

Aug. 8, 1944.

A. J. WAYMAN
LIGHTNING ARRESTER

2,355,490

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FIG. 1

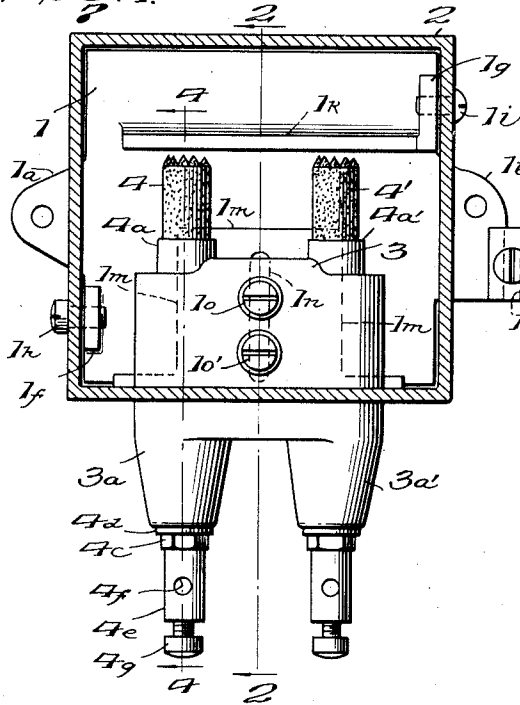


FIG. 2

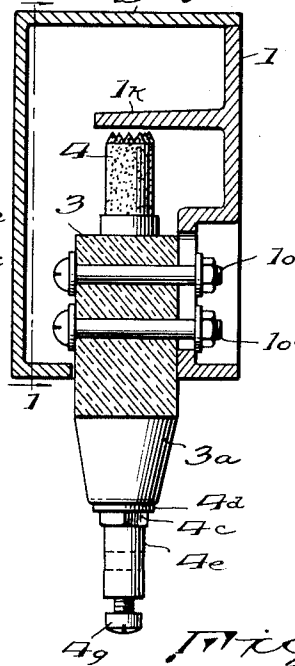
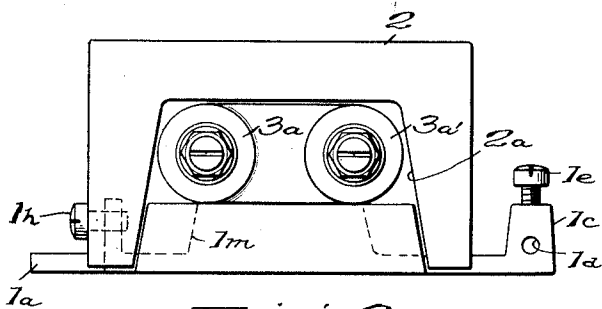


FIG. 3

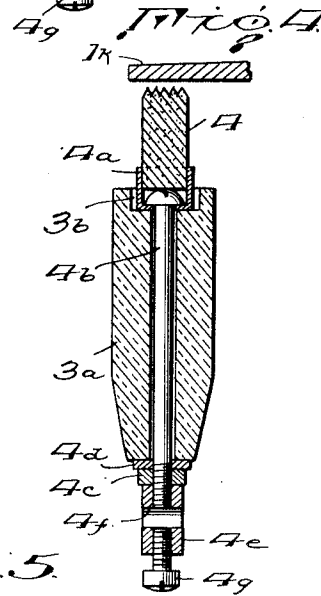
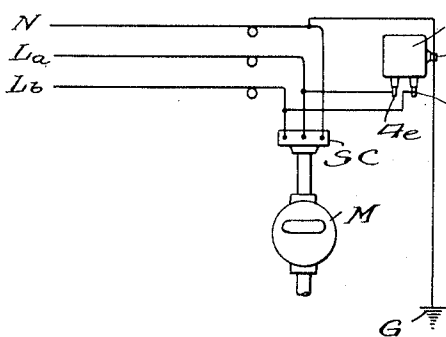


FIG. 5

Inventor
Albert J. Wayman,

By Ralph B. Stewart

Attorney

UNITED STATES PATENT OFFICE

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LIGHTNING ARRESTER

Albert J. Wayman, Youngstown, Ohio

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7 Claims. (Cl. 175—30)

This invention relates to lightning arresters for the protection of apparatus connected to electric service lines. My invention is particularly useful for the protection of electric meters on service lines for dwellings or other buildings, but it is not limited to such use and is capable of general application.

An object of the present invention is to devise a lightning arrester which will protect apparatus connected to power lines against the effects of lightning or other electric surges and, at the same time, will prevent substantial power-flow from the electric service lines.

One embodiment of my invention is illustrated in the accompanying drawing in which:

Figure 1 is a front elevation view, partly in section, of one form of my lightning arrester, the enclosing casing being cut away along the line 1—1 of Figure 2;

Figure 2 is a sectional view of the arrester taken along the line 2—2 of Figure 1;

Figure 3 is a bottom view of Figure 1 showing the entire cover or casing in place;

Figure 4 is a vertical sectional view taken through the center of one of the electrodes of Figure 1 along the line 4—4; and

Figure 5 is a circuit diagram showing the arrester connected to a service lead-in.

Referring to the drawing, the lightning arrester is provided with a base plate 1 which is preferably formed of cast metal comprising an alloy of aluminum and a high percentage of zinc. The base plate is preferably of rectangular shape and a pair of mounting lugs 1a, 1b are formed integral with the plate and extend outwardly in opposite directions from the vertical edges of the plate, these lugs being provided with screw holes, as shown, for mounting the base plate 1 on any suitable flat surface. The plate 1 would normally be mounted in a vertical plane as shown in Figures 1 and 2, although it could be mounted in other positions. A grounding lug 1c is formed integral with the mounting lug 1b and is bored at 1d for receiving the ground conductor which is clamped in place by the screw 1e. A pair of upstanding lugs 1f, 1g are provided near opposite vertical edges of plate 1 as shown in Figure 1. These lugs are bored and threaded for receiving screws 1h and 1i, respectively, which secure the cover 2 to the base plate 1.

Near the upper part of plate 1, a horizontal shelf-like projection or flange 1k is formed integral with the plate 1 and extends out into the cover 2, as shown in Figure 2. This plate

forms a grounded electrode common to the two gaps of the lightning arrester.

Part of the lower portion of the plate 1 is formed as a hollow boss 1m extending into the cover 2 and forming a mounting base for the insulating body 3 which supports the discharge electrodes 4 and 4'. Insulator 3 may be formed of porcelain or other suitable insulating material. The boss 1m is provided with a vertical slot 1n for receiving mounting bolts 1o and 1o' which pass through suitable holes formed in the insulator 3 and secure the insulator to the boss 1m. As will be seen from the drawing, slot 1n allows adjustment of the insulator 3 and electrodes 4 and 4' vertically so that the length of the gap existing between electrodes 4, 4' and the shelf 1k can be adjusted to the desired value. I prefer to apply shellac or some other suitable bonding material between the abutting surfaces of insulator 3 and the boss 1m to securely bond the insulator 3 in adjusted position on boss 1m. This may be done conveniently by saturating a piece of absorbent paper or cloth with shellac and inserting the paper between the boss 1m and the insulator 3 before adjusting and clamping the insulator in position.

The cover 2 is preferably formed of cast metal of the same composition as base plate 1. The cover is of box-like shape with the open side embracing and surrounding the outside edge of base plate 1, as shown in Figures 1, 2 and 3, except that the bottom wall (as shown in Figures 1 and 2) is notched at 2a (see Figure 3) to closely conform to insulator 3 which projects downwardly from the casing. It will be seen that the arrester electrodes 4, 4' and 1k are entirely enclosed in a grounded, two-piece metallic housing or casing formed of non-arcing metal (aluminum-zinc alloy).

Insulator 3, which supports electrodes 4 and 4', is preferably formed of a single body of insulating material (porcelain) and is provided with two legs 3a and 3a' extending downwardly from the arrester casing. Each leg is provided with a bore or hole extending through the top of the insulator for receiving the mounting stem of one of the electrodes 4 and 4'.

The details of the construction for mounting electrodes 4 and 4' are shown in Figure 4.

Electrodes 4 and 4' are preferably formed of carborundum rods having a negative resistance or voltage characteristic and are mounted within copper or brass cups 4a and 4a', respectively. Since both electrode constructions are alike, only one construction will be described as shown in

Figure 4. Electrode cup 4a is mounted within a recess 3b formed in the upper end of insulator 3, and the cup 4a is secured to the insulator by a mounting stem 4b which conveniently may assume the form of a long threaded screw formed of brass or copper, the head of the screw being located in the bottom of the cup as shown, and the end of the screw extending through the leg 3a. The electrode assembly is secured to the insulator by a nut 4c having threaded engagement with the lower end of the stem 4b, a washer 4d being interposed between the nut and the leg 3a. A suitable connector is secured to the lower end of the stem 4b, and in the example shown, this connector comprises a short length of copper or brass rod 4e having threaded engagement with the lower end of stem 4b and being bored at 4f to receive a connecting conductor from the lines to be protected. A clamping screw 4g is threaded into the end of the connector 4e for clamping the conductor in the connector.

The electrode 4 may be secured in the cup 4a simply by frictional engagement, but I prefer to secure the electrode in the cup by brazing, and also secure the cup on the stem 4b by brazing. For the purpose of facilitating the brazing operation, a portion of the lower end of electrode 4 is preferably metallized.

In Figure 5, I have shown the manner in which my lightning arrester is connected for the purpose of protecting a watt-hour meter on service lines leading into an ordinary dwelling. As shown, the service lines consist of a grounded neutral N and two live lines La and Lb supported upon suitable insulators attached to the outside of the dwelling. These lines pass into a service cap Sc and then through a suitable conduit to the meter M, and from the meter M through a suitable conduit which leads to the inside of the house. As shown in Figure 5, a connection is made from the neutral conductor N to the connecting lug 1e on the base plate of the arrester and then to ground G. Also, connections are made from lines La and Lb, respectively, to electrode connectors 4e and 4e'.

In the lightning arrester which I am now manufacturing for the protection of watt-hour meters on service lines having voltages ranging from 110 to 600 volts, I employ an electrode-piece 4 consisting of a round rod of carborundum three-eighths of an inch in diameter and seven-eighths of an inch over all length, the upper end of the electrode having a number of points formed thereon. These points may be formed in any desired manner, but I prefer to form them by molding in the process of manufacturing the electrode. In the actual electrode, there are sixteen cone-shaped points evenly distributed over the upper end of the electrode, one point being located at the center, five additional points surrounding the center point in a circle, and an outer circle including eleven points equally spaced. I prefer to metallize the end surface of the electrode where the points are located, including the surface of the points. At the other end, the end surface and about one-eighth inch of the length is metallized where the electrode is brazed into the cup. Electrode-piece 4, without the mounting cup 4a, has a resistance of approximately 600 ohms from end to end at low current values, and when mounted within the cup 4a, it has a resistance of approximately 500 ohms. Thus, neglecting the air gaps, electrodes 4 and 4' provide a resistance of the order of 1000 ohms be-

tween connectors 4e and 4e' at low current values.

In operation my arrester is very effective in protecting apparatus against damage by voltage surges and in preventing power flow from the line following each discharge across the gaps. I do not attempt to give a theory to explain the operation, but I believe the effectiveness of the arrester in preventing power flow is due to the use of a carborundum electrode having relatively high resistance and which does not vaporize under arcing conditions. The electrode is practically unaffected by the arc. Another factor is in the use of non-arcing metal as the common grounded electrode. This seems to produce a valve-like action between the carborundum electrode and the plate electrode. I also find that the provision of the points at the discharge end of the electrodes is an important factor in preventing power flow. Actual tests have shown that a single point or a flat surface is not as effective as a number of points, as shown.

Not only do the electrodes not deteriorate appreciably under ordinary arcing due to surge discharges, but, due to the high inherent resistance, they also prevent any substantial power flow in case the electrodes should by accident be forced into contact with the grounded plate electrode, it being noted that in such case the electrodes offer a resistance to flow of current of the order of 1000 ohms.

While I have illustrated one embodiment of my invention, it is obvious that modifications may be made, and I do not intend to be restricted to the modification illustrated and described, except in accordance with the appended claims. The number and size of the points on the discharge end of the carborundum electrode may be varied. While I have illustrated a two-gap arrester suitable for use on a two-wire system, or on a three-wire grounded-neutral system, it is obvious that the device may be formed with only one carborundum electrode providing a single discharge gap, in which case a separate device would be provided for each conductor in the line to be protected. Also, as in the case of a three-phase line, the device may have three carborundum electrodes providing three gaps to the grounded electrode.

What I claim is:

1. A protective discharge device comprising a grounded metallic housing, a pair of insulated carborundum rod electrodes, means for mounting said electrodes in parallel relation within said housing with the ends thereof arranged in adjustable spaced relation to a portion of said housing for forming discharge gaps between the ends of said rod electrodes and said housing, each of said rods being of a length sufficient to provide a resistance path of the order of one to five ohms per volt of the circuit to be protected.

2. A protective discharge device comprising a vertical metallic base plate having a horizontal shelf formed integral therewith, a box-like casing cooperating with said base plate to enclose said shelf, a pair of insulated carborundum electrodes mounted in spaced relation to said shelf, and means extending through the lower wall of said casing for providing connections to said electrodes.

3. A protective discharge device comprising a vertical metallic base plate having a horizontal shelf formed integral therewith, a box-like casing cooperating with said base plate to enclose said shelf, an insulated electrode mounted below said shelf and in spaced relation to the lower face

thereof, and means extending through the lower wall of said casing for providing a connection to said electrode.

4. A protective discharge device according to claim 3 wherein said electrode is supported by an insulator sleeve arranged partly within said casing and extending to the outside thereof, and including means for mounting said insulator for vertical adjustment on said base plate, and wherein the connection to said electrode passes through said sleeve.

5. A protective discharge device comprising a vertical metallic base plate having a horizontal shelf formed integral therewith, a box-like casing cooperating with said base plate to enclose said shelf, an insulator mounted upon said base plate below said shelf and arranged for vertical adjustment on said base plate, and a pair of carborundum rod electrodes mounted on said insulator and having the ends thereof arranged in spaced relation to the lower face of said shelf, and means for providing external connections to said electrode.

6. A protective discharge device comprising a metallic base plate having a flange portion formed

at right-angles thereto and comprising one electrode of a discharge gap, an insulator, means for mounting said insulator on said base plate for adjustment towards and from said flange portion, and a carborundum rod electrode mounted on said insulator at right angles to said flange portion and having one end thereof arranged in spaced relation to said flange portion to form a discharge gap therebetween.

7. A protective discharge device comprising a vertical metallic base plate, a conductive horizontal shelf supported from said base plate, a metallic casing supported from said base plate and enclosing said shelf, a tubular insulator mounted with its upper end located within said casing and its lower end extending out of said casing, and a carborundum rod electrode mounted within said casing on said insulator and having one end thereof arranged in spaced relation to the lower face of said horizontal shelf to form a discharge gap, said rod electrode having a conductive stem extending through the passage of said tubular insulator and having terminal means formed on the lower end thereof.

ALBERT J. WAYMAN.