April 29, 1969 H. CHRISTENER 3,441,803

LIGHTNING ARRESTER

Filed Sept. 9, 1966

Fig. 1.

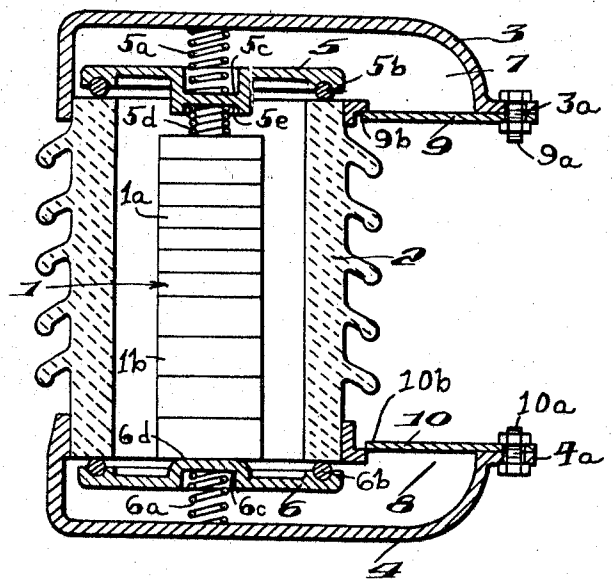


Fig. 3a.

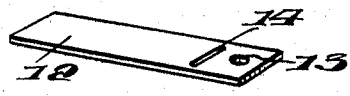


Fig. 3b.

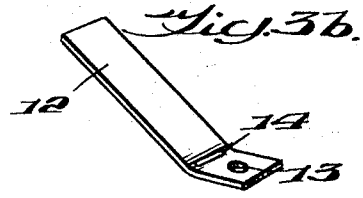


Fig. 4a.

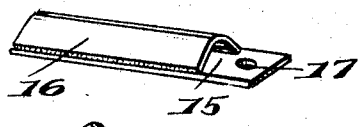


Fig. 4b.

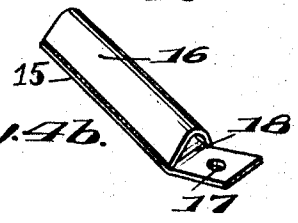


Fig. 2.

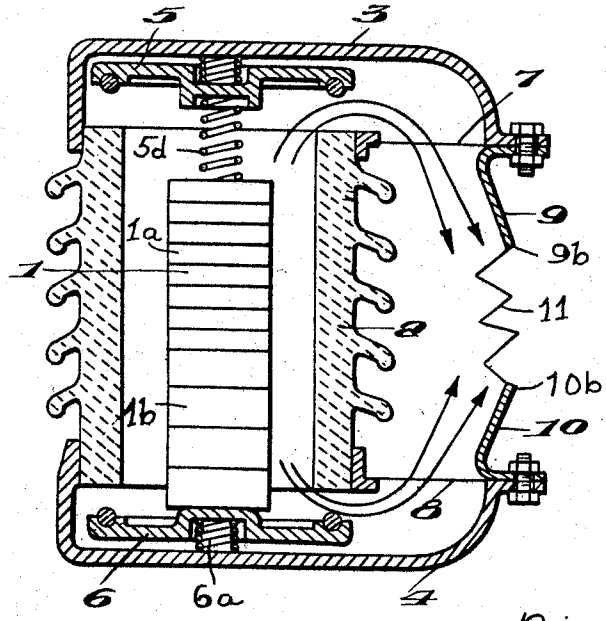
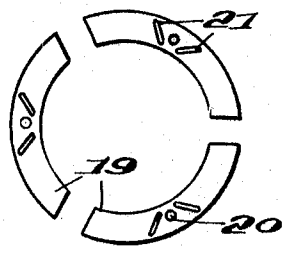


Fig. 5.



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LIGHTNING ARRESTER

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6 Claims

ABSTRACT OF THE DISCLOSURE

A lightning arrester comprises a stack of arrester components such as arc quenching gaps and resistances enclosed within a housing which is closed at both ends by spring-loaded valve plates but which open in response to creation of an over-pressure within the housing and vent the gases through a discharge channel to atmosphere. The mouth of each discharge channel is normally blocked by a cover strip but the free ends of these cover strips are bent when subjected to the over pressure within the housing in a direction towards each other to establish electrodes between which an arc can be struck outside of the housing. The bent strips also serve as a visual signal that the arrester has faulted.

This invention relates to the art of lightning arresters and more particularly to an improved arrangement whereby a safety, pressure relieving device provided for the arrester and which responds in the event of a fault within the arrester, has associated with it a visual signal so that one may readily detect any arrester which has faulted.

As indicated, lightning arresters of the type in which the active parts, such as a stack of arc quenching gaps and resistors, are enclosed by a gas-tight housing of porcelain are customarily provided with a safety device in the form of a safety valve which responds when a predetermined over-pressure of gas within the housing arises as a result of a fault in the active part structure, thereby to effect release of the gas to the outside of the porcelain housing and prevent the housing from breaking. The safety device thus prevents the porcelain housing from exploding.

With conventional constructions in which the pressure-relieving devices are arranged on metal fittings on the front sides of the hollow porcelain housing, the gases which issue are deflected towards one another by baffles or plates located outside of the housing. By such an arrangement, an arc is formed several hundredths of a second after the fault begins, and this arc will burn from one end of the housing to the other, or between one end of the housing and ground, so that the energy reaction within the housing is greatly reduced and substantially greater short-circuit currents can be handled.

It is also of advantage if the arrester is equipped with a device by means of which the response of the explosion-guard is visually indicated, so that it can be immediately recognized by personnel from a considerable distance, thereby informing one that a particular arrester has become damaged. For this purpose, it is known to close off the outlet openings of the pressure-relieving valve or valves by metal bands which rupture in the event of a sudden over-pressure within the arrester housing as the

relief valves open. While the ruptured band provides visual indication of a faulted arrester, it has the disadvantage that parts of the band usually fly off and thus present a danger to personnel. Moreover, flying parts of the bands are liable to damage other equipment located in the vicinity of the arresters.

The object of the present invention is to provide an improved form of a visual indicator for a faulted arrester and which remains in place after the fault takes place. More particularly, the improved visual indicator is constituted by a cover strip for the gas outlet opening from the relief valve, this cover strip being initially plane and secured in place at only one side thereof to the arrester structure, so that the strip will yield in a bending strain along a line adjacent its securing point as a bending stress is imposed upon it by the discharging, high-pressure gases. The cover strip may be made without any particular structural arrangements for establishing the line of bending, or special provisions may be made for this purpose such as by providing a transversely extending, strip weakening, notch at the desired location, or by longitudinally reinforcing one portion of the strip so that one longitudinal portion of the strip has a greater rigidity against bending stresses than another.

The improved cover strip, when bent out, also functions as an electrode for the ensuing arc established outside of the arrester housing, in addition to its visual, fault indicating function.

The foregoing as well as other objects and advantages inherent in the invention will become more apparent from the following detailed description of several embodiments thereof and from the accompanying drawings wherein:

FIG. 1 is a view in central vertical section of a lightning arrester structure in which bendable, cover strips closing the gas outlets of the pressure relief valves are provided at each end of the arrester;

FIG. 2 is a view similar to FIG. 1 but showing the cover strips after having been bent by the over-pressure gases issuing from the relief valves following a fault within the arrester;

FIGS. 3*a* and 3*b* are views, before and after bending, of a modified construction for the cover strip, this embodiment featuring a transverse weakness line established by a notch or recess across the strip adjacent its securing point to facilitate the desired bending action;

FIGS. 4*a* and 4*b* are views, also before and after bending, of a further modified constructioni for the cover strip, this embodiment featuring a longitudinally extending humped reinforcement terminating adjacent the securing point for the strip so as to develop the desired bending action adjacent the end of the reinforcement; and

FIG. 5 is a plan view of still another embodiment for the cover strip, this strip having an arcuate configuration, being secured at only one point intermediate its ends and provided with lines of bending weakness to each side of the center point of security so that each end of the strip will bend upwardly when subjected to the over-pressure discharging gases.

With reference now to the drawings, and to FIG. 1 in particular, the lightning arrester is seen to be comprised of stack 1 of "active" elements such as, for example, arc gaps 1*a* and resistors 1*b* arranged electrically in series. Since this is a conventional arrangement, the actual structure of these active elements has not been de-

tailed and hence, has been illustrated only diagrammatically. The stack 1 of active arrester elemens is enclosed by a porcelain housing 2, and the opposite ends of this housing are enclosed by movable end plates 5 and 6 and associated hollow end fittings 3 and 4, the plates 5 and 6 being loaded by helical springs 5*a* and 6*a*, respectively into closed, sealing position against the end walls of housing 2 with the aid of sealing rings 5*b*, 6*b*. One end of each spring bears against an inner wall of the corresponding end fitting, and the opposite end of each spring is seated in a centrally located recess 5*c*, 6*c*, respectively provided in the end plates 5 and 6. The stack 1 of active arrester elements is held within housing 2 in a spring cushioned manner, one end of the stack being rested against an inner centrally raised portion 6*d* of end plate 6 and the opposite end of the stack being pressed against one end of a helical spring 5*d*, the other end of this spring being seated in another central, lower recess 5*e* in end plate 5 located in alignment with the upper recess 5*c*.

The spring-loaded end plates 5 and 6 function as safety valves which respond in the event of any fault within the arrester housing that results in creation of an overpressure of such magnitude that it would cause an explosion of the housing were it not safely vented to the exterior. The space 7 within the hollow end fitting 3 serves as a passageway for gas discharge when safety valve 5 opens, and similarly space 8 within fitting 4 serves as a passageway for gas discharged through safety valve 6.

In accordance with the present invention, the outlet ends of the gas discharge passageways 7 and 8 are normally shut by initially planar cover strips 9 and 10 respectively, and which are secured in position across the mouths of the passageways at only one end thereof by bolts 9*a*, 10*a* respectively to ear portions 3*a*, 4*a* of the end fittings.

Operation of the arrester is believed to be self-evident from an inspection of FIG. 2. Here it will be seen that excessively high gas pressures created within arrester housing 2 as the result of some fault have moved the spring-loaded end plates 5 and 6 from their seats with the result that the gases leave the housing and flow through passageways 7 and 8. Because of their high pressures, enough pneumatic force has been created on the cover strips 9 and 10 to cause them to bend about their security points in a direction away from the discharge openings so as to allow the gases to discharge into the atmosphere. At the same time, the bent-down positions of the cover strips 9 and 10 give a clear visual indication that fault has occurred. The free ends 9*b* and 10*b* of the strips move towards each other and reach a final position where they will serve as electrodes between which an outer arc 11 strikes and starts to burn practically immediately after the start of the arrester fault, this arc burning in a direction parallel to the arrester housing 2 and which by its electrical shunting action then relieves the active parts 1*a*, 1*b* of the arrester.

In the embodiment of FIGS. 1 and 2, the cover strips 9 and 10 have no particular structural feature designed to establish the desired bending action, this being attained by the bending forces which arise naturally as a result of the fact that the strips are secured only at one end. However, if desired, bending weakness lines may be established in the cover strips to facilitate the desired bending action. One such arrangement is illustrated in FIGS. 3*a* and 3*b*, showing one modification, before and after bending. Here the cover strip 12 includes a hole 13 at one end thereof to permit it to be secured by a bolt to an end fitting of the arrester in the same manner as for the embodiment of FIGS. 1 and 2. Strip 12 also includes a transversely extending notch or recess 14 the ends of which preferably terminate short of the side edges of the strip. This recess 14 is located adjacent the fastening hole 13 and obviously weakens the strip against any bending stress imposed upon the strip so that the strip will be certain to bend about a line coincident with the recess to the position shown in FIG. 3*b*.

FIGS. 4*a* and 4*b* illustrate a second modification for inducing the bending strain to take place in the cover strip at the desired location. Here it will be seen that cover strip 15 has tacked to it a hump-shaped reinforcement 16 which extends longitudinally from one end thereof to a point adjacent the fastening hole 17 at the opposite end portion of the strip. The reinforcement 16 obviously makes that portion of the composite strip structure more rigid than the remainder, so that the bending forces derived from the discharged gas will be concentrated along a transverse line 18 adjacent the fastening hole 17, thus assuring bending of the strip at this location.

FIG. 5 illustrates a somewhat different embodiment of the invention which is applicable for use on lightning arresters which have circular discharge openings for the gas when the relief valves open. Here it will be seen that the cover strip is constituted by three arcuately configured sections 19 each spanning approximately 120° of the complete circular discharge opening. Each section 19 is secured at only one piont thereof, as in principle with the other embodiments, but the point of security is located at the center 20 of each section so that the opposite end portions of each section will bend about transverse weakness lines established by recesses 21 to each side of the center securing point 20.

Other modifications for the arrangement of the cover strips are also possible according to the invention. Instead of the single outlet openings 7 and 8, provided at only one side of end fittings 3 and 4, one or more openings can be provided on both sides of these fittings, or the openings can be circular in which case the arrangement according to FIG. 5 would be used. Also, under certain circumstances it may be sufficient to provide a safety valve at only one end of the arrester housing, in which case, the associated cover strip for the discharge opening of this valve can serve as an electrode to assist in the production of an external arc between the end fitting and ground subsequent to response of the pressure releasing device through opening of the safety valve.

I claim:

1. A lightning arrester comprising a housing enclosing an arrangement of arrester elements, valve means located at opposite ends of said housing and which are responsive to gas pressure generated within said housing by a fault in said elements for placing the interior of said housing in communication with a passageway at the corresponding end of said housing leading to the exterior of said housing thereby to vent the gas and prevent exposion of said housing, and a cover strip placed across the gas outlet from each of said passageways, said cover strips being secured in position at only one point along the same so as to enable the pressure of the gas issuing from said outlets to bend a free end of each of said strip in a direction away from the outlet and towards each other thereby venting the gas and simultaneously establishing a gap between the free ends of said strips between which an arc can be struck outside of the housing shunting the arrester elements, said bent strips also serving as a visual signal that the arrester has faulted.

2. A lightening arrester as defined in claim 1 wherein each said cover strip is provided with a transversely extending line of structural weakness to facilitate the desired bending strain.

3. A lightning arrester as defined in claim 2 wherein said transverse line of structural weakness in said strip to facilitate the bending strain is established by a transversely extending recess.

4. A lightning arrester as defined in claim 2 wherein said transverse line of structural weakness in said strip to facilitate the bending strain is established by a longitudinal reinforcement of a part of the strip.

5. A lightning arrester as defined in claim 1 wherein each said gas outlet from the appertaining passageway has an arcuate configuration and each said cover strip is secured at one point only intermediate the ends of the strip so that opposite end portions of the strip bend outwardly.

6. A lightning arrester as defined in claim 5 wherein each said outlet from said passageway has a circular configuration and each said cover strip is comprised of a plurality of arcuate sections arranged in end to end relation, each said arcuate section being secured at only one point intermediate the ends of the strip so that opposite end portions of the strip bend outwardly.

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