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F. J. OLMER ET AL

2,849,550

ELECTRIC SWITCH

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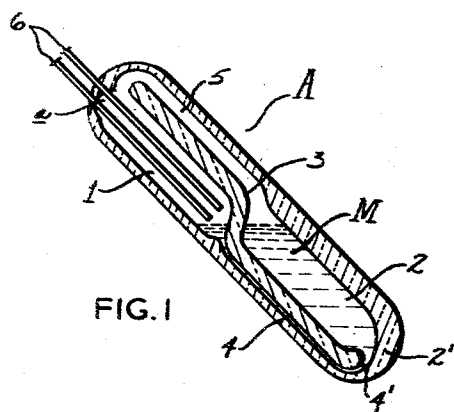


FIG. 1

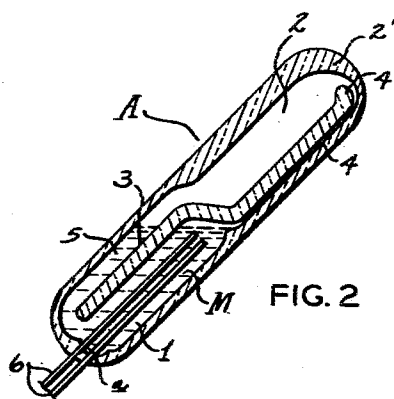


FIG. 2

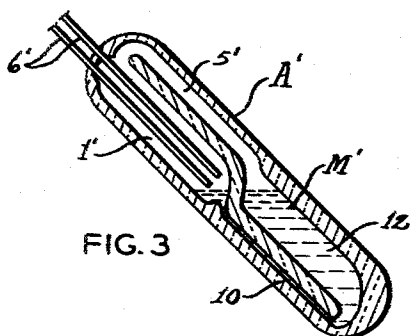


FIG. 3

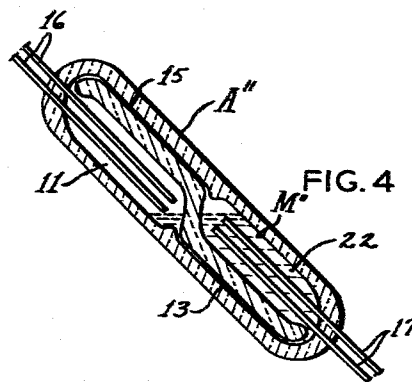


FIG. 4

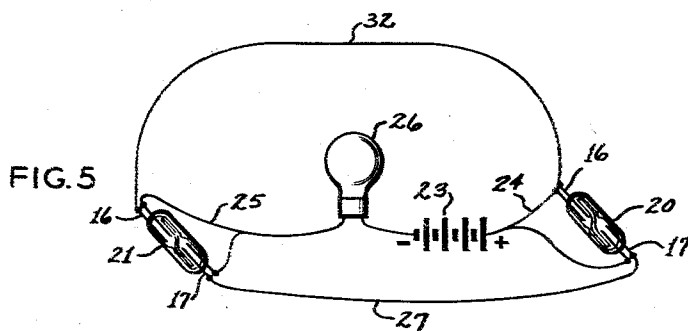


FIG. 5

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1

2

2,849,550

ELECTRIC SWITCH

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9 Claims. (Cl. 200—33)

This invention relates in general to switches and, more particularly, to a time-delay switch.

It is an object of the present invention to provide a small, compact, mercury switch which will reliably and promptly effect circuit closure and cause circuit-opening after a predetermined time interval.

It is another object of the present invention to provide a mercury switch having a relatively fine, narrow and elongated capillary for consistent yet retarded flow therethrough to effect a time delay of defined extent, and being so constructed as to prevent becoming bound through the surface tension of the mercury.

It is an additional object of the present invention to provide a mercury switch which is adapted for substantially instantaneous circuit closure, which contains no moving parts, and which provides for a circulatory flow of mercury, whereby obstruction through air or gas locks is prevented.

It is another object of the present invention to provide a mercury switch which is sturdy and durable; reliable in operation; and which may be economically manufactured.

It is a further object of the present invention to provide a mercury switch for multiple incorporation in the circuit for effecting control from two locations.

These and other detailed objects are obtained by the structures illustrated in the accompanying drawing (one sheet), in which—

Figure 1 is a vertical section of a mercury switch constructed in accordance with and embodying the present invention showing the switch in circuit-open condition.

Figure 2 is a vertical section of the switch showing same in circuit-closed condition.

Figure 3 is a vertical section of another form of a switch constructed in accordance with and embodying the present invention.

Figure 4 is a vertical section of an additional form of the present invention.

Figure 5 is a schematic diagram of a circuit incorporating switches of the type illustrated in Figure 4.

Referring now by reference characters to the drawing, in Figure 1, A represents an electric switch comprising a vessel made of glass, or other nonconductive material, having a mercury charge M, and integrally containing a normally upper chamber 1 and lower chamber 2 which are mutually, partially offset; there being a common partition wall portion 3 between the lower, inner section of the former and the upper, inner section of the latter. At its normally upper end, upper chamber 1 is provided with a recess a. Connecting chambers 1 and 2 between their lower ends is a fine bore, constant diameter, elongated passage or capillary tube 4, extending along the side of the vessel and being upwardly curved at its lower end, as at 4', so that the mercury discharged therefrom will be directed upwardly or laterally into the bottom of chamber 2. The lower end wall of chamber 2, as at 2', corresponds to partition wall 3, both being tapered upwardly and outwardly at substantially the same angle to the longitudinal axis of the vessel, so that the lower

end portions of said chambers 1, 2 are of general funnel-like character, having similar volume and with the cross sections thereof increasing at the same rate, for purposes presently appearing. Lower chamber 2 at its upper end opens into a relatively large diametered return passage 5 which extends along a side wall portion of the vessel, between same and upper chamber 1, in symmetrical relationship with capillary tube 4; being arcuated at its upper end, following the contour of the vessel wall, for opening downwardly or laterally into the upper end of chamber 1.

Through the top, recess-containing portion of upper chamber 1 projects a pair of parallel contact rods or members 6, the lower ends of which terminate at a point substantially coincident with the upper end of the tapered lower end portion of said chamber 1. At their outer ends said contact rods 6 may be suitably connected to conductive leads of a circuit (not shown). To reduce arcing, said vessel may be evacuated or, if desired, may be filled with hydrogen, or other suitable gas.

In use switch A is mounted for operation as by a conventional toggle member (not shown) so as to be rockable through an arc of about 90°, between circuit-opening and circuit-closing positions. In Figure 1, switch A is shown in circuit-open condition, wherein the bulk of the mercury charge M is received within lower chamber 2 and contact rods 6 are out of engagement therewith, and hence are nonconductive. It must be noted that although the circuit through switch A is open, a limited quantity or residual amount of mercury remains in upper chamber 1, substantially filling the tapered, lower, portion thereof, and with its upper surface in immediate, non-contacting adjacency to the lower ends of rods 6. Upon rocking or tilting switch A from the position shown in Figure 1 to that illustrated in Figure 2, the residual mercury M in upper chamber 1 will be brought, by gravity, into contact with rods 6, at their normally upper ends, so that current flow therebetween will be re-established almost instantaneously, while simultaneously mercury is being rapidly returned into chamber 1 through passage 5 to thereby cause the desired circuit operation, such as the lighting of a lamp, starting of a motor, etc. Passage 5 is of sufficient diameter to permit free, unimpeded mercury flow, without time lag, therethrough, with the result that contact rods 6 will be fully immersed in mercury M so that circuit closure through switch A will be reliably maintained.

To effect circuit opening, switch A will be tilted or rocked restoringly to the position shown in Figure 1. However, due to the capillary action involved, the circuit will not become open for a pre-determined interval after the switch has been actuated. Thus, mercury M in flowing from upper chamber 1 to lower chamber 2 must progress downwardly through the narrow, elongated capillary tube 4 with such flow, expectedly, ceasing, when the residual mercury in upper chamber 1 and that in the upper portion of chamber 2 will be level, at which point contact rods will be cleared and hence, out of conductive relationship. Switch A is designed so that about 45 seconds will elapse before the level of mercury in chamber 1 will be below contact rods 6 to permit a pre-determined delay in operation of the system involved, as for instance, providing for an area to remain in an illuminated condition for sufficient duration to allow an individual to move therethrough prior to light extinguishment. Thus, the residual mercury in upper chamber 1 when switch A is in opened condition permits rapid circuit closure, as with switches of various types, such as mechanical, and the like. There are myriad applications for the switch of the present invention, many of which are readily evident.

Switch A is small and most compact, being suitably

3

sized for home use, as in a wall switch. Heretofore, time control mercury switches of this size have not been considered feasible for effecting the desired time lag. In the present instance the provision of the same cross section of the column of mercury at both ends of the capillary tube assures uninterrupted, non-binding flow of mercury from upper chamber 1 to lower chamber 2, since this equality of cross section prevents the surface tension of the mercury from interfering with the continuous, smooth, and reliable flow through the relatively long capillary tube 4. It will be seen that upon rocking switch A from closed condition (Figure 2) to open position (Figure 1) a very small amount of mercury in the normally upper end of passage 5 will immediately be dropped to the lower end of chamber 2 so as to establish a continuity with the mercury in the capillary tube 4, and thereby, substantially, immediately forming a column of increased cross-section so that surface tension will not interrupt the mercury flow, as in structures heretofore utilized. Previous switches contain constricted portions or capillaries of greatly reduced length, and hence, require chambers of substantial proportions with a relatively large quantity of mercury to achieve a time delay. Thus, the vessel herein disclosed reveals novel structural characteristics to render switch A operable in its intended manner without resort to the cumbersome expedients deemed requisite prior to the present invention. It is noteworthy that switch A is so constructed as to provide for a circulatory flow of mercury, with the exception of the small amount referred to hereinabove for prompt establishment of the circuit between rods 6 or for continuity with the stream through capillary 4. The novel circulatory flow of mercury provided herein prevents the development of any obstructing air or gas locks since the same, should switch A not be evacuated, will be moved ahead of the flowing mercury and thus directed into open portions.

Furthermore, in the present invention, provision of a residual amount of mercury in upper chamber 1 conduces to prompt circuit closure developing upon switch actuation, so that time delay is provided only on opening the circuit and not in closing same. Heretofore, mercury switches have historically entailed time delay in both operations, as the mercury must travel through the same constricted passage or through complicated valves. A time delay in circuit closure is generally undesirable and this adverse feature is overcome by the present invention. It must also be noted that switch A does not incorporate any moving parts and therefore, it is not subject to breakdown or mal-function, as is common with those mercury switches involving various valve members.

Referring now to Figure 3, another form of the present invention is shown, comprising a switch A' having an upper chamber 1', lower chamber 12, the latter being connected to the former by a relatively wide-diametered passage 5'; there being contact rods 6' extending into upper chamber 1', all of which elements are substantially identical to the similar elements hereinabove described in connection with switch A. Connecting the lower ends of upper chamber 1' and lower chamber 12 is a narrow, elongated capillary tube 10, the lower end of which terminates spacedly above the bottom wall of lower chamber 12; said capillary tube 10 extending along one side wall portion of the vessel. Switch A' is provided with a mercury charge M', which is of such amount that when switch A is rocked into circuit-opening condition, that is, for flow of mercury from upper chamber 1' into lower chamber 12, a quantity of mercury will be supplied, as through gravity, from passage 5', immediately to the lower end of chamber 12, so that continuity may be established with the mercury flowing through capillary 10 before the surface tension of the same shall have exceeded the pressure or the head. It will thus be seen that in this form of the invention the mercury

4

first flowing through capillary 10 will not form a continuous stream with that in lower chamber 12, as is the case in connection with switch A above described. However, the space between the lower end of capillary 10 and the upper surface of the mercury initially provided in the lower end of chamber 12 is of such extent as to permit establishment of such stream prior to the surface tension exhibiting a force greater than the pressure head causing mercury flow.

Referring to Figure 4, there is illustrated a further form of the present invention, which adapts the same for incorporation in a circuit for control thereof at two locations. In this form the invention comprises a switch A'', being a vessel having an upper chamber 11, a lower chamber 22, the lower ends of which are connected by a fine bore capillary 13, and the upper ends of which are similarly connected by a fine bore capillary 15, said structural features being similar to the corresponding parts of switch A, except that the wide diametered return passage 5 of the latter is in this form replaced by the capillary tube 15 corresponding to capillary tube 4. It will thus be seen that switch A'' is completely symmetrical; there being a pair of contact rods 16 and 17 projecting into chambers 1, 22, respectively. Thus, with a charge of mercury M'' provided in switch A'', it will be seen that in either position one set of rods 16 or 17, as the case may be, will be in conductive relationship, since either one chamber or the other will contain the bulk of the mercury charge. Just as in the case of switch A, residual amounts of mercury will be disposed in chamber 11 or 22 so that upon actuation of the switch immediate conductive relationship will be established between the theretofore disengaged contact rods. Thus, despite the fact that capillaries provide the only passages through switch A'', the substantially instantaneous closure will be effected through the said residual amounts of mercury.

In Figure 5 there is schematically presented a circuit incorporating a pair of switches A'' which will illustrate the usage thereof. In said figure a pair of switches 20, 21, respectively, are located at mutually remote points, with one of the contact rods 16 of each being mutually connected by a lead 32, with the other connecting rod 16 of each switch being connected by a conductive lead 24, 25 to a lamp 26; there being a source of electricity, such as a storage battery 23 provided in either lead 24 or 25. One rod 17 of each switch 20, 21 is connected with the other by a lead 27, while the remaining rod 17 of each switch 20, 21 is connected by said leads 24, 25, respectively, to lamp 26. It will thus be seen that to effect illumination of lamp 26 the contact rods 16 or the contact rods 17 of both switches 20, 21 must be in conductive, or circuit-closing relationship, that is, being immersed in the mercury charge. However, if the contact rods 16 of one switch 20 or 21, as the case may be, are in conductive relationship, while the rods 16 of the other switch are out of conductive relationship (that is, wherein the contact rods 17 of such switch would be immersed in mercury), there will be no electricity supplied to the lamp 26.

Thus, it will be seen that switches 20, 21 permit control of lamp 26 from two remote points, so that the tilting of one switch 20 or 21 into a position opposite to that of the other switch will cause the circuit to be opened, while if both switches are in corresponding position the switch will be closed. Due to the residual mercury in each of the chambers the circuit will be closed promptly upon appropriate actuation of either switch, while circuit opening will be delayed for reasons hereinabove discussed, so that the desired time delay will be provided, regardless of which switch is operated.

It should be understood that changes and modifications in the formation, construction, arrangement, and combination of the several parts of the electric switch may be made and substituted for these herein shown and de-

5

scribed without departing from the nature and principle of our invention.

Having thus described our invention, what we claim and desire to secure by Letters Patent is:

1. A time delay switch comprising an enclosed vessel for a charge of conductive fluid, having first and second chambers, there being first and second passages said passages being mutually offset in end to end relationship, said first passage extending between the normally lower ends of said chambers, and said second passage extending between the normally upper ends of said chambers.

2. A time delay switch as described in claim 1 wherein said chambers are offset in end to end relationship with respect to each other, and there being conductive leads in at least one of said chambers.

3. A time delay switch as described in claim 1 wherein at least one of said chambers is of reduced cross section at its normally lower end.

4. A time delay switch adapted for rockable movement between two position, said passages being mutually offset in end to end relationship and axially parallel to each other comprising an enclosed vessel for a charge of conductive fluid having a normally upper and a normally lower chamber, there being a relatively narrow, elongated passage connecting said chambers at their lower ends and a relatively wide passage connecting said chambers at their upper ends establishing a circulatory path for fluid flow from one chamber to the other upon rocking of said switch from one position to the other, the quantity of said charge of conductive fluid being of greater volume than the volume of either chamber so that while one chamber is substantially full the other will contain a residual amount of such fluid.

5. A time delay switch adapted for rockable movement between two positions comprising an enclosed vessel for a charge of conductive fluid having a normally upper and a normally lower chamber, there being a relatively narrow, elongated passage connecting said cham-

6

bers at their lower ends and a relatively wide passage connecting said chambers at their upper ends, each of said chambers having a portion of increasing cross section from the point of communication with said narrow passage.

6. A time delay switch as described in claim 5 wherein conductive lead members project into said upper chamber for connecting said switch in a circuit, the inner or normally lower ends of said lead members terminating spacedly from the opening of said narrow passage and beyond the portion of the chamber of increasing cross section.

7. A time delay switch as described in claim 5 wherein the lower end of said narrow passage opens into the lower end extremity of said lower chamber.

8. A time delay switch as described in claim 7 wherein the lower end of said narrow passage terminates spacedly above the normally bottom wall of said lower chamber.

9. A time delay switch comprising an enclosed vessel for a charge of conductive fluid having a normally upper and a normally lower chamber, there being fine first and second capillary tubes for connecting the lower and upper ends, respectively, of said chambers establishing a circulatory path for fluid flow from one chamber to the other upon rocking of said switch from one position to the other, the quantity of said charge of conductive fluid being of greater volume than the volume of either chamber so that while one chamber is substantially full the other will contain a residual amount of such fluid, and conductive leads provided in each chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

1,995,541	Hartzell	Mar. 26, 1935
2,319,349	Safford	May 18, 1943

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,849,550

August 26, 1958

Francois J. Olmer et al.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, lines 20 to 22, strike out ", said passages being mutually offset in end to end relationship and axially parallel to each other" and insert the same after "fluid" and before the period in line 33, same column; same column 5, line 20, for "position" read -- positions --.

Signed and sealed this 25th day of November 1958.

(SEAL)

Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents

UNITED STATES PATENT OFFICE
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