May 22, 1945. J. R. MUMA ET AL 2,376,377

LIQUID LEVEL SWITCH

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FIG. 1

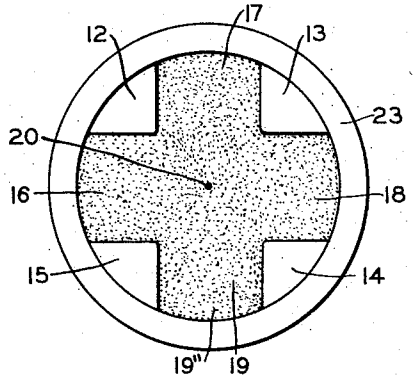


FIG. 2

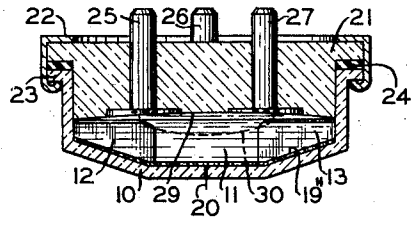


FIG. 4

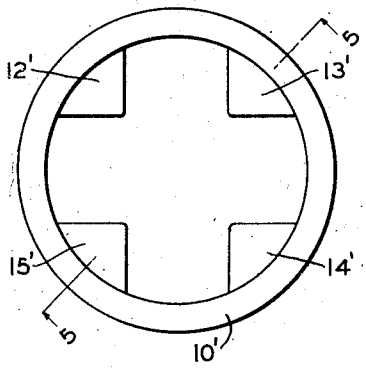


FIG. 3

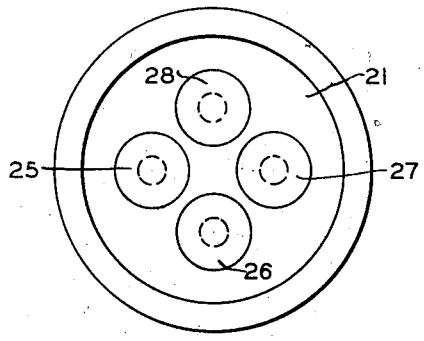
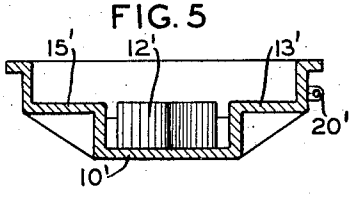


FIG. 5



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FIG. 6

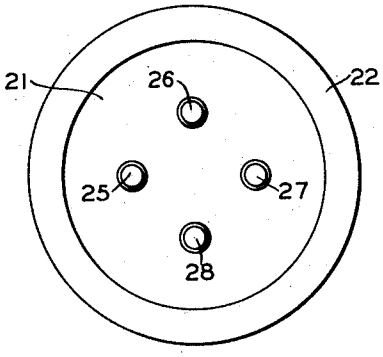


FIG. 7

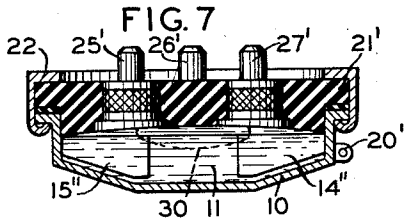


FIG. 9

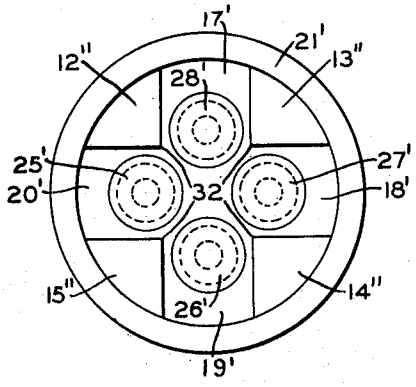


FIG. 8

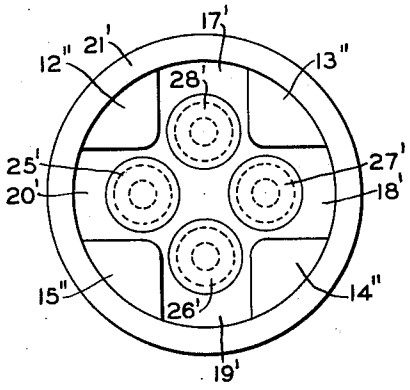
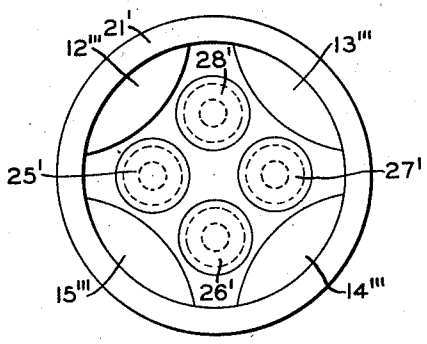


FIG. 10



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UNITED STATES PATENT OFFICE

2,376,377

LIQUID LEVEL SWITCH

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Application July 19, 1943, Serial No. 495,298

9 Claims. (Cl. 200—152)

This invention relates to an electrical switch of the liquid level type in which the relative position of the bubble therein with respect to a number of conducting terminals determines the selectivity of the switch.

The primary feature of the invention resides in the provision of a liquid enclosing receptacle having bosses therein which guide the bubble in its movement relative to the terminals.

Other features and structural details of the invention will be apparent from the following description when read in connection with the accompanying drawings, wherein.

Fig. 1 is a top plan view of the receptacle forming the base of a switch constructed in accordance with the present invention.

Fig. 2 is a vertical section view of an assembled switch having a base as shown in Fig. 1.

Fig. 3 is a bottom plan view of the cover member of the receptacle.

Fig. 4 is a view similar to Fig. 1, showing a modified form of base.

Fig. 5 is a section view taken in line 5—5, in Fig. 4.

Fig. 6 is a top plan view of a switch constructed in accordance with the invention.

Fig. 7 is a view similar to Fig. 2 showing a further modification of the invention.

Fig. 8 is a bottom plan view of the cover or closure member utilized with the form of switch shown in Fig. 7, and

Figs. 9 and 10 are views similar to Fig. 8 showing separate modified constructions of the cover of the switch.

With reference particularly to Figs. 1, 2, 3 and 6, a switch constructed in accordance with the invention is shown to include a closed receptacle 10 which is generally cup-shaped and contains a current conducting fluid 11 therein. The receptacle is formed to include a number of symmetrically arranged internal bosses as indicated at 12, 13, 14 and 15. The side walls of the adjacent bosses define a number of channels 16, 17, 18 and 19 that serve as guide passage ways for the bubble also contained within the closed receptacle. In the present instance, the receptacle which may also be considered to include a cover or closure part 21 is constructed of insulating material. The bottom wall of the receptacle is plated with a current conducting material as indicated at 19'' and a lead 20 connected thereto passes through the insulating body of the receptacle and provides a circuit completing means for leading electrical energy from a suitable source to the liquid in the receptacle. Bosses 12, 13, 14 and 15 are formed in the body of the receptacle, in this instance, the same being symmetrically arranged around the inside periphery thereof.

The closure or cover portion of the receptacle 10 may be fitted therein by means of clamping ring and flanged parts respectively indicated at 22 and 23 that are brought into engagement. A resilient washer 24 may be employed between the connected parts to prevent any leakage of the fluid 11.

The cover 21 is also constructed of insulating material and as shown in detail in Fig. 3 is cylindrically shaped to fit over the top of the cup-shaped base of the receptacle. The cover part includes a number of electrical terminals 25, 26, 27 and 28 which are equidistantly spaced from the center of the part as well as with respect to one another. A recess is provided for each of the inwardly disposed ends of the terminals on the underside of the cover, the exposed faces of the terminals being substantially flush with the inside wall of the cover or the surface over which the bubble moves. The central portion of the inside top wall of the closed receptacle is formed slightly concave as indicated at 29. The cover 21 projects sufficiently far into the base portion of the receptacle as to leave little clearance between the top of the bosses and the inside wall of the cover. The inwardly disposed ends of the terminals are situated in the respective channels so that when the receptacle is inclined from a normal position, the bubble 30 within the receptacle moves from its central position to one in which, guided by the channels, it covers one or more of the inwardly disposed faces of the terminals to thereby open the circuit through this portion of the switch. In use, the improved switch may be secured to the rotor case of a gyro vertical instrument in the manner particularly shown and described in the copending application of O. E. Esval and J. R. Muma, for Tilt correcting devices, Serial No. 428,040, filed January 24, 1942.

With reference to Figs. 4 and 5, a modified form of liquid containing receptacle is illustrated. In this instance, the base of the receptacle 10' is a metal cup constructed of current conducting material whose walls are indented to form the bosses 12', 13', 14' and 15' therein. Lead 20' is directly connected to the conducting receptacle. A cover part of the character shown in Fig. 2 may be employed with this type of switch.

A further modification of the invention is shown in Figs. 7 and 8, in which the bosses are

formed on the cover 21' of the switch as designated at 12'', 13'', 14'' and 15''. The bosses on the cover project inwardly into a hollow cup-shaped receptacle base 10'' which may be made of current conducting material. Cover 21' is constructed of insulating material and like the closure 21 includes an electrical terminal mounted therein for each of the channels 17', 18', 19', and 20' formed therein by the bosses. The terminals are indicated respectively at 25', 26', 27' and 28'.

In the type of bosses illustrated in Figs. 1, 4 and 8, the tip surface of the same is slightly curved, the bosses defining channels that are of substantially constant width throughout the length thereof. As shown in Fig. 9, the tip surface of the respective bosses may be straight as indicated at 32. A further form of boss is shown in Fig. 10, in which the channels defined thereby narrow in width as the same approach the periphery of the cover of the receptacle. The curved bosses employed in this connection are indicated at 12''', 13''', 14''', and 15'''.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, 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.

What is claimed is:

1. An electrical switch formed of a closed receptacle having an unbroken and substantially flat inside upper wall, a current conducting fluid and a non-conducting floating bubble filling said receptacle, said bubble moving along said upper wall with tilt of said receptacle from a normal position, a number of symmetrically arranged bosses in said receptacle defining a number of channels therein effective to guide the movements of the bubble, and an electrical terminal mounted in the top of said receptacle extending to a position substantially flush with said inside upper wall.

2. An electrical switch having a top part, a cup-shaped bottom part fitting said top part and forming therewith a tiltable closed receptacle in which said top part includes an unbroken and substantially flat inside upper wall, a current conducting fluid and a non-conducting floating bubble, filling said receptacle, said bubble moving along the inside wall of said top part with tilt of said receptacle from a normal position, a number of symmetrically arranged bosses in said receptacle defining an equal number of channels therein effective to guide the movements of the bubble, and an electrical terminal leading to each of the channels in said receptacle, said terminals being mounted on said top part and extending to a position substantially flush with the inside wall thereof.

3. A switch as claimed in claim 2, in which said bottom part is constructed of insulating material having a current conducting plating applied to the interior wall thereof.

4. A switch as claimed in claim 2, in which said bottom part is constructed of conducting material and the walls thereof are indented to form the bosses therein.

5. A switch as claimed in claim 2, in which said top part is constructed to include the bosses thereon.

6. An electrical switch having a cylindrical cover with an inner wall, unbroken and substantially flat, a cup-shaped base fitting on the periphery of said cover and forming therewith a tiltable closed receptacle, a current conducting fluid and a non-conducting floating bubble filling said receptacle, said bubble moving along the inner wall of said cover from the center toward the periphery thereof with tilt of the receptacle from a normal position, a number of symmetry arranged bosses in said receptacle defining an equal number of channels therein effective to guide the movements of the bubble, and electrical terminals in said cover, each of which extends to one of said channels and is substantially flush with the inner wall of the cover.

7. A switch as claimed in claim 6, in which said bosses are constructed as a part of the cover.

8. A switch as claimed in claim 6, in which said bosses define channels that narrow in width as the same approach the periphery of the receptacle.

9. A switch as claimed in claim 6, in which the central portion of the inner wall of the cover is slightly concave.

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