ELASTOMERIC SPACER AND/OR DAMPER FOR ELECTRICAL CONDUCTORS

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ABSTRACT
A resilient spacer and/or motion damper for overhead line electrical conductors, which includes an arm having at one end a clamp for receiving an electrical conductor and the other end extending articulately with an elastomeric member into the cavity of a multi-arm spacer hub or a damping weight. The articulated end is permitted controlled movement under resilient restraint and is provided with a fail safe stop.

16 Claims, 4 Drawing Figures
ELASTOMERIC SPACER AND/OR DAMPER FOR ELECTRICAL CONDUCTORS

This invention relates generally to devices for controlling the movement of overhead electrical transmission lines or conductors. The present invention is adapted to be employed as a "line damper" or "line spacer-damper." The function of the former is solely to dampen the movement of a single line, whereas the function of the latter serves to dampen the movement of and maintain two or more "bundled" lines at a predetermined distance.

In the prior art such spacer-damper devices are already well known and in use. Conventionally, such devices employ an articulated arm which projects into a hub with an elastomeric bushing interposed therebetween to resiliently oppose the forced movement of the arm. In the usual situation such forced movement of the overhead line is caused by wind to which the lines are exposed. Hence, the resiliently arranged arms are caused to move almost constantly and sometimes very violently. It becomes therefore important to dampen and soften this movement of and between the conductors in order to do the least violence to the elastomeric member in order to prolong its life and the life of the conductor(s). Line dampers per se have heretofore been constructed without any suitable elastomeric resilient restraint although the benefits of such construction are manifold.

While the spring rate of the elastomeric material can be affected by a judicious selection of the compounding materials, it has been found that this approach by itself does not overcome or provide the desired operating characteristics.

The present invention is intended to provide a device in which the compression of the elastomeric member due to the movement of the arm is reduced and a relationship that may be termed — rolling contact — with soft deflection is established. Such rolling contact provides a relatively soft spring rate when conical or axial movement of the hub relative to the hub or weight takes place.

A further object of the present invention is to provide a device in which the likelihood of disintegration of the elastomeric member is minimized; however, if and when such disintegration should take place, the arm will be prevented from completely leaving the hub or damping body by means of a fail safe stop.

These objectives are accomplished by providing a device for spacing and damping the movement of two or more conductors, or for damping the movement of individual conductors, of an overhead electrical transmission line. The device includes a rigid multi-body member formed with an annular cavity in the periphery thereof, the walls defining the cavity have a radial enlargement located intermediate to the axial ends and establishing in axial cross-section a first constricted area which is curved in an axially concave manner. A rigid arm extends with a concavely formed shaft-like portion articulately into the cavity with its axis substantially perpendicular to the plane of the constricted area. The arm has at the opposite end a clamp for receiving the electrical conductor. A generally tubular elastomeric member is mounted on the shaft-like portion and is interposed under radial compression between the latter and the walls of the cavity. The outside surface of the axially central portion of the elastomeric member has a curvature approximating a mirror image of the radial enlargement of the cavity.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

In the drawings:

FIG. 1 is a side elevational view, partly in section, of a multi-arm conductor spacer hub;

FIG. 2 is a view similar to FIG. 1 showing a triangular hub with a plurality of spacer arms;

FIG. 3 is a view similar to FIG. 1 illustrating a line damper; and

FIG. 4 is an axial section of the elastomeric member in its free state.

Referring now to the drawings, there is shown in FIGS. 1 to 3 an arm 10 having at one axial end a conventional clamp 12 provided with hinged jaws 12a, 12b for receiving and holding a conductor (not shown) in an elastomeric member 14.

The opposite end of the arm 10 articulately extends into a cavity 16 formed in a rigid multi-body member. The term multi-body member is used herein to denote hubs 18 and 19 each adapted to receive a plurality of arms 10, as well as a substantially solid damping body 20, the former being illustrated in FIGS. 1 and 2, and the latter in FIG. 3.

The multi-body member (18, 19, 20) is composed of two or more plates or shells which are secured together with screws, bolts or the like, and in assembled condition establish the annular cavity 16 in the periphery thereof. The wall or walls 22 of the cavity 16 define an opening which is generally cylindrical and of uniform diameter except that intermediate to the axial ends (one end being the solid wall 24 and the other end being formed by the mouth 26 of the cavity 16) there is formed a radial enlargement 28 which establishes in axial cross-section a first constricted area.

The radial enlargement 28 is curved in an axial direction and is located proximate to the longitudinal center of the cavity 16 and its diameter increases from its smallest diameter toward the opposite axial ends. The cavity defines another radial constriction, see 30, the latter being formed close to the mouth 26 of cavity 16. As with the first constriction, the second enlargement is preferably also circumferentially or peripherally continuous, although such continuity is not essential to carry out the function of the second constricted area.

That portion of the arm 10 which extends into the cavity 16 is shaft-like, see 32, and its longitudinal axis is arranged in its unbiased state (i.e., without being under the influence of wind forces) substantially perpendicular to the plane of the first constricted area formed by radial enlargement 28.

The shaft-like portion 32 of arm 10 forms in axial cross-section a substantially concave outside surface which is generally in overall symmetrical alignment with the enlargement 28, which is to say, that the smallest inside diameter of the enlargement 28 coincides with or is juxtaposed to the smallest outside diameter of the shaft-like portion 32.

More specifically, the shaft-like portion 32 terminates within the cavity with an enlarged flange or outwardly flared rim 34 whose maximum outside diameter at least equals or exceeds the smallest outside diameter of the enlargement 28 so as to preclude the arm from
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3. The flange 34 thus provides a metal to metal fail safe contact. The axial extensions or segments of the shaft-like portion 32 generally located within the cavity 16 comprise an axially central segment 36a, and two oppositely contiguous segments 36b and 36c. Segment 36a has a substantially uniform diameter while segments 36b and 36c decrease in outside diameter towards the central segment. The segment 36c faces the radial enlargement 30. The two parts are dimensioned in such a manner so that the inside diameter of the enlargement 30 is substantially greater than the outside diameter of the segment 36c. Thereby the enlargement functions to limit the maximum conical movement of the arm by serving as a metal to metal stopper.

Mounted on the shaft-like portion 32 and more particularly segments 36a, 36b and 36c is an elastomeric member 38. In FIGS. 1 to 3 the member 38 is shown in its normal situ interposed under radial compression between the walls of the cavity 16 and the portion 32. The FIG. 4 shows the member in its relaxed or free state.

The elastomeric member 38 is generally tubular and the inner surface is of substantially uniform diameter while the outer radial surface can be divided again, for convenience of description, into three segments, viz. 40a, 40b and 40c. The opposite axial end segments, see 40a and 40c, are outwardly flared in their free and assembled state while the intermediate segment 40b is curved substantially in a mirror image to the curved enlargement 28. The curved surface 40b is arranged between and substantially contiguous to the flared segments 40a and 40c so as to give the appearance of a small corrugated part.

As will be noted from FIG. 4, the curvature of the flared segments 40a and 40b begins at the axial end faces proximate to one half of the radial thickness of the elastomeric member. The end face 42 axially recedes and then merges into the curvature of the flared surface. In assembled condition one end face 42 abuts enlarged end or rim 34. The outside diameter of the flared segments 40a and 40c is greater than the inside diameter of the enlargement 28 to effect that the outer surface of the member 38 “hugs” the enlargement 28 and permits a rolling contact (in a limited sense) between the contact surfaces. For this purpose it is desirable that the smallest diameter of the outer surface 40b coincides approximately with the smallest diameter of the enlargement 28. The member 38 is generally symmetric. When viewed from the mid point or longitudinal center, the smallest outside diameter is located close to this center.

From the above description it will be obvious that the arm 10 with or without member 38 cannot simply be inserted into the cavity 16. For this reason the body 18, 19, 20 is a multi-section plate or the like. Normally, the member 38 is first forced over the shaft-like portion (36a, 36b, 36c) and thereafter the individual plates (not shown as such) are assembled around the latter and are then secured together. This eliminates having to mold the member 38 in two pieces (semi-cylindrical) as is frequently the practice in the prior art.

While there have been described what are at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is aimed, therefore, in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. Device for spacing two or more conductors and the damping movement thereof, or for damping the movement of individual conductors, of an overhead electrical transmission line, comprising:

   a rigid multi-body member formed with an annular cavity in the periphery thereof, the walls defining the cavity having a radial enlargement located intermediate to the axial ends and establishing in axial cross-section a first constricted area which is curved in an axial direction;

   a rigid arm having at one end a clamping means for receiving a conductor and at the other end being provided with a shaft-like portion extending articulately into said cavity with its longitudinal axis substantially perpendicular to the plane of the constricted area;

   said shaft-like portion forming in axial cross-section a substantially concave outside surface, said portion being arranged in said cavity generally in symmetrical alignment to the constricted cross-section an including an enlarged flange whose outside diameter exceeds the inside diameter of said constricted cross-section;

   and generally tubular, elastomeric member mounted about said shaft-like portion and interposed under radial compression between the latter and the walls of said cavity, the outside surface of the axially central portion of said elastomeric member having a curvature approximating a mirror image of said enlargement.

2. A device according to claim 1, wherein said cavity is formed with a second constricted cross-section, said second cross-section being located proximate to the periphery of the said body member, the inside diameter of said second constricted cross-section being substantially greater than the outside diameter of the shaft-like portion except for said enlarged flange.

3. A device according to claim 1, wherein the enlargement defining the first constricted cross-section substantially gradually decreases from the smallest inside diameter towards the opposite axial ends.

4. A device according to claim 1, wherein said shaft-like portion has an axially central segment with adjacent axial segments on opposite sides of the central segment decreasing in outside diameter towards said central segment.

5. A device according to claim 4, wherein said central segment has a substantially uniform diameter.

6. A device according to claim 1, wherein said elastomeric member has outwardly flared opposed ends.

7. A device according to claim 6, wherein the curved surface of said elastomeric member is between and substantially contiguous to said flared opposed ends.

8. A device according to claim 7, wherein the surface of at least one axial end face defined by about one half the thickness of the elastomeric member is curved to merge into one flared end.

9. A device according to claim 6, wherein the outside diameter of at least one of said outwardly flared opposite ends is greater than said inside diameter of said first constricted cross-section.
10. A device according to claim 6, wherein the smallest diameter of said outer surface between the axial opposed ends coincides approximately with the axial center of the elastomeric member.

11. A device according to claim 6, wherein said elastomeric member is substantially symmetrical about the longitudinal center of the member.

12. A device according to claim 6, wherein the outwardly flared opposed ends of the elastomeric member have maximum outside diameters which are substantially identical.

13. A device according to claim 1, wherein one axial end of said elastomeric member bears against said enlarged flange.

14. A device according to claim 1, wherein said rigid multi-body member is a two shell substantially solid weight secured together.

15. A device according to claim 1, wherein said rigid multi-body member is a two shell hub adapted for receiving a plurality of said shaft-like portions.

16. Device for spacing two or more conductors and damping the movement thereof, or for damping the movement of individual conductors, of an overhead electrical transmission line, comprising:
   a rigid multi-body member formed with an annular cavity in the periphery thereof, the walls defining the cavity having a radial enlargement located intermediate to the axial ends and establishing in axial cross-section a first constricted area which is curved in an axial direction;
   a rigid arm having at one end a clamping means for receiving a conductor and at the other end being provided with a shaft-like portion extending articulately into said cavity with its longitudinal axis substantially perpendicular to the plane of the constricted area;
   said shaft-like portion forming in axial cross-section a substantially concave outside surface, said portion being arranged in said cavity generally in symmetrical alignment to the constricted cross-section;
   a generally tubular, elastomeric member mounted about said shaft-like portion and interposed under radial compression between the latter and the walls of said cavity, the outside surface of the axially central portion of said elastomeric member having a curvature approximating a mirror image of said enlargement;
   and wherein the shaft-like portion within said cavity includes an enlarged flange of an outside diameter substantially equaling the inside diameter of said constricted cross-section and which, together with the thickness of said elastomeric member, significantly exceeds the inside diameter of said constricted cross-section thereby being effective to prevent the axial dislodgement of the shaft-like portion out of said cavity.