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L. R. GOLLADAY
LIGHTNING ARRESTER UNIT
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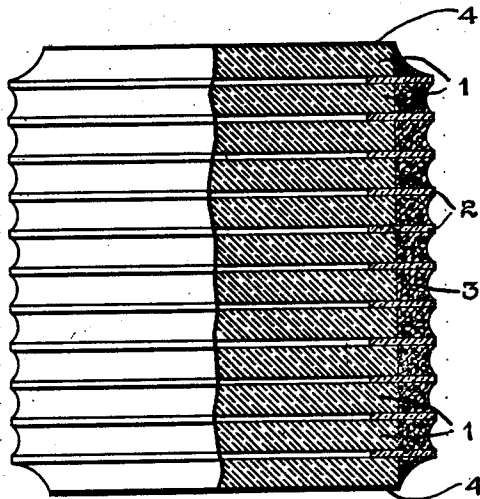


Fig. 1.

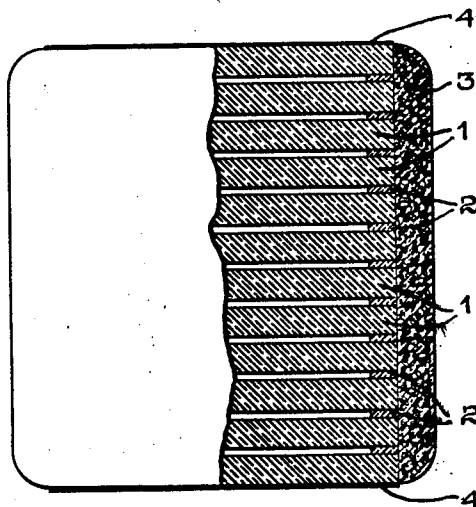


Fig. 2.

WITNESSES:

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LIGHTNING-ARRESTER UNIT

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My invention relates to excess voltage protection devices, and more particularly to lightning arresters of the type embodying a plurality of disks of high resistance material spaced slightly apart.

The said type of lightning arrester is made by assembling flat plates or disks of high resistance material comprising generally a hardened mixture of graphite, carborundum and clay. Discs of such composition, as used in lightning arresters, generally have a resistivity of the order of from one to several hundred ohms per centimeter cube, as against .0037 ohm for carbon, and .0000017 ohm for copper. The lightning arrester is assembled by stacking alternate plates of high resistance material and washers or spacers of mica or other suitable insulating material of such thickness as to space adjacent plates a small distance apart, generally from 3 to 7 mils.

The significance of the 3-mil spacing between the discs is to space the discs about the distance of the cathode glow of a glow discharge. This spacing secures the result that the gap will break down at the minimum voltage at which any gap will break down, for any given gaseous medium, density or electrode-material. A closer spacing will require a higher voltage to initiate the discharge, because there is not sufficient distance between the electrodes to produce ionization by collision except at higher voltages. A much wider spacing will introduce large extra-voltage losses in the anode dark space which then begins to become evident. A 3-mil spacing is so small that tiny particles or grains of the electrode surfaces occasionally touch, which does no harm in view of the exceedingly high resistance of the material.

The significance of using a high-resistance material of the composition mentioned is to prevent the glow discharge, as soon as it is started, from immediately concentrating into an arc, which has a voltage of about 30 volts as against 350 volts for a glow discharge. The high resistance of the electrodes keeps the discharge spread out over the surface of the electrodes, so that the discharge will go out when the voltage drops to a value

only slightly lower than the breakdown voltage, or about 350 volts per gap.

Considerable difficulty and annoyance is experienced in keeping the several members of the lightning arrester in the proper spaced relation, before and during the assembling thereof in a suitable structure for use as a lightning arrester. The present invention is designed to overcome this difficulty, it being among the objects thereof to provide a lightning arrester of the type above set forth, which shall comprise a unit of any desired number of spaced plates held together in fixed relation.

It is a further object of this invention to simplify the manufacture and assembly of lightning arresters of this type.

In practicing my invention, I assemble plates of high resistance material with washers or spacers of mica having a thickness of about three mils, in such manner that the mica spacers project beyond the edges of the high resistance plates. The several plates and spacers are concentrically arranged. This may be accomplished by assembling the members either by hand or in a jig which accurately aligns the various parts. Means are provided for holding the plates and washers in fixed relative positions, such means comprising generally an insulating cement or a cement having a relatively high resistivity, either in a liquid or plastic form which is applied to the edges of the plates and spacers, thus forming an insulating layer on the outside of the assembled structure, binding the parts together, and which hardens in air or by being baked in an oven.

In the accompanying drawings constituting a part hereof, and in which like reference characters designate like parts,

Figure 1 is a vertical, partial cross-sectional view of a lightning arrester unit embodying my invention, and

Fig. 2 is a similar view showing a slightly modified structure.

The lightning arrester or other excess voltage protection device consists of a tall stack of a suitable number of discs or plates 1 of the above-described high resistance material spaced apart by thin washers 2 of mica, or

other suitable material, the edges of the mica extending beyond the edges of the plates. A suitable insulating cement is then applied to all of the edges of the structure and the same allowed to set. This provides a layer 3 of insulating material which adheres strongly to the edges of the plates and the extending portions of the mica washers. The end plates may be provided with coatings 4 of metal to make good contact with the plates of adjacent units.

In Fig. 2 I have shown a slightly modified form of lightning arrester unit in which the mica spacers 2 do not project beyond the edges of the high resistance plates 1. Insulating cement 3 is applied as before and serves the same purpose.

Although any suitable type of cement may be used, I have found that one containing water-glass as a binding agent and suitable insulating material, such as a mixture of feldspar, asbestos fibers and manganese di-oxide, is admirably adapted for my purpose. This cement sets without the aid of heat or pressure and is, therefore, preferable, although other types of cements of an insulating nature, such as those including phenolic condensation products and the like, may also be used.

A lightning arrester unit, made in accordance with my invention, has numerous advantages in that a suitable number of units having a predetermined break-down voltage may be made into a standard unit and a suitable number of such complete units may be readily assembled therefrom with but little labor for high voltage lightning arresters which require a large number of plates.

The hardened coating of insulator material constitutes a mechanical supporting means for the stack of discs constituting a single lightning-arrester unit, and it also makes it possible to stack a number of said units, one on top of another, without requiring an expensive external casing or support for relieving the bottom discs of the excessive weight of the entire stack, which would otherwise be crushed together with too many points in contact, notwithstanding the 3-mil spacers.

The rigid integral insulator coating performs another very important function, the significance of which was not at first appreciated. Notwithstanding the fact that the discs were tested thoroughly, individually and in combination, prior to my invention, when the finished arresters were completed, with their costly porcelain housings and hardware (not shown), an undesirably large percentage of the arresters had to be thrown out on final test, sometimes even after shipment to the customer. I believe that the majority of these defective arresters were the result of a sliding of the discs, one over the other, after they were stacked. My present invention prevents all this and insures that a

unit of stacked discs, when once assembled and successfully tested, will remain in good condition throughout the necessary subsequent handling and shipment, and will, moreover, materially reduce the cost of handling, as well as reduce the cost of the supporting porcelain housings therefor, as above pointed out.

Furthermore, this structure reduces difficulties which may arise from the tendency of an excess voltage discharge to pass along the edges of the structure instead of across the gaps between the plates under high voltage stresses.

The insulating layer also prevents the access of moisture or dust, thereby insuring perfect operation of the lightning arrester. In the modification shown in Fig. 1, wherein the mica separators extend beyond the edges of the plates, the cement layer maintains the same in concentric position.

Although I have described two specific embodiments of my invention, it is apparent that many forms of structure may be devised in accordance with this disclosure. Various materials other than those mentioned in connection with this description may be substituted, therefore, within the scope of this invention.

I claim as my invention:

1. A lightning-arrester unit comprising a stack of discs of composition resistor material spaced about three mils and having a sufficient resistivity to prevent the concentration of the discharge into a low-voltage arc, characterized by having a hardened coating of insulator material, around the side walls of the stack, of sufficient strength and rigidity to protect the stack against displacement or crushing of its composite discs during ordinary usage.

2. A lightning-arrester unit comprising a stack of discs having a resistivity of the order of about one to several hundred ohms per centimeter cube and having a mean spacing of about three mils, characterized by having a hardened coating of insulator material, around the side walls of the stack, of sufficient strength and rigidity to protect the stack against displacement or crushing of its composite discs during ordinary usage.

In testimony whereof, I have hereunto subscribed my name this 11th day of January, 1923.

LAWRENCE R. GOLLADAY.