

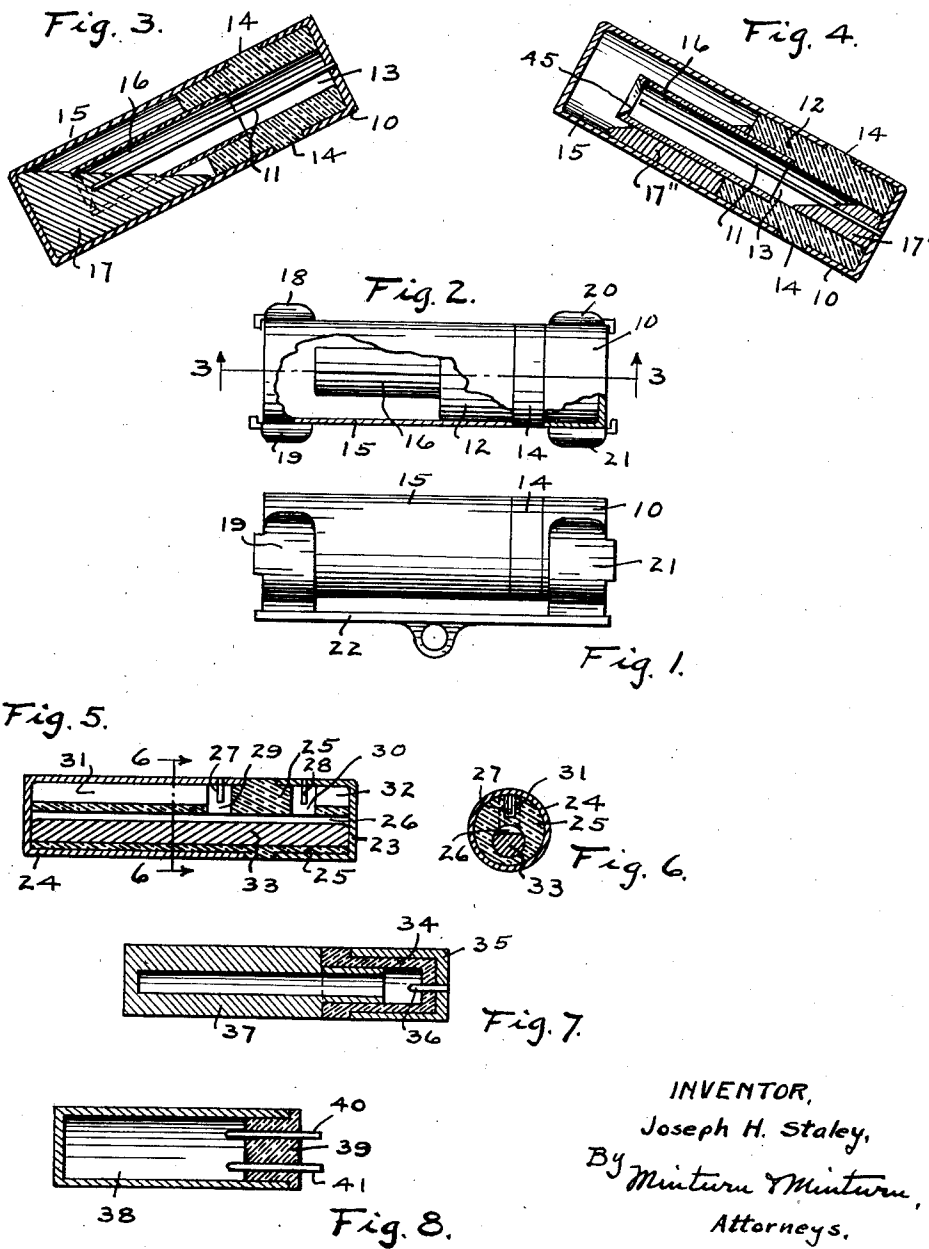
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FLUID TYPE CIRCUIT MAKER AND BREAKER

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FLUID TYPE CIRCUIT MAKER AND
BREAKER

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5 Claims. (Cl. 200—152)

This invention relates to the art of electrical switches in which a quantity of mercury is employed to flow between electrical conductors to make and break a circuit therebetween. A primary object of the invention is to employ a structure that is practically indestructible and which can be made at an exceedingly low cost of production. Another advantage of the invention resides in the particular employment of outside contacting services which permit the mercury containing unit to be mounted in the same manner as the common cartridge type of fuse so that "pigtaills" leading from the unit are avoided. A still further advantage of the invention resides in the fact that no conductors are required to be sealed through a glass wall and yet the unit may be gas filled.

A still further advantage of the invention is that the breaking of the electrical circuit is made between two different masses of mercury rather than between a metallic wall of the unit and another conductor so that pitting of the wall is avoided.

These and other objects and advantages of the invention will become apparent to those versed in the art from the following description which is made in reference to the accompanying drawing in which

Fig. 1 is a side elevation of a unit or cartridge embodying my invention and mounted in a carrier;

Fig. 2, a fragmentary top plan view of the unit;

Fig. 3, a central longitudinal section on the line 3—3 in Fig. 2 with the unit rocked to the closed circuit position;

Fig. 4, a similar sectional view with the unit rocked to the open circuit position;

Fig. 5, a central longitudinal section through a unit modified in form;

Fig. 6, a transverse section on the line 6—6 in Fig. 5;

Fig. 7, a central longitudinal section through another modified form of unit, and

Fig. 8, a central longitudinal section through a still further modified form.

Like characters of reference indicate like parts in the several views in the drawing.

Referring first to the form as shown in Figs. 1-4, I form a hollow cylindrical cover 10 preferably made out of metal and having a wire-like electrode 11 fixed centrally of the cover to extend outwardly therefrom for a substantial distance. I form a bushing 12 out of some suitable insulating material with a hollow bore 13 axially

disposed therethrough and force one end of the bushing to within the cover 10 to be secured therein with a tight pressed fit. The bushing 12 is formed with an annular flange 14 therearound adapted to fit against the rim of the cover 10 and to be of substantially the same external diameter as that of the cover 10.

I form a body 15 preferably of the same external diameter of the cover 10 and carry the open end of this body over the bushing 12 to have the rim of the body come up against the flange 14. The body is fitted over the bushing 12 with either a tight pressed fit or a glued or cemented joint to form an air-tight joint therebetween. The bushing 12 is provided to carry a tubular extension 16 to project well within the body 15 with the bore 13 extending on therethrough. The outer end of the tube 16 is formed to have an internal lip 45 which reduces the effective opening into the tube. The inner face of the lip is preferably left to be at right angles to the wall of the tube whereas the outer face is bevelled so as to have a sharpened edge at the rim of the lip. The electrode 11 terminates just within the outer open end of the extended tube 16. A quantity of mercury 17 is placed within the body 15 and is adapted to flow within the bore 13 and also around the outer side of the tube 16 between it and the wall of the body 15 as the assembly unit may be rocked. The quantity of mercury 17 is predetermined to be an amount such that when the unit is rocked as indicated in Fig. 3 there will be sufficient mercury to enter within the tube 16 a sufficient distance to surround a part of the electrode 11 and still remain as a continuous body in contact with the wall of the body 15. Thus an electrical circuit may be established from the body 15 through the mercury 17, the electrode 11 and the cover 10. This circuit may be broken by rocking the unit to some such position as indicated in Fig. 4 whereby the body of mercury will be broken over the edge of the tube 16 to allow part of the mercury to flow down within the tube as indicated by the globule 17' and the other part of the mercury flow down around the outside of the tube 16 against the end of the bushing 12 as indicated by the globule 17''. This rocking of the unit may be accomplished in any number of ways well known to those versed in the art, one particular way being indicated in Figs. 1 and 2 wherein the unit is mounted to have the body 15 gripped between the fingers 18, 19 and the cover between the fingers 20, 21, all of which fingers are carried by a rockable base 22. In

the form just described it is to be seen that as the mass of mercury is broken over the sharp edge of the lip 45 of the tube 16, that part of the mercury running down the tube still surrounds the end of the electrode 11 and that part running around the outside of the tube still remains in contact with the body 15 whereby the circuit is actually broken between those two parts of the mercury rather than directly between the mercury and the electrode or the mercury and the body. The presence of the lip 45 serves to prevent the inertia of the flowing mercury from causing all of the mercury to flow out from the tube as the mercury is broken over the lip edge, so that part of the mercury will be retained in the tube while the other part flows down around the outside of the tube. In view of this action, any arcing that may occur is between the two parts of the mercury.

The atmospheric air may be exhausted from within the unit at the time the body is carried over the bushing 12 and some gas other than oxygen put in its place to prevent oxidation of the mercury. The tight fit of the body 15 and the cover 10 over the ends of the bushing 12 prevents any escape of the gas. The bushing 12 is preferably made out of some slightly compressible material such as hard rubber, or any of the present well-known synthetic insulating materials employing phenol or formalin as are now available commercially under various trade names although porcelain or the like may be employed particularly where a cement or bonding material is employed. The metallic body and cover may be made out of some non-rusting metal so as to eliminate the possibility of oxidation thereof and provide clean electrical contacting surfaces.

In the form of the invention as illustrated in Figs. 5 and 6 I employ a cover 23 and a body 24 each having their open ends fitted respectively over a bushing 25. This bushing 25 has a longitudinal bore 26 therethrough eccentrically of the axis of the bushing and is provided with longitudinal slots 31 and 32 along the side thereof so as to permit the inturned pins 27 and 28 which are fixed respectively to the body 24 and cover 23 to enter from the ends of the slots and be carried therealong without interference so as to bring the pins to within transverse bores 29 and 30 which open into the eccentric bore 26. A quantity of mercury 33 is placed within the bore 26 and by tilting the assembled unit the mercury may flow accordingly to either end of the bore. A sufficient quantity of mercury is provided so that when the body end is lowered then mercury will flow into the transverse bores 29, 30 and provide an electrical path therebetween around through the mercury remaining in the bore 26. Rocking the unit to lower the body end will allow the mercury to flow out of these transverse bores and down the longitudinal bore to the lower end away from the two electrodes 27, 28 so as to interrupt the circuit therebetween. Some of the mercury may flow down the slot 31 but this is immaterial since it may flow back upon rocking the unit in the reversed direction.

While the form shown in Figs. 5 and 6 has been described as being adapted to be rocked to cause the mercury to flow axially within the unit, this form is also adapted to be revolved about its axis so as to submerge the electrodes 27 and 28 within the mercury as the mercury may flow into the transverse bores 29 and 30.

When used in installations employing the axial rotation of the unit, the electrodes 27 and 28 may be omitted and consequently, the slots 31 and 32 may then be omitted, and a closed end bushing used.

In Fig. 7 is shown a form of the invention in which a cup bushing 34 is provided with a closed outer end over which a cover 35 is pressed to have a central electrode 36 pass through the end of the bushing 34 to extend there within a slight distance. A body 37 is provided with an end having a reduced external diameter and this end is inserted to within the bushing 34 to be pressed therewithin to form a tight fit. The open end of the bushing 34 is provided with an annular flange which extends to between the rim of the cover 35 and the shoulder about the body 37 which appears at the inner end of the extension fitting within the bushing. Both the cover 35 and the body 37 may be made out of a conducting material and by placing a small quantity of mercury within the body 37, the unit may be tilted to lower the cover and thereby the mercury will flow down around the end of the electrode 36 and still remain in contact with the extended end of the body whereby an electrical circuit may be completed between the electrode and the body. By tilting the unit in the opposite direction to lower the body end, the mercury may flow away from the electrode 36 over the end of the extension of the body to break sharply and flow down within the body. The actual breaking of the circuit occurs between the mass of mercury and the electrode 36 so that the conducting surface of the body 37 is not effected by any arcing. The electrode 36 may be made of any suitable metal, iron, steel, "stainless" steel, or steel alloys to resist pitting or burning and being of relatively small dimensions the cost therefore is exceedingly small and the same metal need not be employed in the cover or the body.

A simplified form of the invention is illustrated in Fig. 8 wherein a body in the form of a metallic tube 38 is employed with a cover or plug 39 made of insulating material pressed into the open end thereof. A pair of electrodes 40 and 41 are carried through the plug 39 and by placing a quantity of mercury within the tube 38, a circuit may be formed between the inner ends of the electrodes through the mercury upon lowering the plug end and likewise the circuit may be broken by tilting the tube to raise the plug end.

In all of the various forms above described, I have eliminated the use of glass or like fragile material in forming the container in which the mercury may flow from one point to the other in making and breaking the electrical circuit. In place of such fragile material I have successfully employed metallic containers contrary to prior teachings. Of course such materials as copper and brass are not employed since some amalgamation with the mercury might occur. I use iron or steel or some of the alloys now referred to as stainless steel. By exhausting the air from the tubes and filling them with some gas other than oxygen, the mercury remains in usable condition. While I have here shown and described my invention in more or less minute detail it is obvious that it may assume forms other than those shown and described and I, therefore, do not desire to be limited to those precise forms any more than may be required by the following claims.

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1. For an electric switch, a unit comprising a metallic body, a metallic cover, a bushing sealably engaging both the body and cover forming substantially an air tight joint therebetween, a tubular extension on the bushing projecting within the body, said bushing and extension having a bore extending therethrough, an electrode carried by the cover to extend within said bore, and a quantity of mercury within said body sufficient to cover over the end of said extension and enter within said bore sufficiently to be in contact with said electrode upon tilting the unit to lower the body. 80
2. In a mercury switch, a cartridge unit comprising a tubular metallic body closed at one end, an insulating bushing sealably fitted into the open end of the body, an insulating tube extending from the bushing to within the body terminating at a slight distance from the closed end, a longitudinal bore in the tube, an electrode within the bore, a metallic closure sealably engaged by the bushing over the outer end of the bore through which closure an electrical path may be had to the electrode, and a quantity of mercury in the body adapted to flow into the bore about the electrode upon rocking of the unit. 85
3. In a mercury switch, a cartridge unit comprising a tubular metallic body closed at one end, a bushing sealably fitted into the open end of the body, an insulating tube extending from the bushing to within the body terminating at a slight distance from the closed end, a longitudinal bore in the tube, an electrode within the bore, a metallic closure sealably engaged by the bushing over the outer end of the bore through which closure an electrical path may be had to the electrode, and a quantity of mercury in the body adapted to flow into the bore about the electrode upon rocking of the unit, said tube having an external diameter less than the internal diameter of the body to provide a space therearound into which said mercury may flow, the rim of said tube forming an edge over which said mercury is divided into two parts, one flowing within the tube and the other around the tube. 90
4. In a mercury switch, a cartridge unit comprising a tubular metallic body closed at one end, a bushing sealably fitted into the open end of the body, an insulating tube extending from the bushing to within the body terminating at a slight distance from the closed end, a longitudinal bore in the tube, an electrode within the bore, a metallic closure sealably engaged by the bushing over the outer end of the bore through which closure an electrical path may be had to the electrode, and a quantity of mercury in the body adapted to flow into the bore about the electrode upon rocking of the unit, said tube having an external diameter less than the internal diameter of the body to provide a space therearound into which said mercury may flow, the rim of said tube forming an edge over which said mercury is divided into two parts, one flowing within the tube and the other around the tube, and an inturned lip about the said rim adapted to aid in dividing the mercury. 95
5. In a mercury switch adapted to be rolled about its axis, a two part metallic container, an insulating member in the container having a bore therein adapted to hold a quantity of mercury, said member having a pair of spaced apart transverse bores extending from said first bore to the respective walls of said container, said quantity of mercury being sufficient to fill said transverse bores and bridge therebetween upon the rolling of the container to carry the transverse bores to the under side thereof. 100
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