Oct. 1, 1929. F. CONRAD 1,730,124

INSULATOR

Filed July 7, 1920

Fig. 2.

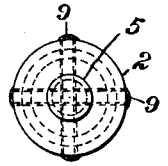


Fig. 3.

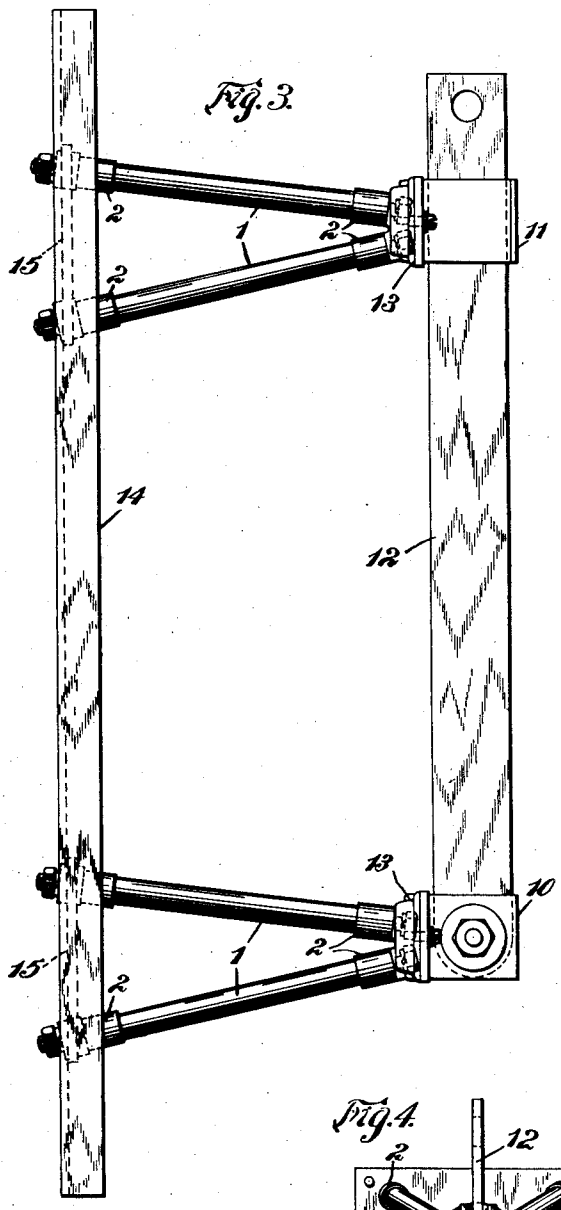


Fig. 1.

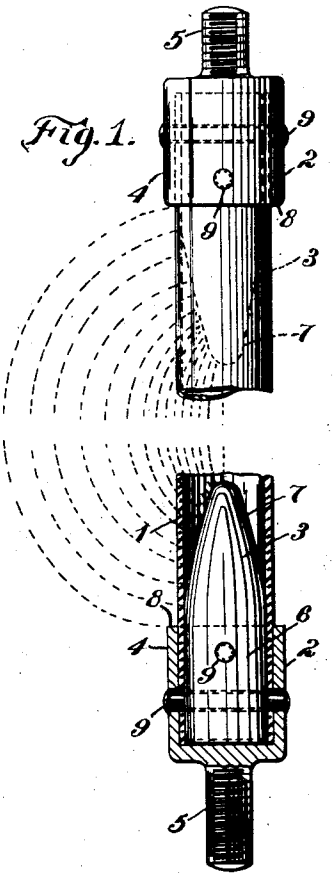
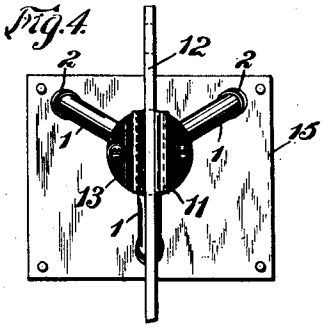


Fig. 4.



WITNESSES:

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Patented Oct. 1, 1929 1,730,124

UNITED STATES PATENT OFFICE

FRANK CONRAD, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

INSULATOR

Application filed July 7, 1920. Serial No. 394,519.

My invention relates to insulators and particularly to electrostatic stress distributing means for insulators employed in connection with relatively high voltage circuits.

One object of my invention is to provide an insulator comprising an insulating tube and metal terminal members therefor in which concentrated electrostatic stresses shall be prevented from passing through the walls of the tube to thereby prevent injury to the latter and that shall so direct portions of the stresses for relatively short distances along the tube adjacent to its ends as to relieve the metal members of damaging or burning flash-over arcs.

Another object of my invention is to provide an insulator that shall be simple and durable in construction, economical in manufacture and effective in operation.

Heretofore, it has been suggested, as means to prevent the concentration of electrostatic stresses at the end of an elongated insulator, to provide metal shields at the end thereof. These shields usually are of transverse disk form and, when used at a distance from the end of a tubular member, there may be a smaller disk inside the tube in a plane with the outer disk. This construction spreads the electrostatic field laterally to prevent the concentration thereof and is based on the theory that two spaced parallel plane members of different potential and infinite area produce a straight-line field therebetween and normal thereto. This construction, while very effective where space and other conditions permit the use of the lateral shields, cannot be employed under certain crowded conditions or conductors of different circuits or of different potential.

In practicing my invention, I provide an electrostatic-stress-distributing member that extends inwardly along the longitudinal axis of an elongated or tubular insulator and is so shaped as to spread the electrostatic stresses longitudinally with respect to the terminal members. This construction permits the distribution of the electrostatic stresses and, conversely, prevents the concentration thereof, without the use of the sometimes widely extending shields and, consequently, is adapted to quite a distinct field of service.

Figure 1 of the accompanying drawings is a fragmentary view, partially in elevation and partially in section, of an insulator embodying my invention.

Fig. 2 is an end view of the insulator illustrated in Fig. 1.

Fig. 3 is a side elevational view of a disconnecting switch in which an insulator embodying my invention may be employed, and

Fig. 4 is an end or front view of one end of the switch of Fig. 3.

An insulator embodying my invention comprises, in general, an insulating tubular member 1, terminal members 2 therefor, and electrostatic stress-distributing members 3.

The tubular member 1 is preferably constructed of wound paper, or other suitable material, impregnated with a binder, subjected to heat and pressure and dried to provide a rigid and durable structure.

The terminal members 2 comprise portions 4 of substantially cup-shape that conform to, and are disposed over, the ends of the member 1 and have outwardly projecting screw-threaded supporting portions 5.

The metal members 3 have portions 6 substantially conforming to the interior surface of the tubular member 1 and abutting the bottoms of the cup-shaped portions 4 and tapered end portions 7 that extend beyond the outer edges 8 of the portions 4 towards the center of the tubular member 1. The end portions 7 are formed as substantially hyperboloids of revolution, which form causes the electrostatic field to assume the shape of an ellipsoid of revolution in which the electrostatic stresses on the surface of the portion 7 are gradually and uniformly decreased in strength from the inner ends of the portions 7 to the inner edges of the portions 4. Pins 9 extend transversely through the portions 4, the tubular member 1 and the electrostatic stress-distributing members 3 to hold the same together.

Where a relatively high difference of potential exists between terminal members, such as the members 2, electrostatic stresses ordinarily extend between and concentrate

at, and within a transverse area bounded by, the edges 8 of the cup-shape portions 4. Where this area is small, in proportion to the difference in potential between the members 2, the stresses will pass through the tubular member in concentrated form and, when flash-over occurs, cause damage, ordinarily known as puncturing, thereto.

By the shape and relation of the electrostatic stress-distributing members 3, the stresses, from one end of the insulator to the other, are more widely distributed longitudinally with respect to the tube adjacent to the ends of the latter and are prevented from concentrating around the edges 8 as illustrated by the dotted lines in Fig. 1. Without the portions 7, the stresses that are shown distributed therealong would seek the relatively small transverse area bounded by the edges 8, thereby effecting a region of highly concentrated stress.

One application of an insulator embodying my invention is illustrated in Figs. 3 and 4 wherein a plurality of tubular members 1 are grouped to support pivot and jaw terminal members 10 and 11, respectively, for a disconnecting switch blade 12. Members 13 support the members 10 and 11, respectively, to the outer ends of the tubular members 1 that are connected at their inner ends to angle iron members 14 and plates 15.

Other applications of an insulator embodying my invention are set forth and described in a copending application, Serial No. 396,452, filed July 15, 1920, by C. Aalborg, and assigned to the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

The stress-distributing members 3 may be employed as substitutes for the aforementioned shields and, when so employed, will be more economical, both as to space and as to cost of manufacture.

While I have shown and described a particular form of my invention, changes may be effected therein without departing from the spirit and scope thereof, as set forth in the appended claims.

I claim as my invention:

1. An insulator comprising an insulating tube, terminal members of substantially cup-shape disposed over the ends thereof to carry the mechanical load on the insulator and tapered electrostatic-stress-distributing members projecting into the tube beyond the inner edges of the cups to prevent concentration of the field and to widely distribute the exterior field of the insulator along the outer longitudinal surface thereof adjacent to its ends.

2. An insulator comprising a tubular insulating member, terminal caps surrounding and secured to the ends of said insulating member and a tapered element secured to each cap and extending inwardly into the insulating member to regions beyond the inner edges of the caps to distribute the normal electrostatic stress field along the insulating member beyond the edges of the caps and thereby prevent the concentration of the field between the inner edges of the caps.

3. An insulator comprising a dielectric member, a supporting member having mechanical connection therewith for supporting the load on the insulator and a conductor mechanically connected with said supporting member and positioned within an inwardly extending opening in the dielectric member and extending in the direction of the field of force set up within said insulator when said conductor is changed to a position beyond all load-supporting portions of the mechanical connection between said supporting member and said dielectric member, said conducting member being covered by dielectric material and serving to distribute the field of force so that lines of force emanating therefrom will be intercepted by the dielectric material, the portion of the conductor adjacent its connection with the supporting member engaging the inner surface of the dielectric member and the portion extending beyond the supporting member being free of such engagement.

In testimony whereof, I have hereunto subscribed my name this 1st day of July, 1920.

FRANK CONRAD.