

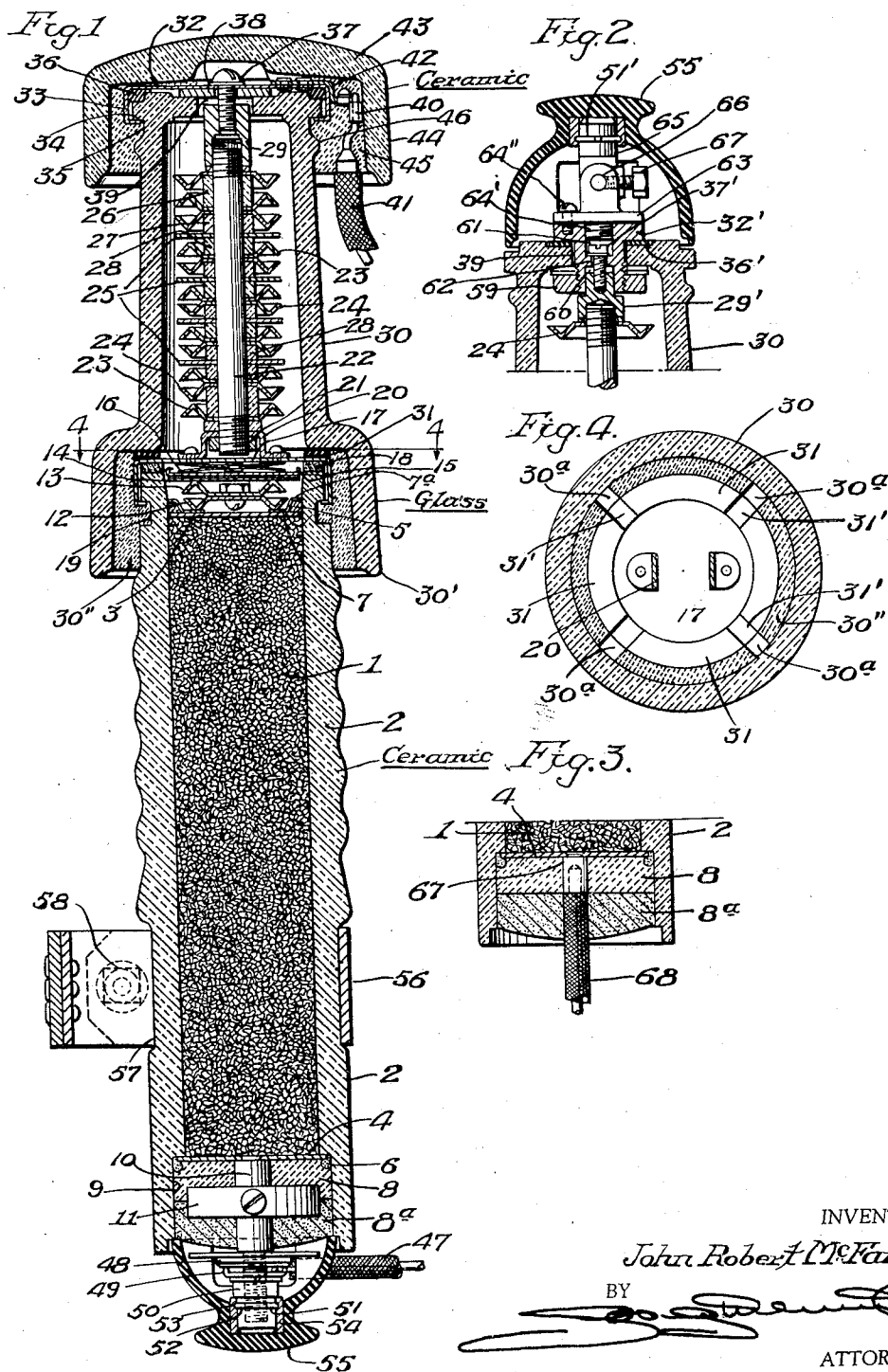
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LIGHTNING ARRESTER

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LIGHTNING ARRESTER

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My invention is an improved lightning arrester of the type characterized by electrodes forming a spark gap structure in series with a "characteristic element" of variable resistivity permitting the ready discharge of lightning or other abnormal voltages but preventing the flow of dynamic current and thereby extinguishing an arc across the gap or gaps.

In accordance with my invention, the "characteristic element" is housed within an opaque ceramic casing which preferably has an unglazed inner wall. The ends of the ceramic casing are preferably closed by disk electrodes, and the joints between the disks and casing are sealed by suitable gaskets or sealing compound. The characteristic element preferably consists of discrete granules of variable resistivity, such for instance as silicon carbide grains or lead peroxide pellets, which are held compacted and pressed against the casing wall by the disk electrodes.

The gap structure is housed, in whole or in part, within a transparent glass casing which is coupled to the ceramic casing by a tension member or connector. The spark gap electrodes are preferably sleeved on this tension member and spaced from one another by insulating rings. Some of the gap electrodes have grooved peripheral sections surrounding the insulator rings. Flat disk electrodes may be inserted between the apexes of adjacent grooved sections to increase the number of gaps.

The glass casings are preferably made of standard form and size for lightning arresters having a wide variety of ratings. The ceramic casings may be made of different lengths to accommodate spark gap electrodes in excess of the capacity of the glass casing and requisite for giving a desired number of spark gaps in arresters of higher ratings and to house characteristic elements of correspondingly greater length.

By my improvements there is provided a lightning arrester structure permitting the visual inspection of the spark gap electrodes while shielding the gaskets and seals of the "characteristic element" chamber from the destructive action of light thereon. By hermetically sealing the "characteristic element" chamber and providing an inner wall therefor which is non-absorbent of moisture and free from moisture-film collecting tendencies, the ingress of moisture-laden air into the "characteristic element" chamber and the accumulation of films of moisture on the chamber wall or in or on the granules of the characteristic element is avoided.

The spark gap electrode casing may also be

sealed, if desired, but it is generally preferable to permit a circulation of air through the spark gap chamber, where there is little or no tendency for the accumulation of moisture such as is caused by the sponge-like action of discrete granules of silicon carbide, oxide pellets, or the like when housed in a casing open to the atmosphere. Even if a film of moisture should form on the hygroscopic inner surface of the glass casing, from which the gap electrodes are generally spaced, such film does not have the same deleterious effect on the operation of the arrester as would the accumulation of a moisture film on the inner wall of the "characteristic element" chamber with which the "characteristic element" makes close contact.

The provision of a ceramic housing for the characteristic element permits the attachment to the arrester of a suitable mounting bracket without setting up undue stresses tending to cause fracture in assemblage, shipping or from mechanical means, while providing a thermally sensitive casing which fractures when a failure of the arrester causes a short circuit.

The characteristic features and advantages of my improvements will further appear from the following description and the accompanying drawing in illustration of preferred embodiments thereof.

In the drawing, Fig. 1 is a vertical sectional view of a lightning arrester showing a preferred embodiment of my invention; Fig. 2 is a fragmentary sectional view of a modified form of top construction; Fig. 3 is a fragmentary sectional view of a modified form of ground connection, and Fig. 4 is a transverse sectional view taken on the line 4—4 of Fig. 1.

In the embodiment of my invention illustrated in the drawing, a "characteristic element" 1 is housed within a cylindrical ceramic casing 2 preferably formed of opaque, wet process porcelain having an unglazed inner wall, or from steatite compounds, such as a double silicate of alumina and magnesia or "Isolantit". Such ceramics may be molded into casings having an accurate and uniform diameter rendering them particularly suitable for housing "characteristic elements" composed of masses of discrete silicon carbide granules whose electrical characteristics are dependent in part upon the ratio of their diameters to their lengths. Such silicon carbide grains should be well compacted together, but even the best commercial packing thereof leaves from thirty to forty percent of air voids in masses composed of commonly used sizes, such as thirty-six grit. The inner wall of the casing is therefore

left unglazed to minimize moisture absorption and tendency to moisture-film collection and prevent the condensation of moisture from air occluded in the mass of grain, even when there is a sudden temperature drop, such as frequently occurs preceding a lightning storm.

The "characteristic element" 1 is held in compacted condition by disk electrodes 3 and 4 at the opposite ends of the mass, the joints between the disks 3 and 4 and the inner wall of the casing being closed by gaskets 5 and 6. The gasket 5 is held in place by the spun lip 7a of a ring 7 secured to the disk 3. The gasket 6 is held in place and the joint between the disk 4 and the casing 1 is sealed to exclude air and moisture by layers of sealing compounds 8 and 8a hardened within the countersunk portion 9 of the casing 2.

As illustrated in Fig. 1, the disk 4 has riveted thereto a terminal post 10 having a cross bar 11 secured thereto and embedded in the sealing compound to prevent rotation of the terminal post.

When the length of the casing 2 is greater than is requisite for the desired length of "characteristic element," the upper end of the casing chamber may be filled by peripherally channeled conducting disks 12 and 13 which may be bolted together in direct contact or spaced from one another to form spark gaps. Conducting washers 14 are seated on the upper disk. The upper washer 14 may be provided with a lip 15 and is engaged by a double leaf spring 16, which is held under compression by a conducting cap 17. A gasket 18, suitably of rubber, is interposed between the top edge of the casing 2 and the bottom of the cap 17 so as to form a tight joint when the cap flange is crimped over with its edge engaged in the groove 19 of the casing 2.

A conducting bracket 20 is riveted to the cap 17 and forms a housing for a nut 21 into which is threaded an insulating rod or bolt 22.

Spark gap electrodes 23, 24 and 25 are sleeved on the rod 22. The electrodes 23 consist of axially apertured disks having upwardly projecting ridges adjacent the peripheries thereof; the electrodes 24 consist of axially apertured disks having downwardly projecting ridges adjacent the peripheries thereof, and the electrodes 25 consist of substantially flat axially apertured disks. By assembling the electrodes on the rod 22 with annular ridges of disks 23 and 24 adjacent to and spaced from one another and their central portions spaced by insulator rings 26, or by inserting flat disks 25 between adjacent projecting ridges of disks 23 and 24 and insulating such electrodes from one another by insulator rings 27 and 28, an effective and compact spark gap assembly may be provided which is clamped together by a conducting coupling nut 29 and connected in series with the "characteristic element" 1.

The spark gap assembly is housed within but spaced from the inner wall of a transparent glass casing 30 which is seated on a gasket 31 on the top of the cap 17, the gasket preferably being composed of spaced segments.

The space between the upper portion of the casing 2 and the lower flange 30' of the casing 30 may be wholly filled with sealing compound 30'', but preferably contains air passages 30a registering with spaces 31' between segments of the gasket 31 so as to permit circulation of air through the casing 30.

A conducting cap 32 for the casing 30 has a flange 33 provided with a lip 34 crimped into the groove 35 in the upper portion of the casing 30,

the gap between the cap and casing being sealed by an elastic gasket 36, preferably of cork. The cap 32 is electrically connected to the coupling 29, and the casing 30 is secured in place relatively to the casing 2 by a screw 37 having its head engaging the cap 32 and supported by an apertured washer 38 and its shank passing through the aperture 39 in the casing 30 into threaded engagement with the coupling nut 29. A line conductor ferrule 40 is connected with the line lead 41 and has a strap 42 riveted to the cap 32.

An insulating cap 43 has a flange 44 and houses the conducting members on the exterior of the casing 30, and may be secured to such casing by a sealing compound or cement 45 solidified in the space between the flange 44 and the casing 30 and embedding the bead 46 on the latter.

To connect the lightning arrester with a ground conductor 47, the terminal boss 10 may have threaded thereon a nut 48 and a cup-like member 49 which is pressed into binding engagement with the conductor by a nut 50, as shown in Fig. 1. The nut 50 may be provided with a groove 51 for the engagement of a spring wire 52 seated in a groove 53 in the inner surface of a ferrule 54 in the insulating cap 55. The cap may thereby be snapped on or off the nut 50.

The arrester may be conveniently mounted on a pole or other support by seating the strap 56 of a mounting bracket in a recess 57 of the casing 2 and drawing together the ends of the strap by means of a nut and bolt 58.

Should it be desired to substitute a line terminal for a line lead, this may be readily done, as shown in Fig. 2. In such case, a conducting plug 32' has its head seated on a gasket 36' on the top of the casing 30 and its shank extends through the aperture 39. A nut 59 is screwed up tight on the projecting threaded section of the shank of the plug 32' to draw the head of such plug tightly against the gasket 36'. The plug shank contains a recess 60 for the reception of a modified form of coupling nut 29'. A screw 37' is inserted through an aperture 61 in the plug 32'. The shank of the screw passes through an aperture 62 in the plug and is screwed into the threaded recess in the top of the coupling nut 29'. A terminal 63 has a shank 64' threaded into the aperture 61 and is held against unscrewing by a screw 64''. The post 65 of the terminal 63 contains an aperture 66 for the insertion of a conductor, which may be clamped in place by a bolt 67. A cap 55 may be snapped over the top of the post 65, which contains a groove 51' similar to the corresponding groove in the nut 50.

If desired, there may be substituted for the ground terminal shown in Fig. 1, a ground lead, shown in Fig. 3, by riveting a ferrule 67 to the disk 4 and inserting in such ferrule a ground lead 68 which is partly embedded in the sealing compounds 8 and 8a.

By my improvements there is provided an arrester having the advantages of visible spark gap electrodes without the disadvantages inherent in the manufacture and use of glass casings of sufficient size to house lightning arresters for protecting high voltage systems. Glass casings of the large size required for high voltage lightning arresters cannot be made by blowing with sufficient accuracy for use in lightning arrester assembly and it is impracticable commercially to produce pressed glass bodies of the dimensions required for high voltage arresters. By my improvements, I am enabled to employ pressed glass sections that can be readily and economically pro-

duced for lightning arresters of all ratings. Such sections permit the visual inspection of a sufficient portion of a gap assembly to determine the condition of the arrester, while the use of a ceramic housing for the characteristic element avoids the deleterious effects of light on the seals for the characteristic element chamber and accumulation of moisture from "breathing," by the arrester or otherwise, is prevented.

10 Having described my invention I claim:

1. A lightning arrester comprising an opaque ceramic casing, a "characteristic element" of variable resistivity under different electrical potentials within said casing, a transparent glass casing substantially coaxial with said ceramic casing, an electrode assembly forming a spark gap within said transparent casing, and means comprising a tension member for securing together said casings with the electrode assembly in series with the "characteristic element."

2. A lightning arrester comprising an opaque ceramic casing, a "characteristic element" of variable resistivity under different electrical potentials housed within said casing, a glass casing having at one end thereof a member telescoped with a portion of said ceramic casing and at the other end thereof an external bead, a cap having a member telescoped over the beaded portion of said glass casing, and a seal between the beaded portion of said glass casing and the cap member telescoped therewith.

3. In a lightning arrester, a spark gap structure including an insulating rod, disks sleeved on said rod, one of said disks being substantially flat and another of said disks having a dished portion extending toward said first disk and spaced therefrom, and a "characteristic element" of variable resistivity under different electrical potentials in series with said spark gap structure.

4. In a lightning arrester, a spark gap structure including a series of disks, insulators between said disks, one of said disks being substantially flat and the disks on either side of said flat disk having grooved sections surrounding said insulators and projecting toward said flat disk, and a "characteristic element" of variable resistivity under different electrical potentials in series with said spark gap structure.

5. A lightning arrester comprising an opaque ceramic casing, a "characteristic element" of variable resistivity under different electrical potentials comprising a mass of discrete granules of variable resistivity housed in said casing, means for compacting said granules within said casing, a transparent glass casing, a tension member connecting said glass casing with said ceramic casing, and electrodes on said tension member and forming a spark gap within said glass casing.

6. A lightning arrester comprising a ceramic casing containing a characteristic element of variable resistivity under different electrical potentials, a member secured to said casing, a glass casing seated on said ceramic casing, and a tension member securing said glass casing to said first named member.

7. A lightning arrester comprising a ceramic casing containing a mass of discrete granules of variable resistivity, a glass casing aligned with said ceramic casing and containing a plurality

of electrodes forming spark gaps, and a rod positioning said electrodes and securing said casings together.

8. A lightning arrester comprising a ceramic casing containing a mass of granules of variable resistivity, a glass casing having a flange overlapping a portion of said ceramic casing, a member secured to said ceramic casing, a rod secured to said member, spaced electrodes on said rod, and a plug in said glass casing and connected with said rod to relatively position said rod and glass casing.

9. A lightning arrester comprising a ceramic casing, a mass of granules of variable resistivity in said casing, a plate in said casing at each end of said mass, a glass casing seated on said ceramic casing and containing an aperture, a series of spaced electrodes in said glass casing, a plug having a shank in said aperture and a head overlapping the glass casing around said aperture, a nut for drawing said head toward said casing, and a connector between said plug and ceramic casing, said connector positioning said electrodes and securing said glass casing relative to said ceramic casing.

10. A lightning arrester comprising a ceramic casing having a countersunk end portion, a plate seated in said countersunk portion, means for sealing the joint between said plate and casing, a mass of granules of variable resistivity in said casing and bearing against the walls thereof and against said plate, a closure at the opposite end of said casing from said plate, a rod connected with said closure, spaced electrodes on said rod, a glass casing enclosing said electrodes and spaced therefrom, said glass casing having a flange overlapping a portion of said ceramic casing, and a connector securing said rod to said glass casing, said connector comprising a plug containing a plurality of sockets, a threaded member having a head in one of said sockets and securing said rod in the other socket, and a terminal having a member secured in the socket containing said head.

11. A lightning arrester comprising an opaque shell non-absorbent of moisture and free from moisture-film collecting tendencies and substantially filled with a characteristic element of variable resistivity under different electrical potentials and having a moisture absorbing tendency, said shell being sealed against ingress of moisture at both ends, a glass shell aligned with said shell first named and having a flange telescoping at an end of said first named shell, a rod in said second named shell and coupling together said first and second named shells, and electrodes spaced along said rod in said second shell and forming spark gaps visible therethrough.

12. A lightning arrester comprising a housing containing an air chamber, a rod in said chamber, electrodes on said rod including flat disc electrodes and electrodes having peripheral ribs spaced from said rod, one of said flat disc electrodes lying between the apexes of two oppositely turned ribbed electrodes, insulators spacing said flat electrode from each of said ribbed electrodes and having a smaller diameter than said ribs, said electrodes forming spark gaps each communicating with said chamber throughout the length thereof.

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