Feb. 11, 1941. G. H. BROWN 2,231,492

WIRE INSULATOR FOR TOWER ANTENNAS

Filed June 16, 1938

Fig. 1.

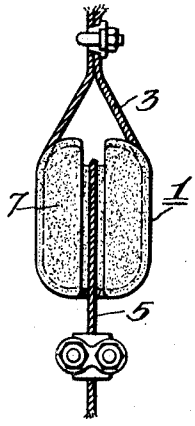


Fig. 2.

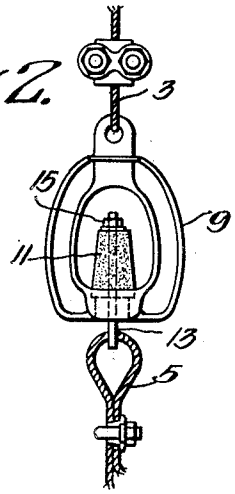


Fig. 3.

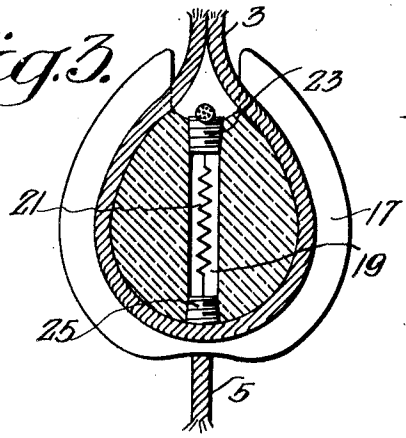


Fig. 4.

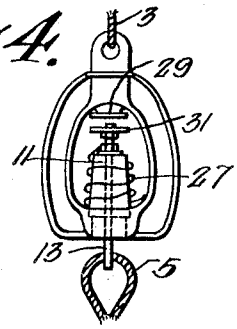


Fig. 5.

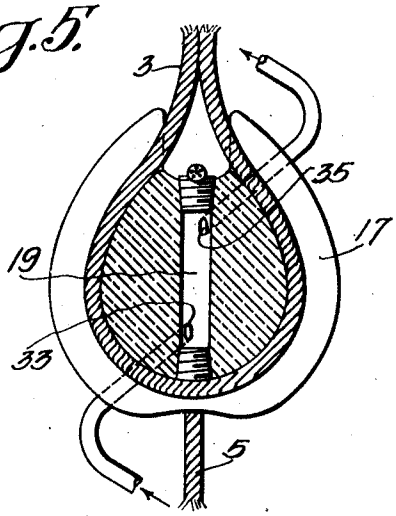
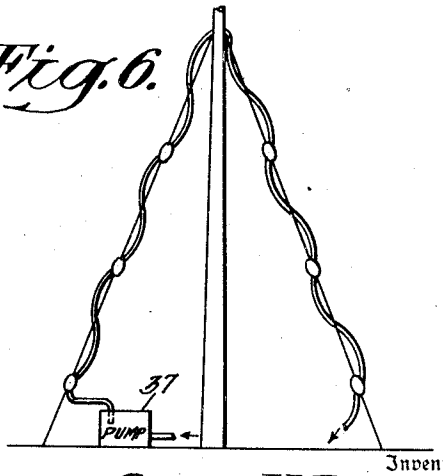


Fig. 6.



Inventor

George H. Brown

By J. Z. Luff

Attorney

Patented Feb. 11, 1941 2,231,492

UNITED STATES PATENT OFFICE

2,231,492

WIRE INSULATOR FOR TOWER ANTENNAS

George H. Brown, Haddonfield, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application June 16, 1938, Serial No. 213,975

4 Claims. (Cl. 250—33)

My invention relates to a means for insulating the guy wires of a tower antenna, and more particularly to insulators which prevent the accumulation of static charges on the guy wires.

It is well known that the guy wires of vertical radiators or antenna masts must be divided into short lengths to reduce the induction of radio frequency currents in the wires. The presence of such currents affects the antenna performance by absorbing power and by altering the radiation characteristics of the antenna.

I have found that the insulators used in the guy wires are not ordinarily subjected to high radio frequency voltages. However, the static voltages which are accumulated on the various sections of the guy wires are frequently great enough to cause a static or corona discharge across the insulator. It has been discovered that in some instances such a discharge creates an arc across the insulator which sufficiently reduces the resistance of the path around the insulator to permit the normal radio frequency voltage to continue the arc. Thus, while the radio frequency voltage is not usually high enough to cause an arc discharge across a guy wire insulator, an arc once started by a static or lightning discharge will be maintained by the radio frequency voltage. This frequently reaches serious proportions and may interrupt the operation of the transmitter.

It is possible to prevent the breakdown of insulators in this manner by preventing the accumulation of the static charge on the various guy wire sections. To accomplish this, a relatively high resistance is connected across each insulator. This resistance is of such a value that the normal radio frequency current through it does not appreciably affect the operation of the transmitter. The resistance, however, is sufficient to drain off the static charges and thus prevent the breakdown of the insulator.

It is, therefore, an object of this invention to prevent the breakdown of guy wire insulators due to the accumulation of static charges.

It is a further object of this invention to prevent the accumulation of static on guy wires.

It is a further object of this invention to provide an insulator which will have a high resistance at radio frequency but which will present a substantially low resistance to static charges.

A still further object of this invention is to provide means for preventing the excessive heating of such an insulator.

A further object of this invention is to provide means for establishing a temporary leakage path to ground for static charges.

This invention will be better understood from the following description when considered in connection with the accompanying drawing. Its scope is indicated by the appended claims.

Referring to the drawing,

Figures 1 and 2 illustrate the application of this invention to two well-known types of insulators,

Figure 3 is a cross-sectional view of an insulator having an internal resistor,

Figure 4 is a diagrammatic representation of one commercial type of insulator which is adapted to be tuned to parallel resonance at the transmitter frequency,

Figure 5 is a cross-sectional view of an insulator having an internal resistor and means for water-cooling, and

Figure 6 represents the application of such water-cooled insulators in an antenna installation.

The objects of this invention may be carried out in several different ways. Fig. 1 represents one practical solution as applied to the well-known "egg" insulator. Such an insulator is indicated at 1. The guy wires are respectively indicated at 3 and 5. The surface of the insulator is sprayed with a suitable metal so as to form a high resistance surface, as indicated by the stippling at 7. The metal is sprayed on the surface between the two guy wires in such a manner that a suitable resistance is obtained. This process of spraying a metal has been utilized in other applications and therefore need not be explained in connection with this invention.

Fig. 2 illustrates the application of this invention to a different type of insulator. A metallic ring 9 supports a piece of insulating material 11 which may be porcelain or the like. This porcelain has a truncated cone shape. An axially located hole is provided through which rod 13 may be inserted. The rod has a threaded end and is held in place by a nut 15 or the like. The guy wires 3 and 5 are connected respectively to the metallic ring 9 and the rod 13. The surface of the insulating material 11 is sprayed with a metal to form a high resistance path between the ring 9 and the rod 13 in the manner illustrated. It is to be understood that this invention is not limited to the particular types of insulators illustrated. Figs. 1 and 2 are merely illustrative of the application of this invention to two particular types of insulators.

It is preferable to protect the resistive surface

from the effects of the weather and the accumulations of dirt. Consequently, I have illustrated in Fig. 3 a preferred embodiment of my invention in which an "egg" type insulator 17 is shown in cross-section. The insulator is provided with an axially extending hole 19 within which may be inserted any suitable resistor 21. Alternatively, the inner surface may be sprayed in the manner described above. A pair of conductive plugs 23 and 25 are provided for the purpose of contacting the resistor and the guy wires. As indicated in this figure, the guy wires 3 and 5 contact the two plugs and exert pressure against them.

An embodiment of my invention is illustrated in Fig. 4 which differs somewhat in principle from that of the preceding illustrations. This principle is illustrated in connection with the ring type insulator which was shown above in Fig. 2. A conductive wire 27 is coiled around the insulator 11 so as to form an inductance. The two ends of the inductor are connected between the metallic ring 9 and the rod 13. This inductor, together with the inherent capacitance of the insulator, is resonant at the frequency of the transmitter. If the normal capacity of the insulator is insufficient, it may be increased, for example, by means of a pair of plates 29 and 31. The first plate 29 is connected to the ring 9. The second plate 31 is adjustably mounted on the threaded portion of the rod 13. When tuned to resonance, this insulator then represents a low impedance to static charges but represents an extremely high impedance to the radio frequency voltages present on the guy wires. Static charges are therefore effectively prevented from accumulating and yet sufficient insulation is obtained at radio frequencies.

In the case of transmitters which operate at extremely high power it has been found that there may be considerable heat dissipation in the resistor. Also in localities which are subjected to severe electrical storms, the dissipation of static charges may be nearly continuous over a period and therefore may generate a great amount of heat. It therefore becomes desirable to provide a cooling means for such an insulator.

In the case of transmitters which operate at extremely high power it has been found that there may be considerable heat dissipation in the resistor. Also, in localities which are subjected to severe electrical storms, the dissipation of static charges may be nearly continuous over a period and therefore may generate a great amount of heat. It therefore becomes desirable to provide a cooling means for such an insulator.

This may be accomplished, for example, as illustrated in Fig. 5. An insulator 17 is shown in cross-section. As in Fig. 3 an axially located opening 19 is provided in which a resistive element may be inserted. In addition, a pair of openings 33 and 35 are provided by which a cooling fluid may be circulated through the aperture. The cooling fluid may be passed successively through several insulators. For example, Fig. 6 illustrates two guy wires of an antenna installation in which the cooling fluid is successively passed up through the insulators in one guy wire and down an adjoining guy wire. A pump 37 is provided for the circulation of the cooling fluid.

It is also feasible in a scheme of this sort to utilize the cooling fluid as the resistance by which the static charge is dissipated. It is known that impurities in water, for example, give it a certain conductivity. By controlling the degree of conductivity of the water, or other cooling fluid, the resistance of the water column within the insulator can be made sufficient to permit the static discharge to leak off the guy wire to ground. Such a system has the advantage that the water need only be circulated when necessary and that, therefore, when the conditions are satisfactory no radio frequency power loss need be experienced.

The resistive element which has been indicated in the several drawing above may conveniently take the form of Thyrite, or other material having similar properties. Thyrite has an extremely high resistance at low voltages, but becomes a good conductor at high voltages. Thus, under ordinary operation, a high resistance is presented to the radio frequency voltages in the guy wires but in the presence of a high voltage static charge the resistance is reduced, and when the static charge is removed the insulating property of the Thyrite is reestablished.

I claim as my invention:

1. An insulator for preventing the accumulation of a static charge upon a first conductor having a high radio frequency potential with respect to a second conductor comprising a dielectric material for insulatingly holding said conductors in fixed spacial relation, and an inductor and a capacitor connected in parallel between said conductors and resonant at said radio frequency, said second conductor being at ground potential, whereby static charges induced on said first conductor are passed off directly to ground.

2. An insulator for preventing the accumulation of a static charge upon a first conductor which is operated at a high radio frequency potential with respect to ground, comprising a dielectric material for insulatingly holding said first conductor in a fixed relation to a second conductor which is at ground potential, and an inductor and a capacitor connected in parallel between said conductors and resonant at said operating frequency, said second conductor being at ground potential so that static charges induced on said first conductor pass immediately to ground.

3. A guy wire insulator for a radio transmitting antenna comprising a dielectric member for insulatingly connecting adjacent ends of sections of said guy wire, and an inductor and a capacitor connected in parallel between said adjacent ends of said guy wire sections, and resonant at the operating frequency of said antenna, whereby a path between said sections is provided for static charges and stray currents of a frequency other than said operating frequency.

4. A guy wire insulator for a radio transmitting antenna comprising a dielectric member for insulatingly connecting adjacent ends of separate sections of said guy wire under tension, one of said sections being at a higher radio frequency potential than the other of said sections, and an inductor and a capacitor connected in parallel between said adjacent ends and mounted on said dielectric, the reactances of said inductor and capacitor being equal at the operating frequency of said antenna, whereby a path between said separate sections is provided for static charges and stray currents of a frequency other than said operating frequency.

GEORGE H. BROWN.