C. ROBINSON.

LIGHTNING ARRESTER.

APPLICATION FILED JUNE 19, 1907.

1,011,493. Patented Dec. 12, 1911.

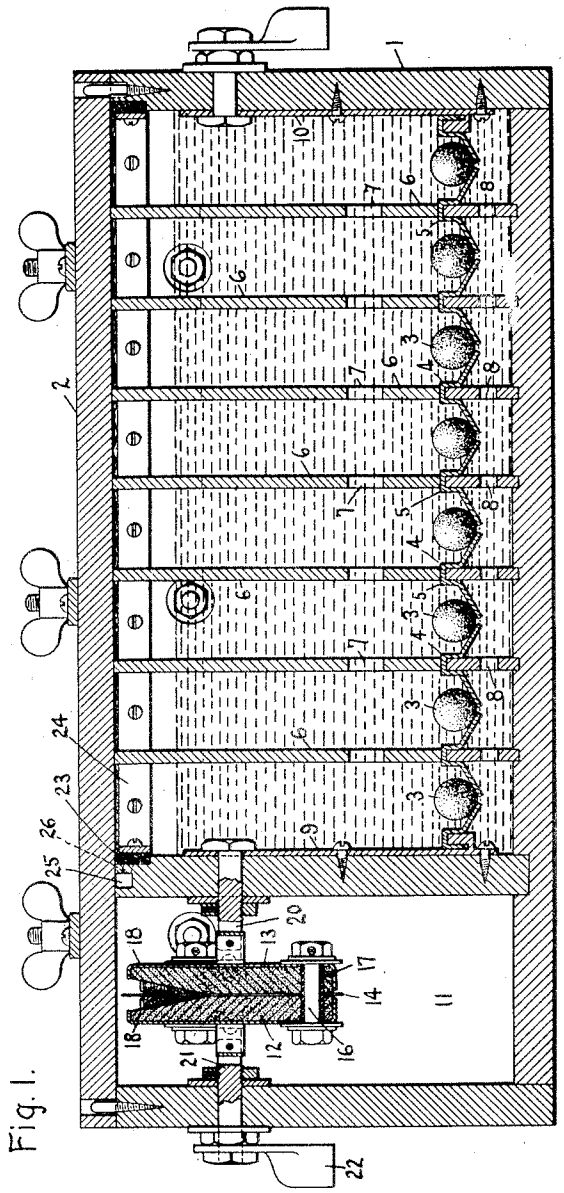

Fig. 1.

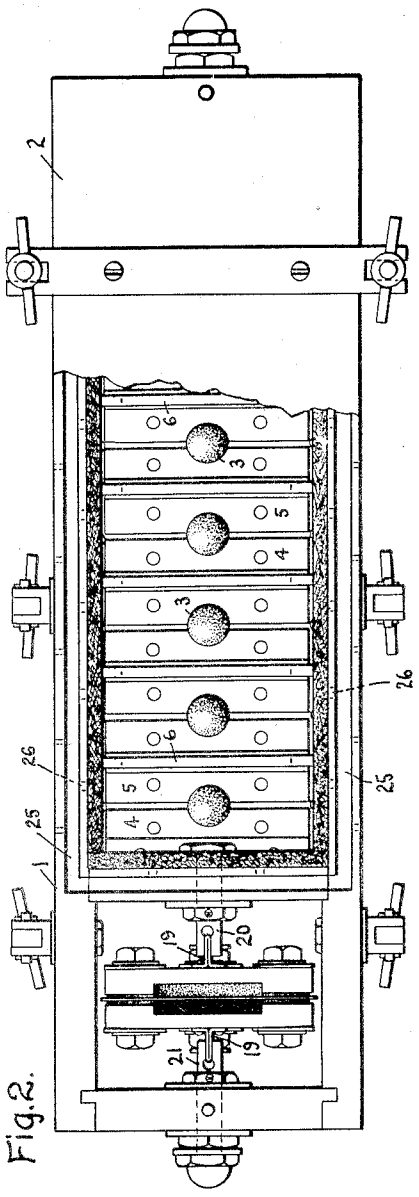

Fig. 2.

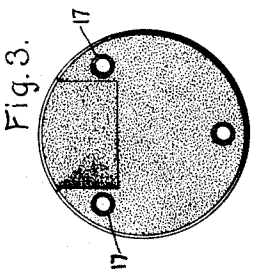

Fig. 3.

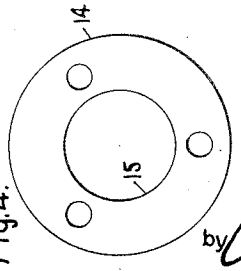

Fig. 4.

Witnesses:
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UNITED STATES PATENT OFFICE.

CONWAY ROBINSON, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

LIGHTNING-ARRESTER.

1,011,493. Specification of Letters Patent. Patented Dec. 12, 1911.

Application filed June 19, 1907. Serial No. 379,704.

To all whom it may concern:

Be it known that I, CONWAY ROBINSON, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Lightning-Arresters, of which the following is a specification.

My present invention relates to protective devices for electrical systems and apparatus, and comprise means for protecting such systems from lightning and other abnormal potential stresses.

My improved protective device comprises a spark-gap coöperating with a series device having special characteristics which enable it to act as a resistance and arc-rupturing device in case the line current follows through on the high potential discharge.

The combined series resistance and arc-rupturing device comprises a plurality of movable members, such as carbon balls, cooperating with conductive elements to establish an electrical path of low or negligible initial resistance. The resistance initially afforded by this device is due largely to the imperfect contacts afforded by the spherical surfaces of the balls, and is much less than that of the series resistance devices commonly used in conjunction with spark-gaps of lightning arresters. It has the further peculiarity that it offers substantially no reactive effect on current of any frequency. When a high potential strain arises on the line conductor, the high potential charge can pass through this series resistance and across the coöperating spark-gap, and even though the discharge may be of enormously high frequency, it will encounter substantially no reactive impedance in its passage to earth. The line-current will usually follow through on the high potential discharge, and must be held down to a safe value until the circuit can be opened. The series device, made up by the carbon balls and other coöperating elements, serves the function of limiting the line-current during the first instant of its flow. The passage of line-current through the balls serves to heat the rather imperfect contacts between the balls and plates and operates to lift the balls from their respective seats, and thereby open the circuit in several different places. This expulsive action of the balls is more certain and rapid when the contacts are immersed in oil or other suitable liquid. The oil seems to vaporize and assist in lifting the ball and then operates to cool the heated parts and to otherwise extinguish the arc.

In order that my invention may be better understood, reference is had to the accompanying drawing, in which—

Figure 1 is a sectional elevation of a protective device embodying my invention; Fig. 2 is a plan view of the same with the cover broken away; and Figs. 3 and 4 are details of the spark-gap members.

The protective device consists essentially of a spark-gap member and a resistance member assembled in separate compartments of a box 1 of wood or other suitable material, provided with a removable cover 2. As illustrated in the drawing, the series resistance member consists of a plurality of carbon balls 3 each resting freely in a trough formed between two metal plates 4 and 5. Each ball of the series is separated from the next by a wooden partition 6 extending from the bottom of the box to its top and provided with longitudinal apertures 7 and 8 to permit free circulation of oil or other liquid medium contained in this compartment of the box. The metal plate 5 of one trough, extends through its partition 6 and is suitably bent to form the metal plate 4 of the next trough. The trough-plates at the ends of the series are connected with the metal plates 9 and 10 by which connections may be established with other parts of the system.

The spark-gap compartment 11 of box 1 incloses a pair of carbon plates 12 and 13 spaced apart to form an air-gap and separated by a mica washer 14. This washer is of the form shown in Fig. 4 and serves to insulate the plates from each other and to limit the sparking surface to an area of circular form corresponding to the circular opening 15 in the mica washer. The carbon plates 12 and 13 and the mica washer 14 are held rigidly together by three bolts 16 insulated from the several parts by sleeves 17. The carbon plates 12 and 13 are cut away to form a flared chute immediately above the opening 15 in the mica disk, so that when an arc forms between the plates it will tend to blow itself upward out of the chute. The mica disk bisects the chute and so tends to cut the arc during its upward movement. It will be noted that the plates

12 and 13 present a large sparking area to each other and that the sparking distance will remain substantially constant, irrespective of any slight corrosion or cutting which might take place after repeated discharges across the gap. The gap is protected from moisture, dirt and insects, and is of durable construction.

Each of the carbon plates 12 and 13 is provided with a sheet metal back 18 by which connection may be established with other parts of the system. I prefer to make this spark-gap device removable, and so provide the metal backs 18 with protruding metal lugs 19, fitting respectively in the slotted ends of the bolts 20 and 21, to which the lugs may be securely keyed. By the means above described, carbon plate 13 is connected with one end of the series resistance, and carbon plate 12 is connected with a terminal 22 by which connection may be made with ground or with some other part of the electrical system.

This lightning arrester is adapted for hard and rough usage. In order that the oil may not leak out between the cover and the box, I provide the upper edge of the oil compartment with a felt packing 23 held in place by a metal strip 24. Back of this felt packing is a groove 25 which extends entirely around the compartment. In case oil leaks past the felt, it is caught in this trough and returned through the felt by way of small drain-pipes or ducts 26 arranged at intervals above the compartment. The porous nature of the felt packing insures escape of expanded gases.

In case of a high potential charge on the line conductor to be protected, the charge jumps the gap between the plates 12 and 13, and passes through all the balls of the series; thus escaping to ground or to another conductor of suitable potential. Almost instantly, by virtue of the heating and vaporizing action of the current, the balls lift from their seats and thus introduce into the circuit a series of oil-gaps. The oil-gaps open the circuit promptly but not too sharply, and, in general, open it at the zero point of the current wave. The rupture of the circuit is, therefore, not liable to set up injurious surges or other high frequency phenomena. The carbon balls and their cooperating metal troughs are capable of absorbing a large amount of electrical energy and of transforming it into heat. The oil also coöperates in this action and serves to cool the plates and prevent destructive vaporization thereof. The total movement of the carbon balls may be very small and they drop back in the troughs ready for a second discharge. The balls are free to move back and forth in the troughs and thereby compensate for any wear or disintegration by continuous changes in the surface presented to the plates of the trough.

What I claim as new, and desire to secure by Letters Patent of the United States, is,—

1. In a lightning arrester, a compartment subdivided by partitions and inclosing a plurality of conductors forming troughs, and a conductive member in each trough movable with respect thereto when traversed by current.

2. In a lightning arrester, a plurality of conductors spaced apart and forming a trough, and a carbon ball making an imperfect contact with each member of each trough and free to move longitudinally in said trough.

3. In a lightning arrester, an oil-break device consisting of a plurality of metal conductors spaced apart to form a trough, a carbon ball resting in said trough and contacting lightly with said conductive members, and oil at the contacting surfaces of said ball.

4. A spark-gap device for lightning arresters, comprising a plurality of carbon plates spaced apart by an insulating washer and having cut-away portions to form an arc-expanding chute.

5. In a lightning arrester, the combination of a box divided into compartments, a resistance-member in one of said compartments and comprising a plurality of plates, and carbon balls forming bridges between said plates, said resistance member being submerged in oil, and a spark-gap member in another compartment and connected in series with said resistance member.

6. In a protector, the combination with suitable electrical connections, of a pair of electrodes provided with opposed spark gap surfaces which converge, and a solid dielectric interposed between the most contiguous portions of said electrodes and arranged to divert passing discharges across the gap between said convergent surfaces.

7. In a protector, the combination with suitable supports and terminal connections, of a pair of electrodes having opposed uncovered convergent surfaces and a dielectric of greater insulating resistance than air separating said electrodes at their place of nearest approach.

In witness whereof, I have hereunto set my hand this 17th day of June, 1907.

CONWAY ROBINSON.

Witnesses:
MARGARET E. WOOLLEY,
HELEN ORFORD.