Aug 5, 1941. P. S. BEAR ET AL 2,251,316

SWITCH

Filed May 22, 1939

FIG. 1.

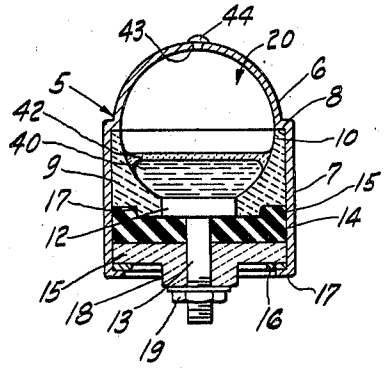
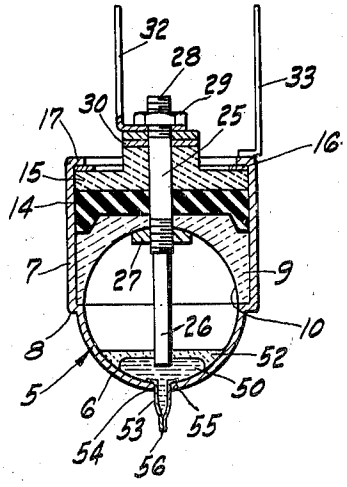


FIG. 2.



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SWITCH

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Application May 22, 1939, Serial No. 274,876

7 Claims. (Cl. 200—152)

This invention relates to switches, and more particularly is directed to a metal envelope type of switch of the mercury contactor type in which the circuit is made or broken by tilting of the switch envelope from a vertical position in any direction.

The present application is a continuation in part of our copending application, Serial No. 156,309, filed July 29, 1937, and relates to switches which may be used for controlling any particular type of circuit in which the tilting of the switch will either make or break the circuit.

One of the primary objects of the present invention is to provide a metal envelope mercury switch which is symmetric about its longitudinal axis, and is adapted to be mounted in a vertical position in such manner that tilting of the switch axis in any direction from the vertical position will result in moving it from one circuit controlling position to another. Such switches are especially adapted for use as safety switches in vehicles for breaking the ignition circuit and the lighting circuit in the event of overturning of the vehicle, thus eliminating the possibility of fire or explosion.

One of the features of the present invention is the use of an insulating material which serves as a centering means for one electrode of the switch, and which is sealed in position along with the electrodes by means of suitable sealing means which allows evacuation of the switch and filling of the same with a gas or liquid providing a reducing atmosphere, as desired.

Still another object of the present invention resides in the provision of a switch structure which is easy to assemble, compact in form, and readily capable of being mounted in any suitable operating position, and which is low in cost.

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 a preferred form of the present invention.

In the drawing:

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

Figure 2 is a similar view of a modified form of switch.

Considering now Figure 1 in detail, this switch embodies a metal envelope indicated generally at 5 having the substantially hemispherical cup-like portion 6, and the cylindrical portion 7 projecting therefrom and of a slightly increased diameter, thereby forming the radial shoulder 8 therebetween.

Disposed in abutment against the shoulder 8 is an insulating member 9 which may be made of a refractory material, such as a ceramic or the like, and which has a substantially spherical recess 10 formed therein and forming with the internal surface of the cup portion 6 of the envelope a substantially spherical chamber within the switch.

The ceramic insulating member 9 has an opening therethrough adapted to receive the head 12 of an electrode stud 13 projecting axially thereinto, the stud 13 projecting beyond the end of the cylindrical portion 7 of the envelope and being threaded adjacent its outer end.

Disposed on the outer face of the ceramic 9 and engaging the back surface of the electrode head 12 is a resilient insulating gasket 14 which has an annular flange portion 15 adapted to seat in the recessed portion 17 of the ceramic 9 whereby axial compression on the member 14 results in sealing the electrode with respect to the ceramic, and also sealing the ceramic with respect to the shell portion 7. Disposed outwardly of the gasket 14 and centered on the shank 13 of the electrode is a compression member 15 which may be formed of refractory material such as ceramic, porcelain, or the like, and which has axial flanged engagement with the outer surface of the gasket 14, whereby axial pressure thereon will compress the gasket into sealing position. Disposed against the outer radial surface of the compression member 15 is a retaining ring 16 formed of metal or the like, which is adapted to be engaged by the spun-over end 17 of the cylindrical portion 7 of the envelope to effect compression on the member 15 and thereby transmit this pressure to the gasket. The metal end of the envelope is spun over the retaining ring 16, while the parts are compressed in position, as described in detail in the copending application of Paul S. Bear, Serial No. 211,420, filed June 2, 1938, and when spun over, provides a sealed envelope preventing the escape of any gases, either into or out of the chamber indicated generally at 20.

The compression member 15 has a reduced axially extending shoulder portion 18 which acts as an insulating spacer between the ring 16, the spun-over end 17, and the shank of the electrode 13. The electrode is secured in position by means of the nut 19 threaded thereover, and any suitable terminal lug may be secured to the end

of the electrode and a corresponding terminal lug secured to the envelope 5 providing the terminals for the switch which may thereby be connected into any desired circuit.

In Figure 2 an inverted form of switch is shown having slight changes in its construction. The switch envelope 5 of this form of the invention is substantially identical with the envelope 5 of Figure 1, and corresponding parts are indicated with corresponding reference numerals. Disposed within the envelope is the ceramic 9 having the spherical surface 10 completing the semi-spherical surface of the portion 6 of the envelope and picked up by the resilient sealing gasket 14 in the same manner. A corresponding compression member 15 is also provided disposed beneath the retaining ring 16 which is engaged by the spun-over edge 17 of the envelope. In this embodiment of the invention the electrode comprises a stud member 25 which has the projecting end 26 extending down to a point adjacent the lower end of the envelope 6 and having an enlarged portion threaded to receive the nut 27 for locking the stud 25 against outward movement. At its opposite end the stud 25 is also threaded, as indicated at 28, to receive the nut 29 clamping the same against the compression member 15, and thereby locking the stud against longitudinal movement. The end 26 of the electrode may be a nickel alloy providing a mercury-to-mercury contact since this material has the characteristic of being wet by mercury.

Suitable insulating washers 30 are interposed between the compression member and a terminal lug member 32 secured to the stud 25 by means of the nut 29. A corresponding terminal lug member 33 is soldered or otherwise bonded to the spun-over edge 17 of the envelope 5 to form the terminals for the switch. It is to be understood that corresponding terminal lug members may be employed to the switch shown in Figure 1 in the same manner.

Considering again the disclosure of Figure 1, it will be noted that there is a body of mercury 40 provided in the chamber 20, which body of mercury has disposed over the surface thereof a thin film 42 of an anhydrous alkaline liquid, such as triethanolamine, having the property of increasing the meniscus height of the mercury and also preventing oxidation of the mercury, as well as forming a floatation medium for impurities found within the switch envelope. The envelope 5 of Figure 1 may be assembled with the parts in position and under compression by spinning over the end 17, and the body of mercury 40 may then be introduced into the chamber 20 through the opening 43 on the upper end of the shell 6. After being thus introduced, the liquid film is introduced on top of the mercury and the chamber may then be suitably evacuated and then sealed by means of the sealing plug 44 having a tapered seat or threaded seat in the opening 43. If desired, hydrogen or a similar reducing gas under pressure may be introduced into the chamber through the opening 43 to drive out all possible air or the like, and may then be sealed in the chamber under such pressure to form a reducing atmosphere in the chamber.

It will be apparent that upon tilting of the switch from its vertical position, the body of mercury 40 will move into a position forming a bridging contact between the electrode head 12 and the chamber wall 6, thereby completing the circuit through the switch, and upon return of the switch to its normal vertical position, the circuit will be broken across the surface of the insulating member 9. Thus, this form of switch provides a construction which is normally in switch open position, but which, upon tilting, moves into switch closing position for closing the circuit therethrough. Such a switch may be used for grounding the ignition and power circuits of a vehicle or the like in case of overturning.

In the form of switch shown in Figure 2, the body of mercury 50 in this form of switch has a similar liquid film 52 thereover, but is of sufficient volume so that it provides contact between the end portion of the stud 26 and the internal surface of the cup-like portion 6 of the envelope. To fill this type of switch, we preferably provide a tubular member 53 which is inserted from the internal side of the shell 6 outwardly through an opening 54 formed in the end thereof, and is provided with a substantially radial flange portion 55 which may be welded or otherwise securely sealed to the internal surface of the switch. The mercury and liquid 52 may be introduced through this tubulation and after the interior of the switch chamber has been evacuated or has been filled with a reducing atmosphere, the tubulation is pinched together as indicated at 56 to seal the envelope, and may then be welded to provide a permanent seal.

With this form of switch the circuit is normally closed between the electrode and the envelope, but tilting of the switch a predetermined amount from its vertical position will result in movement of the body of mercury 50 along the shell 6 to a position where it no longer contacts the end of the stud 26, and consequently breaks the circuit through the switch. Such a switch may be interposed directly in the ignition and lighting circuits of a vehicle, and upon overturning of the vehicle, will open the circuit from the battery to any portion of the power circuit.

It is to be understood that by "overturning" is meant the tilting of the vehicle beyond a predetermined amount in any direction, and is not limited to a complete overturning of the vehicle since movement of approximately 45 degrees of the switch out of its vertical position will result in such changing of its circuit controlling position.

The liquid film 42 employed in these switches is a heavy viscous type liquid, and has an appreciable effect in dampening the movement of the mercury due to vibration or small jolts or shocks, and prevents any breaking of the circuit until the switch has been positively moved through the predetermined angle. Also, the lower end of the portion 26 of the stud 25 may be a nickel alloy which is wet by mercury in order to provide for the retention of a globule of mercury thereon even when the circuit is broken.

We are aware that various changes may be made in certain of the features in the present invention herein shown and illustrated, and therefore do not intend to be limited except as defined by the scope and spirit of the appended claims.

We claim:

1. A switch comprising a drawn metal shell having a hemispherical chamber portion and a cylindrical open end joined to the edge of said portion by a radial shoulder, an insulating support having a hemispherical recess opening toward said corresponding shell portion and abutting against shoulder sealed in the open end of said shell, electrode means in said support and

projecting therebeyond into said shell, and a body of mercury in said shell in contact with said electrode means when said switch is in vertical position, but adapted to move out of contact with said electrode means upon predetermined tilting of the switch in any direction from its vertical axis.

2. A safety switch comprising a hemispherical metal envelope having an enlarged cylindrical end joined thereto by an integral radial shoulder, a ceramic in said end abutting against said shoulder, an electrode carried by said ceramic having a shank projecting axially out of said end of said envelope, said ceramic having a hemispherical recess therein facing said envelope with the electrode head centered in said recess, sealing means in said end, and a body of mercury in said recess sufficient to bridge across said recessed portion of said ceramic from said electrode to said envelope when said switch is tilted from a normal vertical position through a predetermined angle.

3. A switch comprising a cup-like metal envelope having a cylindrical open end, an insulating body centered in said end and having a corresponding cup-shaped recess in the inner face thereof defining with said envelope a spherically shaped switch chamber, an electrode supported in said body and having an outwardly projecting terminal portion, means sealing said body in said end of said envelope, said electrode having means projecting inwardly through said chamber toward the closed end of said envelope, and a body of mercury in said chamber normally bridging between said projecting means and said envelope, and adapted to break contact therebetween upon tilting of said switch beyond a predetermined angle.

4. A switch comprising a hemispherical metal envelope having a cylindrical open end and including means forming a radial shoulder therebetween, an insulating body centered in said end in abutment with said shoulder and sealed with respect to said envelope, an electrode projecting through said body to a point adjacent the base of the envelope and sealed with respect to said body, a body of mercury in the base of said envelope normally bridging between said electrode and envelope when the switch is in vertical position with the open end of the envelope uppermost, but adapted to break contact therebetween upon tilting of the switch beyond a predetermined angle from the vertical.

5. In combination, a metal shell having a hemispherical portion terminating in an enlarged cylindrical end, a ceramic seated on the edge of said hemispherical portion and having a corresponding recess defining with the shell a substantially spherical switch chamber, an electrode having a contact portion projecting through the ceramic into said chamber and having an outwardly projecting shank, means on said contact portion engaging the inner face of said ceramic to axially adjust the position of said contact portion relative to said hemispherical portion, resilient means sealing said electrode and ceramic in said enlarged end of said shell, and a body of mercury in said chamber adapted to make and break contact between said shell and electrode upon tilting of said switch.

6. A metal envelope switch comprising a hemispherical shell having an enlarged cylindrical end joined to the periphery thereof by a radially inturned shoulder, a ceramic seated against said shoulder and having a hemispherical recess therein facing said shell, an electrode centered in said recess, a body of mercury in said shell adapted to bridge between said shell and said electrode when the switch is in one position, and a tubulation projecting from the lower end of said shell and welded thereto for evacuating the shell, said tubulation being pinched and welded to seal the interior of the shell after evacuation.

7. In a metal envelope type mercury switch, a hemispherical shell portion having a radially enlarged cylindrical flange joined to the defining edge of said shell portion by a radial flange, a ceramic insert seated in said flange against said shoulder and having a hemispherical recess forming with said shell portion a spherical switch chamber, said insert having an axial cylindrical bore therethrough, an electrode having a cylindrical head fitted in said bore and an outwardly projecting shank, resilient sealing means engaging the outer faces of said electrode head and insert, compression means engaged by a spun over edge of said flange for holding said sealing means in sealing engagement with said faces, and a body of mercury lying in said recess in engagement with said electrode head and adapted to bridge across said insert to said shell upon tilting of said switch through a predetermined angle.

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