May 13, 1930. A. G. STEINMAYER 1,758,181

LIGHTNING ARRESTER

Filed May 10, 1928 2 Sheets-Sheet 1

Fig. 1.

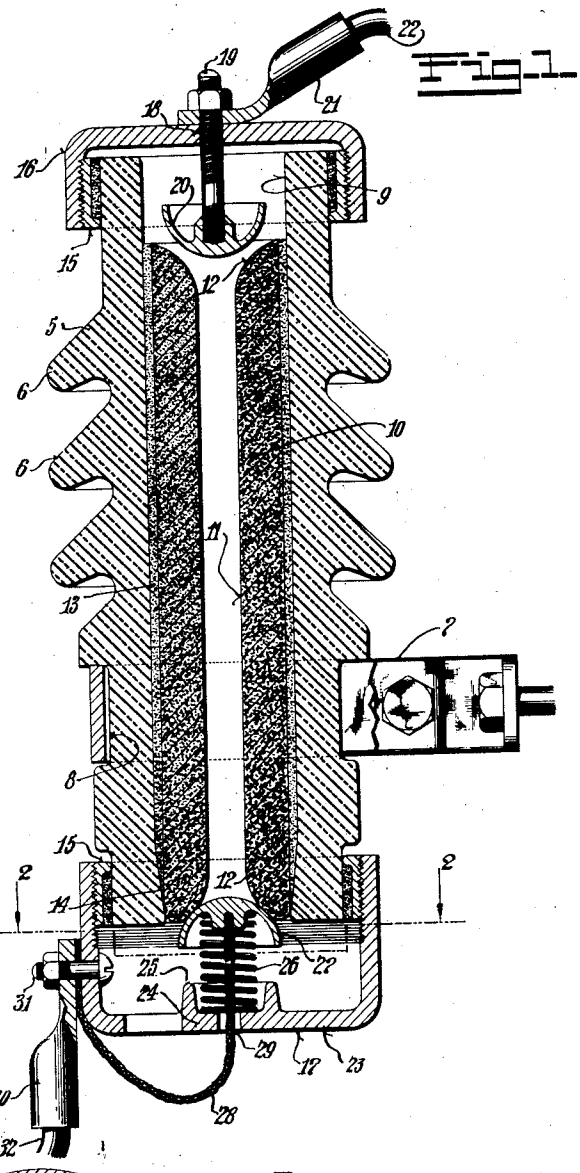
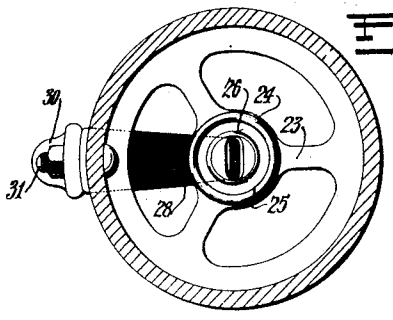


Fig. 2.



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Fig-3-

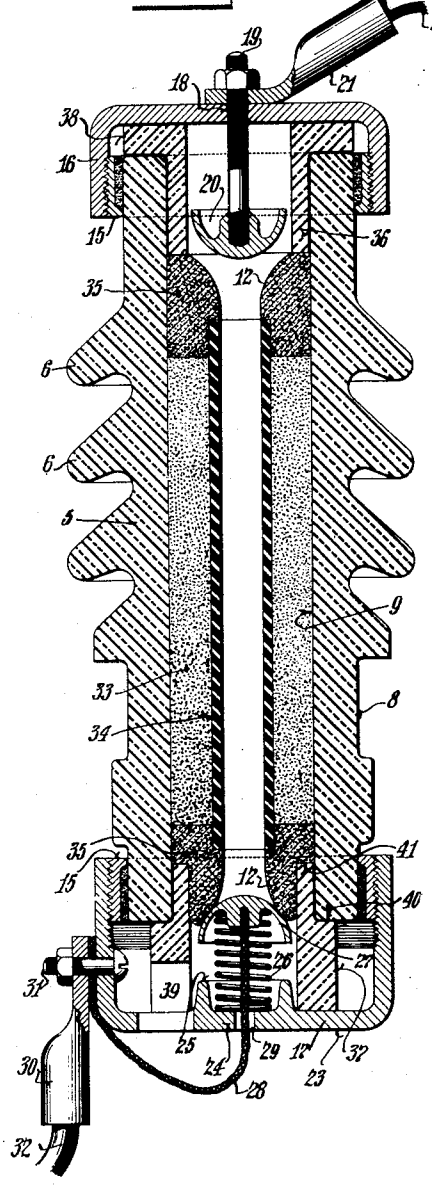
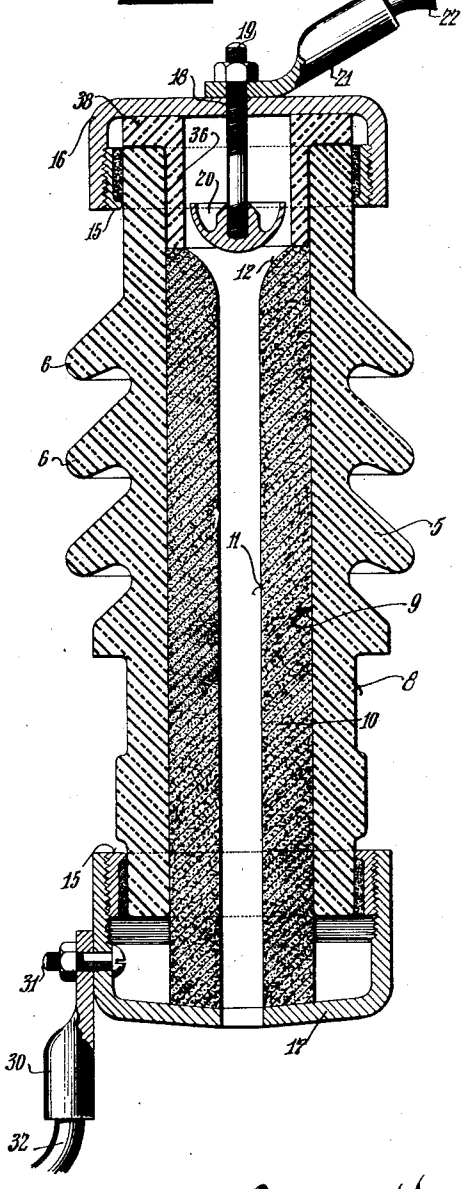


Fig-4-



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Patented May 13, 1930

1,758,181

UNITED STATES PATENT OFFICE

ALWIN G. STEINMAYER, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO LINE MATERIAL COMPANY, OF SOUTH MILWAUKEE, WISCONSIN, A CORPORATION OF DELAWARE

LIGHTNING ARRESTER

Application filed May 10, 1928. Serial No. 276,576.

This invention relates particularly to lightning arresters for use in connection with transmission lines and the like and has as its primary object the provision of means for positively rupturing the power arc which often times follows a discharge and tends to maintain a short from the line to the ground.

Another object of this invention resides in the provision of a lightning arrester of the character described in which a relatively high resistance element in series with the ground connection limits the amount of current which flows in the event a power arc follows the discharge.

Another object of this invention resides in the provision of a lightning arrester of the character described having an adjustable gap across which the current jumps and having means for creating a second gap upon a discharge.

A further object of this invention resides in the provision of a lightning arrester of the character described having a resistance element and a pair of contacts one of which is adjustably spaced from one end of the element to provide a gap across which the current jumps upon a voltage surge and the other being yieldably urged to engagement with the other end of the element and operable to create a second gap upon a discharge produced by the surge.

And a further object of this invention resides in the provision of a lightning arrester of the character described in which the expansion of gases produced by a discharge is utilized to create an auxiliary gap.

With the above and other objects in view which will appear as the description proceeds, my invention resides in the novel construction, combination and arrangement of parts substantially as hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawings, I have illustrated several complete examples of the physical embodiment of my invention constructed according to the best modes I have so far devised for the practical application of the principles thereof, and in which:

Figure 1 is a transverse sectional view taken through a lightning arrester embodying my invention;

Figure 2 is a cross sectional view taken through Figure 1 on the plane of the line 2—2;

Figure 3 is a view similar to Figure 1 of a modified form of my invention, and

Figure 4 is a similar view of another modified form of my invention.

Referring now more particularly to the accompanying drawings in which like numerals designate like parts throughout the several views, 5 represents a tubular insulator which forms the housing or body portion of the arrester and has a plurality of petticoats 6 formed on its outer periphery. A supporting bracket 7 consisting of a band of flexible metal embraces the insulator 5 at an annular groove or recess 8 and provides means for suitably mounting the same. Positioned within the longitudinal bore 9 of the insulator is a tubular resistance element 10 molded from a suitable composition of materials of low conductive properties and having the ends of its bore 11 flared outwardly, as at 12, and being secured in position by cement or other means 13. The lower portion of the insulator bore 9 is taperingly reduced, as at 14, to substantially the outside diameter of the resistance element and thereby provides a restriction for the cement to secure the element against longitudinal downward movement within the bore of the insulator.

Suitably secured, by cement or other means, to each end of the insulator 5 is an exteriorly threaded ring 15 one of which mounts a cap member 16 and the other a base 17. The cap 16 has a threaded aperture 18 in axial alignment with the longitudinal axis of the insulator and the bore 11 of the resistance element to receive a threaded stud 19, on the lower end of which a hemispherical member 20 is secured. The outer end of the stud has a terminal 21 positioned thereon which is impinged between the cap 16 and a nut threaded on the stud, to afford means for electrically connecting a line conductor 22 with the

member 20. The position of the member 20 with respect to the adjacent flared end 12 of the resistance element is readily adjustable by threading the stud into or out of the cap member and is set to a position at which the distance therebetween is sufficient to prevent the normal voltage of the line from jumping the gap.

The base member 17 has its bottom provided with a plurality of spider arms 23 which meet and form a hub 24 having an upstanding annular boss or fin 25. Positioned within the recess of the annular boss is an expansile spring 26, the upper end of which nests within a second hemispherical member 27 to normally urge the same to engagement with the other flared end 12 of the resistance element to maintain an electrical contact therewith. A flexible conductor 28 having one end suitably secured to the hemispherical member 27 passes downwardly through an aperture 29 in the hub of the base member to be connected with a terminal 30 which is secured to the base member by a bolt 31, the end of the flexible conductor being impinged between the adjacent portion of the base member and the terminal, a ground wire 32 being connected with the terminal 30 to lead to the ground, not shown.

In operation, when a surge produced by an electrical discharge is introduced in the transmission line connected with the conductor 22, it, being generally of high frequency and of considerably higher voltage than the voltage of the line, jumps the gap between the member 20 and the adjacent end of the resistance element and passes therethrough to the ground. If the surge is of relatively low voltage the resistance of the element 10 will be sufficient to absorb and limit the voltage to rupture any arc which may tend to hang on, to ground the transmission line, but in the event the voltage of the surge is of such high value that the resistance of the element is not sufficient to absorb the arc, the pressure of the gases produced by the initial arc across the gap at the upper end of the resistance element forces the hemispherical member 27 downwardly against the action of its spring and thus produces a second gap which readily ruptures any arc which may be formed.

In Figure 3 I have illustrated a slightly modified form of my invention in which the molded resistance element 10 is replaced by one formed of a powdered resistance material 33, the powder being placed in the annular space between the wall of the bore 9 of the insulator 5 and the outer surface of a tube 34. Suitably secured to each end of the tube 34 are contacts 35 turned from solid carbon or graphite to provide the desired arcing surface with which the members 20 and 27 cooperate in the manner described in connection with the embodiment illustrated in Figure 1.

The tube 34 together with its contacts 35 is held in its proper longitudinal position by collars 36 and 37 formed of insulating material the collar 36 engages the end of the upper contact and has a flange 38 which is impinged between the adjacent end of the insulator 5 and the inner face of the cap member. The collar 37 engages the lower contact and has openings 39 communicating the bore of the tube with the openings between the spider arms of the base member, to provide passages for the gases and has its upper portion reduced in diameter to form a step 40, the reduced portion extending into the bore of the insulator with the adjacent end of the insulator abutting the step 40 and the end of the collar engaging a stepped portion 41 formed in the contact to suitably space the insulator and the contact from the bottom of the base.

In that embodiment of my invention illustrated in Figure 4, the lower hemispherical member 27 is eliminated and only one gap is provided, which is between the member 20 and the adjacent flared end of the resistance member 10 and in this instance the resistance element extends beyond the end of the insulator 5 to engage the inner face of the base member to thus provide a non-restricted passage for the gases. The electrical connection between the end of the resistance member 10 and the ground being directly through the base member to the terminal.

From the foregoing description taken in connection with the accompanying drawings, it will be readily apparent to those skilled in the art to which an invention of the character described appertains that I provide a novel and improved lightning arrester which is capable of safely conducting any voltage which might occur due to an electrical discharge and one in which the usual power arc is readily extinguished.

What I claim as my invention is:

1. In a device of the class described, a housing, a resistance element fixed within the housing, a contact spaced from one end of the resistance element, and a second contact normally in engagement with the other end of the resistance element but operable upon a discharge of current across the gap at first mentioned end of the resistance element to produce a second gap.

2. In a device of the character described, a housing member, a resistance element mounted within the housing, a contact spaced from one end of the resistance element, the resistance element normally absorbing the current incidental to a discharge across the gap between the resistance element and the contact and means whereby an abnormal discharge of current across the gas produces

a second gap at the other end of the resistance element.

3. In a lightning arrester adapted to be interposed between a line and the ground, a resistance element, a contact spaced from one end of the resistance element to provide a gap across which the current jumps when the voltage of the line exceeds a predetermined value, a second contact normally in engagement with the resistance element, and means whereby the expansion of the gases produced by the arc across the gap moves the second contact out of engagement with the resistance element to create a second gap.

4. In a lightning arrester, a resistance element, a contact spaced from one end of the resistance element to provide a gap, a second contact yieldably urged to engagement with the other end of the resistance element, and means whereby the expansion of gases produced by an arc across the gap moves the second contact out of engagement with the resistance element to create a second gap.

5. In a lightning arrester adapted to be interposed between a line and the ground, a resistance element having a longitudinal bore, a contact spaced from one end of the resistance element to provide a gap across which the current jumps when the voltage of the line exceeds a predetermined value, a second contact, and means yieldably urging the second contact to engagement with the other end of the resistance element, whereby the expansion of gases produced by an arc across the gap, through the longitudinal bore of the resistance element, forces the second contact out of engagement with the adacent end of the resistance element to provide a second gap.

6. In a lightning arrester adapted to be interposed between a line and the ground, a resistance element, means for normally connecting the resistance element with the ground, a contact spaced from one end of the resistance element to provide a gap across which the current jumps upon a surge in line voltage, the resistance element absorbing the current of a normal surge to extinguish the arc across the gap, and means whereby a discharge of current across the gap disconnects the resistance element from the ground to produce a second gap.

7. In a lightning arrester adapted to be interposed between the line and the ground, a resistance element, a contact spaced from one end of the resistance element to provide a gap, a second contact, and means yieldably maintaining the second contact connected with the other end of the resistance element, one of the contacts being connectible with the line and the other with the ground whereby a surge in line voltage establishes an arc across the gap to electrically connect the line with the ground through the resistance element, the resistance element absorbing the current of a normal surge to extinguish the arc across the gap, and an abnormal surge disconnecting the second contact from the resistance element to form a second gap between the line connected contact and the ground.

8. In a lightning arrester adapted to be interposed between a line and the ground, a resistance element, a contact spaced from one end of the resistance element to form a gap across which the current jumps when the voltage of the line exceeds a predetermined value, and means for connecting the other end of the resistance element with the ground, whereby the current flowing from the line to the ground upon establishing an arc across the gap is limited by its passage through the resistance element to extinguish the arc.

9. In a device of the character described, a stationary tubular resistance element forming an elongated chamber, a contact element spaced from one end of the resistance element to provide a gap, means for connecting one of said elements with a line, and means for connecting the other element with the ground, whereby a voltage surge in the line establishes an arc across the gap to electrically connect the line with the ground through the resistance element, the resistance element serving to limit the flow of current to the ground and the expansion of gases within the elongated chamber produced by an arc across the gap tending to extinguish the arc by blowing it through the chamber.

10. In a device of the character described, a stationary tubular resistance element forming an elongated chamber, a contact element spaced from one end of the resistance element to provide a gap, means for connecting one of said elements with a line, means for connecting the other element with the ground, whereby a voltage surge in the line establishes an arc across the gap to electrically connect the line with the ground through the resistance element, the resistance element serving to limit the flow of current to the ground and the expansion of gases within the elongated chamber produced by an arc across the gap tending to extinguish the arc by blowing it through the chamber, and means whereby said expansion of gases produces a second gap at the other end of the resistance element.

11. In a lightning arrester of the character described a housing, a resistance element lining the inner wall of the housing, a stationary contact spaced from one end of the resistance element to provide a gap, a second contact, and means yieldably maintaining the second contact in engagement with the other end of the resistance element whereby a discharge of current across the gap expands the air within the housing to move the second contact out of engagement with the resistance element and produces a second gap.

12. In a lightning arrester of the character described a tubular housing, a tubular resist-

ance element fixed in the housing, a stationary contact spaced from one end of the tubular resistance element to provide a gap, a second contact, and means normally maintaining the second contact in engagement with the other end of the resistance element to close the same, whereby the expansion of gases produced by an arc across the gap forces the second contact out of engagement with the resistance element to provide a second gap.

13. In a device of the character described, a tubular housing, a tubular resistance element mounted within the housing, a contact spaced from one end of the resistance element to provide a gap, means for connecting the contact with a line, a second contact, means yieldably maintaining the second contact in engagement with the other end of the resistance element to close the same, and means for electrically connecting the second contact with the ground, whereby a surge in line voltage establishes an arc across the gap and electrically connects the line with the ground, the flow of current from the line to the ground being limited by the resistance element, and the expansion of gases within the resistance element produced by the arc forcing the second contact out of engagement with the resistance element to provide a second gap.

14. In a lightning arrester of the character described, a tubular resistance element forming an elongated chamber, a contact spaced from one end of the resistance element to provide a gap, and a second contact yieldably engaging the other end of the resistance element to substantially close the chamber whereby a discharge of current across the gap produces a rapid expansion of the air in the chamber which acts directly on the second contact and blows it away from the resistance element to provide a second gap.

In testimony whereof, I have hereunto affixed my signature.

ALWIN G. STEINMAYER.