

April 15, 1930.

H. G. MacDONALD ET AL

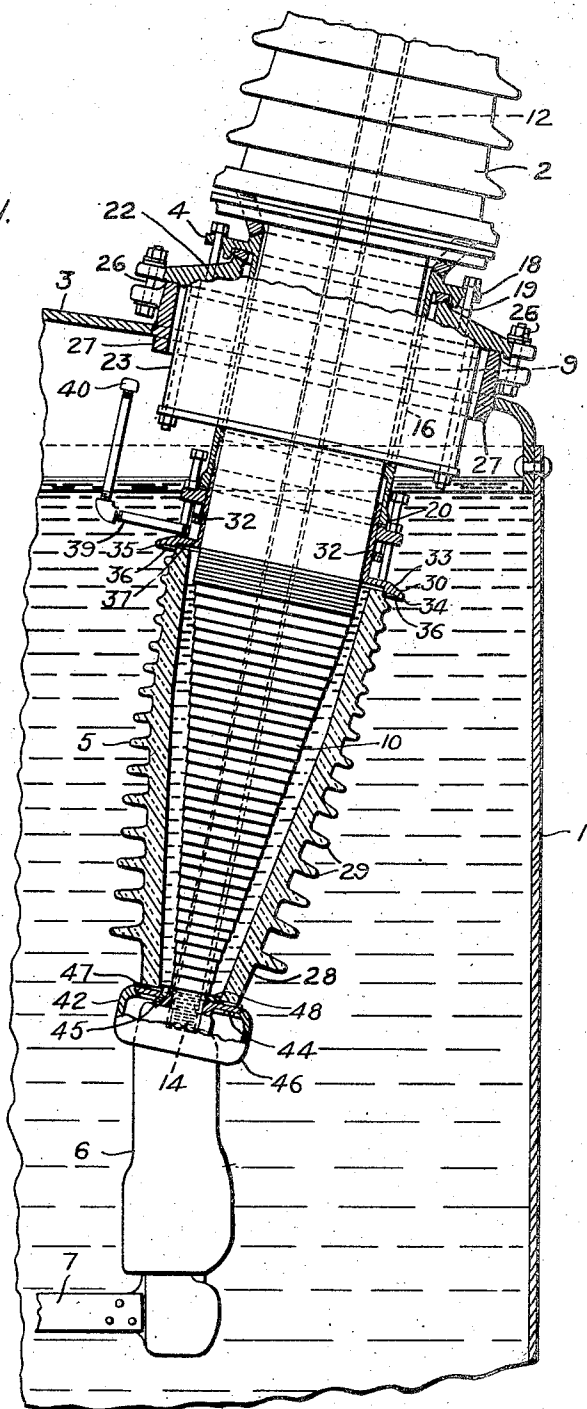
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HIGH VOLTAGE STRUCTURE

Filed Sept. 23, 1927

4 Sheets-Sheet 1

Fig. 1.



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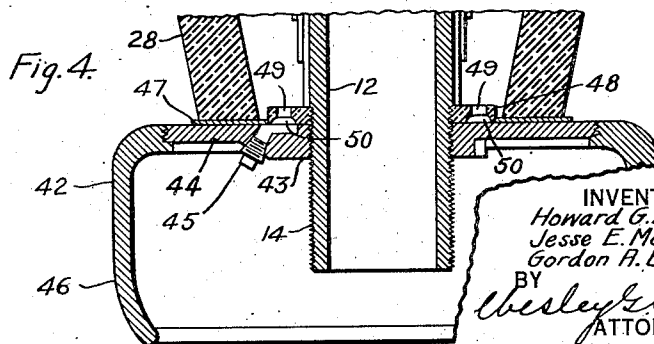
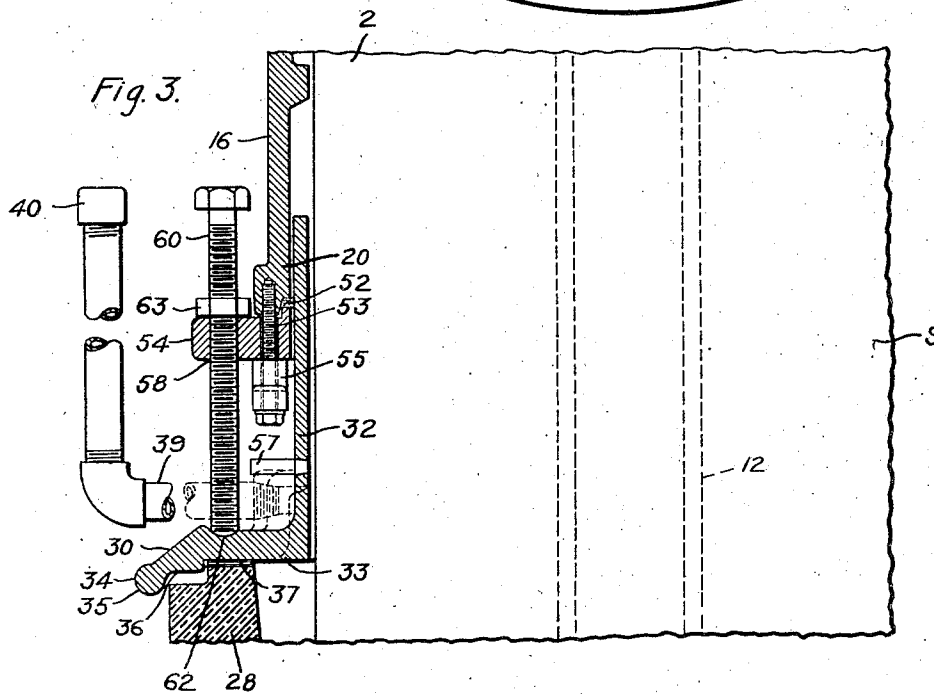
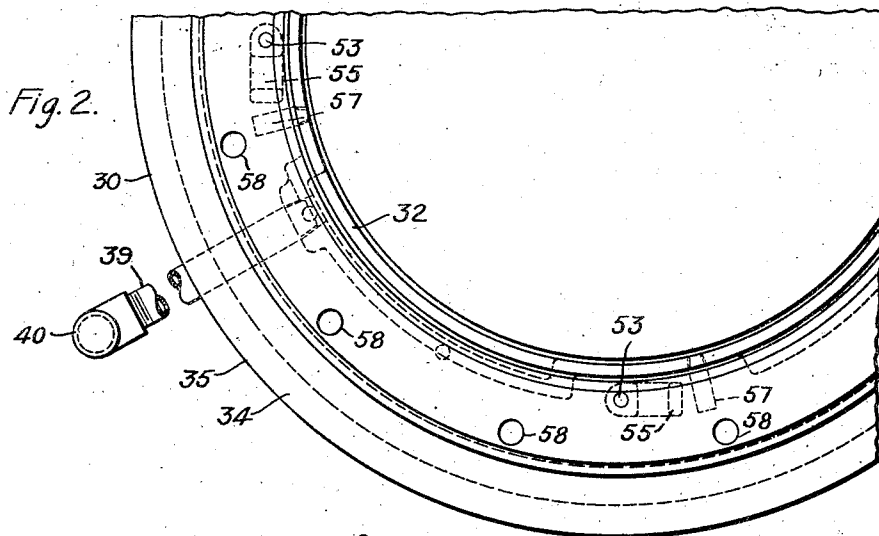
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Fig. 5.

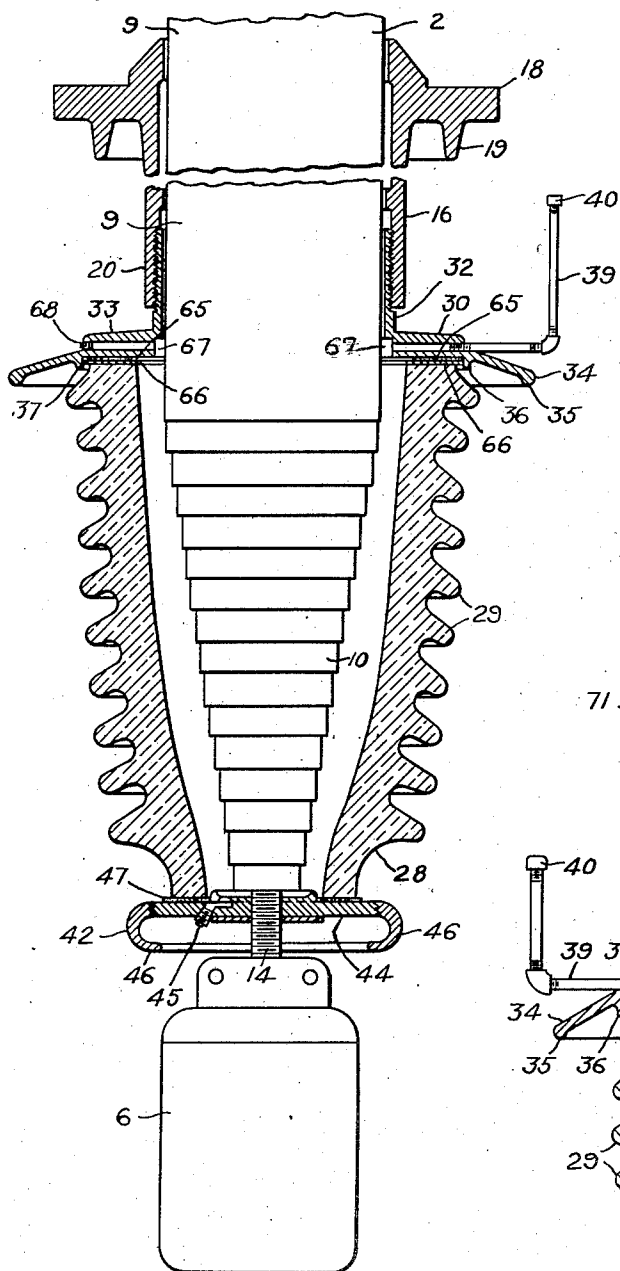
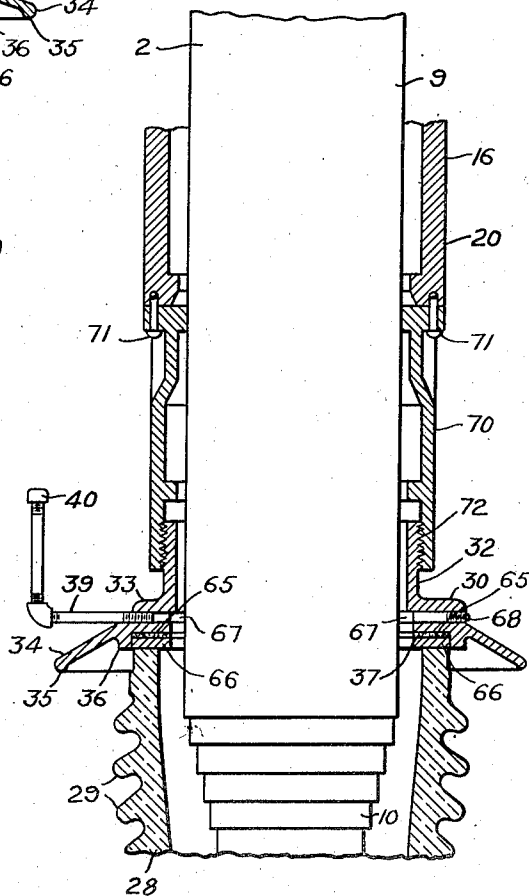


Fig. 6.



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Fig. 7.

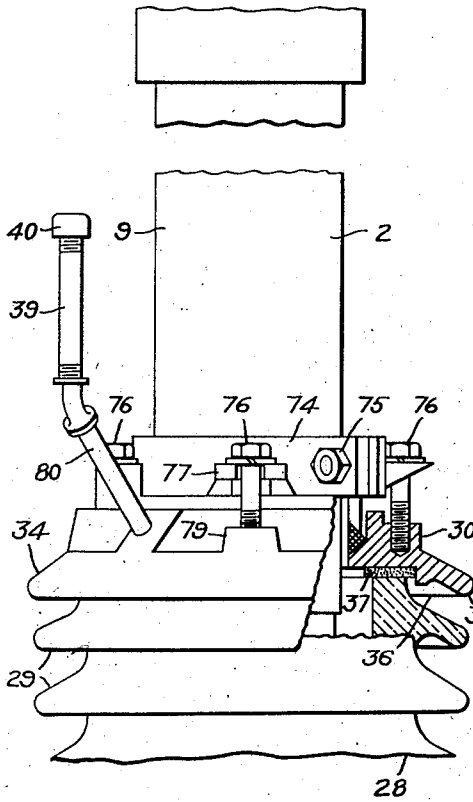
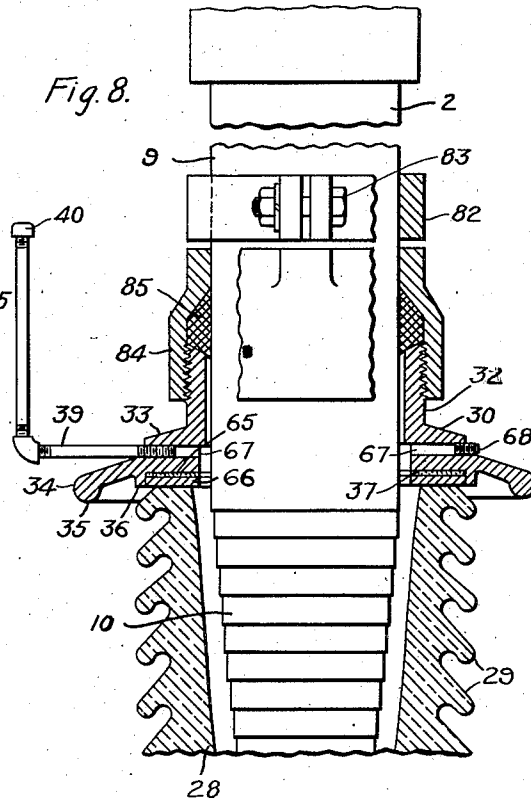


Fig. 8.



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HIGH-VOLTAGE STRUCTURE

Application filed September 23, 1927. Serial No. 221,439.

Our invention relates to high-voltage structures and particularly to terminal or bushing structures for oil-filled circuit interrupters.

One object of our invention is to provide a structure of the above-indicated character in which a body of oil adjacent to a terminal of an interrupter shall be maintained free of injurious elements, such as carbon and metallic particles which are given off by the interrupter contact members under certain conditions.

Another object of our invention is to provide a well or shield structure, for local disposition about a high-voltage bushing, that shall be effectively sealed and that shall embody electrostatic shielding or distributing means.

Another object of our invention is to provide a novel extension element for a portion of a high-voltage bushing of standard form, whereby a container for an insulating fluid may be mounted about a portion of the bushing.

Another object of our invention is to provide end members for a high-voltage fluid receptacle, that shall embody the combined functions of closing the ends of the receptacle, protecting the same against electrostatic stresses and placing the same in accurately adjusted position.

Another object of our invention is to provide means for adjusting a well structure relative to a bushing that shall also be adapted for the reception of a filling element for the well at a selected position relative to the bushing.

Another object of our invention is to provide a high-voltage structure that shall embody a condenser bushing, of a certain type having a portion of its length divided into uniform voltage-gradient steps, and an insulating fluid container for protecting said portion.

Another object of our invention is to provide a novel arrangement of gaskets, between a bushing and a fluid vessel therefor, that shall effectively seal the vessel and facilitate the turning of an adjusting element therefor.

Another object of our invention is to provide a high-voltage well structure that shall

be adapted for mounting on a bushing especially prepared therefor or on a bushing of standard form.

A further object of our invention is to provide a high-voltage structure that shall be simple and durable in construction, economical to manufacture and effective in its operation.

In high-voltage circuit interrupters of the oil-filled type, carbon and metallic particles are sometimes given off to the oil from the contact members, when the interrupters operate under heavy loads.

Since, in such interrupters, the terminal bushings extend into the oil, these particles, which are suspended in the oil about the bushings, lower the surface resistance of the bushings and may thereby, cause break-down of the bushing and other damage, if not the total destruction of the interrupter.

It is our aim to overcome the above-mentioned objection and to provide a bushing structure that shall, in general, be better adapted to withstand high voltages and be an improvement over bushing structures heretofore employed.

Accordingly, in practicing our invention, we provide a bushing, preferably of the condenser type, and means in the form of a well structure, for so maintaining a body of oil, immediately adjacent thereto, free of contaminating influences, such as the above-mentioned conducting particles as to increase the length of life of the bushing and ensure more effective operation.

Means are also provided for sealing, adjusting, mounting, shielding and filling the well structure and for adapting it to be mounted relative to a special, or to a standard, bushing.

Figure 1 of the accompanying drawings is a side view, partially in elevation and partially in section, of a portion of a high-voltage circuit-interrupter structure embodying our invention.

Fig. 2 is an enlarged fragmentary top plan view of a well structure included in the invention, parts being omitted.

Fig. 3 is a longitudinal side sectional view of the structure shown in Fig. 2, with a por-

tion of a condenser bushing shown in elevation,

Fig. 4 is a view, similar to Fig. 3, of the lower end of the bushing and well structure, and

Figs. 5 to 8, inclusive, are views, similar to a portion of Fig. 1, of modified forms of our invention.

Referring to Figs. 1, 2, 3 and 4, the device comprises, in general, a fluid receptacle, such as an oil-filled circuit-interrupter tank 1, a condenser-bushing element 2 that is supported in a wall or cover 3 of the tank 1, as by a structure 4, a well structure 5, and stationary and movable contact elements 6 and 7, respectively.

The condenser-bushing element 2 is of usual construction, embodying tightly-wound alternate layers of metal foil and paper impregnated with a hardened binder, having an intermediate portion 9 of uniform cylindrical form and a tapered end portion 10, on which the layers are stepped or cut off to provide uniform voltage gradient between the inner and outer surfaces of the element.

The element 2 is also, provided with a conducting inner portion in the form of a brass, or other metal, tube 12 which may project slightly from the inner end of the element and be provided with a screw-threaded portion 14.

The supporting structure 4 comprises a tubular member 16 secured to the portion 9, as by a body of cement, a lateral flange portion 18, a reinforcing and positioning flange or rib 19 and a lower end portion 20 for cooperation with the well structure 5, in a manner to be hereinafter pointed out.

The flanges 18 and 19 are for mounting and positioning the condenser-bushing element 2 in an opening in a lid or cover 22 that constitutes part of a current-transformer casing 23. The latter is disposed partially inside and partially outside the cover 3 and is secured thereto, as by bolts 26 and a sleeve 27 that is welded to the cover 3.

The well structure 5 comprises a hollow or tube-like insulating body member 28, preferably constructed of relatively massive and thick-walled porcelain having side walls tending to converge downwardly, exterior surface-creepage flanges 29 on the side walls, and transverse end surfaces that are preferably machined to render them perfectly flat and parallel.

An upper terminal member or hood 30, for the member 28, comprises a tubular portion 32 disposed about the intermediate portion 9 of the condenser bushing 2 in, or telescopically related to, the end portion 20 of the supporting member 4, a laterally-extending annular flange portion 33 and an outwardly-and-downwardly sloping, annular electrostatic-stress-distributing portion 34 having a rounded perimeter 35. An annular shoulder 36

serves to position the hood 30 and the well body 28 relative to each other and also, to position a gasket 37 therebetween. A pipe 39, having a cap 40, is mounted on the member 30 opposite an opening therein for introducing oil into the well structure 5.

A lower terminal member 42 comprises an interiorly screw-threaded portion 43 for mounting the same on the portion 14, a discoidal portion 44 for fitting against the lower end of the porcelain body 28 and having an opening for the reception of a plug 45 therein, and an outer electrostatic-stress-distributing portion 46 of inverted substantially cup-shape. A washer or gasket 47 may be placed between the members 28 and 42.

As shown more clearly in Fig. 4, a washer 48, above the portion 44, has a plurality of angularly-spaced openings 49, in its upper portion, that communicate with an annular groove 50, in its lower portion, over the opening in which the plug 45 is disposed.

Referring again to the upper terminal member 30 of the well 5 and to the tubular member 16, as more clearly shown in Figs. 2 and 3, the lower end 20 of the member 16 is grooved for the reception of a packing ring 52 and provided with openings for the reception of bolts 53 which secure a ring member 54 and hook members 55 in position. Pins 57 project radially from the portion 32 for cooperation with the hooks 55 in a manner to be herein set forth. Tapped openings 58, in the ring 54, are provided for the reception of bolts 60, extending parallel to the bushing, that engage recessed portions 62, in the member 30, and are held in position, as by lock nuts 63.

In assembling the parts, with the bolts 60 sufficiently withdrawn from the position shown, the member 30 is placed over the lower end of the bushing to a position adjacent to the position shown and turned until the pins 57 are disposed over the hooks 55 for temporary positioning thereby. The gasket 37, the insulating well body 28, the gasket 47 and other parts are then placed in position around the bushing in the order named.

After the stationary contact element 6 has received its final adjustment for proper cooperation with the movable contact member 7, the lower terminal structure 42 is adjusted and locked in position on the portion 14, as by screwing the portion 43 downwardly against the element 6.

After this operation, the member 30 is turned to displace the pins 57 from the hooks 55, as shown more clearly in Fig. 2, and the well is then permanently sealed and secured in operative position by turning the bolts 60 against the upper terminal member 30 of the well structure 5 and locking the bolts by means of the nuts 63.

In operation, with the well 5 immersed in the main body of oil in the interrupter cas-

ing, carbon and metallic particles cannot affect the oil in the well, and the graded end portion 10 of the condenser-bushing element 2 is thereby protected.

5 The terminal portions 35 and 46 so distribute the electrostatic field and prevents its concentration as to materially improve the operation of the bushing and to ensure that ultimate flash-over will occur between the
10 metal end members free of the insulating material.

In the modifications of our invention shown in Figs. 5, 6, 7 and 8, corresponding parts are designated by corresponding reference characters.

15 In the form of our invention shown in Fig. 5, the upper terminal or hood 30 of the well structure 5 is screw-threadably mounted in the lower end portion 20 of the tubular supporting member 16 for turning about the
20 bushing 2 to press it against the upper end of the insulating well portion 28.

In view of this turning movement, instead of the gasket 37 of the device of the previous figures, a pair of gaskets 65 and 66 are provided between the members 28 and 30. The
25 upper gasket 65, or the one next to the metal hood 30, is preferably of treated paper, such as vellumoid or similar material that is relatively hard, smooth and flexible and the lower
30 gasket 66, or the gasket next to the porcelain body 28, is preferably of cork. This construction facilitates turning the hood 30 relative to the body 28 and provides an effective
35 seal between the members 28 and 30.

Also, instead of a single opening in the member 30, for the reception of the filling pipe 39, a plurality of radial openings 67
40 therein provide passageways between the exterior and interior of the well and are tapped adjacent to the outer ends thereof.

This construction permits one or more pipe-threaded rods to be placed in the openings 67 for turning the hood 30 and, also, permits a
45 selection of one of the openings 67 for the reception of the filling pipe 39. After this selection, each of the other openings 67 may be closed by a plug 68.

The device shown in Fig. 6 is similar to that of Fig. 5, except that the hood 30, instead of being attached directly to the portion 20 of the tubular supporting member 16, is mounted
50 on an extension member 70. The latter is adapted for attachment to the portion 20 by means of screws 71 and is provided with a lower internally screw-threaded portion 72, similar to the portion 20 of Fig. 5, for the reception of the portion 32 of the hood 30.

In the device of Fig. 7, the well structure 5 is not secured to the supporting member 16 but is mounted on the portion 9 of the condenser bushing element 2 by a split-ring member 74 which is clamped in position by a bolt
60 or bolts 75.

65 Screws 76 cooperate between lugs 77 on the

ring 74 and bosses 79 on the hood 8 for longitudinally adjusting and holding the latter.

Also, in this form of our invention, the pipe 39 has a diagonal section 80 which is screwed into the entrance to a diagonal hold through the hood 30.

In Fig. 8, the well structure is also supported directly on the portion 9 of the condenser-bushing element 2 by a clamp-ring member 82 that is secured in position by a bolt 83. A
75 tubular portion 84, similar to the portion 20 of the other figures, depends from the ring 82 and is internally screw threaded for the reception of the portion 32 of the hood 30. The portion 84 is also adapted to receive a
80 packing ring 85 for compression between the same and the portion 32.

While we have shown and described particular forms of our invention, changes may be effected therein without departing from the spirit and scope thereof, as set forth in the appended claims.

We claim as our invention:

1. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion
90 by another fluid body and maintaining said fluid bodies separate comprising an insulating well member disposed around said inner bushing portion in longitudinally adjustable relation thereto and having an opening adjacent to the bottom thereof and means normally
95 closing said opening but movable to permit drainage of the well.

2. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding only said inner bushing portion
105 by another fluid body and maintaining said fluid bodies separate comprising an insulating well member supported directly on the bushing.

3. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion by another fluid body and maintaining said fluid bodies separate comprising an insulating well member, a longitudinally adjustable upper end member for the well member and means
115 for temporarily holding said end member in position relative to said bushing.

4. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser ter-
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minal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion by another fluid body and maintaining said fluid bodies separate comprising an insulating well member mounted on the bushing at a position removed from said wall.

5. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion by another fluid body and maintaining said fluid bodies separate comprising an insulating well member mounted on the bushing and having its upper end sealed to the bushing in said receptacle.

6. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion by another fluid body and maintaining said fluid bodies separate comprising an insulating well member and downwardly extending electrostatic-field-control means adjacent to the lower end of said well member.

7. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion by another fluid body and maintaining said fluid bodies separate comprising an insulating well member, an adjustable cap member for the well member and means for securing the cap member in adjusted position.

8. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion by another fluid body and maintaining said fluid bodies separate comprising a tubular supporting element disposed in fixed relation to the bushing, an insulating well member and an adjustable well cap member having a tubular portion disposed in longitudinally-slidable telescopic relation to said tubular supporting element.

9. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of

means for surrounding said inner bushing portion by another fluid body and maintaining said fluid bodies separate comprising a stationary tubular element surrounding the bushing, an insulating well structure having a tubular portion telescopically related to said tubular element and means for locking said tubular portion to said tubular element.

10. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion by another fluid body and maintaining said fluid bodies separate comprising a well structure including a tubular insulating body having an end adjacent to one end of the bushing, and annular upper and lower electrostatic-stress-distributing members constituting closure means for the ends of said tubular body having inlet and outlet ports therefor, respectively.

11. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion by another fluid body and maintaining said bodies separate comprising an insulating receptacle surrounding said inner portion having a relatively large number of outer-surface annular surface-creepage flanges and an annular electrostatic-stress-distributing member of inverted substantially cup-shape adjacent to the inner end thereof.

12. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid, of means for surrounding said inner bushing portion by another fluid body and maintaining said bodies separate comprising an insulating receptacle surrounding said inner portion having outer-surface creepage flanges, annular laterally projecting metal end structures constituting sealing means between the bushing and said insulating receptacle and electrostatic-field-controlling means, the lower of said metal end structures having an opening therethrough, and a member normally closing said opening but movable to permit drainage of the well.

13. In a circuit-interrupter structure, the combination with a condenser bushing, of means for surrounding an inner portion thereof by a body of oil separate from a body of oil in which the interrupter is immersed comprising a longitudinally adjustable annular

member adjacent to the inner end of the bushing, a tubular insulating well member on said member, a longitudinally adjustable annular member at the upper end of said well member, said inner-end member having an opening therethrough, and a member normally sealing said opening but movable to permit drainage of the well.

14. In a circuit-interrupter structure, the combination with a condenser bushing, of a well structure for surrounding an inner portion of the bushing by a body of oil separate from a body of oil in which the interrupter is immersed comprising an electrostatic-field-controlling member of inverted substantially cup-shape at the bottom of the well.

15. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid and an upper portion above the wall, of means for surrounding only said inner bushing portion by another fluid body and maintaining said fluid bodies separate from each other and free from the outer bushing portion comprising an insulating well member around said inner bushing portion and means providing a fluid-tight connection between the upper end of said well member and an intermediate portion of said bushing.

16. In a high-voltage structure, the combination with a main receptacle for a fluid, an electrical device therein and a condenser terminal bushing for said device extending through a wall of the receptacle with an inner portion below the level of said fluid and an upper portion above the wall, of means for surrounding only said inner bushing portion by another fluid body and maintaining said fluid bodies separate and free from the outer bushing portion comprising an insulating well member around, and removably mounted relative to, said inner bushing portion and means providing a fluid-tight connection between the upper end of said well member and an intermediate portion of said bushing.

In testimony whereof, we have hereunto subscribed our names this 16th day of September, 1927.

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