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P. K. CRAMBLET

1,827,072

MERCURY SWITCH

Filed Nov. 24, 1928

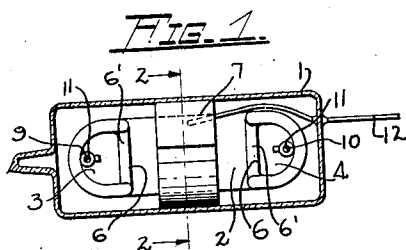
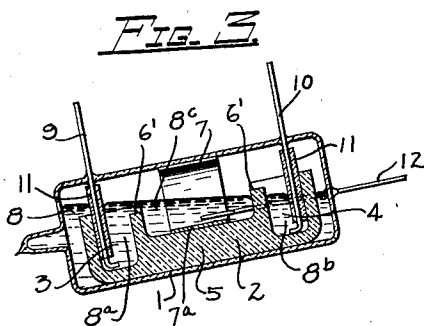


FIG. 5

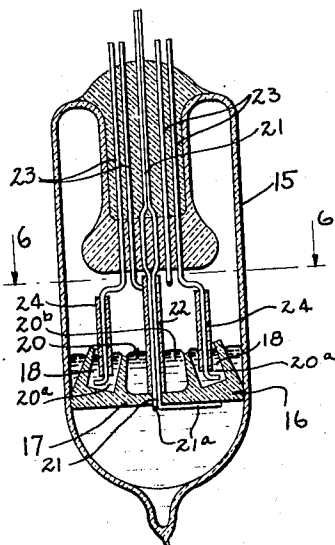


FIG. 2

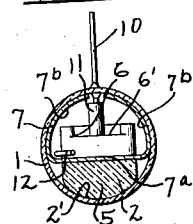


FIG. 4

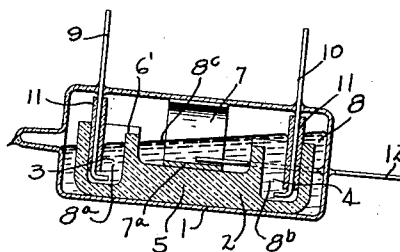
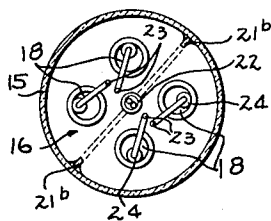


FIG. 6



INVENTOR.

Paul K. Cramblet

BY

Bohmer, Hornsall, Lecher, McNamee and Michael
ATTORNEY.

UNITED STATES PATENT OFFICE

PAUL K. CRAMBLET, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, OF MINNEAPOLIS, MINNE-
SOTA, A CORPORATION OF DELAWARE

MERCURY SWITCH

Application filed November 24, 1928. Serial No. 321,569.

This invention relates in general to mercury switches and more particularly to a mercury switch of the type having an outer envelope and an inner protective element of arc resisting material which receives the direct shock of the arc and interposes its protective structure between the destructive forces set up by the arcing and the outer envelope thereby prolonging the life of the switch.

One of the principal objects of the present invention resides in the provision of a novel protective element which is constituted of comparatively inexpensive material and adapted to be readily and easily constructed and assembled with the switch thereby reducing the cost of manufacture.

Another object is to provide a mercury switch having a protective element of this character which is supported in proper position in the switch in a novel and effective manner which not only lends itself to convenient and economical manufacture but which also provides a reliable and durable switch construction.

In carrying out the present invention a mercury switch is provided which has an outer envelope which may be constituted of soft glass or other comparatively inexpensive material suitable for this purpose. Within the envelope a protective element is provided and preferably is constituted of molded aluminum oxide, which, while inexpensive, may be readily wetted and molded into any one of the variety of shapes or structures. Preferably the aluminum oxide is shaped to provide a plurality of spaced wells and has an intermediate portion between such wells designed to coact with a retaining element which also coacts with the envelope to hold the protective element in position therein.

The use of aluminum oxide has many advantages in that it is not only comparatively inexpensive and susceptible of convenient working but also in that it is apparently entirely unaffected by the arcing. It is adapted to take the full shock of the arc and to stand up under the high temperatures and rapid temperature fluctuations incident to the arcing without any impairment of its structure

or of its desirable qualities. Further, even when in contact with the outer envelope in the assembly it will not tend to fracture or break down the switch structure in use. However, many of the advantages of the invention may be realized by constituting the protective element of various other arc resisting substances such as porcelain, quartz, hard glass, or the like.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described and particularly pointed out in the appended claims, reference being had to the accompanying drawings forming a part of this specification, and in which:

Figure 1 is a plan view of the interior construction of a mercury switch embodying the present invention, the outer envelope being shown in horizontal section;

Figure 2 is a view in transverse vertical section on line 2—2 of Figure 1;

Figure 3 is a view in central vertical longitudinal section showing the mercury switch of Figures 1 and 2 and illustrating the switch tilted to one extreme position;

Figure 4 is a similar view showing the switch tilted in its other extreme position;

Figure 5 is a view in diametrical vertical section illustrating another form of mercury switch embodying the invention; and

Figure 6 is a view in horizontal cross section taken on line 6—6 of Figure 5.

Referring to the drawings and more particularly to Figures 1 to 4, inclusive, the numeral 1 designates an outer envelope which may be constituted of soft glass or other suitable material. Within the outer envelope a protective element designated generally at 2 is provided and is preferably constituted of aluminum oxide or a mixture of aluminum oxide and silicon oxide known to the trade as alundum. In some instances such a mixture also includes a suitable binding material but of course when subjected to the action of heat the aluminum and silicon oxide alone will harden or set. The aluminum oxide or the mixture containing same is wetted and molded to the shape shown and baked or heated

to cause it to set and harden prior to its assembly with the switch and, as shown, is so formed as to have spaced wells 3 and 4 disposed at the ends of an integral connecting or base portion 5. The wells 3 and 4 are of cylindrical form, although they merge into their integral connecting portion 5 and as illustrated, they are open at the top and closed at the bottom. The base of the protective element, that is, the lower portion of its periphery is rounded as at 2' to conform to the curvature of the inner wall of the envelope against which it is engaged (see Figure 2). The confronting portions of the wells 3 and 4 have slots 6 providing a lip or surface 6' located within the protective structure of the well and adapted to receive the arc. By having these slots 6 extend only through that portion of the well which is directly aligned with the connecting portion of the protective element (see Figure 1), the upper extremity of each well is interposed between the arcing zone and the adjacent wall of the outer envelope (compare Figures 1 to 4, inclusive).

For the purpose of holding the protective element in position in the outer envelope, a retaining or holding element 7 is provided and consists of a split ring of resilient metal preferably stainless ferrous metal such as stainless steel or stainless iron. As illustrated, in Figure 2, the retaining element 7 is not of true circular form but has a flat portion 7^a to engage the flat upper surface of the connecting portion of the protective element. Beyond the flat portion 7^a the retaining portion has arcuate portions 7^b which fit snugly up against and have gripping engagement with the inner peripheral wall of the outer envelope. With this construction the retaining element presses the protective element firmly against the outer envelope and due to the frictional engagement between the outer envelope, the retaining element and the protective element, the protective element is firmly held in position in the assembly.

A body of mercury designated at 8, is provided in the outer envelope and has portions 8^a and 8^b filling the wells 3 and 4, respectively, and also has a shiftable portion 8^c intermediate the wells and alternately making and breaking contact with the portions 8^a and 8^b of the wells over the lips 6' of the wells. Electrodes 9 and 10 are sealed through the upper portion of the outer envelope and project down into the wells 3 and 4. For practically their entire extent within the outer envelope the electrodes 9 and 10 are shielded by sleeves 11 of glass or other suitable material but the lower extremities of the electrodes are exposed and are bent at right angles to hold the shields in place. A third electrode 12 is sealed through one end of the outer envelope and curves around one of the wells of the protective element and is constantly im-

mersed in the shiftable portion 8^c of the mercury.

In the form of the invention shown in Figures 5 and 6, a rotary type of switch is shown and comprises an outer envelope 15 of soft glass or other suitable material. Within the outer envelope a protective element designated generally at 16 is provided and as before is constituted of molded aluminum oxide or alundum. In this embodiment the shape and structure of the protective element is somewhat different from that of the previous embodiment and as illustrated the protective element has a plate-like base or connecting portion 17 and integral wells 18 arranged in circular series and having their axes inclined toward the center tube so that the outer portion of the top of each well is higher than the portion nearest the center, thus, interposing between the arcing zone and the outer envelope is a wall of protective material. A body of mercury generally designated at 20 is provided in the outer envelope and has portions 20^a filling the wells 18 and a shiftable portion 20^b adapted to make and break contact with the portions in the wells when the switch is operated. In this form of the invention the protective element is held in position in the outer envelope by virtue of the engagement of its periphery with the inner wall of the envelope and by virtue of the action of one of the electrodes designated generally at 21 and consisting of two strands of wire sealed in through the upper part of the envelope and passing down through the center of the plate 17 of the protective element. Below the protective element the strands of the electrodes 21 are extended away from each other and radially of the plate 17 as indicated at 21^a and have their terminals 21^b bent up into peripheral notches in the plate 17. A shield 22 consisting of a glass sleeve covers the electrode 21 between the plate 17 and the portion of the envelope through which it is sealed. Electrodes 23 are also sealed in through the outer envelope and pass down into the wells 18, there being one electrode 23 for each well 18. Protective sleeves 24 of glass or the like are also provided for the electrodes 23 and prevent direct contact between the portion of the electrodes 23 above the wells and the shiftable portion of the mercury. This type of switch is preferably mounted and operated in the manner fully set forth in the application of Paul K. Cramblet for mercury switch and operating mechanism therefor, filed November 24, 1928, Serial No. 321,566, although, of course, any suitable operating mechanism may be used in lieu thereof.

In both forms of the invention an easily shaped protective element is provided and has spaced wells over the lips of which the mercury to mercury make and break occurs. The wells and the entire structure of the protective element may be completed prior to

assembly and thereafter easily assembled with the switch. The protective element takes part in its own support in such a way as to facilitate the assembly and insure proper support of the protective element without danger of break down of the switch. The aluminum oxide mixture of which the protective element is preferably constituted has the property of standing up under the arc to a marked and extraordinary degree. Even after long and severe use the surface receiving the arc remains unimpaired and will not become slotted or disintegrated in any fashion. Further, a protective element so constructed and so constituted absorbs the shocks and strains of arcing without transmitting them to the envelope in such a way as to break down the envelope or otherwise impair the structure of the switch.

The invention claimed is:

1. A mercury switch including an outer envelope, an inner protective structure of molded arc resistant material and having a peripheral portion engaged with the lower portion only of the inner wall of the outer envelope; a resilient ring like metallic retaining element interposed between and coacting with the upper portion of the envelope and with the upper portion of the protective structure to complete the holding of the protective structure in proper position in the envelope, and a body of mercury in said envelope and having portions making and breaking contact on a surface of the protective structure.

2. A mercury switch comprising an outer envelope, an inner protective structure of molded arc resistant material smaller than the outer envelope and having a base portion engaging a portion only of the inner wall of the outer envelope and also having a well formed therein and provided with an open end in spaced relation to the inner wall of the outer envelope, a resilient and flexible metallic retaining element interposed between and coacting with the protective structure and with a spaced and opposed portion of the inner wall of the outer envelope to hold the protective structure in proper position in the envelope, and a body of mercury having a portion filling the well and a portion outside of the well and making and breaking contact with the portion of the mercury in the well.

3. A mercury switch comprising an outer envelope, an inner protective structure of molded arc resisting material including spaced wells and an integral connecting portion, and a split metallic retaining ring coacting with the connecting portion of the protective element for holding the protective element in position.

4. A mercury switch comprising an outer envelope, an inner protective structure of arc resisting material having spaced wells and a portion connecting said spaced wells, and a

yieldable retaining element in the form of a split approximately ring-like structure engaging the envelope and the intermediate portion of the protective element for holding the protective element engaged with the outer envelope and against displacement relative thereto.

5. A mercury switch comprising an outer envelope, an inner protective structure of arc resisting material including a well having a closed bottom and an open top and having a slot in the top over the floor of which the make and break occurs.

6. A mercury switch comprising an outer envelope, an inner protective structure of molded arc resisting material smaller than the outer envelope and having a base portion engaging a portion only of the inner periphery of the outer envelope and having a well integral with the base portion and formed with an open end in spaced relation to the inner wall of the outer envelope, yieldable means interposed between and coacting with the upper portion of the outer envelope and with the base to hold the protective structure in proper position in the envelope and a body of mercury having a portion filling the well and a portion around the protective structure and making and breaking contact with the portion in the well over a lip of the well.

7. A mercury switch comprising an outer envelope, an inner protective structure of arc resisting material including a plate like body and a series of wells integral with the plate like body and having open ends, the wells being arranged at spaced angular intervals around the envelope, and a body of mercury having portions filling the wells and a shiftable portion making and breaking contact with the portions in the wells.

8. A mercury switch comprising an outer envelope, an inner protective structure of arc resisting material including a plate like body and a series of wells integral with the plate like body and having open ends, the wells being arranged at spaced angular intervals around the envelope, and a body of mercury having portions filling the wells and a shiftable portion making and breaking contact with the portions in the wells, an electrode coacting with the plate like body to hold the protective structure in position and constantly immersed in the shiftable portion of the mercury, and electrodes sealed through the outer envelope and projecting down into the wells.

In witness whereof, I hereto affix my signature.

PAUL K. CRAMBLET.