No. 736,127. PATENTED AUG. 11, 1903.

E. MIES.

MERCURY SAFETY ATTACHMENT FOR ELECTRIC CIRCUITS.

APPLICATION FILED DEC. 31, 1901.

NO MODEL.

Fig.1.

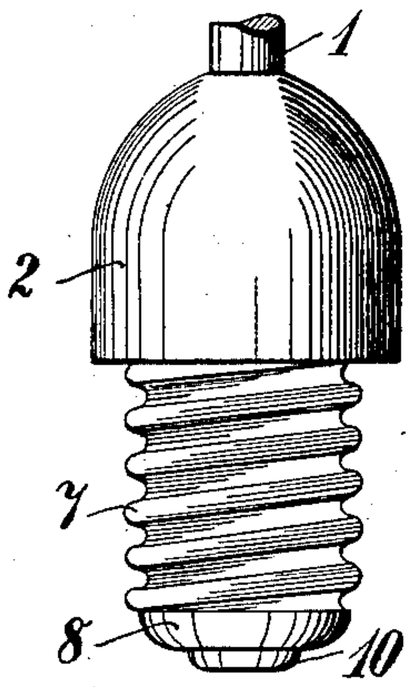


Fig.2.

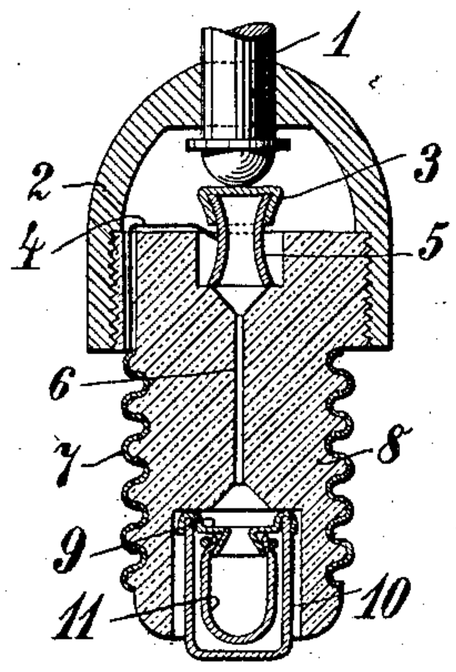


Fig.3.

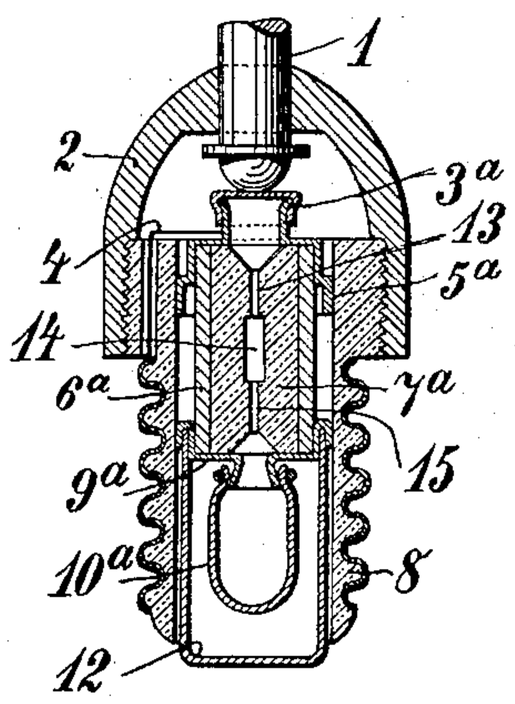


Fig.4.

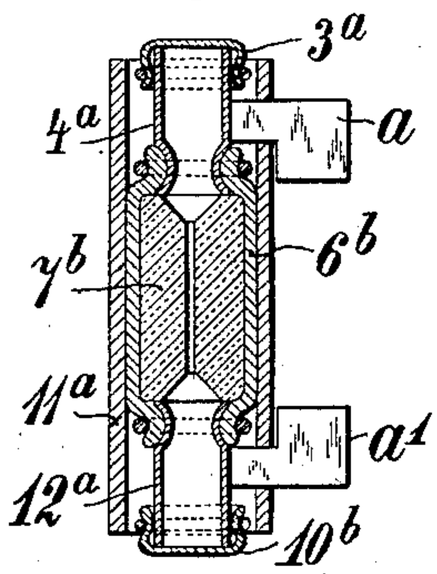


Fig.5.

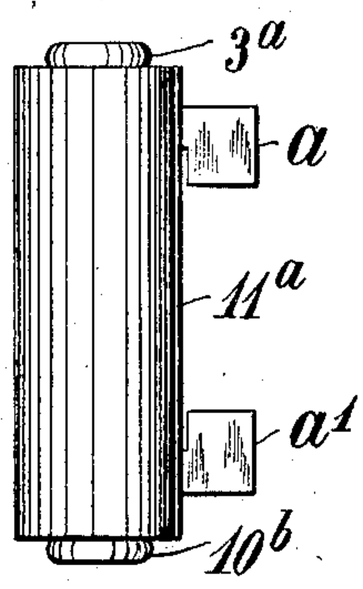


Fig.6.

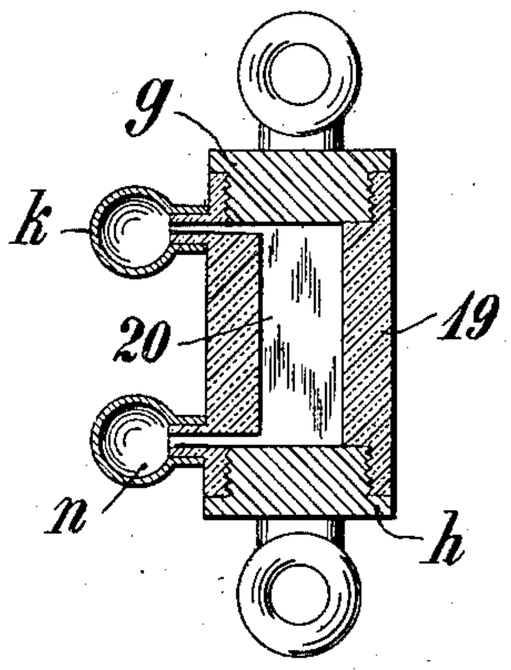


Fig.9.

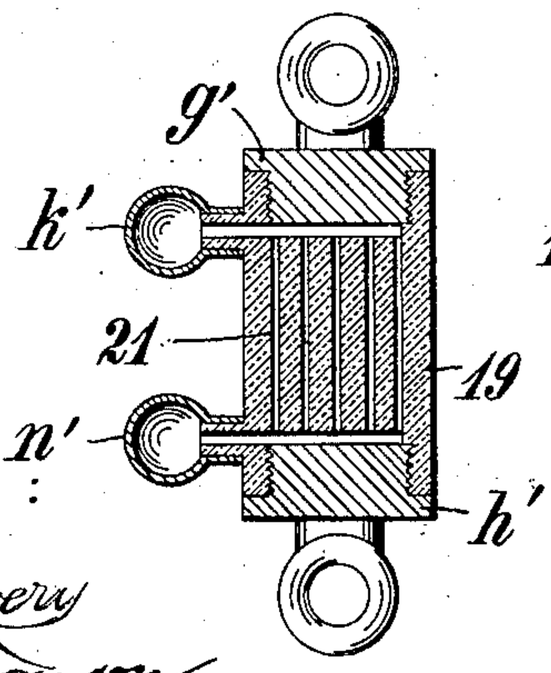


Fig.7.

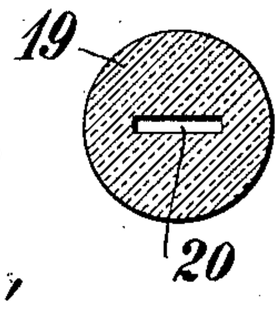
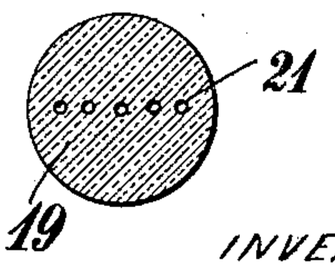


Fig.8.



WITNESSES:

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No. 736,127. Patented August 11, 1903.

UNITED STATES PATENT OFFICE.

EDUARD MIES, OF BÜDESHEIM, GERMANY.

MERCURY SAFETY ATTACHMENT FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 736,127, dated August 11, 1903.

Application filed December 31, 1901. Serial No. 87,867. (No model.)

To all whom it may concern:

Be it known that I, EDUARD MIES, a subject of the German Emperor, residing at Büdesheim, in the Grand Duchy of Hesse, German Empire, have invented a new and useful Improvement in Mercury Safety Attachments for Electric Circuits, of which the following is a description sufficiently full and accurate to enable one skilled in the art to construct and apply the same.

The invention relates to that class of safety appliances which permit a sure and complete breaking of the current in the case of short circuit or overloading and which at once after the interruption of the current can be brought into perfect working order, and thus fully replace an automatic device.

The herein-described safety appliance is based on the well-known use of mercury, and is especially adapted for use with high-tension currents, where unprotected circuits may not be touched and contacts must be avoided, and is applicable to all existing systems of safety appliances.

The essential principle in this invention consists in inclosing the mercury in an absolutely infusible capillary tube which is a non-conductor of electricity and which resists the enormous pressure resulting from the formation of a luminous electric arc. This can be attained, first, by the use of a very thick capillary tube, which does not, however, avoid the danger of breakage, or, second, more effectually and certainly by using a non-conducting infusible tube which is divided in two parts in an axial plane and embedded in an elastic casing.

According to the principles of my invention a sure and effective cut-out is caused by confining the masses of mercury in the capillary tube by elastic caps at the ends of the tube and which are under pressure of the outer air. By this means in spite of the sure, effective, and permanent cutting out in case of short circuit or overloading the device can at will be restored to its original condition by pressure from without upon the elastic caps. As in the case of hitherto-known mercury safety appliances either the capillary tube is burst, and hence rendered permanently worthless, or the current is promptly automatically cut in again, these devices are not suitable even for low-tension currents, to say nothing of the high-voltage currents of modern high-tension practices, as the sudden and great pressure which results from the formation of the luminous arc unquestionably bursts and destroys the tube. For extraordinarily high tensions I may in the practical application of this invention in order to distribute the resulting enormous pressures employ several capillary tubes placed in series connection, thus causing the formation in case of short circuit or overloading of a corresponding number of luminous arcs, each of proportionately less pressure. Each tube may have one or more capillary bores, and said bores may, if desired, be flattened.

In the accompanying drawings there are illustrated in detail several constructive forms of this invention. I do not, however, illustrate all that are possible, neither do I confine myself to the examples here shown and described.

Figure 1 is an exterior view of a safety attachment embodying my invention. Fig. 2 is a longitudinal section thereof. Fig. 3 is a section showing a slight modification. Fig. 4 is a section showing another modification. Fig. 5 is an external view thereof. Fig. 6 is a longitudinal section showing another modification. Fig. 7 is a cross-section thereof, and Figs. 8 and 9 are respectively cross and longitudinal sections of still another modification.

The safety device shown clearly in Fig. 2 consists of a porcelain body 8, which has a bore 6 of about 0.5 millimeter—say 0.02 inch—diameter, terminating at each end in an enlargement. In one end of the body 8 there is cemented a metal nipple 5, which is by means of a wire 4 electrically connected with a metal shell engaging around the body. The nipple 5 is closed by a soft-rubber cap 3 fastened thereto, and on which rests loosely a pressure button or knob 1, extended through an opening in a cover 2. At the opposite end of the body there is cemented a nipple 9, which is closed with a rubber cap 11, inclosed by a metal cap 10, attached to the body. The space between the two rubber caps is filled with mercury, so that the current can pass without hindrance from the shell 7 through the copper wire 4 and the mercury

to the nickel cap 10. In the case of short circuit or overload the mercury in the bore 6 is vaporized by the formation of a luminous arc, which by destroying the column and dispersing the material of which it is composed fully and surely interrupts the current. To restore the device to its original condition of a perfect conductor of electricity under normal conditions, it is only necessary to press lightly on the knob or button 1, which unites the dispersed portions of the mercury column and permits the normal current to traverse the appliance without hindrance.

The modification of the device shown in Fig. 3 differs from that just described in that the capillary porcelain tube 7^a (which has at 13 and 15 a bore of about 0.5 millimeter, equaling, say, 0.02 inch, and at 14 an enlargement of from 1 to 1.5 millimeters, equaling, say, 0.04 to 0.06) consists of two sections divided by a plane passing through the axis of the tube and accurately ground together to perfect contact. These sections are held together by a rubber shell 6^a and further secured by pressed or spun metal shells 5^a and 9^a, which are respectively provided with rubber caps 3^a and 10^a. The cap 10^a is inclosed in a nickel cap 12. In this arrangement the enlargement 14 of the bore is not absolutely necessary and may be dispensed with. The split capillary tube so formed is cemented in the body. In this form of construction the capillary tube cannot be irreparably burst, as the two lengthwise sections of which it consists will temporarily separate under high internal pressure which is permitted by the rubber shell 6^a and will then come together again.

Fig. 4 shows in section, Fig. 5 in external view, an application of my invention to the so-called "Schuckert" safety device. It consists of a tube 11^a of a material that is a non-conductor of electricity and in which there is inclosed a capillary porcelain tube 7^b, consisting of two axially-parted sections and further inclosed in an elastic mass 6^b. Its bore has at each end a funnel-shaped enlargement. In the porcelain body 7^b there are cemented at each end the nickel shells 4^a and 12^a, on which there are riveted the contact-plates a and a'. The nickel shells are closed by soft-rubber caps 3^a and 10^b, by means of which the mercury after being dispersed by the formation of an arc may be restored to its original condition of continuity, and hence of electric conductivity.

Figs. 6 and 7 show a safety appliance the capillary tube 19 of which has a flattened bore 20, and Figs. 8 and 9 a form of construction of the present safety appliance in which there are five bores 21, each about 0.5 millimeter, equaling, say, 0.02 inch, in diameter. When the device, as shown in Fig. 2, is constructed for six amperes of normal current, then that shown in Fig. 9 would normally suffice for thirty amperes. It is here easy to see that the capillary tubes may be of any desired number, according to the amperage of the normal current which the device is intended to carry.

In the two last-named forms of construction the metal screws g and h g' and h' are the electrically-conducting contact-pieces. By pressure upon one of the little hollow rubber balls k and n or k' and n' the appliance can repeatedly be restored after it has operated as a safety device to its normal condition of electric continuity and conductivity.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. A safety device for an electric circuit, comprising a capillary tube for containing mercury, which forms a portion of the circuit, and means, on the tube, actuated by external pressure to restore the mercury to normal condition should the mercury be vaporized by excessive current.

2. A safety device for an electric circuit, comprising a capillary tube, consisting of longitudinally-separated sections, means for holding the sections yieldingly together, and a compression device on the tube.

3. A safety device for an electric circuit, comprising a capillary tube, the bore having an enlargement between its ends, and a compression device on the tube.

4. A safety device for an electric circuit, comprising a non-conducting body portion having a small longitudinal bore enlarged at the ends, and compression devices at said enlarged ends.

5. A safety device for an electric circuit, comprising a capillary tube of infusible non-conducting material, there being enlarged openings at the ends of the capillary bore, and yielding rubber caps for said enlarged openings.

In testimony whereof I have signed my name to this specification in presence of two subscribing witnesses.

EDUARD MIES.

Witnesses:
HEINRICH PFENNIG,
WALTER SCHUMANN.