E. E. F. CREIGHTON.

PROTECTIVE DEVICE.

APPLICATION FILED APR. 18, 1912.

1,191,571.

Patented July 18, 1916.

Fig. 2.

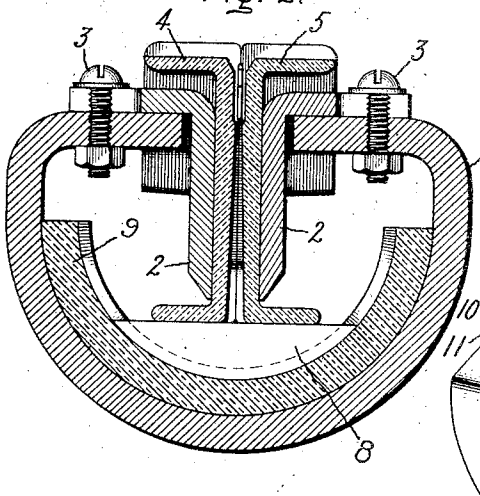


Fig. 1.

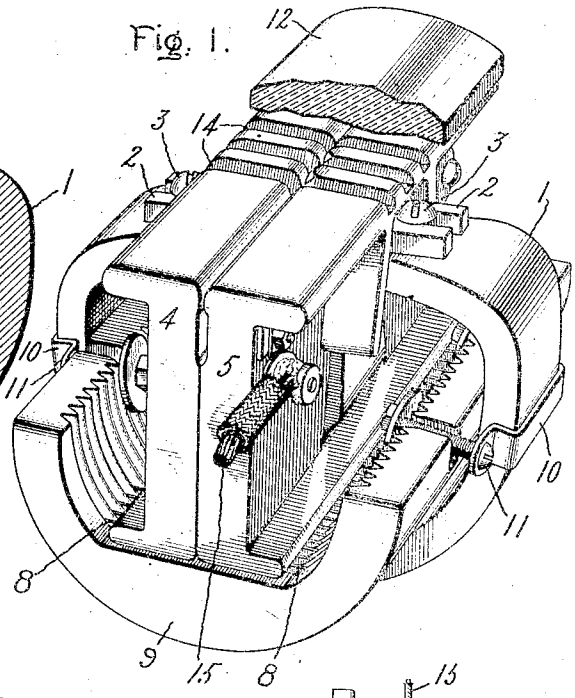


Fig. 3

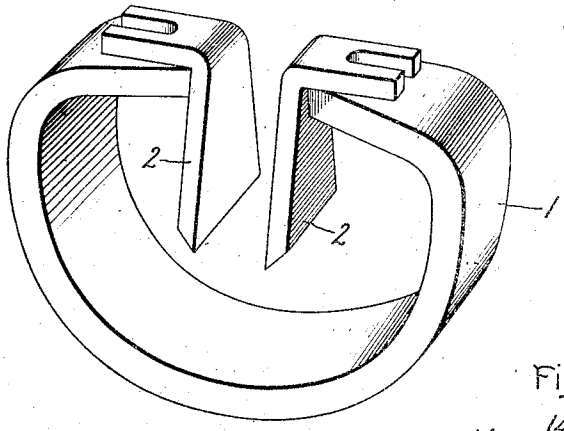


Fig. 5.

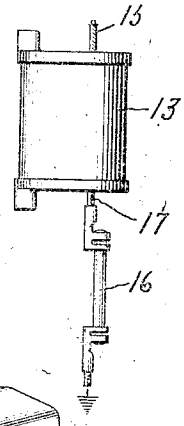
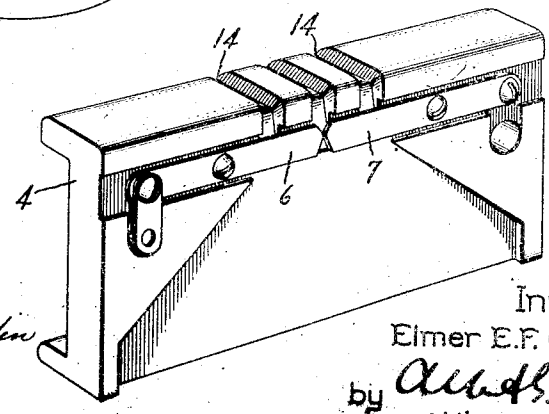


Fig. 4.



Witnesses:

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UNITED STATES PATENT OFFICE.

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PROTECTIVE DEVICE.

1,191,571. Specification of Letters Patent. Patented July 18, 1916.

Application filed April 13, 1912. Serial No. 691,634.

To all whom it may concern:

Be it known that I, ELMER E. F. CREIGHTON, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Protective Devices, of which the following is a specification.

The present invention relates to arc-extinguishing devices, such as lightning arresters in which the arc is extinguished by the action of electromagnetic or magnetic forces.

The object of my invention is to provide an arrester of the arc extinguishing type which is an improvement on those heretofore known in the art and which is reliable and positive in its operation to extinguish overvoltage discharges of considerable energy, particularly on direct current circuits, such as employed on electric railways and signal circuits.

In accordance with my invention a simple, compact, rugged apparatus of novel construction is provided in which the arc formed is driven in by the magnetic field surrounding the arc rather than being blown outwardly as is the usual practice. The arc is driven into a narrow chute and lengthened and further cooled and subdivided by a grid of metal plates in a novel and improved manner.

The novel features of my invention will be pointed out with greater particularity in the claims appended hereto.

Figure 1 is a perspective view of the arrester with the outer casing removed; Fig. 2 is a cross-sectional view taken through the magnet in the central part of the device; Fig. 3 is a perspective view of the substantially U-shaped magnet which forms the framework of the apparatus; Fig. 4 illustrates one of the walls of the arc chute and the arcing electrodes; and Fig. 5 is a view of the outside of the arrester assembled for service.

As shown best in Fig. 3, my arrester comprises a magnet 1 which may be of the electromagnetic type but which is preferably a permanent magnet substantially U-shaped. Mounted on the ends or poles of this magnet are pole tips 2 of the reëntrant type and extending into the U-shaped magnet inclosure. The pole tips are separable from the magnet but are shown attached thereto by nuts and bolts or other suitable means 3 as best shown in Fig. 2. These pole tips are shown as being somewhat wedge-shaped or widening near their ends. This configuration although not essential is of certain advantage as will appear hereinafter to blow or spread the arc to the greatest degree. Between these inwardly extending pole tips are supported two plates 4 and 5 consisting of suitable refractory material, such as unglazed porcelain, and separated by a narrow gap constituting a diverging, fan-shaped constricted arc chute. The chute should be about $\frac{1}{16}''$ in width at the electrodes, diverging to about $\frac{1}{8}''$, but the best dimensions, of course, will vary with the strength of the field and other conditions. The construction of the arc chute can be best seen in Fig. 4 which also shows one of the plates with the arcing electrodes 6 and 7 exposed to view and situated in the region of greatest intensity of the magnetic field. These electrodes consist of copper, or other suitable well conducting material, and their adjacent ends are cut at an angle which is about 15 degrees from the vertical, so that the arc when formed travels along the diverging extremities of the electrodes and finally laterally along the exposed sides of the electrodes as far as the width of the arc chute will permit, thereby avoiding burning at the tips of the electrodes. During this interval, as the ends of the arc are being extended, the arc is being continually bowed out, or lengthened by the magnetic field into the constricted fan-shaped chute. It is finally blown against an arc grid, which consists of transverse metallic plates 8 mounted in corrugations upon the inner surface of a semi-cylindrical refractory shell 9 which is supported by the yoke of the magnet as shown in Figs. 1 and 2. This grid cools, subdivides, and also deflects the vapors of the arc stream. This process takes place of course practically instantaneously and the combined effect of cooling and lengthening of the arc in the constricted arc chute usually results in its rupture. However, if not already ruptured in the chute it is ruptured by the cooling effect of the grid when issuing from the chute. As best shown in Figs. 1 and 2, the shell 9 is firmly fastened to the magnet frame by a strap 10 and nuts and bolts 11. The arc chute plates 4 and 5 are held in position by the magnet pole tips which are laterally movable and are bolted in a fixed position as shown in Fig. 2. This construction, therefore, permits the arc chute and grid to be

accommodated in a small space and rigidly held in position.

I so construct my device that the arcing across the electrodes 6 and 7 occurs in the greatest magnetic field intensity. This magnetic field is maintained in a constant direction by the permanent poles of the magnet 1, which are of unchanging polarity and if one electrode is always positive and the other electrode is always negative, the arc discharge always occurs in the same direction, that is, from the positive electrode to the negative electrode. Having a fixed direction of magnetic field or a fixed polarity of the magnet, and a fixed direction of arc discharge it will necessarily follow that the arc will move in a definite direction. I, therefore, maintain the relation between the poles of the magnet and the arcing electrodes such that when looking through the magnetic field or between the poles in the direction of the center of the magnet, the poles and electrodes are situated in clockwise rotation as follows, south pole, positive electrode, north pole, negative electrode. With this relation fixed, any arc discharge across the electrodes is always moved by the magnetic field of the magnet inwardly through the arc chute and over the cooling plates, thus enabling the construction of a very compact and rugged device, as the extinguishing and cooling means can be mounted within the magnet inclosure. There is another important advantage gained in blowing in rather than blowing out the arc discharge with the relation of magnet poles and electrodes as specified, which is as follows: By blowing-in the arc discharge, the arc, considered as a flexible conductor, sets up a magnetic field in the same direction as the field produced by the magnet, thereby strengthened the magnet by the accumulative or remagnetizing effect. In the blow out type of device the magnetic field produced by the arc discharge opposes the magnetic field of the magnet and thus weakens the magnet field at each discharge of the device. By the remagnetizing effect which I have found takes place, I am, therefore, able to maintain the magnetic field of constant strength and intensity. The upper end of the arc chute is provided with a protective refractory cap 12 shown broken away in Fig. 1, below which is a vent so as to allow gases to be sucked into the arc chute by the magnetically expelled arc stream. For this purpose channels 14 are provided in the top of the arc chute plates. Opportunity is thus afforded for a complete circulation of gases within an inclosing casing. When thus assembled the apparatus is placed in the metallic cylindrical housing or casing 13 as shown in Fig. 5, connections being made to the line to be protected by conductor 15 and to a grounded resistance 16 by conductor 17.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In an arc-extinguishing device, plates of refractory material forming a constricted arc chute, oppositely-disposed electrodes near one side of said chute, metallic plates situated transversely to said chute at its opposite side, and magnetic means for blowing an arc formed across said electrodes into and through said chute and across said plates.

2. In an arc-extinguishing device, a magnet nearly closed upon itself and having reentrant pole tips, plates of refractory material forming a constricted arc chute between said pole tips, and arcing terminals in said chute in the vicinity of maximum field intensity.

3. In an arc-extinguishing device, a substantially U-shaped magnet having reëntrant pole tips, walls of refractory material between said poles constituting a constricted arc chute, arcing terminals in said chute, a refractory plate supported by the yoke of said magnet opposite said chute, and a plurality of metallic plates spaced apart in said plate whereby the arc vapors are cooled and deflected to extinguish the arc.

4. In an arc-extinguishing device, a substantially U-shaped magnet having inwardly turned pole tips, porcelain plates supported by said poles between said pole tips to constitute an arc chute, oppositely-disposed electrodes in said chute, a semi-cylindrical cooling and deflecting plate supported on the inner side of the magnet yoke opposite the chute, a gas vent for the chute on the side opposite the deflecting plate, and a protecting casing inclosing said apparatus.

5. In an arc extinguishing device, a permanent magnet nearly closed upon itself and having reëntrant pole tips, plates of refractory material between said poles forming a narrow constricted arc chute, coöperating flat arcing electrodes having diverging ends mounted at one end of said chute, a semi-cylindrical plate supported by the yoke of said magnet at the opposite end of said chute for cooling and deflecting an arc, said plate having an inner corrugated surface, a plurality of metallic plates mounted within the corrugations of said plate and transversely to said chute, a gas vent for the chute on the side opposite said plate, and a protective casing inclosing said apparatus.

6. In an arc extinguishing device, a magnet nearly closed upon itself and having reentrant pole tips, walls of refractory material between said poles forming a long constricted arc chute, arcing terminals in said chute, a corrugated refractory plate supported by the yoke of said magnet opposite said chute, a plurality of metallic plates mounted in the corrugations of said plate, a gas vent for the said chute on the side op-

posite said refractory plate, and a protective casing inclosing said apparatus.

7. An arc extinguishing device comprising a substantially U-shaped magnet of unchanging polarity having reëntrant pole tips, walls of refractory material between said pole tips forming a constricted arc chute, a positive and a negative electrode oppositely disposed and mounted at one end of said chute and between the poles of said magnet, means for breaking up the arc and cooling the same at the other end of said chute whereby when an arc is formed across said electrodes the arc is drawn in by said magnet toward the center of the magnet through said chute and over said cooling means.

8. An arc extinguishing device comprising plates of refractory material forming a constricted arc chute, coöperating electrodes mounted at one end of said chute, a semicylindrical refractory plate mounted at the opposite end of said chute and corrugated on its inner surface, metallic cooling plates mounted in the corrugations of said surface and transversely to said chute, a substantially U-shaped magnet of unchanging polarity encircling said plates and having its poles adjacent and oppositely disposed to said electrodes, and connections between said electrodes and an electric circuit such that any arc formed at said electrodes is deflected by said magnet.

In witness whereof, I have hereunto set my hand this 17th day of April, 1912.

ELMER E. F. CREIGHTON.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.