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CONDENSER BUSHING

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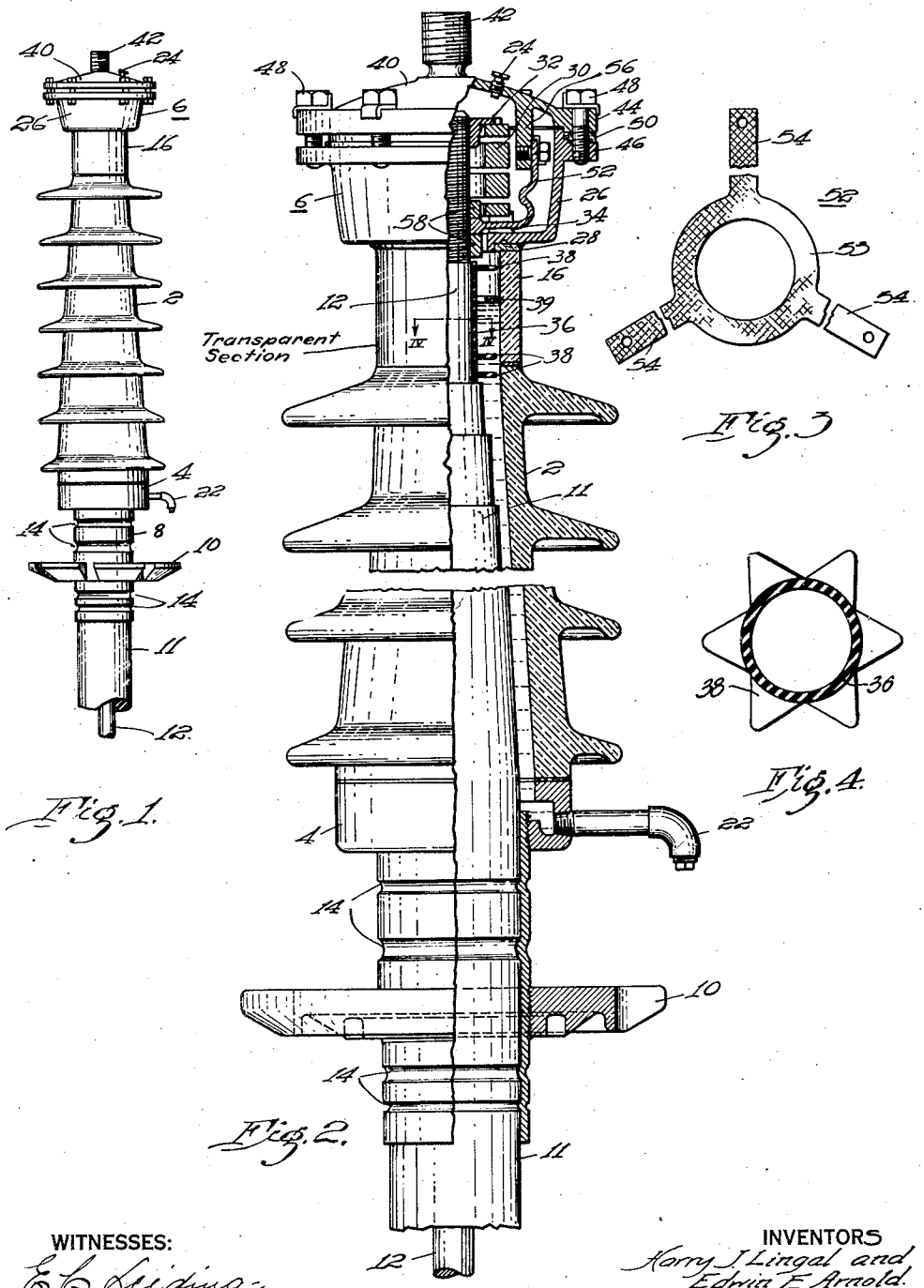

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CONDENSER BUSHING

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The present invention relates to bushings for the electrical insulation of leads to a high-tension electrical apparatus such as encased transformers and circuit breakers.

Bushings of the type contemplated usually comprise a substantially cylindrical weather casing of dielectric material, such as porcelain, mounted upon a flange or collar secured about the opening of the tank of the circuit breaker or transformer. A conductor extending through the weather casing may be connected at its lower end to the electrical apparatus and extends above the upper end for association with a cap closing the end of the casing and means for making connection with an external circuit.

Substantial thought has been given in the past to the design of the cap or upper terminal of the bushing. The bushing is usually filled with oil, or other liquid or semi-liquid dielectric material, thereby necessitating tight joints between the component parts to avoid "breathing" of the bushing with changes in temperature, and this is rendered difficult by reason of the difference in the coefficient of expansion of the porcelain weather casing, the metallic conductor with its surrounding insulation and the metallic fittings of the assembly.

It is an object of the present invention to provide a bushing, or more particularly a terminal cap for a bushing, which will avoid many of the defects inherent in bushings constructed in the past and which affords a desired mechanical and electrical construction in a simple and efficient manner.

Other objects of the invention will be apparent from the following description and the accompanying drawing, wherein:

Figure 1 is a view in elevation with a portion broken away of a bushing constructed in accordance with the present invention,

Fig. 2 is a view in elevation partly in section, on an enlarged scale, of the bushing shown in Fig. 1;

Fig. 3 is a plan view on an enlarged scale of a conducting strap constituting part of the construction shown in Fig. 2; and

Fig. 4 is a view in section of an element shown in Fig. 2 taken on the line IV—IV of Fig. 2.

Referring more particularly to the drawing, a bushing embodying the invention may comprise a weather casing or shell 2 of suitable insulating material, such as porcelain, supported at one end upon a metallic flange 4 and closed at the upper end by a terminal chamber 6. The flange 4 is secured to a tubular metal sleeve 8 to which is secured a mounting flange 10 by means of which the bushing may be supported upon the tank of the electrical apparatus with which the bushing is to be associated.

The bushing encloses a conductor 12 which is insulated from the flanges 4 and 10 and the member 8 by means of a condenser type of insulator 11. This construction is well known in the art and comprises alternately wrapped layers of conducting and dielectric material. The condenser wrapping at the point where it goes through the sleeve 8 is substantially the same diameter as such sleeve and is maintained in position by rolling the sleeve into the condenser wrapping, as indicated at 14, to make a permanent, compressed fluid-tight joint.

A cylinder 16 of transparent material is mounted upon the upper end of the weather casing 2 and the upper end of the cylinder is closed by the metallic terminal chamber or cap 6. In operation the bushing is filled with oil, or other dieelctric fluid-like material to a point midway between the ends of the cylinder 16 so that variations in the level of the fluid may be observed.

In order to drain oil from the bushing, or moisture which may settle to the bottom of the space surrounding the condenser wrapping, a vent 22 may be provided, and, a filling plug 24 may be provided in the top of the terminal chamber 6 in order to add oil to the space within the bushing.

The construction of the chamber 6 is shown in detail in Fig. 2. It comprises a base member 26 proportioned to seat upon the top of the transparent cylinder 16, with a suitable gasket 28 therebetween, and is provided with a central aperture through which the conductor 12 may freely extend. A spiral or other type of compression spring 30 surrounds the upper end of the conductor and rests upon the bottom of the member 26. The upper face of the spring 30 is engaged by a nut 32 having an outwardly projecting flange which overlies the upper convolution of the spring. By screwing down on nut 32 pressure will be exerted through the spring against the bottom of the member 26 and be transmitted through the various parts of the bushing down to the lower flange 4. Accordingly, in spite of variations in temperature or other reasons causing a differential expansion between the conductor 12 and the dielectric parts 2 and 16, all of the gaskets and joints will be maintained in compression ensuring that there will be no breathing action.

Around the aperture in the bottom of the member 26 is provided a plurality of spaced lugs 34

upon which the lower convolution of the spring may rest. Such lugs are preferably integral with the member 26 and are provided with upstanding projections beyond the spring to maintain the spring in a centered position with respect to the conductor and the member 26. Further, the nut 32, by reason of the configuration of its lower part which nests within the spring, prevents lateral movement of the upper end of the spring beyond a predetermined point with respect to the conductor 12. Although normally the spring tension will be sufficient to maintain the parts in their properly assembled relation, the lugs 34 and the nut 32 effectively prevent any lateral movement of the spring 30 which is sufficient to permit the parts to get out of alignment.

A spacing member 36 may be provided to maintain the proper relationship between the conductor 12 and the surrounding dielectric parts. This may comprise a central tube surrounding the conductor and a plurality of outwardly projecting flanges 38. In order not to interfere with the circulation of oil in the bushing, the flanges 38 are preferably of spider form. The spacer 36 and flanges 38 may be of any desired dielectric material and is preferably varnished or otherwise treated to render it impervious to oil, and is supported in position by resting upon the upper edge of a condenser layer.

In order to more clearly indicate the level of the insulating fluid, the spacer 36 may be painted white or colored, and loosely surrounded by a cork float 39 which may be painted black, or other color contrasting with that of the spacer 36. The internal diameter of the float should be substantially greater than the diameter of the sleeve of spacer 36 because in many cases the bushing will be mounted on an angle of as much as 30° from the vertical.

The upper end of the member 26 is closed by a cover 40. It is provided with a stud 42 for making connection to an external circuit, and a peripheral flange 44 adapted to confront a flange 46 on the member 26 and be secured in position by a plurality of bolts 48. A gasket 50 may be disposed between the confronting flanges to make an air and moisture proof joint.

By reason of the construction described, the free end of the conductor 12 is completely enclosed and the entire assembly is sufficiently tight to prevent any breathing action of the bushing. However, the electrical connection between the conductor 12 and terminal stud 42, being through the spring 30 and the member 26, is unsatisfactory for several reasons. The current flowing through the conductor 12 will induce a current in the spring 30 which is, of course, undesirable, and the path from the member 26 through the cover 40 may or may not be electrically efficient depending upon the type of joint made between the confronting flanges 44 and 46. It is proposed therefore, that a flexible conductor 52 be used to connect the conductor 12 directly to the cap 40. Such conducting member may take the form indicated in Fig. 3 which shows a braided collar 53 of a size to slip over the end of conductor 12 and a plurality of straps 54 formed therewith, each of which extends beneath the spring 30 between adjacent lugs 34 to a terminal lug 56 depending from the under face of the cover 40 and suitably bolted thereto. The collar 53 may be secured to the conductor in any suitable manner as by clamping it between a pair of nuts 58. Preferably the straps 54 are of such length that the cover 40 may be removed to afford access to the interior of the bushing without disturbing the electrical connection with the terminal lugs 56.

The construction described affords a relatively simple and quite efficient bushing construction, avoiding many of the undesirable characteristics of bushings used heretofore, and it is desired that no limitations shall be placed upon the invention except as set forth in the appended claims.

We claim as our invention:

1. In an insulating bushing for high-tension electrical apparatus of the type which includes a shell of insulating material, a rigid conductor extending therethrough, and a chambered cap enclosing an end of the conductor and closing an end of the shell; said cap comprising a base of cup shape proportioned to seat on the end of said shell and an aperture therethrough for permitting said conductor to extend loosely into the cap, a compression spring and means for supporting it at one end upon the exposed side of said base and spaced therefrom, means for adjustably securing said spring at its other end to said conductor, a removable cover for said base enclosing the end of said conductor, and a flexible conductor having one end secured to said rigid conductor adjacent to the bottom of said compression spring with the free end of the conductor extending loosely beneath said spring, past the outer surface thereof, and removably connected to said cover within said cap.

2. A bushing as defined in claim 1 in which said flexible conductor comprises a collar of flat flexible conducting material having a plurality of extended portions, means for securing said collar around and to the rigid conductor and means for securing said extended portions to said cover.

3. In an insulating bushing for high-tension electrical apparatus of the type which includes a shell of insulating material, a conductor fixed at one end with respect to one end of said shell and having a free end exposed beyond the other end of the shell and movable with respect thereto; a chambered cap enclosing said free end comprising a base portion proportioned to seat on the end of said shell and having a central aperture for loosely receiving said conductor therethrough, a helical compression spring within said body resting at one end upon the bottom thereof and means for adjustably securing it at its other end to said conductor, a removable cover for said body, and a flexible conducting member electrically connecting said conductor and said cover within said body, a plurality of spaced lugs formed integrally with the bottom of said body for spacing the lower convolution of said spring therefrom, and shoulders on said lugs beyond the outer face of said spring to constitute a centering means for the latter with respect to the conductor.

4. In an insulating bushing for high-tension electrical apparatus of the type which includes a shell of insulating material, a conductor fixed at one end with respect to one end of said shell and having a free end exposed beyond the other end of the shell and movable with respect thereto; a chambered cap enclosing said free end comprising a body portion having a bottom proportioned to seat on the end of said shell and having an aperture for permitting said conductor to extend loosely therethrough, a helical compression spring within said body resting at one end upon the bottom thereof and means for adjustably securing it at its other end to said conductor, a removable cover for said body, a flexible conducting member electrically connecting said conductor and said cover within said body, and a plurality of

spaced lugs formed integrally with the bottom of said body for spacing the lower convolution of said spring therefrom, and means surrounding said conductor within said shell for centering the conductor with respect thereto.

5. A bushing as defined in claim 4 in which a body of insulation surrounds the conductor to a point short of the end of the shell and said centering means abuts and is supported by the end of the insulation.

6. In an insulating bushing for high-tension electrical apparatus of the type which includes a shell of insulating material, a conductor fixed at one end with respect to one end of said shell and having a free end exposed beyond the other end of the shell and movable with respect thereto; a chambered cap enclosing said free end comprising a body of cup-shape having a bottom proportioned to seat on the end of said shell and having an aperture for permitting said conductor to extend loosely therethrough, a spiral compression spring within said body resting at one end upon the bottom thereof and means for adjustably securing it at its other end to said conductor, a removable cover for said body, a flexible conducting member electrically connecting said conductor and said cover within said body, and means for maintaining the desired relative positions of said body, spring and conductor comprising integral lugs on said body having shoulders thereof defining a seat for one end of said spring and a shoulder on the means for securing the other end of the spring to the conductor for limiting lateral movement of that end of the spring.

7. In an insulating bushing for high-tension electrical apparatus of the type which includes a shell of insulating material, a rigid conductor extending therethrough, and a chambered cap enclosing an end of the conductor and closing an end of the shell; said cap comprising a base proportioned to seat on the end of said shell and an aperture therethrough for permitting said conductor to extend loosely into the cap, a compression spring resting at one end upon the exposed side of said base means for adjustably securing it at its other end to said conductor, a removable cover for said base, said base and cover defining a chamber enclosing said conductor, and a flexible conductor having its end electrically connected to said rigid conductor and to said cover, respectively; the base of said cap being provided with integral lugs upon which said one end of said compression spring rests, and said flexible conductor extending from said rigid conductor beneath said spring between adjacent lugs for connection to said cover.

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