MEANS FOR DISCHARGING STATIC ELECTRICITY FROM AIRPLANE RADIO ANTENNAS

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Aircraft in flight picks up static electricity when passing through atmosphere carrying rain, snow or ice crystals and is known by the general term precipitation static. When the effect is due to snow or ice crystals alone it is known as snow static. Snow static is caused by friction between the snow or ice crystals and the exposed surfaces of the airplane. As the static charge accumulates the potential of the plane as an isolated charged body increases above the surrounding air until corona discharge occurs from wing tips, propeller tips, radio antenna or other protruding parts of the plane where the electric field intensity is high. Because of its small diameter and exposure beyond the general surface of the plane, the field intensity at the surface of the antenna wire is high. This causes much of the corona discharge to concentrate on the antenna wire and gives rise to severe static interference with radio reception.

Attempts have been made to prevent corona discharges from the radio antenna by covering the wire with a sheath of plastic insulating material such as polyethylene. This has not proven successful because ice and snow particles striking the insulating sheath build up a surface charge even greater than for metal. This effect is still further exaggerated owing to the concentration of charge on the side of the oncoming particles, so that very high voltages are built up between the surface of the sheath and the antenna wire, resulting in eventual puncture of the insulation.

This invention has for its object the prevention of break-down of the insulating sheath on a radio antenna wire due to the accumulation of surface charge produced by friction with snow or ice crystals.

The method of accomplishing this is to provide a series of conducting rings on the outside of the insulating sheath so spaced that corona discharge can occur between rings to relieve the accumulated potential without puncturing the insulating sheath.

The invention will be better understood by reference to the drawings in which Fig. 1 is a view showing a radio antenna mounted on an airplane. Fig. 2 is an enlarged view of part of the antenna showing the insulating sheath and spaced conductive rings on the outer surface of the sheath.

Referring now to Fig. 1, the antenna wire 10 is supported by insulator 14 attached to tail 16 and by insulating mast 18 projecting upward from body 12. The antenna wire 10 is enclosed in an insulating sheath 20 of a plastic insulating material, such, for example, as polyethylene. The outer surface of the sheath is provided with conducting rings or cylinders 22 distributed throughout the whole length of the antenna and separated by non-conducting spaces 24. The conducting rings or cylinders 22 may be conveniently provided by a coating of graphite paint known by the trade name aquadag or an equivalent.

The antenna wire and sheath are shown in greater detail and to an enlarged scale in Fig. 2. The antenna wire 10 is surrounded by the plastic insulating sheath 20. The graphite paint conducting rings or cylinders are shown at 22 separated by the unpainted non-conducting insulator surfaces 24. The electric field between the conducting rings external to the insulating sheath is indicated roughly by the lines of force 26. Under normal conditions the non-conducting gaps 24 break up the conductive coating on the insulating sheath sufficiently to avoid impairing the efficiency of the antenna. Under snow and ice conditions, electric charge builds up on each graphite paint conducting section, but at a lower rate than for the insulating sheath itself. As the charge builds up on all the paint conducting sections, the potential between sections increases giving rise to the electric field as indicated at 28. This potential is relieved by a silent corona discharge between the thin edges 29 of the conducting rings 22. The discharge takes place along the sheath surfaces 24 and in the air along the lines of force 26. The numerous corona gaps thus provide a conductive path for the charges accumulated on the sheath to pass to the body of the plane by way of insulating mast 18 and insulator 14 whose surfaces are treated similar to the sheath itself. These corona discharge paths thus relieve the insulating sheath of excessive potentials which would otherwise puncture the sheath.

The active portion of antenna wire 10 terminates with insulator 30. Between insulator 30 and the tail of the aircraft the inner wire is merely for the purposes of support; however, there is a series of aligned conductive cylinders 14 around the wire which is provided with a plastic insulating sheath just as in the case of the active portion of the wire 10.

The conductive cylinders on either side of the insulator 30 constitute a discharge gap just as in the cases of the other gaps.

This application is related to my prior co-

1. In means for the reduction of radio static for an airplane, the combination comprising, a radio antenna wire, a plastic insulating sheath surrounding the wire, an insulating antenna mast for the support of one end of the antenna and an insulator supporting the other end, rings of conductive paint on the surface of the antenna sheath and on the antenna mast and insulator, said rings defining non-conducting spaces between the rings on the sheath, mast and insulator, whereby said spaces function as corona discharge gaps for the relief of excess potentials.

2. A radio antenna system comprising a continuous antenna wire, an insulating sheath surrounding the wire, a series of longitudinally separated closely spaced conducting paint elements on the surface of said sheath defining corona discharge gaps therebetween, an insulator supporting one end of said antenna wire having closely spaced conducting paint elements on the surface thereof; a hollow metal mast having an insulated conductor therein supporting the other end of the antenna wire, an insulating sheath surrounding said mast, and longitudinally closely spaced rings of conductive paint elements on said sheath whereby the charge on the end conductive paint elements on the antenna wire is transferred to the metal body of the aircraft.

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