June 13, 1933. G. E. JANSSON 1,913,596

OIL FILLED INSULATING BUSHINGS HAVING RENEWABLE INSULATING ELEMENTS

Filed Nov. 30, 1928

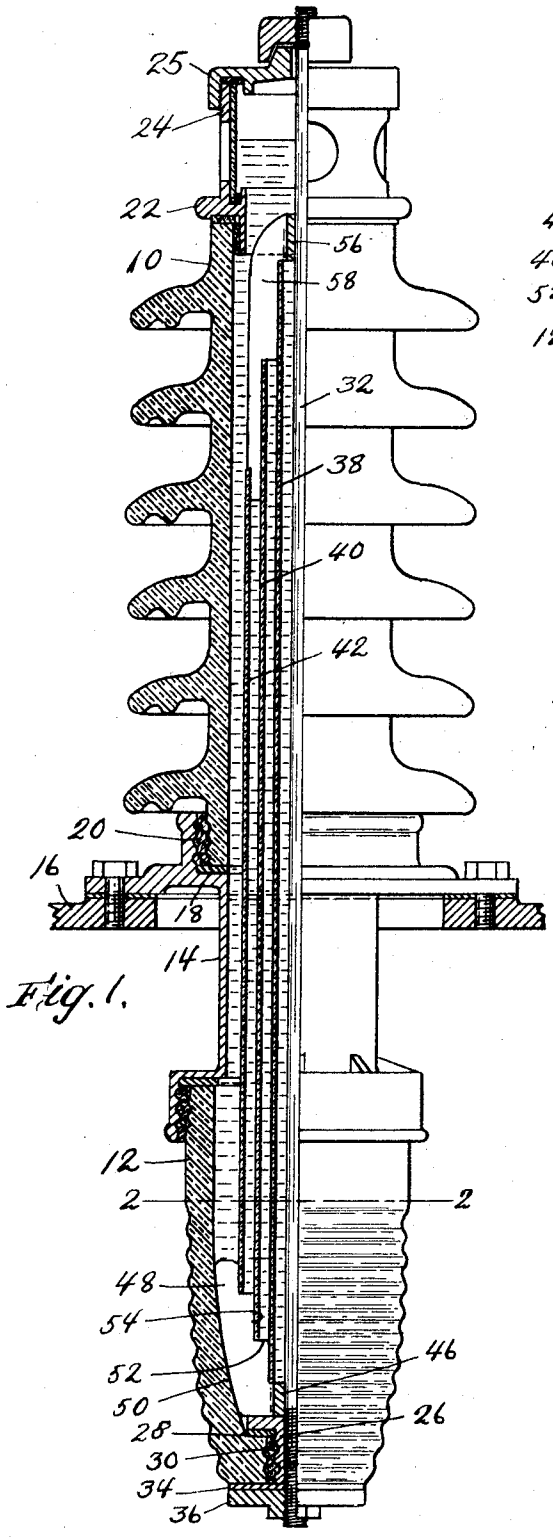


Fig. 1.

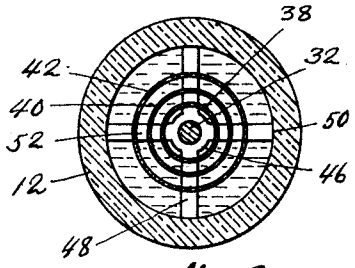


Fig. 2.

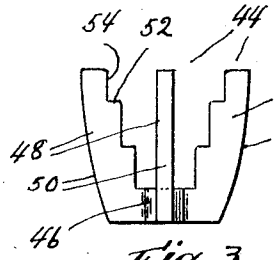


Fig. 3.

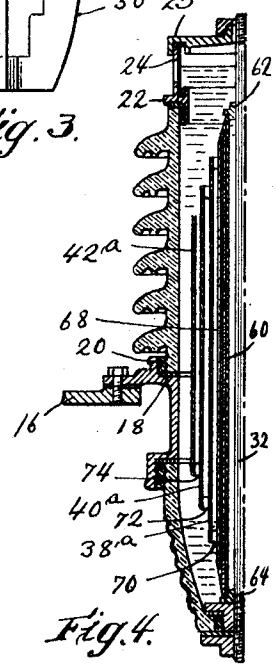


Fig. 4.

Inventor.

Gustaf E. Jansson

by

Attorney

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# UNITED STATES PATENT OFFICE

GUSTAV E. JANSSON, OF ATLANTIC, MASSACHUSETTS, ASSIGNOR TO CONDIT ELECTRICAL MANUFACTURING CORPORATION, OF SOUTH BOSTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS

## OIL FILLED INSULATING BUSHINGS HAVING RENEWABLE INSULATING ELEMENTS

Application filed November 30, 1928. Serial No. 322,685.

This invention relates to high tension oil-filled insulating bushings for electrical apparatus and is intended as an improvement on the bushing illustrated and claimed in my copending application Serial No. 110,126, filed May 19, 1926 which has issued as Patent No. 1,769,261 of July 1, 1930.

The bushing shown in said above application consists of an outer insulating and oil containing shell that has a conducting stud extended through it and has a plurality of insulating tubes concentrically spaced about the stud within the oil. The tubes and the stud are secured together. The outer insulating shell is composed of a plurality of sections which are permanently secured rigidly together in an oil tight manner; and the shell is provided with an open top through which the stud and the attached insulating tubes can be withdrawn for purposes of inspection and repairs. For this purpose it is necessary to remove the bushing from the casing of the electrical apparatus with which it is associated or to gain access in some manner to the interior of the casing for the purpose of disconnecting the stud from the lower end of the bushing. This necessitates breaking the oil seal between the stud and the lower end of the bushing.

It is an object of the present invention to provide a high tension oil filled insulating bushing of the general type shown in my above named application, and especially one having the outer permanently connected shell-sections and wherein the insulating tubes are supported independently of the conducting stud so that they can be removed and replaced through the open top of the bushing independently of the stud without the necessity for removing the bushing from its supporting casing, or gaining access to the lower end of the bushing, or removing the conducting stud.

A further object of the invention is generally to improve the construction and operation of high tension oil-filled insulating bushings.

Fig. 1 is an elevation partly in section of a bushing embodying the present invention.

Fig. 2 is a section taken along line 2—2 of Fig. 1.

Fig. 3 is a side elevation of the support for the insulating tubes within the bushing.

Fig. 4 is a view similar to Fig. 1 and illustrating a modified arrangement of the invention.

As herein shown the bushing consists of a unitary outer insulating shell composed of an upper insulating shell 10 that is of uniform diameter from end to end, a lower insulating shell 12 that is open at its upper end and has a small opening at its lower end, and an intermediate metal sleeve 14 that is rigidly connected permanently in an oil tight manner with the adjacent upper and lower ends of the lower and upper shells respectively and constitutes a support for the bushing on the casing 16 of some suitable electrical apparatus. The connections between the metal sleeve and the upper and lower insulating shells consists of an oil tight packing 18 and a body of cement 20 which holds each shell in pressure applying relation with the packing as is more fully set forth in my above-identified application.

A metal ring 22 is cemented on the top of the upper shell 10 and has an internal diameter that is as large as is practicable and is at least sufficiently large to permit the largest insulating tube, hereinafter to be described, that is within the shell to be passed therethrough. An oil reservoir 24 is associated with said ring 22 as shown in my said application. A metal bushing 26 is located in the opening in the lower end of said lower insulating shell and is sealed therein in an oil tight manner by a packing 28 and a body of cement 30. A conducting stud 32 is extended axially through the insulator and has a screw-threaded connection with said metal bushing 26. Packing material 34 is clamped around said stud and against the lower face of said insulating shell 12 by a nut 36 which is screw-threaded on said stud. The upper end of the stud passes loosely through a cap 25 which is removable from the frame 24 of the oil reservoir and the stud is axially slidable in said cap, to allow for expansion and contraction of the stud.

The construction as above described, is as shown in my copending application. Also as shown in said application a plurality of insulating tubes 38, 40 and 42 are received within said outer shell in concentric spaced relation with each other and with said conducting stud. All of said tubes can be withdrawn through the open top of the outer shell.

In accordance with this invention said insulating tubes are supported in the aforesaid relation in such a manner that they can be withdrawn independently of the stud 32 and without the necessity for removing the bushing from the supporting casing 16 and without the necessity for gaining access to the lower end of the bushing and also without disturbing the oil-tight connection between the stud and the lower end of the bushing. To this end a tube support 44 is located at the bottom of the insulating shell 12 and surrounds the stud 32. Said support is preferably, although not necessarily, of insulating material and includes a hub 46 which closely surrounds the stud 32 whereby it is aligned with and secured axially in position by said stud. Preferably, however, it is loose on said stud and rests upon the inner bottom face of the bushing 26. Said support has a plurality of radially outstanding and upwardly extended arms 48 the outer faces 50 of which are approximately conformed with the configuration of the inner wall of the shell 12. Said arms 48 are provided with a series of steps each having a horizontal shelf 52 and vertical wall 54. The bottom ends of said insulating tubes 38, 40 and 42 are each received on a separate shelf and the walls 54 of said shelf are so spaced with regard to the axis of the conducting stud that the tubes are held in concentric spaced relation against lateral displacement. The tubes are free from positive connection with said support 44 and thus each tube can be withdrawn from the bushing through the outer top thereof independently of all other tubes and without the necessity either for removing the bushing from its casing or for breaking the oil tight seal between the bushing and the stud. This construction thus permits the insulating tubes to be easily withdrawn for examination and inspection and the replacement of a defective tube by a sound tube without the slightest danger of starting oil leaks in the outer shell.

A spacer member 56 surrounds said stud above said insulating tubes and has depending arms 58 which engage the tops of said tubes and hold them in spaced relation. Said member can be removed from its aforesaid relation prior to withdrawing the tubes.

In the modification illustrated in Fig. 4 the insulating tubes are all carried as a unit by a metal tube 60 which surrounds the stud 32. Said metal tube is free from positive connection with said stud and is held in concentric spaced relation therewith by upper and lower metal spacer members 62 and 64 respectively, which members also serve to connect said tube and stud electrically. At least the upper member is free from positive connection with the stud so that it can be removed. When said member is removed the metal tube with the attached insulating tubes can be withdrawn freely through the open top of the bushing.

The metal tube has an insulating layer 68, as paper, attached thereto which may be wound thereon. The innermost insulating tube 38*a* is maintained in concentric spaced relation therewith by blocks 70 interposed between said tube and insulating layer and attached to both at the upper and lower ends of the tube. The other insulating tubes 40*a* and 42*a* are similarly secured together by similar blocks 72 and 74. The metal and insulating tubes thus comprise a structurally integral unit which can be removed from the bushing independently of the stud.

I claim:

1. A high tension insulating bushing comprising an outer oil-containing insulating shell which has an opening at the top, and which is oil tight at the bottom, a stud extended lengthwise in said shell having screw-threaded means which secures it to the oil tight bottom of said shell, a cap on the top of said shell forming a closure for the opening thereof having means securing it in the aforesaid position which permits its removal independently of said stud, and an insulating tube surrounding said stud within and having its ends terminated short of the ends of said shell, said tube being free from attachment to said stud and shell and being smaller than said opening whereby it can be withdrawn from said shell through the top opening thereof without disturbing said stud and said shell.

2. A high tension insulating bushing including a multi-part oil-containing insulating shell which has an opening at the top and is closed at the bottom, means securing together the parts of said shell, a conducting stud extended lengthwise in said shell having means which fixes its lower end to the closed bottom of said shell, said stud being free for axial expansion above said fixed end and also being free from a connection with the upper end of said shell which restrains the stud against free axial expansion and contraction, and an insulating tube located in said shell about said stud and being free from permanent attachment with either, said tube being smaller than the top-opening of said shell and the space above said tube being free from permanent obstruction, whereby said tube can be withdrawn from said bushing through said opening while maintaining the connection be-

tween the parts of said shell and between said shell and stud.

3. An insulating bushing including an insulating shell comprising spaced upper and lower insulating sections and an intermediate metal connecting section secured together in a fluid tight manner, said shell having a closed bottom and an open top, a removable cover on the top of said shell forming a closure for the open top, a stud fixed in the bottom and extended loosely through and terminated at the cover, and an insulating tube loose in the bushing around the stud and withdrawable through the open top and off the stud without disturbance of said bushing and stud.

4. An insulating bushing including an insulating shell comprising spaced upper and lower insulating sections and an intermediate metal connecting section secured together in a fluid tight manner, said shell having a closed bottom and an open top, a removable cover on the top of said shell forming a closure for the open top, a stud fixed in the bottom and extended loosely through and terminated at the cover, an insulating tube loose in the bushing around the stud and withdrawable through the open top and off the stud without disturbance of said bushing and stud, and tube supports which are loose on said stud and which have parts that engage the ends of said tube and hold it in concentric spaced relation with said stud.

5. A high tension insulating bushing including an outer oil retaining insulating shell comprising spaced upper and lower insulating sections and an intermediate metal section secured together in an oil-tight manner, said shell having an opening at the top and being oil-tight at the bottom, a conducting stud extended lengthwise in said bushing and having its lower end fixed in the oil-tight bottom thereof, and an insulating tube located within and enclosed by and free from attachment to said shell in spaced relation with and free from attachment to said stud having means to support it in the aforesaid relation, said tube being smaller than the top-opening of said shell whereby it can be withdrawn through the open top of said shell while maintaining said stud and shell in the aforesaid relation.

6. A high tension insulating bushing having the combination of an outer oil containing insulating shell comprising spacer upper and lower insulating sections and an intermediate metal section secured together in an oil-tight manner, said shell having an opening at the top and being oil-tight at the bottom, a conducting stud extended lengthwise of said shell and having its lower end fixed in the oil-tight bottom of said shell, and a plurality of concentric spaced insulating tubes located within and surrounded along their length by said shell and disposed about said stud and free from positive permanent connection with said stud and shell, and means to support said tubes removably in the aforesaid relation, said tubes being smaller than the top-opening of said shell and the space above said tubes being free from fixed obstruction, whereby they can be withdrawn through the open top of said shell while maintaining said stud and shell in the aforesaid position.

7. A high tension insulating bushing having the combination of an outer oil containing insulating shell comprising spaced upper and lower insulating sections and an intermediate metal section secured together in an oil-tight manner, said shell having an opening at the top, a conducting stud extended through said shell and having means which provides an oil tight connection with and which fixedly supports it in the lower end of said shell, and a plurality of concentric spaced insulating tubes located within said shell about and free from positive connection with each other and with said stud and shell, and means to support said tubes in the aforesaid relation, said tubes being smaller than the top-opening in said shell and the space above said tubes being free from fixed obstruction, whereby the tubes can be withdrawn through the open end of said shell, each tube independently of all other tubes, while maintaining said stud in the aforesaid condition.

8. A high tension insulating bushing having the combination of an outer oil retaining insulating shell consisting of upper and lower tubular insulating sections and an intermediate tubular metal section and means connecting said sections permanently together in a rigid oil tight manner, said upper section having an open top and having substantially a uniform internal diameter from end to end thereof, a conducting stud extended through said shell and having means which fixes it in an oil tight manner in the lower end of said lower insulating section, said stud being free from a fixed connection with said upper section, and an insulating tube contained in said shell in concentric spaced relation with and free from positive connection with said stud and also with said shell and being smaller than the open top of said shell, whereby it is free to be withdrawn from said shell through the open top of said upper section while maintaining the stud in its aforesaid condition, the space above said tube being free from fixed obstruction.

9. A high tension insulating bushing having the combination of an outer oil retaining insulating shell comprising spaced upper and lower insulating members and an intermediate metal connection member, a conducting stud extended through said shell and having means which connects it rigidly to and in an oil tight manner with the lower end of said shell, a tube support surrounding said stud

at the lower end of said shell and having a plurality of spaced tube seats, and a plurality of spaced concentric tubes located within said shell about said stud and upon said seats and being free from positive connection with said stud and also with said shell, the top of said shell being open and the space above the tops of said tubes being free from permanent obstruction whereby said tubes can be removed through the open top of said shell while maintaining said stud in its aforesaid position.

In testimony whereof, I have signed my name to this specification.

GUSTAV E. JANSSON.