July 23, 1963 D. G. SPRIGINGS 3,098,894

ELECTRICAL INSULATOR CONSTRUCTIONS

Filed Oct. 16, 1961

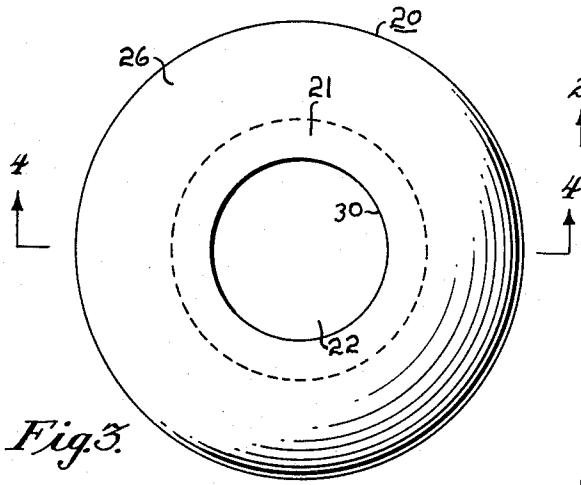

Fig. 3.

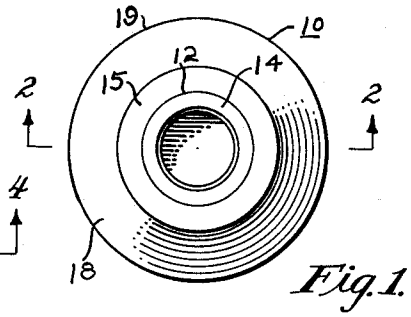

Fig. 1.

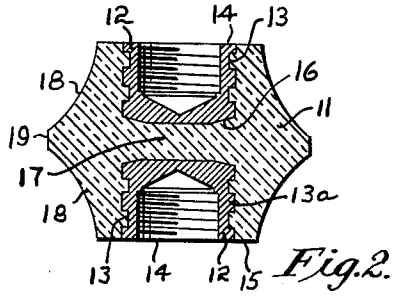

Fig. 2.

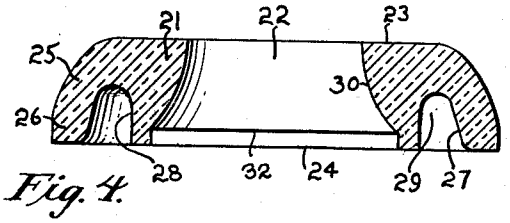

Fig. 4.

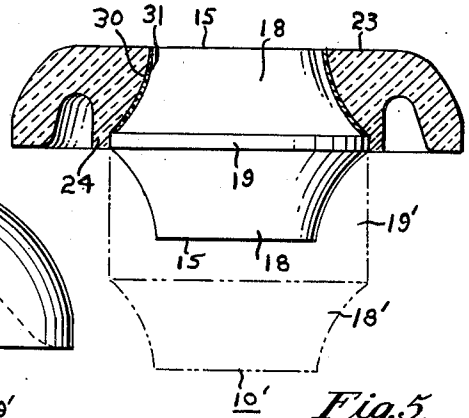

Fig. 5.

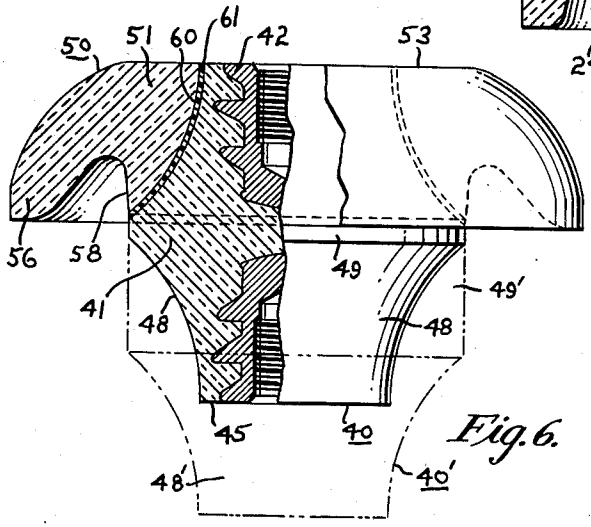

Fig. 6.

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ELECTRICAL INSULATOR CONSTRUCTIONS

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This invention relates generally to electrical insulator constructions, and more particularly relates to an electrical insulator construction which may employ optionally either one or two insulator elements, one of which elements will be hereinafter designated as a body element while the other of the two elements will be designated as a skirt element.

According to the present concept of invention, the body element may be used alone or in conjunction with a skirt element. Additionally, the body and skirt elements are so formed that a family of two-element insulators may be formed by employing a skirt element with one of a plurality of different body elements of differing size. Moreover, the skirt and body elements need not necessarily be made of the same material. For example, since the body element is that to which mechanical securement is made, it may be made of a substance having good insulating properties and superior mechanical strength properties, whereas the skirt element may be made of materials exhibiting superior insulating properties.

Since the skirt element is combined with a body element basically for the purpose of increasing the leakage resistance of the insulator when utilized in a highly contaminating or wet atmosphere, the skirt element can be formed of materials exhibiting high values of arc track resistance and tracking resistance. Arc track resistance is the ability of an insulating material to resist the formation of a conducting path when subjected to electrical arcs across the surface of the insulating material, while tracking resistance is the ability of an insulating material to resist formation of conducting paths when subjected to the continuous application of an electric field stress. Accordingly, it is a primary object of this invention to provide a novel electrical insulator construction which contemplates the provision of an insulating body element and a skirt element so formed that a given skirt element may be utilized with any one of a plurality of different body elements to form a composite insulator, or wherein the body element may be utilized alone.

Another object of this invention is to provide a novel electrical insulator construction as aforesaid wherein the skirt element and body element are formed from different substances directed toward optimizing the insulating properties of the skirt element on the one hand and providing the body element with the combined qualities of good insulation resistance and mechanical strength.

Yet another object of this invention is to provide a novel electrical insulator construction as aforesaid in which the insulator body element is provided with a surface contour which increases the surface insulation resistance while effecting a saving of insulation material.

The foregoing and other objects of this invention will become clear from a reading of the following specification in conjunction with an examination of the appended drawings, wherein:

FIGURE 1 illustrates a plan view of an insulator body element according to the invention;

FIGURE 2 illustrates a longitudinal cross sectional view through the insulator body element shown in FIGURE 1 and as would be seen when viewed along the line 2—2 thereof;

FIGURE 3 illustrates a plan view of an insulator skirt element according to the invention adapted for use with the body element illustrated in FIGURE 1;

FIGURE 4 is a cross sectional view through the skirt element of FIGURE 3 as can be seen when viewed along the line 4—4 thereof;

FIGURE 5 illustrates the skirt element of FIGURE 3 and the body element of FIGURE 1 interfitted and bonded together to form a composite insulator, the body element being shown in elevation and the skirt element being shown in section. Also illustrated in broken lines is a larger body element of the same family as the element shown in FIGURES 1 and 2;

FIGURE 6 is similar to the showing of FIGURE 5 excepting that a larger skirt element than that of FIGURE 3 is illustrated, together with a matching body element illustrated in solid line showing and a dashed line outline of a different body element of the same family.

In the several figures, like elements are denoted by like reference characters.

Turning now to the figures, and considering first FIGURES 1 and 2, there will be seen an insulator body element **10** having an insulator portion illustrated as formed from glass or ceramic insulating material within which are embedded a pair of internally threaded, coaxially aligned, metallic inserts **12**. The inserts **12** are provided on their external surfaces with a plurality of undercuts **13** and knuckles **13***a* into and around which the insulating material **11** is molded to provide a secure mechanical interlock. The outer ends **14** of the inserts **12** are flush with the annular end surfaces **15** of the insulator body material **11**, while the inner ends **16** of the threaded inserts **12** are spaced apart from one another and separated by a thickness **17** of the insulating material. The longitudinally extending outer surface of the body element **10** is contoured to flare radially outward as the surface extends longitudinally from each annular end surface **15** toward the opposite annular end surface **15**, these flared surfaces being designated as **18** in the figures. The radially flared surfaces **18** stop short of intersection with one another and are bridged between by a cylindrical surface **19** of axial extent substantially equal to the thickness **17** of the insulating material intervening the inner ends **16** of the inserts **12**.

The metal inserts **12** may be made typically of steel, brass or aluminum. Optionally, the metal inserts **12** may be dispensed with and the basic insulator material **11** may be drilled and tapped. The insulating material shown sectioned for glass is preferably made of fiberglass reinforced polyester, but may also be made of any high strength plastic such as a suitable epoxy or phenolic resin.

In FIGURES 3 and 4 there is illustrated an insulator skirt element **20** having a hub portion **21** provided with a central through aperture **22** and upper and lower hub end surfaces designated respectively as **23** and **24**. Extending radially outward from the upper portion of the hub **21** and then turning axially downward to a point of termination at approximately the hub lower end surface **24** is a skirt portion **25**. As best seen in FIGURE 4, the lower region **26** of the skirt **25** is of annular form, the inner surface **27** thereof being physically spaced radially outwardly of the outer surface **28** of the hub **21** by the provision of the annular recess **29**. The hub central aperture **22** is defined by the flared inside walled surface **30** which diverges radially outward as it extends longitudinally from the hub upper end surface **23** downward toward the hub lower end **24**, stopping short thereof at the shoulder **32** and continuing to the lower end at a constant diameter. The flare of the hub inside wall surface **30** is the same as the flare of the body element surfaces **18** and the diameter of the hub aperture **22** at its lower end is slightly larger than the diameter of the body element **10** at the point where the radially flared surfaces **18** of the latter join the cylindrical surface **19**

so that when the skirt element 20 is disposed upon the body element 10, as shown in FIGURE 5, the skirt seats upon the body element with the cylindrical surface 19 partially seated in the hub below the shoulder 32. The diameter of the hub central aperture 22 at its upward end is similarly slightly larger than the diameter of the annular end surface 15 of the body element 10 so that a thin annular space is defined between the flared surface 18 of the body element 10 and the flared inside wall surface 30 of the skirt element hub portion 21. This space is filled with a high strength adhesive to permanently bond the body element 10 and skirt element 20, the adhesive being designated in the showing of FIGURE 5 as 31.

In FIGURE 6 there is illustrated a body element 40 and its associated skirt element 50, both of which are seen to generally correspond to their smaller sized counterparts 10 and 20 respectively illustrated and described in connection with the showings of FIGURES 1 through 5. The body element 40 is provided with annular end surfaces 45, radially flared longitudinally extending surfaces 48, and a central cylindrical surface 49 between the radially flared surfaces 48. The internally threaded inserts 42 are molded into the insulating material 41 of which the body element is made. The skirt element 50 is provided with a hub portion 51 and an annular lower skirt portion 56, but the outer surface 58 of the hub 51 is observed to be substantially equal in diameter to the diameter of the body element cylindrical surface 49 so that these two surfaces merge into smooth continuation of one another when the skirt and body elements are bonded together by the adhesive film 61. The thickness of the films 31 and 61 is of course exaggerated in the showings of FIGURES 5 and 6 in order to provide clarity in the drawing.

FIGURES 5 and 6 also show in dashed outline body elements 10' and 40' respectively. The body element 10' differs from the body element 10 only in that the central cylindrical surface 19' is of greater axial extent than is the central cylindrical surface 19, the radially flared surfaces 18' being identical in size and shape to the radially flared surfaces 18. As a consequence, the difference between the body elements 10 and 10' is that there is an increased thickness of insulating material in the region 17 between the facing ends of the threaded inserts to thereby provide an insulator body element of increased insulation properties. Precisely the same relationship is observed to exist between the body element 40 and the body element 40' illustrated in FIGURE 6, namely that the radially flared surfaces 48 and 48' are of identically the same size and contour and that the sole difference resides in the increased longitudinal extent of the central cylindrical surface 49' as compared with the central cylindrical surface 49. The body elements 10 and 10', as well as the body elements 40 and 40', represent two body elements of a family, the members of which differ from one another only with regard to the longitudinal extent of the central cylindrical surface which lies intermediate the radially flared surfaces.

As previously set forth, the body element may be used alone as an insulator or may be used in combination with a proper skirt element. When used alone, the flared surfaces 18 and 48 are effective in discouraging accumulation of dirt particles thereupon because of the relatively steep slope or curvature of these surfaces, this being important because the accumulation of dirt particles upon the surface provides conductive paths which lower the surface resistance of the insulator element. Moreover, the cross-sectional reduction of the flared surfaces 18 from the central cylindrical surface toward the body element end surfaces effects a saving of insulating material as compared to a body element of constant diameter equal to the diameter of the central cylindrical surface, and also increases the length of the surface leakage path. Additionally, when a skirt element is combined with a body element, the annular recess 29 between the skirt 25 and the hub 21 helps to keep the undersurface of the skirt element in a dry condition even in wet weather to thereby help to maintain the surface resistivity of the insulator unit. Finally, the addition of the skirt element to the body element materially increases the strength of the insulator when the latter is secured to a surface with the upper surface of the skirt element placed flatwise in bearing surface engagement and the opposite end of the body element is cantilever loaded.

Having now described my invention in connection with particularly illustrated embodiments thereof, it will be appreciated that variations and modifications of the same may now occur from time to time to those persons normally skilled in the art without departing from the essential scope or spirit of the invention, and accordingly it is intended to claim the same broadly as well as specifically as indicated by the appended claims.

What is claimed as new and useful is:

1. An electrical insulator device comprising a body element and an initially separate skirt element interfitted with the body element and permanently bonded thereto, said body element being formed of insulating material having high mechanical strength and said skirt element being formed of insulating material characterized by high tracking resistance and high arc track resistance; said body element comprising, a pair of opposite annular end surfaces disposed in spaced apart parallel planes with that axis of symmetry of each end surface which is normal to the plane in which the said surface lies being coaxial with the same axis of symmetry of the other end surface and defining the longitudinal axis of the insulator body element, a cylindrical portion coaxial with the said longitudinal axis of the body element and located axially between said annular end surfaces, the axial extent of said cylindrical surface being less than the spacing between said end surfaces, a radially outwardly flaring surface extending axially inward from at least one annular end surface to the end of said cylindrical portion closest to that annular end surface, the intersection of said flaring surface with planes orthogonal to the longitudinal axis of said body element defining areas of circular outer periphery, and means extending axially into the body element from each end surface for effecting mechanical connections thereto; said skirt element comprising, an axially apertured hub portion having upper and lower ends disposed in parallel planes orthogonal to the longitudinal axis of the skirt element, and an annular skirt portion extending radially outward from the upper end of said hub portion and turning axially downward toward the lower end of said hub portion with the inner surface of the annular skirt being spaced radially outward from the outer axially extending surface of said hub portion, the inner axially extending surface of said hub which defines the axial aperture through said hub flaring radially outward as it extends from the hub upper end toward the hub lower end to provide an aperture shaped complementally to the said flared surface of the body element, said body element projecting axially thereinto and being permanently bonded thereto by an intervening film of bonding material.

2. The insulator device according to claim 1 wherein the radially flared axially extending inner surface of said skirt element hub stops short of the hub lower end and continues downward to the lower end at a constant diameter slightly larger than the diameter of the cylindrical surface of said body element to thereby allow the end region of the cylindrical surface to fit snugly therewithin.

3. The insulator device according to claim 1 wherein said pair of annular end surfaces are of equal diameter.

4. The insulator device according to claim 1 wherein said pair of annular end surfaces are of equal diameter and wherein said cylindrical portion is located axially midway between said annular end surfaces.

5. An electrical insulator device comprising a body element and an initially separate skirt element interfitted

with the body element and permanently bonded thereto, said body element being formed of insulating material having high mechanical strength and said skirt element being formed of insulating material characterized by high tracking resistance and high arc track resistance; said body element comprising, a pair of opposite annular end surfaces disposed in spaced apart parallel planes with that axis of symmetry of each end surface which is normal to the plane in which the said surface lies being coaxial with the same axis of symmetry of the other end surface and defining the longitudinal axis of the insulator body element, a cylindrical portion coaxial with the said longitudinal axis of the body element and located axially between said annular end surfaces but of larger diameter than the diameters of said end surfaces, the axial extent of said cylindrical surface being less than the spacing between said end surfaces, a radially outwardly flaring surface extending axially inward from each annular end surface to the end of said cylindrical portion closest to that annular end surface, the intersection of each said flaring surface with planes orthogonal to the longitudinal axis of said body element defining areas of circular outer periphery, and means extending axially into the body element from each end surface for effecting mechanical connections thereto; said skirt element comprising, an axially apertured hub portion having upper and lower ends disposed in parallel planes orthogonal to the longitudinal axis of the skirt element, and an annular skirt portion extending radially outward from the upper end of said hub portion and turning axially downward toward the lower end of said hub portion with the inner surface of the annular skirt being spaced radially outward from the outer axially extending surface of said hub portion, the inner axially extending surface of said hub which defines the axial aperture through said hub flaring radially outward as it extends from the hub upper end toward the hub lower end to provide an aperture shaped complementally to each of the flared surfaces of the body element, said body element projecting axially thereto and being permanently bonded thereto by an intervening film of bonding material.

6. The insulator device according to claim 5 wherein said pair of annular end surfaces are of equal diameter and wherein said cylindrical portion is located axially midway between said annular end surfaces.

7. An electrical insulator device comprising a body element and an initially separate skirt element interfitted with the body element and permanently bonded thereto,

said body element being formed of insulating material having high mechanical strength and said skirt element being formed of insulating material characterized by high tracking resistance and high arc track resistance; said body element comprising, a pair of opposite end surfaces disposed in spaced apart parallel planes with the said end surfaces each being symmetrical with respect to a common axis which is normal to the planes in which said end surfaces lie and which axis also defines the longitudinal axis of the body element, a body portion symmetrical in and coaxial with the said longitudinal axis of the body elemnt and disposed axially between said end surfaces but being of larger cross sectional area than the cross-sectional area of at least one of said end surfaces, the axial extent of said symmetrical body portion being less than the spacing between said end surfaces, a radially outwardly flaring surface extending axially inward from said at least one end surface to the end of said symmetrical body portion closest to that end surface, and means extending axially into the body element from each end surface for effecting mechanical connections thereto; said skirt element comprising, an axially apertured hub portion having upper and lower ends disposed in parallel planes orthogonal to the longitudinal axis of the skirt element, and an annular skirt portion extending radially outward from the upper end of said hub portion and turning axially downward toward the lower end of said hub portion with the inner surface of the annular skirt being spaced radially outward from the outer axially extending surface of said hub portion, the inner axially extending surface of said hub which defines the axial aperture through said hub flaring radially outward as it extends from the hub upper end toward the hub lower end to provide an aperture shaped complementally to the said flared surface of the body element, said body element projecting axially thereinto and being permanently bonded thereto by an intervening film of bonding material.

References Cited in the file of this patent

UNITED STATES PATENTS

1,655,892	Colburn	Jan. 10, 1928
1,778,152	Hawley	Oct. 14, 1930
2,451,969	Mueller et al.	Oct. 19, 1948

FOREIGN PATENTS

307,381	Italy	May 3, 1933
478,170	Great Britain	Jan. 13, 1938