

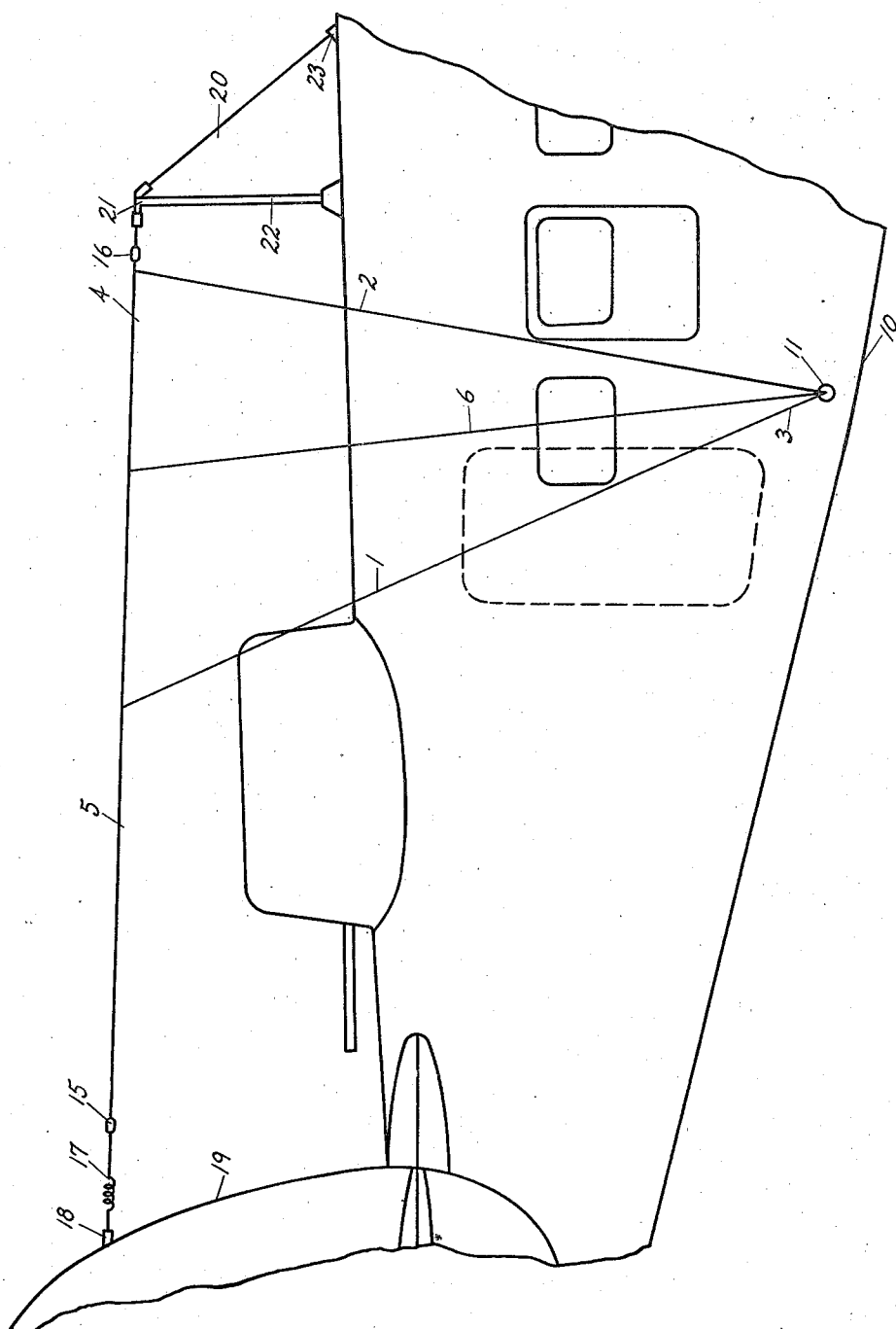
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FAN ANTENNA WITH TAIL

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FAN ANTENNA WITH TAIL

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to antennas and more particularly to a broad-band wire antenna.

The term fan antenna, as conventionally used, is applied to a wire antenna that is substantially of a triangular shape and wherein the triangle base line wire terminates at its intersections with the triangle side line wires.

The objects of the present invention comprise the provision of an improved wire antenna of a desired geometrical shape, such as a triangle or the like, that has broad band characteristics; a wire antenna that simulates a large radiating surface without sacrificing the general impedance characteristics of a solid conductor; a wire antenna wherein the lengths of at least one wire may be altered to control the impedance of the antenna without materially affecting the radiation characteristics thereof; and a wire antenna wherein a base line wire extends beyond its intersection with laterally disposed wires for a sufficient distance to match the input impedance of a coaxial cable thru which the antenna is fed.

With the above and other objects in view which will be apparent to those who are informed in the antenna art from the following description, an illustrative embodiment of the present invention is disclosed in the accompanying drawing wherein the figure is a side elevation of a plane fuselage with an antenna that embodies the present invention mounted thereon.

The fan antenna that has been chosen as being illustrative of one embodiment of the present invention comprises a single wire or individual wires, as preferred, that describe a geometrical figure, such as the triangle shown or the like. The antenna shown comprises a triangle that has a pair of sides 1 and 2 that converge at a point 3, and a base 4 that connects the sides 1 and 2 at their ends remote from their point of convergence 3 and that continues to provide a tail 5.

The convergence point 3 of the antenna sides 1 and 2 may also be an attaching point for a desired number of additional wires 6 that form parts of the antenna, as by extending across the antenna so that their ends remote from the convergence point 3 are attached to the base 4, or the like. The convergence point 3 also provides a desirable connection for the antenna to which a coaxial cable, not shown, or other suitable connector may be attached with the central conductor of the coaxial cable connected with

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the antenna and with its outer conductor grounded to the skin of aeroplane 10, or other desired mounting for the antenna inside of which aeroplane 10 the coaxial cable is disposed. An insulation plate 11 provides a mounting for an antenna connector, not shown, at the antenna convergence point 3.

The antenna is supported in any desired manner, as by means of an insulator 15 at the remote end of the antenna tail 5 and an insulator 16 at the junction of the antenna side 2 with the antenna base 4, or the like. Resilience is preferably imparted to the mounting in any desired manner, as by having a desired type of spring 17 interposed between the insulator 15 and a securing means 18 that is attached to a support, such as the fin 19 of the ship 10 or the like.

The antenna wires are preferably maintained substantially taut in any suitable way, as by means of a cable 20 that has one end attached to the antenna insulator 16 and that passes thru a guide 21 on the top of a strut or antenna mast 22 and that continues over a pulley or the like, not shown, in a housing 23 mounted in the fuselage of the plane 10. The cable 20 is attached in any desired manner within the plane fuselage.

In operation, the antenna that forms the subject matter of the present invention is adapted for use where a simple antenna is needed for broad-band application. The antenna is operated at a substantially high impedance level. The length of the antenna tail 5, in its relation with the dimensions of the remainder of the antenna, controls the input impedance of the antenna. An illustrative installation of the antenna indicates that where the impedance level of the antenna is 170 ohms, the standing wave ratio of the antenna is less than 2 to 1 for the transmission of signals within the wave length range of from 18.5 to 28 megacycles.

Transmitting equipment such as those known in Britain as the "Jostle" jamming equipment transmitter works over a band of frequencies that requires an antenna system that has a constant input impedance over the entire band of frequencies in order that maximum efficiency may be obtained. The required broad band characteristics may be obtained by an antenna with a large radiating surface such as a large cylinder, cone or similar shape. This type of antenna, however, is not adapted for use at low frequencies on aircraft because of their large dimensions, which make the antenna objectionably conspicuous and impractical for tactical

reasons as well as being aerodynamically unsatisfactory.

The fan-shaped array of a plurality of wires such as form the antenna that is contemplated hereby, simulates a large radiating surface without the sacrifice of the needed impedance characteristics that are provided by a solid conductor. In some installations three wires have been successfully used for an antenna that has a limited band width without exceeding a desired standing wave ratio of 2 to 1 owing to the impedance mismatch over the band.

In the present illustrative antenna, the antenna wires 4 and 5 serve as a mechanical continuation of the cable 20 to support the remaining wires and parts of the antenna. The wires 1 and 2 are flared preferably at substantially 30°. The base wire 4 and tail 5 section of the antenna increases the electrical length of the antenna and is an effective method for controlling the impedance thereof without impairing its radiation characteristics. The insulation of the supporting cable 20 from the base wire 4 and tail 5 section of the antenna serves to prevent coupling to the supporting cable 20 which destroys the electrical characteristics of the antenna. The antenna preferably is fed through the skin of the ship 10 by means of an amphenol connector base, not shown, on the inside of the fuselage and a ceramic lead-in insulator 11 that is disposed on the outside of the fuselage.

In flight the antenna has proved very stable and produces negligible drag on the aircraft. The supporting cable 20 preferably is mounted by means of conventionally used brackets 13 that are provided for an original communication antenna. The antenna mounting may be modified so that the present antenna may extend from the antenna mast 22 to the wing tips, or otherwise, as desired.

It has been found that the "Jostle" type of transmitter worked most efficiently into a high impedance load of the order of 150 to 200 ohms with an antenna that was designed to operate at anti-resonance near its mid-band and wherein the wires 4 and 5 totalled 11 feet and the wires 1 and 2 were each 7 feet in length. The transmitter is preferably mounted very close to the antenna feed point so that a short length of high characteristic impedance coaxial cable, not shown, may be used between the transmitter and the antenna.

Field patterns on this type of antenna have been obtained at 24 megacycles in the vertical planes for every 30° around the ship as in the horizontal plane on the horizon.

Maximum signal strength with vertical polarization occurs forward of the ship with a null occurring approximately 30° downward from the horizon. Optimum horizontal polarization occurs upon the antenna side of the aircraft as

would be normally expected. With an antenna that embodies the present invention, ranges up to 25 miles were covered in tests and for any given range the signal magnitude was constant over the entire frequency band.

Using the accepted standard of a 2 to 1 standing wave ratio as a satisfactory broad antenna for purposes of jamming, experimental antennas that embody the present invention have been found to have a useful band width of from 18.6 to 28 megacycles which represents a 40% band width. The antenna, as designed for a 20 to 27 megacycle range, is within the accepted limits and the standing wave ratio varies from 1.5 to 1.8 over the band.

It is to be understood that the antenna that forms the subject matter of the present invention, of which the illustrative antenna that has been shown and described herein is an example, has been submitted for the purposes of illustrating and describing the present invention and that suitable modifications and substitutions may be made in the parts and assembly thereof without departing from the present invention as defined by the appended claim.

What I claim is:

A broad band unsymmetrical wire antenna connected to an input means of predetermined impedance, comprising a base wire, a plurality of spaced side wires connected at their spaced ends to said base wire and converging away from their spaced connections with said base wire, a convergence point at which said side wires join each other, and are electrically connected to said input means, and a tail portion making said antenna unsymmetrical by extending from one end only of said base wire and said tail portion being of a predetermined length and imparting to said antenna an impedance value that substantially matches the characteristic impedance of said input means to which the antenna side wires may be connected at their convergence point.

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