Aug. 27, 1935. J. R. McFARLIN 2,012,689

DEVICE FOR AND METHOD OF PROTECTING LIGHTNING ARRESTERS AND THE LIKE AGAINST MOISTURE

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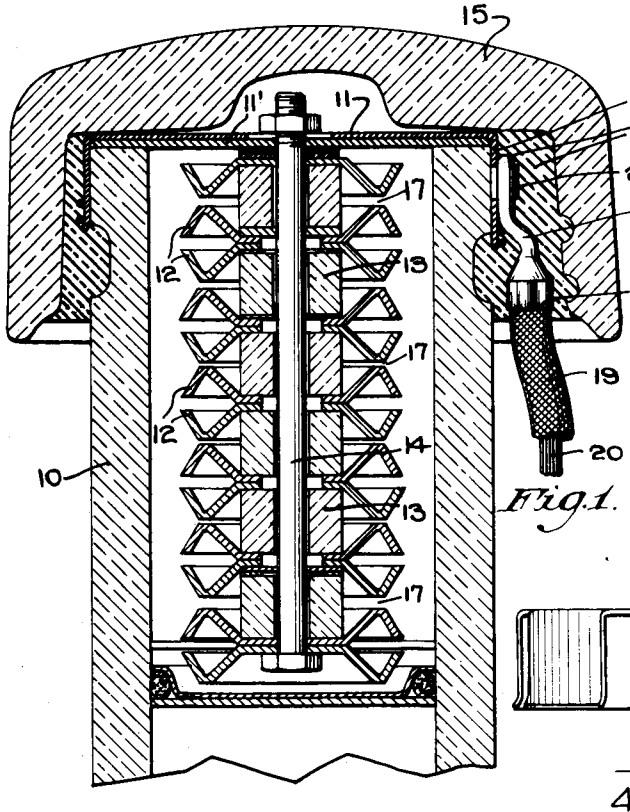


Fig. 1.

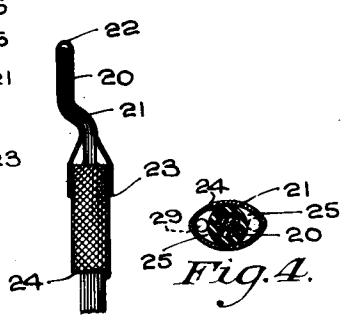


Fig. 3.

Fig. 4.

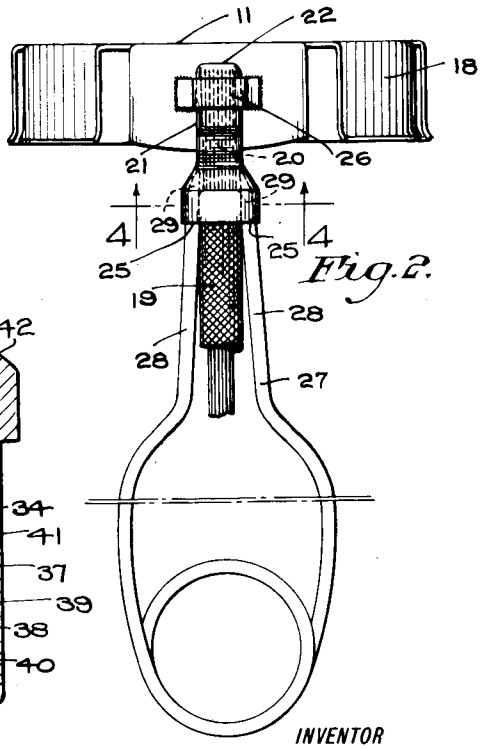


Fig. 2.

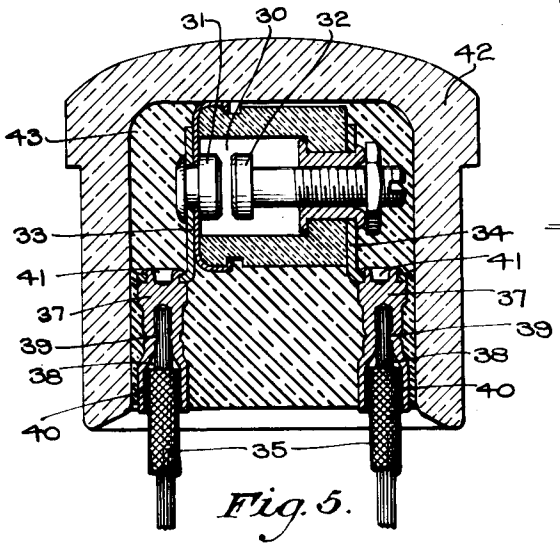


Fig. 5.

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DEVICE FOR AND METHOD OF PROTECTING LIGHTNING ARRESTERS AND THE LIKE AGAINST MOISTURE

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6 Claims. (Cl. 173—324)

This invention relates generally to lightning arresters and the like and more particularly to a means for and method of preventing the passage of moisture into the arrester via the line lead connecting the arrester to the phase conductor.

In a number of instances it has been found that lightning arresters, while in service, have been the cause of more or less serious radio interference and upon investigating this matter I have discovered that in many cases the disturbing effect upon radio reception has been due to the presence of moisture within the arrester. Not only has it been found that moisture-laden arresters have been the cause of radio disturbances but also that the presence of moisture within the arrester sooner or later results in the failure thereof, this being due to the fact that the moisture upon coming into contact with the arrester spark gap electrodes form upon the latter electrically conductive salts of the metal of which the electrodes are formed whereby the gaps between the electrodes are substantially decreased, if not entirely bridged. Also, in that type of arrester wherein in addition to the air gaps other characteristic elements are employed, such as a discrete crystalline conductive mass, or bonded conductive material in the form of rods, plates or blocks, or other conductive material possessing the required characteristics for use in lightning arresters, the presence of moisture within the arrester eventually affects the characteristic element to such extent as to interfere with the normal operation of the arrester, if not to render it wholly inoperative, this being primarily due to the fact that when the characteristic element of the arrester is moist a definite electrically conductive current leakage path is provided by which current may freely pass through the arrester. The current leakage paths so produced by the moisture present within the arrester not only give rise to the "frying" effect which is so disturbing to radio reception but also render the arrester incapable of performing with maximum efficiency its intended functions.

Inasmuch as in practically all arresters the interiors thereof are effectually sealed against the deleterious effects of the elements, the most probable way for moisture to enter the arrester is by way of the conductor or conductors leading to the electrode terminals of the arrester. In certain installations the arresters are so mounted that the upper end thereof is below the power line to which it is connected and in such instances it will be apparent that if the insulation of the arrester line lead is defective or if the connection between the line lead and the power line is not completely moisture-proof, water will enter the line lead and will flow downwardly through the stranded wires thereof and into the body of the arrester. On the other hand, in those installations where the line-lead connection to the arrester is above the line lead connection to the power line, water can still enter the arrester upon being gradually absorbed by the paper, cloth or other serving on the line lead with the result that it reaches the conducting wires thereof and through the latter is conducted into the body of the arrester; or by capillary attraction the water may find its way into the arrester via the stranded wire core of the line lead; or by suction caused by a rapid chilling of the air within the arrester—as by a rain storm occurring on a hot day—moisture present in the stranded core of the line lead may be drawn into the arrester body.

While the foregoing possibilities of moisture entering the interior of the arrester body might be lessened, if not entirely avoided, by moisture-proofing the connection between the line-lead and the power line and by providing a moisture-proof insulating coating for the line-lead, it has been found that even the highest type of moisture-proof connections and conductor insulations eventually deteriorate in use to such extent that they no longer exclude the passage of water or moisture therethrough. Furthermore, practical exigencies demand the use of mechanical connections between the line-lead and the power line as cannot be conveniently taped or otherwise rendered moisture proof and such connections by their very nature afford a principal inlet for water to travel via the line lead into the arrester.

From the foregoing it will be seen that the remedy for preventing the passage of moisture into the interior of the arrester, to be permanently effective, must consist in some other expedient than that of rendering temporarily moisture-proof the line-lead insulation and the connection between the line-lead and the power line. It is to provide this permanently effective expedient that the present invention has been developed, it being among the objects of the invention to provide a means for and method of permanently and effectually precluding the possibility of moisture entering the arrester via the lead line which connects the arrester to the phase conductor or power line.

A more specific object of the invention is to provide in a lightning arrester or the like, a moisture resisting cap which is adapted to be secured to the arrester end of the line lead in such man-

ner that moisture which might reach said cap via the stranded wire core of the line lead will not only be prevented from entering the arrester but will be directed outwardly therefrom instead, thus insuring against the entry of moisture into the body of the arrester and at the same time providing a definite outlet for any moisture or water which may have found its way into the line lead.

Other objects of the invention and advantages resulting therefrom will be apparent more fully hereinafter.

The invention consists substantially in the combination, construction, location and relative arrangement of parts, all as will appear more fully hereinafter, as shown in the accompanying drawing, and as finally pointed out in the appended claims. In the said accompanying drawing:—

Figure 1 is a vertical sectional view of a lightning arrester assembly wherein the line lead connected thereto is equipped with a moisture resisting cap constructed and arranged in accordance with and embodying the principles of the present invention;

Figure 2 is a side elevational view of the upper terminal member of the arrester showing the cap-equipped line lead connected thereto as well as the device employed during the operation of sealing the arrester hood in position for producing the desired moisture outlets in the outer extremity of the moisture resisting cap;

Figure 3 is a vertical sectional view of the arrester line-lead as equipped with its moisture resisting cap;

Figure 4 is a sectional view taken on the line 4—4 of Figure 2; and

Figure 5 is a vertical sectional view of an arrester of the protective gap type showing a modified form and arrangement of means for preventing the passage of moisture into the interior of the arrester via the conductors connected to the electrode terminals thereof.

Referring now to the drawing, it will be observed that the invention has been illustrated in its application to two different types of lightning arresters, one such type being shown in Figure 1 and the other in Figure 5. The principles of the invention, insofar as respects means for and method of excluding the entry of moisture or water into the interior of the arrester body, is the same in each case, and it will be understood that the invention is applicable to other types of lightning arresters and the like than those herein illustrated and to other electrical devices wherein the presence of moisture within the interiors thereof is desired to be prevented. Referring now more particularly to that type of lightning arrester the upper portion of which is shown in Figure 1, it will be observed that it comprises a non-conducting substantially cylindrical casing or main body portion 10, usually of porcelain, upon the top end of which is provided a metallic closure cap 11, constituting the upper terminal member of the arrester, this member 11 being arranged in overlying relation to an electrode supporting plate 11'. Suspended from the central point of the plate 11' are a plurality of vertically spaced pairs of dished spark gap electrodes 12, each pair of these electrodes being maintained in predeterminedly spaced relation by the respective insulators 13. These insulators 13 and the electrodes 12 are maintained in the assembled relation shown by an insulating tie rod 14. The upper end of the arrester assembly is further provided with a porcelain cap 15 which is preferably secured in place by means of a sealing compound 16 introduced into and filling the space between it and the exterior of the casing 10. It is believed that the foregoing description of the lightning arrester shown in Figure 1 will be sufficient for the purposes of explaining the present invention. Should further information be desired respecting the details of construction and operating characteristics of this type of arrester, reference is made for such additional information to my earlier Letters Patent No. 1,763,667, granted June 17, 1930.

As has been previously set forth, and as will be apparent from an examination of the arrester construction shown in Figure 1, the most probable way for moisture to enter within the interior of the arrester body 10, assuming that the hood or cap 15 has been properly sealed to the body 10, is by way of the line lead connecting the terminal cap 11 of the arrester to the power line or phase conductor (not shown). Heretofore and prior to this invention the arrester end of the line lead has been soldered or otherwise secured to the depending flange 18 of the terminal cap 11, the said end of the line lead being stripped of its insulation to afford the desired metallic contact between the conducting core of the line lead and the terminal cap 11. It was found that when the bared end of the line lead was so connected to the terminal cap 11 of the arrester, any moisture which found its way into the interior of the line lead eventually passed via the line lead into the interior of the arrester body, this being due to the fact that no provision was made for preventing the free passage of the moisture beyond that end of the line lead which was connected to the terminal cap 11 of the lightning arrester. Not only does the presence of the moisture within the interior of the arrester seriously affect its normal operation, but also in those instances wherein the bared end of the conductor is soldered to the terminal member of the arrester it has been found that moisture reaching the soldered connection combined with the soldering flux to such extent that corrosion was set up, this corrosion tending to creep into the interior of the arrester with the result that the electrodes eventually became corroded, thus causing failure of the arrester. It is to prevent the passage of moisture or water beyond the end of the conductor which is connected to the arrester terminal and thence into the interior of the arrester body and to prevent the moisture from reaching the soldered connection between the conductor and the arrester terminal that the present invention has been developed and the means for and method of attaining this objective will now be described.

In carrying out the invention, the arrester end of the line lead 19 which connects the terminal cap 11 to the power line or phase conductor (not shown) is stripped of its insulation whereby to expose the conducting core 20 of the line lead (see Figure 3). The bared end 20 of the line lead is then provided with a drawn copper sleeve 21 the outer end of which is closed, as at 22. Preferably, this sleeve is drawn from a copper disc and is of such length that the open end 23 thereof fits over and embraces the insulation 24 of the line lead. The bared end 20 of the line lead is clamped within the sleeve 21, a substantial portion of the body of the latter being flattened in this clamping operation as shown more particularly in Figures 2 and 3. The open end of the

sleeve 21 is somewhat greater in transverse dimension than the diameter of the insulated line lead so as to provide a space or spaces 25 between the enlarged open end of the sleeve 21 and the insulation 24 of the line lead.

The line lead 19 thus equipped with its terminal sleeve 21 is secured to the depending flange 18 of the terminal cap 11 of the arrester in any desired manner. In the particular type of lightning arrester shown, the depending flange 18 is provided with a struck out portion 26 to form a socket or the like into which the closed end of the sleeve 21 is projected and permanently soldered in position.

The operation of securing the sleeve-equipped line lead to the terminal cap 11 of the arrester is preferably completed before the terminal cap 11 is operatively secured to the arrester body 10. After the terminal cap 11 is located in position as shown in Figure 1, the porcelain cap or hood 15 of the arrester is secured in the position shown by the use of the sealing compound 16 which is introduced within the annular space formed between the outer surface of the body 10 and the inner surface of the hood 15. In filling this annular space with the sealing compound, the latter is poured to a depth that preferably covers the enlarged end of the sleeve 21. In order, however, to maintain clear the space or spaces 25 between the insulation of the line lead and the portion of the sleeve which embraces said insulation, a device is employed of the character shown in Figure 2, this device, designated generally by the reference numeral 27, being in the form of a tool having a pair of spring-pressed prongs 28 the sharpened extremities 29 of which are respectively inserted within the spaces 25—25 aforesaid (see Figures 2 and 4). The prongs 28—28 are so inserted into the spaces 25—25 aforesaid just before the sealing compound is poured into the space between the body 10 and the hood 15, the prongs being withdrawn only after the sealing compound has hardened, it being apparent that when the prongs are thus removed one or more outlets are provided which communicate freely with the space surrounding the bared end of the line lead embraced within the sleeve 21. From the foregoing it will be apparent that any moisture or water which might travel through the line lead toward the sleeve equipped end thereof will be prevented from passing into the interior of the lightning arrester by the sleeve 21 and will instead be directed outwardly from the interior of the sleeve through the outlets provided in the manner just described.

In Figure 5 there is illustrated another type of electrical protective device known as a ground gap. In this type of device it is also desirable to provide means for excluding the possibility of moisture entering the interior thereof because such moisture will eventually establish undesirable current leakage paths across the gap 30 formed between the spaced electrodes 31 and 32. In this type of device wherein the electrodes 31 and 32 are respectively provided with terminal elements 33 and 34 the conductors 35 and 35 are respectively connected to the terminal members by means of the conductor terminal sleeves 37. These sleeves 37 are each provided with axially extending sockets 38 within which the bared ends of the conductors 35 are projected. Preferably, the bared ends of the conductors 35 are permanently secured within the terminal sleeves by crimping the latter, as at 39, or by soldering, if desired. The outer end of the terminal sleeve socket 38 is enlarged, as at 40, to freely receive the insulated portion of the conductor, the internal diameter of the enlarged portion 40 of the conductor receiving socket being slightly greater than the external diameter of the insulated portion of the conductor embraced therewithin, thus providing a space between the external surface of the insulation of the conductor 35 and the internal surface of the terminal sleeve embracing the same.

The inner ends of the terminal sleeves 37 are permanently secured, as at 41, to the terminal members 33 and 34 of the ground gap device. The electrode assembly, which includes the terminal sleeves 37 and the conductors connected to the latter, is secured within the insulating body 42 of the device by means of a sealing compound 43. In pouring this sealing compound 43 into the body 42, it will be observed that the compound is filled to a depth just short of the outer extremities of the terminal sleeves 37—37, thereby leaving clear the space between the insulation of each conductor and the inner wall of its respective terminal sleeve. Any moisture which might pass via either of the conductors 35 toward its terminal sleeve 37 will be definitely stopped by the latter and returned outwardly of the ground gap device by way of the space provided between the insulation of the conductor and the embracing portion of the terminal sleeve 37. In principle, the operation of the terminal sleeve as employed in connection with the ground gap device of Figure 5 is identical with that of the terminal sleeve 21 described in connection with the lightning arrester of the type shown in Figure 1.

It will be understood, of course, that the invention is susceptible of various changes and modifications without departing from the general principles or real spirit thereof and it is accordingly intended to claim the same broadly, as well as specifically, as indicated by the appended claims.

What is claimed as new and useful is:—

1. A method for excluding the entry of moisture within the interior of a lightning arrester which consists in stripping one end of the line lead of its insulation, in equipping the stripped end of the line lead with a fitting having a closed end, in electrically connecting said fitting to a terminal member of the arrester, and in providing a passage between the outer surface of the line lead insulation and the internal surface of said fitting through which moisture passing via the line lead to said fitting may be discharged from the latter.

2. A method of rendering moisture-proof the interior of a lightning arrester which consists in interposing a moisture resisting baffle between the arrester terminal and the terminal end of a conductor adapted for connection thereto, in embedding the connection including said moisture resisting baffle in a sealing compound, and in providing a moisture discharge outlet leading from the interior of said baffle to a point exterior of said sealing compound.

3. In a lightning arrester having a chambered body, in combination with a terminal member thereof disposed within said body, an insulated conductor adapted to be connected to said terminal member, the connecting end of said conductor being stripped of its insulation, a sleeve having one end thereof closed and secured to the bared end of the conductor with the open end of said sleeve extending over the insulation of the conductor and in spaced relation thereto, and means for securing said sleeve to said terminal member whereby said sleeve constitutes a

moisture resisting baffle from the interior of which accumulated moisture may be discharged by way of the space afforded between the conductor insulation and the embracing portion of the sleeve, and a sealing compound introduced within said chambered body and embracing said sleeve to seal the chamber against the entry of moisture therein, said sealing compound being arranged relatively to the baffle so as not to seal the interior thereof.

4. In a lightning arrester, in combination with a terminal member thereof, an insulated conductor adapted to be connected to said terminal, an electrically conductive sleeve adapted to be fitted over the bared end of said conductor, the outer extremity of said sleeve being closed and the inner extremity thereof being open and arranged in embracing relation with respect to and spaced from the insulated portion of the conductor, and sealing means within which said terminal member and sleeve are imbedded, said means being arranged to provide atmospheric communication with the interior of the sleeve for effecting the discharge of moisture from within the sleeve outwardly through the open end thereof.

5. In combination with the terminal member of an electrical device, a conductor, one end of which is adapted to be connected to said terminal member, electrically conductive means adapted to be interposed between said conductor end and said terminal member for interrupting the passage of moisture via the conductor to said terminal member, and sealing means surrounding said conductive means and arranged to permit the free discharge of any such moisture to the atmosphere.

6. In combination with the terminal member of an electrical device, a conductor, one end of which is adapted to be connected to said terminal member, an electrically conductive moisture resisting baffle interposed between said conductor and said terminal member for directing the passage of moisture outwardly and away from said terminal member, said baffle being secured to said conductor and serving as the connecting medium between the latter and said terminal member, means for electrically connecting said baffle to the terminal member, and an insulating sealing compound in which said terminal member and baffle are imbedded, said compound being arranged to permit the free discharge of the moisture exteriorly of the said device.

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