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L. H. ROVERE ET AL

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PROTECTOR FOR ELECTRIC CIRCUITS

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*Fig. 1.*

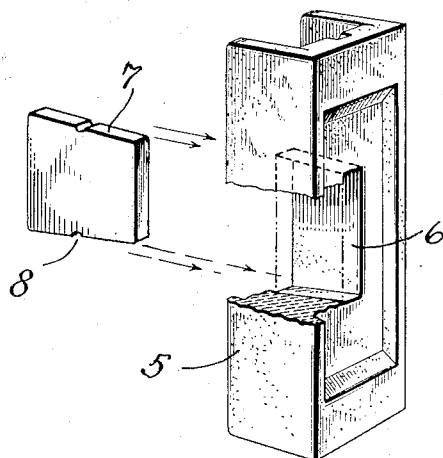


*Fig. 3.*

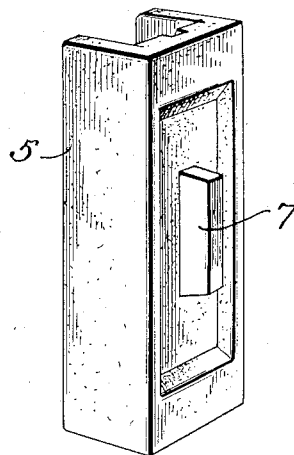


*Fig. 2.*

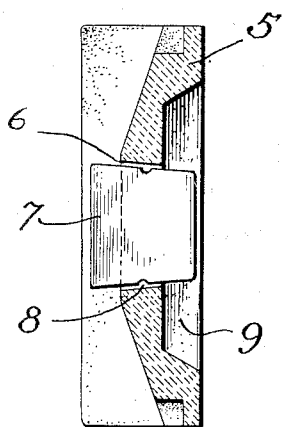
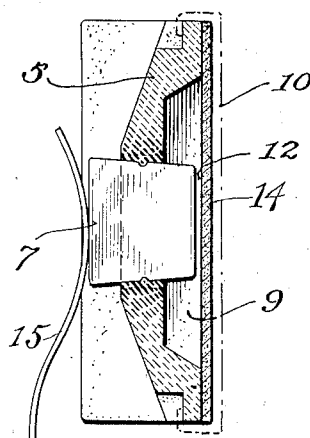


*Fig. 4.*



24

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## UNITED STATES PATENT OFFICE

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## PROTECTOR FOR ELECTRIC CIRCUITS

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4 Claims. (Cl. 175—30)

This invention relates to devices for protecting electrical circuits from abnormal voltages, such as those induced by adjacent unbalanced power circuits, lightning discharges and the like and more particularly to protective devices of the type adapted to provide a ground connection for a circuit when its potential is raised to an abnormal value.

The type of protector commonly used for the protection of circuits of low normal operating voltage consists essentially of two electrodes spaced apart a few thousandths of an inch, one of the electrodes being connected to ground and the other being connected to one wire of the line to be protected. The protectors usually employed in telegraph and telephone practice comprise a flat plate of metal or carbon constituting one electrode, the other electrode consisting of a smaller metal or carbon member suitably held in an insulating block recessed on the inner side with the electrode passing there-through a distance sufficient to leave the required gap between the two electrodes.

When metal electrodes are employed the surfaces become roughened by numerous discharges which are insufficient to completely ground the arrester and this changes the effective air-gap which is very objectionable. Carbon electrodes do not have this fault to such a degree and in other ways are far preferable to metal electrodes.

It is, of course, undesirable to ground the circuit when the excessive voltage is only momentary and hence the arresters are constructed to provide a time-lag between the initial high voltage and the grounding of the line by the contact of the electrodes. Various methods of obtaining this time-lag have been proposed. One method is to form the block which carries the smaller electrode of hard rubber or other material which will soften under the prolonged application of heat.

As stated above, metal electrodes are objectionable. Moreover it is practically impossible to obtain the desired time-lag before the rubber or any other of the usual plastic materials softens. Another method is to form the body of the block of porcelain or glass with an aperture to receive the electrode and to fasten the carbon electrode in the aperture with a cement such as a lead glass which will soften under the application of heat. The cementing process is tedious and expensive and it is difficult to obtain uniformity in the product. It has heretofore been found necessary to employ this

method of securing the carbon electrode in the molded porcelain block by means of a glass or other cement because the carbon electrode will not withstand the very great pressures required in the molding operation.

One object of our invention is to provide an arrester or protective device in which a carbon electrode is firmly held by the shrinkage of the molded block of insulating material which does not soften or become plastic under heat; but which permits a relative movement between the block and electrode upon the prolonged application of heat.

For the purpose of explaining the invention, we shall refer in the following description to the accompanying drawing, in which—

Figure 1 is a perspective view of the moulded block of insulating material, partly broken away to show the manner of inserting the carbon electrode;

Figure 2 is a central longitudinal sectional view showing the electrode in proper position in the aperture in the block;

Figure 3 is a perspective view of the block after it has been cured or baked, the electrode being firmly held by the shrinkage of the material; and

Figure 4 is a central longitudinal sectional view of the completed arrester or protective device with the other plate electrode indicated in broken lines.

We have stated above that we provide an insulating block which is non-plastic and will not soften under heat and that the electrode is firmly held by the shrinkage of the material of the block. The carbon electrode may be held in the body of suitable insulating material, such as a phenolic condensation product, by either one of two methods. In one method the carbon electrode would be molded in the insulating body at the time the latter is formed and molded. In the other method the body of insulation is first formed or molded with an aperture slightly greater than the carbon electrode. The electrode is then inserted in the aperture and the assembled block and electrode are subjected to the usual curing operation by heating at a high temperature. In either method the curing operation will cause the insulating compound to shrink and tightly grip the electrode. The sides of the electrode are preferably provided with shallow grooves into which the material is forced as it shrinks as indicated in Fig. 4. After the block has been cured it is

non-inflammable, very hard and non-plastic when heated.

The block may be of the usual shape as shown, having a recessed inner face into which the electrode projects and which forms a closed chamber 9 when the other plate or sheet metal electrode is in position. We also provide that when desired the two blocks comprising a complete arrester may be fastened to each other. For this purpose we use a metal cap or box 10 into which the ground electrode 14 is placed, and which is provided with ears or tabs which can be locked and bent over recesses in the insulating portion of the other block as shown in Fig. 4.

As in all devices of this character, excessive voltages cause an arc to disrupt the bond between the block or body 5 and the carbon and jump across the narrow gap between the electrodes. If the high voltage is of short duration, the integrity of the device will be unaffected and it will still function as an arrester or protective device. When the excessive voltage continues beyond a momentary discharge so that the arc between the electrodes persists, the heat engendered rapidly raises the temperature of the carbon electrode and the body 5, causing the latter to expand slightly and also causing a very slight charring around the inner wall of the aperture 6, this slight expansion and slight charring being sufficient to loosen the electrode 7, permitting it to be pushed inwardly into contact with the ground plate 14 by the spring contact 15 which bears against the electrode. This action requires a definite amount of heat so that the operation of any arrester is quite uniform and may be predetermined with accuracy.

In this respect we have found these arresters with carbon electrodes normally held in direct contact with the walls of the aperture in the body portion of the arrester are far more reliable and accurate than those which are separated from the body by a layer or film of cement of bonding material. As previously explained the non-metallic electrode such as carbon, is more reliable than the metallic electrode which becomes eroded and varies the air-gap, thereby

shortening the effective useful life of the arrester.

We claim:

1. The method of forming a protector block for electric line protector devices, which consists in forming an apertured insulating body of cold-molded phenolic condensation product which is non-plastic when cured, inserting a non-metallic electrode in said apertured molded body before it is cured, and baking the assembled body with inserted electrode, said electrode being firmly gripped by the shrinkage of the material when cured, while permitting movement of the electrode in the body when the latter is subjected to the heat engendered by an electric arc passing from the electrode.

2. The method of forming a protector block for electric protector devices, which consists in molding an apertured body of cold molded phenolic condensation product which is non-plastic when baked, inserting an electrode into the aperture in said molded body while the latter is in the raw uncured state, and baking said assembled parts to harden said body and cause it to shrink tightly about the electrode.

3. The method of forming a protector block for electric protector devices, which consists in molding an apertured body of cold molded phenolic condensation product which is non-plastic when baked, positioning in the aperture in said body while the latter is in the raw uncured state, an electrode conforming to the shape of the aperture, fitting loosely therein, and so proportioned that the shrinkage of the body when subjected to heat will cause the walls of said aperture to engage the marginal walls of the electrode, and baking said assembled parts.

4. A protector for electric circuits, comprising a dielectric block of cured cold molded phenolic condensation product, and a carbon electrode secured therein only by shrinkage of the cured block, thereby permitting the disruption of the bond between the block and the electrode upon the occurrence of an abnormal current through the electrode.

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