Nov. 27, 1962 C. G. DUENKE 3,066,207

LIQUID-IMMERSED ELECTRICAL DEVICE

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FIG. 1.

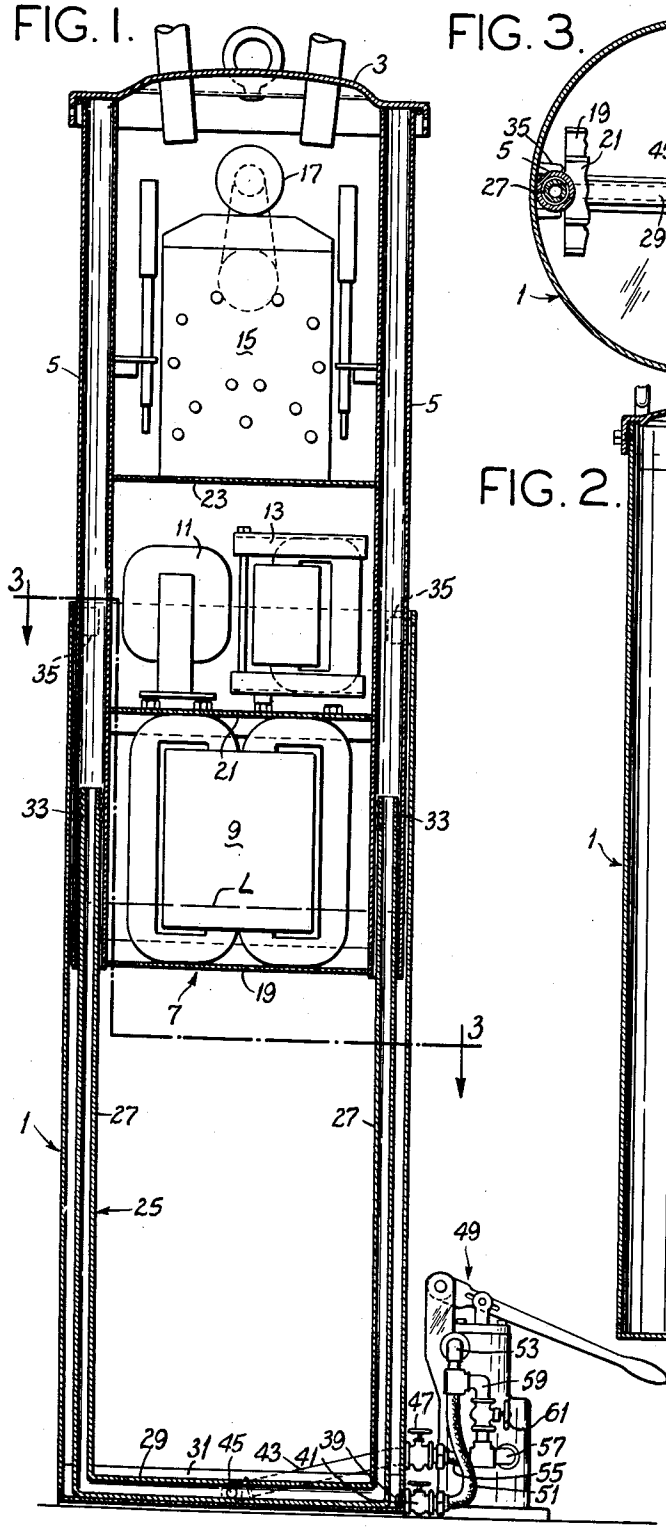


FIG. 3.

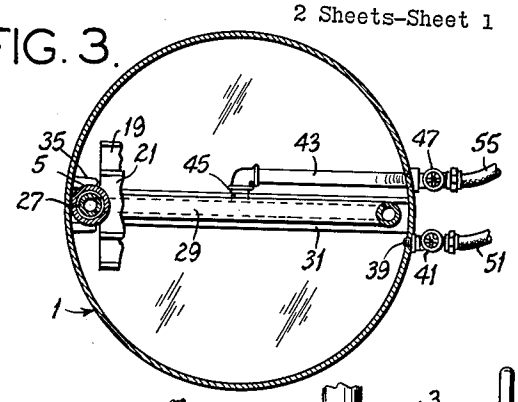
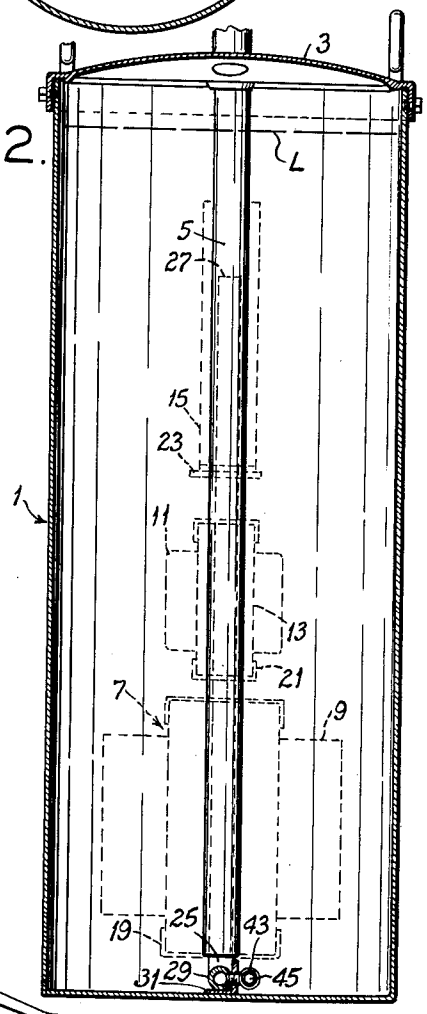


FIG. 2.



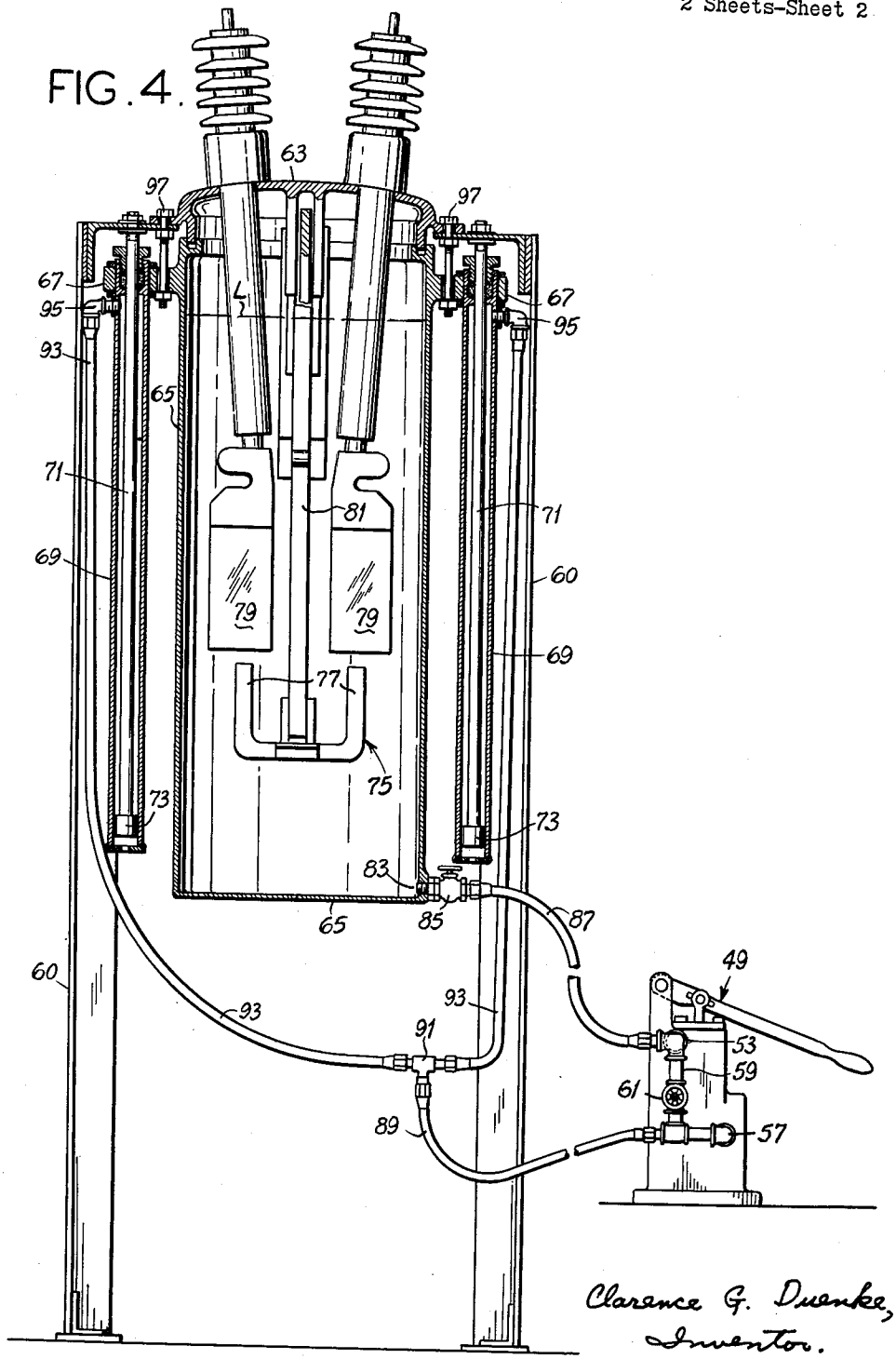
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FIG. 4.



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LIQUID-IMMERSED ELECTRICAL DEVICE

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4 Claims. (Cl. 200—150)

This invention relates to liquid-immersed electrical devices, such as oil-immersed step voltage regulators and oil-immersed circuit breakers, and more particularly to untanking means for such devices.

Liquid-immersed electrical devices of the class described conventionally comprise a tank containing a liquid such as oil and an electrical unit immersed in the liquid in the tank. For conveniently servicing such a device, the electrical unit must be raised relative to the tank, this operation being known as "untanking." Among the several objects of this invention may be noted the provision of such a device with power means for effecting untanking, wherein the power means is of the hydraulic type and utilizes liquid from the tank as hydraulic fluid; the provision of such a device with power means incorporated in the tank and utilizing certain components of the power means for supporting the electrical unit; and the provision of such a device with power means as described which is of economical construction and easy to use. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the constructions hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated,

FIG. 1 is a vertical section of a step voltage regulator embodying the invention, showing the electrical unit of the regulator untanked;

FIG. 2 is a vertical section at right angles to the FIG. 1 section showing the electrical unit in its lowered position in the tank;

FIG. 3 is a horizontal section taken on line 3—3 of FIG. 1; and,

FIG. 4 is a vertical section illustrating a circuit breaker embodying the invention.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings, FIGS. 1–3 illustrate the invention as it is applied to an oil-immersed pole type step voltage regulator such as is used outdoors in an electric power distribution system. As shown, this device comprises a tank 1 which is filled with oil to a level such as indicated at L. A cover for the tank is indicated at 3. It will be understood that the tank 1 is secured to a concrete pad, or mounted in any other conventional manner. Extending down from the cover at opposite sides thereof are two long cylinders 5. Each of these may consist simply of a length of pipe. The upper ends of these cylinders are secured as by welding to the cover and are closed. The cylinders are open at their lower ends. The cylinders 5 serve as supporting means for an electrical unit, generally designated 7, shown to comprise a main transformer 9, a current transformer 11, a switching reactor 13, a switch mechanism 15 and an electric motor drive 17 for the switch mechanism. The main transformer 9 is supported by a platform 19 extending between the cylinders 5 at their lower ends. The current transformer and switching reactor are supported by a platform 21 extending between the cylinders 5 above the main transformer 9. The switch mechanism 15 is mounted on a

platform 23 extending between the cylinders 5 above the current transformer and the switching reactor.

A U-shaped length of pipe, designated in its entirety by the reference character 25, is mounted in the tank 1. The vertical portions or legs of the U-shaped pipe are each designated 27, and the base or connecting portion of the U-shaped pipe is designated 29. The base portion 29 is shown as being secured as by welding to an angle iron 31 at the bottom of the tank. The vertical legs 27 of the U-shaped pipe extend up from the bottom adjacent the cylindrical wall of the tank. The cylinders 5 are telescopically slidable on the legs 27. Packing 33 may be provided at the upper ends of legs 27 for insuring a liquid-tight seal between the cylinders 5 and the legs 27. The cylinders 5 and legs or tubes 27 constitute a hydraulic lift for the cover 3 and the unit 7. The cylinders 5 are vertically slidable in guides 35 at the top of the tank.

At the bottom of the tank is a drain hole 39. A drain valve 41 is threaded in this hole on the outside of the tank. A pipe 43 extends into the tank from the outside and is connected at 45 to the base portion 29 of the U-shaped pipe. On the outer end of pipe 43 is a shut-off valve 47. A manually operable pump is indicated at 49. A conduit 51 (shown as a hose) connects the drain valve and the pump inlet 53. A conduit 55 (shown as a hose) connects the pump outlet 57 to the valve 47. A by-pass conduit 59 including a shut-off valve 61 is connected between the pump inlet and outlet.

FIG. 2 shows the unit 7 in lowered position for immersion in the oil in the tank, the cover 3 engaging the top of the tank. Suitable clamps (not shown) are provided for locking the cover to the tank. To untank the unit 7, the cover clamps are released, valves 41 and 47 are opened, by-pass valve 61 is closed, and the pump is operated to pump oil from the tank through conduit 55, valve 47 and pipe 43 to the base portion 29 of the U-shaped pipe 25, and thence up through the vertical legs 27 of the pipe to the cylinders 5. This raises the cylinders 5, cover 3 and unit 7. To lower the unit 7, the by-pass valve 61 is opened and the weight of unit 7 brings it back down, oil from the cylinders 5 flowing back into the tank through the legs 27, the base portion 29, pipe 43, valve 47, conduit 55, by-pass 59, conduit 51 and the drain valve 41.

It will be understood that the pump 49 may be permanently connected to the lift constituted by the pipe 25 and the cylinders 5, or it may be only temporarily connected when needed, the serviceman carrying the pump with him for use on different devices to be serviced. In the latter case, it is a simple matter to connect conduits 51 and 55 to valves 41 and 47 and to disconnect the conduits when servicing is completed, valves 41 and 47 being closed before disconnection so that no oil is lost from the tank.

FIG. 4 illustrates the invention applied to an oil-immersed circuit breaker. As shown, this device comprises a frame 60 to which is fixed a cover 63 for a tank 65. This tank is filled with oil to a level such as indicated at L. Adjacent to its upper end the tank has outwardly extending lugs 67. Fixed in these lugs and extending downward therefrom are vertical cylinders 69. Piston rods 71 are fixed to the frame 60 at their upper ends and extend down into the cylinders 69. Piston rods 71 have pistons 73 at their lower ends. The cylinders, piston rods and pistons constitute a hydraulic lift for the tank. Suspended from the cover 63 is an electrical unit generally designated 75. While the details of this unit are not material so far as the invention is concerned, it may be mentioned that it includes blades 77 which are upwardly movable from the position shown in FIG. 4 into contact with stationary contact

fingers contained within de-ionizing grids 79. Mechanism for moving the blades is indicated at 81.

At the bottom of the tank is a drain hole 83 in which is threaded a drain valve 85. A manually operable pump 49 is again used, having the by-pass conduit 59 including the shut-off valve 61. A flexible hose line 87 connects the drain valve 85 and the pump inlet 53. A flexible hose line 89 leads from the pump outlet 57 to a T 91, from which hose lines 93 lead to fittings 95 connected into the upper ends of the cylinders 69.

The tank 65 is held in the raised position shown in FIG. 4 by means of bolts 97 extending down from the cover. In this raised position of the tank, the electrical unit 75 is immersed in the oil in the tank. To untank the unit 75, the bolts 97 are released, the drain valve 85 is opened, and the by-pass valve 61 is opened, thereby regulating the rate of descent of the tank. The weight of the tank causes it to slide down, the oil from within the cylinders 69 feeding out of the cylinders through fittings 95, hose lines 93, T 91, hose line 89, by-pass 59 and line 87 to the tank 65. This separates the unit 75 from the tank for servicing. To raise the tank, the by-pass valve 61 is closed, then the pump 49 is operated to pump oil from the tank through hose line 89, T 91 and hose lines 93 to the cylinders 69. This raises the cylinders 69 and the tank back up to the FIG. 4 position.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a liquid-immersed electrical device of the type

comprising a tank containing a liquid such as oil and an electrical unit immersed in the liquid in the tank, the tank and unit being vertically separable for untanking the unit, means for effecting relative vertical movement of the tank and the electrical unit comprising a hydraulic lift located in the tank, a pump for supplying the lift with liquid under pressure, the pump having an inlet and an outlet, the tank having a drain, a conduit connecting the drain and the pump inlet, and a conduit connecting the pump outlet to the lift, whereby the tank liquid is utilized as hydraulic fluid for operating the lift.

2. In a liquid-immersed electrical device as set forth in claim 1, the tank being fixed, and the lift being arranged to raise the unit out of the tank.

3. In a liquid-immersed electrical device as set forth in claim 2, the lift being located in the tank, part of the lift constituting a support for parts of the electrical unit.

4. In a liquid-immersed electrical device as set forth in claim 1, the unit being fixed, and the lift being arranged to allow the tank to be lowered from the unit and to raise the tank.

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