Aug. 7, 1945. S. TERPAK ET AL 2,381,787

BUSHING

Filed Sept. 17, 1942

Fig. 1.

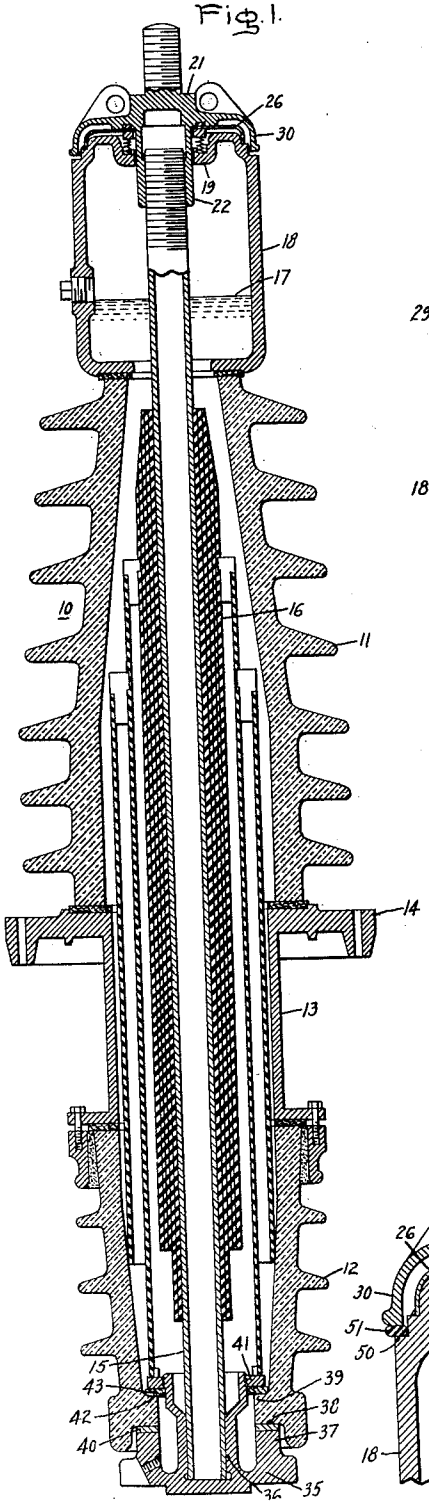


Fig. 2.

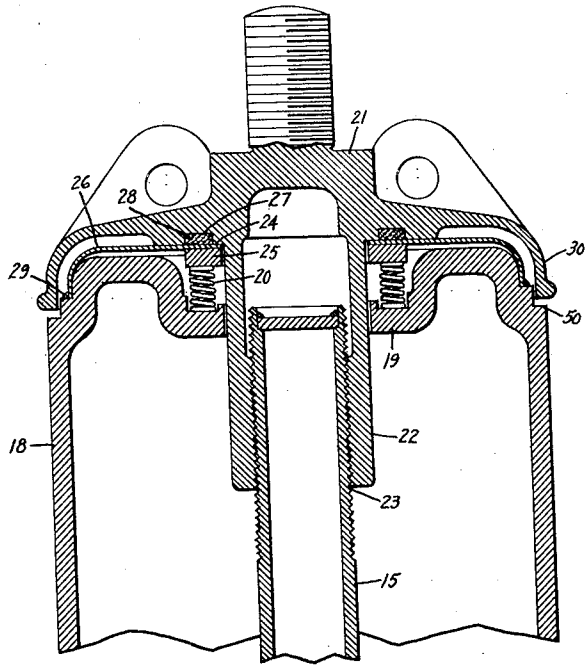


Fig. 3.

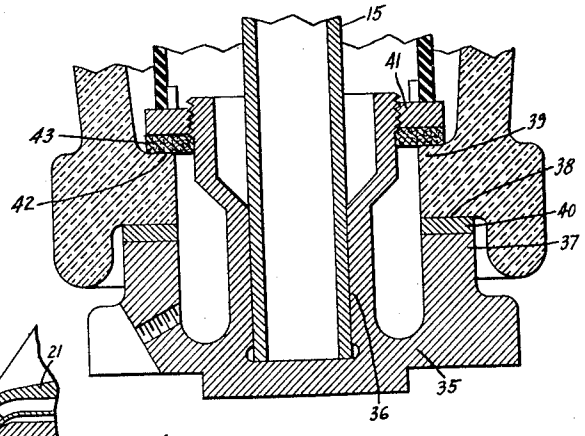


Fig. 4.

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BUSHING

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Application September 17, 1942, Serial No. 458,640

5 Claims. (Cl. 174—19)

Our invention relates to bushings, and to a bushing construction for such electrical apparatus as transformers and circuit breakers.

Bushings have been provided for accommodating electrical conductors which pass through an enclosing casing of electrical apparatus, such as transformers and circuit breakers. Such bushing constructions have included an outer shell of suitable insulating material such as porcelain which is adapted to be supported on the cover of the apparatus. In order to seal the outer end of the bushing construction from the weather, bushings have been employed with a resilient connection between the outer end of the conductor and the top end of the outer porcelain shell, the connection also including a flexible diaphragm which is sealed to the conductor and the porcelain.

It is, therefore, an object of our invention to provide an improved flexible and sealed connection arrangement at an end of a bushing construction.

Another object of our invention is to provide an improved flexible and adjustable connection at one end of a bushing, and an improved relatively rigid connection at the opposite end of the bushing construction.

A further object of our invention is to provide an improved sealed bushing construction for electrical apparatus, which is simple in construction, economical to manufacture and reliable in operation.

Further objects and advantages of our invention will become apparent from the following description referring to the accompanying drawing, and the features of novelty which characterize our invention will be pointed out in the claims annexed to and forming a part of this specification.

In the drawing Fig. 1 is a sectional side elevation of a bushing construction which is provided with an embodiment of our invention; Fig. 2 is a sectional side elevation of the upper portion of the bushing construction illustrated in Fig. 1; Fig. 3 is a sectional side elevation of the lower portion of the bushing construction illustrated in Fig. 1; and Fig. 4 is a fragmentary view of a portion of the upper part of the bushing construction illustrated in Fig. 2 illustrating a modification of our invention.

The illustrated embodiment of our invention includes a bushing construction having a shell arrangement of suitable insulating material and a tubular conductor therein. The inner end of the conductor is relatively rigidly attached to the adjacent inner end portion of the shell, and the outer end of the conductor is relatively adjustably and resiliently attached to the adjacent outer end portion of the shell. The relatively rigid inner end attaching arrangement includes a metallic member which is relatively rigidly attached to the adjacent end of the conductor and has a shoulder portion which abuts against an adjacent collar portion of the shell member. A suitable gasket is provided between these cooperating portions. The inner end of the metallic member has a nut threaded thereon which cooperates with an adjacent inner portion of the shoulder of the shell portion. The outer end of the shell, which is shown as an expansion chamber for dielectric liquid, is relatively resiliently and adjustably attached to the adjacent end of the conductor through a cap member which is threaded to the end of the conductor, there being springs between the cap member and the adjacent end portion of the shell. In order to provide a substantially pressure-tight seal, a flexible diaphragm is provided which is sealed to the cap member and to the end portion of the shell. The cap member is provided with a flange or depending portion which protects the flexible diaphragm, the flange member terminating relatively close to an adjacent portion of the shell end member. The amount of clearance between these portions will give a visual indication of the relative compression of the spring member.

Referring to the drawing, in Fig. 1 we have illustrated a bushing construction including a shell 10 having an upper shell portion 11 and a lower shell portion 12, these portions being composed of any suitable insulating material, such as porcelain. Between these two shell portions there is provided a supporting or clamping flange 13 having a portion 14 which may be attached to the casing of any suitable electric apparatus, such as a transformer or a circuit breaker. Within the shell members there is provided a conductor 15. In order to insulate suitably the conductor 15 we provide a number of concentric tubular members 16 of any suitable insulating material. Further insulation and cooling may be provided for the conductor by filling the bushing with an insulating fluid, such as oil to the level 17 of a chamber member 18 which, as stated above, constitutes the outer end of the shell and is supported on the shell portion 11 and which may provide an expansion chamber in that portion of the housing above the level 17.

In order to relatively flexibly support the conductor 15 to the porcelain shell the upper end of the chamber 18 is provided with an inwardly extending portion 19 for supporting a plurality of

resilient members or springs 20. A terminal cap 21 is provided having a tubular portion 22 which is adjustably attached to the adjacent end of the conductor member 15 in any suitable manner such as by cooperating threads 23. Thus, by rotating the cap member 21 the tubular portion 22 may be threaded on to the adjacent end of the conductor 15 in varying amounts. In order to resiliently support the conductor 15 and cap member 21, the spring members 20 abut against an adjacent flat surface 24 of the terminal cap 21 through any suitable arrangement such as through a tubular washer 25.

In order to seal substantially pressure-tight the upper end of the porcelain shell or expansion chamber 18, a diaphragm 26 is provided which may be sealed to the terminal cap and expansion chamber in any suitable manner. As will be seen more clearly in Fig. 2 of the drawing, a groove 27 is provided for the accommodation of a gasket 28 which abuts against the inner end of the flexible diaphragm 26. In order to seal the outer end of the diaphragm, it is spun over so as to take substantially the same contour as the adjacent surface of the upper end of the expansion chamber 18, and may be attached thereto in any suitable manner, such as by brazing, as is indicated by the numeral 29. The sealed construction is accomplished through a flexible diaphragm so that relative movement between the terminal cap and the expansion chamber 18 will not affect the sealed construction. In order to protect the flexible diaphragm 26 it will be seen that the terminal cap 21 is provided with a flange or depending portion 30 which is spaced from the diaphragm by a suitable distance so as not to contact it but provides a cover therefor.

As will be seen more clearly in Fig. 3, the lower end of the conductor 15 is relatively rigidly attached to the inner end of the lower shell portion 12 through a metallic member 35. This member includes a tubular portion 36 which may be relatively rigidly attached to the adjacent end of the conductor 15 in any suitable manner such as by providing a threaded and sweated joint. In order to support the lower end of the conductor 15 on the lower end of the shell and to absorb the reactive forces which will be present in compressing the springs 20, the metallic member 35 is provided with a shoulder portion 37 which abuts against an adjacent surface 38 of an inwardly extending collar portion 39 at the lower end of the porcelain shell 12. If it is desired to seal this end, a gasket 40 may be provided between the shoulder 37 and the surface 38. The inner end of the metallic member 35 has threaded thereon a nut 41 which may abut against the inner surface 42 of the shoulder portion 39 of the porcelain shell. A gasket 43 may be provided between the nut 41 and the surface 42 if desired.

The above described construction may be assembled by threading and sweating conductor 15 with its insulation 16 into the metallic member 36. After placing gasket 40, lower porcelain 12 and gasket 43 in position the joint seal may be obtained by tightening nut 41. After bolting in position supporting flange 13 the top porcelain 11 may be placed in position. The top chamber 18 which has been preassembled with washer 25, springs 20 and flexible diaphragm 26 can next be placed into position. With gasket 28 in position the terminal cap 21 may be screwed into place and due to the cooperation of the threads 23 the gasket at the lower end will be placed under compression as will the springs 20.

In order to determine the amount of compression of the springs by mere visual inspection it will be seen that the flange portion 30 terminates relatively close to an adjacent portion 50 of the expansion chamber 18. The amount of clearance, therefore, between the adjacent portions will give a visual indication of the amount of compression of the springs 20 for any particular temperature conditions as long as there has been obtained a previous calibration of spring compression in relation to the clearances between the depending flange portion 30 and the adjacent portion 50 of the expansion chamber.

If it is desired to obtain further protection of the flexible diaphragm than that which will obtain by the covering thereof due to the depending flange, the clearance portion may be filled with a flexible gasket member 51 as will be seen in Fig. 4.

Although we have shown and described particular embodiments of our invention, we do not desire to be limited to the particular embodiments described, and we intend in the appended claims to cover all modifications which do not depart from the spirit and scope of our invention.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. In a bushing for electrical apparatus, a shell of insulating material having an end portion, a conductor within said shell, cap means for enclosing said end portion, means for adjustably attaching said end cap to said conductor, resilient means between said end cap and said end portion, said adjustable attaching means providing relative axial adjustment between said end cap and said conductor and for adjusting the compression of said resilient means, flexible diaphragm means between said end cap and said shell end portion, means providing a substantially fluid-tight connection between said diaphragm and said cap and between said diaphragm and said shell end portion, said cap means having a flange portion substantially enclosing said diaphragm and terminating relatively close to said shell end portion, the amount of clearance between said end cap and said shell end portion giving a visual indication of the relative amount of compression of said resilient means.

2. In a bushing for electrical apparatus, a shell of insulating material having a metallic end portion, a conductor within said shell, end cap means, means for adjustably attaching said end cap means to said conductor, spring means, means including end cap means and said spring means for resiliently attaching said conductor to said shell end portion, means for relatively rigidly attaching said conductor to the opposite end of said shell, means including a flexible diaphragm for providing a substantially fluid-tight seal between said shell end portion and said conductor, adjustment between said end cap and said conductor adjusting the compression of said resilient means, said end cap means substantially enclosing said diaphragm means and having a portion spaced from said metallic end portion to provide a relatively small clearance, the amount of clearance giving a visual indication of the relative compression of said resilient means.

3. In a bushing for electrical apparatus, a shell of insulating material having a metallic expansion chamber on one end, a conductor within said shell, end cap means adjustably connected to said

conductor, resilient means for supporting said end cap and conductor on said chamber, means for relatively rigidly attaching said conductor to the opposite end of said shell, axial adjustment of said cap means and said conductor determining the relative compression of said spring means, means including flexible diaphragm means providing a substantially fluid-tight seal between said cap and said chamber, said cap means substantially enclosing said diaphragm means and having a portion adjacent said chamber, the amount of clearance between said chamber and said cap giving a gage of the relative amount of compression of said resilient means.

4. In a bushing for electrical apparatus, a shell of insulating material having a metallic expansion chamber on one end, a conductor within said shell, end cap means adjustably connected to said conductor, resilient means for supporting said end cap and conductor on said chamber, means for relatively rigidly attaching said conductor to the opposite end of said shell, axial adjustment of said cap means and said conductor determining the relative compression of said resilient means, means including flexible diaphragm means providing a substantially fluid-tight seal between said cap and said chamber, said cap means substantially enclosing said diaphragm means and having a portion adjacent said chamber, the amount of clearance between said chamber and said cap giving a gage of the relative amount of compression and resilient means, and flexible gasket means between the adjacent portions of said cap and said chamber for protecting said flexible diaphragm.

5. In a bushing for electrical apparatus, a shell of insulating material having an end portion, a conductor within said shell, end cap means for substantially enclosing said end portion, means for adjustably attaching said end cap means to said conductor, resilient means between said end cap means and said end portion, said adjustably attaching means providing relative axial adjustment between said end cap means and said conductor and for adjusting the compression of said resilient means, means providing a substantially fluid-tight seal between the end cap means and said shell end portion, said end cap means having a flange portion substantially enclosing said seal means and terminating relatively close to said shell end portion, the amount of clearance between said end cap means and said shell end portion giving a visual indication of the relative amount of compression of said resilient means.

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