

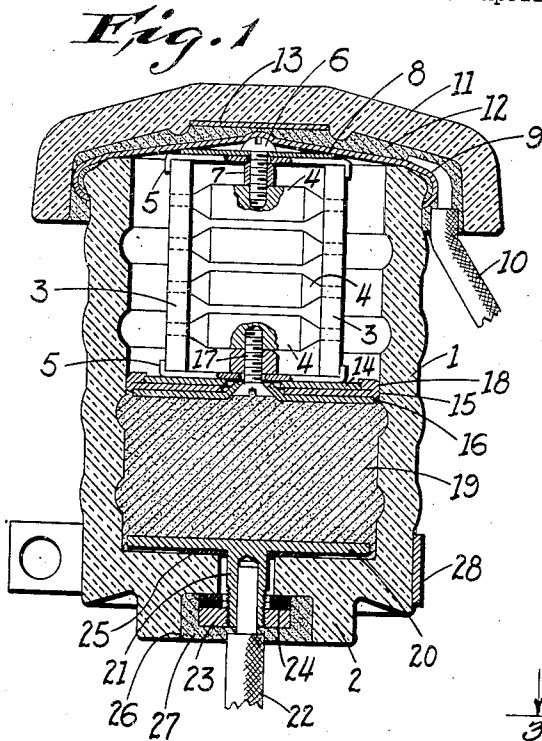
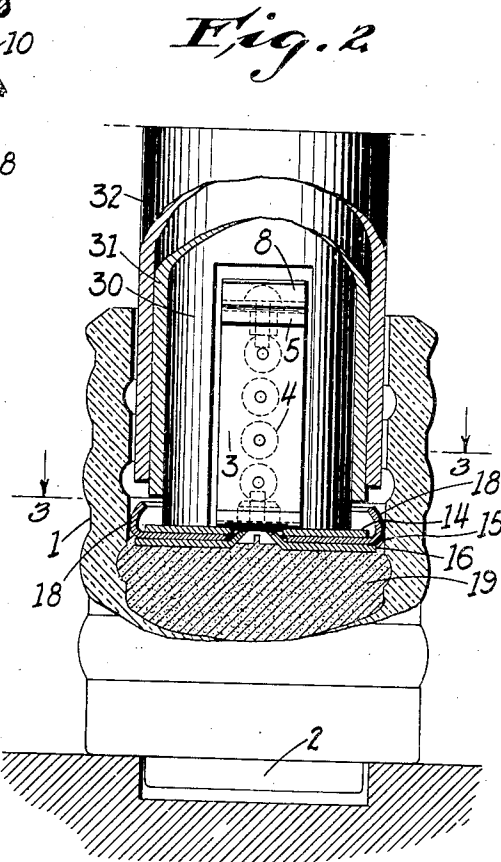
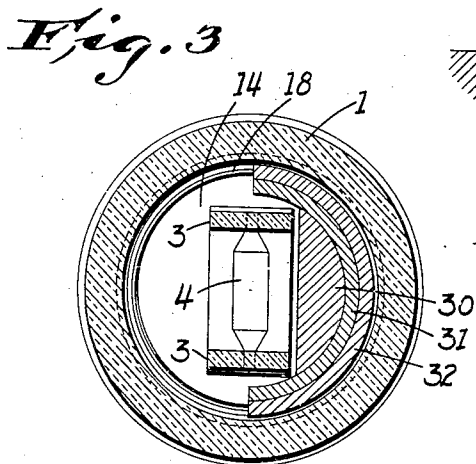
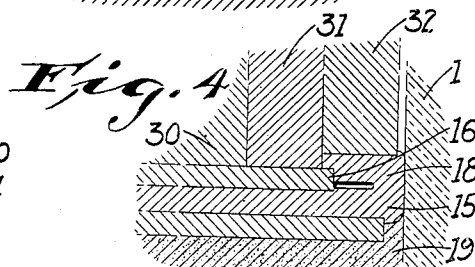
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2,163,697

LIGHTNING ARRESTER AND METHOD OF ASSEMBLING

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LIGHTNING ARRESTER AND METHOD OF ASSEMBLING

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9 Claims. (Cl. 175—30)

This invention relates to improvements in lightning arresters and method of assembling.

The objects of this invention will be appreciated if the arrester structure herein described is clearly visualized. The patents to Earle 2,032,566, issued March 3, 1936, and 2,029,562, issued February 4, 1936, and also the patent to McFarlin 1,763,667, issued June 17, 1930, disclose the generic type to which the present invention pertains.

The lightning arrester herein described comprises a cylindrical insulating container having an arcing chamber provided with an arc gap and a resistance chamber provided with a granular resistance material. This resistance material will be hereinafter referred to as valve material, because its function is to stop the flow of current from a power line after a static charge in the power line has been discharged through the arrester.

The foregoing noted patents suggest that the valve chamber should be sealed to prevent the granules of the valve material from entering the arcing chamber. Possibly the most pertinent reference to the invention herein disclosed is the patent to McFarlin above referred to. However, the novelty of the present invention will be apparent from the following disclosure.

It is one of the objects of this invention to provide for the electrode connecting the gap and valve material a pliable metal cup which is cold pressed into position, said cold pressing being done with a special tool that flattens the wall portion of the cup into intimate contact with the wall of the container and at the same time causes a greater packing of the valve material adjacent the wall of said container than at the more central points and providing an area in which current flowing through the valve material may establish a path immediately adjacent the wall.

A further object is to provide for the pliable metal seal a reinforcing conductive plate above and below the seal adapted to hold the seal in contact with the wall of the container and to carry the major portion of current passing through the arrester, whereby the valve material will be confined to the valve chamber and the seal will be protected against fusion during periods of current flow.

Another object is to provide a novel method of sealing the valve chamber whereby an initial pressure is applied to and maintained on the major portion of the resistance material through relatively rigid plates of an electrode and, thereafter, a greater pressure is applied to

a pliable cup adjacent the wall of the container to spread the cup into positive pressure engagement therewith and to reduce the electrical resistance of the valve material adjacent the wall below the value of the resistance of the valve material at points more remote therefrom.

Arrester containers, either porcelain or glass, are generally cylindrical in contour, but it is practically impossible to secure a product which will in each instance conform exactly to given dimensions and to symmetrical cylindrical outlines. That is, the inner walls of the containers are of irregular shape and the diameters of the bores in the cylinders vary from a specified dimension. This non-conformity of the cylinders with a given specification is due principally to the fact that porcelain and glass containers are subjected to relatively high temperature before they are in completed form and shrink or contract on cooling. In the case of porcelain, a greater portion of the shrinkage takes place during the firing operation and a lesser portion of the shrinkage takes place after the containers are removed from the kilns. In the case of glass, all of the shrinkage occurs while the glass is cooling. In either case, the shrinkage is not uniform throughout the product and accordingly, irregularities appear.

Consequently, it is one of the principal objects to provide for the valve chamber a pliable metal seal which will, under pressure, assume the contour of the wall of the container and adapt a given electrode for use in containers which have varied from a given specification.

Other more specific objects will be apparent from the following specification.

In the drawing:

Fig. 1 is a sectional view in side elevation illustrating a lightning arrester embodying this invention.

Fig. 2 is a view in side elevation partially in section illustrating the arrester container and method of sealing the valve chamber.

Fig. 3 is a sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is an enlarged fragmentary sectional view illustrating the final completion of the assembling operations.

Like parts are identified by the same reference characters throughout the several views.

As shown in Fig. 1, the lightning arrester is provided with a cylindrical container 1 (preferably glass) having a centrally apertured bottom 2. Within the upper end of the container is disposed an arc gap comprising a pair of spaced

ceramic supports 3 upon which a plurality of relatively spaced metal cylinders 4 are mounted. Corresponding ends of the supports 3 are connected together by metal strips 5 which are bent at right angles at their ends to prevent the supports from spreading.

The upper strip 5 is secured to the uppermost metal cylinder 4 by means of a bolt 6 which passes through the strip 5 and the washer 7 and engages the uppermost cylinder 4. This bolt also secures to the strip 5 a spring plate 8 which maintains contact with a metal closure 9 closing the upper end of the container 1. The closure 9 is beaded over the flanged end of the container to hold it in position thereon. A lead-in wire 10 is secured to the closure 9 for making electrical contact therewith.

The metal closure and bared end of the lead-in wire 10 are covered by a cap 11 which preferably comprises glass. A filling of any suitable insulating material 12, such as asphalt, meltable at a relatively low temperature, hermetically seals the upper end of the container 1. The cap 11 may be provided with a metal plate 13 having thereon suitable information visible through the cap.

The lower strip 5 on the gap structure contacts a metal plate 14 which clamps a lead cup or plate 15 to the metal plate 16. The metal plate 16 is provided with a recessed aperture at its central point through which a bolt 17 extends to secure the strip 5, plate 14, cup 15 and plate 16 to the lowermost cylinder 4 on the gap structure. Thus, the gap is provided with an electrode comprising a pair of plates 14 and 16 between which a sealing cup 15 is clamped. The margin 18 of the cup snugly contacts the inner wall of the container 1, thus sealing the container between the arcing chamber and valve chamber within which a body of granular valve or resistance material 19 is disposed.

As will be apparent from the previous paragraph, the electrode which hermetically seals the valve chamber from the arcing chamber, comprises a disk-like electrode which, in the embodiment disclosed, includes a pair of plates 14 and 16 adapted to carry the major portion of current passing through the arrester and reinforcing the bottom of the lead cup, the margin or wall 18 of the cup being freely shaped to conform to and frictionally engage the wall of the container 1.

The plate 16 contacts the upper end of the body of valve material 19 and an electrode plate 20 is provided at the lower end of the body of valve material 19. The electrode plate 20 is provided centrally thereof with an apertured column 21 extending downwardly through the bottom 2 of the container 1. Secured in any suitable manner within the apertured column 21, is a lead-in wire 22. The column 21 is engaged by a clamping nut 23 to secure the plate 20 in position within the container 1. The aperture in the bottom 2 of the container 1 is suitably sealed by means of rubber washers 24 adjacent the nut 23 and rubber washer 25 adjacent the plate 20. The recess 26 in the bottom 2 and within which the nut 23 is disposed, is filled with an insulating material 27 having a low melting point and hermetically sealing the lower end of the container 1.

The lightning arrester above described may be supported in any suitable manner, such as by a band 28 engaging the lower end of the container and suitably secured thereon.

A method of securing the electrode within the container 1 is disclosed in Figs. 2, 3 and 4. The electrode and gap are first secured together before they are placed within the container 1. The lead cup 15 is shaped as shown in Fig. 2 so that its flanged margin arches inwardly toward the gap and away from the inner wall of the container.

The complete tool for securing the electrode in position within the container is not disclosed in its entirety, but is disclosed sufficiently to show the sequence of operation of the tool parts when securing the electrode in position.

The electrode and gap assembly are inserted into the container and supported by the valve material 19. The tool is then inserted so that the bifurcated end of the element 30 rests upon the electrode plate 14 and over the gap previously described. The bifurcations of the element 30 are arcuate and are surrounded by a clamping cylinder 31 which is reciprocal relative to the bifurcated member 30. The clamping cylinder 31 is moved downwardly into pressure engagement with the electrode plate 14. When this cylinder 31 attains a predetermined pressure upon the electrode, the second cylinder 32 surrounding and reciprocal relative to the first-mentioned cylinder 31, moves downwardly into contact with the margin of the arched flange of the lead cup 15. Further movement of the cylinder downwardly causes deformation of the cup flange until it assumes the shape disclosed in Fig. 4.

After the flange has taken the shape shown in Figs. 1 and 4, the cylinder 32 is forced into pressure engagement with the cup 15 to cause the flange 18 to press against the glass. This extra pressure also causes a greater compression of the valve material 19 adjacent the wall of the container 1, than the compression of the valve material centrally thereof. The intimate contact of the lead cup with the wall of the container 1 is sufficient to maintain the compressive pressure upon the valve material after the tool is withdrawn from the container.

The foregoing noted method of securing the electrode within the container provides a means for predetermining within a given range a difference of density of the valve material 19 adjacent the wall of the container 1 and centrally of the valve material. This difference of density will materially lower the relative resistance of the valve material adjacent the container, thereby permitting current flowing through the arrester to take a path adjacent the container.

It is desirable to have the current flow adjacent the container in order to be assured that the container may be destroyed if the current continues to flow beyond a given period of time and to produce visible evidence of breakdown of the arrester when glass is used as a container and is not destroyed by the flow of current through the valve material.

Obviously an all-metal seal has been provided for the valve chamber which is adapted for use in containers which vary from given specifications and which may be shaped under sufficient pressure to cause it to conform throughout its periphery to the contour of the walls of the container and thereby effectively seal the valve chamber and confine the valve material therein.

The valve material has heretofore been described as granular. In the embodiment of the invention disclosed herein, the granules are loosely associated before the electrode of this

invention is applied thereto, but it will be understood that I do not limit myself to the exclusive use of this invention with valve material comprising loosely associated granules. Obviously, the electrode of the invention may be used with any form of high resistance material where it is desired to lower the resistance of that material adjacent the container to a value less than the resistance thereof at other points and/or where it is desired to seal the valve chamber.

I claim:

1. In a lightning arrester container having an arcing chamber provided with an arc gap and a valve chamber having a granular valve material therein, an electrode plate connecting said gap and valve material, said electrode plate including a pliable metal cup secured to said plate and having its side wall pressed longitudinally and radially of said container to exert a predetermined frictional pressure against the wall of the container, thereby to seal the valve chamber.

2. In a lightning arrester container having an arcing chamber provided with an arc gap and a valve chamber having a valve material therein, an electrode connecting said gap and valve material, said electrode comprising a first plate in pressure contact with said valve material, a pliable metal cup on said plate, having its side wall pressed longitudinally and radially of said container to flatten the cup portion of said cup into sealing contact with said container, and a second plate within said cup clamping said cup to the first plate.

3. In a lightning arrester container having an arcing chamber provided with an arc gap and a valve chamber provided with a valve material therein, an electrode comprising a pliable metal cup having its wall pressed longitudinally and radially of said container into contact with the wall of the container, and a relatively non-pliable plate reinforcing said cup and maintaining contact thereof with said wall.

4. In a lightning arrester container having a pressure sealing cap, an arcing chamber provided with an arc gap and a valve chamber provided with a valve material therein, an electrode comprising a pliable metal cup in electrical connection with said gap and valve material and having its wall pressed into direct frictional contact with the wall of the container and held in com-

pressive contact with the valve material by said cap.

5. An electrode for lightning arresters, said electrode comprising a pliable metal cup having its bottom reinforced by relatively less pliable plates and its sides freely pliable for shaping.

6. The method of sealing a valve chamber in a lightning arrester container having a valve material, said method comprising the placing of a disk-like electrode having a pliable metal margin on said material, applying an initial pressure on said electrode and thereafter applying relatively greater pressure on said margin to shape it into conformity with the wall of the container and to compress the material adjacent the wall.

7. The method of sealing a valve chamber in a lightning arrester container having a valve material, said method comprising the placing of a disk-like electrode having a pliable margin coextensive with the wall of the chamber on said material, applying an initial pressure on said electrode and thereafter applying a pressure on said margin to shape it into conformity with the wall of the container.

8. In a lightning arrester comprising an insulating casing divided into a valve chamber having a granular valve material therein and an arcing chamber having an arcing member, an electrode electrically connecting said valve material and said arcing member, comprising a pliable metal cup, a relatively rigid metal plate beneath the cup and contacting said valve material, and a second relatively rigid metal plate within said cup and contacting said arcing member, said relatively rigid metal plate being of less dimension diametrically than the inner diameter of said casing, the wall of said cup being forced into the space between said plates and said casing and in firm contact with said casing, whereby to seal said valve chamber.

9. In a lightning arrester container having an arcing chamber provided with an arc gap and a valve chamber having a granular valve material therein, an electrode plate connecting said gap and valve material, including a pliable metal cup secured to said plate, having its side wall pressed longitudinally and radially of said container to flatten the cup portion of said cup into sealing contact with said container.

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