

W. A. TAYLOR.
CURRENT PROTECTIVE DEVICE.

(Application filed Aug. 3, 1901.)

(No Model.)

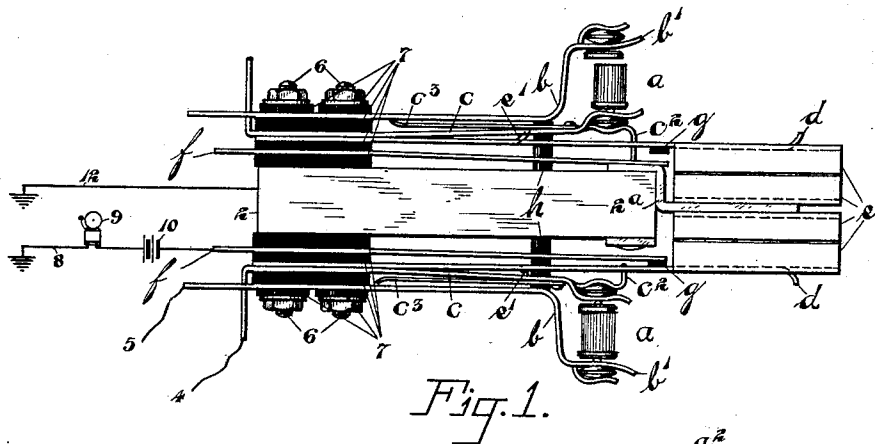


Fig. 1.

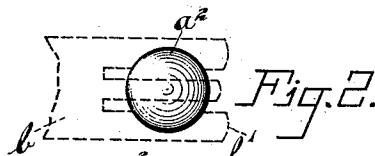


Fig. 2.

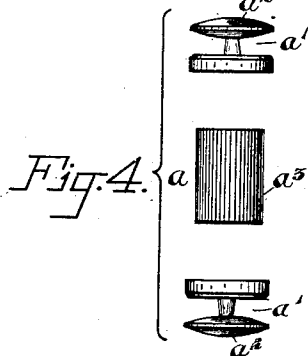


Fig. 4.

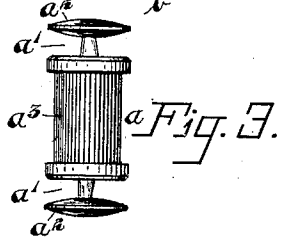


Fig. 3.

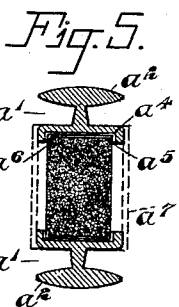


Fig. 5.

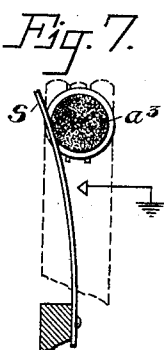


Fig. 7.

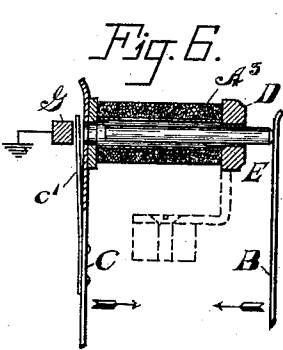


Fig. 6.

Witnesses.
R. H. Burfield
T. W. Dulan

Inventor:-
William A. Taylor,
by Robert Lewis Ames,
Attorney.

UNITED STATES PATENT OFFICE.

WILLIAM A. TAYLOR, OF CHICAGO, ILLINOIS, ASSIGNOR TO KELLOGG SWITCHBOARD AND SUPPLY COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

CURRENT-PROTECTIVE DEVICE.

SPECIFICATION forming part of Letters Patent No. 717,300, dated December 30, 1902.

Application filed August 3, 1901. Serial No. 70,820. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. TAYLOR, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Current-Protective Devices, of which the following is a specification.

My invention relates to thermal arresters to guard against the injurious effects of abnormal currents in electric circuits, and has for its object the provision of a device of the kind described which shall be simple and cheap to manufacture and efficient in operation.

It is intended for use in connection with supports under spring-pressure or other apparatus whereby the device or a portion thereof is normally under stress and forms an element in the electric circuit, but is adapted when operated by an abnormal current passing over the circuit to permit the supports or other apparatus to alter or dis sever the circuit and render operative such protective means as may be employed in that particular system in which the device is used. More specifically stated, the invention comprises a relatively high resistance part adapted to be connected in the circuit, to be protected by material easily weakened under the influence of heat but relatively strong under normal conditions, whereby when an abnormal current passes the said part becomes heated and the said material weakened to permit the supports or other apparatus to alter and sometimes open the circuit.

The invention is capable of use in any relation where it is desired to alter the circuit automatically upon the passing of a current above a predetermined strength, and any material suitable for the particular work in hand may be employed. For telephone-work, where the currents to be so guarded against are relatively weak and only dangerous when they persist for a considerable time, the relatively high resistance part may take the form of carbon, graphite, or similar material, and the easily-weakened material may be any low-fusing alloy or solder; but for other work, as in the case of power-circuits, other material may be found more suitable.

The invention further consists in the novel details of construction and combinations of parts hereinafter particularly described, and pointed out in the appended claims, reference being had to the accompanying drawings, 55 forming a part hereof, in which the same reference characters designate like parts throughout the several views, and in which—

Figure 1 is a plan view of a mounting for the arresters such as is used in telephone-work. Fig. 2 is an end view of the arrester and one of the supports. Fig. 3 is a side view of the arrester. Fig. 4 is a side view of the same, showing its several parts separated. Fig. 5 is a similar view showing the end caps and adjacent portions of the carbon, graphite, or like part in section. Fig. 6 is a view of a modification in which the device is under compression, and Fig. 7 is a view of still another modification. 70

In Fig. 1 the numeral 2 represents a vertical iron plate, constituting that part of the distributing-frame to which the circuits entering a telephone central office are connected before they terminate at the switchboard. This plate might also be a corresponding part of the framework of a terminal head or similar part. 75

The arrester of the preferred form, as shown in Figs. 1 to 5 and designated generally by the letter *a*, is for this class of work preferably composed of a bar or piece *a*³ of carbon, graphite, or other material of relatively high resistance, which is preferably, though not necessarily, cylindrical in form and is provided with metallic end caps or terminals *a*², connected therewith by material that is relatively easily weakened under the influence of heat or that has a low melting-point, such as solder or alloy. While the shape of the portion of the cap engaging the cylinder *a*³ is not an essential feature of the invention and may be constructed as desired, it is preferred to make it fit over the end of the bar *a*³, as shown at *a*⁴ in Fig. 5. The layer of solder or other 85 relatively easily weakened material is also indicated in this figure, as at *a*⁵, though it will be understood that the thickness or extent of this layer may be anything desired. 90

To provide a better electrical connection 100

of the metal end caps with the relatively high resistance medium, as well as to make the solder take better, the ends of the piece a^3 are electroplated, as with copper, which plating is indicated at a^6 in Fig. 5.

The end pieces a^2 , preferably of brass, are grooved, as at a' , and are adapted to be engaged by the forked or slotted ends, such as b' of Fig. 2, of the supports, a tongue being provided centrally between the tongues b' to overlap the end of the cap a^2 and hold the arrester in place. The supports in this instance are the line-conductor terminal springs b and c , connected with the line-wire 4 and the switchboard-wire 5. These springs are mounted upon and secured to the plate 2 by means of double-ended bolts 6, passing through the plate and preferably secured therein by upsetting the metal of the plate around them. The springs are insulated from the plate 2 and from each other by suitable insulating-strips 7, the spring b being bent outwardly at the slotted end to provide room between it and the cooperating spring c for the arrester, as shown in Fig. 1. Lying alongside the spring c is another spring d , forming a support at its outer end for a lightning-arrester e between it and the plate 2, secured to the plate 2. This arrester is of the usual form and consists of suitable carbon blocks separated by a thin mica plate. An additional spring f is also provided and is adapted to close a local circuit to sound an alarm when its free end contacts with the plate 2, said circuit including the conductor 8, bell 9, battery 10, spring f , plate 2, conductor 12, and the ground between conductors 12 and 8. A block g of insulation prevents this spring from touching the spring d . An insulating-stud h passes freely through the springs, except the outer spring, which bears upon it, thus assisting in holding it in position and at the same time being itself held at a fixed distance from the plate 2. The spring f tends to spring outwardly, but is relatively weak, while springs c and d tend to spring inwardly and are of sufficient strength to overcome spring f when otherwise free to act. The arrester a is therefore held in tension by the springs b and c ; but the invention contemplates any suitable construction of the arrester itself, as well as the holder, whereby the same is held in a state of stress whether the same be exerted laterally or in tension or compression. Whenever the springs c or d therefore are released by the arresters a or e they close the alarm-circuit, before described, since spring c has a tongue c^2 passing through an enlarged aperture in the spring d and adapted to press upon the spring f , when no arrester is in place or the arrester is ruptured, to close it against the plate 2, and spring d acts upon block g with the same result. The spring c is grounded at the same time through its tip c^2 and the spring f and serves to ground the line-wire 4. An arrangement may also be provided to ground the outer spring b , as

by means of the light spring c^3 , riveted at its forward end to spring c and adapted to be thrown into contact with the spring b , as shown in the upper set of springs, by a projection e' , formed upon the spring d and passing through a suitable aperture in spring c and bearing against spring c^3 , when spring c is released and moves inwardly. This arrester-holder in its individual capacity is the invention of William Kaisling and is shown, described, and claimed in his application for protective apparatus filed August 8, 1901, Serial No. 71,313.

The operation is substantially as follows: When a current of abnormal strength passes over the line-circuit and therefore through the arrester, the relatively high resistance-block a^3 is heated sufficiently by such current to melt, soften, or weaken the solder, alloy, other material at its ends, when the tension of the holding-springs causes either or both of the ends to be separated from the part a^3 , thus positively opening the circuit and grounding the wires 4 and 5. A lightning discharge is supposed to jump from the outer carbon plate to the inner through the mica and to pass to ground over plates 2^a 2 and wire 12. The spring c^3 of course connects the two springs together; but both are connected to ground. If by any chance one end cap should fail to separate at the proper time, the other cap would still serve to open the circuit, and thus absolute failure of the device would never result. This form has a further advantage over thermal arresters in which a fine-wire coil is used to generate the heat to melt the solder in that the circuit is positively open when the device is operated and cannot become crossed, reconnected, or fail to open, as sometimes occurs with the coil constructions mentioned.

It will be understood that the exact form of the part a^3 is not material and that the specific shape or configuration of the end caps is not essential. So, too, the device may be arranged in compression; but the construction shown is preferred. An insulating-covering a^7 , as in dotted lines in Fig. 5, may be employed, if desired, but is not deemed necessary for satisfactory working. The sizes shown in Fig. 1 are found suitable for ordinary telephone-work.

In Fig. 6 a modified form of the device of my invention is shown in which the holding-springs B and C tend to spring toward each other, and the arrester is therefore under compression instead of in tension, as in the former instance. In this case the high-resistance element A^3 is hollow and is preferably coated inside with some insulating substance. D is a metal cap, which may or may not be soldered to a plating, preferably of copper, on the end of A^3 . Through D a metal pin E passes and is connected therewith by easily-weakened material, preferably a low-melting-point solder. The other end of the high-resistance rod, which may be carbon or graph-

ite, is preferably plated, so as to give a good contact with the holding-spring. This combination is inserted between the retaining-springs B and C under compression. A current of sufficient strength passing from one spring to the other heats the part A³ and melts the solder joining D and E, the heat being transmitted through D by conduction. The pressure of the springs C and B then pushes the pin E through the element A³ and holding-spring C and against the light spring c', which is thus pressed against the grounded contact G, thus short-circuiting the part A³ and grounding both sides of the line. In this form the circuit is not opened, but a dead-ground is connected therewith, which accomplishes the desired results of preventing the strong current from reaching the telephone instruments. It will be understood that the part D may be replaced by a mass of solder, though the arrangement shown is preferred. In this form the whole device is placed under compression; but it will be apparent that the same result would be accomplished by rigidly supporting the part D, as indicated in dotted lines, in which case only the spring B need be under compression, and the spring C may be a simple terminal to conduct the electric current to the part A³. The operation would be the same as before.

Fig. 7 illustrates another manner of operating the device, in which the arrester or substantially the arrester of Figs. 1 to 5 is held by stationary or equivalent terminals and supports, but in which a spring S is adapted to bear laterally upon the arrester, with the result that when the solder or other material is weakened the spring S will snap the part a³ entirely away from the end pieces or bend it to one side and close the circuit to ground.

Although the invention has been described with reference to the several features of construction, I do not wish it to be so limited, as I hold it to include all such alterations, modifications, and changes as fairly fall within its scope and principles; but

What I do claim, and desire to secure by Letters Patent, is—

1. A thermal arrester, comprising a rod of relatively high-resistance material, and low-resistance terminals rigidly and directly connected therewith through the medium of low-fusing material, the low-fusing material being softened or melted by the concentrated heat of the high-resistance material when an abnormal current passes to permit the separation of the rod and one or both terminals, and the said terminals of the arrester being of such form as to permit the ready insertion in and withdrawal of the arrester from its circuit connections, substantially as described.

2. A thermal arrester, comprising a bar of relatively high-resistance material, and terminals therefor of a highly-conducting medium, said terminals being rigidly and directly connected to the ends of said bar by a low-fusing medium, the low-fusing medium being

softened or melted by the concentrated heat of the high-resistance material when an abnormal current passes to permit the separation of the bar and terminals, and said terminals having such form as to allow the ready insertion in or withdrawal of the arrester from its circuit connections, substantially as described.

3. A thermal arrester, comprising a bar of carbon, graphite or similar material, and metallic terminals soldered directly to said bar by a low-fusing solder, said solder being softened or melted by the heat of the bar when an abnormal current passes to permit the separation of the terminals and bar, said parts altogether forming a comparatively firm and rigid element, and said terminals being formed to permit the ready insertion in and withdrawal of said element from its circuit connections, substantially as described.

4. A readily removable and replaceable thermal arrester, comprising a block of carbon, graphite or similar material, and metal end pieces rigidly and directly soldered to said block and forming the terminals of the arrester, said end pieces being formed to enable them to be readily inserted and withdrawn from the circuit connections, and the arrester being adapted to be held in a state of stress by the said circuit connections, whereby when an abnormal current passes over the circuit and through the arrester the said block is heated to soften the solder and to permit the separation of one or both end pieces therefrom, substantially as described.

5. A readily removable and replaceable thermal arrester, comprising a block of carbon, graphite or similar material, the ends of the block being plated with a metal, and cup-shaped end caps adapted to fit over the ends of said block and to be rigidly and directly soldered thereto, said end caps forming the terminals of the arrester and having grooves therein to enable them to be readily inserted into and withdrawn from the circuit-terminal-holding devices, substantially as described.

6. In a protective apparatus, the combination with a readily-removable thermal arrester, comprising a bar of carbon, graphite or similar material having its ends electroplated, and metal end caps fitting over said ends and rigidly and directly connected therewith by solder or similar substance, said caps forming the terminals of the arrester, of holding-springs with which said caps are removably connected, said springs serving to place the arrester in a state of tensile or longitudinal stress and to connect it in an electric circuit, whereby when an abnormal current passes over the circuit containing the springs and arrester, the bar is heated and the solder melted to permit the separation of the bar and one or both of the end caps to open the circuit, substantially as described.

7. In a protective apparatus, the combination with a bar of carbon, graphite or similar material, metallic end caps soldered directly

thereto by a low-fusing solder, said bar and
caps forming a rigid element, of holding-
springs forming circuit connections adapted
to connect with said end caps, and means to
5 permit the said element to be readily inserted
in or withdrawn from the said springs, said
springs being adapted to ground one side of
the line when an abnormally strong current
passes over the circuit containing said springs

and element and heats the said bar to melt the
solder, substantially as described.

In witness whereof I hereunto subscribe my
name in the presence of two witnesses.

WILLIAM A. TAYLOR.

Witnesses:

H. JACOBSEN,

ROBERT LEWIS AMES. ,