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LIGHTNING ARRESTER

Filed Aug. 22, 1945

Fig. 1

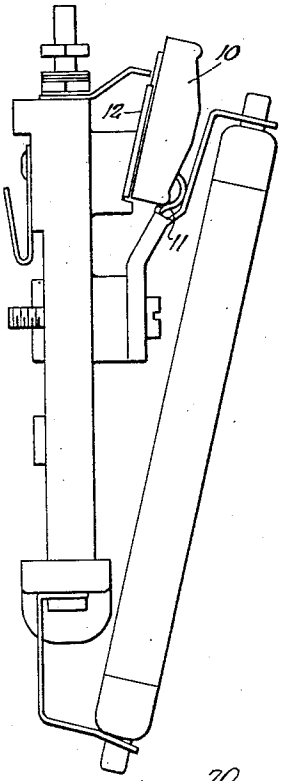


Fig. 3

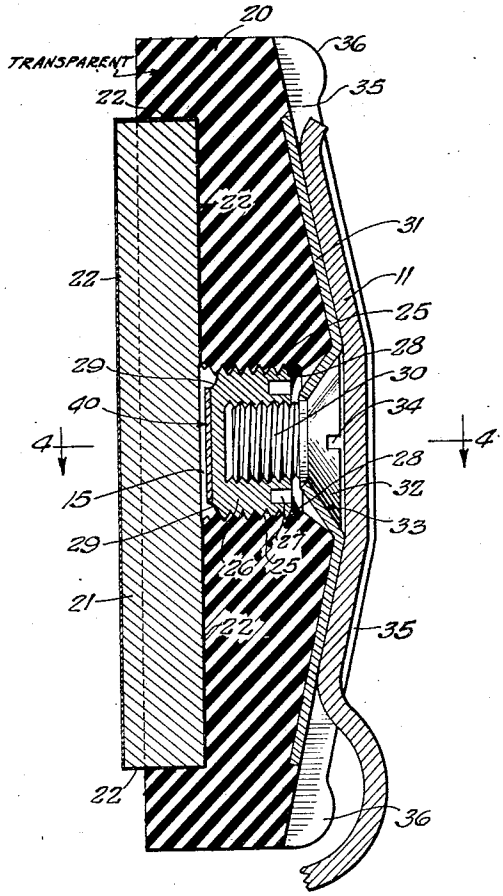


Fig. 2

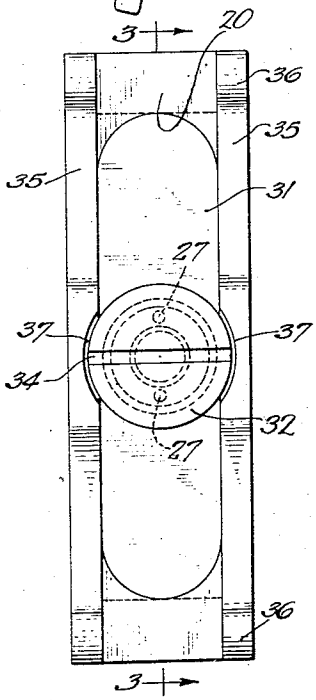
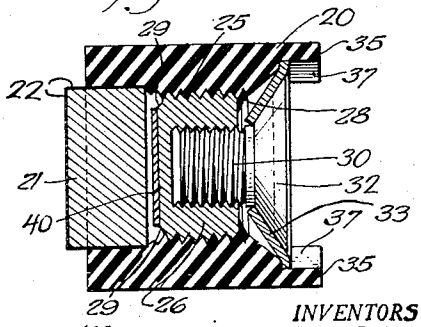


Fig. 4



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LIGHTNING ARRESTER

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6 Claims. (Cl. 175—30)

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This invention relates to lightning arresters or dischargers for telephone lines and the like, to protect the lines and instruments therein from high voltage currents due to lightning or other causes.

The ordinary arrester of this type, as is well known, comprises two small carbon blocks usually separated by a thin dielectric which as a unit is slipped between holding contact springs or supports connected to or in the circuit to be protected.

Such arresters are intended to have fixed spark gaps to give the desired protection, but due to manufacturing difficulties do not always do so. Also, in such arresters the carbons are exposed on their exterior faces and tend to absorb moisture, which lowers their resistance, affects their capacity and causes them to deteriorate. They are exposed more or less to dust, dirt and moisture on their discharging surfaces.

It is an object of this invention to provide an arrester or discharger which shall overcome the objections noted and possess advantages of its own; in which the air gap may be accurately adjusted under test for any desired fixed voltage and will remain so set indefinitely in use; in which the spark gap of the electrodes is enclosed in a chamber which is sealed and kept free from dust, dirt and moisture; in which the exposed surfaces of the carbon electrode are protected from moisture; and which is economical of manufacture, efficient in use, of long life, and possesses many other advantages, as will appear.

In carrying out the invention, an insulating body of thermoplastic material, which may be transparent, is molded of the desired form, preferably if for telephone or like use, to be slipped into place between the holding contact springs or supports of the circuit to be protected, in place of the usual carbon-block arrester assembly referred to. A carbon block forming one of the electrodes is preferably molded in one side of the body with its outer moisture-proofed face exposed for engagement with the holding contact spring or support on that side of the body.

This latter feature—the molding of the carbon electrode in the insulating body—is important and an object of the invention, since it provides a means of including a moisture-proof carbon electrode with its exposed spark gap or discharging surface in a hermetically sealed moisture-proof chamber, strongly and accurately holds the same therein without attaching screws or other mechanical means to hold the electrode in the insulating body or in the device as a whole, and

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lends itself to accurate manufacture by simple production methods.

The other opposed electrode of suitable metal preferably is adjustable, as by being threaded into the molded body, whereby the same may be accurately set for the desired spark gap as determined by test and instruments at the manufacturing plant, the sparking being observable by sight through the insulating body if the same is transparent and the spark gap setting thus determined or checked.

After the setting of the spark gap, the threaded connection of the adjustable electrode with the insulating body may be further sealed against the entrance of moisture to the spark chamber by applying a suitable sealing cement thereto.

Suitable connection is made with this adjustable electrode for contact with one of the circuit contact springs or supports when the body is slipped into position, like other arrester units between the circuit contact springs or supports, the outer face of the carbon electrode on the opposite side of the body contacting with the other circuit spring or support, the result being a moisture-proof, hermetically sealed spark-gap chamber arrester unit which cannot change its rating or deteriorate in use or in handling, but in which the spark gap may be adjusted when desired for different voltages.

Further objects and advantages will appear from the description and claims to follow, in connection with the accompanying drawing, which illustrates, by way of example, but not of limitation, an embodiment of the invention, and in which—

Fig. 1 shows an ordinary installation where the arrester may be used;

Fig. 2 is a face view on an enlarged scale of the complete device, looking at the side with the adjustable electrode;

Fig. 3 is a longitudinal central section of the same through the electrodes and taken on the line 3—3 of Fig. 2; and

Fig. 4 is a central cross-section of the device, also through the electrodes, and taken on the line 4—4 of Fig. 3.

Referring to the drawing, Fig. 1 indicates a typical telephone installation or the like where the arrester of this invention, designated generally by the numeral 10, may be employed in the well known manner in place of the usual carbon block arrester. In such arresters, usually a supporting spring contact 11 presses against one side of the arrester body and besides making electric contact therewith presses the arrester as a unit against a

contact support 12 on the other side of the arrester, which makes electric contact with the other electrode of the device.

The arrester or discharger here shown comprises an insulating body or block 20 of molded thermoplastic material which will shrink on cooling, is preferably devoid of "cold flow" and may be transparent, the material known as polystyrene being found satisfactory for the purpose.

Molded in one side of this body or block 20 is a flat carbon block 21 to form one electrode of the discharger or arrester. By being molded in the insulating block, the carbon block, which may be rectangular in form, is tightly and firmly held therein and continues to be so held in the use of the device, to-wit, in a fixed or immovable relation due to the gripping action of the thermoplastic material upon cooling during the molding operation, and, also, due to the substantial absence of cold flow of the thermoplastic material when thermoplastic material of such a characteristic is used. The outer face of the carbon block extends outside and beyond the outer face of the insulating block to make good electrical contact with the support 12 and spring 11 when inserted in a holder for use.

This carbon block or electrode 21 may be moisture-proofed, preferably by coating its entire surface, with a silver conductive coating 22 which is moisture and weather-proof and electrically conductive, and which may be applied as a coating to the carbon block by dipping, spraying or plating. Before molding the coated electrode in the insulating block, a suitable area on the inside face thereof that will oppose the other electrode in the completed arrester is spot-faced by a suitable tool or tools to remove the coating and leave the carbon surface in cleaned active condition for proper operation as an arrester or discharger.

In the opposite side of the molded block 20 from the carbon electrode there is molded a threaded aperture 25 to receive a correspondingly threaded metallic electrode 26, said electrode fitting tightly therein and having wrench sockets 27 in its outer end or other means provided to enable the same to be threaded into said aperture 25 and to be accurately and firmly adjusted therein with respect to the opposing carbon electrode and, when finally adjusted, to resist the turning effect of the contact screw, yet to be described.

While this threaded connection of the metal electrode 26 with the molded body 20 may be substantially moisture-tight, it is preferred, after the electrode is finally adjusted, to fit a ring 28 of suitable moisture-proof wax or cement about and into the circumferential corner between the outer end of the electrode and the threads of aperture 25, which positively prevents the entrance of moisture by way of the threaded connection to the hermetically sealed chamber 15 that is thus provided. At the same time, the electrode 26 is not anchored so firmly that it may not be turned for adjustment purposes when desired. Due to the high vaporizing point of tungsten, it is desirable to use the same at the gap by welding a tungsten contact 40 to the body of the electrode 26, which body portion may comprise any suitable material as a backing for the tungsten contact 40, such as steel or "Everdur."

In order properly and conveniently to connect the electrode 26 in the circuit and with the holding spring 11 or its equivalent, the electrode may have a central threaded recess into which a screw 30 threads, said screw passing through a contact plate or strip 31 and having a bevelled head 32

adapted to fit into a corresponding depression 33 in the strip 31 and having a turning slot 34 therein. The strip 31, having the outline shown in Fig. 2, fits snugly into a corresponding depression molded in the face of the insulating body 20 and is curved longitudinally, as indicated in Fig. 3, to conform to the curved face of the body, with its depression 33 entering the flaring opening of the threaded aperture 25 in the body for the electrode 26. The contact strip 31 lies in and transversely spans the space between the raised ribs 35 along the longitudinal edges of the body 20, which serve as guide and positioning ribs of the arrester unit on the spring 11 or other support for the arrester in the circuit to be protected. The slightly raised or deeper ends 36 of the ribs 35 are for ease in handling the unit and enabling it to be readily grasped for pulling it out of its supports.

The screw 30, when tightened, electrically connects this contact strip 31 with the electrode 26 by a positive connection. The circuit contact spring 11, which may be suitably curved endwise, makes electric connection with the spring strip 31 and the head 32 of screw 30, and through the latter with the electrode 26.

The ribs 35 along the longitudinal edges of the insulating body may be recessed slightly, as at 37 in Fig. 2, to accommodate the outward flare of the threaded opening 25 in the body, the depression 33 in the contact strip 31 and the head 32 of the screw 30. The spring strip 31 may be sprung or bowed out normally from its position when finally secured in place and a tight fit produced endwise in the depression for it in the body, so that, when the screw 30 is tightened, the strip will be tightly fitted into position, as indicated in Fig. 3, against the body.

The spark gap of the arrester, which is between the central part of the carbon electrode 21 and the inner end of the metal electrode 26, the latter being preferably cut away a little at the circumferential corner 29, is thus provided in moisture-proof hermetically-sealed chamber 15. The gap may be adjusted by screwing the electrode 26 in or out more or less to cause the discharge thereacross or sparking to take place at the desired voltage, suitable testing apparatus at the plant being available for such purpose. If transparent material be used for the body, the sparking becomes visible therethrough and the same may be used to determine the desired length of spark gap or to check the same without disturbing the hermetically sealed chamber 15.

When the gap has been determined and sealing wax or cement 28 applied, the strip 31 is applied and the screw 30 inserted and tightened. The arrester is then ready for use.

If it be desired to readjust the arrester for a different voltage, screw 30 and strip 31 are removed, and by a suitable tool or wrench the electrode 26 is turned, the seal 28 being broken thereby, and the gap is readjusted accordingly. When done, the parts are restored to their former condition and the arrester is ready for use at the new rating.

The adjustment by means of the threaded electrode enables the spark gap to be accurately and firmly adjusted in a most convenient and effective manner and saves the disagreeable and difficult job of grinding off the carbon surfaces in a cut-and-try method.

The structure uniquely provides a hermetically sealed spark gap chamber that may be cleansed of dirt and moisture before being sealed.

Providing a conductive coating on carbon electrode 21 renders the electrode impervious to moisture and prevents any seepage of moisture into chamber 15. Moreover, it prevents undesirable fungus growth or the entrance of other foreign matter that is apt to affect the operation of the device. Embedding electrode 21 in block 20 during the molding operation assures a permanent and an accurate positioning of the electrode which eliminates the inaccuracies heretofore resulting from manufacturing. The inner face will always be in a plane parallel to the inner face 40 of electrode 26 and a hermetical seal secured between body 20 and electrode 26. It will be remembered that thermoplastic material, such as an artificial or synthetic resinous compound or other thermoplastics, will contract upon cooling so that electrode 21 will be firmly held by the molecular tension of the material and a very effective hermetical seal provided that will prevent seepage of moisture into chamber 15 between body 20 and electrode 21. On the other hand, fungus growth in chamber 15 or the entrance thereinto of any foreign matter will be effectively prevented which will allow unlimited use as to the location of the installation.

We have found that once an adjustment of the spark gap is made, further adjustment is not necessary as a general rule, and hence, sealing at 28 may be permanent. If an adjustment is desirable, the seal at 28 will not necessarily be broken to the extent of destroying the hermetical seal of chamber 15, and, if it is broken at all, the time required to make the change and reseal is not sufficient to permit leakage past the threads of electrode 26. Another novel feature resides in the fact that screw 32 may be removed to change strip 31 if required at any time without effecting the seal 28 or disturbing the spark gap adjustment. Arresters of the type disclosed are used in many places. By providing body 20 of transparent thermoplastic material, many advantages will be obtained. Body 20 will not be subjected to ready breakage and will stand rough usage without fracturing. The material will have excellent insulating qualities and is not permeable to moisture or gas. Hence, the arrester may be used in places exposed to inclement weather conditions without breaking down. Moreover, with a material of this type, the advantage of being able to note readily the discharging across the gap through the transparent body will permit locating quickly the circuit that is affected and a quick repair of the lines.

Without further elaboration, the foregoing will so fully explain the gist of our invention that others may, by applying current knowledge, readily adapt the same for use under varying conditions of service, without eliminating certain features, which may properly be said to constitute the essential items of novelty involved, which items are intended to be defined and secured to us by the following claims.

We claim:

1. A lightning arrester unit comprising an elongated molded body of insulating material, an elongated carbon block embedded and molded in one side of said body, said block having its outer face exposed for engagement with a circuit contact terminal, said block being coated with a moisture proof material except for the spark gap area on its inner face, a metal electrode threaded into said body opposed to said carbon block and having its inner end in adjustable spark gap relation therewith, means for rendering said threaded connection moisture proof, said metal electrode having a threaded hole therein opening exteriorly, a metal contact strip overlying said metal electrode on the outside of said body for engaging a circuit contact terminal, and a securing screw inserted through said contact strip and into said threaded hole to mechanically secure the strip, body and electrode together and to electrically connect the strip and electrode, said body and electrode forming a closed and sealed spark gap chamber for the arrester.

2. A lightning arrester unit comprising a molded body of insulating material, a relatively thin flat carbon block embedded and molded flatwise in one side of said body and permanently, tightly and rigidly retained therein by the grip thereon of the material of the body in shrinking including that around the peripheral edge of the block, the outer face of said carbon block being exposed for engagement with a circuit contact terminal and the inner face thereof within the body forming one of the opposed discharge surfaces of the spark gap of the arrester, said body having an aperture opposite said discharge surface of said block, an electrode positioned in said aperture, the space between the said block and electrode enclosed by the adjacent wall of said aperture forming a tightly closed spark chamber, and connecting means from said electrode to the outside of the body for engagement with another circuit contact terminal.

3. A lightning arrester unit comprising a molded body of insulating material, a relatively thin flat carbon block embedded and molded flatwise in one side of said body and permanently, tightly and rigidly retained therein by the grip thereon of the material of the body in shrinking including that around the peripheral edge of the block, the outer face of said carbon block being exposed for engagement with a circuit contact terminal and the inner face thereof within the body forming one of the opposed discharge surfaces of the spark gap of the arrester, said block being coated over the entire surface except for the spark gap area on its inner face with a moisture-proof electrically-conductive coating, said body having an aperture opposite said discharge surface of said block, an electrode in said aperture in moisture-proof relation to the body, and connecting means from said electrode to the outside of the body for engagement with another circuit contact terminal.

4. A lightning arrester unit comprising a molded body of transparent insulating material, a relatively thin flat carbon block embedded and molded flatwise in one side of said body and permanently, tightly and rigidly retained therein by the grip thereon of the material of the body in shrinking including that around the peripheral edge of the block, the outer face of said carbon block being exposed for engagement with a circuit contact terminal and the inner face thereof within the body forming one of the opposed discharge surfaces of the spark gap of the arrester, said body having an aperture opposite said discharge surface of said block, an electrode located in said aperture, said transparent body enabling observation of the sparking during such adjustment and thereafter without opening the spark gap chamber, and connecting means from said electrode to the outside of the body for engagement with another circuit contact terminal.

5. A lightning arrester unit comprising a molded insulating body, a carbon block embedded in one side of the body, the outer face of the block

being exposed for engagement with a circuit terminal and the inner face having a spark gap discharge surface thereon within the body, an electrode in an aperture in the body having a discharge surface in opposed spark gap relation to the discharge surface of said carbon block, a contact strip on the outside of the body for engagement with another circuit terminal and having a depression extending into said aperture over the said electrode, and a screw connecting said strip with the said electrode and to said body, the head of the screw being seated wholly within said depression.

6. A lightning arrester unit comprising a molded insulating body, a carbon block embedded in one side of the body, the outer face of the block being exposed for engagement with a circuit terminal and the inner face having a spark gap discharge surface thereon within the body, said body having an opening therethrough opposed to said discharge surface on the carbon block, a metallic electrode adjustably secured to said body in said opening and having a discharge surface in spark gap relation with that on the carbon block, a contact strip for the arrester on the outside of said body having a conical depression extending and fitting into the said opening in the body over the electrode, and a screw passing

through the bottom of said depression and threading into said electrode, the head of the screw fitting and being seated wholly within the said depression, whereby the head of the screw, the depression and opening may be secured together in nested relation to hold the said contact strip in position on the body without obstruction on the outer face of the contact strip and to electrically connect it with the said electrode and without disturbing the adjustment of said electrode in the body.

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