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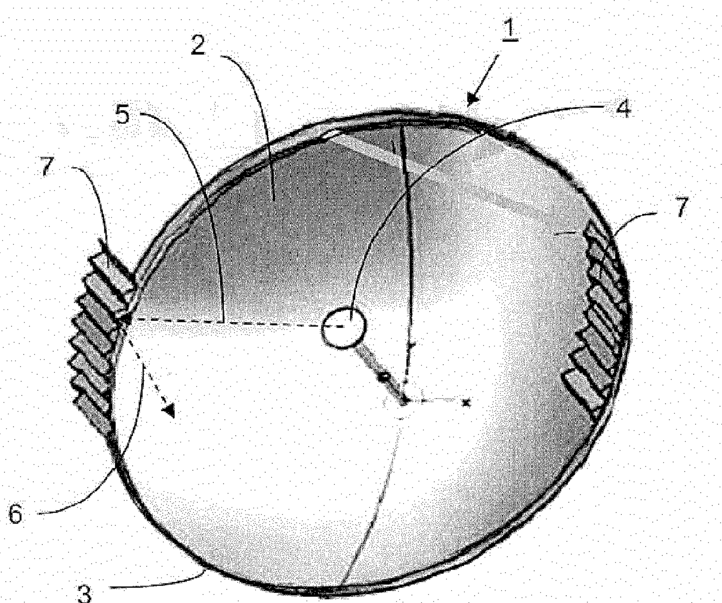
(54) **Parabolic reflector antenna**

(57) The antenna consists of at least one parabolic reflector with a circular edge. At least one screen with a width less than half of the length of the circular edge is arranged on the circular edge on the inside of the perimeter of the parabolic reflector. Preferably, the screen is made of at least two flat sections linked together, two contiguous sections forming a concave angle α that is between 90 degrees and 150 degrees.

FIG. 1



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Description

[0001] This invention pertains to a telecommunication antenna used in particular for mobile communication networks. These directional sectoral or parabolic reflector antennae operate equally well in transmitter mode or in receiver mode, corresponding to two opposite directions of RF wave propagation. It should be noted that all of the arguments that follow apply just as well to both receiving antennae and transmitting antennae. The invention particularly pertains to a parabolic microwave reflector antenna. The invention applies both to double reflector antennae as well as to single reflector antennae.

[0002] A conventional, continuous-aperture antenna consists of one concave reflector, with for example the shape of a paraboloid of revolution around the antenna's axis of symmetry, and a feed mechanism located along the antenna's axis of symmetry that transmits the electromagnetic waves emitted or received by the antenna. The end of the radio frequency waveguide is located at the reflector's focal point. The distance between the reflector and the end of the waveguide should be sufficiently extensive to permit the lighting up of the entire surface of the reflector.

[0003] For these shallow reflector antennas, the F/D ratio is in the region of 0.36. In this ratio, F is the focal length of the reflector (distance between the vertex of the reflector and its focal point) and D is the diameter of the reflector. These antennae show high losses by spillover. These losses by spillover, expressed in dB, lead to pollution of the environment by RF waves and must be limited to levels defined by the standards. In particular to limit broadside radiation, one customary solution is attaching an absorbing shroud to the periphery of the primary reflector which has the shape of a cylinder, of a diameter close to that of the primary reflector and of suitable height, coated inwardly with an RF radiation absorbing layer. Besides the congestion that results from it, this known solution exhibits the drawback of the cost of the absorbent material for the shroud, the cost of the radome, and the cost of the assembly of this shroud on the primary reflector, especially for antennae of significant diameter. Additionally, this solution is only conceivable in cases where the reflector and its absorbing shroud are protected from the environment by a radome. In fact, the absorbent material offers weak resistance under difficult climate conditions. A simple metal shroud cannot withstand wind and allows the reflection of multiple waves because of the absence of absorbent material.

[0004] In a similar manner, sectoral antennae may be equipped with an absorbing shroud, attached to the reflector and surrounding the aligned radiating components, which also exhibits the drawbacks mentioned above.

[0005] The aim of this invention is to propose a parabolic microwave reflector antenna at a moderate price without degraded electrical performance.

[0006] Another aim of the invention is to propose a parabolic reflector antenna with an improved front-to-back ratio.

[0007] Another aim of the invention is to propose a parabolic reflector antenna for which the losses by spillover are reduced while requiring an absorbing shroud of lower height.

[0008] Another aim of the invention is to propose a parabolic reflector antenna in which the diffraction of the waves appearing on the outside edge of the antenna reflector is significantly reduced.

[0009] The purpose of this invention is an antenna with at least one parabolic reflector having an edge and at least one screen, whose width is less than half of the length of the edge, attached to the edge of the parabolic reflector. The screen is attached to the inside of the perimeter of the parabolic reflector and is formed of at least two flat sections linked together, two contiguous sections forming a concave angle α.

[0010] Preferably, the concave angle α should be between 90 and 150 degrees, and also this concave angle α should be preferably in the region of 120 degrees.

[0011] According to a first embodiment, the screen corresponds to the curve of the circular edge of the parabolic reflector.

[0012] According to a second embodiment, the screen is straight and coincides with a cord on the circular edge of the parabolic reflector.

[0013] According to a third embodiment, the screen is straight and coincides with the straight edge of the parabolic reflector.

[0014] According to one particular embodiment, the antenna consists of at least two screens attached to the edge of the parabolic reflector in diametrically opposite positions.

[0015] According to one aspect, the width of the screen is of an order of magnitude of one quarter of the diameter of the parabolic reflector.

[0016] According to another aspect, the sections forming the screen have a polygonal shape, selected for example from among a quadrilateral, a triangle, and a hexagon.

[0017] According to yet another aspect, the screen has a conducting surface. For example, the screen can be made out of metal or covered with metal.

[0018] A screen attached to part of the edge of the parabolic reflector helps improve radiation performance. The shape of this screen is defined so as to avoid wave reflections in the primary beam of the radiation pattern of the antenna. With this configuration, the antenna can achieve high radio performance at a moderate cost.

[0019] The advantage of this invention is that it makes it possible to use a screen area that is less than that of the shroud of the prior art attached to the entire edge of the parabolic reflector, which brings an appreciable advantage in cost and in bulk.

[0020] The invention can be used in applications such as, for example, the realization of terrestrial antennae allowing the reception of a radiofrequency signal emitted by a satellite or the link between two terrestrial antennae, and in a more general manner in any application relating to point-to-point radiofrequency links in the frequency band of 7 GHz to 40 GHz.

[0021] Other characteristics and advantages of the present invention will become apparent upon reading the following description of one embodiment, which is naturally given by way of a non-limiting example, and in the attached drawing, in which:

- Figure 1 illustrates a perspective view of one embodiment of an antenna,
- Figure 2 diagrammatically illustrates a top view of the antenna in figure 1,
- Figure 3 diagrammatically illustrates a detailed top view of an embodiment of an antenna screen,
- Figure 4 illustrates the radiation pattern in the horizontal plane of an antenna of the prior art without an absorbing shroud,
- Figure 5 illustrates the radiating pattern in the horizontal plane of an antenna with a screen,
- Figure 6 illustrates a perspective view of another embodiment of an antenna,
- Figure 7 diagrammatically illustrates a top view of yet another embodiment of an antenna.

[0022] In Figures 4 and 5, the intensity of the radiation J in dB is given on the Y-axis, and the radiation emission/reception angle β is given in degrees on the X-axis.

[0023] In these figures, identical elements are given the same reference numbers.

[0024] Now consider figure 1, which illustrates an embodiment of an antenna 1 that is a parabolic reflector telecommunication antenna 2. The parabolic reflector 2 is concave, and its concave surface has a circular edge 3. A waveguide 4 is placed at the centre of the concave surface of the parabolic reflector 2, and emits radiation 5 toward the internal surface of the parabolic reflector **2,** a part of which **6** is reflected by a screen **7** placed on the circular edge **3** on the inside of the perimeter of the parabolic reflector **2** and which corresponds to the curve of the circular edge of the parabolic reflector **2.** Here, the parabolic reflector **2** consists of two screens **7** attached symmetrically, in diametrically opposite positions, and attached to the inside of the circular edge of the parabolic reflector **2** as shown in the top view in figure 2. The width **8** of the screen **7** is of an order of magnitude of one quarter of the diameter **D** of the parabolic reflector **2.**

[0025] Figure 3 diagrammatically illustrates a detailed top view of an embodiment of a screen **7.** A screen **7** is a conducting part that helps prevent radiation reflected in the direction of the main radiation beam in the horizontal plane. In this case, the screen **7** is made for example of a pleated metal sheet attached to the inside of the edge of the parabolic reflector. Seen from above, the screen **7** is composed of many contiguous flat rectangular sections **30** linked together to form a non-zero angle, like a protective screen. The sections may have any polygonal shape, such as a hexagon, a triangle or a quadrilateral such as a parallelogram, a square, a rectangle, a rhomboid, a trapezoid, etc. Seen from the waveguide **4** placed at the centre of the parabolic reflector **2,** the screen sections **30** each form a concave angle α of between 90° and 150°, and preferably in the region of 120°. By way of example, the antenna **1** in figures 1 and 2 consists of fifteen sections **30.** This disposition allows the screen to reflect all undesirable radiation **32** in a single direction away from the main beam, thus avoiding multiple reflections. The frequency domain is between 25 GHz and 7 GHz, and the dimensions (height, width **31**) of the screen sections **30** are large considering the wavelength.

[0026] Figure 4 illustrates the radiation pattern in the horizontal plane of an antenna of the prior art without an absorbing shroud, and figure 5 illustrates the radiation pattern in the horizontal plane of the antenna in figure 1. A comparison of these two figures shows that the presence of screens on the circular edge of the parabolic reflector considerably reduces the peaks in the radiation pattern at the +90° and -90° angles. Additionally, the screen helps vertically reorient the electromagnetic field toward an area located above or below the horizontal radiation plane, so as to avoid any disturbance of the radiation pattern in the horizontal plane.

[0027] The antenna of the prior art gives a radiation pattern with mediocre performance because of a high level of losses by spillover **40, 41** near the edge of the parabolic reflector. On the other hand, for an antenna **1** equipped with screens **7,** the losses by spillover **50, 51** are greatly reduced.

[0028] Figure 6 illustrates an embodiment of an antenna **60** equipped with two screens **61** attached to the edge **62** of a parabolic reflector **63** in diametrically opposite positions. Each screen **61** corresponds to the curve of the circular edge of the parabolic reflector and is made up of a single section **64,** for example composed of a flat rectangular metal sheet.

[0029] Figure 7 illustrates another embodiment of an antenna **70** consisting of a parabolic reflector **71.** Two straight screens **72** are attached so as to coincide with a cord on the circular edge **73** of the parabolic reflector **71.** Each screen **72** is made up of many contiguous flat sections that are linked together to form a non-zero angle. This embodiment has the advantage of a smaller footprint for the antenna **70.**

[0030] According to yet another embodiment not shown, the screen is straight, of a similar shape to the one in figure 7, and coincides with the straight edge of the parabolic reflector. In this case, the parabolic reflector has an edge that adopts the shape of a square with rounded corners or a rectangle whose ends are half-circles.

[0031] Naturally, the present invention is not limited to the described embodiments, but rather is subject to many variants accessible to the person skilled in the art without departing from the spirit of the invention. In particular one could vary the number of screens, the shape of each screen, the number of sections composing it, and the shape of each section.

Claims

1. An antenna with at least one parabolic reflector having an edge and at least one screen, whose width is less than half of the length of the edge, which is arranged on the edge of the parabolic reflector, **characterised by** the screen being attached to the inside of the perimeter of the parabolic reflector and is formed of at least two flat sections linked together, two contiguous sections forming a concave angle α.

2. Antenna according to claim 1, wherein the concave angle α is between 90 degrees and 150 degrees.

3. Antenna according to claims 1 and 2, wherein the concave angle α is in the region of 120 degrees.

4. Antenna according to claims 1 to 3, wherein the sections forming the screen have a polygonal shape.

5. Antenna according to claims 1 to 4, wherein the screen corresponds to the curve of the circular edge of the parabolic reflector.

6. Antenna according to claims 1 to 4, wherein the screen is straight and coincides with a cord on the circular edge of the parabolic reflector.

7. Antenna according to claims 1 to 4, wherein the screen is straight and coincides with the straight edge of the parabolic reflector.

8. Antenna according to one of the previous claims, consisting of at least two screens attached in diametrically opposite positions.

9. Antenna according to one of the previous claims, in which the screen width is of an order of magnitude of one quarter of the diameter of the parabolic reflector.

10. Antenna according to one of the previous claims in which the screen has a conducting surface.

FIG. 1

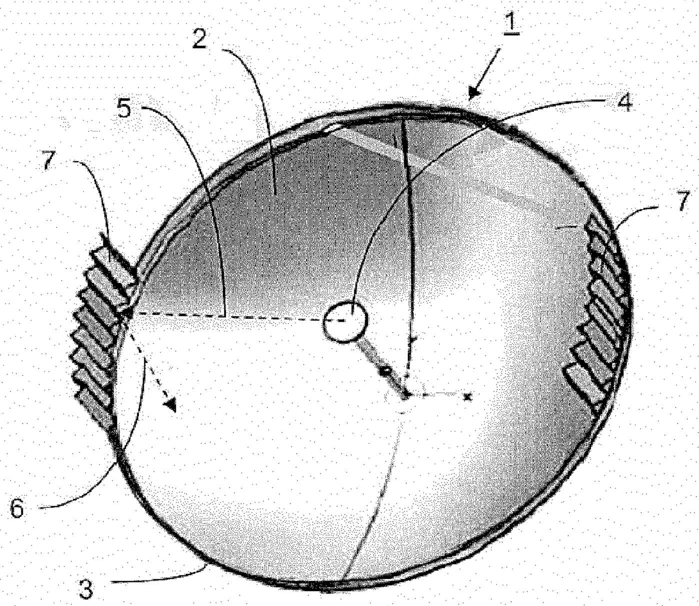


FIG. 2

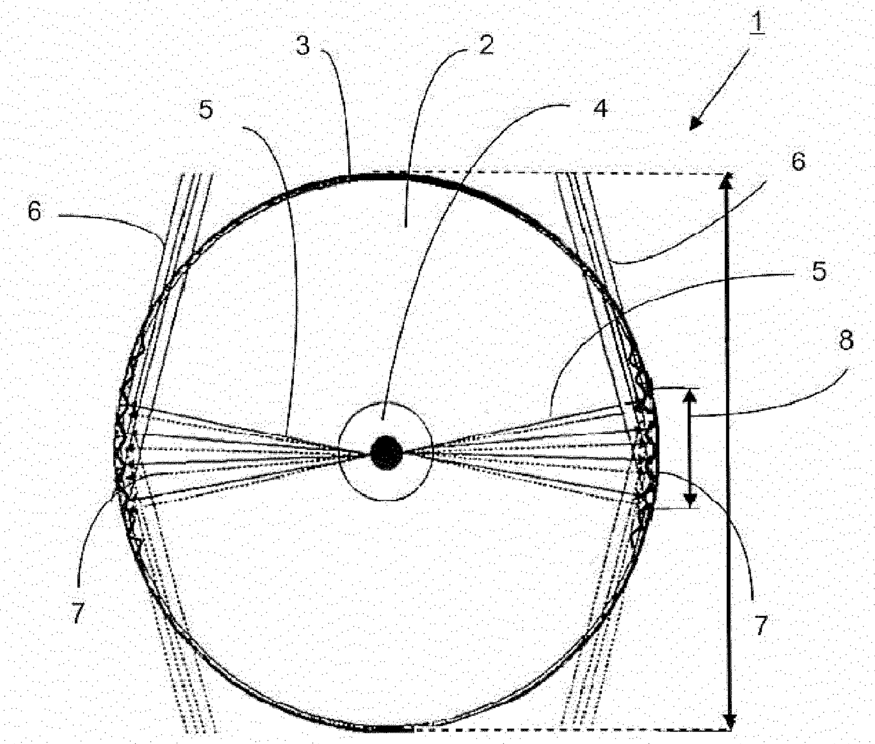


FIG. 3

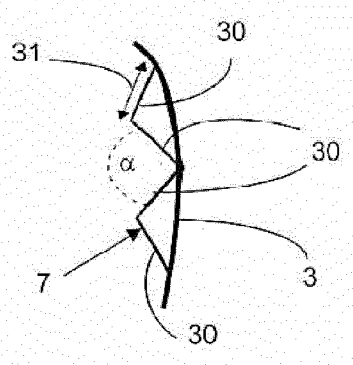
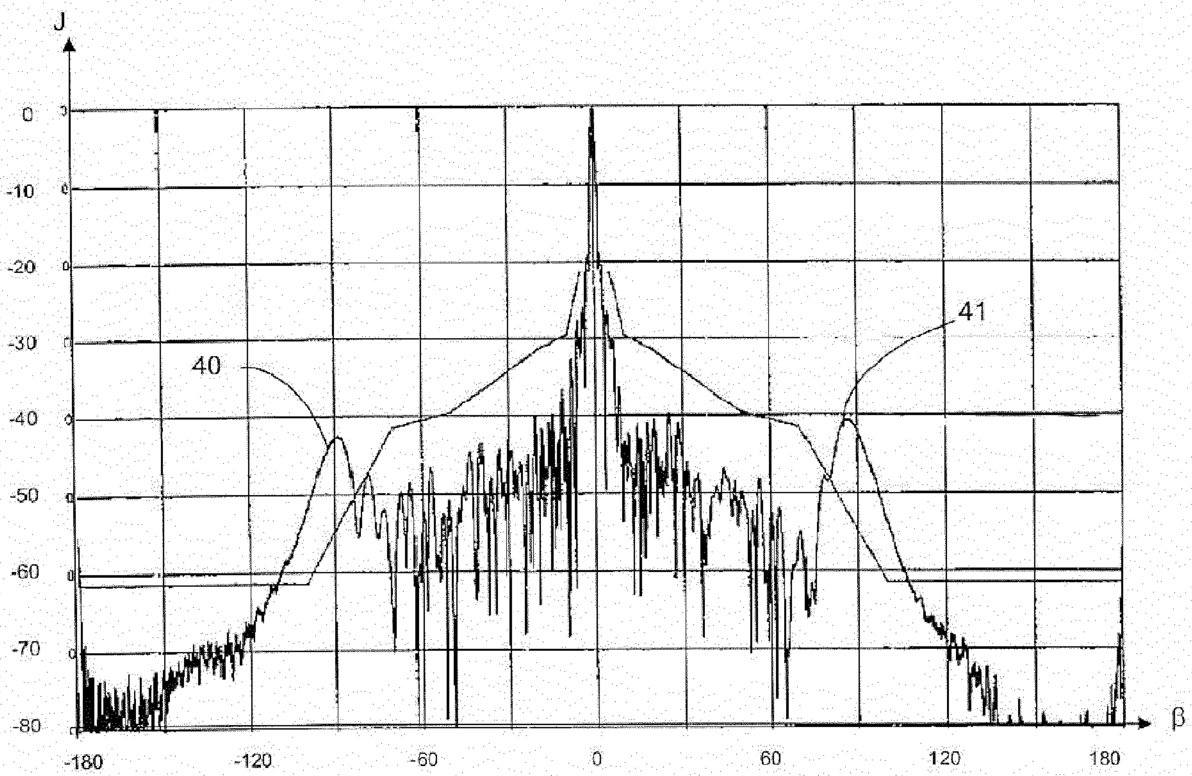

31
30
30
α
7
3
30

FIG. 4


J
0
-10
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-40
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β
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180

FIG. 5

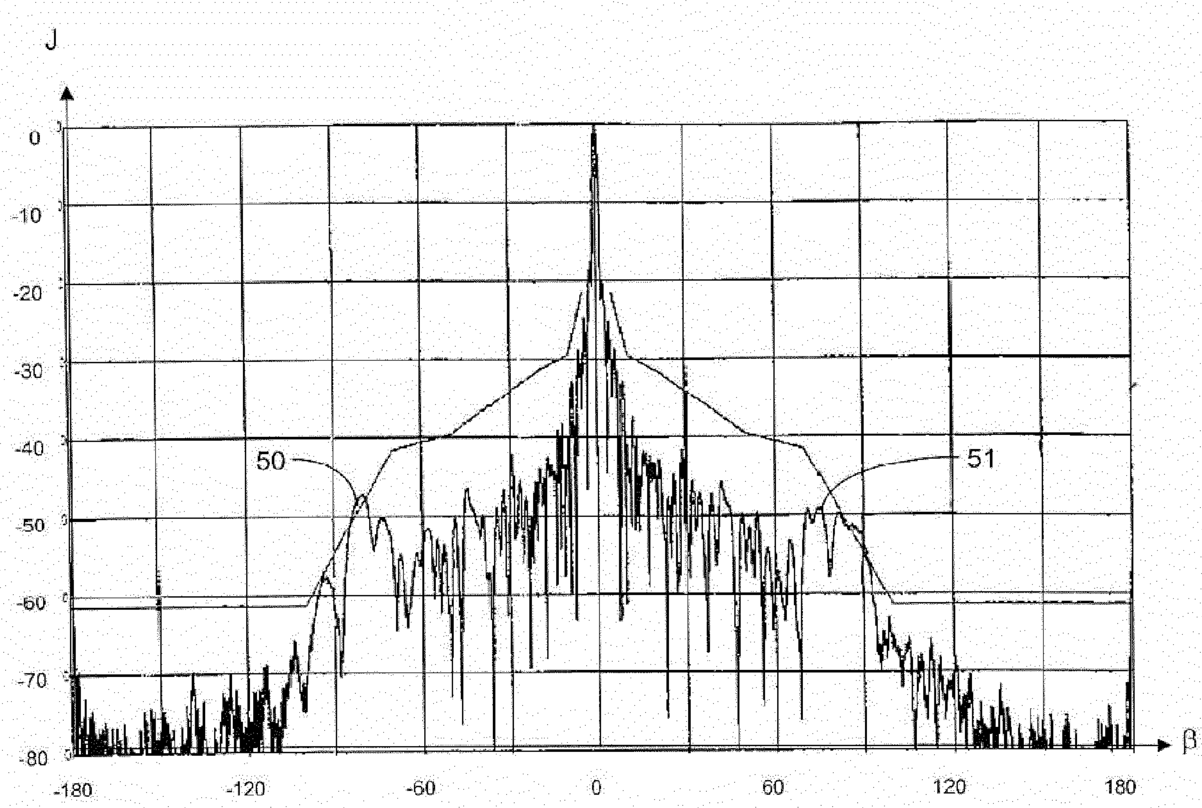


FIG. 6

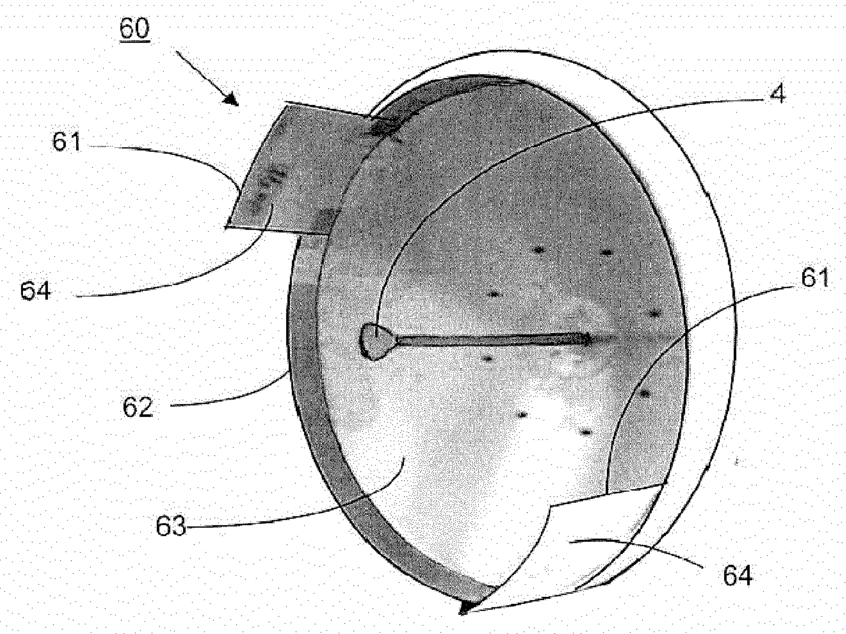
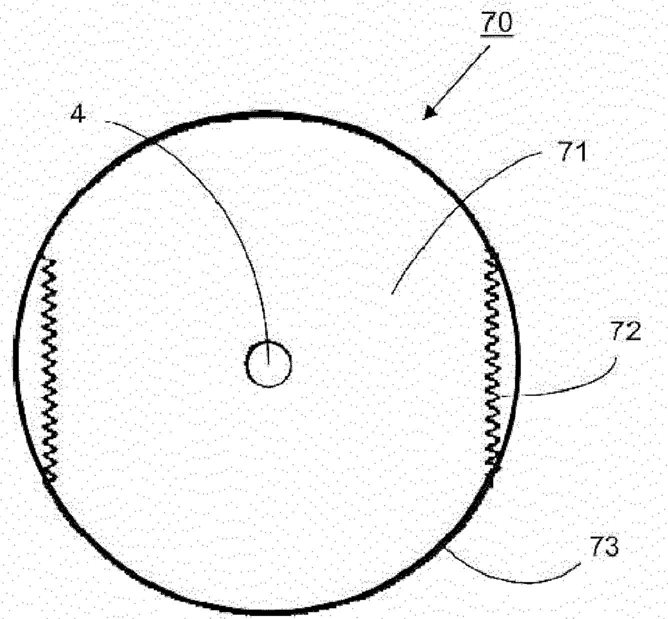


FIG. 7



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EUROPEAN SEARCH REPORT

Application Number
EP 11 19 3349

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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	H01Q

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	23 February 2012	Fredj, Aziz

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CATEGORY OF CITED DOCUMENTS

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