Feb. 12, 1929. 1,701,561

C. S. GORDON

INSULATOR

Filed July 1, 1925

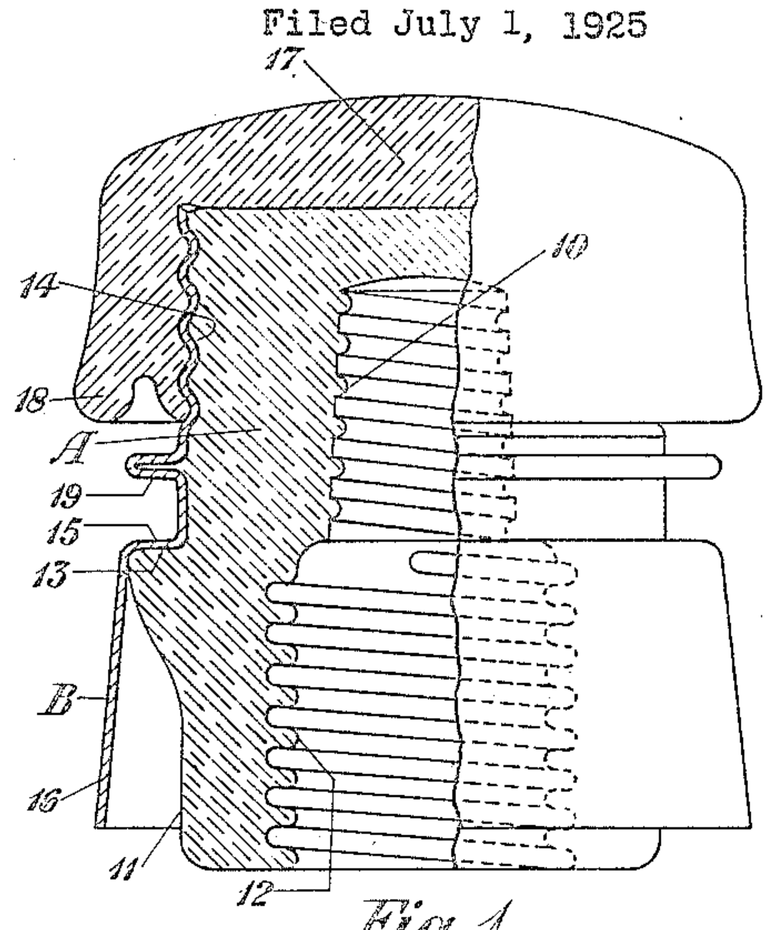

Fig. 1

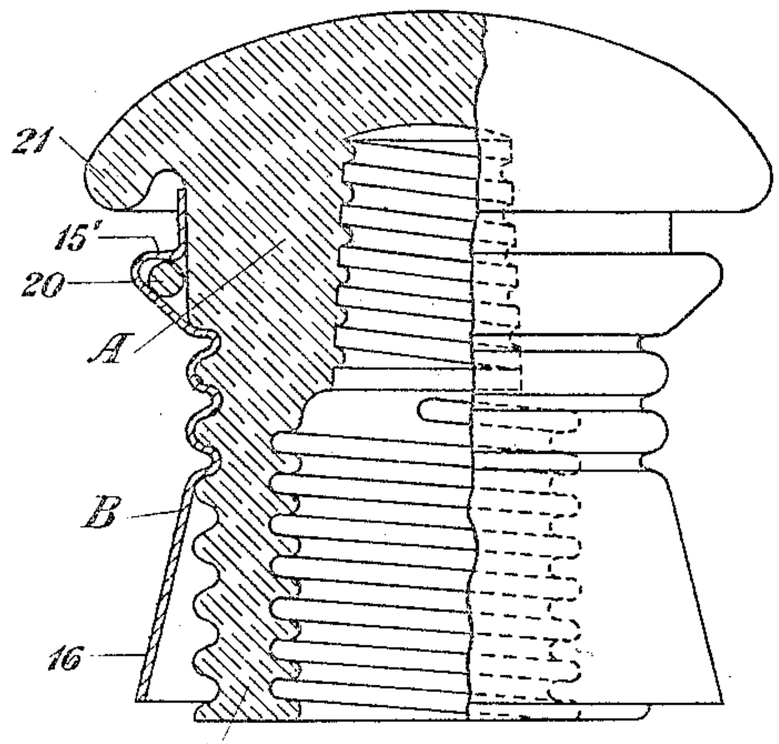

Fig. 2

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INSULATOR.

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This invention relates to improvements in insulators and more particularly to a construction of insulator adapted to stabilize the leakage loss under different weather conditions.

With the development of methods of transmitting telephonic and telegraphic signals by means of carrier currents propagated along open wire lines, new transmission problems have been introduced. Owing to the fact that the carrier currents employed are relatively high in frequency as compared with the voice currents or Morse currents utilized in the ordinary methods of communication it has been found that the attenuation is very markedly increased, so much so, in fact, that repeaters for amplifying the transmitted currents must be separated by much shorter distances, thereby adding to the expense of the plant outside the terminal stations at which the carrier apparatus is applied.

A very material part of this attenuation is due to leakage loss through the insulators which are customarily employed upon open wire lines, and this loss varies through a very wide range under different weather conditions. The insulator acts like a condenser, the glass of the insulator constituting the dielectric, the line wire and tie wire on the outside of the insulator comprising one plate, and the wooden pin upon which the insulator is supported comprising the other plate. The condenser thus formed introduces a leakage loss due to so-called dielectric hysteresis and this loss varies with the capacity of the condenser.

In dry weather, the outer plate of the condenser, that is, the portion of the line wire adjacent to the insulator and its associated tie wire, constitutes a plate of relatively small area so that the capacity is relatively small and hence the leakage loss, even at carrier frequencies, is small as compared with the total attenuation of the circuit. During wet weather, however, the entire outer surface of the insulator becomes wet, with the result that the conductive area external to the insulator is very much increased. As a result, the capacity, and consequently the leakage loss, is very much increased. During the extremes of wet and dry weather the attenuation of the system varies through a wide range due to this cause alone, and this necessitates the provisions of special regulating apparatus for maintaining the transmission equivalent of the circuit constant under all weather conditions. In order to avoid the expense of the regulating arrangements it becomes desirable to devise some method for stabilizing the capacity of the insulator, and hence its dielectric loss, at some constant value. In accordance with the present invention it is proposed to accomplish this result by providing an external conductive sheath to form the outer surface of the insulator to which the line conductor and the wire are attached so that the capacity of the insulator will be determined by the area of the conductive sheath and will not be increased when the insulator becomes wet.

The invention may now be more fully understood from the following detailed description when read in connection with the accompanying drawing, in which Figures 1 and 2 illustrate different modifications of the invention.

Referring to Fig. 1, A designates a body of dielectric material provided with an internal screw-threaded opening 10 into which the supporting pin may be inserted. A downwardly extending petticoat 11 is provided, the petticoat being corrugated, as shown at 12, on its inner surface in order to increase the length of the dry path provided by the petticoat. The corrugations 12 may be conveniently made in the manufacture of the device by the use of an inner core about which the insulating material is molded, the core being provided with external screw threads corresponding to the corrugations 12, these threads being of the same pitch as the screw threads of the opening 10 so that the core or mold may be removed from the block of dielectric material by unscrewing it.

These corrugations increase the length of the leakage path without the increase in diameter of the piece generally incurred in obtaining the needed leakage length. The effectiveness of the protected surfaces in an insulator is expressed by the well-known equation:

$$R = \frac{KL}{C}$$

where R is the resistance of the leakage path, K a constant depending upon the dielectric

and L and C are respectively the length and width of the path. The use of corrugated surface to increase the value of L without a substantial increase in C also minimizes the weight of glass required for making the piece. This feature is of particular importance where special glasses are used, such for example as electric Pyrex glass, which has a very low loss angle.

The outer surface of the petticoat 11 is provided with a ledge, as shown at 13. An outer metallic or conductive covering B may be provided for the block of dielectric material, this covering being provided with screw threads at the top, adapted to engage with external screw threads 14 on the outer surface of the dielectric. It is also provided with a shoulder 15 adapted to engage with the shoulder 13, as the outer shell is screwed into place from above the dielectric block. When so screwed into place the lower skirt 16 of the shell extends downwardly and away from the outer surface of the petticoat 11 to protect the outer surface of the petticoat from moisture.

A cap 17 of dielectric material is provided, having an annular rim which is screw-threaded on its interior to coact with the screw-threaded portion of the shell B. When the shell has been screwed into place with its shoulder 15 resting against the shoulder 13, the cap 17 may be screwed over the upper outer portion of the shell to hold the same in place and to prevent moisture from working in behind the shell. The lower part of the rim 18 of the shell may be corrugated, as shown, if desired, to increase the length of the dry path formed by the rim. Preferably, the shell is crimped, as shown at 19, at a point above the shoulder 15 and below the lower part of the rim 18 of the cap to form a groove in which the line conductor and tie wire may be fastened. The crimped portion prevents the line conductor and tie wire from coming into contact with the dry path formed at the lower side of the rim 18, thereby preventing this dry path from being short-circuited.

As the lower skirt 16 of the shell is quite distant from the pin which forms, in effect, the inner plate of a condenser of which the outer shell is the outer plate, there is but little capacity between the skirt 16 and the pin, and the effective capacity of the insulator which causes the leakage is practically limited to the outer metallic surface from the shoulder 15 to the upper edge of the shell. It will be obvious that the capacity due to this surface is fixed both through wet and dry weather conditions by reason of the dry path provided on the lower side of the rim 18 and also by reason of the dry path formed on the outer and inner surfaces of the relatively short petticoat 11.

It will be seen that by means of these arrangements the alternating current leakage of the insulator, which is proportionate to its capacity, is stabilized at a condition intermediate between dry weather and wet weather conditions, for the effective surface of the outer plate of the insulator acting as a condenser is smaller than the conductive outer surface of the dielectric body would be if it were all exposed to the weather. On the other hand, the surface of the effective outer plate is larger than the conductive surface in dry weather conditions, for such surface is then limited to the line conductor and tie wire. The direct current leakage is stabilized at the wet weather value, which is kept low by the provision of long dry paths on the inner and outer surfaces of the petticoat 11. It is unnecessary to provide any additional repeaters by reason of the use of the outer metallic shell, as repeaters have to be provided even with existing insulators to give sufficient gain for the worst transmission conditions. By stabilizing the insulator in the manner above described, however, all equipment for maintaining transmission constant may be eliminated and the expense proportionately cut down.

A somewhat simpler arrangement is shown in Fig. 2. In this case the lower part of the dielectric body A and petticoat 11 are externally screw-threaded so that the shell B may be screwed into position from the lower end of the insulator. The skirt 16 formed by the lower part of the shell, is so formed as to extend downwardly and away from the petticoat 11 to protect the outer surface of the petticoat from moisture. The screw threads upon the outer surface of the petticoat are also of assistance in lengthening the effective dry path formed on the inner and outer surfaces of the petticoat. The upper portion of the shell is provided with a shoulder 15′ which is reinforced by means of a ring 20 to form a seat for the line conductor and tie wire. Moisture is prevented from entering behind the shell by means of an auxiliary skirt 21, which takes the place of the removable cap of Fig. 1.

It will be obvious that the general principles herein disclosed may be embodied in many other organizations widely different from those illustrated without departing from the spirit of the invention as defined in the following claims.

What is claimed is:

1. An insulator comprising a body of dielectric material having an internal opening into which a pin may be inserted, the outer surface of said body being screw-threaded, a shell of conductive material adapted to cooperate with said screw threads and to be screwed into position over the outer surface of said body, said shell being formed with a shoulder to form a seat to which the line conductor and tie wire may be fastened, and

means extending outwardly above said seat to prevent moisture from working in between the dielectric body and the shell.

2. An insulator comprising a body of dielectric material having an internal opening into which a supporting pin may be inserted, a petticoat extending downwardly from said body and surrounding the pin to form an internal dry path, the outer surface of said dielectric body being screw-threaded, an external shell of conductive material adapted to co-operate with said screw threads and to be screwed into place over the outer surface of said dielectric body, said shell having a lower skirt portion extending downwardly to substantially the lower edge of said petticoat and away from the petticoat to protect the outer surface of the petticoat from moisture, a shoulder also formed on said shell to form a seat for the line conductor and tie wire, and means extending outwardly above said seat to prevent moisture from working in between the dielectric body and the shell.

3. An insulator comprising a body of dielectric material having an internal opening to receive a supporting pin, the outer surface of said body being screw-threaded and provided with a shoulder near the lower margin of said thread, an outer shell of conductive material formed with screw threads to cooperate with the threads on the outer surface of the dielectric body, said shell also being provided with a shoulder so that when it is screwed into place the shoulder of the shell rests against the shoulder of the dielectric body to form a seat for the line conductor and tie wire, and a cap of dielectric material having an internally screw-threaded rim adapted to be screwed into place over the outer surface of the external shell so that the lower portion of the rim will prevent moisture working in between the dielectric body and the shell.

4. An insulator comprising a body of dielectric material having an internal opening to receive a supporting pin, the outer surface of said body being screw-threaded and provided with a shoulder near the lower margin of said thread, an outer shell of conductive material formed with screw threads to cooperate with the threads on the outer surface of the dielectric body, said shell also being provided with a shoulder so that when it is screwed into place the shoulder of the shell rests against the shoulder of the dielectric body to form a seat for the line conductor and tie wire, and a cap of dielectric material having an internally screw-threaded rim adapted to be screwed into place over the outer surface of the external shell so that the lower portion of the rim will prevent moisture from working in between the dielectric body and the shell, said shell being provided with a crimped portion above its shoulder and below the protecting rim of the cap to prevent the line conductor and tie wire from coming into contact with the dry path formed by the lower surface of the rim of the cap.

5. An insulator comprising a body of dielectric material formed with an internal opening to receive a supporting pin, a petticoat extending downwardly from said dielectric body and away from the pin to form a dry path upon its inner surface, screw threads formed upon the upper outer surface of the dielectric body, a shoulder formed on the dielectric body below the screw threads, an outer conductive shell provided with screw threads and a shoulder so that it may be screwed into position with its shoulder resting upon the shoulder of the dielectric body to form a seat for the line conductor and tie wire, and a cap having an internally screw-threaded rim adapted to be screwed into position over the upper part of the shell to protect the seat for the line conductor and tie wire from moisture and also to prevent moisture from working in behind the shell.

6. An insulator comprising a body of dielectric material formed with an internal opening to receive a supporting pin, a petticoat extending downwardly from said dielectric body and away from the pin to form a dry path upon its inner surface, screw threads formed upon the upper outer surface of the dielectric body, a shoulder formed on the dielectric body below the screw threads, an outer conductive shell provided with screw threads and a shoulder so that it may be screwed into position with its shoulder resting upon the shoulder of the dielectric body to form a seat for the line conductor and tie wire, a cap having an internally screw-threaded rim adapted to be screwed into position over the upper part of the shell to protect the seat for the line conductor and tie wire from moisture and also to prevent moisture from working in behind the shell, said shell also being provided with a downwardly extending skirt below its shoulder, said skirt protecting the outer surface of the petticoat from moisture, thereby forming an additional dry path.

In testimony whereof, I have signed my name to this specification this 25th day of June, 1925.

CHESTER S. GORDON.