

No. 897,800.

PATENTED SEPT. 1, 1908.

C. P. STEINMETZ.  
LIGHTNING ARRESTER.  
APPLICATION FILED DEC. 28, 1900.

Fig. 1.

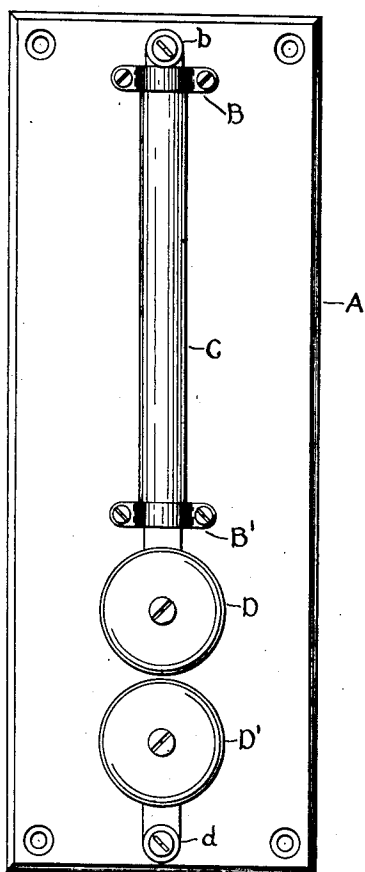
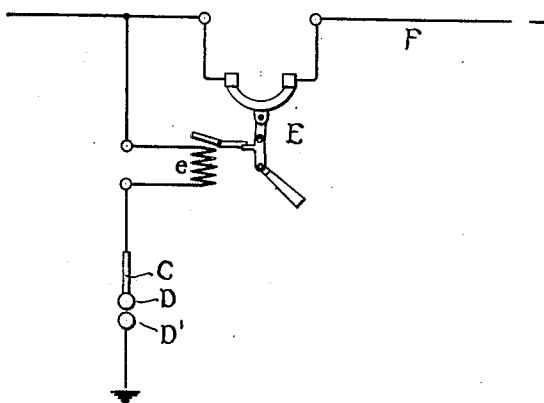


Fig. 2.



Witnesses

*John Ellis Glenn.*  
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Inventor.

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by *Albert S. Davis*  
Atty.

# UNITED STATES PATENT OFFICE.

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## LIGHTNING-ARRESTER.

No. 897,800.

Specification of Letters Patent.

Patented Sept. 1, 1908.

Application filed December 28, 1900. Serial No. 41,351.

*To all whom it may concern:*

Be it known that I, CHARLES P. STEINMETZ, 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 invention relates to lightning arresters, and its object is to provide means whereby the resistance of the lightning-arrester will become less and less as the current continues to flow through it, so that if the ground continues too long, the line will be short-circuited. In combination with a lightning-arrester of this kind, I may employ an electro-magnetic circuit-breaker, in series with it, so that if the ground continues too long, the circuit will be positively opened.

In carrying out my invention, I use a lightning arrester of a type which, as now manufactured, includes a current-resisting element consisting of a stick of graphite mixed with clay. I substitute for this stick one made of a pyro-electrolytic substance, such as magnetite, or a mixture of magnetite and chromite of iron, or a stick of anthracite coal cut from a solid block. Such substances have a high specific resistance at ordinary temperatures, but when heated by the passage of an electric current they become increasingly conductive.

In the drawing, Figure 1 shows a lightning-arrester having a resistance stick of pyro-electrolytic material; Fig. 2 shows such a lightning arrester in combination with a circuit-breaker.

The lightning arrester has an insulating base A, on which are mounted the clips B, B<sup>1</sup> for the resistance stick C, the clip B carrying the line terminal *b*, and the clip B<sup>1</sup>, a cylinder D having a large arcing surface and arranged adjacent to the arcing cylinder D<sup>1</sup> which is connected to the ground-terminal *d*. In my invention the stick C is made of a pyro-electrolytic substance, preferably one containing a salt of iron, such as the tetroxid of iron, Fe<sub>3</sub>O<sub>4</sub>, or a mixture of this with the chromite of iron, Cr<sub>2</sub>FeO<sub>4</sub>. Such a substance has a high initial resistance at ordinary temperatures but heats up rapidly when a current flows through it, its conductivity increasing as its temperature rises.

If it is desired to short-circuit the line in

case the ground continues too long, the stick may be made of such proportions that it will become very hot, and as the conductivity of the tetroxid at red heat is about 100 times what it is at ordinary temperatures, it will be seen that my device will prove to be a most efficient short-circuiting apparatus. When this action is not desired, however, the stick is made so long and with such heat-radiating capacity in proportion to its resistance, that in normal operations it does not reach the point at which it becomes highly conductive.

Should it be desired to open-circuit the line in case the ground continues for any length of time, an electro-magnetic circuit-breaker E, of any well-known type, may be combined with my lightning-arrester, with the tripping coil *e* in series therewith. When the current flowing through the lightning-arrester reaches a certain predetermined value, the circuit-breaker will automatically operate to open-circuit the line F. This allows the line to continue in operation for a short time on any ordinary ground, but protects the line if the ground continues beyond a reasonable point.

In order to protect the clips B, B<sup>1</sup> from the excessively high temperatures of the stick C, the ends of the stick may be treated in such a way as to reduce their ohmic resistance, so that they will not become so hot as the body of the stick. This may be done by dipping the ends in a solution of copper salt with a solution of sugar or other similar hydrocarbon compound. When baked, metallic copper will be deposited in the interstices of the stick, and the conductivity will be so greatly increased that the ends will remain cool even though the body of the sticks becomes very hot. Moreover, it will be easier to make a good contact between this stick and the metallic clips of the lightning-arrester. Or, the ends may be dipped in potassium silicate and baked at a high temperature, thereby producing an intimate mixture of a double silicate of potassium and the pyro-electrolyte with a simple oxid of the pyro-electrolyte. This greatly reduces the resistance at the ends, and makes it possible to support these ends in metallic clips.

What I claim as new and desire to secure by Letters Patent of the United States, is,  
1. In a lightning arrester, the combination

of spark gap terminals, and a resistance in circuit therewith formed essentially of an oxid the resistance of which decreases when heated.

- 5 2. In a lightning arrester, the combination of spark gap terminals, and a resistance in circuit therewith formed of magnetite.

In witness whereof I have hereunto set my hand this 27th day of December, 1900.

CHARLES P. STEINMETZ.

Witnesses:

BENJAMIN B. HULL,  
MARGARET E. WOOLLEY.