

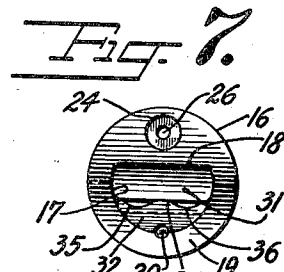
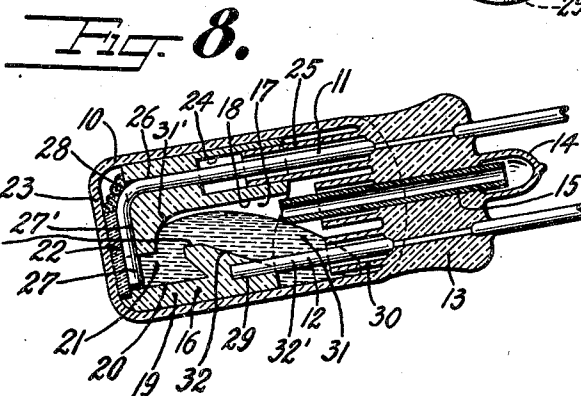
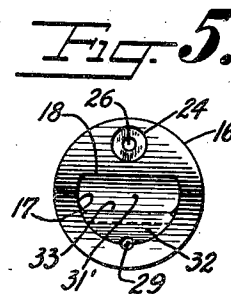
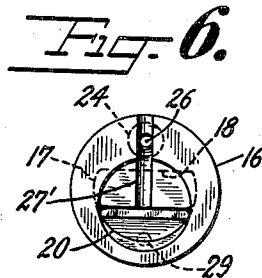
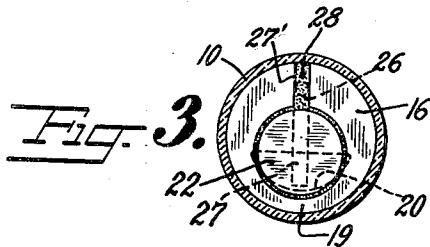
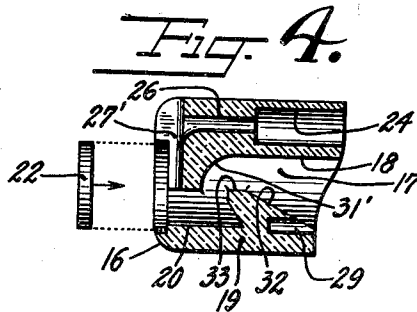
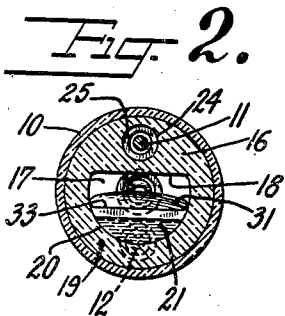
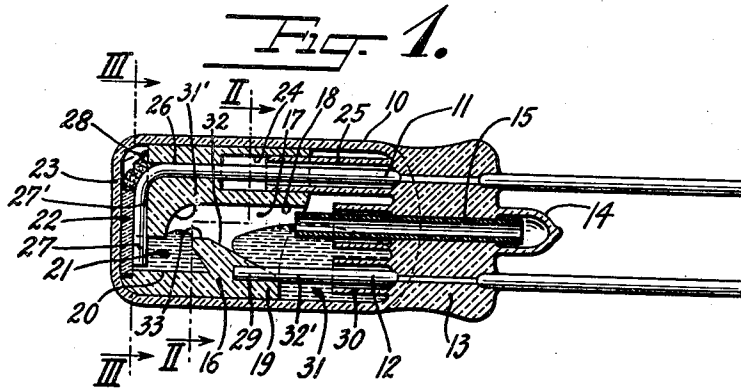
Jan. 2, 1934.

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1,941,971

MERCURY SWITCH

Filed June 29, 1932



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UNITED STATES PATENT OFFICE

1,941,971

MERCURY SWITCH

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Application June 29, 1932. Serial No. 619,890

11 Claims. (Cl. 200—152)

This invention relates to mercury switch devices and relates more particularly to such devices of the tilting make and break type in which electrical connections are opened and closed between two pools of mercury bridging a gap between stationary electrical conductors.

One of the objects of the invention is to provide a compact and serviceable switch of the type above set forth which may be manufactured in volume at low cost.

Another object of the invention is to provide a mercury switch in which a refractory cup is employed to cooperate with and protect electrical conductors.

Another object of the invention is to provide a mercury switch in which a refractory cup is disposed in a sealed container the dimensions of the cup and the capacity of the container being so arranged that the electrical conductors are protected from the gaseous environment within the container.

Other objects and advantages will become apparent from the following description:

The art of mercury switch manufacture is prolific with many types of switches. Sealed containers having electrodes and mercury bodies have been used for a long time. Certain types of mercury switches have also been provided wherein refractory elements are employed in conjunction with a movable body of mercury.

It is well known that in order to prevent deterioration of one or both of the electrodes in mercury switches as the result of the electric arc developed, switches have been made in which the electrical conductors are disposed in separate mercury pools which mercury pools are united and divided and in fact constitute the effective electrodes.

It has also been customary to break an arc across a refractory ridge to prevent deterioration of the glass wall of the envelope and cups have been provided for surrounding one of the electrodes and for retaining a mercury pool so that the arc will break across the lip of the cup.

In the development of a practical mercury switch, however, in which heavy currents are employed, as for example, in a switch employed to break five amperes of current or above, it is necessary to provide a switch construction wherein a refractory element is not only employed to provide a pocket but in which the refractory element may be made to cooperate as a protective medium for the electrical conductors. Furthermore, a practical mercury switch must be made in a compact form in order to compete with the ordinary

mechanical switches. Moreover, it must be so constructed as to have a relatively narrow angle of operation in order to meet the operating requirements in competition with other switch devices. In Patent 1,762,213, issued June 10, 1930, a mercury switch is shown in which a refractory element is employed and in which the said element is provided with a pocket. In the construction shown in this patent the refractory element serves to provide a refractory path of movement for a mercury body and a refractory cup for a pool of mercury. In addition, the said refractory body provides a transverse wall protecting an end of the glass container.

The present construction is an improvement over that shown in the aforesaid patent and includes a refractory body formed with an external cylindrical surface proportioned to fit the interior surface of a cylindrical container. The body is hollowed out to provide a cavernous chamber the floor of which inclines upwardly toward the rear of the cavern and terminates in a pocket to receive a mercury pool. The top of the wall of the cavern is provided with a passage to receive an electrical conductor which extends inwardly and downwardly with its end terminating in a pool.

For the purpose of facilitating the operation of forming the cavern within the refractory body, the end opposite the mouth of the cavern is left open and subsequently closed by a disc. With this construction it is possible to readily shape the body by molding by means of automatic molding apparatus. As above mentioned, one of the electrical conductors passes through and is insulated by the upper wall or ceiling of the cavern. The other electrical conductor, however, extends into the floor of the cavern and its exposed portion is permanently immersed in the main or movable body of mercury.

The distance the movable body of mercury has to travel to unite with the mercury pool is relatively short and, by reason of the proportions or capacity of the cavity together with the capacity of the container, the switch may be tipped to unite the mercury bodies or electrodes without exposing any portion of the electrical conductors to the atmosphere within the container.

The invention will be more fully understood by reference to the accompanying drawing in which Fig. 1 shows a longitudinal cross sectional view of a mercury switch constructed in accordance with the present invention;

Fig. 2 is a view taken on line II—II in Fig. 1;

Fig. 3 is a view taken on line III—III in Fig. 1;

Fig. 4 is a longitudinal cross sectional view of

the refractory element and showing a projected edge view of the end plug;

Fig. 5 is a view looking at the right end of the refractory element shown in Fig. 4;

Fig. 6 is a view looking at the left end of the refractory element shown in Fig. 4, the end plug being removed;

Fig. 7 is a view similar to Fig. 5 but shows a modification of the floor within the refractory element and

Fig. 8 is a view similar to Fig. 1 but shows the switch tipped at an angle to unite the mercury bodies.

A mercury switch constructed in accordance with the selected embodiment of the invention may comprise a glass container 10 having electrical conductors 11 and 12 sealed in a press 13. The container may be evacuated through an exhaust tube 14 and sealed off in the usual manner. In the present construction a refractory sleeve 15 is employed to maintain the exhaust passage opened during the formation of the press 13. Within the container is a refractory body 16 of cylindrical form and proportioned to fit the interior surface of the container which in the present construction is cylindrical. It is to be understood that the container may be made of a different transverse cross section and that the refractory element may also be formed with a similar configuration to fit the container.

The refractory body 16 is hollowed out to provide what may be termed a cavern 17 having an upper wall or ceiling 18 and a lower wall or floor 19. The floor 19 may be inclined upwardly and inwardly from the mouth of the cavern and in the rear of the cavern is provided a pocket or cavity 20 to contain a mercury pool 21. The end wall of the cavern consists of a plug or disk 22 which is cemented in place and serves to complete the enclosure and protect the end wall 23 of the glass container.

The ceiling or top wall of the cavern is provided with an enlarged passageway 24 to receive an insulative sleeve 25 which may be a separate tubular member or integral with the glass container. The electrical conductor 11 is disposed in the sleeve 25 and extends through a reduced passageway 26 which is a continuation of the passageway 24. The conductor 11 is bent at right angles so that an end 27 is disposed in the mercury pool 21. The conductor 11 is inserted into the passage 26 and through the sleeve 25 before the disk 22 is cemented in place and for this purpose an opening or slot 27' is left to receive the bend or elbow of the conductor. After the conductor is in place, however, and the disk 22 secured in place, the exposed portion at the bend is covered by a filling of refractory cement 28.

The lower electrical conductor 12 extends into a cavity 29 formed in the floor 19 of the cavern and may have a tight fit therewith. It will be evident that the electrical conductors 11 and 12 are secured to the refractory body which is supported by these conductive wires. This is a manufacturing advantage since the refractory body may be mounted on the conductors and when so supported the glass container may readily be disposed about the refractory member for the exhausting, sealing and tipping off operations.

An insulative sleeve 30 extending from the press 13 is provided to partially cover a portion of the electrical conductor disposed within the container and a movable mercury body 31 is disposed so as to immerse the remaining exposed portion of the electrical conductor 12.

As will be noted the cavern ceiling or top wall is formed with a curved or arcuate surface 31' which acts as an abutment for the movable mercury pool and acts to limit the depth of the cavern so that the movable mercury body may fill the cavern and extend out of the mouth thereof and over portion 32' of the conductor 12. Thus the conductor 12 is never exposed to the atmosphere within the container and the conductor 11 is likewise shielded by reason of the passage through the refractory element and the sleeve 25.

The movable mercury body may be of such quantity as to partially lie on the inclined surface 32 constituting the floor of the cavern. This inclined surface leads upwardly toward a flat portion 33 and it is found that by providing such flat portion, the mercury is given a quick movement in its final travel when making contact with the mercury pool. By reason of this flat portion instead of the mercury slowly climbing up to the edge of the pool upon a tilting of the switch and then making contact, the mercury climbs up the inclined surface until it reaches the flat portion and then quickly moves over the edge and a more effective and quicker establishment of contact is effected.

As shown in Fig. 7, the surface 33 may be curved so as to provide a slightly raised central portion 34 and lateral trough-like depressions 35 and 36. This gives a broad flat edge to the advancing mercury body as it moves toward the pool instead of a narrow pointed edge and by reason of the greater area, a better contact condition is attained.

By reason of the present invention, a switch construction is provided in which heavy currents may be handled and at the same time a switch of compact form is provided which may be used where the room is limited as for example in a wall switch or other place where it is necessary to carry heavy currents and an economy of space is desirable.

Although a preferred embodiment is shown and described herein it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. In a switch of the mercury to mercury contact type the combination with a sealed container, a pair of electrical conductors extending into and sealed in the wall at one end of the container, a refractory body in said container and having one end adjacent to the wall at the other end of the container, the other end of said body being hollowed out to provide a cavern, a pocket in the floor of said cavern, a mercury pool in said pocket, another body of mercury movable into and out of said cavern, the end of one of said conductors being disposed in said pool and a portion of the other conductor in contact with said movable body of mercury.

2. In a switch of the mercury to mercury contact type having a sealed container, a pair of electrical conductors extending into and sealed in one end of said container, a refractory body having a hollowed-out portion to provide a cavernous chamber facing said end of said container, a pocket in the floor of said chamber, the top wall of said chamber having a passage, one of said conductors extending through said passage and having an end disposed in said cavity the other conductor having an end extending into the bottom wall of said chamber and movable mercury body

for making and breaking electrical connection between said conductors.

3. In a switch of the mercury to mercury contact type having a sealed container, a refractory body having a hollowed-out portion to provide a cavern, the floor of said cavern having a pocket, a mercury pool in said pocket, the top wall of said cavern having a passage, the bottom wall of said cavern having a cavity, a pair of electrical conductors extending into said container, one of said conductors extending through said passage and having an end disposed in said cavity and a movable mercury body in contact with a portion of said last named conductor and movable to connect the same with said pool when the container is tilted.

4. An element for a mercury switch comprising a refractory body hollowed out to provide a cavern, a cavity in the floor of said cavern, and a passage in the wall of said cavern to receive an electrical conductor, said passage communicating with said cavity.

5. An element for a mercury switch comprising an insulative body, said body having a cavity to hold a pool of mercury, a surface extending from the edge of said cavity, a portion of said surface being in the plane of the perimeter of the cavity and the remaining portion of the surface being inclined downwardly with respect to the edge of the cavity.

6. An element for a mercury switch comprising a refractory body of substantially cylindrical form, a recess extending into one end of the body, a cavity at the inner end of said recess, a flat surface extending from the edge of said recess and an inclined surface extending from said flat surface.

7. An element for a mercury switch comprising a refractory body of substantially cylindrical form to fit a cylindrical envelope, a recess extending into one end of said body, a cavity at the inner end of said recess, said cavity extending into the wall at the rear of said recess, and a passage through the wall of said body communicating with said recess.

8. An element for a mercury switch comprising a refractory body of substantially cylindrical form to fit a cylindrical envelope, a recess extending into one end of said body, a cavity at the inner end of said recess, said cavity extending into the wall at the rear of said recess, a passage through the wall of said body communicating with said recess and an inclined surface extending forwardly from said recess.

9. An element for a mercury switch comprising an insulative body, a recess extending into one end of the body, said recess having an inclined surface for the movement of a mercury body thereover, a cavity in said surface and a passage through the wall of said body and communicating with said cavity.

10. An element for a mercury switch comprising an insulative body, a recess extending into one end of the body, said recess having a flat surface and an inclined surface for the movement of mercury thereover, a cavity in said surface to receive a quantity of mercury and a passage in a wall of said body communicating with said cavity.

11. In a switch of the mercury to mercury contact type, the combination with a sealed container, a pair of electrical conductors extending into and sealed into the wall at one end of the conductor, a refractory body in said container having one end adjacent to the wall at the other end of said container, the other end of said body being hollowed-out to provide a cavern, a pocket in the floor of said cavern, a mercury pool in said pocket, one of said conductors being enclosed for the greater portion of its length in an insulative material and for the rest of its length in said mercury pool, the other conductor having an end portion enclosed in said refractory body and a mercury body in said container of sufficient volume to maintain the remaining portion of said last mentioned conductor immersed during movement of the body to make and break contact with said pool.

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