

April 1, 1952

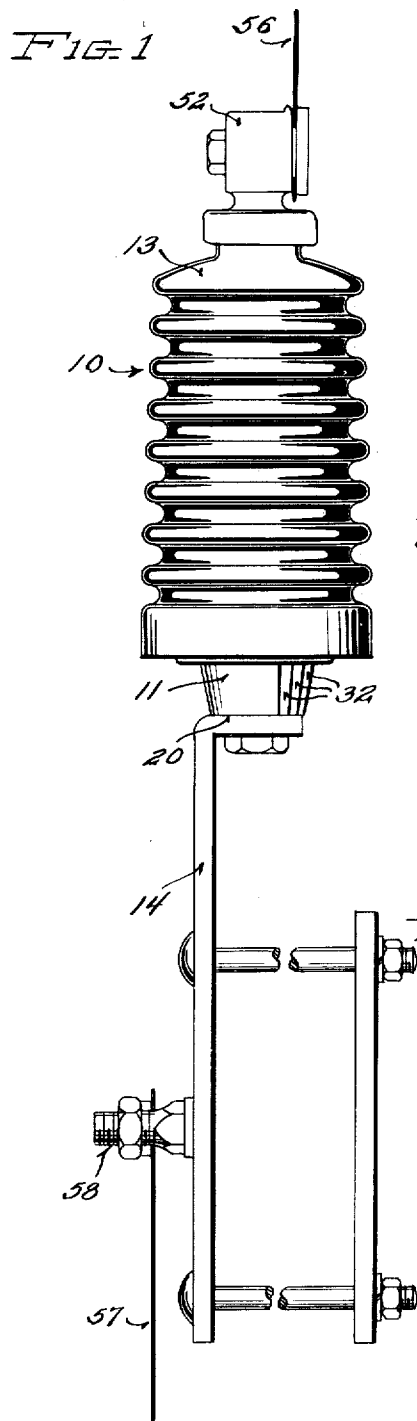
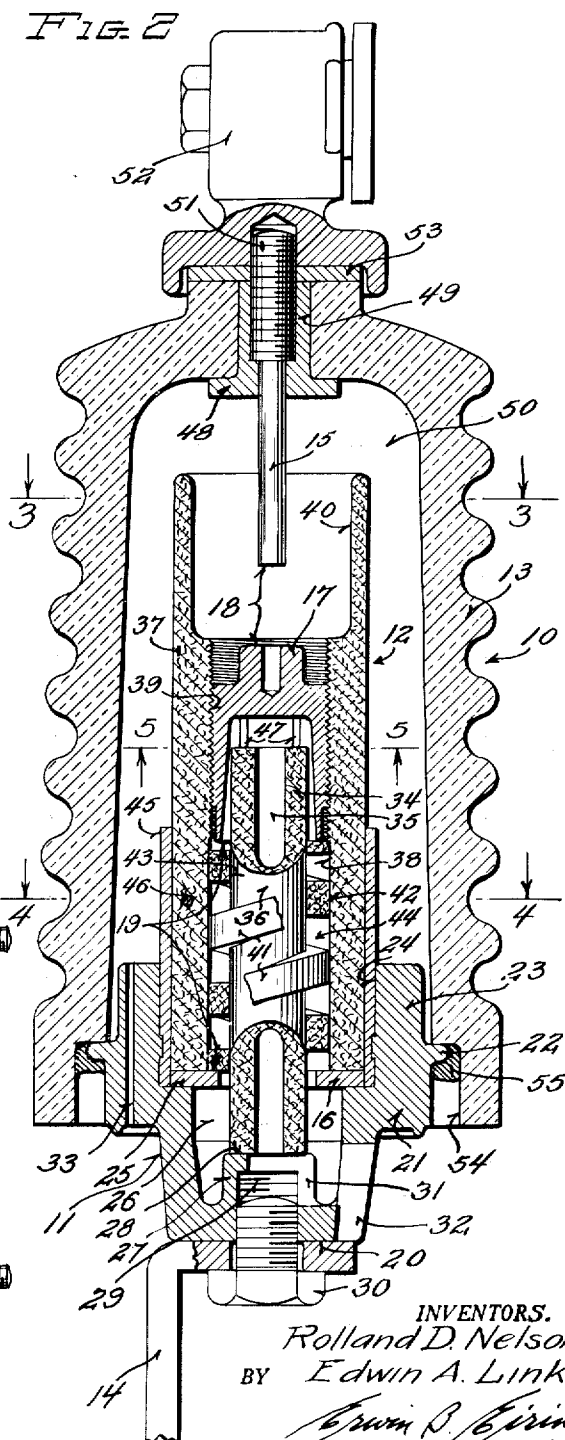
R. D. NELSON ET AL

2,591,370

LIGHTNING ARRESTER

Filed March 29, 1951

2 SHEETS—SHEET 1



INVENTORS.
Rolland D. Nelson,
BY Edwin A. Link
Edwin A. Link
ATTORNEY

April 1, 1952

R. D. NELSON ET AL

2,591,370

LIGHTNING ARRESTER

Filed March 29, 1951

2 SHEETS—SHEET 2

FIG. 3

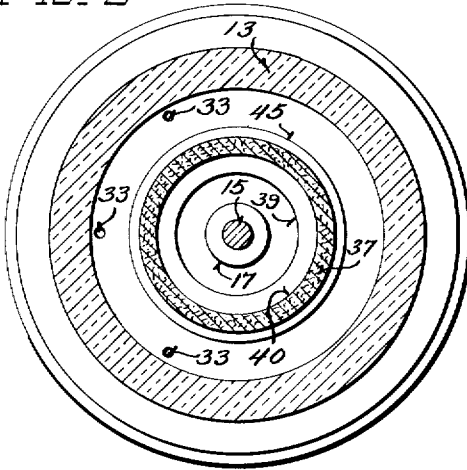


FIG. 4

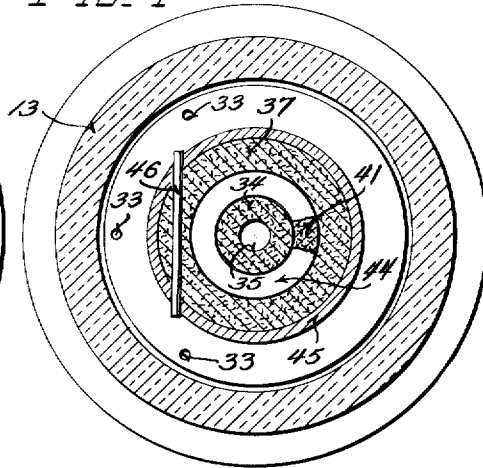


FIG. 5

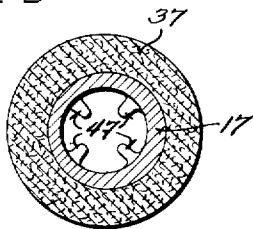


FIG. 7

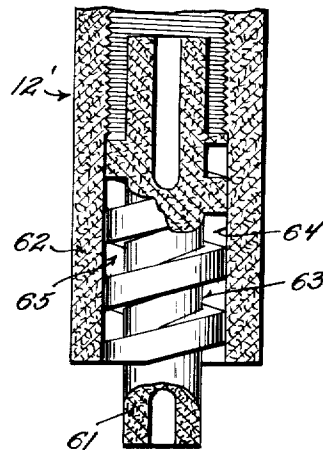
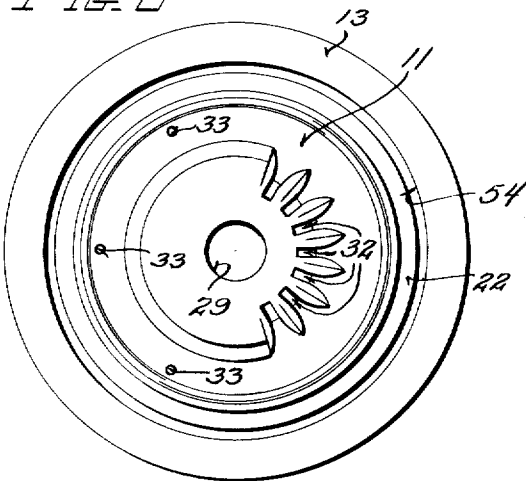


FIG. 6



INVENTORS.
Rolland D. Nelson
BY Edwin A. Link
Brown R. Goring
ATTORNEY

UNITED STATES PATENT OFFICE

2,591,370

LIGHTNING ARRESTER

Rolland D. Nelson, Hales Corners, and Edwin A. Link, Milwaukee, Wis., assignors to Rural Transformer & Equipment Co., Milwaukee, Wis., a corporation of Illinois

Application March 29, 1951, Serial No. 218,232

14 Claims. (Cl. 313—231)

1

This invention relates to electrical discharge devices, or lightning arresters, for preventing excess voltages or high potential current surges in the power line, caused by lightning, atmospheric or other conditions, from flowing into the load lines carrying electrical instrumentalities which might be severely damaged thereby.

The general purpose of lightning arresters, connected to electric transmission and distribution lines are two-fold; first, to discharge excessive voltages produced by lightning or other causes; and second, to interrupt the flow of follow up currents through the arrester upon the return of the system to a normal voltage.

Many forms of lightning arresters have been used, embodying various principles of operation, in attempts to provide devices which were intended to afford successful repeated operation without being destroyed or severely damaged. However, most of these devices have failed to prove entirely satisfactory either because of failure in service or from the standpoint of costliness due to complexity of construction.

This invention is designed to overcome the above noted defects by providing a new and improved lightning arrester, which, due to its simple construction, will afford a device capable of repeated efficient and effective operation in discharging excessive voltages or high-potential current surges and providing means for extinguishing the arc, formed during the operation of the device, by the process of deionization which precludes the flow of follow up currents through the lightning arrester upon the return of the system to a normal operating line voltage.

The primary object of the present invention resides in the provision of a new and improved lightning arrester, including essentially a pair of spaced electrodes and a dielectric structure formed of gas evolving material and providing a means for confining a discharge arc. The dielectric structure is so constructed as to effect the initial establishment of a discharge spark along a restricted path and then, through the action of the evolved gases generated by the established arc, effect the transfer of the discharge arc to another less restricted path of travel having a greater length but offering less resistance than that encountered along the initial shorter restricted path of travel of the discharge arc due to the increased resistance caused by the presence of the evolved gases. The longer path of travel serving to confine the discharge arc within a passage wherein it is extinguished through the process of deionization

2

brought about through the expending force of the evolved gases upon the arc stream.

Another object of the invention resides in the provision of a new and improved lightning arrester including essentially a pair of electrodes and a dielectric structure formed of gas evolving material forming a means for confining a discharge arc and including means for venting the device to alleviate the possibility of rupture of the lightning arrester under the influence of pressure built up as the result of the gases formed by the presence of the arc in the process of discharging the high-potential current surges in the power line.

Another object of the invention resides in the provision of a new and improved lightning arrester including an intermediate electrode positioned in spaced relationship with the line electrode on one side and the ground electrode on the other side, in a manner to afford a series arrangement of the air gaps, including one which is substantially unconfined and a second air gap which is confined within the dielectric structure.

Another object of the invention resides in the provision in a new and improved lightning arrester of a dielectric structure arranged to confine a spark gap and provide a plurality of paths which the discharge spark may follow including one path adapted, by reason of its length and low resistance, for the initial establishment of the discharge spark and an additional path, of predetermined length greater than the other path, to which the discharge spark is transferred when the resistance to the flow of the discharge spark in the initially established path of travel is increased, under the action of the deionizing gas formed as the result of the discharge spark's action on the dielectric structure which is formed of gas evolving material, to a value which is greater than the resistance offered in the additional path of travel having a predetermined greater length.

Another object of the invention resides in the provision in a new and improved lightning arrester of a dielectric structure formed of gas evolving material and comprising a plurality of members arranged for cooperative association to provide a confined chamber in which a discharge spark is established and further providing a plurality of paths along which the discharge spark may travel, one of the paths offering negligible resistance to the establishment of the discharge spark between the adjacent portions of the electrodes housed within the dielectric

3

structure and the other of the paths being of a predetermined length greater than the lower resistance path. The shorter of the alternate paths is partially restricted while the longer one forms a continuous unrestricted passage for the discharge arc.

Another object of the invention resides in the provision of a new and improved dielectric structure forming an essential part of the lightning arrester; the dielectric structure including a plurality of telescopically arranged members formed of gas evolving material and cooperating in a manner to provide a plurality of paths for a discharge arc; one of the paths being shorter and more restricted than the other. The shorter path offering less resistance to the establishing of the discharge arc and the longer path offering an unrestricted passage within which the discharge arc is extinguished by the process of deionization through the action of the evolved gases which increase the resistance to the flow of the discharge arc along its initially established path of travel to an amount greater than the resistance to its flow through the longer unrestricted passage to which it transfers and in which it is extinguished through the expending force of the evolved gas upon the arc stream.

Another object of the invention lies in the provision of a new and improved lightning arrester including an improved form of dielectric structure formed and arranged in a manner such that they cooperate to delineate separate paths of travel for the flow of a discharge arc; one of the paths being partially restricted and shorter in length than the other path which is unrestricted and formed by a groove in one member cooperating with the wall of another member.

Another object of the invention resides in the provision of a new and improved lightning arrester incorporating a dielectric structure formed of a plurality of members composed of vulcanized fibre or other gas evolving material and including a pair of tubular members and a spiral member. These members are constructed in a manner to permit their nested relationship to form a dielectric structure adapted to delineate a pair of paths for a discharge spark; one path being along the surface of one of the tubular members and being partially restricted by the proximity of the surface of the spiral member and the other of the paths being unrestricted and formed by the adjacent convolutions of the spiral member in cooperation with the adjacent walls of the tubular members.

A more specific object of the invention resides in the provision of a new and improved lightning arrester which is simple in construction, economical to produce and one which is adapted for repeated operation over a long period of time without fear of damage or the need of replacement.

Other objects and advantages will become apparent from the following descriptions of illustrative embodiments of the present invention.

In the drawings:

Figure 1 is an elevational view of a lightning arrester constructed in accordance with the teachings of the present invention and adapted for mounting upon a conventional cross arm bracket provided with a ground connection;

Fig. 2 is an enlarged vertical sectional view showing the internal structure of the lightning arrester illustrated in Fig. 1;

Fig. 3 is a horizontal sectional view, taken on the line 3—3 of Fig. 2, showing the upper electrode, the open chamber in which the discharge

4

arc can jump and venting means for relieving gas pressure formed in the chamber as a result of the formation of a high-potential discharge arc;

Fig. 4 is a horizontal sectional view, taken on the line 4—4 of Fig. 2, showing the construction and arrangement of parts in the gas evolving chamber forming the lower spark gap of the lightning arrester;

Fig. 5 is a horizontal sectional view, taken on the line 5—5 of Fig. 2, showing abutment means on the intermediate electrode which serves through contact with a portion of the dielectric structure to establish the correct length of the lower spark gap;

Fig. 6 is a bottom plan view of the lightning arrester, removed from the mounting bracket, showing venting means in the form of ports to relieve pressure and prevent rupture of the arrester under the influence of the deionizing gas generated as the result of the formation of a high-potential discharge arc in the lower enclosed spark gap chamber; and

Fig. 7 shows a modified form of the dielectric structure comprising two gas evolving members constructed in a manner to form a plurality of separate paths along which a high-potential discharge arc may flow; one of the paths being shorter than the other and following a surface on one of the members thus offering negligible resistance to the establishment of a discharge arc; while the other path is of a predetermined length substantially greater than the first mentioned path and delineated by a groove or passageway formed between the two members of the dielectric structure.

Referring more particularly to Fig. 2 of the accompanying drawings, it will be noted that the lightning arrester 10, chosen for illustrative purposes and embodying the teachings of the present invention, comprises a base casting 11 which serves to support a dielectric structure 12 and a conventional hollow porcelain housing element 13. The base casting 11 of the lightning arrester 10 is arranged for mounting in a conventional manner upon a cross arm mounting bracket 14 to support the device in desired operating position.

The functional portions of the lightning arrester 10, which will hereinafter be more specifically described, are contained within or attached to the hollow porcelain housing element 12 and include a metallic line electrode 15, a metallic ground electrode 16, and an intermediate metallic electrode 17. These electrodes 15, 16 and 17 are retained in spaced axial alignment within the lightning arrester 10 to provide a pair of air gaps 18 and 19 arranged in series relationship. The air gap 18 being located between the adjacent portions of the electrodes 15 and 17 while the air gap 19 is located between the adjacent portions of the electrodes 16 and 17.

A brief description of the structural formation of the several parts of the lightning arrester 10 will serve to simplify the understanding of its assembly and mode of operation. The base casting 11 formed of current conducting material such as a metal casting is cylindrical in shape and includes a flat bottom 20, an enlarged body portion 21 provided with an outwardly directed flange 22 and an upwardly extending annular flange 23. The casting 11 has an axially disposed cored cavity including a machined bore 24 extending downwardly from the top of the flange 23 and terminating in a shoulder 25 from which

5

a cavity 26 of reduced diameter projects downwardly to surround a boss 27 having a flat top surface 28, positioned above the lower extremity of the cavity 26. The boss 27 contains a threaded bore 29, extending upwardly from the bottom surface 20 of the casting 11, adapted to receive a cap screw 30 by which the lightning arrester 10 is anchored to the cross arm mounting bracket 14. The boss 27 has a portion of its wall and top interrupted by a slot 31 to provide open communication between the threaded bore 29 and the cavity 26 for a purpose to be hereinafter described. A series of vertically disposed circumferentially spaced slots or openings 32 formed in the wall of the base casting 11 serve to vent the cavity 26 to the atmosphere. Another series of vent passages 33 in the form of axially arranged holes extending through the body portion 21 of the casting 11 provide means for relieving any pressure built up within the upper chamber of the lightning arrester 10.

The dielectric structure 12, illustrated in Fig. 2 of the drawings, comprises a plurality of members, formed of vulcanized fibre or other gas evolving material, an inner tubular member 34 having an axially disposed center bore 35 and a smooth outer surface 36; an outer tubular member 37 having an axial bore 38 provided with a threaded portion 39 and terminating at its upper end in an enlarged bore 40; and a helical member 41. The several members 34, 37 and 41 are constructed so that they may be telescopically arranged with the outer surface 42 of the helical member 41 slidably receivable in the bore 38 of the outer tubular member 37 and lying in close proximity thereto and with the outer surface 36 of the inner tubular member 34 slidably receivable within and lying in close proximity with the inner surface 43 of the helical member 41. The space between the adjacent upper and lower surfaces of the helical member 41 cooperating with the outer surface 36 of the inner tubular member 34 and with the bore 38 of the outer tubular member 37 to delineate an unrestricted helical or spiral passageway 44 between the lower extremity of the intermediate electrode 17 positioned in the threaded portion 39 of the bore 38 and the ground electrode 16 disposed at the lower extremity of the outer tubular member 37 of the dielectric structure 12.

In assembling the lightning arrester 10, the ground electrode 16, which is in the form of a metal washer, is inserted into the bore of a tubular metal shield 45 which is closely fitted into the bore 24 of the base casting 11 and serves to position the tubular member 37 of the dielectric structure 12 which is inserted into the metal shield 45 and pressed downwardly until the ground electrode 16 is seated upon the shoulder 25 of the base casting 11. The tubular member 37 of the dielectric structure 12 is retained in position within the metal shield 45 by means of an anchoring pin 46 which is secured in aligned holes in the member 37 and shield 45 to prevent relative movement of the parts under the influence of the pressure of gas formed by the high-potential discharge arc upon the gas evolving material of the dielectric structure during the operation of the lightning arrester 10. The helical member 41 is then inserted into the bore 38 of the member 37 and positioned so that its lower end is resting upon the upper surface of the ground electrode 16. The inner member 34 of the dielectric structure 12 is then inserted into the helical member 41 and positioned with its lower end in contact with the top surface 28 of

6

the boss 27 disposed within the cavity 26 in the base casting 11. With the several parts of the dielectric structure 12 properly positioned, the intermediate electrode 17 is then threaded into the portion 39 of the bore 38 to a position, in which the abutment portions 47 on the electrode 17 contact the upper extremity of the inner tubular member 34. The length of the member 34 is such that the desired length of the spark gap 19 is established between the lower extremity of the intermediate electrode 17 and the top surface of the ground electrode 16.

The line electrode 15 which cooperates with the intermediate electrode 17 to form another spark gap 18 is rod-like in form and extends vertically through a metal bushing 48 mounted in an opening 49 formed in the top of the porcelain housing element 13. The lower portion of the line electrode 15 projects downwardly into a chamber 50 in the housing 13 while the upper threaded portion 51 of the electrode 15 extends above the top of the housing 13 to provide a means for securing a line connection terminal 52 in position on the housing. A sealing gasket 53 serves to provide a tight connection between the terminal 52 and the housing 13.

The housing 13 is positioned on the base casting 11 by placing the enlarged mouth 54 of the chamber 50 over the horizontally extended flange 22 of the casting 11 so that the shoulder, formed between the chamber 50 and enlarged mouth 54, rests upon the top surface of the flange 22. With the dielectric structure 12 properly assembled and mounted on the base casting 11 and the line electrode 15 secured in position in the porcelain housing element 13, the housing element may then be secured in position on the base casting 11 by the application of suitable sealing material 55 to unite the parts of the lightning arrester 10 into a unitary structure.

The electrical connections to and from the lightning arrester 10 comprise a power line lead 56 which connects the power line to the terminal 52 and a ground wire 57 which has one end connected to a conventional ground connector 58 secured to the cross arm mounting bracket 14 in the usual manner, and its other end grounded.

A description of the operation of the lightning arrester 10 will serve to emphasize its simplicity and effectiveness in discharging high-potential current surges in the power line, due to lightning or other causes, and in extinguishing the discharge arc formed during its operation to prevent the establishment of follow up currents passing through the lightning arrester 10 upon the restoration of normal voltages in the power line. The lightning arrester 10 is so constructed that high-potential current surges occurring in the power line are transmitted through the power line lead 56, the line terminal casting 52 and the line electrode 15, the upper air gap 18 between the lower end of the line electrode 15 and the top of the intermediate electrode 17, thence through the intermediate electrode 17, the lower air gap 19 between the bottom of the intermediate electrode 17, and the ground electrode 16, through the base casting 11, the cross arm mounting bracket 14, and to the ground through the connector 58 and the ground wire 57; to thus discharge the excessive high-potential current.

It should be noted that the upper air gap 18 is located within the enlarged portion 40 of the bore 38 formed in the outer tubular member 37 of the dielectric structure 12 and that the mouth of the bore 40 is in open communication with the

7

chamber 50 of the porcelain housing element 13 which in turn is connected to the atmosphere through the vent holes 33. The venting of the chamber 50 serves to insure against rupture or damage to the lightning arrester 10 resulting from the pressure generated from the affect of the heat of the discharge arc upon the gas evolving material of the dielectric structure 12 in the immediate proximity of the arc. It should also be noted that the relative positioning of the several parts of the dielectric structure 12 located between or adjacent the pieces forming the lower air gap 19 is such that the initial establishment of the discharge arc across the gap 19 will follow the path of least resistance which is substantially a straight line along the surface of the bore 38 between the bottom edge of the intermediate electrode 17 and the top surface of the ground electrode 16. This condition of least resistance to the flow of the arc in a substantially straight line along the surface of the bore 38 is promptly destroyed under the effect of the heat of the arc upon the dielectric structure which evolves a gas that deionizes to materially increase the resistance to the continued flow of the discharge arc along the initially established path of travel, due to the close proximity of the several convolutions of the helical member 41 with the surface 38 along which the discharge arc was established. The increase in resistance to the flow of the discharge arc along the initially established path of travel is substantially instantaneous and of sufficient magnitude to divert the discharge spark to the longer path of travel defined by the helical passageway 44, the resistance of which is now less than that of the initially established path of the discharge arc. In this manner, the discharge arc is considerably lengthened and the gas evolved from the surrounding dielectric members through the heat of the discharge arc is sufficient to deionize the atmosphere of the passageway 44 and effect the extinguishing of the discharge arc by the deionization process coupled with the expending force of the gas under pressure which blows through the passageway 44 and is vented to the atmosphere through the ports 32 formed in the base casting 11. The venting of enclosed air gap 19 not only provides insurance against the rupture of the dielectric structure 12 under the pressure generated within it by reason of the presence of the discharge arc but further provides for the free circulation of air through the air gap chamber to assist in the action of extinguishing the discharge arc under the expending force of the generated gas. The venting and circulating system permits the ready ingress or egress of air to or from the cavity 26 by way of the series of openings 32 formed in the wall of the base casting 11. As will be seen from Fig. 2 of the drawings, air may pass from the cavity 26 through the slot 31, the bore 35 of the inner tubular member 34 and thence outwardly and downwardly between the inner surface of the intermediate electrode 17 and the outer surface 36 of the member 34; into the air gap 19 and thence through the central opening in the ground electrode 16 and into the cavity 26, which is in open communication with the exterior of the lightning arrester 10 through the openings 32. The establishing of the discharge arc in the passageway 44 builds up considerable pressure within the confines of the dielectric structure and causes a rush of generated gas along the path of travel of the discharge spark with the result that the gas follows path of the discharge spark

8

through the passageway 44 in expending its force to assist in the lengthening of the discharge spark and in effecting its extinguishment by the process of deionization within the passageway 44. Upon the extinguishment of the discharge arc, the entire chamber within which the air gap 19 is located is in such condition that it resists the establishment of a follow up current through the lightning arrester 10 after the reestablishment of the normal potential in the power line.

Referring more particularly to the modified form of the dielectric structure shown in Fig. 7 of the accompanying drawings, it will be noted that the dielectric structure 12' chosen for illustrative purposes is composed of an inner member 61 and an outer member 62 both formed of vulcanized fibre or other arc extinguishing or gas evolving material. In this modified form, it will also be noted that the outer surface of the intermediate portion of the member 61 is provided with a helical groove 63 which cooperates with an axial bore 64 in the outer member 62 to form a passage 65 or discharge arc path having a predetermined length which is substantially greater than a straight line arc path along the inner surface of the outer member 62 which represents the path of the discharge arc upon its initial establishment, when the modified form of dielectric structure 12' replaces the structure 12 previously described. It should also be understood that the helical groove 63 or an equivalent formation might as well be formed in the outer member 62 of the structure; or as a matter of fact, the groove 63 need not be of helical form as its sole purpose is to provide a path for the discharge arc which has a predetermined length which is greater than the straight line distance between the adjacent portions of the electrodes which form the air gap in which the dielectric structure is disposed.

From the foregoing description of the illustrative embodiments of the present invention, it will be apparent that a new and improved lightning arrester has been provided which is adapted to function repeatedly and in rapid succession, if necessary, without fear of damage to the arrester or without requiring attention or replacement of parts over years of efficient and effective service.

It should also be noted that the lightning arrester of the present invention, in addition to being simple in construction and relatively inexpensive to manufacture, includes a new and improved dielectric structure which provides a plurality of independent paths of travel for the discharge arc; one for the initial establishment of the discharge spark and another to which the discharge spark may be automatically transferred and in which it may be more readily extinguished through the process of deionization to preclude the possibility of follow up currents passing through the lightning arrester after the reestablishment of the normal line potential after the discharge operation of the arrester is completed.

While the invention has been described in considerable detail, in the foregoing specification, it is to be understood that various changes may be made in its embodiments without departing from or sacrificing any of the advantages hereinafter claimed.

We claim:

1. A lighting arrester comprising a line electrode, a ground electrode, an intermediate electrode disposed between and in spaced relation-

ship with said other electrodes to form an air gap between it and each of said other electrodes, and a dielectric structure formed of arc extinguishing material confining one of said air gaps, said dielectric structure including a plurality of paths of travel for a discharge spark bridging said confined air gap, one of said paths of travel being shorter in length, more restricted and offering less resistance to the establishment of a discharge spark than the other of said paths of travel, the establishment of a discharge spark in said shorter more restricted path effecting an increase in resistance to its continued travel along said path of sufficient magnitude to divert the path of travel of the discharge spark to said longer less restricted path of travel wherein it is extinguished by the process of deionization.

2. A lightning arrester comprising a plurality of metallic electrodes arranged in spaced relationship, said electrodes including a line electrode, a ground electrode and an intermediate electrode, said electrodes cooperating to provide a pair of air gaps arranged in series, and a dielectric structure formed of arc extinguishing material confining one of said air gaps, said dielectric structure including a plurality of paths of travel for a discharge spark bridging said confined air gap, one of said paths of travel being shorter, more restricted and offering less resistance to the establishment of a discharge arc than the other of said paths of travel, whereby the initial establishment of the discharge arc in said shorter path of travel is insured, the establishment of a discharge arc in said shorter path of travel effecting a marked increase in resistance to the continued flow of the discharge arc by reason of the action of the discharge spark upon the confining arc extinguishing material and the restricted nature of said path, the increased resistance in the initially established path of travel having sufficient magnitude to effect the transfer of the discharge arc to said longer, less restricted path of travel wherein it is extinguished by the process of deionization.

3. A lightning arrester comprising a plurality of metallic electrodes arranged in spaced relationship to provide a pair of air gaps, and a dielectric structure formed of arc extinguishing material, said dielectric structure confining one of said air gaps and providing a plurality of paths of travel for a discharge arc bridging the confined air gap, one of said paths being shorter than the other and offering less resistance to the initial establishment of a discharge spark, the establishment of the discharge spark effecting an increase in resistance along said path of travel through the action of the discharge spark upon the dielectric material to divert the discharge spark to said longer path of travel then having a lower resistance wherein it is extinguished by the process of deionization.

4. A lightning arrester comprising a plurality of metallic electrodes arranged in spaced relationship to provide a pair of air gaps in series, and a dielectric structure formed of arc extinguishing material confining one of said air gaps and providing a pair of separate paths of travel for a discharge arc bridging said confined air gap, one of said paths of travel being shorter, more restricted and offering less resistance to the establishment of a discharge arc between the said electrodes of said confined air gap to insure the initial establishment of the discharge arc in said shorter path, the establishment of the discharge arc in said shorter path effecting

an increase in its resistance to the continued flow of the discharge arc through the action of the discharge arc upon said dielectric structure, said increased resistance being of sufficient magnitude to exceed the resistance of said other path of travel whereupon the discharge arc is automatically transferred to said longer path of travel wherein it is extinguished by the process of deionization.

5. A lightning arrester comprising a plurality of metallic electrodes positioned in spaced relationship to provide a pair of air gaps arranged in series, and a dielectric structure formed of arc extinguishing material and confining one of said air gaps, said dielectric structure including a pair of separate paths of travel for a discharge arc bridging said confined air gap, one of said paths being shorter, more restricted and offering less resistance to insure the initial establishment of the discharge arc in said path, and the other of said paths being of a predetermined greater length and unrestricted to provide a passage in which the discharge arc is extinguished, the transfer of said initially established discharge arc being automatically effected through the increased resistance to the continued flow of the discharge arc along the initially established path of travel brought about through the action of the discharge arc upon said dielectric material.

6. A lightning arrester comprising a plurality of metallic electrodes positioned in spaced relationship to provide a pair of air gaps arranged in series, and a dielectric structure formed of arc extinguishing material and confining one of said air gaps, said dielectric structure comprising a cylindrical inner member, a tubular outer member, and an intermediate member disposed between the adjacent surfaces of said inner and outer members and between the adjacent portions of said electrodes forming said confined air gap, said intermediate member cooperating with the adjacent surfaces of said inner and outer members to delineate a plurality of paths of travel for a discharge arc bridging the confined air gap, one of said paths being shorter than another and offering less resistance to insure the initial establishment of the discharge arc therealong, another of said paths having a predetermined length substantially greater than said shorter path and forming an unrestricted passage in which the discharge arc is extinguished by the process of deionization, the establishment of the discharge arc along said shorter path effecting the automatic transfer of the discharge arc to said longer path through the marked increase in resistance to the continued flow of the discharge arc along the initially established path of travel brought about through the action of the discharge arc upon said dielectric structure.

7. A lightning arrester constructed as set forth in claim 6, in which the intermediate member of the dielectric structure is helical in form.

8. A lightning arrester constructed as set forth in claim 6, in which the intermediate member of the dielectric structure forms the means for restricting the shorter path of travel for the discharge arc.

9. A lightning arrester comprising a hollow insulator body forming a housing for a plurality of metallic electrodes positioned in spaced relationship to provide a pair of air gaps arranged in series, and a dielectric structure formed of arc extinguishing material and confining one of said air gaps, said dielectric structure including a pair of separate paths of travel for a discharge arc

11

between said electrodes forming said confined air gap, one of said paths being shorter, partially restricted and offering less resistance to insure the initial establishment of the discharge arc along its path, the other of said paths being of a predetermined length substantially greater than said shorter path and providing a passage in which the discharge arc is extinguished by the process of deionization, the establishment of the discharge arc along said shorter path effecting the automatic transfer of the discharge arc to said longer path through the increased resistance to its continued flow along the initially established path resulting from the action of the discharge arc upon said dielectric structure, which resistance reaches a magnitude greater than the resistance offered by said longer path thereby causing the transfer of the discharge arc to said longer path wherein it is extinguished, and venting means for relieving internal pressure caused by the discharge arc.

10. A lightning arrester constructed as set forth in claim 9 in which the dielectric structure comprises a plurality of telescopically arranged members.

11. A lightning arrester constructed as set forth in claim 9 in which the longer path of travel for the discharge arc is in the form of a tortuous passage.

12. A lightning arerster comprising a hollow insulator body forming a housing for a plurality of metallic electrodes positioned in spaced relationship to provide a pair of air gaps arranged in series, and a dielectric structure formed of arc extinguishing material and confining one of said air gaps, said dielectric structure comprising a plurality of members having adjacent cooperating surfaces, one of said members having a relatively smooth surface and another having a convoluted surface cooperating with said smooth surface to delineate a tortuous air passage form-

12

ing a path of travel for a discharge arc bridging said confined air gap, said smooth surface on one of said members forming a shorter path of travel for the discharge arc to insure its initial establishment along said shorter path, the resistance to continued travel of the discharge arc along said initially established path being substantially increased immediately upon the establishment of the discharge arc through the action of the arc upon the dielectric structure, the resistance thus produced attaining a magnitude greater than the resistance offered by said tortuous air passage to effect the transfer of the discharge arc to said tortuous passage wherein it is extinguished by the process of deionization, and venting means for relieving internal pressure evolved during the presence of the discharge arc.

13. A lightning arrester constructed as set forth in claim 12 in which the dielectric structure comprises a pair of telescopically arranged members.

14. A lightning arrester constructed as set forth in claim 12 in which the dielectric structure comprises a pair of telescopically arranged members having, respectively, smooth and convoluted surfaces cooperating to provide separate paths of travel for a discharge arc.

ROLLAND D. NELSON.
EDWIN A. LINK.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,304,848	Roloson	Dec. 15, 1942
2,332,398	Pittman	Oct. 19, 1943
2,332,399	Pittman	Oct. 19, 1943
2,336,420	Pittman	Dec. 7, 1943