No. 780,544. PATENTED JAN. 24, 1905.

T. VARNEY.

THERMAL CUT-OUT FOR ELECTRIC CIRCUITS.

APPLICATION FILED SEPT. 22, 1902.

Fig. 1.

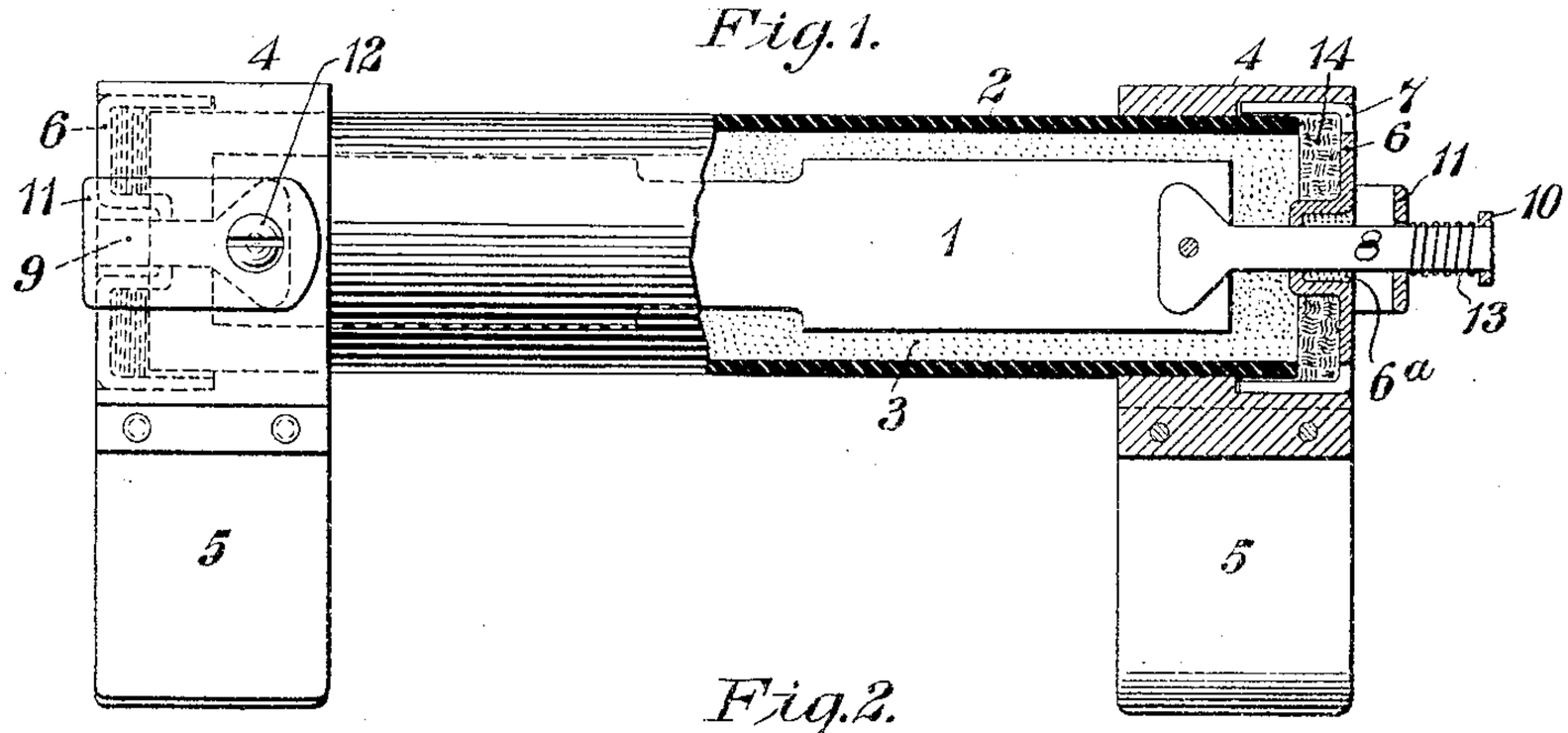
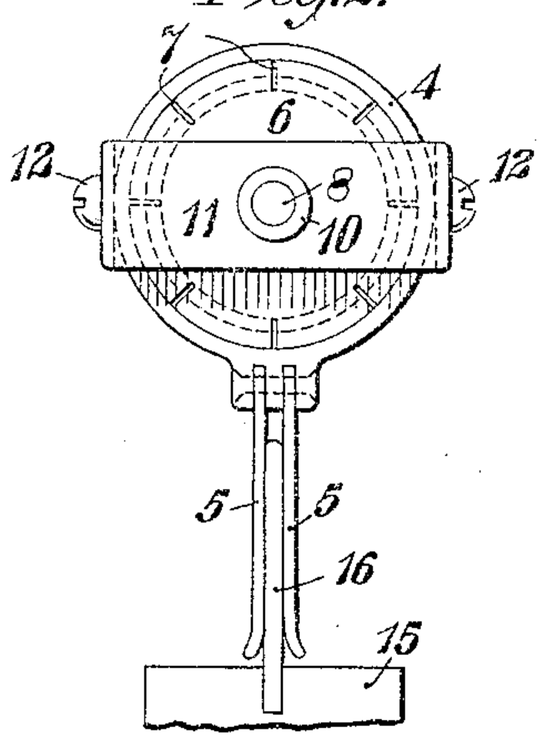


Fig. 2.



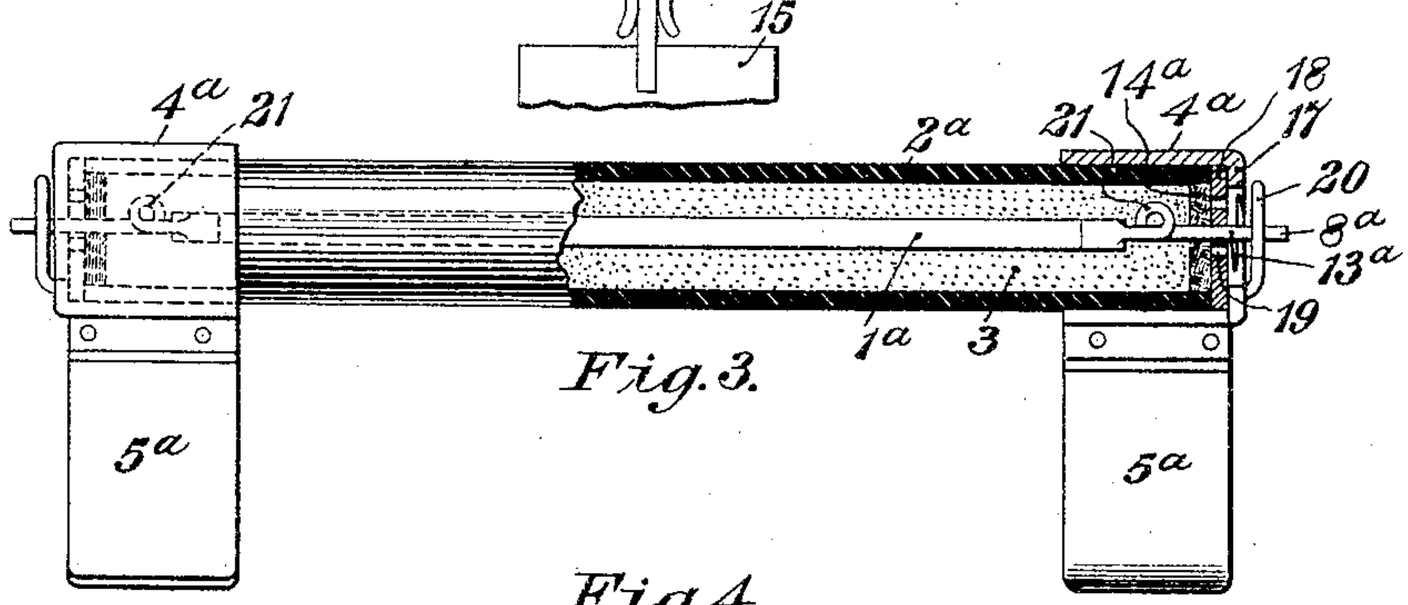
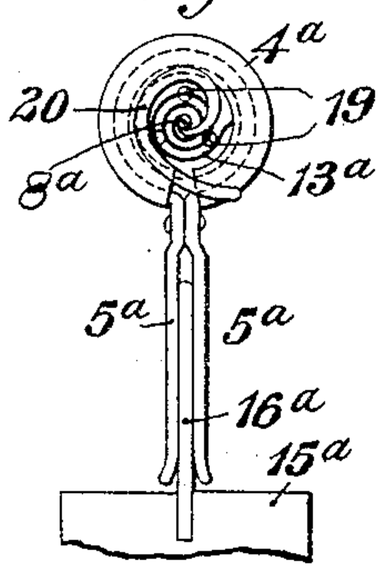


Fig. 3.

Fig. 4.



WITNESSES:

C. L. Belcher

Birney Hines

INVENTOR

Theodore Varney

BY

Sheley & Shaw

ATTORNEY.

PHOTO-LITHOGRAPHED BY SACKETT & WILHELMS LITHO. & PTG. CO. NEW YORK.

No. 780,544. Patented January 24, 1905.

UNITED STATES PATENT OFFICE.

THEODORE VARNEY, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

THERMAL CUT-OUT FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 780,544, dated January 24, 1905.

Application filed September 22, 1902. Serial No. 124,377.

To all whom it may concern:

Be it known that I, THEODORE VARNEY, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Thermal Cut-Outs for Electric Circuits, of which the following is a specification.

My invention relates to thermal cut-outs for electric circuits, and more particularly to that type in which the fusible conductor is inclosed in a casing; and it has for one of its objects to provide a device of this character which shall be positive and accurate in its operation irrespective of its size and the predetermined overload for which it is designed.

Another object of my invention is to provide a device which will operate under heavy overloads and short circuits quietly and without throwing off fire or melted metal, which may be readily inserted in the circuit, and the condition of which may be positively determined at all times.

My invention is illustrated in the accompanying drawings, in which—

Figure 1 is a view, partially in longitudinal section and partially in side elevation, and Fig. 2 an end elevation, of one form of the invention. Fig. 3 is a view, partially in longitudinal section and partially in side elevation, and Fig. 4 an end elevation, of a modified form of the invention.

In the use of thermal cut-outs comprising fusible conductors located in closed cases and surrounded by refractory powder difficulty has been experienced by reason of the fact that when the temperature of the conductor reaches the melting-point the fuse material does not readily disperse through the powder, but hangs in a molten condition without interrupting the circuit. It has been proposed to overcome this difficulty by mixing a flux with the surrounding powder and also by providing an air-cell at about the center of the fuse, but without entire success.

One of the features of the present invention consists in providing means for mechanically breaking the fusible conductor when its temperature has reached the melting-point, thereby rendering the cut-out positive and accurate in its operation. I have found that if the fusible conductor be made of soft metal, such as lead and its alloys, having a low degree of tenacity it may be stretched as far as the case and its terminals will allow without breaking. In order to overcome this difficulty, I propose to employ a fusible conductor formed of a metal having a relatively high degree of tenacity and a low melting-point—such, for example, as zinc or aluminium, or a suitable alloy having these characteristics.

Referring now to the drawings, and particularly to Figs. 1 and 2, the fusible strip 1 is inclosed in a cylindrical tube 2, of fullerboard or other suitable light, tough, and comparatively inexpensive material, and the space within the tube 2 and around the strip 1 is filled with a refractory powder 3 which is a poor conductor of heat and may be calcium or chalk or similar material. The ends of the tube 2 are surrounded by bands 4, of brass or other suitable metal, the meeting ends of which may project laterally to form spring jaws or clips 5, or these jaws or clips may be formed separately and riveted to the bands 4, as indicated. Each end of the tube is provided with a cup-shaped cap 6, which is provided with saw cuts or slits 7, extending the length of the cap and partially through the end, as indicated. The slits may serve as vents and also to form spring-arms between them, which bear against the inner walls of the bands 4.

The fusible strip 1 is provided with terminal pins 8 and 9, of copper or other metal of relatively high conductivity, which project out through central openings in the corresponding caps 6 and are fastened thereto by means of solder 6^a. The pin 8 projects some distance beyond the cap and is provided with a head 10. The outward movement of each cap 6 is limited by means of a strap or yoke 11, which is fastened to the corresponding band 4 by screws 12 or other suitable fastening devices. Between the head 10 of the ter

minal pin 8 and the corresponding strap 11 is interposed a coil-spring 13, and within each cap 6 is placed a body of suitable packing material 14, preferably fibrous asbestos.

The jaws or spring-clips 5 are provided in order to insure good mechanical supports and electrical contacts and also to permit of the ready insertion of the cut-out in the circuit, a portion of one of the circuit terminal blocks or plates 15 being shown in Fig. 2. This block or plate 15 is provided with a saw-cut, in which a contact strip or blade 16 is fastened by means of solder. This blade projects into and closely fits the space between the spring-arms 5.

The spiral spring 13 may be formed of phosphor or silicon bronze or other suitable material and is so proportioned as to normally hold the fuse 1 under tension until it is heated to the melting-point and to then break it.

I have found that in the smaller sizes of fuses—such, for example, as those below ten amperes capacity—the current may be allowed to pass through the spring itself; but as the capacity of the fuse increases the cross-section of the spring must be increased to prevent the removal of the temper by the heating caused by the current. When the size of the spring is increased, its strength increases more rapidly than its conductivity, and there is danger of breaking the fuse when cold. To overcome this difficulty I make use of a movable shunt which provides a path of low resistance around the spring. This shunt may take a variety of forms, that shown in Figs. 1 and 2 being the spring-cap 6, which is soldered to the fuse-terminal and makes sliding contact with the band 4.

In the form of cut-out shown in Figs. 3 and 4 the fusible strip 1^a, the tube 2^a, and the powder 3 may be substantially the same as the corresponding parts shown in Figs. 1 and 2, except that the dimensions are less. The bands 4^a, terminating in spring-clips 5^a, are also substantially the same, except that the ends or portions of the ends of the bands are bent inward, as indicated at 17, to hold in place a metal disk 18, which is provided with vent-holes 19.

The spring 13^a, which may be located at one or at each end of the device, has one end soldered to the corresponding terminal pin 8^a and the other end soldered to the band 4^a. In this form of the device I employ in lieu of the sliding caps 6 of Figs. 1 and 2 flexible shunts 20, the ends of each of which are soldered, respectively, to the corresponding band 4^a and to the terminal pin 8^a, the latter being made of copper or other metal of relatively high conductivity.

In Fig. 4 I have shown the parts 15^a and 16^a as corresponding to the parts 15 and 16 shown in Fig. 2 and as having the same functions.

When an inclosed fuse blows under a heavy overload or short circuit, the resulting vapor creates a pressure within the case which tends to burst the same, force off the end caps, or blow out the fuse-terminals. To prevent the blowing out of the terminals in the case of the smaller fuses having no sliding shunt-caps, I provide each terminal within the case with a loop or turn 21 of the wire constituting the terminal, which strikes against the disk 18, or rather the body of fibrous asbestos 14^a adjacent to the disk, and thereby prevents the terminal from being blown out of the case. In the larger fuses having sliding shunt-caps the straps or yokes 11, which are secured to the bands 4, serve the same purpose. These expedients are important, for the reason that if the powder is expelled from the tube or air is allowed to enter arcing is liable to result.

It will be readily seen that while the fuse-terminals are provided with means for holding them and the fuse rigidly in their proper positions when the fuse is melted the terminal, which is provided with the spring, is moved outward by it, and thus serves to indicate that the fuse is no longer in operative condition.

It will of course be understood that each of the terminals may be provided with a spring, if desired, and that the form, dimensions, and relative arrangement of the several parts of the apparatus may be modified within considerable limits without departing from the spirit and scope of my invention.

I claim as my invention—

1. In a thermal cut-out, a casing, a conductor having a high degree of tenacity and conductivity and a low melting-point and located in said casing, terminals of higher conductivity than the said conductor and secured to the ends thereof, a spring located outside the casing and adapted to break the said conductor when the melting-point of the same is substantially reached and a movable shunt also located outside the casing and adapted to form a low-resistance path for the passage of the current around the spring.

2. In a thermal cut-out, a conductor having a high degree of tenacity and conductivity and a low melting-point, a case containing a refractory powder of low heat conductivity surrounding the said conductor, and conducting-caps on the said case, terminals secured to the ends of the said conductor and having a movable, electrical connection with the end caps of the said case and means for preventing the pressure produced when the fuse blows from displacing the said terminals from their intended positions.

3. In a thermal cut-out, a fusible conductor, a case therefor containing a body of refractory powder, metal end pieces through which the conductor-terminals project, one or more springs outside the case for holding the fusible conductor under tensile strain and metal bands on the ends of the case which have relatively movable electrical connections with the ter-

minals and are provided with contact-jaws for making engagement with circuit-terminals.

4. In a thermal cut-out, a fusible conductor having terminal pins, a case for said conductor having metal end bands provided with spring-jaws and having relatively movable electrical connections with the terminal pins, end pieces through which the conductor-terminals project, and means located outside the case for holding the fusible conductor under tensile strain and for breaking it when its melting-point is approximately reached.

In testimony whereof I have hereunto subscribed my name this 18th day of September, 1902.

THEODORE VARNEY.

Witnesses:
S. P. WILBUR,
JAMES B. YOUNG.