

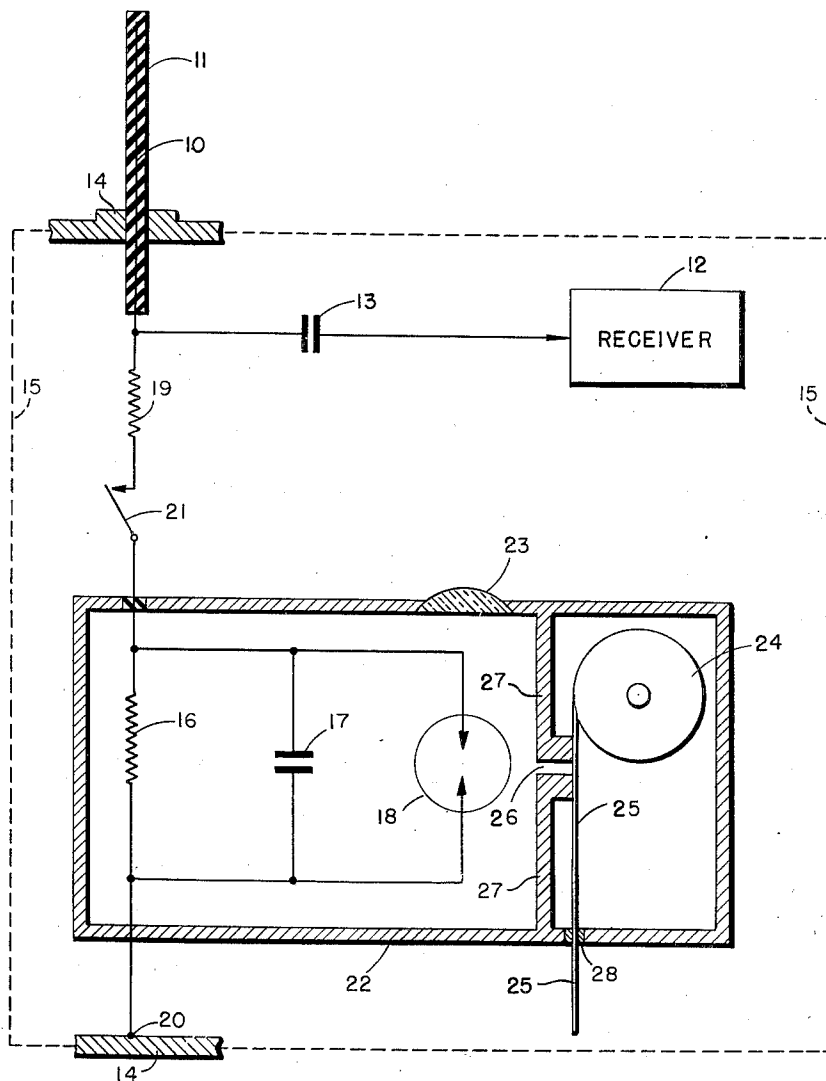
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INSULATION BREAKDOWN INDICATOR AND RECORDER

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INSULATION BREAKDOWN INDICATOR
AND RECORDER

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This invention relates to indicating and recording apparatus and more particularly to an apparatus for indicating and recording 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 realized when a non-insulated antenna is utilized. Therefore, in order to appreciate fully the advantages resulting from use of 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 producing an audio signal in response to electrical breakdown of insulating material surrounding an antenna which is fed to the radio receiver coupled to the antenna to indicate the electrical breakdown.

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

Still another object of the present invention is to provide a novel apparatus for detecting electrical breakdown of insulating material surrounding an antenna and for producing a permanent recording of such electrical breakdown.

Still another object is to provide a lightweight, 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 visual indication of the

electrical breakdown, to produce a permanent recording indicative of the electrical breakdown and which operates in conjunction with the radio receiver associated with the insulated antenna to produce an audio signal in the receiver to aurally indicate the 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.

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

With reference more particularly to the drawing, an 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 the 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 line 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 resistance 16, capacitance 17 and a discharge device 18 connected to form a parallel circuit. The parallel circuit of the foregoing elements is connected in series with the antenna 10 and a point 20 on the aircraft surface 14. The connection to the antenna 10 includes a manually operable switch 21, the purpose of which will appear more fully hereinafter.

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 will flow from the antenna 10, in the order of one or two microamperes for example. However, when electrical breakdown of the insulating material 11 occurs, due

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to the presence of a high potential field surrounding the antenna, 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 high in order to bleed the small currents from the antenna 10 to the surface 14 during normal operation, but to produce a certain voltage across the resistance 16 when moderate or high currents flow from the antenna. Therefore, the capacitance 17 is charged whenever electrical breakdown exists in the insulating material 11. The discharge device 18 may take the form of a gaseous discharge tube or a spark gap or any other suitable device that offers a high internal resistance until a predetermined critical potential is applied thereto at which instant the internal resistance becomes extremely small. The discharge device 18 is designed to conduct current when a critical voltage is applied thereto. Since the internal resistance of the discharge device 18 becomes extremely small at the instant the device becomes conducting the capacitance 17 will be rapidly discharged and a bright flash will be produced at the device 18 to positively indicate electrical damage of the insulating material 11. After the capacitance 17 is discharged the device 18 offers a high resistance and the voltage produced across the resistance 16 again charges the capacitance 17. Therefore, the discharge device 18 will periodically discharge at a rate approximately proportional to the current flow from the antenna 10, or to the extent of electrical damage to the insulating material 11. By choice of operating characteristics of the device 18 and by properly selecting the value of the capacitance 17, the discharge device 18 is made to periodically discharge at a frequency within the audio range. The apparatus therefore functions as a relaxation oscillator to produce an audio signal modulation on the radio frequency present that is applied to the receiver 12 and indicates to the operator that electrical breakdown exists in the antenna insulating material. Since the discharge rate of the device 18 is proportional to the degree of electrical damage to the insulating material 11 the operator may readily determine the extent of electrical damage from the frequency of the audio signal. The switch 21 is provided in order to disconnect the apparatus from the receiver after an audio signal indicative of electrical damage to the insulated antenna is received.

As mentioned heretofore, one of the objects of the present invention is to provide a novel apparatus for producing a permanent recording of electrical damage to insulation material surrounding an antenna. Such an arrangement is highly advantageous when utilized in connection with aircraft radio installations employing insulated antennae. With such means it can be readily determined whether or not the insulating material on the antenna was damaged during operation since the last inspection. As shown in the drawing, the foregoing means includes a light-tight casing 22 which incloses the resistance 16, the capacitance 17 and the discharge device 18. A red viewing screen 23 is provided in the wall of the casing 22 to allow observation of operation of the discharge device 18. Included within the casing 22 is a spool 24 carrying a roll of light responsive film 25, such as blueprint paper for example. The film 25 is passed over a light aperture 26 in a wall 27 which separates the discharge device 18 from the film supporting

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spool 24. The film 25 extends through a suitable light-tight opening 28 in the wall of the casing 22. Whenever the discharge device 18 is rendered conducting, in a manner described heretofore, the bright flash produced thereby impinges upon the portion of the film 25 covering the aperture 26 and thus produces a permanent indication on the film. When it is desired to determine the condition of the antenna insulating material, a sufficient length of the film 25 to include the portion thereof covering the aperture 26 is removed from the casing 22 and inspected.

There is thus provided by the present invention a novel apparatus for determining, indicating and recording 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 insulated antennae since electrical damage to the insulating material is immediately indicated and permanently recorded. Moreover, the apparatus disclosed and described herein 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, means for developing a voltage in response to abnormal current flow in said antenna resulting from electrical breakdown of said insulating material, means responsive to said voltage for producing an audio frequency signal and means for receiving said audio frequency signal.

2. In combination, an antenna surrounded by insulating material, a resistance connected to said antenna for developing a voltage in response to abnormal current flow resulting from electrical breakdown of said insulating material, capacitance means storing said voltage, means responsive to said voltage for producing a periodic electrical discharge at a frequency within the audio range and a receiver coupled to said antenna for reproducing said audio frequency signal.

3. In combination, an antenna surrounded by insulating material, a resistance connected to said antenna for developing a voltage in response to abnormal current flow resulting from electrical breakdown of said insulating material, means responsive to said voltage for producing a periodic electrical discharge signal, means controlling the last-named means for producing said periodic discharge at a frequency within the audio range and a receiver coupled to said antenna for reproducing said audio frequency signal.

4. In combination, an antenna surrounded by insulating material, resistance means coupled to the antenna for developing a voltage in response to abnormal current flow in said antenna resulting from electrical breakdown of said insulating

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material, capacitance means for storing said voltage, means responsive to said voltage to produce a flash discharge of said capacitance means and means responsive to said flash discharge for producing a permanent indication of electrical breakdown of said insulating material.

5. An apparatus for indicating electrical breakdown of insulating material surrounding an antenna comprising resistance means for developing a voltage in response to abnormal current flow in said antenna resulting from electrical breakdown of said insulating material, capacitance means for storing said voltage, means responsive to said voltage to produce a flash discharge of said capacitance means and light responsive means adjacent the last named means for producing a permanent indication of said electrical breakdown in accordance with said flash discharge.

6. An apparatus for determining electrical breakdown of antenna insulating material comprising an insulated antenna, a receiver fed by said antenna, a relaxation oscillator including an ionizable element coupled to the antenna and excited thereby upon insulation breakdown, said oscillator operable during excitation to intermittently load the antenna and modulate radio frequency fed to the receiver to effect aural indication, said ionizable means mounted for visual observation and light sensitive means to provide a permanent indication.

7. An apparatus for determining electrical breakdown of antenna insulating material comprising an insulated antenna, a receiver fed by said antenna, and a relaxation oscillator including an ionizable element coupled to the antenna

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and excited thereby upon insulation breakdown, said oscillator operable during excitation to intermittently load the antenna and modulate radio frequency energy fed to the receiver to effect aural indication.

8. In combination, an antenna surrounded by insulating material, means coupled to the antenna to develop a voltage in response to abnormal current flow in the antenna resulting from electrical breakdown of the insulating material and means responsive to the developed voltage for producing an indication of the electrical breakdown.

9. In combination, an insulated antenna and means producing an indication indicative of antenna insulation failure, said means comprising a resistance coupled to the antenna for developing a voltage in response to abnormal current flow in the antenna resulting from electrical breakdown of the antenna insulation, capacitance means for storing the developed voltage and means responsive to said voltage to discharge said capacitance means and produce an indication of insulation failure.

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