May 12, 1942. J. A. HANNUM 2,282,355

ELECTRIC SWITCH

Filed April 14, 1939

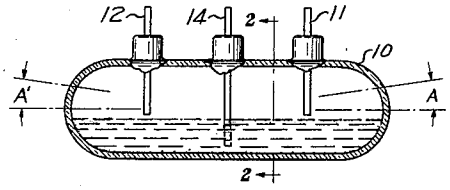


Fig. 1

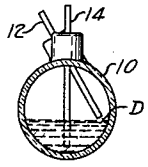


Fig. 2

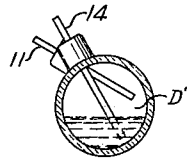


Fig. 3

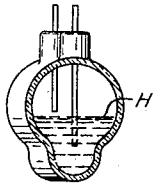


Fig. 4

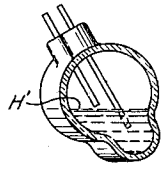


Fig. 5

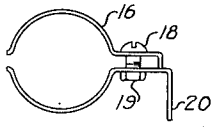


Fig. 6

John A. Hannum

INVENTOR.

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2,282,355

ELECTRIC SWITCH

John A. Hannum, Detroit, Mich.

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6 Claims. (Cl. 200—152)

This invention relates to liquid conductor contactor switches as mercury switches and the like and to a method of operating the same by which the sensitivity may be controlled and adjusted. More particularly, the invention is directed to a switch of simple type which need not be manufactured to close standards, but may thereafter be adjusted to provide the required sensitivity of operation.

Switches of this type have been expensive because in the past it has been difficult to construct them with the required degree of sensitivity. Prior to my invention it has been necessary to accurately locate the various electrodes, both as to length and as to the plane of one with respect to the other, to insure a predetermined sensitivity. The exact amount of liquid to place in the container to provide a proper liquid level has been hard to systematically attain and has been attained only at the sacrifice of simplicity and low cost. In the past some manufacturers have not made switches of this type because they were unable to secure the desired adjustment of timing. Others have made such switches and foregone sensitivity of control or adjustment of operating conditions.

The general object of my invention has been to provide a mercury switch which is simple and inexpensive and which may be easily adjusted to provide a selective or controlled degree of sensitivity.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawing and the following description setting forth in detail certain structure embodying the invention, such disclosed means constituting, however, but one of various means in which the principle of the invention may be used.

In said annexed drawing:

Fig. 1 is a longitudinal section through my improved mercury switch;

Fig. 2 is a transverse section through Fig. 1;

Fig. 3 is a section similar to Fig. 2 showing the switch tilted to provide the desired adjustment;

Fig. 4 is a transverse section through a switch which is a modification of the switch shown in Figs. 1 to 3;

Fig. 5 is a section similar to Fig. 4 showing the switch in adjusted position; and

Fig. 6 is a detail of a clamp used to permit adjustment of the switch as desired.

I have found that I can control the inaccuracies inherent in the manufacture of a mercury switch by providing means for tilting the same about an axis transverse to the principal axis of tilt of the switch to control the relative liquid level with respect to the exposed electrodes. By this invention a switch may be simply constructed without accurate control of the electrode positions, the liquid level or the shape of the container. Thereafter the unit may be easily adjusted to vary the liquid level and compensate for inaccuracies of manufacture and at the same time provide adjustment for different operating conditions.

To this end I provide a switch as shown in Fig. 1, comprising an insulating container 10 carrying two similar electrodes 11 and 12 and a third intermediate electrode 14, the latter being normally immersed in mercury. The switch is tilted through the angles A and A' to provide contact between the electrode 14 and alternate electrodes 11 and 12 by reason of contact by the respective electrodes with the mercury.

I have found that if I so construct my improved switch that it may be rotated about an axis transverse to the angle of tilt I can effectively control inaccuracies in manufacture and produce a switch whose sensitivity may be adjusted or varied at will. Thus, as shown in Fig. 2, the electrodes 11 and 12 are mounted in the container 10 at a substantial angle to the electrode 14. When the switch is in the position shown in Fig. 2 it is only necessary to rock the switch sufficiently to raise the mercury level to the active electrode indicated at 11 or 12 in amount equivalent to the distance D. On the other hand, if the switch is in the position shown in Fig. 3, the mercury level must be shifted through a distance D', thus making the switch less sensitive.

The angular position in which the unit is set may thus be determined by the degree of sensitivity required and by the angle of tilt by which contact is made or broken. If one unit becomes damaged it is possible to replace it with a unit which will give exactly the same operating characteristics as the unit replaced.

A bracket 16 is provided with an encircling band to embrace the unit and adjustably clamp the container in any desired rotative or adjusted position by means of the bolt 18 and nut 19 shown in Fig. 6. The bracket includes a depending flange 20 by which the entire unit may be mounted as desired and adjusted in the plane of the angle of tilt.

A modified form of construction is shown in Figs. 4 and 5 where the container, instead of being cylindrical, is somewhat elliptical in cross-section.

In this modification the desired result is obtained by rotating the container, which is mounted in a bracket, the level of the mercury being controlled by the volume of the corresponding portion of the container in which it lies. Thus, as shown in Fig. 4, due to the shape of the container, the mercury depth is indicated by H, while in Fig. 5 the depth has been materially increased, as shown by H', by reason of the container cross-section and volume. In this modification the electrodes are preferably not positioned out of alignment with each other, since the required sensitivity of control is secured by the shape of the container.

It will be apparent from the foregoing description that the cardinal feature of my invention is to control the height of the liquid level with respect to the position of the electrode or electrodes, which normally are not immersed. The position of the parts as shown in the drawing is not critical and the angle of the electrodes with respect to each other, as well as the shape of the container in the modifications of Figs. 4 and 5, may be varied, depending on the desired sensitivity to be secured. The amount of mercury normally included in a switch constructed according to my invention should be sufficient to completely cover all electrodes when the mercury level is highest, the sensitivity being later adjusted when ready for use in the manner above described.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the structure herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:

1. In a liquid conductor contactor switch of the dual circuit type, an hermetically sealed container with current conducting liquid therein, a pair of electrodes extending through said container, a third electrode extending through said container to complete an electrical circuit with alternate ones of said pair of electrodes when said container is tilted in alternate directions and means to adjust said container by rotation of said container about an axis transverse to said alternate directions to vary the liquid level with respect to said electrodes and thereby control the switch sensitivity.

2. In a liquid conductor contactor switch of the dual circuit type, an hermetically sealed container with current conducting liquid therein, a pair of electrodes extending through said container, a third electrode extending through said container to complete an electrical circuit with alternate ones of said pair of electrodes when said container is tilted about a predetermined axis and means to adjust said container by rotation of said container about an axis transverse to said first axis to vary the liquid level with respect to said electrodes and thereby control the switch sensitivity.

3. In a liquid conductor contactor switch of the dual circuit type, an hermetically sealed container with current conducting liquid therein, a pair of electrodes fixed in said container and extending through the wall thereof, a third electrode fixed in said container and extending through the wall thereof to complete an electrical circuit through said liquid with alternate ones of said pair of electrodes when said container is tilted in alternate directions, means to support said container in an adjusted rotated position transverse to said alternate directions to vary the liquid level with respect to said electrodes and thereby control the switch sensitivity.

4. In a three-electrode double contactor switch, an elongated hollow container adapted to be mounted with the long axis thereof in a generally horizontal position for tilting about a pivot transverse to said axis, an electrode secured in said container and extending inside thereof adjacent the container pivot point, a pair of electrodes secured in said container and extending inside thereof on opposite sides of said first electrode in position to lie above the liquid level in said container when the container is horizontal, and means to support said container in an adjusted tilted position about said pivot to vary the liquid level with respect to said electrodes and thereby control the switch sensitivity.

5. In a three-electrode double contactor switch, an elongated hollow container adapted to be mounted with the long axis thereof in a generally horizontal position for tilting about a pivot transverse to said axis, an electrode secured in said container and extending inside thereof adjacent the container pivot point, a pair of electrodes secured in said container and extending inside thereof on opposite sides of said first electrode and out of axial alignment with said first electrode to the end that the relative distance between said first electrode and said liquid and said other electrodes and said liquid may be varied by tilting said container about its long axis, and means to support said container in an adjusted tilted position about said pivot to vary the liquid level with respect to said electrodes and thereby control the switch sensitivity.

6. In a three-electrode double contactor switch, an elongated hollow container, means to mount said container with the long axis thereof in a generally horizontal position for tilting about a pivot transverse to said long axis, an electrode secured in said container and extending inside thereof adjacent the container pivot point, current conducting liquid in said container in sufficient quantity to electrically engage said electrode in a horizontal position and when said container is tilted through a limited arc transversely of said long axis, a pair of electrodes secured in said container and extending inside thereof and out of contact with said liquid when said container is in a horizontal position and so positioned with respect to said first electrode that when said container is tilted in one direction contact is established through said liquid between the first electrode and one of said pair and when said container is tilted in an opposite direction connection is made through said liquid between said first electrode and the other of said pair, said pair of electrodes being positioned in said container with respect to said first electrode to the end that the relative distance between said first electrode and said liquid and said pair of electrodes and said liquid may be varied by tilting said container about its long axis.

JOHN A. HANNUM.