Sept. 4, 1934. A. O. AUSTIN 1,972,613

ARCING GUIDE FOR INSULATORS

Filed April 12, 1929 4 Sheets-Sheet 1

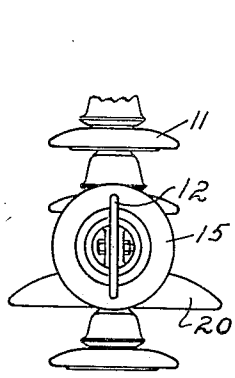


Fig 3.

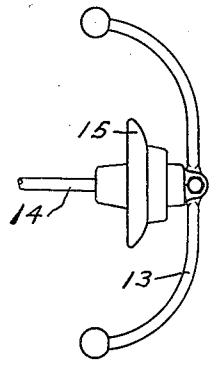


Fig. 2.

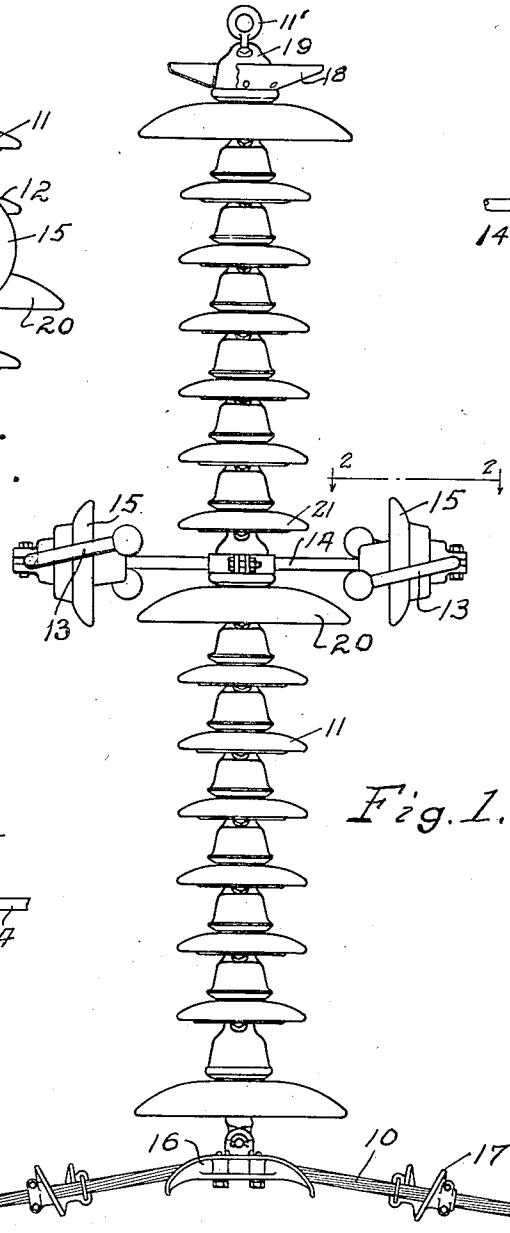


Fig. 1.

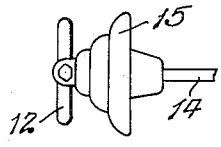


Fig. 11.

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ARCING GUIDE FOR INSULATORS

Filed April 12, 1929 4 Sheets-Sheet 2

Fig. 5.

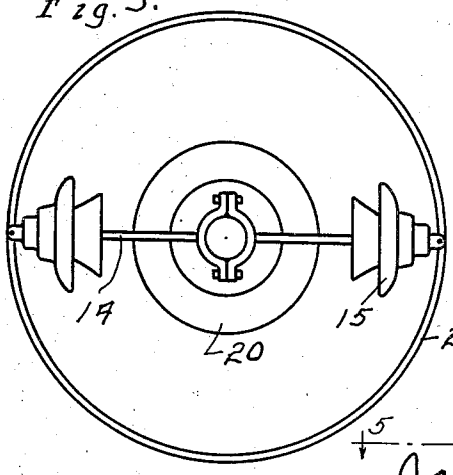


Fig. 4.

Fig. 10.

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ARCING GUIDE FOR INSULATORS

Filed April 12, 1929 4 Sheets-Sheet 3

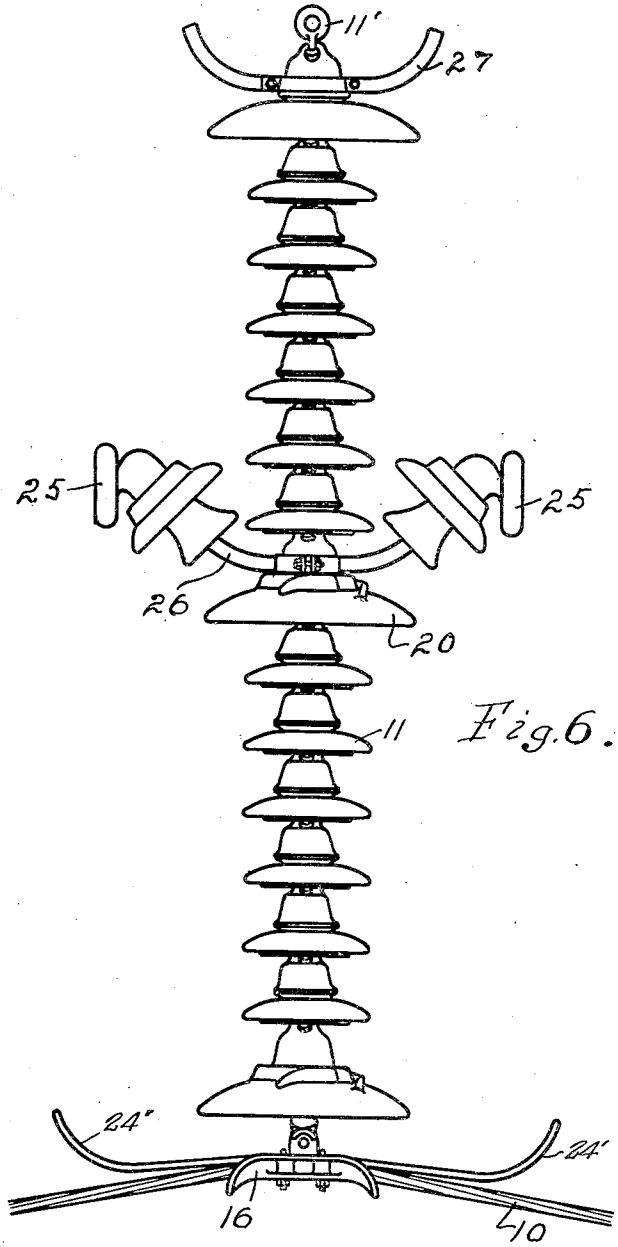


Fig. 6.

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ARCING GUIDE FOR INSULATORS

Filed April 12, 1929 4 Sheets-Sheet 4

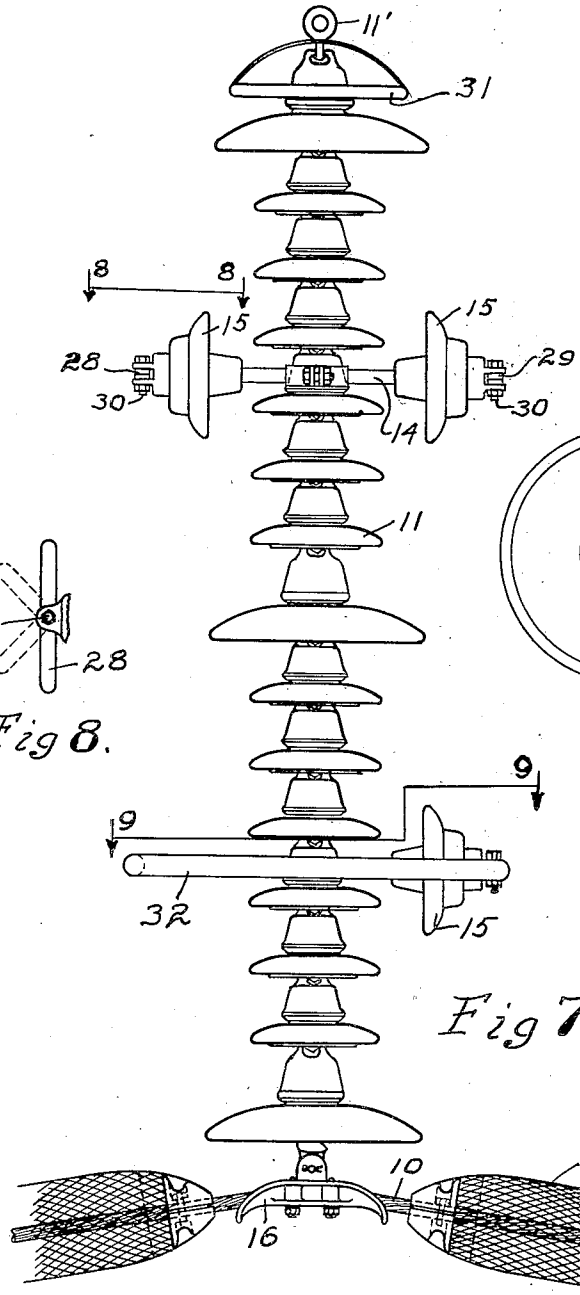


Fig 8.

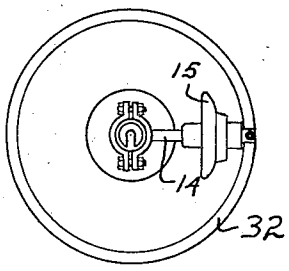


Fig. 9.

Fig 7.

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UNITED STATES PATENT OFFICE

1,972,613

ARCING GUIDE FOR INSULATORS

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Application April 12, 1929, Serial No. 354,562

18 Claims. (Cl. 173—318)

This invention relates to insulators and especially to suspension insulators for high potential transmission lines, and has for one of its objects the provision of means for preventing flashover discharges from cascading or following the insulator string.

A further object is to provide an improved form of control for directing the course of a discharge away from the supporting insulator.

A further object is to provide an insulator support which shall be of improved construction and operation.

Other objects and advantages will appear from the following description.

The invention is exemplified in the combination and arrangement of parts shown in the accompanying drawings and described in the following specification, and it is more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is an elevation of a suspension insulator string showing one embodiment of the present invention applied thereto.

Fig. 2 is a fragmentary plan on line 2—2 of Fig. 1.

Fig. 3 is a fragmentary elevation looking from the left in Fig. 1.

Fig. 4 is a view similar to Fig. 1 showing a modified form of the invention.

Fig. 5 is a horizontal section on line 5—5 of Fig. 4.

Fig. 6 is a view similar to Figs. 1 and 4 showing a further modification of the invention.

Fig. 7 is a view similar to Figs. 1, 4 and 6 showing still another form of the invention.

Fig. 8 is a fragmentary plan on line 8—8 of Fig. 7.

Fig. 9 is a horizontal section on line 9—9 of Fig. 7.

Fig. 10 is an elevation of a portion of an insulator string showing a slightly modified form of the invention.

Fig. 11 is an elevation of the arcing guide shown in Fig. 3 but looking from the right in that figure.

In the insulation of high voltage lines, it is desirable to obtain as high a flashover as possible for the given length or size of the insulator in order to prevent flashovers due to the induced or abnormal voltages upon the line. The most serious of these voltages are due to transient disturbances set up by lightning, switching, or other causes, and are usually a determining factor in the operation of the line rather than the normal operating voltage of the system. In cases where the transmission conductors are subject to abnormally high voltages due to a direct stroke of lightning or to the release of a bound charge which will produce a voltage sufficient to cause the insulator to flash, it is important that the arc strike free to ground and does not cascade over the insulator string.

For the shorter insulator strings or where the field set up by tower and conductor is favorable, the tendency to cascade may be little. There are many conditions, however, where there is a tendency to cascade under a severe surge or transient set up by lightning. In the present invention, the high flashover voltage of the insulator is reduced but little if any but the tendency of the arc to strike into the string is greatly reduced. The combination also makes it possible to provide a free arcing string without materially cutting down the clearance to the tower due to the projection of a ring or other device laterally from the conductor.

Fig. 1 shows one form of the invention in which the conductor 10 is supported by an insulator string 11 attached to the tower by a suitable fitting 11'. At some intermediate point in the string an arc directing electrode 13 is placed. This electrode is supported from the main insulator string by an arm or bracket 14. Insulating element 15 is placed between the arcing electrode and support arm 14. The clamp 16 carrying the conductor may be provided with an arcing device 17 or with an arcing horn commonly used. The upper insulator unit may be provided, if desired, with an arcing flange 18. If the insulator string is placed near the cross arm above, usually no protection is necessary or advisable at the upper end of the string. Without the present invention an arc starting from the conductor or arcing device 17 and tending to strike to ground over the string may follow free for some distance and then strike into the string, due to the electrostatic capacity of the string to ground or the difference in voltage between the point of the streamer and the insulator string. Where the streamer is short, the difference in potential between the adjacent insulator and the point of the streamer is rather small and at high voltages there is an appreciable repulsion, which tends to keep the arc away from the insulator. As the arc advances in the general direction of the axis of the insulator, the difference in potential becomes more marked and the capacity of the insulator string to ground permits such a difference in potential that the point of the arc or discharge may be drawn in. This tends to

cause a cascade on an insulator string which might otherwise be a free arcing string. The further the arc starts from the axis of the string, the less the danger of the cascade. This, however, may require an increase in tower clearance and may be difficult to carry out except along the lines discussed.

The arc directing electrode, as shown in Figs. 3 and 11, may be merely a metal bar carried on the outer terminal of the insulator 15. This bar may be secured to the insulator so that it may be adjusted to different angular positions if desired.

Assuming that an arc starts from the conductor or device 17, it will tend to discharge in a general vertical direction. When the point of the arc is in the vicinity of the electrode 12, it will strike into the same. The potential of the electrode 12 is not far different from that of the insulator to which the arm 14 is attached. Therefore, with the fast moving discharge, this electrode 12 with its insulator 15 will tend to form an electrode for the termination of the discharge streamer. If the streamer is a positive potential it will charge the electrode 12 positively. The support member 14 in the insulator will be charged negatively and a corresponding positive charge will be set up in the insulator string to which the arm 14 is attached. Since there is but a single insulating element 15 acting as a condenser, the potential of the string will be materially raised and will be of the same potential as the streamer and charged electrode 12. The tendency will then be for the arc to continue from the electrode 12 to ground without striking into the string. Since the origin of the arc continuing from 12 may be some distance from the string, the tendency of the arc to strike into the string will be greatly reduced, as the redistribution of potential in the string will tend to give the remaining portion of the string the properties of a short string. The arc can then terminate at the cross arm in the cap 19 of the insulator or at an arcing flange 18, if desired.

It is evident that an arc might start from the upper end of the string as from the cross arm, the cap 19, or a discharge horn or ring 18, striking the electrode 12 or 13 and continuing down to the conductor. This, of course, would depend upon the polarity of the surge imposed upon the conductor 10 and upon the relative fields set up.

The electrode 13 may be in the form of a ring as shown in Fig. 4. The insulator string may be composed of suspension insulators of any form, having uniform diameter or units of large and small diameter. If desired, insulators of large diameter and higher effective flashover may be used adjacent to the intermediate arcing controls. Where the arc starts near the axis of the string, it may be necessary to reduce the arcing voltage of the combination slightly by placing the electrodes so as to cut down the striking distance in a vertical direction.

Large sections 20 may be used on either or both sides of the arms 14, if desired, or the smaller diameter of insulator 21 Fig. 1 may be used on either side. If the arm 14 is connected directly to the electrode, full voltage is placed on the string at the point of contact with the arc. This makes it more difficult to provide a high flashover in the remaining portion of the string than where the insulating member 15 is interposed. In the latter case it is possible to provide a material amount of insulation so that the effective insulation of the string is increased by the amount of the insulator 15. Where the member 15 is not used, it is necessary and advisable to use insulators of very high flashover on either side of the member 14. This is necessary in order to offset the reduction in clearance due to the arm 14. If the necessary clearance is provided by raising the insulating member 21, it will be found that this increases the duty on this member so that the danger of overstress will be increased and, at best, the insulation for a given length of string will be reduced.

In Fig. 4, a somewhat different form of the invention is shown. In this instance, the string is equipped with rings 22 and 23 at the terminals. The arc control electrode 24 is mounted in the string in the same manner as that in Fig. 1. Any suitable arrangement of insulator discs may be used in the combination. The performance in this instance is the same as that in Fig. 1, the arc starting from the electrode 22 or 23. In general, the arc starts from the lower electrode, but there may be conditions where the discharge starts from the other end.

Fig. 6 shows an insulator string in which the clamp is provided with an arcing or discharge horn 24'. The intermediate control electrode 25 is supported by an arm 26 which is inclined at an angle to provide more effective clearance. The intermediate control in this case consists of a member which will readily withstand the power arc and which will tend to pick up the discharge starting from the horn 24'. The upper end of the arc may terminate in the insulator cap and the cross arm at the upper end of the string or in a horn 27 of any suitable size or any other suitable device.

Fig. 7 shows a somewhat different combination embodying the same general principles, however. The conductor is equipped with cages 27' with intermediate arc controls 28 and 29. These arc controls may be of any of the various types and may consist of members which can be adjusted as shown in 30.

The upper end of the string may be equipped with an arcing band or flange 31 or left without any arcing device. If desired, rings or sectors may form the electrodes for the arc control members. Although two arc controls 28 and 29 are shown in the drawings, only one of these control members need be used at a given location, the member on the other side of the insulator being omitted. If desired, these members may be placed on alternate sides. In general, however, attaching the controls at the same point in the string tends to balance up the insulator string. If desired, a single member may support the electrode 32 running around the string. The electrode 32 is extended so as to form the electrode on the opposite side of the string. Where the electrodes for adjacent control members are connected as in Fig. 4, the electrostatic capacity to the center of the string is increased which is an advantage in controlling the field in many cases, as the tendency to flash the insulating members 15 will be reduced. The stronger field set up through the string will tend to hold the arc at a distance from the string as it leaves the electrode. It is evident that the arc control device may be added to practically any type of insulator string to reduce the tendency to cascade under severe operating conditions.

In the modification shown in Fig. 10, there are no insulators interposed between the arcing electrodes 35 and the insulator string but the dielectric units 36 at each side of the potential distributor are made larger than the other insulators

in the string in order to compensate for the change in potential at the intermediate point produced by a discharge arc striking the electrodes 35.

I claim:

1. A multisection insulator string and a device disposed between the ends of said string and insulated from said string but electrostatically connected therewith for redistributing the potential of said string when a discharge arc from either end of said string strikes said device so that the arc does not strike into the string.

2. The combination with an elongated insulator string, of an arcing electrode between the ends of said string and insulated from the main body of the string but electrostatically coupled therewith to serve as a temporary terminus for a high voltage discharge away from the main body of said string.

3. The combination with an insulator comprising a series of dielectric bodies and interposed metallic fittings, of a charged member connected with said insulator at one end thereof, and an arcing guide of conducting material disposed adjacent said insulator between the ends thereof, but insulated from said fittings, for charging the intermediate portion of said insulator in case said arcing guide is engaged by a discharge arc from said charged body, to repel said arc from said insulator.

4. The combination with an insulator, of a charged body connected to one end of said insulator, an arcing guide of conducting material spaced from said insulator between the ends thereof, and a dielectric member interposed between said arcing guide and said insulator.

5. The combination with an insulator, of a high potential conductor connected with one end of said insulator, a bracket of conducting material connected with said insulator between the ends thereof, an insulator mounted on said bracket, and an arcing guide carried by said last named insulator and separated from said bracket by said last named insulator.

6. The combination with an insulator string, of a conductor supported by said string, a bracket carried by said string between the ends thereof and extending from said string in the vertical plane of said conductor, an insulator mounted on said bracket, and an arcing guide of conducting material mounted on said insulator.

7. In combination a grounded support, an insulator string carried by said support, a high potential conductor carried by said string, a bracket projecting from said string at a point between the ends thereof, an insulator mounted on said bracket, and an arcing guide carried by said insulator, said arcing guide having an upwardly and a downwardly directed contact member.

8. An insulator comprising a series of dielectric members connected by metallic fittings, a charged body connected with one end of said series, a metal bracket connected with one of said fittings between the ends of said string, an insulator mounted on said bracket, and a discharge guide mounted on said last named insulator and separated from said bracket by said last named insulator.

9. An insulator comprising a series of dielectric members connected to one another by metallic fittings, a charged body carried at one end of said insulator, a metallic bracket secured to one of said fittings, an insulator mounted on said bracket, and a discharge guide carried by said last named insulator, a dielectric member in said series adjacent said bracket being of a larger size than other dielectric members of said series.

10. An insulator comprising a plurality of disc shaped members of dielectric material connected in series by interposed metallic fittings, a charged body carried at one end of said series, a bracket secured to one of said fittings between the ends of said series, and a discharge guide mounted on said bracket, the disc shaped dielectric member next adjacent said bracket being of greater diameter than the other disc shaped members in the series.

11. An insulator string comprising a plurality of disc shaped dielectric members connected together by metallic fittings, a conductor carried from one end of said insulator string, a metallic bracket secured to one of said fittings between the ends of said insulator and having a plurality of arms projecting therefrom, insulators mounted on the ends of said arms and discharge guides of conducting material carried by said last named insulators.

12. The combination with an insulator string comprising dielectric members connected by metallic fittings, of a high potential conductor carried by said string, a laterally projecting arm secured to a metallic fitting between the ends of said string, an insulator carried by said arm, and an arcing guide carried by said last named insulator, said arcing guide comprising adjustable contact members.

13. The combination with an elongated insulator string, of an arcing electrode connected with said string at a point between the ends thereof for controlling the potential of the body of said insulator string during discharge and for maintaining the path of discharge away from the main body of the insulator, and an insulating member in said string adjacent the point of connection with said electrode having a higher flashover value than other members in said string to compensate for change in potential at said point of connection due to a discharge arc.

14. A multisection insulator string comprising a plurality of dielectric members connected by interposed fittings of conducting material and a device between the ends of said string and insulated from said fittings but electrostatically coupled therewith for redistributing the potential of said string when a discharge arc strikes said device in completing a path between terminals.

15. An insulator comprising a plurality of dielectric members connected to one another by metallic fittings, a bracket secured to one of said fittings between the ends of said insulator, arms projecting from said bracket, dielectric members mounted on the ends of said arms and charge receiving bodies carried by said members and insulated from said bracket by said members, and means electrically connecting said charged receiving bodies together.

16. The combination with an insulator string comprising a plurality of dielectric members connected by metallic fittings, of a ring surrounding said string between the ends thereof, and an insulating support for connecting said ring with said string.

17. An insulator comprising a plurality of dielectric members connected in series by interposed metallic fittings, a conductor carried by said insulator, arcing members at opposite ends of said insulator, a plurality of arms mounted on a fitting between the ends of said insulator

and projecting laterally therefrom, insulating members carried by said arms, and arcing guides supported by said insulating members, said arcing guides being electrically connected with each other and insulated from said fitting.

18. An insulator string comprising alternating dielectric members and metallic fittings, a metallic ring surrounding said string between the ends thereof, a bracket for supporting said ring from a metallic fitting of said insulator, and means for insulating said bracket from said ring.

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