic material.
3. Antenna according to claim 2, characterised in that said metal is harmonic steel.
4. Antenna according to claim 1, characterised in that said means of stabilization (4) consist of a tubular cap (40) designed to be fitted on the said main body (3), with movement from top to

bottom, to carry and hold said radiating elements (2) in said folded position (R) adhering to the same main body (3).

5. Antenna according to claim 1, characterised in that said means of stabilization (4) consist of at least one band (41) of flexible material, designed to wrap from the outside, in the form of a ring, said radiating elements (2) to carry and hold said radiating elements (2) in said folded position (R) adhering to the same main body (3), said band (41) being equipped with joining means provided to bind its edges in said ring configuration.

6. Antenna according to claim 1, characterised in that said means of stabilization (4) consist of a rigid collar ring (42), fitted on said main body (3) and sliding axially with respect to the latter, with movement from top to bottom, to carry and hold said radiating elements (2) in said folded position (R) adhering to the same main body (3), or instead upwards to release them and allow them to return spontaneously to said radial configuration (X).

7. Antenna according to claim 1, characterised in that said means of stabilization consist of a sleve (43) of elastic material, to be fitted on said main body (3) to move and hold said radiating elements (2) into said folded position (R) adhering to the same main body (3), or instead to be removed therefrom in order to release them and allow them to return spontaneously to said fan-like radial configuration (X).

8. Antenna according to any one of the previous claims, characterised in that said radiating elements (2) are doubled, with each pair (2a, 2b) angularly equidistant from the others, when arranged in said fan-like radial configuration (X), and in that two radiating elements (2a, 2b) of each pair are substantially parallel and aligned on the same plane.

9. Antenna according to claim 1, characterised by further including

a base (5), intended to allow fastening to the ground, said base (5) comprising a cylindrical body (51), designed to accommodate the lower portion of said main body (3), and an anchorage (52), fastened to the lower part of said cylindrical body (51) for anchoring said base (5) to the ground, or to any other supporting surface of the antenna (1) itself.

10. Antenna according to claim 9, characterised by further including a ground set of radial ribs (55), intended to act as a reflective plane for the aforementioned antenna (1), fixed to the external surface of said cylindrical body (51).

11. Antenna according to claim 10, characterised in that said ground set of radial ribs (55) comprises a plurality of ribs (56) made with shape memory material.

12. Antenna according to claim 10 and to claim 11, characterized by further including a shaped sheet (57) of non-rigid conductive material, joined to said ribs (56) in order to improve the characteristics of the ground plane of said antenna (1).

FIG. 2A

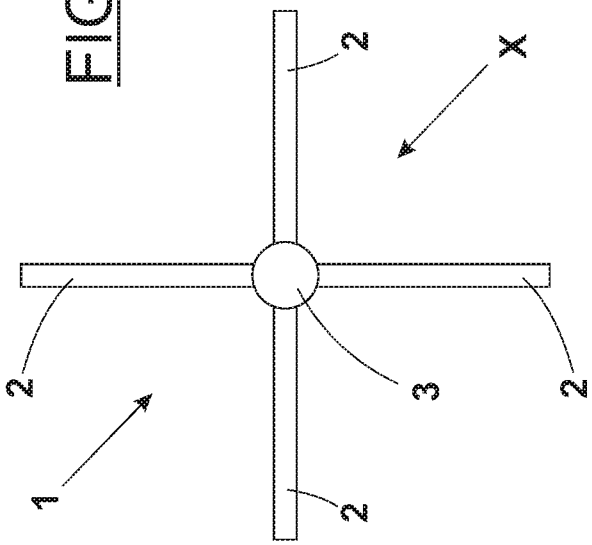


FIG. 2B

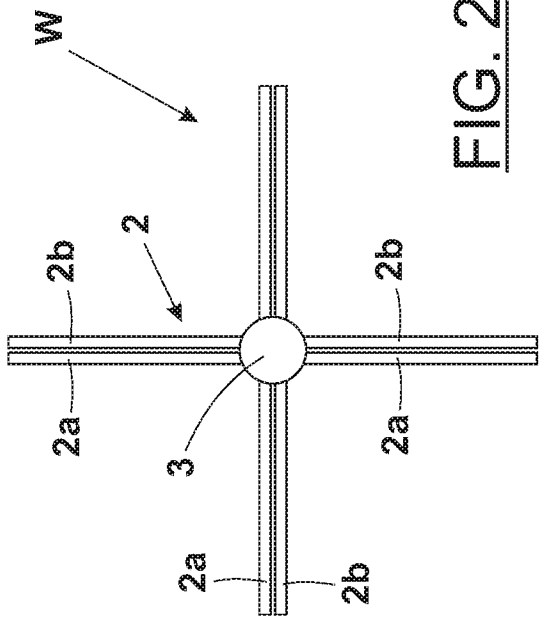
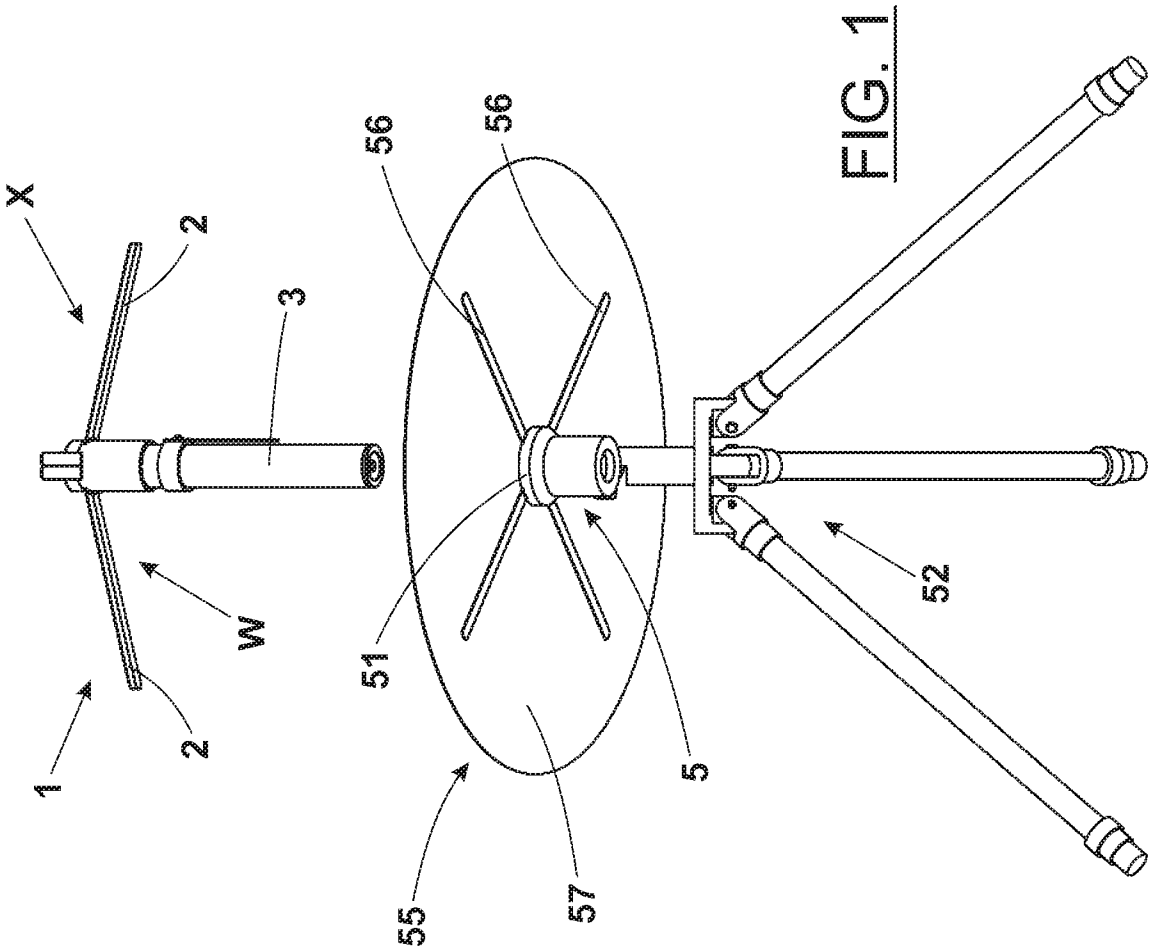


FIG. 1



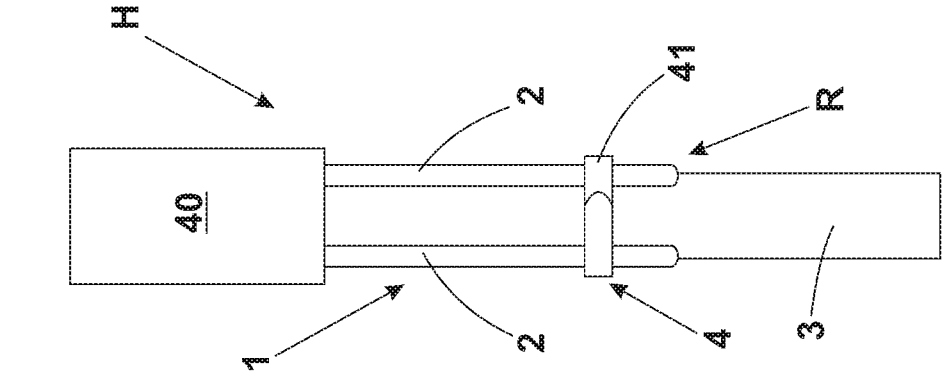


FIG. 7

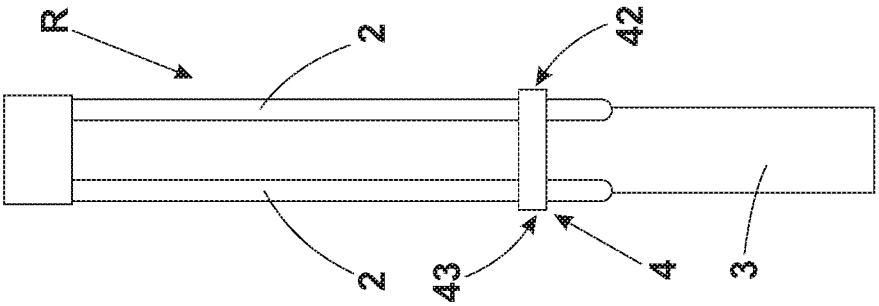


FIG. 6

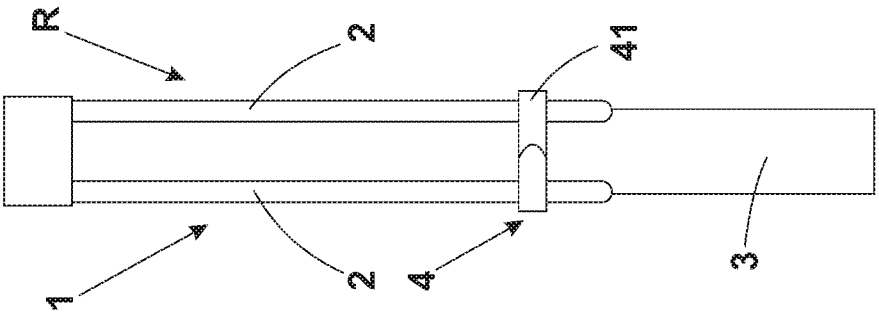


FIG. 5

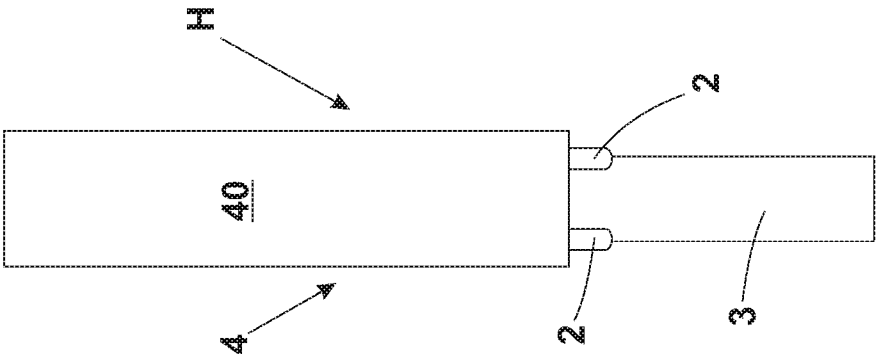


FIG. 4

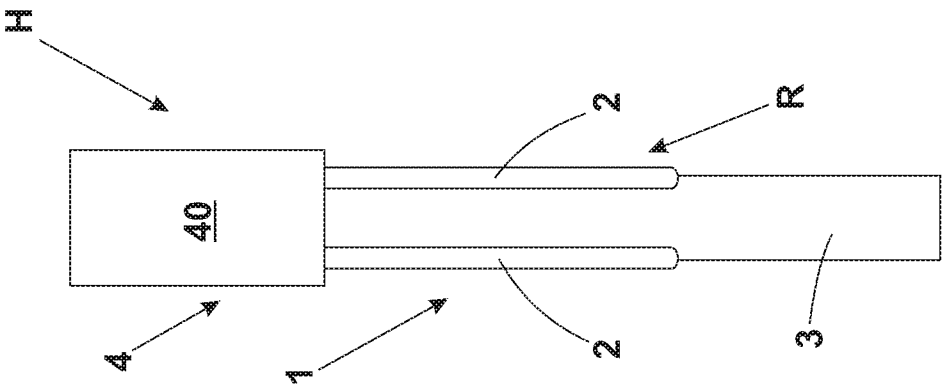


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/056627

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01Q9/32 H01Q9/42 H01Q21/26 H01Q1/27 H01Q1/08
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2017/310013 A1 (MUESSE ALLEN R [US] ET AL) 26 October 2017 (2017-10-26) paragraphs [0037], [0040], [0044], [0045], [0055], [0057] - [0059] figures 1-8	1-4,6,8, 9 10

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 November 2019	29/11/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Taddei, Ruggero

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2019/056627

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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