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PROTECTOR

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1 Claim. (Cl. 317—66)

This invention relates to protectors and more particularly to protective devices for telephone substation equipment.

Protectors of the type to which this invention pertains usually comprise a high resistance path from each line conductor to ground. These paths are of such high resistance as to prevent, for practical purposes, the flow of the low voltage telephone and ringing currents to ground. However, if a high voltage from a power line, lightning or other source is accidentally applied to the line, it passes over the high resistance path to ground rather than through the telephone equipment.

A common form of protector to which this invention is particularly applicable comprises a pair of spring secured blocks of non-conducting material, such as porcelain or the like, each provided with an aperture in which is mounted an insert of conducting material such as carbon. The insert is depressed a few thousandths of an inch below the surface of the porcelain block to provide an air gap between its surface and the surface of an opposed conducting member which is electrically connected to ground by a suitable electrode.

In the operation of the device, when an abnormal current condition obtains, the gaps are broken down and the high currents are by-passed to ground. If such condition continues, substantial heat, sufficient to constitute a fire hazard, may be generated at the protector. To avoid this, it has been the practice heretofore to provide fuses at the protector. This, however, entails substantial cost and unduly increases the price of the protector particularly in view of the low incidence of abnormal conditions and the small percentage of protectors which are affected in their normal lifetime.

One general object of this invention is to decrease the cost of telephone substation protectors without impairing their efficacy. More specifically one object of this invention is to eliminate the need for fuses at such protectors.

A feature of this invention pertains to the provision of a protective device employing air gap arrestors, wherein the annealing of the springs which support the carbon blocks and maintain them in juxtaposition, due to the passage of high current, will cause the supporting springs to deform and establish contact with upstanding portions of the central supporting ground plate or electrode of the protector mounting, thereby establishing a connection to ground.

The invention will be more clearly understood from the following detailed description when read in conjunction with the accompanying drawing, in which:

Fig. 1 is a view in perspective of a protective device illustrative of this invention with parts broken away to disclose the internal arrangement of the protector blocks, supporting springs, and electrodes;

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1 and shows the carbon block supporting springs in their normal position and spaced away from the upstanding ears of the central supporting electrode;

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Fig. 3 is a view similar to Fig. 2 except that the supporting springs have been affected by the passage of high current therethrough to establish contact with the ears of the central electrode;

Fig. 4 is a schematic diagram showing the circuit arrangement of the device shown in Figs. 1 and 2 in its normal condition;

Fig. 5 is a view similar to Fig. 4 but shows the device in its operated position as shown in Fig. 3 wherein connection is made to ground.

As shown in the drawing and in particular Fig. 1, the protective device comprises a suitable base member 10 of insulating material having mounted thereon the line binding post terminals L and L₁, the ground binding post terminal G and the instrument binding post terminals I and I₁. The terminals I, I₁ and L and L₁ are adapted to be connected across a telephone line (not shown), and the terminal G is adapted to be connected to ground, as shown in Figs. 4 and 5.

As shown in the various figures, terminal I and terminal L are connected together by means of the embedded conductor CO which is, in turn, connected to the carbon block supporting spring 11, and the terminals I₁ and L₁ are connected together by means of conductor CO₁, also embedded in the base 10 and connected to the carbon block supporting spring 12.

A suitable recess or well 13 substantially centrally located in the base member 10 and provided with an upstanding circumferentially disposed flange 14 has positioned therein a pair of carbon blocks 15—15 which are in contact with the central upstanding electrode 17. The latter is mounted in the bottom of the recess 13 and has secured thereto a base plate 18 provided with upstanding ears 19 and 20 which are in space relation with respect to the supporting springs 11 and 12 and are electrically connected to the ground terminal G. A pair of members 16—16 composed of suitable insulating material, for example porcelain, are in contact with the carbon electrodes 15—15 and are maintained in position by means of the springs 11 and 12 which bear against suitable inserts or electrodes 21—21 also preferably composed of carbon and carried by the porcelain members 16—16. The springs 11 and 12 are conductively connected to the line terminals I, I₁ and L and L₁, as shown by means of the conductors CO and CO₁ and therefore serve as electrodes in addition to providing a resilient holding means for the carbon inserts 21—21 which, as shown, are in space relation with respect to the carbon block members 15—15.

As shown in the drawing, the supporting spring members 11 and 12 are provided with indented portions 22—22 which serve as a bearing or contacting point for the carbon inserts 21—21. The inserts 21—21 are secured in the porcelain blocks 16—16 by means of a suitable cementitious material, indicated at 50, and thereby maintained in definite space relation with respect to the carbon blocks 15—15 to provide a suitable air gap so that the line terminals I, I₁ and L and L₁ will be normally insulated from the ground terminal 7. However, when an abnormal surge of energy occurs, such as may be due to a lightning discharge or a high current impressed thereon in the vicinity of the associated line, the gap between the carbon inserts 21—21 and the carbon block electrodes 15—15 will be bridged by an arc which under normal conditions will ground the line. However, upon an abnormal or sustained high current, the cementitious material holding the carbon inserts 21—21 in juxtaposition with respect to the carbon blocks 15—15, will melt and permit the inserts 21—21 to contact the carbon blocks 15—15 thereby completing a circuit to ground.

Continuance of the abnormal current condition would result in generation of heat sufficient to melt molding compounds frequently utilized in the manufacture of

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protectors and to create a fire hazard. However, in devices constructed in accordance with this invention such excessive heating is prevented and the potential fire hazard eliminated. Specifically, because of the small area of contact between the springs 12 and the carbon blocks 21, the major portion of the heating due to abnormal currents obtains adjacent these contact areas. Consequently, the portions of the spring adjacent these areas anneal, whereas the lower portions of the springs, that is the portions between the contact areas and the fixed ends of the spring retain their temper. As a result, the springs 12 are forced into a curved configuration as depicted in Fig. 3, thereby to contact the ears 19 and 20 and establish a positive low resistance path to ground.

In a typical device, the springs 12 may be of Phosphor bronze, in the order of $\frac{3}{16}$ inch thick and 50 mils wide, and spaced, normally, from the ears 19 and 20 about 20 to 30 mils. For abnormal currents, such springs deform sufficiently in a few seconds to make firm contact with the ears 19 and 20. The springs have a high current capacity, say of the order of 50 amperes, so that the heat generation is reduced to a harmless value.

While I have shown and described herein the preferred embodiment of my invention, it is to be understood that various changes and modifications may be made therein without departing from the spirit of the invention and I am only limited by the following claim.

What is claimed is:

A protective device comprising a ground terminal, a line terminal, a rigid electrode connected to said ground

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terminal, said electrode having an arm portion and an ear portion laterally displaced from said arm portion, a block of conductive material bearing against said arm portion, a block of non-conductive material bearing against said first block and having an aperture therein, a conductive insert in said aperture and spaced from said first block to define an air gap therewith, fusible cementitious material joining said insert to said second block, a leaf spring electrode connected to said line terminal and having one end fixed, said leaf spring electrode having a first portion near its fixed end opposite said ear portion and having also an indented portion bearing against said conductive insert over a restricted area thereof, said leaf spring electrode being of annealable material, said first portion of said spring electrode and said ear portion being spaced a distance such that upon flow of abnormal current between said terminals sufficient to fuse said cementitious material and cause annealing of the parts of said spring electrode adjacent said indented portion thereof, said spring electrode distorts to force said first portion thereof into contact with said ear portion.

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