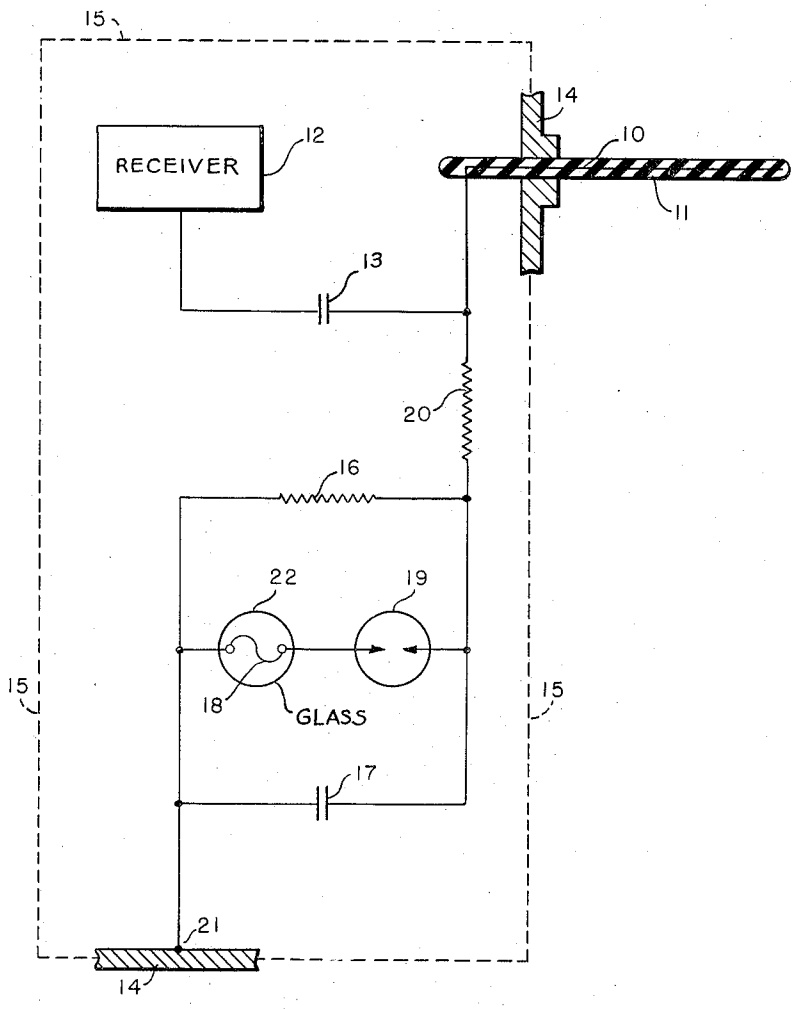
Sept. 5, 1950 J. P. PARKER 2,520,956

BREAKDOWN INDICATOR FOR INSULATED AIRCRAFT ANTENNAS

Filed March 14, 1947



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Patented Sept. 5, 1950 2,520,956

UNITED STATES PATENT OFFICE

2,520,956

BREAKDOWN INDICATOR FOR INSULATED AIRCRAFT ANTENNAS

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Application March 14, 1947, Serial No. 734,843

8 Claims. (Cl. 177—311)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

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This invention relates to indicating apparatus and more particularly to an apparatus for indicating electrical breakdown of insulating material surrounding an antenna.

In order to increase performance of aircraft radio installations it has been found advantageous to suppress the corona effect on the receiving antenna of such installations. The foregoing has been accomplished by completely insulating the receiving antenna with any suitable insulating material, such as polyethylene for example. However, it has been discovered that electrical breakdown of the antenna insulating material occurs under certain operating conditions, for example, when the aircraft flies near active thunder clouds, in which instances extremely high potentials are encountered. When such electrical breakdown occurs the advantages of an insulated antenna are completely nullified and moreover, performance obtained when the insulation on an antenna is electrically damaged falls below the performance resulting from utilization of a non-insulated antenna. Therefore, in order to appreciate fully the advantages resulting from an insulated antenna it becomes necessary to provide means to determine and indicate the electrical condition of the insulating material surrounding the antenna.

It is therefore an object of the present invention to provide novel means for determining and indicating electrical breakdown of insulating material surrounding an antenna.

Another object is to provide a novel apparatus for detecting electrical breakdown of insulating material surrounding an antenna and for producing a permanent indication of such electrical breakdown.

Still another object of the invention is to provide a light-weight, compact and stable apparatus which functions in accordance with abnormal current flow from an insulated antenna resulting from electrical breakdown of the insulating material to produce a permanent visual indication of such electrical breakdown.

Other objects and features of the present invention will appear more fully hereinafter from the following detailed description when considered in connection with the accompanying drawing which discloses one embodiment of the invention. It is to be expressly understood however that the drawing is designed for purposes of illustration only and is not to be considered as a definition of the limits of the invention, reference for the latter purpose being had to the appended claims.

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The single figure of the drawing disclosed a diagram, in block and circuit form, of an apparatus embodying the principles of the present invention.

With reference more particularly to the drawing, a novel apparatus constructed in accordance with the principles of the present invention is disclosed therein in connection with an antenna 10, surrounded by any suitable high voltage insulating material 11, such as a film of polyethylene for example, and a radio receiver 12, of conventional construction, connected to the antenna 10 through a capacitance 13. The antenna 10 extends through and is supported in a suitable opening in a conductive surface 14 of the aircraft. One end of the antenna 10 extends into the envelope defined by the surface 14, as designated by broken lines 15. It is to be expressly pointed out that the insulating material 11 completely surrounds the antenna 10, including the portion thereof extending through the surface 14 and into the envelope defined thereby. The novel apparatus includes a resistance 16, a capacitance 17 and a series combination comprising a fuse 18 and a discharge device 19 inconnected to form a series-parallel circuit. The series-parallel circuit comprising the foregoing elements is connected in series with the antenna 10, through a resistance 20, and a point 21 on the surface 14.

During normal operation, that is, when radio energy is absorbed by the antenna 10 and the insulating material 11 is not electrically damaged, extremely small currents may flow from the antenna 10, in the order of one or two microamperes for example. However, when electrical breakdown of the insulating material occurs, due to the presence of high potentials adjacent the insulating material 11, moderate to extremely high currents will flow from the antenna 10. In view of the foregoing, the value of the resistance 16 is selected to be a high in order to bleed the small currents from the antenna to the point 21 during normal operation, but to produce a certain voltage across the resistance 16 when abnormal moderate to high, currents flow from the antenna 10. Therefore, the capacitance 17 receives a charge whenever electrical breakdown occurs in the insulating material 11. The discharge device 19 may take the form of a gaseous discharge tube or a spark gap or any other suitable device that is characterized with an extremely high internal resistance until a predetermined potential is applied thereto at which instant the internal resistance becomes extremely small. The discharge device 19 is calibrated to pass current

when a critical potential, equal to the charge of the capacitance 17, is applied thereto. Consequently, when the capacitance 17 is charged to maximum voltage the discharge device 19 is rendered conducting and the capacitance 17 is rapidly discharged since the internal resistance of the device 19 becomes extremely small when in a conducting state. The fuse 18 has a low resistance and is designed to burn out or fire at low current values. Since the internal resistance of the device 19 is small during the conducting state and since the resistance of the fuse 18 is low, the instantaneous current flow through the discharge circuit of the capacitance 17 will reach high values and the fuse 18 will fire. Electrical breakdown of insulating material surrounding an antenna is always accompanied with a minimum abnormal current flow from the antenna. Therefore, the value of the resistance 16 is selected so that sufficient potential to completely charge the capacitance 17 is always developed whenever abnormal current flow is present. Consequently, the fuse 18 will be fired whenever electrical damage exists in the insulating material 11.

As mentioned heretofore, one of the objects of the present invention is to provide a novel apparatus which operates in accordance with abnormal current flow from an insulated antenna resulting from electrical damage to the insulating material to produce a permanent visual indication indicative of such electrical damage. Such means, as shown in the drawing, includes the fuse 18 which is inclosed in a glass envelope 22. The fuse 18 and the glass envelope 22 are designed in such a manner so that a permanent decoloration of the glass envelope 22 occurs whenever the fuse 18 is fired. With such an arrangement the electrical condition of the insulating material 11 surrounding the antenna 10 is readily determined. This feature is particularly advantageous when the novel apparatus is employed in connection with aircraft radio installations since the condition of the antenna insulation may be readily and positively determined after each flight or at scheduled inspection periods.

The capacitance 13 and the resistance 20 function to isolate the novel apparatus from the receiver 12 so that operation of the discharge device 19 will not interfere with normal reception.

There is thus provided by the present invention a novel apparatus for determining and permanently indicating electrical breakdown of insulating material surrounding an antenna. With an apparatus constructed in accordance with the principles of the present invention it becomes possible to appreciate fully the advantages derived from utilizing insulated antenna since electrical damage to the insulating material is reliably determined and permanently indicated. Moreover, the novel apparatus is of small, compact and rigid construction and is therefore readily adaptable for use with aircraft radio installations.

Although only one embodiment of the invention has been disclosed and described herein it is to be expressly understood that various changes and modifications may be made therein without departing from the spirit of the invention as well understood by those skilled in the art. Reference therefore will be had to the appended claims for a definition of the limits of the invention.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

What is claimed is:

1. In combination, an antenna surrounded by insulating material, resistance means for developing a voltage in accordance with abnormal current flow in said antenna resulting from electrical breakdown of said insulating material, a capacitance for storing said voltage, a normally open discharge circuit for said capacitance, means responsive to a predetermined value of stored voltage for closing said circuit and means in said circuit responsive to current flow therein to produce an indication of said electrical breakdown of said insulating material.

2. In combination, an antenna surrounded by insulating material subject to high potential fields, a resistance connected to said antenna for developing a voltage in accordance with abnormal current flow resulting from electrical breakdown of said insulating material due to said high potential fields, a capacitance for storing said voltage, a normally open discharge circuit for said capacitance, voltage responsive means for closing said circuit and means included in said circuit responsive to current flow in said circuit for producing a permanent indication of electrical breakdown of said insulating material.

3. In combination, an antenna surrounded by insulating material subject to high potential fields, a resistance connected between said antenna and a point of low potential for developing a voltage in accordance with abnormal current flow resulting from electrical breakdown of said insulating material due to said high potential fields, a capacitance connected to said resistance for storing said voltage, a normally open discharge circuit for said capacitance, voltage responsive means for closing said circuit, a low resistance member in said circuit responsive to current flow therethrough for opening said circuit and means responsive to operation of the last-named means for producing a permanent indication of electrical breakdown of said insulating material.

4. In combination, an antenna surrounded by insulating material, a resistance connected to said antenna and a point of low potential for developing a voltage in accordance with abnormal current flow resulting from electrical breakdown of said insulating material, a capacitance connected to said resistance for storing said voltage, a normally open discharge circuit for said capacitance, voltage responsive means for closing said circuit, a low resistance fuse adapted to fire in response to current flow in said circuit and means responsive to firing of said fuse for producing a permanent indication of electrical breakdown of said insulating material.

5. In combination, an antenna surrounded by insulating material, a resistance connected between said antenna and a point of low potential for developing a voltage in accordance with abnormal current flow resulting from electrical breakdown of said insulating material, a capacitance connected in parallel with said resistance for storing said voltage, a normally open discharge circuit for said capacitance, voltage responsive means for closing said circuit, a low resistance fuse serially connected in said circuit adapted to fire in response to current flow in said circuit and a glass envelope surrounding said fuse and adapted to be effected by firing of said fuse to produce a permanent visual indication of said electrical breakdown.

6. In combination, a conductive enclosure constituting a portion of an aircraft, aperture means in said enclosure, an antenna system extending from within to without said enclosure through said aperture means, high voltage insulation means completely enclosing said antenna system from a point within the enclosure through said aperture means to without said enclosure, means developing a voltage in accordance with abnormal current flow in said antenna system resulting from electrical breakdown of said high voltage insulating means, capacitance means for storing said voltage, a normally open discharge circuit for said capacitance means, means responsive to said voltage for closing said circuit and means included in said circuit and responsive to current flow therein to produce an indication of said electrical breakdown.

7. In combination, an antenna surrounded by insulating material, a receiver fed from said antenna, means connected to said antenna for developing a voltage in accordance with abnormal current flow resulting from electrical breakdown of said insulating material, means for storing

said voltage, a discharge circuit for said voltage storing means, means responsive to current flow in said circuit for producing an indication of electrical breakdown of said insulating material and isolating means between said receiver and the first-named means.

8. In combination, an antenna surrounded by insulating material, a receiver fed from said antenna, means coupled to said antenna operative to determine and indicate electrical breakdown of said insulating material, and isolating means between said receiver and said means.

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