March 29, 1955 J. W. McGEE 2,705,256

HIGH VOLTAGE INSULATOR

Filed July 18, 1947

FIG. 1

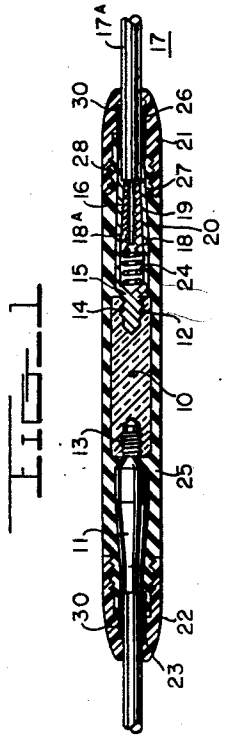


FIG. 2

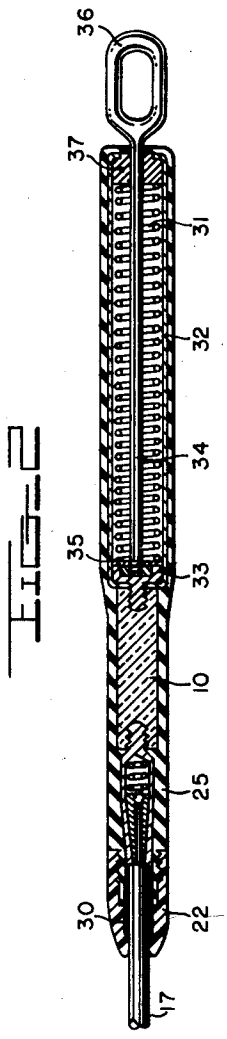
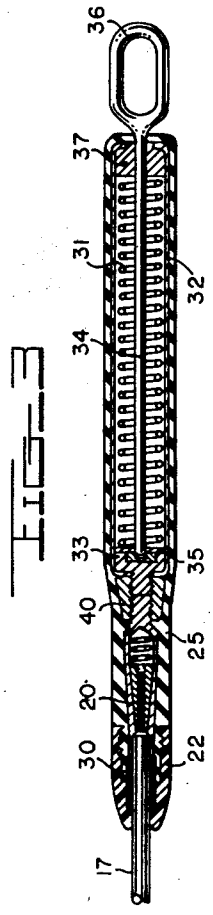


FIG. 3



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HIGH VOLTAGE INSULATOR

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This invention relates to electrical insulators and in particular to electrical insulators offering both high dielectric and structural strengths.

In the operation of radio equipment a most frequently encountered and troublesome problem is that of static interference. This phenomenon is especially noticeable in aircraft installations, and in particular during flights through areas of precipitation. Under this circumstance the aircraft will become highly electrified, or charged to a potential where corona discharges will occur at various points on the aircraft. When these discharges occur at such points on the aircraft as to be coupled to the antenna the attendant noise pulses are generally so severe as to render the associated radio equipment useless.

In general, most aircraft antenna structure and especially wire type antennae and associated hardware (strain insulators, tension insulators, antenna masts, etc.) are by necessity streamlined or formed with surfaces having small radiuses of curvature. Components having these general physical characteristics frequently go into a corona discharge before any other point on the aircraft. Consequently, the antenna itself and associated hardware are often the most prolific sources of static disturbance.

One effective solution to the suppression of corona from the antenna and associated parts has been to cover the antenna and associated parts with a suitable dielectric sheath. It is to be noted, however, that in order for this solution to be effective, the dielectric sheath covering the antenna and the associated components must have high dielectric strength and must completely cover the antenna and components. The proposition of insulating these components, to repeat, must be 100% and nothing less.

It is an object of this invention to provide an insulator suitable for use with insulated aircraft antennae.

It is another object of this invention to construct a high voltage insulator having both high dielectric strength and high tensile strength.

It is another object of this invention to provide an insulator of the foregoing character which is both inexpensively and easily manufactured.

It is another object of this invention to provide a high voltage insulator having smoothly faired contours suitable for use on aircraft antenna.

It is another object of this invention to provide a novel high voltage strain insulator.

It is another object of this invention to provide a novel high voltage tension insulator.

Other objects and features of the present invention will become apparent upon a careful consideration of the following detailed description when taken with the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view of one embodiment of the invention, and

Figs. 2 and 3 are longitudinal sectional views of two different types of tension insulators constructed according to the teachings of the present invention.

Referring to Fig. 1, the insulator exemplified in this figure is one which is suitable for use as a strain insulator. Included in the assembly is an elongated inner dielectric member **10** which may be (for example) cylindrical in shape and which, as will hereinafter be apparent, is selected to provide high tensile strength as well as high dielectric strength. A dielectric material known as "steatite" has been found to be admirably suited to this purpose. Attached to each end of the inner dielectric member **10** is a terminal clamp, or connector, indicated in general at **11** and **12** respectively. In this embodiment, terminal clamps **11** and **12** are attached, such as by the threaded engagements indicated at **13** and **14** to opposite ends of the inner member **10**, and extend in opposite directions from and co-linearly with said inner member. Both terminal clamps **11** and **12** are identical in construction. Accordingly, the constructional details of only one of the clamps, **12**, which is herein shown in section, will be given.

The terminal clamps comprise a chuck assembly having a generally tubular outer metallic housing **16**, formed with an internal diameter of a suitable dimension at its base **15** and tapering to a smaller diameter at its throat **27**. The mouth, or entrance, of the outer housing **16** is internally recessed to a larger diameter as illustrated at **28** to accommodate the insulating sheath **17***a* of the conductor **17** to be held by the terminal clamp. Inserted within the outer housing **16** are a pair of elongated semi-cylindrical metallic jaws **18** and **18***a* which have an external surface tapered to conform to the internal taper of the outer housing **16**. The opposing faces of the jaws **18** and **18***a* are concaved and formed with a series of teeth **19** arranged to grip the bare conductor wire **20** of the conductor **17** as the same is inserted into the clamp. To insure positive gripping of the conductor wire by the metallic jaws **18** and **18***a* the latter are urged toward one another into a biting contact with the conductor wire **20** by means of the joint action of the internally tapered surface of the outer housing **16** and a compression spring **24** inserted between the base of the jaws **18** and **18***a* and the base of the outer housing **16**.

It will be noted that with such construction, the terminal clamps provide easy entrance into the chuck assembly. Once the conductor is inserted therein, however, the same is locked into engagement. Tension on the conductor merely operates to increase the biting engagement of the jaws with the conductor.

In order to render the above described assembly suitable for use as an ultra high voltage insulator having the requirements hereinabove set forth, the inner dielectric member **10** and the metallic terminal clamps **11** and **12** are covered (preferably by moulding) with a dielectric sheath **25** having high dielectric strength. A dielectric material found suitable for this purpose is known as "polyethylene." The end extremities of the outer dielectric insulating sheath **25** are reduced in diameter and externally threaded to engage a pair of bullet shaped end caps **21** and **22**. Caps **21** and **22** are preferably made from a suitable plastic material, such as "lucite," and are internally threaded to engage the threaded ends of the outer dielectric insulation sheath **25**, and are provided with axial openings formed in their tips to permit the passage of conductors **17** therethrough. In addition, end caps **21** and **22** are shaped, tapered to a small diameter at their tips, to provide maximum smoothness and streamlining of the exterior surface of the insulator assembly.

The adjacent ends of the outer dielectric insulating sheath **25** and the end caps **21** and **22** are internally recessed, as indicated at **30**, along a portion of their respective lengths to accommodate respective elongated cylindrical packing glands, **23** and **26**. These glands are made of rubber-like material such as "polyisobutylene" having good dielectric strength, and are so dimensioned in thickness and length, with respect to the internally recessed portions **30** into which they fit as to compress into a snug fit with the insulating sheath **17***a* of the associated conductor **17** when the end caps are threaded down tightly onto the outer insulating sheath **25**.

In the assembling of the end caps **21** and **22** it is important to eliminate all air pockets in the channel, or internally recessed portions **30**, of the end caps and outer sheath **25**. To this end a semi-solid, or jelly-like, dielectric may be injected or applied to the internally recessed portions of the outer dielectric sheath **25** and the end caps **21** and **22** before assembling.

An alternate embodiment of the invention is illustrated in Fig. 2. In this figure the insulator unit is designed to maintain conductor **17** connected thereto under

tension. The reference numerals employed herein and common to Fig. 1 designate components of the insulator which are similar to those employed in the construction of the insulator of Fig. 1 and further description thereof is believed unnecessary. In this embodiment one of the terminal clamps **12** has been replaced by a solenoid spring assembly **31** enclosed within a suitable metallic tubular housing **32** which is threadably attached at one end by means of end plug **33** to the inner dielectric member **10**. Coaxially disposed within the solenoid spring **31** is a suitable metallic plunger rod **34** which carries at its end adjacent the inner insulator **10** a suitable washer and nut assembly **35** for engagement with the spring **31**. The opposite extremity of the rod **32** is provided with an eyelet **36** formed therein to provide a suitable external connection for the insulator. Positioned at the end of the assembly within the tubular spring housing **32** is a second end plug **37** arranged with a central bore serving as a guide for the plunger rod **34**. In this construction tension applied to either the conductor **17** or the plunger **34** serves to compress the spring **31** between the end plug **37** and the washer **35** to thereby maintain conductor **17** taut.

As in Fig. 1 the inner dielectric member **10**, the chuck assembly **11**, and the spring tension unit are all covered with a dielectric sheath **25** which is adapted to provide high dielectric strength.

A variant embodiment of the tension insulator described above is illustrated in Fig. 3. This insulator assembly is useful in instances where the conductor **17** is to be grounded. To this end the inner elongated dielectric member **10** is replaced by a tapered metallic collar **40**. Collar **40** is internally threaded to provide a screw threaded engagement with the chuck assembly **11** and the end plug **33** of the spring tension assembly. With this arrangement there is provided a direct conductive connection between the conductor wire **20** of conductor **17** and the plunger rod **34**.

Although I have shown and described only limited and specific embodiments of the present invention, it is to be understood that I am fully aware that there are many modifications possible thereof without departing from the spirit 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. A high voltage insulator comprising an elongated inner dielectric member of high mechanical strength, connector means attached to each end of said inner member and extending away therefrom, an outer dielectric sheath of high dielectric strength covering said inner member and said connector means, said outer sheath being provided with an opening formed therein adjacent each of said connector means and non-conducting cap members threadably positioned over each of said openings, each of said caps being provided with an opening formed therein through which an insulated wire may pass for engagement with said connector means.

2. A high voltage insulator comprising an elongated inner body member of high mechanical strength, connector means attached to each end of said inner member and extending away therefrom, an outer dielectric sheath of high dielectric strength covering said inner member and said connector means, said outer sheath being provided with an opening formed therein adjacent each of said connector means, and non-conducting cap members threadably positioned over each of said openings, each of said caps being provided with an opening formed therein through which an insulated wire may pass for engagement with said connector means, said cap members and said openings in said outer sheath being provided at their engaging ends with similar internally recessed portions, and a resilient insulating bushing adapted for insertion in said internally recessed portions whereby tightening of said caps will cause said bushings to be compressed into a snug fit with said insulated wire.

3. A high voltage insulator comprising a self-locking connector means, an elongated spring loaded plunger assembly, said plunger formed at one extremity thereof with a suitable anchoring terminal, means mechanically joining said connector means to said plunger assembly whereby movement of said connector is opposed by the action of said plunger assembly, and an outer dielectric sheath of high dielectric strength covering said connector and plunger assembly, said outer sheath being provided at the position of said connector with a threaded opening, and a non-conducting cap member adapted to threadably engage said threaded opening of said outer sheath, said cap being provided with an opening therein through which an insulated wire may pass for engagement with said connector means.

4. A high voltage insulator for an insulated wire antenna comprising, a main body portion, a self locking wire connector device attached to said body portion, an insulating sheathing having high dielectric strength covering said body portion and said connector device, an opening formed in said sheathing at the location of said connector for receipt of the antenna wire, and an insulating cap member surrounding the opening in said sheathing and having a bore therein through which the insulated antenna wire must pass for engagement with said connector device.

5. A high voltage insulator for an insulated wire antenna comprising, a main body portion, a connector device attached to said body portion, an insulating sheathing having high dielectric strength formed over said body portion and said connector device, an opening formed in said sheathing at the location of said connector device through which the antenna wire may be threaded for engagement with said connector device, and an insulating cap member attached to the sheathing and surrounding the opening in said sheathing and having a bore therein through which the insulated antenna wire must pass for engagement with said connector device.

6. A high voltage insulator for an insulated wire antenna comprising, a main body portion, a connector device attached to said body portion, an insulating sheathing having high dielectric strength formed over said body portion and said connector device, an opening formed in said sheathing at the location of said connector device through which the antenna wire may be threaded for engagement with said connector device, and a dielectric sealing means surrounding the opening in said sheathing, said sealing means having a bore therein through which the insulated antenna wire must pass for engagement with said connector device.

7. An insulator for use in anti-static antenna systems, said insulator comprising an inner dielectric member of high mechanical strength, terminal connector means secured at opposite ends of said inner dielectric member and extending therefrom along the longitudinal axis of said insulator, said connector means including means for attaching the ends of insulated wires, and an outer dielectric sheath of high dielectric strength covering said inner dielectric member and said connector means and having in its opposite ends openings extending along said longitudinal axis and communicating with said connector means for snugly receiving such insulated wires for attachment to said connector means.

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