May 31, 1955 P. O. WALTER 2,709,738

LIQUID SWITCH ACTUATED BY A PERMANENT MAGNET

Filed Oct. 8, 1953

Fig. 1.

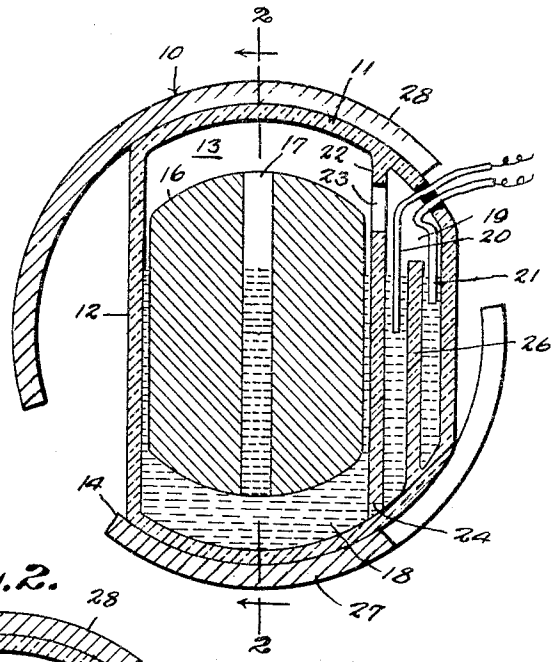


Fig. 2.

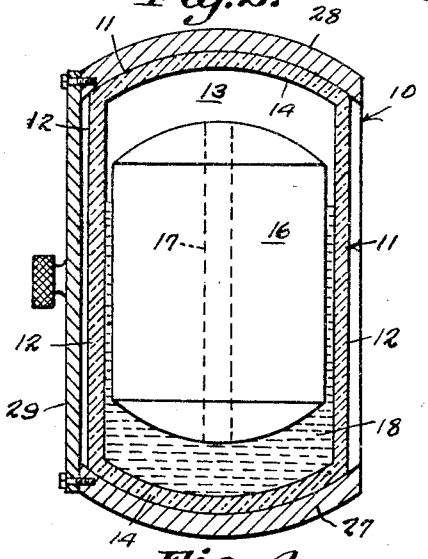


Fig. 3.

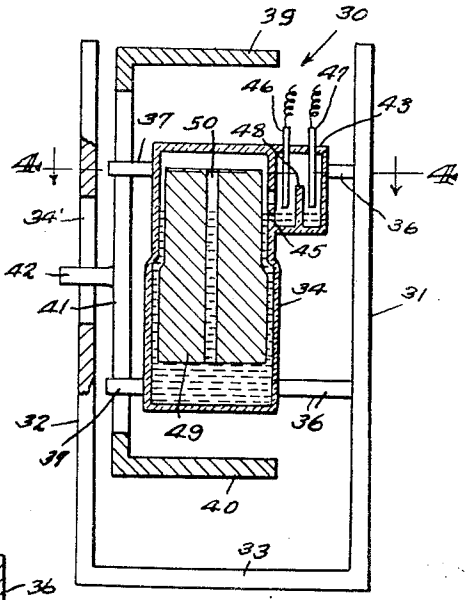
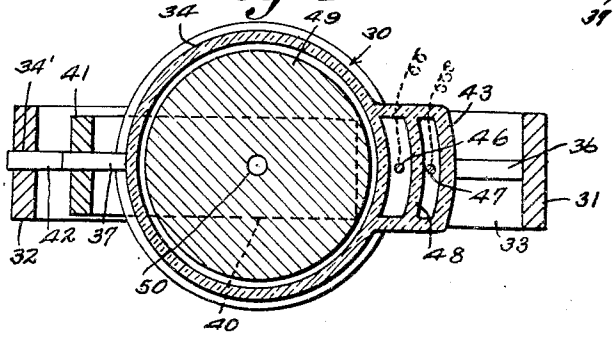


Fig. 4.



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United States Patent Office 2,709,738 Patented May 31, 1955

2,709,738

LIQUID SWITCH ACTUATED BY A PERMANENT MAGNET

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Application October 8, 1953, Serial No. 384,809

4 Claims. (Cl. 200—152)

It is a primary object of this invention to provide a liquid actuated switch of the kind to be more particularly described hereinafter having a chamber with pools of mercury for completing an electric circuit between a pair of electrodes electrically connecting electrodes together and a chamber for a floating magnet in mercury with a manually actuated magnet exteriorly of said chambers for moving the floating magnet to displace the mercury from the floating magnet chamber into the chamber of the electrodes and having a restricted orifice from the electrode containing chamber back to the floating magnet chamber in order to delay the shutting off of the liquid switch.

It is another object of this invention to provide a magnetically actuated float switch of this kind for providing a delayed action in shutting off the mercury switch and having a manually movable magnet for moving the float.

It is a still further object of this invention to provide a float actuated switch of this kind having mercury for the float and for completing and breaking an electric circuit.

Other and further objects and advantages of the invention will be hereinafter described and the novel features thereof defined in the appended claims.

In the drawings:

Fig. 1 is a vertical transverse section of a mercury switch, constructed according to an embodiment of my invention.

Fig. 2 is a horizontal transverse section taken on the line 2—2 of Fig. 1 with the float shown in elevation.

Fig. 3 is a vertical section of a modified form of this invention.

Fig. 4 is a transverse section taken on the line 4—4 of Fig. 3.

Referring to the drawings, the magnetically actuated liquid switch is designated generally by the numeral 10 in the drawings and may be supported where desired to turn the switch on and have a delayed action in turning the switch off. Such a delayed action may be used on a garage door connected with electric lights whereby the electric lights are shut out a short time after the garage door is closed.

The magnetically actuated switch 10 is provided with a non-magnetic body 11 which may be made of copper, glass or other suitable non-magnetic material and the non-magnetic body 11 is hollow throughout forming a float chamber 13 having flat side walls 12 and arcuate top and bottom walls 14 connecting the side walls together. The flat side walls 12 are much in the form of flat circular disks at the opposite ends of the arcuate top and bottom walls.

A metal float 16 is secured within the float chamber 13 and is magnetized so that a north or south pole is formed at one end and the opposite magnetic pole is provided at the other end for the purposes to be described more particularly hereinafter.

An elongated hole 17 is formed in the metal float 16

so that mercury 18 within the float chamber may be free to move upwardly and downwardly in the metal float as the float is moved upwardly and downwardly within the float chamber 13.

An electrode chamber 19 is formed on one side of the float chamber 13 by being formed integral therewith or otherwise suitably secured thereto and an electrode 20 and another electrode 21 is positioned within the electrode chamber 19 and each of the electrodes may be connected to an electric circuit exteriorly of the switch 10 by suitable electric wires.

The electrode chamber 19 is formed with a non-magnetic partition 22 between the electrodes 20 and 21 and the electrode 21 is formed by the flat end of the float chamber adjacent to the electrode chamber and the partition 22 is provided with a hole 23 adjacent to the upper end thereof through which the mercury may be caused to flow from the float chamber 13 to the electrode chamber 19 upon downward movement of the float 16 which will displace the mercury from the float chamber into the electrode chamber and when the mercury is within the electrode chamber for making a suitable connection between the electrodes, the switch may be considered as on.

For actuating the switch 10 permanent magnets are rotatably supported on the arcuate sides of the non-magnetic body 11 and are secured together in horizontally spaced apart relation by a disk 29 overlying and spaced from the flat sides of the body 11. The disk 29 may be rotated on the non-magnetic body by rotation of the disk and exterior magnets by a handle fixed at the center of the disk 29.

When the polarity of the upper magnet 28 is opposite to the polarity of the upper end of the metal float 16, the metal float will be drawn upwardly within the float chamber and when the disk has been rotated about a quarter of a turn the weight of the metal float 16 will draw the float 16 downwardly in the float chamber for displacing the mercury upwardly in the chamber and through the hole 23 into the electrode chamber for completing the electrical circuit between the electrodes within the electric chamber. When the disk has been rotated for moving the float upwardly the mercury may return to the float chamber but the return of the liquid mercury is restricted in its return movement by the restricted opening 24 so that a determined length of time may elapse before the mercury has been lowered in the electrode chamber to break the electrical connection between the electrodes.

In Figs. 3 and 4, there is shown a modified form of this invention wherein the numeral 30 represents a modified form of magnetically actuated liquid switch having a supporting bar 31 which may be fixed to any suitable fixed support and a second supporting bar 32 spaced away from the supporting bar 31 and connected to the supporting bar 31 by a transverse bar 33, the supporting bars 31 and 32 are disposed in a vertical position and the transverse bar 33 is disposed in a substantially horizontal position as clearly shown in the drawings.

The vertically extending supporting bar 32 is provided with a vertically extending slot 34' therethrough for purposes to be more clearly described hereinafter.

A non-magnetic body 34 is supported on the switch 30 between the vertically extending bars 31 and 32 and the body 34 is connected to the supporting arm 31 by transversely extending supporting arms 36 which are fixed at one end to the body 34 and at the other end to the support bar 31. The body 34 is non-magnetic and may be made of copper or glass or some other nonferrous material cylindrical in shape and having a certain diameter at the upper ends thereof and a large diameter at the lower end thereof.

The body 34 is provided with non-magnetic guide arms

37 on the side thereof opposite from the supporting arms 36 and a U-shaped permanent magnet is disposed exteriorly of the body 34 for vertical movement relative to the body and to the supporting means for the body.

The U-shaped permanent magnet is formed with an upper magnet 39 for disposition above the body 34 and a lower magnet 40 for disposition below the body 34 and the upper and lower magnets are connected together by a connecting bar 41 which is slidably engaged on the guide arms 37 for vertical movement and a handle 42 is secured to the connecting bar 41 for extension laterally therefrom and slidably engage in the slot of the supporting bar 32.

An electrode chamber 43 is fixed to or formed integral with the body 34 for communication with the body of the switch 30.

The electrode chamber 43 is communicated with the body 34 by way of a hole 44 adjacent to the upper end of the body 34 and a restricted hole 45 in the body below the hole 44 so that mercury may pass freely from the body 34 to the electrode chamber 43 and is restricted in its movement from the electrode chamber to the body to provide a delayed action in the shutting off of the switch when the mercury is moved out of the electrode chamber and out of engagement with the electrodes 46 and 47, within the electrode chamber. The switch is closed, in an "on" position when the mercury is at a sufficient level in the electrode chamber to contact both of the electrodes over the upper edge of the partition 48 within and fixed to the electrode chamber.

The switch 30 is also provided with a permanent magnet 49 slidably disposed within the non-magnetic body 34 for vertical movement in response to the upper and lower magnet of the U-shaped permanent magnet 38 and the permanent magnet 49, being formed as a solid cylinder being provided with a longitudinally extending hole 50 within which the mercury within the body 34 may be freely passed upon the reciprocation of the permanent magnet 49. The actuation of the magnetically actuated liquid switch 30 is much the same as the operation of the magnetically actuated liquid switch 10 described above but in the switch 10 the movable magnets are moved in an arc whereas in the switch 30 the movable magnets are manually moved in a straight line for displacing the mercury from the body containing the float to the electrode chamber and the restriction delays the time of flow from the electrode chamber to the float chamber or body 34.

While the specific details of this invention have been

herein shown and described, the invention is not confined thereto as changes and alterations may be made without departing from the spirit and scope thereof as defined in the appended claims.

I claim:

1. A magnetically actuated liquid switch of the kind described comprising a non-magnetic hollow body having flat sides on the opposite sides thereof and convex curved walls about the periphery of said flat sides and connected thereto, a permanent magnetic float in said body, a magnetic float chamber in said body, mercury in said float chamber, an upstanding partition on one side of said float chamber having an opening therein adjacent the upper end thereof, an electrode chamber adjacent said float chamber, a non-magnetic partition in said body within said electrode chamber, mercury in said chambers for flowing through said opening and over said partition upon movement of said float downwardly in said float chamber, spaced apart electrodes in said electrode chamber for completing an electric circuit upon contact of said electrodes with said mercury having a level over said partition, a restricted opening in said first mentioned partition below said opening for delaying the flow of mercury from said electrode chamber upon movement of said float in said float chamber, and a permanent magnet exteriorly of said body for raising and lowering said float for opening and closing the switch.

2. A magnetically actuated liquid switch as set forth in claim 1 wherein said last mentioned permanent magnet is provided with inner concave sides rotatably engaging the convex sides of said body.

3. A magnetically actuated liquid switch as set forth in claim 1 wherein said permanent magnet exteriorly of said body is provided with fragmentary arcuate concave magnets rotatably engaging said convex walls of said body and a non-magnetic disk secured to said latter magnet exteriorly of said body and a handle on said disk for actuating the switch.

4. A magnetically actuated liquid switch as set forth in claim 1 wherein the size of the said restricted opening between the said chambers being the determining factor for the time required to open the electric circuit of said switch.

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