Fig. 1

Fig. 2

Fig. 3

Fig. 4

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This invention relates to improvements in mercury to mercury make and break electric switches and more particularly to a delayed action mercury tube switch of this character.

It is an object of this invention to provide a mercury tube switch in which one terminal is isolated in a bath of mercury within a container of insulating material normally floating upon the main body of mercury to which the other terminal connects, with the connection between the terminals normally broken and means to intermittently submerge the container in the main body of mercury to close the circuit between the said terminals and then release the container to emerge and break the said circuit. It is also an object of this invention to delay the normal movement of the container in submerging and emerging. It is a further object of this invention to provide an automatic means to alternately cause the submergence and release of the container actuated by the circuit controlled by said switch.

While the preferred form of this invention is illustrated upon the accompanying drawing for one of the many uses of this device, it is to be understood that minor detail changes may be made without departing from the scope thereof, and the applicant is not limited to the use illustrated and hereinafter described.

In the drawings:

Figure 1 is a new inside elevation of one form of this improved device, with parts broken away, illustrating its use in an automatic sign flashing system, with the wiring and lights of the system shown in diagram and with the insulating container floating upon the main body of mercury and the circuit through the switch broken.

Figure 2 is a top plan view of the container and the switch tube in section taken on the line 2—2, Figure 1.

Figure 3 is a view in transverse vertical central section of the mercury tube with the container floating in the mercury with the circuit broken.

Figure 4 is a similar view with the container submerged and the circuit closed.

In carrying out this invention an hermetically sealed tube 1 of insulating material, preferably glass, is filled about half full with mercury 2 and the air thereabove exhausted and an inert gas preferably substituted therefor before sealing. Before sealing, a cylindrical container 3, closed at the bottom and having outwardly flaring upper edges, formed of isolantite, quartz or other insulating material and provided with an outer sheathing 4 of magnetic metal, preferably iron, and immovably secured thereto, is inserted in the tube. The container 3 is of such dimensions that when the tube is held with its greater dimension in a vertical plane and the container filled with mercury it will float with its upper flared edges a substantial distance above the surface of the main body of mercury. Lead in wires 5 and 6 are seated in each end of the tube, the lower lead in wire 5 contacting with the main body of mercury below the bottom of the container 3 and the upper lead in wire 6 prolonged to enter the center of the container 3. This prolonged lead in wire 6 terminates in a cylindrical electrode 7 secured at its center and at right angles to the lead in wire. The prolonged lead in wire 6 is of such length that when the container 3 is floating normally upon the mercury, the electrode 7 will be adjacent the bottom of the interior of the container and the electrode 7 is of such a diameter as to be just received within the container 3 and slide therein without friction. A notch 8 or small aperture is provided in the periphery of the electrode 7 whereby the mercury in the container can pass from one side of the electrode to the other.

An electromagnet 9 is arranged about the tube 1 with its coils supported in such a relation thereto that when energized it will draw the iron sheathed container 3 downward until it is submerged within the main body of the mercury 2, as shown in Figure 4, and when deenergized will allow the top of the container to emerge, as shown in Figure 3. The normal movement of the container 3 in submerging and emerging is delayed by the fixed notched circular electrode 7 and the rate of movement can be regul-
lated by the size of the notch 8 in the electrode.

The lead-in wires 5 and 6 are connected in the circuit to be controlled. The lead-in wire 5 is in electrical contact with the main body of mercury about the container 3 and the lead-in wire 6 is in electrical contact with the mercury within the container and is thereby isolated from the main body of mercury when the container is normally floating in the main body and the circuit between lead-in inner 5 and 6 is broken. When the electric magnet 9 is energized and the container 3 submerged within the main body of mercury, the circuit between the lead-in wires 5 and 6 will be completed through the main body of mercury coming in contact with the mercury contained within the container 3. As the container submerges the main body of mercury overflows the outwardly flared top or rim to make a quick, positive and definite electrical connection where it contacts with the mercury within the container. As the container emerges the electrical connection is broken by a quick, positive and definite severance as the outwardly flared top of the container cleaves through the surface of the mercury within which it has been submerged.

This mercury to mercury make and break delayed action switch is illustrated as employed to control an electrical sign flashing circuit, as shown in Figure 1. In this application the lead-in wires 5 and 6 are connected in series with the incoming current from the commercial line by wires 10 which pair about an electric sign 11 and then by wire 12 back to the commercial line. The coils of the electric magnet 9 are connected in a shunt circuit 13 about the delayed action switch. In this arrangement when the circuit is broken through the switch the current will pass through the electric magnet 9 which is of such construction to offer sufficient resistance to prevent the lamps 14 from lighting and the flow of current through the coils energize the magnet to draw the magnetic metal sheathed container 3 downward below the surface of the main body of mercury to close the contact between the lead-in wires of the switch and thereafter the coils of the magnet will be shunted out and the current flow through the lamps. As soon as this takes place, the buoyancy of the container, being released from the magnetic force, causes it to rise to break the circuit through the switch and again energize the magnets as the top of the container cleaves through the surface of the mercury.

It is obvious that the rate of movement can be determined by the size of the notch 8 cut in the cylindrical electrode 7 before it is fixed in the tube and it may also be raised by the relation of the coils of the magnet about the tube 1 to the surface of the main body of the mercury in the tube 1 before the parts of the apparatus are secured in fixed position. It is also obvious that a fixed magnet may be employed for the same purpose which may be caused, by any desired mechanical means, to move up and down about the tube to cause the container 3 to be submerged and emerge from the main body of the mercury to make and break the circuit to the lamps. It is also obvious that when a quick make and break is desired the cylindrical electrode 7 may be omitted. The device as illustrated is of such design that it may be produced by automatic glass making machinery.

What I claim is:

1. A delayed action mercury tube switch comprising a glass tube containing a body of mercury and an insulating container having a cylindrical bore, with an open top therein containing mercury normally floating upon the main body of mercury and isolating the smaller body therefrom, a lead in wire in contact with the main body of mercury, a lead in wire normally out of contact with the main body and in contact with the isolated body of mercury terminating in a piston like electrode in the container bore, and means to cause the open top of the container to submerge and emerge in the main body of mercury to make and break an electrical contact between the lead in wires, the rate of movement being determined by the size of the piston like electrode.

2. A mercury tube electric switch comprising a sealed glass tube containing a body of mercury with a container of insulating material having an unobstructed opening in the top thereof normally floating therein, containing an isolated smaller body of mercury therein and having a sheathing of magnetic material thereabout below said open top, electrodes sealed in the glass tube, one in contact with the main body of mercury and one in contact with the smaller isolated body, and a magnet about the glass tube adapted to cause the top of the magnetic sheathed container to submerge and emerge in the main body of mercury to make and break an electric circuit therethrough between the two electrodes.

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