Directive radar antenna with electromagnetic energy compression, for telecommunications.

The radar antenna comprises a main active cavity acting as a wave guide and being connected, through a central opening, to a secondary cavity for reflecting the electromagnetic energy, frontally closed by a pyramid-shaped lenticular body suitable for self-charging and compressing the electromagnetic energy, conveying it toward the apex from which it exits in a highly directional manner.
DIRECTIVE RADAR ANTENNA WITH ELECTROMAGNETIC ENERGY COMPRESSION, FOR TELECOMMUNICATIONS

The present invention relates to an innovative directive radar antenna for telecommunications, with electromagnetic energy compression, characterized by high directionality and gain with respect to other systems, while having very small dimensions.

There are already known telecommunication directive antennas or arrays which, however for providing high directionality and gain, as well as a satisfactory irradiating power efficiency, must be constructed with a comparatively large size and weight.

Moreover these prior arrays are usually specifically designed for irradiating radiowaves in a given frequency range and can not be easily converted for irradiating other radio frequencies or light signals.

The aim of the present invention is to overcome the above mentioned drawbacks by providing a directive radar antenna of high directivity, gain and power efficiency and a very small size and weight.

Within this aim, a main object of the present invention is to provide such a radar antenna which can be easily and simply fitted for transmitting a light radiation.

According to the invention, the above aim and objects are achieved by a directive radar antenna according to the appended claim 1.

More specifically the antenna according to the invention comprises a front lenticular body made of plastics including a plurality of electromagnetic cavities, in which the electromagnetic energy self-charges.

The bottom of the antenna passive cavity, which is frontally closed by the lenticular body made of plastics, is defined by a metallic plate provided with a hole or a central opening from which energy is irradiated and self-accumulates by successive feedbacks in the lenticular body of the antenna.

The pyramid-like shape with cambered walls of the front lenticular body, in which the compression of the electromagnetic energy occurs and which provides an output power of high directionality, can have any spatial configuration, for example an ogive-like shape having a circular base, or a pyramid-like shape having a square or generally polygonal base; more generally, it can be defined as a pyramidal shape or spherical profile and can be defined by the rotation of an arc of circumference.

The possibility of positioning a laser source at the center of the antenna allows moreover to convert said antenna into a highly directive source of luminous power and therefore to use the antenna as a luminous power source for different technological purposes or for other applications.

The radar antenna according to the present invention is described in greater detail hereinafter with reference to the accompanying drawings, wherein:

- figure 1 is a cross-sectional view of the antenna, taken along a plane which passes through the longitudinal axis of the active cavity;
- figure 2 is a cross-sectional view of the antenna, taken along a plane which is orthogonal to the plane of the preceding figure;
- figures 3 and 4 are exemplary views of some specific embodiments of the front lenticular body of the antenna.

As shown in figure 1, the antenna 10 comprises a main cavity 11 constituted by a metallic box-like body defining a sort of rectangular wave guide, also termed hereinafter "active cavity", which is associated with a secondary cavity 12, also termed "energy reflection cavity" or "passive cavity", frontally closed by a lenticular body 13, made of a plastic material or another suitable material, having a wedge-shaped configuration and a particular arrangement.

The active cavity 11, in which the electromagnetic energy is generated, is connected to the secondary cavity 12 through a central passage 14 defined by appropriate holes or superimposed openings in the back wall which delimits the secondary cavity 12 and in the upper wall of the wave guide.

Inside the main cavity 11, in a position coaxial to the passage 14 for the electromagnetic energy, there is a cylindrical body 15 axially adjustable in its position for example by screwing it into two threaded lateral blocks 16, as schematically illustrated, for the adjustment of the operating frequency of the antenna.

Inside the main cavity 11, and on the sides of the central cylindrical body 15, there are a transmitter diode or gun diode 17 and respectively a receiver or detector 18 provided with respective frequency adjustment screws 19 and extending into the cavity 11. The distance of the adjustment screws 19 and 20 from the end walls of the cavity 11 and respectively from the transmitter diode and from the detector diode 17, 18 is one quarter of the wavelength of the generated or received frequency, whereas the distance of the transmitter diode and of the receiver 18 is half the wavelength of the chosen operating frequency.
As previously described, the secondary cavity 12 is connected to the main cavity or active cavity 11 through the central passage 14, and is defined by a flat element or by a planar back wall conveniently spaced by means of lateral walls from the lenticular front closing body 13.

The lenticular body 13 has a specifically designed shape which is adapted for allowing the self-compression of the electromagnetic energy and a highly directive output thereof at the front apex.

Said body is therefore characterized by lateral walls 13a which have a cambered shape or are delimited by portions of spherical surfaces, as schematically illustrated, or by an ogive-like or pyramid-like shape, the base whereof, as shown in figures 3 and 4 merely by way of example, can be circular, square or polygonal depending on the requirements. In particular, figure 3 illustrates a pyramid-like shape with a circular base with a spherical profile, whereas figure 4 illustrates a pyramid-like shape with a square base and with cambered surfaces only on two sides.

The particular combination and configuration of the two cavities 11 and 12 and of the front lenticular body 13 provide the disclosed radar antenna to a minimum. The centralized output of the energy at the apex of the lenticular body furthermore allows to use the radar antenna according to the present invention as a luminous body furthermore allows to use the radar antenna according to the present invention as a luminous body.

The operation of the antenna according to the present invention is characterized by a series of internal reflections, in the cavities and in the front lenticular body, of the electromagnetic energy, which self-charges or accumulates and compresses and is conveyed toward the apex from which it is irradiated in a highly directive manner.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting affect on the scope of each element identified by way of example by such reference signs.

Claims

1. A telecommunication radar antenna with electromagnetic energy compression, characterized in that said antenna comprises: a main active cavity operating as a wave guide, a secondary cavity connected to the main cavity through a central passage, and a front lenticular body having a pyramid-like shape with cambered walls which frontally closes the secondary cavity, so as to provide self-compressed high directionality electromagnetic energy, said main cavity comprising an electromagnetic energy transmission device and an electromagnetic energy detector device which are mutually opposite, frequency adjusting means for adjusting a set generated and/or received frequency of said electromagnetic energy being moreover provided.

2. A radar antenna according to claim 1, characterized in that said lenticular body is made of a transparent plastic material.

3. A radar antenna according to claim 1, characterized in that said lenticular body has a circular or polygonal shape.

4. A radar antenna according to claim 1, characterized in that said lenticular body has a pyramid-like shape delimited by portions of spherical surfaces.

5. A radar antenna according to claim 1, characterized in that said secondary cavity has a planar back wall at the center whereof there is provided an output passage for said electromagnetic energy.

6. A radar antenna according to the preceding claims, characterized in that said frequency and adjusting means comprise a central cylindrical body penetrating into said main cavity and being axially aligned with said central passage.

7. A radar antenna according to claim 6, characterized in that said cylindrical body is axially adjustable by screwing.

8. A radar antenna according to the preceding claims, characterized in that said frequency adjusting means comprise screws for the adjustment of a transmitter diode and of a receiver or detector which are arranged at a distance equal to one quarter of a set operating wavelength of said antenna.

9. A radar antenna according to any one of the preceding claims, characterized in that said central body for adjusting the frequency of said main cavity is a laser energy source.