

March 22, 1960

J. EFTHER

2,929,889

BULB FOR MERCURY SWITCHES AND THE LIKE

Filed Feb. 18, 1959

4 Sheets-Sheet 1

Fig. 1

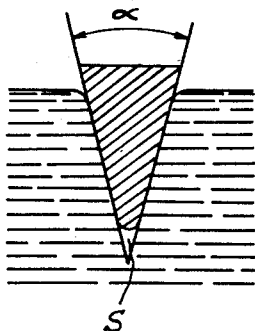


Fig. 2

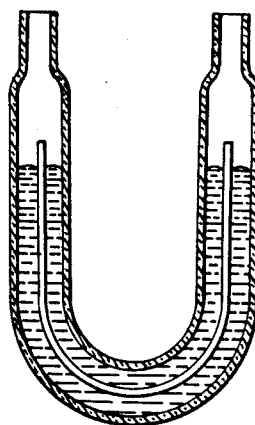


Fig. 3

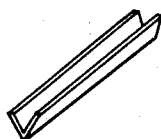


Fig. 4

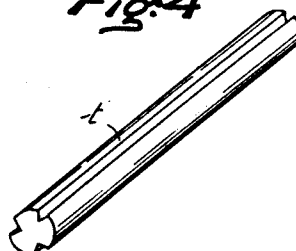


Fig. 5

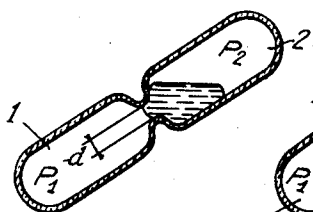


Fig. 6

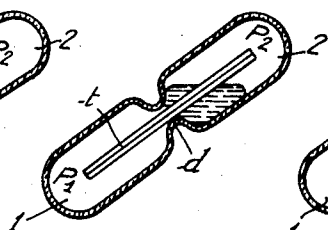
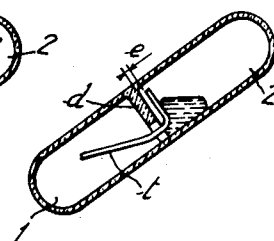


Fig. 7



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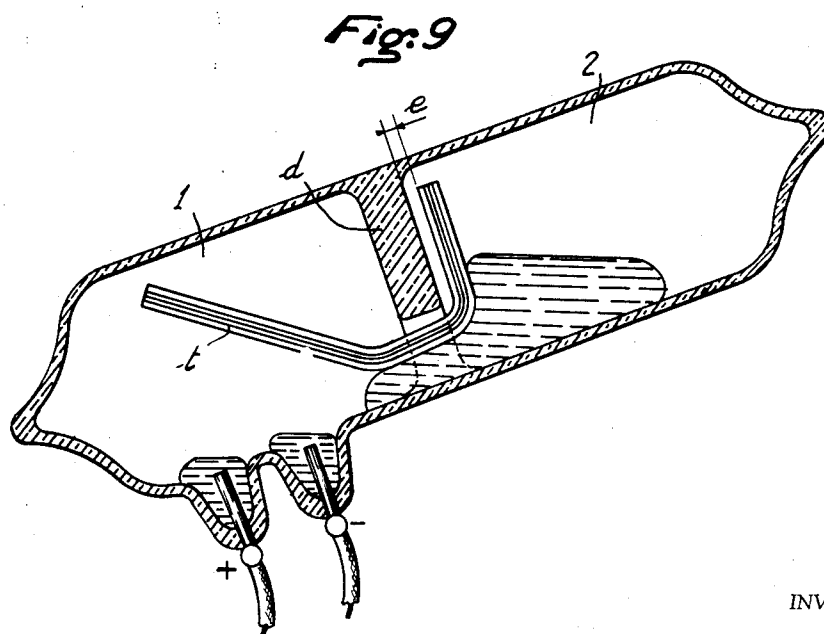
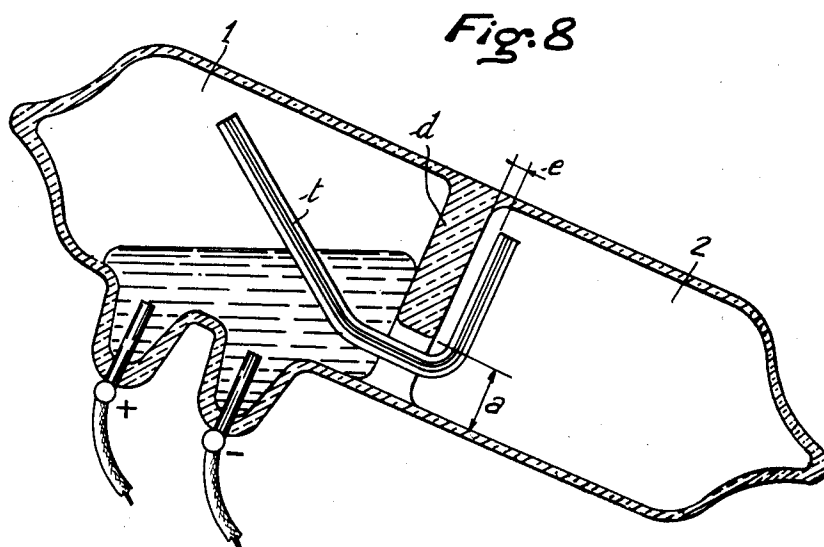
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Fig.10

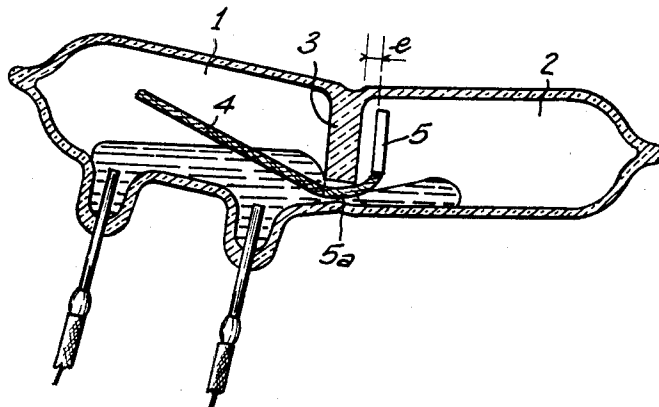
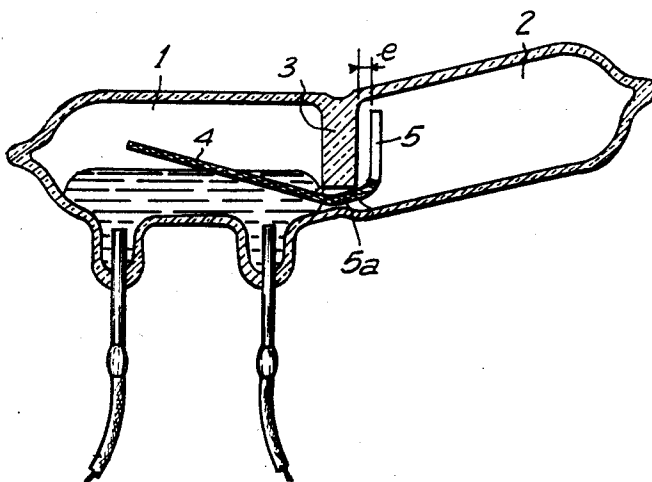


Fig.11



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Fig. 12

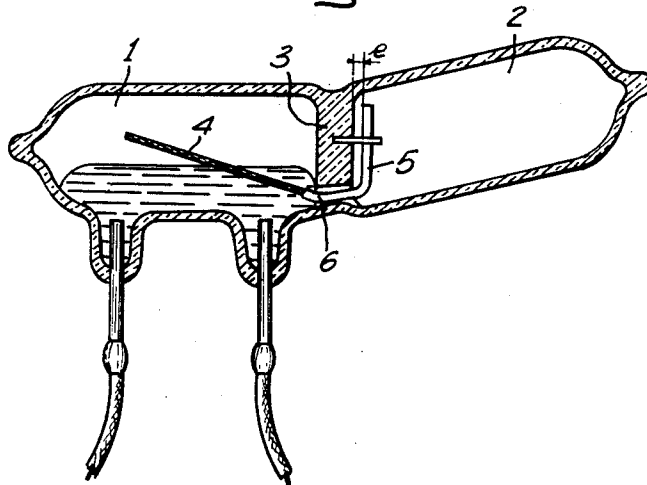
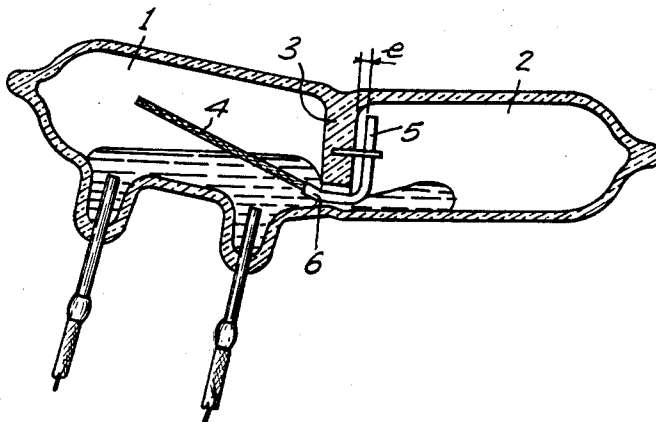


Fig. 13



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BULB FOR MERCURY SWITCHES AND THE LIKE

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Application February 18, 1959, Serial No. 794,054

Claims priority, application France February 28, 1958

1 Claim. (Cl. 200—33)

The present invention relates to bulbs for mercury switches and the like.

It has for its primary object the execution of these bulbs in a manner such that their manufacture may be simplified and be thus less expensive, while providing perfect reliability for the operation of said bulbs.

It is a well-known fact that mercury does not wet certain materials, in particular iron, nickel and the like. Thus, considering a metal bar having an angular cross-section forming a sharp ridge, the angle of the cross-section of said bar being equal to α , as shown in Fig. 1 of the accompanying drawings, and assuming the bar is dipped in a mercury bath, as shown on a large scale in said Fig. 1, the mercury will engage the bar along its lateral surfaces but will leave a free space along the ridge, the cross-sectional area of said space having a value S depending on the value of the angle α .

If it is desired to produce a predetermined loss of head between the ends A and B of a mercury-filled tube, as shown in Fig. 2, it is sufficient to connect A and B through an inner auxiliary guiding member constituted by a bar having the cross-section referred to hereinabove and providing consequently a restricted cross-sectional area for gases between A and B.

In order to allow the invention to be more clearly understood, reference will now be had to the accompanying drawings given by way of example and wherein:

Figs. 1 and 2 are, as already mentioned, explanatory figures.

Figs. 3 and 4 show, in perspective view, two bars which may be used for the purpose specified.

Fig. 5 is a further explanatory figure.

Figs. 6 to 13 show various embodiments of a mercury-containing bulb constituted by two interconnected capacities and incorporating the invention.

Turning to Fig. 3, it shows a metal bar folded into V shape, while Fig. 4 shows a metal rod t in the periphery of which one or more V-shaped grooves have been cut in parallelism with its axis. Such bars or rods may be bent into any desired shape and be immersed in the mercury bath, the mercury not entering or entering only incompletely the folds or grooves of such bars or rods.

It is also a well-known fact that in the case a glass bulb is used for instance, which contains mercury and a gas under a certain pressure P , as illustrated in Fig. 5, and includes a restricted medial section d , the pressures P_1 and P_2 in the two capacities are equal when the bulb is tilted round its throttled section. Gravity then produces a flow of mercury from the capacity 2 into the capacity 1 located in the position illustrated, but this flow will stop after a very short time because the operative volume of the capacity 1 will have been reduced by a drop or drops of mercury entering the capacity 1, while the operative volume of the capacity 2 increases correspondingly, and therefore the pressure P_1 in the capacity 1 will be larger than the pressure P_2 , which stops any further flow of mercury into the capacity 1.

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Now, there is inserted inside the bulb, as illustrated in Fig. 6, a guide, according to the invention, constituted for instance by the rod t illustrated in Fig. 4; the pressures P_1 and P_2 will balance each other, after a time depending on the loss of head which is defined in its turn by the number and size of the V-shaped grooves formed in said rod, so that the flow of mercury from the capacity 2 into the capacity 1 will be obtained at a corresponding speed.

According to the invention and if it is desired to obtain under the same conditions as precedingly a speedy flow from the capacity 2 into the capacity 1, it is sufficient, as illustrated in Fig. 7, to close up the passageway e leading to the throttled section and which is designed in a manner such that the mercury cannot enter said passageway which allows thus a substantial opening for the flow of gas between the two capacities. To form such a passageway e , it is sufficient to bend the end of the rod t in a manner such that the bent end matches the shape of the partition d defining the throttled section, said bent end extending at a small distance from the partition d inside the container 2 while the other end of the rod projects partly beyond the level of the mercury contained in the capacity 1 of the bulb. Thus, such a simple or striated groove or rod t which is bent and suitably positioned allows a slow flow of mercury from the capacity 1 into the capacity 2 and a speedy return flow from the capacity 2 into the capacity 1, according to the direction of tilting.

Through this arrangement, it is possible to produce switches adapted for use in many applications, chiefly when it is desired to obtain a delayed breaking of a circuit and a rapid closing thereof or reversely a speedy breaking and a delayed closing or else when it is desired to obtain both a delayed breaking and a delayed closing.

Figs. 8 and 9 show, on a very large scale, respectively the same bulb as in Fig. 7 in its delayed circuit breaking position and in its position occupied at a moment preceding immediately the rapid closing of the circuit, said switch including as precedingly a rod providing a multiplicity of capillary ducts for the passage of the gas, in a manner similar to the rod illustrated in Fig. 4.

In the case of bulbs wherein the flow of gas between the two capacities is ensured in the conventional manner by a bundle of two or more twisted wires forming a plurality of capillary ducts and the cross-section and number of which are selected in conformity with the magnitude of the loss of head to be obtained, the rigidity of said wires is poor and it is necessary, according to the invention, to give a portion of them a sufficient rigidity, so as to obtain a correct and permanent positioning of the bundle inside the bulb, chiefly as concerns the section of the capillary system lying near the transverse partition 3 defining the throttled section and corresponding to the partition d in Figs. 7, 8 and 9.

Figs. 10 and 11 illustrate respectively in a delayed circuit-breaking position and in a speedily obtained closing position, a bulb inside which the guide 4 is constituted by a capillary system formed in a conventional manner by a bundle of twisted wires extending at a distance e from the transverse partition 3 through which is formed a passageway $5a$; in order to provide permanency of the location of said guide, a tubular member 5 is fitted over one end of the latter. Said tubular element is advantageously shiftable to allow an adjustment of the throughput of the gas passing out of the capacity 2 into the capacity 1.

Laboratory experiments have shown that by extending the small tube 5 at its lower end 6 beyond the partition 3, as shown in Figs. 12 and 13 illustrating said modification, said tube cooperates efficiently in furthering the passage of the gas from the capacity 2 into the capacity 1, whereby the closing action of the circuit is increased,

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When the circuit is actually closed, this extension of the tube 5 is immersed inside the body of mercury (Fig. 13) and has no further action, since only the capillary system forming the guide 4 provides a passage of gas from the capacity 1 into the capacity 2, so as to delay the subsequent breaking of the circuit.

What I claim is:

A mercury switch comprising a tiltable insulating enclosure, a partition wall dividing the enclosure into two chambers with a restricted passageway therebetween, mercury and gas in said enclosure, said mercury normally lying in one of the chambers, a plurality of gas capillaries comprising a bundle of twisted wires formed of material nonwetttable by mercury and extending from one chamber into the other, a tubular element fitted over said twisted wires inside one of the chambers and secured in parallel

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with said partition wall and at a fixed distance therefrom, said tubular element extending into the other of said chambers slightly beyond the restricted passageway and secured therein, said capillaries allowing the gas to flow from one chamber to the other thereby substantially increasing the flow of mercury from one chamber to the other upon tilting of said switch, and a plurality of contacts extending through one of said chambers into contact with the mercury therein when the majority of the mercury is in one of said chambers.

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