April 2, 1935. G. E. JANSSON 1,996,423

OIL INSULATED ELECTRICAL APPARATUS

Filed Feb. 27, 1931

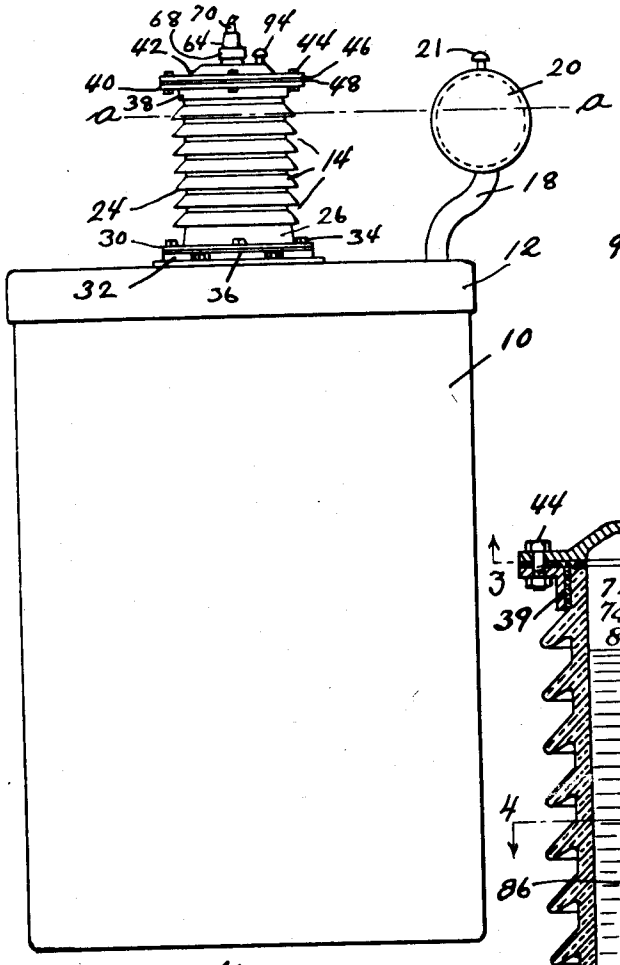


Fig. 1.

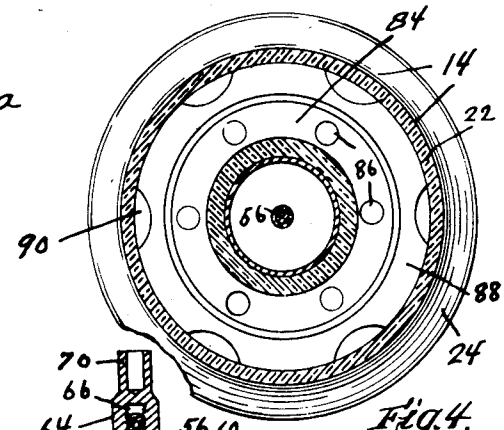


Fig. 4.

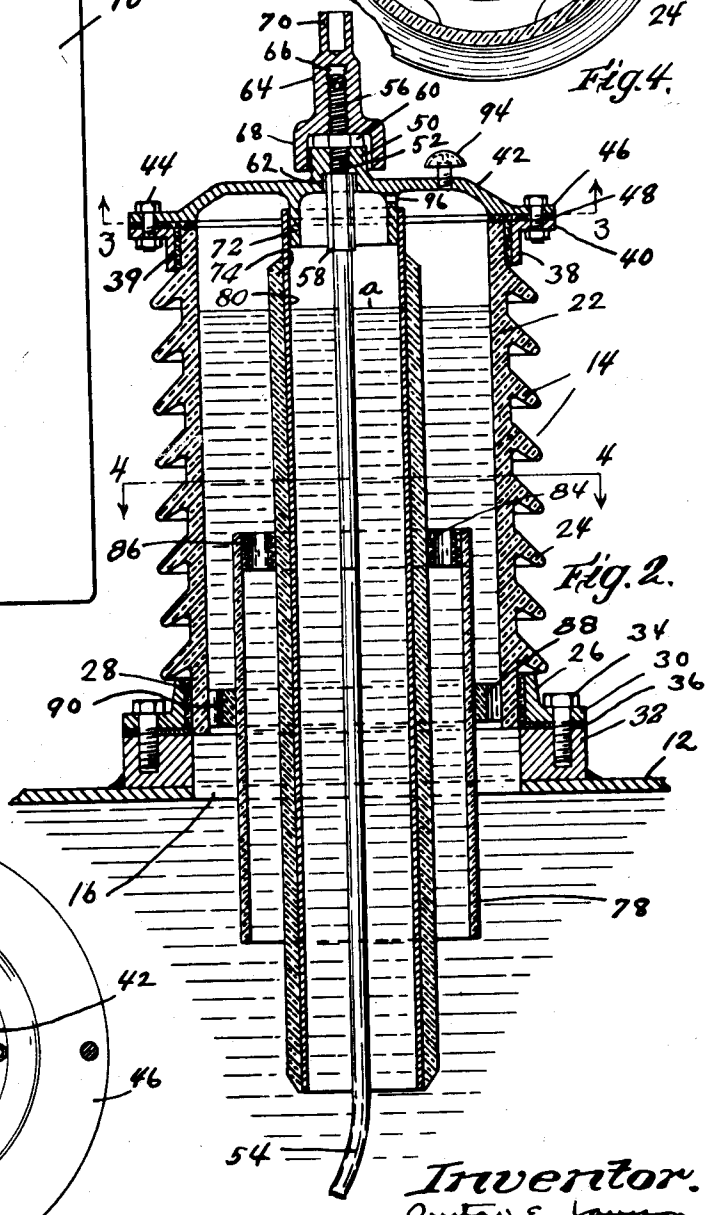


Fig. 2.

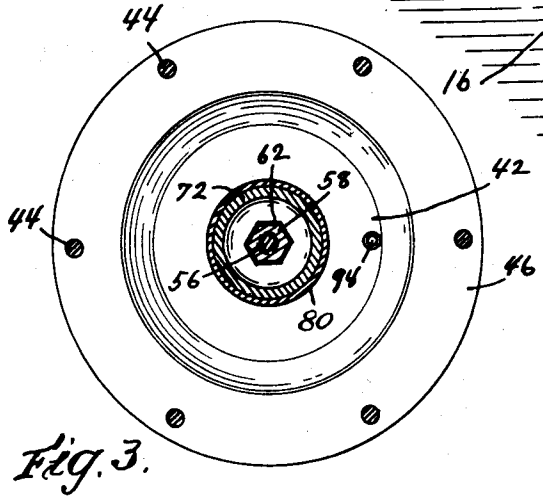


Fig. 3.

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Patented Apr. 2, 1935 1,996,423

UNITED STATES PATENT OFFICE

1,996,423

OIL INSULATED ELECTRICAL APPARATUS

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Application February 27, 1931, Serial No. 518,727

6 Claims. (Cl. 173—318)

This invention relates to high tension electrical apparatus, as electric switches and transformers, which are enclosed in oil containing casings and have elevated oil storage or conservator tanks for keeping the casings full of oil; and to insulating bushings for the high tension terminal leads of such apparatus.

An oil filled insulating bushing, as usually constructed, consists of a tubular shell of insulating material through which a conducting stud extends, and an intermediate metal sleeve having an attaching flange for supporting the bushing on the tank wall. When the voltage to be insulated is high, the tubular shell due to its great length is usually made with a plurality of aligned sections having their juxtaposed ends connected together, usually detachably. In bushings of this type considerable difficulty has been experienced in retaining the oil in the bushing due to its inherent tendency to seep through the joints between the sections. The presence of the insulating oil is essential to the safe operation of the bushing and frequent failures have occurred due to the gradual and often almost imperceptible seepage of oil through the joints.

It is an object of the present invention to cheapen the cost of high tension bushings when applied to oil containing casings having elevated conservator tanks associated therewith and to provide a bushing having a reduced number of oil tight joints, by providing a bushing that upstands above the top of the apparatus casing but mainly under the oil level in the conservator tank, and which is freely open at its lower end to the interior of the casing, and utilizing the elevated head of oil in the conservator tank to maintain the bushing filled with oil at least up to a level that is suitably above the top of the apparatus casing.

Another object of the invention is generally to improve the construction and performance of oil immersed electrical apparatus and insulating bushings therefor.

Fig. 1 is a side elevation of an oil immersed electrical apparatus embodying the present invention.

Fig. 2 is a sectional elevation of an insulating bushing of Fig. 1.

Fig. 3 is a section taken on line 3—3 of Fig. 2.

Fig. 4 is a section taken on line 4—4 of Fig. 2.

As here shown, the invention is illustrated in connection with a single phase transformer comprising an oil containing casing receptacle 10 having a cover 12 which provides a fluid tight closure at the top thereof. Said cover also constitutes the support for a pair of upstanding spaced insulating bushings 14, one of which is shown in Fig. 1, which are secured to said cover 12 over openings 16 therein and which upstand above and extend downwardly below said cover into the casing 10. Said cover 12 is also provided with an upstanding fluid conduit 18 which is freely in communication with the interior of the receptacle and which is also freely in communication with an elevated conservator tank 20 which is suitably supported above the cover 12. Said tank is adapted to contain oil to some level *a—a* and thus maintains the casing completely filled with oil, or other suitable insulating liquid, that is under a small head or pressure. The tank is usually vented to the atmosphere through the vent pipe 21 so that the oil in the casing and tank can expand and contract freely, due to temperature variation thereof, without an excessive variation of pressure.

Each of said insulating bushings 14 includes the outer tubular insulating shell 22 having external capes 24 and which upstands above the cover 12 and is secured in a fluid tight manner thereto about an opening 16. To this end an annular metal sleeve 26 is secured externally to the lower end of said shell by means of a body of cement 28. Said sleeve 26 is provided with an annular outstanding attaching flange 30 which overlies an annular ring 32 carried by the cover 12 about the periphery of the passage 16. Said ring 32 is preferably affixed to the casing by welding although in some cases it may be formed integral therewith. Attaching bolts 34 extend through the flange 30 and are screw-threaded into said ring 32 and serve to clamp said flange against the ring 32, a packing 36 being employed between the confronting faces of the flange and ring whereby to provide a fluid tight seal thereat.

An annular metal collar 38 is secured to the upper end of said shell 22 by means of a body of cement 39. Said collar 38 is formed with an integral outstanding annular flange 40 to which a cover 42 is secured by means of clamping bolts 44 which extend through an annular peripheral flange 46 of said cover and the flange 40 of said sleeve. A packing 48 may be interposed between the flanges 40 and 44, if desired, although an oil tight joint at this point is not essential.

Said cover 42 is provided with a central upstanding neck 50 having an axial passage 52 therethrough. A flexible high tension conductor 54 which is electrically connected at its lower end to the electrical apparatus in the receptacle extends upwardly through said shell 22 and has the

screw-threaded stem 56 of a hexagonal terminal connector 58 which is soldered to its free end passed loosely through said passage 52. A nut 60 which is screw-threaded on said stem above the neck 50 serves to hold the terminal connector 58 in position in said neck. As shown most clearly in Fig. 3, the cover 42 is provided with a hexagonal recess 62 in the lower face thereof aligned with the passage 52 in said neck in which the hexagonal connector 58 is closely received and consequently held against rotation relative to the cover. A terminal member 64 is provided at the upper end of said connector 58 having a screw threaded passage 66 therein to receive the stem 56 of said connector. Said terminal member 64 has an annular depending apron 68 which surrounds the upstanding neck 50 and constitutes a weatherproof closure for the passage 52 therein and is also provided with an upper integral lug 70 for the attachment of a suitable conductor.

The metal cap 42 is further provided with an annular depending flange 72 which is concentric with and is spaced apart a substantial distance from the inner surface of the insulating shell 22 and surrounds and is spaced from the conductor 54. Said flange constitutes means to support one or more concentrically spaced insulating tubes which subdivide the annular space between the shell 22 and the conductor 54. Two tubes 74 and 78 are here shown although a greater number may be employed if desired. The inner tube 74 is composed of strips of bakelized paper, or the like, wound on a relatively thin metal supporting tube 80 which depends from and is electrically connected with the flange 72 of the cap and which is secured in any suitable manner as by being screw threaded thereto. The outer tube 78 is located in the vicinity of the attaching sleeve 26, extending axially above and below said sleeve, and is supported in position by means of an annular insulating ring 84 which is affixed at its inner and outer peripheries to the confronting surfaces of said inner and outer insulating tubes 74 and 78 by means of cement, or by other suitable means. Said ring as shown most clearly in Fig. 4 is provided with a plurality of spaced vertical passages 86 to permit free fluid communication between the spaces above and below said ring. A second insulating ring 88 is cemented to said outer tube 78 externally thereof adjacent the attaching sleeve 26 and occupies the space between said tube 78 and the shell 22 thus to support the inner tubes against lateral movement at the lower ends thereof during transportation. Said insulating ring 88 is preferably free from positive connection with the shell 22 so that, upon dropping the conductor 54 and removing the cover attaching bolts 44, the insulating tubes 74 and 78 may be removed bodily with the cap 42 through the top of the insulating shell 22. By this provision a punctured insulating tube can be replaced without breaking the oil tight joint between the flange 30 and the casing cover 12. As best shown in Fig. 4 the ring 88 is provided with a plurality of spaced, vertical arcuate slots 90 in its external periphery which permit the free passage of fluid along the annular space occupied by said ring.

As above described it will be evident that the interiors of the insulating shells 22 are in free fluid communication with the interior of the casing receptacle 10. Consequently, the level of oil in the bushing will be at the same height as the oil level in the conservator tank, since both are in free communication. Preferably this height is just below the top of the bushing so that oil leakage through the joint between the bushing and the top cap 42 is eliminated and, in any event, the height of oil is intended to be such as to provide adequate insulation for the bushing. The top cap of the bushing is provided with a vent 94 so that the gas space above the oil in the bushing can expand and contract without changing the oil level. The gas space within the innermost tube 80 also has a vent passage 96 for the same purpose. Thus the conservator tank maintains a body of oil in the bushing at a pressure or head not less than that of the atmosphere.

The conservator tank preferably is arranged to have a large horizontal cross-section so that the oil in the casing can expand into the tank without harmfully changing the oil level in the tank and the bushings.

By the use of the conservator tank in the manner above described the bushings and the casing both are maintained full of oil from the same source, and the bushings can be made more economically and perform better than heretofore.

The term "oil" is used herein to denote any fluid that is electrically insulating and can be used satisfactorily in the present apparatus.

Various changes may be made in the construction and arrangement of the parts and in the type of bushing employed without departing from the scope of the invention.

I claim:

1. The combination of electrical apparatus having an oil containing receptacle, a cover for the open top of said receptacle having a passage therethrough, a conductor extended through and spaced apart from the periphery of said passage, an insulating bushing comprising a tubular insulating shell upstanding above the cover of said receptacle, said shell having an annular outstanding attaching flange at its lower end by which it is secured in fluid tight relation to the cover of said receptacle, whereby to form a closure for the passage therein, a cap forming a closure for the open top of said shell having means providing free fluid communication between said receptacle and the atmosphere, and means to maintain the level of the body of oil in said receptacle and insulating shell above the top of said receptacle including a conservator tank which is located in an elevated position above and which is in fluid communication with said receptacle and with the normal level of oil in said tank below said cap.

2. The combination of electrical apparatus having an oil containing receptacle, a fluid tight closure for the top of said receptacle having a passage therethrough, an insulating bushing upstanding above said receptacle cover including a tubular insulating shell having an external attaching flange which is secured in fluid tight relation to said receptacle cover about the passage therein, a cap forming a closure for the open top of said shell having a vent passage therein, a plurality of spaced concentric insulating tubes located within said shell adjacent the attaching flange thereof, and means to maintain the body of insulating oil in said receptacle and bushing at some level above the attaching flange of said bushing and below said cap including an elevated conservator tank adapted to contain a body of oil which is in communication with the oil in said receptacle and the normal oil level of which oil body is below said cap.

3. The combination of electrical apparatus having an oil containing receptacle, a cover pro-

viding a fluid tight closure for said receptacle having an opening therein, a conductor extended through and spaced apart from the periphery of said opening, an insulating shell which is open at the top and bottom surrounding said conductor and upstanding above said receptacle cover, said shell having an external flange which is secured in a fluid tight manner to said cover about said opening, a cap forming a closure for the open top of said shell having a vent opening therein, an inner insulating tube surrounding said conductor having its upper end fixed to said cap and having its lower end extended below said cover into said receptacle, means providing lateral support for said inner tube intermediate its ends, and an elevated conservator tank which is in fluid communication with said receptacle adapted to contain oil to a level which is above the top of said receptacle cover so as to maintain said receptacle completely filled with oil at a pressure above the atmosphere and also to maintain a column of oil in said upstanding conductor insulating shell at a pressure not less than that of the atmosphere.

4. The combination of electrical apparatus having an open top oil receptacle, a cover forming a fluid tight closure therefor having an opening therein, a tubular insulating shell upstanding above said cover and having an open bottom end which encloses the opening in said cover and has a fluid tight connection with said cover about said opening, a cap forming a closure for the top of said receptacle having a vent therein, a conductor extended through said shell and the opening in said receptacle having an electrical connection with said cap, an elevated conservator tank which is in free fluid communication with said receptacle, said tank adapted to contain a body of oil at a level which is intermediate the ends of said shell so as to maintain said receptacle completely full of oil at a pressure greater than that of the atmosphere and also to maintain a column of oil in said shell at a pressure not less than that of the atmosphere, and means located above the level of oil in said tank to vent said tank freely to the atmosphere so as to maintain a common level of oil in said tank and in said shell.

5. Electrical apparatus comprising an oil containing enclosing casing, an insulating bushing extended through said casing and having its interior open to the oil beneath the oil level therein and having a part that upstands above the top of the oil, and means including an elevated oil tank in communication with the oil in said casing to maintain the oil in said casing at a pressure above that of the atmosphere and oil in the upstanding part of said bushing at pressure at least not less than the atmosphere.

6. Electrical apparatus comprising an oil containing enclosing casing, an insulating bushing extended through said casing and having its interior open to the oil beneath the oil level therein and having a part that upstands above the top of the oil, and means including an elevated oil tank in communication with the oil in said casing to maintain the oil in said casing at a pressure above that of the atmosphere and oil in the upstanding part of said bushing at pressure at least not less than the atmosphere, the interior of the bushing above the oil level therein being vented to the atmosphere.

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