

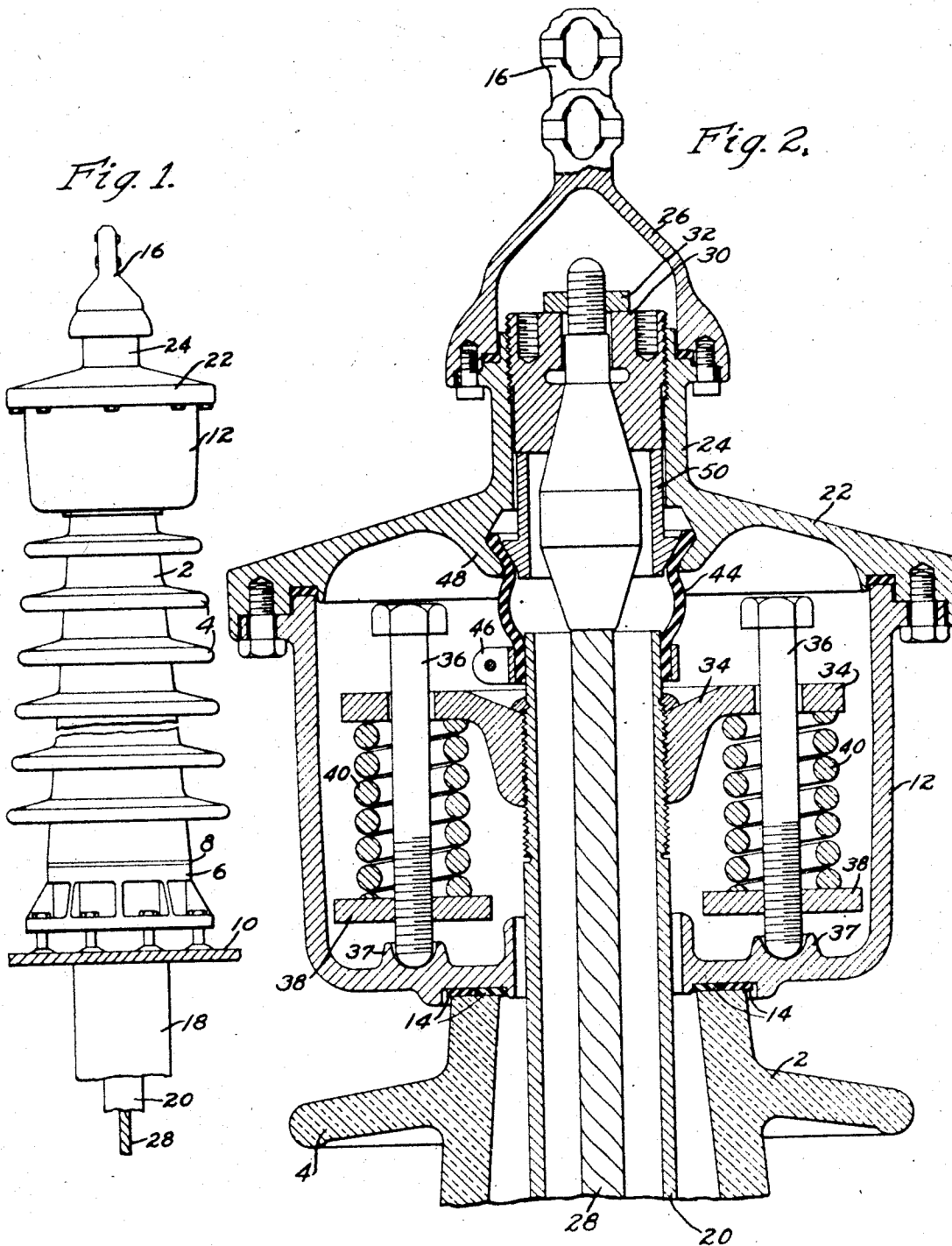
Jan. 7, 1941.

A. A. SKVORTZOFF

2,228,089

TRANSFORMER PUSHING

Filed Oct. 18, 1938



WITNESSES:

Leon M. Harman
Mrs. C. Groome

INVENTOR

Alexander A. Skvortzoff.

BY

W. S. Satterman
ATTORNEY

UNITED STATES PATENT OFFICE

2,228,089

TRANSFORMER BUSHING

Alexander A. Skvortzoff, Sharon, Pa., assignor to
Westinghouse Electric & Manufacturing Com-
pany, East Pittsburgh, Pa., a corporation of
Pennsylvania

Application October 18, 1938, Serial No. 235,611

5 Claims. (Cl. 174—167)

The present invention relates to bushings for insulating the conducting leads of high-tension electrical apparatus, such as transformers and circuit breakers, and has particular reference to an improved cap for closing the exposed end of such bushings.

Bushings of the type contemplated usually comprise an elongated cylindrical member of insulating material, such as porcelain, through which the conductor or lead from the apparatus extends to be connected at the upper end of the casing to a terminal which, in turn, is to be connected to an electrical circuit. The conducting lead in many cases is surrounded by a hollow metallic stud or the stud itself may be used as the conductor. In either event, by reason of the difference in the coefficient of expansion between the metallic and porcelain parts, it is difficult to maintain the bushing fluid tight and to prevent breathing upon change in temperature. The bushing is usually filled with a dielectric fluid, which may be oil or a gum, and upon breathing cycles moisture may be drawn into the bushing with resultant damage.

Further, it is usually undesirable to have communication between the hollow stud and the interior of the bushing, and this is particularly difficult because the thermal expansion and contraction of the hollow stud longitudinally thereof makes it necessary to terminate the stud within the bushing and allow space to permit such expansion and contraction.

It is an object of the present invention to provide a bushing terminal construction which is comparatively simple as compared with prior art structures and which may be assembled or disassembled with a minimum expenditure of time.

It is another object of the invention to provide a bushing terminal cap, in conjunction with a bushing having a hollow metallic stud, in which means is provided to prevent communication between the interior of the stud and the interior of the bushing in spite of contraction and elongation of the stud under the influence of temperature changes.

Other objects of the invention will be apparent from the following description in conjunction with the accompanying drawing, in which:

Figure 1 is a view in elevation with parts in section and parts removed, of a bushing assembly of the type to which the present invention is applicable, and

Fig. 2 is an enlarged view in vertical section of the cap of the bushing shown in Fig. 1, a part of the bushing being broken away.

Referring to Fig. 1, the bushing may comprise a cylindrical casing 2 of dielectric material, such as porcelain, having a plurality of flanges 4 in the usual manner. The casing 2 rests upon a metallic supporting collar 6, being spaced therefrom by a gasket 8. The supporting collar 6 is provided with a flange suitably bolted to a casing 10, only a portion of which is indicated in section, which may be the metallic casing of an oil-immersed transformer, circuit breaker, or the like. The upper end of the bushing is surmounted by a cap 12, shown in greater detail in Fig. 2, which rests upon the end face of the porcelain casing 2, being spaced therefrom by gaskets 14 of different compressibility so that one acts as a stop for the other. The top of the cap 12 is surmounted by a terminal 16 to which the external electrical circuit is to be connected.

By way of example the present invention is intended to be used with a bushing of the condenser type in which alternate layers of conducting and insulating material are wound upon a hollow metallic stud. In Fig. 1, the condenser wrapping is indicated at 18 and the hollow stud at 20. It is to be understood that the condenser wrapping is wound tightly on the stud 20 and is substantially integral therewith. The wound condenser is tightly fitted within the metallic collar 6 in a suitable manner, such as shown in the patent to E. E. Arnold et al. No. 2,088,502, issued July 27, 1937. It is intended that the condenser wrapping 18 be of such tight fit within the collar 6 that an oil-tight joint therebetween is obtained to effectively close the bottom of the bushing structure. It is intended, however, that the invention is applicable to bushings of other than the condenser type, in which event the bottom of the bushing will be closed in some other suitable and usual manner, as by a porcelain shell enclosing the lower end of the bushing and having a plate hermetically sealing its lower end maintained in position by engagement with the bushing stud.

Referring to Fig. 2, the cap 12 comprises a main body portion of substantially cup-shape having a base portion proportioned to rest upon the end face of the insulating shell of casing 2. The body portion is provided with a central aperture through which loosely extends the upper end of the metallic stud 20, the latter terminating within the confines of the cap. The cap is provided with a cover 22 suitably bolted thereto to effect a fluid-tight joint and has a central extension 24 surmounted by a terminal 26 also secured to the extension 24 in a fluid-tight manner.

The conducting lead 28 from the electrical apparatus within the tank 10 is drawn up through the stud 20 and suitably secured to a block 30 threaded to the interior of the cover extension 24, with a nut 32.

Upon variations in temperature, relative movement between the porcelain shell 2 and the stud 20 will occur. The relative movement is quite small, but unless provision is made for it, the destructive forces resulting will, upon contraction of the stud, tend to crush the porcelain or crack the metallic parts of the bushing, and upon elongation, the various gasket joints may open, destroying the fluid-tight character of the bushing. In order to take care of this situation, a fitting 34 is threaded to the upper end of the stud 20, and then preferably brazed to it, and is provided with a plurality of apertures through which bolts 36 extend, terminating at their lower ends in sockets 37 cast into the base of the cap 12. It is intended that the fitting 34 is preferably in the form of a spider and that the bolts 36 will extend loosely through their respective apertures. The number of bolts and springs required must be determined by the size of the bushing, four being indicated, by way of example, in Fig. 2.

Each bolt is provided with a square flat plate 38 adjacent its lower extremity to constitute the seat for a helical spring 40 which surrounds the bolt. The upper end of the spring is in engagement with the under face of the fitting 34. By this means, when the springs 40 are under compression, they will transmit a force from the stud 20 through the fitting 34 and bolt 36 to the base of the cap 12, which will maintain the gaskets 14 under compression, as well as the gasket 8 at the lower end of the porcelain shell. The desired pressure may be maintained by adjustment of the bolts 36, the plates 38 being square will engage the side wall of the cap and not turn with the bolts. The degree of compression of the springs 40 should be so chosen that they will always be under compression in spite of elongation of the stud 20 throughout the normal temperature range encountered in service, and throughout such range the springs are positively retained in operative position by the bolts 36.

The application of this phase of the invention to bushings in which the stud may be solid should be obvious.

In order to prevent communication between the interior of the stud 20 and the cap 12, a tubular flexible member 44 of a fluid-impervious material is secured to the upper end of the stud 20 in fluid-tight manner by means of a clamp 46, and the upper end of the flexible member 44 is clamped between a depending conical flange 48 on the cover 22 and the lower beveled edge of clamping member 50, which is actuated to clamping position, as indicated by screwing down block 30 to an extent necessary to obtain a hermetic seal.

The flexible member 44 may be of any desired material so long as it is fluid-impervious, retains its flexibility over a reasonable period, and will not deteriorate under the influence of the oil, gum or other compound with which the bushing is usually filled. There are on the market many types of synthetic rubber, and fabric impregnated therewith which are suitable for this purpose, and I have found that one of such materials which is satisfactory is sold under the trade name Duprene.

By means of the construction described, it

should be apparent that the invention contemplates an unusually simple construction but at the same time takes care of the many severe conditions encountered in the normal use of bushings of this character.

Also, the construction results in a simple assembly operation involving no soldered joints and a minimum of parts. In such assembly operation, when the cap 12, with the cover 22 removed, is placed in position, the fitting 34 may readily be screwed into place and the bolts 36 inserted with the springs 40 and plates 38 before the springs are placed under compression. The bolts 36 may then be screwed down to place the springs 40 under the desired degree of compression. This may be accomplished by a simple wrench rather than having to resort to expensive jigs to place the springs under compression before they are placed in position in the cap. The lower end of the flexible member 44 may then be clamped to the top of the stud 20 by means of the clamp 46, and it is of sufficient length that if the cover 22 were in position, it would extend into the cavity defined by the depending flange 48 on the under-side of the cover. The clamping member 50 is inserted into the end of the flexible member but not sufficiently to deform such member, and the cover is then placed in proper position and bolted. The flexible member now extends into the cover cavity and the clamping member 50 extends into the cover extension 24. The block 30 is then screwed down to expand the upper end of the flexible member 44 into contact with the flange 46 to complete the clamping and sealing action. The conductor 28 is then fished through and secured to the position shown and the terminal member 26 may then be bolted in position to complete the assembly. The disassembly for inspection or repair is equally simple.

Quite obviously, the design described and shown may be varied to take care of various conditions encountered in service, and it is intended that the invention is not to be limited except as imposed by the appended claims.

I claim as my invention:

1. In a bushing for high tension electrical apparatus including a cylindrical casing of insulating material having a stud extending axially therethrough and projecting beyond an end thereof, said stud having a portion thereof fixed with respect to a portion of said casing, and a cap enclosing the projecting portion of said stud and having a base proportioned to seat on the adjacent end face of said casing; means for securing said cap in such position comprising a fitting secured to said stud, a member extending loosely through a portion of said fitting into engagement with the base of said cap, and adjustable means reacting between said fitting and member for forcing said member against said cap base.

2. In a bushing for high tension electrical apparatus including a cylindrical casing of insulating material having a stud extending axially therethrough and projecting beyond an end thereof, said stud having a portion thereof fixed with respect to a portion of said casing, and a cap enclosing the projecting portion of said stud and having a base proportioned to seat on the adjacent end face of said casing; means for securing said cap in such position comprising a fitting secured to said stud, a member extending loosely through a portion of said fitting into engagement with the base of said cap, and adjustable resilient means under compression reacting between said

fitting and member for biasing said member into engagement with said cap base.

3. In a bushing for high tension electrical apparatus including a cylindrical casing of insulating material having a stud extending axially therethrough and projecting beyond an end thereof, said stud having a portion thereof fixed with respect to a portion of said casing, and a cap enclosing the projecting portion of said stud and having a base proportioned to seat on the adjacent end face of said casing; means acting between said stud and cap base for maintaining said cap in such position comprising a helical spring having one end fixed with respect to said stud and movable therewith, and a seat for the other end of said spring including means engaging said cap base and adjustable axially of the spring to adjustably compress the spring.

4. In a bushing for high tension electrical apparatus including a cylindrical casing of insulating material having a stud extending axially therethrough and projecting beyond an end thereof, said stud having a portion thereof fixed with respect to a portion of said casing, and a cap enclosing the projecting portion of said stud and having a base proportioned to seat on the adjacent end face of said casing; means acting between said stud and cap base for maintaining

said cap in such position comprising a helical spring having one end fixed with respect to said stud and movable therewith, means for compressing said spring comprising a seat for the other end thereof, and means for adjustably positioning said seat axially of the spring including means bearing upon said cap base to transmit the expansive force of the spring against the cap base.

5. In a bushing for high tension electrical apparatus including a cylindrical casing of insulating material having a stud extending axially therethrough and projecting beyond an end thereof, said stud having a portion thereof fixed with respect to a portion of said casing, and a cap enclosing the projecting portion of said stud and having a base proportioned to seat on the adjacent end face of said casing; means for securing said cap in such position comprising a fitting secured to said stud, a bolt extending loosely through an aperture in said fitting parallel to said stud and into engagement with said cap base, a helical spring surrounding said bolt and in engagement at one end with said fitting, and means for adjustably compressing said spring including a seat for the other end thereof threaded to said bolt.

ALEXANDER A. SKVORTZOFF.