

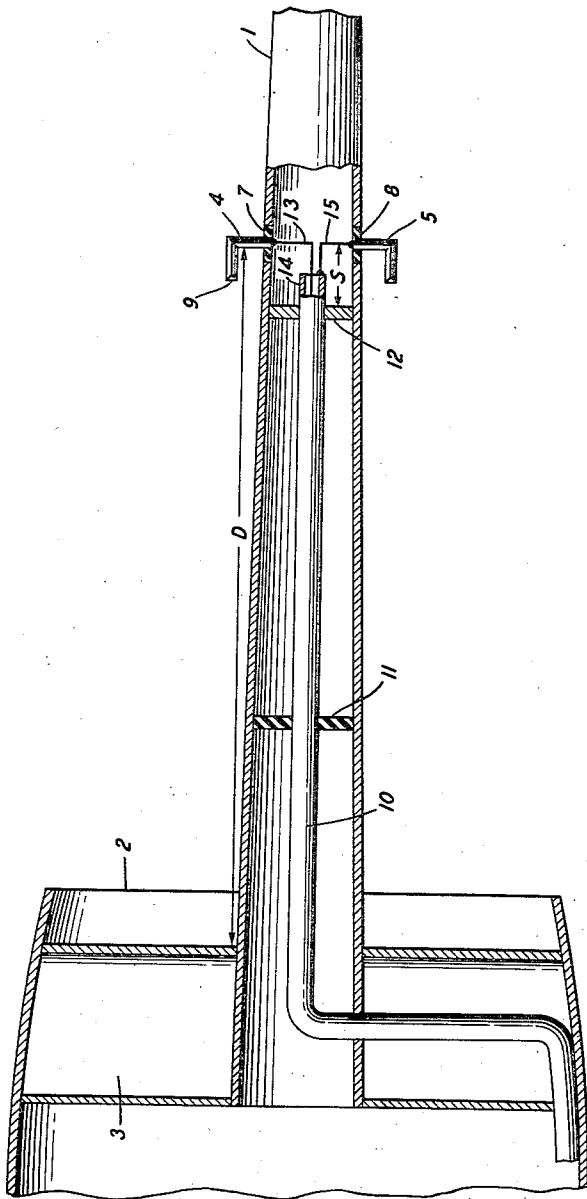
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This invention relates to antenna systems and more particularly to an antenna system for use on an aircraft.

The principal object of the invention is to provide an isotropic field pattern in an airborne antenna system. Other objects are to reduce air turbulence and drag, increase the safety and the operating efficiency, and simplify the mechanical construction of such an antenna.

It is desirable that an airborne antenna system have a coverage pattern which is uniform in all directions so that the aircraft can communicate with other aircraft or ground stations, whatever the relative position. The antenna systems at present found on aircraft are not entirely satisfactory in operation for a number of reasons. Due to the location of the antenna, the reflection and shadow effects caused by the aircraft frame are too great. It is an established fact that in the antenna systems now used for ultra-high-frequency communication the signal is often blanked out by the aircraft frame during the critical periods when the control tower is attempting to give instructions to the approaching aircraft, or when the aircraft is attempting to communicate with another nearby aircraft. Also, standing waves set up on the surface of the aircraft frame not only distort the field pattern but may give rise to radio-frequency voltages of sufficient magnitude to ignite the fuel in a jet plane. Some types of antennas create air turbulence and air-drag, are located too far from the radio transmitter or receiver, or are difficult to manufacture and maintain.

The antenna system in accordance with the present invention overcomes these and other disadvantages. The antenna is mounted on a tube which extends forwardly from the nose of the aircraft, thus greatly reducing the blanking effects heretofore encountered when negotiating a landing or when communicating with a nearby aircraft. Many jet-propelled planes normally have a ram tube which may be used for this purpose. The antenna comprises a pair of oppositely disposed, quarter-wave, dipole elements insulatingly secured at their bases to the tube. The elements are preferably bent and of streamlined cross section to reduce drag and turbulence. The ends of the elements may be beveled for the same reason. The antenna is spaced at least three wavelengths from the base of the ram tube in order to provide a substantially isotropic field pattern. Also, this distance is preferably made an integral number of half wavelengths in order to prevent the formation of standing waves on the outer or inner surfaces of the aircraft. Electrical connection between the antenna and the associated radio receiver or transmitter may be made by means of a transmission line, preferably of the coaxial type, positioned within the tube. The outer conductor of the coaxial line may be grounded to the ram tube at a point a quarter wavelength from the antenna in order to provide a matching termination and thereby increase the operating efficiency.

The nature of the invention and its various objects, features, and advantages will appear more fully in the fol-

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lowing detailed description of a typical embodiment illustrated in the single figure of the accompanying drawing.

A metal ram tube 1 is shown extending in the forward direction from the nose 2 of a jet-propelled airplane. The base of the tube 1 is securely fastened to a dividing island 3 which is vertically positioned at the center of the open nose of the plane which serves as the air intake orifice for the jet engine. The ram tube 1 may be considerably longer than shown, is preferably tapered, and may have a pitot tube or other devices mounted at its forward end. A pair of oppositely disposed dipole elements 4 and 5 are secured at their bases to the insulators 7 and 8, respectively, which are inserted in holes cut in the wall of the tube 1.

Each of the elements 4 and 5 has a length approximately equal to a quarter wavelength at the mid-band frequency f_M of the operating band, has a cross section which is diamond shaped, as shown, or is otherwise streamlined, and has a beveled end as shown at 9. The elements are preferably bent at a right angle to reduce drag and widen the operating band. They may be bent to the rear, as shown, or in the opposite direction. In order to prevent the formation of standing radio-frequency waves on the outer or inner surface of the aircraft frame, the antenna 4—5 is located an integral number of half wavelengths from the dividing island 3. That is, the distance D is made equal to an integral number of half wavelengths at f_M . The elimination of external standing waves greatly increases the uniformity of the radiation pattern. Eliminating internal standing waves avoids the possibility of prematurely igniting the fuel and causing a serious accident. Also, the distance D is preferably made at least three wavelengths at the frequency f_M in order to reduce the shadowing effect to the rear caused by the aircraft frame, thus making the coverage pattern more nearly isotropic.

The antenna 4—5 is connected to the radio transmitter or receiver, not shown, by a comparatively short coaxial transmission line 10 which runs along the inside of the tube 1 and is held in place by supports such as 11 and 12. The inner conductor 13 of the line 10 is connected to the dipole element 4. The outer conductor 14 is connected to the element 5 by a connector 15. The support 12 is made of metal and serves to ground the outer conductor 14 to the tube 1. The distance S between the support 12 and the elements 4, 5 is made a quarter wavelength at the frequency f_M to provide a matching termination for the line 10, thus avoiding reflection of energy and improving the operating efficiency.

It is to be understood that the above-described arrangement is illustrative of the application of the principles of the invention. Numerous other arrangements may be devised by those skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. In a jet-propelled airplane having an air intake orifice in the nose thereof and a dividing island positioned in said orifice, an antenna system comprising a ram tube securely fastened at one end to said dividing island to project in the forward direction, a pair of oppositely disposed, quarter-wave, dipole elements insulatingly secured at their bases to said tube at a distance from said one end, and a transmission line positioned within said tube and electrically connected to said elements.

2. A system in accordance with claim 1 in which said distance is equal to an integral number of half wavelengths.

3. A system in accordance with claim 1 in which said distance is equal to at least three wavelengths.

4. A system in accordance with claim 1 in which said transmission line is of the coaxial type, and means for

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conductively connecting the outer conductor of said line to said tube at a point spaced a quarter wavelength from said elements.

5. A system in accordance with claim 1 in which each of said elements is bent in the backward direction at a right angle.

6. A system in accordance with claim 1 in which each of said elements is bent at a right angle.

7. A system in accordance with claim 6 in which the outer end of each of said elements is beveled.

8. A system in accordance with claim 6 in which each of said elements has a diamond-shaped cross section and a beveled outer end.

9. A system in accordance with claim 2 in which said distance is equal to at least three wavelengths.

10. An antenna system for an aircraft comprising a tapered tube adapted for mounting at its larger end on the nose of the aircraft to extend in the forward direction, a pair of oppositely disposed, quarter-wave, dipole ele-

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ments insulatingly secured at their bases to said tube at a distance from said larger end equal to an integral number of half wavelengths and equal to at least three wavelengths, and a transmission line positioned within said tube and electrically connected to said elements, said elements being bent in a backward direction at a right angle and having a streamlined cross section and beveled ends.

11. A system in accordance with claim 10 in which said tube is metallic and said transmission line is of the coaxial type, and means for conductively connecting the outer conductor of said line to said tube at a point spaced a quarter wavelength from said elements.

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