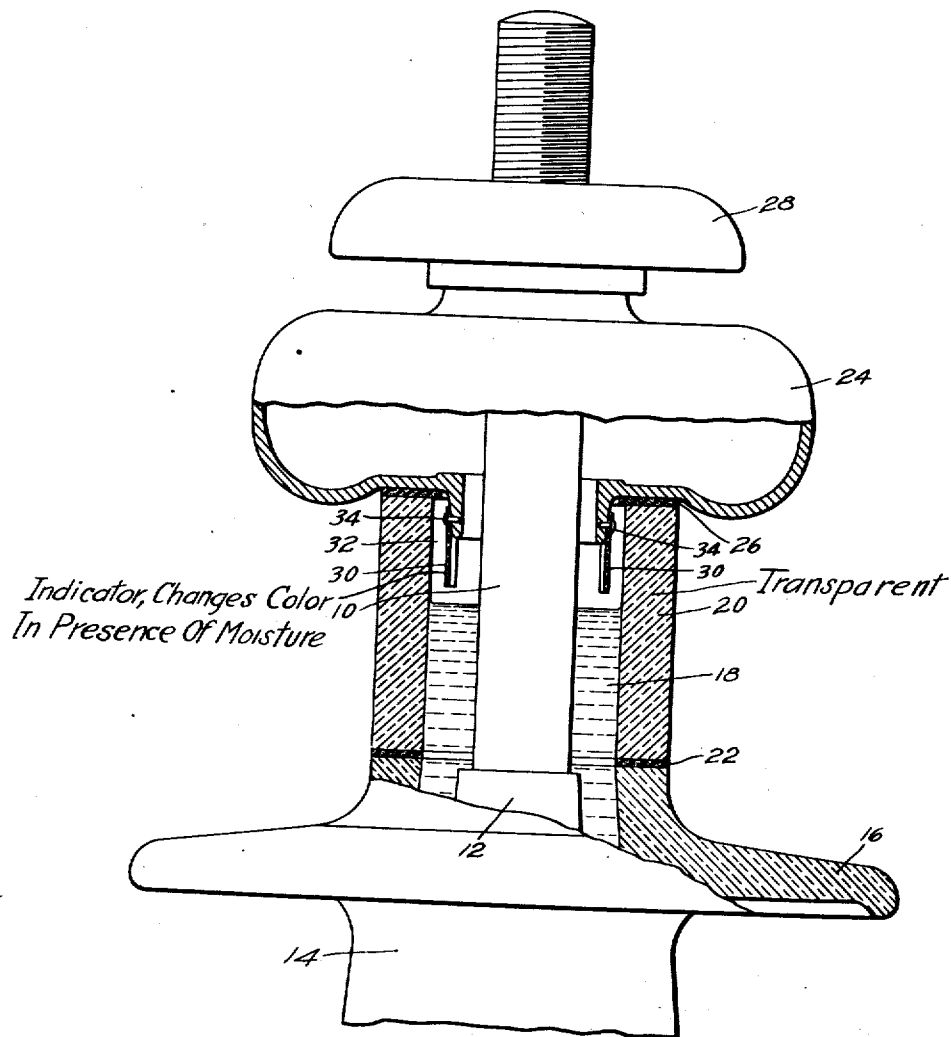


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BUSHING
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BUSHING

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This invention relates to high tension electrical bushings, and particularly to bushings having a visible indicator therein for indicating the presence of moisture.

In condenser bushings used on circuit breakers and transformers, a sealed structure is desired to prevent access of moisture to the condenser or dielectric medium within the bushing. In service, it is found that the seals between the elements of the bushing sometimes become imperfect with the result that the bushing "breathes" and moisture is admitted. In time this moisture in the form of water works its way through the dielectric medium and penetrates the condenser impairing the dielectric properties of the bushing. In order to prevent damage to the bushing occasioned by moisture which may be admitted thereto, it is desired to provide a detector or indicator within the bushing which will indicate the presence of moisture before it causes serious damage to the assembly.

An object of this invention is to provide a bushing having a sensitive detector or indicator for visually indicating the presence of moisture within the bushing.

Another object of this invention is to provide a bushing having a sensitive indicator composed of a carrier and a material responsive to moisture conditions for its color, disposed within the bushing whereby the presence of moisture within the casing is indicated by the color of the material.

Other objects of this invention will become apparent from the following description when taken in conjunction with the accompanying drawing, the single figure of which is a view in elevation and partly in section of a portion of a bushing embodying the teachings of this invention.

Referring to the drawing, the electrical apparatus with which the bushing is to be associated includes a tubular conductor 10 which is wrapped with alternate layers of conducting and insulating material to constitute a condenser type of bushing 12. The lower part of the condenser bushing 12 and the tank of the immersed apparatus with which the bushing is to be employed are not illustrated since they do not form a part of this invention, and the mechanism of the lower part of such bushing structures are well known.

In order to provide a casing about the conductor 10 and condenser bushing 12, a dielectric tube member or weather casing 14 of some suitable material such as porcelain is disposed in spaced relation thereto as illustrated in the drawing. The tubular dielectric member 14 is provided

with a plurality of radial creepage flanges 16 as is usual practice.

Since the space between the condenser and the weather casing is to be filled with a dielectric medium 18 such as oil or other insulating fluids, a casing 20 of a character that the level of the dielectric medium 18 may be observed there-through is disposed in spaced relation thereto. In practice it is preferred to utilize a transparent material such as glass as the casing 20, the casing being so proportioned with respect to the upper end of the tubular dielectric member 14 that it seats thereon in end-to-end relation when disposed about the conductor.

In assembling the tubular dielectric member 14 and the transparent casing 20 about the conductor 10 and condenser bushing 12, the joint between the abutting ends of the members 14 and 20 is sealed with any suitable gasket 22 which is resistant to the conditions encountered in service. Although many different compositions can be used as the gasket 22, in order to ensure a sealed joint between the elements 14 and 20 it is preferred to employ the bushing structure embodying the seal of thermoplastic material for sealing the members 14 and 20 as disclosed and claimed in copending applications, Serial Nos. 184,832 and 184,830, filed January 13, 1938, of James G. Ford and Edwin E. Arnold and granted as Patent Nos. 2,189,632 and 2,189,621, respectively, in practicing this invention.

As is usual practice, in order to provide an expansion chamber for the dielectric medium 18 and to maintain the members 14 and 20 in assembled position with respect to the conductor 10, a hollow chamber or cap 24 is disposed about the end of the conductor and secured thereto to seat on the end of the casing 20. A gasket 26 of any suitable material is disposed between the end of the casing 20 and the cap 24 for sealing the joint therebetween, while a nut cap 28 in threaded engagement with the end of the conductor 10 retains the different elements in assembled position. Specific details of the cap structure and the manner of securing it to the conductor are not illustrated, since any of the well known expansion chamber structures and method of securing them to maintain the casing elements under compression may be employed.

In order to provide a visible detector or indicator responsive to moisture conditions within the bushing for indicating the presence of any moisture in the bushing admitted through faulty joints or otherwise, an indicator 30 is disposed in the bushing in the gas space 32 which is nor-

mally present above the level of the dielectric medium 18 in such manner that it is visible through the transparent casing 20. As illustrated, the indicator 30 is carried by the lower portion of the hollow chamber 24 by means of the pins 24, although any other suitable means for positioning the indicator in the gas space is satisfactory as long as it is visible through the transparent member 20.

In practice, the indicator 30 comprises any suitable carrier capable of carrying other materials as will be explained more fully hereinafter. Fibrous material such as filter paper, blotting paper, cloth or the like, and which is substantially unaffected by exposure to or immersion in the dielectric medium is suitable as the body or carrier of the indicator 30.

In order that the indicator will show the presence of moisture within the bushing, a material which is responsive to moisture conditions for its color is employed in conjunction with the carrier. As specific examples of such materials, cobalt chloride (CoCl_2), cobalt bromide (CoBr_2), cobalt iodide (CoI_2), copper sulphate (CuSO_4), nickel sulphate (NiSO_4) and others are satisfactory. Thus the carrier is at least coated and preferably is impregnated with a chemical compound or salt which is very sensitive to the presence of moisture for its color and is unaffected by immersion in the dielectric medium in the bushing.

In order to utilize such chemical compounds in the indicator, they are formed into a water solution and the carrier is impregnated with a solution after which it is dried to leave the chemical compound in the carrier in an anhydrous or dehydrated form. In this form the detector or indicator 30 is ready for use and is positioned in the gas space above the oil level in the bushing as referred to hereinbefore. The indicator can be placed in the bushing either during the initial assembly of the elements of the bushing or in the field.

As a specific example of a chemical compound suitable for use as the color indicator, cobalt chloride (CoCl_2) is found to be very effective, the hydrates of the cobalt chloride having different colors depending upon the amount of moisture encountered. In employing the cobalt chloride, a solution is prepared ranging from 15 to 45 parts by weight of cobalt chloride and preferably 30 parts by weight to 100 parts by weight of water. The carrier is then impregnated with the solution after which it is dried at a temperature of about 100°C . for a period of time of about one hour to ensure that the indicator contains the dehydrated form of the chemical compound.

When the carrier carries the dehydrated cobalt chloride, the indicator has a very deep blue color which is characteristic of the dehydrated cobalt chloride. As the indicator is exposed to moisture, a definite change in the color of the indicator is noticed, the change of color ranging from a deep blue for the dehydrated form to red for the completely hydrated form of the cobalt chloride. In changing from the deep blue color to the red color, it is first noticed that in the presence of sufficient moisture to form the monohydrate of cobalt chloride, the color is violet, whereas in the presence of sufficient moisture to form the dihydrate of cobalt chloride, the color is rose-red, and upon exposure to sufficient moisture to form the hexahydrate of cobalt chloride the indicator has a definite red color. Thus it is apparent that the indicator visible through the transparent member 20 gives a definite color

range depending upon the degree of moisture within the bushing. The indicator is quite sensitive and, since it is readily visible through the member 20, functions to warn the operator when moisture is admitted to the bushing so that the bushing can be removed from service and the moisture removed from the bushing before the dielectric properties of the bushing are impaired.

The advantages of the apparatus of this invention are quite apparent, it being readily appreciated that such a visible detector or indicator is very sensitive to the presence of moisture and possesses no complicated mechanical parts which can get out of order when the bushing is in service in the field. Further, where moisture is detected and the bushing is removed from service to remove the moisture, fresh indicators containing the chemical compound in its dehydrated form can be substituted for those detectors which have changed their color due to the presence of the moisture. Where desired, the detectors which have changed color can be replaced after they have been given a simple heat treatment to completely dehydrate the chemical compound with which the carrier is impregnated. Further, the indicator utilized in this invention is unaffected by exposure to or immersion in the dielectric medium 18, the indicator remaining quite stable and unaffected except by the presence of moisture.

Although this invention has been described with reference to a particular embodiment thereof, it is, of course, not to be limited thereto except insofar as is necessitated by the disclosed subject matter and the appended claims.

I claim as my invention:

1. In a sealed bushing structure provided with a casing and a liquid dielectric in the casing, the casing being of a character that the level of the liquid dielectric may be observed therethrough, in combination, a carrier disposed in the casing adjacent the level of the dielectric, and a material which is stable in the presence of the liquid dielectric but responsive to moisture conditions for its color carried by the carrier and also normally visible above the level of the liquid dielectric through the casing.

2. In a sealed bushing structure provided with a casing and a liquid dielectric in the casing, the casing being of a character that the level of the liquid dielectric may be observed therethrough, in combination, a carrier disposed in the casing adjacent the level of the dielectric, and a chemical compound which is stable in the presence of the liquid dielectric but responsive to moisture conditions for its color carried by the carrier and also normally visible above the level of the liquid dielectric through the casing.

3. In a sealed bushing structure provided with a casing and a liquid dielectric in the casing, the casing being of a character that the level of the liquid dielectric may be observed therethrough, in combination, a carrier formed of fibrous material disposed in the casing adjacent the level of the dielectric, and a chemical compound which is stable in the presence of the liquid dielectric but responsive to moisture conditions for its color carried by the fibrous material and also normally visible above the level of the liquid dielectric through the casing.

4. In a sealed bushing structure provided with a casing and a liquid dielectric in the casing, the casing being of a character that the level of the liquid dielectric may be observed therethrough,

in combination, a carrier formed of fibrous material disposed in the casing adjacent the level of the dielectric, and a chemical compound which is stable in the presence of the liquid dielectric but responsive to moisture conditions for its color carried by the fibrous material and also normally visible above the level of the liquid dielectric through the casing, the chemical compound being cobalt chloride.

5. In a sealed bushing structure provided with a casing and a liquid dielectric in the casing, the casing being of a character that the level of

the liquid dielectric may be observed there-through, in combination, a carrier formed of fibrous material disposed in the casing adjacent the level of the dielectric, the fibrous material being impregnated with a material which is stable in the presence of the liquid dielectric but responsive to moisture conditions for its color, the impregnated fibrous material being normally visible above the level of the liquid dielectric through the casing for visually ascertaining the color of the impregnating material.

LESLIE E. FROST.