Impact stresses which result from breaking of an electrical transmission line, under a shock load, act to break post insulators which support the line and are secured to supporting poles. The shock load is controlled effectively by supporting proximal ends of the post insulators for pivotal movements through arcuate paths of travel about axes which extend upwardly and outwardly from their respective poles, whereby the shock load is converted into rotary motion and the weight of the line works to dampen the shock load. The pivoting movement is achieved by means of compact, sturdy, inclined hinge assemblies connected between the poles and the proximal ends of their respective post insulators.

2 Claims, 6 Drawing Figures
LINE POST INSULATOR WITH SELF-RESTORING HINGE MEANS

CROSS-REFERENCE

This is a continuation-in-part of U.S. application Ser. No. 43,817 filed June 5, 1970 now abandoned.

BACKGROUND

In large electrical transmission systems, supports for line conductors are cantilevered outward from towers and incorporate truss-like structural arrangements which pivot about axes inclined upwardly and outwardly from the towers so that pivoting movement thereof dampens sudden shock loads that may be imposed on the line conductors. Such installations are taught in U.S. Pat. No. 1,696,569 to Mr. H. O. Hill and in U.S. Pat. No. 2,587,587 to Mr. R. G. Bellezza et al.

The present invention relates to supporting one or more electrical transmission lines from pole or similar structures on horizontal line post insulators. This invention is concerned with dampening shock loads which may be imposed suddenly on post insulators adjacent to a point of braking or other mechanical failure of a line conductor being supported.

It is now customary to use an electrical transmission line system in which lines are anchored fixedly to horizontal post insulators which in turn are supported on poles. Spans between poles may be of considerable length, and relatively large tension forces may be required to be exerted and maintained on each span of line. Because the tension forces exerted on the line may be of an order of magnitude of several thousand pounds, the post insulators are subject to a sudden shock load in the event a line is broken or in the event tension is unbalanced otherwise. Such a shock load, acting through the post insulators, may cause considerable breakage thereof. Failure of a line being supported may give rise also to cascading failures of post insulators in opposite directions resulting in severe damage to a substantial portion of the transmission line system.

SUMMARY OF THE INVENTION

A chief objective of this invention is to improve post insulator construction and to provide for dampening of shock loads in post insulators occurring adjacent to a point of failure of a supported line.

Another objective of the invention is to provide an improved hinge structure which is especially useful for horizontal post insulators, which readily and practically can be connected in cantilever fashion between a pole and a post insulator.

These objectives are realized by supporting a proximal (relative the pole) end of each of the horizontal post insulators for pivoting movement through an arcuate path of travel about an axis which is inclined upwardly and outwardly from the pole. An unbalanced shock load in a broken line (or other unbalanced force conditions) thereby is translated into rotary motion and swings the post insulator into a raised position so that breakage of the post insulator is substantially avoided. Further, the weight of the line acting downwardly opposes the unbalanced moment about the inclined axis thus tending to restore equilibrium to the system. To support the horizontal post insulator for its pivoting movement, an inclined bracket assembly has been designed to be secured fixedly to the pole and to engage hingedly the proximal end of an insulator element.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objectives, features and advantages of the invention will be understood more fully from the following detailed description viewed in conjunction with the accompanying drawings wherein like numerals designate like parts and wherein:

FIG. 1 is a diagrammatic view illustrating an electrical transmission line system including poles with post insulators anchored to the poles and arranged to support an electrical transmission line.

FIG. 2 is another diagrammatic view similar to FIG. 1 but indicating a broken line.

FIG. 3 is a plan view of a post insulator according to this invention and illustrating in dotted lines positions which are assumed by the post insulator and the line when a failure occurs.

FIG. 4 is a side elevation view of the post insulator of FIG. 3.

FIG. 5 is a front elevation view of the post insulator of FIG. 3.

FIG. 6 is a perspective view showing components of the post insulator in separated relationship.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring more in detail to the drawings, an electrical transmission line system is illustrated diagrammatically in FIG. 1. As indicated therein, a series of spaced transmission line poles P1, P2, P3, P4, P5 and P6 support an electrical conductor line C which is secured at each of the poles by horizontal post insulators illustrated diagrammatically by reference characters L1, L2, L3, L4, L5 and L6. Line C is held under tension which may be of several thousands of pounds in magnitude and this tension is present normally in substantially balanced relationship in each of the spans of conductor between adjacent post insulators, which spans are denoted by numerals S1, S2, S3, S4 and S5. As noted earlier, heavy overloading or a break in line C at a point in one of the spans can exert shock loads in post insulators occurring at both sides of the point of break, and these shock loads may be of sufficient magnitude badly to damage the post insulators.

In FIG. 2 there has been illustrated diagrammatically a sudden overloading and braking at point B induced by reason of a vehicle impact resulting from loss of control of vehicle V. It will be understood that overloading and/or breaking of line C may be brought about by various other causes, such as galloping in the line, unequal ice loadings and seizure of stringing blocks during construction. Irrespective of how the break is caused, it will be observed readily that braking span S4 at point B necessarily produces a shock load or sudden imbalance of tension forces and these unbalanced tension forces are exerted on post insulators L3 and L5, and to a lesser degree on post insulators L2 and L6.

In accordance with the present invention, the unbalanced tension forces thus developed are controlled by translating them into pivotal motion and there is induced moments of forces which swing insulators adjacent break point B into raised positions, and as this
occurs breaking of insulator body portions is substantially avoided. Translation of unbalanced tension forces is accomplished, as noted earlier, by supporting the post insulators for pivoting movement about axes of rotation which extend upwardly and outwardly from their poles.

In FIGS. 3-6, there is illustrated a preferred embodiment of horizontal post insulator according to this invention with which unbalanced tension forces in a broken line C are controlled. In general the post insulator is comprised of a bracket B1 mounted on the pole and hinge B2 supported pivotally on bracket B1 and which carries insulator element 2 with attachment means connected to the distal (relative the pole) end thereof for supporting electrical transmission line C. Insulator element 2 is of ceramic (or like material) capable of furnishing a high dielectric characteristic. At the distal end of insulator 2 is provided clamp 4 on retaining part 6, and secured in claim 4 is line C. At the proximal end of insulator element 2 is bolted or otherwise fastened hinge B2 of a hinging arrangement generally designated H. Numeral 10 denotes a pole to which is secured bracket B1 by means of bolts or other desired fastenings. Bracket B1 and hinge B2 are arranged as is shown most clearly in FIGS. 3 and 4, and have supported therebetween complimentary bearing sleeves 15 and 17 as well as hinge sleeves 19 and 21. FIG. 6 illustrates bearing sleeves 15 and 17 as well as hinge sleeves 19 and 21 in separated relationship and shows a pivoting bolt or rod 16 with a threaded nut for attaching these hinge means together in pivoting relationship. Spaced bearing sleeves 15 and 17 are mounted in inclined positions on proximal webs 13 and 18 integral with the base of the bracket. Similarly, hinge B2 is made up of a pair of spaced hinge sleeves 19 and 21 which are mounted on distal webs 23 and 25 and are integral with hinge plate B2. Upper proximal web 13 is provided with upper proximal flanges 26, lower proximal web 18 is provided with lower proximal flanges 27, upper distal web 23 is provided with upper distal flanges 28 and lower distal web 25 is provided with lower distal flanges 29. Hinges B1 and B2 preferably are each cast integrally for structural integrity.

By means of the arrangement of parts described, it will be observed that the movable hinge B2 is supported for pivotal movement about an axis of rotation comprised by the pivot bolt 16 and which extends angularly upwardly and outwardly from pole 10. In the case of an electrical transmission line in which tension forces are substantially balanced, as normally occurs in each of the spans S1, S2, etc., the weight of line C operates to position each of the hinges B2 in a normally centered position with respect to the vertical axis of its pole.

When a break of other unbalance occurs in line C along any of the spans, tension forces in the broken span are instantly released and those insulators immediately adjacent to the break point are suddenly subjected to shock loads of unbalanced tension forces which act transversely of the post insulators. As this occurs, movable hinge B2 provides for translation of the unbalanced tension forces into rotary motion about pivot bolt 16 and moments of forces exerted provide for displacement of hinge B2 through an arc of travel about the inclined axis of bolt 16 into positions as shown in dotted lines in FIGS. 3 and 5, and as a result, some of the unbalanced tension forces are absorbed or dissipated in raising movable hinge component B2 and adjacent portions of line C. It will be evident that by translation of the unbalanced tension forces into rotary motion in the manner described, insulator element 2 is relieved substantially of the tension forces which could exceed the elastic limit of the material of the insulator element, and therefore, breakage of the insulator is avoided.

It will be understood that one may vary the inclined hinge arrangement as well as the upward and outward inclination of the axis about which pivoting is provided. For example, in place of the spaced bearing sleeves in bracket B1, one may employ a single rod fixed at an angle to the pole and allow a movable hinge to pivot on the rod. The movable hinge may have a continuous sleeve for engaging over rod 16. Various other hinging arrangements also may be employed and the bracket may be anchored to a pole in such a way as to swing or pivot slightly to impart a compounded hinging action. Also, movable hinge B2 may be attached permanently to insulator element 2.

The inclined hinging arrangement is characterized by a number of desirable features from an installation standpoint in an electrical transmission line. In addition to the implied application to tangent structures, one may apply the same device to angle structures where the direction of the transmission line changes. A limited number of parts are employed so that weight is kept at a minimum and installation can be accomplished very quickly and conveniently during construction. The pivoting arrangement permits restoration of the post insulator to a normally positioned relationship with its associated pole when a broken conductor has been repaired. The arrangement of parts provides for supporting heavy conductor loads by post insulators which post insulators can handle relatively large increases in loads during icing and other unusual conditions in use. Finally, while there has been illustrated a horizontal line post insulator, the axis of insulator element 2 may extend either vertically or angularly, as desired for various effects.

It will be understood that for any given transmission line tension and weight per span, one may provide a post insulator in which mechanical strength is designed by appropriate dimensional characteristics and material properties to carry loads which may be encountered. It will be understood further by those skilled in design and installation of line post insulators and/or electrical transmission systems that wide deviations may be made from the foregoing preferred embodiment without departing from the spirit of invention set forth in the following claims.

I claim:

1. A post insulator to provide support for an electrical transmission line in spaced and insulated relationship from a generally vertical support structure and comprising in combination: a bracket with means for connecting it fixedly to the support structure, the bracket provided with a stationary hinge means and a movable hinge means with means engaging them pivotally each to the other about an axis which is inclined outwardly and upwardly from the support structure,
an insulator element having a proximal end and a
distal end relative the support structure and with
the proximal end connected fixedly to the movable
hinge means,
the distal end connected to the electrical transmis-
sion line and providing its sole support from the
support structure.
2. The post insulator of claim 1 with the insulator ele-
ment arranged horizontally.

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