

Aug. 13, 1935.

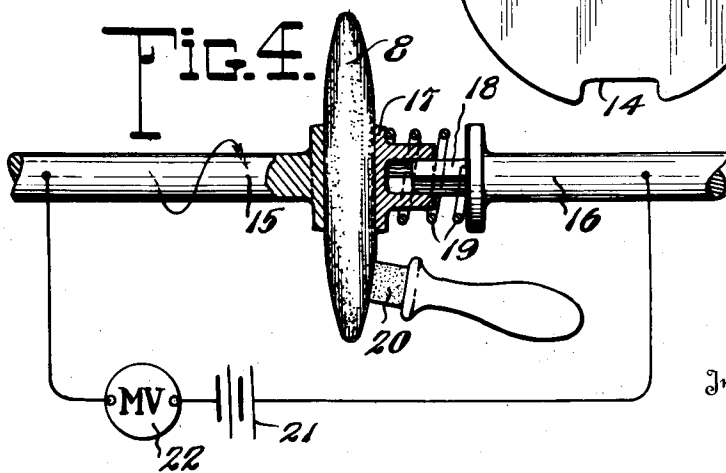
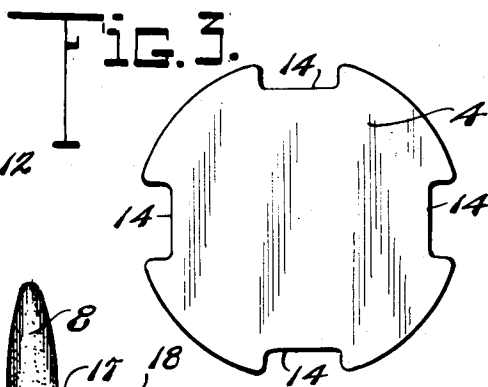
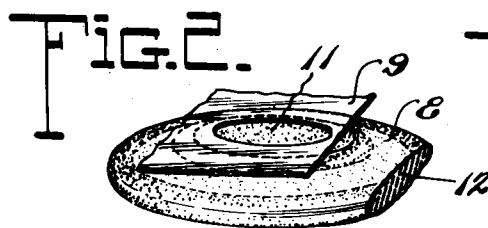
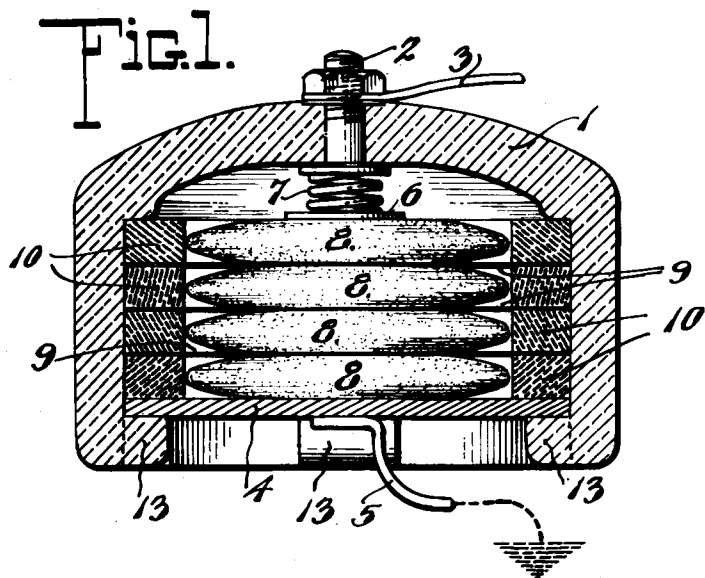
E. R. EVANS

2,011,548

LIGHTNING ARRESTER

Filed April 18, 1930

2 Sheets-Sheet 1



Inventor

E. R. Evans

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Fig. 5.

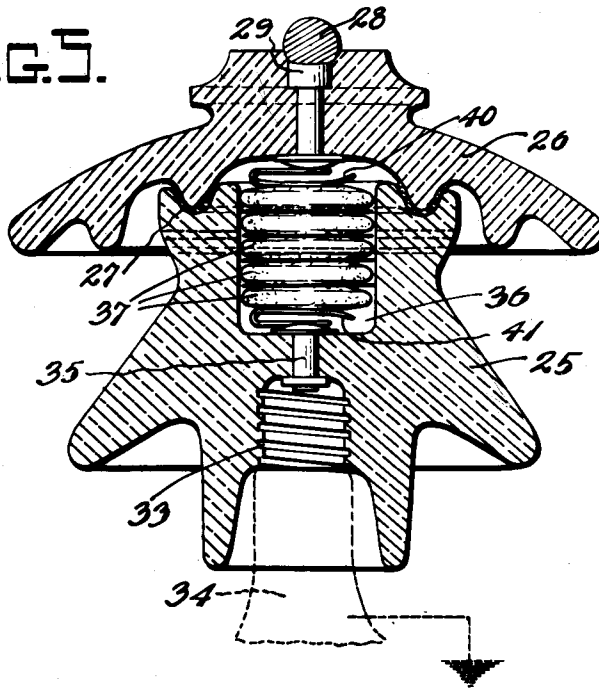
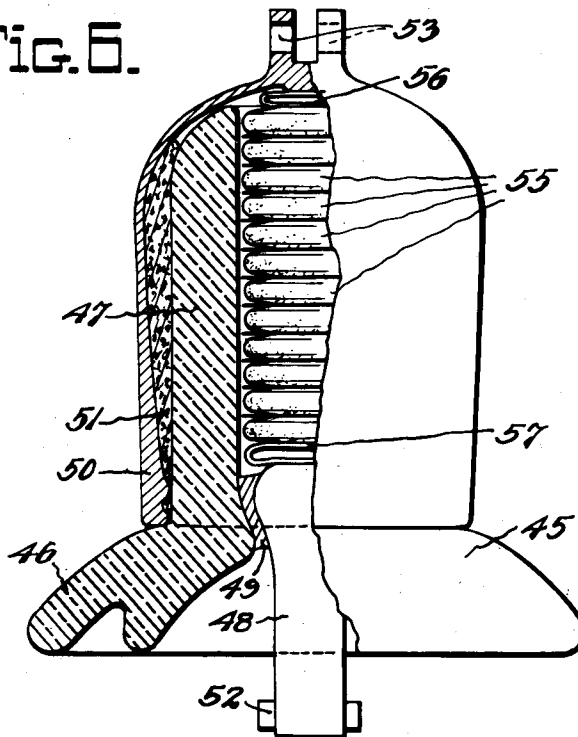


Fig. 6.



Inventor

E. R. Evans

UNITED STATES PATENT OFFICE

2,011,548

LIGHTNING ARRESTER

Earl R. Evans, Washington, D. C.

Application April 18, 1930, Serial No. 445,382

8 Claims. (Cl. 175—30)

My invention relates to lightning arresters of the valve type, the present application being a continuation in part of my prior application, Ser. No. 321,264, filed November 22, 1928.

One object of my invention is to provide a lightning arrester of the space-discharge type of improved construction and operating characteristics which is assembled of gap elements formed substantially of porcelain or other vitreous material.

Another object of my invention is to provide an electrical discharge device of the stacked element type comprising discs of refractory composition having metallic coatings of greater conductivity than said refractory composition and serving as contact or discharge terminals.

Another object of my invention is to provide a lightning arrester of porcelain or the like fired refractory insulating or high-resistance material having arcing surfaces comprising metallic films, the device being preferably arranged to interrupt the discharge current upon the resumption of normal voltage.

For a better understanding of my invention, reference should be had to the accompanying drawings showing certain embodiments thereof.

Referring to the drawings,

Fig. 1 is a central sectional view of a lightning arrester embodying my invention;

Fig. 2 is a perspective view of a portion of one of the insulating spacers and of one of the adjacent disc elements shown in Fig. 1;

Fig. 3 is a detail view of the bottom plate shown in Fig. 1;

Fig. 4 is a view illustrating the method of measuring and controlling the resistance of the surface films on the gap elements or electrodes; and

Figs. 5 and 6 are views of transmission line insulators embodying discharge paths similar to that shown in Fig. 1.

Referring to Figs. 1-3, the lightning arrester or space discharge device shown comprises an enclosing casing 1 of porcelain, pyrex glass or other suitable insulating material. A contact pin or bolt 2 projects through the top of the casing or shell 1 to serve as a terminal for the line conductor 3, preferably making a water-tight seal with the casing 1 through the use of suitable sealing gaskets or washers.

The lower terminal of the arrester comprises a metal plate 4, shown in detail in Fig. 3, to which is secured the grounded conductor 5. The metal plate 4 is provided with notches 14 to permit the same to be positioned within the casing

1 and rest upon the projections 13 thereof. A contact plate 6 and helical spring 7 provide a circuit connection between the terminal 2 and a series or stack of gap electrodes or elements 8 resting upon the bottom plate 4.

The gap electrodes 8, to be described in greater detail hereinafter, are provided with metallized or filmed arcing surfaces, preferably spaced apart about 3 to 10 mils by means of the insulating spacers 9 of mica or the like. The edges of the spacers 9 are held between spacing rings 10 of insulating material of the same thickness as the electrodes 8 and substantially contacting with the peripheral edges of said electrodes to minimize arcing thereover.

The spacers 9 are provided with central openings 11 as shown in Fig. 2 to define the area of the discharge gap between the electrodes. The electrodes or elements 8 are in series relation to form a stack and each comprises a core or body portion 12 coated with a thin film of conducting material, preferably a more or less refractory metal such as copper, aluminum, nickel, iron or steel. The coating or film is preferably formed by the "Schoop" metal spraying process, although any method which will give a thin, tenacious conducting film may be employed. The adherent film thus formed may be termed a protective coating as it prevents concentration of the discharge upon a limited area of the electrodes and also renders the body portion of the electrodes practically non-absorbent when the electrodes are exposed to moisture or dampness.

The core or body portion 12 of the electrodes 8 preferably consists of porcelain or baked clay, pyrex glass or similar vitreous material, or a high-resistance material or composition of materials. For example, a small proportion of powdered metal, carbon or other conducting substance may be mixed with the clay or other substance used for the core but the resistance must remain comparatively large because of the conducting path through the surface film on the electrodes which is adapted to carry a substantial proportion of the current. The core may also be porous in character, particularly where metal particles are distributed through the cross-section thereof, as the particles then form minute gaps in air which break down when the arrester discharges.

The resistance of the gap elements is sufficiently high to prevent the discharge currents from damaging the arrester, and is preferably so large as to limit the space discharge to the "glow" type, whereby the extinction of the discharge current

is assured when the applied voltage drops to the normal value in accordance with the well-known principles of the valve-type gap arrester. To further assist in obtaining this result, the spacing between the electrodes is substantially equal to the length of the "cathode dark space" for the gas pressures and temperatures employed, although the spacing may be varied to obtain any desired characteristics in the arrester.

In Fig. 4 is shown apparatus for measuring the resistance of the discs forming the discharge gap and for controlling the resistance of the surface film thereof. A disc 8 is clamped or held between the ends of the opposed rotating shafts 15 and 16. The shaft 16 may be provided with a retractable tip 17 mounted on the square shank 18 and held against the disc 8 by means of a spring 19 whereby the disc may be readily placed in and removed from cooperative relation with the shafts 15 and 16. An abrasive or grinding tool 20 may be held against the film on the disc 8 to remove part of the same until the resistance has the desired value. As indicated in Fig. 2, the thickness of the film may be non-uniform and is preferably thinnest adjacent to and surrounding the arcing surface where the spacer contacts with the electrode surface. A battery 21 and millivoltmeter 22 may be connected as indicated to the shafts 15 and 16 to measure the resistance of the electrode between the arcing surfaces which correspond roughly to the areas of the tips of the shafts 15 and 16.

In accordance with a further feature of the invention, the described arrester may be constructed to serve as a supporting insulator for the line conductor. Thus as shown in Fig. 5, a pin-type insulator comprises a hollow body portion 25 of porcelain or the like having an upper portion 26 cemented thereto as indicated at 27. The portion 26 is grooved to receive the line conductor 28 which contacts with a terminal member 29. The body portion 25 is threaded as indicated at 33 to receive a grounded pin 34 which contacts with a lower terminal member 35. Within the recess 36 of the body portion 25 are disposed the gap electrodes or elements 37 of the arrester. The stack of gap elements may be constructed as shown in Fig. 1 and contact is made therewith by the contact members 40 and 41. The arrester comprising the elements 37 is designed to withstand the normal line voltage but to provide a discharge path for lightning surges on the line.

In Fig. 6, I have shown a similar arrangement as embodied in a suspension-type insulator. This insulator comprises an insulating body 45 of porcelain or the like having a flaring portion 46 and a hollow central portion 47. A pin 48 is cemented as indicated at 49 to the lower portion of the body 45. A cap member 50 is also cemented to the portion 47 of the insulator as indicated at 51. The pin 48 and cap 50 are provided with cooperating parts 52 and 53 so that a number of units may be connected in series, if desired, in the usual

way. A stack of electrodes 55 forming an arrester of the type shown in Fig. 1 is arranged in the hollow portion 47 of the insulator, the contact members 56 and 57 serving to connect the stack of electrodes to the cap 50 and pin 48.

Various modifications of the structure shown and described herein may be made without departing from the scope of the invention as indicated in the appended claims.

I claim:

1. A gap element of an electric discharge device comprising a high-resistance body portion having a conducting coating, a portion of said coating forming a discharge area and being of greater thickness than another portion of said coating.
2. An electric discharge device operating with a space discharge comprising a stack of electrodes having no sharp points or edges, said electrodes being arranged in series and each consisting of a body of ceramic material having a protective coating of conducting material.
3. An electric discharge device operating with a space discharge comprising disc-shaped portions of granular refractory material having laterally-extending metallic arcing surfaces to distribute the discharge laterally and thereby prevent concentration of the discharge at one point of the cross-section of the discharge device.
4. An electric space-discharge device comprising several closely-spaced stacked electrodes in series relation, each electrode consisting of a high-resistance refractory body completely covered by a conducting metallic film.
5. An electric discharge device operating with a space discharge comprising a series of closely-spaced electrodes consisting principally of porcelain and having a current-conducting surface film extending between the surface portions opposing the adjacent electrodes.
6. An electric space-discharge device comprising electrodes in series relation, each of said electrodes being of ceramic composition and provided with a surface layer of greater conductivity on the sides contiguous to the adjacent electrodes than on other portions of the electrodes.
7. An electric space-discharge device comprising end terminals, layers of baked refractory material between said terminals and extending transversely, and intermediate layers of greater conductivity adapted to distribute the electric discharge laterally and prevent concentration thereof at one point of the cross-section of the discharge device.
8. An electric discharge device of the stacked series-gap type comprising end terminals, a plurality of discs of refractory composition composed principally of ceramic material disposed between said terminals and metallic coatings on said discs covering a substantial portion of the transverse faces thereof.

EARL R. EVANS.