Feb. 7, 1939. L. A. MEISSE 2,146,344

ELECTRIC INSULATOR

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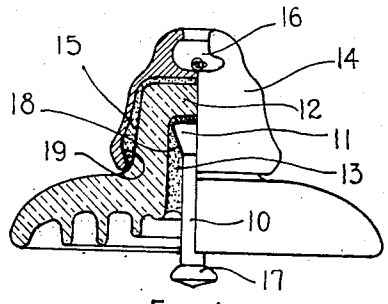


FIG. 1

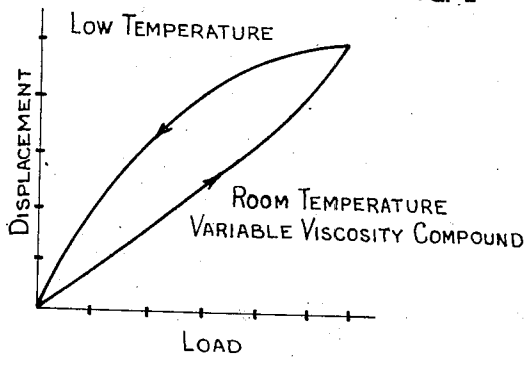


FIG. 2

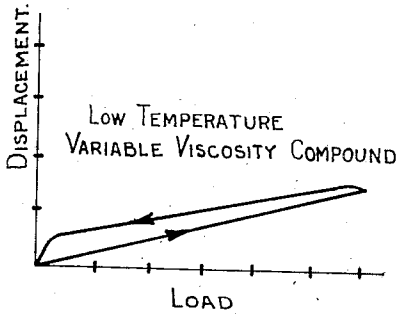


FIG. 3

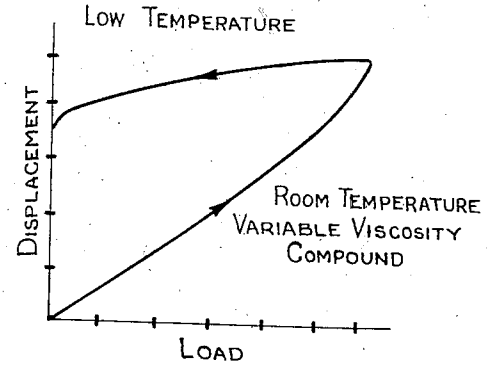


FIG. 4

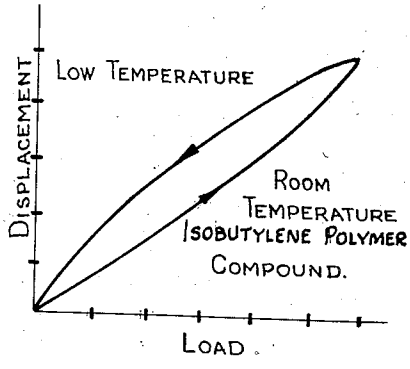


FIG. 5

INVENTOR
Louis A. Meisse.
BY Alphens J. Crane
ATTORNEY

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ELECTRIC INSULATOR

Louis A. Meisse, Mansfield, Ohio, assignor to The Ohio Brass Company, Mansfield, Ohio, a corporation of New Jersey

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7 Claims. (Cl. 173—318)

This invention relates to electric insulators and especially to suspension insulators for high voltage transmission lines of the type in which a wedging connection between the metal and porcelain parts is used to obtain high physical strength.

One object of the invention is to provide an insulator having improved service characteristics, particularly in respect to the effect of temperature variations on the internal stresses in the insulator, and the reaction of the insulator parts to these stresses. A further object of the invention is to provide insulators which shall be of improved construction and operation. Other objects and advantages will appear from the following description. The invention is exemplified by the combination and arrangement of parts shown in the accompanying drawing and described in following specification and it is more particularly pointed out in the appended claims.

In the drawing:

Fig. 1 is an elevation with parts in section showing one embodiment of the present invention.

Figs. 2, 3, 4 and 5 are diagrams illustrating the principles involved in the invention.

In the embodiment of the invention shown in Fig. 1, which represents a typical suspension insulator, the numeral 10 designates the insulator pin having a conical wedging member 11 at its upper end. The pin 10 is secured in a recess in the dielectric member 12 by means of cement 13. A cap 14 is secured to the outer portion of the dielectric member 12 by means of cement 15. The insulator is suspended from the socket eye 16 on top of the cap and joins the next insulator through the ball 17 at the lower end of the pin. The load forces are therefore transmitted through the pin and by means of the wedging face 18 of the pin to the cement 13, and from this cement 13 to the dielectric, and from the dielectric to the cement 15 on the outerside of the dielectric and thence to the wedge face 19 of the cap. In order to produce the required tensile strength, it is necessary that the dielectric be loaded with a large compression component. This compression component is produced by a slip of the hardware parts along their wedge faces. To facilitate this slip it has been the practice in industry to interpose between the cement and metal faces a coating of a viscous bitumen.

Measurement of the slip occurring along the wedge faces indicates service characteristics of the insulator in regard to its response to load changes. It is necessary that these movements shall be reversible and occur with a minimum of time and load lag. Fig. 2 is a diagram of the movement of the hardware in respect to the dielectric on application and removal of load. The ascending arm 20 of the curve shows the progress of such movements on a gradual increase in the applications of a load. The descend curve 21 shows the progress of recuperation of the hardware on gradual decrease of load. The spread between the two arms of the curve is a function of the load and time lag, and will be termed herein the load hysteresis in the insulator. This results in distortion of the internal stresses in an insulator with unfavorable effects on the service and life of the insulator. Nevertheless, in spite of this large hysteresis the insulator will ultimately return to its original condition as seen by the closure of the curve. As the temperature of the insulator is lowered to the vicinity of 0° F., it will be found that the slip along the wedge face ceases due to the increase of the viscosity of the lubricant interposed between the two wedge faces. The diagram for the movement under this condition is shown in Fig. 3, in which case the overall movement has become very slight and the hysteresis, or the horizontal distance between the two arms of the curve, has considerably increased, indicating an increase in the load lag with decrease in temperature.

I have discovered that this characteristic is detrimental to service behavior of the insulator since load changes generally occur simultaneously with temperature changes. For instance, if a warm insulator is loaded slightly above the normal service load, full slippage on the wedge faces occurs similar to the movement shown in the ascending leg in Fig. 2. If the temperature falls while the insulator is still under load the return movement follows the condition shown in Fig. 3, and complete return is prevented by the presence of the initial displacement and the lack of lubricating characteristics along the wedge faces at the lower temperature. This condition is illustrated in Fig. 4 and results in an excess of radial load on the cap due to the thermal contraction of its metal and may result in mechanical failure.

I have found that the life of an insulator can be very materially increased by providing a lubricant on the faces between the hardware and cement or between the cement and porcelain, the frictional resistance and viscosity of which is substantially unaffected by fluctuation in temperature. I have experimented with the use of graphite as such a lubricant, since it satisfies one of the requirements herein set forth that its friction is

little affected by temperature variations. I have found however, that graphite cannot be successfully used without some kind of binder and that the binder should be unaffected in its viscosity by temperature changes. I have found that the interposition of certain straight, long chain hydrocarbons and their polymers, such as an isobutylene polymer, by virtue of their close approach to uniform viscosity over a broad temperature range produce an insulator, the slip characteristics of which are not materially affected by variations in temperature within the range to be expected in service. Material of this nature may be purchased on the market and is manufactured, for instance, by the Advance Solvent & Chemical Co. of New York. I have also found that using such hydrocarbons of approximately uniform viscosity for a considerable temperature range in a mixture with graphite produces equally good results. Furthermore the addition of graphite has a beneficial effect during destructive testing of the insulator in which case the load is carried to a point at which a viscous lubricant is squeezed out and in which instance a layer of graphite remains as a solid lubricant.

A preferred way of practicing this invention is to coat the slip faces of the metal hardware of an insulator with a solution of "Vistanex" dissolved in a petroleum distillate and having dispersed in this solution a quantity of high grade graphite. "Vistanex" is a commercial product made by Advance Solvent & Chemical Co. of New York, and is a long chain hydrocarbon having a range of molecular weight between 7,000 and 70,000 and probably is an isobutylene polymer. On evaporation of the solvent a coating of the hydrocarbon is formed with the dispersion of graphite therein. The insulator hardware is then cemented to the porcelain dielectric in the customary way and cured with steam or hot water. Since the viscosity of the lubricant is not appreciably affected by the temperature, I find that the thickness as applied during the spraying operation is little changed by the elevated temperature during the curing operation, resulting in a uniform product.

While I am unable to describe definitely the chemical constitution of "Vistanex" above, I find that the characteristic qualities of this material are well suited for the present invention because of the fact that its viscosity is practically unaffected by temperature changes to which insulators are commonly subjected and because of the fact that although it acts as a lubricant to facilitate quick response of the insulator to varying load and temperature conditions, it is nevertheless sufficiently tacky to remain in place between the insulator parts and to retain the graphite with which it may be mixed. The fact that it is soluble in a petroleum distillate such as gasoline makes it easy to apply in a suitable even, thin coating.

The operation of an insulator in which the wedging surfaces are coated with bitumen according to the usual previous practice and which is loaded at a temperature of about 70° F., and the temperature lowered to approximately zero before the load is removed is illustrated in Fig. 4. Because the bitumen becomes hard at this low temperature there is but slight recovery resulting in danger of mechanical failure. Fig. 5 shows the operation of an insulator subjected to the same cycle as in Fig. 4 but with the slip surfaces lubricated with an isobutylene polymer compound of approximately uniform viscosity for a considerable temperature range. In this case there is complete recovery and but very slight time lag.

I claim:

1. An insulator comprising a metal part and a dielectric part connected by relatively movable wedging surfaces and a viscous lubricant interposed between said surfaces which has an approximately uniform viscosity over the normal range of temperature to which insulators are subjected in service.

2. An insulator comprising a metal part and a dielectric part connected by wedging bearing surfaces for transmitting the load between said parts and having interposed between said surfaces a straight long chain hydrocarbon lubricant the viscosity of which is but slightly affected by normal atmospheric temperature changes.

3. An insulator comprising a metal part and a dielectric part connected by cooperating bearing surfaces and a cushion and lubricant interposed between said surfaces and comprising a water insoluble, viscous, straight chain hydrocarbon having an approximately uniform viscosity over a large temperature range.

4. An insulator comprising a metal part and a dielectric part connected by cooperating bearing surfaces, and a cushion and lubricant interposed between said surfaces comprising a water insoluble, tacky, hydrocarbon having substantially uniform viscosity for normal variations in atmospheric temperatures.

5. An insulator comprising a metal part and a dielectric part connected by cooperating, relatively movable, bearing surfaces and a coating of isobutylene polymer having a molecular weight between 7,000 and 70,000 interposed between said surfaces.

6. An insulator comprising a metal part and a dielectric part connected by cooperating, relatively movable, bearing surfaces and a cushion and lubricant interposed between said surfaces comprising graphite mixed with a tacky hydrocarbon lubricant having an approximately uniform viscosity for normal atmospheric temperature variations.

7. An insulator comprising a metal part and a dielectric part connected by cooperating, relatively movable, wedging bearing surfaces and a cushion and lubricant interposed between said surfaces comprising an oil free, tacky mixture of graphite and an isobutylene polymer having a molecular weight between 7,000 and 70,000.

LOUIS A. MEISSE.