

July 28, 1942.

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2,291,175

LIGHTNING ARRESTER

Filed June 20, 1941

2 Sheets-Sheet 1

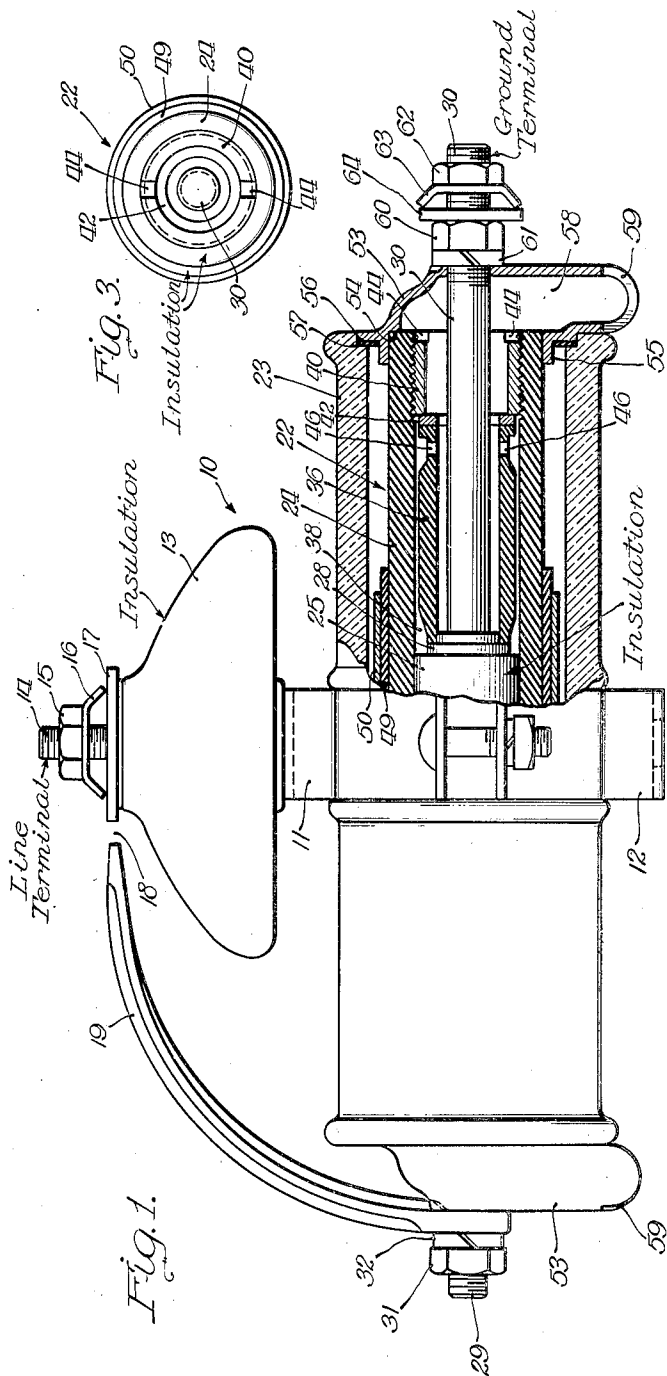


Fig. 1.

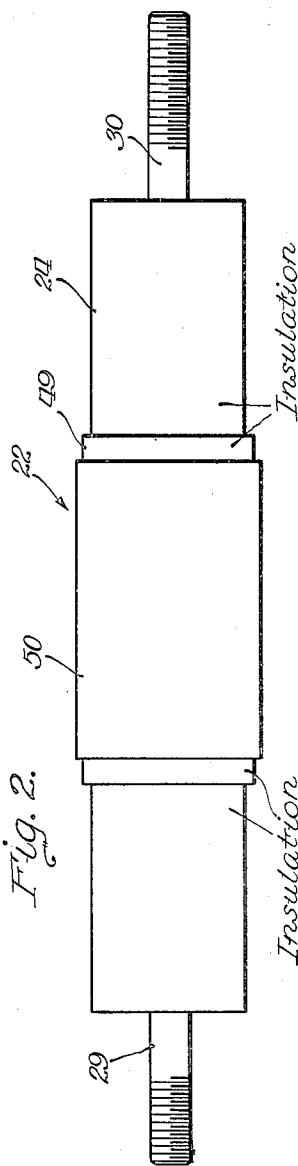


Fig. 2.

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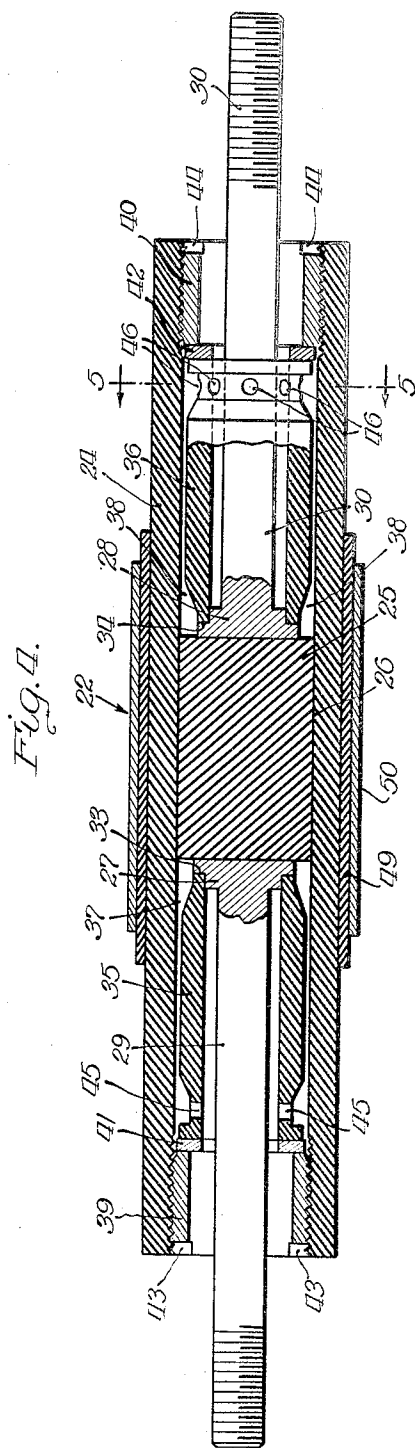
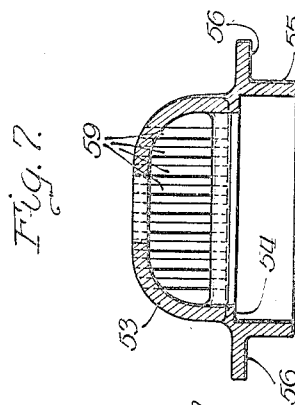
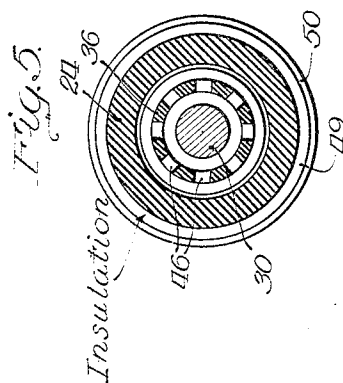
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,291,175

LIGHTNING ARRESTER

Charles L. Stroup, Oak Park, Ill.

Application June 20, 1941, Serial No. 398,880

4 Claims. (Cl. 175—30)

My invention relates, generally, to circuit interrupting devices and it has particular relation to lightning arresters. The present invention constitutes an improvement over the lightning arrester construction disclosed in my co-
5 pending application, Serial No. 321,868, filed March 2, 1940, and represents the commercial embodiment of the construction there shown.

An object of my invention is to prevent bursting of the insulating housing forming a part of the lightning arrester as a result of pressure generated therein on the formation of an arc.

Another object of my invention is to provide for venting the gas expansion spaces within the insulating housing radially inwardly.

Another object of my invention is to provide for venting the housing of the lightning arrester downwardly at its ends.

Still another object of my invention is to provide for clamping the various parts within the tubular insulating housing in predetermined relation thereto in such manner as to resist displacement resulting from pressure generated in the arrester on formation of an arc therein and to facilitate manufacture of the arrester.

Other objects of my invention will, in part, be obvious and in part appear hereinafter.

For a more complete understanding of the nature and scope of my invention, reference can be had to the following detailed description
10 taken in connection with the accompanying drawings in which:

Figure 1 is a view in side elevation, certain parts being broken away to show the interior details of construction, of a preferred embodiment of my invention;

Figure 2 is a view in side elevation of the arrester unit that is inserted in the outer water-proof insulating housing of the lightning arrester shown in Figure 1;

Figure 3 is a view, in end elevation, of the unit shown in Figure 2;

Figure 4 is a longitudinal sectional view of the unit shown in Figure 2, certain portions being shown in elevation;

Figure 5 is a detail sectional view taken along the line 5—5 of Figure 4;

Figure 6 is a view, in end elevation, of one of the end caps employed for closing the ends of the lightning arrester and venting the same
15 downwardly; and

Figure 7 is a detail sectional view taken along the line 7—7 of Figure 6.

Referring now particularly to Figure 1 of the drawings, it will be observed that the reference
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character 10 designates, generally, a lightning arrester construction which is intended for use on distribution circuits ranging upwardly in voltage from 2,300 volts. The construction includes
25 a metallic bracket formed by two cooperating parts 11 and 12. The lower part 12 of the bracket is arranged to be mounted on a cross-arm or the like so that the lightning arrester construction 10 is mounted in a substantially horizontal position as shown.

The upper part of the bracket 11 carries a pin type insulator 13 from which a terminal 14 projects upwardly for connection to the line or conductor to which the lightning arrester construction 10 is to be connected. A nut 15 threaded on terminal 14 serves to hold a clamp member 16 against a conductor disposed thereunder and on top of a metallic washer 17. A gap 18 is provided between the metallic washer 17 and an arcing
30 horn 19 so as to prevent the application of line voltage to the arc extinguishing parts of the lightning arrester construction 10 which will be described hereinafter.

A lightning arrester assembly, indicated generally at 22, is provided within a weather-proof housing 23, of frangible insulating material such as glass or porcelain, for extinguishing arcs that may occur on operation of the lightning arrester construction 10. The lightning arrester assembly
35 22 is of unitary construction and can be assembled as such for insertion in the housing 23.

In Figures 2, 3, 4, and 5 of the drawings, the details of construction of the lightning arrester assembly 22 are shown. As there illustrated, particularly in Figure 4, the assembly comprises a tubular housing 24 of insulating material such as fiber and it has intermediate its ends an imperforate plug 25 of insulating material such as fiber. The housing 24 and plug 25 are formed of
40 fiber or other similar material so as to be capable of evolving an arc extinguishing medium, such as water vapor, when subjected to the heat of an arc for assisting in extinguishing the same. The plug 25 has a contact fit with the inner surface of the insulating housing 24 so that the juxtaposed surfaces as indicated at 26 are close together. It is along these surfaces that an arc is formed on operation of the device. Because of the extremely limited space for the arc, relatively
45 great pressures are generated which, together with the arc extinguishing medium evolved from the juxtaposed surfaces of the housing 24 and plug 25, serve to quickly extinguish the arc. Usually the arc is extinguished within one-half cycle or less of the alternating current, such as a

60-cycle current, with which distribution systems are usually energized.

At the ends of the imperforate plug 25 are electrodes 27 and 28 which, as shown, are substantially less in diameter than the diameter of the plug 25. The arc is formed between the electrodes 27 and 28 and is required to make two changes in direction in order to follow the path provided over the juxtaposed surfaces of the housing 24 and plug 25. As described in my co-pending application, referred to hereinbefore, this facilitates the extinction of the arc. Conductor rods 29 and 30 extend axially outwardly from the electrodes 27 and 28. As shown, they may be formed integrally with the electrodes 27 and 28 or they may be formed separately and threaded into the electrodes 27 and 28 as desired. It will be observed that the arcing horn 19 is secured to the conductor rod 29 by means of a nut 31 and a lock washer 32, as shown in Figure 1 of the drawings.

The electrodes 27 and 28 are provided with shoulder portions 33 and 34 facing outwardly against which the inner ends of sleeves 35 and 36 of insulating material abut. The sleeves 35 and 36 are preferably of fiber. They are spaced from the adjacent inner surfaces of the insulating housing 24 so as to form gas expansion spaces 37 and 38 into which gases evolved during arc extinction can expand. The outer ends of the gas expansion spaces 37 and 38 are closed by threaded metallic sleeves 39 and 40 which react against washers 41 and 42 that abut the outer ends of the sleeves 35 and 36. The metallic sleeves 39 and 40 cooperate with internal threads at the ends of the insulating housing 24 and are provided with recesses 43 and 44 for receiving a suitable spanner wrench.

When the threaded metallic sleeves 39 and 40 are located as illustrated, they serve to hold the parts inside of the insulating housing 24 securely in place in proper spaced relationship. When properly tightened, they place the insulating housing 24 somewhat in tension and the plug 25, electrodes 27 and 28, and sleeves 35 and 36 somewhat in compression.

The gas expansion spaces 37 and 38 are vented by apertures 45 and 46 which open radially inwardly from the gas expansion spaces 37 and 38 into the interior of the sleeves 35 and 36. The interior of the sleeves 35 and 36 is vented to the atmosphere as will be presently apparent.

As indicated hereinbefore, relatively high pressures are generated along the juxtaposed surfaces of the housing 24 and plug 25 when an arc is formed between the electrodes 27 and 28. With a view to preventing the insulating housing 24 from bursting, due to these pressures, a sleeve 49 of insulating material, such as fiber, is provided around both the housing 24 and plug 25 underneath a reinforcing ring or sleeve 50 of steel. The reinforcing ring or sleeve 50 fits closely over the sleeve 49 which in turn fits closely over the housing 24 so that bursting of the housing 24 in this region is effectively prevented. Since the insulating plug 25 is relatively short as compared to the length of the housing 24, the reinforcing ring or sleeve 50 is correspondingly short, being long enough as shown to extend somewhat beyond the ends of the plug 25, and therefore it does not substantially reduce the external dielectric properties of the housing 24.

As shown in Figure 1 of the drawings, the insulating housing 24 is of the same length as the water-proof housing 23. It is held therein by suitable metallic end caps 53, the details of con-

struction of which are shown in Figures 1, 6, and 7 of the drawings. Each of the end caps 53 is provided with a shoulder portion 54 which abuts the outer end of the insulating housing 24 and a forwardly extending flange portion 55 which surrounds the adjacent end of the insulating housing 24. The radially projecting shoulder 56 abuts a ring of suitable packing 57 which interfits with a suitable recess in the adjacent end of the water-proof housing 23. Each of the end caps 53 provides a space 58 which communicates through the threaded metallic sleeves 39 and 40, Figure 4, into the interior of the sleeves 35 and 36 which communicates with the gas expansion spaces 37 and 38 through the radial apertures 45 and 46, as previously described. The space 58 in each of the end caps 53 is vented downwardly through a plurality of apertures 59 in the form of milled slots in its undersurface. The slots 59 are preferably relatively narrow so as to prevent the entrance of insects and so forth into the interior of the lightning arrester construction 10.

The end cap 53 of the lefthand end of the water-proof housing 23 is held in place by the nut 31 and lock washer 32 which also holds the arcing horn 19 in position as previously described. The end cap 53 at the righthand end is held in place by a nut 60 and a lock washer 61.

The conductor rod 30 at the righthand end of the water-proof housing 23 is arranged to be connected to ground. For this purpose a conductor is secured to the conductor rod 30 by means of a nut 62 which serves to fasten a clamp member 63 securely against a conductor placed underneath it against a washer 64.

In operation, on the occurrence of an over-voltage such as is caused by a lightning or switching surge, the gap 18 breaks down and an arc is formed between the electrodes 27 and 28 along the juxtaposed surfaces of the housing 24 and plug 25. Because of the confined space in which the arc is formed due to the contact fit between the housing 24 and plug 25 and further because of the arc extinguishing medium evolved from them, the arc is quickly extinguished and the gases incident thereto expand in the spaces 37 and 38 provided therefor and are expelled through the apertures 45 and 46 to the atmosphere through the vents 59 in the end caps 53. As soon as the arc between the electrodes 27 and 28 is extinguished, the arc at the gap 18 is also extinguished.

Since certain changes can be made in the foregoing construction and different embodiments of the invention can be made without departing from the spirit and scope thereof, it is intended that all matter described herein and shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In a lightning arrester, in combination, a tubular housing, a plug within said tubular housing spaced a substantial distance from at least one end thereof, said housing and plug being formed of insulating material capable of evolving an arc extinguishing medium due to the heat of an arc, electrodes at the ends of said plug between which an arc may be formed along the juxtaposed surfaces of said housing and plug, conductor means extending out of said one end of said housing from the adjacent electrode therein, and a sleeve of insulating material extending outwardly from said adjacent electrode and spaced from the inner surface of said housing to provide therebetween a gas expansion

space the outer end of which is closed, there being one or more apertures in said sleeve adjacent its outer end opening radially inwardly for venting said space.

2. In a lightning arrester, in combination, a relatively long tubular housing, a relatively short plug within said housing intermediate its ends, said housing and plug being formed of insulating material capable of evolving an arc extinguishing medium due to the heat of an arc, electrodes at the ends of said plug between which an arc may be formed along the juxtaposed surfaces of said housing and plug, conductor means extending from each electrode out of its end of said housing, and a sleeve of insulating material extending outwardly from each electrode and spaced from the inner surface of said housing to provide therebetween gas expansion spaces the outer ends of which are closed, there being one or more apertures in each sleeve adjacent its outer end opening radially inwardly for venting said spaces.

3. In a lightning arrester, in combination, a tubular housing, a plug within said tubular housing spaced a substantial distance from at least one end thereof, said housing and plug being formed of insulating material capable of evolving an arc extinguishing medium due to the heat of an arc, electrodes at the ends of said plug between which an arc may be formed along the juxtaposed surfaces of said housing and plug, conductor means extending out of said one end of said housing from the adjacent electrode therein, a sleeve of insulating material extending outwardly from said adjacent electrode and spaced from the inner surface of said housing to provide therebetween a gas expansion space,

the outer end of said sleeve being spaced from said one end of said housing and there being one or more apertures in said sleeve adjacent its outer end opening radially inwardly for venting said space, and clamp means disposed interiorly of said housing at said one end thereof including means reacting against the adjacent end of said sleeve for holding the same in a predetermined position in said housing and closing the outer end of said gas expansion space.

4. In a lightning arrester, in combination, a relatively long tubular housing, a relatively short plug within said housing intermediate its ends, said housing and plug being formed of insulating material capable of evolving an arc extinguishing medium due to the heat of an arc, electrodes at the ends of said plug between which an arc may be formed along the juxtaposed surfaces of said housing and plug, a conductor rod extending axially out of each end of said housing from the adjacent electrode therein, a sleeve of insulating material extending outwardly from abutting relation with each electrode and spaced from the inner surface of said housing to provide therebetween a gas expansion space, the outer end of each sleeve being spaced from the adjacent end of said housing and there being one or more apertures in each sleeve adjacent its outer end opening radially inwardly for venting each space, and clamp means disposed interiorly of said housing at each end and adapted to react against the adjacent end of the sleeve thereat for holding the same in predetermined position in said housing and closing the outer end of each expansion space.

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