

Oct. 14, 1930.

W. R. WALKER

1,778,439

RETARDED CIRCUIT MAKER AND BREAKER

Filed June 26, 1924

6 Sheets-Sheet 1

Fig. 1

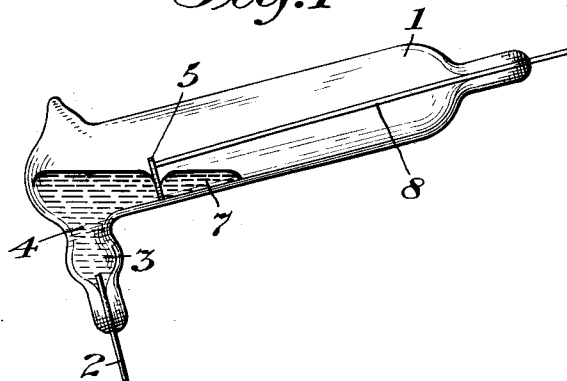


Fig. 2

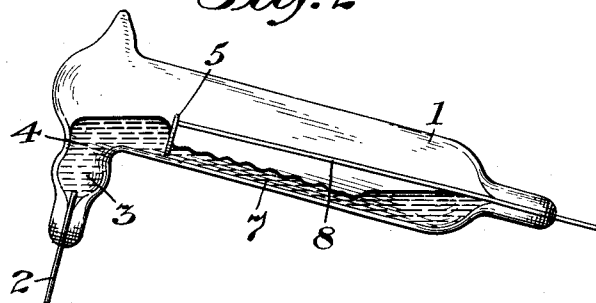


Fig. 3

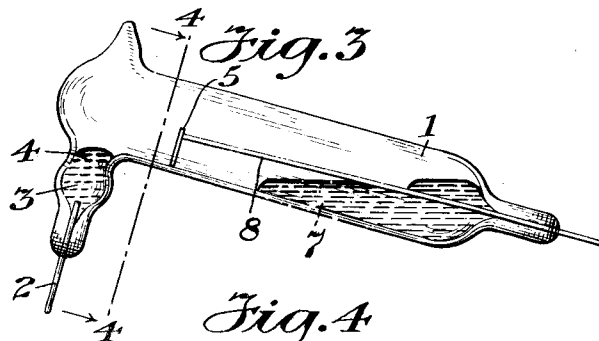
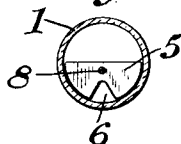


Fig. 4



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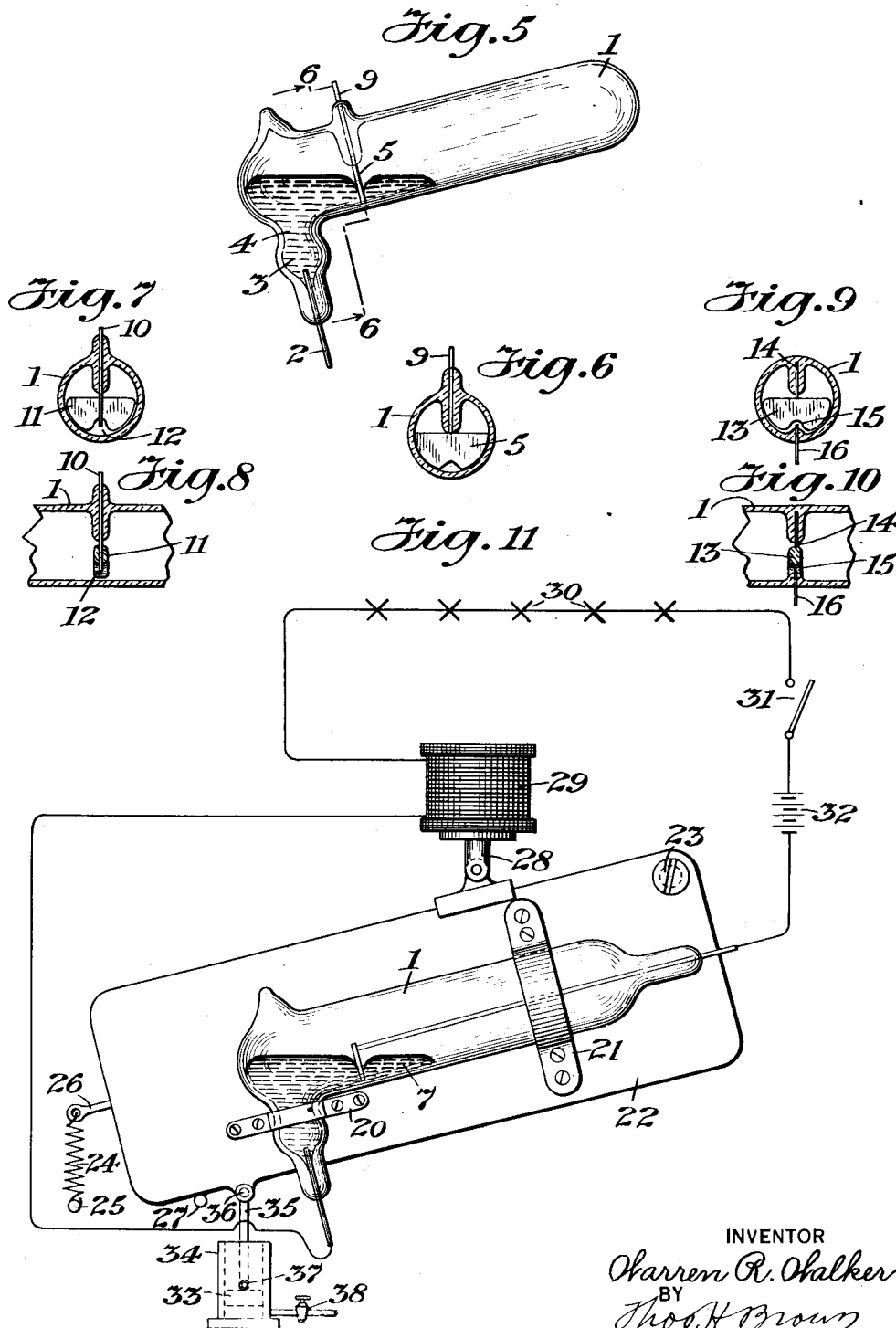
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6 Sheets-Sheet 2



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Fig. 12

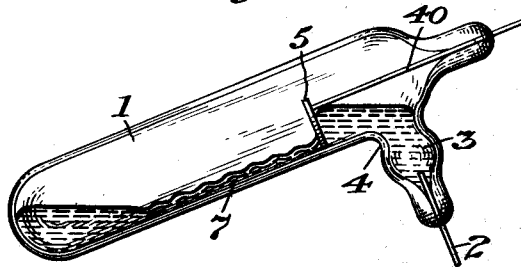


Fig. 13

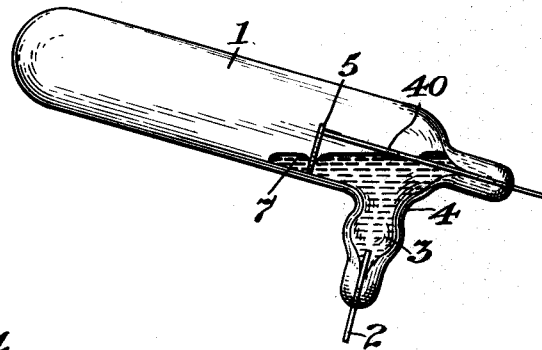


Fig. 14

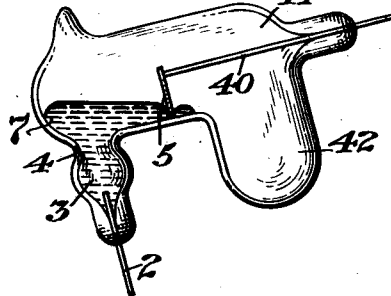
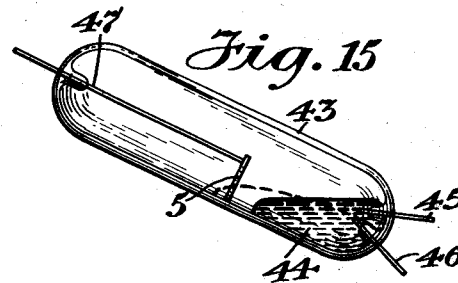


Fig. 15



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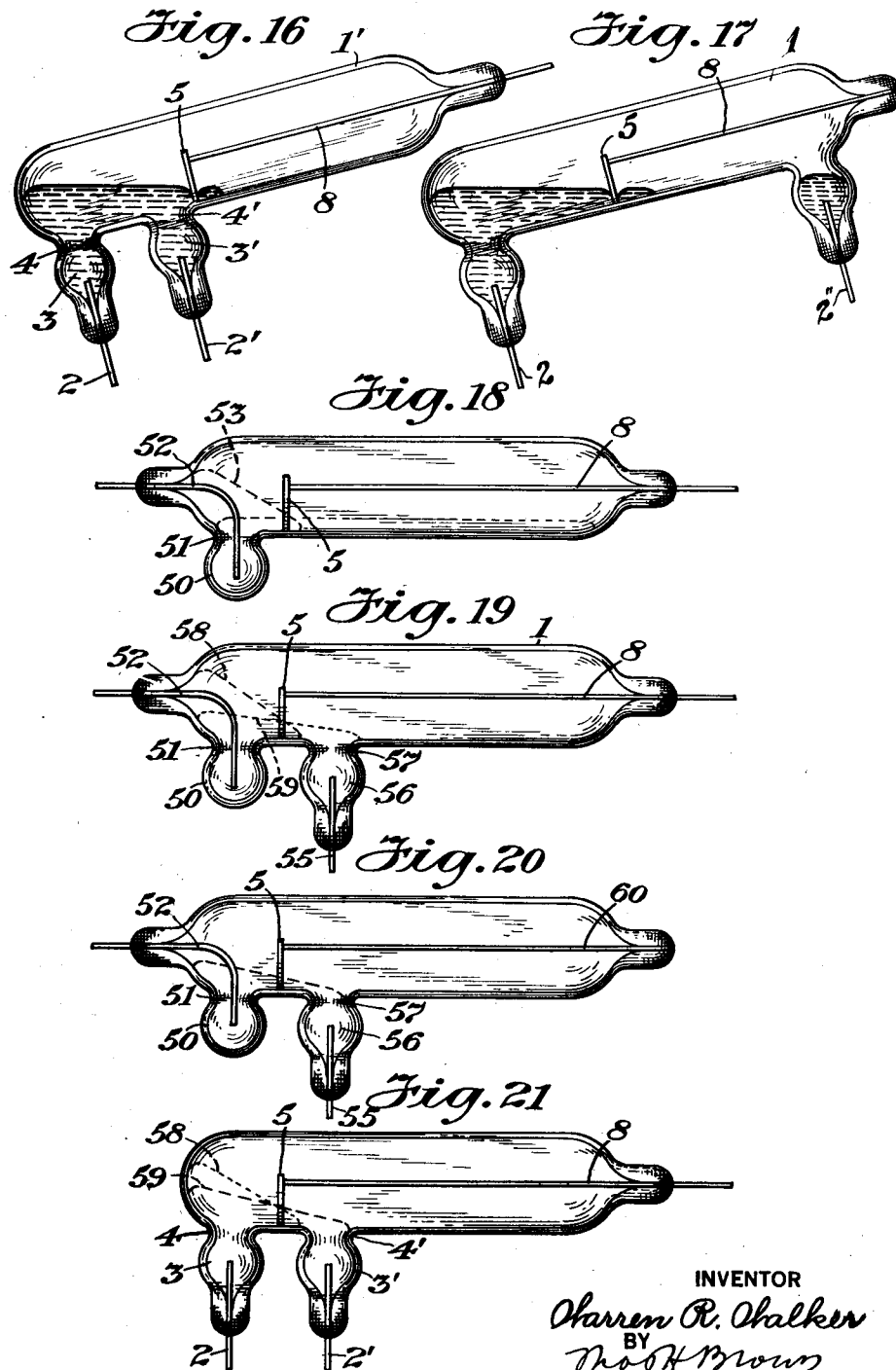
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RETARDED CIRCUIT MAKER AND BREAKER

Filed June 26, 1924

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1,778,439

RETARDED CIRCUIT MAKER AND BREAKER

Filed June 26, 1924

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Fig. 22

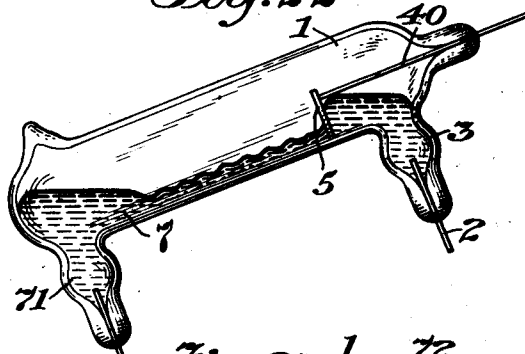


Fig. 23

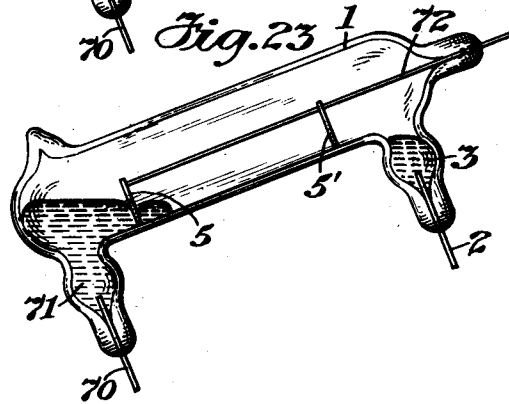


Fig. 24

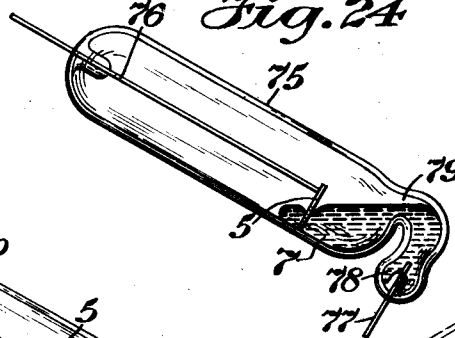


Fig. 25

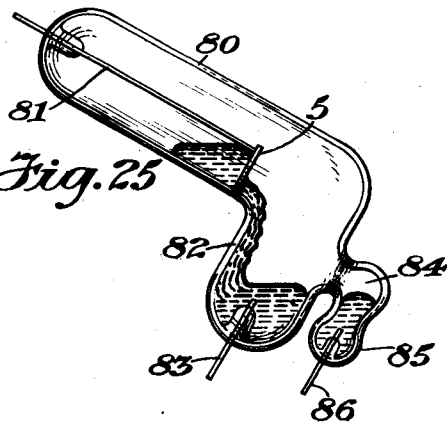
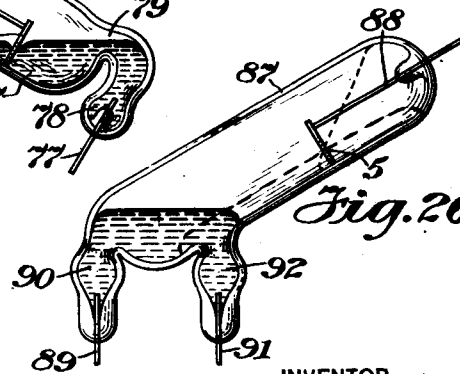


Fig. 26



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RETARDED CIRCUIT MAKER AND BREAKER

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Fig. 27

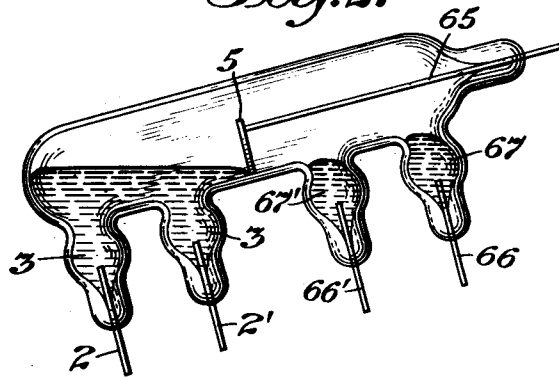


Fig. 28

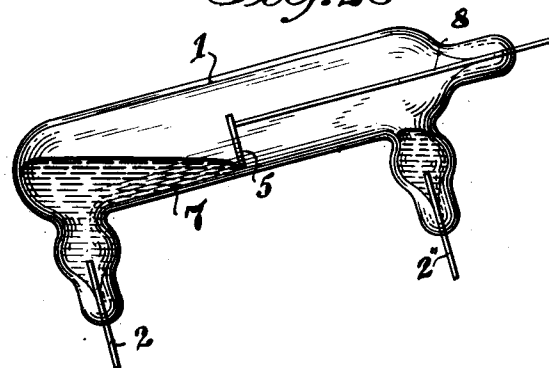
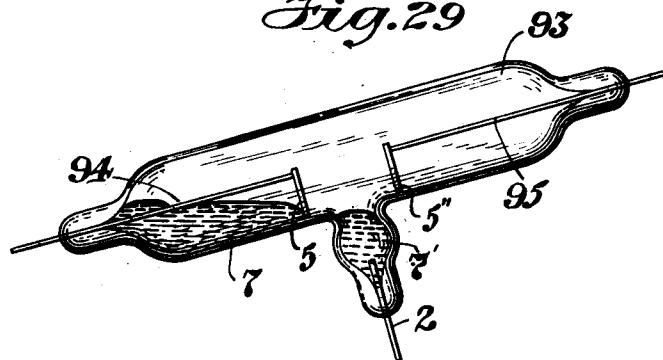


Fig. 29



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UNITED STATES PATENT OFFICE

WARREN R. WALKER, OF NEW DORP, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC VAPOR LAMP COMPANY, OF HOBOKEN, NEW JERSEY, A CORPORATION OF NEW JERSEY

RETARDED-CIRCUIT MAKER AND BREAKER

Application filed June 26, 1924. Serial No. 722,426.

My present invention relates to electric switches of the liquid flow type and particularly to such a switch in which there is a time lag in either or both the circuit making motion and the circuit breaking motion.

For injecting a time lag in liquid flow type switches it has heretofore been general practice to employ either a baffle of insulating material with a small liquid passage formed therethrough or a restricted tube of insulating material for the flow of the liquid from one position of the switch to another but these forms involve difficulties rising from a lack of a positive and definite make or break between the electrode terminals of the switch in time relation to said liquid and said baffle.

I have discovered that by positioning one of the electrodes in such a switch close to or at the baffle thereof that the timing of the making or breaking of the circuit is more accurately accomplished and more easily adjusted.

I have also discovered that by making the baffle of such a switch separate from the wall of the switch container but suitably supported in close proximity thereto and having when necessary a restricted opening therein that the construction of the switch is considerably simplified.

In switches embodying my invention I therefore make the timing baffle of conducting material and support it by means of a lead-in wire supported by the wall of the switch container. In some forms I make the baffle of insulating material such as glass separate from the switch container but supported by one of the lead terminals of the switch which terminal has a portion exposed to connection with the switch liquid at said baffle. In other forms I make the baffle support and the lead separate but the electrode close to the baffle in which case the baffle may be either of insulating or conducting material.

It is an object of my invention to provide a liquid time switch of the baffle type in which the relation between the making or breaking of the circuit between the electrodes therein is positive and definite with relation to the flow of the liquid of the switch past said baffle.

It is also an object of my invention to provide

a liquid flow time switch of the baffle type in which the baffle is separate from the switch wall.

It is another object of my invention to provide such a switch in which said baffle or a part thereof serves as one of the electrodes of the switch.

I employ the switch of my invention for automatically opening and closing the circuit of a load such as an advertising sign which is intermittently cut off and turned on at definite intervals for predetermined periods of time. Such a circuit and various embodiments of my invention are shown in the drawings in which:

Fig. 1, is an elevation view of a switch of my invention embodying a metal baffle which serves as one of the electrodes, with the switch in the closed position.

Fig. 2, is a similar view of the switch in the open circuit position showing the liquid thereof flowing through the baffle for opening the circuit through the switch at a definite period of time after the switch has moved into this position.

Fig. 3, is a view similar to that of Fig. 2 with the liquid having come to equilibrium.

Fig. 4, is a sectional view through Fig. 3 along line 4—4 showing the baffle in elevation.

Fig. 5, is a view similar to Fig. 1 showing the baffle mounting lead brought in through the upper part of the switch envelope.

Fig. 6, is a view through Fig. 5 along line 6—6.

Figs. 7 and 8 shown in side section and in elevation a baffle similar to that of Fig. 1 but made of material such as glass and with a supporting electrode extending into the path of liquid flowing therethrough.

Figs. 9 and 10 show in side section and in elevation baffle and electrode separate but at the same point in the line of flow of the liquid through the switch.

Fig. 11 is a diagrammatic view of a circuit flashing circuit embodying the switch of this invention.

Figs. 12 to 29, inclusive, show further

modifications of switches embodying my invention.

In Figs. 1 to 4 inclusive a tubular envelope 1 supports at one end an electrode 2 sealed through the wall thereof at a downward bulbous extension 3 connecting with the main body through the stricture 4. At about a quarter of the distance from first said end of the body 1 to the other end is positioned the baffle electrode 5 extending across the interior of such switch through substantially half the cross sectional area from bottom to top and closely following the contour of the wall along the bottom thereof. From the bottom of said baffle and extending upwardly is formed the inverted V shaped notch 6 which serves to allow a restricted flow of the mercury 7 of the switch therethrough and which is made of such a size as to cause said flow to occupy predetermined periods of time between certain limits according to the proportions of the switch. The electrode lead 8 sealed in through the wall of said envelope 1 at the opposite end from electrode 2 extends horizontally through the switch to the said electrode 5 which is connected to it mechanically and electrically and which it supports in its desired position. In Fig. 1 the switch is shown as being tipped toward the electrode end in which position the mercury 7 passes freely over the top of the baffle 5 to instantly make electric connection between said electrodes 2 and 5. In Fig. 2 the switch is shown as being tipped into the circuit breaking position with the mercury flowing through the restricted passageway 6 of the electrode 5 through the definite period of time into the open circuit position shown in Fig. 3.

In Figs. 5 and 6 the baffle 5 of the device shown in Figs. 1 to 4 is shown as being supported by and electrically connected to the electrode 9 which is sealed downwardly through the switch envelope from a point directly above said electrode 5.

In Figs. 7 and 8 the electrode 10 which is sealed through the upper wall of the switch body 1 extends downwardly to within a short distance of the bottom of the switch body and supports the glass baffle 11 having in its bottom edge the notch 12, into which said electrode 10 enters.

Figs. 9 and 10 show the envelope 1 having mounted therein the baffle 13 which is either of glass or metal and which is supported by the wire 14 sealed into the wall 1 at a suitable point such as the top of the wall. In the notch 15 of baffle 13 is positioned the electrode 16 sealed through the wall of the switch directly below said notch.

In Fig. 11 the switch 1 of Fig. 1 is mounted by straps 20 and 21 to the panel 22 which is pivotally mounted at 23. The spring 24 fixed at one end to the pin 25 on the panel

support and at its other end to the arm 26 on said panel 22 tends to move one end of said panel downwardly and against pin 27 in said panel support. On the upper edge of said panel 22 is pivotally mounted the magnetic armature 28 above and in operable relation to which is mounted the solenoid 29 which is connected in series with said switch 1 through load 30, the hand switch 31, and a source of power 32. At its lower end said panel 22 is connected to piston 33 of the dash pot 34 by means of rod 35 which is pivoted at 36 to said panel 22 and to said piston at pivot 37. The valve 38 at the bottom of the cylinder of the dash pot serves to regulate the speed of the downward movement of the piston therein.

In the operation of my switch in the system shown in Fig. 11, upon the closing of switch 31 current flows through switch 1 and the solenoid 29, whereupon said solenoid attracts said armature 28 causing switch 1 to be lifted upwardly about pivot 23 into the open circuit position, the mercury therein at first appearing as in Fig. 2 of these drawings and occupying a predetermined period of time in flowing through the baffle to the position which it finally assumes as in Fig. 3. Upon the opening of the circuit through this flow of mercury and the consequent de-energization of said solenoid 29 said spring 24, now being unopposed by said solenoid 29, moves said panel 22 and switch 1 downwardly at a rate predetermined by the adjustment of valve 38 into the closed circuit position as shown in Fig. 11. The solenoid 29 is thus again energized and the switch moved into the open circuit position whereupon said mercury 7 flows to open the circuit through a predetermined period of time as before described. The action of the solenoid 29, switch 1, and spring 24 continue cyclically in this manner. The dash pot 34 serves to regulate and control the movement of said panel 22 and switch 1 upon the down stroke caused by said spring 24 and to regulate the period through which switch 1 remains open. In this manner both the interval of time during which switch 1 is open and the interval during which it is closed are predetermined.

Fig. 12 shows in elevation a switch similar to that of Fig. 1 but having the baffle electrode support lead 40 sealed through the end near the other electrode 2 of the switch, said supporting lead 40 being shorter than the corresponding lead 8 of Fig. 1 and with the baffle electrode 5 positioned substantially the same with respect to said electrode 2 as in the switch of Fig. 1. In this view the switch is shown as being in the circuit opening position.

Fig. 13 shows the same switch in the closed circuit position. The operation and appli-

cation of this switch is similar to that of the switch of Fig. 1, but as can be seen from the different relative positions of the external portions of leads 2 and 8 of Fig. 1, and 2 and 40 of Fig. 12, these two forms of substantially the same switch are adaptable for different mechanical mounting and design of apparatus.

The switch of Fig. 14 is similar to that of Fig. 1 but has a shorter body 41 with a depression or cup 42 formed at the bottom thereof for receiving the conducting liquid in the open circuit position of the switch. This allows for more compact mounting of the switch. The degree of rotation of this switch for the operation thereof is determined according to the volume of mercury supplied therein.

Fig. 15 shows a switch somewhat similar to that of Fig. 1 but having two electrodes 45 and 46 sealed respectively the one above the other through the wall of the switch body 43 at the end opposite that through which the baffle electrode support lead 47 is sealed. This switch can be used either as a time making switch for completing a circuit between electrodes 45 and 46, or for a time breaking switch for disconnecting a circuit between electrodes 45 and 46, or as a switch for controlling the combination of these actions. The combinations of making and breaking with and without time elements therefor are secured by varying the connections of the electrodes and the mounting and operation of the switch.

Fig. 16 shows a switch similar to that of Fig. 1 but having an additional electrode 2' between the electrode 2 and the electrode 5 of the switch of Fig. 1. This switch is adaptable for various combinations of connections between the electrodes 2, 2' and 5 thereof such as described for the switches of Figs. 1 and 15 and so on.

Fig. 17 shows a double acting time delay circuit breaking switch similar to the switch of Fig. 1 having the baffle electrodes 5 therein near electrode 2 and having at the opposite end the pool electrode 2''. This switch operates in a manner similar to that of the switch of Fig. 1 to make and break circuits between baffle electrode 5 and the pool electrodes 2 and 2''.

Fig. 18 shows a switch similar to that of Fig. 1 but in which the pool electrode 52 is sealed through the end of the switch opposite that through which lead 8 is sealed and entering the pool 50 through stricture 51 centrally from above instead of being sealed through the bottom thereof as is electrode 2 through the bottom of pool 3 of Fig. 1. The operation of this switch is substantially that of the switch of Fig. 1.

In Fig. 19, is shown a switch similar to that of Fig. 18 but having an additional pool electrode 55 sealed into the pool 56 formed there-

in at the opposite side of baffle electrode 5 from pool electrode 52 and at a short distance from said baffle electrode, this distance being substantially the same as that between electrodes 5 and 52. As denoted by dash line 58 and dotted line 59, which represent mercury positioned in the switch at different positions, said switch can be operated in a manner similar to the switch of Fig. 1 to achieve different electrical circuit making and breaking operations between electrodes 5, 52 and 55.

Fig. 20 is a variation of the switch of Fig. 19 and in which baffle 5 is not in use as an electrode and the support 60 thereof is not continued beyond the said wall as is lead 8 of Fig. 19.

Fig. 21 is substantially the same switch as that of Fig. 19 but with the two electrodes 2 and 2' being sealed through the bottom of their respective pools 3 and 3'.

Fig. 22 shows a switch similar to that of Fig. 12 with an additional electrode 70 mounted at the end opposite electrodes 2 and 5. This switch is operable as shown in the figure for establishing a circuit between electrodes 5 and 70 during the time flow of mercury 7 for the breaking of a circuit between electrodes 2 and 5. The operations for making and breaking a circuit between electrodes 2, 40 and 70 will readily appear from the form of the switch.

Fig. 23 shows the switch of Fig. 22 but having a double baffle electrode comprising the baffle 5 and 5' which are supported by the lead 72. This switch is adaptable for time breaking of circuits between lead 72 and electrode 70 and between electrode 72 and electrode 2, as well as the establishment of a circuit between electrode 72 and 70 during the time flow for circuit breaking between said electrode 72 and electrode 2. Other combinations of connections for making and breaking circuits between electrodes 2, 70 and 72 will be readily apparent from the form of this structure.

Fig. 24 shows a time making switch embodying the baffle electrode of my invention. In this switch the body 75 has sealed through one end thereof the support lead 76 on the inside end of which is mounted the baffle electrode 5, and has formed at its opposite end the chamber 78 which has sealed through the bottom thereof the electrode 77 and which connects with said body 75 at or near the top thereof through passageway 79. In this switch when it is tipped from a position in which the mercury is at the end opposite electrode 77 to the position shown in Fig. 24 the flowing mercury delayed by said baffle 5 will finally reach the lower limit of passageway 79 and connect the electrodes 5 and 77 at a definite period of time after the movement of the switch into the latter position. When the switch is in the open circuit position, that is with the mercury at the end opposite the said electrode 77 and with the

axis of the switch at an angle to the horizontal of say 45 degrees more or less, the chamber 78 will continue to hold a portion of the mercury 7 of the switch whereby when the switch is moved to the circuit making position and mercury flows from body 75 through passageway 79 circuit will be established between two bodies of mercury thereby insuring against arcing between the mercury and one of the electrodes. In another form of this switch I form chamber 78 through the wall of body 75 and extending into said body, in which form said chamber 78 is substantially an annular wall surrounding electrode 77 and sealed to the bottom of the body 75, the upper edge extending an appreciable distance above the said electrode 77.

In Fig. 25 is shown a modification of the switch of Fig. 24 in which the main switch body 80 has formed in its bottom near one end the depression or chamber 82 through the bottom of which is sealed the electrode 83. The chamber 84 in turn connects through the side wall of chamber 82 and has sealed through its bottom the electrode 86. Through the opposite end of body 80 is sealed lead 81 which supports the baffle electrode 5 positioned to delay mercury flow from body 80 into chamber 82, whereby after movement of the switch into the position shown in the figure connection is made after a predetermined time between electrodes 83 and 86. In the meantime electrical connection is established between electrode 5 and 83 which is used if and as desired in an electrical system. Other variations of connections and disconnections between electrodes 81 and 83 and 86 will be readily apparent from the structure.

Fig. 26 shows the switch body 87 which has connected therewith near its top at one end the chamber 90 which has sealed therethrough the electrode 89. At or near the same end, but at the bottom of said body 87, is the chamber 92 which has sealed through its bottom the electrode 91. At the opposite end of the switch is sealed the support lead 88 which carries the baffle electrode 5. As described in Fig. 25 various connections between electrodes 5, 89 and 91 and movements of the switch for various making and breaking of connections between said electrodes with or without a time element involved will be readily apparent from the structure.

Fig. 27 shows a switch similar to that of Figs. 16 and 17 in which there is a combination of the features of the switches of these two figures. From the structure of this switch or from the descriptions of preceding forms the various connections and disconnections between electrodes 2 and 2', 66 and 6' and baffle electrode 5 with or without time elements will be readily apparent from the structure.

Fig. 28 shows a switch similar to that of Fig. 17 but in which the baffle electrode 5

is positioned substantially equally distant between electrodes 2 and 2'.

Fig. 29 shows a switch body 93 which has sealed through its opposite ends the electrode supports 94 and 95 respectively which support the baffle electrode 5 and 5' respectively. Between said baffle electrodes is formed the chamber or pool 3 having sealed therein through its bottom the electrode 2. Instantaneous connection or disconnection between said electrodes 2, 94 and 95 by various movements and positions of the switch will be apparent from the foregoing descriptions of other types of switch and from the structure of the switch itself.

It is to be understood, however, that my invention is not limited to a switch of this type in which an electrode is situated at the baffle or in which the baffle is supported by a wire sealed to the envelope wall as other relations between baffle and electrode and other means for supporting a baffle separate from the envelope give good results in the operation of the switch.

When desired a proper atmosphere as of hydrogen, nitrogen, carbon dioxide, or any suitable gas or mixture of gases is provided in the switch envelope to aid in the dissipation of the heat of the arc, quenching the arc, and so on.

I claim:

1. A time delay switch of the liquid flow type, comprising a container having electrodes extending thereinto, a contact making liquid therein, and a flow restricting baffle separate from said container but mounted therein substantially at the position of one of said electrodes, said baffle impeding the flow of said liquid to connect and disconnect said electrodes more in one direction than in the opposite direction.

2. A time delay switch of the liquid flow type, comprising a sealed vitreous container, electrodes sealed therein, a conducting liquid in said container, a flow restricting baffle separate from said container mounted therein, said baffle impeding the flow of said liquid to connect and disconnect said electrodes more in one direction than in the opposite direction, and a support for said baffle.

3. A delay switch of the liquid flow type comprising a sealed vitreous container, a flow restricting baffle therein and a support therefor comprising a wire fixed to said baffle and fixed to said container, said baffle having an orifice near the bottom thereof, electrodes sealed into said container, and a conducting liquid therein.

4. A time delay switch of the liquid flow type comprising a sealed vitreous container, conducting liquid in said container, electrodes sealed through the container wall, and a terminal on one of said electrodes formed as a flow restricting element for said liquid.

5. In a time delay switch of the liquid

flow type a sealed vitreous container having electrodes sealed thereinto and a circuit making liquid therein, a terminal of conducting material for one of said electrodes formed into a baffle positioned in the line of flow of the said liquid.

6. In an electric switch of the liquid flow type, a sealed vitreous container, electrodes sealed thereinto, a conducting liquid in said container, and a terminal for one of said electrodes formed separate from said container and to restrict the flow of said liquid from one of its positions to another in the use of the switch.

7. In a time delay switch of the liquid flow type comprising a sealed container of insulating material, a conducting fluid in said container, electrodes sealed into said container, and a flow restricting baffle for said liquid mounted in the container in the line of flow of said liquid and supported by one of said electrodes.

8. A mercury electric time switch comprising a longitudinal sealed envelope, an electrode sealed through the wall thereof at one end, another electrode sealed through the opposite end thereof and extending longitudinally within said envelope to a point near first said electrode and terminating in a wall or barrier provided with a relatively small opening at or near its bottom portion, and a body of mercury in said envelope.

9. A mercury electric time switch comprising a longitudinal sealed envelope, an electrode sealed through the wall thereof at one end, another electrode sealed through the opposite end thereof and extending longitudinally through said envelope to a point near first said electrode and terminating in a transverse wall or barrier provided with a relatively small opening at or near its bottom portion, and a body of mercury in said envelope, and a gaseous filling therein.

10. A mercury electric time switch comprising a longitudinal sealed envelope, an electrode sealed thereinto, a baffle plate of electrical conducting material in said envelope and another electrode sealed into the envelope and connecting with and supporting said baffle plate, a body of mercury in said envelope, and a filling of gas or vapor therein.

11. In a circuit making and breaking device, in combination, a fluid containing receptacle having a wall or barrier of electrical conducting material therein provided with a relatively small opening at or near its bottom portion, a terminal at one end of said receptacle and sealed through the walls thereof, a second terminal sealed through the wall of said container and connected to and supporting said wall or barrier, and a conducting fluid in said receptacle and adapted when the receptacle is oscillated to flow over said barrier and make connection between

said terminal and barrier which connection is subsequently broken as a level of the fluid is restored at the passage of the fluid through the opening of said wall or barrier.

12. In an electric switch, a sealed vitreous envelope, electrodes sealed through said envelope, mercury therein, and a baffle extending across the line of flow of mercury in said envelope in the operation of the switch, said baffle being separate from the envelope and spaced away therefrom at contiguous points at such a distance as to avoid the setting up of strains in the envelope by said baffle through any contraction or expansion of the envelope or baffle but being close enough at said contiguous points for the surface tension of the mercury to prevent the flow thereof between said baffle and envelope at said contiguous points, and said baffle having a supporting connection with said envelope.

13. In an electric switch, a sealed vitreous envelope, electrodes sealed through said envelope, mercury therein, and a baffle extending across the line of flow of mercury in said envelope in the operation of the switch, said baffle being separate from the envelope and spaced away therefrom at contiguous points but close enough at said contiguous points for the surface tension of the mercury to prevent the flow thereof between said baffle and envelope at said contiguous points, and said baffle having a supporting connection with said envelope.

14. In an electric switch, a sealed vitreous envelope, electrodes sealed through said envelope, mercury therein, and a baffle extending across the lower part of said envelope in the line of flow of mercury therein in the operation of the switch, said baffle being separate from the envelope and spaced away therefrom at contiguous points but close enough at said contiguous points for the surface tension of the mercury to prevent the flow thereof between said baffle and envelope at said contiguous points, and said baffle having a supporting connection with said envelope and a restricted passage near its bottom for the flow of said mercury.

15. In an electric switch, a sealed vitreous envelope, electrodes sealed through said envelope, mercury therein, and a baffle mounted to one of said electrodes extending across said envelope in the line of flow of mercury therein in the operation of the switch, said baffle being separate from the envelope and spaced away therefrom at contiguous points but close enough at said contiguous points for the surface tension of the mercury to prevent the flow thereof between said baffle and envelope at said contiguous points.

16. An electrode for mercury flow contact devices, comprising in combination a seal-in wire and a flow restricting baffle mounted to said electrode, said baffle having a small

opening near the bottom thereof for mercury flow therethrough.

17. An electrode for mercury flow contact devices, comprising in combination a seal-in wire and a flow restricting baffle of electrical conducting material mounted to said electrode.

18. A mercury electric time switch comprising a longitudinal sealed envelope, an electrode sealed thereinto, a baffle plate of electrical conducting material in said envelope and another electrode sealed into said envelope and connecting with and supporting said baffle plate.

Signed at Hoboken, in the county of Hudson and State of New Jersey, this 24th day of June A. D. 1924.

WARREN R. WALKER.

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