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ELECTRICAL DISCHARGE DEVICE

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Fig. 1.

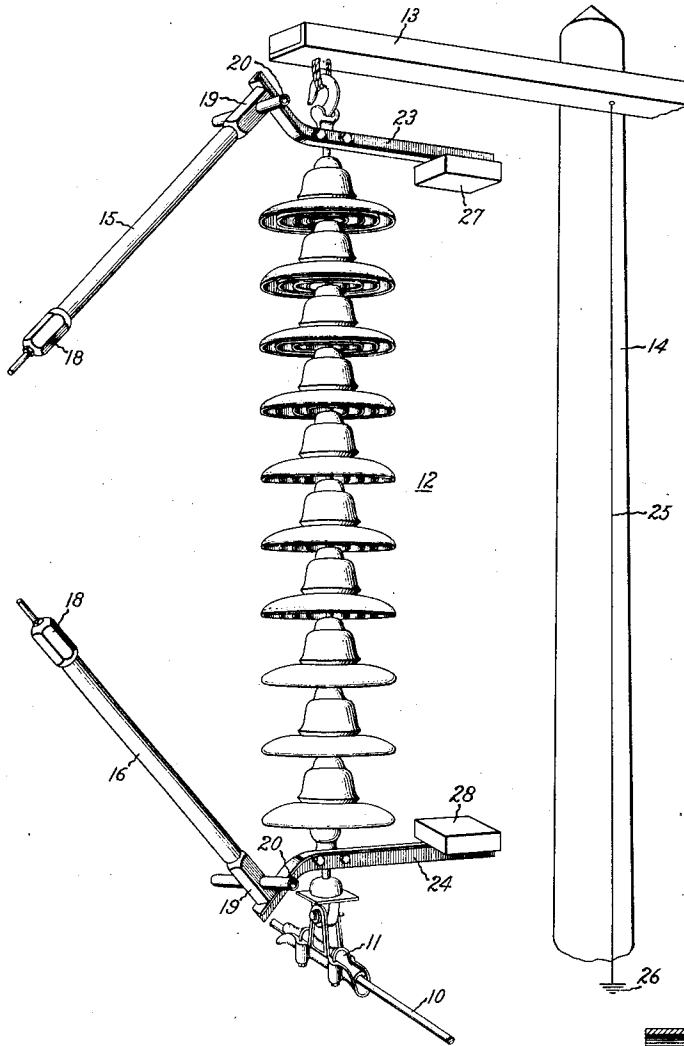
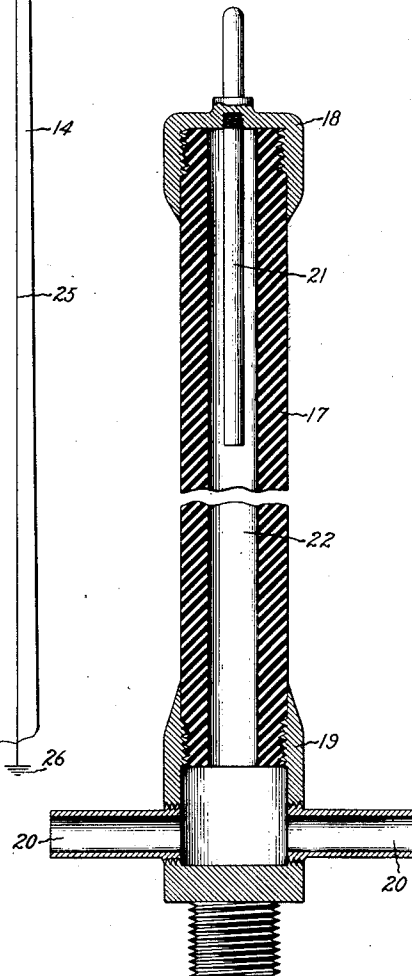


Fig. 2.



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UNITED STATES PATENT OFFICE

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ELECTRICAL DISCHARGE DEVICE

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2 Claims. (Cl. 175—30)

This invention relates to electrical discharge devices. High voltage electrical power transmission circuits are usually provided with some form of electrical discharge device which is a good insulator under normal voltage conditions but becomes a good conductor under abnormally high voltage conditions such as may appear on the circuit in the form of transient high voltage surges caused by lightning or switching operations. The high voltage charge on the transmission circuit is thus discharged and damage to the transmission line and connected apparatus is avoided. One form of discharge device which has been successfully used for this purpose includes an insulating tube provided with an electrode at each end and supported in the discharge path. The electrodes are so arranged that any discharge between them will always occur within the tube. The tube itself is made of some insulating material such as hard fiber which will give off a considerable amount of gas when heated by the arc and create a high pressure and turbulence of the gas within the tube. At least one end of the tube is open and the high gas pressure extinguishes the arc by blowing it out through the open end of the tube. The electrodes must be spaced far enough apart within the tube so that the gap between them will not break down under normal voltage conditions but of course not too far to prevent an arc under dangerously high voltage conditions. The spacing of the electrodes must therefore be considerable for proper protection of an electrical circuit which normally operates at extremely high voltage. With such a large gap, a rather long insulating tube must be used and the pressure produced by an arc in such a long tube may be so high as to rupture the tube unless the opening in the tube is large enough to prevent such dangerously high pressure. However, if the opening in the tube is too large, then the arc may not be sufficiently confined. If the arc is not substantially in contact with the inner surface of the tube, then the gas will be produced too slowly to extinguish the arc effectively.

The general object of the present invention is to provide an improved arrangement of tubular discharge device for very high voltage operation.

The invention will be better understood from the following description taken in connection with the accompanying drawing in which Fig. 1 is a view of a short section of an electrical power transmission circuit provided with electrical discharge protection in accordance with the invention, and Fig. 2 is a longitudinal, sectional view

of one of the tubular discharge elements shown in Fig. 1.

The high voltage transmission line conductor 10, shown in Fig. 1, is secured by metal clamp 11 to a suspension insulator 12 supported from a cross arm 13 on a wooden pole 14. Two tubular discharge members 15 and 16 are arranged to provide a discharge path from the high voltage conductor 10 to ground. The discharge members 15 and 16 are similar in construction. Each of these members includes an insulating tube 17 with one end closed by a metal cap 18 and the other end provided with an electrode 19 having side or lateral openings 20. The cap 18 supports a metal pin 21 projecting into the opening 22 in the tube 17 to compel any arc between the two electrodes to occur within the tube rather than along its outer surface.

Two metal arms 23 and 24 are secured to the upper and lower ends respectively of the suspension insulator 12. The arm 24 is conductively connected to the high voltage conductor 10 and the arm 23 is conductively connected through a metallic part of the cross arm 13 and a ground wire 25 to a ground 26. The electrode 19 of the discharge element 15 is secured to one end of the arm 23 with the tube extending at an acute angle to the axis of the insulator 12 and discharge openings 20 at the end of the element 15 adjacent the arm 23. The other end of the arm 23 is provided with a weight 27 to balance the weight of the discharge element 15, not only to avoid a twisting strain on the insulator support but also to provide additional inertia to reduce the effect of a shock during interruption of an arc in the discharge member 15. The discharge member 16 is similarly supported from the arm 24 at an acute angle to the insulator 12 and is similarly balanced by a weight 28, its discharge openings 20 being at the end of the element 16 adjacent the arm 24 and conductor 10. The electrode caps 18 of the discharge elements 15 and 16 are spaced to provide an intermediate series gap in the discharge circuit between the high voltage conductor 10 and the ground 26 so that there can be no constant leakage to ground and consequent deterioration of the tubes under normal conditions.

With the arrangement which has been described the discharge path from the high voltage conductor 10 to ground includes three discharge gaps, one of these gaps being the external gap between the two discharge elements 15 and 16 and the other two gaps being the internal gaps within these two discharge elements.

A dangerously high voltage on the conductor

10 will cause the three gaps in the discharge circuit to break down and an arc will form across each of these gaps. Each of the discharge elements 15 and 16 is subjected, however, to only approximately half the total voltage and must extinguish only half the total arc or less. The opening in the tube of each of the discharge elements 15 and 16 may therefore be small enough to assure efficient generation of gas by the arc so that the arc cannot persist but must be effectively extinguished. If the arc is not thus effectively and rapidly extinguished, of course the normal voltage on the conductor 10 will maintain the arc and this will cause interruption of the service supplied by the power transmission circuit.

The invention has been explained by describing and illustrating two tubular discharge elements arranged in a particular manner to provide a protective discharge path to ground but it will be apparent that a different number of series arranged tubes may be used and that other changes may be made without departing from the spirit of the invention and the scope of the appended claims.

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

1. The combination with a high voltage conductor and an insulator supporting said conductor, of two insulating tubes, each tube having spaced electrodes to form a discharge gap within

the tube, one of said tubes having one end secured to one end of said insulator and the other tube having one end secured to the other end of said insulator, the other ends of said tubes being spaced to form an intermediate gap, said tubes extending at acute angles to said insulator to form a discharge path between the two ends of the insulator, each tube having its end adjacent said intermediate gap closed and having an opening at its other end for discharge from the tube of gas produced within the tube by an arc.

2. The combination with a high voltage conductor and an insulator supporting said conductor, of two insulating tubes, each tube having spaced electrodes to form a discharge gap within the tube, one of said tubes having one end secured to one end of said insulator and the other tube having one end secured to the other end of said insulator, said tubes being arranged with their discharge gaps in series and with an intermediate gap between the tubes, and each tube having its end adjacent said intermediate gap closed and having a discharge opening at its other end.

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