Nov. 30, 1954 R. D. HANCOCK 2,695,938

ELECTRICAL SWITCH

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Fig. 1

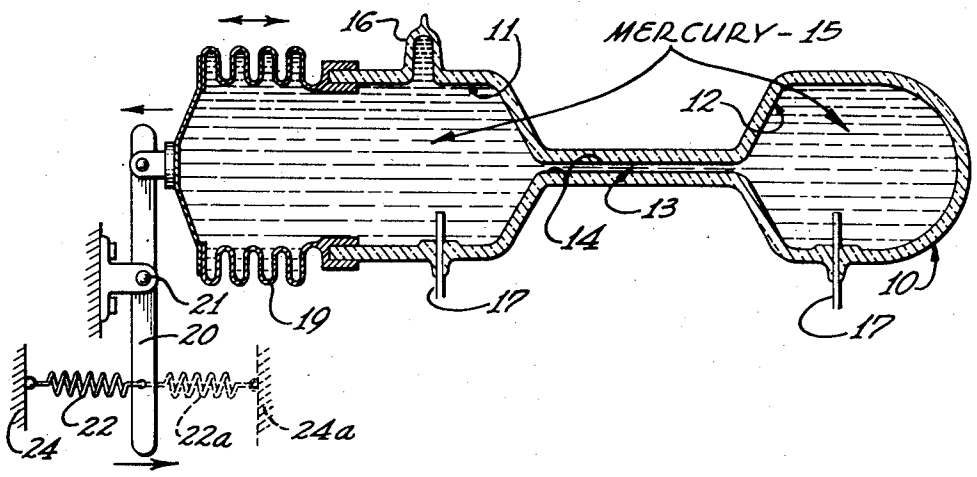
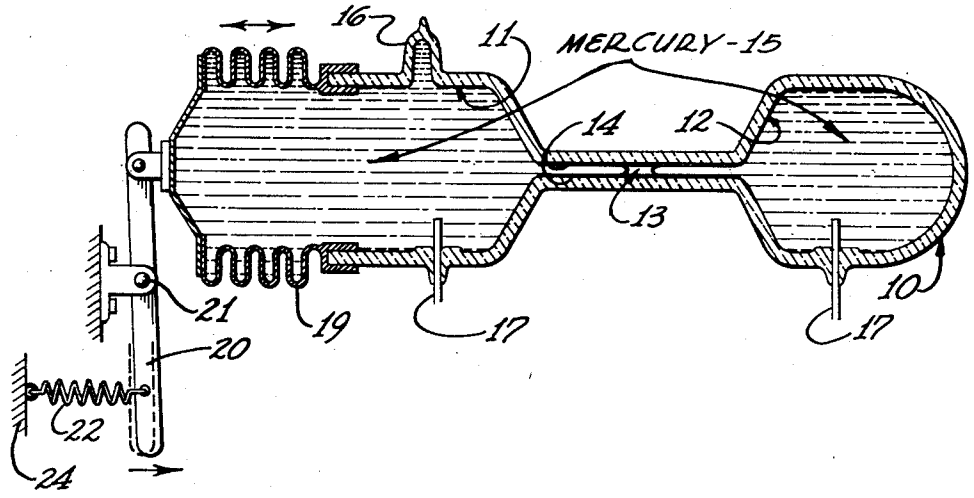


Fig. 2



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ELECTRICAL SWITCH

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7 Claims. (Cl. 200—152)

The present invention relates to electric switches, and more particularly to a method and means for making and breaking electrical contacts.

One of the objects of the present invention is to provide a reliable electrical switch capable of rapid, efficient operation.

Other objects and advantages will become apparent as the disclosure continues.

Briefly as to method, the present invention comprises the steps of confining two masses of mercury, connecting the mercury masses together through a mercury column of capillary size, and then varying the amount of pressure exerted upon the mercury in one of the masses between pressure where the mercury is continuous through the capillary column and a pressure where the mercury is separated in the capillary column. It has been found that, under these conditions, the mercury will always separate only in the capillary column, thus providing a desirable mercury to mercury contact.

In one preferred apparatus form, the switch of the present invention employs an enclosure shaped to form a pair of chambers joined together through a capillary tube. The chambers are filled with a conductive fluid such as mercury, which is continuous from one chamber through the capillary tube into the adjoining chamber. A contact extending through the enclosure is positioned in each chamber on either side of the capillary, and means are provided to vary the amount of pressure exerted upon the mercury in one of the chambers between a pressure where the mercury is continuous through the capillary, and a pressure where the mercury is separated in the capillary, whereby a conductive path for electricity between the contacts can be made or broken by actuating the pressure varying means.

Figure 1 is a longitudinal sectional view of one embodiment of the present invention in the closed state.

Figure 2 is a longitudinal sectional view of the embodiment of the present invention shown in Figure 1 in the open state.

Referring to Figure 1, one preferred embodiment of the present invention is shown wherein a non-resilient enclosure **10** of a vitreous material such as glass for example, is shaped to form two chambers **11** and **12** which are joined together to communicate, one with the other, through a capillary passage **13** which has a coating **14** of silicone compound, so that mercury to be added will not tend to wet the glass. It should be here noted that the diameter of the capillary passage as shown in Figures 1 and 2 is greatly exaggerated for ease of illustration.

The enclosure **10** is filled with a conductive fluid **15**, preferably mercury; the mercury **15** in one chamber **11** being continuous through the capillary passage **13** with the mercury **15** in the adjoining chamber **12**. The sealed tubulation **16** in the exterior wall of the enclosure **10** is for the purpose of filling the enclosure with clean mercury **15** by methods which are well known in the art.

A contact **17** is sealed in the wall of the enclosure **10** on each side of the capillary passage **13**, having one end thereof extending into the mercury **15** in each chamber **11** and **12**, the other end thereof extending to the exterior of the enclosure **10**.

A bellows **19**, of a material which is compatible with mercury, is integrally connected and sealed to form a portion of one of the chambers **11** of the enclosure **10**. The bellows **19** is capable of flexing to increase the volume of the chamber **11**, thereby changing the pressure

which is exerted upon the mercury **15** so that the mercury **15** will be separated in the capillary passage **13**, as shown in Figure 2, to break the conductive path for electricity through the mercury **15**. When the bellows is returned to normal state, i. e., unflexed, the chamber **11** returns to normal capacity, increasing the pressure upon the mercury **15** so that the mercury reunites in the capillary **13**, thereby reestablishing the conductive path for electricity through the mercury **15**. The mercury always breaks in the capillary tube, and provides a mercury to mercury contact.

A lever **20**, pivotally connected at one end thereof to the end of the bellows **19**, is rockable about a central pivot **21** to flex the bellows **19** for operation of the switch. A spring **22** connected at one end thereof to solid support **24**, the other end thereof being connected to the end of the lever **20** opposite the end which is connected to the bellows **19**, can be provided to maintain the switch in closed position. By placing the spring **22** on the opposite side of the lever **20** as shown by dotted line **22***a*, the switch can then be maintained in the open position. Means necessary to move the lever **20** to flex the bellows **19** are available in a number of devices such as solenoids, magnetostrictive rods, etc., and one preferred use for the device is for high speed direct current interruption.

It can be seen that a novel electric switch having a number of distinct advantages is thus provided by the present invention.

While in order to comply with the statute, the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific features shown, but that the means and construction herein disclosed comprise the preferred form of putting the invention into effect, and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

What is claimed is:

1. An electrical device of the kind having an envelope containing two bodies of mercury, contact means positioned in each body of mercury, and a length of capillary tubing adapted to be occupied by mercury forming part of said bodies, comprising: chambers arranged coaxially with and separated by the capillary tubing, one of said chambers being variable in volume; contacts in said chambers; means for completely filling said chambers and capillary tubing with mercury while the volume of said variable volume chamber is reduced so as to prevent the presence of any other medium than mercury in the envelope; and means for varying the volume of the variable volume chamber to provide at times a continuous mercury path between said contacts and at other times to interpose a gap in said path.

2. An electrical device as set forth in claim 1 and in which one of said chambers is formed with a side tube through which the switch envelope may be completely filled with mercury after the switch parts have been assembled, the tube being then sealed off leaving the switch completely filled with mercury.

3. An electrical device as set forth in claim 1 and in which a bellows is fitted to at least one of said chambers, the switch envelope and said bellows being completely filled with mercury.

4. An electrical device as set forth in claim 1 and addition comprising a coating of silicone compound on the inside of the capillary tube to prevent wetting of the walls of the tube by the mercury.

5. An electrical device as set forth in claim 3 and in which resilient means are provided normally exerting tension upon said bellows to provide a normally open switch; and means for relieving the tension of said resilient means to at times permit the mercury in said capillary tube to unite to provide a closed path.

6. An electrical device as set forth in claim 3 and in which resilient means are provided normally exerting pressure upon said bellows to effect junction of the mercury in the capillary tube and to provide a normally closed switch; and means for relieving the pressure exerted by said resilient means to thereby increase the vol-

ume of said envelope to effect interruption of the current path through the switch.

7. An electrical device as set forth in claim 5 and in which said resilient means are limited in stroke to keep, at all times, mercury within the capillary tube.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,037,732	Crist et al.	Sept. 3, 1912
1,504,997	Walker	Aug. 12, 1924
1,614,621	McCabe	Jan. 18, 1927
2,150,053	Chilowsky	Mar. 7, 1939
2,163,709	Schimkus	June 27, 1939
2,332,947	Strommer	Oct. 26, 1943

FOREIGN PATENTS

Number	Country	Date
22,717 of 1897	Great Britain	Oct. 4, 1898