

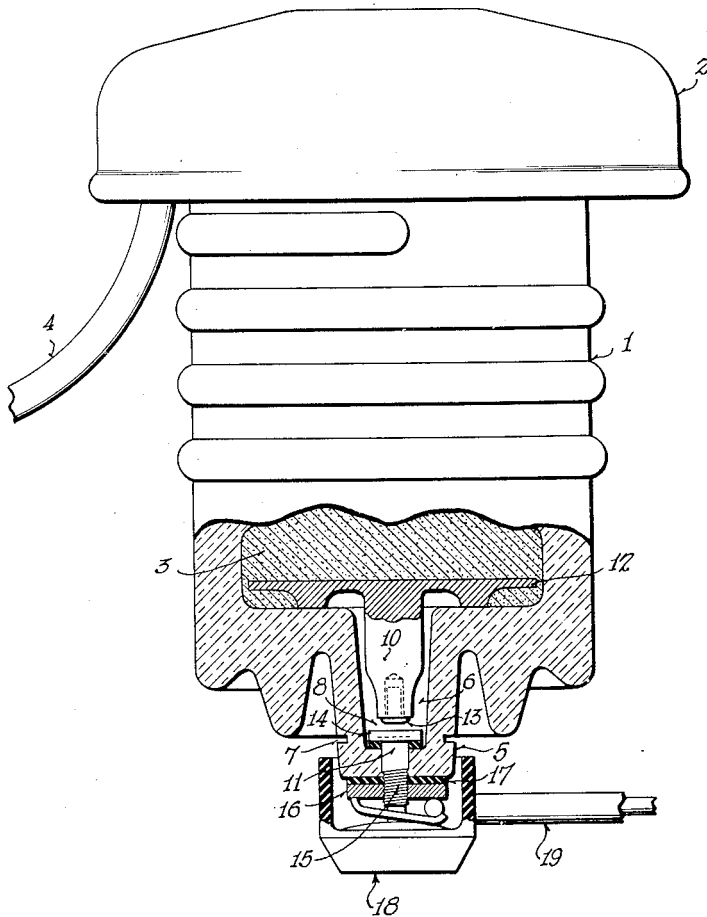
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CIRCUIT INTERRUPTING DEVICE

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## CIRCUIT INTERRUPTING DEVICE

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10 Claims. (Cl. 200—115)

This invention relates to circuit interrupting devices and has to do more especially with an automatic interrupter designed to serve as a protective means operative principally as a result of failure of other protective apparatus or as a result of excessive delay in the operation of such other apparatus.

The subject device is particularly useful as an adjunct to a lightning arrester designed for use on power circuits and having means incorporated therein for suppressing the flow of power current across the extinguisher gap after an arc has been established by lightning discharge or surges in a power line.

This application is a division of my co-pending application Serial No. 269,065 filed April 21, 1939, entitled Automatic circuit interrupting device.

Lightning arresters for use on power lines usually comprise a single or multiple stage spark gap in series with so-called valve material such as silicon carbide which is characterized by low impedance when subjected to very high potentials and high impedance when subjected to relatively low potentials—properties which render it very useful for lightning arrester service. Occasionally the valve material in such an arrester becomes defective and, therefore, inoperative to extinguish the arc across the spark gap, with the result that the power current will maintain a previously established arc unless some additional provision is made for opening the circuit upon the failure of the arrester to extinguish the arc in the normal manner.

In my above-identified co-pending application I have disclosed several devices, including that of the present divisional application, which are designed to open a circuit in response to a current flow of predetermined duration, and not otherwise—and each of said devices is most particularly adapted for use as an adjunct to or part of the lightning arrester structure.

The objects of the present invention include those of the parent application, which are to provide a device which will operate dependably to open a circuit after a predetermined time lapse and which will function to effect a complete separation of the ground conductor (in the case of a lightning arrester) from the arrester structure, so that it will be visibly evident upon casual inspection whenever a circuit interrupter has operated.

A further object of this invention is to provide a unitary structure including the circuit interrupter in combination with other apparatus such as a lightning arrester, in a single housing, and

thus effect a substantial reduction in the manufacturing cost.

The outstanding novel feature of the present invention resides in the use of a single housing, preferably of moulded glass, in which is housed all the operative parts of the device, including the circuit interrupted—which housing has an integral hollow stem of reduced diameter in which is housed the circuit interrupter mechanism and which stem preferably is locally weakened by a groove therein so that upon operation of the circuit interrupter mechanism the housing will rupture along said groove and allow the ground conductor or other conductor to drop.

Referring to the drawing which accompanies this specification, reference numeral 1 identifies a hollow cylindrical housing which is preferably of glass, but may be made of other dielectric material such as porcelain. Secured to the upper end of the housing and functioning as a closure therefor is a cap 2 which likewise may be made of glass or porcelain or other suitable dielectric material.

Within the upper portion of the housing is a suitable spark gap structure (not shown) and below the spark gap structure is a filling 3 of valve material such as comminuted silicon carbide. A lead-in conductor 4 serves to connect the power line with one end of the spark gap. For showing of the spark gap structure and other details of the upper part of the arrester, see Fig. 1 of the parent application hereinbefore identified.

At the bottom of housing 1 and integral therewith is a depending stem 5 of reduced diameter having an internal cavity or chamber 6. Near the lower end and circumscribing the stem 5 is a peripheral groove 7, the purpose of which is to weaken the cross section of the stem at the groove so that the portion of the stem below the groove and the parts carried thereby will be broken away from the portion of the stem above the groove when the circuit interrupter operates.

Groove 7 is preferably ground in with sharp internal fillets so that a clean break will be insured along the line of cleavage defined by said groove.

Enclosed within chamber 6 is a spark gap 8, defined conjointly by downwardly projecting upper electrode 10 and a lower electrode 11. The upper electrode 10 is preferably integral with a conductor plate 12, the upper surface of which is in contact with valve material 3. In the lower end of electrode 10 is an axial recess designed to receive and hold an explosive cap or cartridge 13 which is designed to explode when its tem-

perature is raised to a suitable predetermined value. The lower electrode 11 is flanged at its upper end, the upper surface of the flange being recessed axially so as to form an annular rim portion 14. Electrode 11 has a threaded shank 15 which passes through an aperture in the otherwise closed end of the lower portion of neck 5 and is secured in place by a threaded member 16—a suitable gasket 17 being interposed between the lower surface of the neck and the threaded member 16. The remaining structure designated as a whole by numeral 18 constitutes a connector by means of which a ground conductor 19 is supported by the housing and maintained in electrical connection with electrode 11.

In the normal operation of the device as a lightning arrester, an arc will occur across the gap 8, between the upper electrode 10 and the annular rim 14 of the lower electrode, but due to the functioning of the valve material 3, the arc is extinguished very rapidly and no power current of any substantial duration will jump the gap before the arc is fully suppressed. However, should the lightning arrester get out of order, as sometimes happens, the arc may not promptly be extinguished and, in such event, enough heat will be developed at the gap 8 to explode cartridge 13—whereupon the housing is ruptured at groove 7 and the terminal portion 18 including electrode 11 and conductor 19 will fall toward the ground, causing an immediate wide separation between electrodes 10 and 11 and a corresponding widening of gap 8, which results in immediate extinction of the arc. Thus, the electrical equipment in the circuit may be protected from damage which would otherwise result from the failure of the lightning arrester and, in addition, the dropping of the terminal connection and the ground wire provides a visible indication that a lightning arrester has failed.

I claim:

1. An electrical device including a circuit-interrupter, said device comprising a housing of dielectric material having a main body portion and an integral hollow stem of reduced diameter projecting from said main body portion, said stem having a localized portion of substantially reduced cross section at which said stem is most likely to rupture in response to internally applied force, said circuit-interrupter comprising a pair of spaced electrodes having a gap therebetween disposed within said stem, one only of said electrodes being carried by the portion of said stem which is remote from said main body portion, and an external connector also carried by said last-mentioned portion of said stem and electrically connected with said last-mentioned electrode, said circuit-interrupter including delayed operation force generating means operative to rupture said stem at said localized portion.

2. An electrical device including a circuit-interrupter, said device comprising a housing of dielectric material having a main body portion and an integral hollow stem of reduced diameter projecting from said main body portion, said stem being at least partially circumscribed by a peripheral groove therein which substantially reduces its cross-sectional area locally at an intermediate point lengthwise thereof, said stem being most likely to rupture along said groove in response to internally applied force, said circuit interrupter comprising a pair of spaced electrodes having a gap therebetween disposed within said stem, one only of said electrodes being carried by the portion of said stem which is re-

mote from said main body portion, and an external connector also carried by said last-mentioned portion of said stem and electrically connected with said last-mentioned electrode, said circuit-interrupter including delayed-operation force generating means operative to rupture said stem along said groove.

3. An electrical device including a circuit-interrupter, said device comprising a housing of dielectric material having a relatively attenuated depending hollow stem, said stem being at least partially circumscribed by a peripheral groove therein which substantially and abruptly reduces its cross-sectional area and thereby provides a definite line of cleavage along which said stem is most likely to rupture in response to internally applied force, said circuit-interrupter comprising a pair of spaced electrodes having a gap therebetween disposed within said stem, one of said electrodes being carried by the lower portion of said stem which is below said groove, and an external connector also carried by said lower portion of said stem and electrically connected with said last-mentioned electrode, said circuit-interrupter including delayed-operation force generating means operative to rupture said stem along said groove.

4. An electrical device including a circuit-interrupter, said device comprising a generally cylindrical housing of dielectric material having an integral depending hollow stem of reduced diameter, said stem being circumscribed by a peripheral groove ground therein which abruptly reduces its cross-sectional area and thereby provides a definite line of cleavage along which said stem will rupture in response to internally applied explosive force, said circuit-interrupter comprising a pair of spaced electrodes disposed within said stem and having an arc gap therebetween, an explosive element disposed near said gap within said stem, said explosive element being operative, upon detonation, to rupture said stem along the line defined by said groove, said explosive element being designed to detonate in response to a predetermined temperature applied thereto, one only of said electrodes being carried by the lower portion of said stem which is below said groove, and an external connector also carried by said lower portion of said stem and electrically connected with said last-mentioned electrode.

5. An electrical device comprising a generally cylindrical hollow housing of dielectric material having an integral depending hollow stem of reduced diameter, said stem being circumscribed by a groove therein which abruptly reduces its cross-sectional area and thereby provides a definite line of cleavage along which said stem will rupture in response to internally applied explosive force, lightning-arrester structure enclosed within the upper portion of said housing and circuit-interrupter structure enclosed within said stem, said circuit-interrupter structure comprising a pair of spaced electrodes defining, conjointly, an arc gap, one only of said electrodes being carried by the portion of said stem below said groove, an explosive element carried by one of said electrodes adjacent said arc, and an external connector carried by said lower portion of said stem and electrically connected with said last-mentioned electrode.

6. A lightning arrester including a dielectric housing having a projecting recessed portion of lesser diameter than and integral with said housing, an electrode in the housing having an elec-

trode portion projecting into said recessed portion, a terminal electrode projecting from the exterior into said recessed portion and terminating in spaced relation to said electrode portion, and an explosive cap carried by and subject to heat generated in said electrode portion.

7. A lightning arrester including a dielectric housing having a projecting recessed portion of lesser diameter than and integral with said housing, said recessed portion having a localized frangible area annularly thereof, an electrode in the housing projecting into said recessed portion, a second electrode projecting from the exterior to the interior of said recessed portion and terminating in spaced relation to the first mentioned electrode, and an explosive cap carried by and subject to heat generated in one of said electrodes.

8. A lightning arrester including a dielectric housing having a projecting recessed portion of lesser diameter than and integral with said housing, said recessed portion having a localized frangible area annularly thereof, an electrode in the housing, a second electrode projecting from the exterior to the interior of said recessed portion and terminating in spaced relation to the first mentioned electrode, and heat responsive means carried by one of said electrodes for ef-

fecting rupture of said recessed portion when subjected to a predetermined temperature.

9. A lightning arrester including a dielectric housing having a localized annular frangible area integral therewith, an electrode in said housing adjacent said area, a second electrode projecting from the exterior to the interior of said housing and terminating in spaced relation to the first mentioned terminal, said second electrode being carried by that portion of the housing defined by said annular area, and heat responsive means carried by one of said electrodes for effecting rupture of said area when subjected to a predetermined temperature.

10. A lightning arrester including a dielectric housing of frangible material, a portion thereof being more readily frangible than the remaining portion, an electrode in said housing adjacent said more readily frangible portion, a valving material in said housing in contact with said electrode and normally holding it in position, a second electrode carried by said more readily frangible portion and projecting from the exterior to the interior of said housing, said electrodes defining a gap, and heat responsive means carried by one of said electrodes for effecting rupture of said more readily frangible portion.

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