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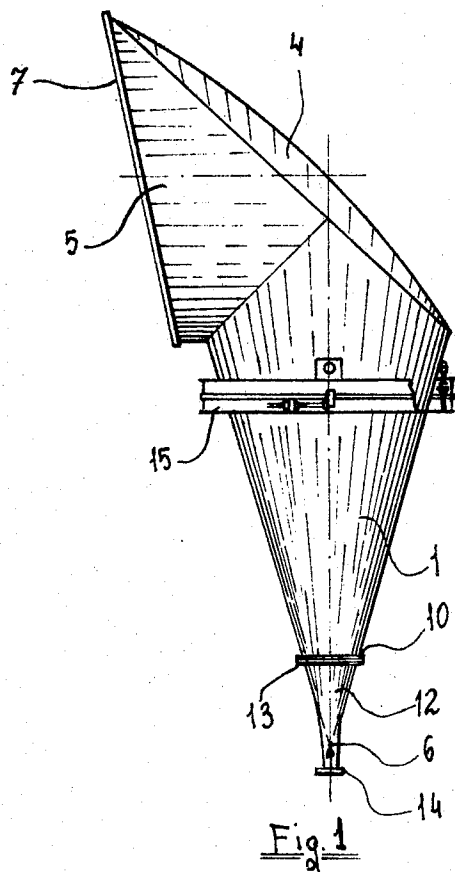
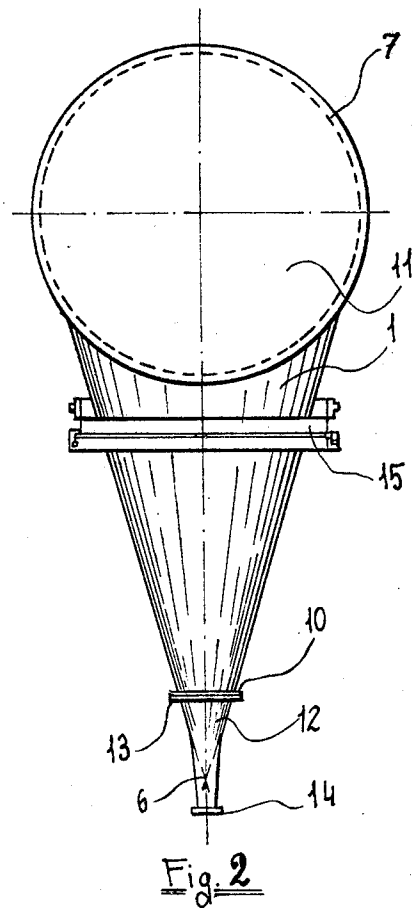
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HORN-REFLECTOR ANTENNA

Filed Oct. 12, 1966

2 Sheets-Sheet 1



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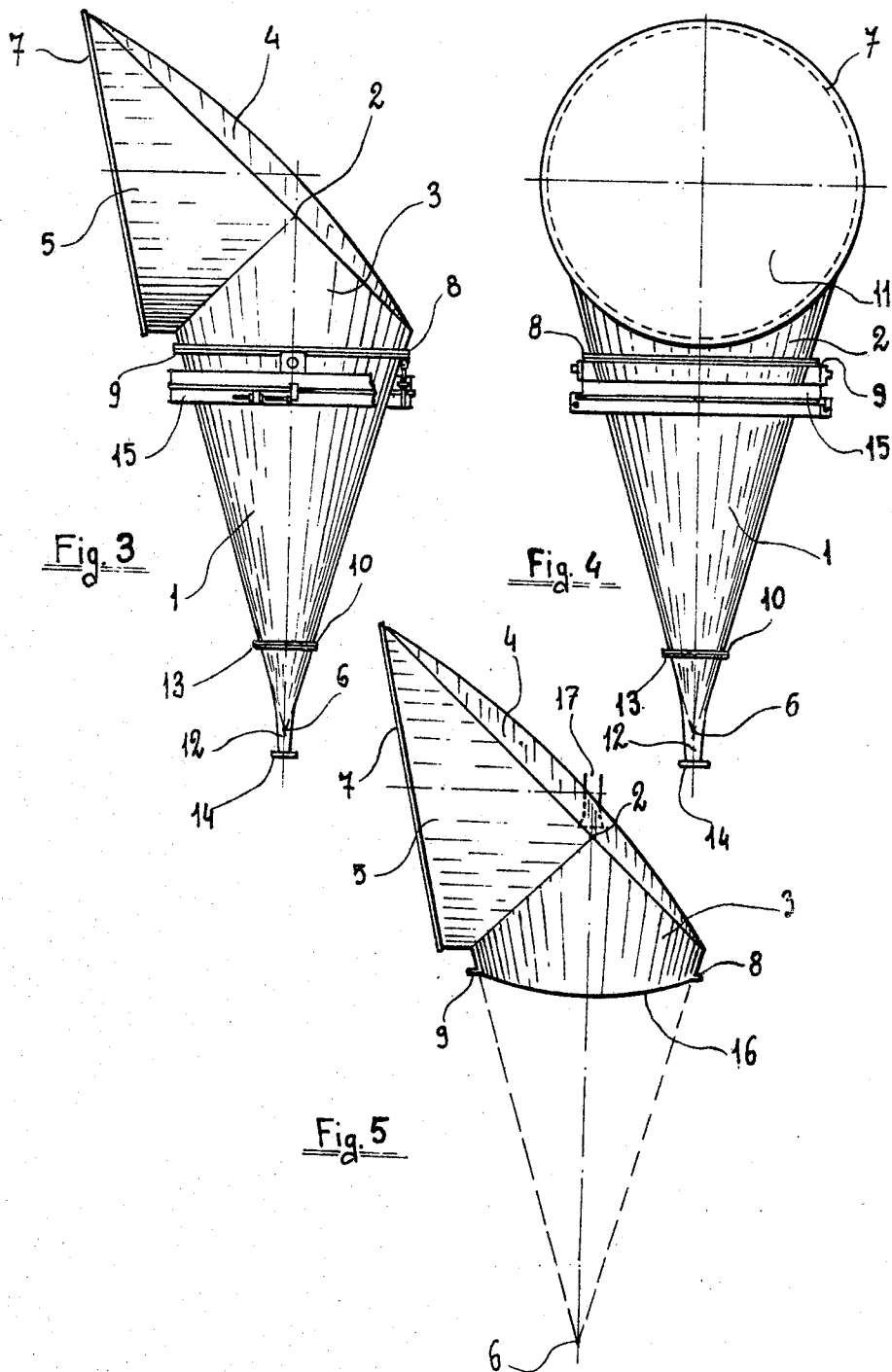
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HORN-REFLECTOR ANTENNA

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4 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to a horn reflector antenna having a conical horn, a parabolic reflector and a cylindrical mouth and formed by a double-walled panel constituted by two layers of reinforced synthetic resin with interposed insulating material, the inner surface of the panel being metallized, said antenna being constituted by two constructional units, the first unit consisting essentially of said horn and the second unit comprising said parabolic reflector and said mouth. The first unit may be a truncated cone and the second unit consisting of a conical portion, the parabolic reflector and the cylindrical mouth, each of the two units being molded in a single piece.

The present invention relates to an antenna of the horn-reflector type, substantially made of one single body, said antenna being used in the broadcasting and receiving of radio waves and, more particularly, for high capacity radio-link connections.

Antennae for the receiving and broadcasting of radio waves comprised of a pyramidically or conically shaped horn that intersects with a reflecting parabolic surface and, in the case of a conical horn, with a cylindrical surface which forms the opening or mouth of the antenna are already known in the art.

The pyramidal or conical horn has its vertex in the focal point of the paraboloid of revolution to which belongs the reflecting parabolic surface, and has its axis generally perpendicular to the axis of said paraboloid; the axis of the cylindrical surface that forms the opening or mouth of the antenna, in the case that a conical horn is adopted, is parallel to the axis of the paraboloid of revolution.

It is also known that such antennae display good characteristics of directivity for electromagnetic waves and good characteristics of band width of utilizable frequencies.

Furthermore, it is known that among said horn-reflector antennae, these having a conically shaped horn, particularly used in communications with artificial satellites, display an efficiency quite superior to that of the antennae having a pyramidically shaped horn.

The horn-reflector type antennae heretofore known are made of several composite elements comprised of panels of suitable materials (i.e. aluminum) reinforced on the outside surface by metal profiles (i.e. structural shapes); the pyramidal horn antennae are generally comprised of as many flat elements (interlocked to each other) as there are faces of the pyramidal horn, and by a certain number of sectors forming the reflecting parabolic surface.

The conical horn antennae are comprised of numerous elements suitably interconnected to each other to form the conical, the parabolic, and the cylindrical surfaces, the latter forming the mouth of the antenna.

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The possibility of composing the said antennae through the assemblage of a generally quite considerable number of elements, while facilitating the transport of the antenna to the setting up site where it can also be completely assembled, presents, however, some very serious disadvantages.

In fact, in said antennae the seal for the pressurized dry air is made precarious by the numerous existing seams, thus giving rise to the danger of formation of condensate within the apparatus; the use of gaskets and putties or cements for improving the tightness of said seams (which have the inconvenience of presenting a considerable extent) do not always avoid said drawback.

For the same reason, the numerous connections render the screening of the radio frequencies imperfect with the consequent possibility of leakages and a consequent reduction in the directional characteristics of the antenna.

Furthermore, the numerous connections make it impossible to achieve a perfect continuity of the inside surface of the apparatus, with the consequent possibility of obtaining an imperfect electrical operation of the antenna.

The assemblage costs for said antennae on the setting up site, generally quite a distance from the manufacturing site, are rather high, since it requires highly specialized labor and many working hours, owing to the considerable precision required in the assembly of the different elements comprising the equipment.

Moreover, since the elements comprising the antenna are made of metal, the thermal insulation of the equipment is rather poor with the consequent danger of the formation of condensates due to variations in ambient temperatures.

Thus, an object of the present invention is that of providing an antenna of the horn-reflector type whose component pieces or elements are reduced to a minimum, thereby reducing the number of connections or joints between said elements, as well as the extent of said connections, and thus eliminating all of the above mentioned drawbacks concerning the pressurized dry air tightness and the screening of the radio-frequencies and improving the radio-electrical characteristics of said antenna.

Another object of this invention is that of facilitating the assembling of said antennae on sites even far-removed from the place of their manufacture, thus ensuring a considerable practical and economical advantage.

A further object is that of reducing the weight of the equipment with considerable advantage for its transport and its installation.

Still another object is that of providing an antenna possessing high thermal insulation characteristics.

These and other objects that will become more clearly apparent to one skilled in this art from the detailed description that follows, are realized by an antenna of the horn-reflector type for the receiving and broadcasting of radio waves, and substantially comprised of a single body.

The present invention will now be described more in detail by reference to the figures of drawings, which are given by way of illustration and in which:

FIG. 1 represents schematically a side view of an antenna of the horn-reflector type with a conical horn and a reflector with a parabolic surface, said antenna being comprised of a single piece according to a form of embodiment of this invention.

FIG. 2 represents a frontal view of the antenna of FIG. 1.

FIG. 3 represents schematically a side view of a horn-reflector antenna with a conical horn and a reflector with

a parabolic surface, consisting of two pieces, according to another form of embodiment of this invention.

FIG. 4 represents a frontal view of the antenna of FIG. 3.

FIG. 5 represents schematically a side view of an antenna of the horn-reflector type, in which the horn is partially replaced by a reflecting hyperbolic surface irradiated with waves from a wave emitter, according to another form of embodiment of this invention.

It is to be borne in mind that in the various drawings equal or equivalent components of the antenna are all indicated by the same reference numeral.

With reference to FIGS. 1 and 2, the antenna of this invention is formed by one single piece comprising a truncated cone shaped portion 1, forming the horn, by a portion 4 with a parabolic surface constituting the reflector which transforms the wave front from spherical to flat and vice versa, and by a cylindrical portion 5 that constitutes the mouth or opening of the antenna; mouth 5 preferably presents the outlet section cut according to an inclined plane with respect to the axis of cylinder 5.

The vertex 6 of the horn is located in the focal point of the paraboloid of revolution to which belongs the reflector 4; the axis of horn 1 and that of mouth 5, are, respectively, perpendicular and parallel to the axis of the paraboloid of revolution.

In some cases, obviously, the axis of the horn may be inclined with respect to the axis of the paraboloid of revolution.

Horn 1 and mouth 5, formed in one single body, together with reflector 4, are fitted at their ends, respectively, with flanges 10 and 7, these latter also being comprised of one single piece of portions 1 and 5 of the antenna; flange 7 is used for fixing window 11 which shuts off the mouth of the antenna so as to preserve in it an atmosphere of pressurized dry air; flange 10 serves for connecting the antenna with the union element 12, of a known type, which joins the antenna to the wave guide not represented in the drawings.

The union 12 is fitted with flanges 13 and 14, respectively, for fixing to the horn and the wave guide of the antenna.

The window 11 is of a material through which radio or electromagnetic waves may pass (for instance of glass fiber reinforced polyester resin) and is affixed airtight to flange 7 by means of bolts and gaskets; flanges 10 and 13 are joined together in the same way ensuring airtightness.

15 indicates a mechanical system, known per se, which serves to support the antenna and is used for orienting the same.

FIGS. 3 and 4 represent a variant of this invention, wherein the antenna is comprised of two elements, each made as one single body: element 1 of a truncated-cone shape forming the horn, and element 2, constituted by one single piece consisting of a conical portion 3, jointed tapering into horn 1, of a portion with a parabolic surface 4, forming the reflector which transforms the wave front from spherical into a flat one or vice-versa, and of a cylindrical portion 5 which forms the mouth of the antenna.

Element 2 and horn 1, both made in one single piece, are provided at their ends respectively with flanges 7, 8 and 9, 10, which also are in one single piece with elements 1 and 2. Flanges 8 and 9 serve for connecting the two elements 1 and 2 constituting the antenna.

The pairs of flanges 8, 9 and 10, 13 are coupled to each other in an airtight way, as previously explained.

FIG. 5 represents another variant of the present invention in which the conical horn (1 in FIGS. 3 and 4) has been partially replaced by a reflector with a hyperbolic profile 16 which reflects the radio waves and whose focus coincides with focus 6 of the parabolic reflector 4; 17 indicates a small electro-magnetic horn provided with a union joining it to the wave guide not represented in the drawing.

Also according to this variant of the invention, elements 2 and 16 are each made of one single piece and are connected to each other through flanges 8 and 9. Of course, also in this embodiment the antenna may be made of one single piece comprising portion 2 and portion 16; in this latter case flanges 8 and 9 are absent.

The horn-reflector antenna made in one single piece, or at most in two pieces, is comprised, according to this invention, of a double-walled panel formed by two layers of reinforced synthetic resin (such as, for example, polyester resin reinforced with glass fibers) with the interposition of an insulating or nonconducting material (for instance: balsa wood, polyurethanes, foamed plastic material).

The double-walled panel has an inner surface, that constitutes the inside surface of the antenna, suitably metallized (for instance with zinc, aluminum, silver, or copper); and the thickness of the panel is about 30 mm.

It must be noted that the contact surfaces of the above cited flanges, since they too are metallized, allow an excellent contact even from an electromagnetic point of view.

The advantages attendant this invention are clearly evidenced by the description given hereinabove, and may, in any event, be summarized as follows: Excellent tightness of the pressurized dry air, excellent thermal insulation, excellent electromagnetic isolation and great ease of assembly.

Of course, other modifications and variants may be introduced into the present invention, as previously described and illustrated, without thereby falling without the scope of the present invention.

Thus, for instance, the dimensions and the materials used may vary according to requirements; the shape of the horn may be conical, pyramidal, or replaced by equivalent elements; in the case of a pyramidal horn and of an antenna constituted by two elements, the parabolic reflector is joined to the faces of the pyramid by means of rims obtained in one single piece from the same bodies of the two respective component elements of the antenna; the parabolic reflector may be replaced by a flat surface in case the focal point is at a suitable distance from said reflector; and the cylindrical mouth or opening of the antenna may be omitted.

What is claimed is:

1. A horn reflector antenna having a conical horn, a parabolic reflector and a cylindrical mouth and formed by a reinforced synthetic resin panel, the inner surface of the panel being metallized, said antenna being constituted by two constructional units, the first unit consisting essentially of said horn and the second unit comprising said parabolic reflector and said cylindrical mouth, each of said units being provided at its two ends with flanges, two flanges being arranged for connecting said two units and the other flanges being arranged, respectively, for connecting the antenna, through a union element, with an associated wave guide and for affixing an airtight closing window on said mouth.

2. A horn reflector antenna as defined in claim 1, wherein said flanges have plane surfaces, said two units being assembled in an airtight manner.

3. An antenna substantially of the horn reflector type formed by a fiber-reinforced laminar panel and in which the horn is truncated and partially replaced by a reflecting surface illuminated by a small feed horn, said antenna being constituted by two constructional units, the first unit comprising essentially said reflector, the mouth of the antenna and said truncated form and the second unit consisting of said reflecting surface, said first unit being provided at its two ends with flanges, one of the flanges being arranged for affixing an airtight closing window on said mouth and the other for connecting the antenna with a corresponding flange of said second unit.

4. An antenna as defined in claim 3 and in which said reflecting surface has a hyperbolic profile, wherein said

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flanges for connecting said two units have a hyperbolic profile, said two units being assembled in an airtight manner.

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