

July 10, 1928.

1,676,754

W. R. WALKER

MERCURY SWITCH

Filed June 17, 1925

Fig. 1

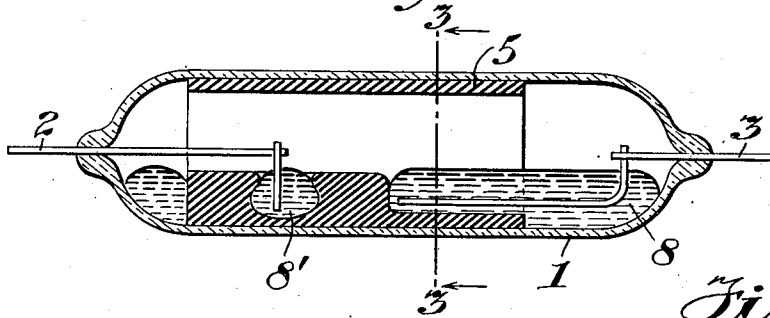


Fig. 2

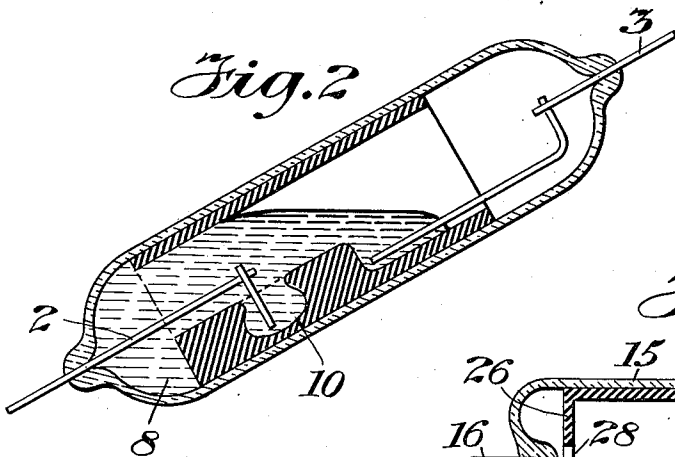


Fig. 3

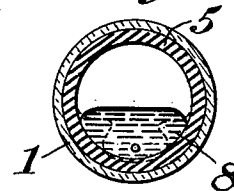


Fig. 4

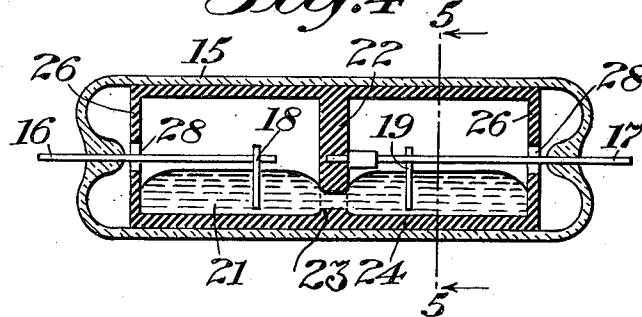


Fig. 6



Fig. 5

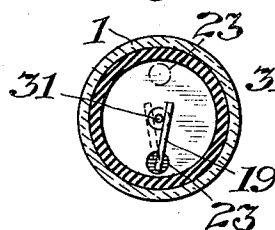
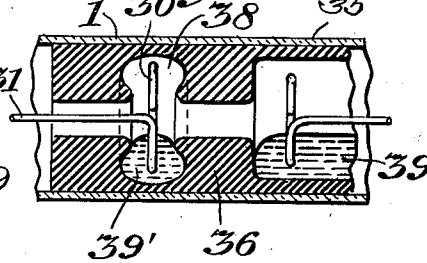


Fig. 7



INVENTOR

Warren R. Walker

BY

The W. Brown
HIS ATTORNEY

UNITED STATES PATENT OFFICE.

WARREN R. WALKER, OF GREAT KILLS, NEW YORK, ASSIGNOR TO COOPER HEWITT ELECTRIC COMPANY, OF HOBOKEN, NEW JERSEY, A CORPORATION OF NEW JERSEY.

MERCURY SWITCH.

Application filed June 17, 1925. Serial No. 37,646.

The present invention relates to electric switch devices useful for the opening and closing of electric circuits in the art generally. The invention relates more particularly to an electric switch of the liquid flow type having a receptacle within which terminates a plurality of electrodes, and a liquid for making and breaking a conducting path between said electrodes, and a lining for said receptacle for protecting it against changes in temperature due to the production of arcs during the opening and closing of the switch and for protecting it against any erosive action of any such arcs. It further relates to such a lined receptacle switch in which the lining has formed thereon or therein a well for holding a quantity of conducting liquid about the end of one of the electrodes of the switch protecting it by causing the circuit to be broken by the separation of the liquid into two bodies and by the joining of such bodies. The invention further relates to such a switch in which the lining is made of an arc resisting material capable of withstanding high temperatures and rapid fluctuations in temperature.

I have discovered that a switch capable of breaking currents of high values at frequent intervals can be made of relatively cheap material and by simple methods by providing an electric switch of the liquid flow type having a sealed envelope with electrodes terminating therein and in contact with a conducting liquid therein which is capable of breaking such electrical contact and with a protective lining for said envelope extending between said electrodes and to such other points as are necessary for said protection, which lining has formed therein a well for holding a quantity of the conducting liquid about the end of one of the electrodes at all positions in the normal operation of the switch and for separating the liquid into two bodies for the breaking of the circuit therethrough.

The lining in some cases is made to hold all of the conducting liquid in all positions of the switch as well as to separate the liquid to open the circuit therethrough in which case the envelope serves to hold an atmosphere about the circuit making and breaking parts of the switch such for example as an atmosphere of hydrogen.

It is therefor an object of my invention to

provide an electric switch of the liquid flow type having a receptacle or envelope for the liquid and the co-operating electrodes which envelope is provided with a lining for protecting it against any arcing produced in the switch. The lining is adapted to separate the liquid into two parts for the breaking of the circuit through the switch and the material thereof is of such a nature as to withstand arcing and rapid fluctuations in temperature. Other objects of my invention will appear from the accompanying drawing, the description thereof and from the claims.

In the drawing Fig. 1 is a longitudinal sectional view through an electric switch comprising a sealed envelope having an electrode sealed therethrough at each end, mercury therein and having a lining which extends between the ends of said electrodes and to appreciable distances towards the ends of the envelope and has formed in its inner wall a well for holding a quantity of the mercury about the end of one of the electrodes of the switch and for separating the portion about said end from the main portion of mercury in the open circuit position of the switch as is shown in this figure,

Fig. 2 is a similar sectional view showing the switch of Fig. 1 in the closed circuit position,

Fig. 3 is a sectional view taken along the lines 3—3 of Fig. 1 and looking in the direction of the arrows,

Fig. 4 shows an alternative embodiment of my invention in a longitudinal sectional view showing the switch lining as being formed with its ends partly closed so that the lining holds the mercury in two pools in all normal positions of the switch which pools are separated by a perforated partition, the mercury of said two pools being connected or disconnected through said perforation either by rotation or tipping of the switch,

Fig. 5 is a sectional view of the device of Fig. 4 taken along the line 5—5 and looking in the direction of the arrows in that figure,

Fig. 6 is an end view of an annular electrode adapted for use in place of the electrodes shown in Figs. 2 and 5 whereby the electrode makes contact with the mercury at different rotational positions of the switch, and

Fig. 7 is a longitudinal sectional view in

part of a switch similar to that of Fig. 1 but in which the wall is formed as an annular groove with incut sides in the inner surface of the lining and having an annular electrode of the type shown in Fig. 6 positioned in said annular well and in contact with the mercury therein whereby the switch can be mounted in any rotational position of the envelope.

In Figs. 1, 2 and 3 the sealed longitudinal envelope 1 of glass or similar material has sealed through each end thereof electrodes 2 and 3 terminating within the envelope. The envelope is provided with a lining 5 which extends between the ends of said electrodes and over an appreciable distance toward each end of the envelope, this lining being made of an arc resisting material such as fused quartz, porcelain, or other vitreous material, or a molded compound. A quantity of mercury 8 is provided within the envelope for establishing current connection between said electrodes and for breaking such connection by suitable flow thereof caused by movement of the envelope. At a thickened portion of said lining on its inner surface is formed a well 10 in which terminates a downwardly extending terminal of said electrode 2 and which serves to hold a pool 8' of the mercury in an open circuit position of the switch. The electrode 3 extends inwardly and downwardly into the main body of the mercury. This switch is operated by tilting to separate or unite the two bodies of mercury 8 and 8' in a manner well known in the art.

In Figs. 4 and 5 the sealed envelope 15 has sealed therethrough the electrodes 16 and 17 which are axially aligned and each of which carries a downwardly extending portion 18 and 19 respectively, which terminate within the mercury 21 of the switch.

Said electrode 17 extends inwardly past the point at which terminal 19 is mounted thereto and is fixed into the septum 22 which is formed integral with the lining 24 of said envelope 15 and has an opening 23 there-through near the wall of the lining. The lining 24 has at each end a wall thereacross for keeping the mercury 21 inside the lining at normal positions of the switch, the openings 28, 28 being provided therein for the insertion of the electrodes. A suitable atmosphere of heat conducting material such as hydrogen is provided in the envelope.

In the operation of this embodiment of my invention circuit is made and broken through the mercury 23 between electrodes 16 and 17 by rotating the switch to bring the opening 23 below or above the level of mercury 21, position of said opening being indicated by the dotted lines in Fig. 5. The switch can also be operated by tilting by having the opening 21 at a suitable distance from the bottom of the switch to keep a body of

mercury around that electrode terminal from which the main body of mercury is made to flow to open the circuit. Other variations in the operation and in the structure of this switch will be apparent in the disclosure in my co-pending application Serial Number 24,733, filed April 21, 1925, wherein is indicated how this switch may be operated for use as a time switch and may be varied to secure various timing operations.

In Fig. 6 is shown an annular electrode terminal 30 mounted on an electrode lead 31 which may be substituted for the electrode terminals and leads above described for insuring contact between them and the mercury in the various positions of the switch.

In Fig. 7 is shown in part a switch envelope 35 and a lining 36 therefor similar to that shown in Figs. 1 and 2 but in which the well in the lining is formed in the form of an annular channel 38 having inset sides for holding mercury 39' therein when the switch is tilted. Within the annular channel 38 is mounted an annular electrode terminal 30 similar to that shown in Fig. 6 supported on electrode lead 31. A similar annular electrode is mounted at the other end of the switch in contact with the main body of mercury 39. This switch is operated by tilting in the manner of the operation of the switch in Figs. 1 and 2 but through its structure it may be mounted in its supports at any rotational position therefor about its axis.

I claim—

1. In an electric switch of the liquid flow type, an envelope, electrodes terminating in said envelope, a lining for and a conducting fluid in said envelope, said lining being formed to hold the liquid from contact with the envelope in any rotational position of the envelope about a given axis and with a well therein to hold a part of said liquid separate from the main part in an open circuit position of the switch and one of said electrodes terminating in said well, said liquid being in amount sufficient to join said electrodes in a closed circuit position of the switch.

2. In a mercury switch, a sealed tubular envelope having electrodes sealed thereinto, mercury in said envelope in sufficient amount to join the electrodes in a closed circuit position of the switch, a lining extending in said envelope between said electrodes, said lining being formed with an annular channel in its inner surface and one of said electrodes being formed with an annular terminal positioned in said annular channel, and said annular channel being of such shape as to hold a quantity of mercury in contact with the annular terminal at an open circuit position in any rotational position of the switch about an axis at or near the horizontal.

3. In a mercury switch, a tubular envelope, a tubular lining in said envelope having a pocket therein between the limits thereof, leads sealed into said envelope, one
5 of them terminating in said pocket, mercury in said envelope in sufficient quantity to fill said pocket and to form a conducting path between said electrodes in a closed circuit position of the switch, said lining being
formed to present within the limits of the envelope an edge for separating the mercury of said pocket from the main body thereof in an opening of the switch.

Signed at Hoboken, in the county of Hudson and State of New Jersey this 27th day
15 of May, A. D. 1925.

WARREN R. WALKER.