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DISCONNECTOR

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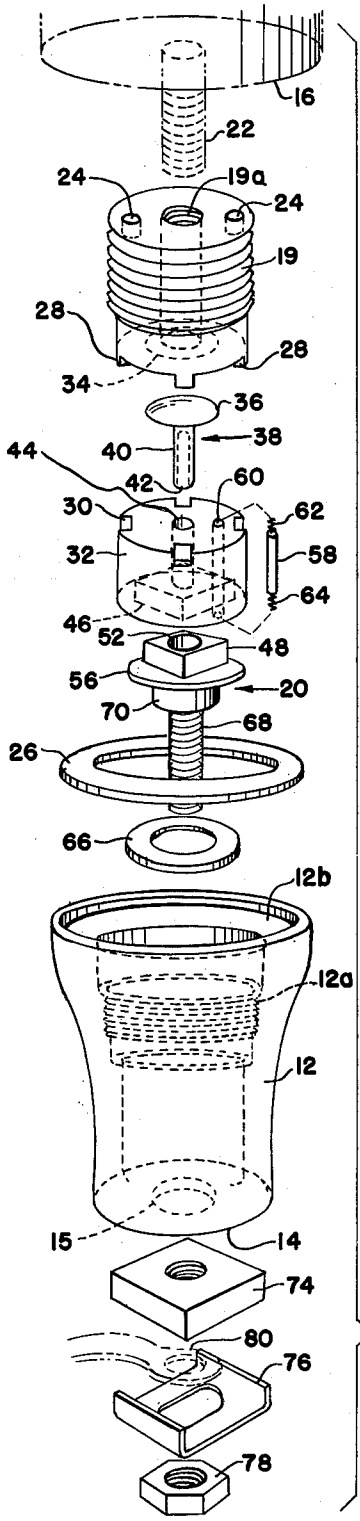


FIG. 2

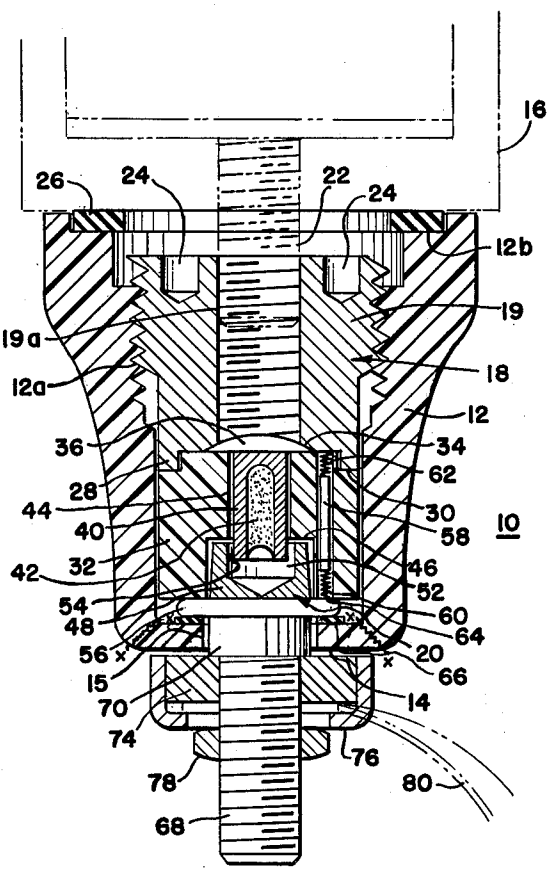


FIG. 1

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DISCONNECTOR

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This invention relates to disconnectors adapted for use in conjunction with lighting arresters for the protection of electric transmission lines.

It has been the practice to provide a disconnector for use in conjunction with a lightning arrester for the purpose of permanently opening the circuit between the arrester and ground when the arrester has failed or is malfunctioning. It is desirable to disconnect the arrester from the circuit after such failure or malfunctioning in order to prevent an abnormal flow of current through the failed arrester to ground, which current, unless interrupted, results in the opening of fuses or circuit breakers and, hence, causes outage of the circuit until the faulty arrester can be located and replaced. In order to facilitate the finding and replacement of the faulty arrester, it is desirable to provide a disconnector which will visually indicate, upon casual inspection, that the arrester is faulty.

A common type of disconnector in present use is one which employs an explosive charge to break a thin section of its housing thus disconnecting the circuit and giving a visual indication of arrester failure. These disconnectors employ a spark gap in which the heat generated by the arc across the gap ignites the explosive charge to sever the thin section of the housing and, hence, disconnects the arrester from the circuit. During a sudden surge of voltage across the gap for a short duration of time as might be caused by lightning or other disturbance on the line, the heat generated by the arc is not sufficient to ignite the explosive. However, if, after the surge has passed, an abnormally high current is present because of the failure of the arrester, the heating caused by the prolonged duration of the arc will ignite the explosive charge, thus disconnecting the arrester before fuses or circuit breakers are opened on the line. In order to prevent the buildup of a potential difference across the spark gap, which buildup causes radio interference because of the sparkover or corona effect resulting therefrom, the electrodes of the gap are shunted by a resistor or other impedance thereby discharging any charge accumulating on the electrodes. A common difficulty in these present disconnectors is that many times during their installation the thin section of their housing is ruptured by the lineman applying too much torque when attaching the ground lead and, in view of this problem, some manufacturers recommend the use of torque-wrenches to reduce breakage during installation.

Therefore, it is an important object of the present invention to provide a new and improved disconnector of the general character described above but so constructed and arranged that the thin section of the housing is not easily ruptured during installation.

A further object of the invention is to provide a disconnector of the character indicated which is simple in construction, easy to manufacture and relatively low in cost.

Another important object of the present invention is to provide a new and improved disconnector of simple, compact construction for use in conjunction with a lightning arrester for the purpose of disconnecting the arrester from the circuit when an abnormally high follow current is present due to arrester failure and, at the same time, for minimizing sparkover effect across the arc gap of the disconnector, thus eliminating radio interference.

According to the present invention, the foregoing and other objects are realized by providing a disconnector comprising an insulating housing or shell having a thin section at one end thereof and containing a first terminal adapted to be connected to a lightning arrester and a second terminal extending through the thin section of the housing for connection to a ground lead. The terminals are positioned in spaced relation to define a spark gap and an insulating spacer is disposed between the terminals and around the gap. An impedance carried by the spacer is electrically connected between the two terminals to shunt the spark gap, and explosive means are contained within one of the terminals for rupturing the thin section of the housing in order to expel the second terminal from the housing. Any torque applied to the second terminal during assembly of the ground lead is transmitted to the arrester via a path which does not include the thin section of the housing and, as a consequence, these forces have little or no tendency to rupture the housing.

The invention, both as to its construction and manner of operation together with further objects and advantages, will best be understood by reference to the following detailed description taken in conjunction with the accompanying drawing wherein:

FIG. 1 is a sectional view of a disconnector characterized by the features of the present invention; and

FIG. 2 is an exploded, perspective view of the disconnector shown in FIG. 1 and illustrates the various parts making up the disconnector.

Referring now to FIGS. 1 and 2, a disconnector characterized by the features of the present invention is there indicated generally by the reference numeral **10** and comprises a generally bell-shaped insulating housing or shell **12** having at the smaller end a thin, fracturable section **14** provided with a central aperture **15**. As will be evident from FIG. 1, the section **14** is substantially thinner than the remaining portions of the housing **12** so that it will rupture along the region indicated at "X" when subjected to a downward force as described more fully hereinafter.

As was indicated previously, the disconnector **10** includes a first terminal means **18** located adjacent the open or large end of the housing **12** and a second terminal means **20** adjacent the smaller end. The first terminal means includes an externally threaded, electrically conducting, cylinder **19** inserted into an internally threaded portion **12***a* of the housing **12**. In order to secure the disconnector to the bottom of a lightning arrester **16**, both mechanically and electrically, the cylinder **19** is provided with an axial threaded bore **19***a* for receiving a terminal bolt **22** of the lightning arrester **16**. The external threads of the cylinder **19** are provided with a suitable thread sealant in order to prevent disengagement of the cylinder **19** from the housing **12** and to effect a weather-tight seal therebetween. Means, such as a set of recesses **24**, are provided in the outer face of the cylinder for engagement by a wrench or tool to permit the cylinder **19** to be threaded into the housing **12**. A gasket **26** is seated within an annular recess **12***b* in the upper rim of the housing and engages the lower end of the arrester **16** to effect a moisture-tight seal.

The lower surface of the cylinder **19** is provided with a plurality of depending radially spaced lugs **28** which are seated within spaced recesses **30** in a cylindrically shaped, insulating spacer **32** disposed therebelow in order to interlock these two members to prevent relative rotative movement therebetween and to transmit torsional forces applied to the terminal means **20** in a manner described in detail below. A recess **34** is provided in the bottom face of the cylinder **19** around the lower end of the bore **19***a* for the purpose of accommodating a

rounded head 36 of a hollow stemmed terminal cap 38 forming part of the first terminal means 18. The head 36 is firmly seated within the recess 34 by the spacer 32, thus forming a good electrical connection between the two members making up the first terminal means. The hollow stem 40 of the terminal cap 38 extends through a central bore 44 in the spacer 32 and is at least partially filled with an explosive material 42. The extreme, lower end of the stem 40 protrudes into an axially disposed, square shaped spark gap containing recess 46 formed in the lower end of the spacer 32. The recess 46 also receives a portion of the second terminal means 20 which cooperates with the first terminal means 18 to define a spark gap 54. More specifically, the second terminal means 20 includes an upper, square head 48 extending into the recess 46 to form an interlock for preventing relative rotative movement between the spacer 32 and the terminal means 20 and for transmitting between these two members torsion forces applied to the second terminal means as described below. The square head 48 is provided with an axial recess 52 somewhat larger in diameter than the outside diameter of the hollow stem 40 of the terminal cap 38, thus forming an air space defining the spark gap 54.

The second terminal means 20 is provided with an enlarged washer-like portion 56 formed integrally with and disposed directly below the square head 48. This washer-like portion 56 engages the lower face of the insulating spacer 32 and thus serves to limit the depth of insertion of the head 48 into the recess 46, thereby retaining the lower terminal means 20 in fixed spaced relationship with the terminal cap 38 and maintaining a spark gap of predetermined size. An impedance 58, such as a resistor or a coil, is disposed within a through passage 60 defined in the insulating spacer 32. The passage 60 is spaced from and extends parallel to the axial bore 44. The upper end of the impedance 58 is electrically connected to the lower face of the cylinder 19 by means of an electrically conducting, compression spring 62, while the lower end of the impedance 58 is electrically connected to the upper face of the washer-like portion 56 by means of a similar spring 64. Thus, it will be apparent that the spark gap 54 is electrically shunted by the impedance 58. A gasket 66 is interposed between the lower surface of the washer-like portion 56 and the thin fracturable section 14 of the housing 12 to effect a seal therebetween.

The terminal means 20 also includes a threaded shank 68 formed integrally with the head 48 and the washer-like portion 56. A collar 70 is drive fitted onto the shank 68 and seated tightly against the washer-like portion 56. The collar 70 extends through the aperture 15 and, since it is slightly thicker than the section 14, it extends slightly beyond the plane of the lower face of the latter section. The shank 68 extends well below the collar 70 and receives a lug nut 74 which, when tightened, seats against the collar and, hence, does not exert pressure on the thin, fracturable section 14.

A clamping member 76 is slipped onto the shank 68 and a lock nut 78 is also threaded onto the shank 68 for the purpose of rigidly securing a ground lead 80 to the second terminal means 20. When the lug nut 74 and the lock nut 76 are tightened, for example, by use of a wrench, the torque applied thereto is transmitted through the terminal means 20, through the insulating spacer 32, through the first terminal means 18 and to the bolt 22 depending from the arrester 16 and, as a result, the thin fracturable section 14 is not subject to rupture due to excess tightening torque.

During the normal operation of the arrester 16, the disconnector 10 operates as a spark gap in a manner well known in the art. Thus, when short duration surges caused by lightning or other line disturbances are present, current from the arrester 16 passes through the cylinder 19 to the terminal cap 38, jumps the spark gap 54 to the

second terminal means 20 and is dissipated through the ground lead 80 to ground. The heat caused by arcing across the spark gap 54 during such a short duration surge is not sufficient to ignite the charge 42. However, if for any reason the arrester 16 fails to interrupt the current flow after the surge has passed so that an abnormal current continues to flow through the arrester 16, the heat generated by the arc across the spark gap 54 becomes sufficient to ignite the explosive material 42 thus creating an explosive force acting against the head 48 of the terminal means 20. The washer-like portion 56 is thus urged downwardly to rupture the thin, fracturable section 14 along the region indicated at "X" in FIG. 1 and the entire terminal means 20 falls away from the assembly to break the circuit between the arrester 16 and ground. Since the terminal means 20 is securely attached to the ground lead 80, it is freely suspended and, hence, can be seen upon casual inspection by a ground observer to indicate that the arrester 16 has failed and must be replaced. The shunting impedance 58 serves to dissipate to ground any charge accumulating on the first terminal means 18 thus preventing the formation of corona or sparking which might cause interference to radios or the like.

While a particular embodiment of the invention has been shown, it will be understood, of course, that the invention is not limited thereto since many modifications will readily occur to those skilled in this art and it is therefore contemplated by the appended claims to cover any such modifications as fall within the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. In a disconnector adapted for use with a lightning arrester, an insulating shell having a portion with a relatively thin wall section, first terminal means within said shell adapted to be connected to said arrester, second terminal means extending into said shell and adapted to be connected to a ground lead, an insulating spacer within said shell and disposed between said first and second terminal means, said first terminal means including a portion extending through said spacer and separated from said second terminal means to form a spark gap, explosive means contained in one of said terminal means for rupturing said shell along said thin wall section and for thus expelling said second terminal means upon an abnormal flow of current across said spark gap for a predetermined time, and said first and second terminal means including members interlocked with said spacer to join said spacer and both terminal members to form a unitary torque transmitting assembly for transmitting torque between the two terminal members independently of the thin wall section of the shell.

2. In a disconnector, the combination as set forth in claim 1, and additionally including impedance means shunting said spark gap for normally preventing the formation of a potential difference between said first and second terminal means.

3. The combination defined in claim 2 wherein said spacer is provided with a passage therethrough and wherein said impedance means is disposed within said passage and is electrically connected at its opposed ends to said first and second terminal means respectively.

4. In a disconnector adapted for use with a lightning arrester, an insulating housing having a portion with a relatively thin wall section, first terminal means threadably engaged within said housing and adapted to be connected to said arrester, second terminal means extending through an aperture defined in said thin wall section and adapted to be connected to a ground lead, an insulating spacer within said housing disposed between said first and second terminal means, said first terminal means including a portion extending through said spacer and separated from said second terminal means to form a spark gap, explosive means contained in one of said

terminal means for rupturing said shell along said thin wall section and for thus expelling said second terminal means upon an abnormal flow of current across said spark gap for a predetermined time, and said first and second terminal means including members interlocked with said spacer to join said spacer and both terminal members to form a unitary torque transmitting assembly for transmitting torque between the two terminal members independently of the thin wall section of the shell.

5. In a disconnector adapted for use with a lightning arrester, an insulating shell having a portion with a relatively thin wall section, first terminal means adapted to be connected to said arrester, second terminal means adapted to be connected to a ground lead, an insulating spacer within said shell disposed between said first and second terminal means, said first terminal means including a cylindrical member threadably engaged within said shell and a second member extending through said spacer and containing explosive means, said second terminal means extending into and interlocking with said spacer and spaced from said explosive material containing member to form a spark gap, said explosive means being adapted to rupture said thin wall section and for thus expelling said second terminal means from said housing upon an abnormal flow of current across said spark gap for a predetermined time, and said first and second terminal means including members interlocked with said spacer to join said spacer and both terminal members to form a unitary torque transmitting assembly for transmitting torque between the two terminal members independently of the thin wall section of the shell.

6. The combination defined in claim 5 wherein said second terminal means includes a radially extending stop engaging said spacer and limiting the extension of said second terminal means into said spacer.

7. In a disconnector adapted for use with a lightning arrester, an insulating shell having an inturned end flange of relatively thin wall section and defining a central aperture, first terminal means adapted to be connected to said arrester within said shell, second terminal means adapted

to be connected to a ground lead, a generally cylindrical insulating spacer within said shell disposed between said first and second terminal means and having a central axial bore therethrough, a recess at one end of said spacer in communication with said bore, said first terminal means including a generally cylindrical first member having external threads threadedly engaged with said shell and a second member extending into said bore in said spacer and containing explosive means, said second terminal means extending into said recess and interlocking with said spacer and spaced from said second member to form a spark gap, said explosive means being adapted to rupture said thin walled end flange and to expell said second terminal means from said shell upon an abnormal flow of current across said spark gap for a predetermined time, a collar on said second terminal means seated against said one end of said spacer and having a diameter greater than the diameter of said aperture defined by said thin walled end flange of said shell, said second terminal means having a shank portion extending through said aperture and a nut threaded onto said shank portion for attaching said ground lead to said second terminal means, spacing means defined on said shank portion extending slightly outward of said shell for preventing said nut from touching said shell when tightened on said shank portion, and said first and second terminal means and said spacer including elements interlocked with one another to join said spacer and said first and second terminal means to form a unitary torque transmitting assembly for transmitting torque between the two terminal means independently of said thin walled end flange of the shell.

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