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S. K. WEST

2,136,532

RADIO ANTENNA

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2 Sheets-Sheet 1

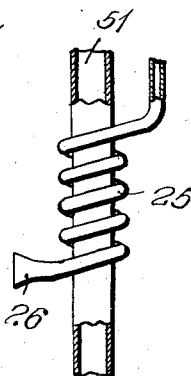
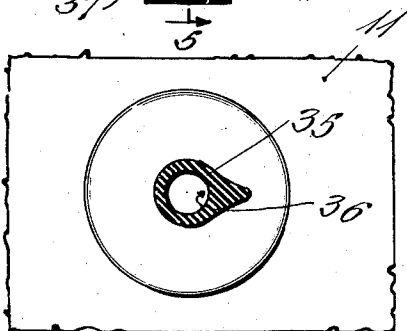
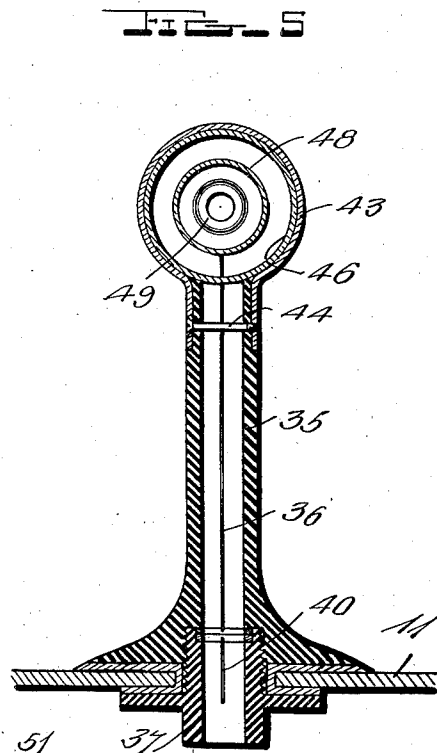
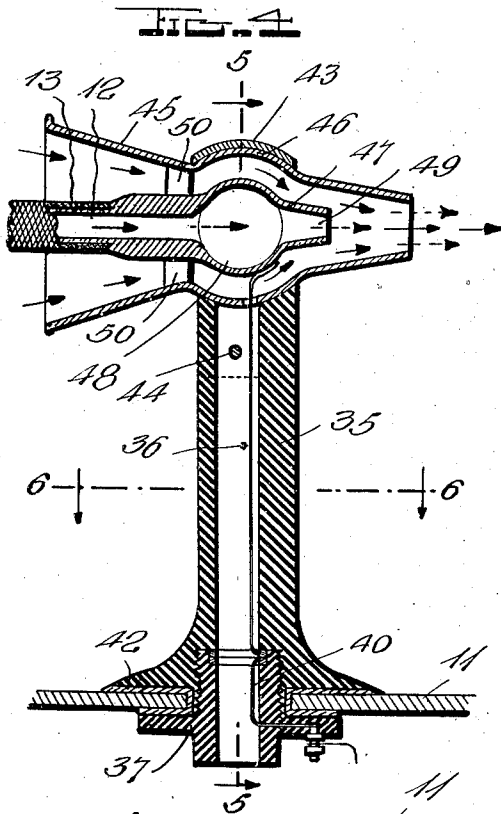
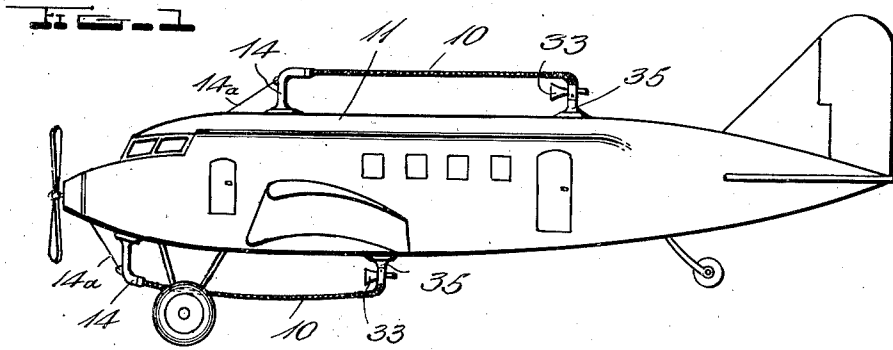


Fig. 7a

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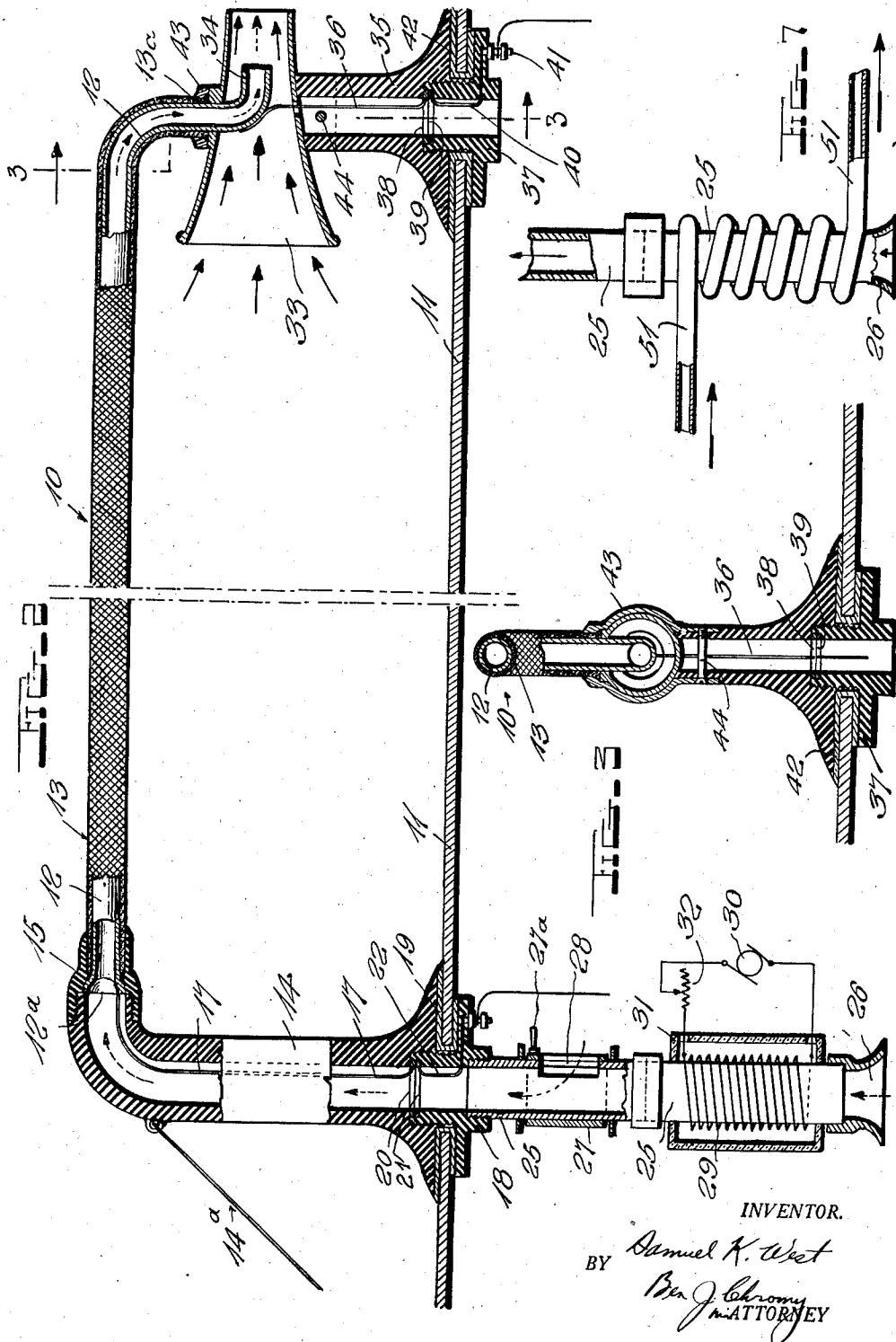
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RADIO ANTENNA

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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,136,532

RADIO ANTENNA

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13 Claims. (Cl. 250—33)

This invention relates to electrical apparatus generally. More particularly this invention relates to vehicle or aircraft radio antenna systems which have means incorporated therein to prevent the formation of ice on the surfaces thereof.

An object of this invention is to provide an antenna adapted to be carried exposed on the surface of a vehicle or craft, said antenna having means adapted to circulate a heated fluid medium in contact with it for preventing the formation of ice thereon.

Another object of this invention is to provide a tubular antenna adapted to be carried exposed on the surface of a vehicle or craft, said antenna having means for circulating a heated medium therethrough to prevent the formation of ice thereon.

A further object of this invention is to provide an antenna of tubular material adapted to be carried exposed on the outside of a mobile craft or vehicle, said antenna being supported by suitable insulation means at one end thereof having a passage therethrough communicating with the inside of a cabin of the vehicle or craft for feeding heated gas, for example, air from said cabin into the tubular antenna, the other end of the tubular antenna being provided with a device facilitating the drawing or passage of the heated gas through the tubular antenna.

Still a further object of this invention is to provide a tubular antenna member having attached to one of the ends thereof a supply of gas, the temperature of which is well above freezing.

Other and further objects of this invention will be apparent to those skilled in the art to which it relates from the following specification and the claims.

My invention is particularly adapted for use on aircraft which are equipped for radio communication which must be available for use under all forms of weather conditions. As is well known to aviators, ice forms very readily on various parts of the exterior of the aircraft, especially when said craft is flying at high altitudes. These ice formations may occur in the summer as well as in the winter although, of course, they occur more frequently in the winter time.

Ice forming on the antenna may break the antenna conducting member or cause it to sag and sway close to or in contact with the aircraft fuselage, in cases where the antenna is above the fuselage, or in cases where the antenna is below the fuselage, the ice may cause the antenna to

break off and dangle from, or entirely leave, the aircraft.

Furthermore, ice formation on the antenna insulators impairs the electrical insulating qualities of the insulators and renders the antenna and the radio communication facilities of the aircraft useless as long as the ice formation exists. It is the main object of my invention to overcome these difficulties caused by ice forming on the antenna or parts thereof. As will be observed, my invention is also applicable to use on ships and boats equipped with radio apparatus as well as motor vehicles, trains, aeroplanes and the like.

In accordance with this invention I provide an antenna of tubular material supported by insulators at each end thereof, at least one of the insulators being preferably provided with a passage arranged to communicate with the passage through the tubular antenna. A supply of air from the inside of the cabin of the vehicle or craft is passed through the tubular antenna member through the passage formed in the insulator. The air fed through the tubular antenna member from the inside of the cabin is of a temperature well above freezing, consequently in passing through the tubular antenna member, this air will heat the said member and maintain it above freezing temperature or at a sufficiently high temperature to prevent the usefulness of the antenna system from being impaired either by ice, frost, condensation or the like forming thereon.

While I have shown the use of heated air passing through the antenna from the inside of the aircraft cabin, other gases may be passed through the antenna and various ways of heating the gases, such as, electrical heating devices, the exhaust gas of combustion engines and the like may be employed.

In practice I prefer to draw the heated medium through the antenna tube by a suitable device formed on the trailing end of the antenna, said device being caused to draw air through the antenna tube when the aircraft is moving forward. Various ways of drawing air through the antenna tube may be employed, however, and I do not therefore desire to limit the invention specifically to the embodiments shown.

Referring to the drawings, briefly, Figure 1 illustrates the application of my radio antenna to aircraft; Figure 2 is an enlarged view of an embodiment of my antenna; Figure 3 is a sectional view along the line 3—3 of Figure 2; Figure 4 is a view of a modified form of air

drawing device employed at the trailing end of my antenna; Figure 5 is a sectional view taken along the line 5-5 of Figure 4; Figure 6 is a view of a cross-section of the insulator supports and Figures 7 and 7a are views showing a modified form of heating arrangement adapted to be used for heating the air stream through the antenna of my invention.

In Figure 1 I have shown two antenna arrangements supported on surfaces of the aircraft. One such arrangement designated by the reference numeral 10 is shown supported on the top of the aircraft 11 and another arrangement which is the same as the antenna 10 and is designated by the reference numeral 10a is supported on the bottom of the aircraft 11. Either position may be used as desired, the position used depending upon the wishes of the persons making the insulation. The antenna conductor 10 is made up of a solid wall tubular member 12 positioned inside of a braided conductor member 13 which is stretched over the solid wall tubular member and is substantially coextensive therewith. Both the tubular member 12 and the braided member 13 are anchored at their leading ends to the insulator support 14 by means of a cap-like member 15 which is threaded to the insulator 14 and the braided conductor 13 is sufficiently anchored at both ends to enable it to support the tube 12 should the latter become separated into two parts or tend to do so. Where desired the member 13 may be made of non-conducting material, such as, textile cord, twine, and the like, to prevent static electrical charges, caused by dust and other charged particles coming in contact with the metal antenna conductor, from accumulating or forming on the aforesaid antenna conductor. The forward end of the insulator 14 is braced by wire 14a to the aircraft as shown in Figure 1. The end 12a of the tube 12 is flanged inside of the cap 15 to grip the inner surfaces of this cap and prevent this tube 12 from being drawn out of the cap 15 by forces such as are encountered during the normal use of the antenna. The braided conductor encircling the tube 12 is held in position inside of the cap 15 by the flange end 12a of this tube. The insulator 14 is provided with a passage 16 therethrough and the lead-in conductor 17 connected to the antenna 10 is passed through this passage. The insulator 14 may be made of materials, such as, isolantite, porcelain, synthetic condensation products such as Bakelite and the like, and the body of this insulator is preferably made of a cross-section such as shown in Figure 6 to decrease the air resistance of this support. The base of the insulator is flanged as illustrated and is provided with a supporting nut 18 engaging said base. Threads are provided to the insulator base and the nut member may be assembled in engagement with the wall 11 of the aircraft and hold the antenna firmly upon the aircraft. A grommet 19 is positioned in a hole formed in the wall 11 of the aircraft and the threaded nut 18 is fitted into the hole in the center of this grommet to be screwed into the threaded base portion of the insulator 14 and draw said base portion against and firmly into contact with surfaces of said grommet. This grommet is sufficiently resilient to serve as a cushion-like support for the insulator assembly and yet not permit undesirable vibration of the antenna structure. The lead-in 17 is connected to a metallic washer 20 supported in the base of the insulator in such a way that a similar washer 21 supported on the nut 18 engages the former washer 20 when the insulator

14 and the nut member 18 are assembled into position upon the aircraft wall 11. A conducting wire 22 such as the lead-in 17 is connected to the washer 21 and to the binding post 23 for the purpose of facilitating the connection of the antenna 10 to the wire 24 which is connected to the radio apparatus employed in conjunction with the aforesaid antenna. If it is found that the use of the washers 20 and 21 and the binding post 23 introduces undesirable electrical capacities into the antenna circuit, these washers and binding post may be dispensed with and the lead-in 17, provided with suitable insulation covering, brought down direct through the tube 25 and out of the mouth 26 thereof.

The tube 25, made of metallic or suitable insulation material, is threaded into the nut member 18 and is also provided with a tubular member 27 for the purpose of controlling the size of an auxiliary opening or port 28 formed in the tube 25. A handle 27a or similar device is employed on the tube 27 to facilitate rotation of this tube with respect to its supporting tube 25 and to permit the openings 28 formed in the tubes 25 and 27 to be brought either into or out of alignment. Thus the tube 25 may be opened through the opening 28 and air drawn into said tube from the interior of the aircraft cabin without first passing said air through the lower and electrically heated portion of the tube 25. The purpose of this opening 28 is to permit easy control of the heating of the air passing through the antenna system. This heating control may not be so desirable where the air is heated electrically as the operation of the electrical heating unit 29 which is connected to the electrical generator 30, and is positioned inside of a suitable insulation casing 31 may be controlled readily. However, where the air passing through the tube 25 is heated by some other means, such as, a water or exhaust gas heater shown in Figure 7, in which control of the heating of the air may not be readily obtained in the heater itself, then the auxiliary vent 28 controlled by a suitable closing device such as tube 27, is essential. The heating of the electrical heating unit 29 may be controlled by increasing or decreasing the electric current fed therethrough from the generator 30 by means of a suitable rheostat 32 connected in series with the heating unit and the generator.

The air received at the mouth 26 of the tube 25 is heated by the electrical heater 29 and passed through the passage 16 of the insulator 14 on into the tubular antenna 10 and is released from the trailing end of the antenna. The passage of the hot air through the antenna is facilitated by the operation of the venturi 33 connected to the trailing end 34 of the antenna member 10 and supported away from the surface of the aircraft 11 by the insulator 35. This insulator 35 is also formed of a cross-section, such as shown in Figure 6, to decrease air resistance thereof.

Where desired, a lead-in 36 may be attached to the end 34 of the antenna or adjacent thereto and this lead-in may be used instead of the lead-in 17 which is connected to the forward end of the antenna. This lead-in 36 is brought down through the hollowed-out interior of the insulator 35 and is connected to the washer 38 which contacts a similar washer 39. This latter washer 39 is supported by the threaded insulation member 37 which engages the base of the insulator 35 and holds the insulator in position upon the wall 11 of the aircraft. A suitable grommet 40 of rubber or similar resilient mate-

rial is positioned in the hole formed in the wall 11 through which the threaded portion of the member 37 protrudes, and screws into the base portion of the insulator 35. The conducting wire 40 is connected to the washer 39 which is of conducting material and in contact with the washer 38. The lower end of the wire 40 is connected to the binding post 41 which is in turn connected to the input circuit of the radio receiving or transmitting apparatus carried by the aircraft. Where desired, the lead-in 36 may be passed directly through the hole in the insulation member 37 and the washers 38 and 39 eliminated.

The venturi 33 is supported on the insulator 35 by a suitable band 43, the ends of which are held in engagement with the top portion of the insulator by means of a small bolt 44 as shown in detail in Figure 3 which is a sectional view taken along the line 3—3 of Figure 2. This band 43 engages the venturi 33 substantially along the central portion of said venturi and also serves to grip the end 13a of the braided conductor 13 which is stretched over the solid wall tubular member 12. The end 13a of the braided conductor 13 and the adjoining portions of the tube 12 may be soldered or brazed to the strap member 43 and thus held together rigidly. At the same time the venturi 33 may be soldered or brazed to the tube 12 along the inner surfaces of the aforesaid venturi adjacent to said tube. However, where the venturi is made of insulation material such as synthetic resin condensation products, it is supported on the end of the insulator 35 and only the tube 12 and the braided conductor 13 are soldered, brazed, or otherwise integrally attached to the strap 43.

In Figures 4 and 5 I have shown a modified form of apparatus used for drawing the air or other gaseous medium through the tubular antenna. This form of my invention employs a substantially frusto-conical tubular member 45 bulged in the central part 46 thereof beneath the supporting strap 43 attached to the insulator at 35 by means of a bolt 44. The trailing end of the antenna is provided with a tubular member 47 which has formed a bulb-like section 48 therein adjacent to the somewhat constricted mouth 49 thereof. This tube 47 is welded or otherwise attached to the tubular member 12 and the braided conductor 13 and is supported by a spider-like arrangement 50 in the inside of the member 45 spaced from the inner walls of the member 45 and positioned so that the bulb-like section 48 is inside of the bulged section 46. This is more clearly illustrated in Figure 5 which is a sectional view taken along the line 5—5 of Figure 4. The purpose of this device 45 is to facilitate the drawing of the air or other gaseous medium through the tubular antenna in such a way that heated air from the inside of the aircraft cabin will be caused to pass through the hollow antenna at a sufficient rate to prevent the formation of ice, frost, and condensation upon the outside of the antenna member.

In Figures 7 and 7a I have illustrated a modified form of heating arrangement which may be used to heat the air passing through the tube 25. The form of the heating arrangement shown in Figure 7 employs a tubular member 51 wound in the shape of a helix around the tube 25. In the form shown in Figure 7a the tube 25 connected to the antenna is coiled around the heated tube 51. Exhaust gases from the internal combustion engine employed for driving the aircraft or similar vehicle upon which this inven-

tion is employed, are passed through the tube 51 and in doing so transmit heat to the tube 25 and the gases being drawn through the latter tube. Hot water from the engine cooling system also may be passed through the tube 51 for the purpose of heating the air drawn through the tube 25 if desired.

While I have described this invention in detail with respect to certain preferred embodiments thereof, it is, of course, understood that various modifications in the constructional detail thereof may be made without departing from the spirit and scope of this invention and therefore I do not desire to limit this invention to the exact details described and shown except insofar as they may be defined by the claims.

What I claim is as follows:

1. A radio antenna adapted for use on aircraft, comprising: a tubular antenna member of electrically conducting material, insulation supporting means for supporting said antenna member, means for fastening said insulation supporting means to the aircraft, a heating device including an auxiliary pipe and insulation means for connecting said auxiliary pipe to said tubular antenna, said heating device adapted to have a gaseous medium to be heated drawn there-through, and means other than the said heating device for drawing said gaseous medium after it is heated by said heating device through said tubular antenna member substantially to prevent the formation of ice, frost or condensation on said antenna member detrimental to the operation thereof while said antenna is connected to said signaling apparatus in condition for use.

2. A radio antenna adapted for use on aircraft propelled by an engine of a type having a hot exhaust pipe, comprising: a tubular antenna member, insulators for supporting said antenna member on the aircraft and spaced therefrom, an auxiliary pipe coiled around and positioned adjacent to the hot exhaust pipe of the engine, means for connecting said auxiliary pipe to said tubular antenna member, and means other than the engine of the aircraft for drawing a hot gaseous medium through said auxiliary pipe and said tubular antenna member, said auxiliary pipe being sufficiently close to the hot exhaust pipe of the engine to absorb enough heat therefrom whereby the gaseous medium drawn through said auxiliary pipe and said tubular antenna member is hot enough to prevent ice, frost or condensation on said antenna member detrimental to the operation thereof.

3. A radio antenna comprising: a tubular antenna member including an elongated electrically conducting tube, said tube being sufficiently rigid to be substantially self-supporting when horizontally suspended, a pair of substantially vertical insulators for horizontally supporting said antenna member, at least one of said insulators having a passage therethrough communicating with the passage through said tubular antenna member, and means for passing a heated gaseous medium through said last mentioned insulator and said tubular antenna member substantially to prevent the formation of ice, frost, or condensation on said antenna member detrimental to the operation thereof.

4. A radio antenna particularly adapted for use on aircraft comprising: a tubular antenna member in the form of an elongated electrically conductive tube, means for supporting said tubular antenna member on the fuselage of an aircraft extending fore and aft thereon, means for feed-

ing a supply of gaseous medium having a temperature well above freezing into the leading end of said tubular antenna member and means for sucking said gaseous medium through said tubular member, said last means being attached to the trailing end of said tubular antenna member.

5. A radio antenna comprising: a tubular antenna member of electrically conducting material, insulation supporting means for supporting said antenna member, means for fastening said insulation supporting means to a mobile craft to support said antenna longitudinally on said craft, nozzle means for drawing gaseous medium through said antenna, means for fastening said nozzle means at the trailing end of said antenna, and means for feeding a heated gaseous medium into the front end of said tubular antenna member substantially to prevent the formation of ice, frost, or condensation on said antenna member detrimental to the operation thereof.

6. A radio antenna comprising: a tubular antenna member including an elongated electrically conducting tube, said tube being sufficiently rigid to be substantially self-supporting when horizontally suspended, a pair of substantially vertical insulators for horizontally supporting said antenna member longitudinally on said craft, the front one of said insulators having a passage therethrough communicating with the passage through said tubular antenna member, nozzle means for drawing gaseous medium through said antenna; means for fastening said nozzle means to the trailing end of said antenna, and means for feeding a heated gaseous medium into said last mentioned insulator and said tubular antenna member substantially to prevent the formation of ice, frost, or condensation on said antenna member detrimental to the operation thereof.

7. A radio antenna particularly adapted for use on aircraft comprising: a tubular antenna member in the form of an elongated electrically conductive tube, means for supporting said tubular antenna member on the fuselage of an aircraft extending fore and aft thereon, means for feeding a supply of gaseous medium having a temperature well above freezing into the leading end of said tubular antenna member, a nozzle device for sucking said gaseous medium through said tubular member, and means for attaching said nozzle to the trailing end of said tubular antenna member.

8. A radio antenna comprising: a tubular antenna member including an elongated electrically conducting tube and a woven tube-like conductor stretched over said conductive tube, said tube being sufficiently rigid to be substantially self-supporting when horizontally suspended, a pair of substantially vertical insulators for horizontally supporting said antenna member, at least one of said insulators having a passage therethrough communicating with the passage through said tubular antenna member, and means for passing a heated gaseous medium through said last mentioned insulator and said tubular antenna member substantially to prevent the formation of ice, frost, or condensation on said antenna member detrimental to the operation thereof.

9. A radio antenna particularly adapted for use on aircraft comprising: a tubular antenna member in the form of an elongated electrically conductive tube and a woven tube-like conductor

stretched over said conductive tube, means for supporting said tubular antenna member on the fuselage of an aircraft extending fore and aft thereon, means for feeding a supply of gaseous medium having a temperature well above freezing into the leading end of said tubular antenna member and means for sucking said gaseous medium through said tubular member, said last means being attached to the trailing end of said tubular antenna member.

10. A radio antenna for cabin type aircraft comprising: a tubular antenna member of electrically conducting material, insulation supporting means for supporting said antenna member extending fore and aft over the fuselage of said aircraft, means for fastening said insulation supporting means to the walls of said aircraft, means for transmitting heated gaseous medium into said tubular antenna member from the inside of the cabin of said aircraft substantially to prevent the formation of ice, frost, or condensation on said antenna member detrimental to the operation thereof.

11. A radio antenna for cabin type aircraft comprising: a tubular antenna member including an elongated electrically conducting tube, said tube being sufficiently rigid to be substantially self-supporting when horizontally suspended, a pair of substantially vertical insulators for horizontally supporting said antenna member, the front one of said insulators having a passage therethrough communicating with the passage through said tubular antenna member, an auxiliary tube connected to the passage of said last mentioned insulator and extending into the cabin of the aircraft, a heating device for feeding a heated gaseous medium through said auxiliary tube and said last mentioned insulator into said tubular antenna member and a nozzle attached to the trailing end of said tubular antenna to suck said heated gaseous medium through said antenna as said aircraft is driven, said nozzle functioning to suck sufficient quantities of said heated gaseous medium through said antenna substantially to prevent the formation of ice, frost, or condensation on said antenna member detrimental to the operation thereof.

12. In apparatus of the class described, the combination of a tubular antenna member attached to the cabin of an aircraft, means connected to one end of said tubular member projecting into and terminating on the inside of the cabin of said aircraft, said tubular member having a passage therethrough for passing atmosphere from the inside of said cabin to the outside through said passage, a nozzle attached to the outside end of said tubular member for drawing said atmosphere through said tubular member as said aircraft is driven.

13. In apparatus of the class described, the combination of a tubular antenna member attached to the cabin of an aircraft, means connected to one end of said tubular member projecting into and terminating on the inside of the cabin of said aircraft, said tubular member having a passage therethrough for passing atmosphere from the inside of said cabin to the outside through said passage, and means attached to the outside end of said tubular member for drawing said atmosphere through said tubular member as said aircraft is driven.

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