

Sept. 13, 1932.

J. RAH

1,877,586

TOP CAP ASSEMBLY FOR HIGH VOLTAGE BUSHINGS

Filed Feb. 15, 1930

2 Sheets-Sheet 1

Fig. 2.

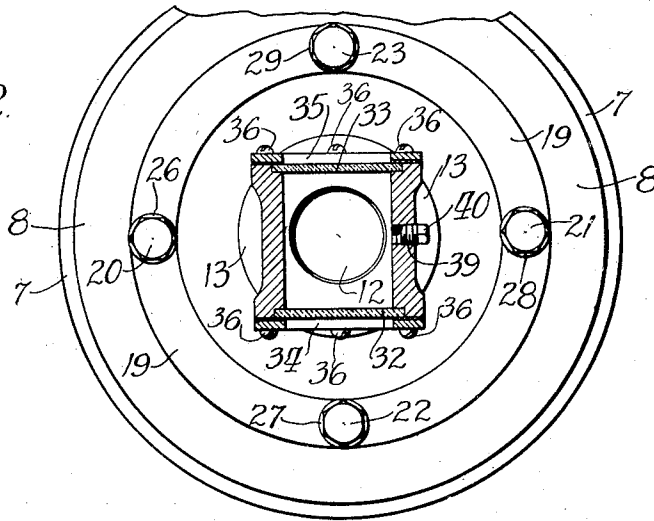
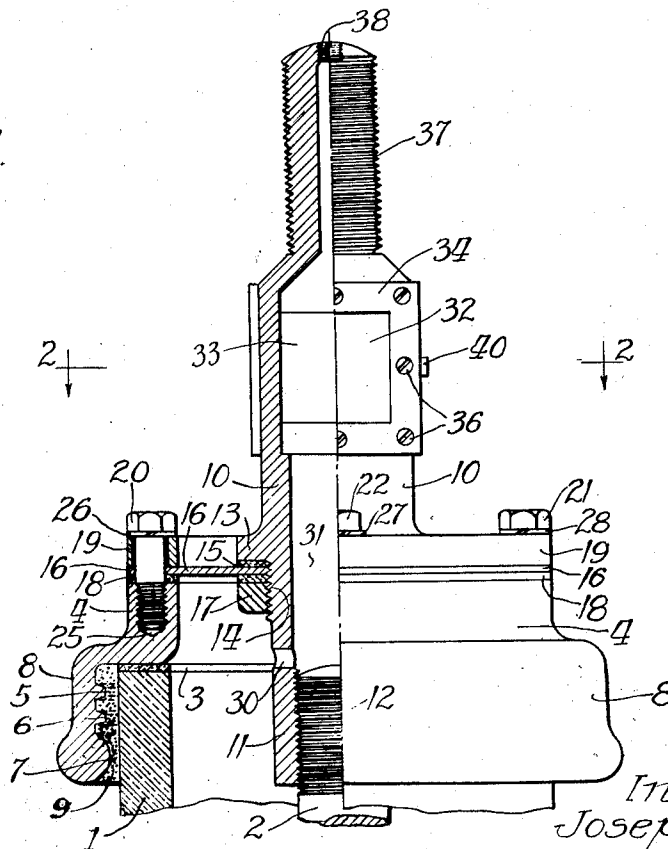


Fig. 1.



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2 Sheets-Sheet 2

Fig. 3.

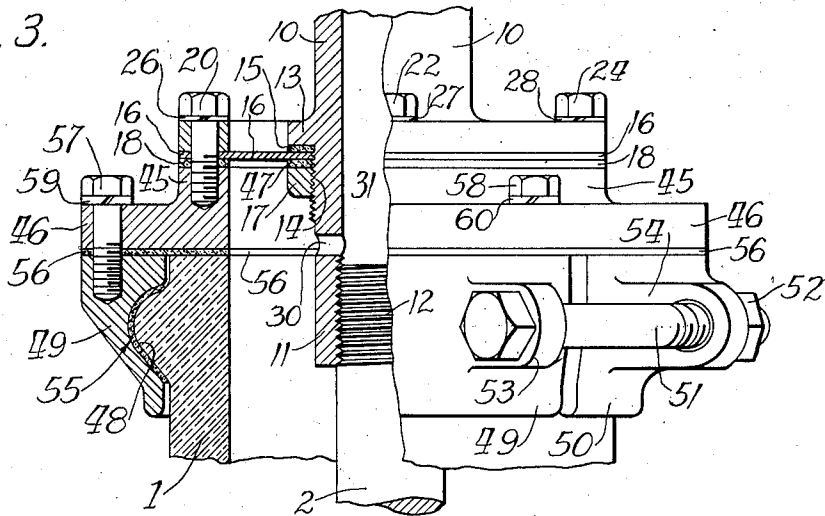
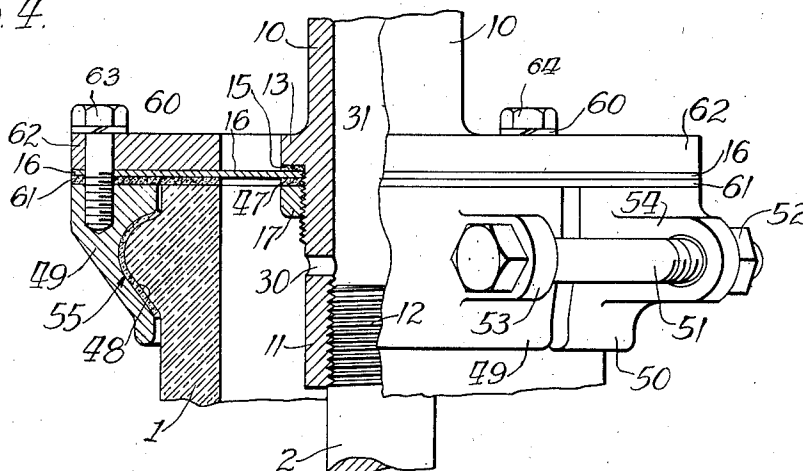


Fig. 4.



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UNITED STATES PATENT OFFICE

JOSEPH RAH, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE DELTA STAR ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

TOP CAP ASSEMBLY FOR HIGH VOLTAGE BUSHINGS

Application filed February 15, 1930. Serial No. 428,615.

My invention relates, generally speaking, to high voltage bushings, and is particularly concerned with a novel and improved top cap assembly for such bushings.

5 The name high voltage bushing, as used in this specification and in the appended claims, denotes a device for receiving an electric conductor in insulated relation, and carrying a terminal member for establishing connection
10 between the conductor and a current conducting or distributing body which may be a bus bar.

The device contemplated in the following is particularly adapted for the use in connection
15 with circuit breakers but is by no means exclusively limited to this use.

A bushing of this type consists, in one embodiment, of an insulating casing filled with oil and attached to an apparatus, as for ex-
20 ample to the lid of a circuit breaker tank. It extends through the lid into the interior of the circuit breaker tank and projects therefrom to the exterior. A conductor rises within the tank and within this oil-filled insulating bushing and is attached within the bush-
25 ing to a terminal member which projects from the top cap of the bushing in order to provide for establishing connection between the conductor and a bus bar.

30 One of the problems arising in connection with the design of such bushings has to do with the different coefficients of expansion of the insulating casing of the bushing and of the electric conductor within this casing.
35 The conductor must be securely attached within the oil-filled insulating casing. Its co-efficient of expansion is higher than the co-efficient of expansion of the insulating casing, and accordingly, it expands during
40 operation proportionally more than the casing, creating strains and stresses which, under certain conditions might be detrimental to the assembly and cause cracks in the insulating casing with resulting leakage.

45 It has, therefore, been the desire to design a device which would in some manner prevent the possibly detrimental effects resulting from the different co-efficients of expansion of the conductor and of the insulating casing.

Another point stressed particularly by

55 maintenance engineers is concerned with provisions for indicating the oil level within the bushing in a definite and dependable manner. It must be considered in connection with this particular requirement that the oil within the casing expands during operation due to the heat developed by the current conductor im-
60 mersed in the oil within the casing. An oil indicator showing the variation of the oil level due to expansion would not answer this requirement satisfactorily. Furthermore, the conductor must be completely immersed in oil at all times, and due to this requirement
no margin is left for indicating the oil contents within the bushing in a conventional manner.

Other requirements have to do with the general design of the device, which must be of sturdy structure, with all parts easily ac-
70 cessible for assembly and for inspection or for readjustments. The device must be oil-tight and safe and dependable in installation and in maintenance.

It is the aim of my invention to furnish, broadly stated, a high voltage bushing of
75 the class explained, which exhibits all desirable features, partly intimated above, and which incorporates numerous novel features and improvements not found in prior devices of this type.

80 One object of the invention is concerned with a bushing, and particularly with the top cap assembly thereof, which is characterized by simplicity of design, by sturdy and dependable structure, and by safe and economic
85 operation.

Another object resides in features of simplified assembly and accessibility of all parts.

A further object relates to provisions for insuring an oil-tight fit of the assembly.
90

95 Still another object has to do with the provision of a flexible diaphragm for attaching a terminal to the top cap of the bushing in coaxially movable relation thereto, in order to provide for equalizing longitudinal strains and stresses caused by different expansion of the insulating casing and of the conductor therein which is connected to the terminal.

A further object resides in the provision of an air cushion or air pocket interposed be-
100

tween the oil level within the bushing and the closing or sealing diaphragm mentioned above, for the purpose of equalizing the expansion of oil due to the heat developed during operation.

Another object is concerned with the provision of an oil indicator for the bushing, which is combined with the terminal connected to the conductor within the bushing.

10 A further object relates to the combination of certain structural elements in such a manner as to utilize them for a variety of purposes, that is to say, for utilizing the terminal member for sealing the assembly oil tight
15 and for further utilizing the terminal member to serve as an oil indicator for the bushing.

Another object relates to communicating provisions between the interior of the indicator terminal and the interior of the bushing
20 to insure positive and true indication of the oil contents within the bushing regardless of the expansion of the oil, that is to say, communicating provisions which do not transmit
25 the full value of variations of the oil level in the bushing to the indicator, so that the indicator shows at all times a true mean oil level.

30 Still a further object resides in removable provisions for inserting oil into the indicating terminal member which is in communication with the interior of the bushing.

Another object has to do with removable provisions for attaching a test or exhaust
35 pipe to the indicating terminal.

A further object is concerned with mounting provisions for adjustably and yieldably attaching the terminal of the bushing to the insulating casing in order to permit adjustments
40 in accordance with lateral strains and stresses imposed upon the assembly under ordinary conditions of installation, operation, and maintenance.

Other objects not mentioned in the previous statements will appear as the description progresses.

The invention will be best understood with reference to the appended two sheets of drawings, in which:

Figure 1 shows a top cap assembly for a high voltage bushing, partly in cross section and partly in plan view to facilitate explanations and understanding;

Figure 2 illustrates a cross sectional view
55 of the assembly as taken on line 2—2 of Figure 1;

Figure 3 discloses a modified way of attaching the indicating terminal to the insulating casing by means of adjustable sectional clamps; and

Figure 4 shows still another modification of the assembly disclosed in Figure 3.

Like parts in all figures are indicated by like reference numerals.

65 I will now describe and particularly ex-

plain the invention in detail, first with reference to Figures 1 and 2.

Reference numeral 1, in these figures, indicates the insulating casing of the bushing. This casing is of tubular form and may be fastened to the lid of a circuit breaker, extending partly into the interior of the circuit breaker tank and projecting from the tank to the exterior. A conductor 2 having a threaded portion 12, and maintaining conductive relation with a conductor in the circuit breaker, rises within the tubular casing.

Only the top section of the casing 1 and of the conductor 2 have been shown, because, as stated previously, the invention is primarily concerned with the top cap assembly of the bushing. The description of the location, the fastening of the bushing to the circuit breaker proper, and of the relations existing between the bushing and the circuit breaker, as presented above is deemed sufficient for rendering easy understanding.

Continuing now the explanations of the invention, there is a gasket 3 attached to the end of the insulating casing 1, and a cap member 4, engaging the gasket 3, is firmly attached to the casing 1 by means of cementing. The protuberances 5, 6 and 7 on the inside of the cap rim 8 are provided for the purpose of firmly merging with the cement filling 9
95 between the cap rim 8 and the casing 1.

It is understood, of course, that the outside of the casing 1 is sanded at the portion provided for cementing in order to insure that the cement filling attaches firmly to this sanded surface.

As stated previously, one object of the invention resides in combining certain structural elements and utilizing these elements for more than one purpose. This principle is realized in the present case by using a hollow terminal member 10 which is attached to the conductor 2 by means of an internal thread provided in the lower portion 11 of the terminal, and by also employing this terminal member for sealing the assembly oil tight as will be described presently.

Recalling another statement of objects, it will be remembered that my invention contemplates a flexible and yet dependable mechanical connection between the conductor within the bushing and the insulating casing, in order to provide for different expansion of the casing and the conductor relative to each other, thereby equalizing strains and stresses caused by such difference in expansion, and preventing breakage of the insulating casing or warping of other parts. This flexible connection must be oil tight of course. It is accomplished as follows:

The terminal member 10 is provided with a shoulder 13 and with a threaded portion 14. A gasket 15 is attached to the shoulder 13 and a diaphragm 16 is attached to the threaded portion 14 and in engagement with

the gasket 15 and is firmly held in this position by means of a nut member 17 also attached to the threaded portion 14 for holding the diaphragm 16 in firm engagement with the terminal member 10.

The assembly as described above is now fastened to the cap member 4 and in oil tight relation therewith. A gasket 18 is for this purpose attached to the cap member 4. The diaphragm 16 is then placed on this gasket, and a top or closing ring 19 is placed on the diaphragm for holding the same peripherally in place and connected firmly to the cap member 4. Bolts, such as 20, 21, 22 and 23 are employed for attaching the ring 19. These bolts are received in threaded holes, such as 25 provided in the cap member 4. Reference numerals 26, 27, 28 and 29 indicate ordinary washers.

The terminal member 10 is now completely attached in oil tight relation relative to the insulating casing 1, and the attachment, it will be appreciated, is flexible and yieldable due to the diaphragm 16. A difference in expansion between the conductor 2 (which is attached to the terminal member 10) and the insulating casing 1 will be equalized and adjusted by the flexible diaphragm 16 without transmitting strains or stresses or causing any strains or stresses to any part of the assembly.

Breakage resulting from this cause is therefore eliminated.

Before continuing the description of the structural details attention is called to the feature of providing an air pocket between the closing diaphragm 16 and the oil level within the bushing. The oil level will rise approximately slightly above the gasket 3. When the oil expands, the expansion will be against the force of the air cushion which will act to equalize the expansion of the oil within desirable limits.

An opening 30 is provided in the terminal member 10 within the bushing for maintaining communication with the hollow interior 31 of the terminal member 10. Two oppositely disposed glass plates 32 and 33 are attached to the terminal 10 by means of frame members 34 and 35 which are fastened to the body of the terminal by means of screws 36. The upper portion of the terminal 10 is provided with a thread 37 for the purpose of attaching the terminal to a current conducting or distributing body which may be a bus bar. The terminal is hollow throughout for the purpose of inserting oil into its interior, and the opening is finally sealed with a plug 38. There may be an opening 39 in the terminal, sealed by means of a pipe plug 40, for the purpose of attaching a filling, a test, or an exhaust pipe to the terminal.

The operation is as follows:

When the top cap assembly is completely attached as was described above, oil is filled in

through the opening on top of the terminal 10. The oil will flow through the opening 30 into the interior of the casing 1. When the oil level within the casing rises to approximately the opening 30, pressure will develop against the air pocket between the diaphragm and the oil level, and the oil will accordingly rise within the terminal. The terminal is filled with oil to about the center of the glass plates, and the opening in the upper end of the terminal is finally plugged by means of the plug 38. Expansion of the conductor 2 (transmitted to the terminal 10) and expansion of the insulating casing 1, will be equalized by means of the flexible diaphragm as has been noted previously. The expansion of the oil within the casing 1 will encounter the air pocket as explained. The oil level within the terminal, and visible through the indicating glass plates will not follow the full variation of the oil level within the bushing, but will oscillate only within a very small margin. This is due firstly to the inertia of the oil within the terminal, secondly to the influence of the residual air between the plug 38 and the oil level in the terminal, and lastly due to the equalizing influence of the air pocket provided in the bushing between the oil level therein and the flexible diaphragm.

On the other hand, any diminution of the oil within the bushing, as it may be caused by leakage from any cause, will immediately manifest itself by a lowering of the oil level within the indicator terminal. The conductor is thus securely immersed in oil, and the attention of the attendant will be called to a condition of leakage or other damage before the oil level has dropped to such extent as to expose the conductor.

It will be seen from the above that my invention provides a novel and improved top cap assembly for a high voltage bushing, including an insulating casing for receiving an electric conductor, and having a terminal member for rigid attachment to this conductor within the insulating casing, together with flexible means for adjustably and yieldably attaching the terminal in oil tight relation to the insulating casing, and other means including the terminal, for indicating the true mean oil level within the casing in a definite manner.

In Figures 3 and 4, I have shown modifications of the device illustrated in Figures 1 and 2, which I will describe next.

Referring to the modification shown in Figure 3, the conductor 2 and the manner of attaching the same to the terminal member 10, and also the flexible attachment of the terminal 10 to the cap member 45, are the same as explained in connection with Figures 1 and 2.

The chief difference between this modification and the assembly previously described

resides in the manner in which the top cap member is attached to the insulating casing. In the previous case, this attachment was shown to be rigid, by cementing the cap member to the insulating body, and in the modification about to be explained, the attachment is adjustable and laterally yieldable.

The insulating body is provided with a rounded peripheral protuberance 48. Attached to this protuberance is a sectional or split clamp consisting of sections which conform to the shape of the protuberance 48. The sections indicated by reference numerals 49 and 50 are peripherally attached together by means of bolts, such as 51, and nuts 52. The bolts project through peripheral extensions 53 and 54 provided on the clamp sections. Interposed between the clamp sections embracing the insulating body, and the peripheral protuberance 48 on the insulating body, is a layer 55 of lead or of other suitable substance for the purpose of insuring a firm grip of the clamp on the insulating casing and at the same time providing for a cushioning effect therebetween.

The top cap member 45 is provided with a flange 46 for attachment to the sectional clamps 49 and 50. A gasket 56 is interposed between the clamp and the insulating body and the flange 46 for providing an oil tight joint.

The flange is fastened to the clamp sections by means of bolts such as 57 and 58, extending through holes in the flange 46 and in the gasket 56 and taking hold in threaded holes provided in the clamp sections. Numerals 59 and 60 designate ordinary washers.

It will be appreciated that the use of sectional clamps for attaching the top cap assembly to the insulating casing represents many advantages. The arrangement is mechanically removable and adjustable, and will yield to lateral strains and stresses imposed upon the assembly under ordinary conditions, as for example stresses occasioned by a lateral pull or jerk on the terminal member incident to shipping and to installation or repair work. The top cap of the bushing will, therefore, adjust itself automatically to lateral strains and stresses within reasonable limits without damage to the insulating casing or to any structural element, and without altering the oil tight fit of the assembly.

In Figure 4, I have shown another modification of the assembly still more simplified with regard to the one just explained.

The insulating casing shown in Figure 4 is somewhat longer than the casing shown in Figure 3, and again provided with a peripherally extending protuberance 48. A sectional mounting clamp is again attached to this protuberance in the manner already described.

A gasket 61 is in engagement with the in-

sulating casing 1 and with the sectional clamp. The diaphragm 16, fastened to the oil level indicating terminal member 10 is attached to this gasket, and the entire assembly is completed by fastening a simple mounting or closing ring 62 by means of bolts such as 63 and 64 which are secured in threaded holes provided in the various clamp sections.

The operation of the modification shown and described above with reference to Figures 3 and 4 is the same as explained in detail in connection with Figures 1 and 2, with the additional feature of adjustably and yieldably attaching the terminal assembly to the insulating casing for the purpose of equalizing lateral strains and stresses imposed upon the terminal, and thus avoiding breakage or damage.

The inventive ideas disclosed above may, of course, receive a variety of expressions, differing in detail from the structures shown and described in this specification without departing from the spirit of the invention. I, therefore, want to have it understood that I do not intend to limit myself in any way in the structural details or in the application of my invention, otherwise than specifically stated in the claims which follow.

I claim as my invention:

1. A device for establishing connection between two current conductors, having a tubular insulating casing for receiving a conductor, terminal means for attachment to said conductor, a flexible substantially flat ring-shaped diaphragm, means for securing the inner portion of said diaphragm to said terminal means, and means for securing the outer portion of said diaphragm to said casing.

2. A device for establishing connection between two current conductors, having a tubular insulating casing for receiving a conductor, terminal means for attachment to said conductor, a lateral flange on said terminal means, a laterally extending flexible member clamped to said flange, and means for rigidly clamping said member to one end of said casing for securing said terminal means in axially adjustable relation relative to said casing.

3. A device for establishing connection between two current conductors, having a tubular insulating casing for enclosing a conductor extending into said casing substantially centrally thereof, terminal means for attachment to said conductor at one end of said casing, flexible diaphragm means attached rigidly to said terminal means and laterally extending therefrom, a mounting member secured yieldably to said end of said casing exteriorly thereof, and means for attaching said flexible diaphragm to said mounting member.

4. A device for establishing connection between two current conductors, having a tubular insulating casing for receiving a conductor, terminal means for attachment to said

conductor, a flexible diaphragm axially displaceable relative to said casing, means for centrally attaching said diaphragm to said terminal means and in oil-tight relation therewith, mounting means, means for adjustably and yieldably attaching said mounting means to said casing, and means for adjustably attaching said diaphragm peripherally to said mounting means and in oil-tight relation thereto.

5. A device for establishing connection between two current conductors, having a tubular insulating casing for receiving a conductor, terminal means, means on said terminal means for establishing connection with said conductor within said casing, a flexible diaphragm, means on said terminal for attaching the inner portion of said diaphragm thereto and in oil-tight relation therewith, a tubular mounting member, means for attaching said mounting member to said casing at one end thereof, means for attaching the outer portion of said diaphragm to said mounting member and in oil-tight relation thereto and to said casing, and means on said terminal for connecting said terminal to another conductor outside said casing.

6. An oil containing bushing for a high voltage device including an electric conductor, having a tubular insulating casing for receiving said conductor, a single unitary tubular terminal, means for directly connecting said terminal with said conductor within said casing, flexible mounting means for attaching said terminal to said casing in oil-tight relation therewith and axially movable thereto, means on said terminal for supplying oil to said casing through said terminal to immerse said conductor within said casing and to provide an oil column within said tubular terminal, an air cushion forming within said casing below said flexible mounting means, and means on said terminal for indicating variations of the oil level within said casing against said air cushion by means of said oil column within said tubular terminal, said oil column communicating with the oil within said casing.

7. An oil containing bushing for establishing connection between two current conductors having a tubular insulating casing for receiving a conductor, terminal means, means for rigidly attaching said terminal means to said conductor within said casing, adjustable means for attaching said terminal means to said casing in axially movable relation thereto and in oil-tight relation therewith, means for supplying oil to said casing, and means on said terminal means for indicating the oil contents within said casing.

8. An oil containing device for receiving an electric conductor, having an insulating casing, tubular terminal means rigidly connected to said conductor within said casing, flexible means for movably attaching said terminal

means to said casing and in oil-tight relation thereto, said flexible means being effective to permit displacement of said conductor and of said terminal means axially to said casing in response to expansion and contraction of said conductor, and means attached to said terminal means exterior of said casing for indicating the oil contents within said casing, said oil within said casing communicating into said tubular terminal means.

9. An oil containing bushing for a high voltage device including an electric conductor, having a tubular insulating casing for receiving said conductor, tubular terminal means connected firmly to said conductor within said casing and projecting therefrom, adjustable mounting means including a flexible diaphragm for attaching said terminal means to said casing in oil-tight relation thereto and in axially displaceable relation therewith, means in said terminal for supplying oil to said casing, and means on said terminal for visibly indicating the oil contents within said casing.

10. An oil containing bushing for a high voltage device including an electric conductor, having a tubular insulating casing for receiving said conductor, tubular terminal means connected firmly to said conductor within said casing and projecting therefrom, adjustable mounting means including a laterally extending flexible diaphragm for attaching said terminal means to said casing in oil-tight relation therewith and in axially displaceable relation thereto, means on said terminal means for supplying oil to said casing through a communicating duct in said tubular terminal means, and means on said terminal for indicating the fluctuations of the oil contents within said casing and within said terminal.

11. An oil containing bushing for a high voltage device including an electric conductor, comprising a tubular insulating casing for receiving said conductor, said conductor extending substantially centrally into said casing, tubular terminal means connected firmly to said conductor within said casing at one end thereof and projecting therefrom, adjustable mounting means including a laterally extending flexible diaphragm rigidly secured to said terminal means for attaching said terminal means to said casing in oil-tight relation therewith and in axially displaceable relation thereto, means on said terminal for supplying oil to said casing through an opening in said terminal means to immerse said conductor within said casing and to provide an oil column extending into said tubular terminal, and means on said terminal for indicating variations of the oil level within the casing by means of said oil column extending into said terminal.

12. An oil containing bushing for a high voltage device including an electric conductor,

comprising a tubular insulating casing for receiving said conductor, said conductor extending substantially centrally into said casing, tubular terminal means connected firmly to said conductor within said casing and projecting therefrom at one end thereof, adjustable mounting means including a flexible diaphragm rigidly secured to said terminal means and laterally extending therefrom for securing said terminal means to said casing in oil-tight relation therewith and in axially displaceable relation thereto, means on said terminal for supplying oil to said casing through a communicating opening in said tubular terminal to immerse said conductor within said casing and to provide an oil column extending into said tubular terminal, an air cushion forming within said casing below said flexible diaphragm, and means on said terminal for indicating variations of the oil level within said casing against said air cushion by means of said oil column extending into said tubular terminal.

13. An oil containing bushing for a high voltage device including an electric conductor, having a tubular insulating casing for receiving said conductor, tubular terminal means connected firmly to said conductor within said casing and projecting therefrom, adjustable mounting means including a flexible diaphragm for attaching said terminal means to said casing in oil-tight relation therewith and in axially movable relation thereto, means on said terminal for supplying oil to said casing through a communicating opening in said tubular terminal to immerse said conductor within said casing and to provide an oil column extending into said tubular terminal, an air cushion forming within said casing below said diaphragm means attached to said terminal for indicating variations of the oil level within said casing below said air cushion by visibly exposing said oil column extending into said terminal, a pipe plug, and means on said terminal for attaching said pipe plug thereto.

14. An oil containing bushing for a high voltage device including an electric conductor comprising a tubular insulating casing for receiving said conductor a unitary tubular terminal means connected firmly and directly to said conductor within said casing and projecting therefrom at the end of said casing, a rounded enlargement at the end of said casing integral therewith, a split clamp yieldably secured to said enlargement, flexible means secured to said clamp and to said terminal for movably securing said terminal in oil-tight relation thereto, means on said terminal for supplying oil to said casing through a communicating opening in said terminal for immersing said conductor within said casing and for providing an oil column within said tubular terminal, and means on said terminal for indicating variations of the oil

level within said casing by means of said oil column within said terminal.

15. An oil containing bushing for a high voltage device including an electric conductor, comprising a tubular insulating casing for receiving said conductor, a unitary tubular terminal member connected directly to said conductor within said casing and projecting therefrom at the end thereof, a rounded circumferentially extending enlargement at the end of said casing integral therewith, a split clamp yieldably secured to said enlargement, a flexible diaphragm rigidly secured to said terminal and to said clamp for movably securing said terminal in oil-tight and adjustable relation to said casing, means on said terminal for supplying oil to said casing through an opening in said terminal communicating with the interior of said casing to immerse said conductor within said casing and to provide an oil column extending into said tubular terminal, an air cushion forming within said casing below said flexible diaphragm, and means on said terminal for indicating variations of the oil level within said casing against said air cushion by means of said oil column extending into said tubular terminal.

16. An oil containing bushing for establishing connection between two current conductors, including a tubular insulating casing for receiving a conductor, terminal means, means for attaching said terminal means to said conductor, adjustable mounting means yieldably attached to said casing, flexible intermediate means for attaching said terminal means to said mounting means in oil-tight relation relative to said casing and axially movable thereto, means for supplying oil to said casing, and means attached to said terminal for indicating the oil contents within said casing.

17. An oil containing device for receiving an electric conductor, including an insulating casing, tubular terminal means, means for firmly attaching said terminal to the conductor within said casing, adjustable mounting means peripherally and yieldably attached to said casing, a flexible diaphragm secured to said terminal and laterally extending therefrom, means for attaching the outer portion of said diaphragm to said mounting means in oil-tight relation relative to said casing, and means attached to said terminal exteriorly of said casing for indicating variations of the oil contents within said casing.

18. An oil containing bushing for a high voltage device including an electric conductor comprising a tubular insulating casing for receiving said conductor, tubular terminal means firmly connected to said conductor within said casing and projecting therefrom, adjustable mounting means yieldably attached to one end of said casing, a flexible diaphragm, means for rigidly securing the inner

portion of said diaphragm to said terminal and in oil-tight relation therewith, means for rigidly securing the outer portion of said diaphragm to said mounting means in oil-tight relation thereto and to said casing, means on
5 said terminal for supplying oil through said terminal to the interior of said casing to immerse said conductor therein and to provide an indicating oil column within said tubular
10 terminal, and means attached to said terminal for visibly exposing said oil column to observe the variations of the oil level.

19. An oil containing bushing for a high voltage device including an electric conductor, having a tubular insulating casing for receiving said conductor, tubular terminal means firmly connected to said conductor within said casing and projecting therefrom, adjustable mounting means yieldably attached to said casing at the end thereof, a
20 shoulder on said terminal, a flexible diaphragm rigidly secured to said shoulder in oil-tight relation with said shoulder of said terminal, means for attaching the outer portion of said diaphragm to said mounting
25 means in oil-tight relation thereto and to said casing, means on said terminal for supplying oil through said terminal to the interior of said casing to immerse said conductor therein and to provide an indicating oil column
30 extending into said tubular terminal, an air cushion forming within said casing below said diaphragm, and means attached to said projecting terminal exterior of said casing
35 for visibly exposing said oil column to observe the variations of the oil level against said air cushion within said casing.

20. The top cap assembly for a high voltage oil containing bushing including a current conductor, having a tubular insulating casing for receiving said conductor, a terminal attached to said conductor, means for attaching said terminal to said casing in oil-tight relation therewith and axially movable
45 and laterally yieldable thereto, and means attached to said terminal for indicating the variations of the oil contents within said bushing.

In witness whereof, I hereunto subscribe
50 my name this 11th day of February, 1930.

JOSEPH RAH.

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