June 21, 1938. K. HUNCIKER 2,121,235

MERCURY SWITCH

Original Filed April 12, 1933

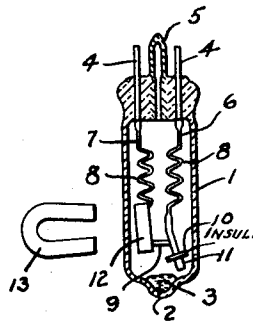


Fig. 1

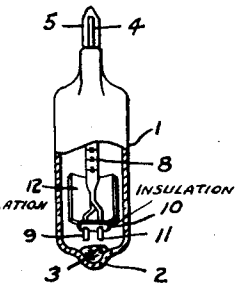


Fig. 2

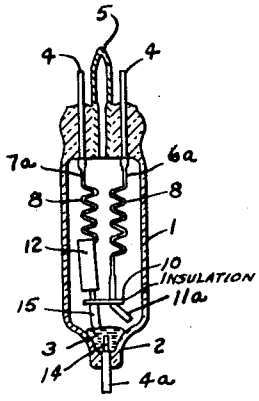


Fig. 3

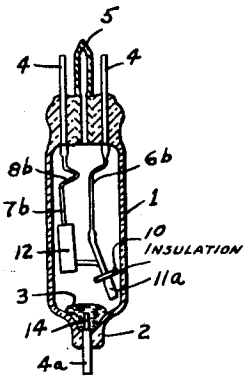


Fig. 4

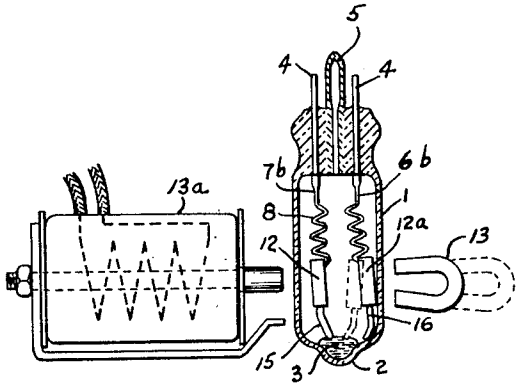


Fig. 5

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2,121,235

MERCURY SWITCH

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Original application April 12, 1933, Serial No. 665,628. Patent No. 2,085,316, dated June 29, 1937. Divided and this application January 2, 1937, Serial No. 118,807

5 Claims. (Cl. 200—112)

This invention relates to improvements in mercury switches and more particularly to that type of mercury switch in which the tube and contained mercury remains stationary and movement is imparted to elements also contained within the tube to make and break the circuit therein.

This application is a division of this applicant's prior co-pending application, Serial No. 665,628, filed April 12, 1933 which became Patent No. 2,085,316 on June 29, 1937.

The mercury tube switch comprising a sealed tube or envelope, usually of glass, containing a movable body of mercury and an inert gas having spaced apart electrodes sealed in the walls and entering the interior so that upon tilting the mercury is caused to flow from end to end to close and open the circuit between the electrodes is a commercial product well known in the switch art.

It is an object of this invention to produce a switch of this general character which requires but a small amount of mercury and in which the tube and mercury remain stationary while one or more of the electrodes are caused to move into and out of contact with the mercury to make and break the circuit therein, thereby not only making a saving in the cost of the mercury employed but also obviating the internal stresses and strains upon the tube heretofore caused by the mercury hammer in the tilting tube type.

It is also an object of this invention to actuate one or more of the electrodes by magnetic force, thereby obviating the necessity of a mechanical snap movement heretofore used in the rapid tilting of the tube to throw the mercury from one position to another, and allow mercury tube switches to be employed under conditions where snap action switches would be impracticable.

With these and other objects in view reference is made to the accompanying sheet of drawings which illustrates preferred embodiments of this invention with the understanding that minor detail changes may be made therein without departing from the scope thereof.

In the drawing—

Figure 1 is a vertical central sectional view, with parts shown in front elevation, of one form of this invention.

Figure 2 is a view partly in side elevation and partly in central vertical section of Figure 1.

Figure 3 is a view similar to Figure 1 of a modification.

Figure 4 is a view similar to Figure 1 of a further modification.

Figure 5 is a view similar to Figure 1 of a different form of this invention illustrating in front elevation the actuating means thereof.

In all the embodiments of this invention as illustrated the switch includes a cylindrical glass envelope or tube 1, closed at the lower end preferably to form a depending pocket or cup 2 adapted to receive and retain a small body of mercury or other fluid electrical conductor 3. The upper end is preferably closed by a pinch seal which embraces and seals in the body thereof one or more leading-in wires 4 and a filling stem 5 through which the gas is substituted for the contained air, mercury inserted and the stem then tipped off. The leading-in wires are of such character as to seal readily in the body of the envelope and extend a sufficient distance beyond the exterior of the sealed end for the ready attachment of the circuit wires, not shown. Electrodes extending within the tube 1 are welded or otherwise secured to the inner ends of the leading-in wires.

In Figures 1 and 2, the electrodes 6 and 7 are each preferably flattened, as shown in Figure 2, and corrugated or fluted adjacent its leading-in wire as at 8 to increase its flexibility and resiliency. Electrode 7 is then extended over the mercury 3 and terminated in a bent-down end 9 normally out of contact with the mercury 3 and supports a yoke 10 of insulating material through which it passes and terminates a lesser distance from the tube 1 than the distance of the extremity of 9 from the mercury 3. The other electrode 6 terminates in a round portion passing through the yoke 10 spaced apart from the other electrode and ends in a portion 11 parallel to the end 9 of the other electrode and also normally out of contact with the mercury 3. That part of the electrode 7 between the corrugation 8 and extension which passes over the mercury 3 supports a preferably semi-cylindrical section or member 12 of magnetic metal spaced apart from the wall of the tube 1 and adapted to respond as an armature when affected by the field of a magnet, such as the fixed magnet 13 shown in Figure 1.

In this form when the armature is actuated by the magnet to move in the direction of the adjacent wall of the tube 1 both ends 9 and 11 are, by means of the yoke 11 brought into contact with the mercury 3 to close the circuit therethrough and when the magnetic force is removed the armature 12 is released and the corrugated or fluted portions 8 of electrodes 6 and 7

straighten out, removing the ends 9 and 11 from the mercury to break the circuit.

While a fixed magnet is shown by way of example, an electro-magnet may be employed which may be stationary, if desired, with means to energize it when it is desired to close the circuit. When it is desired to use a fixed magnet, such as 13, any desired means may be employed to reciprocate it toward and away from the tube 1.

In the form illustrated in Figure 3 an additional leading-in wire 4a is sealed in the pocket 2 to which is welded or otherwise secured a short electrode 14 which is always submerged in the mercury 3. The electrode 7a is constructed in the manner shown in Figure 1 with the end 15 normally in contact with the mercury 3 and the electrode 6a constructed in the manner shown in Figure 1 with the end 11a normally out of contact with the mercury 3, the said two ends passing through the yoke 10 holding them in spaced relation and when the armature 12 is drawn toward the adjacent wall of the tube 1, the end 15 is moved out of contact with the mercury 3 and through the yoke 10 the end 11 is moved into contact with the said mercury. Since the electrode 14 of the leading-in wire 4a is always in contact with the mercury 3, a circuit is always closed through the switch from the electrode 14 through either electrode 7a or electrode 6, depending upon the actuation of the armature 10.

Figure 4 illustrates a modification in which the electrodes 6b and 7b are both flattened to produce resilient flexibility and the electrode 7b is preferably provided with one corrugation or fluted portion 8b to add to its flexibility, otherwise, they are both of the same construction as shown in Figures 1 and 2 with the ends passing through the yoke 10 and both normally out of contact with the mercury 3. In this form the leading-in wire 4a is sealed in the walls of the pocket 2 and supports the electrode 14 always submerged in the mercury 3, so that when the circuit is closed the current flowing from electrode 14 divides and passes through the electrodes 6b and 7b.

Figure 5 illustrates another form of this general type of switch illustrating the application of this principle to two actuating means. In this instance, the electrode 7b is constructed in the same manner as shown in Figure 3 and the electrode 6b is corrugated or provided with a fluted portion 8 to provide resilient flexibility and therebelow supports a magnetic member 12a similar to the armature 12, and the end 16 is bent to normally terminate above and out of contact with the mercury 3, as shown in full lines. Under normal conditions, that is when the switch is removed from the influence of an electro-magnetic field, and the armature 12a attracted by the magnet 13, the electrode 7b will through its end 15 contact the mercury 3, while the end 16 of the other electrode 6b will be out of contact with the mercury so that the circuit is broken within the tube 1.

This switch is of particular use where one magnet 13 will normally operate to open and close the circuit through the switch and another magnet 13a, such as an electro-magnet, may be employed, when energized to open the circuit when closed by the magnet 13 by withdrawing the end 15 out of the mercury. An example of such use may be found in a control system for an electrically operated and controlled fluid fuel burner mechanism when the magnet 13 may be reciprocated to close and open the burner motor circuit, or a control circuit thereof, by a room thermostat and the other magnet 13a being an electro-magnet, as shown, may be connected in a circuit containing a commercial boiler control responsive to interior conditions of the boiler which circuit is normally open in the boiler control but which is caused to close upon excessive temperature or pressure within the boiler. The energization of the magnet 13a will draw the armature 12 towards the adjacent wall of the tube 1 and withdraw the end 15 of the electrode 6b from the mercury 3 and maintain it out of contact irrespective of the position of the magnet 13 until the conditions within the boiler become normal and the circuit again opened within the boiler control.

What I claim is:

1. An electric switch including a sealed tube, a body of electrical conducting fluid contained in one end thereof, a plurality of integral flexible electrodes supported in the opposite end adapted to be brought into contact with the fluid to close the circuit therethrough, means upon an electrode responsive to an external force to flex said electrode, and means within the tube actuated by the flexation of one electrode to flex the other.

2. An electric switch including a sealed tube, a body of electrical conducting fluid contained in one end thereof, a plurality of integral flexible electrodes supported in the opposite end adapted to be brought into contact with the fluid to close the circuit therethrough, means upon an electrode responsive to an external force to flex said electrode, and means within the tube actuated by the flexation of one electrode to flex the other including an insulated connection between said electrodes.

3. An electric switch including a sealed tube, a body of electrical conducting fluid contained in one end thereof, an electrode adapted to be submerged in said fluid and a plurality of integral flexible electrodes supported in the opposite end adapted to be brought into contact with the fluid to close the circuit therethrough, means upon an electrode responsive to an external force to flex said electrode, and means within the tube actuated by the flexation of one electrode to flex the other.

4. An electric switch including a sealed tube, a body of electrical conducting fluid contained in one end thereof, an electrode adapted to be submerged in said fluid and a plurality of integral flexible electrodes supported in the opposite end adapted to be brought alternately into contact with the fluid to close the circuit therethrough, means upon an electrode responsive to an external force to flex said electrode, and means within the tube actuated by the flexation of one electrode to flex the other.

5. An electric switch including a sealed tube, a body of electrical conducting fluid contained in one end thereof, an electrode adapted to be submerged in said fluid and a plurality of integral flexible electrodes supported in the opposite end adapted to be brought alternately into contact with the fluid to close the circuit therethrough, means upon an electrode responsive to an external force to flex said electrode, and means within the tube actuated by the flexation of one electrode to flex the other including an insulated connection between the electrode maintaining them in spaced relation so that only one of said electrodes can contact the fluid at a time.

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