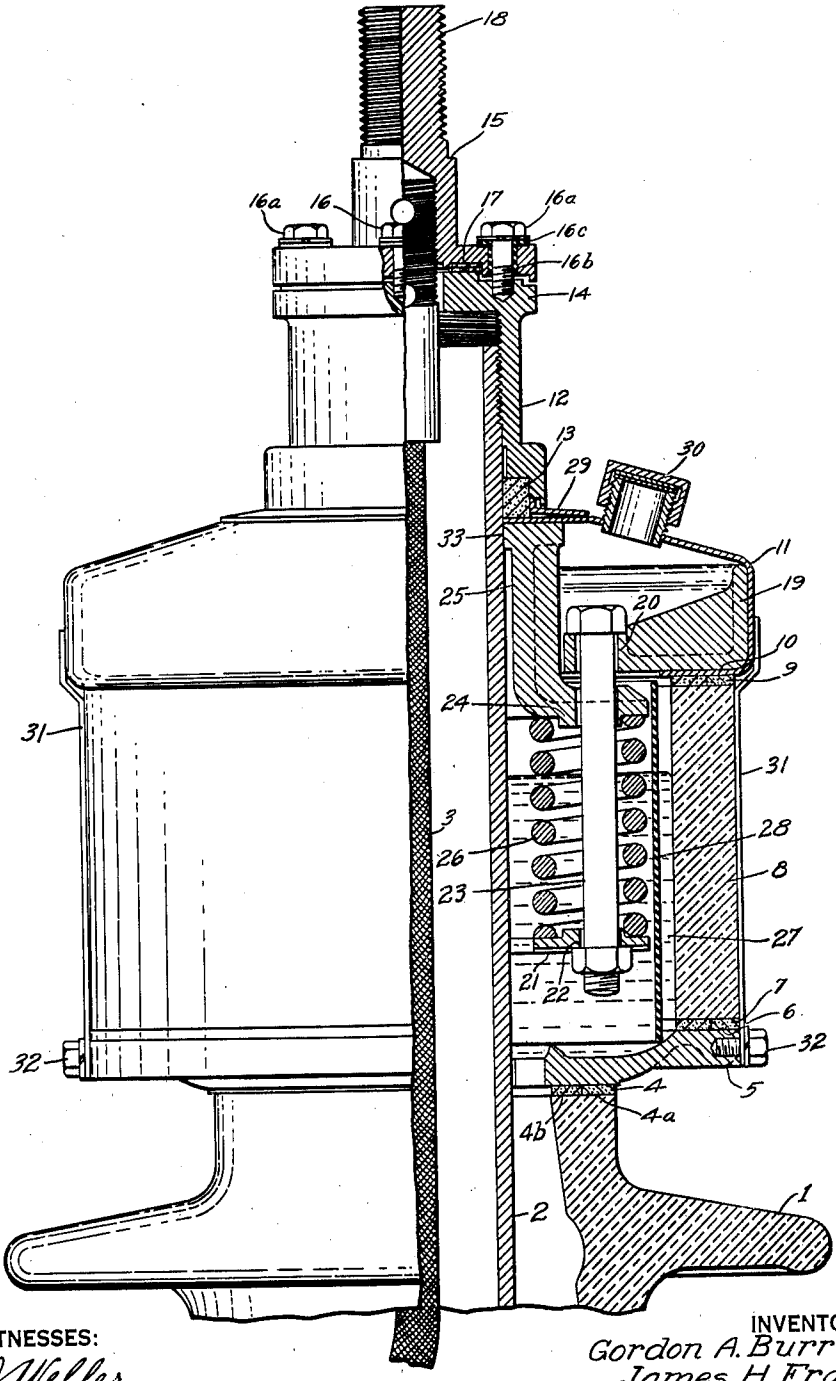
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BUSHING CAP

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BUSHING CAP

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Our invention relates to insulating bushings and has particular relation to a closure member for high-voltage bushings of the type employing an insulating fluid, such as oil or gum. The invention may be employed in usual oil-filled bushings, as well as in fluid-immersed bushings of the well-known condenser type.

One of the most serious difficulties encountered in the construction and design of these bushings is that of sealing the interior against air and moisture. If these elements do get into the bushing, the insulating liquid is likely to deteriorate and its insulating qualitites become impaired. This problem of obtaining a satisfactory seal is particularly difficult because of the different thermal expansion properties of the insulating and metal parts which make up the bushing. According to our invention, we provide a high-voltage bushing with a cap of flexible material which is biased to sealing position by spring means so that the seal is not impaired by temperature changes. Our construction offers the further advantage that it is possible to insulate the conductor from the insulating portion of the bushing for power factor testing without breaking the seal at any point.

It is, accordingly, an object of our invention to provide a novel and improved closing method and means for high-voltage insulating bushings.

Another object of our invention is to provide an improved flexible cap construction for an insulating bushing.

It is another object of our invention to provide an insulating bushing of the fluid-filled type with a cap including a flexible hood which is biased to sealing position irrespective of temperature changes.

A further object of the invention is to provide an insulating bushing which may be readily adapted for power factor testing without disturbing its sealed condition.

Other objects and advantages will appear from the following description taken in conjunction with the accompanying drawing, in which the single figure shows a cap in accordance with our invention arranged on an insulating bushing.

In the drawing is shown a tubular insulating casing 1, which is preferably of porcelain and of a usual construction, having a metallic stud 2 extending therethrough. This stud 2 may be either solid or hollow, as preferred. If a hollow stud such as is shown in the drawing is provided, the stud itself may be employed as the main conductor or a flexible conductor 3 may be disposed therethrough for that purpose. Use of this flexible conductor makes for convenient power factor testing in a manner which will subsequently be described. If it is desired, a condenser arrangement of a usual type may surround the stud 2 within the casing 1.

Disposed on the open upper end of the tubular casing 1 with a gasket 4 therebetween is an annular gauge glass support 5. The gasket 4 is preferably of the type described in U. S. Patent No. 2,000,688 and includes an outer annular member 4a of relatively hard material and an inner member 4b of relatively soft material. Located on an annular seat 6 on the support is a similar gasket 7, on which rests a cylindrical gauge glass 8. Another gasket 9, likewise similar to the gasket 4, is seated on the upper end of the gauge glass and a turned-under portion 10 of flexible metallic closing member or hood 11 is seated thereon. A nut member 12 threaded on the upper end of the stud 2 is arranged to retain a gasket 13 in position against the exterior of the inner edge of the hood 11. Over the open upper end 14 of the nut 12 is located a terminal cap 15 which is secured thereto by bolts 16 and 16a. The joint between the nut 12 and terminal is properly gasketed at 17 and the terminal cap has a threaded upper end 18 for receiving the electrical lead.

The diametrically opposed bolts 16 are passed through the terminal 15 and screwed into the nut 14 in a usual manner. However, the other pair of bolts 16a are electrically insulated from the terminal 15 by means of insulating sleeves 16b and insulating washers 16c. By removing only the bolts 16, it is thus possible to insulate the cap 15 and conductor 3 from the nut 12 for power factor testing without disturbing the seal 17. It will be evident that different numbers of bolts and different arrangements of insulated and uninsulated bolts may be employed if desired.

Within this cap structure and seated against the interior of the portion 10 of the hood 11 is an annular sealing plate 19 having a plurality of apertures 20 near its inner edge. A clamping ring 21 having holes 22 corresponding with the apertures 20 is disposed from the sealing plate by means of a plurality of bolts 23. These bolts also extend through holes in a vertical flange portion 24 of a clamping plate 25 which encircles the stud 2. Around each of these bolts 23 is a helical spring 26 which is compressed between the clamping ring 21 and the flange 24. The gauge glass 8 serves as an expansion cham-

ber for an insulating liquid designated by 27. A Micarta tube 28 is disposed within the glass 8 and has its exterior surface marked to afford a contrasting background upon which the level of the insulating liquid may readily be noted.

To improve the seal between the hood 11 and the end nut 12 a spring disk 29 is disposed therebetween at the outside of the gasket 13. This disk 29 also electrically connects the hood 11 and nut 12 and thus avoids interference to radio reception which might result from discharges therebetween in the absence of a positive connection. The hood member 11 is preferably provided with a liquid filling plug and cap indicated at 30. To aid in retaining the gauge glass 8 in its proper place a number of straps 31, preferably of spring metal, are secured in contact with the outer surface thereof by bolts 32 threaded into the gauge glass support 5. In the case where the backing is filled with a plastic material in lieu of a liquid the gauge glass 8 becomes unnecessary and a metallic cap may be substituted therefor.

From the above description the operation and advantages of this construction may be readily understood. The springs 26 are partially precompressed to exert a downward bias on the sealing plate 19, thereby exerting a closing pressure on the gaskets 4, 7 and 9 which seal the gauge glass and lower portion of the cover 11. Because of this partial precompression, springs of relatively large moment may be employed. The springs likewise exert an upward bias on the clamping plate 25 causing an annular portion 33 thereof to exert a closing pressure on the gasket 13 between the cover 11 and stud 2. In this manner all of the joints through which air or moisture might otherwise enter the bushing are flexibly biased to sealing position irrespective of the temperature or relative expansion of the various bushing or cap parts. The construction is equally adaptable to carrying the current through the conducting stud 2 or a flexible conductor such as is indicated at 3. In addition, a definite electrical interconnection of parts results permitting the apparatus to withstand heavy short circuits with a minimum of burning.

The present invention also provides a structure which is easily adapted to permit power factor testing of the bushing itself or of the equipment with which it is employed. With the conventional bushing it is usually necessary to detach the lead from the equipment, which may be a transformer, either at the top or bottom and insulate it from the other parts. The alternative to this procedure is to provide a so-called insulating head which is of expensive construction and adds considerable height to the bushing. With a bushing built in accordance with the invention, it is only necessary to remove the uninsulated bolts 16 in the manner previously described in order to insulate the bushing from the transformer and place the equipment in condition for testing. Since the seal to the transformer need not be broken, this feature is very valuable in the case of equipment in which admission of air is particularly undesirable.

The convenience of assembly resulting from this construction should also be noted. The various expansion chamber and cap portions may be loosely assembled about the stud 2 since the expansion of the spring 26 is limited by the upper horizontal surface of the flange portion 24 of the clamp bracket 25 contacting the underside of the inner portion of the sealing plate 19. The entire assembly may then be compressed by a press or external clamps until the spring 26 is compressed the desired amount and the nut 12 screwed on the stud. After that, the terminal cap 15 may be secured in place.

While we have shown and described a particular form of our invention, changes may be effected therein without departing from the spirit and scope thereof as set forth in the appended claims.

We claim as our invention:

1. In a bushing for high tension apparatus including a tubular casing of insulating material having a stud extending axially therethrough, a centrally apertured flexible metal hood for closing the end of said casing about said stud, said hood having an inwardly extending bottom flange for forming part of a sealed joint with the end of said casing, means secured about said stud for engaging the outside of said hood to form a seal therebetween, a first member disposed loosely about said stud for engaging the inside of said hood opposite said sealing means, a second member disposed within said hood for engaging the inside of said flange above its joint with said casing, said members including portions disposed in spaced superimposed relationship, and means including a spring disposed beneath said members outside said hood for resiliently biasing the superimposed portions of said members toward each other to exert sealing pressures on the portions of the hood which the respective members engage.

2. In a bushing including a tubular casing of insulating material having a stud extending axially therethrough, an apertured flexible metal hood for closing the end of said casing about said stud, said hood having an inwardly extending bottom flange forming part of a joint with the end of said casing, means secured about said stud for engaging the outside of said hood to form a seal therebetween, a first member disposed loosely about said stud for engaging the inside of said hood opposite said sealing means and including a flange portion extending outwardly from said stud, a second member disposed about said first member for engaging the inside of said flange above the joint formed thereby and having an inner portion superimposed above the flanged portion of said first member in spaced relationship thereto, a centrally apertured plate disposed about said stud, means supporting said plate from said second member in a position therebelow with the flange portion of said first member therebetween, and spring means compressed between said plate and said flanged portion to bias said members against the portions of said hood which they respectively engage.

3. In a bushing including a tubular casing of insulating material having a stud extending axially therethrough, an apertured flexible metal hood for closing the end of said casing about said stud, said hood having an inwardly extending bottom flange forming part of a joint with the end of said casing, means secured about said stud for engaging the outside of said hood to form a seal therebetween, a first member disposed loosely about said stud for engaging the inside of said hood opposite said sealing means and including a flange portion extending outwardly from said stud, a second member disposed about said first member for engaging the inside of said flange above the joint formed thereby and having an inner portion superimposed above the flanged portion of said first member in spaced relation-

ship thereto, a ring disposed about said stud below said first member, a plurality of spaced bolts extending from the inner portion of said second member to said ring to support it with the flange portion of said first member therebetween, said flange portion having openings therein to permit said bolts to pass therethrough, and a helical spring disposed about each of said bolts and compressed between said ring and said flange portion to bias said members against the portions of said hood which they respectively engage.

4. In a bushing for high tension electrical apparatus including a tubular casing of insulating material having a stud extending axially therethrough, a centrally apertured hood of flexible construction for closing the end of said bushing about said stud, said hood having an inwardly extending bottom flange for forming part of a sealed joint with the end of said casing, means secured about said stud for engaging the outside of said hood to form a seal therebetween, a first member disposed loosely about said stud for engaging the inside of said hood opposite said sealing means, a second member disposed within said hood for engaging the inside of said flange above its joint with said casing, said members including portions disposed in spaced superimposed relationship, resilient means, and means securing said resilient means to the superimposed portions of said members for resiliently biasing them toward each other so that the members exert sealing pressures on the portions of said hood which they respectively engage.

5. In an insulating bushing including a tubular casing of insulating material having a stud extending axially therethrough, a hood of flexible construction having an opening therein for closing the end of said casing about said stud, said hood having an inwardly extending bottom flange for forming part of a sealed joint with the end of said casing, means secured about said stud for engaging the outside of said hood to form a seal therebetween, a first member disposed loosely about said stud for engaging the inside of said hood opposite said sealing means, a second member disposed within said hood for engaging the inside of said flange above its joint with said casing, said members including portions disposed in spaced superimposed relationship, and means disposed within said tubular casing for resiliently biasing the superimposed portions of said members toward each other to exert sealing pressures on the portions of the hood which the respective members engage.

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