

May 6, 1924.

1,492,584

E. R. STOEKLE

ELECTRIC SWITCH

Filed May 17, 1920

Fig. 1.

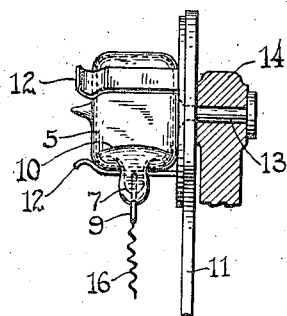


Fig. 2.

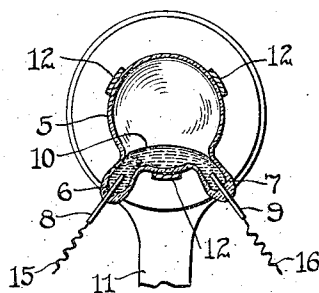


Fig. 3.

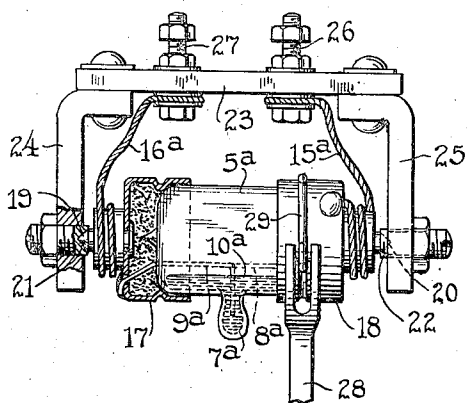
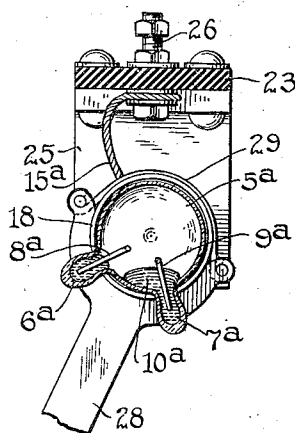


Fig. 4.



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ELECTRIC SWITCH.

Application filed May 17, 1920. Serial No. 381,792.

To all whom it may concern:

Be it known that I, ERWIN R. STOEKLE, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Electric Switches, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

This invention relates to electric switches.

More particularly the invention relates to electric switches of the general type disclosed and claimed in a co-pending application of Henry N. Wade of July 19, 1919, Serial No. 312,057. Such type of switch comprises a plurality of co-operating contacts, at least one of said contacts being composed of conductive fluid such as mercury, and an oscillable support for said contacts enabling relative movement of certain of said contacts for making and breaking circuit therebetween while maintaining the collective center of gravity of the aforementioned parts substantially undisplaced vertically.

The present invention has among its objects that of providing a switch of the aforesaid character wherein provision is made against loss of efficiency due to contamination of the conductive fluid thereof through disintegration or dissolution, under the influence of possible arcs, of associated solid elements of the conductive circuit.

Another object is that of providing such a switch wherein the various parts are particularly designed and constructed to minimize deterioration of the support due to the effects of possible arcing.

Another object is that of minimizing or materially reducing the operative force and space requirements of switches of the character aforesaid by rendering the same capable of making and breaking circuit respectively upon reverse angular movement thereof substantially within the limits of the contour of the switch itself.

Other objects and advantages will hereinafter appear.

In the accompanying drawing wherein are illustrated certain of the embodiments which the invention may assume in practice.

Figure 1 is a side elevational view of a preferred construction;

Figure 2 is a vertical sectional view thereof;

Figure 3 is a view similar to Figure 1 but illustrating a slightly modified construction; while,

Figure 4 is a vertical sectional view illustrating such modified construction in a different operative position from that illustrated in Figure 2.

Referring to Figures 1 and 2 of the drawing, the same illustrate a switch comprising a substantially circular sealed bulb or container 5 of glass or other suitable insulating material adapted to oscillate in a vertical plane about its own major axis. Said container is provided with downwardly extending hollow radial portions forming internal wells or pockets 6 and 7 arranged to include therebetween a radial angle preferably less than 90 degrees, the openings connecting said wells with the interior of the container proper being relatively restricted. Conductors 8 and 9 are sealed within the lower terminal portions of said projections respectively, said conductors being located in the main exteriorly of the container and having their upper portions positioned within the respective wells. The lower portion of said container including said wells is filled with a dense conductive fluid medium 10 such as mercury, the quantity thereof being sufficient to extend continuously between said wells for providing electrical connection of the conductors 8 and 9 so long as the container occupies an angular position wherein said wells are substantially symmetrically arranged with reference to the vertical. Upon rotation of said container through a predetermined angle, which in practice need not exceed 20 degrees, the mercury contained within one well is elevated above the level of the main body of mercury within the container for effecting sudden interruption of such electrical connection between mercury surfaces exclusively, whereas obviously upon restoration of the container to such symmetrical relation, said circuit connection is similarly re-established. Such interruption of circuit is ordinarily effected without appreciable arcing, however, under certain conditions and particularly in breaking a relatively heavy current, a material arc of brief duration may be drawn.

In practice the space within the container not occupied by the aforementioned conductors, including the fluid conductor 10, is preferably evacuated prior to sealing of the

container, for removal of any gaseous matter which might react unfavorably upon the exposed conductive parts. This feature, however, is not absolutely essential and on the other hand such space might be filled with an electrically inert and non-oxidizing gas to minimize the effects of possible arcing between the mercury surfaces undergoing separation, whereas under certain conditions such space might even be left open to atmosphere.

Obviously throughout the aforescribed circuit controlling action of the switch, the container and the main body of the mercury therein are not displaced bodily to any appreciable extent. Moreover the slight elevation of one of the radial extensions and the small portion of mercury contained therein, together with its associated solid conductors, is practically completely compensated by corresponding lowering of the other radial extension and its similarly associated parts. Thus the mechanical power required to effect such operation is minimized and the device rendered sensitive to influences of exceedingly small magnitude, whereas such actuation involves practically no sudden release of stored energy, whereby said element is particularly adapted to mounting directly upon a delicately adjusted operating member for performing its intended circuit controlling functions without to any appreciable degree interfering with the normal functions of such operating member. Also, by the foregoing construction and arrangement of parts, whereby movement of the container is limited to rotation substantially within its own contour, the operative space requirements of the switch are minimized.

Also the construction and arrangement whereby the upper portions of the solid conductors 8 and 9 are located entirely within the respective wells without penetrating the contour of the container proper, in practice insures that such portions of said solid conductors are at all times completely immersed in liquid mercury, the high surface tension of the mercury, whereby the free upper surface thereof inherently tends to assume a convex contour, being utilized to promote such desired effect. Thus there is present within the container no unprotected solid matter which is capable of deterioration or disintegration under the action of possible arcs, whereby contamination of the liquid mercury and resultant loss of efficiency of the switch are prevented.

Further, due to the relatively restricted size of the openings between the respective wells and the main body of the container, the aforementioned tendency of the free surface of the mercury to assume a convex contour is accentuated, whereby at the moment of separation of the mercury in either well from the main body of mercury in the container,

the portions of such bodies of mercury which are last in contact with one another, and between which any possible arc would necessarily be drawn, are spaced a material distance upwardly from the adjacent wall of the container. Such portion of the container is thus located outside the region of material influence of any arcs which may occur, such effect being of the utmost importance in prolonging the period of service of the container, assuming the same to be constructed of glass or other material susceptible of deterioration due to arcing.

In practice the aforescribed switch is directly mounted upon an oscillable support 11 having forwardly projecting clips 12 to engage and secure the container 5 thereto. Said support is preferably provided with a horizontal stud 13 arranged in coincidence with the major axis of said container and adapted to serve as a pivot for oscillatory mounting of said support and said switch upon a relatively fixed body indicated at 14. The lower end of said support 11 may if desired be utilized for oscillation thereof and of the switch to effect operation of the latter. Flexible leads 15 and 16 may be utilized for connecting the respective conductors 8 and 9 in suitable relation in the circuit to be controlled. Furthermore, the aforescribed switch may optionally be constructed to substantially conform in external appearance to the structure illustrated in Figures 3 and 4 to be now described.

The switch illustrated in said Figures 3 and 4 is in most essential respects similar to that aforescribed. In this instance, however the container 5^a is substantially cylindrical in contour, the solid conductors 8^a and 9^a being located interiorly thereof and provided with adjacent terminal portions adapted to dip downwardly within the respective wells 6^a and 7^a.

Said container is preferably provided with conductive end caps 17 and 18 permanently secured to the respective terminal portions thereof by cementing or otherwise, while the relatively remote ends of the respective solid conductors 8^a and 9^a are permanently and electrically connected to the respective end caps, preferably by soldering. The respective end caps are preferably provided with grooves and with reduced end portions terminating in axially located studs 19 and 20 providing for oscillatory mounting of the switch upon a support, the latter being provided with adjustable bearings 21 and 22 to receive said studs. In practice said support may advantageously comprise a horizontal insulating board 23 having registering vertically extending legs 24 and 25 adapted to support said bearings in horizontally spaced relation. Flexible leads 15^a and 16^a may be coiled about the reduced portions of the respective end caps and terminally soldered

thereto, the opposite ends of said leads being secured respectively to terminal bolts 26 and 27 to provide line connections for the switch. A suitable operating device indicated at 28 may be clamped to said element by means of a clip 29 located within one of said grooves.

The operation of this construction for making and breaking circuit is similar to that aforescribed, whereas the device possesses similar functional advantages except as regards the degree of protection of the solid conductors.

What I claim as new and desire to secure by Letters Patent is:

1. An electric switch comprising a quantity of conductive fluid, and an oscillating container therefor having a well to receive such fluid and to be completely filled by less than the total amount thereof when said container occupies a given angular position, said well being formed to retain its full content of such fluid for separation thereof from the remainder of said fluid upon a given angular movement of said container.

2. An electric switch comprising a quantity of conductive fluid and an oscillating container therefor having an upwardly concave surface to receive such fluid and also having a well in open communication with the interior of the container and to be completely filled by less than the total quantity of such fluid when said container occupies a given angular position, said well being formed to retain its full content of such fluid for separation thereof from the remainder of said fluid upon a given angular movement of said container.

3. An electric switch comprising a quantity of conductive fluid and a container therefor adapted to oscillate with reference to a horizontal axis, said container having an upwardly concave surface arranged concentric to said axis and also having a well in open communication with the interior of the container and to be completely filled by less than the total quantity of such fluid when said container occupies a given angular position, said well being formed to retain its full content of such fluid for separation thereof from the remainder of said fluid upon a given angular movement of said container.

4. An electric switch comprising a quantity of conductive fluid, a coating conductor and a support for said elements rotatable substantially within its own dimensions for effecting relative movement of said elements for making and breaking circuit by lifting a small portion of said fluid above the main body thereof, while maintaining the center of gravity of said elements substantially undisplaced vertically.

5. An electric switch comprising a conductive fluid and a container therefor rotatable

substantially within the limits of its own contour to lift a small portion of said fluid above the main body thereof to break circuit, while maintaining the center of gravity of said switch substantially undisplaced vertically.

6. In an electric switch, in combination, a quantity of conductive fluid, solid conductors extending within said fluid at spaced points to provide terminals therefor and a support for said elements rotatable substantially within its own contour for effecting separation and union respectively of large and small portions of said fluid surrounding certain of said conductors, while maintaining the collective center of gravity of said parts substantially undisplaced vertically.

7. In an electric switch, in combination, a hollow substantially cylindrical support of insulating material adapted to oscillate about its axis and having small spaced portions of its internal surface depressed to provide pockets, solid conductors within said pockets respectively and provided with circuit connections and a body of conductive fluid having portions filling the respective pockets about said conductors and movable with said support and a relatively large portion adapted to connect and disconnect said former portions upon movement of said support in opposite directions to make and break circuit respectively, while maintaining the center of gravity of said elements substantially undisplaced vertically.

8. An electric switch comprising a conductive fluid, a container therefor movable to effect division of said fluid while maintaining the center of gravity thereof substantially undisplaced vertically, and solid conductors extending into said container for immersion in said fluid, said solid conductors having the portions thereof which are adjacent the line of division of said fluid completely immersed therein, certain of said solid conductors having their immersed portions disposed upon opposite sides of the line of division of said fluid.

9. An electric switch comprising a conductive fluid, a container therefor movable to effect division of said fluid while maintaining the center of gravity thereof substantially undisplaced vertically, terminals to be electrically disconnected upon such separation of said fluid, said terminals comprising solid conductors penetrating said container and having their interiorly located parts completely immersed in said fluid during the period of division of the latter.

10. An electric switch comprising a conductive fluid and a container therefor movable to effect division thereof, said container having parts arranged to cause said fluid to direct away from the adjacent wall of

the container any are drawn by such division of said fluid.

11. An electric switch comprising a conductive fluid, an upwardly concave container therefor having a downwardly extending portion providing an internal fluid containing pocket communicating with the interior of the container through a restricted opening, said container being movable to effect division of said fluid adjacent said opening and said opening being proportioned and arranged to cause said fluid to direct away from the adjacent wall of the container any are formed incident to such division of the fluid.

12. In an electric switch, in combination, a hollow substantially circular insulating container having therein a body of conductive fluid adapted to make and break an electric circuit upon oscillation of said container, a pair of caps surrounding the respective ends of said container, said caps being respectively provided with reduced studs located axially of said container and providing pivots for oscillatory mounting of said container upon a suitable support.

13. In an electric switch, in combination, a hollow elongated circular insulating container, a body of conductive fluid contained therein and adapted to make and break an electric circuit respectively upon reverse

angular movement of said container about a horizontal axis, and end caps mounted upon the respective terminal portions of said container, said caps having studs for mounting of the container within a suitable support each of said caps being further provided with a portion of reduced diameter to be surrounded by a flexible lead and means for securing terminal portions of such leads to said caps.

14. In an electric switch, in combination, a hollow elongated circular tube of insulating material containing a body of conductive fluid, solid conductors penetrating said tube and projecting within said conductive fluid at spaced points, conductive caps surrounding the respective terminal portions of said tube and rigidly secured thereto being insulated from one another by said tube, the remote terminal portions of said conductors being permanently electrically connected with the respective caps, said tube having means adapted during oscillation thereof to make and break circuit between the portions of said fluid which are respectively in electrical connection with said solid conductors.

In witness whereof, I have hereunto subscribed my name.

ERWIN R. STOEKLE.