Sept. 30, 1941. H. L. RORDEN 2,257,652

BUSHING INSULATOR

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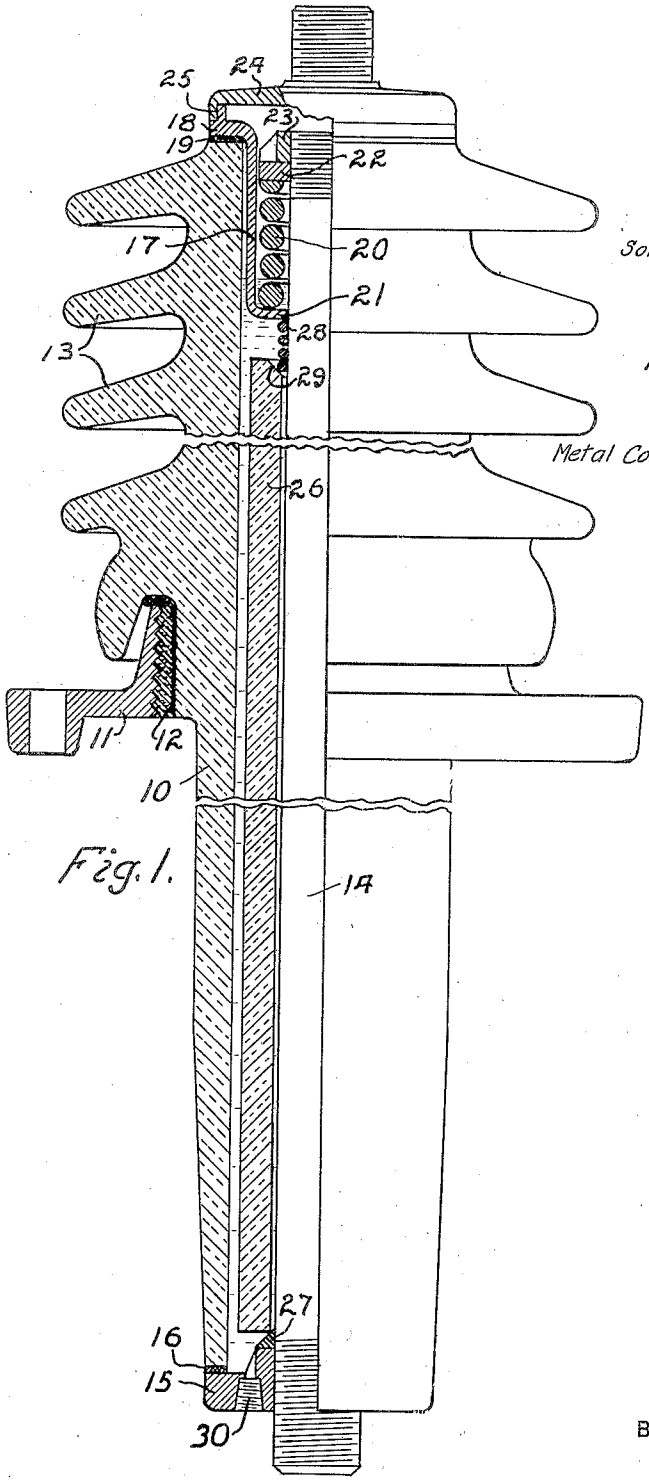


Fig. 1.

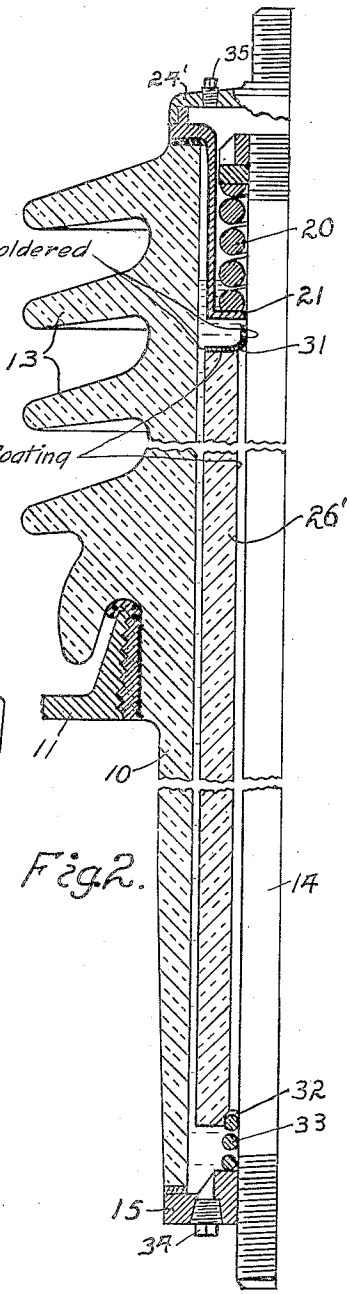


Fig. 2.

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BUSHING INSULATOR

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11 Claims. (Cl. 174—12)

This invention relates to bushing insulators of the oil filled type and has for one of its objects the provision of an insulator in which the filling liquid will be completely sealed from contact with the atmosphere and in which a large expansion chamber to accommodate expansion and contraction of the filling liquid for temperature changes is unnecessary.

A further object of the invention is to provide a bushing of the type named in which the oil space will be small so that expansion and contraction of the filling liquid will be reduced to a minimum.

A further object of the invention is to provide a compression type bushing in which the compression joints have small contact areas so that for a given amount of force exerted upon the joint there will be a high pressure per unit area.

A further object of the invention is to provide a device of the class named which shall be of improved construction and operation.

Other objects and advantages will appear from the following description.

The invention is exemplified by the combination and arrangement of parts shown in the accompanying drawing and described in the following specification and it is more particularly pointed out in the appended claims.

In the drawing:

Fig. 1 is a part elevation and part section showing one embodiment of the present invention.

Fig. 2 is a fragmentary section showing a modified form of the invention.

In most high voltage bushing insulators it has been found desirable to fill the space within the insulator with a dielectric fluid such as transil oil, which fluid expands and contracts with temperature changes. In order to accommodate this expansion and contraction, it has been the practice to provide an air space at the top of the bushing which may communicate with the outer atmosphere so that as the oil or other liquid expands and contracts there is a breathing action to and from the expansion chamber at the top of the bushing. As the air is drawn into and out of this chamber it contacts with the surface of the oil in the bushing and has a tendency in time partially to oxidize the oil and to impart moisture from the air to the body of the oil. This, of course, is detrimental to the quality of the oil and produces a sludging which tends to decrease the efficiency of the bushing.

Many expedients have been proposed to overcome this difficulty, such as breathing traps provided with moisture absorption mediums or the provision of a completely sealed expansion chamber at the top of the bushing of sufficient size to contain enough air so that the compression of the air will accommodate the expansion and contraction of the liquid. The present invention approaches the problem in a different way so as to avoid the necessity of large expansion chambers and chemical or mechanical dryers. A completely sealed bushing is provided in which the oil space is so reduced that the necessity for a large expansion chamber is avoided and in which the compression spring is disposed in a supporting pocket inside the bushing itself so that the external expansion chamber is not required for the purpose of housing such a compression spring. In this way the necessity for the large expansion chamber is completely avoided, resulting in a much more economical bushing and one of considerable less length than is necessary where an expansion chamber is used.

In the embodiment shown the numeral 10 designates a tubular dielectric member extending continuously through the opening in a supporting flange 11 and secured to the flange by cement 12. The dielectric tube may be provided with flanges 13 on its upper end. The conductor rod 14 is located in the opening in the dielectric member 10 and has a closure plate 15 threaded on its lower end and provided with a gasket 16 bearing against the lower end of the tubular member 10 to form a liquid tight joint at this point. The upper end of the tube 10 is provided with a supporting pocket member 17 having an outwardly extending flange 18 resting on a gasket 19 which engages the upper end of the tube 10. Within the pocket member 17 is a spring 20 supported by an inwardly extending flange 21 at the lower end of the pocket member and engaging a washer 22 at the upper end of the spring. The washer 22 is held in place by a collar 23 threaded on the upper end of the conductor 14. The closure cap 24 covers the upper end of the pocket member 17 and after the parts are completely assembled is soldered to the pocket member at 25 so as to form a hermetically sealed joint. In order to provide supplemental insulation and to fill a large portion of the space within the tubular member 10 about the conductor 14 a second tube 26 surrounds the conductor 14 below the lower end of the pocket member 21. This tube at its lower end rests upon a tapered seat 27 which centers the lower end of the tube and holds it in concentric relation with the conductor 14. The seat 27 is preferably made of a

relatively soft metal, such as lead, in order that there will be no danger of chipping the tubular member 26 which is commonly made of porcelain or other fragile dielectric material. The outer tube 10 may also be of porcelain or any suitable dielectric. The upper end of the tube 26 is held in alignment by means of a spring 28 surrounding the tube 14 and bearing on the lower face of the pocket member 21 and on an internally beveled surface 29 at the upper end of the tube 26. The closure member 15 may be provided with a drain opening 30 which is closed by a pipe plug after the parts are assembled and the insulating liquid has been placed in the bushing. The bushing may be inverted for filling after it has been completely assembled. In assembling the parts the closure plate 15 is threaded on the lower end of the conductor 14 with the tapered seat 27 in place. The tube 26 is then placed over the conductor and the parts thus assembled inserted in the tube 10 from its lower end. The spring 28, the pocket member 17, the spring 20 and the washer 22 are then placed over the upper end of the conductor and the nut 23 tightened on the threaded upper end of the conductor sufficiently to produce the desired compression on the gaskets 16 and 19. It will be noted that the only places requiring gaskets are the upper and lower ends of the tubular member, which are of relatively small area as compared to the area of gaskets applied at the central flange where a bushing is made of separate upper and lower sections. Because of the small area of the gaskets 16 and 19 a given pressure on the spring 20 will produce a much greater pressure per unit area on the gaskets than would be the case if large gaskets at the flange were used. Because of this increased pressure per unit area a much greater internal pressure due to expansion of the oil can be tolerated without leakage than would be the case if a large flange gasket were employed.

Another advantage of the construction employing a continuous piece extending through the flange opening instead of the conventional cone and dome construction is that the space within the bushing is very much smaller than is provided where the cone and dome construction is used. The major portion of the small space within the bushing made according to the present invention is occupied by the solid dielectric member 25 thus greatly reducing the oil space within the bushing. The amount of oil required is, therefore, reduced to a minimum so that the expansion and contraction for a wide temperature range is small and only a very small cushion of air is required to accommodate this expansion and contraction. After the parts have been assembled, as explained above, the cap 24 is soldered in place and the bushing inverted and filled from the lower end and the pipe plug tightly threaded into the opening 30. This completely seals the bushing against any communication with the outer atmosphere, the compression of the spring 20 exerting sufficient force on the gaskets 16 and 19 to prevent any leakage at these points. Sufficient oil is placed in the bushing to bring the surface level slightly above the lower end of the pocket member 17 when the bushing is in upright position, as indicated in the drawing. This leaves a small air pocket in the upper end of the bushing which is sufficient to accommodate the expansion and contraction of the small amount of oil within the bushing without producing an internal pressure sufficiently great to overcome compression on the gaskets 16 and 19. A simple and economical construction is thus provided in which the dielectric liquid is completely sealed within the bushing and in which provision is made for the expansion and contraction of the filling liquid without a large and expensive expansion chamber and without the production of excessive pressures within the bushing.

In the form of the invention shown in Fig. 2 the space within the inner baffle 26' surrounding the conductor 14 is closed at its upper end by a collar 31 which is soldered to the outer surface of the conductor 14 and to the upper end of the baffle 26'. The upper end and the inner surface of the baffle 26' are coated with a thin layer of copper or other metal so that the collar 31 can be soldered to the end of the baffle and so that the inner surface of the baffle will have the same potential as the conductor. This avoids the necessity of dielectric liquid between the conductor and the inner surface of the baffle and in this form of the invention the dielectric liquid is excluded from this space by a quantity of air entrapped in the space and prevented from escape by the collar 31. The lower end of the baffle 26' is centered by a spring 33 in a manner similar to the spring 28 in Fig. 1.

In assembling the bushing the baffle 26 is placed over the conductor 14 and the collar 31 is soldered in place to the baffle and conductor. The spring 33 is then placed in position in contact with the beveled surface 32 and the closure plate 15 is threaded on the end of the conductor to compress the spring 32 and hold the baffle 26 properly centered on the conductor. The conductor and baffle are then inserted into the outer dielectric member 10 from the lower end after which the other parts of the bushing are assembled in the manner previously described in connection with Fig. 1.

In the form of the invention shown in Fig. 2, however, it is preferred to place the oil in the bushing while the bushing is in upright position so as to entrap the air in the space about the conductor and within the baffle 26'. The oil may be poured into the bushing through an opening in the cover 24', the opening being closed after filling by a pipe plug 35. Another way to fill the bushing is to connect the opening in the closure member 15 with a source of supply as by means of a connecting hose and then exhaust air through the opening in the cover 24' until the desired amount of oil is drawn into the bushing. Either method of filling will entrap the air in the space about the conductor 14. This not only reduces the amount of oil required to fill the bushing, but also, provides additional air cushioning space to accommodate expansion and contraction of the oil.

The metallic coating on the inner surface of the supplemental baffle 26' may be applied in any well known suitable manner. One method of applying such a coating is described in the patent to Ray Higgins, 2,119,989 dated January 7, 1938, and assigned to The Ohio Brass Company of Mansfield, Ohio. Preferably, also, a high resistance conducting coating is applied to the outer surface of the lower end of the outer dielectric shell 10 extending from the flange to a point below the oil level of the apparatus housing in which the bushing is used in the manner shown and described in my prior Patent Number 2,209,003 filed January 31, 1939.

I claim:

1. A bushing insulator comprising a tubular dielectric member, a conductor extending through said dielectric member and spaced therefrom, and means engaging said conductor for holding said dielectric member away from said conductor, said holding means and dielectric member having engaging faces one of which is tapered and one of which is resiliently pressed into engagement with the other face to hold said dielectric member spaced from said conductor, said dielectric member being laterally movable relative to said conductor at the end next to said engaging faces and being held in its centered position by said faces.

2. A bushing insulator comprising a conductor, an insulating tube surrounding said conductor and spaced therefrom and centering means at opposite ends of said tube for centering said tube relative to said conductor, the centering means at one end of said tube engaging said conductor and having spring pressed tapered bearing connection with said tube, said tube and conductor being relatively movable laterally and held in relatively centered position by said bearing connection.

3. In a bushing insulator a central conductor, a dielectric baffle surrounding the conductor and spaced therefrom, means for hermetically closing the upper end of the space between the baffle and conductor to entrap air or other gas within this space, the lower end of said space being open, a hermetically sealed housing enclosing said baffle and the portion of said conductor therein and an insulating liquid within said housing and excluded from the space within said baffle by the gas entrapped therein.

4. In a bushing insulator a continuous tubular dielectric member having a central conductor extending therethrough and having space within said dielectric member surrounding said conductor, means for sealing said space from communication with the outer atmosphere, a supplemental tubular dielectric member within said first named dielectric member and filling the major portion of the space between said first named dielectric member and said conductor but having its inner surface spaced away from the outer surface of said conductor, means for sealing the space between said supplemental dielectric member and conductor at the upper end of said space, the space within said supplemental dielectric member communicating with the space outside of said supplemental dielectric member at the lower end of said supplemental dielectric member, the inner surface of said supplemental dielectric member being electrically conducting and electrically connected with said conductor, a gaseous medium disposed within the space between said supplemental dielectric member and conductor and an insulating liquid disposed in the space within said first named dielectric member but excluded from the space within said supplemental dielectric member by said gaseous medium.

5. A bushing insulator comprising a continuous integral dielectric tube of substantially uniform internal diameter throughout its length, a conductor disposing axially within said tube, a closure member for one end of said tube secured to said conductor and bearing on said end and, in cooperation with said conductor, completely sealing said end, a pocket member bearing on the other end of said tube and extending into said tube, a spring disposing within said pocket member inside of said tube and bearing on said pocket member, a stop on said conductor bearing on said spring so that said spring reacts between said pocket member and conductor to exert tension on said conductor and hold said closure member and said pocket member against opposite ends of said tube respectively, a cover for said pocket member which, in cooperation with said pocket member, completely seals the end of said tube opposite said closure member, the space within said tube being thus hermetically sealed off against ingress and egress of fluid to or from the space outside of said tube, the space within said tube being partially filled with liquid and partially filled with gas, a supplementary solid dielectric tube disposed within said first mentioned tube about said conductor and spaced from said conductor and in alinement with said pocket member and occupying the major portion of the space within said first mentioned tube not occupied by said pocket member to minimize the amount of space occupied by said liquid and therefore the volumetric expansion and contraction of said liquid, for temperature changes, the space between said supplemental tube and said conductor being hermetically sealed at its upper end and open at its lower end and filled with a gaseous medium to exclude liquid therefrom.

6. In a bushing insulator a tubular dielectric member having the opening therethrough tapered adjacent one end thereof, a conductor of less diameter than said opening and extending through said opening, said conductor and tubular member being relatively movable laterally and resilient means engaging said conductor and bearing on the tapered surface of said opening for centering said tubular member relative to said conductor.

7. In a bushing insulator a tubular dielectric member having a portion of the surface of the opening therein tapered, a conductor extending through said opening and of less diameter than said opening, said conductor and tubular member being relatively movable laterally and a resilient ring member surrounding said conductor and bearing on said conductor and on the surface of the tapered portion of said opening to center said dielectric member and conductor relative to each other.

8. In a bushing insulator a tubular dielectric member, a conductor of less diameter than the opening in said dielectric member extending through said dielectric member, said conductor and dielectric member being relatively movable laterally, the opening in said dielectric member being flared outwardly at one end thereof and a helical spring surrounding said conductor and bearing on said conductor and on the outwardly flared surface of said opening for centering said dielectric member relative to said conductor.

9. In a bushing insulator a tubular dielectric member, a conductor of less diameter than the opening in said dielectric member extending through said dielectric member, said conductor and dielectric member being relatively movable laterally, the opening in said dielectric member being flared outwardly at one end thereof, a helical spring surrounding said conductor and bearing on said conductor and on the outwardly flared surface of said opening for centering one end of said dielectric member relative to said conductor and means for centering the other end of said dielectric member relative to said conductor.

10. In a bushing insulator a tubular dielectric member, a conductor of less diameter than the opening in said dielectric member extending through said dielectric member, said conductor and dielectric member being relatively movable

laterally, the opening in said dielectric member being flared outwardly at one end thereof, a helical spring surrounding said conductor and bearing on said conductor and on the outwardly flared surface of said opening for centering one end of said dielectric member relative to said conductor and means for centering the other end of said dielectric member relative to said conductor and for closing the space between said conductor and dielectric member at one end of said space.

11. A bushing insulator comprising a central member, a dielectric tube surrounding said member and movable laterally relative thereto, a tapered seat for supporting said tube at its lower end and for centering said tube relative to said central member and a spring engaging said central member and bearing upon a tapered surface at the upper end of said tube for centering the upper end of said tube relative to said central member.

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