June 1, 1943. C. W. TRAUTMAN 2,320,682

MERCURY SWITCH

Filed Dec. 6, 1940

FIG. 1.

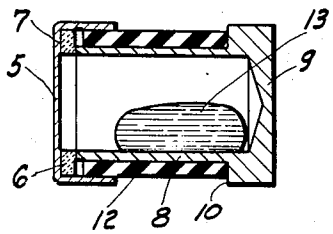


FIG. 3.

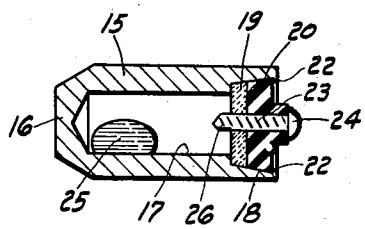


FIG. 2.

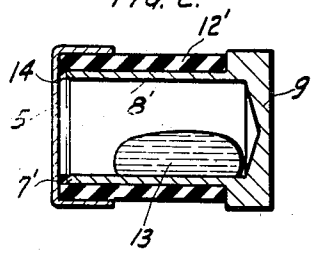


FIG. 4

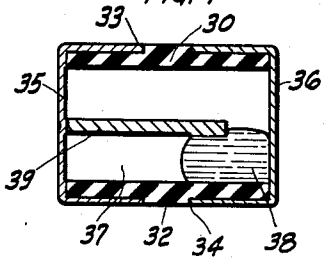


FIG. 7.

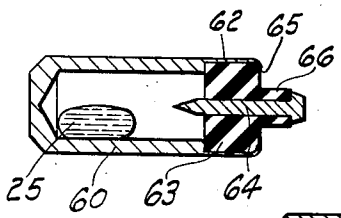
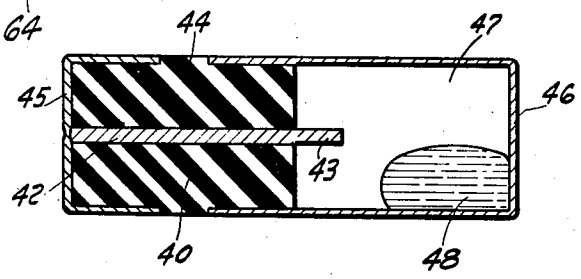


FIG. 5.



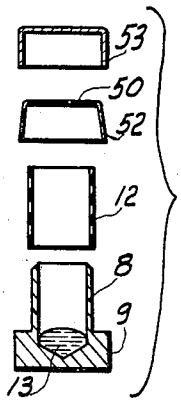
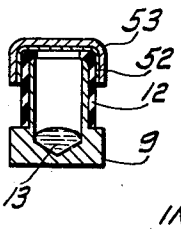


FIG. 6.

FIG. 8.



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MERCURY SWITCH

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Application December 6, 1940, Serial No. 368,779

3 Claims. (Cl. 200—152)

This invention relates to mercury switches, and more particularly is concerned with mercury switches of the type used for illuminating glove compartments, trunk openings, doors and the like in vehicles in which the switch is tilted from one position to the other to open and close a circuit therethrough.

One of the primary objects of the present invention is to make a switch of this class which is very inexpensive, can be made of simple parts, and can be readily assembled.

The switch is designed to take a relatively low current, usually being operated on a storage battery or like circuit, and consequently the switch does not need any great current capacity but must be reliable in operation and simple in construction.

It is also desirable that the switch be of very simple compact form so that it can be contained within a simple bracket along with a lamp, preferably one terminal of the switch being directly connected to the lamp base.

One of the particular features of distinct advantage in the present invention is the utilization of the construction in which the shell is of smooth bore, presenting no interference to the movement of the mercury during the tilting of the switch.

Since the switch is not used on heavy currents, I have found it unnecessary to provide a structure which is of the evacuated type, such as is commonly employed in connection with mercury switches, but at the same time, the switch must be very rugged and able to withstand shocks and jolts. For this reason, a metal envelope type switch is much more to be desired than the glass type, and the present invention is directed particularly to a cheap, simple, metal envelope mercury switch.

Other objects and advantages of the present invention will appear more fully from the following detailed description which, taken in conjunction with the accompanying drawing, will disclose to those skilled in the art, the particular construction and operation of the preferred form of the present invention.

In the drawing:

Figure 1 is a sectional view through one form of switch embodying the present invention;

Figure 2 is a modified view of the structure shown in Figure 1;

Figure 3 is a sectional view of another form of the invention;

Figure 4 is a sectional view showing a switch in which two similar metal cap members are employed;

Figure 5 is a further modification of the switch shown in Figure 4;

Figure 6 is an exploded view of a still further modification of the switch of Figures 1 and 2.

Figure 7 is a modification of the structure shown in Figure 3; and

Figure 8 is an assembled view of the switch shown in Figure 6.

Referring now in detail to the drawing, in Figure 1 I have provided a cup-shaped stamped metal cap 5 within which is seated an annular ceramic or similar refractory ring 6. Seated against the face of the ring 6 is the forward end 7 of a cylindrical sleeve portion 8 of a cup-shaped member 9 which, at its opposite end is provided with the enlarged thickened portion forming the radial shoulder 10. Interposed between the annular flange portion of the cap 5 and the sleeve portion 8 is an annular sleeve of fiber, rubber, or similar insulating material 5, which is adapted to have a pressed fit within the open end of the cap 5. With such a construction, it will be apparent that the sleeve portion 8 of the member 9 is insulated from the cap member 5, both by the annular sleeve 12 and by the ceramic ring 6. Disposed within the interior of the switch is a body of mercury 13 which is adapted when the switch is tilted in a counter-clockwise direction from the position shown in Figure 1 to roll to the left hand end of the structure, thereby making a connection through the mercury between the cap 5 and the sleeve 8, thus closing the circuit through the switch structure.

It will be noted that in this form of the invention the external diameter of the cap 5 and the shoulder 10 are equal, and consequently the entire switch structure can be disposed within a tubular holder and placed in position so that one end thereof may bear against a lamp base whereby, upon closing of the circuit through the switch, the lamp is actuated. Since the switch carries only a small current, the width of the ceramic ring 6 may be reduced as there is little or no tendency for any arcing within the switch. It will be noted that the sleeve 8 and the ring 6 are of equal internal diameter, thereby providing a smooth bore along which the mercury may roll, and introducing no barriers tending to restrict or hold back the mercury from one end of the switch to the other.

In Figure 2 a structure corresponding to that shown in Figure 1 is provided, except that in this form of the invention the ceramic ring 6 is omitted and in place thereof, the annular insulating sleeve 12' is extended a sufficient dis-

tance so as to form an axial spacer having an end flange 14 spacing the chamferred end 7' of the sleeve portion 8' of the member 9 away from the base of the cap member 5. This provides for an insulating spacer therebetween, and as the cap member is pressed into position, it abuts against the flange 14 to be held away from the sleeve 8'. This construction is also assembled by pressing the sleeve 12' over the sleeve 8', and then pressing the cap member 5 over the open end of the structure to a point such as shown in the drawing, providing the annular insulating flange 14 between the end of the sleeve 8' and the base of the cap 5. The switch is operated in the same manner as shown in connection with Figure 1, and constitutes merely a simplification thereof.

In Figure 3 a modified form of the invention is shown in which a relatively heavy piece of bar stock is formed into a cup-shaped member indicated generally at 15. This member has one end thereof closed as indicated at 16, and is bored to provide the hollow passage 17 therein. The open end of this member is provided with a tapered counterbore 18 adapted to receive the ceramic insulating disc 19 and the formed rubber block 20. The rubber block 20 is preferably of semi-hard rubber which may be pressed into the counterbored passageway 18 to form a seal for the end of the switch and is then held against withdrawal outwardly by striking over portions 22 at the peripheral edge of the opening 18. Extending through the block 20 and the ceramic disc 19 is the shank portion 23 of an electrode having a head portion 24 forming one terminal connection for the switch. A suitable body of mercury 25 within the bore 17 is adapted to be moved along the smooth floor of the switch into and out of contact with the inner extending end 26 of the electrode 23, thereby making and breaking the circuit between the cup-shaped member 15 and the electrode 23. Here again it will be noted that the interior of the switch is free of projections or barriers, and provides a smooth floor for the mercury to roll on.

In Figure 4 I have provided a switch structure which comprises a cylindrical insulating sleeve member 30 having adjacent its center the thickened portion 32 forming oppositely facing shoulders 33 and 34. These radial shoulders form stops against which the cup-shaped cap members 35 and 36 abut, these cap members being pressed over the external surface of the sleeve 30 into abutting engagement with the shoulders 33 and 24. This press fit closes the switch chamber 37 and forms a substantially sealed chamber within which is disposed the body of mercury 38.

Secured to the base of one of the cap members is an electrode pin 39 which is welded or otherwise suitably secured in axially extending position within the base of the cap member. The member 39 extends substantially to the center of the switch, and the body of mercury 38 when the switch is tilted rolls downwardly into contact therewith to close the circuit between the cap members 35 and 36.

Since these members are both of the same structure they can be formed rapidly in mass production by stamping and the entire switch structure is very cheap and can be easily assembled by automatic machinery.

The form of the invention shown in Figure 5 is similar to that shown in Figure 4, except that one of the cap members has been axially lengthened and the rubber member comprises a solid block.

In this form of the invention the solid rubber block 40 is provided with an axial bore therethrough carrying the electrode stem 42 which projects outwardly from one end of the block, as indicated at 43. The block is provided with the external annular shoulders 44 intermediate its ends, and a cap member 45 is pressed over the outer end of the block and has the electrode stud 42 welded or otherwise mechanically and electrically bonded thereto.

The opopsite cap member 46 is pressed over the opposite end of the block 40 into abutting engagement with the radial shoulder 44, but is of appreciable length to form with the end of the block a switch chamber 47 within which is disposed the body of mercury 48. Upon tilting of the switch, the mercury 48 moves into and out of contact with the projecting end of the electrode, thereby making and breaking the circuit through the switch.

It will be noted that in all forms of the invention the members are secured together to form the switch chamber by means of press fits and the external diameter of the switch is uniform at both ends. Further, it will be apparent that in each of the forms of the invention, a smooth floor or trackway for movement of the mercury is provided and the switches are symmetrical about their longitudinal axes so that no attention need be paid to their radial position within the clamp or bracket.

In Figure 6 I have disclosed an improvement of the switch shown in Figures 1 and 2 in which punch press operations may be employed in assembling the structure. The body member 9 of this form has the cylindrical extension 8 over which is pressed the Bakelite sleeve 12, it being understood that the body of mercury 13 is already within the sleeve 8. An inner cap 50 of thin sheet material, and preferably having the outwardly flaring flange 52, is then placed over the end of sleeve 12, after which the cap 53, of heavy turned stock is pressed into telescoping relation over cap 50. This swages the cap flange 52 within the cap 53, forming a tight pressed fit, rendering the switch air tight and locking the caps against displacement, as clearly shown in Figure 8.

In Figure 7 the switch of Figure 3 has been modified to provide a cup-shaped shell 60 having a cylindrical counterbore 62 receiving the semi-hard rubber plug 63 carrying the electrode pin 64. The shell has its end 65 spun over to lock the plug compressed into sealing engagement with the bore. A suitable shoulder portion 66 insulates the electrode pin 64 radially with respect to the shell. If desired, the interior of this, or any of the other switches shown may have a partial filling of triethanolamine for arc quenching and cooling.

It will be obvious that with constructions of this type a very rugged metal envelope type switch is provided which is simple to assemble and the parts of which can be economically made either by stamping or boring to produce a very economical structure.

I am aware that various changes may be made in certain of the details of the invention herein disclosed and described, and I therefore do not intend to be limited except as defined by the scope and spirit of the appended claims.

I claim:

1. In a switch, a cylindrical insulating sleeve,

a pair of cup-shaped electrode caps pressed over opposite ends of said sleeve and held in insulated relation thereby, a body of mercury in said sleeve and movable axially along the internal surface of said sleeve, said cap members having their internal facing surfaces exposed to said mercury at opposite ends of said sleeve, and an electrode pin on one of said cap members projecting axially through said sleeve to a point adjacent the other cap member and radially spaced from said internal sleeve surface a distance less than the meniscus height of said body of mercury, whereby said mercury contacts said pin at all times and is stabilized against undesired motion thereby.

2. The switch of claim 1 further characterized in the provision of an annular external rib intermediate the ends of said sleeve forming an abutment for the peripheral edges of said cap members.

3. In a switch, an insulating sleeve, a cup-shaped cap member pressed over each end of said sleeve and supported thereon in insulated relation, the internal surface of said sleeve and the end faces of said cap members defining a cylindrical switch chamber, a body of mercury in said chamber movable over the internal surface of said sleeve as a runway upon tilting of said switch, and an internal pin on the end face of one of said cap members projecting axially through said chamber to a point adjacent the other cap member end face, said pin being spaced radially from said internal sleeve surface a distance less than the meniscus height of said mercury.

CHARLES W. TRAUTMAN.