No. 795,538. PATENTED JULY 25, 1905.

J. J. O'CONNELL.

PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS.

APPLICATION FILED JULY 20, 1904.

2 SHEETS—SHEET 1.

Fig. 1.

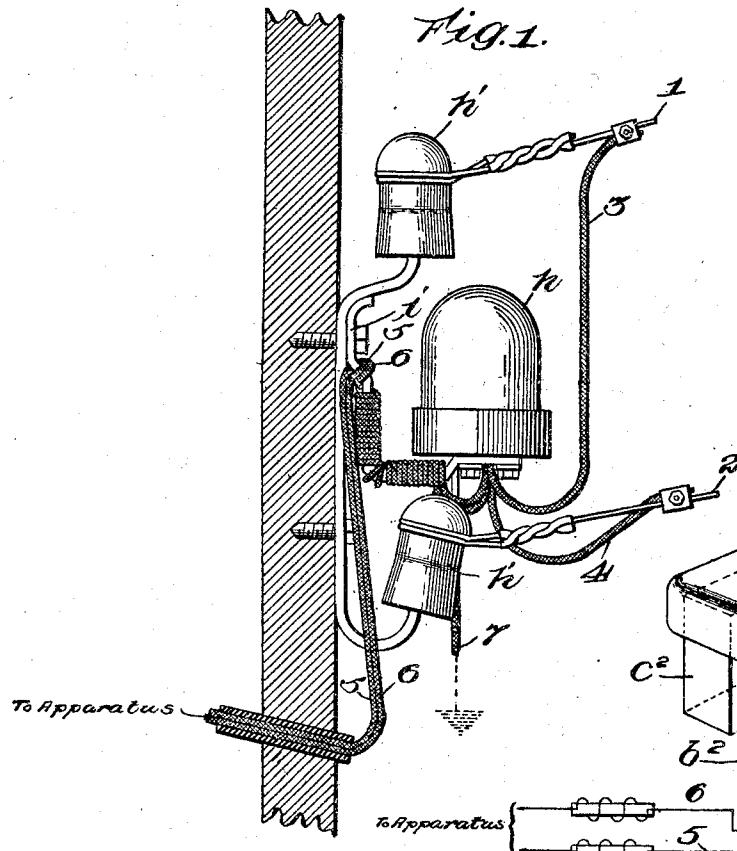


Fig. 7.

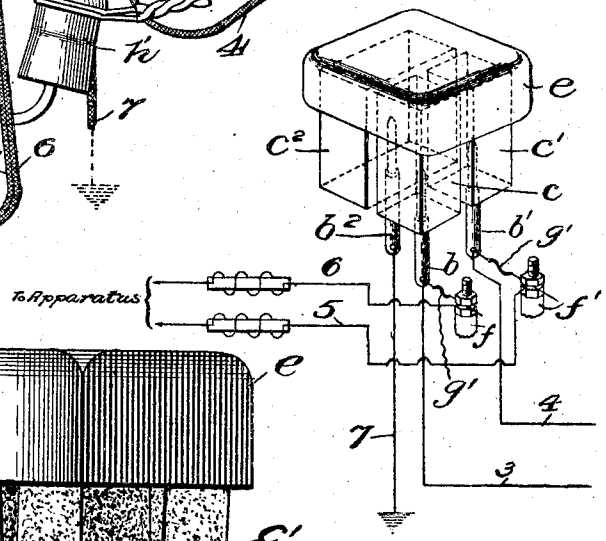
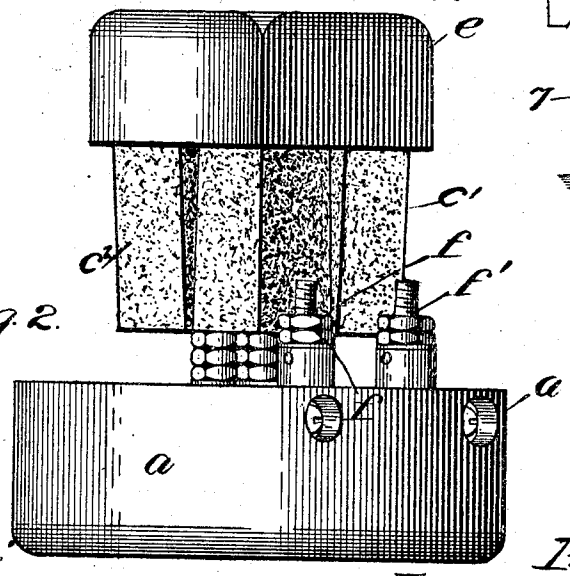


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

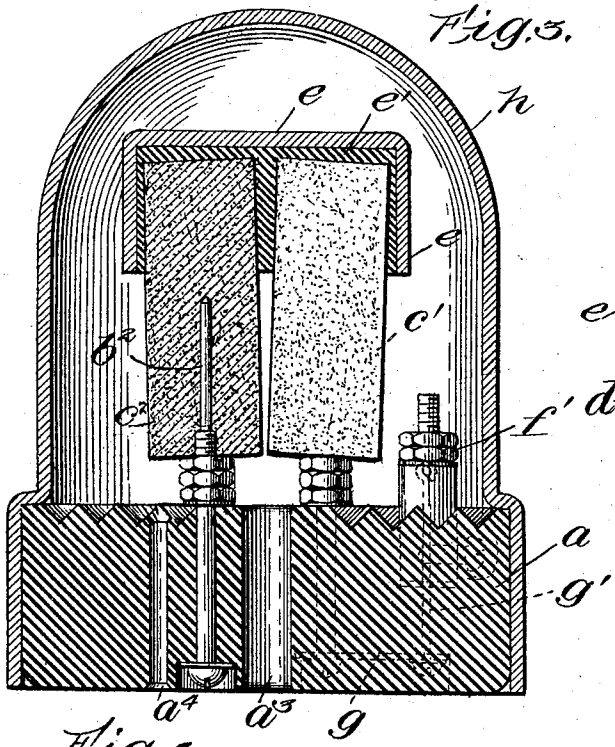


Fig. 4.

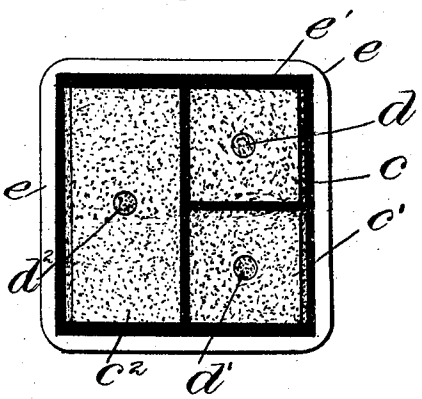


Fig. 5.

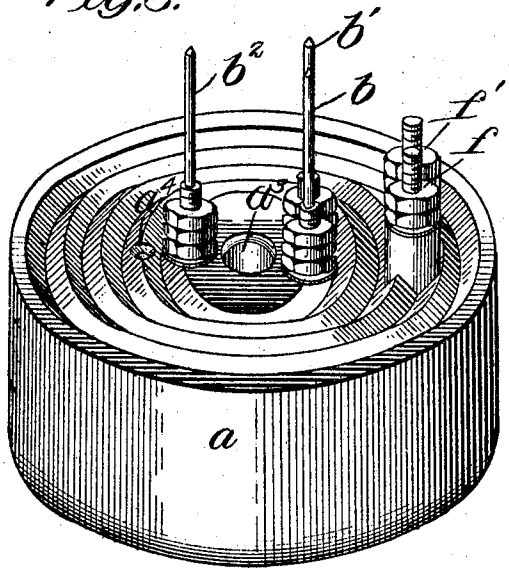
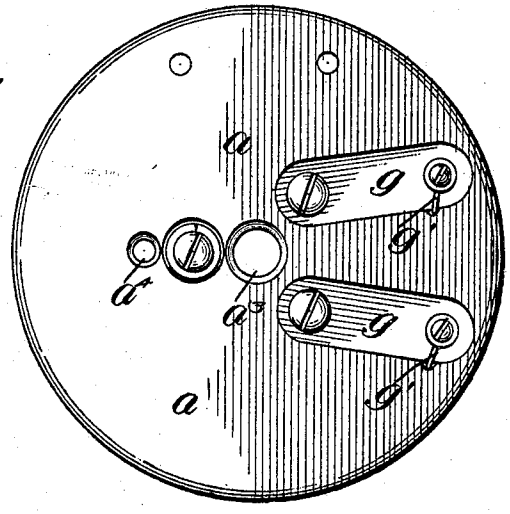


Fig. 6.



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UNITED STATES PATENT OFFICE.

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PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS.

No. 795,538. Specification of Letters Patent. Patented July 25, 1905.

Application filed July 20, 1904. Serial No. 217,302.

To all whom it may concern:

Be it known that I, JOSEPH J. O'CONNELL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Protective Devices for Electric Circuits, of which the following is a full, clear, concise, and exact description.

My invention relates to a protective device for electric circuits, and has for its object to provide an improved protector which will be especially adapted for outdoor use for guarding circuits against injury from lightning discharges and dangerous currents from other sources.

My invention contemplates a protective device which will be very substantial and durable in construction, so as to be capable of use in circuits carrying large currents and also to meet the conditions of outdoor use.

One feature of the invention lies in the construction whereby the arrester-plates are rigidly held together as a unit in a fixed relation to one another while thoroughly insulated. An absolutely-fixed and constant separation is thereby maintained between the plates, so that it becomes unnecessary to interpose solid dielectrics between them, as is the usual practice. Such dielectrics are a well-known source of trouble in protective devices of this character, since particles of the arrester-plates and other matter are apt to collect upon the top and sides of the dielectrics, and so short-circuit the plates. In my construction these conducting particles simply fall out or are blown from between the plates at the time of the discharge. The arrester-plates are given the maximum separation at the point where they enter the solid body which receives their upper ends, so as to minimize danger of short-circuiting due to accumulations upon the intervening surface of the solid. The plates being held rigidly with a fixed separation between them cannot be shifted to vary their relative positions, and thus cause trouble in the circuit by becoming insensitive to the potential difference at which they are required to operate. The arrester-plates are adapted to be removed from their operating positions as a unit for the purpose of inspection, &c., and to permit the substitution of new units or sets therefor.

Other features of the invention consist in the provision of certain auxiliary apparatus and in the peculiar arrangement of said apparatus in association with the arrester to cooperate therewith in the protection of apparatus with which the device may be associated.

I will describe my invention particularly by reference to the accompanying drawings, and the particular parts, improvements, or combinations which I regard as novel will be pointed out in the appended claims.

Figure 1 is a view in elevation of the protective device of my invention, illustrating its application to an electric circuit at the point where the same enters a building. Fig. 2 is a perspective view of the protective device with the hood removed. Fig. 3 is a vertical sectional view. Fig. 4 is a bottom view of the arrester-plates and their supporting-cap. Fig. 5 is a perspective view of the base and the terminals supported thereby. Fig. 6 is a bottom view of the base, and Fig. 7 is a diagram illustrating the circuit connections of the protective device shown.

The same characters of reference are used to designate the same parts wherever shown.

The insulating-base a of the arrester carries three pins b b' b^2, upon which are mounted the arrester-plates c c' c^2. The ends of the arrester-plates are drilled to form holes d d' d^2, in which the pins are adapted to enter, said pins thus making electrical connection with the arrester-plates in addition to serving as supports therefor.

The arrester-plates c c' c^2, which are preferably blocks of carbon, are held rigidly in a fixed relation to one another by means of an insulating-cement. This may be accomplished by securing the ends of the plates in a cap e, containing suitable cement e', such as sulfur. The cement may be first melted and poured into the cap e and the ends of the plates placed in the cap, with the proper air-space between them. When the cement cools, the plates will be rigidly held thereby in a fixed relation to one another, with the inner surface of the plate c^2 lying adjacent and opposed to the inner surfaces of the plates c c'. I prefer to arrange the arrester-plates so that their inner faces diverge upwardly, as shown, to provide a maximum separation of the plates at the point where they leave the cement in order to minimize the danger of short-circuiting the

plates by accumulations of carbon-dust, &c., upon the surface of the intervening cement.

In practice the two pins $b\ b'$, carrying the plates $c\ c'$, may constitute the line-terminals, the line conductors passing through the hole a^3 in the base, while the pin b^2, which carries the arrester-plate c^2, may be connected to earth by a conductor passing through the hole a^3 or a separate hole a^4 in the base.

I have found it desirable to employ fuses in conjunction with the arrester-plates $c\ c'$, which would be electrically connected with the line-wires, and to this end I preferably provide additional terminals $f\ f'$ upon the base to which the line-wires may be connected, the pins $b\ b'$ being connected to said terminals by means of conducting-strips $g\ g$ and fuses $g'\ g'$. The fuses $g'\ g'$ pass through the base of the arrester, which thus serves as an inclosing case therefor. The fuses, which are of a somewhat delicate construction, are thus protected from injury, and any arc occurring due to the melting of a fuse will be immediately disrupted and blown out.

The upper surface of the base is preferably grooved, thereby decreasing the danger of short circuits occurring between the terminals mounted upon the base by reason of particles of carbon accumulating thereon. The base carries a hood h, adapted to protect the apparatus mounted on said base.

The base a is adapted to be secured to a bracket i, which may be mounted on the side of a building or pole, as desired. Said bracket may support upon its ends glass insulators $h'\ h'$, to which the line-wires 1 2 are secured. The conductors 3 4 lead from said conductors 1 2, respectively, through the opening a^3 in the base a of the protective device to the pins $b\ b'$, carrying the carbon arrester-plates $c\ c'$, which are electrically connected with the terminals $f\ f'$. The conductors 5 6 are led from the terminals $f\ f'$ through the hole a^3 in the base to the inside of the building, where they may be connected with suitable electrical apparatus, such as a telephone set. Short lengths of said conductors are preferably wound in parallel about a portion of the bracket i, which is of iron, thus forming an impedance-coil through which the telephone-currents may flow practically unhindered, but which will tend to obstruct the currents due to a lightning discharge. The conductor 7 extends from the pin b^2, carrying the arrester-plate c^2, through the hole a^4 in the base to earth. The said impedance-coil, as shown, is located between the arrester and the instrument to be protected, so that it will act as a dam to abnormal currents tending to pass by the arrester.

It will be observed that the means which I have adopted for mounting the carbon plates does not necessitate any spring-clips bearing upon the carbon plates, which might tend to displace them or vary their distance of separation.

I claim—

1. In a protective device for electric circuits, the combination with the base, of electrical terminals mounted thereon, extensions for said terminals, arrester-plates having holes therein in which said extensions are adapted to enter to complete electrical connection with said plates, and means adapted to hold said plates in close proximity to one another, whereby the arrester-plates may be lifted as a unit from the terminal extensions.

2. In a protective device for electric circuits, the combination with the base, of electrical terminals mounted thereon, pins carried by said terminals, arrester-plates having holes therein in which said pins are adapted to enter to complete electrical connection with and support said plates, means adapted to hold said plates in close proximity to one another, and a hood fitting over said base.

3. In a protective device for electric circuits, the combination with the base, of line-terminals mounted thereon, pins carried by said base, two of said pins being connected with said line-terminals, the other pin being grounded, carbon blocks having holes therein in which said pins are adapted to enter to support said blocks and make electrical connection therewith, means adapted to hold said blocks rigidly in a fixed relation to one another, and a hood fitting over said base.

4. In a protective device for electric circuits, the combination with the base, of electrical terminals carried thereby, arrester-plates mounted upon said base and electrically connected with said terminals, and insulating-cement for the ends of said plates adapted to hold said plates rigidly in a fixed relation to one another.

5. In a protective device for electric circuits, the combination with the base, of electrical terminals mounted thereon, extensions for said terminals, arrester-plates having holes therein in which said extensions are adapted to enter to support said plates in electrical connection with said terminals, insulating-cement for the ends of said plates adapted to hold said plates rigidly in a fixed relation to one another, and a hood fitting over said base.

6. In a protective device for electric circuits, the combination with the base, of electrical terminals carried thereby, carbon arrester-blocks mounted upon said base and electrically connected with said terminals, said blocks being separated from one another by an air-space, a cap for said blocks, and cement in said cap in which the upper ends of said blocks are embedded and insulated from one another; whereby a fixed separation is maintained between said blocks.

7. In a protective device for electric circuits, the combination with the base, of electrical ter-

minals mounted upon said base, arrester-plates mounted upon said terminals and separated from one another by an air-space, a cap for said plates, insulating-cement for said cap in which the ends of said plates are embedded, whereby a fixed separation is maintained between said plates, and a hood fitting over said base.

8. In a protective device for electric circuits, the combination with a base, of line-terminals mounted thereon, pins carried by said base, and projecting from the upper surface thereof, two of said pins being electrically connected with said line-terminals, the remaining pin being grounded, arrester-plates carried by said pins and separated by an air-space, a cap for said plates, insulating-cement for said cap in which the ends of said plates are embedded, whereby the plates are rigidly held in a fixed relation to one another, and a hood for said base.

9. In a protective device for electric circuits, the combination with the base, of line-terminals mounted thereon, pins carried by said base and projecting from the upper surface thereof, conductors connecting two of said pins with said line-terminals, the remaining pin being grounded, carbon blocks drilled to fit upon said pins, a cap for said blocks, insulating-cement in said cap in which the upper end of each block is embedded, whereby the blocks are rigidly held in a fixed relation to one another, the upper surface of said base being grooved to prevent particles of carbon blown from the blocks during discharges from short-circuiting said terminals, and a hood for said base.

10. In a protective device for electric circuits, the combination with the base, of electrical terminals mounted thereon, arrester-plates, a cap therefor, insulating-cement in said cap in which the ends of said plates are embedded, whereby a fixed separation is maintained between the said plates, said plates when assembled being mounted upon said terminals, a hood fitting over said base, and a bracket upon which said base is mounted adapted to be secured to a pole or the side of a building.

11. In a protective device, the combination with an iron bracket, of a lightning-arrester mounted thereon, and conductors leading from said arrester and wound upon a portion of said bracket to form an impedance-coil adapted to obstruct currents due to lightning discharges while permitting normal currents to flow unhindered.

12. In a protective device for electric circuits, the combination with the base, of electrical terminals carried thereby, arrester-plates mounted upon said base and electrically connected with said terminals, said plates being separated by an air-space, and insulating-cement for the ends of said plates adapted to hold said plates rigidly in a fixed relation to one another, the inner faces of said plates diverging upwardly to provide a maximum separation of the plates at the point where said plates enter the cement; whereby danger of short-circuiting of the plates by foreign material accumulating upon the surface of the cement between said plates is minimized.

13. In a protective device, the combination with an iron support, of a lightning-arrester mounted thereon having three carbon plates rigidly mounted adjacent to but insulated from each other, an earth connection for one of said plates, line conductors connected respectively to the other two plates, and extensions of said line conductors leading from said last-mentioned two plates to the instrument to be protected, said extensions being wound around said iron support to form impedance-coils; whereby lightning discharges are diverted from said extensions to earth through the arrester, as described.

14. The combination with an iron bracket bearing two line-insulators h' h', of an extension of said bracket, a protective device mounted thereon, said protecting device comprising a carbon-plate lightning-arrester having an earth connection, lines terminating upon said line-insulators, conductors extending from said lines to said carbon-plate arrester, and extensions of said line conductors leading from said arrester to the instrument to be protected, said extensions being wound around a portion of said iron bracket to form impedance-coils, whereby lightning discharges are diverted from said extensions to earth through the arrester.

15. In a protective device for electric circuits, the combination with the base, of a pair of line-terminals mounted thereon, a lightning-arrester mounted upon said base and having its plates connected with said line-terminals, an earth connection for said lightning-arrester, extension-conductors leading from said line-terminals to the instrument to be protected, and a fuse included in each extension-conductor, each of said fuses being inclosed in an open-ended tubular passage in the base, whereby said fuses are protected and the continuance of an arc when an abnormal current passes through them is avoided.

In witness whereof I hereunto subscribe my name this 9th day of June, A. D. 1904.

JOSEPH J. O'CONNELL.

Witnesses:
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M. E. LAUNBRANCH.