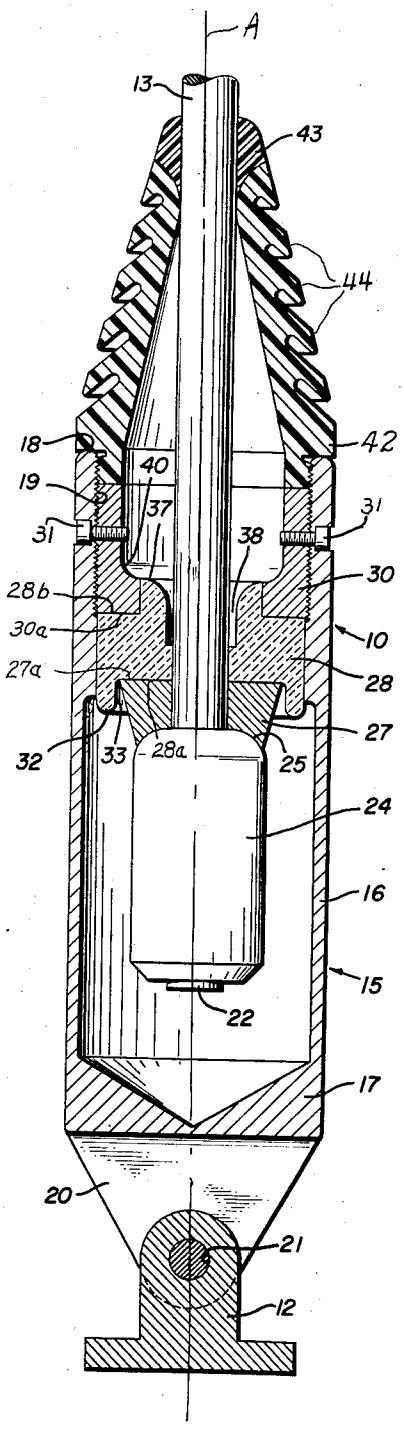
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STRAIN INSULATOR

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STRAIN INSULATOR

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1 Claim. (Cl. 174—163)

This invention relates to a strain insulator for mechanically connecting two tension members having different electrical potentials.

A surface ship carrying radio equipment requires an outside antenna which generally comprises a length of electrically insulated wire supported independently above the deck. The antenna wire often is difficult to mount separately on certain types of ships, particularly sailing craft, without creating a problem of interference with the boom and sail-hoisting gear of the ship. A guy wire, mast-supporting cable or similar tension member is suitable electrically for use as an antenna and would overcome the problems of separate antennas if such a tension member could be efficiently electrically insulated without impairing its load-bearing function. Moreover, the problem of providing serviceable outside insulators for seagoing ships has been complicated by salt-water spray which seriously impairs proper functioning of the insulators. Our invention concerns an improved strain insulator for this general purpose and which overcomes the difficulties of insulator breakdown which results from constant exposure to salt-water spray.

An object of our invention is the provision of a compact strain insulator that is capable of withstanding high tensile loads. Another object is the provision of a strain insulator assembly in which the components having different electrical potentials and minimum air space between them are completely enclosed and sealed so that the possibility of leakage between these components as a result of dust, water and other foreign matter is minimized. Still another object is the provision of a strain insulator in which undesirable capacitance is substantially eliminated. A further object is the provision of a strain insulator which will continue to support a tension load in the event of mechanical failure of the insulating material. A more specific object is the provision of a strain insulator which can be mounted on the end of a cable without necessitating back looping of the cable. A further object is the provision of a rugged, foolproof strain insulator that has a minimum protrusion.

These and other objects of our invention will become apparent from the following description of a preferred embodiment thereof, reference being had to the accompanying drawing comprising a longitudinal section through the insulator assembly.

A preferred embodiment of our invention is shown in the drawing as a generally cylindrical strain insulator **10** symmetrically arranged about a longitudinal axis A and connected at opposite ends to tension members **12** and **13**, respectively, which extend outwardly from the insulator along the axis A. By way of example, member **12** may be a link of a turnbuckle that is anchored to the deck of a sail ship and member **13** may comprise a metallic guy wire or cable which extends to the top of the mast. In such an application of our strain insulator, the guy wire is mechanically connected to the mast through another and substantially identical strain insulator so that the length of guy wire between the insulators is electrically isolated from the ship structure and as such is suitable for use as an antenna for radio equipment.

Insulator **10** comprises an outer tubular element shown as a cup-shaped, metallic sleeve **15**, preferably made of Monel metal, having a cylindrical side wall **16**, an end wall **17**, and an open end **18** formed with internal threads **19** adjacent to the mouth of the opening. Tension member **12** is mechanically connected to sleeve end wall **17** by suitable means such as a projection **20**, which is integral with and extends outwardly from the end wall and which has an aperture **21** by means of which member **12** is secured to the projection. Tension member **13** extends through the open end of the sleeve radially spaced from side wall **16** and with the inner end **22** of member **13** axially spaced from end wall **17** when the insulator is under load.

In order to adapt the end **22** of member **13** for transmitting tension forces to sleeve **15**, an enlarged sleeve-like element **24** having a diameter greater than member **13** is secured as by swaging near the end **22** of the member. The end face **25** of element **24**, remote from end **22** of member **13**, is curved as shown and defines an outwardly extending shoulder on member **13**. A frustoconically shaped bushing or inner compression ring **27** disposed coaxially of member **13** ahead of element **24** is formed to seat on shoulder **25** and has a load-bearing face **27***a* on the side toward the open end of sleeve **15**. Element **24** and ring **27** together comprise an abutment on member **13** for transmitting mechanical forces from member **13** to sleeve **15**. An electrical insulating ring **28**, preferably made of a laminated plastic material such as a melamine reinforced with glass fiber, fits closely around tension member **13** and engages the inner surface of sleeve **15** for radially supporting the member within the sleeve. Ring **28** has a flat face **28***a* engageable with face **27***a* of ring **27**. The axial forces of member **13** are applied to sleeve **15** through an outer compression ring **30** which preferably threads into the open end of the sleeve and extends in from sleeve wall for a limited distance. Ring **30** has an inside diameter substantially greater than the diameter of member **13** and has an inner load-bearing face **30***a* which engages the adjacent face **28***b* of insulating ring **28**. Ring **30** essentially comprises a removable end flange on sleeve **15** and transmits tension forces from sleeve **15** to member **13** through insulating ring **28** and inner compression ring **27**. When the strain insulator is fully assembled, ring **30** is axially spaced from the open end of the sleeve and is secured to the sleeve by a plurality of set screws **31**. It will be noted that mechanical forces which load the members **12** and **13** in tension are applied in opposite directions against insulating ring **28** so that the latter is stressed mainly in compression. Since electrical insulators generally have maximum strength when stressed in compression, our strain insulator is capable of withstanding tension loads of high magnitude in the order of 15,000 pounds or more without encountering mechanical failure of the insulating material.

Insulating ring **28** fits snugly between tension member **13** and the inner surface of sleeve **15** and effectively electrically insulates these parts from each other and likewise insulates the inner compression ring **27** from outer compression ring **30**. In order to reduce electrical leakage between ring **27** and sleeve **15**, the surface between the outer edge of ring face **27***a* and sleeve **15** is lengthened by means of an annular rib **32** formed on the face **28***a* of insulating ring **28**. Rib **32** projects over the adjacent outer marginal edge of compression ring **27** and the inner surface **33** of the rib is spaced outwardly from ring **27**. With this arrangement, electrical leakage between proximate parts of ring **27** and sleeve **15** is less likely to occur since the surface of the rib is sufficiently long substantially to prevent such leakage. The opposite or upper face **28***b*

of the insulating ring is formed with a similar axially projecting annular rib 37 having a smaller diameter than rib 32. Rib 37 extends between compression ring 30 and member 13 and insulates these parts from each other. Insulating ring 37 preferably is counterbored as indicated at 38 effectively to increase the length of the leakage path around rib 37 from ring 30 to the point of contact of the insulating ring with member 13. It will be noted that the inner surface 40 of ring 30 curves outwardly from its junction with rib 37 to further increase the radial spacing between adjacent portions of member 13 and ring 30 and to minimize undesirable capacitance between the parts.

In order to insure that the coupling between tension members 12 and 13 is maintained in the event of a mechanical failure of insulating ring 28, the maximum diameter of face 27*a* of inner ring face 27 is substantially greater than the minimum diameter of face 30*a* of outer ring 30, and accordingly these opposed faces of the rings radially overlap each other; that is, portions of ring faces 27*a* and 30*a* are axially aligned. The width of radial overlap of ring faces 27*a* and 30*a* is sufficient to provide adequate load-bearing engagement between the respective compression rings if insulating ring 28 should fail and continued mechanical coupling of the tension members is assured.

In order to cover the open end of sleeve 15 and to seal the interior of the strain insulator, a bullet-shaped cap 42 made of insulating material, such as nylon, is threaded into the open end of sleeve 15 and tapers from a maximum diameter at the sleeve to a minimum diameter remote from the sleeve for snug engagement with member 13. A sealing compound 43 seals the outer end of cap 42 to member 13. The exterior of cap 42 preferably is formed with a series of annular fins 44 for improving the surface insulation of the cap.

The procedure for assembling the strain insulator is as follows: cap 42, outer compression ring 30, insulating ring 28 and inner compression ring 27, in that order, are slipped over the end 22 of tension member 13, and element 24 thereafter is swaged on the end of the tension member. Sleeve 15 is telescoped over the end of member 13 and the compression and insulating rings 27 and 28, respectively; outer ring 30 is threaded into the open end 18 of the sleeve to the position shown in the drawing, and set screws 31 are tightened to lock ring 30 to the sleeve. Cap 42 then is threaded on the end of the sleeve and against outer compression ring 30, and sealing compound 43 is placed around the junction of cover 42 and member 13 to complete the assembly. Tension member

12 is connected to projection 20 on sleeve end wall 17 and tension is applied through the insulator to tension member 13. The other end, not shown, of member 13 is secured in the same manner to another and substantially identical strain insulator which is anchored to a rigid structure. A suitable electrical connection between member 13 and the radio equipment is made.

Modification of and changes to the above descirbed preferred embodiment of our invention may occur to those skilled in the art without departing from the precepts of the invention. Accordingly, the scope of our invention is defined by the appended claim.

We claim:

A strain insulator for mechanically coupling two tension members, comprising a cup-shaped sleeve having a longitudinal axis and having one end closed and the other end open, means for connecting one tension member to the closed end of said sleeve, the other member extending into the open end of said sleeve and being spaced from the sleeve, a first compression ring within and spaced from said sleeve and positively engaging said other member for transmitting an axial force from said other member toward the open end of said sleeve, a second compression ring spaced from said other member and positively engaging said sleeve for transmiting an axial force from said sleeve in opposition to said first-named force, said compression rings having opposed radially overlapping load-bearing faces, an electrical insulating ring disposed between and in engagement with said faces of the compression rings, said insulating ring having annular ribs projecting axially from opposite ends thereof, one rib being radially spaced from and overlying the load-bearing face of said first compression ring, the other rib being radially spaced from said other tension member and overlying the load-bearing face of said second compression member, and an insulating cap connected to and extending axially out from the open end of said sleeve, said cap converging into sealed engagement with said other tension member for sealing the interior of said sleeve.

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