Sept. 19, 1939. A. O. AUSTIN 2,173,292

INSULATOR

Original Filed May 17, 1930 2 Sheets-Sheet 1

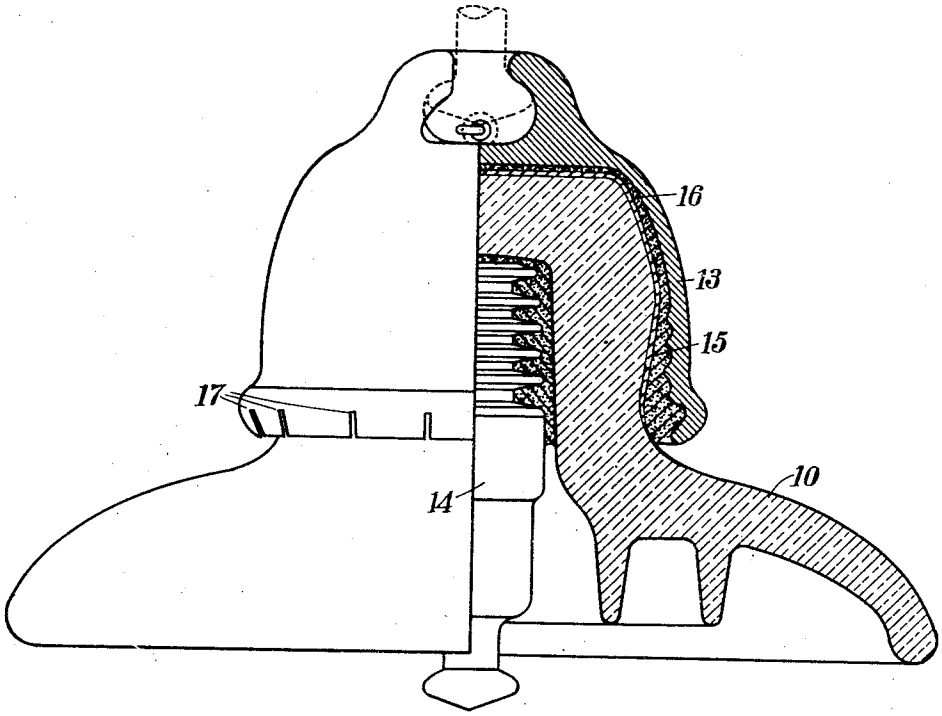


Fig. 1

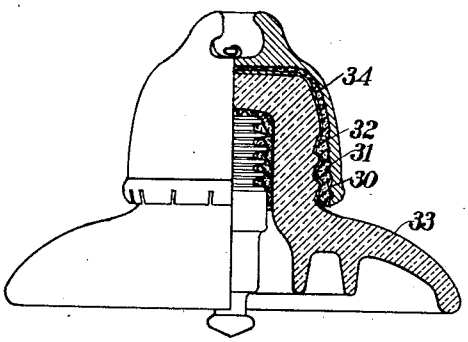


Fig. 3

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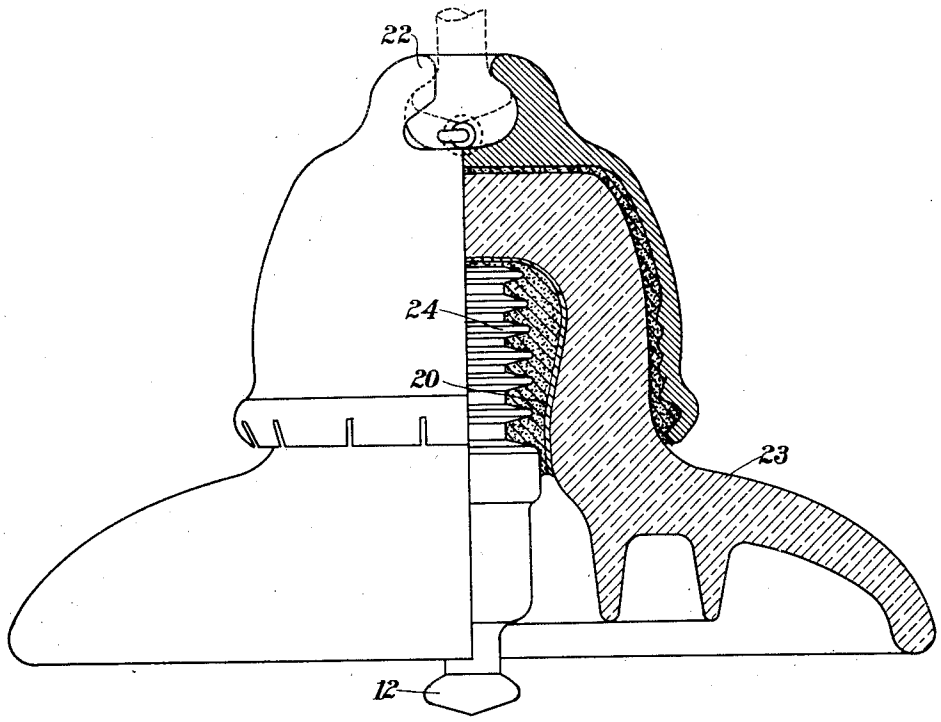


Fig. 2

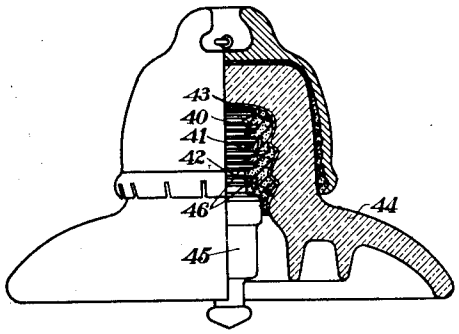


Fig. 4

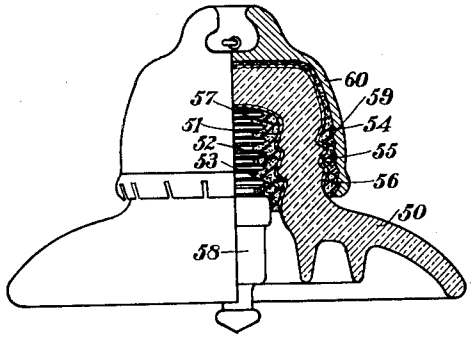


Fig. 5

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2,173,292

UNITED STATES PATENT OFFICE

2,173,292

INSULATOR

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Original application May 17, 1930, Serial No. 453,180. Divided and this application January 10, 1935, Serial No. 1,239

2 Claims. (Cl. 174—189)

This invention relates to insulators subjected to mechanical stresses and has for its object the provision of devices of this class which shall be of improved construction and operation and which are adapted to accommodate themselves to conditions of stress and temperature to which they are subjected.

The invention is exemplified by 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 with parts in section showing one embodiment of the present invention.

Figs. 2, 3, 4 and 5 are views similar to Fig. 1 showing modified forms of the invention.

This application is a division of application Serial No. 453,180, filed May 17, 1930, patent No. 1,994,265 dated March 12, 1935 which is in part a continuation of application Serial No. 32,715, filed May 25, 1925.

In suspension insulators or insulators used in tension of the usual cap and pin form, there is a tendency for the metallic parts to distort under heavy load. In addition, the differential expansion between the metal and porcelain also tends to change the relation of stress both in the metal and the dielectric. Under some conditions the distortion of the metal may permit the rearrangement of stress in the dielectric such that the dielectric member will be cracked, destroying its electrical reliability. One of the chief difficulties, particularly on insulators of high mechanical strength, is the radial distortion of the cap.

Fig. 1 shows one method of correcting this defect. The dielectric member 10 is cemented into a cap 13. A pin 14 is cemented in a recess in the head of the dielectric member. When load is applied to the cap 13 and pin 14 by their attaching means, there is a tendency to pull the dielectric head out of the cap 13. The resultant pressure tends to expand the cap 13. This will permit the dielectric member to deform and crack under the stress. In order to offset the expansion of the cap 13, the dielectric member is given a wedge shaped head. The tapered bearing surface 15 will maintain pressure against the cement by slipping down as the cap expands from increased temperature or due to the load. This surface is preferably smooth and coated with graphite or some material which will lubricate the surface. The remainder of the head is preferably relieved from any stress by dipping or otherwise applying a yielding coating 16. It is evident that while the expansion of the cap may be compensated for, it is also evident that the cap can set up a very heavy pressure tending to pinch the head off under low temperature conditions, particularly where the load or tension on the insulator is slight. In order to relieve this maximum stress which tends to shear off the head, two methods may be used. The radial stress set up by the cap may be reduced by providing it with slots 17 suitably spaced. This tends to taper off the radial pressure and minimize the danger of shearing, particularly under low temperatures. This construction has distinct advantages over a construction where the cement is allowed to slip in the cap. In the latter case the tangential forces in the cement tend to make it difficult to control the pressure between the dielectric and the cement. Where the dielectric, however, has a tapered head, the cement being comparatively weak in tension can always expand and permit adjustment of the head for a distortion in the cap.

A tapered surface to permit slipping for maintaining the radial pressure in the cement may be applied to the inner surface of the dielectric as in Fig. 2. A tapered surface 20 is preferably coated with graphite or graphite and wax or oil. A graphite lubricant is particularly suitable for this purpose since it is not affected by temperature. Where wax or bitumen is used between the parts, it tends to harden in cold weather and to prevent rather than facilitate return of the parts under the force of contraction of the cap. At the time when the lubricant is needed to prevent the cap from pinching off the head of the insulator, wax or bitumen is at its worst but graphite is practically unaffected. When a heavy load is applied to the attachments 12 and 22, the resultant forces on the head of the dielectric member 23 tends to cause it to deform. The radial distortion tends to weaken the cement and permit shearing at a lower load. In this particular case this is compensated for by the cement sliding on the tapered surface 20 so as to maintain proper radial pressure. The grading of the stress may be materially improved by the use of a pin 12 having resilient flanges 24 which have been described in my previous patent No. 1,489,-689, dated April 8, 1924.

In insulators having large bearing surfaces, the reduction of the diameter of the head, due to its tapered form, is very material where the stress is carried on a single bearing surface extending for a considerable distance along the axis of the

insulator. This may be offset as shown in Fig. 3. In this case several tapered surfaces **30**, **31** and **32** are provided on the outside of the head of the dielectric **33**. These surfaces are preferably coated as previously explained and the head coated with a yielding material **34**. The angularity of the tapered bearing surfaces **30**, **31** and **32** may be changed so that the stress may be tapered off at the end surfaces and the heaviest load placed on **31**. This tends to reduce the shearing stress and permits of an increased load being placed on the insulator without danger of causing a stress which will crack the dielectric. The stress on the inner surface may be carried by a cement joint, the load being distributed by the use of a resilient pin and resilient sanded surface as explained in my previous patent No. 1,284,975, dated November 19, 1918. As heavy loads or tensions on the insulator usually occur at low temperatures, there is a tendency for the cap to contract under these conditions and compensate for deformation caused by the stresses set up by the load. In this case, it may not be necessary to apply any compensation to the cap, particularly where the latter has a heavy cross section. The pin, however, has a tendency to contract and relieve the stress as well as the cement, which usually has a lower linear coefficient of expansion for temperature changes.

By providing the inner surface of the dielectric with slipping surfaces **40**, **41** and **42**, as shown in Fig. 4, it is possible to maintain the radial force on the cement **43** between the surface of the dielectric **44** and the pin **45**. As previously explained, this surface is preferably coated with a thin coating of graphite, wax, oil of some combination in order to control the coefficient of friction. Where slipping is desired, it is necessary to use some material on the surface, for if Portland cement is used, there is likely to be a slight bond between the cement and surface in time so that slipping will not take place except at excessive loads.

Heretofore asphaltic and bituminous materials have been used between insulator parts but these materials cling to the adjacent surfaces and retard relative movement so that damage to the fragile dielectric is very apt to occur before the parts can adjust themselves. Graphite is a non-clinging lubricant which is substantially unaffected by temperature changes and repeated tests show that where this material is used, the relative movement of the parts to provide adjustment thereof for changing conditions takes place instantaneously and avoids damage due to time lag, such as has been heretofore experienced.

The slope of the bearing surfaces **40**, **41** and **42** may be changed as to angle as shown in Fig. 3 in order to control the stress. A material control in the stress may also be effected by the use of a pin having resilient flanges **46** or through the control of the effective cross-section in the pin.

It is evident that compensating surfaces may be applied to both the inner and the outer surfaces of the dielectric. This is shown in Fig. 5. A dielectric member **50** is equipped with inner sloping surfaces **51**, **52** and **53** and outer sloping surfaces **54**, **55** and **56**. The inner surfaces permit compensating for deformation or changes in the inner wall of the dielectric as well as in the cement **57** and pin **58**. In general, however, by the use of a resilient pin, a grading of the stress on the inner surface may be effected by controlling the relative stiffness of the flanges on the pin at different points. The tapered slipping on the outside of **54**, **55** and **56** tends to compensate for cap and dielectric deformation, as well as the deformation of the cement **59** between the dielectric **50** and the cap **60**. The angularity may be varied in accordance to the conditions which it is desired to set up and may vary considerably for different designs.

If the metal is allowed to slip, the cement may absorb a large part of the force due to the radial component set up in the cement. In the case where the dielectric member slips, however, the cement being weak in tension simply checks at different places and permits the proper relation between the parts, tending to develop a high ultimate for a given area.

In the case of the inner tapered surface, the cement projects between the flanges of the resilient pin, forming annular rings or galleries. These galleries may be given an appreciable deflection and form a part of the means for distributing the load. If these galleries are to function properly, it is important that the radial forces or pressure be maintained. This is effected by placing the compensating surface on the dielectric. The resilient caps, in accordance with my previous Patent No. 1,552,663, dated September 8, 1925, may be used to advantage in order to distribute the load properly to make up for any unevenness on the coating of the surface or to prevent excessive stress due to contraction at low temperature.

I claim:

1. An insulator comprising inner and outer parts, one of which is a dielectric member, said parts having tapered cooperating bearing surfaces, a graphite lubricant between said surfaces, the taper of said surfaces being greater than the critical taper at which the friction between said surfaces when so lubricated will prevent relative movement of said parts in the direction of their axes under the force of differential expansion or contraction of said parts so that the resultant of said force in the direction of the axis of said parts will produce relative movement of said parts, relieving the stress set up therein by said force.

2. An insulator comprising inner and outer parts, one of which is a dielectric member, cement interposed between said parts and being bonded to one of said parts and having a tapered bearing surface engaging a complementary bearing surface on the other of said parts, said bearing surfaces being unbonded to each other, a graphite lubricant between said bearing surfaces, the direction of taper of said bearing surfaces being such that the load on said insulator presses said surfaces toward each other, the angle of taper of said bearing surfaces being greater than the critical angle at which the friction between said surfaces when so lubricated will prevent relative movement of said parts in the direction of their axes under the force of differential expansion or contraction of said parts so that the resultant of such force will produce relative movement of such parts, relieving the stress set up therein by such force.

ARTHUR O. AUSTIN.