

Nov. 1, 1949

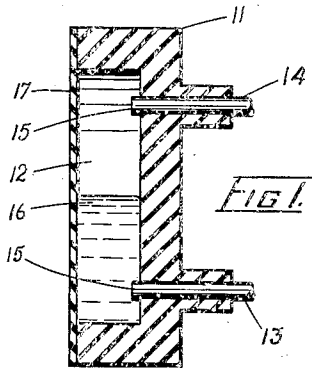
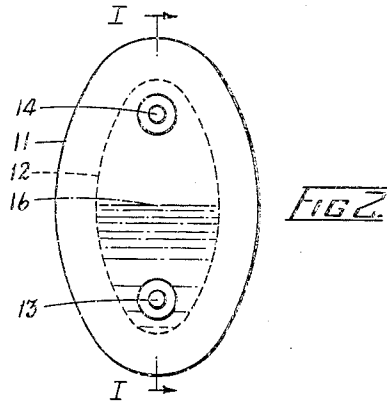
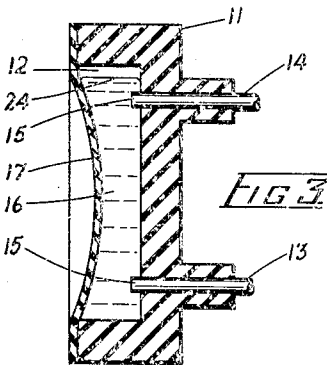
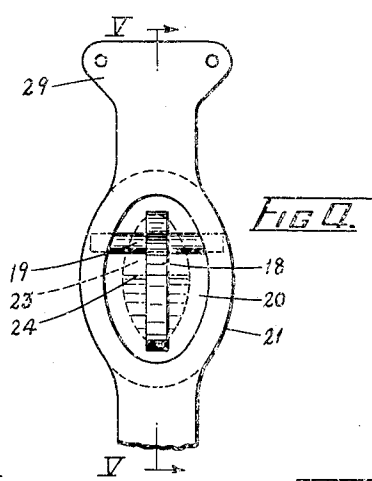
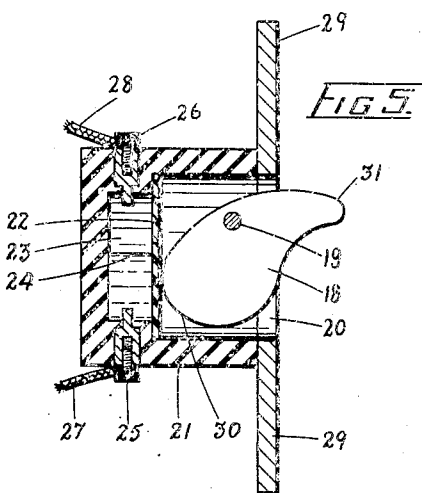
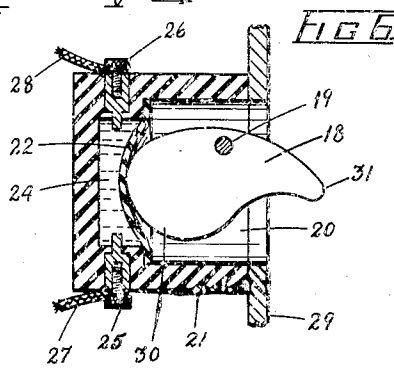
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2,486,785

MERCURY SWITCH

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2 Sheets-Sheet 1



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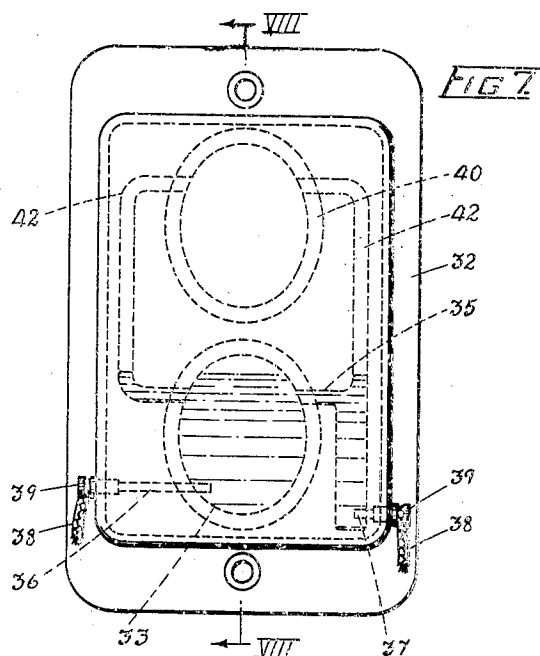
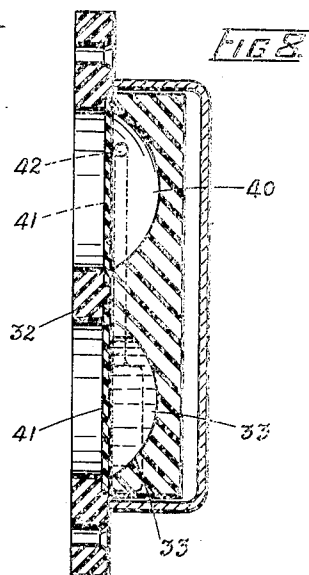
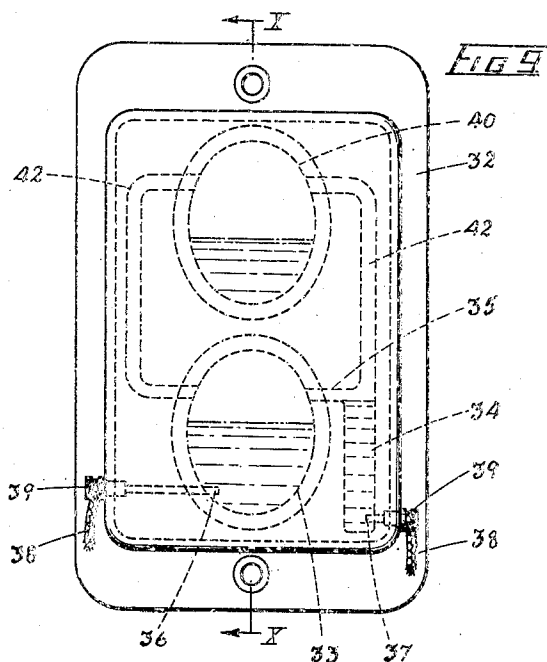
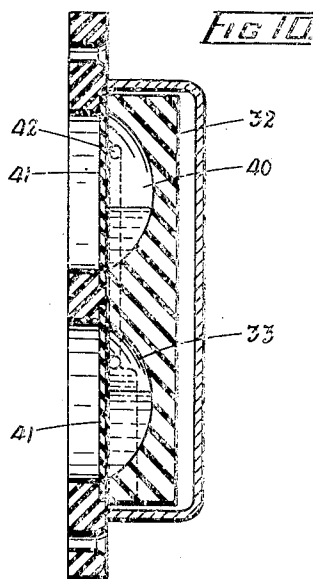
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MERCURY SWITCH

Filed June 18, 1948

2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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MERCURY SWITCH

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4 Claims. (Cl. 200—152)

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My invention appertains to improvements in mercury switches for making and/or breaking an electric circuit by a displacing movement or flow of the liquid conductor.

A general object of my invention resides in the provision of a switch structure which will operate noiselessly and without an attendant arcing in establishing an electric circuit between gapped contacts, and one in which such contact members are not exposed.

More specifically the aim of the present invention is to provide a mercury switch comprising a body of mercury contained in a chambered unit in which the wall of the chamber is formed in part of a flexible membrane, such as elastic rubber, which is capable of being readily depressed to cause a displacing movement or flow of the mercury so that it will bridge electric contacts for establishing an electric circuit or for breaking an electric circuit.

To further particularize, the mercury in the chamber may be in conductive engagement with one of a pair of electric contact members. The other electric contact member may be disposed above the level of the mercury removed from electric engagement therewith so that when the elastic membrane is depressed the mercury will be displaced with an attenuation of the body of fluid accompanied by an upward rise of level into conducting engagement with said other contact member, whereby to establish an electric circuit. The electric circuit is broken by withdrawal of the depressive force on the elastic membrane. The structure thus provides for making and breaking an electric circuit manually either by direct hand pressure or through the agency of a mechanical device.

In a further aspect of the invention a depressive movement is imparted to the elastic membrane through the agency of a suitable mechanical device, where desired in order to maintain the electric circuit in closed condition for a period of time, as in the use of the switch for a lighting circuit, for example. Such a mechanical device may take the form of a cam or an eccentric having a handle.

In a further aspect of the invention a pair of intercommunicating chambers may be provided with a body of mercury communicating at a point somewhat below the level of the fluid and each provided with an electric contact member in conductive engagement with the fluid so that an electric circuit is normally in closed condition. Either of the chambers is supplied with an elastic membrane which functions on depression to cause the

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mercury to flow into a third chamber which is elevated with regard to said pair of chambers. The flow of the liquid conductor to the third chamber disrupts the electric path between said pair of chambers thus breaking the electric circuit. Said third chamber may be supplied with an elastic membrane which is depressible to return the conducting liquid to said pair of chambers for re-establishing the electric circuit.

The invention is admirably suited for an outlet box switch, and for a switch for electric lamps and bells, etc. In fact it is susceptible of fairly wide application in the control of electric circuits, as will be understood by those skilled in the art.

The invention is illustrated in the accompanying drawings, in which:

Fig. 1 is a vertical section of an embodiment of the invention taken on line I—I of Fig. 2.

Fig. 2 is a rear elevational view of Fig. 1.

Fig. 3 is a vertical sectional view similar to Fig. 1 but showing the elastic membrane in a depressed position in which the electric contact members are bridged by the conductive liquid.

Fig. 4 is a front elevational view of a variant form of the invention in which the elastic membrane is actuated by a manually operable device.

Fig. 5 is a vertical section taken on line V—V of Fig. 4.

Fig. 6 is a similar view to Fig. 5 but showing the elastic membrane depressed by the manually operable device.

Fig. 7 is a front view of a further modified form of the invention.

Fig. 8 is a vertical sectional view thereof taken on line VIII—VIII of Fig. 7.

Fig. 9 is a similar view to Fig. 7 but showing how the electric circuit is broken.

Fig. 10 is a vertical section taken on line X—X of Fig. 9.

The invention as disclosed in Figs. 1, 2 and 3 of the drawings comprises a switch body 11 formed of a suitable electrically non-conductive material, such as hard rubber, "Bakelite" or phenol condensation composition. The switch body may be of any desirable shape or form. It is provided with a closed chamber 12 partly filled with a dense electrically conductive liquid, such as mercury for example. The chamber is shown as of an elliptical configuration arranged vertically.

Embedded in the switch body is a pair of terminals 13 and 14 for an electric circuit (not shown). Said terminals are spaced apart, one being disposed near the bottom of said chamber and the

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other being disposed near the top thereof. Said terminals project into the chamber, as at 15, to form electric contact members. The mercury is at a level substantially above the lower contact member 13, which level is substantially below the contact member 14, as indicated in Figs. 1 and 2. In consequence the lower contact member 13 is in constant electric engagement with the mercury. The body of mercury is indicated at 16.

The front wall 17 of said chamber is formed of an elastic membrane, such as pliant rubber for example. The elastic membrane or diaphragm is secured marginally to provide a sealed, leak-proof chamber. Any approved means may be employed to attach the elastic membrane. It may, for instance, be vulcanized in place.

To close the electric circuit it is only necessary to press the elastic membrane 17 inwardly, as shown in Fig. 3, which displaces the mercury by an attenuating movement that causes its level to rise to or above the upper contact member 14. In this way the contacts 13 and 14 are electrically connected by the body of mercury. Release of the depressive force allows the elastic membrane to relax with an attendant lowering of the level of the mercury.

The mercury switch is well suited for use in a regular wall outlet box. The body portion 11 may be supplied with suitable means for attaching it to such a box. The switch is easy to operate, and its operation is noiseless. The elastic membrane is readily depressible by thumb pressure.

In the variant form of the invention depicted in Figs. 4, 5 and 6, there is disclosed a mechanical device for actuating the elastic membrane. The mechanical device comprises, for example, a cam lever 18 pivoted at 19 in an opening 20 formed in the switch body 21 in front of the elastic diaphragm 22 which constitutes the front wall of the chamber 23 containing the body of mercury 24. The contact members for the electric circuit are indicated at 25 and 26 and shown as connected to lead wires 27 and 28. The switch body 21 is shown as provided with ears 29 for securing it in a conventional outlet box. The cam lever 18 is provided with an eccentric element 30 for inwardly bulging the diaphragm 22 in order to cause the mercury to rise into engagement with the upper contact member 26. The grip portion 31 enables the cam lever to be manipulated by hand. It will be evident from an inspection of Fig. 6 that the cam lever not only functions to depress the diaphragm but also serves to releasably retain it in a depressed condition so that the circuit can be kept closed as long as desired.

In the modification of the switch structure, illustrated in Figs. 7 to 10 inclusive, there is provided a switch body 32 having two chambers 33 and 34 disposed alongside each other and intercommunicating by means of a horizontal fluid passage 35 located in the vicinity of the upper ends thereof. Each of these chambers is provided, near its lower end, with an electric contact member denoted at 36 and 37 respectively, which contact members extend through the switch body for external connection to lead wires 38 by means of the terminals 39.

A third chamber 40 is provided in the switch body 32 above the chamber 33. Each of the chambers 33 and 40 is provided with a diaphragmatic front wall 41 formed of an elastic membrane. The chamber 34 is merely a well having at its upper end a fluid passage 42 in addition to said fluid passage 35. The fluid passage 42 leads up-

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wardly to said chamber 40 and communicates with an upper portion thereof.

The chambers 33 and 34 are partly filled with mercury to a level slightly above the fluid passage 35, as shown in Figs. 7 and 8. The electrically conductive liquid thus closes the electric circuit comprising the contact members 36 and 37. According to this arrangement the electric circuit can be broken by depressing the diaphragm of the lower chamber 33, which causes a portion of the mercury to flow through the passage 42 into the upper chamber 40, where it is trapped. In this way level of the mercury in the chambers 33 and 34 is lowered below the passage 35, as shown in Figs. 9 and 10. When it is desired to re-establish the electric circuit the diaphragm of the upper chamber 40 is depressed to expel mercury therefrom and return it to the lower chambers. Preferably a second fluid passage is provided between the chambers 33 and 40 as indicated at 42.

What is claimed is:

1. A mercury switch comprising a switch body of insulating material, provided with a first chamber, a second chamber and a passage between said chambers, said chambers being arranged in side by side relation and said passage forming a communication between the top portions thereof, an electric contact element exposed in each of said chambers and extending through said switch body to form electric terminals, a body of mercury in each of said chambers, and said chambers being enclosed by walls, the enclosing walls of said first chamber including a flexible side wall forming a diaphragm for exerting a displacing influence on the body of mercury in this chamber whereby the mercury can be caused to flow through said passage into union with the body of mercury in said second chamber to provide a path for electric energy between said contact elements which is broken when the mercury in said passage is parted.

2. In a mercury switch provided with a switch body having an enclosed chamber containing a body of mercury as an electric liquid conductor and having electric terminal contacts including at least one electric contact element exposed in said chamber; the improvement comprising the provision in said switch body of a second enclosed chamber disposed above said chamber and a passage between said chambers, said passage communicating with said second chamber in the vicinity of the top portion thereof whereby mercury displaced from the first mentioned passage to said second chamber upon depression of said diaphragm is retained in said second chamber.

3. A mercury switch as defined in claim 2, in which the second chamber is provided with a diaphragm for effecting a return flow of mercury through the passage.

4. A mercury switch comprising a switch body of insulating material provided with a first chamber, a second chamber and a third chamber; said chambers being isolated from one another by enclosing walls, the enclosing walls of said first and second chambers including a side wall of elastic material constituting a diaphragm for the respective chambers, said second chamber being disposed above said first chamber and said third chamber being disposed at a side of said first chamber, passages provided in said switch body to form a communication between the upper parts of said chambers, electric contact elements exposed in said first and third

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chambers at the lower part thereof and extending outwardly of said switch body to form circuit terminals, and a body of mercury in said first and third chambers at a level to fill the passage between these chambers, whereby depression of the diaphragm of said first chamber causes a flow of mercury to said second chamber to lower the level of said body of mercury to empty the passage between said first and third chambers so that electrical energy cannot flow 10 between said electric contact elements.

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