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R. BEUVAIN

3,245,080

AIRCRAFT RADOME-ANEMOMETER BOOM HAVING MEANS TO DESTROY
ANY SPURIOUS SURFACE WAVE

Filed Dec. 11, 1961

3 Sheets-Sheet 1

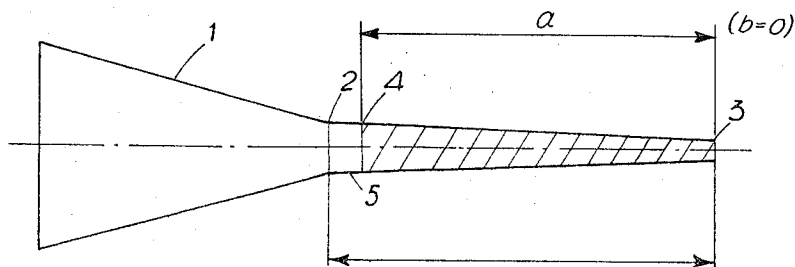


FIG. 1

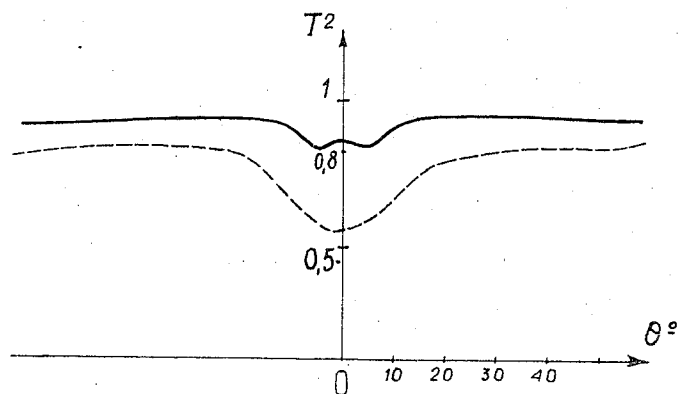


FIG. 2

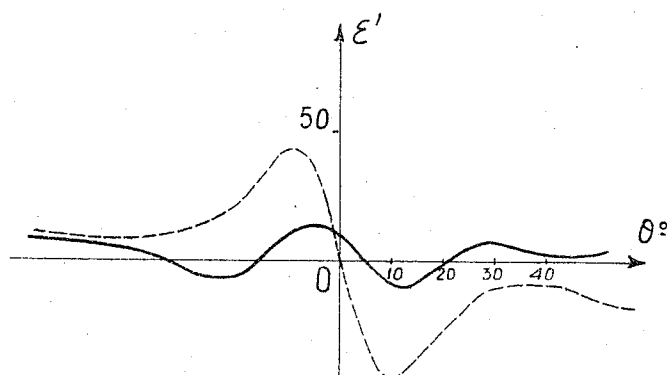


FIG. 3

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3 Sheets-Sheet 2

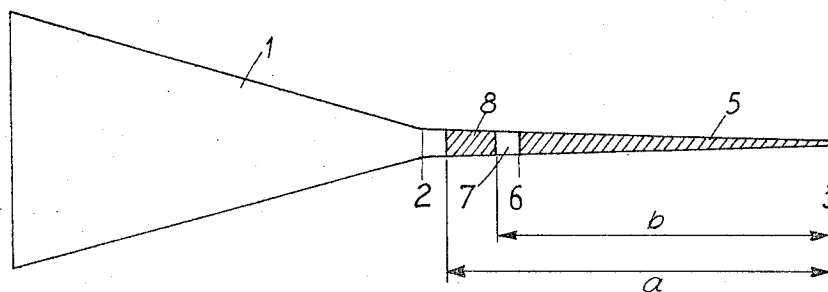


FIG. 4

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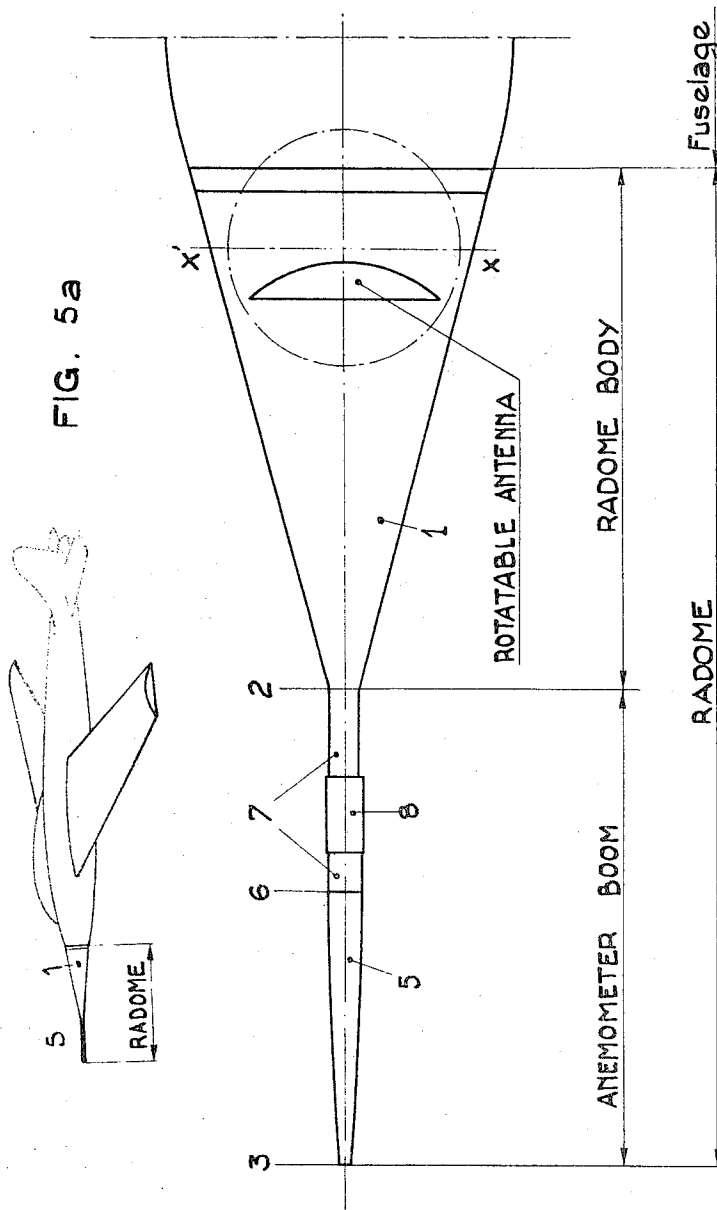
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AIRCRAFT RADOME-ANEMOMETER BOOM HAVING MEANS TO DESTROY ANY SPURIOUS SURFACE WAVE

René Beuvain, Paris, France, assignor to C.S.F.-Compagnie Generale de Telegraphie Sans Fil, a corporation of France

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3 Claims. (Cl. 343-708)

The present invention relates to radomes provided with an anemometer boom.

As is well known radomes, i.e. housings of dielectric material adapted to ensure the protection of aerials, and especially of airborne radar aerials, are sometimes equipped with an anemometer boom or tube which extends from the body of the radome, this location being advantageous for protection against disturbances due to shock-waves during high-speed flights.

In this case, the radiation from the radar antenna may, under certain conditions, give rise to a surface wave along the boom, the latter thus behaving like a substantially directive, secondary radiator.

The desired radiation may be considerably affected by interferences from these spurious radiations, particularly when the radar antenna is coaxial with the boom.

The transmission losses, i.e. the quantity of energy absorbed or reflected by the radome and the refraction errors due to the radome are thus substantially increased in this area.

According to the invention the radiation from the anemometer boom is modified by depositing a metal coating on a dielectric portion of it so that the interferences with the main radiation do not cause any significant disturbance.

The invention will be best understood from the following description and appended drawing, wherein:

FIG. 1 shows an anemometer boom of dielectric material according to the invention;

FIGS. 2 and 3 are graphs illustrating the improvements obtained in one embodiment of the invention, in so far as transmission losses and the refraction errors are respectively concerned;

FIG. 4 represents an anemometer boom which is made of metal over the greater part of its length but comprises a dielectric portion modified according to the invention; and

FIGS. 5a and 5b are sketches showing the elements of the device according to the invention functionally related in an aircraft application.

The dielectric anemometer boom which is shown in section in FIGS. 1, 5a and 5b is shaped as an elongated truncated cone 5 and is connected to the body, 1 of the radome, also having the shape of a truncated cone. Boom 5 extends from the transversal section 2 to the transversal section 3.

Inside the radome body is placed a rotatable antenna forming a part of the radar system carried by the aircraft shown FIGS. 5a and 5b. This antenna is shown FIG. 5 in cross-section by a plane whose trace on the figure is along $x'-x$, the dashed and dotted circle representing the inner profile of the radome body in this plane.

According to the invention, the boom has a metal coating obtained for example by metallization over a certain length thereof. The spurious radiation, instead of occurring over the whole length of the boom with a substantial directivity, is now essentially localized at the ends of the metallized area. The radiation is considerably more diffuse and two parameters are now available, for reducing the disturbing interference with the desired radiation,

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namely the axial distances a and b from the transversal sections limiting the metallized portion, which is hatched in the drawing, to the free end of the boom. In the example shown in FIG. 1, b is taken equal to zero and cannot be shown; both parameters a and b are more clearly shown in FIG. 4.

The optimum arrangement depends upon the position of the radar antenna and the diagram of the desired radar radiation and on the shape of the radome body and boom. In practice, the exact area to be metallized is to be experimentally determined, the accuracy desired in so far as to the two above parameters are concerned, being of the order of, say, $\lambda/10$, where λ is the operating wave length.

It is generally advantageous to make $b=0$ and to adjust suitably the distance a , since spurious radiations may be provided by the unmetallized free end of the boom. On the other hand the free end of the boom is thus protected against erosion. This is the case in the example shown in FIG. 1.

Generally, the metallized area will cover the major portion of the boom outer surface. In the example illustrated in FIG. 1, $b=0$ and a corresponds to the axial distance between sections 4 and 3.

FIGS. 2 and 3 show graphically the results obtained in one specific case: the aerial includes a paraboloid of a diameter of 50 cm., illuminated by a four-channel source, of the monopulse type, the "sum" signals of which are subject to transmission losses, and "difference" signals of which are subject to transmission losses, and refraction errors. The aerial is protected by a radome of laminated polyester glass. The radome is provided with an anemometer boom which is 120 cm. long and is coated with a metallic coating of colloidal silver applied, for example, by means of a brush, over the whole of the distance $a-b=a=110$ cm. extending from the free end of the boom up to the section 4, since b is taken here equal to zero.

In FIG. 2, the angles, expressed in degrees, between the axis of the desired radiation pattern and the boom axis, are plotted on the abscissa and the square of the modula of the transmission factor T on the ordinate, ordinate 1 corresponding to a transmission without losses.

In FIG. 3 the refraction errors expressed in minutes are plotted on the ordinates, the same magnitude as in FIG. 2 being plotted on the abscissa.

In both figures, the dotted curve and the solid curve give the values measured before and after the adjunction of the metal coating according to the invention.

If the major portion of the anemometer boom, i.e. the portion comprised between sections 6 and 3, is of metal, as is the case for boom 5 shown in FIG. 4, there still exists a dielectric portion 7 comprised between sections 2 and 6, this portion connecting the boom to the radome body 1. The parasitic sources exist at ends 6 and 3 of the metal portions but the position of these sources is generally not the optimum one.

In this case a part 8 of portion 7 of the boom is covered with a metal coating providing two further radiation sources at respective ends of part 8.

As in the preceding case, the location of the coating is in practice determined experimentally, two parameters, corresponding to the transversal sections limiting the coating, being available.

It is to be understood that the metal coating may be obtained as well by metallizing the dielectric portion concerned as by mean a metal sheath which surrounds this portion.

It is to be understood that the invention is in no way limited to the embodiments described and illustrated, which were given only by way of example.

What is claimed, is:

1. A radome, for protecting a radiation source located therein, said radome comprising an elongated anemometer boom, whose spurious surface wave disturbs the forward radiation pattern of said source, said boom comprising at least a dielectric tubular outer portion, and a tubular metallic coating partially covering said dielectric portion, to compensate for the presence of said spurious wave. 5

2. A radome, for protecting a radiation source located therein, said radome comprising an elongated dielectric boom, whose spurious surface wave disturbs the forward radiation pattern of said source, said boom having a free end, and a metallic tubular coating covering only partially an outer portion of said boom, said portion extending from said free end, to compensate for the presence of said spurious wave. 10 15

3. A radome, for protecting a radiation source located therein, said radome comprising an elongated anemometer boom, whose spurious surface wave disturbs the forward radiation pattern of said source, said boom comprising a metallic tubular outer portion and a dielectric tubular 20

outer portion, and a metallic tubular coating partially covering said dielectric portion, to compensate for the presence of said spurious wave.

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HERMAN KARL SAALBACH, *Primary Examiner.*

E. LIEBERMAN, *Assistant Examiner.*